Plan and deploy Qlik Sense

Qlik Sense®
June 2019
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1 About this document

2 Planning your Qlik Sense Enterprise deployment
   2.1 Introducing Qlik Sense Enterprise
   2.2 System requirements for Qlik Sense Enterprise
   2.3 Supported browsers
   2.4 Qlik Sense Enterprise deployment examples
   2.5 Qlik product licenses

3 Deploying Qlik Sense Enterprise on Windows
   3.1 Before you install Qlik Sense Enterprise on Windows
## Contents

- Installing Qlik Sense on a single node .......................................................... 90
- Installing Qlik Sense in a multi-node site ......................................................... 98
- Creating a file share ......................................................................................... 111
- Failover .............................................................................................................. 112
- Installing and configuring PostgreSQL ............................................................ 113
- Installing and configuring PostgreSQL on Azure ............................................. 118
- Configuring a proxy for Qlik License Service communication in Qlik Sense Enterprise on Windows .......................................................... 121
- Changing the user account to run Qlik Sense services ...................................... 122
- Performing a silent installation ....................................................................... 124
- 3.3 Setting up Qlik Sense Enterprise on Windows after installation .................. 129
- Connecting Qlik Sense to your user directory ................................................ 129
- Assigning licenses to users ............................................................................. 129
- Configuring the monitoring apps ..................................................................... 130
- How Qlik Sense uses HTTPS and certificates .................................................. 131
- Creating and opening apps ............................................................................. 131
- Working with streams, apps and publishing ..................................................... 131
- 3.4 Upgrading and updating Qlik Sense Enterprise on Windows ....................... 132
- Upgrades and migrating persistence models ................................................... 132
- Upgrades and centralized logging ................................................................... 132
- Upgrading ......................................................................................................... 132
- Upgrading and migrating from synchronized to shared persistence ................ 141
- Performing a silent upgrade ........................................................................... 144
- Repairing an installation .................................................................................. 145
- Performing a silent repair ................................................................................ 146
- Patching Qlik Sense ......................................................................................... 147
- Uninstalling Qlik Sense .................................................................................... 149
- 3.5 Backup and restore Qlik Sense Enterprise on Windows ............................... 150
- Qlik Sense certificates ...................................................................................... 150
- Qlik Sense Repository Database ...................................................................... 150
- Shared persistence file share .......................................................................... 151
- Backing up certificates .................................................................................... 151
- Restoring certificates ....................................................................................... 160
- Backing up a Qlik Sense site ........................................................................... 170
- Restoring a Qlik Sense site ................................................................................ 172
- 3.6 Qlik Sense Enterprise on Windows security .............................................. 175
- Protection of the platform ................................................................................ 176
- Authentication ................................................................................................. 177
- Authorization .................................................................................................... 177
- Auditing ............................................................................................................. 178
- Confidentiality ................................................................................................. 178
- Integrity ............................................................................................................. 178
- Availability ........................................................................................................ 179
- Certificates ....................................................................................................... 179
- Protecting the platform .................................................................................... 180
<table>
<thead>
<tr>
<th>Contents</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authentication</td>
<td>184</td>
</tr>
<tr>
<td>Limitations</td>
<td>194</td>
</tr>
<tr>
<td>Authorization</td>
<td>197</td>
</tr>
<tr>
<td>Security example: Opening an app</td>
<td>201</td>
</tr>
<tr>
<td>3.7 Logging</td>
<td></td>
</tr>
<tr>
<td>Updated logging framework</td>
<td>202</td>
</tr>
<tr>
<td>Legacy logging framework</td>
<td>202</td>
</tr>
<tr>
<td>Centralized logging framework</td>
<td>202</td>
</tr>
<tr>
<td>Reading and analyzing log files in Qlik Sense</td>
<td>202</td>
</tr>
<tr>
<td>Centralized logging</td>
<td>202</td>
</tr>
<tr>
<td>Qlik Logging Service</td>
<td>203</td>
</tr>
<tr>
<td>Qlik Logging Service – configuration and integration</td>
<td>207</td>
</tr>
<tr>
<td>Requirements</td>
<td>219</td>
</tr>
<tr>
<td>Storage</td>
<td>219</td>
</tr>
<tr>
<td>Naming</td>
<td>222</td>
</tr>
<tr>
<td>Rows</td>
<td>223</td>
</tr>
<tr>
<td>Fields</td>
<td>223</td>
</tr>
<tr>
<td>Trace logs</td>
<td>234</td>
</tr>
<tr>
<td>Configuring the logging</td>
<td>246</td>
</tr>
<tr>
<td>Telemetry logging</td>
<td>253</td>
</tr>
<tr>
<td>3.8 Troubleshooting - Deployment</td>
<td>256</td>
</tr>
<tr>
<td>Understand the problem</td>
<td>256</td>
</tr>
<tr>
<td>Use the log files</td>
<td>257</td>
</tr>
<tr>
<td>Qlik Sense client or application problems</td>
<td>258</td>
</tr>
<tr>
<td>Other resources</td>
<td>258</td>
</tr>
<tr>
<td>Cannot find the repository database superuser password</td>
<td>258</td>
</tr>
<tr>
<td>Cannot access the hub or the QMC after installation</td>
<td>259</td>
</tr>
<tr>
<td>One or more Qlik Sense services did not start after installation</td>
<td>259</td>
</tr>
<tr>
<td>Anti-virus software scanning affects performance</td>
<td>260</td>
</tr>
<tr>
<td>Exit codes</td>
<td>260</td>
</tr>
<tr>
<td>Rim node loses connection to the central node</td>
<td>262</td>
</tr>
<tr>
<td>Repository cannot connect to database after installation</td>
<td>262</td>
</tr>
<tr>
<td>Unable to upgrade, reinstall or add a rim node due to password validation failure</td>
<td>262</td>
</tr>
<tr>
<td>The database is unavailable, how do I find the Qlik logging service files</td>
<td>263</td>
</tr>
<tr>
<td>Troubleshooting - database not configured for IP address or range</td>
<td>264</td>
</tr>
<tr>
<td>Troubleshooting app distribution in multi-cloud</td>
<td>264</td>
</tr>
<tr>
<td>The logging database has grown too big</td>
<td>265</td>
</tr>
<tr>
<td>Cannot read or write to the logging database</td>
<td>266</td>
</tr>
<tr>
<td>How can I debug if there are log entries missing in the database?</td>
<td>266</td>
</tr>
<tr>
<td>How can I manage storage to fit our needs and the needs of the operational IT department?</td>
<td>266</td>
</tr>
<tr>
<td>Qlik logging service database urgently needs to be reduced in size</td>
<td>267</td>
</tr>
<tr>
<td>Logging issues when trying clean up the database</td>
<td>267</td>
</tr>
<tr>
<td>Upgrade fails with message &quot;Qlik Sense Superuser password validation failure&quot;</td>
<td>268</td>
</tr>
<tr>
<td>Failed to remove soft deleted records</td>
<td>268</td>
</tr>
</tbody>
</table>
## Contents

The Qlik Sense Mobile app encounters a network error and must close ........................................... 273

### 4 Deploying Qlik Sense Enterprise on Kubernetes ............................................................... 274

4.1 Installation and configuration ........................................................................................................ 274
4.2 Before you install Qlik Sense Enterprise on Kubernetes ......................................................... 274
   System requirements for Qlik Sense Enterprise on Kubernetes ................................................. 275
   Supported browsers in Qlik Sense Enterprise on Kubernetes .................................................... 275
   Multi-cloud services ...................................................................................................................... 277
4.3 Preparing for Qlik Sense Enterprise on Kubernetes ................................................................. 279
   Preparing your local tools .............................................................................................................. 280
4.4 Installing Qlik Sense Enterprise on Kubernetes ........................................................................ 281
   Providing configuration settings ................................................................................................. 281
   Installing Qlik Sense .................................................................................................................... 281
   Accessing the deployment ........................................................................................................... 283
   Using Minikube ........................................................................................................................... 283
   Installing Qlik Sense Enterprise on Kubernetes to a Red Hat OpenShift platform ..................... 285
4.5 Setting up Qlik Sense Enterprise on Kubernetes after installation ........................................... 287
   Distributing apps to Qlik Sense Enterprise on Kubernetes ......................................................... 287
   Setting up identity providers ........................................................................................................ 287
   Configure your hosts file .............................................................................................................. 292
   Log in to your tenant .................................................................................................................... 292
   Configure your hosts file .............................................................................................................. 296
   Log in to your tenant .................................................................................................................... 296
   Configuring your hosts file ........................................................................................................... 300
   Log in to your tenant .................................................................................................................... 300
   Adding programmatic configuration to QSEoK ............................................................................ 300
   Configuring certificates in your Qlik Sense Enterprise on Kubernetes deployment .................... 301
   Configuring MongoDB in Qlik Sense Enterprise on Kubernetes ................................................. 302
   Configuring a proxy for Qlik License Service communication in Qlik Sense Enterprise on Kubernetes ......................................................................................................................... 303

### 5 Deploying Qlik Sense Enterprise in a multi-cloud environment ........................................... 304

5.1 Qlik Sense deployments to Qlik Cloud Services ........................................................................ 304
5.2 Multi-Cloud Setup Console - start page ................................................................................... 305
   Qlik Sense Enterprise on Kubernetes - IdP settings .................................................................... 306
   MSC - Deployments ..................................................................................................................... 307

### 6 Deploying Qlik Sense Mobile .................................................................................................. 309

6.1 The Qlik Sense Mobile app ....................................................................................................... 309
6.2 Enterprise Mobile Management (EMM) and Qlik Sense Mobile ............................................. 309
6.3 Qlik Sense Mobile security ....................................................................................................... 310
   Authentication .............................................................................................................................. 310
   Certificates .................................................................................................................................. 310
   Configuring the certificate validation policy for the Qlik Sense Mobile app ......................... 311
6.4 Installing Qlik Sense Mobile ..................................................................................................... 311
   Qlik Sense Mobile and VPP ......................................................................................................... 312
Deploying the Qlik Sense Mobile app using AirWatch ................................................. 312
Deploying Qlik Sense Mobile with Microsoft Azure and Intune ................................. 316
Connecting to Qlik Sense using BlackBerry Access .................................................. 321
Connecting to Qlik Sense from the Qlik Sense Mobile app ...................................... 323
6.5 Deploying mashups to the Qlik Sense Mobile app ................................................. 325
  Why use mashups in the Qlik Sense Mobile app ..................................................... 325
  Restricting access to mashups in the Qlik Sense Mobile app ................................ 325
6.6 Customizing Qlik Sense Mobile with AppConfig .................................................. 326
  List of configurable settings in AppConfig .............................................................. 326
6.7 Qlik Sense Mobile for BlackBerry ................................................................. 327
  Authentication configurations for Qlik Sense Mobile for BlackBerry ..................... 328
  Deploying Qlik Sense Mobile for BlackBerry ......................................................... 329
  Qlik Sense Mobile for BlackBerry policy settings ............................................... 331
  Activating Qlik Sense Mobile for BlackBerry ....................................................... 334
1  About this document

This guide will introduce you to planning and installing Qlik Sense.

This document is derived from the online help for Qlik Sense. It is intended for those who want to read parts of the help offline or print pages easily, and does not include any additional information compared with the online help.

You find the online help, additional guides and much more at help.qlik.com/sense.
2 Planning your Qlik Sense Enterprise deployment

To successfully plan and prepare for your Qlik Sense deployment, do the following:

*Introducing Qlik Sense Enterprise*
Get a brief introduction to Qlik Sense Enterprise.

*Deployment examples*
See different examples of deploying Qlik Sense Enterprise.

*Qlik product licenses*
Understand how Qlik Sense uses license keys and LEF for site licensing.

Understand how Qlik Sense uses tokens for user access allocation (token-based licensing).

Ensure that you have your Qlik Sense license key available.

2.1 Introducing Qlik Sense Enterprise

Qlik Sense Enterprise is the full version of Qlik Sense, supporting a full spectrum of analytics use cases on a multi-cloud platform. This includes self-service data visualization to empower users to explore data, guided analytics to align users to a standard business process or workflow, embedded analytics to enhance websites and applications, and custom analytic applications to support specific business processes or use cases.

Qlik Sense Enterprise can be deployed on combinations of on-premise and cloud sites, all within a fully governed, self-service oriented environment that provides scalability and trust for your organization.

Qlik Sense Enterprise includes a containerized multi-cloud architecture, enabling you to deploy entirely on-premise, in a private cloud, and/or in Qlik's hosted cloud.

- Using Qlik Sense Enterprise on Windows, you can continue to deploy on-premise and in the cloud.
- Using Qlik Sense Enterprise on Kubernetes, you can deploy Qlik’s new highly-elastic, cloud-native architecture on-premise or in the cloud of your choice.
- For a Software as a Service (SaaS) solution, you can use Qlik Sense Enterprise on Cloud Services, and deploy entirely in Qlik’s cloud.

*Qlik Sense Enterprise on Windows*

Qlik Sense Enterprise on Windows support a wide variety of use cases. This includes self-service data visualization to empower users to explore data, guided analytics to align users to a standard business process or workflow, embedded analytics to enhance websites and applications, and custom analytic applications to support specific business processes or use cases. Qlik Sense Enterprise on Windows includes the Qlik Analytics Platform.
2 Planning your Qlik Sense Enterprise deployment

You can distribute Qlik Sense apps to cloud environments, using Qlik Sense Enterprise multi-cloud capabilities. Choose Qlik Cloud Services, hosted by Qlik, use Qlik Sense Enterprise on Kubernetes to host your own private cloud, or use both.

You create apps in Qlik Sense Enterprise on Windows and set policies so they are distributed to your cloud users. In the cloud environment, users can use the apps, and use and create collections.

Qlik Sense Enterprise on Kubernetes

Qlik Sense Enterprise on Kubernetes is an implementation of Qlik Sense Enterprise running on a Kubernetes cluster using containers. This approach allows deployments into Kubernetes clusters running in public or private clouds on customer managed infrastructures. It comes with mostly the same capabilities as Qlik Sense Enterprise on Windows.

The implementation of Qlik Sense Enterprise on Kubernetes can vary depending on the configuration required.

Qlik Sense Enterprise on Cloud Services

Qlik Cloud Services is the cloud environment that Qlik hosts and runs for customers. To use this environment, you must activate a Qlik account, then create and configure a Qlik Cloud Services tenant.

App consumers see apps in the public collections that are defined by distribution rules. They can also create their own private collections, and mark favorites.

2.2 System requirements for Qlik Sense Enterprise

This section lists the requirements that must be fulfilled by the target system in order to successfully install and run Qlik Sense.

Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Platforms</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Microsoft Windows Server 2012 R2</td>
</tr>
<tr>
<td>• Microsoft Windows Server 2016</td>
</tr>
<tr>
<td>• Microsoft Windows Server 2019</td>
</tr>
</tbody>
</table>

For development and testing purposes only:

| • Microsoft Windows 8.1 (64-bit version only) |
| • Microsoft Windows 10 (64-bit version only) |

These operating systems are supported by Qlik Sense. Third-party software may require service packs to be installed.

<table>
<thead>
<tr>
<th>Processors (CPUs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-core x64 compatible processors</td>
</tr>
</tbody>
</table>

We recommend that you use at least 4 cores per node in a Qlik Analytics Platform deployment.
## 2 Planning your Qlik Sense Enterprise deployment

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Memory</strong></td>
<td>Minimum: 8 GB (depending on data volumes, more may be required). Qlik Sense is an in-memory analysis technology. The memory requirements for the Qlik Sense products are directly related to the amount of data being analyzed.</td>
</tr>
<tr>
<td><strong>Disk space</strong></td>
<td>Total: 5.0 GB required to install</td>
</tr>
</tbody>
</table>
| **Storage**         | - A network file share is required for the storage to be accessible by all servers in the site. In case of a single-server deployment, local disk storage may be sufficient.  
                      - Sufficient storage is required for the volume of apps and content used in the deployment.                                                                                                 |
| **Security**        | - Microsoft Active Directory  
                      - Microsoft Windows Integrated Authentication  
                      - Third-party security                                                                                                                                                                     |
| **WebSockets**      | Web browsers and infrastructure components (such as proxies and routers) must support WebSockets.                                                                                                   |
| **.NET framework**  | 4.5.2 or higher                                                                                                                                                                                |
| **PowerShell**      | 4.0 or higher                                                                                                                                                                                   |
| **Repository database** | PostgreSQL 9.6.x  
PostgreSQL is included in the Qlik Sense setup by default. However, you can also download and install it manually.                                                                                   |
| **Centralized logging database** | PostgreSQL is an open source object-relational database management system. It is released under the PostgreSQL license, which is a free and open source software license.                                      |
| **Internet protocol** | - IPv4  
                      - IPv6  
                      - Dual stack (IPv4 and IPv6)                                                                                                                                                                    |
| **Network**         | The configured hostname must resolve to an IP address on the host machine.                                                                                                                       |
## 2 Planning your Qlik Sense Enterprise deployment

<table>
<thead>
<tr>
<th>Qlik Management Console (QMC), supported browsers</th>
<th>Microsoft Windows 8.1:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Microsoft Internet Explorer 11</td>
</tr>
<tr>
<td></td>
<td>• Google Chrome</td>
</tr>
<tr>
<td></td>
<td>• Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)</td>
</tr>
<tr>
<td>Microsoft Windows Server 2012, Windows Server 2012 R2, Windows Server 2016:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Microsoft Internet Explorer 11 (not supported on Windows Server 2012)</td>
</tr>
<tr>
<td></td>
<td>• Google Chrome</td>
</tr>
<tr>
<td></td>
<td>• Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)</td>
</tr>
<tr>
<td>Microsoft Windows 10:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Microsoft Internet Explorer 11</td>
</tr>
<tr>
<td></td>
<td>• Microsoft Edge</td>
</tr>
<tr>
<td></td>
<td>• Google Chrome</td>
</tr>
<tr>
<td></td>
<td>• Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)</td>
</tr>
<tr>
<td>Apple Mac OS X 10.11 and 10.12:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Apple Safari</td>
</tr>
<tr>
<td></td>
<td>• Google Chrome</td>
</tr>
<tr>
<td></td>
<td>• Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)</td>
</tr>
<tr>
<td>CefSharp embedded browser v55 or later (CefSharp allows you to embed the Chromium open source browser inside .Net apps)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>QMC, minimum screen resolution</th>
<th>Desktops, laptops, and Apple Mac: 1024x768</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No mobile or small screen support.</td>
</tr>
</tbody>
</table>

| QlikView compatibility | It is not possible to install Qlik Sense on a machine with QlikView Server already installed. |

> We do not recommend that you install Qlik Sense on domain controller machines, as group policies may prevent Qlik Sense from getting access to required services.

---

### Qlik Sense Enterprise on Cloud Services

**Maximum app size** 500 MB
2 Planning your Qlik Sense Enterprise deployment

<table>
<thead>
<tr>
<th>Storage</th>
<th>500 GB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum concurrent reloads</td>
<td>5</td>
</tr>
<tr>
<td>Maximum reloads per day</td>
<td>100</td>
</tr>
</tbody>
</table>

When distributing to Qlik Cloud Services, your Qlik Sense Enterprise on Windows deployment must be either the current version or one of the previous 2 releases (starting from the June 2018 release).

Qlik Sense Enterprise on Kubernetes

The Kubernetes environment must have Internet access to the Qlik Helm and Container Image repository.

Kubernetes service vendors:

- Microsoft Azure using Azure Kubernetes Service (AKS)
- Amazon Web Services (AWS) using Amazon Elastic Container Service for Kubernetes (EKS)
- Amazon Web Services (AWS) deployed via Kubernetes Operations (KOPs)
- Google Cloud using Google Kubernetes Engine (GKE)
- Red Hat OpenShift 4+

Non-managed Kubernetes deployments:

- Kubernetes 1.10.x+

**Kubernetes package manager**

- Helm v2.12.0+

**Local/Evaluation/Test environment**

- Windows: Minikube v0.33 +
- Red Hat MiniShift v1.21.0+
- Mac: Docker for Desktop with Kubernetes enabled: v2.0.0.3

**Database**

- MongoDB 3.6+

**File system**

- Storage attached to the cluster that supports ReadWriteMany. This can be configured as a Storage Class or a Persistent Volume Claim

**Processors (CPUs)**

- Minimum 4 cores (additional depending on data volumes)

**Memory**

- Minimum 8 GB (additional depending on data volumes)

**Disk space**

- 5 GB total required to install

**IDP**

- For user authentication an OIDC compatible IDP is required
2 Planning your Qlik Sense Enterprise deployment

Qlik Sense Mobile app

iOS supported versions:
- iOS 11.2 or later

iOS 11.0 or later is required for SAML authentication.

Device compatibility:
- iPad Air 2 or later
- iPad Pro or later
- iPhone 6 and 6 Plus
- iPhone 6S and 6S Plus
- iPhone 7 and 7 Plus
- iPhone 8 and 8 Plus
- iPhone X

Qlik Sense Mobile for iOS compatibility with Qlik Sense:
- Qlik Sense September 2017 and later releases
- Qlik Sense November 2018 or later is required to access mashups from the Qlik Sense Mobile for iOS app.

Qlik Sense February 2018 or later is required to reduce the size of apps for download to your iOS device.

Android OS supported versions:
- Android 6.0 or later

Device compatibility:
- 64-bit CPU architecture (ARM)
- RAM: 2 GB or more is recommended
- Screen resolution: 720x1280 HDPI (267 ppi)

Qlik Sense Mobile for Android compatibility with Qlik Sense:
- Qlik Sense November 2018 and later releases

Qlik Sense Enterprise November 2017 or later:

Per-app VPN support

Qlik Sense Mobile per-app VPN through Enterprise Mobile Management (EMM) is designed to work with the environments and versions listed in this section.
Planning your Qlik Sense Enterprise deployment

- iPad with iOS version 11.2.2 or later.
- iPhone with iOS version 11.2.2 or later.

Qlik Sense Enterprise November 2018 or later:
- Android version 6.0 or later.

Access to Qlik Sense Enterprise using AirWatch per-app VPN is supported on the following browsers:
- VMware browser
- AppleSafari
- GoogleChrome

Qlik Sense Mobile for BlackBerry app

OS support
- iOS 11.2 or later

BlackBerry UEM support
- BlackBerry UEM 12.9.1
- BlackBerry UEM 12.10 or higher

Device compatibility
We recommend using Apple devices powered by A10 processor or higher:
- iPad Pro 2nd generation or later
- iPad (2018)
- iPhone 7 and 7 Plus
- iPhone 8 and 8 Plus
- iPhone X

Qlik Sense Mobile for BlackBerry app compatibility with Qlik Sense
The Qlik Sense Mobile for BlackBerry app is compatible with Qlik Sense February 2019 and later releases.

2.3 Supported browsers

Qlik Sense is designed to work on the platform and web browser combinations described in this section, using default browser settings.

Each Qlik Sense release is tested for compatibility with the latest publicly available browser versions. Due to the frequency of browser version updates, Qlik does not include specific browser version numbers in the system requirements.

Each Qlik Sense release is compatible with and supported on the latest iOS versions that are publicly available at the time of the Qlik Sense release. Due to the frequency of iOS version updates, Qlik does not include specific iOS version numbers in the system requirements.
Improving performance in Internet Explorer

Qlik Sense connects to your browser using WebSockets. Each new tab that you open uses additional WebSocket connections. By default, Internet Explorer 11 limits the number of WebSocket connections to 6 per Internet Explorer session. This can limit your ability to open new tabs or configuration windows.

Your Windows administrator can change this setting using the Local Group Policy Editor. The setting is available under Administrative Templates > Windows Components > Internet Explorer > Security Features > AJAX > Set the maximum number of WebSocket connections per server. Only your system administrator should change this configuration.

You can also open apps in new Internet Explorer sessions, instead of new tabs. If an app will not open in a new tab, copy the url from the address bar in the Internet Explorer tab. Select File > New Session from the Internet Explorer top menu. Paste the url in the address bar, and then press Enter. The app opens in the Internet Explorer new session window.

Qlik Management Console (QMC)

Microsoft Windows 8.1
- Microsoft Internet Explorer 11
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)

Microsoft Windows Server 2012 R2, 2016, 2019
- Microsoft Internet Explorer 11
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)

Microsoft Windows 10
- Microsoft Internet Explorer 11
- Microsoft Edge
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)

Apple Mac OS X 10.11 and 10.12
- Apple Safari 10 or later
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)

CefSharp embedded browser v55 or later (CefSharp allows you to embed the Chromium open source browser inside .Net apps)
2 Planning your Qlik Sense Enterprise deployment

Minimum screen resolution for desktops, laptops, and Apple Mac is 1024x768. The QMC does not support tablets or iPads.

Qlik Sense (the hub)

Microsoft Windows 7
- Microsoft Internet Explorer 11
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)

Microsoft Windows 8.1
- Microsoft Internet Explorer 11
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)

Microsoft Windows 10
- Microsoft Edge
- Microsoft Internet Explorer 11
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)

Apple Mac OS X 10.11 and 10.12
- Apple Safari 10 or later
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments).

Microsoft Windows Server 2012 R2
- Microsoft Internet Explorer 11
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)

Microsoft Windows Server 2016
- Microsoft Internet Explorer 11
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)

CefSharp embedded browser v55 or later (CefSharp allows you to embed the Chromium open source browser inside .Net apps)
2 Planning your Qlik Sense Enterprise deployment

Microsoft Windows Server 2019

- Microsoft Internet Explorer 11
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)

CefSharp embedded browser v55 or later (CefSharp allows you to embed the Chromium open source browser inside .Net apps)

iOS

Version 11.2 or later (script editing is not supported on tablet devices).

Qlik Sense version: Qlik Sense EnterpriseSeptember 2017 or later.

Supported devices:

- iPad Air or later
- iPhone 5S or later

Supported browsers:

- Apple Safari
- Google Chrome
- VMware browser (using AirWatch per-app VPN)
- BlackBerry Access 2.9.1 or later (using BlackBerry Dynamics platform)

> iOS 11.3 is required for using BlackBerry Access browser.

Android

Version 6.0, 7.1, 8.1 and 9.0 (script editing is not supported on tablet devices):

- Google Chrome
- BlackBerry Access 2.9.1 or later (using BlackBerry Dynamics platform)

Windows 10 phone

- Microsoft Edge

> Minimum screen resolution for desktops and laptops is 1024x768; tablets is 1024x768; small screens is 320x568.

2.4 Qlik Sense Enterprise deployment examples

This section provides examples of how to install Qlik Sense Enterprise.
2  Planning your Qlik Sense Enterprise deployment

Qlik Sense Enterprise on Windows deployments

A Qlik Sense site is a collection of one or more nodes (servers) connected to a single repository database, and sharing a single license. Each site also contains a common set of data in the form of apps and configuration data.

Single-node sites

A single node site is the smallest site possible and consists of a single node (single server), which is also the central node of the site. It contains the Qlik Sense services, the repository database, and the file share all on a one server computer.

Multi-node sites

Multi-node sites offer more scalability options for larger organizations. In a multi-node environment, the Qlik Sense site is distributed across two or more nodes that share the same set of data and the same license key. In larger sites, you can configure one or more rim nodes to improve scalability, capacity, and resilience. All rim nodes connect to a central node.

Benefits of multi-node sites include:

- Better scalability, making it easier to increase capacity
- Improved resilience and reliability
- Ability to move apps or roles to specific nodes
- Flexibility to suit customer network deployments

Qlik Sense Enterprise on Windows: multi-node deployment

Qlik Sense Enterprise on Kubernetes deployments

Qlik Sense Enterprise on Kubernetes is an implementation of Qlik Sense Enterprise running on a Kubernetes cluster using containers. This approach allows deployments into Kubernetes clusters running in public or private clouds on customer managed infrastructures. It comes with mostly the same capabilities as Qlik Sense Enterprise on Windows.

Qlik Sense Enterprise on Kubernetes deployments

Qlik Sense Enterprise on Cloud Services deployments

This deployment provides the ability to scale up the number of apps (read only) for user consumption. The QCS cluster is deployed as a fully-managed service provisioned and administered by Qlik.

Qlik Cloud Services deployment

Qlik Sense Enterprise on Windows: basic deployment

In a basic single-node deployment, all services are deployed to a single server. This type of deployment is best suited to a small organization operating within a single time zone.
2 Planning your Qlik Sense Enterprise deployment

For larger organizations, an enterprise deployment is recommended, see Qlik Sense Enterprise on Windows: multi-node deployment (page 20).

Services

In a single-node deployment, the Qlik Sense services behave as follows:

- Qlik Sense Repository Service
  Within a single node site, there is only one instance of the Qlik Sense Repository Service (QRS) running and it has direct access to the central repository database.

- Qlik Sense Scheduler Service
  When deployed in a single node site, the Qlik Sense Scheduler Service (QSS) acts as both master and slave.

Basic single-node deployment example

In this deployment scenario, all Qlik Sense services run on a single node. This kind of deployment works best in a single time zone, where reloads of data can be done during the night.

Qlik Sense Enterprise on Windows: multi-node deployment

You can configure a Qlik Sense enterprise deployment in a variety of different ways to suit the needs of your organization. For example, you can install Qlik Sense services to run on a single node or on multiple nodes for better performance and scalability. In a small single-node deployment, you deploy all services to a single server, which we do not recommend for larger organizations.
This section provides three examples of Qlik Sense deployments.

The following terms are used in the deployment scenarios:

- Central node: the central point for managing all nodes in a site.
- Scheduler or Reload node: reloads apps on a schedule, but does not serve content to users.
- Consumer node: serves apps to users, but is not used to create, process, or reload data.
- Development node: allows users to create and reload new apps, but does not serve normal consumer traffic.
- Proxy node: provides load balancing of user traffic to other nodes but does not contain a Qlik Sense Engine Service (QES).

An alternative to using a proxy node is to have a proxy installed on each consumer node and balance the traffic using a hardware load balancer.

Multi-node deployment examples

The scenarios described here are examples of a small, medium, large, and extra-large Qlik Sense enterprise deployments. Every deployment of Qlik Sense is different and these examples only aim to provide a rough indication of what resources would be appropriate for a given workload. The figures included here are flexible, allowing extra capacity for growth and for handling peaks in demand. They are not intended to set a maximum limit on your deployment.

If you have an attribute significantly higher than any of the figures below (such as more reloads or apps) then contact your Qlik partner and perform a full sizing exercise. For more general scalability and performance information, see Performance (page 87).

The following table provides some basic performance information for each type of deployment example:

<table>
<thead>
<tr>
<th></th>
<th>Single-node (small)</th>
<th>Multi-node (medium)</th>
<th>Multi-node (large)</th>
<th>Multi-node (extra-large)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apps</td>
<td>50</td>
<td>100</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>Active apps per day</td>
<td>25</td>
<td>50</td>
<td>125</td>
<td>125</td>
</tr>
<tr>
<td>Total users (from UDC)</td>
<td>500</td>
<td>1000</td>
<td>50000</td>
<td>50000</td>
</tr>
<tr>
<td>Concurrent users (equals active users within the same hour)</td>
<td>50</td>
<td>100</td>
<td>500</td>
<td>1000</td>
</tr>
<tr>
<td>Average app size (in gigabytes)</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Maximum app size (in gigabytes)</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Content creation (objects)</td>
<td>20</td>
<td>40</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>
2  Planning your Qlik Sense Enterprise deployment

| Reloads per hour | 10 | 20 | 400 | 400 |

These figures are examples that you can use for guidance but may vary depending on how you have configured your Qlik Sense deployment.

Single-node (small)

This example illustrates a small, single-node Qlik Sense production deployment where all services are configured to run on the same server.
2 Planning your Qlik Sense Enterprise deployment

Multi-node (medium)
This example illustrates a typical medium-size, multi-node Qlik Sense production deployment consisting of three nodes:

- Central node/reload node
- Two consumer nodes

In this configuration, the repository database (PostgreSQL), and the file share are installed together with other Qlik Sense services on the central node. It has two dedicated consumer nodes.

![Diagram of multi-node (medium) deployment]

Multi-node (large)
This example illustrates a typical large, multi-node Qlik Sense production deployment providing the ability to scale up both reloads and user load. This deployment consists of the following nodes:

- Active central node/reload node
- Passive central node/reload node
- Four consumer nodes
- One developer node

In this configuration example, the repository database (PostgreSQL) and the file share are installed on separate, dedicated servers.
2 Planning your Qlik Sense Enterprise deployment

The active and passive central nodes must have all services installed. Configure the proxy service on consumer nodes to handle user traffic and on both the active/passive central nodes to handle admin traffic.

**Only one central node can be active at any one time, while the other node remains passive. However, the scheduler service is always active regardless of whether the central node is in an active or passive state.**

Multi-node (extra large)

This example illustrates an extra large, multi-node Qlik Sense production deployment consisting of seven consumer nodes, providing the ability to scale up both reloads and user load. Two nodes are dedicated to large-size apps, three are dedicated to medium-size apps, and two are dedicated to small-size apps. Each consumer node can be configured with security and custom load balancing rules to restrict the size of the apps they can serve.
2 Planning your Qlik Sense Enterprise deployment

However, to ensure that the system can still cope with the load you can pre-load some apps in memory. For example, you could pre-load all medium and large sized apps, ensuring that they can be loaded in less than two seconds, even during peak hours. For more information on pre-loading apps, see App preload - a cache warmer.

With very large deployments, development of applications can be resource intensive. It may therefore be appropriate to have a separate deployment dedicated to app development. If you prefer to keep developer and consumer nodes in the same deployment, ensure the resource limits are suitable for the developer nodes. This includes reload time, hyper cube timeout, and amount of RAM.

This deployment consists of the following nodes:

- Active central node/reload node
- Passive central node/reload node
- Seven consumer nodes
- Two developer nodes
2 Planning your Qlik Sense Enterprise deployment

The active and passive central nodes must have all services installed. Configure the proxy service on consumer nodes to handle user traffic and on both the active/passive central nodes to handle admin traffic.

**Only one central node can be active at any one time, while the other node remains passive. However, the scheduler service is always active regardless of whether the central node is in an active or passive state.**

AWS deployment

In an Amazon Web Services (AWS) deployment, you install Qlik Sense Enterprise on an Amazon virtual private cloud infrastructure that is flexible, high performance, and quick to set up.

Deploying Qlik Sense Enterprise on AWS will enable you to quickly add new applications in a simple, and scalable manner. You can do this with a basic knowledge of AWS security and scalability options but without the need to
2  Planning your Qlik Sense Enterprise deployment

follow complex on-premise installation and configuration procedures. Using AWS will enable you to get your Qlik Sense infrastructure up and running in fraction of the time required for an on-premise deployment, and will enable you to scale your deployment quickly and easily, regardless of unexpected changes in demand.

You can deploy Qlik Sense to AWS manually, or you can use an Amazon Machine Image (AMI) available in the AWS Marketplace that includes Qlik Sense preinstalled. However, predefined images do not include a file share, so can only support single node Qlik Sense deployments.

Benefits of using AWS cloud

- A quick and effective way of deploying Qlik Sense to the cloud.
- Simple and cost-effective, reducing overall deployment times.
- Quick and easy to deploy Qlik Sense applications.
- Fewer hardware management overheads.
- Scalable, elastic storage that can be expanded and contracted on demand.
- Geographic deployment to multiple regions around the world makes lower latency possible.
- A reliable and high performance platform.

Components

To successfully deploy Qlik Sense on AWS cloud you need a basic understanding of the architecture and services available in an AWS deployment. As part of a Qlik Sense deployment on AWS, you need the following components:

- An Amazon AWS account
- Amazon Management Console - available when you log in to your AWS account.
- VPC - Amazon Virtual Private Cloud
- EC2 - Amazon Elastic Cloud instance running on a VPC. Allows you to scale your deployment up and down as your requirements change.

AWS services

You should also have a basic understanding of other AWS services that you can use for managing resources and as data stores for your Qlik Sense applications:

- RDS - Managed relational database service as an alternative to a PostgreSQL repository database. Provides high availability without the same complexity.
- S3 - Simple Storage Service. Scalable, object-based cloud storage.
- Dynamo DB - NoSQL database service
- Elastic IP - remapping of IP addresses
- EMR - Elastic MapReduce. Managed Hadoop service
- Redshift - Data warehouse
- Cloud formation - for managing resources automatically

For more information about AWS services, see the Amazon AWS website.

Microsoft Windows versions

Your AWS instance needs to be running a Microsoft operating system onto which you can install a Qlik Sense instance. Qlik Sense supports the following Windows operating systems for an AWS deployment:
Planning your Qlik Sense Enterprise deployment

- Windows Server 2012
- Windows Server 2012 R2
- Windows Server 2016

Qlik Sense Enterprise
Install a single-node Qlik Sense server on your EC2 instance.

Qlik Sense Enterprise configuration:
Use the QMC to configure the following:

- Licensing
  - Tokens (only token-based license)
  - User access (token-based license) or Professional access (user-based license)
  - CPU cores
- Security groups

Create a proxy setup for allowing HTTP access.

Other considerations
When you deploy Qlik Sense to AWS for the first time you should also consider the following.

Security
To configure security on an AWS deployment you need a good understanding of how to set up AWS security groups, key pairs, and also security groups in Qlik Sense. You use the Amazon Management Console to configure AWS security and the QMC to configure all security and authentication settings in Qlik Sense Server.

For more information about security, see AWS and Azure security (page 85), and for more on Qlik Sense security, see Security (page 81)

Connectivity
AWS web services that you can use as data stores for Qlik Sense applications to retrieve data from when building applications:

- Amazon DynamoDB – NoSQL database
- Amazon RDS – managed relational database service
- Amazon Redshift – data warehouse as a service
- Amazon Simple Storage Service (S3) – scalable, object-based cloud storage
- AWS Elastic Map Reduce (EMR) – managed Hadoop service

In an AWS deployment you can use the following connectivity mechanisms to connect to different data sources:

- ODBC connection
- OLE DB connection
- REST API connection
- Native connector to a specific source

Connectivity scenarios:
2 Planning your Qlik Sense Enterprise deployment

- Qlik Sense instance that uses both data stored in Amazon RDS and Amazon Redshift.
- Qlik Sense instance that uses data coming from an AWS data source as well as a combination between flat files and web based data sources (i.e. a web service data feed).
- Hybrid Qlik Sense instance - uses data stored in AWS data sources as well as data stored on premise.

For more information about connectivity, see Connecting to data sources.

Scalability

As environments grow in terms of number of users, number and size of applications, number of data sources it is important to understand how to size the environment correctly and how to scale the environment accordingly. You need to create a multi-node environment to effectively scale up or down, by creating dedicated servers for different purposes. You can then allocate resources correctly across the following Qlik Sense services.

- Engine Service – The QIX engine, provides in-memory Associative Data Indexing and calculation supporting analysis.
- Proxy Service – Manages authentication, handles user sessions and load balancing.
- Repository Service – Manages Qlik Sense applications, controls access, and handles configuration.
- Scheduling Service – Manages reloads of Qlik Sense applications and other scheduled tasks.
- Service Dispatcher – Launch and manage the data profiling service for the data load model, migration service to make sure the app can run in the installed version of Qlik.

For more information about scalability, see the Qlik Sense Performance Benchmark technical brief.

AWS deployment example

AWS provides a cloud infrastructure with all the services and computing power you need to provide a reliable, cloud deployment platform for Qlik Sense that can performance, regardless of unexpected changes in demand, and concurrency.

Qlik Sense single-node deployment on AWS

Components in a typical Qlik Sense single-node deployment on AWS:

- VPC - Virtual Private Cloud. A logically isolated virtual network that shares a common security configuration that you define.
- Subnet - you need at least one subnet within the VPC. This could be a public, or private subnet.
- Public subnet - subnet with direct access to the internet.
- Private - a subnet that cannot be reached from the internet.
- RDS - Relational database service. Use this for the repository to provide high availability without the same complexity as a PostgreSQL database.
- NAT instance (optional) - restricts traffic to private subnets but allows outgoing traffic to the internet. For example, if an EC2 instance is launched inside the private network it can access the internet.
- Windows Server instance - deployed inside the default subnet to host your Qlik Sense installation.
- Security groups - act as a virtual firewall controlling which IP addresses can gain access to your instance. Use the Amazon Management Console to create a security group called Qlik Sense.
- Key pair - a Qlik Sense.pem file that you create and store locally. This file handles authentication when you connect to your AWS instance.
2 Planning your Qlik Sense Enterprise deployment

- IAM - Identity and Access Management. You need IAM to manage the fine-grained permissions required for access to different AWS services.
- Qlik Sense Server node - a single node deployed on Windows Server inside the default subnet.

Deployment options:

- Qlik Sense node in a public subnet with direct Internet access.
- Qlik Sense node in a private subnet without Internet access.

The decision whether to choose a public or private subnet in your deployment depends on your overall solution requirements.

The following example shows a complete Qlik Sense Enterprise, single node deployment on Amazon Virtual Private Cloud.

![Diagram of Qlik Sense Enterprise deployment on Amazon Virtual Private Cloud](image)

Azure deployment

In a Microsoft Azure deployment, you install Qlik Sense Enterprise on a Azure cloud infrastructure that is flexible, high performance, and is quick to set up.

Deploying Qlik Sense Enterprise on Azure will enable you to quickly add new applications in a simple, and scalable manner. You can do this with a basic knowledge of Azure security and scalability options but without the need to follow complex on-premise installation and configuration procedures. Using Azure will enable you to get your Qlik Sense infrastructure up and running in fraction of the time required for an on-premise deployment, and will enable you to scale your deployment quickly and easily, regardless of unexpected changes in demand.

You can deploy Qlik Sense to Azure manually, or you can use an Virtual Hard Disk (VHD) available in the Azure Marketplace that includes Qlik Sense preinstalled. However, predefined images do not include a file share, so can only support single node Qlik Sense deployments.
Benefits of using Microsoft Azure cloud
- A quick and effective way of deploying Qlik Sense to the cloud.
- Simple and cost-effective, reducing overall deployment times.
- Quick and easy to deploy Qlik Sense applications.
- Microsoft Server Message Block (SMB) 3.0 file system - This makes the Qlik Sense file share highly resilient to failures, and AWS does not offer a similar alternative.
- Scalable, reliable and high performance cloud platform.
- Microsoft security and networking functionality.
- Geographic deployment to multiple regions around the world makes lower latency possible.
- A reliable and high performance platform.

Components
To successfully deploy Qlik Sense on Azure cloud you need a basic understanding of the architecture, and services available in an Azure deployment. As part of a Qlik Sense deployment on Azure, you need the following components:
- Azure Virtual Machine
- Azure SMB 3.0 file system storage
- Azure Virtual Network
- Azure Resource Group
- Azure Resource Manager

Azure services
You should also have a basic understanding of other Azure services that you can use for managing resources and as data stores for your Qlik Sense applications:
- Azure Portal
- Azure Active Directory and Identity Management
- Azure SQL Database – SQL Server 2016 on the Cloud
- Azure SQL Data Warehouse – Enterprise level scale-out, massively parallel processing, highly scalable database for both relational and non-relational data.
- Azure Storage – scalable cloud storage (Blob Storage, Table Storage, Azure Queues and Azure Files)
- Azure HDInsight – elastic map reduce (Hadoop as Service)

For more information about Azure services, see the Microsoft Azure website.

Microsoft Windows versions
Your Azure instance needs to be running a Microsoft operating system onto which you can install a Qlik Sense instance. Qlik Sense supports the following Windows operating systems for an Azure deployment:
- Windows Server 2012
- Windows Server 2012 R2
- Windows Server 2016
2 Planning your Qlik Sense Enterprise deployment

Qlik Sense Enterprise
Install a single-node Qlik Sense server on your Azure instance.

Qlik Sense Enterprise configuration:
Use the QMC to configure the following:

- Licensing
  - Tokens (only token-based license)
  - User access (token-based license) or Professional access (user-based license)
  - CPU cores
- Security groups

Create a proxy setup for allowing HTTP access.

Other considerations
When you deploy Qlik Sense to Azure for the first time you should also consider the following.

Security
Use the Resource Manager to configure Azure security and the QMC to configure all security groups and authentication settings in Qlik Sense.

For more information about security, see AWS and Azure security (page 85), and for more on Qlik Sense security, see Security (page 81)

Connectivity
Qlik Sense applications can use the following Azure web services as data stores:

- Azure SQL Database – SQL Server 2016 on the Cloud
- Azure SQL Data Warehouse – enterprise level scale-out, massively parallel processing, highly scalable database for both, relational and non-relational data
- Azure Storage – scalable cloud storage (Blob Storage, Table Storage, Azure Queues and Azure Files)
- Azure HDInsight – elastic map reduce (Hadoop as Service)

In an Azure deployment you can use the following connectivity mechanisms to connect to different data sources:

- ODBC connection
- OLE DB connection
- REST API connection
- Native connector to a specific source

Connectivity scenarios:

- Qlik Sense instance that uses data stored in Azure SQL Database and Azure SQL Data Warehouse.
- Hybrid Qlik Sense instance - uses data stored in Azure data sources as well as data stored on premise.

For more information about connectivity, see Connecting to data sources.
2 Planning your Qlik Sense Enterprise deployment

Scalability and sizing
As your environment grows in terms of number of users, number and size of applications, and the number of data sources, it is important to understand how to size and scale your environment correctly. Resources need to be allocated correctly across the following Qlik Sense services:

- Engine Service – The QIX engine, provides in-memory Associative Data Indexing and calculation supporting analysis
- Proxy Service – Manages authentication, handles user sessions and load balancing
- Repository Service – Manages Qlik Sense applications, controls access, and handles configuration
- Scheduling Service – Manages reloads of Qlik Sense applications and other scheduled tasks
- Service Dispatcher – Launch and manage the data profiling service for data load model, migration service to make sure the app can run in the installed version of Qlik (runs on the central node only) and chart sharing between two users

For more information about scalability, see the Qlik Sense Performance Benchmark technical brief.

Azure deployment example
Microsoft Azure provides a cloud infrastructure with all the services and computing power you need to provide a reliable, cloud deployment platform for Qlik Sense that can performance, regardless of unexpected changes in demand, and concurrency.

Qlik Sense single-node deployment on Azure
Components in a typical Qlik Sense deployment on Azure:

- Azure Virtual Network (VNet) - a logically isolated area of the Azure cloud where you can launch Azure resources in a virtual network that you define.
- Subnet - you need at least one subnet (either public or private) within the Virtual Network. This could be a public or private subnet.
  - Public subnet - subnet with direct access to the internet.
  - Private - a subnet that cannot be reached from the internet.
- Virtual Machine - A Windows Server virtual machine instance deployed in the default subnet onto which you can install and configure your instance of Qlik Sense server.
- Resource Group/Resource Manager - enables you to deploy, manage, and monitor the different components in your Microsoft Azure solution as a group. This makes it easier to deploy, update or delete components in a single, coordinated operation using the Resource Manager.
- Network Security groups - a list of Access Control List (ACL) rules that allow or deny network traffic to the Virtual Machine instances in a Virtual Network.
- Azure Active Directory and Identity Management - depending on the expected administration of the environment, integration with Azure Active Directory and Identity Management may be needed to manage fine-grained permissions for access to various Azure services involved in the deployment process.
- Qlik Sense Server node - a single node deployed on Windows Server inside the default subnet.

Deployment options:
2 Planning your Qlik Sense Enterprise deployment

- Qlik Sense node in a public subnet with direct Internet access.
- Qlik Sense node in a private subnet without Internet access.

The decision whether to choose a public or private subnet in your deployment depends on your overall solution requirements.

The following example shows a complete Qlik Sense Enterprise, single node deployment on Azure Cloud.

![Diagram showing Qlik Sense Enterprise deployment on Azure Cloud]

Qlik Sense Enterprise on Kubernetes deployments

This diagram shows an example of a Qlik Sense Enterprise on Kubernetes deployment with a single Kubernetes cluster connected to a Qlik Sense Enterprise on Windows node. The cluster contains one or more of the Qlik Sense microservices such as the Engine or other services deployed across a set of nodes. This deployment provides the ability to scale up the number of apps (read only) for user consumption. The Kubernetes cluster, which is deployed within a public or private cloud, shares data volumes and a MongoDB instance. An Identity Provider (IdP) authenticates users while QSE authorizes access to multi-cloud apps using built-in security rules. The IdP allows the same named users to access content in Qlik Sense Enterprise and the cloud environment, subject to security rules. The Kubernetes cluster, public or private cloud, and network infrastructure are all managed by the customer.
Qlik Cloud Services deployment

This diagram shows Qlik Cloud Services (QCS) connected to a Qlik Sense Enterprise node. This deployment provides the ability to scale up the number of apps (read only) for user consumption. The QCS cluster is deployed as a fully-managed service provisioned and administered by Qlik.
2.5  Qlik product licenses

Here is a summary of the license options that are available for the different Qlik Sense related products. Licensing allows you to manage the usage of the Qlik Sense software in your organization.

For detailed information on Qlik Sense licensing options, see Qlik’s legal terms, product terms, and Licensing Service Reference Guide:

- [Qlik Legal Terms](#)
- [Qlik Product Terms](#)
- [Qlik Licensing Service Reference Guide](#)

**Unified license**

As of the April 2019 releases of Qlik Sense and QlikView, Qlik Sense customers can use a unified license in multiple deployments. A unified license shares the same signed key between:

- multiple Qlik Sense Enterprise deployments
- multiple QlikView Server deployments
- QlikView Server and Qlik Sense Enterprise deployments

Applying the same signed key to multiple deployments lets you share the same users and access types. Users can access all connected deployments using the same Professional or Analyzer access allocation.
Qlik Sense Enterprise

Qlik Sense Enterprise is the server version of Qlik Sense that you can deploy on a single node, or on multiple nodes. Qlik Sense Enterprise deployments are licensed via a serial and control number, or a signed key. Your Qlik Sense Enterprise license is based either on access types, or on tokens.

Access types license

Access types licenses are the Professional and Analyzer Users licenses (user-based) and Analyzer Capacity licenses (capacity-based). These licenses can be combined. These licenses can be perpetual or subscription based. A Professional and Analyzer Users license can be activated using a serial and control number (LEF based licenses), or with a signed key. You must use a license with a signed key if you are licensing analyzer capacity access.

After changing to a license with a signed key, you cannot return to using the old LEF based license model.

Token license

You use tokens to allocate access passes to users so that they can access Qlik Sense. The License Enabler File (LEF) determines the number of tokens that you can allocate to different access passes. A user without an access pass cannot access apps.

With a Qlik Sense Token license you use tokens to allocate access passes to users. You can allocate user access and login access.

The token license is available only to customers with existing Qlik Sense Token licenses.

Core-based site license

Qlik Sense Enterprise core-based sites are licensed based on the number of CPU cores on which the software will operate. A Core means a single processing unit within a processor or CPU, whether physical or virtual, including a vCPU or virtual core, which is capable of executing a single software thread at a time.

Qlik Sense Desktop

Qlik Sense Desktop is a free version of Qlik Sense that you can download on your computer, see www.qlik.com. To download Qlik Sense Desktop, you are required to create a Qlik account, and accept the Qlik Sense Desktop license agreement. In addition, when you install the software, you need to accept the software license agreement.

For a comparison between Qlik Sense and Qlik Sense Desktop, see Comparing versions of Qlik Sense.
2 Planning your Qlik Sense Enterprise deployment

Qlik DataMarket

Qlik DataMarket offers a collection of up-to-date data from external sources accessible directly from within Qlik Sense. The available data includes current and historical weather and demographic data, currency exchange rates, as well as business, economic, and societal data.

Qlik DataMarket has two license options, one free and one licensed. The free option gives you access to a limited data set. The licensed option gives you access to premium data packages. You activate the license in the same way as for Qlik Sense Enterprise by entering owner information, serial number, and control number.

For detailed instructions on how to apply a Qlik DataMarket license, see: Activating the Qlik DataMarket license.

It is not necessary to accept Qlik DataMarket terms and conditions when using Qlik Sense Desktop. Access credentials are also not required because the premium data sets are not available on Qlik Sense Desktop.

Qlik NPrinting

You can install and configure Qlik NPrinting to connect to QlikView documents or Qlik Sense apps. The licensing requirements and procedures are different depending on if you connect Qlik NPrinting to QlikView or Qlik Sense.

Qlik NPrinting versions 16.0.0.0 and later are licensed by a LEF. If you are using an earlier version of Qlik NPrinting, we suggest that you upgrade to Qlik NPrinting versions 16.0.0.0 or later.

For details regarding licensing Qlik NPrinting with QlikView, QlikView Desktop, and Qlik Sense, see Licensing Qlik NPrinting.

A Qlik Sense token is not required for the Qlik NPrinting service account. However, because you often perform troubleshooting within the Qlik NPrinting service account, it is helpful to assign a token to the Qlik NPrinting service account so that it has access to the Qlik Sense hub.

Qlik Sense Licenses

Qlik Sense Enterprise is the server version of Qlik Sense that you can deploy on a single node, or on multiple nodes. Qlik Sense Enterprise licenses are based either on access types, or on tokens.

For detailed information on Qlik Sense licensing options, read Qlik's legal terms, product terms, and Licensing Service Reference Guide:

- Qlik Legal Terms
- Qlik Product Terms
- Qlik Licensing Service Reference Guide
2 Planning your Qlik Sense Enterprise deployment

If you want to set up Qlik Cloud Services or Qlik Sense Enterprise on Kubernetes, please contact your Qlik representative or Qlik Support to obtain a valid license for the setup.

Unified license
As of the April 2019 releases of Qlik Sense and QlikView, Qlik Sense customers can use a unified license in multiple deployments. A unified license shares the same signed key between:

- multiple Qlik Sense Enterprise deployments
- multiple QlikView Server deployments
- QlikView Server and Qlik Sense Enterprise deployments

Applying the same signed key to multiple deployments lets you share the same users and access types. Users can access all connected deployments using the same Professional or Analyzer access allocation.

Qlik Sense Enterprise
A Qlik Sense Enterprise deployment can be licensed using two different models: the serial and control number and the signed license key. The License Enabler File (LEF) defines the terms of your license and the access types that you can allocate to users. Your Qlik Sense Enterprise license is based either on access types, or on tokens. A core-based license is also available.

User-based and capacity-based licenses
A user-based license grants a predefined number of access allocations that can be assigned to unique and identified users. In Qlik Sense Enterprise, user-based licenses are either Professional and Analyzer Users licenses, or User access passes allocated with a Token license.

A capacity-based license grants a predefined number of time allocations for accessing Qlik Sense Enterprise that can be used by identified or anonymous users. In Qlik Sense, capacity-based licenses are either based on Analyzer Capacity access, or Login access pass allocated with a Token license.

Access types license
Access types licenses are the Professional and Analyzer Users licenses (user-based) and Analyzer Capacity licenses (capacity-based). These licenses can be combined. These licenses can be perpetual or subscription based. A Professional and Analyzer Users license can be activated using a serial and control number or with a signed key. You must use a license with a signed key if you are licensing analyzer capacity access.

After changing to a license with a signed key, you cannot return to using the old serial and control number license model.

Professional and Analyzer Users license
A Professional and Analyzer Users license is composed of Professional and Analyzer access types.

- Professional access (user-based) is allocated to an identified user to allow the user to access streams and apps within a Qlik Sense site. The professional access is intended for users who need access to all features
in a Qlik Sense installation. A user with professional access can create, edit, and publish sheets or apps, and make full use of the available features, including administration of a Qlik Sense site.

- Analyzer access is allocated to an identified user to allow the user to access streams and apps in the hub. The analyzer access is intended for users who consume sheets and apps created by others. A user with analyzer access cannot create, edit, or publish sheets or apps, but can create and publish stories, bookmarks and snapshots based on data in apps. The user can also create bookmarks, print objects, stories, and sheets, and export data from an object to Excel.

**Analyzer Capacity license**

An Analyzer Capacity license is composed of Analyzer Capacity access type.

- Analyzer capacity is a consumption-based license type, which is similar to analyzer access regarding available features. Users can access streams and apps in the hub and consume sheets and apps created by others. Analyzer capacity access allows users to create and publish stories, bookmarks, and snapshots based on data in apps. Creating, editing, or publishing sheets or apps is not possible. With an analyzer capacity license, you subscribe to analyzer time, a defined amount of minutes per month (calendar date). These minutes are shared between users and can be consumed by anyone who is part of the user group, including anonymous users. Consumption is measured in units of 6 minutes. For each new 6-minute period, a unit is consumed.

**Dynamic access assignment**

Dynamic access assignment is available for Qlik Sense Enterprise on Kubernetes and Qlik Sense Enterprise on Cloud Services deployments and is managed in the management console.

See: [Management console](#)

To simplify assignment of access to users, you can enable dynamic assignment. Choose between four options:

- Dynamic assignment enabled for both professional and analyzer access:
  Professional access is assigned, if available, otherwise analyzer access. If neither of those are available, analyzer capacity is assigned, if available.

- Dynamic assignment enabled only for professional access:
  Professional access is assigned, if available, otherwise analyzer capacity is assigned, if available.

- Dynamic assignment enabled only for analyzer access:
  Analyzer access is assigned, if available, otherwise analyzer capacity is assigned, if available.

- Dynamic assignment disabled for both professional and analyzer access:
  Analyzer capacity access is assigned, if available.

You can upgrade from analyzer access to professional access, but not downgrade from professional to analyzer.

If you change to a new license key, all your assignments are removed, because they are associated with the license, not the tenant. However, if you start using the old license key again, the assignments will be present.

**Token license**

You use tokens to allocate access passes to users so that they can access Qlik Sense. The License Enabler File (LEF) determines the number of tokens that you can allocate to different access passes. A user without an access pass cannot access apps.
There are two types of access passes that can be allocated using tokens:

- User access pass (user-based) is assigned to unique and identified users allowing them unlimited access to apps, streams, and other resources.
- Login access pass (capacity-based) allocates a block of passes to a group for infrequent or anonymous access. Allows full access for a limited period.

When you allocate tokens, the number of available tokens is reduced. Each access type costs a certain number of tokens, and if the token balance is zero or insufficient, you cannot allocate more to the access types. You can free up tokens and choose to use the tokens differently. The number of tokens for the Qlik Sense site can be increased or decreased by activating a new license.

For more information on access passes and the token consumption model, see Managing licenses.

Core-based site license

Qlik Sense Enterprise core-based sites are licensed based on the number of CPU cores on which the software will operate. The license is administered using a License Enabler File (LEF), which limits the maximum number of cores on which the Qlik associative engine and its components may operate. A Core means a single processing unit within a processor or CPU, whether physical or virtual, including a vCPU or virtual core, which is capable of executing a single software thread at a time.

License Enabler File

In Qlik Sense there are two alternative license models: the serial and control number and the signed license key. The License Enabler File (LEF) defines the terms of your license and the access types that you can allocate to users.

When licensing Qlik Sense using a serial and control number, the LEF can be downloaded when the serial number and the control number have been entered in the Qlik Management Console (QMC). The LEF can also be pasted directly into the QMC, if, for example, no network connection is available. There are two license types that can be activated using a serial and control number: Professional and Analyzer Users licenses, and Qlik Token licenses.

When licensing Qlik Sense using a signed key, the LEF file is stored in the License Backend.

For a complete overview on licenses, see: Qlik Sense Licenses (page 38)

If you want to set up Qlik Cloud Services or Qlik Sense Enterprise on Kubernetes, please contact your Qlik representative or Qlik Support to obtain a valid license for the setup.

Professional and Analyzer Users license

Professional and Analyzer Users licenses grant a predefined number Professional and Analyzer (user-based) access type allocations. The LEF file determines the allocation of the access types.
2 Planning your Qlik Sense Enterprise deployment

Analyzer Capacity licenses (capacity based) can only be licensed using a signed key. When combining professional, analyzer, and analyzer capacity access types in the same Qlik Sense Enterprise installation, you must license it using a signed key.

Token license
You use tokens to allocate access passes to users so that they can access Qlik Sense. The License Enabler File (LEF) determines the number of tokens that you can allocate, and holds the number of tokens available for the central node in a site. This means that a Qlik Sense site needs at least one (1) LEF. A user without an access pass cannot access apps.

The token license is available only to customers with existing Qlik Sense Token licenses.

You cannot use QlikView CAL-based licenses with Qlik Sense as the tokens are not compatible with the Client Access Licenses (CALs) used in QlikView.

Increase in tokens
When the number of tokens in the LEF increases (for example, when buying additional tokens), the new tokens are added to the pool of unallocated tokens that can be used to allocate access passes that allow users to access Qlik Sense.

Decrease in tokens
When the number of tokens in the LEF decreases, the following happens:

1. Unallocated tokens are removed.
2. If step 1 is not enough to meet the decreased number of tokens in the LEF, any tokens that are freed up by removal of access passes cannot be used for new allocations until the number of allocated tokens is below the new number set in the LEF.

Access assignment
Qlik Sense Enterprise licenses are based either on access types, or on tokens. Depending on your license, you can allocate either access types or access passes to users, to allow them to access Qlik Sense.

- Access types licenses are the Professional and Analyzer Users licenses (user-based) and Analyzer Capacity licenses (capacity-based).
  - With a Professional and Analyzer Users license you can allocate professional access and analyzer access.
  - With an Analyzer Capacity license you can allocate analyzer capacity access, where consumption is time based (analyzer time).
- With a Qlik Sense Token license you use tokens to allocate access passes to users. You can allocate user access and login access.
2 Planning your Qlik Sense Enterprise deployment

Access types

Professional and Analyzer Users licenses and Analyzer Capacity licenses grant a predefined number of access allocations. The License Enabler File (LEF) defines the terms of your license and the access types that you can allocate to users. You must use a license with a signed key if you are licensing analyzer capacity access.

Professional access

Professional access is allocated to an identified user to allow the user to access streams and apps within a Qlik Sense site. The professional access is intended for users who need access to all features in a Qlik Sense installation. A user with professional access can create, edit, and publish sheets or apps, and make full use of the available features, including administration of a Qlik Sense site.

For Qlik Sense installations licensed with a serial and control number, if you remove professional access allocation from a user, the access type is put in quarantine, if it has been used within the last seven days. If it has not been used within the last seven days, the professional access is released immediately. You can reinstate quarantined professional access, to the same user, within seven days.

Quarantine is not applicable for Qlik Sense installations licensed using a signed key.

The maximum number of parallel user connections for a single user of this type of access pass is five (5). If you use a license with a signed license key, accessing the QMC also counts and adds to the maximum number of parallel sessions, which is five. To avoid unnecessary session consumption, the root admin should not be allocated any type of access.

When a user with the maximum number of parallel user connections ends a connection (for example, by logging out) five minutes must pass before the user can use the access pass to add another connection (for example, by logging in).

Analyzer access

Analyzer access is allocated to an identified user to allow the user to access streams and apps in the hub. The analyzer access is intended for users who consume sheets and apps created by others. A user with analyzer access cannot create, edit, or publish sheets or apps, but can create and publish stories, bookmarks and snapshots based on data in apps. The user can also create bookmarks, print objects, stories, and sheets, and export data from an object to Excel.

For Qlik Sense installations licensed with a serial and control number, if you remove analyzer access allocation from a user, the access type is put in quarantine, if it has been used within the last seven days. If it has not been used within the last seven days, the analyzer access is released immediately. You can reinstate quarantined analyzer access, to the same user, within seven days.

Quarantine is not applicable for Qlik Sense installations licensed using a signed key.

The maximum number of parallel user connections for a single user of this type of access pass is five (5). When a user with the maximum number of parallel user connections ends a connection (for example, by logging out) five minutes must pass before the user can use the access pass to add another connection (for example, by logging in).
Analyzer capacity access

Analyzer capacity is a consumption-based license type, which is similar to analyzer access regarding available features. Users can access streams and apps in the hub and consume sheets and apps created by others. Analyzer capacity access allows users to create and publish stories, bookmarks, and snapshots based on data in apps. Creating, editing, or publishing sheets or apps is not possible.

With an analyzer capacity license, you subscribe to analyzer time, a defined amount of minutes per month (calendar date). These minutes are shared between users and can be consumed by anyone who is part of the user group, including anonymous users. Consumption is measured in units of 6 minutes. For each new 6-minute period, a unit is consumed.

Access passes

With a Qlik Sense Token license you use tokens to allocate access passes to users. The License Enabler File (LEF) determines the number of tokens that you can allocate to different access passes. A user without an access pass cannot access apps.

User access pass

This type of access pass allows a unique and identified user to access the hub.

The access pass is valid within an entire Qlik Sense site. For example, if a user first connects to a node in the USA and then, at a later stage, connects to a node in the UK, the user consumes the same access pass, if the two nodes are connected to the same central node.

See: Architecture (page 52)

The maximum number of parallel user connections for a single user of this type of access pass is five (5). When a user with the maximum number of parallel user connections ends a connection (for example, by logging out) five minutes must pass before the user can use the access pass to add another connection (for example, by logging in).

One (1) token corresponds to one (1) access pass. The access passes are allocated using the Qlik Management Console (QMC).

You can have both a user access pass and the possibility to consume login access passes. If you have five active sessions, opening an additional session will consume from your login access passes.

Removing user access pass allocation

When a user access pass is removed, it enters a quarantine for seven (7) days, counting from the last time that the access pass was used. For example, if the access pass is used on January 10, the tokens used to allocate the access pass are not available for new allocations until January 18. During the quarantine period, the original allocation of the access pass can be reinstated, which means that the quarantine period ends and the user can start using the access pass again.
Login access pass

This type of access pass allows an identified or anonymous user to access the hub for a maximum of 60 continuous minutes per 28-day period. If the user exceeds the 60 minutes time limitation, the user connection does not time out. Instead, another login access pass is used. If no more login access passes are available, the user connection is discontinued.

- If an identified user is disconnected, the user can re-connect and continue to use the same access pass, if re-connecting within the 60 minutes.
- If an anonymous user is disconnected, the user gets a new access pass when re-connecting.

The login access pass tracks the number of logins and runs over 28 days. For example, if 1000 logins are assigned to Group A, the users in Group A can use 1000 logins over 28 days. If 100 logins are consumed on Day 1, the 100 logins are available again on Day 29.

The maximum number of parallel user connections for a single user of this type of access pass is five (5). Note that this only applies to identified users. An anonymous user can only have one (1) user connection. When a user with the maximum number of parallel user connections ends a connection (for example, by logging out) five minutes must pass before the user can use the access pass to add another connection (for example, by logging in). However, a user can have more connections than allowed by a single access pass by consuming additional access passes.

One (1) token corresponds to ten (10) access passes. The access passes are allocated using login access groups in the QMC.

App reloads will extend the session and consume access passes also when the app is not actively used. If a browser page is open with an app, app reloads will result in additional access pass consumption.

Removing login access pass allocation

When a login access group is removed, the tokens used to allocate the access pass become available in accordance to the following procedure:

1. For every ten (10) unused login access passes, one (1) token is freed up.

2. For every ten (10) login access passes that leave the used state after the period specified in the Access assignment (page 42) section above has passed, one (1) token is freed up.
3  Deploying Qlik Sense Enterprise on Windows

Deploying Qlik Sense Enterprise on Windows consists of the following workflow items.

3.1  Before you install Qlik Sense Enterprise on Windows

To successfully plan and prepare for your Qlik Sense deployment, do the following:

System requirements for Qlik Sense
Check that your environment fulfills the system requirements.

Ports
Check that the required ports are available on your system.

Supported browsers
Check that your browsers are supported.

Architecture
Understand the Qlik Sense architecture, and the different node types.

Persistence
Understand the persistence model used by Qlik Sense.

Services
Understand the Qlik Sense services.

User accounts
Understand and set up the various user accounts required to install and run the Qlik Sense services.

If you intend to run Qlik Sense services as a user without administrator privileges, some additional configuration steps are required.

File share
Create a file share to store your Qlik Sense application data.

Security
Understand how Qlik Sense uses certificates for security. Certificates are installed by default.

Licensing Qlik Sense
Understand how Qlik Sense uses license keys and LEF for site licensing.

Understand how Qlik Sense uses tokens for user access allocation (token-based licensing).
3 Deploying Qlik Sense Enterprise on Windows

Ensure that you have your Qlik Sense license key available.

Qlik Sense installation
Once you have reviewed and completed these items, you are ready to install Qlik Sense.

System requirements for Qlik Sense Enterprise on Windows
This section lists the requirements that must be fulfilled by the target system in order to successfully install and run Qlik Sense Enterprise on Windows.

Qlik Sense Enterprise on Windows

| Platforms | • Microsoft Windows Server 2012 R2  
|          | • Microsoft Windows Server 2016  
|          | • Microsoft Windows Server 2019  
|          | For development and testing purposes only:  
|          | • Microsoft Windows 8.1 (64-bit version only)  
|          | • Microsoft Windows 10 (64-bit version only)  
|          | These operating systems are supported by Qlik Sense. Third-party software may require service packs to be installed. |
| Processors (CPUs) | Multi-core x64 compatible processors  
|                  | We recommend that you use at least 4 cores per node in a Qlik Analytics Platform deployment.  
| Memory | 8 GB minimum (depending on data volumes, more may be required)  
|        | Qlik Sense is an in-memory analysis technology. The memory requirements for the Qlik Sense products are directly related to the amount of data being analyzed.  
| Disk space | 5.0 GB total required to install  
| Storage | • A network file share is required for the storage to be accessible by all servers in the site. In case of a single-server deployment, local disk storage may be sufficient.  
|         | • Sufficient storage is required for the volume of apps and content used in the deployment.  
|         | Qlik periodically runs network file share performance tests on Qlik Sense using WinShare, and FreeNAS with SMB 3.0. For more information on network file share solutions, contact your Qlik representative. |
## 3 Deploying Qlik Sense Enterprise on Windows

| **Security** | • Microsoft Active Directory  
• Microsoft Windows Integrated Authentication  
• Third-party security |
| **WebSockets** | Web browsers and infrastructure components (such as proxies and routers) must support WebSockets. |
| **.NET framework** | 4.5.2 or higher |
| **PowerShell** | 4.0 or higher |
| **Repository database** | PostgreSQL 9.6.x |
| **Centralized logging database** | PostgreSQL is included in the Qlik Sense setup by default. However, you can also download and install it manually. |

The version of PostgreSQL 9.6.x installed with Qlik Sense does not include pgAdmin tools. You can download and install them manually if required.

PostgreSQL is an open source object-relational database management system. It is released under the PostgreSQL license, which is a free and open source software license.

| **Internet protocol** | • IPv4  
• IPv6  
• Dual stack (IPv4 and IPv6) |
| **Network** | The configured hostname must resolve to an IP address on the host machine. |
### 3 Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Qlik Management Console (QMC), supported browsers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Microsoft Windows 8.1:</strong></td>
</tr>
<tr>
<td>• Microsoft Internet Explorer 11</td>
</tr>
<tr>
<td>• Google Chrome</td>
</tr>
<tr>
<td>• Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)</td>
</tr>
<tr>
<td><strong>Microsoft Windows Server 2012, Windows Server 2012 R2, Windows Server 2016:</strong></td>
</tr>
<tr>
<td>• Microsoft Internet Explorer 11 (not supported on Windows Server 2012)</td>
</tr>
<tr>
<td>• Google Chrome</td>
</tr>
<tr>
<td>• Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)</td>
</tr>
<tr>
<td><strong>Microsoft Windows 10:</strong></td>
</tr>
<tr>
<td>• Microsoft Internet Explorer 11</td>
</tr>
<tr>
<td>• Microsoft Edge</td>
</tr>
<tr>
<td>• Google Chrome</td>
</tr>
<tr>
<td>• Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)</td>
</tr>
<tr>
<td><strong>Apple Mac OS X 10.11 and 10.12:</strong></td>
</tr>
<tr>
<td>• Apple Safari</td>
</tr>
<tr>
<td>• Google Chrome</td>
</tr>
<tr>
<td>• Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)</td>
</tr>
<tr>
<td><strong>CefSharp embedded browser v55 or later</strong> (CefSharp allows you to embed the Chromium open source browser inside .Net apps)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>QMC, minimum screen resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Desktops, laptops, and Apple Mac:</strong> 1024x768</td>
</tr>
<tr>
<td>No mobile or small screen support.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>QlikView compatibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is not possible to install Qlik Sense on a machine with QlikView Server already installed.</td>
</tr>
</tbody>
</table>

*We do not recommend that you install Qlik Sense on domain controller machines, as group policies may prevent Qlik Sense from getting access to required services.*

**Supported browsers Qlik Sense Enterprise on Windows**

Qlik Sense is designed to work on the platform and web browser combinations described in this section, using default browser settings.
Each Qlik Sense release is tested for compatibility with the latest publicly available browser versions. Due to the frequency of browser version updates, Qlik does not include specific browser version numbers in the system requirements.

Each Qlik Sense release is compatible with and supported on the latest iOS versions that are publicly available at the time of the Qlik Sense release. Due to the frequency of iOS version updates, Qlik does not include specific iOS version numbers in the system requirements.

Improving performance in Internet Explorer

Qlik Sense connects to your browser using WebSockets. Each new tab that you open uses additional WebSocket connections. By default, Internet Explorer 11 limits the number of Websocket connections to 6 per Internet Explorer session. This can limit your ability to open new tabs or configuration windows.

Your Windows administrator can change this setting using the Local Group Policy Editor. The setting is available under Administrative Templates > Windows Components > Internet Explorer > Security Features > AJAX > Set the maximum number of WebSocket connections per server. Only your system administrator should change this configuration.

You can also open apps in new Internet Explorer sessions, instead of new tabs. If an app will not open in a new tab, copy the url from the address bar in the Internet Explorer tab. Select File > New Session from the Internet Explorer top menu. Paste the url in the address bar, and then press Enter. The app opens in the Internet Explorer new session window.

Qlik Management Console (QMC)

Microsoft Windows 8.1

- Microsoft Internet Explorer 11
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)

Microsoft Windows Server 2012 R2, 2016, 2019

- Microsoft Internet Explorer 11
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)

Microsoft Windows 10

- Microsoft Internet Explorer 11
- Microsoft Edge
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)

Apple Mac OS X 10.11 and 10.12

- Apple Safari 10 or later
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)
3 Deploying Qlik Sense Enterprise on Windows

CefSharp embedded browser v55 or later (CefSharp allows you to embed the Chromium open source browser inside .Net apps)

Minimum screen resolution for desktops, laptops, and Apple Mac is 1024x768. The QMC does not support tablets or iPads.

Qlik Sense (the hub)

Microsoft Windows 7
- Microsoft Internet Explorer 11
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)

Microsoft Windows 8.1
- Microsoft Internet Explorer 11
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)

Microsoft Windows 10
- Microsoft Edge
- Microsoft Internet Explorer 11
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)

Apple Mac OS X 10.11 and 10.12
- Apple Safari 10 or later
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments).

Microsoft Windows Server 2012 R2
- Microsoft Internet Explorer 11
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)

Microsoft Windows Server 2016
- Microsoft Internet Explorer 11
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)

CefSharp embedded browser v55 or later (CefSharp allows you to embed the Chromium open source browser inside .Net apps)
3 Deploying Qlik Sense Enterprise on Windows

Microsoft Windows Server 2019
- Microsoft Internet Explorer 11
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)

CefSharp embedded browser v55 or later (CefSharp allows you to embed the Chromium open source browser inside .Net apps)

iOS
Version 11.2 or later (script editing is not supported on tablet devices).

Qlik Sense version: Qlik Sense Enterprise September 2017 or later.

Supported devices:
- iPad Air or later
- iPhone 5S or later

Supported browsers:
- Apple Safari
- Google Chrome
- VMware browser (using AirWatch per-app VPN)
- BlackBerry Access 2.9.1 or later (using BlackBerry Dynamics platform)

iOS 11.3 is required for using BlackBerry Access browser.

Android
Version 6.0, 7.1, 8.1 and 9.0 (script editing is not supported on tablet devices):
- Google Chrome
- BlackBerry Access 2.9.1 or later (using BlackBerry Dynamics platform)

Windows 10 phone
- Microsoft Edge

Minimum screen resolution for desktops and laptops is 1024x768; tablets is 1024x768; small screens is 320x568.

Architecture
The Qlik Sense architecture consists of one or more nodes. Each node runs some or all of the software services that perform specific roles in a Qlik Sense site. You can distribute services across nodes for better performance and scalability. The architecture is flexible enough to suit the needs of most organizations, and can vary from small, single-server sites to large, multi-server installations.
A multi-node, distributed architecture offers the most flexibility, consisting of multiple nodes that together form a scalable and high performance site. You define a central node as the main point of control.

Sites
A Qlik Sense site is a collection of one or more nodes (servers) connected to a single repository database, and sharing a single license. Each site also contains a common set of data in the form of apps and configuration data.

Single-node sites
A single node site is the smallest site possible and consists of a single node (single server), which is also the central node of the site. It contains the Qlik Sense services, the repository database, and the file share all on a one server computer.

Multi-node sites
Multi-node sites offer more scalability options for larger organizations. In a multi-node environment, the Qlik Sense site is distributed across two or more nodes that share the same set of data and the same license key. In larger sites, you can configure one or more rim nodes to improve scalability, capacity, and resilience. All rim nodes connect to a central node.

Benefits of multi-node sites include:

- Better scalability, making it easier to increase capacity
- Improved resilience and reliability
- Ability to move apps or roles to specific nodes
- Flexibility to suit customer network deployments

Nodes
A node is a computer that performs a specific role in your Qlik Sense site. You can configure each node to run or combine a different set of Qlik Sense services, so that each node performs a specific role.

Typical node roles:

- Consumer or user node - delivers apps to end users
- Scheduler node - handles all app reloads
- Proxy node - manages authentication, session handling, and load balancing

You can also configure your site for failover so that it is not dependent on the central node. In this case, if there is a failure, then one of the rim nodes in the site becomes the central node. For more information on how to configure fail over, see Creating a node and Service cluster.

A typical multi-server Qlik Sense site consists of two main types of nodes:

- Central node - the minimum configuration. Every site includes a central node.
- Rim node - you can configure rim nodes to perform different roles in your site.

Each node in a Qlik Sense site can:

- Perform different roles
- Deploy a set of Qlik Sense services
3 Deploying Qlik Sense Enterprise on Windows

- Operate independently

You assign a purpose to each node depending on what you think it will be used for:

- Production
- Development
- Both

For more information on node purpose, see: Creating a node.

Configuring Qlik Sense nodes correctly increases system resilience, reduces the need for maintenance, and increases deployment flexibility.

Storage

Qlik Sense uses the following default storage.

Repository database

A PostgreSQL database that contains the Qlik Sense app metadata, including the paths to the binary files in the file share. This data is referred to as entity data and is usually small in size. The PostgreSQL database can be installed locally or on a remote server and must be accessible to the central node.

File share

A file share is used to store app data as binary files and must be accessible to all nodes in your Qlik Sense site. The file share stores application objects, such as visualizations, and dimensions and measures. Apps are stored in the proprietary QVF portable format, for example <App name>.qvf. These files are referred to as binary data and the data model element of the files can be large in size.

You can create a file share either on the same server as the central node or on another server.

See: Creating a file share (page 111)

Clients

You use Qlik Sense clients to communicate and interact with Qlik Sense sites.

Hub

The hub is where you find all the apps you have access rights to. It runs in a web browser. You use the hub to access and publish apps in Qlik Sense. Hub traffic only travels between the node (delivering apps) and the hub client unless the site is on a single node.

Qlik Management Console

You use the Qlik Management Console (QMC) to configure and administer a Qlik Sense site.

The QMC only communicates logically with the central node. This means that:

- The QMC always uses the Qlik Sense Proxy Service (QPS) on the central node.
- For maximum performance within a multi-node site, you should not allow any user traffic on the central node.
Apps
A Qlik Sense app is a collection of reusable data items (measures, dimensions, and visualizations), sheets, and stories. It is a self-contained entity that includes the data you want to analyze in a structured data model.

In Qlik Sense, the term app is equivalent to the term document in QlikView.

Services
The Qlik Sense services run as Microsoft Windows services, which you can deploy on a single server or on separate server nodes that have dedicated roles in a Qlik Sense site. For example, you could deploy a scheduler node that only runs the scheduler service and manages the reloads of apps.

The Qlik Sense services are as follows.

Qlik Sense Repository Service (QRS)
Required by all Qlik Sense services to run and serve apps, and connects to the repository database. The Qlik Sense Repository Service manages persistence, licensing, security, and service configuration data. The QRS is needed by all other Qlik Sense services to run and serve apps. In a multi-node site, one instance of the Qlik Sense Repository Service (QRS) runs on each node, connecting it to the shared repository database.

In addition, the QRS stores the app structures and the paths to the binary files. The app data is stored as .qvf files in the file share.

Paths
The following table lists the paths used by the Qlik Sense Repository Service (QRS).

<table>
<thead>
<tr>
<th>Executable</th>
<th>%ProgramFiles%\Qlik\Sense\Repository\Repository.exe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data</td>
<td>%ProgramData%\Qlik\Sense\Repository</td>
</tr>
<tr>
<td>Logs</td>
<td>%ProgramData%\Qlik\Sense\Log\Repository</td>
</tr>
<tr>
<td></td>
<td>See: Logging (page 202)</td>
</tr>
<tr>
<td>Repository database</td>
<td>In a default Qlik Sense installation, the repository database is an instance of PostgreSQL installed locally that runs its own database cluster specifically for the repository. All files related to the repository database in a default Qlik Sense installation are stored in the following folder: %ProgramData%\Qlik\Sense\Repository\PostgreSQL</td>
</tr>
</tbody>
</table>

Bootstrap mode
You can use the following parameters to start the Qlik Sense Repository Service in bootstrap mode when you need to deploy Qlik Sense with a service account that does not have administrator privileges.

See: Changing the user account to run Qlik Sense services (page 122)
3 Deploying Qlik Sense Enterprise on Windows

- **-bootstrap**
  Use this parameter to start Qlik Sense Repository Service in bootstrap mode.

- **-bootstrap=install**
  Use this parameter to start Qlik Sense Repository Service in bootstrap mode when installing.

- **-bootstrap=uninstall**
  Use this parameter when uninstalling Qlik Sense.

- **-iscentral**
  Use this flag in addition to the bootstrap flag when installing or configuring a central node.

Do the following:

1. Stop all Qlik Sense services except Qlik Sense Repository Database.
2. Run repository.exe -bootstrap from an elevated command prompt.
3. Start Qlik Sense services.

**Metrics**

This section lists the metrics related to the Qlik Sense Repository Service (QRS).

**Selecting the metrics to display (page 64)**

**REST API metrics**

The following metrics are available in the Performance Monitor in Microsoft Windows:

- Number of DELETE calls
- Number of GET calls
- Number of POST calls
- Number of PUT calls
- Number of HTTP status 200 (OK)
- Number of HTTP status 201 (Created)
- Number of HTTP status 400 (Bad request)
- Number of HTTP status 401 (Unauthorized)
- Number of HTTP status 403 (Forbidden)
- Number of HTTP status 406 (Not acceptable)
- Number of HTTP status 409 (Conflict)
- Number of HTTP status 415 (Unsupported media type)

By default, when you are running Qlik Sense with an administrator account, bootstrap is executed each time the Qlik Sense services are restarted. To disable automatic bootstrap in the Qlik Sense repository, you must update the configuration file. By default, the Repository.exe.config file can be found in C:\Program Files\Qlik\Sense\Repository\ on your Qlik Sense machine. Edit the configuration file and change the value of the disableAutomaticBootstrap key to true. Restart the Qlik Sense Repository Service using the Windows Services application to enable this new configuration.
Number of HTTP status 500 (Internal server error)
Number of HTTP status 503 (Service unavailable)

Qlik Sense Repository Database (QRD)
In a default Qlik Sense installation, the Qlik Sense Repository Service (QRS) uses the Qlik Sense Repository Database (QRD) service to read and write data in the repository database. By default a PostgreSQL database is installed locally with your Qlik Sense installation otherwise you can choose to install PostgreSQL on a separate dedicated server.

Paths
The following table lists the paths used by the Qlik Sense Repository Database (QRD) service.

<table>
<thead>
<tr>
<th>Executable</th>
<th>Data</th>
<th>Logs</th>
</tr>
</thead>
<tbody>
<tr>
<td>In a default Qlik Sense installation, the repository database is an instance of PostgreSQL that creates its own database cluster. The following folder contains the contains the PostgreSQL executable file for the QRD: %ProgramFiles%\Qlik\Sense\Repository\PostgreSQL&amp;lt;database version&gt;\bin</td>
<td>%ProgramData%\Qlik\Sense\Repository\PostgreSQL</td>
<td>There are no logs for the QRD service. Instead see the PostgreSQL log files.</td>
</tr>
</tbody>
</table>

Qlik Sense Proxy Service (QPS)
The Qlik Sense Proxy Service (QPS) manages site authentication, session handling, and load balancing.

On the central node in a multi-node site, you should have a dedicated Qlik Sense Proxy Service (QPS) for the Qlik Management Console (QMC) and not for the hub.

Paths
The following table lists the paths used by the Qlik Sense Proxy Service (QPS).

<table>
<thead>
<tr>
<th>Executable</th>
<th>Data</th>
<th>Logs</th>
</tr>
</thead>
<tbody>
<tr>
<td>%ProgramFiles%\Qlik\Sense\Proxy\Proxy.exe</td>
<td>%ProgramData%\Qlik\Sense\Proxy</td>
<td>%ProgramData%\Qlik\Sense\Log\Proxy See: Logging (page 202)</td>
</tr>
</tbody>
</table>

Bootstrap mode
You can use the following parameters to start the Qlik Sense Proxy Service in bootstrap mode when you need to deploy Qlik Sense with a service account that does not have administrator privileges.

See: Changing the user account to run Qlik Sense services (page 122)

- -bootstrap
  Use this parameter to start Qlik Sense Proxy Service in bootstrap mode.
3 Deploying Qlik Sense Enterprise on Windows

- **-bootstrap=install**
  Use this parameter to start Qlik Sense Proxy Service in bootstrap mode when installing.

- **-bootstrap=uninstall**
  Use this parameter when uninstalling Qlik Sense.

Do the following:

1. Stop Qlik Sense services.
2. Run `proxy.exe -bootstrap` from an elevated command prompt.
3. Start Qlik Sense services.

**Metrics**

This section lists the metrics related to the Qlik Sense Proxy Service (QPS). The following metrics are available in the Performance Monitor in Microsoft Windows:

*See: Performance log (page 240)*

*See: Selecting the metrics to display (page 64)*

- **ActiveConnections**: The number of active connections from the client.
  A connection is a stream (or a socket) between a Qlik Sense client and the Qlik Sense Proxy Service (QPS). This stream is often connected to another stream, which runs from the QPS to the Qlik Sense Repository Service (QRS) or the Qlik Sense Engine Service (QES). The two streams allow the client to communicate with the QRS or the QES.

- **ActiveStreams**: The number of active data streams (or sockets), either from the browser to the QPS or from the QPS to the QRS or the QES.

- **ActiveSessions**: The number of active sessions in the QPS.
  A Qlik Sense user gets a proxy session when the user has been authenticated. The session is terminated after a certain period of inactivity.

- **LoadBalancingDecisions**: The number of users who currently have at least one engine session.

- **PrintingLoadBalancingDecisions**: The number of users who have been load balanced to the Qlik Sense Printing Service (QPR).

- **Tickets**: The number of issued login tickets that have not yet been consumed.

- **ActiveClientWebsockets**: The number of active WebSockets between the client and the QPS.

- **ActiveEngineWebsockets**: The number of active WebSockets between the QPS and the target Qlik Sense service.

The metrics are also available as entries in the Performance log for the QPS.

**Qlik Sense Scheduler Service (QSS)**

The Qlik Sense Scheduler Service (QSS) manages the scheduled reloads of apps, as well as other types of reload triggering based on task events. Depending on the type of deployment, the Qlik Sense Scheduler Service runs as master, slave, or both on a node.
### Master

There is only one master Qlik Sense Scheduler Service within a site and it is always located on the central node, where the master Qlik Sense Repository Service runs. The central node must have the Qlik Sense Scheduler Service installed even if more QSS nodes are added because the QSS on the central node coordinates all QSS activities within the site.

The master QSS handles all task administration. For example, which tasks to execute and when to execute a specific task. When the time comes to execute a task, the master QSS sends the task ID to a slave QSS within the site. The load balancing operation performed by the master QSS determines which slave QSS to distribute the task ID to.

When a slave QSS completes a task, it returns the task state (successful or fail) to the master QSS. The master QSS uses the task state to perform task chaining. It uses the task state to determine if other events are affected by the state of the completed task and need to be executed. You configure task chaining in the Qlik Management Console (QMC).

If the slave QSS fails to perform the task, the master QSS repeatedly requests the same or another slave QSS to perform the task until it has been completed or until the maximum number of attempts has been reached.

### Slave

If a Qlik Sense Scheduler Service (QSS) runs on a rim node, the QSS is considered to be a slave QSS. When receiving a task ID from the master QSS, the slave QSS reads the task from the local repository database and executes the task. When a slave QSS completes a task, it returns the task state (successful or fail) to the master QSS.

### Tasks

Tasks are used to perform a wide variety of operations and can be chained together in any arbitrary pattern. The tasks are handled by the Qlik Sense Scheduler Service (QSS) and managed in the Qlik Management Console (QMC).

### Reload

The reload task is used to fully reload the data in an app from the source. Any old data is discarded.

### Paths

The following table lists the paths used by the Qlik Sense Scheduler Service (QSS).

<table>
<thead>
<tr>
<th></th>
<th>Path</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executable</td>
<td><code>%ProgramFiles%\Qlik\Sense\Scheduler\Scheduler.exe</code></td>
</tr>
<tr>
<td>Data</td>
<td>-</td>
</tr>
<tr>
<td>Logs</td>
<td><code>%ProgramData%\Qlik\Sense\Log\Scheduler</code></td>
</tr>
</tbody>
</table>

See: Logging (page 202)

### Bootstrap mode

You can use the following parameters to start the Qlik Sense Scheduler Service in bootstrap mode when you need to deploy Qlik Sense with a service account that does not have administrator privileges.

See: Changing the user account to run Qlik Sense services (page 122)
3 Deploying Qlik Sense Enterprise on Windows

- **--bootstrap**
  Use this parameter to start Qlik Sense Scheduler Service in bootstrap mode.

- **--bootstrap=install**
  Use this parameter to start Qlik Sense Scheduler Service in bootstrap mode when installing.

- **--bootstrap=uninstall**
  Use this parameter when uninstalling Qlik Sense.

Do the following:

1. Stop Qlik Sense services.
2. Run `scheduler.exe --bootstrap` from an elevated command prompt.
3. Start Qlik Sense services.

**Metrics**

This section lists the metrics related to the Qlik Sense Scheduler Service (QSS). The following metrics are available in the Performance Monitor in Microsoft Windows:

See: [Selecting the metrics to display](page 64)

- Number of connected slaves
- Number of Qlik Sense Engine Service (QES) instances that are running on a slave (this metric is only available on the node where the QES instances run)
- Number of running processes
- Number of running tasks as understood by the master
- Number of running tasks on the slave
- Number of task messages that have been dispatched by the slave
- Number of task messages that have been received by the master
- Number of task retries
- Number of tasks that have completed successfully when executed by the slave
- Number of tasks that have failed when executed by the slave
- Number of tasks that the master has acknowledged as completed
- Number of tasks that the master has acknowledged as failed
- Number of times that the settings have been updated
- Number of tasks that have attempted to start
- Number of tasks that have attempted to stop

**Qlik Sense Engine Service (QES)**

The Qlik Sense Engine Service (QES) handles all application calculations and logic. In a multi-node site, we recommend that you have a dedicated Qlik Sense Engine Service (QES) on the central node that you use specifically for the Qlik Management Console (QMC) and not for the hub.

**Paths**

The following table lists the paths used by the Qlik Sense Engine Service (QES).
Deploying Qlik Sense Enterprise on Windows

Executable

%ProgramFiles%\Qlik\Sense\Engine\Engine.exe

Data

%ProgramData%\Qlik\Sense\Engine

Logs

%ProgramData%\Qlik\Sense\Log\Engine

See: Logging (page 202)

Configuration

%ProgramData%\Qlik\Sense\Engine\Settings.ini

This file contains the QES settings. The file is created when the service first runs.

Qlik Logging Service

The Qlik Sense services (proxy, scheduler, repository, and engine) transfer log messages to the Qlik Logging Service. The Qlik Logging Service centralizes the logging by collecting all the messages and inserting them into the PostgreSQL database.

Qlik Sense Printing Service (QPR)

This service manages export in Qlik Sense. In a multi-node site, one instance of the Qlik Sense Printing Service (QPR) runs on each node. Export requests from clients are directed to the printing services in the multi-node site using round robin load balancing. If the first export request is load balanced to the QPR on node 1, the second export request is load balanced to the QPR on node 2, and so on.

Paths

The following table lists the paths used by the Qlik Sense Printing Service (QPR).

<table>
<thead>
<tr>
<th>Executable</th>
<th>%ProgramFiles%\Qlik\Sense\Printing\Printing.exe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data</td>
<td>%ProgramData%\Qlik\Sense\Printing</td>
</tr>
<tr>
<td>Logs</td>
<td>%ProgramData%\Qlik\Sense\Log\Printing</td>
</tr>
</tbody>
</table>

See: Logging (page 202)

Qlik Sense Service Dispatcher (QSD)

This is a service controller used to launch and manage the following Qlik Sense services:

- Broker Service: acts as an interface to and an intermediary between services started by the Qlik Sense Service Dispatcher (QSD). The service is launched and managed by the Qlik Sense Service Dispatcher (QSD) when required.
- Data Profiling Service: is used to access and modify the app load data model. It communicates directly with the Qlik Sense Engine Service (QES) on the node. The service is launched and managed by the Qlik Sense Service Dispatcher (QSD) when required.
- Hub Service: controls which content a user is allowed to see based on their access rights as defined in the QMC. The service is launched and managed by the Qlik Sense Service Dispatcher (QSD) when required.
- Migration Service: ensures that your apps can be used in the currently installed version of Qlik Sense. This service only runs on the central node in a site. The service is launched and managed by the Qlik Sense Service Dispatcher (QSD) when required.
3 Deploying Qlik Sense Enterprise on Windows

- Web Extension Service: is used to control web extensions such as visualizations, mashups, and widgets. The service is launched and managed by the Qlik Sense Service Dispatcher (QSD) when required.
- Capability Service: is used to handle Qlik Sense .NET SDK system feature configuration.
- Converter Service: is used by the QlikView converter tool.
- On-demand App Service: generates on-demand apps that load subsets of data from very large data sets.
- Hybrid Deployment Service (HDS): manages target deployments and credentials related to hybrid connectivity between environments, specifically the distribution of apps from the QSE.
- Hybrid Setup Console (HSC): serves the HSC user interface which is used to configure target deployments and app distribution.
- App Distribution Service (ADS): distributes apps and associated metadata to defined distribution targets, based on policy based app distribution rules.
- Precedents Service: examines and captures precedents in the data models and field use in charts from apps for use in insight advisor. The service also captures user-learned feedback from insight advisor.

**Paths**

The following table lists the paths used by the Qlik Sense Service Dispatcher (QSD) and the services that are launched and managed by the QSD.

| Executables | 
| --- | --- |
| QSD: `%ProgramFiles\Qlik\Sense\ServiceDispatcher\ServiceDispatcher.exe` |
| Services that are launched and managed by the QSD: |
| `%ProgramFiles\Qlik\Sense\ServiceDispatcher\node\node.exe` |

| Logs | 
| --- | --- |
| Broker Service: `%ProgramData\Qlik\Sense\Log\BrokerService` |
| Data Profiling Service: `%ProgramData\Qlik\Sense\Log\DataProfiling` |
| Hub Service: `%ProgramData\Qlik\Sense\Log\HubService` |
| Migration Service: `%ProgramData\Qlik\Sense\Log\AppMigration` |
| Web Extension Service: `%ProgramData\Qlik\Sense\Log\WebExtensionService` |
| On-demand App Service: `%ProgramData\Qlik\Sense\Log\OdagService` |
| Capability Service: `%ProgramData\Qlik\Sense\Log\CapabilityService` |
| Hybrid Deployment Service: |
| `%ProgramData\Qlik\Sense\Log\HybridDeploymentService` |
| Hybrid Setup Console: `%ProgramData\Qlik\Sense\Log\HybridSetupConsole` |
| App Distribution Service: |
| `%ProgramData\Qlik\Sense\Log\AppDistributionService` |
| Precedents Service: `%ProgramData\Qlik\Sense\Log\PrecedentsService` |

See: Logging (page 202)

**Deployment examples of nodes running Qlik Sense services**

You can deploy Qlik Sense services to run individually or combine them on dedicated server nodes.
• Complete: A single-node deployment that includes all Qlik Sense services.
• Consumer node: A node that delivers Qlik Sense apps to end users. It includes the Qlik Sense Engine Service service, the Qlik Sense Proxy Service, and the Qlik Repository service.
• Proxy node: A node that manages Qlik Sense authentication, session handling, and load balancing. It includes the QRS, and the QPS services.
• Engine node: A node that provides the analytical power of Qlik Sense to the client. It includes the QRS, and the QES services.
• Proxy and engine node: A combined node that includes the QRS, QPS, and QES service.
• Scheduler: A node that manages scheduled reloads of Qlik Sense apps and other types of reload triggering. It includes the QRS, QSS, and QES services. In order to perform reloads the QSS requires the QES to be running on the same node.

Service dependencies
This section describes the dependencies related to the Qlik Sense services (for example, dependencies on the operating system and other software).

Repository database
The Qlik Sense Repository Service (QRS) connects to the repository database to store and retrieve data necessary for the Qlik Sense services on the node on which the QRS is running. In a default Qlik Sense installation, the Qlik Sense Repository Service (QRS) uses the Qlik Sense Repository Database (QRD) service to read and write data in the repository database. A PostgreSQL database is used by default.

File share
The file share stores the binary files for the Qlik Sense apps.

Directory service
The QRS and Qlik Sense Proxy Service (QPS) communicate with a configured directory service (for example, Microsoft Active Directory) using, for example, LDAP or ODBC.

Start and restart of services
When a node starts up, the Qlik Sense services are started automatically.

Start-up behavior
The Qlik Sense Repository Database (QRD) and Qlik Sense Repository Service (QRS) are started first.

When any other Qlik Sense service starts, it contacts its local QRS to get configuration parameters. If the service has not been configured to run, it periodically checks back with the local QRS.

Manual start
If you need to start services manually, start them in the following order:

a. Qlik Sense Repository Database (QRD)
b. Qlik Sense logging service
c. Qlik Sense Service Dispatcher (QSD)
d. Qlik Sense Repository Service (QRS)
3  Deploying Qlik Sense Enterprise on Windows

e. Qlik Sense Proxy Service (QPS), Qlik Sense Engine Service (QES), Qlik Sense Scheduler Service (QSS), and Qlik Sense Printing Service (QPR) in no specific order

The order is important because the QRS is dependent on the QRD and the rest of the services are dependent on the QRS.

Qlik License Service

The Qlik License Service is included in Qlik Sense Enterprise February 2019 and later releases and is used when Qlik Sense is activated using a signed key license. The Qlik License Service stores the information about the license, and communicates with a License Back-end Service, hosted by Qlik, for product activations and entitlement management. Port 443 is used for accessing the License Back-end Service and retrieving license information.

In a Qlik Sense Enterprise on Windows multi-node deployment, the Qlik License Service is installed on every node. You can manage the status of the Qlik License Service by starting and stopping the Qlik Sense Service Dispatcher, listed in the list of services running in the Windows machine.

Selecting the metrics to display

To select which metrics to display for the Qlik Sense services in the Microsoft Windows, Performance Monitor:

1. Select **Start>Run**.
2. Enter `perfmon` and click **OK**.
3. In the left panel, expand Monitoring Tools .
4. Select **Performance Monitor**. The Performance Monitor is displayed in the right panel.
5. Click the + (plus) icon in the toolbar at the top of the Performance Monitor. The Add Counters dialog is displayed.
6. Select the computer to add counters from in the Select counters from computer: drop-down list. The Available counters list is populated with counters.
7. In the Available counters list, locate the following counter sets:
   - Qlik Sense Proxy Service
   - Qlik Sense Repository Service - REST API
   - Qlik Sense Repository Service
   - Qlik Sense Scheduler Service
8. Click the + (plus) sign next to a counter set to expand the set.
9. In the Performance Monitor, select the counters to display .
10. Click Add >> to add the counters.
11. The added counters are listed in the Added counters list.
12. Click **OK**.

The counters you added are now displayed in the Performance Monitor.
3  Deploying Qlik Sense Enterprise on Windows

Ports

Qlik Sense Enterprise and Qlik Sense Enterprise on Windows use ports to communicate between web browsers (users) and proxies, and between services in single and multi-node deployments.

Qlik Sense Enterprise on Kubernetes runs on a Kubernetes cluster which has no specific port requirements that are different to any other application that is hosted on Kubernetes. For more general information on Kubernetes ports requirements, see the Kubernetes cluster documentation.

Ports overview

The following table is an overview of the ports used in a Qlik Sense deployment.

<table>
<thead>
<tr>
<th>Component</th>
<th>Inbound</th>
<th>Outbound</th>
<th>Internal only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qlik Sense Proxy Service (QPS)</td>
<td>80 (HTTP)</td>
<td>4239 (QRS websocket)</td>
<td>4244 (Windows authentication)</td>
</tr>
<tr>
<td></td>
<td>443 (HTTPS)</td>
<td>4242 (QRS REST API)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4243 (REST API)</td>
<td>4747 (Engine)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4899 (Printing)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4900 (Broker)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4949 (Data profiling)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7070 (Logging service)</td>
<td></td>
</tr>
<tr>
<td>Qlik Sense Engine Service (QES)</td>
<td>4747 (QES listen port)</td>
<td>7070 (Logging service)</td>
<td>4242 (QRS REST API)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4748 (notifications from QRS)</td>
</tr>
<tr>
<td>Qlik Sense Repository Service (QRS)</td>
<td>4242 (REST API)</td>
<td>4242 (REST API)</td>
<td>4545 (Migration service)</td>
</tr>
<tr>
<td></td>
<td>4239 (from QPS - websocket)</td>
<td>4243 (Proxy REST API)</td>
<td>4570 (Certificate unlock)</td>
</tr>
<tr>
<td></td>
<td>4444 (Setup API - inbound on rim nodes)</td>
<td>4444 (Setup API – outbound on central node)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4899 (from QPR)</td>
<td>4747 (Engine)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4748 (Engine notification API)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5050 (Scheduler master API)</td>
<td></td>
</tr>
</tbody>
</table>
### 3 Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Service</th>
<th>Port(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Qlik Sense Scheduler Service (QSS)</strong></td>
<td>5050 (Master REST API)</td>
</tr>
<tr>
<td></td>
<td>5151 (Slave REST API)</td>
</tr>
<tr>
<td></td>
<td>5252 (Monitoring API - optional)</td>
</tr>
<tr>
<td><strong>Qlik Sense Repository Database (QRD)</strong></td>
<td>4432 (default listen port)</td>
</tr>
<tr>
<td></td>
<td>for database connections</td>
</tr>
<tr>
<td><strong>Qlik Sense Printing service (QPR)</strong></td>
<td>4899 (QPR listen port)</td>
</tr>
<tr>
<td><strong>Qlik Sense Service Dispatcher (QSD)</strong></td>
<td></td>
</tr>
<tr>
<td>Starts up the following services:</td>
<td></td>
</tr>
<tr>
<td>Qlik License Service</td>
<td>443 (HTTPS)</td>
</tr>
<tr>
<td>Broker service</td>
<td>4900</td>
</tr>
<tr>
<td>9200 (License Service)</td>
<td></td>
</tr>
<tr>
<td>4242 (QRS REST API)</td>
<td></td>
</tr>
<tr>
<td>7070 (Logging Service)</td>
<td></td>
</tr>
</tbody>
</table>

No additional ports.

| **Qlik Sense Repository Database (QRD)**     | 443 (Sense web server - proxy)   |
|                                             | 4242 (QRS REST API)              |
|                                             | 8088 (CEF debugging)             |

No additional ports.

| **Qlik Sense Printing service (QPR)**        | 9028 (Hub service)               |
|                                             | 9031 (Capability service)        |
|                                             | 9032 (About)                     |

Other ports:

- 3003 (Converter service)
- 4545 (App migration)
- 4555 (Chart sharing)
- 4949 (Data profiling)
- 4950 (Precedents service)
- 5928 (QSE Event Processor)
### 3 Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Service</th>
<th>Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>9041 (Connector registry proxy - server)</td>
<td>9041</td>
</tr>
<tr>
<td>9051 (Connector registry proxy - desktop)</td>
<td>9051</td>
</tr>
<tr>
<td>9054 (Precedents service)</td>
<td>9054</td>
</tr>
<tr>
<td>9079 (Depgraph service)</td>
<td>9079</td>
</tr>
<tr>
<td>9080 (Web extension service)</td>
<td>9080</td>
</tr>
<tr>
<td>9090 (DownloadPrep)</td>
<td>9090</td>
</tr>
<tr>
<td>9098 (On-demand app service)</td>
<td>9098</td>
</tr>
<tr>
<td>21060 (Resource Distribution Service)</td>
<td>21060</td>
</tr>
<tr>
<td>46277 (Deployment based warnings service)</td>
<td>46277</td>
</tr>
<tr>
<td>64210 (Open source graph database layer used by Precedents service)</td>
<td>64210</td>
</tr>
<tr>
<td>9081 (Qlik Notifier Service)</td>
<td>9081</td>
</tr>
<tr>
<td>9082 (Qlik Mobility Registrar)</td>
<td>9082</td>
</tr>
<tr>
<td>4242 (QRS REST API)</td>
<td>4242</td>
</tr>
<tr>
<td>4747 (QES)</td>
<td>4747</td>
</tr>
<tr>
<td>Data profiling service</td>
<td>4949 (listen port for REST API and websocket)</td>
</tr>
</tbody>
</table>
To allow access to the file share, ensure that you open the Microsoft Windows SMB port 445.

Ports used internally within a node

The ports in the following table are used between Qlik Sense services that run on the same node. In most cases, the ports do not have to be open through any firewalls.

<table>
<thead>
<tr>
<th>Service</th>
<th>Port</th>
<th>Direction</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Converter Service</td>
<td>3003</td>
<td>Internal</td>
<td>This port is used by the Converter Service which is utilized by QlikView converter.</td>
</tr>
<tr>
<td>QPS</td>
<td>4243</td>
<td>Inbound</td>
<td>Qlik Sense Proxy Service (QPS) REST API listen port. If web ticketing is used for security, this port is used by the software or service that requests tickets for users. If the software or service is remote, this port needs to be open to the location from which it is called.</td>
</tr>
<tr>
<td>QRD</td>
<td>4432</td>
<td>Internal</td>
<td>Default listen port for the Qlik Sense Repository Database (QRD). With shared persistence, this port is used to listen for connections from the Qlik Sense Repository Service (QRS).</td>
</tr>
<tr>
<td>Migration Service</td>
<td>4545</td>
<td>Internal</td>
<td>This port is used by the Migration Service for app migration purposes. The service is launched and managed by the Qlik Sense Service Dispatcher (QSD) when required. The Migration Service only runs on the central node.</td>
</tr>
<tr>
<td>Chart Sharing Service</td>
<td>4555</td>
<td>Internal</td>
<td>This port is used by the Chart Sharing Service for chart sharing between Qlik Sense users. The service is launched and managed by the Qlik Sense Service Dispatcher (QSD) when required. This port uses HTTPS for communication.</td>
</tr>
</tbody>
</table>
## 3 Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Service</th>
<th>Port</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>QRS</td>
<td>4570</td>
<td>Internal</td>
<td>Certificate password verification port, only used within multi-node sites by Qlik Sense Repository Services (QRSs) on rim nodes to receive the password that unlocks a distributed certificate. The port can only be accessed from localhost and it is closed immediately after the certificate has been unlocked. The communication is always unencrypted.</td>
</tr>
<tr>
<td>QES</td>
<td>4748</td>
<td>Internal</td>
<td>This callback port is used by the Qlik Sense Repository Service (QRS) for sending HTTP events to the Qlik Sense Engine Service (QES).</td>
</tr>
<tr>
<td>Data Profiling Service</td>
<td>4949</td>
<td>Internal</td>
<td>This port is used by the Data Profiling Service to access and modify the app load data model. It communicates directly with the Qlik Sense Engine Service (QES) on the node.</td>
</tr>
<tr>
<td>Broker Service</td>
<td>4900</td>
<td>Internal</td>
<td>Default listen port for the Broker Service.</td>
</tr>
<tr>
<td>Hub Service</td>
<td>9028</td>
<td>Internal</td>
<td>Default listen port for the Hub Service.</td>
</tr>
<tr>
<td>Capability Service</td>
<td>9031</td>
<td>Internal</td>
<td>This port is used by the Capability Service to handle Qlik Sense system feature configuration.</td>
</tr>
<tr>
<td>About Service</td>
<td>9032</td>
<td>Internal</td>
<td>Default listen port for inbound calls to the About Service.</td>
</tr>
<tr>
<td>Depgraph Service</td>
<td>9079</td>
<td>Internal</td>
<td>This port is used by the Service Dispatcher launched microservices.</td>
</tr>
<tr>
<td>Web Extension Service</td>
<td>9080</td>
<td>Internal</td>
<td>Default listen port for the Web Extension Service.</td>
</tr>
<tr>
<td>DownloadPrep</td>
<td>9090</td>
<td>Internal</td>
<td>This port is used by the Service Dispatcher launched microservices.</td>
</tr>
<tr>
<td>On-demand App Service</td>
<td>9098</td>
<td>Internal</td>
<td>Default listen port for the On-demand App Service.</td>
</tr>
<tr>
<td>Connector registry proxy (server)</td>
<td>9041</td>
<td>Internal</td>
<td>This port is used by the distributed connectivity service for discovering and listing connectors.</td>
</tr>
<tr>
<td>Connector registry proxy (desktop)</td>
<td>9051</td>
<td>Internal</td>
<td>This port is used by the distributed connectivity service for discovering and listing connectors.</td>
</tr>
<tr>
<td>Qlik Notifier Service</td>
<td>9081</td>
<td>Internal</td>
<td>This port is used by the Qlik Notifier Service, which handles push notifications to mobile devices. It is installed on each node in a Qlik Sense Enterprise deployment.</td>
</tr>
<tr>
<td>Qlik Mobility Registrar</td>
<td>9082</td>
<td>Internal</td>
<td>This port is used by the Qlik Mobility Registrar, which is installed on each node in a Qlik Sense Enterprise deployment.</td>
</tr>
</tbody>
</table>

Ports used from user web browser
The default ports are exposed to the Qlik Sense users and need to be open through any firewalls in the site.
3   Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Service</th>
<th>Port</th>
<th>Direction</th>
<th>Purpose</th>
<th>Host</th>
</tr>
</thead>
<tbody>
<tr>
<td>QPS</td>
<td>443</td>
<td>Inbound</td>
<td>Inbound user web traffic when using HTTPS.</td>
<td>Qlik Sense Proxy Service (QPS) in the site.</td>
</tr>
<tr>
<td>QPS</td>
<td>80</td>
<td>Inbound</td>
<td>Inbound user web traffic when using HTTP (optional).</td>
<td>Qlik Sense Proxy Service (QPS) in the site.</td>
</tr>
<tr>
<td>Map</td>
<td>443</td>
<td>Inbound</td>
<td>User web traffic for standard map background. For users hosting their own map server, use the name of the host server.</td>
<td>maps.qlikcloud.com</td>
</tr>
<tr>
<td>Map</td>
<td>443</td>
<td>Inbound</td>
<td>User web traffic for satellite map background.</td>
<td>services.arcgisonline.com</td>
</tr>
</tbody>
</table>

Ports used between nodes and Qlik Sense services

The ports in this section are used for communication between the Qlik Sense services.  

In a single node site, all ports listed in this section are used by the various services, but do not need access through firewalls.

In a multi-node site, the ports in use vary depending on the services installed and running on each node. The ports need to be open in any firewalls between the nodes, but do not have to be open to the Qlik Sense users.

**Minimum ports used for communication in multi-node sites**

The following ports must always be open between the nodes in a multi-node site. The ports must be open to allow for service health, and some specific operations.

<table>
<thead>
<tr>
<th>Service</th>
<th>Port</th>
<th>Direction</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>QRS</td>
<td>4242</td>
<td>Bi-directional between the central node and all proxy nodes</td>
<td>This port is used for a number of operations including new user registration.</td>
</tr>
<tr>
<td>QRD</td>
<td>4432</td>
<td>Inbound from Qlik Sense nodes to the repository database</td>
<td>The default listen port used by all nodes in a site for connecting to the Qlik Sense Repository Database.</td>
</tr>
</tbody>
</table>
3 Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>QRS</th>
<th>4444</th>
<th>Between the central node and all rim nodes</th>
</tr>
</thead>
</table>

This port has two functions:

- Security distribution port, only used by Qlik Sense Repository Services (QRSs) on rim nodes to receive a certificate from the master QRS on the central node. The communication is always unencrypted, but the transferred certificate package is password-protected.

- Qlik Sense Repository Service (QRS) state port, used to fetch the state of a QRS in a Qlik Sense site. The state is fetched using `http://localhost:4444/status/servicestate`.
  The returned state is one of the following:
  - 0: Initializing. Once the node has been initialized, the node state changes into one of the other states.
  - 1: Certificates not installed. There are no certificates installed on the node. The node stays in this state until it has received the certificate and the certificate password.
  - 2: Running. The node is up and running and all APIs have been initiated.

Ports used between master and slave schedulers

The ports in the following table are used when a slave Qlik Sense Scheduler Service (QSS) is used.
3  Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Service</th>
<th>Port</th>
<th>Direction</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>QSS</td>
<td>5050</td>
<td>Inbound (from scheduler nodes only)</td>
<td>This port is used by the master QSS on the central node to issue commands to and receive replies from slave QSS nodes.</td>
</tr>
<tr>
<td>QSS</td>
<td>5151</td>
<td>Inbound (from the central node only)</td>
<td>A slave QSS runs on a slave scheduler node and is accessed only by the master QSS on the central node.</td>
</tr>
</tbody>
</table>

Ports used between a proxy node and an engine node

The ports in the following table define the minimum needed to allow regular user traffic and load balancing between a proxy node and an engine node.

<table>
<thead>
<tr>
<th>Service</th>
<th>Port</th>
<th>Direction</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>QES</td>
<td>4747</td>
<td>Inbound (from proxy nodes)</td>
<td>Qlik Sense Engine Service (QES) listen port. This is the main port used by the QES.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The port is used via the Qlik Sense Proxy Service (QPS) for communication with the Qlik Sense clients.</td>
</tr>
<tr>
<td>QRS</td>
<td>4239</td>
<td>Inbound (from proxy nodes)</td>
<td>Qlik Sense Repository Service (QRS) WebSocket port.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The port is used via the Qlik Sense Proxy Service (QPS) by the Qlik Sense hub to obtain apps and stream lists.</td>
</tr>
<tr>
<td>QRS</td>
<td>4242</td>
<td>Inbound (from proxy nodes)</td>
<td>Qlik Sense Repository Service (QRS) REST API listen port.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>This port is mainly accessed by local Qlik Sense services. However, the port must be open to all proxy nodes in a multi-node site to deliver images and static content.</td>
</tr>
<tr>
<td>Data Profiling Service</td>
<td>4949</td>
<td>Inbound (from proxy nodes)</td>
<td>This port is used by the Data Profiling Service when accessing and modifying the application load model. The service is launched and managed by the Qlik Sense Service Dispatcher (QSD) when required.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The port is access via the Qlik Sense Proxy Service (QPS).</td>
</tr>
<tr>
<td>Broker Service</td>
<td>4900</td>
<td>Inbound (from proxy nodes)</td>
<td>Default listen port for the Broker Service.</td>
</tr>
<tr>
<td>Hub Service</td>
<td>9028</td>
<td>Inbound (from proxy nodes)</td>
<td>Default listen port for the Hub Service. Open for local services such as the broker service on the engine node.</td>
</tr>
</tbody>
</table>
3 Deploying Qlik Sense Enterprise on Windows

Ports used between a proxy node and a node running the printing service

The Qlik Sense Printing Service (QPR) may be installed on the same node as other services or on a separate node. The ports in the following table must be accessible between a QPS and all QPRs to which the QPS can load balance traffic.

<table>
<thead>
<tr>
<th>Service</th>
<th>Port</th>
<th>Direction</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>QPR</td>
<td>4899</td>
<td>Inbound (from proxy nodes)</td>
<td>Qlik Sense Printing Service (QPR) port.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>This port is used for printed export in Qlik Sense. The port is accessed by any node that runs a QPS.</td>
</tr>
</tbody>
</table>

Qlik Sense Desktop ports

The following ports are used by Qlik Sense Desktop.

<table>
<thead>
<tr>
<th>Component</th>
<th>Port</th>
<th>Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qlik associative engine</td>
<td>9076</td>
<td>Internal</td>
</tr>
<tr>
<td>Migration Service</td>
<td>9074</td>
<td>Internal</td>
</tr>
<tr>
<td>DataPrep Service</td>
<td>9072</td>
<td>Internal</td>
</tr>
<tr>
<td>Broker Service (Desktop)</td>
<td>4848</td>
<td>Internal/inbound</td>
</tr>
<tr>
<td>Capability Service</td>
<td>9075</td>
<td>Internal</td>
</tr>
<tr>
<td>About Service</td>
<td>9078</td>
<td>Internal</td>
</tr>
<tr>
<td>Broker Service</td>
<td>9070</td>
<td>Internal</td>
</tr>
<tr>
<td>NPrinting</td>
<td>9073</td>
<td>Internal</td>
</tr>
<tr>
<td>Hub Service</td>
<td>9071</td>
<td>Internal</td>
</tr>
<tr>
<td>Converter Service</td>
<td>9077</td>
<td>Internal</td>
</tr>
<tr>
<td>Dependency Graph Service</td>
<td>9033</td>
<td>Internal</td>
</tr>
<tr>
<td>Web Extension Service</td>
<td>9034</td>
<td>Internal</td>
</tr>
<tr>
<td>Connector Registry Proxy</td>
<td>9051</td>
<td>Internal</td>
</tr>
</tbody>
</table>

Ports examples

This section provides examples of the ports that are used in different Qlik Sense deployments.

*The diagrams in this section do not show all outbound proxy node ports. For a full list of proxy node ports see the Ports overview (page 65) table.*

Single node site

This example shows the ports that are used in a single node site.
Multi-node site
The following is an example of the ports that are used in a multi-node site that consists of five nodes.

Proxy node in demilitarized zone
This example shows the ports that are used in a multi-node site when deploying a proxy node in a demilitarized zone.
Separate proxy and engine node

This example shows the ports that are used in a multi-node site when deploying a separate proxy and engine node.
High availability proxy and engine nodes

This example shows the ports that are used in a multi-node site when deploying more than one proxy and engine node.
Separate scheduler node and high availability proxy and engine nodes
This example shows the ports that are used in a multi-node site when deploying a separate scheduler node and more than one proxy and engine node.
Separate proxy and scheduler nodes and high availability engine nodes
This example shows the ports that are used in a multi-node site when deploying separate proxy and scheduler nodes and more than one engine node.
3  Deploying Qlik Sense Enterprise on Windows

Generic scale out

This example shows the ports that are used in a multi-node site when scaling the site by adding additional proxy, engine, or scheduler nodes.
Persistence

A Qlik Sense site stores data to both a repository database, and a file share. The repository database stores system and app meta data, while the file share stores binary application data such as, data models and app content. In a single node deployment, both the repository database and the files share are usually located on the same machine as the Qlik Sense services. In a multi-node deployment, a cluster is formed around a single repository database and file share. In many cases these may be on separate dedicated servers to improve resilience or performance.

For best performance we recommend that you locate all your Qlik Sense servers in the same geographic location or data center as the repository database and the file share with a network latency below 4 milliseconds.

File share

In a Qlik Sense site, a file share is used to store the binary application data including data models and the app content. It can be located on any one of the nodes in the Qlik Sense site or on a dedicated server for better resilience and performance. You create this folder before you install Qlik Sense. See: Creating a file share (page 111)

The requirements for the share are:

- The Qlik Sense nodes in the cluster must have network latency below 4 milliseconds to connect to the file share server. Performance can degrade if this is not the case.
- The bandwidth to the file share must be appropriate for the amount of traffic on the site. The frequency and size of the apps being saved after reloading, and opened into memory, drives this requirement. 1 Gigabit networking is suggested.
- The file share can run on:
  - A Windows Server OS. The Windows server may have storage allocated to it from a storage area network (SAN), use local disks, or virtual storage in the case of a virtual machine.
  - A non-Windows device such as a Linux server or hardware NAS device that supports SMB 3.0.

Qlik periodically runs network file share performance tests on Qlik Sense using WinShare, and FreeNAS with SMB 3.0. For more information on network file share solutions, contact your Qlik representative.

- The file storage must have a single read and write master. Storage can be replicated to standby storage, but only one location can be used to read and write to.

Repository database

In a Qlik Sense site, a PostgreSQL repository database is used to store all data for the Qlik Sense Repository Service including system and meta data. It can be located on one of the nodes in the Qlik Sense site or on a dedicated server for better resilience and performance. If you want to install it on a dedicated server, you do this before installing Qlik Sense.

You have two options for the repository database:
3  Deploying Qlik Sense Enterprise on Windows

- Install as a local database on a central node. This option can be used for both single-node and multi-node deployments, and is done during installation using the Qlik Sense setup program.
- Install as a remote database on a separate server. This option provides higher performance and resilience, and is the recommended approach in a multi-node deployment. See: Installing and configuring PostgreSQL (page 113)

The requirements for the database are:

- The Qlik Sense nodes in the cluster must have network latency below 4 milliseconds to connect to the repository database server. Performance can degrade if this is not the case.
- If you run a PostgreSQL database on a dedicated server, it must use PostgreSQL version 9.6.

PostgreSQL can be run on various platforms including Windows, Linux, or cloud-hosted services such as Amazon RDS. If you use Linux or Amazon RDS, it is your responsibility to install and configure a running instance of PostgreSQL for Qlik Sense to use.

Security

Security and availability in a shared persistence deployment
In shared persistence deployments the network traffic between the servers, the database and the file share is not encrypted by default after an installation. You may also need to consider setting up replication of the database to handle cases where the central database fails.

Maintaining database password integrity
Here are some guidelines to maintain password integrity in a Qlik Sense shared persistence deployment.

- It is important that you disable the Store password option for your user in PostgreSQL. If this option is enabled, the password is stored in a file, and incoming connections without a password will be able to connect to the database.
- Change password by executing this query in the PostgreSQL database:
  ```sql
  ALTER USER <user> WITH PASSWORD '<newpassword>'';
  ALTER ROLE is displayed after successfully changing the password.
  Do not change password in the PostgreSQL user interface for the same reasons as above.
  - Use md5 hashing.
  - Do not set your password to PASSWORD '', that is, an empty string, since this is not handled well in PostgreSQL.
  
Database traffic encryption
Qlik Sense supports database traffic encryption using SSL, but you need to perform some manual configuration to setup SSL and MD5 password protection in a shared persistence deployment.
3 Deploying Qlik Sense Enterprise on Windows

The Qlik Sense installer cannot use SSL encryption for establishing connection to PostgreSQL. When SSL encryption is enabled, the installer does not recognize any already installed PostgreSQL databases, and as a consequence, installation cannot be completed. Workaround: temporarily disable SSL during installation or upgrade.

Do the following:

1. Edit the following values in postgresql.conf:
   
   ```
   listen_addresses = '*'
   port = 4432
   ssl = on
   ssl_cert_file = 'server.pem'
   ssl_key_file = 'server_key.pem'
   #ssl_ca_file = ''
   #ssl_crl_file = ''
   ```

2. Add the following lines in pg_hba.conf
   
   ```
   hostssl all all all md5
   ```

3. Remove any other lines starting with hostssl or host in pg_hba.conf.

4. Copy server.pem, and server_key.pem from %PROGRAMDATA%\Qlik\Sense\Repository\Exported Certificates\Local Certificates to %PROGRAMDATA%\Qlik\Sense\Repository\PostgreSQL\9.6.

5. Use the Connection String Editor to add the following setting to the repository.exe.config on the central node, and all rim nodes that belong to the cluster. To open the Connection String Editor, navigate to C:\Program Files\Qlik\Sense\Repository\Util\QlikSenseUtil and open the QlikSenseUtil.exe file as an administrator.

6. In the Connection String Editor tab, click Read to open the Repository.exe file connection string.

7. Add ‘Ssl Mode=Require;’ to the connection string:
   
   ```
   <add name="QSR" connectionString="User ID=qliksenserepository;Ssl Mode=Require;Host='fullhostname.com';Port='4432';Database=QSR;Pooling=true;Min Pool Size=0;Max Pool Size=90;Connection Lifetime=3600;Unicode=true;Password='randompass';"
   providerName="Devart.Data.PostgreSql" />
   ```

8. Click Save value in config file encrypted to save your changes.

9. Start all Qlik Sense services and verify that everything works.

10. Verify the authentication using the pgAdmin tool in PostgreSQL:

    Users postgres and qliksenserepository must enter a valid password to connect.

Forcing the database connection to use TLS 1.2 only

You can configure the database connection to support TLS 1.2 only, and block connections using TLS 1.1 or lower.

Do the following:

- Add the following parameter to the connection string: "SSL TLS Protocol=1.2"
3 Deploying Qlik Sense Enterprise on Windows

We recommend these additional configuration changes to maintain database integrity:

- Configure the database to only accept connections from servers where the repository is running.
- Configure SSL to reject weak cipher suites by adding this line to the file `postgresql.conf`:
  
  ```
  ```

Database replication and failover

This section describes how to set up database replication and failover in a shared persistence environment. Additionally, the file storage content will also need to be replicated. To fail over to a standby node in case the central database or node is lost, one or more standby databases can be configured for streaming replication from the database on the primary node.

When editing text files related to the Qlik Sense installation, do the following:

1. Copy the file to another location on the server.
2. Edit the file and save the changes.
3. Copy the updated file back to its original location.

Setting up replication to standby nodes for failover

The instructions in this section describe how to set up asynchronous streaming replication to one or more standby nodes. Before starting, ensure that the environment is configured and running, and install PostgreSQL on a standby machine.

The paths in the instructions are adapted to a default PostgreSQL installation used as database on a dedicated machine. If you are using a PostgreSQL database installed by Qlik Sense you need to adapt the paths used, as the database is installed in

```
%ProgramData%\Qlik\Sense\Repository\PostgreSQL\<version>\.
```

Configure the primary database server

On the primary database server, do the following:

1. Open the file `%ProgramFiles%\PostgreSQL\9.6\data\postgresql.conf`
   Locate and set the following settings
   ```
   wal_level = replica
   max_wal_senders = 3
   wal_keep_segments = 8
   hot_standby = on
   ```

2. Create a user account that can be used for replication. To do so from a command prompt, run the following command. Adjust the hostname as needed, and specify a suitable password. You may be prompted for a password, this is the password that was specified during installation.
   ```
   "C:\Program Files\PostgreSQL\9.6\bin\psql.exe" -h <hostname> -p 4432 -W -c "CREATE USER replicator REPLICATION LOGIN ENCRYPTED PASSWORD 'secretpassword';"
   ```

3. Open the file `%ProgramFiles%\PostgreSQL\9.6\data\pg_hba.conf`
   At the bottom of the file add:
   ```
   host replication replicator 0.0.0.0/0md5
   ```
3  Deploying Qlik Sense Enterprise on Windows

You can restrict the subnet access further, if required.

4. Restart the PostgreSQL service.

**Configure the standby database server**

On the standby PostgreSQL database server, do the following:

1. Stop the Postgres service.
2. Delete all content from `%ProgramFiles%\PostgreSQL\9.6\data`.
3. From the command line run the following command adjusted to use the name of the primary server:
   
   ```
   "C:\Program Files\PostgreSQL\9.6\bin\pg_basebackup.exe" -h <primaryServer> -d "C:\Program Files\PostgreSQL\9.6\data" -U replicator -v -P -p 4432
   ```
   You can ignore any warnings about copying files manually.
4. In a text editor, create a file called `recovery.conf` and place it in `%ProgramFiles%\PostgreSQL\9.6\data`.
5. Open `recovery.conf` and add the following text, adjusting the hostname and port:
   ```
   standby_mode = 'on'
   primary_conninfo = 'host=<primaryServer> port=4432 user=replicator password=secretpassword'
   trigger_file = 'failover'
   recovery_target_timeline = 'latest'
   ```
6. Start the PostgreSQL service.

You should now be able to connect to the database and view the data being streamed over from the primary node in read only mode.

**Manual database failover**

If the database on primary node is lost, a standby node needs to take over.

Do the following:

1. On the standby node that is to become the new primary node, create a file called `failover` in the folder `%ProgramFiles%\PostgreSQL\9.6\data`

   ```
   The failover file should have no file extension.
   ```

   The file triggers PostgreSQL to cease recovery and enter read/write mode. PostgreSQL also changes the name of the file `recovery.conf` to `recovery.done` to reflect the transition.
2. On each node, change the repository database connection string to point to the hostname or IP address of the new database node. As the connection string is encrypted in the config file, you need to use the `Connection String Editor` to decrypt the string, edit it, and write back an encrypted string.
   a. To open the `Connection String Editor`, navigate to `C:\Program Files\Qlik\Sense\Repository\Util\QlikSenseUtil` and open the `QlikSenseUtil.exe` file as an administrator.
   b. In the `Connection String Editor` tab, click `Read` to open the `Repository.exe` file connection string.
   The decrypted database connection string is displayed.
c. Replace the value for **Host** with the hostname or IP address of the new database node.
d. Click **Save value in config file encrypted** to save your changes.

### AWS and Azure security

Before you deploy Qlik Sense on AWS or Azure you need to get an overview of the basic security implications. In AWS and Azure there are specific tools that you use during setup to configure permissions and to set security options. Once you have deployed Qlik Sense to your chosen cloud environment, you use the Qlik Management Console to configure security in the same way as you would in an on-premise Qlik Sense deployment.

### Qlik Sense

An overview of your Qlik Sense security considerations:

- In Qlik Sense, you manage all security and authentication settings from the Qlik Management Console.
- A module in the Qlik Sense Proxy Service handles authentication of Microsoft Windows users.
- Authentication is often used in conjunction with a single sign-on (SSO) system that supplies a reverse proxy or filter for authentication of the user.
- Other authentication methods are available, and it is possible to implement your own customized solutions for different authentication scenarios.

### Resources managed directly from the QMC:

- Admin roles to grant QMC users administrator level access to various sections
- Proxy certificate for communication between the web browser and the proxy component
- Virtual proxies to allow different modules based on the URI to be used to access the Qlik Sense environment
- Custom properties enabling you to use your own values in security rules
- Access control and security rules to grant users access to Qlik Sense resources

### Authentication methods used by Qlik Sense:

- NTLM/Kerberos
- Security Assertion Markup Language (SAML)
- Anonymous authentication
- Session/Ticket API

For more information about Qlik Sense security, see **Security (page 81)**

### AWS

To configure security in an AWS deployment you need a basic understanding of how to set up AWS security groups, key pairs, and Qlik Sense security groups. Use the Amazon Management Console to configure AWS security, and the Qlik Management Console to configure all security and authentication settings in Qlik Sense. A module in the Proxy Service (QPS) handles the authentication of Microsoft Windows users. If required, it is also possible to implement your own custom authentication solutions.

Use the Amazon Management Console to configure:
3 Deploying Qlik Sense Enterprise on Windows

- AWS security groups - configure access rules for an initial Qlik Sense security group for your EC2 instance.
- Key pair - In the AWS console, create a Qlik Sense key pair. Save the qlik sense.pem keypair file locally, as you will need it later to access your instance.

You can use AWS Directory Services to set up security and authentication on the Qlik Sense server side. This service makes it easier to setup and run Microsoft Active Directory (AD) in the AWS cloud, or connect your AWS resources to an existing on-premises Microsoft Active Directory.

AWS Directory Service provides you with the following three directory types:

- AWS Directory Service for Microsoft Active Directory (Enterprise Edition), also referred to as Microsoft AD
- Simple AD
- AD Connector

AWS Directory Services makes it possible to connect AWS resources to an on-premises directory using the same corporate credentials. This option uses the Microsoft Security Support Provider Interface (SSPI) to read the Windows user name and password working in a similar way to single sign-on. If you have multiple nodes in the Qlik Sense Server environment, all nodes need to be part of the same domain.

For more information, see AWS security.

Azure

Use the Resource Manager to configure Azure security and the QMC to configure all security groups and authentication settings in Qlik Sense. In Azure, to configure security you first set up a subnet, a virtual network, an IP address for an instance, and network security rules. This is similar to configuring ports in a firewall. You then set up a network interface that your instance can use, and bind it to the previously set up network and subnet. A module in the Qlik Sense Proxy Service (QPS) handles the authentication of Microsoft Windows users. If required, it is also possible to implement your own custom authentication solutions.

Use the Azure Resource Manager to configure:

- Azure security groups
- Azure Active Directory and Identity Management

Azure Active Directory (Azure AD) is Microsoft’s multi-tenant cloud based directory and identity management service. For IT administrators, Azure AD provides an easy to use solution to give users single sign-on (SSO) access to other cloud SaaS Applications, such as Office365, Salesforce.com, and Concur. Azure AD also includes a full suite of identity management capabilities including multi-factor authentication, device registration, self-service password management, self-service group management, privileged account management, role based access control, application usage monitoring, rich auditing, and security monitoring and alerting.

For more information, see Azure security.
Performance
This topic aims to provide some basic information on performance to consider before you install Qlik Sense. There are several different considerations to think about when planning your Qlik Sense deployment:

- Size of deployment - small single-node, medium, or large multi-node site?
- Number of nodes in your site?
- Local or dedicated repository database?
- Local or network file share?
- Number of CPU cores required for each node?
- RAM required for each node?

Geographical deployments
The current persistence model does not support geographical deployments. For best performance we recommend that you locate all your Qlik Sense servers in the same geographic location or data center as the repository database and the file share with a network latency below 4 milliseconds.

Capacity and performance
Qlik Sense supports up to a maximum of 12 nodes. In addition to the number of nodes, there are other factors that contribute to total capacity:

- Workload
- Hardware speed
- Network speed

For example, if the disk speed of the file share and the central node is too slow, you may expect low performance during some operations, such as importing or duplicating apps.

We recommend scalability testing and engaging with Qlik consulting services for larger deployments.

DMZ deployments
All nodes in a site, including nodes without an engine, require access to both the database and file share. In demilitarized zone (DMZ) deployments this may require opening additional ports, or taking an alternative approach, compared to a DMZ deployment with synchronized persistence.

Central node dependencies
The central node is responsible for handling a number of vital operations on your site. If the central node fails, some operations will fail to run, including:

- Master scheduler - responsible for triggering reloads
- License distribution - allowing new users to obtain a license
- Extension objects

To reduce the dependency on the central node you can configure one or more nodes as a failover candidate. For more information, see Failover (page 112).
3 Deploying Qlik Sense Enterprise on Windows

User accounts

In order to successfully install and deploy Qlik Sense you must set up some user accounts before you start your Qlik Sense installation.

Windows user accounts are created and configured using your Windows server administration tools.

If you choose to manually install and configure your PostgreSQL repository database, users are created and configured using your PostgreSQL database administration tools. If you choose to have Qlik Sense install the repository database for you, the Qlik Sense setup wizard will create the users during installation.

The following are the users that you may need to create before you install Qlik Sense:

- Windows Qlik Sense services administrator
- Windows Qlik Sense services user that is not an administrator
- PostgreSQL database superuser
- Qlik Sense Repository Database administrator

You must create the required Windows user accounts before you install Qlik Sense because you are prompted to enter them during the installation. If you choose to install as a Windows local administrator and wish to change to a Windows dedicated Qlik Sense service user after installation, see *Changing the user account to run Qlik Sense services* (page 122).

When you create your Windows user accounts you must set a password for each one. Windows user account passwords may expire in accordance with the Windows domain security rules settings. If you do not update the passwords for each Windows service setting, the services will stop working. To avoid this, you can select the **Password never expires** check box in the Windows user profile, if your security protocol allows it.

Windows Qlik Sense services administrator

We recommend that you use a dedicated Windows user account to run the Qlik Sense services. If your dedicated Windows Qlik Sense services user is an administrator, you can login as that user to install Qlik Sense. If your dedicated Windows Qlik Sense services user is not a local administrator, you must use an administrator account to install Qlik Sense.

Windows Qlik Sense services user that is not an administrator

If you wish to use a dedicated Windows user account that is not an administrator to run the Qlik Sense services, you must create that account before you install Qlik Sense. The Windows Qlik Sense services user runs the following services:

- Qlik Sense Repository Service
- Qlik Sense Proxy Service
- Qlik Sense Engine Service
- Qlik Sense Scheduler Service
- Qlik Sense Printing Service
- Qlik Sense Service Dispatcher

For more information about services, see *Services* (page 55).
The Windows Qlik Sense services user that is not an administrator must meet the following requirements:

- Member of the **Qlik Sense Service Users** and **Performance Monitor Users** groups. You add the Windows Qlik Sense services user that is not an administrator to these groups after you install Qlik Sense.
- Only used for Qlik Sense Windows services. This is necessary to avoid conflicts with other Windows services in the same computer.

### PostgreSQL database superuser

The PostgreSQL database superuser is a role that bypasses all permission checks, except the right to log in. It is not a Windows, or Qlik Sense user, it is a PostgreSQL user configured in the repository database.

If you choose to install the PostgreSQL database manually, you are prompted to create a PostgreSQL database superuser and password during installation. That user ID and password are used to connect your PostgreSQL database. For details about creating users with the PostgreSQL administration tools, see *Installing and configuring PostgreSQL (page 113)*.

If you choose to install the Qlik Sense Repository Database locally during the Qlik Sense installation, the PostgreSQL installation is done automatically.

> **Note:** When you install Qlik Sense, if you select the Install local database option, the QSR, SenseServices, and QSMQ databases are created automatically. These databases also share the same PostgreSQL login role. For more information, see *Installing and configuring PostgreSQL (page 113)*.

### Qlik Sense Repository Database administrator

The Qlik Sense Repository Database administrator role has full access to the Qlik Sense Repository Database that contains all configuration data for the Qlik Sense site. It is not a Windows, or Qlik Sense user, it is a PostgreSQL user configured in the repository database.

If you choose to install PostgreSQL manually, the Qlik Sense Repository Database administrator is also created manually using the PostgreSQL administration tools. For details about creating users with the PostgreSQL administration tools, see *Installing and configuring PostgreSQL (page 113)*. You must enter the location of the Qlik Sense Repository Database and the login credentials for the Qlik Sense Repository Database administrator during the Qlik Sense setup on the **Shared persistence database connections settings** page.

If you choose to install the Qlik Sense Repository Database locally using the Qlik Sense setup, you are prompted to set a user name and password for the Qlik Sense Repository Database administrator during the setup.

You must keep that password for backup and restore activities. It may also be needed for support.

### User accounts for the logging database

Two user accounts, which use PostgreSQL password authentication, are automatically created during Qlik Sense installation. User account qlogs_writer is used internally by the logging service to write to the database. In fact, this user owns the logging database QLogs. User account qlogs_reader is used by the monitoring apps to read from the database. There is also a user account called qlogs_users, which is basically a group. It does not have a password and cannot be used to access the database. It exists only for the purpose of managing network access to the PostgreSQL database.
3.2 Installing Qlik Sense Enterprise on Windows

When you install Qlik Sense you have several deployment options depending on the size and requirements of your organization. Before you begin the installation process choose the appropriate architecture for your needs. Consider scalability and performance and factors such as how many apps you want to run, how many concurrent users you need, or how many reloads you want per hour.

<table>
<thead>
<tr>
<th>Size of organization</th>
<th>Qlik Sense deployment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>Single-node</td>
</tr>
<tr>
<td>Medium</td>
<td>Single-node or multi-node</td>
</tr>
<tr>
<td>Large</td>
<td>Multi-node</td>
</tr>
</tbody>
</table>

For more information on architecture options and considerations before you install see the following:

- Architecture (page 52)
- Planning your Qlik Sense Enterprise deployment (page 9)
- Qlik Sense Enterprise on Windows: multi-node deployment (page 20)

Installing Qlik Sense on a single node

A basic installation of Qlik Sense can be done by installing all of the Qlik Sense services on a single node. This kind of deployment works best in a single time zone, where reloads of data can be done during the night. To determine if a single-node installation is the right choice for you, see Planning your Qlik Sense Enterprise deployment (page 9).

For information about multi-node deployments of Qlik Sense, see Installing Qlik Sense in a multi-node site (page 98).

Before you install:

- Check that your environment meets the system requirements.
  See: System requirements for Qlik Sense Enterprise (page 10)
- Check that the required ports are available.
  See: Ports (page 65)
- Check that your browser is supported.
  See: Supported browsers (page 15)
3 Deploying Qlik Sense Enterprise on Windows

- Prepare the user accounts required to run the Qlik Sense services.
  See: User accounts (page 88)
- Understand how Qlik Sense uses LEF for site licensing and user access allocation, and have your license key available.
  See: Qlik Sense Licenses (page 38)

Do the following:

1. Log in to the computer where you plan to install Qlik Sense as a local Windows administrator.
   See: User accounts (page 88).
2. Create a file share before you run the Qlik Sense setup. The file share is a shared folder that stores all the Qlik Sense application data.
   a. Create a new folder.
   b. Right click on the folder, and click Properties.
   c. On the Sharing tab, and click Share.
   d. Enter the names of Windows users that you want to share the folder with, and click Add. Share this folder with your Windows Qlik Sense administrator and your Windows Qlik Sense services user. For more information, see User accounts (page 88).
   e. In the Permission level column, select Read/Write, and click Share.

   Make note of the network path displayed on the confirmation screen. You will enter this information during the Qlik Sense setup. The network path will be in the following format: \server-name\QlikShare

3. Download the Qlik_Sense_setup.exe file from www.qlik.com, and launch the setup.
4. Do the following:
   a. Accept the license agreement, and click Next.
   b. On the Create or join a cluster screen, click Create cluster.
   c. On the Host Name screen, enter the name of the computer that you are installing Qlik Sense on and click Next.
d. On the **Shared persistence database connections settings** screen, select the **Install local database** check box if you want to install a local repository or leave the check box unchecked if you want to connect to an existing repository database.

*Installing and configuring PostgreSQL (page 113)*

If you want to connect to an existing repository database, then enter the following values:

<table>
<thead>
<tr>
<th>Field name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Database host name</td>
<td>Enter the full URL to your repository database.</td>
</tr>
<tr>
<td>Database port</td>
<td>4432</td>
</tr>
</tbody>
</table>
3  Deploying Qlik Sense Enterprise on Windows

- **Database user** Enter the username that will be used to access the database.
  
  *Do not enter the username postgres.*

- **Database user password** Create your own database user password to access your repository database in the PostgreSQL database.

  e. On the **Database configuration** screen, click **Next**. There is no need to configure the database service to allow connections from other nodes in a single-node installation.

  f. On the **Shared persistence storage** screen, enter the path or URL to your file share, for example \\<domain>\QlikShare, and click **Next**. Your file share can either be a local folder or a remote folder.

  g. On the **Centralized Logging** screen, leave the **Configure centralized logging** check box selected if you want to set up centralized logging, or clear the check box if you want logs to be written to files. If you decide not to set up centralized logging at this time, you can set it up later by using the logging service utility; see Qlik Logging Service (page 203).
3  Deploying Qlik Sense Enterprise on Windows

If you want to write logs to a new database that is installed with Qlik Sense, click **New logging database**. Enter the following values and click **Next**.

<table>
<thead>
<tr>
<th>Field name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log writer password</td>
<td>Create a password for the qlogs_writer user to access the centralized PostgreSQL database.</td>
</tr>
<tr>
<td>Log reader password</td>
<td>Create a password for the qlogs_reader user to access the centralized PostgreSQL database.</td>
</tr>
</tbody>
</table>

If you want to write logs to an existing database on the same node that you are installing Qlik Sense on or on another node, click **Standalone logging database**. Enter the following values and click **Next**.
3 Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Field name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hostname</td>
<td>Enter the host name or IP of the centralized PostgreSQL database.</td>
</tr>
<tr>
<td>Port</td>
<td>4432</td>
</tr>
<tr>
<td>Log writer</td>
<td>Enter the password for the qlogs_writer user to access the centralized PostgreSQL database.</td>
</tr>
<tr>
<td>Log reader</td>
<td>Enter the password for the qlogs_reader user to access the centralized PostgreSQL database.</td>
</tr>
</tbody>
</table>

If you use a logging database on another node, ensure that this is a new and empty logging database before proceeding with the installation. If a QLogs db is already present on the remote database the schemas may be incompatible. See: Installing and configuring PostgreSQL (page 113)

h. On the **Installation location** screen, choose your own installation location or install Qlik Sense to the default location on the C:\ drive, and click **Next**.

i. On the **Repository Database Superuser Password** screen, enter a password for the PostgreSQL repository database superuser. Confirm the password and click **Next**. See, User accounts (page 88).

j. On the **Service Credentials** screen, enter the domain, user name and password for the account that you want use to run the Qlik Sense services, and click **Next**.

> **If you enter a username that is more than 20 characters long, it must be in UPN format, and must include the full domain name. For example, longusername@full.domain.name.**

k. On the **Ready to install** screen, optionally select to create desktop shortcuts and automatic start of the Qlik Sense services when the setup is complete.

> **If you selected local system as the user account type in the Service Credentials screen, but want to use a dedicated service account to run the Qlik Sense services, clear the Start the Qlik Sense services when the setup is complete selection.**

l. In the **Extension bundles** section, optionally select to install the extension bundles. Then, select which extension bundles you want to install from the list of those available for your Qlik Sense installation.

You can always add or remove extension bundles from your Qlik Sense installation at a later moment. See: Modifying extension bundles installation (page 98)

m. If you have chosen not to install the extension bundles, click **Install**. Otherwise, click **Next**.

n. If you are installing any of the extension bundles, accept the extension bundle license agreement. Then, click **Install**.

5. You will see a message indicating that Qlik Sense has been installed successfully.
3 Deploying Qlik Sense Enterprise on Windows

Click Finish.

6. If you selected local system as the user account type in the Service Credentials screen, but wish to use a dedicated service account to run the Qlik Sense services change the user account type and manually start the Qlik Sense services now. See Changing the user account to run Qlik Sense services (page 122)

You are ready to license your Qlik Sense installation.

Licensing Qlik Sense

Before you can start using Qlik Sense you must activate your site license.

Do the following:

1. Open the QMC.
   When you open the QMC for the first time the Site license properties screen is displayed.

2. Enter the license information from the License Enabling File (LEF).
   The property group Site license contains properties related to the license for the Qlik Sense system. All fields are mandatory and must not be empty.

   If you want to set up Qlik Cloud Services or Qlik Sense Enterprise on Kubernetes, please contact your Qlik representative or Qlik Support to obtain a valid license for the setup.

<table>
<thead>
<tr>
<th>Property name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owner name</td>
<td>The user name of the Qlik Sense product owner.</td>
</tr>
<tr>
<td>Owner organization</td>
<td>The name of the organization that the Qlik Sense product owner is a member of.</td>
</tr>
<tr>
<td>Serial number</td>
<td>The serial number assigned to the Qlik Sense software.</td>
</tr>
<tr>
<td>Control number</td>
<td>The control number assigned to the Qlik Sense software.</td>
</tr>
</tbody>
</table>

3. Expand LEF access and click Get LEF and preview the license. If you received your LEF via email, you can copy and paste the information into the text field.

   Failed to get LEF from server is displayed if the serial number or control number is incorrect.

4. Click Apply.
   Successfully licensed is displayed.

5. Click Close.

You have activated your Qlik Sense site license.

You are ready to connect to a user directory (optional), allocate user access or professional access, and set up permissions.
Allocating access to users

Your license is either based on access types, with professional access allocation as an option, or on tokens, with user access allocation as an option.

Access types license

Your Qlik Sense license includes a number of professional access allocations that are used to grant users in your organization access to Qlik Sense.

Do the following:

1. In the QMC, from the Start menu, click License management.
   The License usage summary screen is displayed.
2. Click the Professional access allocations tab.
3. Click the + Allocate button.
   The Users screen is displayed.
4. Select the users that you want to provide access to from the list and click Allocate.

   **Allocate** is disabled if the number of available allocations is insufficient for the number of selected users.

The users that you allocated access to appear in the Professional access allocations overview table.

Token-based license

Your Qlik Sense license includes a number of tokens that are used to allocate Qlik Sense access to users in your organization.

Do the following:

1. In the QMC, from the Start menu, click License management.
   The License usage summary screen is displayed.
2. Click the User access allocations tab.
3. Click the + Allocate button.
   The Users screen is displayed.
4. Select the users that you want to provide access to from the list and click Allocate.

   **Allocate** is disabled if the number of tokens available for allocation is insufficient for the number of selected users.

The users that you allocated access to appear in the User access allocations overview table.

Additional configuration

After you install Qlik Sense, you may want to:
Deploying Qlik Sense Enterprise on Windows

- Create load balancing rules in the QMC to improve resilience and performance in a multi-node site. For more information, see Load balancing.
- Configure the virtual proxy advanced settings to add your own hosts names to the white list. For more information, see Host white list.
- Configure the user directory connector to retrieve users from a user directory. For more information, see User imports (UDC).

You are now ready to start using Qlik Sense. See: Get started.

Modifying extension bundles installation

You can add or remove extension bundles from your Qlik Sense deployment at any moment. If you have a multi-node installation, extension bundles are installed on the central node.

You can see which extensions are installed in your deployment by checking the Extensions section in the Qlik Management Console (QMC).

Do the following:

1. In Control Panel, open Programs and Features.
2. In the list of programs, double-click the extension bundle that you want to modify.
3. The Extension Bundle Setup Wizard opens. Click Next.
4. Select Change.
5. On the Custom setup screen, click on the bundle icon to select how to modify the bundle installation:
   - If the bundle is installed, select Entire feature will be unavailable to uninstall it.
   - If the bundle is not installed, select Entire feature will be installed on local hard drive to install it.
   Then, click Next.
6. Click Change.
7. When the setup modification is complete, a message invites you to manually restart the Qlik Sense Repository Service.
8. Click Finish to close the Extension Bundle Setup Wizard.
9. Manually restart the Qlik Sense Repository Service to make the changes effective.

You can verify that the changes have been correctly applied by checking the Extensions section in the QMC.

Installing Qlik Sense in a multi-node site

A Qlik Sense multi-node deployment offers more configuration options than single node deployments. In a multi-node site, you can distribute Qlik Sense services across one or more server nodes to optimize scalability and performance.

Preparing a large, enterprise multi-node deployment requires careful planning, so first ensure that you have considered all the architecture and configuration options available.
3  Deploying Qlik Sense Enterprise on Windows

For more information about single-node deployments of Qlik Sense, see Installing Qlik Sense on a single node (page 90).

For more information on multi-node architecture and configuration options see:

- Planning your Qlik Sense Enterprise deployment (page 9)
- Architecture (page 52)
- Security (page 81)
- Performance (page 87)

Before you install:

- Check that your planned environment meets the system requirements. See: System requirements for Qlik Sense Enterprise (page 10)
- Prepare the user accounts required to run the Qlik Sense services on the computer where you plan to install Qlik Sense. See: User accounts (page 88)

  Important: If during the installation, you want to run the Qlik Sense services as a local user, without administrator rights, then you must create this user first.

- Ensure that your firewall is enabled and you have created the appropriate rules to allow rim nodes to communicate with the central node. See: Ports (page 65) for a full list of ports.
- Repository database - if you already have a Qlik Sense repository database on another server from a previous installation, you can continue to use this in your new deployment. If you do not intend to use this database then remove it before you start.
- Create a local file share to store your Qlik Sense application data. See: Creating a file share (page 111)
- Understand how Qlik Sense uses the License Enabler File (LEF) for licensing, and have your license key available. See: Qlik Sense Licenses (page 38)

This topic includes the following sections:

- Installing Qlik Sense (page 99)
- Adding a Qlik Sense node (page 108)

Installing Qlik Sense

You can install a Qlik Sense server as either a central node or as a rim node. In a multi-server site, rim nodes must be connected to a central node. See: Architecture (page 52). If you are installing a central node, you may also wish to configure a failover candidate. You only have the option to create a failover candidate when you are creating a node. For more information on how to configure a failover candidate, see Creating a node and Service cluster.
3 Deploying Qlik Sense Enterprise on Windows

To install a node:

1. Create a file share before you run the Qlik Sense setup. The file share is a shared folder that stores all the Qlik application data and must be accessible to all nodes in your Qlik Sense site. You can create a file share either on the same server computer as the central node or on another server.
   See: Creating a file share (page 111)
2. Log in to the computer where you plan to install Qlik Sense as a domain or local Windows administrator. You must have full administrator rights to run the Qlik Sense setup. You can start the Qlik Sense services as either an administrator or a local user without administrator privileges.
   See: User accounts (page 88).
4. Run the installation program as an administrator, and on the first screen click Install.
5. Read the License agreement screen. If you agree, select the check box and click Next.
6. On the Create or join a cluster screen, you have two options:
   a. Create cluster - To install a central node. All the other nodes in your site will connect to this node.
   b. Join cluster - To install a rim node that connects to a central node (if you choose this option, fewer screens are displayed in the setup).
7. On the Host Name screen, enter the address for the Qlik Sense node that you are installing, and click Next. The address must be in a format that other nodes can use when connecting to this node, otherwise the connection will fail.
   For example:
   - IP address: 10.1.123.234
   - Machine name: WIN-QS1BOL9FM99D
   - Fully qualified machine name: WIN-QS1BOL9FM99D.CUSTOMER.COM
Deploying Qlik Sense Enterprise on Windows

3

Ensure that the recommended server node name displayed in the Enter the address for this machine field matches the one you will use to access this node, otherwise enter an appropriate address or fully qualified domain name. Only use the fully qualified name if you understand the full implications.

8. On the Shared persistence database connections settings screen, select the Install local database check box if you want to install a local repository database, or leave the check box unchecked if you want to connect to an existing repository database hosted on another server.

Installing and configuring PostgreSQL (page 113)

If you want to install a local repository database, then enter the following values:
### 3 Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Field name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Database host name</td>
<td>localhost</td>
</tr>
<tr>
<td>Database port</td>
<td>4432</td>
</tr>
<tr>
<td>Database user</td>
<td>qliksenserepository</td>
</tr>
</tbody>
</table>

*Do not enter the username postgres.*

Database user password: Create a password to access the local repository database.

If you want to connect to an existing repository database on another server, then enter the following values:

<table>
<thead>
<tr>
<th>Field name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Database host name</td>
<td>Enter the full URL to your repository database.</td>
</tr>
<tr>
<td>Database port</td>
<td>4432</td>
</tr>
<tr>
<td>Database user</td>
<td>qliksenserepository</td>
</tr>
</tbody>
</table>

This is the login role you created in the PostgreSQL database (QSR)

Database user password: Enter the password you created in PostgreSQL.

Make a note of these values as you will need them again when you install a rim node.

*All Qlik Sense servers must be in the same geographic location or data center as the repository database and the file share.*

9. On the **Database configuration** screen, under **Advanced settings**, configure the listen addresses, IP ranges, and max connections from other nodes, and click **Next**. This is an optional step if you install a local repository database. You can also configure the database service listener directly in your PostgreSQL repository database. See: *Installing and configuring PostgreSQL* (page 113)

Enter the following values:

<table>
<thead>
<tr>
<th>Field name</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listen addresses</td>
<td>*</td>
<td>The IP address(es) to listen on. Use the value * to allow access for all IP addresses. If entering multiple listen addresses use a comma separated list.</td>
</tr>
<tr>
<td>IP ranges</td>
<td>0.0.0.0/0, ::/0</td>
<td>To allow all servers to access the repository database, use the value 0.0.0.0/0 (for all IPv4 addresses) and ::/0 (for all IPv6 addresses). If entering multiple IP addresses use a comma separated list.</td>
</tr>
</tbody>
</table>
## 3 Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Field name</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max connections</td>
<td>100</td>
<td>Specify the maximum number of concurrent connections to the database. The default value for a single server is 100. Multiply this value by the number of nodes in the cluster.</td>
</tr>
</tbody>
</table>

This screen does not appear if you are using a remote PostgreSQL database or if you are installing a rim node (Join cluster option).

10. On the **Shared persistence storage** screen, enter the path or URL to your file share, for example `\<domain>\QlikShare` and click **Next**. Your file share can either be a local folder or a remote folder on another server.  
    *Creating a file share (page 111)*

    This screen does not appear if you are installing a rim node (Join cluster option).

11. On the **Centralized Logging** screen, leave the **Configure centralized logging** check box selected if you want to set up centralized logging, or clear the check box if you want logs to be written to files. If you decide not to set up centralized logging at this time, you can set it up later by using the logging service utility; see Qlik Logging Service (page 203).
If you are installing Qlik Sense on a central node and you want to write logs to the database that is installed with Qlik Sense, click New logging database. Enter the following values and click Next.

<table>
<thead>
<tr>
<th>Field name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log writer password</td>
<td>Create a password for the qlogs_writer user to access the centralized PostgreSQL database.</td>
</tr>
<tr>
<td>Log reader password</td>
<td>Create a password for the qlogs_reader user to access the centralized PostgreSQL database.</td>
</tr>
</tbody>
</table>

⚠️ Do not use mixed character sets when creating a password.
If you want to write logs to an existing database on another node, click **Standalone logging database**. Enter the following values and click **Next**.

<table>
<thead>
<tr>
<th>Field name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hostname</td>
<td>Enter the hostname or IP address of the standalone logging database.</td>
</tr>
<tr>
<td>Port</td>
<td>Enter the port number that you specified for the standalone logging database.</td>
</tr>
<tr>
<td>Log writer password</td>
<td>Enter the password for the qlogs_writer user.</td>
</tr>
<tr>
<td>Log reader password</td>
<td>Enter the password for the qlogs_reader user.</td>
</tr>
</tbody>
</table>

If you use a logging database on another node, ensure that this is a new and empty logging database before proceeding with the installation. If a QLogs db is already present on the remote database the schemas may be incompatible.

See: *Installing and configuring PostgreSQL (page 113)*

12. On the **Installation location** screen, choose a location to install Qlik Sense or use the default location on the C:\ drive, and click **Next**.

13. On the **Repository Database Superuser Password** screen, create a superuser password for the PostgreSQL database, and click **Next**.

   This screen does not appear if you are using a remote PostgreSQL database or if you are installing a rim node (Join cluster option).

14. On the **Service Credentials** page, enter the domain, user name and password for the account that you want use to run the Qlik Sense services, and click **Next**.

   *User accounts (page 88)*

   If you enter a username that is more than 20 characters long, it must be in UPN format, and must include the full domain name. For example, longusername@full.domain.name.

15. On the **Ready to install** screen, optionally select to create desktop shortcuts and automatic start of the Qlik Sense services when the setup is complete.

   If you want to use a dedicated service account to run the Qlik Sense services, clear the **Start the Qlik Sense services when the setup is complete** selection.

16. In the **Extension bundles** section, optionally select to install the extension bundles. Then, select which extension bundles you want to install from the list of those available for your Qlik Sense installation. You can always add or remove extension bundles from your Qlik Sense installation at a later moment. See: *Modifying extension bundles installation (page 110)*.

17. If you have chosen not to install the extension bundles, click **Install**. Otherwise, click **Next**.

18. If you are installing any of the extension bundles, accept the extension bundle license agreement. Then, click **Install**.
19. You will see a message indicating that Qlik Sense has been installed successfully. Click Finish.

20. If you selected local system as the user account type in the Service Credentials screen, but wish to use a dedicated service account to run the Qlik Sense services, change the user account type and manually start the Qlik Sense services now. See User accounts (page 88)

Configuring PostgreSQL multi-node connections

In the postgresql.conf configuration file, you need to edit the max_connections setting, depending on how many nodes you require in your site. If you do not configure this setting correctly, and reach the connection pool limit, then PostgreSQL will reject any further connections.

To configure the max_connections setting:
1. Stop the Qlik Sense services.
2. Navigate to the postgresql.conf file in C:\ProgramData\Qlik\Sense\Repository\PostgreSQL\<version> of your Qlik Sense installation.
3. To edit this setting, open the file in a text editor as an administrator.
4. Make the following configuration changes:
   
<table>
<thead>
<tr>
<th>Setting</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>max_connections</td>
<td>600</td>
<td>To calculate this value multiply x 100 the number of servers in your deployment. For example, 600 = 6 nodes.</td>
</tr>
</tbody>
</table>

   5. Save your changes.
   6. Start the Qlik Sense services.

You are ready to license your Qlik Sense installation.

Licensing Qlik Sense

Before you can start using Qlik Sense you must activate your site license.

To activate your license:
1. Open the QMC.
2. When you open the QMC for the first time the Site license properties page is displayed.
3. Enter the license information from the License Enabler File (page 41) (LEF).
   The property group Site license contains properties related to the license for the Qlik Sense system. All fields are mandatory and must not be empty.

   If you want to set up Qlik Cloud Services or Qlik Sense Enterprise on Kubernetes, please contact your Qlik representative or Qlik Support to obtain a valid license for the setup.
### Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Property name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owner name</td>
<td>The user name of the Qlik Sense product owner.</td>
</tr>
<tr>
<td>Owner organization</td>
<td>The name of the organization that the Qlik Sense product owner is a member of.</td>
</tr>
<tr>
<td>Serial number</td>
<td>The serial number assigned to the Qlik Sense software.</td>
</tr>
<tr>
<td>Control number</td>
<td>The control number assigned to the Qlik Sense software.</td>
</tr>
</tbody>
</table>

4. Expand **LEF access** and click **Get LEF and preview the license**. If you received your LEF via email, you can copy and paste the information into the text field.

   *Failed to get LEF from server is displayed if the serial number or control number is incorrect.*

5. Click **Apply**.

   **Successfully licensed** is displayed.

6. Click **Close**.

You have activated your Qlik Sense site license.

You are ready to connect to a user directory (optional), allocate user access or professional access, and set up permissions.

**Allocating access to users**

Your license is either based on access types, with professional access allocation as an option, or on tokens, with user access allocation as an option.

**Access types license**

Your Qlik Sense license includes a number of professional access allocations that are used to grant users in your organization access to Qlik Sense.

Do the following:

1. In the QMC, from the **Start** menu, click **License management**.
   
   The **License usage summary** screen is displayed.

2. Click the **Professional access allocations** tab.

3. Click the **+ Allocate** button.
   
   The **Users** screen is displayed.

4. Select the users that you want to provide access to from the list and click **Allocate**.

   *Allocate is disabled if the number of allocations available is insufficient for the number of selected users.*

The users that you allocated access to appear in the **Professional access allocations** overview table.
3 Deploying Qlik Sense Enterprise on Windows

In a multi-node site, all nodes share the same license, so you only need to activate your license once on the central node.

If you have created a rim node, you are now ready to register the rim node with the central node.

Token-based license

Your Qlik Sense license includes a number of tokens that are used to allocate Qlik Sense access to users in your organization.

Do the following:

1. In the QMC, from the Start menu, click License management. The License usage summary screen is displayed.
2. Click the User access allocations tab.
3. Click the + Allocate button. The Users screen is displayed.
4. Select the users that you want to provide access to from the list and click Allocate.

Allocate is disabled if the number of tokens available for allocation is insufficient for the number of selected users.

The users that you allocated access to appear in the User access allocations overview table.

In a multi-node site, all nodes share the same license, so you only need to activate your license once on the central node.

If you have created a rim node, you are now ready to register the rim node with the central node.

Adding a Qlik Sense node

After installing a central node and a rim node, configure the central node to connect to the rim node. Before you can verify that a rim node is running correctly you must connect it to the central node. Use the QMC on the central node to register a rim node.

To configure a central node to connect to a rim node:

1. On the central node, open the QMC, and click Nodes.
2. Click Create new.
3. In the Edit node window, enter the following configuration details about the node you want to connect to:

<table>
<thead>
<tr>
<th>Field name</th>
<th>Description</th>
<th>Example value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Provide a suitable name for the node.</td>
<td>For example,</td>
</tr>
</tbody>
</table>

Plan and deploy Qlik Sense - Qlik Sense, June 2019
3  Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Host name</th>
<th>Enter the full URL of the node you want to connect to.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Node purpose</td>
<td>Choose a suitable purpose for the node:</td>
</tr>
<tr>
<td></td>
<td>• Production</td>
</tr>
<tr>
<td></td>
<td>• Development</td>
</tr>
<tr>
<td></td>
<td>• Both</td>
</tr>
<tr>
<td>Node configuration</td>
<td>Select this node as a failover candidate.</td>
</tr>
<tr>
<td>Service activation</td>
<td>Select the services you want to run on this server node:</td>
</tr>
<tr>
<td></td>
<td>• Repository</td>
</tr>
<tr>
<td></td>
<td>• Engine</td>
</tr>
<tr>
<td></td>
<td>• Printing</td>
</tr>
<tr>
<td></td>
<td>• Proxy</td>
</tr>
<tr>
<td></td>
<td>• Scheduler</td>
</tr>
</tbody>
</table>

**Consumer node 1**

For example, `<domain>-<servername>.qliktech.com`

For example, choose **Production** for a scheduler node or **Development** for a developer node used for creating apps.

For more information on types of nodes, see: [Creating a node](#)

Check that your license supports the node purpose that you have chosen.

For example, if you select this node as a failover candidate it means that this node can perform the same role as the central node if the central node fails. See: [Failover (page 112)](#)

For example, if you are installing a consumer node, select the **Repository** and **Engine** services.

For more information on which services to run on different types of nodes, see: [Architecture (page 52)](#) and [Services (page 55)](#)
4. Click **Apply**. The central node generates a certificate that you use to register the rim node. If the central node cannot connect to the rim node you will see a **Node registration** error message. If you get this error, first check that you have opened port 4444 on the central and rim nodes to allow certificates to be sent.

5. The **Install certificates** pop-up window then opens providing you with a URL and a password to authorize the certificate on the rim node.

6. On the rim node, paste the URL into a new browser window.

7. On the **Install certificates** page (in your browser), enter the password and click **Submit**. If successful, you see the **Successfully licensed** message.

8. Follow the same authorization procedure for each node that you want to add to your deployment.

9. To verify that all rim nodes are configured correctly, open the QMC, click **Nodes** and you can see the status of all the nodes in your deployment.

### Verify your installation

To verify that Qlik Sense has installed correctly:

1. Open the Qlik Management Console (QMC).
2. Open the Qlik Sense Hub.

If the QMC and Hub open without any security warnings displayed in the browser, then you have installed Qlik Sense correctly.

### Additional configuration

After you have installed and verified that Qlik Sense is running correctly, you may find the following configuration information useful:

- **Load balancing** - create load balancing rules in the QMC to improve resilience and performance in a multi-node site.
- **Host white list** - configure the virtual proxy advanced settings to add your own hosts names to the white list.
- **User imports (UDC)** - configure the user directory connector to retrieve users from a user directory.

> If you are installing custom connectors in a multi-node setup, the custom connectors must be installed on each node.

You are now ready to start using Qlik Sense.

**Get started.**

### Modifying extension bundles installation

You can add or remove extension bundles from your Qlik Sense deployment at any moment. If you have a multi-node installation, extension bundles are installed on the central node.
3  Deploying Qlik Sense Enterprise on Windows

You can see which extensions are installed in your deployment by checking the Extensions section in the Qlik Management Console (QMC).

Do the following:

1. In Control Panel, open Programs and Features.
2. In the list of programs, double-click the extension bundle that you want to modify.
3. The Extension Bundle Setup Wizard opens. Click Next.
4. Select Change.
5. On the Custom setup screen, click on the bundle icon to select how to modify the bundle installation:
   - If the bundle is installed, select Entire feature will be unavailable to uninstall it.
   - If the bundle is not installed, select Entire feature will be installed on local hard drive to install it.
   Then, click Next.
6. Click Change.
7. When the setup modification is complete, a message invites you to manually restart the Qlik Sense Repository Service.
8. Click Finish to close the Extension Bundle Setup Wizard.
9. Manually restart the Qlik Sense Repository Service to make the changes effective.

You can verify that the changes have been correctly applied by checking the Extensions section in the QMC.

Creating a file share

Creating a file share or shared folder is a necessary prerequisite before you install Qlik Sense. The file share is used to store all the Qlik application data and must be accessible to all nodes in your Qlik Sense site. You can create a file share either on the same server as the central node or on a separate server. If you have a large multi-node site we recommend that you configure the file share on a dedicated server for better resilience and performance.

If you create the file share on a separate server then you can follow the same steps as for a central node but you must ensure that the same Windows domain user that you use to run the Qlik services has read and write access to the file share folder.

To create a file share and share the folder with specific users:

1. Create a local folder on your server computer. For example, create a folder called QlikShare on the C:\ drive.
2. Right click the folder, and then click Properties.
3 Deploying Qlik Sense Enterprise on Windows

3. Click the **Sharing** tab, and then click **Share**.
4. Enter the name of your Windows user, and click **Add**.
5. In the **Permission level** column, select **Read/Write**, then click **Share**.

*Make a note of the network path shown in the confirmation screen as you use this later during setup of your shared persistence storage folders. The network path will be in the following format:*\server-name\QlikShare

Ensure that permissions on the folder, subfolders, and files are set to full control for the user account you selected.

To do this:

1. Click the **Security** tab.
2. Select the user account you want to use for the installation.
3. Click **Advanced** and check that your user has full control and that this permission applies to the folder, subfolders, and files.
4. Click the **Effective Access** tab and then click **Select a user** and enter your user account name.
5. Click **View effective access** and check in the **Permission** column that your user has full control.

**Failover**

To avoid having a single point of failure in a multi-node site, when you add a new node to your deployment you can assign it the role of failover candidate. This means that any server or node in your Qlik Sense site can perform the same role as the central node. The role of the central node can now be swapped, for example if the central node has been offline for more than 10 minutes.

**Automatic failover**

After you have configured a node to become a failover candidate, each node in your site will regularly check the primary node (central node) for a heartbeat. If there is no communication between the primary node and the other nodes in the site after 10 minutes then the primary node will be replaced by the next available node. If more than one node is set as a failover candidate each node will compete to get a lock on a database field and the winner becomes the central node. There is an additional field in the QMC to show which node is currently the central node.

**Manually migrating the central node**

If you decide that you want to move the central node to another node in your site, you can manually migrate it using the following REST API calls:

- Get /qrs/serverNodeConfiguration to get a list of server GUIDs.
- Do an empty POST to /qrs/failover/tonode/\{serverNodeConfigurationID\} to retrieve the ID of the node you want to migrate to.
Installing and configuring PostgreSQL

To improve performance in a Qlik Sense multi-node deployment, you have the option to install your repository (QSR), SenseServices, QSMQ, QLogs logging, and Licenses databases on a dedicated, remote PostgreSQL server.

In Qlik Sense Enterprise, configuring all the components of a Multi-Cloud deployment is optional. However, all deployments, whether Multi-Cloud or on-premise require the installation of the SenseServices database and QSMQ databases.

The Qlik Sense repository database (QSR)
The QSR is the primary database in your Qlik Sense deployment.

If you want to install the QSR database on a dedicated PostgreSQL server, you must install and configure PostgreSQL before you install Qlik Sense, as you will need to enter the PostgreSQL server/host details in the Qlik Sense installer.

The Qlik Sense services database (SenseServices)
The SenseServices database contains schemas for each of the Qlik Sense services and allows growth independently of the Qlik Sense Repository Database, while still sharing the same PostgreSQL instance and login role.

The Qlik Sense message queue database (QSMQ)
The QSMQ database provides a light-weight method of passing messages internally between services in Qlik Sense Enterprise. The NOTIFY and LISTEN functionality in PostgreSQL allows services to be notified about new messages that have been written to the messaging table.

The Qlik Sense logging database (QLogs)
The QLogs database centralizes logging by collecting log messages from all Qlik Sense nodes in your deployment and stores them in a PostgreSQL database.

When you install the QLogs database as a standalone logging database, you can configure it either before or after you install Qlik Sense.

- If you install the QLogs database before the Qlik Sense installation, then you will need to create the QLogs database login roles manually.
- If you install the QLogs database after installing Qlik Sense, use the qlik.Logging.Service.exe setup command. When you run this command, you specify a remote host and the script will automatically create the QLogs database and login roles for you. For more information, see: Qlik Logging Service (page 203)

The licenses service database (Licenses)
The licenses database contains a local copy of license data to allow faster response times and more robustness. It is only accessed by the licenses service.
3 Deploying Qlik Sense Enterprise on Windows

The QSR, SenseServices, QSMQ, and Licenses databases share the same login role and must be installed on the same PostgreSQL instance.

If you already have a PostgreSQL database installed as part of a previous deployment, then you can continue to use it.

If Qlik Sense uses a PostgreSQL database on a dedicated infrastructure, then it can use PostgreSQL version 9.6. You can run the instance of PostgreSQL on platforms including Windows, Linux or cloud hosted services, such as Amazon RDS. However, Qlik will only offer configuration support when PostgreSQL is running on Windows. If you use Linux or Amazon RDS, it is your own responsibility to install and configure a running instance of PostgreSQL for Qlik Sense to use.

To install a dedicated PostgreSQL server with QSR, SenseServices, QSMQ, QLogs, and Licenses database:

- Install PostgreSQL
- Create the PostgreSQL databases, and configure login roles.
- Edit the configuration files to allow access from Qlik Sense nodes.
- Verify that the database has installed and is running correctly.

Installing PostgreSQL

Before installing a dedicated PostgreSQL server instance, check that your server fulfills the system requirements on www.postgresql.org.

To install PostgreSQL on a dedicated server:

1. Log in to the server where you want to install PostgreSQL as an administrator. See: User accounts (page 88)
2. Download PostgreSQL EnterpriseDB version 9.6 from the PostgreSQL website.
3. Run the PostgreSQL setup wizard.
5. On the Password screen, create a password for the PostgreSQL superuser.
   You will use this password when you connect to the PostgreSQL database and you will also be prompted for it when you run the Qlik Sense setup.
6. On the Port screen, specify port 4432. This port is required for communication between all the nodes in a site.
7. In the Advanced Options screen, accept the default locale.
3 Deploying Qlik Sense Enterprise on Windows

8. In the **Ready to Install** screen, click **Next** to run the setup.
9. After running the setup, you have the option to install **Stack Builder**. Clear the check box if you want to install this later.
10. Click **Finish** to complete the installation.

When you install PostgreSQL EnterpriseDB, the pgAdmin tool is included.

**Creating a PostgreSQL database**

You can create a repository QSR, SenseServices, QSMQ, QLogs (logging), and Licenses database manually with the pgAdmin tool or using a script.

To create a new, empty PostgreSQL database using the pgAdmin tool:

1. Open the **pgAdmin** tool.
2. In the **pgAdmin Browser**, under **Servers**, right-click the PostgreSQL node and then click **Connect Server**.
3. Enter your PostgreSQL superuser password to make a connection. A green status bar appears in the lower right corner of your screen when the server connection is successful.
4. Right-click the **Databases** node, click **Create**, and then click **Database**.
5. Enter the name of the database you are creating, and then click **Save**.

To create a new, empty PostgreSQL database by running a script in the pgAdmin tool:

1. Open the **Query Tool**. First select an existing database, such as **postgres**, to display the **Query Tool** option in the **Tools** menu.
2. Execute the following script:

```
CREATE DATABASE "<databasename>" ENCODING = 'UTF8'; --creates an empty database.
```

Replace `<databasename>` with **qsr** for the repository database, **senseservices** for the SenseServices database, **qsmq** for the message queue database, **licenses** for the license service, and **qlogs** if you are creating a logging database.

**Creating login roles**

You need to create login roles for users when you create a PostgreSQL database. You can create login roles using the pgAdmin tool or by running a script.

The QSR, SenseServices, QSMQ, and Licenses login role

To create login roles using the pgAdmin tool:

1. Right-click the **Login/Group Roles** node. To create a new database user, click **Create**, and then click **Login/Group Role**.
2. In the **Create - Login/Group Role** window, in the **General** tab, enter the name **qliksenserepository**.
3. In the **Privileges** tab, enable **Can login?** and leave the other default privileges unchanged.
4. In the **Definition** tab, enter a password of your choice, and click **Save**.

When you run the Qlik Sense setup, in the **Shared persistence database connections settings**
screen, you are asked to enter the **Database user** password that you created here so that Qlik Sense can connect to the repository database.

5. Make **qliksenserepository** the owner of the **QSR, SenseServices, and QSMQ** databases. To do this, right-click the **QSR, SenseServices, QSMQ, and Licenses** databases you created earlier, and then click **Properties**.

6. In the **General tab**, in the **Owner drop-down**, select **qliksenserepository** as **Owner** of the **QSR, SenseServices, QSMQ, and Licenses** databases and click **Save**.

To create login roles by running a script in the pgAdmin tool:

Open the **Query Tool**. Select an existing database, to display the **Query Tool** option in the **Tools** menu.

Run the following script:

```
CREATE ROLE "qliksenserepository" WITH LOGIN NOINHERIT NOSUPERUSER NOCREATEDB NOCREATEROLE NOREPLICATION VALID UNTIL 'infinity'; -- change <qliksenserepository_user_pass> to your password for the repository service user
ALTER ROLE "qliksenserepository" WITH ENCRYPTED PASSWORD '<qliksenserepository_user_pass>';
GRANT qliksenserepository TO postgres;

ALTER DATABASE "QSR" OWNER TO "qliksenserepository";
ALTER DATABASE "SenseServices" OWNER TO "qliksenserepository";
ALTER DATABASE "QSMQ" OWNER TO "qliksenserepository";
ALTER DATABASE "Licenses" OWNER TO qliksenserepository;

GRANT TEMPORARY, CONNECT ON DATABASE "QSMQ" TO PUBLIC;
GRANT ALL ON DATABASE "QSMQ" TO postgres;
GRANT CREATE ON DATABASE "QSMQ" TO "qliksenserepository";
GRANT TEMPORARY, CONNECT ON DATABASE "SenseServices" TO PUBLIC;
GRANT ALL ON DATABASE "SenseServices" TO postgres;
GRANT CREATE ON DATABASE "SenseServices" TO "qliksenserepository";

GRANT TEMPORARY, CONNECT ON DATABASE "Licenses" TO PUBLIC;
GRANT ALL ON DATABASE "Licenses" TO postgres;
GRANT CREATE ON DATABASE "Licenses" TO qliksenserepository;
```

*Include a password for qliksenserepository as you will be prompted for this when you install Qlik Sense.*

The QLogs login role

To create login roles for the QLogs database by running a script in the pgAdmin tool:

1. Open the **Query Tool**. Select an existing database, to display the **Query Tool** option in the **Tools** menu.

2. Run the following script:

```
CREATE ROLE qlogs_users WITH NOLOGIN NOINHERIT NOSUPERUSER NOCREATEDB NOCREATEROLE NOREPLICATION VALID UNTIL 'infinity';
CREATE ROLE qlogs_reader WITH LOGIN NOINHERIT NOSUPERUSER NOCREATEDB NOCREATEROLE NOREPLICATION VALID UNTIL 'infinity';
CREATE ROLE qlogs_writer WITH LOGIN NOINHERIT NOSUPERUSER NOCREATEDB NOCREATEROLE NOREPLICATION VALID UNTIL 'infinity'; --creates users and assigns privileges
ALTER ROLE qlogs_reader WITH ENCRYPTED PASSWORD '<qlogs_reader_password>'; --a
```
### 3 Deploying Qlik Sense Enterprise on Windows

password to qlogs_reader

```sql
ALTER ROLE qlogs_writer WITH ENCRYPTED PASSWORD '<qlogs_writer_password>'; --adds qlogs_reader and qlogs_writer to qlogs_users
```

password to qlogs_writer

```sql
GRANT qlogs_users TO qlogs_reader;

GRANT qlogs_users TO qlogs_writer; --sets qlogs_writer as an owner
```

group
database

---

Include a password for qlogs_reader and qlogs_writer as you will be prompted for these when you install Qlik Sense.

### Configuring PostgreSQL

To allow communication between your PostgreSQL repository database and your Qlik Sense nodes, edit the pg_hba.conf and postgresql.conf configuration files.

Make a backup copy of the postgresql.conf and pg_hba.conf files before you start, so that you have the option to revert back to the original settings.

#### postgresql.conf

The postgresql.conf file enables you to specify general parameters for your PostgreSQL server, such as for auditing, authentication, and encryption. Edit this file to control which Qlik Sense nodes can access your PostgreSQL database server.

To edit the postgresql.conf file:

1. Navigate to the postgresql.conf file in C:\Program Files\PostgreSQL\<version>\data of your PostgreSQL installation.
2. Open the file in a text editor as an administrator.
3. Make the following configuration changes:

<table>
<thead>
<tr>
<th>Setting</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>listen_addresses</td>
<td>*</td>
<td>Enter the IP address(es) to listen on. If entering multiple listen addresses, use a comma separated list. Enter * to listen for connections from all IP addresses.</td>
</tr>
<tr>
<td>max_connections</td>
<td>600</td>
<td>Defines the maximum number of client connections allowed. To calculate this value, multiply by 100 the number of nodes in your deployment.</td>
</tr>
</tbody>
</table>

4. Save your changes.

For more detailed information about setting these parameters, see the PostgreSQL documentation.
3 Deploying Qlik Sense Enterprise on Windows

**pg_hba.conf**

The `pg_hba.conf` file handles client authentication. Each record specifies a connection type, such as a client IP address range, database name, user name, and the authentication method used.

To edit the `pg_hba.conf` file:

1. Navigate to the `pg_hba.conf` file in `C:\Program Files\PostgreSQL\<version>\data` of your PostgreSQL installation.
2. Open the file in a text editor as an administrator.
3. Locate the following line:
   ```
   host all all 127.0.0.1/32 md5
   ```
   This line determines which servers can access the repository database server. The default address setting, `127.0.0.1/32`, only allows local host to access the database.
4. Replace `127.0.0.1/32` with a sub net specification that covers all the IP addresses of the nodes in your site.
   When specifying these settings, add one row for each node, using `/32` as a suffix for each address, or add a sub net that covers all addresses using, for example, `/24` as a suffix:
   - IPv4 (32-bit addresses):
     - To specify a single address: `192.168.1.0/24`, or `172.20.143.89/32`
     - For a small network: `172.20.143.0/24, or 10.6.0.0/16 for a larger one.`
     - To allow access from all IPv4 addresses: `0.0.0.0/0`
   - IPv6 (128-bit numeric addresses):
     - For a single host: `::1/128` (in this case the IPv6 loopback address)
     - For a small network: `fe80::7a31:c1ff:0000:0000/96`
     - To allow access from all IPv6 addresses: `::/0`

   **Important:** When you add the IPv6 connections and use hostname in the address column, both the forward and reverse nslookup of the client machine must return valid values for PostgreSQL to accept the connection from the client. For more information refer to the PostgreSQL documentation.

5. Save your changes.

For more information on how to set a more restrictive IP address, see the PostgreSQL documentation.

You have installed and configured a PostgreSQL database on a separate server. You are now ready to resume your installation of Qlik Sense.

** Installing and configuring PostgreSQL on Azure **

This topic describes how to install and configure PostgreSQL on Microsoft Azure. For more general instructions regarding PostgreSQL installation and configuration, see **Installing and configuring PostgreSQL** (page 113).

To improve performance in a Qlik Sense multi-node deployment, you have the option to install your repository (QSR), SenseServices, QSMQ, and Licenses databases on a dedicated, remote PostgreSQL server.
In Qlik Sense Enterprise, configuring all the components of a Multi-Cloud deployment is optional. However, all deployments, whether Multi-Cloud or on-premise, require the installation of the SenseServices database and QSMQ databases.

The Qlik Sense repository database (QSR)

The QSR is the primary database in your Qlik Sense deployment.

If you want to install the QSR database on a dedicated PostgreSQL server, you must install and configure PostgreSQL before you install Qlik Sense, as you will need to enter the PostgreSQL server/host details in the Qlik Sense installer.

The Qlik Sense services database (SenseServices)

The SenseServices database contains schemas for each of the Qlik Sense services and allows growth independently of the Qlik Sense Repository Database, while still sharing the same PostgreSQL instance and login role.

The Qlik Sense message queue database (QSMQ)

The QSMQ database provides a light-weight method of passing messages internally between services in Qlik Sense Enterprise. The NOTIFY and LISTEN functionality in PostgreSQL allows services to be notified about new messages that have been written to the messaging table.

The licenses service database (Licenses)

The licenses database contains a local copy of license data to allow faster response times and more robustness. It is only accessed by the licenses service.

The QSR, SenseServices, QSMQ, and Licenses databases share the same login role and must be installed on the same PostgreSQL instance.

If you already have a PostgreSQL database installed as part of a previous deployment, then you can continue to use it.

If Qlik Sense uses a PostgreSQL database on a dedicated infrastructure, then it can use PostgreSQL version 9.6. You can run the instance of PostgreSQL on platforms including Windows, Linux or cloud hosted services, such as Amazon RDS. However, Qlik will only offer configuration support when PostgreSQL is running on Windows. If you use Linux or Amazon RDS, it is your own responsibility to install and configure a running instance of PostgreSQL for Qlik Sense to use.

Setting up a PostgreSQL database in Azure

Before you install Qlik Sense, you need to set up a database in Azure.

Do the following:
2. Search for **Azure Database for PostgreSQL**.
3. For the **PostgreSQL server** input fields, enter your values. The following three values must be filled in:
   - **Server name**: `<your unique instance name, example: qliksensedemo>`
   - **Server admin login name**: `postgres`
   - **Version**: 9.6
4. Under **Connection security**, click **Add client IP** to whitelist the connection.
5. Disable SSL encryption.

### Connecting to the database using pgadmin 4.x

Do the following:

1. If not already installed, download and install the *pgAdmin* tool from the following site:
   https://www.pgadmin.org/download/pgadmin-4-windows/.
2. Create a connection to the instance you checked out, in this case:
3. Enter user: `postgres@qliksensedemo`
4. Enter the password that you used when setting up the database.

   > When installing the Sense database, you need to specify the user as `qliksenserepository@dbinstance`, while remaining as `qliksenserepository` in the Azure PostgreSQL instance.

5. Once connected to the Azure instance, open up a database and open the query tool.

6. In the **Query Editor**, add the following lines of code:
   -- one by one, for creating the DB
   ```sql
   CREATE DATABASE "QSR" ENCODING = 'UTF8';
   CREATE DATABASE "SenseServices" ENCODING = 'UTF8';
   CREATE DATABASE "QSMQ" ENCODING = 'UTF8';
   CREATE DATABASE "Licenses" ENCODING = 'UTF8'; //one at a time
   -- from here the whole script
   CREATE ROLE "qliksenserepository" WITH LOGIN NOINHERIT NOSUPERUSER NOCREATEDB NOCREATEROLE NOREPLICATION VALID UNTIL 'infinity'; -- change `<qliksenserepository_user_pass>` to your password for the repository service user
   ALTER ROLE "qliksenserepository" WITH ENCRYPTED PASSWORD '<qliksenserepository_user_pass>';
   GRANT qliksenserepository TO postgres;
   ALTER DATABASE "QSR" OWNER TO "qliksenserepository";
   ALTER DATABASE "SenseServices" OWNER TO "qliksenserepository";
   ALTER DATABASE "QSMQ" OWNER TO "qliksenserepository";
   ALTER DATABASE "Licenses" OWNER TO qliksenserepository;
   GRANT TEMPORARY, CONNECT ON DATABASE "QSMQ" TO PUBLIC;
   GRANT ALL ON DATABASE "QSMQ" TO postgres;
   ```
3 Deploying Qlik Sense Enterprise on Windows

```
GRANT CREATE ON DATABASE "QSMQ" TO "qliksenserepository";
GRANT TEMPORARY, CONNECT ON DATABASE "SenseServices" TO PUBLIC;
GRANT ALL ON DATABASE "SenseServices" TO postgres;
GRANT CREATE ON DATABASE "SenseServices" TO "qliksenserepository";

GRANT TEMPORARY, CONNECT ON DATABASE "Licenses" TO PUBLIC;
GRANT ALL ON DATABASE "Licenses" TO postgres;
GRANT CREATE ON DATABASE "Licenses" TO qliksenserepository;
```

The new script does not include Qlogs, because Qlik Sense logging service does not support PostgreSQL in cloud deployments.

Installing Qlik Sense

Now that you have set up the PostgreSQL database on Azure, you can install Qlik Sense.

Do the following:

1. Follow the installation instructions in Installing Qlik Sense on a single node (page 90) The following values must be used on the appropriate pages:
2. On the page Shared persistence database connection settings:
   - **Database host name**: qliksensedemo.postgres.database.azure.com
   - **Database port**: 5432
   - **Database user**: qliksenserepository@qliksensedemo

When you have installed Qlik Sense your setup is complete.

Configuring a proxy for Qlik License Service communication in Qlik Sense Enterprise on Windows

You can handle the communication between the Qlik License Service and the License Backend with a proxy.

The Qlik License Service is included in Qlik Sense Enterprise February 2019 and later releases and is used when Qlik Sense is activated using a signed key license. The Qlik License Service stores the information about the license, and communicates with a License Back-end Service, hosted by Qlik, for product activations and entitlement management. Port 443 is used for accessing the License Back-end Service and retrieving license information.

In a Qlik Sense Enterprise on Windows multi-node deployment, the Qlik License Service is installed on every node. You can manage the status of the Qlik License Service by starting and stopping the Qlik Sense Service Dispatcher, listed in the list of services running in the Windows machine.

With Qlik Sense June 2019 or later you can configure the communication between Qlik License service and the Qlik License Backend to be handled by a proxy.

In Qlik Sense Enterprise on Windows, configuration of a proxy for the Qlik License Service is done using command line parameters. Both HTTP and HTTPS scheme are supported.
3 Deploying Qlik Sense Enterprise on Windows

Do the following:

1. Navigate to the `service.conf` file, which by default is located in:
   ```
   %Program Files%\Qlik\Sense\ServiceDispatcher\service.conf
   ```

2. Locate the section `[licenses.parameters]`, which by default contains the following lines:
   ```
   [licenses.parameters]
   -qsefw-mode
   --app-settings="..\Licenses\appsettings.json"
   ```
   3. Add the line `-proxy-uri=http://myproxy.example.com:8888` as shown below:
   ```
   [licenses.parameters]
   -qsefw-mode
   -proxy-uri=http://myproxy.example.com:8888
   --app-settings="..\Licenses\appsettings.json"
   ```
   Where "http://myproxy.example.com" is the address of your company's proxy, and "8888" is the port used by the proxy.

4. Save the file and close.

5. Restart the Qlik Sense Service Dispatcher, which handles the execution of the Qlik License Service.

6. If you have a multi-node installation, repeat these steps for all the nodes in your installation.

Changing the user account to run Qlik Sense services

Before you install, change or upgrade your Qlik Sense installation, you must choose an administrator or non-administrator account to run the Qlik Sense services. For example your company policy may require you to run the Qlik Sense services as a user without administrator privileges.

⚠️ If you want to upgrade from Qlik Sense 3.1 SR2 or later to Qlik Sense June 2017 you must use a service user account (local or domain) and not a Local System account to run the services. If you use a Local System account to upgrade, you will get an error.
See: Upgrading from Qlik Sense 3.1 SR2 or later to Qlik Sense June 2017 or later (page 135)

Using an account without administrator privileges to run the Qlik Sense services during the installation of a node

To install a rim node in this way you need to run an additional bootstrap command from an elevated command prompt to register the rim node on the central node.

⚠️ If you are installing a central node you can follow the same procedure as a regular administrator installation.

To install a node:

1. Log in to the computer where you plan to install Qlik Sense as an administrator.
   See: User accounts (page 88).
2. Download the Qlik_Sense_setup.exe file from www.qlik.com
3 Deploying Qlik Sense Enterprise on Windows

3. On the Create or join a cluster screen, select Join cluster.

4. On the Shared persistence database connections settings screen, ensure that you specify the correct hostname and password to the repository database that you want to connect to.
   See: Installing Qlik Sense (page 99)

5. On the Service Credentials screen, enter your non-administrator user account, user name, and password. For example, enter your user name as follows: \{\{senseserviceuser or domain\}\}senseserviceuser.

   If you enter a username that is more than 20 characters long, it must be in UPN format, and must include the full domain name. For example, longusername@full.domain.name.

On the final screen of the installation program, you do not have the option to start the Qlik Sense services, instead the following message is displayed: The service user does not have administrator privileges. See the documentation for more information.

Next, run the bootstrap command in an elevated command prompt while registering the rim node with a certificate.

To run the bootstrap command:

1. On the rim node, open an elevated command prompt window. The bootstrap command elevates your rights enabling you to perform tasks that require an administrator, such as installing certificates and adding performance counters.

2. In the command prompt, navigate to the installed location: Program Files\Qlik\Sense\Repository and run the Repository.exe -bootstrap command. While the bootstrap is running, in the QMC on the central node, register the rim node with a certificate that is generated. For more information, in Services (page 55), see the Repository service.

3. On the central node, register the rim node in the QMC, see: Adding a Qlik Sense node (page 108). After you have registered the rim node the bootstrap process will terminate.

4. Exit the command prompt.

5. In Windows, Services, start all Qlik Sense services.

Changing the user account type to run the Qlik Sense services on an existing site

Follow the instructions in this section if you used an administrator user account when installing Qlik Sense, and later wish to change to use an account without administrator privileges to run the Qlik Sense services.

Do the following:

1. In Windows, either create a new or use an existing domain or local user account to run the Qlik Sense services.

2. If the service account user does not have administrator privileges, you must add the user to the following groups in Computer Management > System Tools > Local Users and Groups > Groups.
   - Qlik Sense Service Users
   - Performance Monitor Users

3. Open the Control Panel and then select System and Security>Administrative Tools>Services.
4. Stop all services except the **Repository Database**.

5. Assign **Full control** permission for the dedicated service account to the folder 
   `%ProgramData%\Qlik\Sense`.

6. As an administrator, open an elevated command prompt.

7. Navigate to the `Program Files\Qlik\Sense\Proxy` folder and run `Proxy.exe -bootstrap`.

8. Navigate to the `Program Files\Qlik\Sense\Scheduler` folder and run `Scheduler.exe -bootstrap`.

9. Navigate to the `Program Files\Qlik\Sense\Repository` folder and run `Repository.exe -bootstrap`.
   
   If you are changing the user account on your primary or central node, run `Repository.exe -bootstrap -iscentral`.

10. Close the elevated command prompt.

11. Change the log on credentials for each of the Qlik Sense services as follows:
   
   a. Right-click the service and select **Properties**.
   
   b. Select the **Log On** tab and then **This account**.
   
   c. Enter the credentials for the dedicated service account and click **OK**.

The services are as follows:
- Qlik Sense Engine Service
- Qlik Sense Printing Service
- Qlik Sense Proxy Service
- Qlik Sense Repository Service
- Qlik Sense Scheduler Service
- Qlik Sense Service Dispatcher

**If you are using a user account with administrative privileges, keep the Qlik Sense Repository Database running under the Local System account. Do not change the account.**

**Depending on your setup some of the services may not be available.**

12. Start the Qlik Sense Service Dispatcher, and then the Qlik Sense Repository Service (QRS).

13. Start the rest of the Qlik Sense services.

**Performing a silent installation**

When running a silent installation, Qlik Sense is installed with no dialogs at all. This means all features, properties and user selections have to be known before performing a silent installation. All setup options that are available in the user interface of the installer can be performed with silent operations.

Do the following:

1. Select **Start > All Programs > Accessories > Command Prompt**.

   The **Command Prompt** window is displayed.
3 Deploying Qlik Sense Enterprise on Windows

2. In the **Command Prompt** window, navigate to the folder containing the `Qlik_Sense_setup.exe` file.
3. Enter `Qlik_Sense_setup.exe` followed by the silent installation syntax preferred.

   **Note that elevation will take place if run from an unelevated process and the UAC is on.**

**Syntax**

```
Qlik_Sense_setup.exe [-silent] {-log "path\filename"} [layout="path"]
{desktopshortcut=1|0} {skipstartservices=1|0} {installdir="path"}
{userwithdomain="domain\user"} {userpassword="password"}
{dbpassword="password"} [hostname="www.machinename.domain.com"]
{sharedpersistenceconfig="configfilepath"} {skipvalidation=1|0}
{databasedumpfile="path"}
```

**Commands**

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>-silent</code> (or <code>-s</code>)</td>
<td>Command line-driven setup without UI (mandatory).</td>
</tr>
<tr>
<td><code>-log</code> (or <code>-l</code>)</td>
<td>[log file name with path] Log file directory and log file name.</td>
</tr>
<tr>
<td><code>-layout</code></td>
<td>[destination directory] Extracts files (including <code>.msi</code> files) to the destination directory.</td>
</tr>
</tbody>
</table>

**Arguments**

Arguments are separated by space and presented in the form `[Argument]="[Value]"`. The double quotes can normally be omitted but may be needed, for example, when a path contains spaces.

The default values are the same as those used in the setup user interface.

<table>
<thead>
<tr>
<th>Argument</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>desktopshortcut</code></td>
<td><code>1</code> (defaults to <code>1</code> on clean installs)</td>
<td>Installs desktop shortcuts.</td>
</tr>
</tbody>
</table>
## 3 Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Example 1: To install Qlik Sense</th>
</tr>
</thead>
</table>
| skipstartservices         | 1|0 (defaults to 0 on clean installs, otherwise the current state.) | Qlik_Sense_setup.exe -s spc="\configpath\spc.cfg"  
userwithdomain=mydomain\myUser  
userpassword=myPassword  
dbpassword=mydbpassword |
| installdir                 | [path to custom install directory]                                         |                                  |
| userwithdomain             | [domain\username]                                                          |                                  |
| userpassword               | [password]                                                                  |                                  |
| dbpassword                 | [password]                                                                  |                                  |
| hostname                   | [address of the central node]                                              |                                  |
| sharedpersistenceconfig    | [path to configuration file including the filename]                         |                                  |
| (or spc)                   |                                                                            |                                  |
| skipvalidation             | 1|0                                                                        |                                  |
| databasedumpfile           | [path to database dump file]                                                |                                  |

- **If you enter a username that is more than 20 characters long, it must be in UPN format, and must include the full domain name. For example, longusername@full.domain.name.**

### Example 1: To install Qlik Sense

```bash
Qlik_Sense_setup.exe -s spc="\configpath\spc.cfg"  
userwithdomain=mydomain\myUser  
userpassword=myPassword  
dbpassword=mydbpassword
```
Example 2: To install Qlik Sense while redirecting the installation and log files to a different location

Qlik_Sense_setup.exe -s -l "c:\mylogpath" spc="\configpath\spc.cfg" installdir="c:\mycustompath" userwithdomain=mydomain\myUser userpassword=myPassword dbpassword=mydbpassword

Shared persistence configuration file syntax

Configure the shared persistence storage model, using the sharedpersistenceconfig argument, and point to a configuration file that contains the settings to be used in the installation.

Example:

Qlik_Sense_setup.exe -s spc="\configpath\spc.cfg" userwithdomain=domain\yourserviceuser userpassword=yourserviceuserpassword dbpassword=yoursuperuserpassword

The configuration file is in XML format. You need to create the file according to the example described here.

```xml
<?xml version="1.0"?>
  <DbUserName>username</DbUserName>
  <DbUserPassword>password</DbUserPassword>
  <DbHost>IP or Hostname</DbHost>
  <DbPort>4432</DbPort>
  <RootDir>\server\share</RootDir>
  <StaticContentRootDir>\server\share\StaticContent</StaticContentRootDir>
  <CustomDataRootDir>\server\share\CustomData</CustomDataRootDir>
  <ArchivedLogsDir>\server\share\ArchivedLogs</ArchivedLogsDir>
  <AppsDir>\server\share\Apps</AppsDir>
  <CreateCluster>true</CreateCluster>
  <InstallLocalDb>false</InstallLocalDb>
  <ConfigureDbListener>true</ConfigureDbListener>
  <ListenAddresses>*</ListenAddresses>
  <IpRange>0.0.0.0/0,::/0</IpRange>
  <MaxConnections>100</MaxConnections>
  <!- -JoinCluster>true</JoinCluster>--->
  <ConfigureLogging>true</ConfigureLogging>
  <SetupLocalLoggingDb>true</SetupLocalLoggingDb>
  <QLogsWriterPassword>writerpw</QLogsWriterPassword>
  <QLogsReaderPassword>readerpw</QLogsReaderPassword>
  <QLogsHostname>ip/hostname</QLogsHostname>
  <QLogsPort>4432</QLogsPort>
</SharedPersistenceConfiguration>
```

Configuration file syntax

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DbUserName</td>
<td>User name of the repository database user.</td>
</tr>
</tbody>
</table>
3 Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DbTypePassword</td>
<td>Password of the repository database user.</td>
</tr>
<tr>
<td>DbTypeHost</td>
<td>Hostname of the machine running the repository database.</td>
</tr>
<tr>
<td>DbTypePort</td>
<td>Port used to communicate with the repository database.</td>
</tr>
<tr>
<td>DbTypeRootDir</td>
<td>Root directory for the file share to use as content storage. We recommend that you keep the content in this folder’s sub-directories, but this can be changed in the StaticContentRootDir, CustomDataRootDir and ArchivedLogsDir settings.</td>
</tr>
<tr>
<td>DbTypeAppsDir</td>
<td>Directory to store apps in.</td>
</tr>
<tr>
<td>DbTypeStaticContentRootDir</td>
<td>Root directory for all static content of the site.</td>
</tr>
<tr>
<td>DbTypeCustomDataRootDir</td>
<td>Root directory for all custom data of the site, for example, custom connectors.</td>
</tr>
<tr>
<td>DbTypeArchivedLogsDir</td>
<td>Directory to save archived log files in.</td>
</tr>
<tr>
<td>DbTypeCreateCluster</td>
<td>Set CreateCluster to true if you want to create a new cluster, or set JoinCluster to true if you want to join an existing cluster. You can only use one of these settings in the configuration file. The other setting needs to be removed, or commented out like &lt;!-&lt;JoinCluster&gt;true&lt;/JoinCluster&gt;-&gt;.</td>
</tr>
<tr>
<td>DbTypeJoinCluster</td>
<td>Set to true if you want to install a local PostgreSQL database on the node when you create a new cluster. This setting can only be used together with the CreateCluster setting.</td>
</tr>
<tr>
<td>DbTypeInstallLocalDb</td>
<td>Set to true if you want to configure the PostgreSQL database installed by Qlik Sense to listen to database connections from other nodes. You need to configure the ListenAddresses and IpRange settings.</td>
</tr>
<tr>
<td>DbTypeListenAddresses</td>
<td>Addresses that the database service should listen to.</td>
</tr>
<tr>
<td></td>
<td>You can supply a comma separated list of IPv4 or IPv6 addresses, or 0.0.0.0 (for all IPv4 addresses), ::/0 (for all IPv6 addresses) or * (for all addresses).</td>
</tr>
<tr>
<td>DbTypeIpRange</td>
<td>Subnet specification that covers the IP addresses of all nodes in your site. Either add one row for each node, using /32 as suffix for each address, or add a subnet that covers all addresses using, for example, /24 as suffix. To allow all servers to access the repository database, use 0.0.0.0/0. If entering multiple IP addresses or ranges, use a comma separated list. A range can be either IPv4 or IPv6.</td>
</tr>
<tr>
<td>DbTypeMaxConnections</td>
<td>Specify the maximum number of concurrent connections to the database. The default value is 100. If you have a multi-node site multiple this value by the number of nodes in the cluster. For example, &lt;MaxConnections&gt;100&lt;/MaxConnections&gt; is a single server deployment.</td>
</tr>
<tr>
<td>DbTypeConfigureLogging</td>
<td>Set ConfigureLogging to true if you want to set up centralized database logging.</td>
</tr>
<tr>
<td>DbTypeSetupLocalLoggingDb</td>
<td>Setting SetupLocalLoggingDb to true is equivalent to clicking New Logging Database in the installer UI. A new logging database will be installed with Qlik Sense.</td>
</tr>
</tbody>
</table>
3 Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>QLogsWriterPassword</td>
<td>Password of the qlogs_writer user account.</td>
</tr>
<tr>
<td>QLogsReaderPassword</td>
<td>Password of the qlogs_reader user account.</td>
</tr>
<tr>
<td>QLogsHostname</td>
<td>Host name of the logging database. Set QLogsHostname when SetupLocalLoggingDb is set to false.</td>
</tr>
<tr>
<td>QLogsPort</td>
<td>Port number of the logging database. Set QLogsPort when SetupLocalLoggingDb is set to false.</td>
</tr>
</tbody>
</table>

Deprecated command line arguments

The use of the following command line arguments is no longer recommended.

`rimnode` Determines the Repository role.

`-rimnodetype` (or `-rnt`) Installs all the features required for the rim node type selected. The node type can be any one of:

- Complete
- Proxy
- Engine
- Scheduler

3.3 Setting up Qlik Sense Enterprise on Windows after installation

This section guides you through the process of setting up your Qlik Sense site after installing. You can configure the server to fit with your organization’s particular needs. Below are the common task most deployments will require.

Connecting Qlik Sense to your user directory

Qlik Sense has a range of methods for authenticating users. Windows authentication is the default method.

When a user connects to Qlik Sense for the first time a user record is created to identify that user. Once this record is created, the administrator can track the user’s activity and assign her a license and permissions.

Administrators can also connect to a user directory (for example, Active Directory or LDAP) to obtain further information about that user (such as user groups). The user information can be fetched in advance and then kept in sync with the user directory. This is optional but recommended since it will provide you with the best management experience.

See the following sections in the Manage Qlik Sense sites guide:

- Setting up a user directory connector and schedule by task
- Managing users

Assigning licenses to users

Users need a license to open an app.
Your license is either based on access types, with professional access allocation as an option, or on tokens, with user access allocation as an option.

- Access types: you can allocate professional access and analyzer access. Depending on how you have licenses Qlik Sense, the distribution of the two access types is determined by the LEF file or by the signed key.
- Token-based license: you can allocate user access and login access. The LEF determines the number of tokens that you can allocate to the two access types.

User-based licenses
User-based licenses grant a predefined number of professional and analyzer access allocations. The distribution of the access types is determined by the LEF.

Manage Qlik Sense sites: Managing licenses
Manage Qlik Sense sites: Managing professional access
Manage Qlik Sense sites: Managing analyzer access

See the following sections in the Manage Qlik Sense sites guide:

- Managing licenses
- Allocating professional access
- Allocating analyzer access

Token-based licenses
Qlik Sense offers a token-based system that allows the administrator to assign the most suitable license type to each user. Licenses can be allocated on an individual basis or automatically by using rules to define who is allowed to obtain a license, for example, all users in a specific department.

See the following sections in the Manage Qlik Sense sites guide:

- Managing licenses
- Allocating user access
- Creating new login access

Configuring the monitoring apps
All installations of Qlik Sense (single node and multi-node) require configuration of the monitoring apps for them to work properly.

See the following sections in the Monitor Qlik Sense sites guide:

- Configuring the monitoring apps
How Qlik Sense uses HTTPS and certificates

Qlik Sense deploys securely by default when it is installed. It uses self-sign certificates to ensure that data is transferred to users in a secure way. When users access the system they by default receive a warning that the certificate used by the site is not trusted. The user can then accept the certificate and proceed to use Qlik Sense securely.

There are two options to prevent the warning; one is to use a trusted certificate from either a trusted provider or an internal corporate source. The other option is to run the site using HTTP only. Both options are available as settings on the Qlik Sense Proxy Service (QPS).

Regardless of which option you choose, the services in Qlik Sense always use encryption when communicating.

See the following sections in the Manage Qlik Sense sites guide:

- Changing proxy certificate
- Editing proxies

Creating and opening apps

To create and open apps on the server users must browse to the Qlik Sense hub using their web browser. The hub lists two areas: Work contains the apps belonging to the user who has logged in, and Streams contains the other apps the user has access to. After the installation the administrators see two built-in monitoring apps, while all other users do not see any apps. Click on an existing app to open it. To create a new app, click Create new app.

Working with streams, apps and publishing

A stream is a way to group together apps that have similar permissions. Once an app has been created, an administrator can publish it to a stream. The app then becomes visible to users who have access to that stream. Apps, streams and publishing are managed in the Qlik Management Console (QMC).

See the following sections in the Manage Qlik Sense sites guide:

- Managing streams
- Managing apps
- Publishing app

See also:
The following section in the Manage Qlik Sense sites guide: Managing nodes and services
3.4 Upgrading and updating Qlik Sense Enterprise on Windows

You can upgrade from Qlik Sense 3.1 SR2 to Qlik Sense June 2017 or later using the Qlik Sense setup program. Upgrading from any version of Qlik Sense earlier than 3.1 SR2 to Qlik Sense June 2017 or later cannot be done using the setup program. To upgrade to Qlik Sense June 2017 or later, see Upgrading (page 132).

You can update your Qlik Sense deployment by applying patches. A patch primarily includes software updates and fixes that are applied to the existing Qlik Sense version. For more information, see Patching Qlik Sense (page 147).

Upgrades and migrating persistence models

Qlik Sense June 2017 or later only supports the shared persistence model. It does not support the synchronized persistence model. When you upgrade your Qlik Sense 3.1 SR2 deployment to Qlik Sense June 2017 or later, you will be migrated to a shared persistence model.

You can upgrade from synchronized persistence to shared persistence if the existing deployment is running Qlik Sense version 3.1 SR2. See, Upgrading and migrating from synchronized to shared persistence (page 141).

When upgrading a central node from synchronized persistence to shared persistence, the existing repository database is shared with all nodes. If you want to setup a dedicated repository database on a separate machine, you must perform a new installation. For more information, see Installing and configuring PostgreSQL (page 113), and Installing Qlik Sense in a multi-node site (page 98).

Upgrades and centralized logging

Upgrading from Qlik Sense June 2017 or earlier provides the option to configure centralized logging through the installer wizard. Upgrading from Qlik Sense September 2017 or later does not provide this option. During the upgrade, centralized logging will be set up only if it was configured in the earlier Qlik Sense version. If centralized logging was not set up, the logging service will still be installed and running but without the database.

Upgrading

You can upgrade from Qlik Sense 3.1 SR2 or later to Qlik Sense June 2017 or later using the Qlik Sense setup program. When upgrading, the previous version is completely replaced by the new version.

To upgrade from Qlik Sense 3.1 SR2 or later with a shared persistence model to Qlik Sense June 2017 or later, see Upgrading from Qlik Sense 3.1 SR2 or later to Qlik Sense June 2017 or later (page 135).

⚠️ Do not uninstall Qlik Sense before upgrading to Qlik Sense June 2017 or later. If you are upgrading to Qlik Sense June 2017 or later, and you have uninstalled Qlik Sense, see Upgrading to Qlik Sense June 2017 or later after uninstalling Qlik Sense 3.1 SR2 or later (page 137).
3 Deploying Qlik Sense Enterprise on Windows

Qlik Sense June 2017 and later versions do not support the synchronized persistence model. To upgrade from Qlik Sense 3.1 SR2 or later to Qlik Sense June 2017 or later and migrate from a synchronized persistence model to a shared persistence model, see Upgrading and migrating from synchronized to shared persistence (page 141).

Upgrading from any version of Qlik Sense earlier than 3.1 SR2 to Qlik Sense June 2017 or later cannot be done using the setup program. To upgrade from earlier versions of Qlik Sense with a synchronized persistence model to Qlik Sense June 2017 or later, see Upgrading to Qlik Sense June 2017 or later from Qlik Sense versions earlier than 3.1 SR2 (page 138).

When you upgrade to a newer version of Qlik Sense, you will not get the option to configure centralized logging in the installer. Instead, if you want to enable centralized logging, you must configure it using the Qlik Logging service. See: Qlik Logging Service (page 203)

Qlik Sense November 2017 and later versions do not support soft deleted records. Qlik Sense will clean up all soft deleted records on the first startup of the Qlik Sense Repository Service after an upgrade. For troubleshooting, refer to Failed to remove soft deleted records (page 268).

During upgrade, the Repository.exe.config file located in %ProgramFiles%\QlikSense\Repository is overwritten with default settings.
If the file was manually changed in your previous deployment, you must create a backup of the file before upgrading, and use the backup to restore your customized settings. Once the Repository.exe.config is restored, you must restart the Qlik Sense services.

Qlik Sense apps

When you upgrade Qlik Sense all existing apps need to be migrated to ensure compatibility between the versions. This happens automatically when the system starts the first time after the upgrade. If the migration fails for one or more apps, these apps will not be available in the Hub after the upgrade. Apps that are not migrated are indicated in the Apps section of Qlik Management Console, where you can also perform a manual migration.

Multi-node deployments

In a multi-node deployment, all nodes must run the same version of Qlik Sense to be able to communicate with each other. It is recommended to upgrade with all nodes offline, and to start with the central node.

When upgrading a rim node, ensure that you use the same log-in account as was used for the initial installation of that node. Failure to do so means that the central node will not find the certificates installed on the node and you will need to perform a clean installation of the node.
3 Deploying Qlik Sense Enterprise on Windows

Qlik Sense Repository Database

Qlik Sense June 2017 and later versions use PostgreSQL version 9.6 for the Qlik Sense Repository Database. If you upgrade in place without uninstalling Qlik Sense the Qlik Sense Repository Database is upgraded to PostgreSQL version 9.6 and your data, and standard settings are carried forward. If you have made custom configurations to your PostgreSQL installation, those must be recreated in the PostgreSQL after upgrade.

PostgreSQL version 9.6 is installed with the latest version of Qlik Sense. If you have uninstalled Qlik Sense but maintained your PostgreSQL database, and you want to upgrade your Qlik Sense deployment, you must create a database dump file and restore the PostgreSQL database manually. You will also need to manually reconfigure any custom parameters.

The PostgreSQL installation included in the Qlik Sense June 2017 or later setup does not include pgAdmin tools. For information about manually installing the PostgreSQL database, see Installing and configuring PostgreSQL (page 113).

Before you upgrade Qlik Sense, do the following:

- Review System requirements for Qlik Sense Enterprise (page 10).
- Download the Qlik_Sense_setup.exe file.
- Make sure you have logged on as an administrator using an account that has an actual password defined, that is, not a blank password.
- If you are running the Qlik Sense services with a LocalSystem account then you must change to a service user account before beginning the upgrade.
  See: Upgrading from Qlik Sense 3.1 SR2 or later to Qlik Sense June 2017 or later (page 135)
- Create a backup of your Qlik Sense deployment before upgrading.

Do the following:

1. Stop your Qlik Sense services.
2. Upgrade your central node by launching the Qlik Sense setup file (Qlik_Sense_setup.exe).
3. Select Upgrade to upgrade your existing shared persistence deployment.
4. Accept the license agreement and click Next.
5. On the Service Credentials page, enter the Username and Password for your Windows Qlik Sense service user account.
   If the user is member of a domain, enter the service account as <domain>\<username>. For more information, see User accounts (page 88).
6. On the Ready to upgrade page, select the appropriate check boxes if you want the setup to create desktop shortcuts and automatically start the Qlik Sense services when the setup is complete, and click Upgrade.
7. Check that all of the Qlik Sense services have started successfully.
8. Check that all apps have been migrated successfully on the central node. If migration has failed for one or more apps, resolve the issues before continuing.
3 Deploying Qlik Sense Enterprise on Windows

If the node running the app migration goes offline, migration will stop. It will not restart automatically. In a single node environment, all apps will have Migration status set to Unknown. See: Migrating apps. In a multi-node environment with failover nodes, the primary node will be replaced by the next available node, but migration will not restart. See: Failover (page 112). To resume migration, you will need to restart the following services, in order: Qlik Sense Service Dispatcher (QSD) and Qlik Sense Repository Service (QRS). See: Services (page 55).

9. Deploy the Qlik Sense upgrade with shared persistence on the remaining nodes.

Any custom manual configurations that you make to the PostgreSQL database must be manually reproduced after the upgrade.

Upgrading from Qlik Sense 3.1 SR2 or later to Qlik Sense June 2017 or later

Before you upgrade, if your Qlik Sense 3.1 SR2 or later installation is running services using a Local System account, you need to change this to use a service user account (local or domain) before upgrading to Qlik Sense June 2017 or later. If you continue to use a Local System account to run the services when upgrading you will get an error.

Changing the user account type to run the Qlik Sense services on a central node

Do the following:

1. In Windows, either create a new or use an existing domain or local user account to run the Qlik Sense services.
2. If the service account user does not have administrator privileges, you must add the user to the following groups in Computer Management > System Tools > Local Users and Groups > Groups.
   - Qlik Sense Service Users
   - Performance Monitor Users
3. Open the Control Panel and then select System and Security>Administrative Tools>Services.
4. Stop all services except the Repository Database.
5. Assign Full control permission for the dedicated service account to the folder %ProgramData%\Qlik\Sense.
6. As an administrator, open an elevated command prompt.
7. Navigate to the Program Files\Qlik\Sense\Proxy folder and run Proxy.exe -bootstrap.
8. Navigate to the Program Files\Qlik\Sense\Scheduler folder and run Scheduler.exe -bootstrap.
9. Navigate to the Program Files\Qlik\Sense\Repository folder and run Repository.exe -bootstrap.
   If you are changing the user account on your primary or central node, run Repository.exe -bootstrap -iscentral.
10. Close the elevated command prompt.
11. Change the log on credentials for each of the Qlik Sense services as follows:
   a. Right-click the service and select Properties.
   b. Select the Log On tab and then This account.
   c. Enter the credentials for the dedicated service account and click OK.

The services are as follows:
- Qlik Sense Engine Service
- Qlik Sense Printing Service
- Qlik Sense Proxy Service
- Qlik Sense Repository Service
- Qlik Sense Scheduler Service
- Qlik Sense Service Dispatcher

If you are using a user account with administrative privileges, keep the Qlik Sense Repository Database running under the Local System account. Do not change the account.

Depending on your setup some of the services may not be available.

12. Start the Qlik Sense Service Dispatcher, and then the Qlik Sense Repository Service (QRS).
13. Start the rest of the Qlik Sense services.

Upgrading from Qlik Sense 3.1 SR2 or later with a shared persistence model to Qlik Sense June 2017 or later

Do the following:

1. Stop your Qlik Sense services.
2. Upgrade your central node by launching the Qlik Sense setup file (Qlik_Sense_setup.exe).
3. Select Upgrade to upgrade your existing shared persistence deployment.
4. Accept the license agreement and click Next.
5. On the Service Credentials page, enter the Username and Password for your Windows Qlik Sense service user account.
   If the user is member of a domain, enter the service account as <domain>\<username>. For more information, see User accounts (page 88).
6. On the Ready to upgrade page, select the appropriate check boxes if you want the setup to create desktop shortcuts and automatically start the Qlik Sense services when the setup is complete, and click Upgrade.
7. Check that all of the Qlik Sense services have started successfully.
8. Check that all apps have been migrated successfully on the central node. If migration has failed for one or more apps, resolve the issues before continuing.
3  Deploying Qlik Sense Enterprise on Windows

If the node running the app migration goes offline, migration will stop. It will not restart automatically. In a single node environment, all apps will have Migration status set to Unknown. See: Migrating apps. In a multi-node environment with failover nodes, the primary node will be replaced by the next available node, but migration will not restart. See: Failover (page 112). To resume migration, you will need to restart the following services, in order: Qlik Sense Service Dispatcher (QSD) and Qlik Sense Repository Service (QRS). See: Services (page 55).

9. Deploy the Qlik Sense upgrade with shared persistence on the remaining nodes.

Any custom manual configurations that you make to the PostgreSQL database must be manually reproduced after the upgrade.

Upgrading to Qlik Sense June 2017 or later after uninstalling Qlik Sense 3.1 SR2 or later
If you have uninstalled Qlik Sense but maintained your PostgreSQL database, and you want to upgrade to Qlik Sense June 2017 or later, you must create a database dump file and restore the PostgreSQL database manually. You will also need to manually reconfigure any custom parameters.

Do the following:

1. Copy the PostgreSQL folder from %ProgramData%\Qlik\Sense\Repository\PostgreSQL to a temporary location outside of the %ProgramData% folder.
2. Download and install PostgreSQL version 9.6 from the PostgreSQL website. For more information, see Installing and configuring PostgreSQL (page 113).
3. Open a Command Prompt in Microsoft Windows.

The pg_ctl.exe command should not be run as an administrator.

4. Navigate to the location where the PostgreSQL repository database is installed, %ProgramFiles%\PostgreSQL\<database version>\bin, and run the following commands:
   a. `pg_ctl.exe start -w -D "C:\SenseDB\9.6"`
   b. `set PGUSER=postgres`
   c. `set PGPASSWORD=password`
   d. `pg_dumpall.exe > [<path to dump file>]`
   e. `pg_ctl.exe stop -w -D "C:\SenseDB\9.6"

5. In the Command Prompt window, navigate to the folder containing the Qlik_Sense_setup.exe file.
6. Run the following command to install Qlik Sense and restore your Qlik Sense Repository Database.
   `qlik_Sense_setup.exe databasedumpfile=<path_to_dump_file>`
Deploying Qlik Sense Enterprise on Windows

The path to the dump file must be entered as an absolute path, using a relative path will result in an installation failure.

7. Follow the setup to complete the installation. For more information, see Deploying Qlik Sense Enterprise on Windows (page 46).

Upgrading to Qlik Sense June 2017 or later from Qlik Sense versions earlier than 3.1 SR2

Qlik Sense June 2017 and later versions do not support the synchronized persistence model. To upgrade to Qlik Sense June 2017 or later from any version of Qlik Sense earlier than 3.1 SR2 and migrate from a synchronized to shared persistence model, do the following:

You cannot upgrade from Qlik Sense versions earlier than 3.1 SR2 to Qlik Sense June 2017 or later using the Qlik Sense setup program. If you attempt to upgrade using the setup program you will receive an error.

The new hostname must match the one used before the upgrade. Using a different hostname will cause a mismatch in the certificate, which will prevent you from accessing the hub. You can verify the previous hostname by:

- Checking the certificate name
- Checking the file C:\Programdata\Qlik\Sense\Host.cfg (String encoded based64)

See also Restoring a central node to a machine with a different hostname section in Restoring a Qlik Sense site (page 172)

1. Create a backup of your existing Qlik Sense deployment. For more information, see the help for the version of Qlik Sense that you are currently running.
2. Change the PostgreSQL authentication mode in the configuration settings to allow the password to be changed.
   a. Stop the Qlik Sense Repository Database service.
   b. Open the Client Authentication file located in ProgramData\Qlik\Sense\Repository\PostgreSQL\<database version>\pg_hba.conf.
   c. Change the ADDRESS to 127.0.0.1/32, and change the METHOD to trust for IPv4 local connections and local host replication.
   d. Change the ADDRESS to ::1/128, and change the METHOD to trust for IPv6 local connections and local host replication.
   e. Start the Qlik Sense Repository Database service.
3. Change the Qlik Sense Repository Database password.
   To change the password using PostgreSQL command line:
3 Deploying Qlik Sense Enterprise on Windows

a. Open a command prompt and navigate to 
   \ProgramFiles\Qlik\Sense\Repository\PostgreSQL\<database version>\bin.
b. Connect to the database by entering the following command: 
   psql.exe -p 4432 -U postgres.
c. Enter the following command to set the new user password: 
   ALTER USER qliksenserepository WITH PASSWORD '<newpassword>'; 
   ALTER ROLE is displayed after successfully changing the password.

To change the password using the pgAdmin tool:
   a. Launch pgAdmin and connect to the Qlik Sense Repository Database.
   b. Expand the tree in the left pane and click Login Roles > qliksenserepository.
   c. Right-click on qliksenserepository and select Properties.
   d. Click the Definition tab, and enter a Password.

4. Reset the PostgreSQL authentication mode in the configuration settings to require authentication.
   a. Stop the Qlik Sense Repository Database service.
   b. Open the Client Authentication file located in 
      \ProgramData\Qlik\Sense\Repository\PostgreSQL\<database version>\pg_hba.conf.
   c. Change the METHOD back to md5.
   d. Start the Qlik Sense Repository Database service.

5. Create a database dump file.
   If Qlik Sense is installed:
      a. Stop all Qlik Sense services except Qlik Sense Repository Database service. Ensure that the Qlik
         Sense Repository Database service is running.
      b. Open a command prompt and navigate to the location where the PostgreSQL database is
         installed, and enter the following commands:
         • set PGUSER=postgres
         • set PGPASSWORD=[superuserpassword]
         • pg_dumpall.exe -p 4432 > [path to dump file]
   If Qlik Sense has been uninstalled:
      a. Copy the PostgreSQL folder from %ProgramData%\Qlik\Sense\Repository\PostgreSQL\9.6 to a
         temporary location outside of the %ProgramData%\Qlik folder.
      b. Download and install PostgreSQL version 9.6 from the PostgreSQL website. For more
         information, see Installing and configuring PostgreSQL (page 113).
      c. Open a Command Prompt in Microsoft Windows.
      d. Navigate to the location where the PostgreSQL repository database is installed, cd 
         "%ProgramFiles%\PostgreSQL\9.6\data\bin", and run the following commands:
         • pg_ctl.exe start -w -D "c:\SenseDB\9.6"
         • set PGUSER=postgres
         • set PGPASSWORD=password
         • pg_dumpall.exe > [path to dump file]
         • pg_ctl.exe stop -w -D "c:\SenseDB\9.6"
6. Make a backup of log and application data in the following folders:
   - %ProgramData%\Qlik\Sense\Log
   - %ProgramData%\Qlik\Sense\Apps
   - %ProgramData%\Qlik\Sense\Repository\Content
   - %ProgramData%\Qlik\Sense\Repository\Extensions
   - %ProgramData%\Qlik\Sense\Repository\AppContent (if available)
   - %ProgramData%\Qlik\Sense\Repository\SharedContent (if available)

7. Make a backup of any locations where content that supports the Qlik Sense environment may be kept (for example, QVD files created by load scripts).

8. Create a file share, see Creating a file share (page 111).

9. Create the following sub-folders in the file share:
   - Apps
   - ArchivedLogs
   - CustomData
   - StaticContent

10. Copy following content from your synchronized persistence deployment to the file share:

<table>
<thead>
<tr>
<th>Content</th>
<th>Copy from</th>
<th>To subfolder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apps</td>
<td>..\ProgramData\Qlik\Sense\Apps</td>
<td>Apps</td>
</tr>
<tr>
<td>Logs</td>
<td>..\ProgramData\Qlik\Sense\Repository\Archived Logs</td>
<td>ArchivedLogs</td>
</tr>
<tr>
<td>Static</td>
<td>..\ProgramData\Qlik\Sense\Repository\AppContent</td>
<td>StaticContent</td>
</tr>
<tr>
<td>content</td>
<td>..\ProgramData\Qlik\Sense\Repository\Content</td>
<td></td>
</tr>
<tr>
<td></td>
<td>..\ProgramData\Qlik\Sense\Repository\DefaultContent</td>
<td></td>
</tr>
<tr>
<td></td>
<td>..\ProgramData\Qlik\Sense\Repository\Extensions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>..\ProgramData\Qlik\Sense\Repository\DefaultApps</td>
<td></td>
</tr>
<tr>
<td></td>
<td>..\ProgramData\Qlik\Sense\Repository\SharedContent</td>
<td></td>
</tr>
</tbody>
</table>

   Each of these folders must be added as a sub-folder of the StaticContent folder.

11. Ensure that all Qlik Sense nodes are synchronized, and take all nodes offline by stopping the Qlik Sense services in Windows.

12. Uninstall Qlik Sense. Accept the defaults when uninstalling to preserve the certificates settings.

13. In the Command Prompt window, navigate to the folder containing the Qlik_Sense_setup.exe file.

14. Run the following command to install Qlik Sense and restore your Qlik Sense Repository Database.

```
qlik_Sense_setup.exe databasedumpfile=<path_to_dump_file>
```
15. Uninstall Qlik Sense on each of your rim nodes in multi-node deployment. Select the option to completely uninstall Qlik Sense when you uninstall on the rim nodes.

16. Install Qlik Sense on each of the rim nodes.

17. Connect the rim nodes in the QMC, select each node, and click the **Redistribute** button.

### Upgrading and migrating from synchronized to shared persistence

You can upgrade and migrate from synchronized persistence to shared persistence if the existing deployment is running Qlik Sense version 3.1 SR2 or later. For more information about persistence models, see Persistence (page 80).

The files that are persisted in a Qlik Sense deployment must be available to all nodes via the file share. They can be stored on any of the nodes in the cluster, or on another server. If you are migrating from a synchronized persistence deployment to a shared persistence deployment, you must first create the file share to use as shared storage, and copy your data from the synchronized persistence deployment into the file share folders. For instructions on how to create a file share, see Creating a file share (page 111).

Before you upgrade Qlik Sense, do the following:

- Review System requirements for Qlik Sense Enterprise (page 10).
- Download the Qlik_Sense_setup.exe file.
- Create a backup of your Qlik Sense deployment before upgrading.

**It is recommended that you run the Qlik Sense Enterprise cleanup script before upgrading to Qlik Sense Enterprise 2.2 or 3.x, if the repository database has large amounts of data.**

The cleanup script can also be run after upgrading to Qlik Sense Enterprise 2.2 or 3.x, and for versions June 2017 and newer if the script was not run before upgrading, when the Qlik Sense Repository Service cannot start due to database query timeouts or other database issues.

For more information, see Database Cleanup Script For Qlik Sense Enterprise 2.x and 3.x.

### Backing up a synchronized persistence site

Proceed as follows to backup a Qlik Sense site deployed with the synchronized persistence model:

1. Make a backup of the certificates used to secure the Qlik Sense services. This only needs to be done once.

   *Backing up certificates (page 151)*

2. Stop all Qlik Sense services except the Qlik Sense Repository Database (QRD).
3. Make a backup of the repository database.
   a. Open a Command Prompt with administrator privileges in Microsoft Windows.
   b. Produce a dumpfile for the repository database (that is, a single file for the entire database):
      i. Navigate to the installation location.
         \%ProgramFiles\%Qlik\Sense\Repository\PostgreSQL\<database version>\bin
         \%ProgramFiles\%Qlik\Sense\Repository\PostgreSQL\<database version>\bin
      ii. pg_dump.exe -h localhost -p 4432 -U postgres -b -f "c:\QSR_backup.tar" QSR
         If you are prompted for the PostgreSQL super user password, enter the password that was
given during the installation of Qlik Sense.
         
         To avoid being prompted for the password (for example, if you want to
         automate the Qlik Sense backup process), you can use the pgpass
         functionality in PostgreSQL. See the PostgreSQL documentation for more
         information.
   c. Make a backup of the dumpfile for the repository database.

4. Make a backup of log and application data in the following folders:
   - \%ProgramData\%Qlik\Sense\Log
   - \%ProgramData\%Qlik\Sense\Apps
   - \%ProgramData\%Qlik\Sense\Repository\Content
   - \%ProgramData\%Qlik\Sense\Repository\Extensions
   - \%ProgramData\%Qlik\Sense\Repository\AppContent (if available)
   - \%ProgramData\%Qlik\Sense\Repository\SharedContent (if available)

5. Make a backup of any locations where content that supports the Qlik Sense environment may be kept
   (for example, QVD files created by load scripts).

6. Start the Qlik Sense services. If the services are started manually, start them in the following order:
   a. Qlik Sense Repository Service (QRS)
      If the user running Qlik Sense services is not local administrator on the machine, you need to start
      Repository.exe from an elevated command prompt using the -bootstrap parameter.
      Services (page 55)
   b. Qlik Sense Proxy Service (QPS), Qlik Sense Engine Service (QES), Qlik Sense Scheduler Service
      (QSS), and Qlik Sense Printing Service (QPR) in no specific order
      The order is important because the QRS is dependent on the QRD and the rest of the services are
dependent on the QRS.

Upgrading to a shared persistence deployment
Do the following:

1. Create a file share, see Creating a file share (page 111).
2. Create the following sub-folders in the file share:
   - Apps
   - ArchivedLogs
3 Deploying Qlik Sense Enterprise on Windows

- StaticContent

3. Ensure that all Qlik Sense nodes are synchronized, and take all nodes offline by stopping the Qlik Sense services in Windows.

4. Copy following content from your synchronized persistence deployment to the file share:

<table>
<thead>
<tr>
<th>Content</th>
<th>Copy from</th>
<th>To subfolder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apps</td>
<td>..\ProgramData\Qlik\Sense\Apps</td>
<td>Apps</td>
</tr>
<tr>
<td>Logs (optional)</td>
<td>..\ProgramData\Qlik\Sense\Repository\Archived Logs</td>
<td>ArchivedLogs</td>
</tr>
<tr>
<td>Static content</td>
<td>..\ProgramData\Qlik\Sense\Repository\AppContent ..\ProgramData\Qlik\Sense\Repository\Content ..\ProgramData\Qlik\Sense\Repository\DefaultContent ..\ProgramData\Qlik\Sense\Repository\Extensions ..\ProgramData\Qlik\Sense\Repository\DefaultApps ..\ProgramData\Qlik\Sense\Repository\SharedContent</td>
<td>StaticContent</td>
</tr>
</tbody>
</table>

Each of these folders must be added as a sub-folder of the StaticContent folder.

5. Upgrade your central node by launching the Qlik Sense setup file (Qlik_Sense_setup.exe).

6. Accept the license agreement and click Next.

7. On the Shared persistence storage page, enter the path or URL to your file share folders that you prepared and click Next.

8. On the Database service listener page, if you have a multi-node deployment, enter the following:
   - Listen addresses - add the addresses that the database service should listen to.
     You can enter a comma separated list of IPv4 or IPv6 addresses, or 0.0.0.0 (for all IPv4 addresses), \::/0 (for all IPv6 addresses) or * (for all addresses).
   - IP ranges - add a subnet specification that covers the IP addresses of all nodes in your site.
     Either add one row for each node, using /32 as suffix for each address, or add a subnet that covers all addresses using, for example, /24 as suffix. To allow all servers to access the repository database, use 0.0.0.0/0. You can also enter a comma separated list of multiple IP addresses.
   - Max connections - specify the maximum number of concurrent connections to the database.
     The default value is 100 multiplied by the number of nodes in the cluster (this field is only available in Qlik Sense February 2018, and later).

9. On the Service Credentials page, enter the Username, and Password for your WindowsQlik Sense service user account.
   If the user is member of a domain, enter the service account as <domain>\<username>. See: User accounts (page 88).

3 Deploying Qlik Sense Enterprise on Windows

If you cannot find the password, see the troubleshooting topic: Cannot find the repository database superuser password (page 258)

11. On the Ready to upgrade page, select the appropriate check boxes if you want the setup to create desktop shortcuts and automatically start the Qlik Sense services when the setup is complete, and click Upgrade.

12. Check that all of the Qlik Sense services have started successfully.

13. Check that all apps have been migrated successfully on the central node. If migration has failed for one or more apps, resolve the issues before continuing.

14. In a multi-node deployment, uninstall Qlik Sense on each of the rim nodes. Select the option to remove certificates and data folders when you uninstall on the rim nodes.

15. Install Qlik Sense with shared persistence on the remaining nodes, and join the existing cluster created when you upgraded the central node.

Performing a silent upgrade

You can silently upgrade the current Qlik Sense installation. All setup options that are available in the user interface of the installer can be performed with silent operations.

Do the following:

1. Select Start > All Programs > Accessories > Command Prompt. The Command Prompt window is displayed.

2. In the Command Prompt window, navigate to the folder containing the Qlik_Sense_setup.exe file.

3. Enter Qlik_Sense_setup.exe followed by the silent installation syntax preferred.

Note that elevation will take place if run from an unelevated process and the UAC is on.

Syntax

Qlik_Sense_setup.exe [-silent] [-log "path\filename"]
(desktopshortcutcut=1|0) (skipstartservices=1|0) (installdir="path")
[userpassword="password"] (dbpassword="password")

Qlik_Sense_setup.exe -? or -h Brings up the on-screen silent setup help.
3 Deploying Qlik Sense Enterprise on Windows

Commands

- `-silent` (or `-s`) Command line-driven setup without UI. (mandatory).
- `-log` (or `-l`) `[log file name with path]` Log file directory and log file name.

Arguments

Arguments are separated by space and presented in the form `[Argument]="[Value]"`. The double quotes can normally be omitted but may be needed, for example, when a path contains spaces.

The default values are the same as those used in the setup user interface.

- `desktopshortcut` 1|0 (defaults to 1 on clean installs) Installs desktop shortcuts.
- `skipstartservices` 1|0 (defaults to 0 on clean installs, otherwise the current state.) To skip starting services after the installation has finished.
- `installdir` [path to custom install directory] Need only be defined if the default install directory will not be used (%ProgramFiles%\Qlik\Sense).
- `userpassword` [password] The password of the user used to run the services.
- `dbpassword` [password] Password for the database superuser that creates the user that runs the database.

The default values are the same as those used in the setup user interface.

Example: Upgrading the installation

This example shows how to silently upgrade an installation and add desktop shortcuts.

```
Qlik_Sense_setup.exe -s desktopshortcut=1
```

Deprecated command line arguments

For a list of the command line arguments that are no longer recommended, see Installing silently.

Repairing an installation

The **Repair** option restores all missing files, shortcuts and registry values without any credentials being changed.
If patches have been applied to Qlik Sense, the Repair option is disabled. You must uninstall all patches before you can use the Repair option, as it will restore the installation to the original installed version.

Do the following:

1. To start repairing the installation, open the Control Panel and select Uninstall a program. Then select Qlik Sense from the list of programs and click Change.
   The Qlik Sense Setup maintenance screen is displayed.
   You can also perform this action by double-clicking the Qlik_Sense_setup.exe file. In that case, you must use the correct version of the setup file when repairing your Qlik Sense installation, that is, the same version used when installing Qlik Sense.

2. Click Repair.
   The Ready to repair screen is displayed.

3. Click Repair.
   • If UAC is enabled, the User Account Control screen is displayed.
   • If UAC is disabled, the repair process starts.

4. Click Yes to start repairing your Qlik Sense installation.
   This is only applicable if UAC is enabled.

   The progress is displayed.

   When finished, click Repair Summary to confirm that Qlik Sense has been restored successfully. Click Back.

5. Click Finish.

You have now successfully repaired your Qlik Sense installation.

Performing a silent repair

You can silently repair the current Qlik Sense installation. All setup options that are available in the user interface of the installer can be performed with silent operations.

Do the following:

1. Select Start > All Programs > Accessories > Command Prompt.
   The Command Prompt window is displayed.

2. In the Command Prompt window, navigate to the folder containing the Qlik_Sense_setup.exe file.

3. Enter Qlik_Sense_setup.exe followed by the silent installation syntax preferred.
3 Deploying Qlik Sense Enterprise on Windows

Syntax

Qlik_Sense_setup.exe [-silent] [-repair] [-log "path\filename"]

Qlik_Sense_setup.exe -? or -h Brings up the on-screen silent setup help.

Commands

-silent (or -s) Trigger the silent mode (mandatory).
-repair Repair the product silently.
-log (or -l) Log file directory and log file name.

The user must have access to this directory.

If this option is not defined, the log file will be stored with the default name in the default location.

Example:

This example shows how to silently repair the Qlik Sense installation.

Qlik_Sense_setup.exe -s -repair

Patching Qlik Sense

You can update your Qlik Sense deployment when a patch of the software is available for installation. A patch primarily includes software updates and fixes that are applied to the existing Qlik Sense version.

Patches are installed without the need to remove earlier updates or the major release. Qlik Sense patches are cumulative. By installing the latest patch, updates and fixes introduced in previous patches are also installed.

When you uninstall a patch, the individual updates from the installed version of Qlik Sense are removed.

In a multi-node site, all nodes must run the same version of Qlik Sense. We recommend installing patches with all nodes offline, and starting with the central node.

Before you install a patch Qlik Sense, do the following:

- Review System requirements for Qlik Sense Enterprise (page 10).
- Download the Qlik_Sense_update.exe file.
- Make sure you have logged on with Administrator rights using an account that has an actual password defined, that is, not a blank password.
3 Deploying Qlik Sense Enterprise on Windows

- Create a backup of your Qlik Sense deployment. If Qlik Sense is installed on a Virtual Machine (VM) it may be sufficient to take a snapshot of the machine before upgrading. For more information, see Backing up a Qlik Sense site (page 170).

⚠️ When updating a rim node, ensure that you use the same log-in account as was used for the initial installation of that node. Failure to do so means that the central node will not find the certificates installed on the node and you will need to perform a clean installation of the node.

Do the following:

1. Stop the Qlik Sense services.
2. Run the setup to install a patch on the central node. When the installation is complete, the Summary is displayed.
3. Click Finish to close the Summary.

ℹ️ If the patch did not install successfully, the Failed screen is displayed. For more detailed information, see the installation log located in your temp folder accessed with environment variable %temp%.

You have successfully applied a patch to your Qlik Sense deployment.

4. Start the Qlik Sense services.
5. Repeat this procedure for each of the remaining nodes.

ℹ️ You cannot repair an installation using the repair option on the setup program once patches have been applied. The repair option is only available for the original software version, so any patches installed must be uninstalled before you can use the repair option.

ℹ️ Follow the same procedure to uninstall patches.

Silent patching

When a software patch is available for your Qlik Sense installation, you can use the command line tool to silently install the updates. Patches include software updates and fixes that are applied to the existing Qlik Sense version.

Commands

Use the following commands to silently run patch updates.

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>install</td>
<td>Runs a command line-driven install without a user interface. For feedback, see the log files, and the return values.</td>
</tr>
</tbody>
</table>
Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>uninstall</td>
<td>Runs a command line-driven uninstall without a user interface. For feedback, see the log files, and the return values.</td>
</tr>
<tr>
<td>startservices</td>
<td>Used with [install], or [uninstall], this command determines whether the services should be started automatically or not.</td>
</tr>
<tr>
<td>log=[path to logfile]</td>
<td>Specifies the location for the patch to writes log files.</td>
</tr>
<tr>
<td>unpack=[path]</td>
<td>Unpacks the patch contents without installing.</td>
</tr>
<tr>
<td>help (or -h, /h, -?, /?)</td>
<td>Opens the help dialog.</td>
</tr>
</tbody>
</table>

To troubleshoot silent patching, start by examining the installation log files. The default location of the log files is: `C:\Users\[username]\AppData\Local\Temp`.

Example
The following command is an example of the syntax you can use for running a patch update file:

```
qlik_sense_update.exe install startservices
```

This command installs the update, and restores the services to the same state they were in before the update.

### Uninstalling Qlik Sense

If any updates have been applied to Qlik Sense since installation, the Uninstall option will also remove all the updates.

Do the following:

1. To start uninstalling, open the Control Panel and select **Uninstall a program**. Then select **Qlik Sense** from the list of programs and click **Uninstall**.
   
   A confirmation screen is displayed asking if you are sure that you want to uninstall Qlik Sense from your computer. Select the **Remove Qlik Sense certificates and data folders** checkbox if you want to remove all files from the machine ready for a new configuration.

   If the machine is a central node in a Qlik Sense site, there may be rim nodes on other machines that require access to the central node to function properly.

   You can also uninstall Qlik Sense by double-clicking the `QlikSense_setup.exe` file and then selecting **Uninstall from the Maintenance screen. In that case, you must use the correct version of the setup file when uninstalling your Qlik Sense installation, that is, the same version used when installing Qlik Sense.**

2. Click **Uninstall** to start uninstalling Qlik Sense.
   
   If User Account Control (UAC) is disabled, the uninstall starts.
3 Deploying Qlik Sense Enterprise on Windows

If UAC is enabled, the **User Account Control** dialog is displayed. Click **Yes** to start the uninstall.

The progress of the uninstall process is displayed. When finished the uninstall dialog confirms that Qlik Sense has been uninstalled successfully.

3. Click **Finish**.

You have now uninstalled Qlik Sense.

3.5 Backup and restore Qlik Sense Enterprise on Windows

To ensure that your Qlik Sense site can be recovered in the event of a system failure or when a node in your deployment needs to be moved or replaced, we recommend that you create regular backups. These backups are used to restore your Qlik Sense site when needed.

If you creating a backup to upgrade from a synchronized persistence deployment to a shared persistence deployment, see [Upgrading and migrating from synchronized to shared persistence](page 141).

To back up a deployment running Qlik Sense 3.2.x or earlier, refer to the documentation for the release that you are running.

To backup a Qlik Sense site, you must back up the following:

- Qlik Sense certificates
- Qlik Sense Repository Database
- Shared persistence file share

### Qlik Sense certificates

Qlik Sense uses certificates to secure communication between components that are installed on different computers. It is recommended that you back up the certificates on the central node in a Qlik Sense site immediately after installation, so that they can be restored if needed.

Backed up certificates can be used to restore certificates on the same node as they were exported from. A backed up server certificate can also be moved from one node of a Qlik Sense site to another node in the same site. For more information, see [Restoring certificates](page 160).

For more information about how to back up the Qlik Sense certificates, see Backing up a Qlik Sense site (page 170).

### Qlik Sense Repository Database

The Qlik Sense Repository Database is a PostgreSQL database that contains system data and meta data about apps. The Qlik Sense Repository Database can reside on the central node or on another computer. If the Qlik Sense Repository Database was installed during setup it will be located on the central node. If the Qlik Sense Repository Database was installed manually, it may be located on another computer.

The Qlik Sense Repository Database should be backed up on a regular basis to avoid data loss.
3 Deploying Qlik Sense Enterprise on Windows

For more information about how to back up the Qlik Sense Repository Database, see Backing up a Qlik Sense site (page 170).

For more information about how to restore the Qlik Sense Repository Database, see Restoring a Qlik Sense site (page 172).

Shared persistence file share

The shared persistence file share is used to store Qlik Sense app data, such as visualizations, and dimensions and measures. It also stores static content, such as images and extensions, as well as system logs. It is accessible to all nodes in your Qlik Sense site. The file share can reside either on the same server as the central node or on another server.

The file share should be backed up on a regular basis to avoid data loss.

For more information about how to back up the file share, see Backing up a Qlik Sense site (page 170).

For more information about how to restore the file share, see Restoring a Qlik Sense site (page 172).

Rim nodes maintain local log files that may be worth backing up in order to identify and investigate issues. It may also be worth backing up any general operating system data that may be required.

Backing up certificates

When you install Qlik Sense, you should create a backup of the certificates on the central node.

Do the following:

1. Open a command prompt, and launch the Microsoft Management Console (mmc) as the user that runs the Qlik Sense services.
2. Select File>Add/Remove Snap-in.
3. Double-click Certificates.
4. Select **Computer account** and click **Next**.
5. Select **Local computer** and click **Finish**.

![Select Computer dialog box](image)

6. Double-click **Certificates**.

![Add or Remove Snap-ins dialog box](image)
7. Select **My user account** and click **Finish**.

8. Click **OK**.
3 Deploying Qlik Sense Enterprise on Windows

9. Expand **Certificates (Local Computer)** in the left panel.

![Certificate Manager Window]

10. Expand the **Trusted Root Certification Authorities** folder and select the **Certificates** folder.

11. Right-click the certificate that is Certificate Authority (CA) for all nodes in the Qlik Sense site and select **All Tasks > Export**. The CA is named `<computer_that_issued_the_certificate>-CA` by default.

![Certificate Export Window]

12. Click **Next**.
13. Select **Yes, export the private key** and click **Next**.
14. Select **Personal Information Exchange**.
15. Tick the **Export all extended properties** box and then click **Next**.
3  Deploying Qlik Sense Enterprise on Windows

16. Enter and confirm a password. Then click **Next**.

   The password is needed when importing the certificate.
17. Enter a file name for the .pfx file and click Next.

It is recommended to include the server name in the file name to avoid confusion with other certificate files.
18. Click **Finish**.

The .pfx file that contains the CA for all nodes in the Qlik Sense site is stored in the selected location.

19. Starting at step 11, repeat the procedure and export the server certificate (that is, the SSL certificate), which is located under **Certificates (Local Computer)>Personal>Certificates**. The server certificate a) has the same name as the Domain Name System (DNS) name of the machine, and b) is signed by the CA for all nodes in the site.

20. Starting at step 11, repeat the procedure and export the client certificate (that is, the ID of the client), which is located under **Certificates - Current User>Personal>Certificates**. The client certificate is named *QlikClient* and is signed by the CA for all nodes in the site.

21. Close the MMC console.

   No changes need to be saved.

### Restoring certificates

In case of a system crash, the certificates may need to be restored on the central node of your Qlik Sense site.

Do the following:

1. Open the Task Manager in Microsoft Windows and stop all Qlik Sense services except the Qlik Sense Repository Database (QRD) service.
2. Open a command prompt, and launch the Microsoft Management Console (mmc) as the user that runs the Qlik Sense services.

3. Select **File > Add/Remove Snap-in.**

4. Double-click **Certificates.**

5. Select **Computer account** and click **Next.**
6. Select **Local computer** and click **Finish**.

7. Double-click **Certificates**.
8. Select **My user account** and click **Finish**.

9. Click **OK**.
10. Expand **Certificates (Local Computer)** in the left panel.

11. Right-click the **Trusted Root Certification Authorities** folder and select **All Tasks>Import**.
12. Click Next.

13. Browse to the file that contains the backed up Certificate Authority (CA) for all nodes in the site and then click Next. The CA is named <computer_that_issued_the_certificate>-CA by default.
14. Enter the password for the .pfx file (that is, the password that was given when the file was exported).

15. Select Mark this key as exportable and Include all extended properties. Then click Next.
16. Select **Place all certificates in the following store** and click **Next**.
17. Click Finish.
18. Click the Refresh button and check that the imported CA is available in the Trusted Root Certification Authorities folder.

19. Starting at step 11, repeat the procedure and import the server certificate to Certificates (Local Computer)>Personal>Certificates. The server certificate a) has the same name as the Domain Name System (DNS) name of the machine, and b) is signed by the CA for all nodes in the site.

20. Starting at step 11, repeat the procedure and import the client certificate (that is, the ID of the client) to Certificates - Current User>Personal>Certificates. The client certificate is named QlikClient and is signed by the CA for all nodes in the site.

21. Close the MMC console.
   No changes have to be saved.

22. Start the Qlik Sense services. If the services are started manually, start them in the following order:

   If you are restoring the certificates as part of the Restoring a Qlik Sense site (page 172) procedure, do not start the Qlik Sense services.

   a. Qlik Sense Repository Service (QRS)
      If the user running Qlik Sense services is not local administrator on the machine, you need to start Repository.exe from an elevated command prompt using the -bootstrap parameter.
      Services (page 55)
b. Qlik Sense Proxy Service (QPS), Qlik Sense Engine Service (QES), Qlik Sense Scheduler Service (QSS), and Qlik Sense Printing Service (QPR) in no specific order

The order is important because the QRS is dependent on the QRD and the rest of the services are dependent on the QRS.

### Backing up a Qlik Sense site

Backing up a Qlik Sense site includes backing up the following:

- Repository database: The database contains all configuration data for the site
- Log data: The centralized logging database
- The file share: The shared folder in that contains application data, such as data models used in the Qlik Sense apps, and QVD files

To restore your Qlik Sense deployment you will also need a back up of your Qlik Sense certificates. For more information, see *Backing up certificates* (page 151).

You must perform this backup procedure on each of the nodes that host the components listed above.

> Rim nodes maintain local log files that may be worth backing up in order to identify and investigate issues. It may also be worth backing up any general operating system data that may be required.

Do the following:

1. Stop all Qlik Sense services except the Qlik Sense Repository Database (QRD), on every node in your deployment.
2. Make a backup of the repository database by creating a database dump file:
   a. Open a Command Prompt in Microsoft Windows.
   b. Navigate to the location where the PostgreSQL repository database is installed.
      - If your deployment includes a local database on the central node that was installed using the Qlik Sense setup program, the location will be: 
        ```
        %ProgramFiles%\Qlik\Sense\Repository\PostgreSQL\<database version>\bin.
        ```
      - If you installed PostgreSQL manually, the location will be: 
        ```
        %ProgramFiles%\PostgreSQL\<database version>\bin.
        ```
   c. Run the following command:
      ```
      pg_dump.exe -h localhost -p 4432 -U postgres -b -F t -f "c:\QSR_backup.tar" QSR
      ```
      If you are prompted for the PostgreSQL super user password, enter the password that was created during the Qlik Sense setup.
To avoid being prompted for the password (for example, if you want to automate the Qlik Sense backup process), you can use the pgpass functionality in PostgreSQL. See the PostgreSQL documentation for more information.

3. Make a backup of all of the content in the file share.
4. If you have centralized logging configured, make a backup of the centralized logging database by running the following command:
   ```
   pg_dump.exe -h localhost -p 4432 -U postgres -b -f "c:\QLogs_backup.tar" QLogs
   ```
5. Make a backup of any locations where content that supports the Qlik Sense environment may be kept (for example, QVD files created by load scripts).
6. Restart the Qlik Sense services.

**Backing up the Qlik Sense Repository Database after uninstalling Qlik Sense**

We recommend creating your database dump file before you uninstall Qlik Sense.

If you uninstall Qlik Sense before creating the database dump file, do the following:

1. Copy the PostgreSQL folder from %ProgramData%\Qlik\Sense\Repository\PostgreSQL to a temporary location outside of the %ProgramData% folder.
2. Download and install PostgreSQL version 9.6 from the PostgreSQL website. See: Installing and configuring PostgreSQL (page 113).
3. Open a Command Prompt in Microsoft Windows.
   
   The `pg_ctl.exe` command should not be run as an administrator.

4. Navigate to the location where the PostgreSQL repository database is installed.

   If your deployment includes a local database on the central node that was installed using the Qlik Sense setup program, the location will be:
   
   `%ProgramFiles%\Qlik\Sense\Repository\PostgreSQL\<database version>\bin`

   If you installed PostgreSQL manually, the location will be:
   
   `%ProgramFiles%\PostgreSQL\<database version>\bin`.

4. Run the following commands:
   a. `pg_ctl.exe start -w -D "c:\SenseDB\9.6"`
   b. `set PGUSER=postgres`
   c. `set PGPass=Password"
3 Deploying Qlik Sense Enterprise on Windows

d. `pg_dumpall.exe > [<path to dump file>]`

e. `pg_ctl.exe stop -w -D "C:\SenseDB\9.6"

If you are prompted for the PostgreSQL super user password, enter the password that was created during the Qlik Sense setup.

To avoid being prompted for the password (for example, if you want to automate the Qlik Sense backup process), you can use the pgpass functionality in PostgreSQL. See the PostgreSQL documentation for more information.

Restoring a Qlik Sense site

Consider the following when restoring a site:

- Qlik Sense software
- If you want to restore the site to a central node with a new hostname, see Restoring a Qlik Sense site to a machine with a different hostname (page 173).
- Repository database: The database contains all configuration data for the site.
- Certificates for the Qlik Sense services: The certificates are used to encrypt the traffic between the services and the users. Make sure to backup the certificates in order not to lose any encrypted data (for example, passwords for data connections).
- Log data
- Application data: The data models in the Qlik Sense apps.
- Any content that supports the apps (for example, QVD files)

When performing the procedure below you must log in using an account that had the Root Admin role when the site was backed up. If you log in using a local admin account and the machine name is different, your permissions will not follow through.

Do the following:

1. Restore the certificates used to secure the Qlik Sense services.
   
   Restoring certificates (page 160)

2. Install Qlik Sense on the computer where you plan to restore.

   Make sure to deselect Start the Qlik Sense services when the installation has completed during the installation setup.

3. Start the Qlik Sense Repository Database (QRD).

4. Restore the repository database:
   a. Place the backed up repository database on the machine targeted for the restore.
   b. Open a Command Prompt with administrator privileges in Microsoft Windows.
3 Deploying Qlik Sense Enterprise on Windows

c. Run the following commands to restore the repository database (adjust the paths as needed):
   i. `cd "%ProgramFiles%\Qlik\Sense\Repository\PostgreSQL\<database version>\bin"`
   ii. `createdb -h localhost -p 4432 -U postgres -T template0 QSR`
       If the command fails because a database already exists, run the following command and then repeat the `createdb` command:
       `dropdb -h localhost -p 4432 -U postgres QSR`
   iii. `pg_restore.exe -h localhost -p 4432 -U postgres -d QSR "c:\QSR_backup.tar"`

5. Restore log and application data to the file share used for storage of log and application data.
6. Restore any supporting content to its original location as required.
7. Start the Qlik Sense services. If the services are started manually, start them in the following order:
   a. Qlik Sense Repository Service (QRS)
      If the user running Qlik Sense services is not local administrator on the machine, you need to start
      `Repository.exe` from an elevated command prompt using the `-bootstrap` parameter.
      See: Services (page 55)
   b. Qlik Sense Proxy Service (QPS), Qlik Sense Engine Service (QES), Qlik Sense Scheduler Service
      (QSS), and Qlik Sense Printing Service (QPR) in no specific order
      The order is important because the QRS is dependent on the QRD and the rest of the services are
      dependent on the QRS.

Restoring a Qlik Sense site to a machine with a different hostname

You can restore a Qlik Sense site to a machine with a host name that is different from the site that you backed up. However, if the machine is a central node in a multi-node site, you need to slightly adapt the procedure as follows:

- All rim nodes need to be reset, that is, you need to remove them and then add them again.
- Run `repository.exe -bootstrap -standalone -restorehostname` from an elevated command prompt to start
  the Qlik Sense Repository Service (QRS). When QRS is up and running, restart the QRS without `-restorehostname`.
  See: Services (page 55)

> The parameter `-standalone` means that Repository runs as a normal executable process (as opposed to running as a service, and registering in Windows Service Manager).

When restoring your site, you must log in using an account that had the Root Admin role when the site was backed up. If you log in using a local admin account and the machine name is different, your permissions will not follow through.

Back up the current server

Perform the following steps on the server machine that you want to restore to a different server.

1. Create a local folder called `Backup` or something similar to store the files you want to restore later. For example: `C:\ProgramData\Qlik\Sense\Repository\Backup`.
2. In Qlik Management Console, go to the Certificates section and export new certificates using the FQDN of
the new server. Ensure that you include the private key and the certificates must be in the Windows format.

3. Backup your certificates using the Microsoft Management Console (MMC). For detailed steps, see Backing up certificates (page 151). On your original server, export the following certificates from the QMC to your Backup folder. Ensure that you export the private key.

   - client
   - root
   - server

4. On the service cluster, open the your backup location QMC, Cluster Settings, copy the full UNC path of the QlikShare (the full path name including back slashes), for example \<computer_name\>QlikShare

5. In Windows, Services, stop all services, except the Qlik Sense Repository Database.

6. Backup the QSR database. For detailed instructions, see Backing up a Qlik Sense site (page 170). Copy the database dump file to your backup folder.

7. Copy all sub folders from the QlikShare (the path specified in the Service Cluster section of the QMC) to your backup folder.

8. Copy your Backup folder from the current folder to the same location on your target machine.

Restoring to a machine with a different host name

Perform the following steps on the target server machine, where you want to restore Qlik Sense.

1. Create a QlikShare folder on the target server computer. For example, create a folder called QlikShare on the C:\ drive.

2. Move your backup folder and database dump file to your target server machine.

3. Restore the following backed up certificates from the old machine used to secure the Qlik Sense services:

   - client
   - root
   - server

   Use the MMC to import them to your target server. Ensure that you mark the certificates as exportable. For detailed steps, see Restoring certificates (page 160)

4. Install the same version of Qlik Sense on the computer where you plan to restore. Do not start the services until you have finished the configuration steps.

   ![Warning](image)

   Make sure to deselect Start the Qlik Sense services when the installation has completed during the installation setup.

5. Start the Qlik Sense Repository Database (QRD) service.

6. Restore the backup copy of the repository database:

   a. Open a Command Prompt with administrator privileges in Microsoft Windows.

   b. Run the following command to restore the repository database on a clean server:

      ```
      "pg_restore.exe -h localhost -p 4432 -U postgres -d QSR "c:\QSR_backup.tar"
      ```
If running this command on a server where a repository database may have been previously installed, you may get the following error message:

```
pg_restore: [archiver (db)] connection to database "QSR" failed: FATAL: database "QSR" does not exist
```

If you get this error, follow the steps below:

i. Navigate to:
   ```
   cd "%ProgramFiles%\Qlik\Sense\Repository\PostgreSQL\<database version>\bin"
   ```

ii. Run `createdb -h localhost -p 4432 -U postgres -T template0 QSR`.
    If the command fails because a database already exists, you get the following error message:
    ```
    createdb: database creation failed: ERROR: database "QSR" already exists
    ```

iii. Run `dropdb -h localhost -p 4432 -U postgres QSR` to drop the database.

iv. Execute the `createdb` command again.

7. Restore the log and application data to the QlikShare folder.

8. To launch Qlik Sense with the new hostname:
   a. Open a Command Prompt with administrator privileges in Microsoft Windows.
   b. Change the directory to the Repository installation path
      - Default path: C:\Program Files\Qlik\Sense\Repository
   c. Execute the following command:
      ```
      Repository.exe -bootstrap -standalone -restorehostname
      ```
      When the command has completed successfully check for errors in the logs and the following message is displayed:
      ```
      Bootstrap mode has terminated. Press ENTER to exit.
      ```

9. Start the Qlik Sense services. If the services are started manually, start them in the following order:
    - Qlik Sense Service Dispatcher
    - Qlik Logging Service
    - Qlik Sense Repository Service
    - Qlik Sense Proxy Service
    - Qlik Sense Engine Service
    - Qlik Sense Scheduler Service
    - Qlik Sense Printing Service

10. Try to access the QMC or the Hub to verify that the migration has been successful. Also, from the Qlik Management Console reload the monitoring apps to verify that your certificates have been installed correctly.

### 3.6 Qlik Sense Enterprise on Windows security

Security in Qlik Sense Enterprise on Windows consists of the following:
Protection of the platform
How the Qlik Sense platform itself is protected and how it communicates and operates.

Authentication
Who is the user and how can the user prove it? Qlik Sense uses standard authentication protocols (for example, Integrated Windows Authentication), HTTP headers, and ticketing to authenticate every user requesting access to data.

Authorization
What does the user have access to? Authorization is the procedure of granting or denying users access to resources.

Auditing
The Qlik Sense platform tracks changes in the repository database, provides comprehensive audit and security logging, and monitors applications.

Confidentiality
Qlik Sense protects confidentiality by:
- encrypting network connections with Transport Layer Security (TLS)
- leveraging the operating system file system and server access controls to protect content on Qlik Sense nodes
- protecting memory using operating system controls
- securing application access at the resource level
- encrypting sensitive information (e.g. passwords and data connection strings)
- protecting app data using data reduction

Integrity
Operating system controls like the file system are leveraged to provide integrity by protecting data at rest, encrypting sensitive information, and preventing data write back to the source system.

Availability
Qlik Sense deployed in a multi-node environment is designed for resiliency and reliability.

Protection of the platform
Security in Qlik Sense relies not only on the Qlik Sense software, but also on the security of the environment it is deployed in. The following are must be considered to maximize the security of your Qlik Sense deployment:

Network security
Server security
Process security
App security

Network security
All communication between Qlik Sense services and web clients use web protocols that use Transport Layer Security (TLS). TLS uses digital certificates to encrypt information exchanged between services, servers, and clients. Encrypted information flows through tunnels requiring two certificates to secure the connection; a server certificate to identify the correct server and a client certificate to allow the client to communicate with the identified server.
3 Deploying Qlik Sense Enterprise on Windows

Server security

The operating system security system controls access to certificates, storage, memory, and CPU resources. Qlik Sense uses these controls to protect the platform by only allowing authorized users and processes access to required resources.

Process security

Qlik Sense goes through a rigorous testing process during development to mitigate security risks and handle unanticipated events. Additional testing verifies Qlik Sense can stand up against known security threats toward the software.

App security

Attribute based access control provides a comprehensive framework to govern user capabilities within the platform. Row and column level data reduction through section access dynamically manages the data that users view and select in applications.

Authentication

All authentication in a Qlik Sense deployment is managed by the Qlik Sense Proxy Service (QPS), including clients connecting to the Hub or the Qlik Management Console (QMC). Qlik Sense requires an external identity provider to verify an individual user’s identity. Upon verification, Qlik Sense transfers the user to the Hub or QMC, encrypting traffic using TLS and certificates with various methods, including support for single sign-on (SSO) solutions to minimize the number of times a user must log on to access apps and websites. The QPS supports the use of multiple proxies and each proxy can use multiple authentication methods over a network protected by Transport Layer Security (TLS).

Each Qlik Sense Proxy Service in a Qlik Sense deployment uses virtual proxies to support authentication. Virtual proxies allow one proxy to support multiple authentication schemes, perform session management, and load balancing across multi-node deployments. Virtual proxies may link to one or many Qlik Sense Proxy Service nodes to direct traffic, load balance between engines, or provide specific access to administrative layers of a deployment.

Authorization

After a user authenticates and gains access to Qlik Sense, authorization through an attribute based access control (ABAC) model enforces application visibility and self-service capabilities within applications. In Qlik Sense, ABAC is defined as an access control method where user requests to perform actions on resources are granted based on assigned attributes of the user, assigned attributes of the resource, environment conditions, and a set of security rules that are specified in terms of those attributes and conditions. Attributes from Active Directory, LDAP, and databases are loaded into Qlik Sense. In addition, attributes may be defined and managed directly within Qlik Sense as well.

Qlik Sense supports authorization in the following ways:
3 Deploying Qlik Sense Enterprise on Windows

- Security rules
- Section access
- Dynamic data reduction

Auditing
Governance is critical in enterprise business intelligence. Qlik Sense delivers auditing, monitoring and logging using the QMC, applications, and log files to inform administrators and mitigate risks in deployments.

Qlik Sense supports auditing in the following ways:

- The repository database stores information about when the database was last changed and who made the change.
- The logging framework provides audit and security logs.
- The logs are centrally stored.
- The log format is resistant to injection from the Qlik Sense clients.
- The license logs are signed with a signature to protect them from tampering.

Confidentiality
Qlik Sense provides confidentiality by encrypting network connections with TLS, leveraging the operating system file system and server access controls to protect content on Qlik Sense nodes, protecting memory using operating system controls, securing application access at the resource level, encrypting sensitive information (e.g. passwords and data connection strings), and protecting app data using data reduction.

Qlik Sense supports confidentiality in the following ways:

- The network uses Transport Layer Security (TLS) for encryption and certificates for authentication.
- The information stored in the file share and the repository database, including Qlik Sense content, is protected by the operating system using server access control and file system controls.
- The process memory and loaded data for Qlik Sense are protected by the physical server and the operating system controls.
- The apps are secured using access control on the resource level.
- Sensitive information (for example, passwords and connection strings) that is used to access external data sources is stored with encryption.
- The app data is protected using data reduction.

Integrity
Qlik Sense provides integrity through operating system controls like the file system to protect data at rest, encrypt sensitive information, and prevent data write back to the source system.

Qlik Sense supports integrity in the following ways:

- Stored data is protected using the operating system controls (for example, the file system).
- Sensitive information (for example, passwords and connection strings) that is used to access external data sources is stored with encryption.
Qlik Sense does not support write back to the source system (that is, the Qlik Sense clients cannot edit the data sources).

Availability
Qlik Sense supports availability in the following ways:

- The nodes in a multi-node site are resilient by design. Each node connects to a central node to access the data it needs to fulfill its role.
- The Qlik Sense protocols are designed to be fault tolerant.

Certificates
A certificate is a data file that contains keys that are used to encrypt communication between a client and a server in a domain. Certificates also confirm that the domain is known by the organization that issued the certificate. A certificate includes information about the keys, information about the identity of the owner, and the digital signature of an organization that has verified that the content of the certificate is correct. The pair of keys (public and private keys) are used to encrypt communication.

Qlik products use certificates when they communicate with each other. They also use certificates within products, for communication between components that are installed on different computers. These are standard TLS certificates.

The organization that issues the certificate, the certificate authority, is said to “sign” the certificate. You can arrange to get certificates from a certificate authority, to show your domain is known. You can also issue and sign your own (“self-signed certificates”).

Some common errors
Because it generally important for security to know whether a site is known, browsers will display error messages related to certificates and might block communication.

Some common errors are related to the certificate authority. For example, if there is no certificate authority or if the certificate has expired, the default level of security in most browsers will stop communication with a message about “unsigned certificates”, “expired certificates”, or similar terms. If your security administrators know that the certificate is still good, you can create an exception so the error is ignored for that certificate.

Other common errors are related to how the domain is named. For example, companyname.com is a different domain from www.companyname.com, and localhost is a different domain from a server name. A fully qualified domain name is an unambiguous name for a domain. For example, a server at companyname.com might be named mktg-SGK, and can be referred to that way, but the fully qualified domain name is mktg-SGK.companyname.com. (This is called whitelisting.)

Encryption and keys
The kind of encryption used in certificates in Qlik products requires a pair of keys (asymmetric encryption). One key, the public key, is shared. The other key, the private key, is used only by the owner.

PEM is an ASCII text format for public certificates. It is portable across platforms.
3 Deploying Qlik Sense Enterprise on Windows

You can get certificates and key pairs from certificate authorities or you can generate them. To get a certificate signed, you will need to also generate a signing request.

Protecting the platform

The security in Qlik Sense does not depend only on the Qlik Sense software. It also relies on the security of the environment that Qlik Sense operates in. This means that the security of, for example, the operating system and the cryptographic protocols (such as TLS/SSL) has to be set up and configured to provide the security needed for Qlik Sense.

The figure below shows the components that have to be considered in order to maximize the security.

Network security

For all Qlik Sense components to communicate with each other in a secure way, they need to build trust.

In Qlik Sense, all communication between the Qlik Sense services and clients is based on web protocols. The web protocols use Transport Layer Security (TLS) for encryption and exchange of information and keys and certificates for authentication of the communicating parties.

TLS provides a way to build encrypted tunnels between identified servers or services. The parties that communicate are identified using certificates. Each tunnel needs two certificates; one to prove to the client that it is communicating with the right server and one to prove to the server that the client is allowed to communicate with the server.
3 Deploying Qlik Sense Enterprise on Windows

So, how to make sure that the certificates are from the same Qlik Sense trust zone? All certificates that belong to a trust zone are signed with the same signature. If the signature exists in the certificate, it is accepted as proof that the certificate belongs to the trust zone.

When the protected tunnels and the correct certificates are in place, the Qlik Sense services have a trust zone to operate within. Within the trust zone, only services that belong to the specific Qlik Sense site can communicate with each other.

The Qlik Sense clients are considered to be outside of the Qlik Sense trust zone because they often run on less trusted end-user devices. The Qlik Sense Proxy Service (QPS) can bridge the two zones and allow communication between the clients and the Qlik Sense services, if the user is authenticated to the system.

TLS-protected tunnels can be used to secure the communication between the Qlik Sense clients and the QPS. As the clients are outside of the Qlik Sense trust zone, the communication between the clients and the QPS uses a certificate with a different signature than the one used within the trust zone.

See also:
- Certificate trust (page 185)

Server security

Qlik Sense uses the server operating system to gain access to resources. The operating system provides a security system that controls the use of the server resources (for example, storage, memory, and CPU). Qlik Sense uses the security system controls to protect its resources (for example, files, memory, processes, and certificates) on the server.
Through the use of access control, the security system grants access to Qlik Sense files (for example, log files, database files, certificates, and apps) only to certain users on the server.

The security system also protects the server memory, so that only authorized processes are allowed to write to the Qlik Sense part of the memory.

In addition, the security system is responsible for assigning users to processes. This is used to restrict who is allowed to interact with the Qlik Sense processes on the server. The processes are also restricted in terms of which parts of the operating system they are allowed to access.

So, by using the controls in the security system, a secure and protected environment can be configured for the Qlik Sense processes and files.

**Process security**

Each process executes in an environment that poses different threats to the process. In this layer of the security model, the focus is on ensuring that the software is robust and thoroughly analyzed from a security perspective.
Rugged software
For software to be considered as rugged, it must cope with all potential threats to the confidentiality, integrity, and availability of the information, and be robust when used in ways not anticipated.

Several mitigating actions have been implemented in the Qlik Sense software in order to make it rugged:

- Authorization of communication using certificates
- Validation of all external data that is sent to the system
- Encoding of content to avoid injection of malicious code
- Use of protected memory
- Encryption of data
- Audit logging
- Use of checksums
- Isolated execution of external components
- Escaping of SQL data

Threat analysis
To ensure that the Qlik Sense software is secure and rugged, threat analysis of the design has been performed as part of the development process. The following threat areas, often abbreviated as STRIDE, have been covered:

- Spoofing
- Tampering
- Repudiation
- Information disclosure
- Denial of service
- Elevation of privilege

In addition to the threat analyses, exploratory security testing has also been performed on the Qlik Sense software.

App security
The major components of the Qlik Sense app security are:

- Access control system: The access control system grants users access to the resources in Qlik Sense.
- Data reduction: The data reduction functionality is based on the concept of section access, which is a way to dynamically change which data a user can view. This makes it possible to build apps that can be used by many users, but with different data sets that are dynamically created based on user information. The reduction of data is performed by the Qlik Sense Engine Service (QES).

Using these components, the resources and data (that is, the content) consumed by the Qlik Sense users can be secured.
3  Deploying Qlik Sense Enterprise on Windows

Authentication

All authentication in Qlik Sense is managed by the Qlik Sense Proxy Service (QPS). The QPS authenticates all users regardless of Qlik Sense client type. This means that the QPS also authenticates users of the Qlik Management Console (QMC).

In Qlik Sense, authentication and authorization are two distinct, unconnected actions. In addition, the sources of information used for authentication do not have to be the same as for authorization, and the other way around.

Qlik Sense always asks an external system to verify who the user is and if the user can prove it. The interaction between Qlik Sense and the external identity provider is handled by authentication modules.

For a module to communicate with Qlik Sense, it has to be trusted. Transport Layer Security (TLS) and certificate authentication are used to authorize external components for communication with Qlik Sense.

In Qlik Sense, the authentication of a user consists of three distinct steps:

1. Authentication module: Get the user identity and credentials.
2. Authentication module: Request an external system to verify the user identity using the credentials.
3. Transfer the user to Qlik Sense using the Ticket API, the Session API, headers, or SAML.

The first two steps are always handled by the authentication module. It is up to the authentication module to verify the user in an appropriate way.

The third step can be performed in the following ways:

- Using the Ticket API, which transfers the user and the user's properties using a one-time ticket.
- Using the Session API, whereby an external module can transfer web sessions that identify the user and the user's properties to Qlik Sense.
- Using headers, with which a trusted system can transfer the user using HTTP headers. This is a common solution for integrating with Single Sign-On (SSO) systems.
- Qlik Sense can be configured to allow anonymous users (using, for example, SAML).

See also:

Network security (page 180)

Default authentication module

After a default installation of Qlik Sense, the Qlik Sense Proxy Service (QPS) includes a module that handles authentication of Microsoft Windows users. The module supports the use of Kerberos and NTLM.

If you want to use Kerberos authentication, you need to make sure that browsers that are used to access the Qlik Sense are configured to support Kerberos.
Certificate trust

Qlik Sense uses certificates for authentication. A certificate provides trust between nodes within a site.

Certificate trust requirements

The requirements described in this section must be fulfilled for the certificate trust to function properly.

When using Transport Layer Security (TLS) in Microsoft Windows environments, the private key must be stored together with the certificate in the Windows certificate store. In addition, the account that is used to run the Qlik Sense services must have permission to access the certificate private key.

If you want to use TLS 1.2 authentication, you need to enable TLS 1.2 support in the Windows registry of the server machine. You should consider the impact of enabling TLS 1.2, as this is a global system setting.

Communication ports

To set up certificate trust, the Qlik Sense Repository Services (QRSs) require that the ports listed in the following table can be opened and used for communication. If any communication passes through a network firewall, the ports in the firewall must be opened and configured for the services.

<table>
<thead>
<tr>
<th>Port no.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4570</td>
<td>Certificate password verification port, only used within multi-node sites by Qlik Sense Repository Services (QRSs) on rim nodes to receive the password that unlocks a distributed certificate. The port can only be accessed from localhost and it is closed immediately after the certificate has been unlocked. The communication is always unencrypted. This port uses HTTP for communication.</td>
</tr>
<tr>
<td>4444</td>
<td>Security distribution port, only used by Qlik Sense Repository Services (QRSs) on rim nodes to receive a certificate from the master QRS on the central node. The communication is always unencrypted, but the transferred certificate package is password-protected. This port uses HTTP for communication.</td>
</tr>
</tbody>
</table>

Ports (page 65)

Unlocking distributed certificates

When adding a new rim node to a site, the distributed certificate needs to be unlocked.

Manage Qlik Sense sites
Certificate architecture

Certificates are used within a Qlik Sense site to authenticate communication between services that reside on different nodes. In addition, certificates can be used to build a trust domain between services that are located in different domains or areas (for example, internal networks, extranets, and Internet) without having to share a Microsoft Active Directory (AD) or other user directories.

The architecture is based on the master Qlik Sense Repository Service (QRS) on the central node acting as the certificate manager or Certificate Authority (CA). The master QRS creates and distributes certificates to all nodes within a site. The master QRS is therefore an important part of the security solution and has to be managed from a secure location to keep the certificate solution secure.

The root certificate for the installation is stored on the central node in the site, where the master QRS runs. All nodes with Qlik Sense services that are to be used within the site receive certificates signed with the root certificate when added to the master QRS. The master QRS (that is, the CA) issues digital certificates that contain keys and the identity of the owner. The private key is not made publicly available – it is kept secret by the nodes. The certificate enables the services in a Qlik Sense deployment to validate the authenticity of the other services. This means that the master QRS is responsible for making sure that a service that is deployed on a node is a service within the site.
After the nodes have received certificates, the communication between the Qlik Sense services is encrypted using Transport Layer Security (TLS) encryption.

Confirming certificates using Microsoft Management Console

Certificates can be visually confirmed in the Microsoft Management Console (MMC) with the certificate snap-in added.

If the certificates have been properly deployed, they are available in the locations listed in the table.

<table>
<thead>
<tr>
<th>Certificate</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>QlikClient</td>
<td>Certificates - Current User&gt;Personal&gt;Certificates</td>
</tr>
<tr>
<td>&lt;full computer name&gt;-CA</td>
<td>Certificates - Current User&gt;Trusted Root Certification Authorities&gt;Certificates</td>
</tr>
<tr>
<td>&lt;full computer name&gt;-CA</td>
<td>Certificates (Local Computer)&gt;Trusted Root Certification Authorities&gt;Certificates</td>
</tr>
<tr>
<td>&lt;computer name&gt;</td>
<td>Certificates (Local Computer)&gt;Personal&gt;Certificates</td>
</tr>
</tbody>
</table>

Certificate handling

This section describes how the certificates are handled when a Qlik Sense service starts.

**Client certificate**

This section describes how the master Qlik Sense Repository Service (QRS) on the central node in a site handles the client certificate when a Qlik Sense service starts.

The client certificate is located in the following place in the Microsoft Windows certificate store:

**Current User>Personal>Certificates**

When a Qlik Sense service starts, the QRS searches the certificate store to see if there are any Qlik Sense certificates. Depending on the results of the search, the QRS does the following:
3  Deploying Qlik Sense Enterprise on Windows

- If no client certificate is found, the QRS logs that no certificate was found.
- If only one client certificate is found, the QRS checks if it is valid. If the certificate is not valid, the QRS logs that an invalid certificate was found.
- If more than one client certificate is found, the QRS deletes all certificates. Duplicates are not allowed. In addition, the QRS logs the number of valid and invalid certificates that were found and deleted.

If certificates are found to be missing or invalid, you must run the QRS in bootstrap mode to recreate the certificates. For more information, see Services (page 55).

Server certificate
This section describes how the master Qlik Sense Repository Service (QRS) on the central node in a site handles the server certificate when a Qlik Sense service starts.

The server certificate is located in the following place in the Microsoft Windows certificate store:

Local Computer>Personal>Certificates

When a Qlik Sense service starts, the QRS searches the certificate store to see if there are any Qlik Sense certificates. Depending on the results of the search, the QRS does the following:

- If no server certificate is found, the QRS logs that no certificate was found.
- If only one server certificate is found, the QRS checks if it is valid. If the certificate is not valid, the QRS logs that an invalid certificate was found.
- If more than one server certificate is found, the QRS deletes all certificates. Duplicates are not allowed. In addition, the QRS logs the number of valid and invalid certificates that were found and deleted.

If certificates are found to be missing or invalid, you must run the QRS in bootstrap mode to recreate the certificates. For more information, see Services (page 55).

Root certificate
This section describes how the master Qlik Sense Repository Service (QRS) on the central node in a site handles the root certificate when a Qlik Sense service starts.

The root certificate is located in the following places in the Microsoft Windows certificate store:

Current User>Trusted Root Certification Authorities>Certificates

Local Computer>Trusted Root Certification Authorities>Certificates

When a Qlik Sense service starts, the QRS searches the certificate store to see if there are any Qlik Sense certificates. Depending on the results of the search, the QRS does the following:

- If no root certificate is found, the QRS logs that no certificate was found.
- If only one root certificate is found, the QRS checks if it is valid. If it is not valid, the QRS logs a fatal error that an invalid root certificate was found, which means that the service is shut down, and that the administrator must manually delete any unwanted certificates. In addition, the QRS logs information about the certificates that are affected by this.
3 Deploying Qlik Sense Enterprise on Windows

- If more than one root certificate is found, the QRS logs a fatal error that an invalid root certificate was found, which means that the service is shut down and that the administrator manually has to delete any unwanted certificates. In addition, the QRS logs information on the certificates that are affected by this.

If certificates are found to be missing or invalid, you must run the QRS in bootstrap mode to recreate the certificates. For more information, see Services (page 55).

In order not to break any certificate trust between machines, the QRS does not remove any root certificates. It is up to the administrator to decide on what to do with invalid root certificates.

See also: Services (page 55)

Invalid certificate

The definition of an invalid certificate is as follows:

- The operating system considers the certificate to be too old or the certificate chain is incorrect or incomplete.
- The Qlik Sense certificate extension (OID “1.3.6.1.5.5.7.13.3”) is missing or does not reflect the location of the certificate:
  - Current User/Personal certificate location: Client
  - Local Machine/Personal certificate location: Server
  - Local Machine/Trusted Root certificate location: Root
  - Current User/Trusted Root certificate location: Root
- The server, client, and root certificates on the central node do not have a private key that the operating system allows them to access.
- The server and client certificates are not signed by the root certificate on the machine.

Maximum number of trusted root certificates

When a Qlik Sense service starts, it checks the number of trusted root certificates on the machine where it is running. If there are more than 300 certificates on the machine, warning messages containing the following information are logged:

- There are too many root certificates for the service to trust.
- The Microsoft Windows operating system will truncate the list of certificates during the Transport Layer Security (TLS) handshake.

If the Qlik Sense root certificate (<host-machine>-CA) that the Qlik Sense client certificate belongs to is deleted from the list of certificates because of the truncation, the service cannot be authenticated.

To manually view the root certificates on a machine, open the Microsoft Management Console (MMC) and go to Certificates (Local Computer)\Trusted Root Certification Authorities.

Authentication solutions

Qlik Sense authentication can be managed with any of the following solutions:
3 Deploying Qlik Sense Enterprise on Windows

- Ticket solution, see Ticket solution (page 190)
- Session solution, see Session solution (page 191)
- Header solution, see Header solution (page 192)
- SAML, see SAML (page 193)
- JWT, see Limitations (page 194)
- Anonymous users, see Anonymous users (page 195)
- Configuring single sign-on (SSO) from Microsoft SQL (MSSQL) server, see Configuring single sign-on (SSO) for Microsoft SQL (MS SQL) Server (page 195)

Ticket solution
The ticket solution is similar to a normal ticket. The user receives a ticket after having been verified. The user then brings the ticket to Qlik Sense and, if the ticket is valid, is authenticated. In order to keep the tickets secure, the following restrictions apply:

- A ticket is only valid for a short period of time.
- A ticket is only valid once.
- A ticket is random and therefore hard to guess.

All communication between the authentication module and the Qlik Sense Proxy Service (QPS) uses Transport Layer Security (TLS) and must be authorized using certificates.

The figure below shows a typical flow for authenticating a user with tickets.
1. The user accesses Qlik Sense.
2. Qlik Sense redirects the user to the authentication module. The authentication module verifies the user identity and credentials with an identity provider.
3. Once the credentials have been verified, a ticket is requested from the QPS. Additional properties may be supplied in the request.
4. The authentication module receives a ticket.
5. The user is redirected back to the QPS with the ticket. The QPS checks that the ticket is valid and has not timed out.
6. A proxy session is created for the user.
7. The user is now authenticated.

For information about the Authentication (Ticket) API for the Authentication module, see Ticket.

Session solution
The session solution allows the Qlik Sense Proxy Service (QPS) to use a session from an external system to validate who the user is.

All communication between the authentication module and the QPS uses Transport Layer Security (TLS) and must be authorized using certificates.

The figure below shows a typical flow for authenticating a user using a session from an external system.
1. The user accesses the identity provider, which, for example, can be integrated into a portal. The identity provider gets the user identity and credentials and then verifies them. After that, the identity provider creates a new session.

2. The identity provider registers the session token with the Qlik Sense session module.

3. The identity provider sets the session token as a session cookie.

4. The user accesses the QPS to get content (for example, through an iframe in the portal).

5. The QPS validates the session to the session module.

6. If the session is valid and has not yet timed out, the user is authenticated.

The name of the session cookie used by the authentication module can be configured in the Qlik Management Console (QMC).

For more information about the session module, see Session module API.

**Header solution**

Header authentication is often used in conjunction with a Single Sign-On (SSO) system that supplies a reverse proxy or filter for authenticating the user.

The figure below shows a typical flow for authenticating a user using header authentication.
1. The user accesses the system and authenticates to the reverse proxy.
2. The reverse proxy injects the username into a defined HTTP header. The header must be included in every request to the Qlik Sense Proxy Service (QPS).
3. The user is authenticated.

- **For this solution to be secure, the end-user must not be able to communicate directly with the QPS but instead be forced to go through the reverse proxy/filter.**

- **The reverse proxy/filter must be configured to preserve the host name, that is, the host header from the client must not be modified by the reverse proxy/filter.**

- **The name of the HTTP header used for the user can be configured in the Qlik Management Console (QMC).**

**SAML**

Security Assertion Markup Language (SAML) is an XML-based, open-standard data format for exchanging authentication and authorization data between parties (for example, between an identity provider and a service provider). SAML is typically used for web browser single sign-on (SSO).

**How SAML works**

The SAML specification defines three roles:
3 Deploying Qlik Sense Enterprise on Windows

- Principal: Typically a user
- IdP: The identity provider
- SP: The service provider

The principal requests a service from the SP, which requests and obtains an identity assertion from the IdP. Based on the assertion, the SP decides whether or not to perform the service requested by the principal.

**SAML in Qlik Sense**

Qlik Sense supports SAML V2.0 by:

- Implementing an SP that can integrate with external IdPs
- Supporting HTTP Redirect Binding for SAML requests
- Supporting HTTP Redirect Binding and HTTP POST Binding for SAML responses
- Supporting SAML properties for access control of resources and data

Limitations:

- Qlik Sense does not support SAML message signature validation.

**JWT**

JSON Web Token (JWT) is an open standard for secure transmission of information between two parties as a JavaScript Object Notation (JSON) object. JWT is used for authentication and authorization. Because JWT enables single sign-on (SSO), it minimizes the number of times a user has to log on to cloud applications and websites.

**How JWT works**

A JWT consists of three parts: a header, a payload, and a signature.

- The header usually consists of two parts: type (typ) and algorithm (alg). The algorithm is used to generate the signature.
- The payload is a JSON object that consists of the claims that you want to make. Claims are statements about an entity (usually the user) and additional metadata.
- The signature is used to verify the identity of the JWT sender and to ensure that the message has not been tampered with.

Authentication is performed by verifying the signature. If the signature is valid, access is granted to Qlik Sense.

**Limitations**

The following limitations exist:

- Encrypted JWTs are not supported.

*When using HTTPS, all traffic, including JWTs, are encrypted during transport.*
3 Deploying Qlik Sense Enterprise on Windows

- Only the following signing algorithms are supported:
  - RS256 - RSA signature with SHA256
  - RS384 - RSA signature with SHA384
  - RS512 - RSA signature with SHA512

Anonymous users

If anonymous use of Qlik Sense is allowed, users who are not authenticated are not automatically redirected to an authentication module. Instead, the user first gets anonymous access and is then, if the user chooses to sign in, redirected to the authentication module to supply user identity and credentials.

Configuring single sign-on (SSO) for Microsoft SQL (MS SQL) Server

If your database files access data from MS SQL Server, you can configure the host server to enable SSO. ODBC data source single sign-on permits clients to use one Windows authenticated login to access data in shared files.

To configure SSO for MS SQL Server, a Windows domain administrator must do the following:

- Create service principal names (SPN) in Active Directory
- Configure delegation for the Qlik Sense services administrator account
- Configure the Qlik Sense server for SSO
- Configure the MS SQL Server for SSO

The Microsoft SQL Server Connector in the Qlik ODBC Connector Package also supports SSO. If you are using the connector in the ODBC Connector Package, use the following configuration instructions: Configuring SSO for the Microsoft SQL Server connector.

The same Qlik Sense services administrator account used during the Qlik Sense (central node) installation must be used. If a different account is used, the Qlik Sense services administrator account must own the HTTP service principal. For more information, see User accounts (page 88).

Creating service principal names (SPN) in Active Directory

A service principal name (SPN) is a unique identifier of a service instance. SPNs are used during authentication to associate a service instance with a service logon account. This allows a client application to request that a service authenticate an account even if the client does not have the account name. A SPN always includes the name of the host computer on which the service instance is running, so a service instance might register a SPN for each name or alias of its host.

Before the authentication service can use a SPN to authenticate a service, the SPN must be registered on the account object that the service instance uses to log on. A given SPN can be registered on only one account. For Win32 services, a service installer specifies the logon account when an instance of the service is installed. The installer then composes the SPNs and writes them as a property of the account object in Active Directory Domain Services. If the account of a service instance changes, the SPNs must be re-registered under the new account.

When a client connects to a service, it locates an instance of the service, composes an SPN for that instance, connects to the service, and presents the SPN for the service to authenticate.
To set up SSO for MS SQL server, you must create SPNs for the Qlik Sense services administrator account.

Do the following:

1. Log on as a domain administrator.
2. Open an elevated command prompt.
3. Enter the following to create a SPN for the Qlik Sense services administrator:

   ```
   setspn -A HTTP/<Qlik_Sense_server>:<port> \<Qlik_Sense_services_administrator>
   ```

   *The <Qlik_Sense_server> must be entered as the fully qualified domain name of the server.*

   *The <Qlik_Sense_server> is the central node where the Qlik Sense is running.*

4. Enter the following to create a SPN for the MS SQL Server services administrator:

   ```
   setspn -A MSSQLSvc/<server_name>:<port> \<services_administrator>
   ```

   *The <server_name> must be entered as the fully qualified domain name of the server.*

5. Enter the following commands to verify the result of your SPN setup:

   a. `setspn -L \<Qlik_Sense_services_administrator>` to verify the Qlik Sense services administrator.
   b. `setspn -L \<MS_Sql_server_services_administrator>` to verify the MS SQL Server services administrator.

**Configuring delegation for the Qlik Sense services administrator account**

Delegation allows a front-end service to forward client requests to a back-end service so that the back-end service can also impersonate the client. Impersonation is used to check whether a client is authorized to perform a particular action, while delegation is a way of flowing impersonation capabilities, along with the client’s identity, to a back-end service.

To configure SSO for MS SQL Server, you must set up delegation rights to the MS SQL Server service for the Qlik Sense services administrator.

A Windows domain administrator can change the delegation tab on the Qlik Sense services administrator account properties page.

Do the following:

1. Log on as a Windows domain administrator.
2. Right click on your Qlik Sense services administrator account and click Properties.
3. Go to the Delegation tab, and select Trust this user for delegation to specified services only, then select Use any authentication protocol.
4. Click Add....
5. On the Add Services window, click Users or Computers....
3 Deploying Qlik Sense Enterprise on Windows

6. On the Select Users or Computers window, enter the domain and user name of the Microsoft SQL Server services administrator and click OK.

7. On the Add Services window, select the MS SQL Server service and click OK.

You can verify your delegation configuration on the Delegation tab. The MS SQL Server service should now be set as the service to which the Qlik Sense services administrator can present delegation credentials.

**Configuring the Qlik Sense server for SSO**

To configure the Qlik Sense server for SSO with MS SQL Server, you must:

- Add the Qlik Sense services administrator to the **Administrator** group on the Qlik Sense server if it’s not already part of that group.
- Add Qlik Sense services administrator as part of the **Act as part of the operating system** role in the Local Security Policy.

Do the following:

1. Log on to the Qlik Sense server as an administrator.
3. Under Policy, right click on **Act as part of the operating system** and select **Properties**.
4. On the Local Security Setting tab, click **Add User or Group**....
5. Add the Qlik Sense services administrator account, and click **OK**.

**Configuring MS SQL Server**

To configure the MS SQL Server for SSO, you must ensure that the MS SQL Server service runs as the MS SQL Server services administrator.

Do the following:

1. Log on to the MS SQL Server as an administrator.
2. Open the **Sql Server Configuration Manager**.
3. Select **SQL Server Services**.
4. Select **SQL Server** in the right pane and verify that the **Log On As** column is populated with your MS SQL Server services administrator account.

> You must reboot after making changes to remove the SQL self registration of the SPN under machine account and register the SPN manually on the domain account.

**Authorization**

Authorization is the procedure of granting or denying users access to resources.
3 Deploying Qlik Sense Enterprise on Windows

In Qlik Sense, authentication and authorization are two distinct, unconnected actions. In addition, the sources of information used for authentication do not have to be the same as for authorization, and the other way around.

In Qlik Sense, there are two authorization systems:

- **Access control**: The access control system grants users access to the resources in Qlik Sense. The access control system is implemented in the Qlik Sense Repository Service (QRS) and independent of the operating system.
- **Data reduction**: The data reduction functionality is based on the concept of section access, which is a way to dynamically change which data a user can view. This makes it possible to build apps that can be used by many users, but with different data sets that are dynamically created based on user information. The reduction of data is performed by the Qlik Sense Engine Service (QES).

The two authorization systems are unconnected and configured separately.

**Access control**

This section describes the different types of access control:

- **Resource access control**: Is the user allowed to access the app? Which functions in the app is the user allowed to use (for example, printing, exporting, and snapshots)?
- **Administrator access control**: Which access rights are needed for the different roles and responsibilities of the administrators?

**Resource access control**

The resource access control system in Qlik Sense is based on properties. This means that the access is based on rules that refer to properties connected to resources and users in Qlik Sense.

All authorization to resources is enforced by the Qlik Sense Repository Service (QRS). The QRS only gives other Qlik Sense services access to resources that the current user is allowed to access.

The resource access control system determines the access based on the following parameters:

- **User name and user properties**: The user name and user properties are supplied by the Qlik Sense Proxy Service (QPS) that authenticated the user.
- **Action**: The method that the user is trying to perform on a resource (for example, create, read, or print).
- **Resource**: The entity that the user is trying to perform an action on (for example, app, sheet, or object).
- **Environment**: The environment is supplied by the QPS and describes, for example, time, location, protection, and the type of Qlik Sense client used.

**Resource access control rules**

The system administrator can set up rules for the resources access control. The rules are divided into three parts:

- **Resource filter**: The resources that the rule applies to.
- **Condition**: A logical condition that, if evaluated as true, grants access.
- **Action**: The action that the user is allowed to perform, if the condition is true.
Properties connected to resources or users may be used in the rules. Examples of properties include the name of user or resource, type of resource, and Active Directory groups for users or custom-defined properties.

**Resource access control streams**

To make the management of the Qlik Sense authorization systems efficient, apps can be grouped into streams. From an authorization perspective, a stream is a grouping of apps that a group of users has read (often referred to as “subscription”) or publish access to.

By default, Qlik Sense includes the following streams:

- **Everyone:** All users have read and publish rights to this stream.
- **Monitoring apps:** Contains a number of apps for monitoring of Qlik Sense.

Streams are created and managed in the Qlik Management Console (QMC).
Administrator access control

In addition to setting up the access control for the users, it is important to configure the access control for the administrators so that they get access rights in the Qlik Management Console (QMC) that correspond to their roles and responsibilities.

Common administrator roles include the following:

- RootAdmin
- AuditAdmin
- ContentAdmin
- DeploymentAdmin
- SecurityAdmin

For a presentation of the access rights for the respective administrator roles, see the topic Default administration roles in the document Manage Qlik Sense sites.

Data reduction

Data reduction is used to determine which data a user is allowed to see: all of it or just parts of it?

The data reduction functionality is based on the concept of section access, which is a way to dynamically change which data a user can view. This makes it possible to build apps that can be used by many users, but with different data sets that are dynamically created based on user information. The reduction of data is performed by the Qlik Sense Engine Service (QES).

The definition of access rights for section access is maintained in the apps and configured through the load script.
Security example: Opening an app

The figure below shows the flow in the Qlik Sense security system when a user logs in and opens an app.

1. **Authentication**: The authentication module in the Qlik Sense Proxy Service (QPS) handles the authentication. The credentials provided by the user are verified against information from the identity provider (for example, a directory service such as Microsoft Active Directory).

2. **Session creation**: When the user credentials have been successfully verified by the authentication module, a session is created for the user by the session module in the QPS.

3. **Access control system**: When the user tries to open an app, the Qlik Sense Engine Service (QES) requests the Qlik Sense Repository Service (QRS) to check if the user is authorized to perform the action. The QRS then checks the repository database, where, among other things, all users and access rules are stored.

   *A user is imported into the repository database from a User Directory (UD) (for example, Microsoft Active Directory) using Qlik Sense User Directory Connectors (UDCs). The import is triggered by the Qlik Sense Scheduler Service (QSS) and the intervals in-between imports can be scheduled.*

4. **Dynamic data reduction**: When the user has been successfully authorized by the QRS, the app is opened. Before the data is displayed to the user, the QES performs a dynamic data reduction, where the data that the user is allowed to see is prepared.
3.7 Logging

The log messages produced by Qlik Sense provide important information about the general well-being of the deployment.

The logging is based on the log4net component in Apache Logging Services. This means that Qlik Sense uses a standardized logging framework and conforms to standard logging procedures.

Updated logging framework

An updated logging framework was introduced in Qlik Sense version 2.0. Unless otherwise stated, the documentation describes the updated logging framework.

Legacy logging framework

The legacy logging framework is still available in Qlik Sense, but the logs are as of Qlik Sense version 2.0 referred to as trace logs. The log files remain the same, in the old logging format, but they are stored in a new location.

See: Trace logs (page 234)

Centralized logging framework

As of the September 2017 release of Qlik Sense, centralized logging gives you the ability to log directly into a PostgreSQL database. With all logs in one place it will be easier for you find the relevant logs. If you install Qlik Sense with centralized logging, which is included in a default installation, log entries are persisted in two locations: the existing log files and the centralized logging database.

Reading and analyzing log files in Qlik Sense

The log files can be read and analyzed using Qlik Sense, which includes the following pre-defined, log-related data connections after installation:

- **ServerLogFolder**: Links to the active log files.
- **ArchivedLogsFolder**: Links to the archived log files.

The data connections can be edited in the Qlik Management Console (QMC).

In addition, users with root, security, content, or deployment administrator rights can use the Qlik Sense log data in apps by selecting one of the data connections listed above in the data load editor.

Centralized logging

With the introduction of shared persistence, all nodes have direct access to a common database and file system. The Qlik Sense services (proxy, scheduler, repository, and engine) transfer log messages to the Qlik Logging Service. The Qlik Logging Service centralizes the logging by collecting all the messages and inserting them into
Centralized logging uses the log4net library to write log information to the database. The Qlik Sense Repository, Proxy, and Scheduler services use the RemotingAppender from log4net to transfer log messages to a remote logging sink that is read by the Qlik Logging Service. The Engine loggers use a pipe connection to the Repository service, which, in turn, persists the data to the Qlik Logging Service. All services use TCP localhost port 7070 to establish communication. The Qlik Logging Service collects all messages and inserts them into the PostgreSQL database named QLogs using a custom AdoNetAppender. The configuration for the Qlik Logging Service is stored in an XML file named QlikCentralizedLogging.config. As part of the centralized logging database feature, the Monitoring Apps include an ODBC (PostgreSQL) data connection. By default, this data connection points to the QLogs database on localhost port 4432. This data connection is not used when only file logging is enabled.

Centralized logging uses the log4net library to persist log information collected from Qlik Sense services to the database.

Built-in log4net appenders (page 248)

Qlik Logging Service

The Qlik Logging Service is used to centralize logging, which makes it easier for you to find the log that you are looking for.

When centralized logging (the Qlik Logging Service) is on, file logging is also on, by default. Log entries from the Qlik Sense services (repository, proxy, scheduler, and engine) are persisted in two locations—the existing log files and the centralized logging database. The legacy log files do not have any built-in file management to clear up hard disk space.

Although the Qlik Logging Service will be installed as a Windows service, you can use it directly as a command line tool to configure or change the database settings. The available commands are included in this topic.
Currently, there is no support for streaming messages from the Qlik Logging Service to third-party tools or customers. The only supported way is through the Monitoring apps.

Command line options
These are the available commands for the Qlik Logging Service.

Usage: Qlik.Logging.Service.exe <action> [<args>]

The following commands can be used to set up, update, or validate the logging database:

setup - creates the logging database and sets up roles and access permissions.
update - updates the connection string parameters for the logging database with user-provided values.
validate - validates connection string parameters from the configuration file and database connectivity.
archive - moves database entries to the archive table.
purge - removes (permanently) database entries from the archive table.
version - displays version information for the service.
help - displays help message.

Setting up the logging database
The setup command is typically used by the installer at the time of the Qlik Sense installation. The setup command creates the logging database and sets up access roles and required permissions.

Usage: Qlik.Logging.Service.exe setup [<options>]

Options
--hostname or -h (Required)
Name of the machine where the logging database is hosted.
--port or -p (Required)
Port number used to access the logging database.
--postgres_user or -u (Required)
PostgreSQL user name credentials required to create the logging database.
--postgres_pswd or -x (Required)
PostgreSQL password required to create the logging database.
--reader_pswd or -r (Required)
Password for qlogs_reader user role, used for reading logging database entries.
--writer_pswd or -w (Required)
Password for qlogs_writer user role, used for writing to the logging database.

--force or -f (Optional)

Drop the existing database and users, if present.

Updating the connection string parameters

The update command is used to modify the connection, the configuration settings of the logging database, or both.

Usage: Qlik.Logging.Service.exe update [<options>]

Options

--hostname or -h (Optional)

Name of the machine where the logging database is hosted.

--port or -p (Optional)

Port number used to access the logging database.

--reader_pswd or -r (Optional)

Password for qlogs_reader user role, used for reading logging database entries.

--writer_pswd or -w (Optional)

Password for qlogs_writer user role, used for writing to the logging database.

--archive_age or -a (Optional)

Sets value for archive age. The value is specified in days. Specify --hours to interpret archive age as hours, for example, --archive_age X --hours.

--purge_age or -q (Optional)

Sets value for purge age. The value is specified in days. Specify --hours to interpret purge age as hours, for example, --purge_age X --hours.

--file_logging or -f (Optional)

Switches on or off file logging. Valid values are 'on' or 'off'.

--database_logging or -d (Optional)

Switches on or off database logging. Valid values are 'on' or 'off'.

--maximum_db_size_in_gb or -s (Optional)

Sets value for maximum database size. The value is specified in GB. A value less than two (2) disables the functionality that limits the database size.

Validating the logging database connection

Usage: Qlik.Logging.Service.exe validate [<options>]
3 Deploying Qlik Sense Enterprise on Windows

Options
None. The connection string is read from the logging configuration and is used to validate the state of the database and the connection.

Archiving the log entries
Archives all the log entries that are older than the specified cutoff time (in days).

Usage: Qlik.Logging.Service.exe archive [options]

Options
--cutoff or -c (Required)
--hours (Optional)

Cutoff time in days. Specify --hours option to interpret cutoff time as hours, for example, archive --cutoff x --hours. Specify zero (0) to archive all the entries.

Purging log entries
Purges all the archived log entries that are older than the specified cutoff time (in days).

⚠️ Purge is an irreversible operation. Log entries are removed from the database and cannot be restored. This operation does not affect log messages in the log files.

Usage: Qlik.Logging.Service.exe purge [options]

Options
--cutoff or -c (Required)
--hours (Optional)

Cutoff time in days. Specify --hours option to interpret cutoff time as hours, for example, purge --cutoff x --hours. Specify zero (0) to purge all the entries.

Version
Usage: Qlik.Logging.Service.exe version [options]

Options
None. Displays Qlik Logging Service and logging database versions.

Help
Usage: Qlik.Logging.Service.exe help [options]

Options
None. Displays usage.
Qlik Logging Service – configuration and integration

This topic describes the configuration and integration features that are available for the Qlik Logging Service. The features should be considered "Advanced Features" to be used in the context of troubleshooting issues with the assistance of Qlik technical support.

Dynamic configuration

Most of the functionality provided by the Qlik Logging Service is controlled by the configuration file:

`QlikCentralizedLogging.config` typically located here: `C:\ProgramData\Qlik\Sense\Log`. This file contains all the settings recognized by the Qlik Logging Service in xml format and is typically modified directly by the Qlik Logging Service when executing the update or setup commands during command line invocation.

The "Dynamic Configuration" feature introduces a new setting:

`CentralizedLoggingConfigurationNotificationEnabled`, its default value is "false". This setting is always dynamic, meaning that changing its value by directly modifying the configuration file and saving it will cause the Qlik Logging Service to read and use its new value. When this setting is set to "false", the default value, changes to other settings in the configuration file are not detected by the Qlik Logging Service and will require a service restart to take effect. When the setting is set to "true", changes to any of the settings below will be detected and applied immediately by the Qlik Logging Service after saving the configuration file.

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>CentralizedLoggingLogMaxFileSizeMb</td>
<td>The logging service logs to a file, this setting controls the maximum size in MB of the log file before it is rolled over.</td>
<td>1...</td>
</tr>
<tr>
<td>CentralizedLoggingLogEnabled</td>
<td>Turns on/off logging to file by the logging service.</td>
<td>True, False</td>
</tr>
<tr>
<td>CentralizedLoggingEnabled</td>
<td>Enables or disables the logging service functionality. When <code>true</code>, the service accepts incoming log entries, when <code>false</code>, the service continues to run, but it does not offer any logging functionality.</td>
<td>True, False</td>
</tr>
<tr>
<td>CentralizedLoggingServerBufferSize</td>
<td>Sets the size in log entries of the internal buffer. Writes to the database occur when the internal buffer is full. For example if set to 10, writes to the database will occur when 10 log entries are received.</td>
<td>1...</td>
</tr>
<tr>
<td>CentralizedLoggingServerTimeoutSeconds</td>
<td>Sets the timeout in seconds required to trigger a database write. On an idle system log entries may not accumulate often. This threshold will force a database write even if the internal buffer is not full.</td>
<td>1...</td>
</tr>
<tr>
<td>CentralizedLoggingLogLevel</td>
<td>Controls the verbosity level of the log.</td>
<td>Off, Fatal</td>
</tr>
</tbody>
</table>
### 3 Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MaximumDatabaseSizeInGB</td>
<td>Sets the maximum size for the database in GB, when the size of the database exceeds this number, the logging service will trim/remove entries from the database until the size of the database goes below the maximum set.</td>
</tr>
<tr>
<td>Error, Warn, Info, Debug, All</td>
<td>A value less than 2 disables the functionality.</td>
</tr>
<tr>
<td>CentralizedLoggingConfigurationNotificationEnabled</td>
<td>Enables or disables dynamic configuration settings. When set to True, changes to a dynamic configuration setting take effect immediately without requiring a service restart. When False, a re-start is required for the new setting value to take effect. Notice that this setting is always dynamic.</td>
</tr>
<tr>
<td>CentralizedLoggingDBSizeCheckPeriod</td>
<td>Sets how often to check the size of the database. The quantity is expressed in milliseconds.</td>
</tr>
<tr>
<td>0, 600000..2147483646</td>
<td>A value of zero (0) disables the functionality, 600000 (ten minutes) is the minimum value accepted. Values less than that are automatically set to that minimum and 2147483646 (~596 hours) is the maximum.</td>
</tr>
<tr>
<td>CentralizedLoggingDBArchiveCheckPeriod</td>
<td>Sets how often to check for the need to archive log entries, the quantity is expressed in milliseconds.</td>
</tr>
<tr>
<td>0, 600000..2147483646</td>
<td></td>
</tr>
</tbody>
</table>
### 3 Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CentralizedLoggingDBPurgeCheckPeriod</td>
<td>Sets how often to check for the need to purge archived entries, the quantity is expressed in milliseconds.</td>
<td>0, 600000..2147483646 (~596 hours)</td>
</tr>
<tr>
<td>CentralizedLoggingDBStatsCheckPeriod</td>
<td>Sets how often to retrieve database statistics. The quantity is expressed in milliseconds.</td>
<td>0, 300000..2147483646 (~596 hours)</td>
</tr>
<tr>
<td>CentralizedLoggingPlatformPerformanceCheckPeriod</td>
<td>Sets how often to retrieve platform performance metrics, the quantity is expressed in milliseconds.</td>
<td>0, 1000..2147483646</td>
</tr>
</tbody>
</table>
3 Deploying Qlik Sense Enterprise on Windows

CentralizedLoggingProcessPerformanceCheckPeriod

Sets how often to retrieve process performance metrics, the quantity is expressed in milliseconds.

- Value: 0
- 1000 (one second)
- Maximum: 2147483646 (~596 hours)

A value of zero (0) disables the functionality, 1000 (one second) is the minimum value accepted. Values less than that are automatically set to that minimum and 2147483646 (~596 hours) is the maximum.

CentralizedLoggingPlatformPerformanceCounters

Set of platform performance counters to collect every CentralizedLoggingPlatformPerformanceCheckPeriod period. The format expected is:

- Database payload key; Counter Category; Counter Name [;] [Counter Instance]|

CentralizedLoggingProcessPerformance

Set of processes to collect performance counter for every CentralizedLoggingProcessPerformanceCheckPeriod period.

The format expected is:

- Process Name | Process Name | ...

Process Name is the simple name for the process for example the default value of this setting is:

- engine|proxy|repository|scheduler

CentralizedLoggingPlatformEvents

Set of platform events to monitor. The format expected is:
3 Deploying Qlik Sense Enterprise on Windows

EventLogX, [EventSourceX]:EventID0,
EventID1, ..., EventIDn

EventLogY, [EventSourceY]:EventID0, ..., EventIDn

Qlogs statistics
The Qlik Logging Service periodically collects statistics about the Qlogs database, which is the database used for all logging entries. How often these statistics are collected is controlled by the CentralizedLoggingDBStatsCheckPeriod setting. Setting its value to zero (0) disables collection and its default value is ten (10) minutes expressed in milliseconds (10 * 60 * 1000 = 600000). The information collected contains record counts and size information and can be viewed with the following query:

```
SELECT * FROM public.view_db_stats;
```

Windows Event Log integration
Integration with the Windows Event Log is a new feature that allows the Qlik Logging Service to collect information about configured Windows events. The set of events monitored by the Qlik Logging Service is set via the CentralizedLoggingPlatformEvents setting. Clearing its value disables the feature. Its default value is:

```
<add key="CentralizedLoggingPlatformEvents"
```

This is an explanation of the events configured by default.

<table>
<thead>
<tr>
<th>Event log</th>
<th>Event source</th>
<th>Event ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>System</td>
<td></td>
<td>1074</td>
<td>User initiated system re-start</td>
</tr>
<tr>
<td>System</td>
<td></td>
<td>6013</td>
<td>System uptime</td>
</tr>
<tr>
<td>System</td>
<td></td>
<td>36888</td>
<td>Schannel (TLS protocol) errors</td>
</tr>
<tr>
<td>System</td>
<td></td>
<td>36874</td>
<td>Schannel (TLS protocol) errors</td>
</tr>
<tr>
<td>System</td>
<td></td>
<td>2013</td>
<td>Low disk space</td>
</tr>
<tr>
<td>System</td>
<td></td>
<td>7031</td>
<td>Service terminated unexpectedly</td>
</tr>
<tr>
<td>System</td>
<td></td>
<td>4202</td>
<td>TCP/IP network configuration issue</td>
</tr>
<tr>
<td>Application</td>
<td>Engine</td>
<td>300</td>
<td>Engine caught unexpected exception</td>
</tr>
<tr>
<td>Application</td>
<td>PostgreSQL</td>
<td>0</td>
<td>PostgreSQL error</td>
</tr>
<tr>
<td>Application</td>
<td>.NET Runtime</td>
<td>1026</td>
<td>.NET process terminated</td>
</tr>
</tbody>
</table>

Additional events may be monitor by modifying the value of the CentralizedLoggingPlatformEvents setting as follows:
As shown above, the Event Log is one (1), the Event Source is two (2) and the Event ID is three (3). To capture the event highlighted above, the value "Application, Perflib: 1008" would need to be appended to the CentralizedLoggingPlatformEvents setting as shown below:

```xml
```

Notice that the Event Source is optional, but useful when multiple event sources may use the same event ID. For the example above, omitting the event source "Perflib" would have resulted in the monitoring of event ID 1008 for ALL applications. Multiple event IDs may be monitored for the same Event Log and Event Source and they are separated by commas "," and multiple Event Log and Event Sources may be monitored and they are separated by the bar "|" character.

Any Windows events captured by the Qlik Logging Service may be viewed by executing the following query against the Qlogs database:

```
SELECT * FROM public.view_platform_events;
```

Windows Performance Monitor integration

The Qlik Logging Service integrates with the Windows Performance Monitor, it periodically queries the system for configured metrics. The integration is divided into two sections, one that monitors configured platform metrics and one that monitors configured processes.

Platform metrics

The period used to monitor platform metrics is controlled by the CentralizedLoggingPlatformPerformanceCheckPeriod setting. A value of zero (0) disables this functionality and its default value is five (5) minutes expressed in milliseconds (5 * 60 * 1000 = 300000).

The metrics or performance counters collected are configured in the setting CentralizedLoggingPlatformPerformanceCounters and its default value is:

```xml
<add key="CentralizedLoggingPlatformPerformanceCounters" value="CPUUtilizationPercent;Processor;Processor Time;_Total|CPUUserUtilizationPercent;Processor;% User Time;\_Total|CPUInterruptPercent;Processor;% Interrupt Time;\_Total|CPUQueueLength;System;Processor Queue Length|DiskFreeSpacePercent;LogicalDisk;% Free Space;\_Total|DiskIdleTimePercent;PhysicalDisk;% Idle Time;\_Total|DiskTimePerReadSeconds;PhysicalDisk;Avg. Disk sec/Read;\_Total|DiskTimePerWriteSeconds;PhysicalDisk;Avg. Disk sec/Write;\_Total|DiskIOQueueLength;PhysicalDisk;Avg. Disk Queue Length;\_Total|MemoryCacheBytes;Memory;Cache Bytes|MemoryCommittedBytesInUsePercent;Memory;% Committed Bytes In Use|MemoryAvailableBytes;Memory;Available MBytes|MemoryFreePageEntries;Memory;Free System Page Table Entries|MemoryPoolNonPagedBytes;Memory;Pool Nonpaged Bytes|MemoryPoolPagedBytes;Memory;Pool Paged
```
3 Deploying Qlik Sense Enterprise on Windows

Bytes|MemoryPagesPerSecond;Memory;Pages/sec|NetworkBytesPerSecond;Network Interface;Bytes
Total/sec;*|NetworkOutputQueueLength;Network Interface;Output Queue Length;*|"

**Default value table**

<table>
<thead>
<tr>
<th>Database field</th>
<th>Category</th>
<th>Counter name</th>
<th>Counter instance</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPUInterruptPercent</td>
<td>Processor</td>
<td>% Interrupt Time</td>
<td>_Total</td>
</tr>
<tr>
<td>CPUQueueLength</td>
<td>System</td>
<td>Processor Queue Length</td>
<td></td>
</tr>
<tr>
<td>CPUUserUtilizationPercent</td>
<td>Processor</td>
<td>% User Time</td>
<td>_Total</td>
</tr>
<tr>
<td>CPUUtilizationPercent</td>
<td>Processor</td>
<td>% Processor Time</td>
<td>_Total</td>
</tr>
<tr>
<td>DiskFreeSpacePercent</td>
<td>LogicalDisk</td>
<td>% Free Space</td>
<td>_Total</td>
</tr>
<tr>
<td>DiskIdleTimePercent</td>
<td>PhysicalDisk</td>
<td>% Idle Time</td>
<td>_Total</td>
</tr>
<tr>
<td>DiskIOQueueLength</td>
<td>PhysicalDisk</td>
<td>Avg. Disk Queue Length</td>
<td>_Total</td>
</tr>
<tr>
<td>DiskTimePerReadSeconds</td>
<td>PhysicalDisk</td>
<td>Avg. Disk sec/Read</td>
<td>_Total</td>
</tr>
<tr>
<td>DiskTimePerWriteSeconds</td>
<td>PhysicalDisk</td>
<td>Avg. Disk sec/Write</td>
<td>_Total</td>
</tr>
<tr>
<td>MemoryAvailableMBytes</td>
<td>Memory</td>
<td>Available MBytes</td>
<td></td>
</tr>
<tr>
<td>MemoryCacheBytes</td>
<td>Memory</td>
<td>Cache Bytes</td>
<td></td>
</tr>
<tr>
<td>MemoryCommittedBytesInUsePercent</td>
<td>Memory</td>
<td>% Committed Bytes In Use</td>
<td></td>
</tr>
<tr>
<td>MemoryFreePageEntries</td>
<td>Memory</td>
<td>Free System Page Table Entries</td>
<td></td>
</tr>
<tr>
<td>MemoryPagesPerSecond</td>
<td>Memory</td>
<td>Pages/sec</td>
<td></td>
</tr>
<tr>
<td>MemoryPoolNonPagedBytes</td>
<td>Memory</td>
<td>Pool Nonpaged Bytes</td>
<td></td>
</tr>
<tr>
<td>NetworkBytesPerSecond</td>
<td>Network Interface</td>
<td>Bytes Total/sec</td>
<td></td>
</tr>
<tr>
<td>NetworkOutputQueueLength</td>
<td>Network Interface</td>
<td>Output Queue Length</td>
<td></td>
</tr>
</tbody>
</table>

The format of the `CentralizedLoggingPlatformPerformanceCounters` setting value follows the naming and structure used by the Windows Performance Monitor as shown below:
Additional performance counters may be added by modifying the value of the `CentralizedLoggingPlatformPerformanceCounters` setting. The value of the setting uses the following format:

- Each performance counter is separated by the bar "|" character.
- Each performance counter is made up of four fields separated by the semicolon ";" character and whitespace can be added freely to improve readability.
  - The first field is optional and corresponds to the name that will be used to store the performance counter in the database. If the field is not provided, the name of the counter is used instead.
  - The second field is the counter category and corresponds to one (1) on the image above.
  - The third field is the counter and corresponds to two (2) on the image above.
  - The fourth field is the counter instance and corresponds to three (3) on the image above, this field is optional and when set to the wildcard character "*" or not provided all instances available are collected.

To add the counter shown above, the following would need to be appended to the `CentralizedLoggingPlatformPerformanceCounters` setting: "| Test1 ; ICMP ; Messages/sec ; *". The performance counter will now be collected based on the period set by the `CentralizedLoggingPlatformPerformanceCheckPeriod` setting and can be retrieved from the database using the following query against the Qlogs database:
Deploying Qlik Sense Enterprise on Windows

Platform metrics may be viewed by executing the following query against the QLogs database:

```sql
SELECT BTRIM(e.payload->>'Test1', '')::INTEGER AS icmp_msg_per_sec
FROM public.log_entries e
WHERE e.logger = 'Qlik.Logging.Service.Platform.Performance'
```

Performance metrics are collected for the processes configured via the `CentralizedLoggingProcessPerformance` setting and its default value is:

```xml
<add key="CentralizedLoggingProcessPerformance" value="engine|proxy|repository|scheduler" />
```

The format of the setting also follows the naming and structure used by the Windows Performance Monitor as shown below:

![Performance Monitor](image)

All performance counters available are collected for each process listed with each process separated by the bar "|" character. To collect metrics for additional processes, the "simple name" of the process would need to be appended to the `CentralizedLoggingProcessPerformance` setting, for example to add chrome as shown above, the string "| chrome" would be appended to the `CentralizedLoggingProcessPerformance` setting.

Process metrics may be viewed by executing the following query against the QLogs database:

```sql
SELECT * FROM public.view_platform_metrics;
```
3  Deploying Qlik Sense Enterprise on Windows

SELECT * FROM public.view_process_metrics;

Export
The Qlik Logging Service is able to export the log data it manages. This complementary feature will make it easier to share log data with Qlik’s tech support. The export command is available when using the Qlik Logging Service as a command line tool.

Usage: Qlik.Logging.Service.exe <export> [[<export_options>]]

Although the exported data is not encrypted, it is in binary format due to compression and not readable by tools other than the Qlik Logging Service.

Export
The "export" command will copy all log data managed by the Qlik Logging Service to a destination. The following command options can be used to control what gets exported and where to:

--output_file or -o (Required): Identifies the location where exported data should be persisted. The location can be a disk file or the address of a Qlik Logging Service that is listening for exported data. When specifying a file, the export process will create or replace the target file. When specifying a waiting service the format is: <hostname or host ip address>:port, that is the name of the host or its ip address optionally followed by a colon (":") and the port number used by the listening host. If no port is specified, the default 7081 will be used.

--hostname or -h: Limits the exported data to the subset that originated from the specified host. The comparison is case insensitive.

--level or -l: Limits the exported data to the subset that is equal to the specified level. The comparison is case insensitive.

--to_timestamp: Limits the exported data to the subset created before the specified date. See "Date Format" section below for more details.

--from_timestamp: Limits the exported data to the subset created after the specified date. See "Date Format" section below for more details.

--process_name: Limits the exported data to the subset that originated from the specified process. The comparison is case insensitive.

Examples
These commands where tested from a "Command Prompt" without elevated permissions.

To export all contents to a file:
Qlik.Logging.Service export --output_file c:\Temp\qlogs.bin

To export all content originating from host "Node1" between 09/01/2018 and 09/02/2018 at 10:00PM to a waiting network reachable host listening on port 80:
Qlik.Logging.Service export --from_timestamp "2018-09-01" --to_timestamp "2018-09-02 22:00:00" --hostname node1 --output_file somehost.domain.com:80
3 Deploying Qlik Sense Enterprise on Windows

Date format
The format expected is "YYYY-MM-DD [HH:MM:SS]", the date portion is required while the time portion is optional and when omitted defaults to "00:00:00".

- Date
  - YYYY: year, 4 digits
  - MM: month, 2 digits, 01 through 12
  - DD: day of the month, 2 digits, 01 through 31

- Time
  - HH: hour, 2 digits, 00 through 23
  - MM: minute, 2 digits, 00 through 59
  - SS: second, 2 digits, 00 through 59

Technical notes

Unicode null character
Processes using the Qlik Logging Service may under very rare circumstances log entries containing the Unicode character NULL (\u0000). This character is problematic for many tools as it is most commonly used to denote the end of a string. When a Unicode character has been inserted into the QLogs database, you may see error messages like this one from PostgreSQL:

```
ERROR: unsupported Unicode escape sequence
DETAIL: \u0000 cannot be converted to text.
CONTEXT: JSON data, line 1: ("Message":....
STATEMENT: fetch 200 in "SQL_CUR4"
```

Executing the following script against the Qlogs database will replace all occurrences of the Unicode NULL character "\u0000" with the string "<UNICODE_NULL>"

```
SET statement_timeout = 0;
SET lock_timeout = 0;
SET client_encoding = 'UTF8';
SET standard_conforming_strings = on;
SET check_function_bodies = false;
SET client_min_messages = warning;

CREATE OR REPLACE FUNCTION public.validate_payload(IN payload JSON) RETURNS TEXT AS $$
BEGIN
  RETURN payload->>'XXXXX';
EXCEPTION
  WHEN OTHERS THEN RETURN 'XXXXX';
END
$$ LANGUAGE plpgsql;

DO $$
BEGIN
  UPDATE public.log_entries
  SET payload = REGEXP_REPLACE(payload::TEXT, '\\u0000', '<UNICODE_NULL>', 'g')::JSON
  WHERE id IN (
    SELECT d.id
    FROM (SELECT id, validate_payload(payload) AS payload
```

Plan and deploy Qlik Sense - Qlik Sense, June 2019 217
FROM public.log_entries
    ) AS d
WHERE d.payload = 'XXXXX'
);
UPDATE public.archive_entries
    SET payload = REGEXP_REPLACE(payload::TEXT, '\u0000', '<UNICODE_NULL>', 'g')::JSON
    WHERE id IN (SELECT id, validate_payload(payload) AS payload
                   FROM public.archive_entries
               ) AS d
WHERE d.payload = 'XXXXX'
;
END $$ LANGUAGE plpgsql;

DROP FUNCTION IF EXISTS public.validate_payload(IN payload JSON);

Configuration file reset

If for some reason the Qlik Logging Service configuration file qlikcentralizedLogging.config becomes corrupt or in some way unreadable, it can be deleted and a new file with default values will be created the next time the service is started. The same is true for individual settings, removing a setting from the configuration file will trigger its replacement with default values during the next service start sequence.

Multi-node configuration

In a multi-node environment, the Qlik Logging Service usually runs on all nodes. With the default configuration, all nodes will be executing database management functions. This is not a problem, but a more efficient configuration would designate a single node as the one in charge of maintaining the database. For example, on a three (3) node deployment, the Qlik Logging Service running on each node could be configured as follows:

Central node and rim node 1
<!-- Centralized Logging Configuration -->

<!-- DB Size Management disabled -->
<add key="CentralizedLoggingDBSizeCheckPeriod" value="0" />

<!-- Archive Management disabled -->
<add key="CentralizedLoggingDBArchiveCheckPeriod" value="0" />

<!-- Purge Management disabled -->
<add key="CentralizedLoggingDBPurgeCheckPeriod" value="0" />

<!-- DB Stats Collection disabled -->
<add key="CentralizedLoggingDBStatsCheckPeriod" value="0" />

<!-- Platform Performance Collection enabled (1 minute) -->
<add key="CentralizedLoggingPlatformPerformanceCheckPeriod" value="60000" />

<!-- Process Performance Collection enabled (1 minute) -->
<add key="CentralizedLoggingProcessPerformanceCheckPeriod" value="60000" />

Rim node 2 (Database management)
<!-- Centralized Logging Configuration -->

Multi-node configuration

In a multi-node environment, the Qlik Logging Service usually runs on all nodes. With the default configuration, all nodes will be executing database management functions. This is not a problem, but a more efficient configuration would designate a single node as the one in charge of maintaining the database. For example, on a three (3) node deployment, the Qlik Logging Service running on each node could be configured as follows:

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<add key="CentralizedLoggingProcessPerformanceCheckPeriod" value="60000" />

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<!-- DB Size Management disabled -->
<add key="CentralizedLoggingDBSizeCheckPeriod" value="0" />

<!-- Archive Management disabled -->
<add key="CentralizedLoggingDBArchiveCheckPeriod" value="0" />

<!-- Purge Management disabled -->
<add key="CentralizedLoggingDBPurgeCheckPeriod" value="0" />

<!-- DB Stats Collection disabled -->
<add key="CentralizedLoggingDBStatsCheckPeriod" value="0" />

<!-- Platform Performance Collection enabled (1 minute) -->
<add key="CentralizedLoggingPlatformPerformanceCheckPeriod" value="60000" />

<!-- Process Performance Collection enabled (1 minute) -->
<add key="CentralizedLoggingProcessPerformanceCheckPeriod" value="60000" />

Rim node 2 (Database management)
<!-- Centralized Logging Configuration -->
3 Deploying Qlik Sense Enterprise on Windows

<-- DB Size Management enabled (5 minutes, 6GB max size) -->
<add key="CentralizedLoggingDBSizeCheckPeriod" value="300000" />
<add key="MaximumDatabaseSizeInGB" value="6" />

<-- Archive Management enabled (60 minutes) -->
<add key="CentralizedLoggingDBArchiveCheckPeriod" value="3600000" />

<-- Purge Management enabled (60 minutes) -->
<add key="CentralizedLoggingDBPurgeCheckPeriod" value="3600000" />

<-- DB Stats Collection enabled (5 minutes) -->
<add key="CentralizedLoggingDBStatsCheckPeriod" value="300000" />

<-- Platform Performance Collection enabled (1 minute) -->
<add key="CentralizedLoggingPlatformPerformanceCheckPeriod" value="60000" />

<-- Process Performance Collection enabled (1 minute) -->
<add key="CentralizedLoggingProcessPerformanceCheckPeriod" value="60000" />

Requirements
The requirements described in this section must be fulfilled for the Qlik Sense logging to function properly.

Securing the file system
The system administrator must secure the file system so that the log files cannot be tampered with.

> By default, the account used for the Qlik Sense installation gets full permissions for the log folder, %ProgramData%\Qlik\Sense\Log, whereas the Users group only gets read permission. No other accounts or users get any permissions for the log folder.

Synchronizing time
The nodes within a Qlik Sense site must have synchronized time.

For the date and time stamps to be correct, all nodes within a site must be configured to synchronize their system clocks with either an internal or an external Network Time Protocol (NTP) service to ensure that all log entries are time-stamped accurately. NTP is a networking protocol for synchronizing the clocks of computer systems over packet-switched, variable-latency data networks.

Setting time zone
It is recommended that every node within a Qlik Sense site is set to the correct time zone so that the time zone corresponds to the geographical location of the node.

Storage
The default log files are stored in folders under %ProgramData%\Qlik\Sense\Log. The local log configuration file can be used to set up the logging so that the log files are also stored in another location.

Log folder
The following table describes the contents of the %ProgramData%\Qlik\Sense\Log folder.
## 3 Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Folder</th>
<th>Sub-folder</th>
<th>Files</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>\AppMigration</td>
<td></td>
<td>This folder contains log files related to the Migration Service.</td>
<td></td>
</tr>
<tr>
<td>\BrokerService</td>
<td></td>
<td>This folder contains log files related to the Broker Service.</td>
<td></td>
</tr>
<tr>
<td>\DataProfiling</td>
<td></td>
<td>This folder contains log files related to the Data Profiling Service.</td>
<td></td>
</tr>
<tr>
<td>\Engine</td>
<td>&lt;MachineName&gt;_ Exit_Engine_ &lt;Date&gt;.txt</td>
<td>NewSet. is a temporary log file that is used by the Qlik Sense Engine Service (QES) until the log pipe to the Qlik Sense Repository Service (QRS) is up and running. NewSet. log file is not archived.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt;MachineName&gt;_ Start_Engine_ &lt;Date&gt;.txt</td>
<td>NewSet. is a temporary log file that is used by the Qlik Sense Engine Service (QES) until the log pipe to the Qlik Sense Repository Service (QRS) is up and running. NewSet. log file is not archived.</td>
<td></td>
</tr>
<tr>
<td>\Audit</td>
<td>&lt;MachineName&gt;_ AuditActivity_ &lt;Service&gt;.txt</td>
<td>This log tracks user-related actions.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt;MachineName&gt;_ AuditSecurity_ &lt;Service&gt;.txt</td>
<td>This log contains information on security-related actions.</td>
<td></td>
</tr>
<tr>
<td>\System</td>
<td>&lt;MachineName&gt;_ Service_ &lt;Service&gt;.txt</td>
<td>This log contains information on service and system operations, including all errors.</td>
<td></td>
</tr>
<tr>
<td>\Trace</td>
<td>&lt;MachineName&gt;_ &lt;Facility&gt;_ &lt;Service&gt;.txt</td>
<td>The trace log files are stored in this folder. See: Trace logs (page 234)</td>
<td></td>
</tr>
<tr>
<td>\HubService</td>
<td></td>
<td>This folder contains log files related to the Hub Service.</td>
<td></td>
</tr>
<tr>
<td>\Printing</td>
<td>\Audit</td>
<td>&lt;MachineName&gt;_ AuditActivity_ &lt;Service&gt;.txt</td>
<td>This log tracks user-related actions.</td>
</tr>
</tbody>
</table>
# Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Folder</th>
<th>Sub-folder</th>
<th>Files</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><code>&lt;MachineName&gt;_AuditSecurity_&lt;Service&gt;.txt</code></td>
<td>This log contains information on security-related actions.</td>
</tr>
<tr>
<td><code>\System</code></td>
<td></td>
<td><code>&lt;MachineName&gt;_Service_&lt;Service&gt;.txt</code></td>
<td>This log contains information on service and system operations, including all errors.</td>
</tr>
</tbody>
</table>
| `\Trace` |            | `<MachineName>_Facility_<Service>.txt` | The trace log files are stored in this folder.  
See: [Trace logs (page 234)](#) |
| `\Proxy` | `\Audit` | `<MachineName>_AuditActivity_<Service>.txt` | This log tracks user-related actions. |
| `\Repository` | `\Audit` | `<MachineName>_AuditActivity_<Service>.txt` | This log tracks user-related actions. |
| `\Scheduler` | `\Audit` | `<MachineName>_AuditActivity_<Service>.txt` | This log tracks user-related actions. |
### Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Folder</th>
<th>Sub-folder</th>
<th>Files</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><code>&lt;MachineName&gt;_AuditSecurity_&lt;Service&gt;.txt</code></td>
<td>This log contains information on security-related actions.</td>
</tr>
<tr>
<td><code>\System</code></td>
<td></td>
<td><code>&lt;MachineName&gt;_Service_&lt;Service&gt;.txt</code></td>
<td>This log contains information on service and system operations, including all errors.</td>
</tr>
<tr>
<td><code>\Trace</code></td>
<td></td>
<td><code>&lt;MachineName&gt;_Facility_&lt;Service&gt;.txt</code></td>
<td>The trace log files are stored in this folder.</td>
</tr>
<tr>
<td><code>\Script</code></td>
<td></td>
<td></td>
<td>This folder contains log files related to app reloads.</td>
</tr>
<tr>
<td><code>\WebExtensionService</code></td>
<td></td>
<td></td>
<td>This folder contains log files related to the Web Extension Service.</td>
</tr>
</tbody>
</table>

### Archived log files

Archived log files are by default stored in the `\<server>\<share>\ArchivedLogs` folder. You define the location of the file share folder during installation. Archived log files have the file extension `.log`, whereas active log files have the extension `.txt`.

### Naming

The Qlik Sense log files are named in accordance to the following file rollover procedure:

1. The log is stored in a file named `<MachineName>_LogType_<Service>.txt`.
2. When the file is full or a pre-defined amount of time has passed, the file extension is automatically changed to `.log` and a time stamp is appended to the file name for uniqueness and archiving. This means that the new file name becomes `<MachineName>_LogType_<Service>_YYYY-MM-DDTHH.mm.ss>Z.log`. The file is then moved to the repository database on the central node by the Qlik Sense Repository Service (QRS) and archived.
3. A new log file, named `<MachineName>_LogType_<Service>.txt`, is created.

Save if the `.log` file is deleted before being copied to the repository database on the central node, the file is lost and cannot be recreated.

The format of the file name is as follows:
3  Deploying Qlik Sense Enterprise on Windows

- **<MachineName>** = Name of the server where the log was created.
- **<LogType>** = The type of events that are covered by the log.
- **<Service>** = The service that the log originates from (for example, Proxy or Repository).
- **<YYYY-MM-DDTHH.mm.ss>Z** = Time stamp for when the log file was closed for new entries, where:
  - YYYY: Year
  - MM: Month
  - DD: Day in month
  - T: Delimiter, time designator
  - HH: Hour
  - mm: Minutes
  - ss: Seconds
  - Z: UTC designator, indicates that the time stamp is in UTC format

**Rows**

The first row of each log file contains a header that, in turn, contains the names of all fields, separated by tabs.

Each log entry is one row and the characters listed in the following table are replaced with Unicode characters.

<table>
<thead>
<tr>
<th>Character</th>
<th>Unicode replacement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>\t</td>
<td>\u21d4</td>
<td>Symbol for horizontal tabulation, HT.</td>
</tr>
<tr>
<td>\n</td>
<td>\u2193</td>
<td>Symbol for line feed, LF.</td>
</tr>
<tr>
<td>\f</td>
<td>\u2192</td>
<td>Symbol for form feed, FF.</td>
</tr>
<tr>
<td>\r</td>
<td>\u21b5</td>
<td>Symbol for carriage return, CR.</td>
</tr>
</tbody>
</table>

**Fields**

This section describes the fields in the Qlik Sense log files.

Audit activity log

The following table lists the fields in the audit activity log, **<MachineName>_AuditActivity_<Service>.txt**.

> The Audit activity log does not include a Severity field. This is because all rows in the log have the same log level.
### 3 Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Field</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sequence#</td>
<td>Int</td>
<td>1 - 2147483647 by default, but can be configured using custom logging as described in Appenders (page 246). Each row in the log starts with a sequence number that is used to ensure that the log is not tampered with (that is, that no rows are inserted or deleted). The sequence number wraps a) when the last sequence number is reached, or b) when the logging, for some reason, is restarted without the last sequence number being reached.</td>
</tr>
<tr>
<td>ProductVersion</td>
<td>String</td>
<td>The version number of the Qlik Sense service (for example, 1.2.1.3).</td>
</tr>
<tr>
<td>Timestamp</td>
<td>ISO 8601</td>
<td>Timestamp in ISO 8601 format, YYYYMMDDThhmmss.fffK, where:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- YYYY: Year</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- MM: Month</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- DD: Day in month</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- T: Delimiter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- hh: Hour</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- mm: Minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ss: Seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- fff: Milliseconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- K: Time zone offset</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For example, 20110805T145657.000+0200 means year 2011, month 8, day 5 at 14:56:57 GMT+2.</td>
</tr>
<tr>
<td>Hostname</td>
<td>String</td>
<td>The name of the server.</td>
</tr>
<tr>
<td>Id</td>
<td>String</td>
<td>A unique identifier of the log entry (added by Log4net).</td>
</tr>
<tr>
<td>Description</td>
<td>String</td>
<td>A human-readable message that summarizes the action in the system.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Format:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Command=&lt;CommandName&gt;;Result=&lt;ReturnCode (Int)&gt;;ResultText=&lt;Description, Success, or Error message&gt;</td>
</tr>
<tr>
<td>ProxySessionId</td>
<td>String</td>
<td>The ID of the proxy session.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 = Internal system command or a command that does not go through the QPS</td>
</tr>
<tr>
<td>ProxyPackageId</td>
<td>String</td>
<td>A unique ID of each HTTP(S) package that passes through the Qlik Sense Proxy Service (QPS).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 = Internal system command or a command that does not go through the QPS</td>
</tr>
</tbody>
</table>
### 3 Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Field</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
</table>
| RequestSequenceId | String | The combination of RequestSequenceId and ProxyPackageId is unique for every row in a log file and creates the timeline for the proxy session. The combination also forms a primary key in the log file. The initial RequestSequenceId is an integer. Subrequests are linked to the initial request by adding a dot and an ID for the subrequest:  
  - Initial request: RequestSequenceId = 1  
    - Subrequest 1 based on the initial request: RequestSequenceId = 1.0  
    - Subrequest 2 based on the initial request: RequestSequenceId = 1.1  
  0 = Internal system command or a command that does not go through the Qlik Sense Engine Service (QES) |
| UserDirectory   | String | The user directory linked to the logged in Qlik Sense user.                                                                                |
| UserId          | String | The Qlik Sense user that initiated the command. System = Internal system command                                                          |
| ObjectId        | String | The internal ID of the object. Used to link system actions to user actions.  
  0 = Cannot get the ID of the object  
  In some cases the ObjectId field contains multiple IDs, separated by the "|" (pipe) sign. Example: ObjectId field containing multiple IDs  
  Log event: Start reload task  
  Contents of the ObjectId field: ed5715cd-2d7f-44ec-825f-44084efb3443|d63c7e4e-6089-4314-b60f-ed47ba6c35cc  
  - First ID: The ID of the task.  
  - Second ID: The ID of the app. |
### Field | Format | Description
---|---|---
ObjectName | String | The human-readable name of the object. The ObjectName is linked to the Objectid. Not available = Cannot link the ObjectName to the Objectid or the Objectid is missing.
In some cases the ObjectName field contains multiple names.
**Example: ObjectName field containing multiple names**
Log event: Start reload task
Contents of the ObjectName field: MyReload|MyApp
- First identifier (MyReload): The name of the task.
- Second identifier (MyApp): The name of the app.
The list of ObjectNames always matches the list of ObjectIds, meaning that the ObjectName in the first position is identified by the ID in the corresponding position of the ObjectId field. In this example the following IDs apply (see also the description of the ObjectId field):
- MyReload = ed5715cd-2d7f-44ec-825f-44084efb3443
- MyApp = d63c7e4e-6089-4314-b60f-ed47ba6c35cc
Service | String | The Qlik Sense service on the server that hosts the process.
Origin | String | The origin of the request:
- AppAccess
- ManagementAccess
- Not available
Context | String | The context of the command.
The context can be a URL that is linked to the command or a short version of the module path linked to the command.
Command | String | The core name of the use case or system command.
Result | String | Return code:
- 0, 200 - 226: Success
- Any other number: Error
Message | String | Text that describes the log entry. If the request is successful, this field contains "success".
Id2 | String | A unique row identifier (the checksum is added by Log4Net).
3 Deploying Qlik Sense Enterprise on Windows

Audit security log

The following table lists the fields in the audit security log, `<MachineName>_AuditSecurity_<Service>.txt`.

- **This log is not available for the Qlik Sense Engine Service (QES).**

- **The Audit security log does not include a Severity field. This is because all rows in the log have the same log level.**

<table>
<thead>
<tr>
<th>Field</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sequence#</td>
<td>Int</td>
<td>1 - 2147483647 by default, but can be configured using custom logging as described in Appenders (page 246). Each row in the log starts with a sequence number that is used to ensure that the log is not tampered with (that is, that no rows are inserted or deleted). The sequence number wraps a) when the last sequence number is reached, or b) when the logging, for some reason, is restarted without the last sequence number being reached.</td>
</tr>
<tr>
<td>ProductVersion</td>
<td>String</td>
<td>The version number of the Qlik Sense service (for example, 1.2.1.3).</td>
</tr>
<tr>
<td>Timestamp</td>
<td>ISO 8601</td>
<td>Timestamp in ISO 8601 format, YYYYMMDDThhmmss.fffK, where:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- YYYY: Year</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- MM: Month</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- DD: Day in month</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- T: Delimiter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- hh: Hour</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- mm: Minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ss: Seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- fff: Milliseconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- K: Time zone offset</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For example, 20110805T145657.000+0200 means year 2011, month 8, day 5 at 14:56:57 GMT+2.</td>
</tr>
<tr>
<td>HostName</td>
<td>String</td>
<td>The name of the server.</td>
</tr>
<tr>
<td>Id</td>
<td>GUID</td>
<td>A unique identifier of the log entry (added by Log4net).</td>
</tr>
<tr>
<td>Description</td>
<td>String</td>
<td>A human-readable message that summarizes the action in the system.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Format:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Command=&lt;CommandName&gt;;Result=&lt;ReturnCode (Int)&gt;;ResultText=&lt;Description, Success, or Error message&gt;</td>
</tr>
</tbody>
</table>
## 3 Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Field</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
</table>
| ProxySessionId| String | The ID of the proxy session.  
0 = Internal system command or a command that does not go through the QPS |
| ProxyPackageId| String | A unique ID of each HTTP(S) package that passes through the Qlik Sense Proxy Service (QPS).  
0 = Internal system command or a command that does not go through the QPS |
| RequestSequenceId| String | The combination of RequestSequenceId and ProxyPackageId is unique for every row in a log file and creates the timeline for the proxy session. The combination also forms a primary key in the log file.  
The initial RequestSequenceId is an integer. Subrequests are linked to the initial request by adding a dot and an ID for the subrequest:  
- Initial request: RequestSequenceId = 1  
  - Subrequest 1 based on the initial request: RequestSequenceId = 1.0  
  - Subrequest 2 based on the initial request: RequestSequenceId = 1.1  
0 = Internal system command or a command that does not go through the Qlik Sense Engine Service (QES) |
| UserDirectory | String | The user directory linked to the logged in Qlik Sense user.  
System = Internal system command |
| UserId        | String | The Qlik Sense user that initiated the command.  
System = Internal system command |
### 3 Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Field</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ObjectId</td>
<td>String</td>
<td>The internal ID of the object. Used to link system actions to user actions.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 = Cannot get the ID of the object</td>
</tr>
<tr>
<td></td>
<td></td>
<td>In some cases the ObjectId field contains multiple IDs, separated by the &quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Example: ObjectId field containing multiple IDs</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Log event: Start reload task</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contents of the ObjectId field: ed5715cd-2d7f-44ec-825f-44084efb3443</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• First ID: The ID of the task.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Second ID: The ID of the app.</td>
</tr>
<tr>
<td>ObjectName</td>
<td>String</td>
<td>The human-readable name of the object. The ObjectName is linked to the ObjectId.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not available = Cannot link the ObjectName to the ObjectId or the ObjectId is missing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>In some cases the ObjectName field contains multiple names.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Example: ObjectName field containing multiple names</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Log event: Start reload task</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contents of the ObjectName field: MyReload</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• First identifier (MyReload): The name of the task.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Second identifier (MyApp): The name of the app.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The list of ObjectNames always matches the list of ObjectIds, meaning that the ObjectName in the first position is identified by the ID in the corresponding position of the ObjectId field.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>In this example the following IDs apply (see also the description of the ObjectId field):</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• MyReload = ed5715cd-2d7f-44ec-825f-44084efb3443</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• MyApp = d63c7e4e-6089-4314-b60f-ed47ba6c35cc</td>
</tr>
<tr>
<td>SecurityClass</td>
<td>String</td>
<td>A categorization of the security-related information:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Security: Access to resources, authentication, authorization</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• License: License access, license usage, license allocation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Certificate: Certificate-related information</td>
</tr>
<tr>
<td>ClientHostAddress</td>
<td>String</td>
<td>The hostname/IP address of the client.</td>
</tr>
</tbody>
</table>
3  Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Field</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service</td>
<td>String</td>
<td>The Qlik Sense service on the server that hosts the process.</td>
</tr>
<tr>
<td>Origin</td>
<td>String</td>
<td>The origin of the request:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- AppAccess</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ManagementAccess</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Not available</td>
</tr>
<tr>
<td>Context</td>
<td>String</td>
<td>The context of the command.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The context can be a URL that is linked to the command or a short version of</td>
</tr>
<tr>
<td></td>
<td></td>
<td>the module path linked to the command.</td>
</tr>
<tr>
<td>Command</td>
<td>String</td>
<td>The core name of the use case or system command.</td>
</tr>
<tr>
<td>Result</td>
<td>String</td>
<td>Return code: 0, 200 - 226: Success</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Any other number: Error</td>
</tr>
<tr>
<td>Message</td>
<td>String</td>
<td>Text that describes the log entry. If the request is successful, this field</td>
</tr>
<tr>
<td></td>
<td></td>
<td>contains &quot;success&quot;.</td>
</tr>
<tr>
<td>Checksum</td>
<td>ID</td>
<td>Each row has a checksum. The security log file also includes a file signature.</td>
</tr>
</tbody>
</table>

Server log
The following table lists the fields in the service log, `<MachineName>_Service_<Service>.txt`.

<table>
<thead>
<tr>
<th>Field</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sequence#</td>
<td>Int</td>
<td>1 - 2147483647 by default, but can be configured using custom logging as described in Appenders (page 246). Each row in the log starts with a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>sequence number that is used to ensure that the log is not tampered with (that is, that no rows are inserted or deleted). The sequence number wraps a)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>when the last sequence number is reached, or b) when the logging, for some reason, is restarted without the last sequence number being reached.</td>
</tr>
<tr>
<td>ProductVersion</td>
<td>String</td>
<td>The version number of the Qlik Sense service (for example, 1.2.1.3).</td>
</tr>
</tbody>
</table>
## 3 Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Field</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timestamp</td>
<td>ISO 8601</td>
<td>Timestamp in ISO 8601 format, YYYYMMDDThhmmss.fffK, where:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- YYYY: Year</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- MM: Month</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- DD: Day in month</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- T: Delimiter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- hh: Hour</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- mm: Minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ss: Seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- fff: Milliseconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- K: Time zone offset</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For example, 20110805T145657.000+0200 means year 2011, month 8, day 5 at</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14:56:57 GMT+2.</td>
</tr>
<tr>
<td>Severity</td>
<td>String</td>
<td>Row log level, can be configured using custom logging as described in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Appenders (page 246):</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Debug: Information useful to developers for debugging purposes.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>This level is not useful during normal operation as it generates vast</td>
</tr>
<tr>
<td></td>
<td></td>
<td>amounts of logging information.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Info: Normal operational messages that may be harvested for</td>
</tr>
<tr>
<td></td>
<td></td>
<td>reporting, measuring throughput, and so on. No action is required.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Warn: Not an error message, but an indication that an error will occur,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>if no action is taken (for example, the file system is 85% full).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Error: Messages regarding unexpected situations and errors that</td>
</tr>
<tr>
<td></td>
<td></td>
<td>prevent the server from operating normally.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Fatal: Messages that the Qlik Sense service or application has to shut</td>
</tr>
<tr>
<td></td>
<td></td>
<td>down in order to prevent data loss.</td>
</tr>
<tr>
<td>HostName</td>
<td>String</td>
<td>The hostname of the server that runs the process or executes the task.</td>
</tr>
<tr>
<td>Id</td>
<td>GUID</td>
<td>A unique identifier of the log entry (added by Log4net).</td>
</tr>
<tr>
<td>Description</td>
<td>String</td>
<td>A human-readable message that summarizes the action in the system.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Format:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Command=&lt;CommandName&gt;;Result=&lt;ReturnCode (Int)&gt;;ResultText=&lt;Description,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Success, or Error message&gt;</td>
</tr>
<tr>
<td>ProxySessionId</td>
<td>String</td>
<td>The ID of the proxy session.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 = Internal system command or a command that does not go through the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>QPS</td>
</tr>
</tbody>
</table>
### Field | Format | Description
--- | --- | ---
ProxyPackageId | String | A unique ID of each HTTP(S) package that passes through the Qlik Sense Proxy Service (QPS).
 |  | 0 = Internal system command or a command that does not go through the QPS
RequestSequenceId | String | The combination of RequestSequenceId and ProxyPackageId is unique for every row in a log file and creates the timeline for the proxy session. The combination also forms a primary key in the log file.
 |  | The initial RequestSequenceId is an integer. Subrequests are linked to the initial request by adding a dot and an ID for the subrequest:
 |  | • Initial request: RequestSequenceId = 1
 |  | • Subrequest 1 based on the initial request: RequestSequenceId = 1.0
 |  | • Subrequest 2 based on the initial request: RequestSequenceId = 1.1
 |  | 0 = Internal system command or a command that does not go through the Qlik Sense Engine Service (QES)
UserDirectory | String | The user directory linked to the logged in Qlik Sense user.
 |  | System = Internal system command
UserId | String | The Qlik Sense user that initiated the command.
 |  | System = Internal system command
ObjectId | String | The internal ID of the object. Used to link system actions to user actions.
 |  | 0 = Cannot get the ID of the object
 |  | In some cases the ObjectId field contains multiple IDs, separated by the "|" (pipe) sign.

**Example: ObjectId field containing multiple IDs**

Log event: Start reload task

Contents of the ObjectId field: ed5715cd-2d7f-44ec-825f-44084efb3443|d63c7e4e-6089-4314-b60f-ed47ba6c35cc

- First ID: The ID of the task.
- Second ID: The ID of the app.
### Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Field</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ObjectName</td>
<td>String</td>
<td>The human-readable name of the object. The ObjectName is linked to the Objectid. Not available = Cannot link the ObjectName to the Objectid or the Objectid is missing. In some cases the ObjectName field contains multiple names. Example: ObjectName field containing multiple names</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Log event: Start reload task</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contents of the ObjectName field: MyReload</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• First identifier (MyReload): The name of the task.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Second identifier (MyApp): The name of the app.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The list of ObjectNames always matches the list of ObjectIds, meaning that the ObjectName in the first position is identified by the ID in the corresponding position of the ObjectId field. In this example the following IDs apply (see also the description of the ObjectId field):</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• MyReload = ed5715cd-2d7f-44ec-825f-44084efb3443</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• MyApp = d63c7e4e-6089-4314-b60f-ed47ba6c35cc</td>
</tr>
<tr>
<td>Service</td>
<td>String</td>
<td>The Qlik Sense service on the server that hosts the process.</td>
</tr>
<tr>
<td>Origin</td>
<td>String</td>
<td>The origin of the request:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• AppAccess</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• ManagementAccess</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Not available</td>
</tr>
<tr>
<td>Context</td>
<td>String</td>
<td>The context of the command.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The context can be Internal System command or User Activity command (based on URL for the command).</td>
</tr>
<tr>
<td>Command</td>
<td>String</td>
<td>The core name of the use case or system command.</td>
</tr>
<tr>
<td>Result</td>
<td>Int</td>
<td>Return code:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 0, 200 - 226: Success</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Any other number: Error</td>
</tr>
<tr>
<td>Message</td>
<td>String</td>
<td>Text that describes the log entry. If the request is successful, this field contains &quot;success&quot;.</td>
</tr>
<tr>
<td>Id2</td>
<td>String</td>
<td>A unique row identifier (the checksum is added by Log4Net).</td>
</tr>
</tbody>
</table>
Qlik Sense engine service log fields

The following table lists the fields that are unique for the Qlik Sense Engine Service (QES) logs.

<table>
<thead>
<tr>
<th>Field</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EngineTimestamp</td>
<td>ISO 8601</td>
<td>The date and time when the QES wrote the log message to file.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Timestamp in ISO 8601 format, YYYYMMDDThhmmss.ffk, where:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• YYYY: Year</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• MM: Month</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• DD: Day in month</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• T: Delimiter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• hh: Hour</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• mm: Minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• ss: Seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• fff: Milliseconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• k: Time zone offset</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For example, 20110805T145657.000+0200 means year 2011, month 8, day 5 at 14:56:57 GMT+2.</td>
</tr>
<tr>
<td>EngineVersion</td>
<td>String</td>
<td>The version number of the QES that executed the request.</td>
</tr>
</tbody>
</table>

Trace logs

The legacy logging framework is still available in Qlik Sense, but the logs are as of Qlik Sense version 2.0 referred to as trace logs. The log files remain the same, in the old logging format, but they are stored in a new location.

Storage

The trace log files are stored in the %ProgramData%\Qlik\Sense\Logs\Service\Trace folder.

Naming

The trace log files are named in accordance to the following file rollover procedure:

1. The log is stored in a file named <MachineName>_<Facility>_<Service>.txt.
2. When the file is full or a pre-defined amount of time has passed, the file extension is automatically changed to .log and a time stamp is appended to the file name for uniqueness and archiving. This means that the new file name becomes <MachineName>_<Facility>_<Service>_<YYYY-MM-DDTHH.mm.ss>Z.log. The file is then moved to the repository database on the central node by the Qlik Sense Repository Service (QRS) and archived.
3. A new log file, named <MachineName>_<Facility>_<Service>.txt, is created.

⚠️ If the .log file is deleted before being copied to the repository database on the central node, the file is lost and cannot be recreated.
The format of the file name is as follows:

- `<Machine>` = Name of the server where the log was created.
- `<Facility>` = The type of events that are covered by the log.
  
  *Logger (page 237)*

- `<Service>` = The service that the log originates from (for example, Proxy or Repository).
- `<YYYY-MM-DDTHH.mm.ss>Z` = Time stamp for when the log file was closed for new entries, where:

  - `YYYY`: Year
  - `MM`: Month
  - `DD`: Day in month
  - `T`: Delimiter, time designator
  - `HH`: Hour
  - `mm`: Minutes
  - `ss`: Seconds
  - `Z`: UTC designator, indicates that the time stamp is in UTC format

**See also:**

- *Logger (page 237)*

**Rows**

The first row of each log file contains a header that, in turn, contains the names of all fields, separated by tabs.

Each log entry is one row and the characters listed in the following table are replaced with Unicode characters.

<table>
<thead>
<tr>
<th>Character</th>
<th>Unicode replacement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>\t</code></td>
<td><code>\u21d4</code></td>
<td>Symbol for horizontal tabulation, HT.</td>
</tr>
<tr>
<td><code>\n</code></td>
<td><code>\u2193</code></td>
<td>Symbol for line feed, LF.</td>
</tr>
<tr>
<td><code>\f</code></td>
<td><code>\u2192</code></td>
<td>Symbol for form feed, FF.</td>
</tr>
<tr>
<td><code>\r</code></td>
<td><code>\u21b5</code></td>
<td>Symbol for carriage return, CR.</td>
</tr>
</tbody>
</table>

**Fields**

This section describes the fields in the trace log files.

**Common fields**

The following table lists the fields (in order of appearance) included in all trace log files.
## Field | Description
---|---
Sequence# | 1 - 2147483647 by default, but can be configured using custom logging as described in Qlik Sense Appenders (page 246). Each row in the log starts with a sequence number that is used to ensure that the log is not tampered with (that is, that no rows are inserted or deleted). The sequence number wraps either when the last sequence number is reached or when the logging, for some reason, is restarted without the last sequence number being reached.

Timestamp | Timestamp in ISO 8601 format, YYYYMMDDThhmmss.fffK, where:
- YYYY: Year
- MM: Month
- DD: Day in month
- T:Delimiter
- hh: Hour
- mm: Minutes
- ss: Seconds
- fff: Milliseconds
- K: Time zone offset
For example, 20110805T145657.000+0200 means year 2011, month 8, day 5 at 14:56:57 GMT+2.

Level | Row log level, can be configured using custom logging as described in Qlik Sense Appenders (page 246):
- Debug: Information useful to developers for debugging purposes. This level is not useful during normal operation since it generates vast amounts of logging information.
- Info: Normal operational messages that may be harvested for reporting, measuring throughput, and so on. No action required.
- Warn: Not an error message, but an indication that an error may occur, if no action is taken (for example, the file system is 85% full). Each item must be resolved within a given time.
- Error: Non-urgent failures that are relayed to developers or administrators. Each item must be resolved within a given time.
- Fatal: Indicates a failure in a primary system (for example, loss of primary ISP connection) and must be corrected immediately.
- Off: No logs, except for license logs, are produced.

Hostname | Server name.
## 3 Deploying Qlik Sense Enterprise on Windows

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Logger</strong></td>
<td>Logger in <code>&lt;Facility&gt;..&lt;Service&gt;..&lt;Fully qualified name of class&gt;</code> format, where:</td>
</tr>
<tr>
<td></td>
<td>- <code>&lt;Facility&gt;</code>:</td>
</tr>
<tr>
<td></td>
<td>- Application: Log events that are related to the app running in Qlik Sense.</td>
</tr>
<tr>
<td></td>
<td>- Audit: Log events that provide an audit trail of a user's activities and administration of the Qlik Sense platform.</td>
</tr>
<tr>
<td></td>
<td>- Exit: Log events that are related to the shutdown of the Qlik Sense Engine Service (QES).</td>
</tr>
<tr>
<td></td>
<td>- License: Log events that are related to the Qlik Sense license.</td>
</tr>
<tr>
<td></td>
<td>- ManagementConsole: Log events that are related to the Qlik Management Console (QMC).</td>
</tr>
<tr>
<td></td>
<td>- Performance: Log events that are related to the performance of the Qlik Sense platform or app.</td>
</tr>
<tr>
<td></td>
<td>- QixPerformance: Log events that are related to the performance of the QIX protocol in the QES.</td>
</tr>
<tr>
<td></td>
<td>- Security: Log events that are related to security issues.</td>
</tr>
<tr>
<td></td>
<td>- Session: Log events that are related to the termination of a proxy session.</td>
</tr>
<tr>
<td></td>
<td>- SSE: Log events that are related to server-side extensions.</td>
</tr>
<tr>
<td></td>
<td>- Synchronization: Log events that are related to the synchronization of the Qlik Sense Repository Service (QRS) instances in a multi-node site.</td>
</tr>
<tr>
<td></td>
<td>- System: Log events that are related to the Qlik Sense platform and not to the app running on the platform (for example, log messages related to the QMC, QRS, Qlik Sense Proxy Service (QPS), and so on).</td>
</tr>
<tr>
<td></td>
<td>- TaskExecution: Log events that are related to the execution of tasks by the Qlik Sense Scheduler Service (QSS).</td>
</tr>
<tr>
<td></td>
<td>- Traffic: Log events that are related to debugging.</td>
</tr>
<tr>
<td></td>
<td>- UserManagement: Log events that are related to the management of the users.</td>
</tr>
<tr>
<td></td>
<td>- <code>&lt;Service&gt;</code>: The Qlik Sense service that the log originates from (for example, QRS or QPS).</td>
</tr>
<tr>
<td></td>
<td>- <code>&lt;Fully qualified name of class&gt;</code>: Indicates the part of the service that generated the log message.</td>
</tr>
<tr>
<td>Thread</td>
<td>Thread name or Managed Thread ID (if available).</td>
</tr>
<tr>
<td>Id</td>
<td>Globally Unique Identifier (GUID) for the log message.</td>
</tr>
<tr>
<td>ServiceUser</td>
<td>Name of the user or account used by the Qlik Sense service.</td>
</tr>
<tr>
<td>Message</td>
<td>Log message.</td>
</tr>
</tbody>
</table>
### Exception
- **Description**: Exception message.
  - *This field is only present when there is an exception message.*

### StackTrace
- **Description**: A trace to the place in Qlik Sense where the exception occurred.
  - *This field is only present when the Exception field is present.*

### ProxySessionId
- **Description**: The ID of the proxy session for the user.
  - *This field is not present in all log files.*

### Id2 or Checksum
- **Description**: The last field in a log entry either contains an Id2 or a Checksum:
  - **Id2**: Log message GUID (same as Id described earlier). This is the normal value.
  - **Checksum**: To protect logs that contain sensitive information (for example, audit, security, and license logs) from tampering, the last field in such log entries contains a cryptographic hash of the entire row up to the hash itself.

### Additional fields
The common fields are present in all trace log files. Some trace logs contain additional fields, which are listed in this section. In addition, optional fields can be defined.

### Application log

#### Qlik Sense Repository Service (QRS)
The following fields are specific to the Application log for the QRS:
- **Application**: The name of the application (if there is a name to associate with the log entry).

#### Qlik Sense Scheduler Service (QSS)
The following fields are specific to the Application log for the QSS:
- **Application**: The name of the application (if there is a name to associate with the log entry).

### See also:
- [Common fields (page 235)]

### Audit log

#### Qlik Sense Repository Service (QRS)
The following fields are specific to the Audit log for the QRS:
3 Deploying Qlik Sense Enterprise on Windows

- Action: The action that the user performed (add, update, delete, export).
- ActiveUserDirectory: The user directory for the user.
- ActiveUserId: The ID of the user.
- ResourceId: The ID of the resource on which the user performed the action.

Qlik Sense Proxy Service (QPS)

The following fields are specific to the Audit log for the QPS:

- ConnectionId: The ID of the connection.
  
  ActiveConnections field in Performance log (page 240)
- ActiveUserDirectory: The user directory for the user.
- ActiveUserId: The ID of the user.
- TicketId: The ID of the login ticket that was issued for the user. The ticket ID exists until it is consumed by the QPS.
- IpAddress: The IP address of the client.
- AppId: The ID of the app (empty if no app is loaded).
- TargetHost: The call from the client is forwarded to a Qlik Sense Engine Service (QES) or QRS. This field contains the name of the machine on which the service is running.
- VirtualProxy: The virtual proxy prefix in (prefix) format.

Qlik Sense Engine Service (QES)

The following fields are specific to the Audit log for the QES:

- ActiveUserDirectory: The user directory for the user.
- ActiveUserId: The ID of the user.
- EngineTimestamp: The time when the QES wrote the log message to file.
- EngineThread: The ID of the thread that was used when the QES wrote the log message to file.
- ProcessId: The ID of the QES process from which the log message originates.
- ServerStatus: The time when the QES started.
- AppId: The ID of the app.
- Type: The type of operation that the user performed to generate the audit message.
- Qlik Sense User: The user who generated the audit message.

See also:

- Common fields (page 235)

License log

Qlik Sense Repository Service (QRS)

The following fields are specific to the License log for the QRS:
3 Deploying Qlik Sense Enterprise on Windows

- **AccessTypeId:** The ID of the access type entity.
- **AccessType:** The name of the access type (LoginAccess or UserAccess).
- **Operation:** The operation that was performed (Add, Update, Delete, UsageGranted, UsageDenied, Available, Timedout, or Unquarantined).
- **UserName:** The name of the user (who, for example, uses an access pass).
- **UserId:** The ID of the user in Qlik Sense.

See also:
- Common fields (page 235)

Performance log

Qlik Sense Repository Service (QRS)
The following fields are specific to the Performance log for the QRS:

- **Tracenumber:** A unique ID for the call to the QRS REST API.
- **Httpmethod:** The HTTP method that was used (Get, Put, Post, or Delete).
- **Url:** The URL that was used.
- **Resourcetype:** The type of resource.
- **Method:** The backend code that was called.
- **Elapsedmilliseconds:** The time (in milliseconds) to complete the call to the QRS REST API.

Example: Get http://mytest/cars/4

- **Httpmethod:** Get
- **Url:** http://mytest/cars/4
- **Resourcetype:** cars
- **Method:** get/cars/{0}

Qlik Sense Proxy Service (QPS)
The following fields are specific to the Performance log for the QPS:

- **ActiveConnections:** The number of active connections (in any form or shape) from the client. A connection is a stream (that is, a socket) between a Qlik Sense client and the Qlik Sense Proxy Service (QPS). This stream is often connected to another stream, which runs from the QPS to the Qlik Sense Repository Service (QRS) or the Qlik Sense Engine Service (QES). The two streams allow the client to communicate with the QRS or the QES.

- **ActiveStreams:** The number of active data streams (that is, sockets), either from the browser to the QPS or from the QPS to the QRS or the QES.

- **ActiveSessions:** The number of active sessions in the QPS. A Qlik Sense user gets a proxy session when the user has been authenticated. The session is terminated after a certain period of inactivity.
3 Deploying Qlik Sense Enterprise on Windows

- **LoadBalancingDecisions**: The number of users who currently have at least one engine session.
- **PrintingLoadBalancingDecisions**: The number of users who have been load balanced to the Qlik Sense Printing Service (QPR).
- **Tickets**: The number of issued login tickets that have not yet been consumed.
- **ActiveClientWebssockets**: The number of active WebSockets between the client and the QPS.
- **ActiveEngineWebssockets**: The number of active WebSockets between the QPS and the target Qlik Sense service.

The logging entries are also available as metrics; see [Proxy service](#).

**Qlik Sense Engine Service (QES)**

Each entry (that is, row) in the Performance log corresponds to a snapshot (that is, a number of measurements) of the performance of the QES at the given point in time.

The following fields are specific to the Performance log for the QES:

- **ActiveUserDirectory**: The user directory for the user.
- **ActiveUserId**: The ID of the user.
- **EngineTimestamp**: The time when the QES wrote the log message to file.
- **EngineThreadId**: The ID of the thread that was used when the QES wrote the log message to file.
- **ProcessId**: The ID of the QES process from which the log message originates.
- **Exe Type**: The configuration type (release or debug version) of the QES process.
- **Exe Version**: The version number of the QES process.
- **Server Started**: The time when the QES started.
- **Entry Type**: The reason (Server Starting, Normal, or Server Shutting Down) for the log entry in the **Performance log**.
- **ActiveDocSessions**: The number of active engine sessions at the given point in time.
- **DocSessions**: The number of engine sessions at the given point in time.
- **ActiveAnonymousDocSessions**: The number of active anonymous engine sessions at the given point in time.
- **AnonymousDocSessions**: The number of anonymous engine sessions at the given point in time.
- **ActiveTunneledDocSessions**: The number of active tunneled engine sessions at the given point in time.
- **TunneledDocSessions**: The number of tunneled engine sessions at the given point in time.
- **DocSessionStarts**: The number of started engine sessions since the previous snapshot.
- **ActiveDocs**: The number of active apps in the QES at the given point in time.
- **RefDocs**: The number of apps in the QES at the given point in time.
- **LoadedDocs**: The number of loaded apps in the QES at the given point in time.
- **DocLoads**: The number of app loads in the QES since the previous snapshot.
- **DocLoadFails**: The number of failed app loads in the QES since the previous snapshot.
- **Calls**: The number of calls to the QES since the previous snapshot.
- **Selections**: The number of selections in the QES since the previous snapshot.
3 Deploying Qlik Sense Enterprise on Windows

- ActivesIpAddrs: The number of IP addresses of active connected clients in the QES at the given point in time.
- IpAddrs: The number of IP addresses of all connected clients in the QES at the given point in time.
- ActiveUsers: The number of active users in the QES at the given point in time.
- Users: The total number of users in the QES at the given point in time.
- CPULoad: A measurement of the load on the CPU on which the QES runs at the given point in time.
- VMCommitted(MB): The committed Virtual Memory (in megabytes) at the given point in time.
- VMAssigned(MB): The allocated Virtual Memory (in megabytes) at the given point in time.
- VMFree(MB): The free Virtual Memory (in megabytes) at the given point in time.
- VMlargestFreeBlock(MB): The largest free Virtual Memory block (in megabytes) at the given point in time.

See also:
- Common fields (page 235)

QIX performance log

Qlik Sense Engine Service (QES)

The following fields are specific to the QIX performance log for the QES:

- ActiveUserDirectory: The user directory for the user.
- ActiveUserId: The ID of the user.
- EngineTimestamp: The time when the QES wrote the log message to file.
- EngineThread: The ID of the thread that was used when the QES wrote the log message to file.
- ProcessId: The ID of the QES process from which the log message originates.
- SessionId: The ID of the engine session for which the QIX method call was made.
- CServerId: The ID of the server instance that handled the request.
- Server Started: The time when the QES started.
- Method: The name of the QIX method that was called.
- RequestId: The ID of the request in which the QIX method call was handled.
- Target: The memory address of the target for the QIX method call.
- RequestException: The ID of an exception (if any) that occurred as a result of the QIX method call.
- ProcessTime: The amount of time that was needed to process the request.
- WorkTime: The amount of time that the request did actual work.
- LockTime: The amount of time that the request had to wait for an internal lock.
- ValidateTime: The amount of time that the request used for validation.
- Handle: The ID of the interface that handled the request. The interface can be Global, a certain sheet, a certain object, or similar.
3  Deploying Qlik Sense Enterprise on Windows

See also:
- Common fields (page 235)

Qlik Management Console log

The Qlik Management Console log is not created until there is an event (for example, an error message) for the Qlik Management Console (QMC) to write in the log.

Qlik Sense Repository Service (QRS)

The following fields are specific to the Qlik Management Console log for the QRS:

- Browser: The web browser that is used to run the QMC.

See also:
- Common fields (page 235)

Server-side extension log

Qlik Sense Engine Service (QES)

The following fields are specific to the server-side extension (SSE) log for the QES:

- ActiveUserDirectory: The user directory for the user.
- ActiveUserId: The ID of the user.
- EngineTimestamp: The time when the QES wrote the log message to file.
- EngineThread: The ID of the thread that was used when the QES wrote the log message to file.
- ProcessId: The ID of the QES process from which the log message originates.
- QixRequestId: The ID established by the initiator of the request. If this member is not present, the RPC call is assumed to be a notification.
- AppId: The ID of the app that includes the call to the server-side extension (SSE) plugin through an analytic connection.
- AppTitle: The title of the app that includes the call to the SSE plugin through an analytic connection.
- SSEPlugin: If the log message was created during a call to the SSE plugin, the mapping/alias of that plugin, for example, SSEPython for a Python plugin. If the log message was created without a call to the SSE plugin, for example, while initializing the SSE, the value is a dash (-).
- SSEPluginAddress: Two elements separated by a colon that define the analytic connection to the SSE plugin.
  - <Host>: DNS name (or IP-address) of the plugin.
  - <Port>: Port on which the plugin listens, typically 50051.

For example, localhost:50051.
3 Deploying Qlik Sense Enterprise on Windows

See also:

- Common fields (page 235)

Session log

Qlik Sense Engine Service (QES)

The following fields are specific to the Session log for the QES:

- ActiveUserDirectory: The user directory for the user.
- ActiveUserId: The ID of the user.
- EngineTimestamp: The time when the QES wrote the log message to file.
- EngineThread: The ID of the thread that was used when the QES wrote the log message to file.
- ProcessId: The ID of the QES process from which the log message originates.
- Exe: The configuration type (release or debug version) of the QES process.
- Exe Version: The version number of the QES process.
- Server Started: The time when the QES started.
- AppId: The ID of the app that was loaded by the finished engine session.
- App Title: The title of the loaded app that was used during the finished engine session.
- Doc Timestamp: The last modified timestamp of the app that was loaded by the finished engine session.
- Qlik Sense User: The user that started the finished engine session.
- Exit Reason: The reason for the engine session to finish.
- Session Start: The time when the engine session started.
- Session Duration: The duration (in milliseconds) of the finished engine session.
- CPU Spent (s): The CPU time (in seconds) that was spent handling requests during the finished engine session.
- Bytes Received: The number of bytes of data that were received during the engine session.
- Bytes Sent: The number of bytes of data that were sent during the engine session.
- Calls: The number of calls that were made during the engine session.
- Selections: The number of selections that were made during the engine session.
- Authenticated User: The authenticated user that used the engine session.
- Secure Protocol: An on/off flag that indicates whether the protocol was run over a secure connection.

See also:

- Common fields (page 235)

System log

Qlik Sense Scheduler Service (QSS)

The following fields are specific to the System log for the QSS:
3  Deploying Qlik Sense Enterprise on Windows

- TaskName: The name of the task that was executed.
- TaskId: The ID of the task that was executed.
- User: The name of the user who executed the task. When the QSS starts a scheduled execution of a task, the QSS is listed as user.
- ExecutionId: A unique ID that identifies the execution of the task. A task gets a new ExecutionId every time it is executed.
- AppName: The name of the app that executed the task (if any).
- AppId: The ID of the app that executed the task (if any).

Qlik Sense Engine Service (QES)

The following fields are specific to the System log for the QES:

- ActiveUserDirectory: The user directory for the active user who was logged in when the log message was generated in the QES.
- ActiveUserId: The user ID for the active user who was logged in when the log message was generated in the QES.
- EngineTimestamp: The time when the QES wrote the log message to file.
- EngineThread: The ID of the thread that was used when the QES wrote the log message to file.
- ProcessId: The ID of the QES process from which the log message originates.
- Server Started: The time when the QES started.

See also:

- Common fields (page 235)

Task execution log

Qlik Sense Scheduler Service (QSS)

The following fields are specific to the Task execution log for the QSS:

- TaskId: A unique ID of the task that was executed.
- TaskName: The name of the task that was executed.
- AppId: A unique ID of the app that executed the task (if any).
- AppName: The name of the app that executed the task (if any).
- ExecutionId: A unique ID that identifies the execution of a task. A task gets a new ExecutionId every time it is executed.
- ExecutionNodeId: A unique ID that identifies the node in the site on which the specific execution of the task was performed.
- Status: The result of the execution of the task (successful, failed, aborted, skipped, or retry).
- StartTime: The time when the execution of the task started.
- StopTime: The time when the execution of the task stopped.
- Duration: The time (in milliseconds) for the execution of the task to be completed.
- FailureReason: Empty, unless an error occurred during the execution of the task.
See also:
- Common fields (page 235)

Traffic log

Qlik Sense Engine Service (QES)
The following fields are specific to the traffic log for the QES:

- ActiveUserDirectory: The user directory for the user.
- ActiveUserId: The ID of the user.
- EngineTimestamp: The time when the QES wrote the log message to file.
- EngineThread: The ID of the thread that was used when the QES wrote the log message to file.
- ProcessId: The ID of the QES process from which the log message originates.

See also:
- Common fields (page 235)

Configuring the logging

The standard logging in Qlik Sense is configured using the Qlik Management Console (QMC).

Customized logging is setup using appenders and the local log configuration file, LocalLogConfig.xml.

Appenders

The logging in Qlik Sense implements a custom appender, QSRollingFileAppender, which is based on the log4net component. The custom appender is used internally by the Qlik Sense logging system.

QSRollingFileAppender and some of the built-in, predefined appenders in the log4net framework can be used to configure customized logging, which is specified in the local log configuration file, LocalLogConfig.xml.

QSRollingFileAppender can also log events in the local log file (for example, the Microsoft Windows event log) or send log information to a remote log server.

QSRollingFileAppender

QSRollingFileAppender inherits from log4net.Appenders.FileAppender and all parameters, except for AppendToFile, are also available to QSRollingFileAppender. QSRollingFileAppender stores the log files in accordance to the MaxFileSize and MaxFileTime parameters.

Configuring the appender

The QSRollingFileAppender configuration is as follows:

```xml
<appender name="MyQSRollingFileAppender" type="Qlik.Sense.Logging.log4net.Appender.QSRollingFileAppender">
<param name="threshold" value="info" />
<param name="encoding" value="utf-8" />
</appender>
```
Deploying Qlik Sense Enterprise on Windows

<param name="file" value="C:/ProgramData/Qlik/Sense/Log/output.log"/>
<param name="maximumfiletime" value="720" />
<param name="maximumfilesize" value="512KB" />
<layout type="log4net.Layout.Patternlayout">
  <converter>
    <param name="name" value="rownum" />
    <param name="type" value="Qlik.Sense.Logging.log4net.Layout.Pattern.CounterPatternConverter" />
  </converter>
  <converter>
    <param name="name" value="longIso8601date" />
    <param name="type" value="Qlik.Sense.Logging.log4net.Layout.Pattern.Iso8601TimeOffsetPatternConverter" />
  </converter>
  <converter>
    <param name="name" value="hostname" />
    <param name="type" value="Qlik.Sense.Logging.log4net.Layout.Pattern.HostNamePatternConverter" />
  </converter>
  <converter>
    <param name="name" value="guid" />
    <param name="type" value="Qlik.Sense.Logging.log4net.Layout.Pattern.GuidPatternConverter" />
  </converter>
  <converter>
    <param name="name" value="user" />
    <param name="type" value="Qlik.Sense.Logging.log4net.Layout.Pattern.ServiceUserNameCachedPatternConverter" />
  </converter>
  <converter>
    <param name="name" value="encodedmessage" />
  </converter>
  <converter>
    <param name="name" value="encodedexception" />
    <param name="type" value="Qlik.Sense.Logging.log4net.Layout.Pattern.EncodedExceptionPatternConverter" />
  </converter>
  <param name="ignoresexception" value="false" />
  <param name="header" value="Sequence#\tTimestamp\tLevel\tHostname\tLogger\tThread\tId\tUser\nMessage\tException\tId2\n" />
  <param name="conversionpattern" value="%rownum{9999}\t%longIso8601date\t%level\t%hostname\t%logger\t%thread\t%guid\%newline%innermostmessage%guid%newline" />
</layout>
</appender>

Converters

log4net.Layout.Patternlayout and a couple of custom converters are used to format rows in logs based on QSRollingFileAppender:

- Qlik.Sense.Logging.log4net.Layout.Pattern.CounterPatternConverter: Add a sequence number to the log row. Parameter:
  - Integer: The last number of the sequence before it is reset.
3 Deploying Qlik Sense Enterprise on Windows

- Qlik.Sense.Logging.log4net.Layout.Pattern.HostNamePatternConverter: Add the host name to the log row.
- Qlik.Sense.Logging.log4net.Layout.Pattern.EncodedExceptionPatternConverter: Add information on the logged exception to the log row. Parameter (one of the following):
  - MESSAGE: The message in the logged exception.
  - INNERMOSTMESSAGE: The message in the innermost exception of the logged exception.
  - SOURCE: The source of the exception (that is, the name of the app or the object that caused the error).
  - STACKTRACE: The stack trace for the exception.
  - TARGETSITE: The target site for the exception (that is, the method that threw the current exception).
  - HELPLINK: Link to the help file associated with the exception.

Built-in log4net appenders

In addition to the Qlik Sense custom appender, QSRollingFileAppender, the log4net framework comes with a set of built-in predefined appenders that also can be used in the local log configuration file, LocalLogConfig.xml:

- AdoNetAppender
- AnsiColorTerminalAppender
- AspNetTraceAppender
- ColoredConsoleAppender
- ConsoleAppender
- EventLogAppender
- FileAppender
- NetSendAppender
- RemoteSyslogAppender
- RemotingAppender
- RollingFileAppender
- SmtpAppender
- SmtpPickupDirAppender
- TelnetAppender
- UdpAppender

Each appender has its own set of parameters to control the output.
3 Deploying Qlik Sense Enterprise on Windows

See also:
- Apache Logging Services

Example: EventLogAppender

The following example shows how to use the EventLogAppender in the local log configuration file, `LocalLogConfig.xml`, for the Qlik Sense Proxy Service (QPS). In the example, all QPS audit log entries at warning level are sent to the Microsoft Windows event log.

```xml
<appender name="EventLogAppender" type="log4net.Appender.EventLogAppender">
  <param name="threshold" value="warn" />
  <param name="applicationName" value="Qlik Sense Proxy Service" />
  <layout type="log4net.Layout.PatternLayout">
    <param name="conversionPattern" value="%message" />
  </layout>
</appender>

<logger name="Audit.Proxy">
  <appender-ref ref="EventLogAppender" />
</logger>

Example: SmtpAppender

The following example shows how to use the SmtpAppender in the local log configuration file, `LocalLogConfig.xml`, for the Qlik Sense Proxy Service (QPS). In the example, all QPS audit log entries at warning level are sent to an email address (to@domain.com).

```xml
<appender name="MyMailAppender" type="log4net.Appender.SmtpAppender">
  <param name="threshold" value="warn" />
  <param name="to" value="to@domain.com" />
  <param name="from" value="from@domain.com" />
  <param name="subject" value="test logging message" />
  <param name="smtpHost" value="SMTPServer.domain.com" />
  <param name="port" value="25" />
  <param name="bufferSize" value="512" />
  <param name="lossy" value="true" />
  <layout type="log4net.Layout.PatternLayout">
    <param name="conversionPattern" value="%newline%date %-5level %message%newline%newline%newline" />
  </layout>
</appender>

<logger name="Audit.Proxy">
  <appender-ref ref="MyMailAppender" />
</logger>
```

Local log configuration file

The logging in Qlik Sense can be set up to produce customized logging as an addition to the default logging.

To set up customized logging, create a local log configuration file named `LocalLogConfig.xml` in the `%ProgramData%\Qlik\Sense\<Service>` folder.

```
The logging defined by the local log configuration file does not affect the default logging.
```
3  Deploying Qlik Sense Enterprise on Windows

Requirements
The requirements described in this section must be fulfilled for the customized logging to function properly.

Conforming to the XML schema
The local log configuration file must conform to the XML schema because the Qlik Sense Repository Service (QRS), Qlik Sense Proxy Service (QPS), and Qlik Sense Scheduler Service (QSS) have built-in schema validation.

If the local log configuration file is not accepted by the services, an error is logged in the System log.

Maximum file size
The size of the local log configuration file must not exceed 1 MB.

XML schema
The XML schema for the local log configuration file, LocalLogConfig.xml, is as follows:

```xml
<?xml version="1.0" encoding="utf-8" ?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
  <xs:complexType name="ParamType">
    <xs:attribute name="name" type="xs:string" use="required"/>
    <xs:attribute name="value" type="xs:string" use="required"/>
  </xs:complexType>

  <xs:simpleType name="AppenderNameType">
    <xs:restriction base="xs:string">
      <xs:pattern value="[^$].*"/> <!-- '$' is not allowed as prefix-->
    </xs:restriction>
  </xs:simpleType>

  <xs:complexType name="ConverterType">
    <xs:sequence>
      <xs:element name="param" minOccurs="0" maxOccurs="unbounded" type="ParamType"/>
    </xs:sequence>
  </xs:complexType>

  <xs:complexType name="FilterType">
    <xs:sequence>
      <xs:element name="param" minOccurs="0" maxOccurs="unbounded" type="ParamType"/>
    </xs:sequence>
    <xs:attribute name="class" type="xs:string" use="optional"/> <!-- log4cxx-->
    <xs:attribute name="type" type="xs:string" use="optional"/> <!-- log4net-->
  </xs:complexType>

  <xs:complexType name="EvaluatorType">
    <xs:sequence>
      <xs:element name="param" minOccurs="0" maxOccurs="unbounded" type="ParamType"/>
    </xs:sequence>
    <xs:attribute name="class" type="xs:string" use="optional"/> <!-- log4cxx-->
    <xs:attribute name="type" type="xs:string" use="optional"/> <!-- log4net-->
  </xs:complexType>

  <xs:complexType name="LayoutType">
    <xs:sequence>
    </xs:sequence>
  </xs:complexType>
</xs:schema>
```
Deploying Qlik Sense Enterprise on Windows

Example:

In this example, the local log configuration file is configured to write the system logs at debug level in

%ProgramData%\Qlik Sense\Log\Proxy\Debug_System_Proxy.txt.

<?xml version="1.0"?>
<configuration>
  <appender name="LocalApp_AppenderSystem"
    type="Qlik.Sense.Logging.log4net.Appender.QSRollingFileAppender">
    <param name="threshold" value="debug" />
    <param name="encoding" value="utf-8" />
    <param name="file" value="C:\ProgramData\Qlik\Sense\Log\Proxy\Debug_System_Proxy.txt" />
    <param name="maximumfiletime" value="720" />
    <param name="maximumfilesize" value="512KB" />
    <layout type="log4net.Layout.PatternLayout">
      <param name="name" value="rownum" />
      <param name="type" value="Qlik.Sense.Logging.log4net.Layout.Pattern.CounterPatternConverter" />
      <converter>
        <param name="name" value="longIso8601date" />
        <param name="type" value="Qlik.Sense.Logging.log4net.Layout.Pattern.Iso8601TimeOffsetPatternConverter" />
      </converter>
      <param name="name" value="hostname" />
      <param name="type" value="Qlik.Sense.Logging.log4net.Layout.Pattern.HostNamePatternConverter" />
      <param name="name" value="guid" />
      <param name="type" value="Qlik.Sense.Logging.log4net.Layout.Pattern.GuidPatternConverter" />
      <param name="name" value="serviceuser" />
      <param name="type" value="Qlik.Sense.Logging.log4net.Layout.Pattern.ServiceUserNameCachedPatternConverter" />
      <param name="name" value="encodedmessage" />
      <param name="name" value="encodedexception" />
      <param name="type" value="Qlik.Sense.Logging.log4net.Layout.Pattern.EncodedExceptionPatternConverter" />
    </layout>
    <param name="ignoresexception" value="false" />
    <param name="header" value="Sequence#	Timestamp	Level	Hostname	Logger	Thread	Id	ServiceUser	Message	Exception
ActiveUserDirectory	ActiveUserId	ProxyTimestamp	ProxyThread
Id2
" />
    <param name="conversionpattern" value="%rownum{9999}	%longIso8601date
%level%	%hostname%	%logger%	%thread%	%guid%	%serviceuser%	%encodedmessage1000000%	%encodedexception{innermostmessage:1000000}
%property{ActiveUserDirectory}	%property{ActiveUserId}	%property{ProxyTimestamp}	%property{ProxyThread}%guid%newline" />
  </appender>
</configuration>
See also:

- Converters (page 247)

Telemetry logging

With the February 2018 release of Qlik Sense, you can capture granular usage metrics from the Qlik in-memory engine based on configurable thresholds. This provides, among other things, the ability to capture CPU and RAM usage of individual chart objects and CPU and RAM usage of reload tasks.

Enabling telemetry logging

Do the following:

1. In the Qlik Management Console (QMC), navigate to Engines, select an engine and go the setting QIX performance log level under Logging.
2. Choose one of the following values:
   - Off: No logging will occur.
   - Error: Activity meeting the error threshold is logged. Recommended option.
   - Warning: Activity meeting the error and warning thresholds is logged. Recommended option.
   - Info: All activity is logged. Only recommended during troubleshooting because the log files may become very big.

   \[\text{The options } \text{Fatal and Debug are not applicable in this scenario.}\]

3. Repeat steps 1 and 2 for each engine for which you want to enable telemetry.
4. Set threshold parameters. Edit C:\ProgramData\Qlik\Sense\Engine\Settings.ini. If the file does not exist, create it. You may need to open the file as an administrator to make changes. Set the values according to the following list. We recommend that you start with these threshold values and increase or decrease them as you become more aware of how your particular environment performs. Too low values will create very large log files.

   \[\text{[Settings 7]}\]
   \[
   \begin{align*}
   \text{ErrorPeakMemory} &= 2147483648 \\
   \text{WarningPeakMemory} &= 1073741824 \\
   \text{ErrorProcessTimeMs} &= 60000 \\
   \text{WarningProcessTimeMs} &= 30000
   \end{align*}
   \]

5. Save and close the file.
6. Restart the Qlik Sense Engine Service.
7. Repeat steps 4-6 for each engine for which you want to enable telemetry.
Parameter descriptions

ErrorPeakMemory: Default 2147483648 bytes (2 Gb). If an engine operation requires more than this value of Peak Memory, a record is logged with log level error. Peak Memory is the maximum, transient amount of RAM an operation uses.

WarningPeakMemory: Default 1073741824 bytes (1 Gb). If an engine operation requires more than this value of Peak Memory, a record is logged with log level warning. Peak Memory is the maximum, transient amount of RAM an operation uses.

ErrorProcessTimeMs: Default 60000 millisecond (60 seconds). If an engine operation requires more than this value of Process Time, a record is logged with log level error. Process Time is the end-to-end clock time of a request.

WarningProcessTimeMs: Default 30000 millisecond (30 seconds). If an engine operation requires more than this value of Process Time, a record is logged with log level warning. Process Time is the end-to-end clock time of a request.

You can only track either process time or peak memory. It is not required to track both metrics. However, if you set ErrorPeakMemory, you must set warningPeakMemory. If you set ErrorProcessTimeMs, you must set WarningProcessTimeMs.

Reading the logs

Currently telemetry is only written to log files. It does not yet leverage the centralized logging to database capabilities.

Telemetry data is logged to \ProgramData\Qlik Sense\Log\Engine\Trace\hostname_.QixPerformance.Engine.txt and rolls to the ArchiveLog folder in your ServiceCluster share.

In addition to the common fields found described, fields relevant to telemetry are the following:

Level: The logging level threshold the engine operation met.

ActiveUserId: The User ID of the user performing the operation.

Method: The engine operation itself, see Important Engine Operations (page 255).

DocId: The ID of the Qlik application.

ObjectId: For chart objects, the Object ID of chart object.

PeakRAM: The maximum RAM an engine operation used.

NetRAM: The net RAM an engine operation used. For hypercubes that support a chart object, the net RAM is often lower than Peak RAM as temporary RAM can be used to perform set analysis, intermediate aggregations, and other calculations.

ProcessTime: The end-to-end clock time for a request including internal engine operations to return the result.
### Important Engine Operations

The **Method** column details each engine operation and are too numerous to completely detail. The most relevant methods to investigate are as follows and will be the most common methods that show up in the logs if a **Warning** or **Error** log entry is written.

**Method Description**
- **Global::openApp** - Opening an application
- **Doc::DoReload, Doc::DoReloadEx** - Reloading an application
- **Doc::DoSave** - Saving an application
- **GenericObject::GetLayout** - Calculating a hypercube (that is, a chart object)

**Comments**

For best overall representation of the time it takes for an operation to complete, use **ProcessTime**.

About **Error** and **warning** log level designations: These designations were used because they conveniently fit into the existing logging and QMC frameworks. A row of telemetry information written out as an error or warning does not at all mean the engine had a warning or error condition that should require investigation or remedy unless you are interested in optimizing performance. It is simply a means of reporting on the thresholds set within the engine **Settings.ini** file and it provides a means to log relevant information without generating overly verbose log files.

In addition to the above information, once the logs mentioned above are created, the Telemetry Dashboard for Qlik Sense can be downloaded and installed to read the log files and analyze the information.

The Telemetry Dashboard provides the ability to capture CPU and RAM usage of individual chart objects, CPU and RAM usage of reload tasks, and more.

The dashboard can be downloaded at: [Telemetry Dashboard for Qlik Sense](#).

Do the following:

1. Run the installer, the files are installed at `C:\Program Files\Qlik\Sense`.
2. Once installed, you will see two new tasks, two data connections, and one new app in the QMC.
3. In the QMC, change the ownership of the application to yourself, or the user you want to open the app with.
4. Open the **Tasks** section in the QMC, select `TelemetryDashboard-1-Generate-Metadata`, and click **Start** at the bottom. This task will run, and automatically reload the app upon completion.
5. Use the application from the hub to browse the information by sheets.
### 3.8 Troubleshooting - Deployment

There are several things you can do to troubleshoot and resolve problems before logging a case with product support. The general guidance here is designed to help you to understand the problem and know where to look for possible errors and potential solutions.

Before you call support:

- **Understand the problem** *(page 256)*
- **Use the log files** *(page 257)*
- Study the Qlik Sense Help.
- Read the troubleshooting topics in this section.

If you cannot find a solution in the product help, then follow the general guidance in this topic.

#### Understand the problem

Understanding the problem may help you to find a solution, and will enable you to provide Qlik support with the information needed to process your case more effectively. Ensure that you understand the problem and can describe it as fully as possible before seeking further support:

<table>
<thead>
<tr>
<th>Questions to ask</th>
<th>Answers - that may lead to a better understanding of the problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who experienced the problem?</td>
<td>What type of users were affected, and how many? This can help you to determine if it is a global issue, a configuration problem, a component problem, or due to user configuration.</td>
</tr>
<tr>
<td>What happened after an action was performed?</td>
<td>Pay attention to any symptoms, behavior, and error messages. This can help you to identify which component is causing the error, and which log files to use.</td>
</tr>
<tr>
<td>When did the problem first occur?</td>
<td>When is it triggered, and what user action or system action causes it? For example, is it due to a trigger reload, or if a user clicks on an object in an app.</td>
</tr>
<tr>
<td>Have you experienced this issue before?</td>
<td>If yes, how often has the problem occurred?</td>
</tr>
<tr>
<td>Where did this issue occur first?</td>
<td>Describe where in the system or environment the problem occurs? Is it on the client side, server backend, or in a specific application. For example, does the end user have a direct connection to the Qlik Sense hub, or are they passing through a third-party reverse proxy before reaching the hub?</td>
</tr>
<tr>
<td>Why do you think it happened?</td>
<td>Gather the relevant log files. Compare log files that</td>
</tr>
</tbody>
</table>
Use the log files

To troubleshoot and resolve issues effectively you need to understand how to use the log files. You also need to know when to use the default logs, and when to use the archived log files.

When you get an error message, the following steps can help you to identify which component has failed:

1. Read the error message carefully as it can tell you which component has failed.
2. Navigate to the default log files, or the archived logs folder for the failed component.
3. When you have navigated to the correct folder, search for errors in the log file to identify the issue.

Default log files

In Qlik Sense, the log files are by default stored in `C:\ProgramData\Qlik\Sense\log`. After 12 hours they are moved to the archived logs folder.

There is one Log folder per machine, and the following sub-folders for each component (engine, repository, proxy, and scheduler):

- Audit - High level user action logs. For example, open app, reload app, get ticket, and login success.
- System - Service logs including all errors, and system or service operations.
- Trace - Debug diagnostics. For example, user selections, https redirects, method work times, and session information.

If you are running a multi-node environment, ensure you are connected to the correct node.

Criteria for moving the default logs to the archived logs folder:

- On service restart or crash
- If the file is larger than a predefined size
- If the file is more than 12 hours old

Archived log files

The archived logs folder is located in the Qlik Sense file share that you created as part of the Qlik Sense installation. Use the archived log files if the problem occurred more than 12 hours ago.

To find the archived logs, open the QMC and go to Service Cluster, Cluster Settings, and you can see the path that you specified during installation.

Unlike the standard logs, the archived log files are stored in a central, shared location, so if you are running a multi-node environment, you will find one sub-folder per node. Like the default log files, the archived log files also contain Audit, System, and Trace sub-folders for each main component.

For more information on the location of the log files for each component, see: Storage (page 219)
3  Deploying Qlik Sense Enterprise on Windows

In Qlik Sense Sept 2017 and later centralized logging replaces the synchronized persistence logging framework.

Qlik Sense client or application problems
If you get an error in a Qlik Sense application, the following questions can help you to narrow down the issue:

- Was the application working before the error occurred?
- Is the issue present in the Qlik Sense Desktop client?
- Is the issue specific to a browser, or is it present in all browsers?
- Does this issue affect a specific user, user group, or all users?
- Does this issue occur in one application, or every application?

Other resources
Once you have gathered all the information you need, use the following links to research other possible solutions:

- Knowledge base
- Community website
- Log a case with product support.

Cannot find the repository database superuser password

Possible cause
In your Qlik Sense installation, you cannot find your repository database superuser password.

Proposed action
You can find the repository database superuser password using the Connection String Editor which is included in the Qlik Sense diagnostic tools.

To open the Connection String Editor:

1. Navigate to C:\Program Files\Qlik\Sense\Repository\Util\QlikSenseUtil and double-click the QlikSenseUtil.exe file.
2. In the LogOnForm screen, enter the database user and password that you used during the Qlik Sense installation.
3. In the Diagnostics Tool, click the Connection String Editor tab.
4. In the Connection String Editor click Read to see the encrypted connection string.
Cannot access the hub or the QMC after installation

Possible cause

After you have installed Qlik Sense, the services are started automatically, which can take a few minutes. You cannot access the Hub or the Qlik Management Console until the services have started up correctly.

Proposed action

Check that the services have started and that the appropriate ports are available.

Do the following:

1. In Windows, open the Task Manager and check that all Qlik Sense services have started.
2. Check that the ports needed by Qlik Sense are available.

One or more Qlik Sense services did not start after installation

Possible cause

The Qlik Sense Repository Service (QRS) cannot start if there is no repository database, and if the QRS is not running, none of the other Qlik Sense services can start.

Proposed action

Restart the service, check the user account, restart the server, or check the logs.

Do the following:

1. Stop the service and start it again.
   
   You can also try changing the Start Type of the failing service from Automatic to Automatic (Delayed Start) in the Task Manager in Windows.

2. Check that the user that runs the Qlik Sense services is member of the Local Administrators group.
   
   If you are using a domain administrator account, check that there is no problem related to the User Account Control (UAC).

3. Restart the server on which Qlik Sense is running.

4. Check the log files for the service to see if there is any information regarding why the service has not started.
   
   The log files are available in the %ProgramData%\Qlik\Sense\Log\<Service> folder.
3 Deploying Qlik Sense Enterprise on Windows

Set the ServicesPipeTimeout setting in the Registry Editor in Windows to 120000 milliseconds (that is, two minutes). This is needed to give the Qlik Sense Repository Service (QRS) enough time to start.

Microsoft Knowledge Base: 884495

Serious problems might occur if you modify the registry incorrectly by using the Registry Editor or by using another method. Make sure that you can recover if the changes lead to problems.

5. If the steps in this topic do not solve the problem, uninstall and reinstall Qlik Sense.

Anti-virus software scanning affects performance

Possible cause

Anti-virus software scanning can have an effect on the performance of Qlik Sense.

Proposed action

Configure the anti-virus software scanning so that it does not interfere with Qlik Sense. Make sure that regular scans and live/real-time scans are turned off for the following locations:

- \%ProgramData\Qlik
- Any additional folder path configured for storing QVF files
- All executables under \%ProgramFiles\Qlik\Sense
  - Engine\Engine.exe
  - Engine\QVConnect32.exe
  - Engine\QVConnect64.exe
  - Logging\Qlik.Logging.Service.exe
  - MigrationService\MigrationService.exe
  - Printing\Printing.exe
  - Printing\Qlik.Printing.CefSharp.exe
  - Proxy\Proxy.exe
  - Repository\Repository.exe
  - Repository\PostgreSQL\9.6\bin\postgres.exe
  - Scheduler\Scheduler.exe
  - ServiceDispatcher\ServiceDispatcher.exe
  - ServiceDispatcher\Node\node.exe

Exit codes

Exit codes can be particularly useful when using the silent mode operations. The exit code can be viewed in the command prompt window by using the following command:

Echo %errorlevel%
3  Deploying Qlik Sense Enterprise on Windows

The following table contains a complete list of the exit codes.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Success</td>
</tr>
<tr>
<td>-1</td>
<td>General fatal error</td>
</tr>
<tr>
<td>-2</td>
<td>Command line parsing error</td>
</tr>
<tr>
<td>-3</td>
<td>Not implemented error</td>
</tr>
<tr>
<td>-4</td>
<td>Downgrade</td>
</tr>
<tr>
<td>-5</td>
<td>Malformed bundle XML</td>
</tr>
<tr>
<td>-6</td>
<td>Install condition not met</td>
</tr>
<tr>
<td>-7</td>
<td>Unknown upgrade scenario</td>
</tr>
<tr>
<td>-8</td>
<td>Pending reboot must be applied first</td>
</tr>
<tr>
<td>-9</td>
<td>Patch run with no baseline installed</td>
</tr>
<tr>
<td>-10</td>
<td>Disallowed setup process running</td>
</tr>
<tr>
<td>-11</td>
<td>Unsupported minor upgrade error</td>
</tr>
<tr>
<td>-12</td>
<td>Invalid policy</td>
</tr>
<tr>
<td>-13</td>
<td>User validation failed</td>
</tr>
<tr>
<td>-14</td>
<td>Database superuser password validation error</td>
</tr>
<tr>
<td>-15</td>
<td>Not supported error</td>
</tr>
<tr>
<td>-16</td>
<td>Host name from certificate retrieval error</td>
</tr>
<tr>
<td>-17</td>
<td>Inconsistent upgrade</td>
</tr>
<tr>
<td>-18</td>
<td>General silent workflow error</td>
</tr>
<tr>
<td>-19</td>
<td>OS bitness not supported</td>
</tr>
<tr>
<td>-20</td>
<td>OS too old</td>
</tr>
<tr>
<td>-21</td>
<td>OS type not supported</td>
</tr>
<tr>
<td>-22</td>
<td>Patch is superseded</td>
</tr>
<tr>
<td>-23</td>
<td>General MSI Error</td>
</tr>
<tr>
<td>-24</td>
<td>Disabled services exist</td>
</tr>
<tr>
<td>-1335</td>
<td>CAB is corrupt</td>
</tr>
<tr>
<td>-1601</td>
<td>Disk space</td>
</tr>
<tr>
<td>-1602</td>
<td>User exit</td>
</tr>
<tr>
<td>-1923</td>
<td>Cannot install service</td>
</tr>
<tr>
<td>-7777</td>
<td>Unknown dark process exception</td>
</tr>
</tbody>
</table>
Rim node loses connection to the central node

**Possible cause**
The Windows setting *"System cryptography: Force strong key protection for user keys stored on the computer"* is enabled. This setting is not supported by Qlik Sense.

**Proposed action**
Disable *"System cryptography: Force strong key protection for user keys stored on the computer"*.

Repository cannot connect to database after installation

The installation was successful, but when the repository service is started it fails to connect to the database.

**Possible cause**
You used a database username and/or password that contains characters from mixed character sets.

**Proposed action**
1. Uninstall Qlik Sense and select **Remove Qlik Sense certificates and data folders** at the end of the installation.
2. Reinstall using a database username and password with characters from the same character set.

Unable to upgrade, reinstall or add a rim node due to password validation failure

**Possible cause**
When you install Qlik Sense with the setup program and choose to install a local database, you also create a database user (*qliksenserepository*) and a password. If you previously installed Qlik Sense with synchronized persistence then the database user will have a randomly generated password.

When you upgrade, reinstall, or add a rim node to your installation you to need to use this password again. If you did not create a super user password when you installed PostgreSQL or cannot remember the database user password, then you cannot continue to upgrade, reinstall, or add a rim node unless you change this password.

**Proposed action**
Use the command prompt to change the PostgreSQL database user password.

Do the following:

Change the client authentication settings to trust so you can change the password.

To do this:
1. In **Services**, stop the Qlik Sense Repository Database service, if it is running.
2. In PostgreSQL, change the authentication mode in the configuration settings to allow the password to be
3  Deploying Qlik Sense Enterprise on Windows

changed. To do this, navigate to ProgramData\Qlik\Sense\Repository\PostgreSQL\<database version> and open the pg_hba.conf file in a text editor.

3. Change the PostgreSQL client authentication method from md5 to trust.

   *The client authentication settings are case sensitive.*

4. Save your changes.

5. Start the Qlik Sense Repository Database service.

To change the password open a command prompt and do the following:

1. Enter the following commands:
   a. To navigate to your repository database installation:
      ```
      cd C:\Program Files\Qlik\Sense\Repository\PostgreSQL\9.6\bin
      ```
   b. To connect to the database:
      ```
      psql.exe -h 127.0.0.1 -p 4432 -U postgres
      ```
   c. To set your new user password:
      ```
      ALTER USER qlksenserpository WITH PASSWORD '<newpassword>';
      ```
      This is either qlksenserpository or the user you set manually during the first installation of PostgreSQL. ALTER ROLE is displayed after successfully changing the password.

2. Stop the Qlik Sense Repository Database service.

3. Revert the pg_hba.conf authentication mode method back to md5.

4. Start the Qlik Sense Repository Database service.

Update the connection string for the Qlik Sense Repository Database using the Connection String Editor which is included in the Qlik Sense diagnostic tools.

To do this:

1. In your Qlik Sense installation, to open the Connection String Editor, navigate to C:\Program Files\Qlik\Sense\Repository\Util\QlikSenseUtil and double-click the QlikSenseUtil.exe file.
2. In the LogOnForm screen, enter the database user and password that you used during the Qlik Sense installation.
3. In the Diagnostics Tool, click the Connection String Editor tab.
4. In the Connection String Editor, click Read to see the encrypted connection string.
5. Update the connection string credentials with name="qsr" with your new repository database password.
6. Click Save value above in config file encrypted to save your changes.
7. Start the Qlik Sense Repository Database service.

You can now continue to upgrade, reinstall, or add a rim node to your Qlik Sense installation.

The database is unavailable, how do I find the Qlik logging service files

**Possible cause**

The database is temporarily unavailable.
Proposed action

1. Check that all the Qlik Sense services are running. If the Qlik Sense Repository Database service has stopped, then try to restart it.
2. Check the log files for possible errors. The repository logs will indicate if there are any start-up problems. In Qlik Sense, navigate to C:\ProgramData\Qlik\Sense\Log to view the log files.

Troubleshooting - database not configured for IP address or range

If you find the following error message in the installation logs: "psql: FATAL: no pg_hba.conf entry for host [ipv4 or ipv6]", it means the database needs to be configured.

Possible cause

The database is not configured to allow connection from that IP address or range.

Proposed action

Add an IP address or range in the Shared Persistence configuration file, see Shared persistence configuration file syntax (page 127), or in the installation UI, see step 9 in Installing Qlik Sense (page 99)

Troubleshooting app distribution in multi-cloud

There is more than one possible cause when app distribution fails in a multi-cloud environment. You could encounter problems on the QSEoW side (with custom properties), at the IdP (with names and groups), during the actual distribution, and after distribution (with apps not being displayed).

Publishing is a little slow

Possible cause

You have published an app, and when checking the collection, the app is not present.

Proposed action

Allow some time to pass before troubleshooting why an app does not appear in a collection, publishing is not instantaneous.

Custom properties not in lowercase

You have created distribution policies and published an app to a multi-cloud collection. The app does not show up and no error message is displayed.

Possible cause

The custom properties you use in distribution policies are not in lowercase.

Proposed action

Use only lowercase letters for custom properties in distribution policies.
A temporary error occurred

Possible cause
A temporary error occurred.

Proposed action
Restart the Qlik Sense Service Dispatcher.

Do the following:
1. In Windows, open Services.
2. Scroll down and right-click the Qlik Sense Service Dispatcher. Select Restart.

An unknown error occurred

Possible cause
An error occurred and you do not know why.

Proposed action
Investigate the log files for multi-cloud services, for example, the App Distribution Service and Hybrid Deployment Service, see Multi-cloud services.

The logging database has grown too big

Possible cause
The size of the logging database can grow so much that it needs to be reduced in size.

Proposed action
Choose one of the following alternatives to reduce the size of the logging database:

- Decrease the archive and the purge time frame. Run the following command:
  \`Qlik.Logging.Service.exe update --archive_age 15 --purge_age 30.\`
- Set the maximum database size. Run the following command:
  \`Qlik.Logging.Service.exe update --maximum_db_size_in_gb n.\`
  Where \( n \) is a positive integer.

\[\text{If } n \text{ is a value less than two (2), the enforcement functionality is disabled. If } n \text{ is equal to or greater than two (2), the functionality is enabled, allowing the Logging service to delete entries from the database once the maximum size specified is exceeded. Please note that this process is inexact and therefore it is not possible for the Logging service to enforce the maximum database size precisely.}\]

- Manually purge the database.
3  Deploying Qlik Sense Enterprise on Windows

- Turn off database logging. Run the following command:

**Cannot read or write to the logging database**

You have installed Qlik Sense successfully, but you cannot connect to the logging database.

**Possible cause**

You used a password that contains characters from mixed character sets. The log writer and log reader password cannot handle all mixed characters.

**Proposed action**

1. Uninstall Qlik Sense and select **Remove Qlik Sense certificates and data folders** at the end of the installation.
2. Reinstall using a password with characters from the same character set.

**How can I debug if there are log entries missing in the database?**

**Possible cause**

Some log messages are missing in the database.

**Proposed action**

Turn on error logging in the `QlikCentralizedLogging.config` file to enable all log file messages to be collected.

Do the following:

1. Go to `C:\ProgramData\Qlik\Sense\Log\QlikCentralizedLogging.config`.
2. Change the value of the following line to "True":
   ```xml
   <DllErrorLoggingEnabled value="false" />
   ```
3. Restart the Qlik Logging Service.
4. Go to `C:\ProgramData\Qlik\Sense\Log`.
6. Monitor this file for errors generated due to Qlik Logging Service issues.

**How can I manage storage to fit our needs and the needs of the operational IT department?**

**Possible cause**

Storage of log data has become a concern.

**Proposed action**

There is more than one possible solution to this problem.

Do the following:
3 Deploying Qlik Sense Enterprise on Windows

a. Make use of the archive and purge functionality by adjusting the rate at which both events occur against the logging database only. File logging does not provide file management controls.
   1. Open a command prompt with administrator privileges.
   2. Go to C:\Program Files\Qlik\Sense\Logging.
   3. Run Qlik.Logging.Service.exe update --archive_age x (where x is the number of days).
   4. Run Qlik.Logging.Service.exe update --purge_age x (where x is the number of days).
   5. Restart the Qlik Logging Service.

b. Set a maximum database size so that the Qlik Logging Service can automatically trim older rows out of the database to maintain overhead.
   1. Open a command prompt with administrator privileges.
   2. Go to C:\Program Files\Qlik\Sense\Logging.
   3. Run Qlik.Logging.Service.exe update --maximum_db_size_in_gb x (where x is the size in GB).
   4. Restart the Qlik Logging Service.

**Qlik logging service database urgently needs to be reduced in size**

**Possible cause**

The database admin has identified an immediate need to clear space.

**Proposed action**

The database admin can use the manual purge option offered through the Qlik Logging Service.

Do the following:

1. Open a command prompt with administrator privileges.
2. Go to C:\Program Files\Qlik\Sense\Logging.
3. Run Qlik.Logging.Service.exe archive --cutoff x --hours (where x is the number of hours).
4. Run Qlik.Logging.Service.exe purge --cutoff x --hours (where x is the number of hours).
5. If presented with a message stating the system is too busy, retry the command.
6. If the second try generates the same message, try again at a less busy time on the server.
7. Restart the Qlik Logging Service.

**Logging issues when trying clean up the database**

**Possible cause**

The size of the Qlogs database has grown too large and the database admin is having resource issues when trying to clean up the database.

**Proposed action**

Shut off database logging to clean up the storage problem.
3 Deploying Qlik Sense Enterprise on Windows

This solution should only be used as a last resort. All purges are permanent.

Do the following:

1. In Windows, open **Services**.
2. Stop the following services:
   - Qlik Sense Engine Service
   - Qlik Sense Proxy Service
   - Qlik Sense Scheduler Service
   - Qlik Sense Repository Service
3. Open a command prompt with administrator privileges.
4. Go to `C:\Program Files\Qlik\Sense\Logging`.
5. Run `Qlik.Logging.Service.exe archive --cutoff_in_hours X` (where X is the number of hours).
6. Run `Qlik.Logging.Service.exe purge --cutoff_in_hours X` (where X is the number of hours).
7. Restart the Qlik Logging Service.
8. Verify the reclaimed data storage.
9. Start all stopped Qlik Sense services, beginning with the Qlik Sense Repository Service.

**Upgrade fails with message "Qlik Sense Superuser password validation failure"**

When upgrading Qlik Sense 3.2 or earlier to June 2017 or later, the installation fails and you get the following error message: "Qlik Sense Superuser password validation failure". Despite using the correct password, you get the same error every time you attempt the upgrade.

**Possible cause**

The upgrade failed because you entered an incorrect superuser or repository password during the first upgrade attempt.

Although you inserted an incorrect password, you were still able to create the PostgreSQL 9.6 version of the database, and the wrong password was registered in the settings. Therefore, later upgrade attempts will fail because the passwords in PostgreSQL 9.6 no longer match.

**Proposed action**

Delete the `c:\ProgramData\Qlik\Sense\Repository\PostgreSQL\9.6` folder and try running the upgrade procedure again. Make sure you enter the correct password.

**Failed to remove soft deleted records**

When upgrading Qlik Sense to November 2017 or later, the installation fails and you get the following error message: "Failed to remove soft deleted records. An exception was thrown while invoking the constructor 'Void .ctor()' on type 'DatabaseContext'".
3 Deploying Qlik Sense Enterprise on Windows

Possible cause

The database contains soft deleted records that generate an error when upgrading to a version of Qlik Sense without soft deletes, that is, November 2017 or later.

Proposed action

Run a script to delete the soft deleted records.

WARNING: Back up the whole QRS database before executing the script. If an error occurs, restore the backup, find out the data discrepancy, fix the issue and execute again, see Backup and restore Qlik Sense Enterprise on Windows (page 150).

Do the following:

1. Stop all the services, except the Qlik Sense Repository Database.
2. Save the script below to a file as recurse_cleanup.sql.
3. Move the file recurse_cleanup.sql to %ProgramFiles%\Qlik\Sense\Repository\PostgreSQL\<database version>\bin.
4. Open a command prompt with elevated privileges.
5. Navigate to %ProgramFiles%\Qlik\Sense\Repository\PostgreSQL\<database version>\bin, for example: cd "C:\Program Files"\Qlik\Sense\Repository\PostgreSQL\9.6\bin.

   If you installed PostgreSQL manually, the location where to place and run the script from will be: %ProgramFiles%\PostgreSQL\<database version>\bin.

6. Run \psql.exe -h localhost -d QSR -U postgres -p 4432 -a -f recurse_cleanup.sql
7. If prompted, enter database superuser password.
8. Restart Qlik Sense Service Dispatcher, then start the Qlik Sense Repository Service in the given order.

If running the script on a non-English OS, you may encounter errors during the script execution. The errors can be caused by the character set conversion between server (PostgreSQL) and client (Powershell). To enable automatic character set conversion, run the following command from the command prompt before opening Powershell and executing the script: SET PGCLIENTENCODING=UTF-8. The variable is lost the moment the command prompt is closed. For more information refer to Character Set Support.

Script for deleting soft deleted records in the Qlik Sense Repository Database

```sql
/*

Script Name: Recurse cleanup
Description: the script is intended to delete all entities marked as soft deleted in the QRS database
Caution: BACKUP the whole QRS database before executing the script!
*/
```
Deploying Qlik Sense Enterprise on Windows

```sql
-- Step 1. Update records according to QRS special logics

-- Step 1.1 Get all Qlik Sense Tables
CREATE OR REPLACE FUNCTION get_all_sense_tables() RETURNS SETOF information_schema.tables AS $BODY$
BEGIN
    RETURN QUERY SELECT *
    FROM information_schema.tables
    WHERE table_schema='public'
    AND table_type='BASE TABLE'
    AND table_catalog='QSR'
    AND table_name <> '__MigrationHistory';
END;
$BODY$
LANGUAGE plpgsql;

-- Step 1.1.2 Filter Qlik Sense Tables with name of column
CREATE OR REPLACE FUNCTION get_tables(columnname varchar) RETURNS SETOF information_schema.columns AS $$
BEGIN
    RETURN QUERY SELECT DISTINCT *
    FROM information_schema.columns as isc
    WHERE isc.column_name = columnname
    AND isc.table_name IN (SELECT ts.table_name FROM get_all_sense_tables() as ts);
END $$
LANGUAGE plpgsql;

-- Step 1.1.3 Change ownership of soft deleted users to sa_repository
CREATE OR REPLACE FUNCTION fix_orphanOwners() RETURNS void AS $BODY$
DECLARE
    username character varying;
DECLARE
    tables CURSOR FOR
        SELECT * FROM get_tables('Owner_ID');
BEGIN
    SELECT E'\'sa_repository'' INTO username;
    FOR table_record IN tables LOOP
        EXECUTE 'UPDATE '' || table_record.table_name || '' SET "Owner_ID" = (SELECT "ID" FROM "Users" WHERE "UserId" = ' || username || ') WHERE "Owner_ID" IN (SELECT "ID" FROM "Users" WHERE "Deleted" = true)';
    END LOOP;
END
$BODY$
```
3  Deploying Qlik Sense Enterprise on Windows

```sql
LANGUAGE 'plpgsql';

SELECT * FROM fix_orphan_owners();

-- Step 1.1.4 Remove created DB functions for fixing ownership relations
DROP FUNCTION fix_orphan_owners();
DROP FUNCTION get_tables(columnname varchar);
DROP FUNCTION get_all_sense_tables();

-- Step 1.2 Unpublish App if Steam is deleted
UPDATE "Apps"
    SET "Stream_ID" = null, "Published" = false
WHERE "Stream_ID" IN (SELECT "ID" FROM "Streams" where "Deleted" = true);

UPDATE "AppObjects"
    SET "Approved" = false, "Published" = false
WHERE "App_ID" IN (SELECT "ID" FROM "Apps" where "Published" = false);

/* Step 2. Prepare for deletion: Alter foreign keys to Casacade Delete

####################################################################################################
#########################
*/
CREATE TABLE temp_foreign_key (  
    constraint_name VARCHAR,
    table_name VARCHAR,
    column_name VARCHAR,
    ref_table_name VARCHAR,
    ref_column_name VARCHAR
);

INSERT INTO temp_foreign_key (constraint_name, table_name, column_name, ref_table_name, ref_column_name)  
SELECT fk.constraint_name, child.table_name, child.column_name, parent.table_name, parent.column_name  
FROM information_schema.referential_constraints fk  
    JOIN information_schema.key_column_usage AS child ON fk.constraint_name = child.constraint_name  
    JOIN information_schema.key_column_usage AS parent ON fk.unique_constraint_name =  
    WHERE fk.constraint_schema = 'public'  
    AND child.position_in_unique_constraint = parent.ordinal_position  
    AND fk.delete_rule = 'NO ACTION';

-- Step 2.2 Create a function the replace foreign keys with new on DELETE option
CREATE OR REPLACE FUNCTION replace_foreign_key (new_option VARCHAR) RETURNS void AS  
$BODY$
DECLARE  
    fks CURSOR FOR  
        SELECT * FROM temp_foreign_key;  
BEGIN  
    FOR rec IN fks LOOP  
        EXECUTE 'alter table "' || rec.table_name || '" drop constraint "' || rec.constraint_name || '"';  
        EXECUTE 'alter table "' || rec.table_name || '" add constraint "' || rec.constraint_name || '" FOREIGN KEY ("' || rec.column_name || '")'  
    END LOOP;

END
$BODY$
DECLARE
```

Plan and deploy Qlik Sense - Qlik Sense, June 2019 271
3 Deploying Qlik Sense Enterprise on Windows

REFERENCES "'" || rec.ref_table_name || "'" || rec.ref_column_name || "'" || new_option || ';
     END LOOP;
END;
$BODY$
LANGUAGE plpgsql;

-- Step 2.3 execute the function to replace all foreign keys with CASCADE on Delete
SELECT *
FROM replace_foreign_key('on delete cascade');

/* Step 3. Delete entities marked as Soft Deleted

####################################################################################################
##########################
*/
-- 3.1 Create a function to delete all SoftDeleted records
CREATE OR REPLACE FUNCTION delete_softdeleted_records(keep_for_days int) RETURNS void AS
$BODY$
DECLARE
   entity_tables CURSOR FOR
      SELECT table_name
      FROM information_schema.columns
      WHERE table_schema='public'
      AND column_name='Deleted';
BEGIN
   FOR tbl IN entity_tables LOOP
      EXECUTE 'delete from "'||tbl.table_name||'" where "Deleted" = true and "ModifiedDate" <= CURRENT_DATE - '|| keep_for_days || '';
   END LOOP;
END;
$BODY$
LANGUAGE plpgsql;

-- Step 3.2 execute the function to delete entities
SELECT *
FROM delete_softdeleted_records(3);

/* Step 4. Resume foreign keys to No Action on Delete

####################################################################################################
##########################
*/
SELECT *
FROM replace_foreign_key('');

/* Step 5. Drop temp objects

####################################################################################################
##########################
*/
DROP FUNCTION delete_softdeleted_records(keep_for_days int);
DROP FUNCTION replace_foreign_key(new_option varchar);
DROP TABLE temp_foreign_key;
The Qlik Sense Mobile app encounters a network error and must close

**Possible cause**

If your Qlik Sense Mobile app was deployed using the VMware Tunnel for per-app VPN security, and the per-app VPN is later disabled in the iOS **Settings**, the following error will appear the next time the Qlik Sense Mobile app is launched:

**The Qlik Sense Mobile app has encountered a network error and must stop. Restart the mobile app.**

**Proposed action**

Ensure that the VMware Tunnel is enabled on your device.

Do the following:

1. On your iOS device, go to **Settings > VPN > VMware Tunnel > Connect On Demand** and toggle it on.
4 Deploying Qlik Sense Enterprise on Kubernetes

As part of a Qlik Sense Enterprise Multi-Cloud deployment, you can install Qlik Sense Enterprise on Kubernetes. This is an implementation of Qlik Sense Enterprise running on a Kubernetes cluster using containers. This approach allows deployments into Kubernetes clusters running in public or private clouds on customer managed infrastructures.

Before you install:

- Have your license key available with the capabilities enabled.

You will need to contact Qlik to obtain an updated LEF to enable your Qlik Sense Enterprise on Kubernetes.

- Check that your environment meets the system requirements. You need a running Kubernetes cluster to install.

4.1 Installation and configuration

An implementation of Qlik Sense Enterprise on Kubernetes can vary depending on the configuration required. The following pages detail how to perform a basic installation followed by additional pages on the key elements required to do a production implementation:

4.2 Before you install Qlik Sense Enterprise on Kubernetes

To successfully plan and prepare for your Qlik Sense Enterprise on Kubernetes deployment, do the following:

System requirements for Qlik Sense
Check that your environment fulfills the system requirements.

Supported browsers
Check that your browsers are supported.

Services
Understand the Qlik Sense services.

Licensing Qlik Sense
Understand how Qlik Sense uses license keys and LEF for site licensing.
Understand how Qlik Sense uses tokens for user access allocation (token-based licensing).
Ensure that you have your Qlik Sense license key available.

Qlik Sense installation
Once you have reviewed and completed these items, you are ready to install Qlik Sense.
System requirements for Qlik Sense Enterprise on Kubernetes

This section lists the requirements that must be fulfilled by the target system in order to successfully install and run Qlik Sense Enterprise on Kubernetes.

The Kubernetes environment must have Internet access to the Qlik Helm and Container Image repository.

Kubernetes service vendors:
- Microsoft Azure using Azure Kubernetes Service (AKS)
- Amazon Web Services (AWS) using Amazon Elastic Container Service for Kubernetes (EKS)
- Amazon Web Services (AWS) deployed via Kubernetes Operations (KOPs)
- Google Cloud using Google Kubernetes Engine (GKE)
- Red Hat OpenShift 4+

Non-managed Kubernetes deployments:
- Kubernetes 1.10.x+

Kubernetes package manager
- Helm v2.12.0+
- Windows: Minikube v0.33 +

Local/Evaluation/Test environment
- Red Hat MiniShift v1.21.0+
- Mac: Docker for Desktop with Kubernetes enabled: v2.0.0.3

Database
- MongoDB 3.6+

File system
- Storage attached to the cluster that supports ReadWriteMany. This can be configured as a Storage Class or a Persistent Volume Claim

Processors (CPUs)
- Minimum 4 cores (additional depending on data volumes)

Memory
- Minimum 8 GB (additional depending on data volumes)

Disk space
- 5 GB total required to install

IDP
- For user authentication an OIDC compatible IDP is required

Supported browsers in Qlik Sense Enterprise on Kubernetes

Qlik Sense is designed to work on the platform and web browser combinations described in this section, using default browser settings.

Each Qlik Sense release is tested for compatibility with the latest publicly available browser versions. Due to the frequency of browser version updates, Qlik does not include specific browser version numbers in the system requirements.
4 Deploying Qlik Sense Enterprise on Kubernetes

Each Qlik Sense release is compatible with and supported on the latest iOS versions that are publicly available at the time of the Qlik Sense release. Due to the frequency of iOS version updates, Qlik does not include specific iOS version numbers in the system requirements.

Microsoft Windows 7
- Microsoft Internet Explorer 11
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)

Microsoft Windows 8.1
- Microsoft Internet Explorer 11
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)

Microsoft Windows 10
- Microsoft Edge
- Microsoft Internet Explorer 11
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)

Apple Mac OS X 10.11 and 10.12
- Apple Safari 10 or later
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments).

Microsoft Windows Server 2012 R2
- Microsoft Internet Explorer 11
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)

Microsoft Windows Server 2016
- Microsoft Internet Explorer 11
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)

CefSharp embedded browser v55 or later (CefSharp allows you to embed the Chromium open source browser inside .Net apps)

Microsoft Windows Server 2019
- Microsoft Internet Explorer 11
- Google Chrome
- Mozilla Firefox (requires hardware acceleration, not supported in virtual environments)

CefSharp embedded browser v55 or later (CefSharp allows you to embed the Chromium open source browser inside .Net apps)
iOS
Version 11.2 or later (script editing is not supported on tablet devices).

Qlik Sense version: Qlik Sense Enterprise September 2017 or later.

Supported devices:
- iPad Air or later
- iPhone 5S or later

Supported browsers:
- Apple Safari
- Google Chrome
- VMware browser (using AirWatch per-app VPN)
- BlackBerry Access 2.9.1 or later (using BlackBerry Dynamics platform)

iOS 11.3 is required for using BlackBerry Access browser.

Android
Version 6.0, 7.1, 8.1 and 9.0 (script editing is not supported on tablet devices):
- Google Chrome
- BlackBerry Access 2.9.1 or later (using BlackBerry Dynamics platform)

Windows 10 phone
- Microsoft Edge

Minimum screen resolution for desktops and laptops is 1024x768; tablets is 1024x768; small screens is 320x568.

Multi-cloud services
You have several options when deploying a Qlik Sense Enterprise on Windows environment. For an overview of the Qlik Sense multi-cloud architecture and your different deployment options, see Deploying Qlik Sense Enterprise in a multi-cloud environment (page 304). The services that you need to run in a multi-cloud deployment can be categorized as follows.

Typically the services running in a QCS deployment are similar to those running in a Qlik Sense Enterprise on Kubernetes deployment but are not accessible, because Qlik manages the infrastructure. You can connect to QCS SaaS but do not have the same configuration options as a Kubernetes deployment.

Services on Windows deployments
The services listed below are required if you use the multi-cloud capabilities in a Qlik Sense Enterprise on Windows deployment.
# 4 Deploying Qlik Sense Enterprise on Kubernetes

## Services

<table>
<thead>
<tr>
<th>Service</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>App Distribution Service</td>
<td>Distributes apps and associated metadata to defined distribution targets, based on policy-based app distribution rules.</td>
</tr>
<tr>
<td>Hybrid Deployment Service</td>
<td>Stores configuration details including credentials and URLs for all target environments in a multi-cloud deployment.</td>
</tr>
<tr>
<td>Hybrid Setup Console Service</td>
<td>Multi-cloud Setup Console UI functions for managing target environments configured in a multi-cloud deployment including credentials and service URLs.</td>
</tr>
<tr>
<td>Resource Distribution Service</td>
<td>Publishes installed extensions and themes to the Resource Library in each cloud environment.</td>
</tr>
</tbody>
</table>

## Services on Kubernetes and Qlik Cloud Services deployments

The services that you run in Qlik Sense Enterprise on Kubernetes can vary depending on your deployment requirements.

<table>
<thead>
<tr>
<th>Service</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronos</td>
<td>Scheduler back end service.</td>
</tr>
<tr>
<td>Cloud hub</td>
<td>Serves the hub functionality to users in Qlik Cloud Services and Qlik Sense Enterprise on Kubernetes.</td>
</tr>
<tr>
<td>Collections</td>
<td>Organizes and structures content supplied to the hub. It also applies access control rules.</td>
</tr>
<tr>
<td>datafiles</td>
<td>Allows user to upload/manage data files that can be accessed during reload of an app.</td>
</tr>
<tr>
<td>edge-auth</td>
<td>Service that works together with external Identity Providers to authenticate users upon entry to the deployment. Also manages tickets that authorize secure access to internal resources.</td>
</tr>
<tr>
<td>elastic-infra</td>
<td>A collection containing non-Qlik services: MongoDB, Redis, and nginx-ingress. It bootstraps an elastic-infra deployment on a Kubernetes cluster using the Helm package manager. It starts up the basic resources needed to connect all the components and functionality required in a cloud environment.</td>
</tr>
<tr>
<td>Engine</td>
<td>Handles all application calculations and logic.</td>
</tr>
<tr>
<td>Feature Flags</td>
<td>Responsible for toggling features on and off in advanced scenarios.</td>
</tr>
<tr>
<td>Insights</td>
<td>REST service for the functionality behind the “Share” dialog on a sheet. The service is responsible for sharing Qlik Sense insights by generating, tracking and serving persistent permalinks to the shared resources. Permalinks can be shared in various social media.</td>
</tr>
<tr>
<td>Licenses</td>
<td>The license service is used to enforce user licensing in Qlik Cloud Services and Qlik Sense Enterprise on Kubernetes.</td>
</tr>
</tbody>
</table>
## 4 Deploying Qlik Sense Enterprise on Kubernetes

<table>
<thead>
<tr>
<th>Handles user locale selection for the client.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides a discovery service for Engines in the deployment, their current health, and availability of applications.</td>
</tr>
<tr>
<td>Service for on-demand app generation of Qlik Sense apps.</td>
</tr>
<tr>
<td>Processes a set of rules on Qlik Cloud Services and Qlik Sense Enterprise on Kubernetes that perform ABAC security evaluation against Qlik objects (for example, apps). It is sometimes referred to as the Rules Service. It uses a REST API for the rules engine and management API for rule based policies and replaces the QRS Rules Engine, Policy Decision Service.</td>
</tr>
<tr>
<td>Handles engine requests for connection management.</td>
</tr>
<tr>
<td>Responsible for routing user session traffic to the Engine services.</td>
</tr>
<tr>
<td>Implements the productions of Reports with data and chart images.</td>
</tr>
<tr>
<td>A general-purpose resource storage service for supporting content such as themes and extensions.</td>
</tr>
<tr>
<td>Used to store and return tenant (user) information.</td>
</tr>
<tr>
<td>Manages resources that are made available temporarily.</td>
</tr>
<tr>
<td>Responsible for managing and retrieving user information.</td>
</tr>
<tr>
<td>The Desktop and web browser instance of the Qlik Sense client run by developers on Qlik Sense Enterprise and by consumers on QCS and Qlik Sense Enterprise on Kubernetes.</td>
</tr>
</tbody>
</table>

### 4.3 Preparing for Qlik Sense Enterprise on Kubernetes

Qlik Sense Enterprise on Kubernetes is deployed to a Kubernetes cluster in the form of a set of container images in a package provided as a Helm chart. To be able to install, the following items are required to be in place as a minimum (also refer to the system requirements for more details).

- A running Kubernetes cluster – this can be run locally for development purposes or deployed to cloud vendors including AWS, Google Cloud and Azure.
- The Kubernetes cluster must have access to file storage to persist data. This should be provided as a Storage Class that allows `readwritemany` access. You will need the name of this Storage Class when installing.
- You also require a license key for Qlik Sense Enterprise and this must be in the signed license key format. A serial number and control number cannot be used. Contact Qlik support if you do not have this version of your license.

The Qlik documentation does not cover the installation and configuration of a Kubernetes cluster and you should review the documentation for this at either [https://Kubernetes.io](https://Kubernetes.io) or for the cloud vendor or product you are using.
You will also need the following tools installed on your local machine to interact with your Kubernetes environment, issue commands and deploy software:

- **Kubectl** - Install kubectl on the machine you will run admin commands from. You can find further details for your operating system at [https://Kubernetes.io](https://Kubernetes.io).

  *This can point to different clusters if you have more than one. Ensure that the commands go to the right Kubernetes instance.*

- **Helm** - Helm is a package manager built for Kubernetes. It has a concept known as charts, used to define what services are required, what images are used, and default settings when the run in the Kubernetes cluster. It is used to push the Qlik Sense package into Kubernetes and relies on kubectl, so it must be installed on the same machine as kubectl. Qlik uses helm to define a default chart to make deployments simple for customers.
  
  To install Helm on your local machine follow the instructions for your operating system at [https://docs.helm.sh/](https://docs.helm.sh/).

### Preparing your local tools

Once you have set up your Kubernetes cluster, you must prepare your local tools to work with your Kubernetes cluster. To prepare your local tooling you must:

- Bind kubectl to your Kubernetes cluster
- Add Qlik's helm chart repository
- Initialize helm to work with your Kubernetes cluster

Before you begin you should have the following installed on your local machine:

- **Kubectl**
- **Helm**

To bind kubectl to your Kubernetes cluster:

1. Verify that kubectl is pointing to your Kubernetes cluster using the following command:
   ```
kubectl config current-context
   ```
2. If kubectl is not pointing to your Kubernetes cluster, use the following command to get a list of available clusters:
   ```
kubectl config get-clusters
   ```
3. Set the kubectl to point to the desired cluster using the following command:
   ```
kubectl config set-cluster <cluster-name>
   ```

To add Qlik's helm chart repository:

1. Run the following command to add Qlik's helm chart repository to Helm. This is where Qlik Sense is pulled from:
   ```
helm repo add qlik https://qlik.bintray.com/stable
   ```
2. Use the following command to get a list of all configured repositories and verify that the Qlik helm chart repository was successfully added:
   ```
helm repo list
   ```
4 Deploying Qlik Sense Enterprise on Kubernetes

To use helm to with your Kubernetes cluster it needs to be initialized to create the helm Tiller pod that handles installations:

1. The following command is used to do this in simple cases
   To use helm to deploy into Kubernetes, the helm Tiller pod is added to the Kubernetes cluster first.
   The following command is used to do this in simple cases:
   ```
   helm init --wait
   ```

2. If the Kubernetes cluster has security features such as RBAC enabled then the following commands should be run in addition:
   ```
   kubectl create serviceaccount --namespace kube-system tiller
   kubectl create clusterrolebinding tiller-cluster-rule --clusterrole=cluster-admin --serviceaccount=kube-system:tiller
   ```
   ```
   helm init --upgrade --wait
   kubectl patch deploy --namespace kube-system tiller-deploy -p '{"spec":{"template":{"spec":
   "serviceAccount":"tiller"}}}'}
   ```

4.4 Installing Qlik Sense Enterprise on Kubernetes

Once you have set up your Kubernetes cluster and prepared your local tools, you are ready to install Qlik Sense Enterprise into your Kubernetes cluster.

To recap, as a minimum before you install you will have:

- Set up a Kubernetes cluster and added a Storage Class with readwritemany storage
- Prepare your local tools to work with your Kubernetes cluster

The steps below cover the steps to install a first simple install. This includes deploying a test instance of MongoDB and a simple IDP to get you running. To move it to a production ready state, you should review the additional topics for the following areas:

- Understanding and configuring an IDP to authenticate users
- Configuring a separate MongoDB instance
- Viewing and handling logs

Providing configuration settings

When installing Qlik Sense Enterprise on Kubernetes you can specify settings to the installer in two ways:

- As parameters in the helm install command.
- Referencing the settings in a values.yaml and using this in the helm install command.

Storing the configuration settings in a values.yaml allows you to reuse the settings in multiple deployments and add new config sections simply. This can also be version controlled.

Use of a values.yaml file will be used predominately in the Qlik help. You can find more information about YAML files online on sites such as [https://en.wikipedia.org/wiki/YAML](https://en.wikipedia.org/wiki/YAML).

Installing Qlik Sense

Complete the following steps to install Qlik Sense:
1. Create a text file called **values.yaml**.
   a. Add the following content to the file:
      ```yaml
      # This setting enables dev mode to include a local MongoDB install
      devMode:
        enabled: true

      # This setting accepts the EULA for the product engine:
      acceptEULA: "yes"
      ```
      
      *If devMode.enabled is set to true, a MongoDB instance is deployed inside of your Qlik Sense Enterprise on Kubernetes in Kubernetes for development and testing purposes only.*

   b. Add the following content to point the services requiring storage to the Kubernetes Storage Class, update the name of the Storage Class as needed.
      ```yaml
      # These settings specify the storage for the services
      global:
        persistence:
          storageClass: my-storage-class
      ```
      
      *If you are using Kubernetes via Docker for Desktop or Minikube then you should not add this section.*

   c. If you are using Minikube for test purposes, you should review and add the additional configuration here: *Using Minikube (page 283).*

   d. Save the file.

2. Qlik Sense will dynamically create engines to run scheduled reloads. To be able to do this, the engine needs to be configured in Kubernetes as a custom resource. This step only needs to be done once for a cluster. Run the following command to install custom resource definitions used by dynamic engines:
   ```bash
   helm install --name qliksense-init qlik/qliksense-init
   ```

3. The next step is to install the Qlik Sense package. Run the following command:
   ```bash
   helm install -n qliksense qlik/qliksense -f values.yaml
   ```
   The software now starts deploying to the Kubernetes cluster, including downloading all the images and running them.

4. You can now use `kubectl` to check the progress. Run the following command:
   ```bash
   kubectl get pods
   ```
   If your deployment was successful you will see something similar to this:
   ```
   NAME                    READY   STATUS      RESTARTS   AGE
   qliksense-collections-7f456595b8-vjhtf   1/1       Running    0   2m
   qliksense-edge-auth-858f89b849-42z66     2/2       Running    0   2m
   ...
   ```
   *It typically takes a few minutes to initialize and show a status of "Running".*
4  Deploying Qlik Sense Enterprise on Kubernetes

If services do not start check the log files of the service for more information. If some services remain in a pending state, check that the Kubernetes cluster has readwrite many storage available as a storage class and that it is correctly referenced in the YAML.

Accessing the deployment

To connect to the hub and confirm the install you need to obtain the URL for the install inside the Kubernetes cluster. This can vary depending on the configuration and / or vendor as follows.

For most cloud vendors (for example AWS, GCP or Azure) the IP address will be generated during the installation automatically. You can find the address by running the following command:

```
kubectl describe service qliksense-nginx-ingress-controller
```

For Docker Desktop, the IP will typically be the machine loop-back address `127.0.0.1`. For Minikube, the IP can be obtained by running the command `minikube ip`.

Creating an alias to the IP address

In this simple deployment an example Identity Provider is automatically configured. This allows you to login to the hub with some sample accounts. This service will by default only listen to the URL `https://elastic.example`, it cannot be browsed to on the IP address alone. To this end you must add a Host file entry to point the IP address from above to the alias on `elastic.example`.

This step is only required when running a basic example, a production example will use a real Identity Provider during which the correct DNS entry for the cluster will be used.

The simple IdP is for test purposes only and you should configure a full IdP by reviewing Setting up identity providers (page 287).

Logging in and applying the license

You can now browse to the hub at `https://elastic.example`. You will be asked to login and you can use the sample account of `harley@qlik.example` with a password of `Password1!`.

You should now navigate to `https://elastic.example/console` to apply the license before being able to create applications. See Management console.

Using Minikube

Minikube is a test environment that allows for a Kubernetes environment to run locally on a Windows, Mac or Linux machine. It can be used to run Qlik Sense Enterprise on Kubernetes for local test purposes.

Minikube does not support the LoadBalancer resource that all other Kubernetes providers use and requires running on a different port, an additional configuration section is required when using it.
4 Deploying Qlik Sense Enterprise on Kubernetes

These additional configuration items should not be used with any other Kubernetes provider as they will not work.

Preparing Minikube

Before you start, review the installation documentation for Minikube for your operating system here: https://kubernetes.io/docs/setup/minikube/.

When you start Minikube, ensure that it has enough resources by running the following (you may need to run minikube delete first):

```
minikube start --memory 8000 --cpus=2
```

Additional configuration when using Minikube

With Minikube running, follow the installation steps in Installing Qlik Sense Enterprise on Kubernetes (page 281) but add the following additional section into values.yaml.

```
# MINIKUBE SPECIFIC SETTINGS (dont not use with other K8 providers)

elastic-infra:
  nginx-ingress:
    controller:
      service:
        type: NodePort
        nodePorts:
        https: 32443
      extraArgs.report-node-internal-ip-address: ""

hub:
  ingress:
    annotations:
      nginx.ingress.kubernetes.io/auth-signin: https://$host:32443/login?returnto=$request_uri

management-console:
  ingress:
    annotations:
      nginx.ingress.kubernetes.io/auth-signin: https://$host:32443/login?returnto=$request_uri

edge-auth:
  oidc:
    redirectUri: https://elastic.example:32443/login/callback
```

Accessing the installation on Minikube

Once it is started, you can get the IP address the Kubernetes cluster is running on with the following command:

```
minikube ip
```
Deploying Qlik Sense Enterprise on Kubernetes

When using Minikube you must specify the port 32443 in the URLs used to access the product IP, for example https://elastic.example:32443.

Installing Qlik Sense Enterprise on Kubernetes to a Red Hat OpenShift platform

To install Qlik Sense Enterprise on a Red Hat OpenShift Kubernetes platform there are a few additional considerations:

- OpenShift default namespace is `myproject`
- OpenShift typically comes with its own docker image registry. All charts now support `global.imageRegistry` so that customers can point all image pulls from their own image registry.
- OpenShift does not allow containers to run as root by default.
- OpenShift discourages cluster wide access.
- OpenShift expects services to be exposed by routes.
- OpenShift has its own certified container registry and discourages non-certified containers.
- OpenShift deployments do not typically require internet access. Qlik Sense Enterprise on Kubernetes does require internet access.

Once you have set up your Kubernetes cluster and prepared your local tools, you are ready to install Qlik Sense Enterprise into your Kubernetes cluster. See Installing Qlik Sense Enterprise on Kubernetes (page 281).

Qlik supports deployments of Qlik Sense Enterprise on Kubernetes to Red Hat OpenShift platforms, however the deployment is not currently certified by Red Hat.

Using MiniShift

To get an OpenShift platform running use MiniShift to create a virtual machine (VM) and provision a local, single-node OpenShift cluster in the VM. RedHat provides MiniShift as a simple to run OpenShift platform. MiniShift is available at https://github.com/minishift/minishift.

1. Download the latest version of MiniShift.
2. Unzip it to a directory, and add this directory to your path.
3. Install helm (mandatory) and kubectl (optional).
4. Set the resource settings for MiniShift to ensure that there are adequate resources to fully deploy Qlik Sense Enterprise on Kubernetes, using the following commands:
   
   ```bash
   minishift config set memory 8192
   minishift config set cpus 4
   ```

5. Start up MiniShift using the following command:
   ```bash
   minishift start --vm-driver=virtualbox
   ```

6. Configure your environment using the following command:
   ```bash
   minishift oc-env
   ```

7. Create a new project. A project is the OpenShift equivalent of a kubernetes namespace.
Note that in this example we use oc instead of kubectl. In most cases they do the same thing, however oc does some things that cannot be done with kubectl.

oc new-project tiller

8. Set a variable so helm knows where to find tiller.
   
   $Env:TILLER_NAMESPACE="tiller"

9. Configure the helm client.
   
   helm init --client-only

10. Installing tiller on OpenShift requires a special process. OpenShift provides a yaml file to do that. Run the following command:
    
    oc process -f https://github.com/openshift/origin/raw/master/examples/helm/tiller-template.yaml -p TILLER_NAMESPACE="$Env:TILLER_NAMESPACE" -p HELM_VERSION=v2.9.1 | oc create -f -

11. To confirm it is ready run the following command:
    
    oc rollout status deployment tiller

12. Create a project for the Qlik deployment using the following command:
    
    oc new-project qlik

13. To configure security you must log in as a system admin using the following command:
    
    oc login -u system:admin

14. Configure the security settings needed by running the following commands:
    
    oc policy add-role-to-user edit "system:serviceaccount:$(Env:TILLER_NAMESPACE):tiller"
    oc policy add-role-to-user cluster-admin "system:serviceaccount:$(Env:TILLER_NAMESPACE):tiller"
    oc adm policy add-scc-to-user anyuid "system:serviceaccount:$(Env:TILLER_NAMESPACE):tiller"
    oc adm policy add-cluster-role-to-user cluster-admin "system:serviceaccount:$(Env:TILLER_NAMESPACE):tiller"
    oc adm policy add-scc-to-group anyuid system:authenticated
    oc adm policy add-scc-to-user privileged "system:serviceaccount:$(Env:TILLER_NAMESPACE):tiller"
    oc adm policy add-cluster-role-to-user admin system:serviceaccount:qlik:default
    oc adm policy add-scc-to-user admin system:serviceaccount:qlik:default

15. Define the storage and make it writable using the following command:
    
    minishift ssh -- "sudo chmod -R o+rwx /var/lib/minishift/base/openshift.local.pv*"

16. Log in as a developer using the following command:
    
    oc login -u developer

17. Add the Qlik helm repository and update it using the following commands:
    
    helm repo add qlik https://qlik.bintray.com/stable
    helm repo update

18. You can now deploy Qlik Sense Enterprise on Kubernetes using the minishift.yaml file.
    
    helm upgrade --install qsefe qlik/qsefe --set devMode.enabled=true,engine.acceptEULA="yes" -f C:\dev\minishift.yaml

19. To monitor deployments you can run kubectl get pods, or oc get pods.
4.5 Setting up Qlik Sense Enterprise on Kubernetes after installation

This section guides you through the process of setting up your Qlik Sense Enterprise on Kubernetes site after installing. You can configure the server to fit with your organization’s particular needs. Below are the common tasks most deployments will require.

An implementation of Qlik Sense Enterprise on Kubernetes can vary depending on the configuration required. The following pages detail on the key elements required to do a production implementation:

- Distributing apps to Qlik Sense Enterprise on Kubernetes (page 287)
- Setting up identity providers (page 287)
- Configuring certificates in your Qlik Sense Enterprise on Kubernetes deployment (page 301)
- Configuring MongoDB in Qlik Sense Enterprise on Kubernetes (page 302)

Distributing apps to Qlik Sense Enterprise on Kubernetes

Once you have Qlik Sense Enterprise on Kubernetes running, you can distribute apps into it from your Qlik Sense Enterprise on Windows deployment. To distribute apps, complete the following steps:

1. Create a Deployment in the Multi-cloud Setup Console on your Qlik Sense Enterprise on Windows deployment.
   See Multi-Cloud Setup Console - start page and MSC - Deployments.
2. Create a distribution policy to decide which applications should be distributed.
   See Distribution policies - introduction.
3. Publish the application setting the collection, userswithaccess or groupswithaccess properties on the app.
   See Publishing apps to cloud hub collections.

Once you have distributed the apps, you will be able to open them from the hub.

Setting up identity providers

An identity provider (IdP) manages identity information for users and provides authentication services. The identity provider enables single sign-on (SSO) so that you can access other websites, without having to log in repeatedly. In contrast to on-premise technologies, such as Active Directory and LDAP, identity providers also offer a consistent and governed experience when accessing cloud services, eliminating the need to create accounts for each new service.

If user accounts are stored in Active Directory, the IdP can still enable integration into cloud software.

In Qlik Sense Enterprise on Cloud Services, Qlik Sense Enterprise on Kubernetes or in a multi-cloud deployment, an IdP delivers the following:
4 Deploying Qlik Sense Enterprise on Kubernetes

- Secure authentication of a user and a common identity (user ID and groups) passed between all deployments.
- Common user identity to assign a license to (to avoid double use).
- Common user ID and attributes, such as groups, to use when applying access control to content.

*Example: IdPs in a multi-cloud deployment*

**IdP requirements**

Both Qlik Cloud Services and Qlik Sense Enterprise on Kubernetes integrate with an IdP using the OpenID Connect (OIDC) standard. This is a standard that allows both interactive login, where a user logs in via a browser, and automated login, using APIs via a software product.

Qlik Sense Enterprise on Windows currently does not support OIDC, but supports SAML, or any method that allows a consistent user identity to the one provided by the IdP.

*In summary, an IdP for multi-cloud must support both OIDC and SAML.*

The following is required from the IdP to be able to set up Qlik Sense Enterprise on Kubernetes to use it:

- **discoveryUrl**: the OpenID Connect Discovery URL which allows applications, such as Qlik Sense, to use the IdP with minimal configuration.
- **clientId**: uniquely identifies the client from the IdP.
- **clientSecret**: the secret that the client uses along with the client ID to authentication with the IdP.
- **realm**: the name to associate with the IdP.
- **hostname**: the hostname that is used for the deployment of Qlik Sense Enterprise on Kubernetes.

These values are added to the `values.yaml` file under the identity-providers section when installing Qlik Sense Enterprise on Kubernetes.

Step-by-step examples of this configuration are provided for the following IdP vendors:
4 Deploying Qlik Sense Enterprise on Kubernetes

- Okta
  See Setting up Okta.
- Auth0
  See Setting up Auth0.
- ADFS
  See Setting up ADFS.

Setting up ADFS

ADFS is an authentication and authorization platform.

You can configure ADFS as an identity provider (IdP) for use with Qlik Sense Enterprise on Kubernetes (QSEoK) and Qlik Sense Enterprise on Windows (QSEfW). You will create an application group, a server application, and a Web API to be used for interactive login (QSEoK). You will also map claims from Active Directory to the ID token.

Creating required ADFS resources for QSEoK for interactive logins

For setting up ADFS, you need an application group and a server application.

The following procedures are examples using ADFS 10. Please review the ADFS documentation for more information and latest instructions.

Adding an application group and creating a server application

Do the following:

1. Open the Add Application Group Wizard.
2. Enter a name for the application group.
3. For Template, select Server application.
4. Click Next.
   The Server application page is opened.
5. Enter a name for the application.
   Example: 1234567890
6. Enter a client identifier for the application, and note it down, it will be used as client ID.
   Example: https://adfs.elastic.example/1234567890.

   In this example, https://adfs.elastic.example is the tenant domain and 1234567890 is a unique identifier for the application. The client identifier must be a URL. ADFS will only include custom claims in the id_token for applications with URL IDs, see Customize claims to be emitted in id_token when using OpenID Connect or OAuth with ADFS 2016.

7. For Redirect URI, set the redirect URL to the login callback for the tenant in the format https://<host>/login/callback/.
   Example: https://adfs.elastic.example/login/callback
8. Optionally, enter a description.
9. Click Next.
Deploying Qlik Sense Enterprise on Kubernetes

The Configure Application Credentials page is opened.

10. Select **Generate a shared secret**. Note down this secret, you will not have access to it again. You will use it as client secret.

11. Finish the wizard.

Adding a web API to the application group

You will add a web API to the application group that you created.

Do the following:

1. Open the application group you created earlier.
2. Select **Add application > Web API**.
3. Add the client ID from the application group as in identifier.
4. Click **Next**.
   The Choose Access Control Policy page is opened.
5. Apply a policy and click **Next**.
   The Configure Application Permissions page is opened.
6. For **Permitted scopes**, select the following: `allatclaims`, `email`, `openid`, and `profile`.
7. Finish the wizard.

Configure claims for the `id_token`

Do the following:

1. Open the application group to edit the web API you created. Open the **Issuance Transform Rules** tab.
2. Create a rule from the rule template **Send LDAP Attributes as Claims**.
3. Select **Active Directory** as the attribute store.
4. Add claims mappings. You may need to type the outgoing claim.
5. Map **Token-Groups - Unqualified Names to groups**.
6. Map **Display-Name to display_name**.
7. Finish the claims mapping.

Using ADFS as an IdP for Qlik Sense Enterprise on Kubernetes

You can use ADFS as an identity provider for logging into a Qlik Sense Enterprise on Kubernetes tenant using a user from ADFS.

Connecting Qlik Sense Enterprise on Kubernetes with ADFS

Before you start, make sure you have the following:

- ADFS installation
- the required resources configured in ADFS
- Configuration settings from your ADFS application: `discoveryUrl`, `clientId`, and `clientSecret`
- The following values from your hybrid deployer: public key, key ID, and issuer.
Deploying Qlik Sense on Kubernetes

Many of the code examples contain placeholder values that need to be replaced by your own values.

You provide configuration to Qlik Sense Enterprise on Kubernetes by using a `values.yml` file. The `values.yml` file should look like the following example:

```yaml
devMode:
  enabled: true

engine:
  acceptEULA: "yes"

identity-providers:
  secrets:
    idpConfigs:
      - discoveryUrl: "https://adfs-host/adfs/.well-known/openid-configuration"
        clientId: "https://adfs.elastic.example/1234567890"
        clientSecret: "<client secret>"
        realm: "ADFS"
        hostname: "adfs.elastic.example"
        useClaimsFromIdToken: true
        claimsMapping:
          sub: ["sub", "appid"]
          client_id: "appid"
          name: "display_name"
    issuerConfig:
      issuer: https://the-issuer
      primary: false
      realm: "ADFS"
      hostname: "adfs.elastic.example"
      staticKeys:
        - kid: "thekid"
          pem: |
          -----BEGIN PUBLIC KEY-----
          MHYWEAAYHoZ2z3j0CAQQF4EEACIDYgAE5MxQjXXrvq0KSAREIQxs9Q7+/aetjEboUv8t8/cf73ad56cb4QDhtHAL7vJ4MUPALJ9imDmVq5o9b1j5zO16Rt1gLdVd
          nqstc+P4tyxqGadiT3AOU3jka7jYgHA
          -----END PUBLIC KEY-----
```

It is important to note that the `userClaimsFromIdToken` flag is set to true. The flag instructs edge-auth to use the claims from the ID token instead of querying for userinfo. This is because ADFS returns very little in the userinfo response and instead includes most information in the ID token.

You will have to insert your own values for `discoveryUrl`, `clientId`, `clientSecret`, `realm` and `hostname`.

Applying the configuration to your cluster

Use Helm (see https://helm.sh/) to apply the configuration in your `values.yml` file to your Kubernetes cluster:

```bash
$ helm upgrade
  --install
  qliksense qlik/qliksense
  -f values.yml
```
4 Deploying Qlik Sense Enterprise on Kubernetes

To make sure that your configuration has been applied, you can run the `get values` command to see the resolved configuration:

```
$ helm get values qliksense
```

```yaml
devMode:
  enabled: true
engine:
  acceptEULA: "yes"
identity-providers:
  secrets:
    idpConfigs:
      - discoveryUrl: "https://adfs-host/adfs/.well-known/openid-configuration"
        clientId: "https://adfs.elastic.example/1234567890"
        clientSecret: "<client secret>"
        realm: "ADFS"
        hostname: "adfs.elastic.example"
        useClaimsFromIdToken: true
        claimsMapping:
          sub: ['sub', "appid"]
          client_id: "appid"
          name: "display_name"
    - issuerConfig:
      issuer: https://the-issuer
      primary: false
      realm: "ADFS"
      hostname: "adfs.elastic.example"
      staticKeys:
        - kid: "thekid"
          pem: |
            -----BEGIN PUBLIC KEY-----
            MIWEAYHKoZIzj0CAqyFK4ECAECDgACvMQSxOjXr7q+vqokSAREQXsr5Q7+/aetjEb
            OUHt8/cf73axS6cb4QVtHbAL5ej4MUqAL91iDmVqe58o9bJ520a16t1gjLDvd
            nqts+Cx24xgAdtIjAQj3jka7jyghA
            -----END PUBLIC KEY-----
```

Configure your hosts file

This section is only relevant if there is no DNS.

In order for `<hostname>` to resolve, add the following to your `/etc/hosts` file:

```
127.0.0.1 <hostname>
::1 <hostname>
```

Log in to your tenant

You are now set to log into your tenant with a user from your ADFS deployment. In your browser, go to `https://<tenant address>` and you should be redirected to an ADFS login page. After a successful login you reach a home page to which apps are distributed.
Setting up Auth0

Auth0 is an authentication and authorization platform.

You can configure Auth0 as an identity provider (IdP) for use with Qlik Sense Enterprise on Kubernetes (QSEoK) and Qlik Sense Enterprise on Windows (QSEfW).

Creating an Auth0 application and connection for QCS or QSEoK for interactive logins

Create an Auth0 application, and connect it to an Auth0 database connection.

An Auth0 application allows an application, (QSEfW/QCS/QSEoK), to use Auth0 for authentication. An Auth0 connection is a source of users, in this example, a database that you populate with users.

We assume that you have an Auth0 account and tenant created.

The following procedures are examples. Please review the Auth0 documentation for more information and latest instructions.

Creating a new application in Auth0

Do the following:

1. In the left menu in Auth0, open Applications.
2. Click Create application.
3. Give the application a name, select Single Page Web Applications and click Create.
4. Optionally, select your web app technology.
5. Select Settings.
6. In the box Allowed Callback URLs, add the URL to your host in the format https://<host>/login/callback/.
7. Scroll down and click Save changes.
8. Note down the Client ID value.
9. Note down the Client Secret value.
10. Scroll to the bottom and select Advanced Settings.
11. Select the Endpoints tab.
12. Note down the OpenID configuration URL for later.

Creating a database connection in Auth0

You will now create a database connection and configure your application to use this connection.

Do the following:

1. In the left menu, select Connections > Database.
2. Fill in a name for the database connection and click Create.
3. In the left menu, select Applications.
4. Open the tab **Connections**.

5. Enable the new database connection for your application.

Creating a new user (optional)

Do the following:

1. In the left menu, select **Users**.
2. Click **Create your first user**.
3. Fill in the fields and select the newly created connection.

Creating an Auth0 API and application for programmatic access

Begin by creating the API.

You set up programmatic access so that you can distribute content into Qlik Cloud Services (QCS) or QSEoK.

In Auth0, you will create a new API. In this case, the Auth0 API represents the protected QSEoK resource API. In OAuth terms, you configure Auth0 for the Client Credentials Grant flow.

Begin by creating a new API for your application.

Do the following:

1. In the left menu, select **APIs**.
2. Click **Create API**.
3. Enter an API name.
4. For **Identifier**, enter **qlik.api**.
5. Click **Create**.
6. Go to the **Scopes** tab.
7. Add a new scope with the value **any** in the name and description and click **Add**.

Just like you created an Auth0 application for interactive logins above, you will now create an Auth0 application for programmatic authentication.

Do the following:

1. In the left menu, select **Applications**.
2. Click **Create Application**.
3. Select **Machine to Machine Applications**.
4. Click **Create**.
5. Select the API created above.
6. In the **Scopes** box, select **any**.
7. Click **Authorize**.
8. Select the **Settings** tab. In the **Allowed Web Origins** box, add the URL to your deployment.
9. Note down the **Client ID** value.
10. Note down the **Client secret** value.
Deploying Qlik Sense Enterprise on Kubernetes

11. Scroll to the bottom and select Advanced Settings.
12. Click the Endpoints tab.
13. Note down the OAuth Token URL value.
   
   This value together with client ID and client secret will be used in the configuration of QSE for Windows when adding a deployment.
14. In the left menu, select APIs and open your new API. Select the Machine to Machine Applications tab.
15. Verify that your new application has access to your new Auth0 API.

Using Auth0 as an IdP for Qlik Sense Enterprise on Kubernetes

You can use Auth0 as an identity provider for logging into a Qlik Sense Enterprise on Kubernetes (QSEoK) tenant and also for interacting with the tenant programmatically.

**Connecting QSEoK with Auth0**

Before you start, make sure you have the following:

- Auth0 account
- Auth0 tenant
- Auth0 app, configured with interactive login and programmatic access
- Configuration settings from your Auth0 application: discoveryUrl, clientId, and clientSecret

Many of the code examples contain placeholder values that need to be replaced by your own values.

You provide configuration to QSEoK by using a values.yml file. The values.yml file should look like the following example:

```yaml
devMode:
  enabled: true

engine:
  acceptEULA: "yes"

identity-providers:
  secrets:
    idpConfigs:
      - discoveryUrl: "<OpenID Configuration from Application>"
        clientId: "<Client ID from Application>"
        clientSecret: "<Client Secret from Application>"
        realm: "<Name for this IdP>"
        hostname: "<Hostname for your QSEoK tenant>"
        claimsMapping:
          client_id: [ "client_id", "<id>" ]
```

You need to enter the values for discoveryUrl, clientId, clientSecret, realm, hostname, and id (claims mapping).

**Applying the configuration to your cluster**

Use Helm (see https://helm.sh/) to apply the configuration in your values.yml file to your Kubernetes cluster:

```bash
$ helm upgrade
   --install
```
4 Deploying Qlik Sense Enterprise on Kubernetes

```bash
qliksense qlik/qliksense
-f values.yml
```

To make sure that your configuration has been applied, you can run the `get values` command to see the resolved configuration:

```
$ helm get values qliksense
```

```yaml
devmode:
  enabled: true
engine:
  acceptEULA: "yes"
identity-providers:
  secrets:
    idpConfigs:
    - discoveryUrl: "https://tenant.auth0.com/.well-known/openid-configuration"
      clientId: "<client ID>"
      clientSecret: "<client secret>"
      realm: "Auth0"
      hostname: "<hostname>"
```

Configure your hosts file

*This section is only relevant if there is no DNS.*

In order for `<hostname>` to resolve, add the following to your `/etc/hosts` file:

```
127.0.0.1  <hostname>
::1  <hostname>
```

Log in to your tenant

You are now set to log into your tenant. In your browser, go to `https://<tenant address>` and you should be redirected to an Auth0 login page. After a successful login you reach a home page to which apps are distributed.

Setting up Okta

Okta is an authentication and authorization platform.

This topic presents how to set up Okta to be used with Qlik Sense Enterprise on Kubernetes (QSEoK) and Qlik Sense Enterprise on Windows (QSEfW). You can configure Okta as an identity provider (IdP) for use with QSEoK and QSEfW.

You will create the following:

- an application for interactive login (QSEoK)
- programmatic use of Okta

Creating an Okta application and user for QSEoK for interactive logins

Create an Okta application and a user. An Okta application allows an application, (QSEfW/Qlik Cloud Services (QCS)/QSEoK), to use Okta for authentication.

We assume that you have an Okta account and tenant created.
4 Deploying Qlik Sense Enterprise on Kubernetes

When you install Qlik Sense Enterprise on Windows, with Multi-Cloud, you must use a developer account for Okta, see Okta Developer.

Creating a user
Create a user in Okta. You can skip this step if you have already created users.

Do the following:

1. Fill in first name and last name.
2. **Username**: Use your email address for user name.
3. Primary email: Same as **Username**.
4. For **Password**, select **Set by admin**.
5. Enter a password for the new user.
6. Optionally, clear the selection **User must change password in first login**.

Creating a new application in Okta
Create a new application, a tenant for QSEoK from Okta.

Do the following:

1. In Okta, go to **Applications** and click **Add Application**.
2. For **Platform**, select **Web** and click **Next**.
3. Enter a name for the app.
4. Enter a base URI.
   
   *This is the IP address or server name from your QSEoK. Example: https://40.118.9.61*
5. Enter a login redirect URI.  
   As for the base URI, you use the IP address or server name from your environment. Example:  
   https://40.118.9.61/login/callback
6. In the **Grant type allowed** section, for client acting on behalf of itself, select **Client Credentials**.
7. Click **Done**.

Configuration for programmatic access
Configure Okta to support usage programmatically (in this case to support distribution to QSEoK or QCS).

Creating an Okta API resource server and application for programmatic access
In Okta, you create a new Resource Server API. In this case, the Okta Resource Server API represents the protected QSEoK resource API. In OAuth terms, you need to configure Okta for the Client Credentials Grant flow.

First, create a new Authorization Server (under the API tab) for your tenant.

Do the following:
1. In the top menu, select API.
2. Open Authorization Servers.
3. Click Add Authorization Server.
4. Fill in name, audience (must be qlik.api), and description.
5. Save the API.
6. Open the Scopes tab.
7. Click Add Scope tab.
8. Enter a name and description, and select Set as default scope.
9. Click Create.
10. Open the Access Policies tab.
11. Click Add Policy.
12. For name and description, enter Grant Clients.
13. For Assign to, keep the selection All clients.
14. Click Create Policy.
15. Click Add Rule.
16. Enter a name for the rule.
17. Clear the selections under Client acting on behalf of a user.
18. Click Create Rule.

Creating an Okta application for programmatic authentication

Just like you created an Okta application for interactive logins above, you will now create an Okta application for programmatic authentication.

Do the following:

1. In the Okta top menu, open Applications.
2. Click Add Application.
3. For Platform, select Service and click Next.
4. Enter a name for the app.
5. Click Done.

Using Okta as an IdP for Qlik Sense Enterprise on Kubernetes

You can configure Qlik Sense Enterprise on Kubernetes (QSEoK) to use Okta as an identity provider.

After completing the steps, you will be able to log into a QSEoK tenant using an Okta user name and password as well as interact with the QSEoK tenant programmatically.

We assume that you are running QSEoK on a Mac which has Kubernetes running using Docker for Mac. Also without this exact configuration, you should be able to use the same concepts if running Kubernetes in other supported ways.

Configuring QSEoK to use Okta IdP

Before you start, make sure you have the following:
Okta account
Okta tenant
Okta app, configured with interactive login and programmatic access.

Configuration settings from your Okta application:
- **discoveryUrl**: The OpenID Connect Discovery URL which allows applications, such as QSEoK, to use Okta with minimal configuration.
- **clientId**: Uniquely identifies the client that is using Okta for authentication.
- **clientSecret**: Secret that the client uses along with the Client ID to use Okta for authentication.

Many of the code examples contain placeholder values that need to be replaced by your own values.

You provide configuration to QSEoK by using a `values.yml` file. The `values.yml` file should look like the following example:

```yaml
devMode: enabled: true

engine:
  acceptEULA: "yes"

identity-providers:
  secrets:
    idpConfigs:
      - discoveryUrl: "<OpenID Configuration from Application>"
        clientId: "<Client ID from Application>"
        clientSecret: "<Client Secret from Application>"
        realm: "<Name for this IdP>"
        hostname: "<Hostname for your QSEoK tenant>"
```

You need to enter the values for `discoveryUrl`, `clientId`, `clientSecret`, `realm`, and `hostname`.

In Okta, you can find your `Client ID` and `Client secret` under the **General** tab in the **Client Credentials** section for the application you created.

**Applying the configuration to your cluster**

Use Helm (see [https://helm.sh/](https://helm.sh/)) to apply the configuration in your `values.yml` file to our Kubernetes cluster:

```
$ helm upgrade qliksense qlik/qliksense -f values.yml
```

To make sure that your configuration has been applied you can run `get values` command to see the resolved configuration:

```
$ helm get values qliksense
devMode:
  enabled: true
engine:
  acceptEULA: "yes"
identity-providers:
  secrets:
    idpConfigs:
```
**Configuring your hosts file**

*This section is only relevant if there is no DNS.*

For `<hostname>` to resolve, add the following to your `/etc/hosts` file:

```
127.0.0.1   <hostname>
::1       <hostname>
```

**Log in to your tenant**

You are now set to log into your tenant. In your browser, go to `https://<tenant address>` and you should be redirected to an Okta login page. After a successful login you reach a home page to which apps are distributed.

**Adding programmatic configuration to QSEoK**

You now need an IdP configuration to QSEoK to point to the application and authorization server created above. Note that a primary: true was added to the existing configuration you had.

```yaml
devMode:
  enabled: true

engine:
  acceptEULA: "yes"

identity-providers:
  secrets:
    idpConfigs:
      clientId: "<client ID code>"
      clientSecret : "<client secret code>"
      realm: "Okta"
      hostname: "<hostname>"
      primary: true
      primary: false
      realm: "Okta"
      hostname: "<hostname>"
      claimsMapping:
        client_id: ["client_id", "cid"]
```

Use Helm to apply the configuration in your `values.yml` file to your Kubernetes cluster:

```bash
$ helm upgrade qliksense qlik/qliksense -f values2.yml
```
4 Deploying Qlik Sense Enterprise on Kubernetes

Configuring certificates in your Qlik Sense Enterprise on Kubernetes deployment

By default, Qlik Sense Enterprise on Kubernetes is installed with a self-signed certificate that will not be trusted by users browsers. To replace this with a SSL certificate that you own, complete the steps below.

In this example, the certificate is in a file called tls.crt and the associated private key is in a file called tls.key.

Create the secret resource in Kubernetes

1. Create a file called secret.yaml which will hold the certificate and its key. See the yaml definition below for an example:

   ```yaml
   apiVersion: v1
   kind: Secret
   metadata:
     name: my-certificate
     namespace: default
   type: kubernetes.io/tls
   data:
     tls.crt: xxxxxxxxxxxxxxxxxxxx
     tls.key: xxxxxxxxxxxxxxxxxxx
   ```

2. You can give the name field a meaningful name. In this example we've use my-certificate. The tls.crt field is the base64 encoded value of your certificate. You can get this value using the following command:

   ```sh
   $ cat tls.crt | base64
   ```

3. The base64 decoded value will be displayed on the screen. Enter it for the tls.crt value in your .yaml file.

4. Do the same for the tls.key:

   ```sh
   $ cat tls.key | base64
   ```

5. Enter the resulting base64 value in your .yaml file.

6. Now create the secret resource in Kubernetes using the following command:

   ```sh
   $ kubectl apply -f secret.yaml
   ```

7. You can verify the secret has been created using the following command:

   ```sh
   $ kubectl get secret my-certificate
   ```

Configure the Ingress to use the Certificate

1. Configure the Qlik Sense ingress to use the secret created in the previous procedure by adding the following to your values.yaml file:

   ```yaml
   # References the “my-certificate” secret created within the “default” namespace
   nginx-ingress:
     controller:
       default-ssl-certificate: “default/my-certificate”
   ```

2. Update your cluster using the following command:

   ```sh
   $ helm upgrade --install qliksense qlik/qliksense -f values.yaml
   ```
Verifying the Certificate with your Browser

1. Using your browser, go to the domain you configured to verify the certificate presented by Qlik Sense’s ingress controller.

Configuring MongoDB in Qlik Sense Enterprise on Kubernetes

Qlik Sense Enterprise on Kubernetes uses MongoDB as a database for persisting content for several services (excluding Qlik Sense app files).

By default, a pre-configured MongoDB Community Edition is added during the installation of Qlik Sense Enterprise on Kubernetes (QSEoK). This is only intended to be used for quick start, testing and evaluation purposes. If you use this version, your MongoDB data may be lost if the Kubernetes cluster is updated.

You can set up a production-ready MongoDB environment in the following ways:

- Deploy a separate MongoDB server or cluster alongside Qlik Sense.
- Use a MongoDB DBaaS provider (such as MongoDB Atlas or mlab)

Configuring the MongoDB connection

When installing QSEoK you can specify your MongoDB connection as follows:

- A parameter in the `helm install` command.
- Referencing the connecting settings in a `values.yaml` and using this in the `helm install` command.

Using CLI parameters

You can extend the basic `helm install` command by setting the following properties:

- Set the `devMode.enabled` value to `false` to disable development mode.
- Set the `mongodb.uri` value with the connection string to MongoDB.

Example:

```
helm upgrade \
  --install qliksense qlik/qliksense \
  --set mongodb.uri=<your-connection-string>,engine.acceptEULA="yes"
```

Example: Connection URI format

The connection string format will vary depending on the configuration used. This format will be different if using a Kubernetes secret to connect with.

```
mongodb://user:password@mongodbhost:port/databasename`
```

Some services assume that SSL is enabled in MongoDB. If SSL is not being used then add `"?ssl=false"` to end of the connection URI.

Referencing values.yaml

Create the `values.yaml` file and include the settings you want to reference in the `helm install` command.
- Set the `devMode.enabled` value to `false` to disable development mode.
- Set the `mongodb.uri` value with the connection string to MongoDB.

**Example: values.yaml**

```yaml
engine:
    acceptEULA: "yes"

devMode:
    enabled: false

mongodb:
    uri: "<your-connection-string>"

identity-providers:
    secrets:
        idpConfigs:
            - <your IdP configuration here>

The values.yaml file is then referenced in the `helm install` command:

```
helm upgrade \  
  --install qliksense qlik/qliksense \  
  -f values.yaml
```

### Configuring a proxy for Qlik License Service communication in Qlik Sense Enterprise on Kubernetes

You can handle the communication between the Qlik License Service and the License Backend with a proxy.

The Qlik License Service is included in Qlik Sense Enterprise February 2019 and later releases and is used when Qlik Sense is activated using a signed key license. The Qlik License Service stores the information about the license, and communicates with a License Back-end Service, hosted by Qlik, for product activations and entitlement management. Port 443 is used for accessing the License Back-end Service and retrieving license information.

With Qlik Sense June 2019 or later you can configure the communication between Qlik License service and the Qlik License Backend to be handled by a proxy.

In Qlik Sense Enterprise on Kubernetes, configuration of a proxy for the Qlik License Service is done using helm configurations. Both HTTP and HTTPS scheme are supported.

Add the following content to the `values.yaml` file:

```yaml
## Proxy configuration
# Set the following values when deploying behind a proxy

# The URI to the tunneling proxy scheme://host:port (e.g. http://proxy.company.com:8888)
uri:
```
5 Deploying Qlik Sense Enterprise in a multi-cloud environment

Once you have installed Qlik Sense Enterprise on Windows, you can set up a multi-cloud environment. To do this, connect your Qlik Sense Enterprise on Windows to a cloud hub on:

- Qlik Sense Enterprise on Kubernetes, which supports deployment to public or private clouds on a customer-managed infrastructure
- Qlik Cloud Services, where Qlik manages the infrastructure

You can set up one of each of these deployments to connect to a single Qlik Sense Enterprise on Windows. Once your multi-cloud deployment is configured, you can distribute Qlik Sense apps that you create in Qlik Sense Enterprise on Windows to the cloud for consumption.

To set up your deployment to connect to Qlik Cloud Services, see Qlik Sense deployments to Qlik Cloud Services (page 304).

To set up your deployment to connect to Qlik Sense Enterprise on Kubernetes, see Deploying Qlik Sense Enterprise on Kubernetes (page 274).

5.1 Qlik Sense deployments to Qlik Cloud Services

A multi-cloud deployment allows you to distribute Qlik Sense apps to the cloud for consumption. You can set up your deployment to connect Qlik Sense Enterprise on Windows to Qlik Cloud Services where your services are hosted and managed by Qlik. Contact Qlik to obtain a Qlik Cloud Services account.

The current status of Qlik Cloud Services and recent communications can be viewed here: https://status.qlikcloud.com

To set up your Qlik Cloud Services deployment:

1. Deploy Qlik Sense Enterprise on Windows. For more information, see Installing Qlik Sense in a multi-node site (page 98).
2. Follow the link in the email to activate your Qlik Cloud Services account, create your Qlik Cloud Services tenant, and configure your deployment.

Qlik Cloud Services deployment configuration

To set up your QCS deployment you must register for a trial or subscription. Once you receive your welcome email, you will log in to activate your account, create your Qlik tenant domain, and configure your deployment. Your tenant domain will be the URL used to access your deployment.

Multi-cloud and Qlik Cloud Services support the OpenID Connect (OIDC) identity providers Auth0 and Okta.
5 Deploying Qlik Sense Enterprise in a multi-cloud environment

5.2 Multi-Cloud Setup Console - start page

The Multi-cloud Setup Console is where you set up and configure your Qlik Sense multi-cloud solution. To open the Multi-cloud Setup Console, go to https://<server name>/api/msc.

The tiles from left to right represent the major steps when setting up Qlik Sense Enterprise on Windows, with Multi-Cloud.

Before you start setting up your multi-cloud, make sure you have the following:

- a valid Qlik Sense multi-cloud license
- the required data for the IdP configuration
- the required data for the deployment settings

To set up your multi-cloud environment:

1. Click the tile **Qlik Sense license** to fill in the site license details.

   
   *If you want to set up Qlik Cloud Services or Qlik Sense Enterprise on Kubernetes, please contact your Qlik representative or Qlik Support to obtain a valid license for the setup.*

2. Click the tile **Set up identity providers** to open the IdP setup instructions for Qlik Sense Enterprise on Kubernetes (QSEoK). For QSEoK, the IdP setup is done via a configuration file. For Qlik Cloud Services, setup is done in forms on qlikcloud.com that are submitted to Qlik.

3. Click the tile **Deployments** to open the deployments settings page. The settings page is the same for Qlik Sense Enterprise on Kubernetes and Qlik Cloud Services. You get setup values from your IdP provider.

4. Click the tile **Manage users** to open the page for user related issues.

5. Click the tile **Qlik Management Console** to open the QMC to make deployment edits.
Deploying Qlik Sense Enterprise in a multi-cloud environment

Qlik Sense Enterprise on Kubernetes - IdP settings

Configure your IdP for Qlik Sense Enterprise on Kubernetes (QSEoK) using a YAML configuration file.

For multi-cloud, you can only use identity providers that are compatible with OpenID Connect (OIDC).

Setting up the IdP for Qlik Sense Enterprise on Kubernetes

Before setting up the IdP for QSEoK, you must:

- Create a Kubernetes environment.
- Install the client tools to interact with your Kubernetes environment.
- Deploy QSEoK into Kubernetes.
- Accept the EULA for QSEoK.
- Configure your MongoDB connection.

For a detailed description of the steps, see Qlik Sense multi-cloud deployments with Qlik Sense Enterprise on Kubernetes.

You set up the (IdP) for QSEoK in the YAML configuration file.

Do the following:

1. Open your YAML configuration file, and enter the Discovery endpoint. Also know as Discovery URL.
2. Enter IdP Client ID. This is the ID of the configured client at the IdP for interactive user authentication.
3. Enter Client secret. The secret for the client configured at the IdP.
4. Enter User ID claims mapping. The claim to use as User ID.
5. Enter Groups claim mapping. The claim to use as containing groups.

Code example with simple-oidc-provider

This code example is only intended for testing and must not be used in production.

The simple-oidc-provider supports OIDC discovery, which simplifies the main configuration. Use discoveryUrl.

```json
{
    "clientId": "foo",
    "clientSecret": "bar",
    "realm": "simple",
    "hostname": "myhost",
    "claimsMapping": {
```
5 Deploying Qlik Sense Enterprise in a multi-cloud environment

"sub": [ "sub", "client_id" ]
}

The simple-oidc-provider does not return a sub claim for client credentials tokens. The remedy for this is the claims mapping "sub": [ "sub", "client_id" ]. This will map the sub claim to the sub claim whenever possible but will fall back on the client_id claim.

Logging out from the multi-cloud environment

When you log out from the multi-cloud environment, you may see an almost blank page, with only an OK in the top left corner. This can be the default page for the identity provider for your tenant. The page is configurable for your identity provider.

MSC - Deployments

With a multi-cloud setup, you can either deploy to Qlik Sense Enterprise on Kubernetes or Qlik Cloud Services. Qlik Sense Enterprise on Kubernetes supports deployment to public or private clouds on a customer managed infrastructure. Qlik Cloud Services supports deployment on an infrastructure managed by Qlik. Currently, you can set up one of each of these deployments.

The setup differs depending on whether or not you use a local bearer token.

Setup with a local bearer token

A local bearer token simplifies the deployment setup. Instead of using the token endpoint, client ID, and client secret properties to retrieve a bearer token from the IdP, a bearer token is generated locally.

Before you start setting up your deployment, make sure you have the API endpoint, provided by Qlik in your welcome email.

To set up your deployment:

1. In the bottom left corner, click Set up new.
2. Enter a deployment name.
3. Enter the API endpoint, which is sent to you from Qlik.
4. Enter audience: qlik.api. Audience is needed by the app distribution service to get API tokens from cloud.
5. Select Use local bearer token and click Apply. The local bearer token settings are displayed.
6. By default, the Qlik Cloud Services format check box is selected. The text box then displays the IdP definition. If you clear the check box selection, the IdP definition is displayed in regular text. Use this format when you deploy to Qlik Sense Enterprise on Kubernetes.
7. Choose the format you want to use and click Copy to clipboard to save the text. You need this text when you configure your tenant.
8. For QCS, you paste the IdP definition in the Paste local bearer text box on the tenant configuration page.

For Qlik Sense Enterprise on Kubernetes, you paste the IdP definition in the values.yaml file.
Setup with IdP integration

Before you start setting up your deployment, make sure you have the following:

- Client ID and client secret (collected from your IdP provider)
- Token endpoint
- API endpoint (provided by Qlik in your welcome email)

To set up your deployment:

1. In the bottom left corner, click **Set up new**.
2. Enter a deployment name. (You can use this name in distribution policies for the distribution of apps.)
3. Enter Client ID and Client secret.
4. Enter Token endpoint, also known as **Authentication URL**.
5. Enter API endpoint, which is sent to you from Qlik.
6. Enter audience: qlik.api. Audience is needed by the app distribution service to get API tokens from cloud.
6 Deploying Qlik Sense Mobile

The Qlik Sense Mobile app allows you to securely connect to your Qlik Sense Enterprise deployment from a supported mobile device. The Qlik Sense Mobile app can be deployed and managed using Enterprise Mobile Management (EMM) software.

For more information about deploying and managing Qlik Sense Mobile, see Installing Qlik Sense Mobile (page 311).

6.1 The Qlik Sense Mobile app

The Qlik Sense Mobile app can be installed on supported devices running compatible versions of iOS or Android OS, and connected to a Qlik Sense Enterprise deployment.

For a detailed list of devices, OS versions, and Qlik Sense versions supported, see System requirements for Qlik Sense Enterprise (page 10)

The Qlik Sense Mobile app connects to a Qlik Sense Enterprise hub. When connected, you can view and consume Qlik Sense apps and mashups available on the Qlik Sense Enterprise installation. Qlik Sense Mobile for iOS devices supports offline access to Qlik Sense apps. You can download the Qlik Sense apps for use offline when no internet connection is available. The Qlik Sense administrator controls which apps are available to download for offline use, using the QMC. See: Creating security rules.

- The download of Qlik Sense apps for offline access is supported only on Qlik Sense Mobile app for iOS, and on Qlik Sense Mobile for BlackBerry app.

- Developing Qlik Sense apps offline using the Qlik Sense Mobile app is not currently supported.

When you log into the Qlik Sense Mobile app for the first time, you must authenticate your credentials against the Qlik Sense Enterprise server. For more information, see Connecting to Qlik Sense from the Qlik Sense Mobile app (page 323). Once you have authenticated your credentials and logged in to the app, you may choose to have the Qlik Sense Mobile app remember your credentials. To protect your data, ensure that the device is protected by a password and locked when not in use. For more information, see Qlik Sense Mobile security (page 310).

6.2 Enterprise Mobile Management (EMM) and Qlik Sense Mobile

Using a supported EMM, you can remotely deploy and manage the Qlik Sense Mobile app on all of your organization’s supported mobile devices. Using an EMM console you can:

- Distribute the Qlik Sense Mobile app to mobile devices.
- Configure the Qlik Sense hub list in the Qlik Sense Mobile app.
- Configure the certificate validation policy.
6 Deploying Qlik Sense Mobile

For more information about configuring the certificate validation policy, see Configuring the certificate validation policy for the Qlik Sense Mobile app (page 311).

For more information about deploying and managing Qlik Sense Mobile with AirWatch, see Deploying the Qlik Sense Mobile app using AirWatch (page 312).

6.3 Qlik Sense Mobile security

Qlik Sense Mobile connects to a Qlik Sense Enterprise hub. When you are connected, you can view Qlik Sense apps and mashups, and download Qlik Sense apps using the Qlik Sense Mobile app.

> The download of Qlik Sense apps for offline access is supported only on Qlik Sense Mobile app for iOS, and on Qlik Sense Mobile for BlackBerry app.

Authentication

When you log into the Qlik Sense Mobile app for the first time, you must authenticate your credentials against the Qlik Sense Enterprise server. Once you have authenticated your credentials, and logged in to the Qlik Sense Mobile app, you may choose to have the Qlik Sense Mobile app remember your credentials. For more information about how to set the options for credentials management, see Logging in to the Qlik Sense Mobile app. To protect your data, ensure that the device is protected by a password and locked when not in use. This can be configured through your Enterprise Mobile Management (EMM) console.

The Qlik Sense Mobile app can be used offline for up to 10 days (240 hours). This time period starts when the Qlik Sense Mobile app is first launched following the last log in to the Qlik Sense Enterprise server. When the 10 day period expires, you must to log back into the Qlik Sense Enterprise server to continue using the Qlik Sense Mobile app.

Section access in the data load script can also be used for security. A single file can be used to hold the data for a number of users or user groups. Qlik Sense then uses the information in the section access for authentication and authorization on the Qlik Sense Enterprise server, and dynamically reduces the data, so that users only see their own data. The security is built into the file itself, which means downloaded files are also protected. For more information, see Managing security with section access.

Certificates

When Qlik Sense is deployed over SSL, the Qlik Sense Mobile app obtains a certificate from the Qlik Sense server and verifies that it is valid. This allows the Qlik Sense Mobile app to trust that the server it is talking to is a legitimate Qlik Sense server. The Qlik Sense Mobile app will always reject the certificate if it is not valid. Every Qlik Sense hub that you add to the hub list must therefore have a valid certificate.

To ensure that a certificate is valid, you need to check that the certificate:

- Is signed by a certificate authority, such as VeriSign, or signed by a certificate authority that has been added to the list of trusted certificate authority for the device (either manually added to the device or
Deploying Qlik Sense Mobile

pushed to the device from an EMM console).

- Is not expired.
- Has a common name or a name that matches the domain name of the Qlik Sense hub.

Configuring the certificate validation policy for the Qlik Sense Mobile app
The certificate validation policy applies when Qlik Sense is deployed over SSL, and the Qlik Sense Mobile app encounters invalid certificates from a Qlik Sense server that has been added to the hub list by the device user.

You can configure the certificate settings from your EMM console.

Do the following:

1. Make sure the Qlik Sense Mobile app has been installed on the device.
2. If the Qlik Sense server has a certificate that is not signed by a trusted certificate authority, make sure that the certificate that was used to sign the server certificate is added to the list of trusted certificate authorities for the device either manually or using your EMM.
   a. Configure the certificate from your EMM console.
      If your EMM console does not have this functionality, you can use this software to make the edits and then upload the changes to your EMM console:

         Apple Configurator
      The available settings are:
      - Ask user
      - Always allow
      - Always reject
   b. Push the changes to the device.

6.4 Installing Qlik Sense Mobile
The Qlik Sense Mobile app can be downloaded and installed directly from the Apple App Store or Google Play Store. The Qlik Sense Mobile app includes a Qlik Sense demo server that is hosted by Qlik, and allows you to view and download apps. You can connect to the Qlik Sense demo server without Qlik Sense Enterprise account credentials. To connect the Qlik Sense Mobile app to your Qlik Sense Enterprise deployment, your Qlik Sense administrator must configure the connection and deploy to users.

The download of Qlik Sense apps for offline access is supported only on Qlik Sense Mobile app for iOS, and on Qlik Sense Mobile for BlackBerry app.

Qlik Sense Mobile can be deployed and managed using either Enterprise Mobile Management (EMM) software, or Apple Developer Enterprise Program tools.
To deploy using Apple Developer Enterprise Program tools, you must be a member of the Apple Developer Enterprise Program. For more information about deploying using Apple Developer Enterprise Program tools, see the Apple Developer Enterprise Program documentation.

Using a supported EMM, you can remotely deploy and manage the Qlik Sense Mobile app on all of your organization's mobile devices. From an EMM console you can:

- Distribute the Qlik Sense Mobile app to mobile devices.
- Configure the Qlik Sense hub list.
- Configure the certificate validation policy.

For more information about configuring the certificate validation policy, see Configuring the certificate validation policy for the Qlik Sense Mobile app (page 311).

Qlik Sense Mobile and VPP

Qlik Sense Mobile can be deployed using the Apple Volume Purchase Program (VPP).

The Apple Volume Purchase Program (VPP) is a service that allows registered organizations to purchase iOS apps in bulk. After making a bulk purchase, the organization receives redemption codes for each app bought. Those app codes can then be distributed to individual users, who use the codes to download public apps from the Apple App Store. Codes can be distributed to users through email, a web portal, or Enterprise Mobile Management (EMM) software. Instead of pushing software and profiles out to devices, organizations can push licenses to devices while downloading apps directly from the Apple App Store.

Volume-purchased software and licenses can be distributed to users in the following ways:

- Email redemption URLs directly to users, which allows them to download and install the app.
- Post redemption URLs on an enterprise-hosted web page that is accessible only to authorized users.
- Use the Apple Configurator utility to push redemption codes to local connected devices.

Note that this method is only recommended for small work groups.

- Push redemption codes to remotely managed devices using EMM software to push redemption codes to remotely managed devices.

The Apple Volume Purchase Program allows businesses and schools to retain ownership of purchased apps, so apps can be reclaimed and redistributed as needed.

Deploying the Qlik Sense Mobile app using AirWatch

The Qlik Sense Mobile app can be deployed using AirWatch. To deploy using AirWatch, add the app to your AirWatch Catalog. Once the app is added to your AirWatch Catalog, you can choose to either push the app directly to your users' devices, or allow them to install the app manually.

To deploy the app using AirWatch:
1. Open your AirWatch Management Console.
2. Go to **Apps & Books > Applications > List View > Public** and select **Add Application**.
3. Select the **Platform**.
4. Select **Enter URL** and enter the URL to download the Qlik Sense Mobile app.
5. Click **Next**.
6. Configure options on the **Details** tab.
7. Assign the application to smart groups on the **Assignment** tab.
8. Configure the **App Delivery Method**:
   - On Demand - Deploys the app to a catalog and lets the user decide if and when to install it.
   - Automatic - Deploys the app to a catalog on a device upon enrollment. After the device enrolls, the user is prompted to install.
9. Select **Send Application Configuration** if you want to populate the Qlik Sense Mobile app with links to your Qlik Sense hub.
10. Assign a **Required Terms of Use** for the application on the **Terms of Use** tab.
11. Select **Save & Publish** to view the device assignment page that lists the assigned devices.
12. Select **Publish** to deploy the application.

For details about how users download and install the app manually using AirWatch, see *Connecting to Qlik Sense using AirWatch* (page 315).

**Qlik Sense Mobile and per-app VPN support**

The Qlik Sense Mobile app supports per-app VPN tunneling when deployed using AirWatch.

Per-app VPN functionality, provides endpoint security by limiting connections at the application level, instead of at a device level. The VMware Tunnel restricts app access to white-listed domains, and specific databases that white-listed domains can access.

The following are the current minimum requirements for AirWatch support:

- AirWatch Agent version 5.5.1
- VMware Tunnel version 2.0.4

To enable per-app VPN tunneling support for Qlik Sense Mobile in AirWatch you will need to customize your VMware Tunnel configuration. For more information, see *Configuring AirWatch for per-app VPN* (page 313).

**Configuring AirWatch for per-app VPN**

The Qlik Sense Mobile app supports per-app VPN tunneling when deployed using AirWatch. To enable per-app VPN tunneling, you must:
Deploying Qlik Sense Mobile

- Customize your VMware Tunnel server configuration.
  To enable per-app VPN to work with the Qlik Sense Mobile app, you must disable Datagram Transport Layer Security (DTLS).

  *This may impact other applications that use User Datagram Protocol (UDP).*

- Add network traffic rules so that the VMware Tunnel bypasses Qlik Sense Mobile local network traffic.

**Customize your VMware Tunnel server configuration**

If your VMware Tunnel server was deployed using a Linux installer, complete the following steps to disable DTLS so that the VMware Tunnel server uses TLS for all traffic.

Do the following:

1. Log in to your VMware Tunnel server using Secure Shell or ssh.
3. Add `dtls_channel 0`.
4. Restart the vpn server using `sudo service vpnd restart`.

**Add VMware Tunnel rules**

Do the following:

1. Open your AirWatch Management Console.
2. From the **Settings** menu, go to **System > Enterprise Integration > VMware Tunnel > Network Traffic Rules**.
3. On the **Device Traffic Rules** tab, add the following rules:

<table>
<thead>
<tr>
<th>Rank</th>
<th>Application</th>
<th>Action</th>
<th>Destination Hostname</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Qlik Sense Mobile-iOS</td>
<td>Bypass</td>
<td>127.0.0.1</td>
</tr>
<tr>
<td>2</td>
<td>Qlik Sense Mobile-iOS</td>
<td>Tunnel</td>
<td>*</td>
</tr>
</tbody>
</table>

Once you have configured AirWatch for per-app VPN support of the Qlik Sense Mobile app, you can proceed with your deployment. For more information, see *Deploying the Qlik Sense Mobile app using AirWatch* (page 312).

**Configuring the Qlik Sense Mobile app hub list using AirWatch**

When you deploy the Qlik Sense Mobile app using AirWatch, you can choose to push the link to the Qlik Sense Enterprise hub directly to your users using AirWatch.

Do the following:
1. Open your AirWatch Management Console.
2. Go to Apps & Books > Applications.
3. Select the Qlik Sense Mobile app.
4. Click Assign.
5. Select the radio button for the group that you want to deploy the application configuration file to and click Edit.
6. On the Add Assignment page, expand the ADVANCED section, then expand the APPLICATION CONFIGURATION section.
7. In the Configuration Key field, enter mdm.
8. Ensure that the Value Type is set to String.
9. In the Configuration Value field, enter name and URL for each Qlik Sense Enterprise hub in the following format:
   ```json
   {  
     "Accounts": [  
       {"name":"Account 1","url":"http://www.ahub.com"},  
       {"name":"Account 2","url":"http://www.asecondhub.com"}  
     ]
   }
   ```
10. Click Add.
11. Click Save & Publish.
12. Click Publish.
13. Go to the More menu and select Send Application Configuration.

The Qlik Sense Enterprise hubs that you added will appear in your users' Qlik Sense Mobile app list under Select an account the next time that they open the app.

Connecting to Qlik Sense using AirWatch

To connect to Qlik Sense from a mobile device using AirWatch per-app VPN, you must:

- Download the AirWatch Agent app
- Register the device
- Install a supported app or browser

To connect to Qlik Sense using AirWatch on iOS:

1. Download the AirWatch Agent app.
2. Open AirWatch Agent and enroll using one of the available options:
   - Email address
   - Server details
   - QR code
3. On the Authenticate screen, enter your user name and password and select Next.
4. On the Secure screen, select Redirect & Enable to enable management of your device by installing the Device Manager configuration profile. You are redirected and asked for permission to open Settings. Select Allow.
5. In Settings, select **Install** to install the Device Manager configuration profile, and then select **Trust** to confirm that you allow your device to be enrolled into remote management.

6. Once the installation of the Device Manager configuration profile is complete, select **Done**. You will be redirected to AirWatch Agent where a **Configure** screen confirms that the authentication procedure is complete. Select **Done**.

**If a pop-up appears asking to install VMware Tunnel, select **Install** to allow the installation of the VMware Tunnel app. If the pop-up does not appear, you can install VMware Tunnel from AirWatch Catalog. See step 9.**

7. In AirWatch Agent you can now manage your enrolled devices in the **My Device** portal.

**You may be asked to create a device passcode to access AirWatch Agent. The passcode will be required every time you access the app. If you already have a passcode configured on your device you can enter it here to maintain the same passcode. If you enter a new passcode here it will overwrite your existing device passcode.**

8. Close AirWatch Agent.

9. If you haven't installed VMware Tunnel already, open AirWatch Catalog, which has now been added to your device, and install it.

10. Open VMware Tunnel app and select **Continue** to enable it.

11. Open AirWatch Catalog and install the Qlik Sense Mobile app or one of the supported browsers. For a list of mobile browsers that support the connection to Qlik Sense Enterprise through AirWatch per-app VPN, see [System requirements for Qlik Sense](#).

**The Qlik Sense Mobile app allows you to download Qlik Sense apps for offline use.**

**Your AirWatch Agent administrator may have already populated the hub list with your Qlik Sense server connection.**

12. To connect to Qlik Sense for the first time using the Qlik Sense Mobile app, see [Connecting to Qlik Sense from the Qlik Sense Mobile app](#) (page 323).

To connect to Qlik Sense using AirWatch on Android, follow the instruction for your specific device found here: [AirWatch Agent for Android](#).

**Deploying Qlik Sense Mobile with Microsoft Azure and Intune**

The Qlik Sense Mobile app can be deployed using Microsoft Azure and Intune. Some configuration changes are required in the Microsoft Azure portal to enable Single Sign On (SSO) and Intune management of Qlik Sense Mobile.

**Before you begin:**
• Azure AD Connect must be configured to replicate your primary domain (Active Directory) and the Azure Portal (Azure Active Directory).
• Azure AD Application Proxy Connector must be installed and configured.

To deploy the app using Microsoft Azure and Intune:

• Set up a Qlik Sense Enterprise virtual proxy
• Set up Kerberos constrained delegation in Active Directory
• Add an Azure enterprise application for Qlik Sense Enterprise virtual proxy
• Add an Azure app registration for Qlik Sense Mobile
• Add the Qlik Sense Mobile app to the Intune Company Portal
• Define a Qlik Sense Mobile app protection policy
• Define a Qlik Sense Mobile configuration policy
• Deploy the Qlik Sense Mobile app

Set up a Qlik Sense Enterprise virtual proxy
1. Open the Qlik Management Console on the Qlik Sense Enterprise server.
2. Go to Proxies > Central Proxy.
3. Enable Kerberos Authentication.
4. From the Qlik Management Console home page, go to Virtual Proxies.
5. Click Create new Virtual Proxy.
6. Enter the following information:
   • Identification
   • Authentication
   • Load Balancing
   • Host white list sections

   Note the prefix used, it will be used later in the Azure Portal configuration (https://sense_server fqdn/prefix).

   The Windows Authentication pattern must be set to Mozilla.

7. Click Save.

Set up Kerberos constrained delegation in Active Directory
1. Log in to a server that has access to Active Directory in your primary domain.
2. Open a Windows Power Shell as an administrator.
3. Create a Service Principal Name (SPN) for the Qlik Sense Enterprise installation using the following command:
   setspn.exe -U -S HTTP/sense_server fqdn domain\sense_server_service_account
4. Open Active Directory Users and Computer.
5. Find the computer that hosts the Azure AD App Proxy, to modify the machine properties.

6. Go to the Delegation tab and choose Trust the computer for delegation to specified services only.

7. Select Use any authentication protocol and add the SPN created.

8. Open ADSI, confirm that the Azure AD app proxy host is set to delegate to the Qlik Sense server.

Add an Azure enterprise application for Qlik Sense Enterprise virtual proxy

1. Log in to the Azure portal and select Azure Active Directory Service.

2. Select Application Proxy and confirm there is at least one active application proxy.


4. Click New application.

5. Select On-premises application.

6. Enter a name for the new application.

7. Enter the URL for the server where Qlik Sense Enterprise is installed.

   Include the QSE virtual proxy prefix is in the URL path. For example: https://sense_server_fqdn/prefix

8. Setup the External URL.

   This will be used later for the App Registration for Microsoft Intune. For example, https://sensekcd-qlikemmnet.msappproxy.net/prefix/. Note: The URL consists of a prefix (sensekcd-) followed by your tenant name followed by msappproxy.net followed by the QSE virtual proxy prefix.

9. Ensure that the application is using Azure Active Directory for its Pre-Authentication method.

10. Ensure that a valid Connector Group is selected to direct traffic to the application proxy.

11. Select Single sign-on properties for the Enterprise Application.


13. Enter the SPN you created earlier.

14. Choose On-premises user principal name for Delegated Login Identity.

15. Click Save.

16. Select the enterprise application you added and click Properties.

17. Set User assignment required to Yes, and click Save.

Add an Azure app registration for Qlik Sense Mobile

1. Log in to the Azure portal and select Azure Active Directory Service.

2. Select Apps Registrations.

3. Click New Application Registration.

4. Enter a Name.
5. Enter an **App registration type** of native.
6. Enter a **Redirect URL** of msauth://comqliksense.mobile/17PV4mdIRAc%2F3SeFXILsSWg1aDU%3D.
7. For the **App Registration** click **Settings** and select **Redirect URLs**.
8. Add an additional redirect URL of qliksense-intune://com.qlikqliksense.mobile and click **Save**.
9. Take note of this app registration’s **Application ID**.
10. Add and grant the following delegated permissions:
    - Microsoft Mobile Application Management - Read and Write the User’s App Management data
    - The Web app / API defined above - Access <Web App / API name>
    - Microsoft Graph – Read Directory Data
    - Windows Azure Active Directory – Sign in and read user profile

**Add the Qlik Sense Mobile app to the Intune Company Portal**

1. Log in to the Azure portal and select the Intune service.
2. Select **Client Apps**.
3. Select **Apps**.
4. Click **Add**.
5. Select an **App type** of **Android Store App** for Android, or **iOS Store App** for iOS.
6. Click **Configure** and enter the following:
   - Name
   - Description
   - Publisher
   - App store URL: enter the link to the Qlik Sense Mobile app on the Apple App Store for iOS devices, or the Google Play Store for Android devices.
   - Minimum operating system

7. Click **OK**.
8. Once the app is uploaded, click **Assignments** and ensure that the appropriate users and devices are assigned to the app.
9. Refresh the list of apps. You should see the new app of type **Managed Android Store App** for Android, or **Managed iOS Store App** for iOS, with an **Assigned value** of YES.

**Define a Qlik Sense Mobile app protection policy**

1. Log in to the Azure portal and select the Intune service.
2. Select **Client Apps**.
3. Select **App protection policies**.
6  Deploying Qlik Sense Mobile

4. Click **Create Policy**.
5. Enter a **Name** and **Description**.
6. Enter a **Platform** of **Android** or **iOS**.
7. Enter a value of **Yes** for **target to all app types**.
8. Click on **Select Required Apps** and select the Qlik Sense Mobile for Android or iOS app added above.

   *For iOS you must add the Qlik Sense Mobile app via its bundle id com.qlik.qliksense.mobile. For Android you add the Qlik Sense Mobile app via its package id com.qlik.qliksense.mobile.*

9. Click **Settings** and configure the various settings, then click **Save**.
10. If the protection policy is configured to limit data transfer from Qlik Sense Mobile then the limitation should be set to **policy managed apps** so that Qlik Sense Mobile can send diagnostics emails.

   *For Android use a browser to display help and use a PDF viewer to display the Qlik Sense Mobile **Terms and Conditions** document.*

   *For iOS protection policy a similar setting is required to allow Qlik Sense Mobile to send diagnostic emails. Help and terms and conditions are displayed within the iOS Qlik Sense Mobile app itself.*

**Define a Qlik Sense Mobile configuration policy**

1. Log in to the Azure portal and select the Intune service.
2. Select **Client Apps**.
3. Select **App configuration policies**.
4. Click **Add**.
5. Enter a **Name** and **Description**.
6. Select an enrollment type of **Managed Apps** for Android or **Managed Devices** for iOS.
7. Click **Assignments** and assign the appropriate users or user groups.
8. Click **Select the required app** and select the Qlik Sense Mobile app added to the **Company Portal**.
9. Click **Configuration settings** and enter a name of **mdm**.
10. For **Value** enter the json document `{ "Accounts" : [{ "name":"Your server name","url":"<external URL>"}, "config" : { "AADAppld" : "<the Application Id noted above>" } } }
11. Click **Save**.
12. Ensure that the app configuration shows as assigned with an enrollment type of **Managed apps** for Android, or **Managed devices** for iOS.

**Deploy the Qlik Sense Mobile app to Android devices**

1. On an Intune enrolled Android device open the **Company Portal** and install Qlik Sense Mobile.
2. Launch Qlik Sense Mobile.
3. You should be prompted to indicate that the app is being managed. If you don’t then there is likely a configuration issue with the App protection policy.
4. You should see your Qlik Sense Mobile deployment in the Qlik Sense Mobile server list. If you don’t then there is likely a configuration or a user assignment issue.
5. Logging in to Qlik Sense Mobile deployment should follow the Azure SSO login flow.

**Deploy the Qlik Sense Mobile app to iOS devices**

1. On an Intune enrolled iOS device open the **Company Portal** and install Qlik Sense Mobile.
   Intune will present a dialog asking to manage Qlik Sense Mobile.
2. Click **Yes** or **Manage**.
3. Launch Qlik Sense Mobile.
   You should see the Qlik Sense Mobile server you defined above. If you don’t then there is likely a configuration or a user assignment issue.
4. Click on the server and log in using SSO if required.
5. You will see an Intune dialog indicating that the App data is managed. Click **OK**. Qlik Sense Mobile will exit.
6. Logging in to Qlik Sense Mobile deployment should follow the Azure SSO login flow.

**Connecting to Qlik Sense using BlackBerry Access**

You can access Qlik Sense and consume apps from a mobile device using BlackBerry Access browser. A BlackBerry Access administrator must first set up a BlackBerry Dynamics deployment and configure URL connections to one or multiple Qlik Sense servers. The administrator then registers users and generates secret keys that users must use to access the BlackBerry server from their mobile devices. Once inside the BlackBerry Dynamics environment, users can reach their Qlik Sense hubs.

**Configuring BlackBerry Dynamics**

**Prerequisites**
- Qlik Sense Enterprise June 2018 or later must be installed.
- See BlackBerry documentation for BlackBerry Access system requirements.

**Allocating access rights**

The Qlik Sense administrator must allocate access rights to users in the Qlik Sense Management Console (QMC), before deploying BlackBerry Dynamics.

Do the following:

1. In the QMC, select **License management** on the start page or from the **Start** drop-down menu to display the overview.
2. Select **User access allocations** in the panel to the right.
3. Click **Allocate** in the action bar.
   The **Users** dialog opens.
4. Select users in the list and click **Allocate**.
For more on user access, see Managing user access.

Deploying BlackBerry Dynamics

Do the following:

1. **Set up a BlackBerry Dynamics deployment.** Using BlackBerry server services, set up a new BlackBerry Dynamics deployment. Once your deployment is set up, log in using BlackBerry Access administrator credentials to access the BlackBerry Dynamics dashboard.

2. **Register users.** You can synchronize your Dynamics deployment with an active directory to import and update users' information, such as email addresses, in the BlackBerry Dynamic environment. Every user registered in your BlackBerry Dynamics deployment is listed under **USERS, Users and Groups.**

3. **Create apps.** Users use apps to connect to different Qlik Sense servers for which they have been granted access. To create a new app:
   - Go to the section **APPS, Manage Apps** of the Dynamics dashboard.
   - Click on the **Add App** button.
   - Select **Web** from the list of app types. A web app consists of an URL address that users reach using the BlackBerry Access browser.
   - Insert the URL address of the Qlik Sense Enterprise server for which you have allocated access rights to users.

Further to web apps, in a BlackBerry Dynamics environment you can create Public apps, (apps compatible with BlackBerry EMM environment), Custom apps, or assign GD Entitlement ID. For more information, see BlackBerry Dynamics documentation.

4. **Add apps to App groups.** Apps can be grouped together in App groups. You can create and manage App groups from the Dynamics dashboard under **APPS, App Groups.**

5. **Grant users access to specific apps or app groups.** Under **APPS, App Groups,** you can assign users to one or multiple App groups, therefore granting these users access to the set of apps that are included in a specific App group. You can also set restrictions to prevent users from accessing specific apps or App groups.

> You must also grant your users access to the BlackBerry Access browser app.

6. **Assign users to policy sets.** You can assign different policy sets to different users. Users are clustered in groups based on which policy set is assigned to them. A policy set defines access rights and restrictions. Users registered with a certain policy set can access certain apps or App groups, and are prevented from accessing others, if restrictions are applied.

7. **Assign unique access keys to users.** Once a user has been registered with specific policy sets and
granted access to apps and App groups, the administrator must generate access keys and provide them to the user.

Generating access keys
An access key is needed to activate the BlackBerry Access browser app and allow the connection to the BlackBerry Dynamics deployment. If the environment is properly set up, users will receive their access keys via email as soon as they are generated. Once an access key is in use, it disappears from the list of available access keys in the BlackBerry Dynamics dashboard. An access key is only active for a limited time. By default, an access key expires after 30 days from the last log-in into the BlackBerry Dynamics environment from the device.

Accessing Qlik Sense using BlackBerry Access
Registered users can use BlackBerry Access on a mobile device and reach Qlik Sense via browser.

Prerequisites
- For a detailed list of BlackBerry Access app, iOS, and Android supported versions, see Supported browsers.
- An access key to enroll your device. If you have not received any access key, contact the BlackBerry Access administrator.

Connecting to Qlik Sense from a mobile device using BlackBerry Access
Do the following:
1. Download the BlackBerry Access app from the Apple App Store or the Google Play Store.
2. Open BlackBerry Access and choose to enroll.
3. Enter the email address which received your access key. Enter the access key you received, and click OK.
4. Create a password when prompted.
5. Once inside the BlackBerry Dynamics environment, select the app, which is the Qlik Sense server URL address, you want to access. You can also type the URL of the Qlik Sense server you want reach in the address bar at the top.
6. Insert your Qlik credentials to access the Qlik Sense hub.

Connecting to Qlik Sense from the Qlik Sense Mobile app
When you install and launch the Qlik Sense Mobile app for the first time you are prompted to select either the Qlik Sense demo server or a Qlik Sense Enterprise server to connect to.

The Qlik Sense demo server is hosted by Qlik, and allows you to view Qlik Sense apps and mashups, and download apps. You can connect to the Qlik Sense demo server without Qlik Sense Enterprise account credentials.

You must connect to the Qlik Sense demo server at least once while online before you can access content while offline.
To connect to a Qlik Sense Enterprise server, you must log in with your Qlik Sense Enterprise account credentials. Before you can connect to a Qlik Sense server and log in with your Qlik Sense Enterprise account credentials from the Qlik Sense Mobile app you will need to authenticate your credentials against the Qlik Sense Enterprise server.

The Qlik Sense Enterprise authentication link must be generated by your administrator in the Qlik Management Console. Your Qlik Sense administrator will provide you with information about how you can receive the link using one of the following methods:

- Retrieving the authentication link from your Qlik Sense Enterprise hub
- Receiving the authentication link from your administrator

**If your Qlik Sense Mobile app is deployed and managed through an EMM, the hub list may already be populated for you, in which case you do not need to complete this procedure.**

### Retrieving an authentication link from the Qlik Sense Enterprise hub

Do the following:

1. Open your mobile browser and enter the URL for your Qlik Sense Enterprise hub.
2. Click ... in the top toolbar of the hub, and then click **Client authentication**.
3. A dialog box opens asking you to confirm that you want to open the authentication link using the Qlik Sense. Click **Open** to confirm.
4. The Qlik Sense Mobile app opens and the server is added to the welcome page.
5. Click the server name to log in. You may be asked to enter your Qlik Sense Enterprise credentials.

After this, when you launch the Qlik Sense Mobile app, you can click the server name and log in using your Qlik Sense Enterprise credentials without authenticating against the Qlik Sense Enterprise hub each time.

### Receiving the authentication link from your administrator

Do the following:

1. Click the authentication link provided by your Qlik Sense administrator. If you cannot click the link, copy the link into your mobile browser.
2. A dialog box opens asking you to confirm that you want to open the authentication link using the Qlik Sense. Click **Open** to confirm.
3. The Qlik Sense Mobile app opens and the server is added to the welcome page.
4. Click the server name to log in. You may be asked to enter your Qlik Sense Enterprise credentials.

After this, when you launch the Qlik Sense Mobile app, you can click the server name and log in using your Qlik Sense Enterprise credentials without authenticating against the Qlik Sense Enterprise hub each time.
6.5 Deploying mashups to the Qlik Sense Mobile app

Qlik Sense mashups are webpages that contain Qlik Sense app objects, such as charts and data. When a mashup is published in the Qlik Sense Enterprise hub, it can be also accessed from the Qlik Sense Mobile app.

Why use mashups in the Qlik Sense Mobile app

Using mashups in the Qlik Sense Mobile app enables faster loading and reduced data consumption for the mobile device. Mashups are generally less resource intense than Qlik Sense apps. This means that less data has to be retrieved from the Qlik Sense Enterprise server when loading a mashup in the Qlik Sense Mobile app.

A mashup retrieves the necessary data from the Qlik Sense server every time it is opened. This ensures that the mashup is always up to date with the Qlik Sense Enterprise installation.

- **Qlik Sense November 2018 or later is required to access mashups from the Qlik Sense Mobile app.**
- **The use of Qlik Sense mashups is not supported in Qlik Sense Mobile for BlackBerry app.**

Only mashups published in Qlik Sense can be accessed from the Qlik Sense Mobile. In the Qlik Sense Mobile app, mashups are listed in a dedicated **Mashups** stream. All public mashups in a Qlik Sense Enterprise installation are visible in the Qlik Sense Mobile app. An admin can restrict access to specific users by creating a security rule in the Qlik Management Console. See: **Restricting access to mashups in the Qlik Sense Mobile app (page 325).**

Restricting access to mashups in the Qlik Sense Mobile app

To restrict access to mashups in the Qlik Sense Mobile app to specific users, the Qlik Sense Enterprise administrator must setup a security rule in the Qlik Management Console (QMC).

Do the following:

1. In the QMC, create a custom property by doing the following:
   - Set a name for the new custom property, for example, "StreamAccess".
   - In the **Resource Types** section, select the **Extension** and **Users** check boxes to apply the custom property to these resource types.
   - In the **Value** section, create a new custom property value, for example,"MyMashup".
   See: "Creating a custom property" in the Manage Qlik Sense sites guide.
2. To allow access to mashups to specific users, apply the custom property created in step 1 to the selected users. In the QMC, go in the **Users** section and edit users by adding "MyMashup" in the **StreamAccess** field.
3. To allow access to extensions to specific users, apply the custom property created in step 1 to the selected users. In the QMC, go in the **Extension** section and edit extensions by adding "MyMashup" in the **StreamAccess** field.
4. Create a new stream. Add to the stream the Qlik Sense apps that contain the data used in the mashups.

5. To prevent users from accessing a mashup, change the extension security rule as follows:
   - Create a copy of the default extension security rule.
   - Edit the copy you created by adding the condition ([resource.name!="MyMashup"), where
     "MyMashup" is the custom property you created in step 1.
   - Disable the default extension security rule to make the new one effective.

See: "Security rules installed in Qlik Sense" in the Manage Qlik Sense sites guide.

6. Create the following security rule for extensions: (user.@StreamAccess="MyMashup") to allow specific
   users to access all extensions.

See: "Creating security rules" in the Manage Qlik Sense sites guide.

7. Apply the same security rule (user.@StreamAccess="MyMashup") to the stream you created in step 4 to
   allow specific users to access the stream.

See: "Editing streams" in the Manage Qlik Sense sites guide.

6.6 Customizing Qlik Sense Mobile with AppConfig

When administering Qlik Sense Mobile in an Enterprise Mobile Management (EMM) environment, you can customize the Qlik Sense Mobile experience for your users by editing the AppConfig file.

The AppConfig is a .json or .xml configuration file that can be edited using a Mobile Device Manager system. By editing the AppConfig file, you can for example change the default stream shown when Qlik Sense Mobile is launched, hide the demo server, or set a mashup as landing page. The way you modify the AppConfig file may vary depending on which Mobile Device Manager you use.

List of configurable settings in AppConfig

The following table shows the list of configurable settings in the AppConfig.

<table>
<thead>
<tr>
<th>Value</th>
<th>Type of value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>hideDemoServer</td>
<td>App setting</td>
<td>Hide the demo server in the account list.</td>
</tr>
<tr>
<td>hideAnalytics</td>
<td>App setting</td>
<td>If set to true, analytics are not displayed nor sent to Qlik.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If set to false, the end user can choose to send analytics to Qlik.</td>
</tr>
<tr>
<td>Accounts</td>
<td>List</td>
<td>This value is a json formatted list of accounts. Each item has a name that</td>
</tr>
<tr>
<td></td>
<td></td>
<td>is shown to the user and a url used to authenticate the user.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The value is formatted as follows:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>({&quot;name&quot;:&quot;Account 1&quot;,&quot;url&quot;:&quot;<a href="http://www.hub-A.com%22%7D">http://www.hub-A.com&quot;}</a>,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>{&quot;name&quot;:&quot;Account 2&quot;,&quot;url&quot;:&quot;<a href="http://www.hub-B.com%22%7D">http://www.hub-B.com&quot;}</a>)</td>
</tr>
<tr>
<td>DefaultStream</td>
<td>Account config</td>
<td>Changes the default stream that is selected when the Qlik Sense hub is</td>
</tr>
<tr>
<td></td>
<td></td>
<td>loaded.</td>
</tr>
<tr>
<td>LandingPage</td>
<td>Account</td>
<td>The path to a resource that should be loaded in place of the hub when a</td>
</tr>
</tbody>
</table>
Deploying Qlik Sense Mobile

<table>
<thead>
<tr>
<th>Value</th>
<th>Type of value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AADAppId</td>
<td>config</td>
<td>user successfully accesses Qlik Sense.</td>
</tr>
<tr>
<td>Account</td>
<td>config</td>
<td>This value is used for Microsoft Azure Single Sign On. The value for this key is a string equal to the QSM Azure Active Directory App registration Application/Client Id.</td>
</tr>
</tbody>
</table>

Setting a mashup as landing page

By editing the AppConfig file, you can set a mashup or a mashup stream as the landing page for users accessing Qlik Sense.

In the **Configuration Value** field, enter the following:

```json
{
   "name":"Account 1",
   "url":"http://www.hub-A.com",
   "config":{
      "DefaultStream":"mashups",
      "LandingPage": "/extensions/MyMashup/MyMashup.html"
   }
}
```

Where:

- "Account" and "http://www.hub-A.com" are the account and Sense hub to which these settings will be applied.
- "LandingPage" is the path to the mashup to be used as landing page.
- "DefaultStream" is the ID for a default stream that is loaded when accessing Qlik Sense.

6.7 Qlik Sense Mobile for BlackBerry

Qlik Sense Mobile for BlackBerry is the Qlik Sense mobile application running on iOS and integrated with the BlackBerry Dynamics platform. Qlik Sense Mobile for BlackBerry allows you to access and consume Qlik Sense apps from within the secure BlackBerry Dynamics EMM environment.

The administrator sets up and configures the BlackBerry Dynamics environment.

- [Authentication configurations for Qlik Sense Mobile for BlackBerry](#)
- [Deploying Qlik Sense Mobile for BlackBerry](#)
- [Configuring Qlik Sense Mobile for BlackBerry policy settings](#)

Users activate Qlik Sense Mobile for BlackBerry. Once installed and activated, Qlik Sense Mobile for BlackBerry works the same way as the Qlik Sense Mobile app.

- [Activating Qlik Sense Mobile for BlackBerry](#)
- [Qlik Sense Mobile app](#)
For a list of system requirements for Qlik Sense Mobile for BlackBerry, see: System requirements for Qlik Sense.

Authentication configurations for Qlik Sense Mobile for BlackBerry

Users must identify themselves when connecting to Qlik Sense Enterprise from Qlik Sense Mobile for BlackBerry.

Qlik Sense Mobile for BlackBerry supports a subset of the authentication solutions configurable on the Virtual Proxy:

- **Ticket solution**: The user must enter their Qlik credentials (domain\user name and password) to access Qlik Sense Enterprise. See: Ticket solution.

- **SAML authentication**: The user is redirected to a third-party identity provider for being authenticated. See also: SAML.

- **Windows Integrated Authentication**: The user authenticates via a Kerberos protocol. See Windows Integrated Authentication (page 328).

> Additional authentication solutions may be compatible with Qlik Sense Mobile for BlackBerry, but they are not officially supported.

For a complete overview on authentication solutions in Qlik Sense, see: Authentication solutions.

Windows Integrated Authentication

The Virtual Proxy can be configured to recognize any string from the HTTP User Agent of Qlik Sense Mobile for BlackBerry in the Windows authentication pattern. In this case, the Windows Integrated Authentication is attempted between the client and the Qlik Sense Hub.

Kerberos authentication solution

To allow Kerberos authentication, the following is required:

- Kerberos authentication must be enabled in the QMC. See: Editing proxies.

- A Kerberos SPN (Service Principal Name) associates the host URL with the Windows identity of the Qlik Sense Proxy Service.

Kerberos Constrained Delegation

If the BlackBerry infrastructure is configured to support Kerberos Constrained Delegation (KCD), users are not prompted to enter their credentials. The authentication procedure is handled using the credentials used for activating Qlik Sense Mobile for BlackBerry. See: Activating Qlik Sense Mobile for BlackBerry.

To implement Kerberos Constrained Delegation, contact BlackBerry.

If Kerberos Constrained Delegation is not enabled within the BlackBerry Dynamics EMM environment, users are required to enter their Windows User Principal Name (UPN) and password.

If Kerberos authentication is disabled in the QMC, or the required Kerberos SPN (Service Principal Name) is missing, users are required to enter their Windows user name and password.
Deploying Qlik Sense Mobile for BlackBerry

Qlik Sense Mobile for BlackBerry lets users access Qlik Sense from a secure BlackBerry Dynamics EMM environment. With Qlik Sense Mobile for BlackBerry, you can manage data flow, deploy Qlik Sense apps, and set security and compliance policies for specific users or groups.

This document covers settings specific to a Qlik Sense Mobile deployment in the BlackBerry Dynamics environment. For a complete guide, check BlackBerry’s documentation. For an overview of the BlackBerry Dynamics platform and architecture, see the following BlackBerry documentation: BlackBerry Dynamics.

Prerequisites

Set up a BlackBerry UEM environment
To access Qlik Sense using the Qlik Sense Mobile for BlackBerry app, an administrator must first set up a BlackBerry Dynamics environment by installing and configuring BlackBerry UEM.

For detailed documentation on how to install and configure BlackBerry UEM, see the following BlackBerry documentation: BlackBerry UEM.

Enable BlackBerry Dynamics Direct Connect
To use Qlik Sense Mobile for BlackBerry, the BlackBerry Dynamics administrator must enable BlackBerry Dynamics Direct Connect in the BlackBerry UEM admin console. For further information, see the following BlackBerry documentation: What is Direct Connect?.

Configuring Qlik Sense Mobile for BlackBerry
The BlackBerry Dynamics administrator can enable and configure Qlik Sense Mobile for BlackBerry from the BlackBerry UEM admin console.

The BlackBerry Dynamics administrator must do the following to allow users to consume Qlik Sense apps:

- Add Qlik Sense Mobile for BlackBerry in the BlackBerry Dynamics environment.
- Configure Qlik Sense Mobile for BlackBerry.
- Assign Qlik Sense Mobile for BlackBerry to users or groups of users.

Adding Qlik Sense Mobile for BlackBerry in the BlackBerry Dynamics environment
The BlackBerry Dynamics administrator must add Qlik Sense Mobile for BlackBerry to the list of permitted apps in the BlackBerry Dynamics environment.

Do the following:

1. In the BlackBerry UEM admin console, navigate to Apps and click the "Add an app" icon, located on the right of the search tab. A pop-up window opens.
2. Select the Apple App Store icon.
3. Enter "Qlik Sense Mobile for BlackBerry" in the App name, vendor or URL search field and select the appropriate geographic App Store. Then, select Search.
4. Select the **Add** button beside Qlik Sense Mobile for BlackBerry to add the app.
5. Adjust category and other properties of the app as required and select **Add**.
6. Qlik Sense Mobile for BlackBerry is now on the list of permitted apps in the BlackBerry Dynamics environment.

### Creating App configurations

App configurations allow you to configure the list of Qlik Sense servers that the users will be granted access to. The list of server is displayed when a user launches the Qlik Sense Mobile for BlackBerry app.

*In Qlik Sense Mobile for BlackBerry it is not possible to configure client authentication links for adding Qlik Sense servers. Qlik Sense servers can only be added by the BlackBerry Dynamics administrator through App configuration settings in BlackBerry UEM admin console.*

Do the following:

1. In the BlackBerry UEM admin console, navigate to **Apps** and select Qlik Sense Mobile for BlackBerry from the list of available apps. A dedicated window opens.
2. In the **Settings** tab, under **BlackBerry Dynamics**, create a new app configuration by clicking the "+" button. A pop-up window opens.
3. In the **App configuration** window:
   a. Enter a name for the App configuration profile.
   b. Choose whether you want to allow HTTP traffic.
   c. Insert the list of Qlik Sense servers you want to connect to the Qlik Sense Mobile for BlackBerry app, including the Virtual Proxy used for authentication. For more information on authentication solutions for Qlik Sense Mobile for BlackBerry, see: *Authentication configurations for Qlik Sense Mobile for BlackBerry* (page 328).
   For each server, enter a label as shown below. The label will be shown in the list of servers displayed in Qlik Sense Mobile for BlackBerry.
   
   ```
   Server-1; https://<Server-1 address>/VirtualProxy/
   ```
   
   *The hosts must be added separately to a Connectivity Profile in the BlackBerry UEM admin console.*
   d. Click **Save**. This saves and closes the **App configuration** window.
4. Click **Save**. This saves and closes the Qlik Sense Mobile for BlackBerry window.

### Creating a BlackBerry Dynamic connectivity profile

When a user selects a Qlik Sense server from the list in Qlik Sense Mobile for BlackBerry, an access request is sent to the selected server. For the request to successfully reach the server, you must create specific BlackBerry Dynamics connectivity profiles.

For instructions on how to create a BlackBerry Dynamics connectivity profile, see the following BlackBerry documentation: *Add an app server to a BlackBerry Dynamics connectivity profile.*
Assigning Qlik Sense Mobile for BlackBerry to users or user groups

You must assign Qlik Sense Mobile for BlackBerry to single users or groups of users to allow users to activate the app on their devices. You can also create app groups containing multiple apps and assign those to users and user groups instead.

See: Users and groups in the BlackBerry documentation.

App groups

App groups are collections of permitted apps in the BlackBerry Dynamics environment. You can create an app group that contains Qlik Sense Mobile for BlackBerry and other permitted apps, assign specific app configuration policies, and assign the app group to users or groups of users. All the apps included in the app group are assigned to the selected users.

To learn how to create and edit app groups, see the following BlackBerry documentation: Managing app groups.

Assign Qlik Sense Mobile for BlackBerry to a user

Do the following:

1. In the BlackBerry UEM admin console, navigate to Users, open the All users sub-section, and select a user from the list.
2. In the dedicated user screen, open the Apps drop-down section and click on the "+" button.
3. In the list, select the Qlik Sense Mobile for BlackBerry app or an app group that contains it, and click Next.
4. Select the app configuration profile and the other settings, or leave the default options.
5. Click on Assign.
6. Qlik Sense Mobile for BlackBerry is now assigned to the selected user.

Assign Qlik Sense Mobile for BlackBerry to a user group

Do the following:

1. In the BlackBerry UEM admin console, navigate to Groups, open the Users sub-section, and select a user group from the list.
2. In the dedicated user group screen, under Assigned apps click on the "+" button.
3. In the list, select the Qlik Sense Mobile for BlackBerry app or an app group that contains it, and click Next.
4. Configure the required settings, or leave the default options.
5. Click on Assign.
6. Qlik Sense Mobile for BlackBerry is now assigned to the selected user group.

Qlik Sense Mobile for BlackBerry policy settings

The BlackBerry Dynamics administrator controls security configurations by editing policy profiles and user settings in the BlackBerry UEM admin console.
This document covers settings specific for a Qlik Sense Mobile deployment in the BlackBerry Dynamics environment. For a complete overview on policies and profiles settings, see the following BlackBerry documentation: BlackBerry Dynamics profile settings.

Data leakage prevention
The BlackBerry Dynamics administrator can prevent users from copying data outside the BlackBerry Dynamics environment.

Do the following:

1. In the BlackBerry UEM admin console, navigate to Policies and profiles and open the Managed devices section.
2. In the Policy drop-down menu, select BlackBerry Dynamics.
3. Select the policy profile that you want to edit from the list of available policies.
4. Click on the edit icon.
5. Navigate to the Data leakage prevention section.
6. Select Do not allow copying data from BlackBerry Dynamics apps into non BlackBerry Dynamics apps to prevent users from sharing data outside the BlackBerry Dynamics environment.
7. Select Do not allow copying data from non BlackBerry Dynamics apps into BlackBerry Dynamics apps to prevent users from adding data copied from apps that are not part of the BlackBerry Dynamics environment.
8. Click on Save to apply the changes.

Diagnostic and logging
Users can send application diagnostics using BlackBerry Work or a different email client such as the native iOS client. A mail client different from BlackBerry Work can only be used if the BlackBerry Dynamics administrator allows users to copy data outside of the BlackBerry Dynamics environment. See: Data leakage prevention (page 332).

Sending application diagnostics from the Qlik Sense Mobile for BlackBerry app
Do the following:

1. In the Qlik Sense Mobile for BlackBerry app, tap on the BlackBerry Launcher icon.
2. In the Launcher menu, open the settings menu.
3. In the settings menu select Diagnostic.
4. Select Send application diagnostics.
5. The email client opens.

Sending application diagnostic when data leakage prevention is enforced
If the BlackBerry Dynamics administrator has enabled the data leakage prevention configuration, users can only send diagnostics using the BlackBerry Work email client. If the user selects Send application diagnostics and BlackBerry Work is not installed on the device, an error message invites the user to configure an email service.
Configuring detailed diagnostics

The BlackBerry Dynamics administrator can enable or prevent users from sending detailed diagnostics from the Qlik Sense Mobile for BlackBerry app. Detailed diagnostics are enabled at application level by editing a policy profile, or at device level by editing the registered device for a specific user.

Configuring detailed diagnostics in the policy profile

Do the following:

1. In the BlackBerry UEM admin console, navigate to the Policies and profiles section and open the Managed devices sub-section.
2. In the Policy drop-down menu select BlackBerry Dynamics.
3. Select the policy profile that you want to edit from the list of available policies.
4. Click the edit icon.
5. Navigate to the Detailed logging section.
   - To enable detailed diagnostics, select Enable detailed logging for BlackBerry Dynamics apps.
   - The Detailed diagnostics option is made available in the diagnostics settings for Qlik Sense Mobile for BlackBerry. The user can turn on detailed diagnostics using the toggle.
   - To disable detailed diagnostics, select Prevent users from turning on detailed logging in BlackBerry Dynamics apps.
   - Only the Send application diagnostics option is visible in the Qlik Sense Mobile for BlackBerry app.

Configuring detailed diagnostics for a specific device

Do the following:

1. In the policy editing window, leave both Enable detailed logging for BlackBerry Dynamics apps and Prevent users from turning on detailed logging in BlackBerry Dynamics apps unselected. For detailed instructions see: Configuring detailed diagnostics in the policy profile (page 333).
2. In the BlackBerry UEM admin console, navigate to Users and open the All users sub-section.
3. Select a user from the list.
4. In the user profile window, select one of the activated devices available for the selected user. You select a device by clicking on the correspondent tab.
5. In the tab for the device you selected, open the BlackBerry Dynamics apps drop-down menu.
6. Locate the Qlik Sense Mobile for BlackBerry app. If Qlik Sense Mobile for BlackBerry is not listed in this section, it is not assigned for that user on the selected device.
7. In the App actions column for Qlik Sense Mobile for BlackBerry, open the drop-down menu.
   - Select Logging on to enable detailed diagnostics.
     - The user can turn on detailed diagnostics using the toggle.
   - Select Logging off to prevent detailed diagnostics.
     - Only the Send application diagnostics option is visible in the Qlik Sense Mobile for BlackBerry app.
Activating Qlik Sense Mobile for BlackBerry

You can activate the Qlik Sense Mobile for BlackBerry app by entering your credentials and an access key. Once Qlik Sense Mobile for BlackBerry has been activated, you can access and consume Qlik Sense applications.

To activate Qlik Sense Mobile for BlackBerry you must:

- Download Qlik Sense Mobile for BlackBerry.
- Activate it using an access key.
- Create a password for the app.

Do the following:

1. Download Qlik Sense Mobile for BlackBerry from the Apple App Store.
2. In a web browser, navigate to BlackBerry UEM Self-Service console website for the BlackBerry Dynamics domain you are registered in.
   For example: https://bbruem.<yourBlackBerryDynamicsdomain>.com, where
   <yourBlackBerryDynamicsdomain> is the name of your registered BlackBerry Dynamics domain.
   If you do not know the correct BlackBerry Dynamics domain, contact your BlackBerry Dynamics administrator.
3. In the log-in screen, enter your user name and password. If you do not know your user name or your password, contact your BlackBerry Dynamics administrator.
4. In the BlackBerry UEM Self-Service console, navigate to Access keys.
5. Click on the "+" button to generate a new access key.
6. On the mobile device, launch Qlik Sense Mobile for BlackBerry.
7. Enter the email address you used to register with the BlackBerry Dynamics environment. If you do not know which email address you should use, contact your BlackBerry Dynamics administrator.
8. Enter the access key you generated in the BlackBerry UEM Self-Service console. Do not add the dash characters.
9. If requested, create a password for accessing Qlik Sense Mobile for BlackBerry. This password will be requested every time you launch the app or after the time out period.
10. Qlik Sense Mobile for BlackBerry is now activated. Select a hub from the list and enter your Qlik credentials to access the streams and documents in that Qlik Sense Enterprise site.