Sentinel LDK 9.0 with Sentinel LDK-EMS

INSTALLATION GUIDE

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Preface

This guide describes how to install all required components of Sentinel LDK.

About This Guide

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What's Included in Sentinel LDK

> "Sentinel LDK Software Package" on page 8

Describes the Sentinel LDK software package.

Installing Sentinel LDK

> "Installing Sentinel LDK with Sentinel LDK-EMS (Thales-Hosted)" on page 13

For companies who subscribe to Sentinel LDK-EMS (hosted by Thales), describes how to install and configure the required Sentinel LDK components.

> "Installing Sentinel LDK with Sentinel LDK-EMS (On-Premises)" on page 19

For companies who work with Sentinel LDK-EMS installed on the company network, describes how to install and configure the required Sentinel LDK components.

Setting Up Cloud Licensing

> "Configuring High Availability for Cloud Licensing" on page 61

For companies who work with Sentinel LDK-EMS and want to host a license server for cloud licensing, describes how to configure their server for high availability.

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Configuring Sentinel LDK to Recognize Your Vendor Code

> "Introducing Your Sentinel Vendor Keys to Sentinel LDK" on page 50

Describes how to introduce your Sentinel Vendor keys to the Sentinel LDK system. This ensures that your applications are protected and licensed with the unique codes that have been assigned to you.

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> "Installing Sentinel LDK Run-time Environment for Mac" on page 91

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Describes additional options for installing Sentinel LDK Run-time Environment.

Post-Installation Software Updates

> "Installing Software Updates" on page 103

This section describes how the Sentinel LDK software manager checks for software updates to ensure that you are always working with the latest version of Sentinel LDK.

> "Modifying and Uninstalling Sentinel LDK Components" on page 105

Describes how to completely uninstall Sentinel LDK.

Training

For additional information and training about Sentinel LDK implementation issues, contact our team of international consultants who can provide you with tailored training sessions on the following:

> Integration of Sentinel LDK into your product

> Analysis of the best protection strategy for your applications

> Assistance in implementation of your protection and licensing models

CHAPTER 1: Sentinel LDK Software Package

The software described in this section is hosted on Thales servers or is provided in the Sentinel LDK installation package (except where noted).

> **NOTE FOR MAC AND LINUX** This document describes how to install Sentinel LDK on a Windows platform. To set up Sentinel LDK Vendor Tools on a Mac or Linux platform, see:
>
> > For Sentinel LDK with Sentinel LDK-EMS (on-premises or Thales-hosted): Sentinel LDK Getting Started Guide for Mac or Sentinel LDK Getting Started Guide for Linux
> >
> > For Sentinel LDK with an alternate entitlement management system: Sentinel LDK Getting Started Guide for Mac or Sentinel LDK Getting Started Guide for Linux

Sentinel LDK-EMS—Entitlement Management System

Sentinel LDK-EMS is a back-office server application that enables you to define, produce and update Sentinel protection keys and to define and process entitlements (customer orders).

Sentinel LDK-EMS supports the Sentinel LDK method of enforcement. The Sentinel LDK-EMS database contains all the licensing and entitlement information for you customers. Sentinel LDK-EMS Web Services enable you to integrate the entitlement and production functionality of Sentinel LDK-EMS in your own back-office management software. For details, see https://docs.sentinel.thalesgroup.com/ldk/home.htm.

Sentinel LDK-EMS is set up in one of the following manners:

> **Sentinel LDK-EMS (Thales-hosted):** You can subscribe to Sentinel LDK-EMS as a service from Thales. In this case, Thales installs Sentinel LDK-EMS and sets up the Sentinel LDK-EMS database on its own servers.
>
> **Sentinel LDK-EMS (on-premises):** You can install Sentinel LDK-EMS locally and set up the Sentinel LDK-EMS database on your own server.

In either case, the instance of Sentinel LDK-EMS can be accessed throughout your organization using web browsers. The Sentinel LDK-EMS Customer Portal can be accessed from customer sites to activate software licenses by entering Product Keys or to update licenses automatically.

> **NOTE** For the Demo version of Sentinel LDK, you must install Sentinel LDK-EMS on your own server.

Sentinel LDK Vendor Suite

Sentinel LDK Vendor Suite is used by software developers and consists of the elements described below.

Vendor Tools

Vendor Tools are installed on the developers' machines and are used to implement protection and licensing for your applications. The most-used Sentinel LDK Vendor Tools are:

> **Sentinel LDK Envelope**

Applies security to your software within a protective shield. Available for Windows, Mac, and Linux platforms.

> **Sentinel LDK ToolBox**

Enables you to familiarize yourself with the Sentinel Licensing API and to generate code to include in your software's source code. Available for Windows platforms.

Sentinel LDK APIs

Sentinel LDK APIs are installed on developers' machines or are included in protected applications. The provided APIs are as follows:

> **Sentinel Licensing API**

Enables you to protect your application by inserting calls to a Sentinel protection key throughout your source code.

On the machine where Sentinel LDK Vendor Tools are installed, a **Sample** folder contains samples for various compilers and programming languages. Each sample includes:

- Libraries that must be linked to your application
- A sample application that demonstrates the use of the API

Sample folders are also provided in the Sentinel LDK directory structures for Linux and macOS.

These samples enable you to integrate protection into your own software using a variety of programming languages.

> **Sentinel Admin API**

Sentinel Admin API provides the functionality available in Admin Control Center and Admin License Manager in the form of callable API functions. You can call functions to retrieve information from local or remote License Managers and to perform actions in these License Managers.

> **Sentinel License Generation API**

For sites that already have a licensing infrastructure in place or that prefer to implement an alternative to Sentinel LDK-EMS, Sentinel LDK offers a standalone licensing solution.

You can use Sentinel License Generation API together with your existing licensing server software and ERP and CRM back-office systems for maximum flexibility and control over your business processes.

Sentinel License Generation API provides the functionality required to generate and maintain Sentinel protection keys, but without any of the back-office services that are provided by Sentinel EMS or Sentinel LDK-EMS. All the required services are provided by the system that you choose to implement. You would use Sentinel LDK only to handle the protection and Feature-control functions for your applications.

> ****WARNING****
> **Sentinel License Generation API cannot be used in parallel with Sentinel LDK-EMS to update licenses for a given customer.**

- **Sentinel Run-time Installer API**

  The functions in this API can be used to integrate the installation of the Sentinel LDK Run-time Environment into your custom setup application.

For links to these API references, see: https://docs.sentinel.thalesgroup.com/ldk/apis.htm

Sentinel LDK Run-time Environment

Sentinel LDK Run-time Environment is the main link between a Sentinel protection key and a protected application or data file following its deployment at a customer's site. Depending on the type of protection key used, end users may need to have Sentinel LDK Run-time Environment installed in order to run the protected application or to access a protected data file.

You can integrate the Sentinel LDK Run-time Environment installer into the installation of your protected application.

Sentinel LDK Run-time Environment is also required by Sentinel LDK Vendor Tools and by Sentinel EMS and Sentinel LDK-EMS to update protection keys. The Sentinel LDK Installer installs the Run-time Environment on your machines when you install any of the Sentinel LDK components.

Sentinel Admin Control Center is included in the Run-time Environment. Sentinel Admin Control Center is a customizable, Web-based, vendor and end-user utility that enables centralized administration of Sentinel License Managers and Sentinel protection keys.

Use Sentinel Admin Control Center to monitor licenses and sessions when a protected application or data file is operating, to manage cloud licensing, and to manage detachable licenses.

For links to the Sentinel LDK Run-time Environment readme files, see:
https://docs.sentinel.thalesgroup.com/ldk/rte.htm

Sentinel LDK Cloud Portal

Sentinel LDK Cloud Portal is a web-based application for software vendors who want to host cloud licenses (CL keys) on their own servers. Sentinel LDK Cloud Portal transfers the management of llicened users from Sentinel

Admin Control Center to a streamlined, web-based application. Sentinel LDK Cloud Portal simplifies setting up and distributing client identities to licensed users located anywhere, granting them access to the protected applications running on their own machines.

Each licensed user can be granted a license to all products in specific CL keys, or the license can be limited to specific products in the CL key.

Sentinel LDK Cloud Portal enables the software vendor to optionally offload the responsibility of managing licensed users to designated users in each customer's organization. The designated users can log in to Sentinel LDK Cloud Portal to generate and deliver client identities, set and modify licensed user permissions, and revoke or restore access. Alternatively, software vendors can continue to manage licensed users themselves on behalf of customer organizations or for direct individual customers.

CHAPTER 2: Installing Sentinel LDK

This section describes how to install Sentinel LDK with an entitlement management system, as described in "Sentinel LDK-EMS—Entitlement Management System" on page 8.

From the deployments listed below, install the one that corresponds to the entitlement management system to which you subscribed.

In this section:

Installing Sentinel LDK with Sentinel LDK-EMS (Thales-Hosted)

The section describes how to install Sentinel LDK on a Windows machine, including a launcher for Sentinel LDK-EMS.

For a description of the various components that comprise Sentinel LDK, see "Sentinel LDK Software Package" on page 8.

The following procedures are described:

> "Installing Sentinel LDK Vendor Suite with Sentinel LDK Launcher" below

  This procedure describes how to install Sentinel LDK Vendor Suite with the Sentinel LDK launcher for starting Sentinel LDK-EMS.

> "Installing a Launcher for Sentinel LDK-EMS" on page 15

  This procedure describes how to install the Sentinel LDK launcher for starting Sentinel LDK-EMS.

> "Configuring Sentinel LDK to Work With Sentinel LDK-EMS" on page 17

  This procedure describes how to set the Sentinel LDK-EMS URL for integration with Sentinel LDK.

> "Upgrading Sentinel Vendor Suite From Earlier Versions" on page 18

  This section describes how to upgrade to the latest version of Sentinel LDK from earlier versions of Sentinel LDK.

Installing Sentinel LDK Vendor Suite with Sentinel LDK Launcher

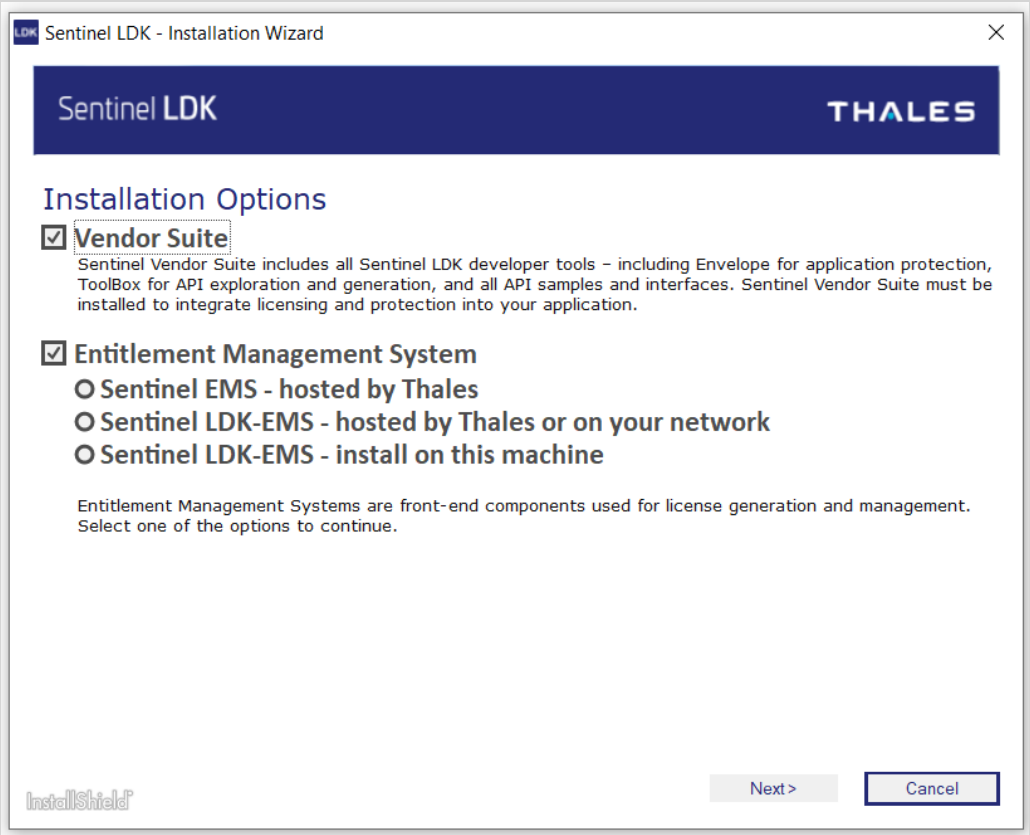
Follow the instructions below to install Sentinel LDK Vendor Suite with a Sentinel LDK launcher for starting Sentinel LDK-EMS.

(Otherwise, if you want to install only a Sentinel LDK launcher for starting Sentinel LDK-EMS, go to "Installing a Launcher for Sentinel LDK-EMS" on page 15.)

To install Sentinel LDK Vendor Suite with a Sentinel LDK launcher:

1. Ensure that you do not have any Sentinel Vendor keys or Sentinel HL keys connected to your machine.
2. Go to Thales Customer Support Portal for Sentinel LDK.
3. In the **Product Versions** box, click **9.0 SDK**.
4. Download **Sentinel-LDK_SDK_Windows.zip** and unzip the installation package to a temporary folder on your machine.
5. Browse to the **Windows** folder and double-click **setup.exe**.
6. Click **Start the Sentinel LDK Setup**. The Sentinel LDK Installation Wizard welcome window is displayed.
7. Click **Next**. You are asked to accept the license agreement.

8. Accept the agreement and click **Next**. The Installation Options screen is displayed:



9. Ensure that the following options are selected:

   - **Vendor Suite**

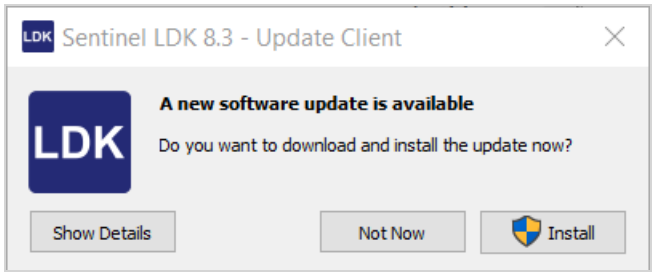
   Entitlement Management System

   – **Sentinel LDK-EMS – hosted by Thales or on your network**

   Click **Next**.

10. Follow the instructions to install Sentinel LDK Vendor Suite.

After the Installation Wizard has completed, Sentinel LDK Software Manager checks automatically to determine if a later version of any of the Sentinel LDK software is available. If a later version is found, a message similar to the following is displayed:



11. You can click **Install** to install the update. For more information regarding this message, see "Installing Software Updates" on page 103.
12. When the installation process is completed: Configure the Sentinel LDK launcher to start Sentinel LDK-EMS as described in "Configuring Sentinel LDK to Work With Sentinel LDK-EMS" on page 17.

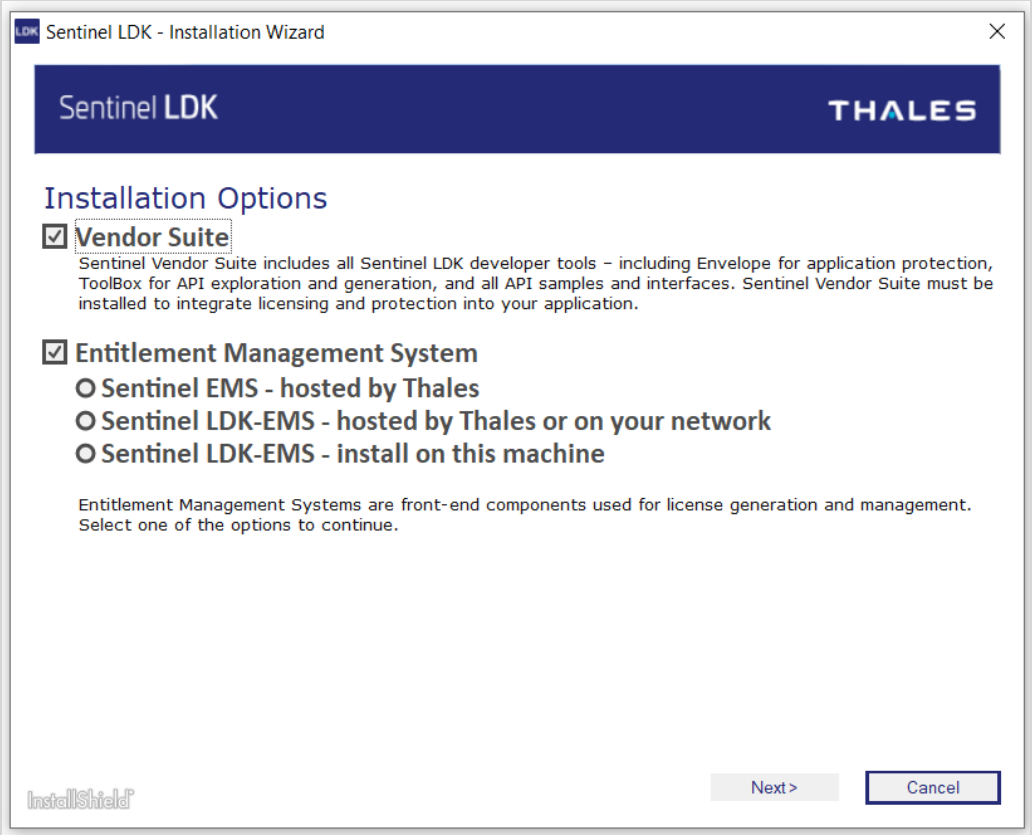
Installing a Launcher for Sentinel LDK-EMS

If you are not installing Sentinel Vendor Suite on the machine, use the procedure below to install a Sentinel LDK launcher for starting Sentinel LDK-EMS.

(Otherwise, if you want to install both Sentinel LDK Vendor Suite and a Sentinel LDK launcher for starting Sentinel LDK-EMS, go to "Installing Sentinel LDK Vendor Suite with Sentinel LDK Launcher" on page 13.)

To install a launcher for Sentinel LDK-EMS:

1. Ensure that you do not have any Sentinel Vendor keys or Sentinel HL keys connected to your machine.
2. Go to Thales Customer Support Portal for Sentinel LDK.
3. In the **Product Versions** box, click **9.0 SDK**.
4. Download **Sentinel-LDK_SDK_Windows.zip** and unzip the installation package to a temporary folder on your machine.
5. Browse to the **Windows** folder and double-click **setup.exe**.
6. Click **Start the Sentinel LDK Setup**. The Sentinel LDK Installation Wizard welcome window is displayed.
7. Click **Next**. You are asked to accept the license agreement.
8. Accept the agreement and click **Next**. The Installation Options screen is displayed:



9. Ensure that only the following options are selected:

   - **Entitlement Management System**
     - **Sentinel LDK-EMS – hosted by Thales or on your network**

   Click **Next**.

10. Follow the instructions to install the Sentinel LDK launcher.

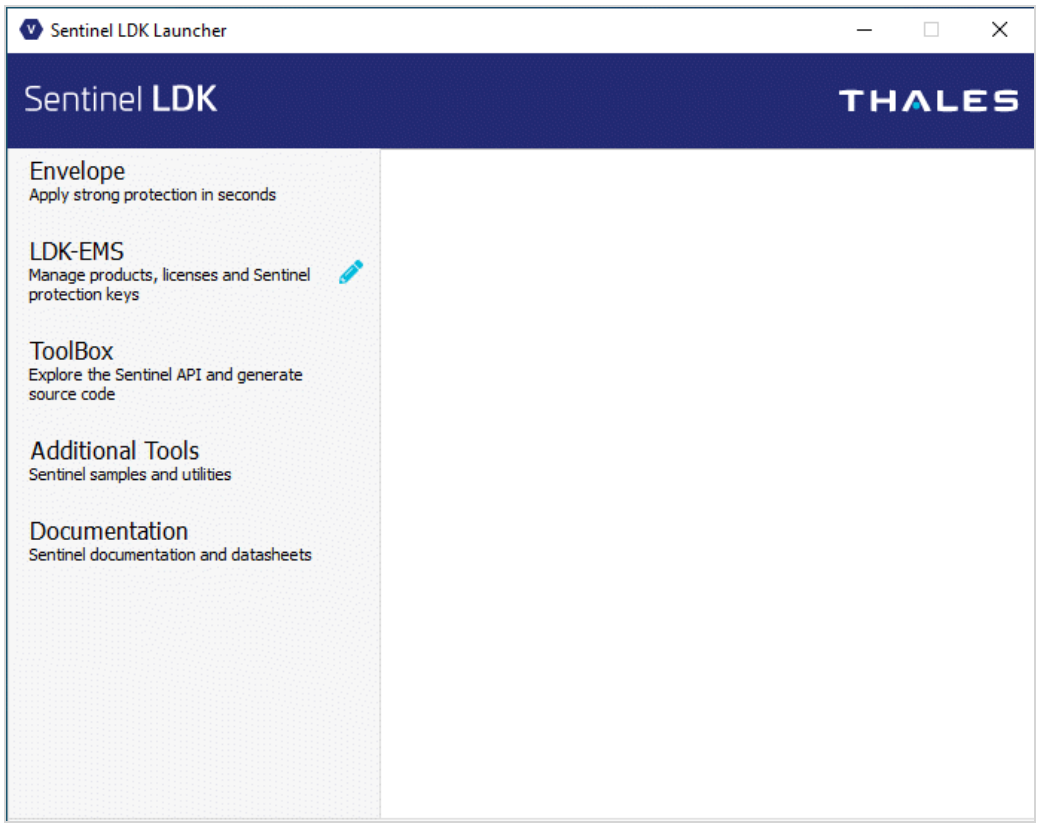
11. When the installation process is complete: Configure the Sentinel LDK launcher to start Sentinel LDK-EMS as described in "Configuring Sentinel LDK to Work With Sentinel LDK-EMS" on the next page.

Configuring Sentinel LDK to Work With Sentinel LDK-EMS

Follow the instructions below to configure Sentinel LDK to work with Sentinel LDK-EMS on a Windows machine.

To configure Sentinel LDK to work with Sentinel LDK-EMS:

1. From the Start menu, select **Thales > Sentinel LDK**. The Sentinel LDK Launcher is displayed.



2. Set the Sentinel LDK-EMS URL.
   a. In the navigation pane, next to **Sentinel LDK-EMS**, click the edit button . The Set Up Access to Sentinel LDK-EMS screen is displayed.
   b. Enter the URL for Sentinel LDK-EMS and click **Save**.
3. Set the Sentinel LDK-EMS URL for Sentinel Admin Control Center.
   a. From the navigation pane, click **Additional Tools > Admin Control Center**. Sentinel Admin Control Center opens.
   b. In the Options pane, click **Configuration**. The Configuration page is displayed.
   c. From the top of the page, click the **Network** tab. The Network page is displayed.
   d. In the **EMS URL** field, add the URL for Sentinel LDK-EMS. (Do not overwrite any existing URLs in the field.)
   e. Click **Submit**.

Upgrading Sentinel Vendor Suite From Earlier Versions

This section describes how to upgrade to Sentinel Vendor Suite 9.0 from an earlier version of Sentinel LDK, Sentinel HASP, or HASP SRM.

To upgrade Sentinel Vendor Suite:

1. On each machine where you installed Vendor Suite, rerun the installation process described in "Installing Sentinel LDK Vendor Suite" on page 31.
2. After completing the installation procedure on each machine, re-introduce your Developer key.

Installing Sentinel LDK with Sentinel LDK-EMS (On-Premises)

These components can be installed on the same machine (for example, to experiment with the Demo Tutorial). However, in production environments, these components are typically installed on separate machines. (The Vendor Suite is often installed on multiple developers' machines.)

For a description of the various components that comprise Sentinel LDK, see "Sentinel LDK Software Package" on page 8.

For information on supported platforms for Sentinel LDK, see the Sentinel LDK Release Notes.

The following procedures are described:

- "Installing Sentinel LDK-EMS on Your Machine" below

  This procedure describes how to install Sentinel LDK-EMS by itself or together with Sentinel LDK Vendor Suite on a single machine.

- "Installing Sentinel LDK Vendor Suite" on page 31

  This procedure describes how to install Sentinel LDK Vendor Suite with the Sentinel LDK launcher for starting Sentinel LDK-EMS.

- "Installing a Remote Launcher for Sentinel LDK-EMS" on page 33

  This procedure describes how to install a remote Sentinel LDK launcher for starting Sentinel LDK-EMS.

- "Configuring Sentinel LDK to Work With Sentinel LDK-EMS on Your Network" on page 35

  This procedure describes how to set the Sentinel LDK-EMS URL for integration with Sentinel LDK.

- "Upgrading From Earlier Versions" on page 36

  This section describes how to upgrade to the latest version of Sentinel LDK from earlier versions of Sentinel LDK.

- "Sentinel LDK-EMS Network Configuration Options" on page 40

  For Sentinel LDK-EMS (on-premises), describes advanced network options, including how to install the Sentinel LDK-EMS Service components on separate servers.

- "Troubleshooting a Sentinel LDK-EMS Installation" on page 45

  Discusses the solutions to some of the frequently asked questions relating to the installation of the Sentinel LDK-EMS Service in a network environment.

Installing Sentinel LDK-EMS on Your Machine

When installed on your machine, Sentinel LDK-EMS is installed under Windows as a service (referred to as the *Sentinel LDK-EMS Service*). An installation of Sentinel LDK-EMS provides the database server and all the required web services for your organization. Any authorized user in the organization can access the Sentinel

LDK-EMS web interface or can use an application that employs Sentinel LDK-EMS Web Services.

To upgrade from an earlier version of Sentinel LDK-EMS, see "Upgrading From Earlier Versions" on page 36.

> **NOTE** Sentinel LDK-EMS can be installed on multiple computers, either to divide the workload among different machine or to ensure high availability, or both. Similarly, Sentinel LDK-EMS can be installed separately from the Sentinel LDK-EMS database.
>
> For more information, see "Sentinel LDK-EMS Network Configuration Options" on page 40.
>
> If you experience any problems during or after Sentinel LDK-EMS installation, see "Troubleshooting a Sentinel LDK-EMS Installation" on page 45.

This section lists the prerequisites for installation and provides additional information to that provided in the Installation wizard.

In this section:

Installing and Configuring SQL Server Manually (Optional)

You can optionally install and configure SQL Server as a standalone operation without using the Sentinel LDK installation wizard. This is typically required:

- When you install the Sentinel LDK-EMS database on a different machine from Sentinel LDK-EMS Service.
- When you want to use a version of Microsoft SQL Server other than the default version. (By default, the Sentinel LDK installation wizard installs SQL Server 2019 Express.)

Download and install Microsoft SQL Server from: https://www.microsoft.com/en-in/download/details.aspx?id=42299

In this section:

Installing SQL Server

When using the **Express** setup type to install Sentinel LDK-EMS, you have the option to first install SQL Server manually on the machine where you will install Sentinel LDK-EMS.

When using the **Advanced** setup type, an SQL Server must already exist and must be active, either on the local machine or on a different machine.

If you install SQL Server manually, you can install any of the supported versions of SQL Server.

To install SQL server, use one of the following methods:

> Install the SQL Server instance using a command prompt (silent installation). For example: For SQL Server Express 2019, use:

```
SQLEXPR_x64_ENU.exe /q /IACCEPTSQLSERVERLICENSETERMS /ACTION=Install /FEATURES=SQL
/INSTANCENAME=EMSDATABASE /SAPWD=DBA!sa@EMSDB123 /SQLSVCSTARTUPTYPE=Automatic
/SECURITYMODE=SQL /SQLSVCACCOUNT="NT AUTHORITY\Network Service" /TCPENABLED=1
```

For other versions of SQL Server, the syntax of the installation command may be different.

Installation software for SQL Server Express 2019 can be found in the Sentinel LDK installation package, under: *\Windows\3rdparty\MSSQLExpress2019*

> Install the SQL Server instance using a normal installation, and specify the following:

a. (For the **Express** setup type) Specify the instance Name as: `EMSDATABASE`

b. Select the mix mode installation. (Windows authentication and SQL Authentication)

The password for the **sa** user is as follows:

> For the **Express** setup type: The password for the **sa** user must be: `DBA!sa@EMSDB123`

> For the **Advanced** setup type: The password for the **sa** user should not contain any characters from a non-English language. (Numbers and special characters such as !,@ and # are allowed.)

Configuring SQL Server

When you choose to install SQL Server manually for either the **Express** or **Advanced** setup type of Sentinel LDK-EMS installation, you must use the specifications described in this section.

Enable TCP/IP

1. Open SQL Server Configuration Manager (**Start > Programs > Microsoft SQL Server 2019 > SQL Server Configuration manager**)
2. In the left pane, expand the node SQL Server 2019 Network Configuration.
3. Select Protocols for EMSDATABASE. The protocol names and their status appear in the right pane. (For the **Advanced** setup type, you can use any instance name.)
4. In the right pane, double-click **TCP/IP**. The TCP/IP Properties dialog box is displayed.

5. Under the **Protocol** tab, select **Yes** from the list against the Enabled context menu.
6. Restart the SQL Server (EMDATABASE) service.

Configure the TCP/IP Port

1. Right-click **TCP/IP**. In the context menu, select **Properties**. The TCP/IP Properties dialog is displayed.
2. Select the **IP Addresses** tab.
3. Expand the **IPAll** node and do the following:
   a. Set the **TCP Port** field to blank. The SQL Server Express will not automatically choose another port when it restarts.
   b. Set the desired port number in the TCP Dynamic Port field (for example, 1433).
   c. Click **OK**.
4. Restart the SQL Server (EMDATABASE) service.

Infrastructure and Prerequisites

This section describes:

> "Infrastructure" below
> "Prerequisites" on the next page
> "Hardware" on the next page
> "Software" on page 24
> "SSL Certificate" on page 24

Infrastructure

Sentinel LDK-EMS uses the following infrastructure software:

> OpenJDK (installed by default by Sentinel LDK)

  OR

  Java Runtime Environment (JRE 8 Update 191)

> Microsoft .NET Framework 3.5 and 4.0

> **NOTE** Microsoft SQL Server 2019 Express Edition requires both Framework 3.5 and Framework 4.0.
>
> If Framework 3.5 is not enabled on your machine:
>
> - The Installer attempts to install Framework 3.5. This requires internet connectivity.
> - An alternative method to enable Framework 3.5 on your machine is to follow the instructions provided on the Web pages that follow.
>
>   For Windows 10, 11:
>
>   https://docs.microsoft.com/en-us/dotnet/framework/install/dotnet-35-windows
>
>   For Windows Servers:
>
>   https://docs.microsoft.com/en-us/windows-server/administration/server-manager/install-or-uninstall-roles-role-services-or-features#BKMK_arfw

- MS SQL Server 2019 Express Edition
- Tomcat 9.0.73

These will be installed by the Sentinel LDK installation procedure.

(If you choose to install MS SQL independently, you can use any of the supported versions of MS SQL. For supported version, see the Sentinel LDK Release Notes.)

Prerequisites

Installation of Sentinel LDK-EMS requires the following:

Hardware

- Minimum CPU: Intel Core™ i5 (latest generation or higher iX generation) Dual Core

  Recommended CPU: Intel Core™ i5 (latest generation or higher iX generation) Quad Core
- Minimum recommended RAM for Sentinel LDK-EMS production server: 16 GB

  Minimum recommended RAM for development, SDK evaluation: 8 GB
- Minimum disk space: 25 GB

Thales highly recommends that you install your production Sentinel LDK-EMS server on a dedicated machine.

The URL on which Sentinel LDK-EMS will be hosted should contain only characters that satisfy the RFC 952 standard (that is: A-Z, 0-9, minus sign and period).

> **NOTE** Sentinel LDK-EMS Service must be installed on a machine whose computer name does not exceed 15 characters.

Software

For the list of supported operating systems, see the Sentinel LDK Release Notes.

SSL Certificate

Sentinel LDK-EMS can be configured to use either the HTTP or HTTPS protocol for communication between the Sentinel LDK-EMS web server and the web browsers used to access Sentinel LDK-EMS.

The HTTPS protocol encrypts the communication between the server and web browsers. However:

- The communication with HTTPS is somewhat slower than with HTTP.
- To work with HTTPS, you may want to purchase an SSL (Secure Sockets Layer) certificate from a certificate authority. An SSL certificate is a digital certificate that authenticates the identity of a web site to visiting web browsers and encrypts information for the server using SSL technology. (The Sentinel LDK-EMS installation process automatically generates an SSL certificate. However, each user's web browser will generate a security exception with this certificate each time the user logs in.)

By default, Sentinel LDK-EMS is configured during installation to use HTTP. You can change this setting during installation or afterwards to use HTTPS. To change this setting after Sentinel LDK-EMS has been installed, see Sentinel LDK–EMS Configuration Guide.

To learn how to install an SSL certificate that you obtained from a certificate authority, visit https://tomcat.apache.org/tomcat-9.0-doc/ssl-howto.html#Installing_a_Certificate_from_a_Certificate_Authority.

For more information on HTTPS and SSL certificates, you can access the web sites listed below. (These links were valid when this guide was released.)

- http://info.ssl.com/article.aspx?id=10694
- https://www.thawte.com/resources/ssl-information-center/get-started-with-ssl/index.html
- http://www.verisign.com/ssl/buy-ssl-certificates/index.html
- http://en.wikipedia.org/wiki/Certificate_authority

Securing Your Sentinel LDK-EMS Installation

Among the actions taken to secure your installation of Sentinel LDK-EMS, Thales recommends that you include the following:

- Use a strong password for logging in to Sentinel LDK-EMS, and change the password periodically.
- Deploy a WAF (web application firewall) in front of Sentinel LDK-EMS.
- The Microsoft SQL Server connection to the Sentinel LDK-EMS database should be enabled with HTTPS.
- Use the latest version of TLS to secure communication with Sentinel LDK-EMS.

Types of Installation Setup

The Sentinel LDK-EMS installation wizard offers two types of installation setup:

Express

This setup type searches for the Sentinel LDK-EMS database and SQL Server on the local machine. If they are present, the installation wizard connects automatically to the database. If they are not present, the installation wizard installs the Sentinel LDK-EMS database and SQL Server automatically on the local machine.

No configuration screens are displayed during the installation process. If SQL Server is installed by the wizard, the SQL Server instance has the following user name and password:

- User Name: **sa**
- Password: **DBA!sa@EMSDB123**

Advanced

For this setup type, an SQL Server must already exist and must be active, either on the local machine or on a different machine. The installation wizard can either create a new Sentinel LDK-EMS database schema in SQL Server, or it can connect to an existing Sentinel LDK-EMS database.

With this setup type, you can also choose where to install Sentinel LDK-EMS and whether to use SSL security for Sentinel LDK-EMS web access.

> **NOTE** To create the Sentinel LDK-EMS database yourself, see "Installing and Configuring SQL Server Manually (Optional)" on page 20.

Installing Sentinel LDK-EMS

You use the Sentinel LDK installation wizard from the Sentinel LDK installation package to install Sentinel LDK-EMS. The installation wizard enables you to create a default installation with a basic configuration.

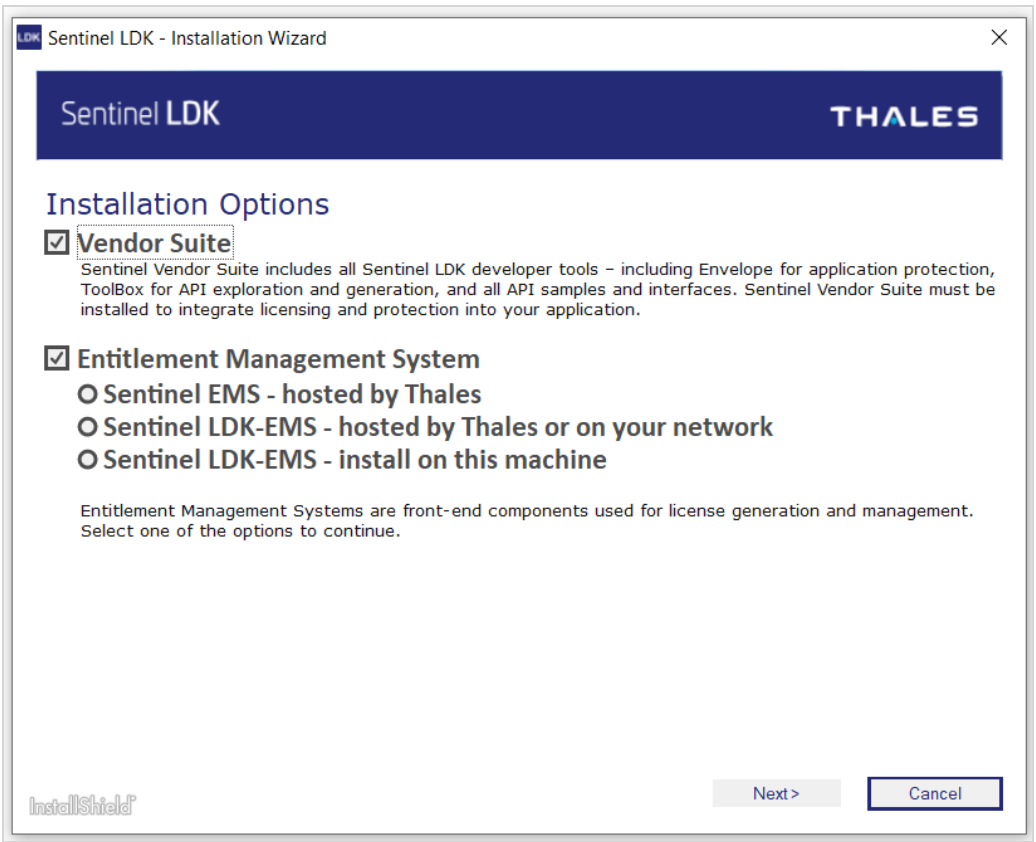
To run the Sentinel LDK Installation Wizard:

1. Log in to an account that has full administrator rights on the machine.
2. Close all open applications (including web browsers) on the machine where you will install Sentinel LDK-EMS.

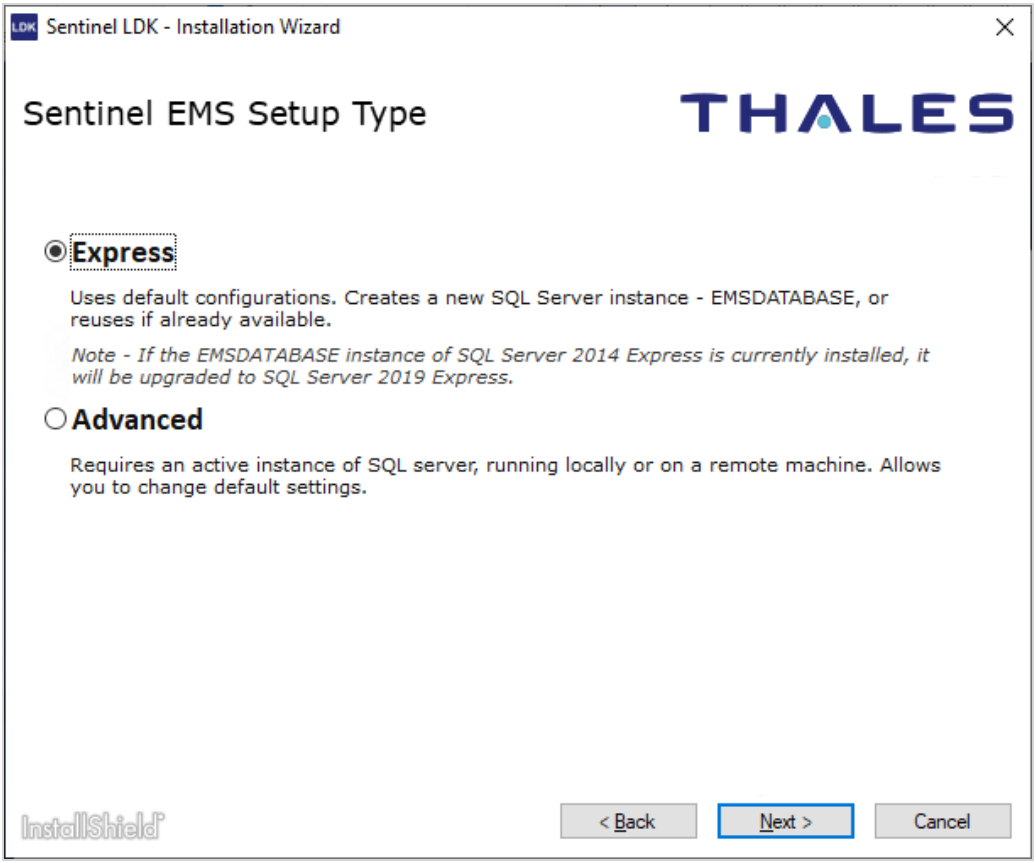
   > **NOTE** Before starting the Sentinel LDK Installation Wizard, ensure that no Windows update installation or any other **msi** installation is in progress.

3. Go to Thales Customer Support Portal for Sentinel LDK.
4. In the **Product Versions** box, click **9.0 SDK**.

5. Download **Sentinel-LDK_SDK_Windows.zip** and unzip the installation package to a temporary folder on your machine.
6. Browse to the **Windows** folder and double-click **setup.exe**.
7. Click **Start the Sentinel LDK Setup**. The Sentinel LDK Installation Wizard welcome window is displayed.
8. Click **Next**. You are asked to accept the license agreement. Read the license agreement carefully.
9. Accept the agreement and click **Next**. The Installation Options screen is displayed:



10. In the Installation Options screen, ensure that the following options are selected:
    - **Vendor Suite** (Select only if you are also installing Vendor Suite on the same machine.)
    - **Entitlement Management System**
        - **Sentinel LDK-EMS** – install on this machine
11. Click **Next**. The Setup Type screen is displayed:



12. In the Setup Type screen, select one of the following:

    - **Express**. The installation wizard complete the installation of Sentinel LDK-EMS using the defaults described earlier. A minimal amount of additional user input is required.

      If you selected the check box for Sentinel LDK Vendor Suite, then Sentinel LDK Vendor Suite is also installed.

    - **Advanced**. The installation wizard will prompt you for information on setting up the Sentinel LDK-EMS database and SSL security. (Ensure that Microsoft SQL Server for the database is active when you run the installation wizard.)

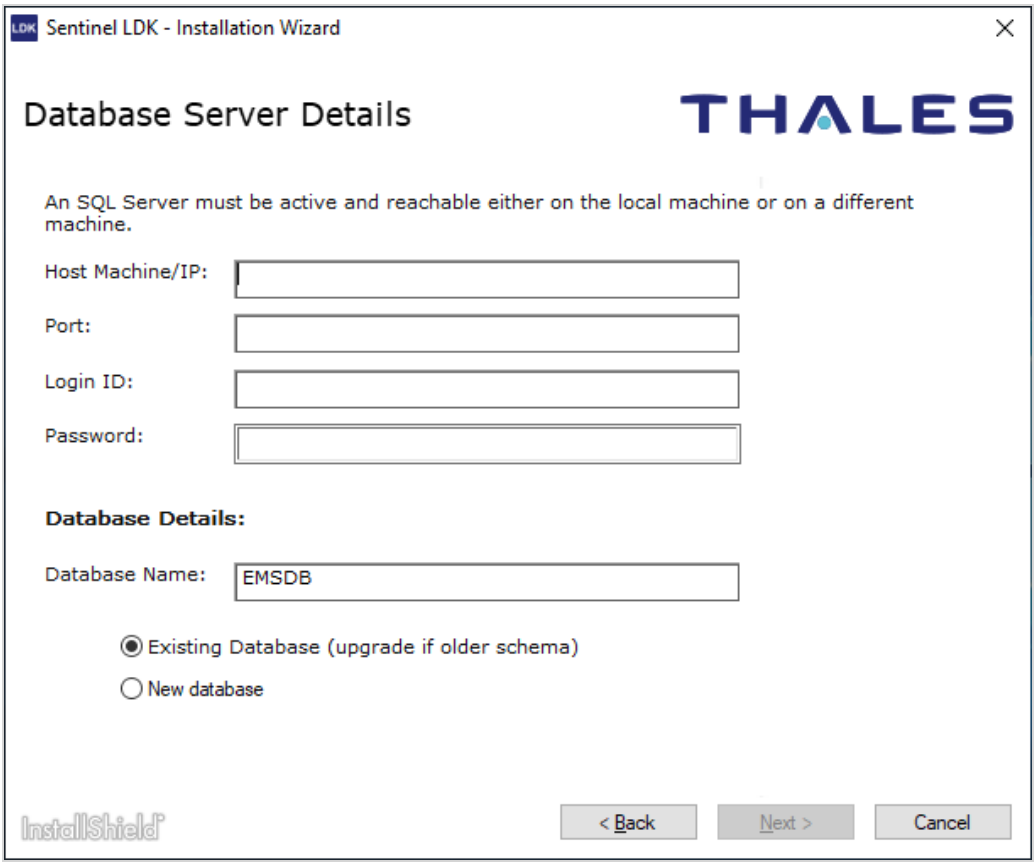
      For more information, see "Types of Installation Setup" on page 25.

13. Click **Next**. The Destination Folder screen is displayed. If you want, change the destination folder for Sentinel LDK.

14. Click **Install**. Installation proceeds. This requires several minutes. Accept all defaults during installation.

15. If you selected the **Express** setup type, continue with Step 16.

Otherwise, the Database Server Details screen is displayed.

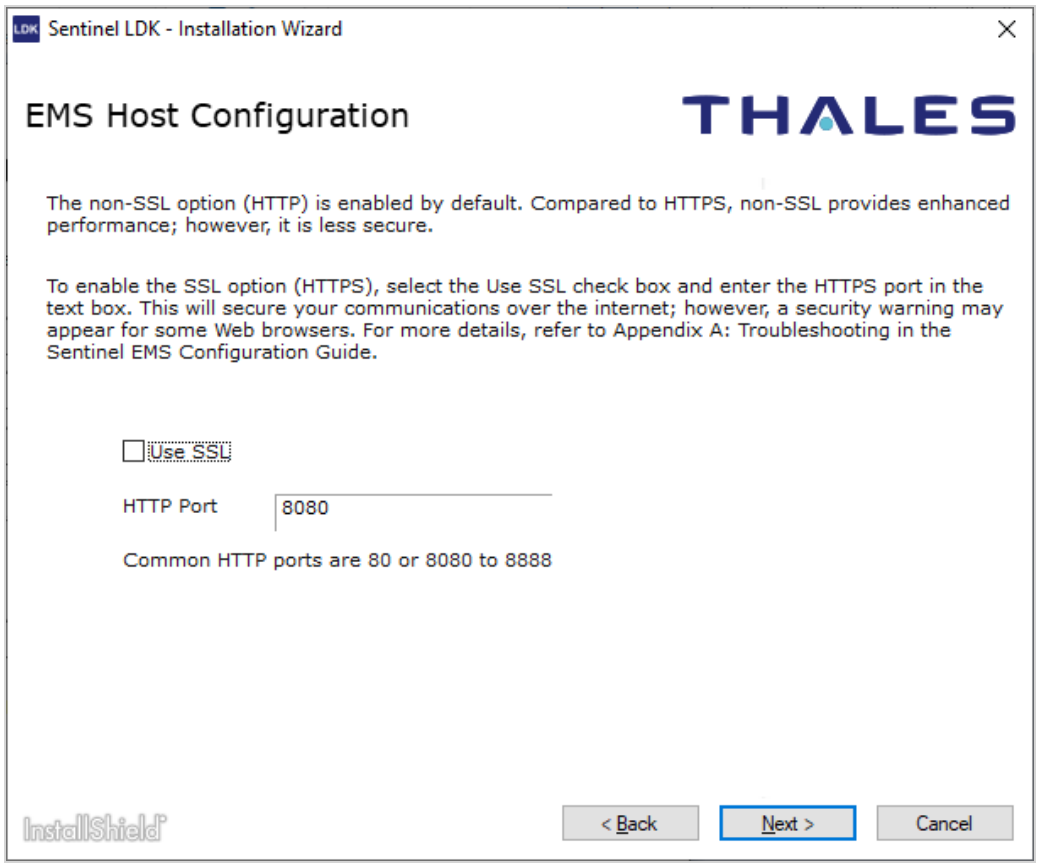


16. In the Database Server Details screen, enter the details for the existing SQL Server instance that will be used for the Sentinel LDK-EMS database. Then, in the Database Details area, select one of the following options:

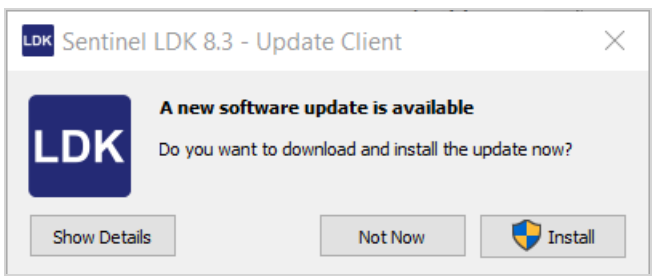
    - **Existing database.** The installation wizard configures Sentinel LDK-EMS to use the existing Sentinel LDK-EMS database whose details you specified.
    - **New database.** The installation wizard creates a new Sentinel LDK-EMS database in the SQL Server instance that you specified above.

      When you create a new database, you can select or clear the option **Fill Demo Data**. (The option is selected by default.) If the option is selected, the installation wizard adds demo information for the DEMOMA Batch Code to the Sentinel LDK-EMS database. Each Sentinel LDK-EMS user that is assigned the DEMOMA Batch Code can view and generate reports based on the demo information.

17. Click **Next**. The LDK-EMS Host Configuration screen is displayed.



18. In the LDK-EMS Host Configuration screen, you can:
    - Select the **Use SSL** check box if you want to use the HTTPS protocol. To use the HTTP protocol, leave the check box clear.
    - Change the HTTP port for accessing Sentinel LDK-EMS.
19. Click **Next**. Installation of Sentinel LDK-EMS continues to completion.
20. After the installation, Sentinel LDK Software Manager checks automatically to determine if a later version of any of the Sentinel LDK software is available. If a later version is found, a message similar to the following is displayed:



You can click **Install** to install the update. For more information regarding this message, see "Installing Software Updates" on page 103.

21. When the entire installation process is completed, connect the Sentinel Master key to the machine on which the Sentinel LDK-EMS Service is installed.

> **NOTE** If you need to re-install Sentinel LDK-EMS for any reason, you must first remove the existing Sentinel LDK-EMS program.
>
> Removing Sentinel LDK-EMS *does not* delete the existing database.

Configuring Sentinel LDK-EMS to Work With JRE

After installation or upgrade, Sentinel LDK-EMS works with OpenJDK. If you want to work with JRE, follow the steps below.

To configure Sentinel LDK-EMS to work with JRE:

1. Set the JRE_HOME system variable to point to the path of the of an x64 JRE installation.

   To check system variables, go to **Control Panel > System > Advanced > Environment Variables**.

2. After modifying JRE_HOME, reboot the machine. Sentinel LDK-EMS now works with JRE.

Accessing Sentinel LDK-EMS

After you install Sentinel LDK-EMS, you can log in to the default administrator account. The user name and password for the default administrator are **admin**.

> **NOTE** The first time you log in to Sentinel LDK-EMS, you must change the default password for the **admin** account. You can also change this password at any time from the top-right corner of Sentinel LDK-EMS.

To open Sentinel LDK-EMS:

1. **Prerequisite:** Under Windows Services, start **Sentinel LDK-EMS Service** on the machine where Sentinel LDK-EMS Service is installed if the service is not already started.
2. From the Start menu, open **Sentinel LDK**. The Sentinel LDK Launcher is displayed. You can access most of the Vendor Suite applications from this screen.
3. In Sentinel LDK Launcher, click **Sentinel LDK-EMS**. If needed, configure the Sentinel LDK-EMS location as described in "Configuring Sentinel LDK to Work With Sentinel LDK-EMS" on page 17.

Configuring Sentinel LDK-EMS

You can configure Sentinel LDK-EMS from the Sentinel LDK-EMS Administration Console. Some examples of configuration settings include:

- SMTP mail server to be used by Sentinel LDK-EMS to send various types of email notifications.
- Configuring Sentinel LDK-EMS to use the HTTPS protocol (if this was not done during installation of Sentinel LDK-EMS).
- Configuring license and certificate settings.

These and many other topics are described in the Sentinel LDK-EMS Configuration Guide (described below).

To access the Sentinel LDK-EMS Administration Console:

1. Log in to Sentinel LDK-EMS as the default administrator (**admin**) or as a user with the **Super User** or the **Batch Code Admin** role.
2. Select **Administration > Administration Console**.The Sentinel LDK-EMS Administration console is displayed.

To access the Sentinel LDK-EMS Administration Console documentation (Sentinel LDK-EMS Configuration Guide):

Do any of the following:

- Access the online version of the Sentinel LDK–EMS Configuration Guide.
- In Sentinel LDK-EMS Administration Console, click the **Help** link at the top-right corner of the page.
- Open the local, PDF version of the Sentinel LDK-EMS Configuration Guide:
  a. From the Start button, enter **Sentinel LDK**. The Sentinel LDK Launcher is displayed.
  b. Select **Documentation > Manuals and Tutorials** and navigate to **Sentinel LDK-EMS > Sentinel LDK-EMS Configuration Guide**.

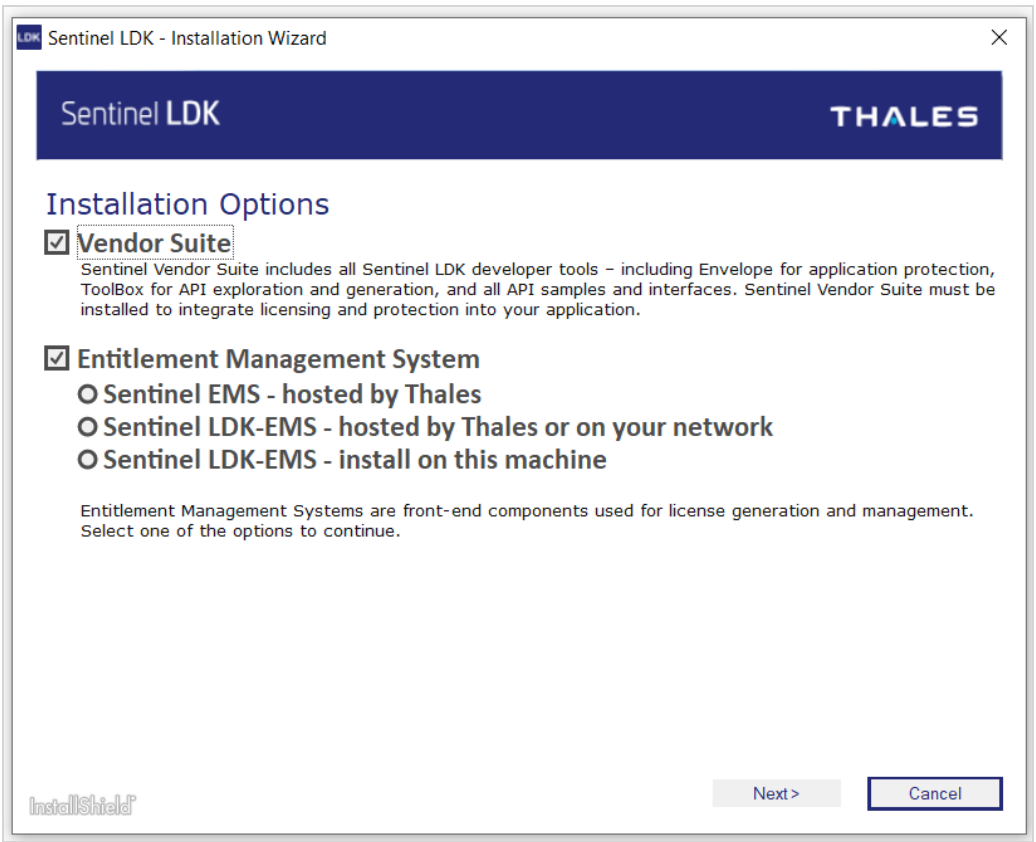
Installing Sentinel LDK Vendor Suite

Use the procedure below to install Sentinel LDK Vendor Tools on your machine without installing Sentinel LDK-EMS.

To install Sentinel LDK Vendor Suite with a Sentinel LDK launcher:

1. Ensure that you do not have any Sentinel Vendor keys or Sentinel HL keys connected to your machine.
2. Go to Thales Customer Support Portal for Sentinel LDK.
3. In the **Product Versions** box, click **9.0 SDK**.

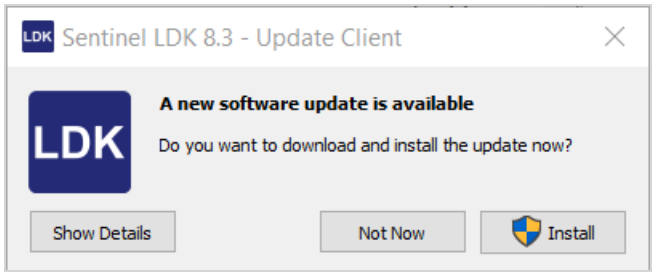
4. Download **Sentinel-LDK_SDK_Windows.zip** and unzip the installation package to a temporary folder on your machine.
5. Browse to the **Windows** folder and double-click **setup.exe**.
6. Click **Start the Sentinel LDK Setup**. The Sentinel LDK Installation Wizard welcome window is displayed.
7. Click **Next**. You are asked to accept the license agreement.
8. Accept the agreement and click **Next**. The Installation Options screen is displayed:



9. Ensure that the following option is selected:
   - **Vendor Suite**

   Click **Next**.
10. Follow the instructions to install Sentinel LDK Vendor Suite.

After the Installation Wizard has completed, Sentinel LDK Software Manager checks automatically to determine if a later version of any of the Sentinel LDK software is available. If a later version is found, a message similar to the following is displayed:



11. You can click **Install** to install the update. For more information regarding this message, see "Installing Software Updates" on page 103.
12. If Sentinel LDK-EMS is installed on your network (not on this machine), set the Sentinel LDK-EMS URL, as described in "Configuring Sentinel LDK-EMS" on page 31.

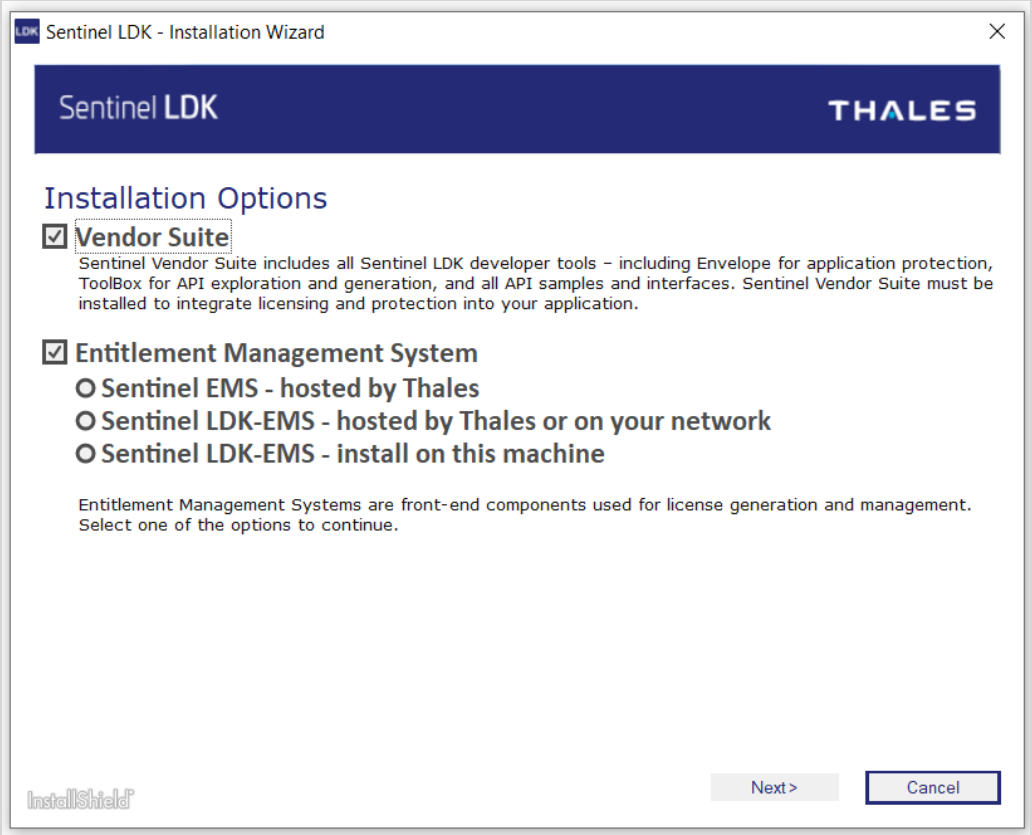
Installing a Remote Launcher for Sentinel LDK-EMS

If you are not installing Sentinel Vendor Suite on the machine, use the procedure below to install a Sentinel LDK launcher for starting Sentinel LDK-EMS.

(Otherwise, if you want to install both Sentinel LDK Vendor Suite and a Sentinel LDK launcher for starting Sentinel LDK-EMS, go to "Installing Sentinel LDK Vendor Suite with Sentinel LDK Launcher" on page 13.)

To install a launcher for Sentinel LDK-EMS:

1. Ensure that you do not have any Sentinel Vendor keys or Sentinel HL keys connected to your machine.
2. Go to Thales Customer Support Portal for Sentinel LDK.
3. In the **Product Versions** box, click **9.0 SDK**.
4. Download **Sentinel-LDK_SDK_Windows.zip** and unzip the installation package to a temporary folder on your machine.
5. Browse to the **Windows** folder and double-click **setup.exe**.
6. Click **Start the Sentinel LDK Setup**. The Sentinel LDK Installation Wizard welcome window is displayed.
7. Click **Next**. You are asked to accept the license agreement.
8. Accept the agreement and click **Next**. The Installation Options screen is displayed:



9. Ensure that only the following options are selected:

   - **Entitlement Management System**
     - **Sentinel LDK-EMS – hosted by Thales or on your network**

   Click **Next**.

10. Follow the instructions to install the Sentinel LDK launcher.

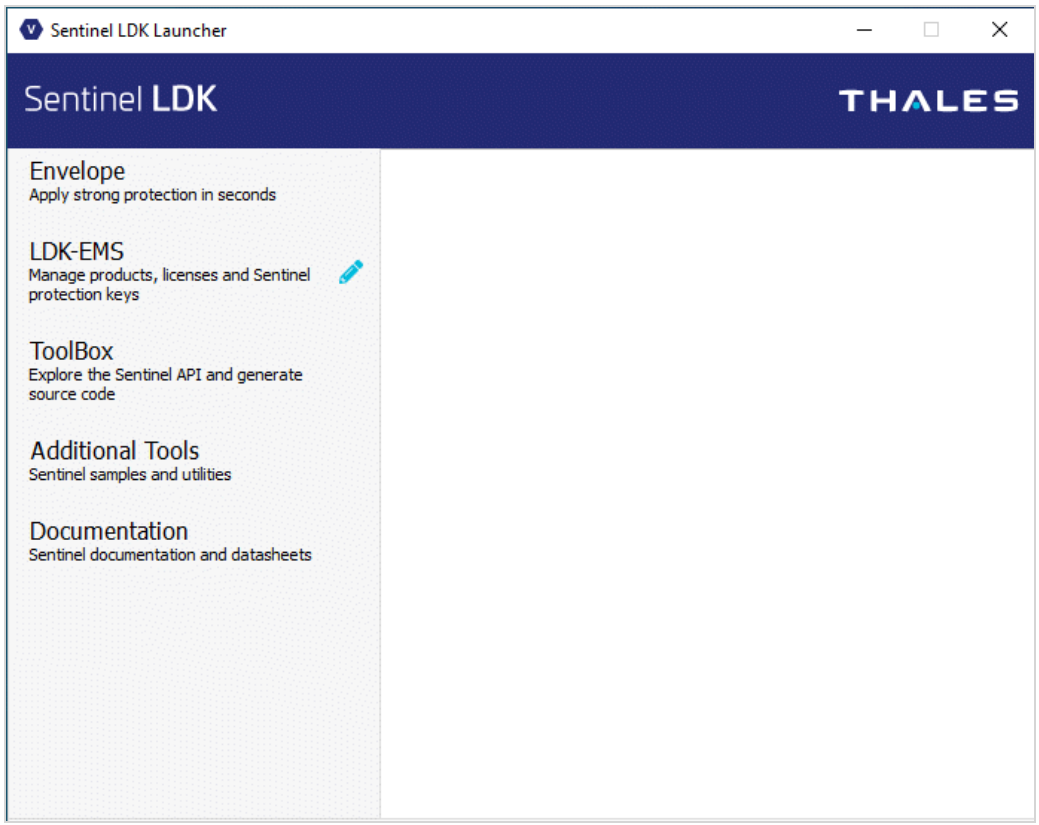
11. When the installation process is completed: Configure the Sentinel LDK launcher to start Sentinel LDK-EMS as described in "Configuring Sentinel LDK to Work With Sentinel LDK-EMS on Your Network" on the next page.

Configuring Sentinel LDK to Work With Sentinel LDK-EMS on Your Network

Follow the instructions below to configure Sentinel LDK to work with Sentinel LDK-EMS on a Windows machine.

To configure Sentinel LDK to work with Sentinel LDK-EMS:

1. From the Start menu, select **Thales > Sentinel LDK**. The Sentinel LDK Launcher is displayed.



2. Set the Sentinel LDK-EMS URL.
   a. In the navigation pane, next to **Sentinel LDK-EMS**, click the edit button . The Set Up Access to Sentinel LDK-EMS screen is displayed.
   b. Enter the URL for Sentinel LDK-EMS and click **Save**.
3. Set the Sentinel LDK-EMS URL for Sentinel Admin Control Center.
   a. From the navigation pane, click **Additional Tools > Admin Control Center**. Sentinel Admin Control Center opens.
   b. In the Options pane, click **Configuration**. The Configuration page is displayed.
   c. From the top of the page, click the **Network** tab. The Network page is displayed.
   d. In the **EMS URL** field, add the URL for Sentinel LDK-EMS. (Do not overwrite any existing URLs in the field.)
   e. Click **Submit**.

Upgrading From Earlier Versions

This section describes how to upgrade to Sentinel LDK 9.0 from an earlier version of Sentinel LDK, Sentinel HASP or HASP SRM.

Upgrade considerations:

- When upgrading from Sentinel LDK versions 7.3 through 7.8 to Sentinel LDK 9.0, all non-English locales of Customer contacts and Channel Partner contacts in Sentinel LDK-EMS are converted to the English locale. A solution for this issue is provided in the technical note available here.

  > **NOTE** You can ignore this issue if all of your Customer contacts and Channel Partner Contacts are set up to use the English locale or if you are not upgrading Sentinel LDK-EMS.

- The procedure for upgrading to Sentinel LDK v.9.0 has only been tested for Sentinel LDK versions 8.3 and later.

  If you plan to upgrade from an earlier version of Sentinel LDK, please contact Technical Support to validate the upgrade scenario. (This applies whether you are upgrading Sentinel LDK Vendor Suite, Sentinel LDK-EMS, or both.)

- After you complete an upgrade of Sentinel LDK-EMS, the file **server.xml** includes only TLS version 1.2 as the acceptable cryptographic protocol. This version of TLS is more secure than earlier versions.

  If you included TLS version 1.0 or 1.1 as an acceptable protocol until now and you want to retain that version, you must modify **server.xml** manually.

  > **NOTE** The TLS 1.0 and 1.1 cryptographic protocols have known vulnerabilities. Thales highly recommends that you not add TLS 1.0 or 1.1 as an acceptable protocol.

  For more information, see "Retaining TLS 1.0 or 1.1 as an Acceptable Protocol" on page 39.

In this section:

Upgrading From Sentinel LDK v.6.x or Later

If Sentinel LDK-EMS or Sentinel LDK Vendor Suite from Sentinel LDK v.6.x or later has been installed on your machine, use the procedures below to upgrade to Sentinel LDK v.9.0.

In this section:

Upgrading Vendor Suite

No special action is required to upgrade from any earlier version of the Vendor Suite. The Sentinel LDK installation wizard automatically uninstalls and reinstalls Vendor Suite.

Upgrading Sentinel LDK-EMS

To upgrade from Sentinel LDK-EMS v.6.x or later:

1. Back up the Sentinel LDK-EMS database.
2. Install Sentinel LDK-EMS as described in this section. The installation wizard automatically detects the existence of an earlier version of Sentinel LDK-EMS and offers you the option to upgrade to the latest version.

   > **NOTE** Thales recommends that you clear your web browser cache before you start working with the current version of Sentinel LDK-EMS.

3. Re-introduce your Master key or Developer key as described in "Using the Master Wizard to Introduce a Sentinel Vendor Key" on page 54.
4. (Optional) Sentinel LDK-EMS works with OpenJDK. If you want to use JRE, continue to "Configuring Sentinel LDK-EMS to Work With JRE" on page 30 to set the JRE_HOME system variable to point to the path of the installed JRE.

Modifying the Sentinel LDK-EMS Database for Advanced Channel Partner Functionality

This topic is relevant if you have recently added or plan to add the Channel Partner module tor your Sentinel LDK Master license.

> **NOTE** If you have not created any channel partners in Sentinel LDK-EMS, no special actions are required before you add the Channel Partner module. You can ignore this topic.

Until you add the Channel Partner module to your Sentinel LDK Master license, Sentinel LDK-EMS allows you to associate the entitlements for a given customer with different channel partners. Once the Channel Partner module is added, each customer can only be associated with a single channel partner.

Before you can work effectively with the advanced Channel Partner functionality provided by the module, a script must be run that modifies the Sentinel LDK-EMS database to create direct links between existing channel partners and their customers. The script ensures that no customers are associated with multiple channel partners. If a customer is associated with multiple channel partners, the script links the customer to only one of the channel partners. A log file lists the customers for whom multiple channel partners were found.

You must work with your channel partners to resolve these conflicts and ensure that each customer is connected to a single channel partner. If necessary, resolve conflicts by creating new customers in Sentinel LDK-EMS.

The script to modify the Sentinel LDK-EMS database is executed using the following methods:

- During the Sentinel LDK-EMS upgrade procedure, the Installer automatically executes the script. Any conflicts that are found are recorded in the Installer log at *%SystemDrive%\EMS_Log\emsInstaller.log*.
- Click the **Sync Data for Channel Partner Module** button in the Sentinel LDK-EMS Administration Portal to run the script. Any conflicts that are found are recorded in the configuration log at *%ProgramFiles (x86)\Thales\Sentinel EMS\EMSServer\webapps\ems\log\emsConfig.log*.

The script can be executed multiple times.

You can add the Channel Partner module to your Sentinel LDK Master license before or after the script is executed. However, you should plan to add the module to your LDK Master license as close as possible to the time when the script is executed (using either method).

Resolving Sentinel LDK-EMS Upgrade Issues

> **NOTE** This topic is applicable when you upgrade from Sentinel LDK-EMS v.6.3 or later to v.9.0.

The Sentinel LDK-EMS installation procedure automatically merges components that you have customized in Sentinel LDK-EMS. In addition, all configuration changes that you performed in the existing Sentinel LDK-EMS are backed up under %EMS_HOME%\Backup. If you find any differences after you upgrade to Sentinel LDK-EMS v.9.0, you can manually merge the conflicting files.

To resolve any differences that you may find after upgrade, you can map the backup and current locations to manually merge the files. The following table provides the details of the components that are placed in the backup location.

Customizable Component	Backup Location %EMS_HOME%\Backup\...	Original Location %EMS_HOME%\EMSServer\ webapps\...
Template Files (TPLs)		
.TPL files	WEB-INF\classes	ems\WEB-INF\classes
Themes and Languages		
Themes	themes	ems\themes
Images	themes\blackGolden\images	ems\themes\ blackGolden\images
Language (messages_ [language_code].properties)	WEB-INF\classes	ems\WEB-INF\classes

Customizable Component	Backup Location %EMS_HOME%\Backup\...	Original Location %EMS_HOME%\EMSServer\webapps\...
Samples		
emsWSDemo	emsWSDemo	emsWSDemo
Others		
ems.properties	WEB-INF\classes	ems\WEB-INF\classes
message.properties	WEB-INF\classes	ems\WEB-INF\classes

Retaining TLS 1.0 or 1.1 as an Acceptable Protocol

After you complete a new installation or upgrade of Sentinel LDK-EMS, the file **server.xml** includes only TLS version 1.2 as the acceptable cryptographic protocol. This version of TLS is more secure than earlier versions.

If, for any reason, you want to include TLS version 1.0 or 1.1 as an acceptable protocol, you must modify **server.xml** manually as described below.

> **NOTE** The TLS 1.0 and 1.1 cryptographic protocols have known vulnerabilities. Thales highly recommends that you not add TLS 1.0 or 1.1 as an acceptable protocol.

To retain TLS 1.0 or TLS 1.1 as acceptable protocols in server.xml:

1. On the machine where Sentinel LDK-EMS is installed, open the following file in a text editor:

   %ProgramFiles(x86)%\Thales\Sentinel EMS\EMSServer\conf\server.xml

2. Locate the following string in the **Connector** tag:

   ```
   sslEnabledProtocols ="TLSv1.2"
   ```

3. Add `TLSv1` or `TLSv1.1` (or both) to the string. For example:

   ```
   sslEnabledProtocols ="TLSv1+TLSv1.1+TLSv1.2"
   ```

4. Save the file.

5. In the Services window, stop and then restart **Sentinel LDK-EMS Service**.

Sentinel LDK-EMS Network Configuration Options

Sentinel LDK-EMS is a web-based, multi-tier application with two primary components: Sentinel LDK-EMS Service and the Sentinel LDK-EMS database. These components can be installed on a single machine or on separate machines (server).

The web application front end in Sentinel LDK-EMS Service provides two portals, one for software vendor users and another for customers (primarily for activation purposes). Sentinel LDK-EMS Service can be installed and configured for each portal on a separate machine. (This is not a typical configuration for web applications.)

Based on the vendor requirements, a number of security provisions are possible for Sentinel LDK-EMS installation. Instances of Sentinel LDK-EMS are usually installed on a DMZ (demilitarized zone) using an external firewall that controls external access, and an internal firewall that allows access to the Sentinel LDK-EMS database.

Sentinel LDK-EMS listens on a TCP port for incoming requests. If the installation is configured for SSL, the requests are encrypted using the built-in SSL feature. Sentinel LDK-EMS then communicates with the Sentinel LDK-EMS database (a single database for the entire system) to process the requests.

This section describes the considerations and procedures for installing the Sentinel LDK-EMS components, including different configurations for installing Sentinel LDK-EMS on multiple machines in a network environment.

> **NOTE** Thales recommends that you:
> - Frequently back up your Sentinel LDK-EMS database to protect your data.
> - Add adequate security measure including SSL communication link and a firewall to protect your data and application.

In this section:

- "Standard Production Configuration for Sentinel LDK-EMS" below

  Installation of Sentinel LDK-EMS Service and the Sentinel LDK-EMS database on two separate machines.

- "Sentinel LDK-EMS Web Portals on Separate Servers" on page 42

  Installation of the Sentinel LDK-EMS Vendor web portal and the Customer web portal on two separate machines. The Sentinel LDK-EMS database is installed together with the Vendor web portal or on a third machine.

Standard Production Configuration for Sentinel LDK-EMS

Sentinel LDK-EMS Service and the SQL server for the Sentinel LDK-EMS database are each installed on a separate machine. Sentinel LDK-EMS Service is protected by an external firewall.

In this section:

- "Installing Sentinel LDK-EMS" on the next page

> "Configuring the Firewall" below

> " Main Points of the Standard Production Configuration" on the next page

> "Configuration Summary" on the next page

Installing Sentinel LDK-EMS

1. On one machine, create an SQL database with a user name and password. The user must have SQL sysadmin or dbcreator privileges for this database.
   For more information, see "Installing and Configuring SQL Server Manually (Optional)" on page 20.
2. On a second machine, run the Sentinel LDK-EMS installation procedure. In the procedure, ensure the following:
   a. Select only **Sentinel LDK-EMS** for installation. It is not necessary to install **Vendor Suite**.
   b. Select the **Advanced** setup type.
   c. In the Sentinel LDK-EMS Database Configuration screen, specify the information for the SQL database you created earlier.
   d. Select **Use existing database**.

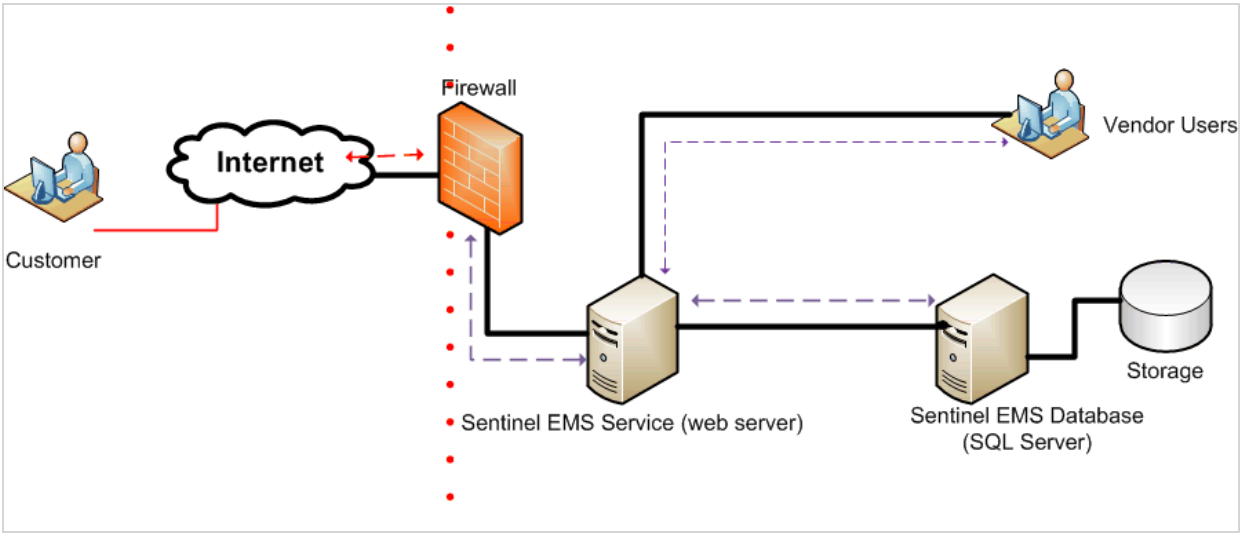
   The full Sentinel LDK-EMS installation procedure is described in "Installing Sentinel LDK-EMS on Your Machine" on page 19.
3. Complete the installation wizard.

   Thales recommends that you specify to use the SSL communication protocol.

Configuring the Firewall

An external firewall should be configured to accept requests and to forward only the valid request to Sentinel LDK-EMS.

You can set firewall rules that enables your customers to access Sentinel LDK-EMS, but does not allow them to access the SQL database server, as shown in the diagram that follows.



Main Points of the Standard Production Configuration

- End users (customers) and vendor employees have access to a common Application server.
- Differentiation is by authentication and authorization (access rights).
- External end users can access only a selected URL.
- The Sentinel LDK-EMS database can be accessed only by the internal network of the vendor.

Configuration Summary

- Deploy Sentinel LDK-EMS Service and MS SQL Server for the Sentinel LDK-EMS database on two separate machines.
- Use an external firewall. Configure the firewall to allow only for the customer URL (set of URL expose only for Customer access).
- Place the web server (Sentinel LDK-EMS Service with Tomcat) and the SQL Server inside the firewall.
- The Sentinel Master key must be attached to the machine where Sentinel LDK-EMS Service is installed.

Sentinel LDK-EMS Web Portals on Separate Servers

The Sentinel LDK-EMS web front consists of two portals:

- For vendor users
- For customers (primarily used for activation)

These Sentinel LDK-EMS portals are usually installed on a single machine (as described in the previous section). However, you can choose to configure Sentinel LDK-EMS so that each portal and the Sentinel LDK-EMS database are all installed on separate machines.

Each server listens on a TCP port for incoming requests. The requests are encrypted using the SSL feature if configured accordingly. Each server then communicates with the Sentinel LDK-EMS database (a single database for the entire system) to process the requests.

In this section:

Installing Sentinel LDK-EMS

1. On one machine, create an SQL database with a user name and password. The user must have SQL sysadmin or dbcreator privileges for this database.
   For more information, see "Installing and Configuring SQL Server Manually (Optional)" on page 20.
2. For the Vendor portal: On a second machine (or the same machine), run the Sentinel LDK-EMS installation procedure. In the procedure, ensure the following:
   a. Select only **Sentinel LDK-EMS** for installation. It is not necessary to install **Vendor Suite**.
   b. Select the **Advanced** setup type.
   c. In the Sentinel LDK-EMS Database Configuration screen, specify the information for the SQL database you created earlier.
   d. Select **Use existing database**.

   The Sentinel LDK-EMS installation procedure is described in "Installing Sentinel LDK-EMS on Your Machine" on page 19.
3. Complete the installation wizard.

   Thales recommends that you specify to use the SSL communication protocol.
4. For the Customer portal: On a separate machine, run the Sentinel LDK-EMS installation procedure again. In the procedure, ensure the following:
   a. Select only **Sentinel LDK-EMS** for installation. It is not necessary to install **Vendor Suite**.
   b. Select the **Advanced** setup type.
   c. In the Sentinel LDK-EMS Database Configuration screen, specify the information for the SQL database you created earlier.
   d. Select **Use existing database**.
5. Complete the installation wizard.

   Thales recommends that you specify to use the SSL communication protocol.
   No additional configuration is required.

6. On the Customer portal machine: configure Sentinel LDK-EMS so that the installation can only be accessed using a customer-related URL (requests which are only applicable to the Customer portal). This configuration is a manual process. Contact Thales Professional Services for assistance to perform the required configuration.

Configuring the Firewalls

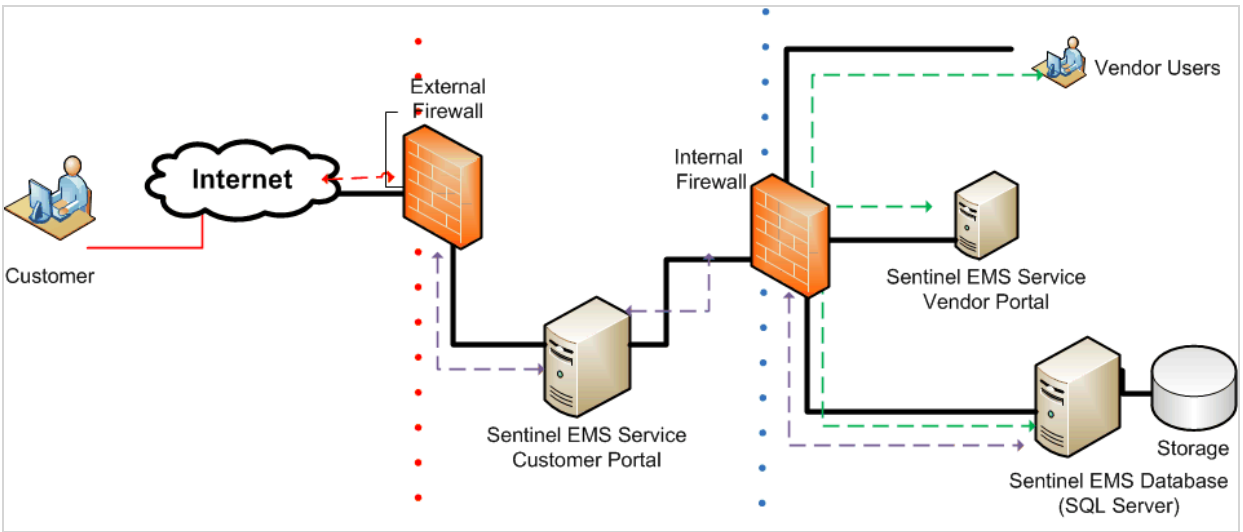
The external firewall should be configured to accept only requests that are related to the Customer portal. The requests should be forwarded to the instance of Sentinel LDK-EMS Service that acts as the Customer portal. Sentinel LDK-EMS Service then accesses the remote Sentinel LDK-EMS database through the internal firewall.

The Sentinel LDK-EMS Vendor portal and the Sentinel LDK-EMS database could be installed on a single machine or on two separate machine inside the internal fire wall.

External access to the Vendor portal should be blocked by the external firewall.

All access to the Sentinel LDK-EMS database and the Vendor portal should be only through the internal firewall.

The diagram that follows shows the configuration described in this section.



Main Points of the Separate Portals Configuration

> End users (customers) and vendor employees access Sentinel LDK-EMS on different application servers.

> Differentiation is by authentication and authorization (access rights).

> External end users can access only the Customer portal of Sentinel LDK-EMS using a selected URL.

> Internal vendor users can access the Vendor portal of Sentinel LDK-EMS.

> The Sentinel LDK-EMS database can be accessed only by the internal network of the vendor.

Configuration Summary

> Deploy Sentinel LDK-EMS Service as a Vendor portal and as a Customer portal on two separate machine

- Deploy MS SQL Server for the Sentinel LDK-EMS database inside the internal firewall, on a separate machine or on the same machine as the Vendor portal.
- Use two proxies (internal and external).
- Configure the external proxy to allow only for the customer URL (set of URLs exposed only for Customer access), to allow access to the Customer portal.
- Set up Sentinel LDK-EMS Service for the Customer portal to access only the Sentinel LDK-EMS database and only through the internal firewall.
- Place the instance of Sentinel LDK-EMS Service for the Vendor portal inside the internal firewall
- Place the SQL server behind the internal proxy.
- A Sentinel Master key must be attached to each machine where Sentinel LDK-EMS Service is installed.

Troubleshooting a Sentinel LDK-EMS Installation

This section describes issues that might occur during or after the installation of Sentinel LDK-EMS (on-premises) and provides possible solutions.

In this section:

- "Problems During Installation" below
- "Problems After Installation" on page 47
- "Frequently-Asked Questions" on page 48

Problems During Installation

This section describes problems that may occur during the installation process for Sentinel LDK-EMS.

Issue: During Sentinel LDK-EMS installation, the following message is displayed:

Kindly Start the Service -SQLServer(EMSDATABASE) and then click OK

When you click **OK**, the installation fails with multiple errors.

Solution:

Your machine contains earlier versions of JRE, and you manually installed JRE 8 in addition to the earlier versions.

Uninstall the earlier versions of JRE, and then rerun the Sentinel LDK Installation Wizard to install Sentinel LDK-EMS.

Issue: During Sentinel LDK-EMS installation, the following message is displayed:

Solution:
Check which version of Windows Installer (from Microsoft) is present on your machine. (From the Start menu, Click **Run**. In the Open Box, type `msiexec.exe` and click **OK**. The Windows Installer screen is displayed. The version appears on the first line of the screen.)

If the version on your machine is earlier than 4.5, download and install version 4.5 from the Microsoft web site.

Issue: The Sentinel LDK-EMS installer detects an earlier version and attempts to remove it, but fails.

Solution:
Do one of the following:

> If Sentinel LDK-EMS is visible in the **Programs and Features** screen (which you can access from the Control Panel), remove it from there. Restart the installation.

> If Sentinel LDK-EMS is not visible in the **Programs and Features** screen or if it is not successfully uninstalled by removing it:

a. From the Windows Start menu, select **Run** and enter **regedit**. The Registry Editor is displayed.

b. Locate and delete the following entry:

32-bit machine:

HKEY_LOCAL_MACHINE\SOFTWARE\SafeNet\Sentinel EMS

64-bit machine:

HKEY_LOCAL_MACHINE\Software\Wow6432Node\Safenet\Sentinel EMS

c. Locate and delete the following entry:

32-bit machine:

HKEY_LOCAL_MACHINE\SOFTWARE\SafeNet\Sentinel EMS

64-bit machine:

HKEY_LOCAL_MACHINE\Software\Wow6432Node\Safenet\Sentinel EMS

d. Restart the installation.

Issue: Installation of Sentinel LDK-EMS failed.

Solution:
Do one or more of the following:

> Check if the operating system on the machine is supported for Sentinel LDK-EMS installation.

> Check log files at **%Systemdrive%\EMS_log** to see if any issues are listed.

> Make a note of the step at which the installation failed. Report the issue to Technical Support.

Issue: Miscellaneous problems

Previous uncompleted installation of Sentinel LDK-EMS

The machine on which Sentinel LDK-EMS is being installed may have some previous incomplete installation / removal of software in an incomplete state.

This could be due to any software, including Sentinel LDK-EMS.

Solution:
Boot your system before trying to install Sentinel LDK-EMS.

Problems After Installation
This section describes problems that may occur after successfully installing Sentinel LDK-EMS.

Issue: The Login button on the Login screen does not function

Due to high security settings in the web browser, the Login button on the login screen of Sentinel LDK-EMS does not work.

Solution:
In your web browser, do the following:

1. From the menu bar, go to **Tools > Internet Options**. A dialog is displayed.
2. Click the **Security** tab.
3. Click **Sites** and add the URL of Sentinel LDK-EMS to the list of trusted sites.
4. Apply the changes and restart your browser.

This problem has been seen under Windows Server 2003 and Windows Server 2008.

Issue: Port not available

Given the following situation:

> A user is not able to access the Sentinel LDK-EMS site (localhost/ems)

> In the Services screen, Sentinel LDK-EMS Service has the status **Started**.

This can be caused by a port conflict. The HTTP/HTTPS port for Sentinel LDK-EMS may be in use by another application.

Check the Sentinel LDK-EMS log file. This can be found at:

%ProgramFiles(x86)%\Thales\Sentinel EMS\EMSServer\webapps\ems\log\)

(For 32-bit machines: %ProgramFiles%\....)

If the log file shows a “JVM binding” issue, this indicates that the port used by the Sentinel LDK-EMS web application run is in use by another application.

Solution:
To resolve a port conflict:

Use the Netstat command to identify which application has occupied the required port. Do one of the following:

> Stop the conflicting application as follows:

  a. Enter: `netstat -aon | findstr "8080"`
  The relevant process ID is displayed.

  b. Use the Task Manager to cancel the process with this process ID.

  c. Restart Tomcat.

> Configure Sentinel LDK-EMS to use a different port.
  Modify the port used by Sentinel LDK-EMS in the web_service.xml file and the database.

> Remove and then reinstall Sentinel LDK-EMS (removal does not remove the Sentinel LDK-EMS database).

Issue: Users are not able to access Sentinel LDK-EMS

Solution:
Sentinel LDK-EMS Service may be installed behind a firewall, and it was not added in the exception list for the firewall.

Frequently-Asked Questions

This section describes and answers some of the frequently asked questions relating to the installation of Sentinel LDK-EMS (on-premises) in a network environment.

Can I use a non-system administrator (sa) account?

Yes, you can use a non-system administrator account as follows:

1. Open the Microsoft SQL Server Management utility and create a new login. Ensure that:
   - The login uses SQL server authentication
   - The defined database is the Sentinel LDK-EMS database (by default, EMSDB)

- User mapping maps the login to the Sentinel LDK-EMS database, enabling all roles except db_denydatawriter and db_denydatareader

2. Edit all the configuration files and change the CONNECT_STRING parameters as follows:
   - Change **uid** to the login name that you defined
   - Change **pwd** to the password that you defined

   Note that this string is displayed many times in the configuration files and must be changed in every instance.

   The configuration files are:
   - context.xml
   - ems-quartz.xml
   - ems.properties
   - emsconfig.properties
3. Restart the server.
4. Check the connection by entering the following URL in your browser: https://<server>:<port>/ems/ (OR http://<server>:<port>/ems/)

   The test will return a **Database connection: PASSED** message.

How can I best secure my Sentinel LDK-EMS system?

> Implement the standard IT information security protocols that are applicable to your organization.

> Ensure that only the TCP port number, as defined for HTTP/HTTPS ports configured in Tomcat, are accessible.

> Ensure that only Sentinel LDK-EMS can access the SQL database.

> Change the default admin password. For details, see the Sentinel LDK–EMS User Guide.

> Ensure that personnel in your organization are designated appropriate roles in Sentinel LDK-EMS, and that their accounts are inaccessible when they are no longer part of the organization. For more information about assigning roles, see the Sentinel LDK–EMS User Guide.

CHAPTER 3: Introducing Your Sentinel Vendor Keys to Sentinel LDK

When you order Sentinel protection keys from Thales, you are assigned a unique Batch Code. Your Batch Code represents your unique confidential Vendor Code.

Your Sentinel LDK Starter Kit contains a Sentinel LDK Master key and a Sentinel LDK Developer key (referred to collectively as *Sentinel Vendor keys*). Each Sentinel Vendor key contains your unique Vendor Code.

You must "introduce" one of your Vendor keys to Sentinel LDK using the Sentinel LDK Master Wizard. Introducing a Vendor key means running the Master Wizard on a machine that has access to the Vendor key. This enables the Master Wizard to perform a number of important functions as described in "Master Wizard Functions" on the next page.

If you have multiple Batch Codes, you must introduce one of your Vendor keys for each Batch Code.

You must introduce one of your Sentinel Vendor keys to the system:

- Before you use Sentinel LDK Vendor Suite for the first time.
- After each time you upgrade to a new version of Sentinel LDK.

This ensures that your applications are protected and licensed with the unique codes that have been assigned to you and that you are working with the latest APIs and libraries.

> **NOTE** The Sentinel LDK Master key is required only when working with Sentinel LDK-EMS (on-premises). Vendors who are working with Sentinel LDK-EMS (hosted by Thales) can handle all functions using the Sentinel LDK Developer key.

For more information about Batch Codes, see the description of personalized Vendor and Batch Codes in the Sentinel LDK Software Protection and Licensing Guide.

In this section:

Master Wizard Functions

This section describes the functions performed by the Master Wizard and the machines on which the Master Wizard must be run for each function.

The Master Wizard performs one or more of the following:

> **Configure Sentinel LDK-EMS**

The wizard "introduces" (registers) a new Batch Code in Sentinel LDK-EMS. This is required so that Sentinel LDK-EMS will recognize the Batch Code and perform actions for that Batch Code.

You can run the Master Wizard on any machine that can connect to Sentinel LDK-EMS (hosted by Thales or on-premises).

Run the Master Wizard before you start working with Sentinel LDK-EMS. Thales recommends that you rerun the Master Wizard after each new release of Sentinel LDK.

> **Download vendor-specific APIs and the vendor library**

The wizard downloads vendor-specific APIs and the vendor library from Thales servers. These are generated individually for each Batch Code and are used by Sentinel LDK Envelope and Licensing API to implement license enforcement.

Run the Master Wizard on each machine where you have installed Vendor Suite.

Run the wizard before you start working with Sentinel LDK-EMS. Thales recommends that you run the Master Wizard after each new release of Sentinel LDK.

> **Generate customized RTE installers**

> **NOTE** To generate the customized RTE installers for Mac and for Linux, use the Windows version of the Master Wizard.

The wizard downloads Run-time Environment (RTE) installers from Thales servers and customizes them on your machine. The Master Wizard customizes the installers by embedding your vendor library and the server address for Sentinel EMS or Sentinel LDK-EMS.

The installers are saved to:

%UserProfile%\Documents\Thales\Sentinel LDK <version>\Redistribute\Runtime Environment

These installers can be distributed to:

- Customers who require the Run-time Environment to access protection keys.
- (Under Windows) Customers who will use the Sentinel LDK-EMS Customer Portal to activate or update licenses.

Run the Master Wizard on any machine where the Sentinel LDK launcher is installed.

Thales recommends that you run the Master Wizard after each new release of Sentinel LDK or of the Run-time Environment.

Methods of Introducing a Vendor Key

You can introduce your Vendor key using either of the following methods:

> Download over the Internet

Using this method, the Master Wizard connects to the Thales server over the Internet and downloads the required files to your machine. This is the easiest method.

> Extraction from a Master Wizard Package

If the machine where you want to introduce a Vendor key cannot connect to the Internet, you can request a Master Wizard Package (MWP) file from Thales customer services. You will receive an MWP file that was generated specifically for your Batch Code and contains all of your customized libraries and RTE installers. The Master Wizard reads this file and extracts the libraries and installers that you select.

You select your preferred method of introduction when you run the Master Wizard.

Remote Connection of Vendor Keys

Sentinel Master key (for Sentinel LDK-EMS on premises) and Developer keys can be connected remotely using available third-party solutions. These solutions can be used in cases where a physical key cannot be connected due to the lack of a USB port or inability to physically access the machine. You can connect your Master or Developer keys to an over-the-network USB solution and access them from any physical or virtual machine as if they were connected locally.

There are several such solutions, both software-based (that can be installed on any PC with a USB port) and dedicated devices. Among the dedicated devices, Thales recommends utnserver Pro, myUTN-2500, dongleserver Pro, and dongleserver ProMAX by SEH Technology. These devices were tested for Thales Sentinel HL keys, and are backed by partnership between SEH Technology and Thales.

Selecting the Version-Enforcement Option

API libraries that are customized for your Batch Code are used by Sentinel LDK Envelope and Sentinel Licensing API to protect your applications. These libraries are generated by Thales specifically for your Batch Code. You download these customized vendor libraries using the Master Wizard when you introduce your Vendor keys.

The Master Wizard offers you a choice of two types of libraries, each incorporating one of the options described below. The option that you select determines how protected applications interact with the Run-time Environment (the RTE). The available options are:

> **Version-restricted option** (Recommended for best security and reliability in the protected application)

For protected applications that require the RTE: With the version-restricted option, the applications will require a *minimum version* of the RTE (the earliest version that contains the latest important security and reliability enhancements). Use of the version-restricted option ensures that end users cannot downgrade to an earlier version of the RTE and that they use a version of the RTE that provides the best quality together with all the latest security and reliability fixes. This restriction applies both for local deployment of the RTE and for deployment of the RTE on a remote license server machine.

For each new release of Sentinel LDK, the required *minimum version* number is updated only if the RTE for that release contains significant security and reliability enhancements.

Example: The required *minimum version* of the RTE for applications protected with versions 7.9 through 8.0 of the customized vendor libraries remains as RTE version **7.90**, because this version of the RTE contains the latest significant security and reliability enhancements. Later versions of the RTE contain less important enhancements and fixes.

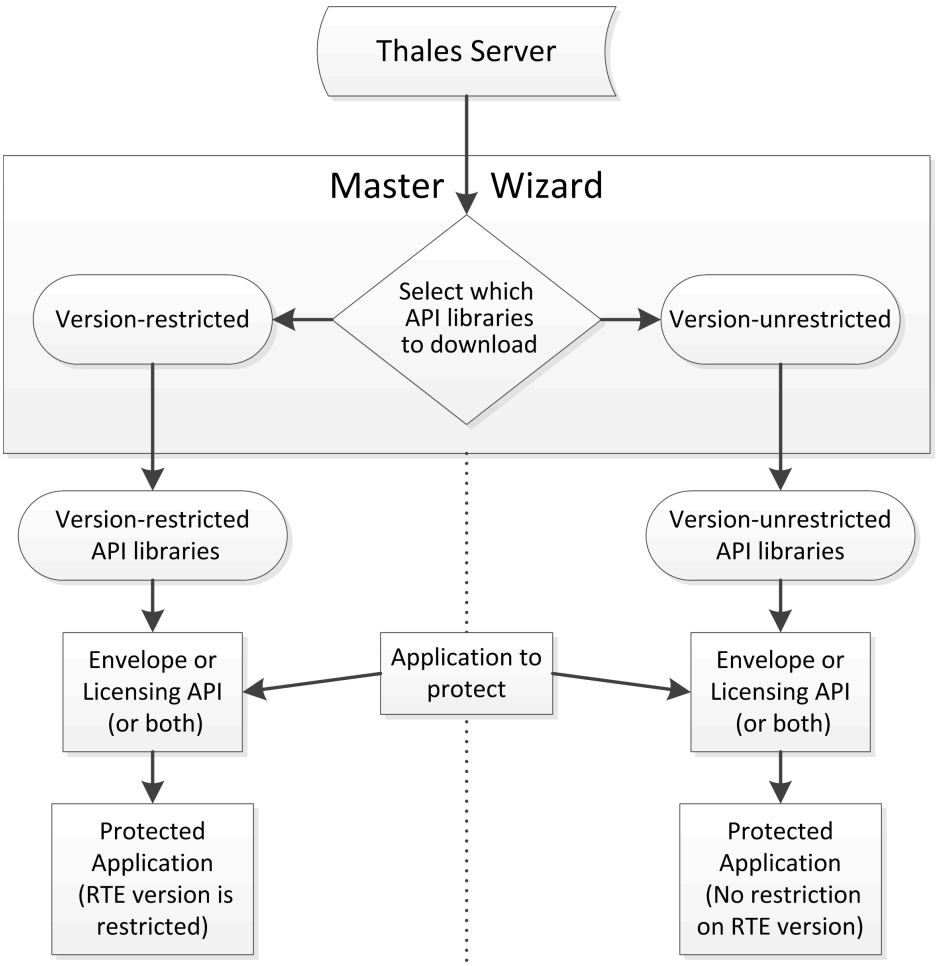
> **NOTE** The version-restricted option is only relevant for the static Licensing API because the user can replace the new version of the dynamic Licensing API with an older version.
>
> **Example:** Given that the dynamic Licensing API version 8.1 has a security issue. The vendor downloads the version-restricted dynamic Licensing API 8.2 using the Master Wizard, and then releases the new version of the dynamic Licensing API. However, a user can bypass any new security enhancements in the new version if they can obtain the old version of the dynamic Licensing API and replace the new version.

> **Version-unrestricted option** (For compatibility with all versions of the RTE)

For protected applications that require the Run-time Environment: The applications will not check the version number of the RTE. Applications protected with this option can be used with all versions of the RTE. Select this option only if you want to avoid upgrading the RTE at end user sites. This option simplifies deployment, especially when network license servers are used, but does not guarantee that security and reliability fixes in later RTE versions are employed.

> **NOTE** With either option, users will need to upgrade their RTE if the protected application uses specific functionalities that require a later version of the RTE.

The diagram that follows illustrates how this process operates.



For more information, see “Required Version of the Run-time Environment” in the Sentinel LDK Software Protection and Licensing Guide.

Using the Master Wizard to Introduce a Sentinel Vendor Key

Perform the procedure that follows to run the Sentinel LDK Master Wizard and introduce one of the Sentinel Vendor keys (Master Key or Developer Key).

NOTE You can use either a Developer key or a Master key with the relevant Batch Code to perform this process. There is no requirement to use a specific key. However:

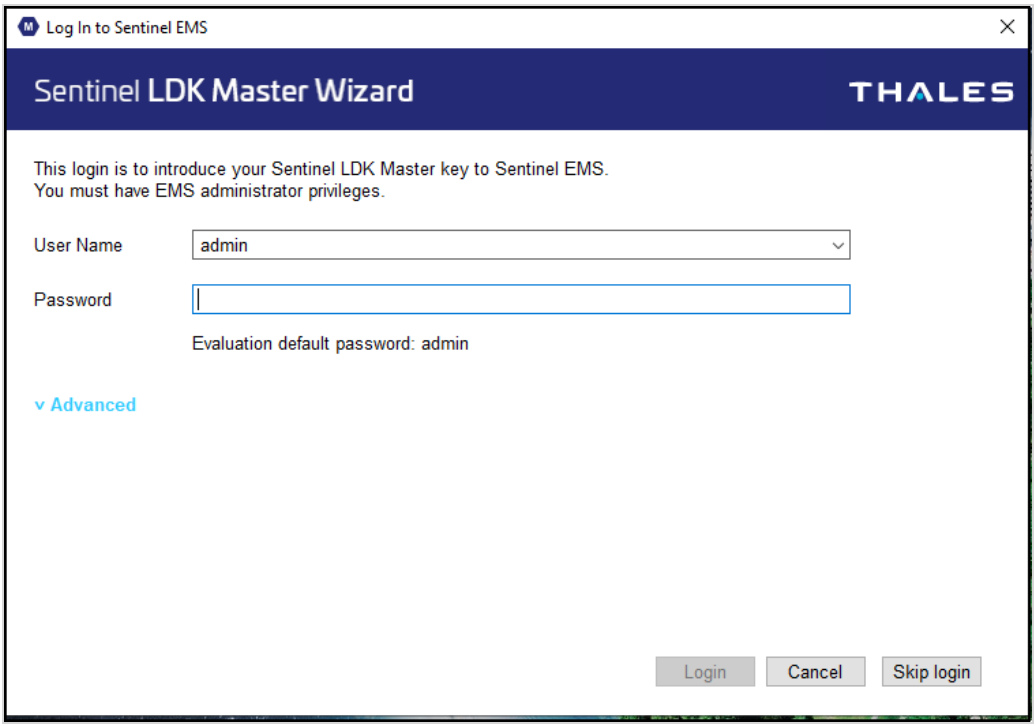
- To generate licenses using Sentinel LDK-EMS (on-premises), the Master key must be left connected to the local machine where Sentinel LDK-EMS is installed.
- To protect applications, a Developer key must usually be left connected to each machine where Sentinel LDK Envelope is used.

To introduce a Sentinel Vendor key:

1. **Prerequisite:** Choose the machine on which to run the Master Wizard and decide what you want to accomplish before starting this procedure. For details, see "Master Wizard Functions" on page 51.
2. In the Windows Services window, ensure that the Sentinel LDK-EMS Service is active.
3. Connect a Vendor key to the relevant machine in one of the following ways:
   - Connect the key to the machine locally.
   - Connect the key to the machine using a remote USB solution as described in "Remote Connection of Vendor Keys" on page 52.
4. From the Start menu, select: **Thales > Sentinel LDK.** The Sentinel LDK Launcher program selection screen is displayed.
5. From the Sentinel LDK Launcher screen, choose **Additional Tools > Sentinel Master Wizard**.

   > **NOTE** If you open either Sentinel LDK Envelope or Sentinel LDK ToolBox, and the application detects a Vendor key with a new Batch Code, the Master Wizard starts automatically.

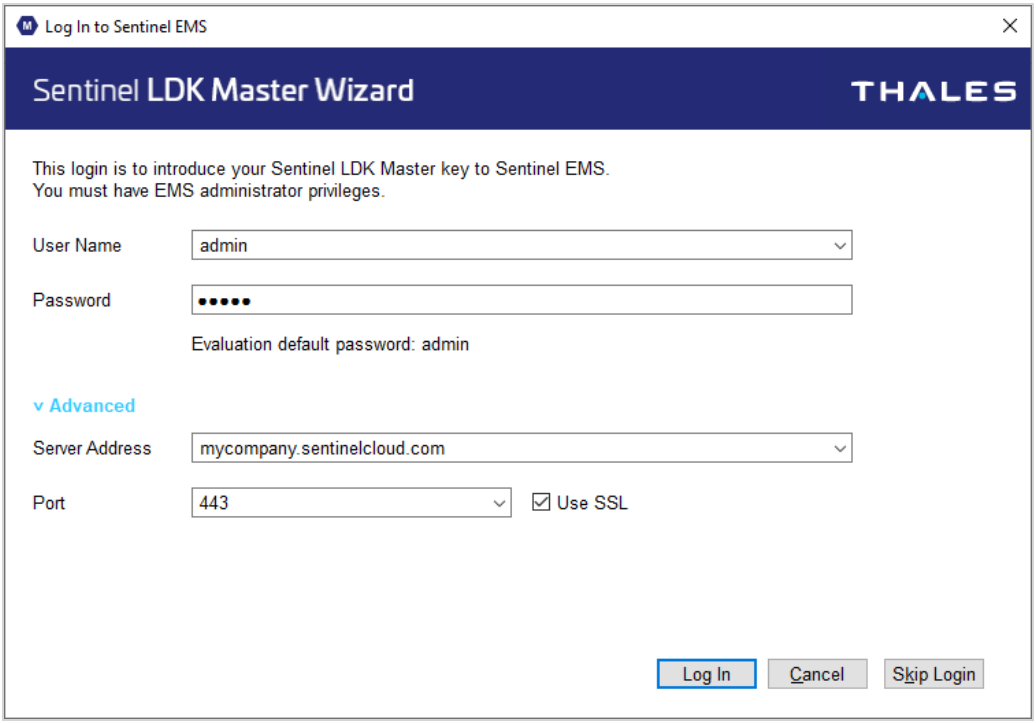
   The Log In to Sentinel LDK-EMS window is displayed:



6. In the user name and password fields:
   - If you are running the wizard to configure Sentinel LDK-EMS (as described in "Master Wizard Functions" on page 51), enter the user name and password for an EMS administrator; otherwise, leave these fields blank.

7. If you are configuring Sentinel LDK-EMS (hosted by Thales or on a remote machine) or you want to generate customized RTE installers (as described in "Master Wizard Functions" on page 51):

   a. Click **Advanced**. *Use these additional fields to specify public information for accessing Sentinel LDK-EMS from your customers' machines.*



   b. In **Server Address:** Specify the URL for accessing Sentinel LDK-EMS.

   c. In **Port**:

      - For Sentinel LDK-EMS (Thales-hosted): Enter **443**.
      - For Sentinel LDK-EMS (on-premises): Enter **8080** or the port as configured for your site.

   d. In **Use SSL**:

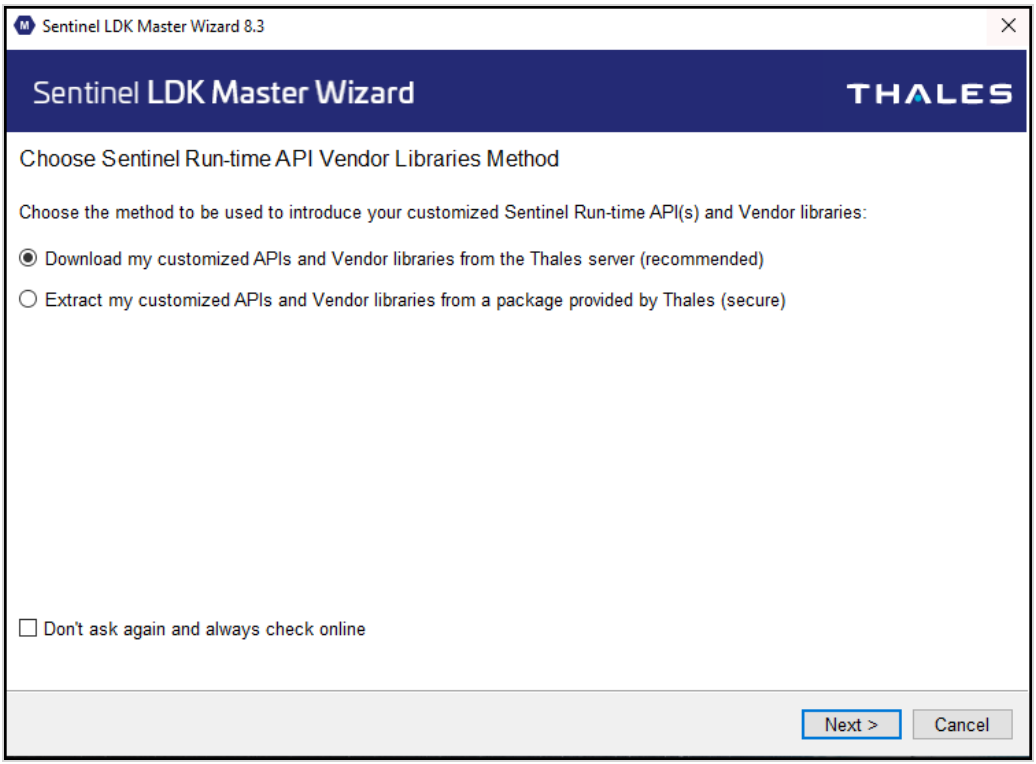
      - For Sentinel LDK-EMS (Thales-hosted): Select the check box.
      - For Sentinel LDK-EMS (on-premises): Select or clear the check box as configured for your site.

NOTE For Sentinel LDK-EMS (on-premises): If the public information provided in the fields above cannot be used to access your on-premises Sentinel LDK-EMS server within your network, you must run the Master Wizard a second time to configure Sentinel LDK-EMS:

- First, complete the wizard and save the customized RTE installers generated by the wizard to a different location.
- Next, run the wizard again to configure Sentinel LDK-EMS. In the Advanced fields above, specify the information for accessing the Sentinel LDK-EMS server in your local network.

8. If you provided a user name and password above, click **Login**. Otherwise, click **Skip login**.

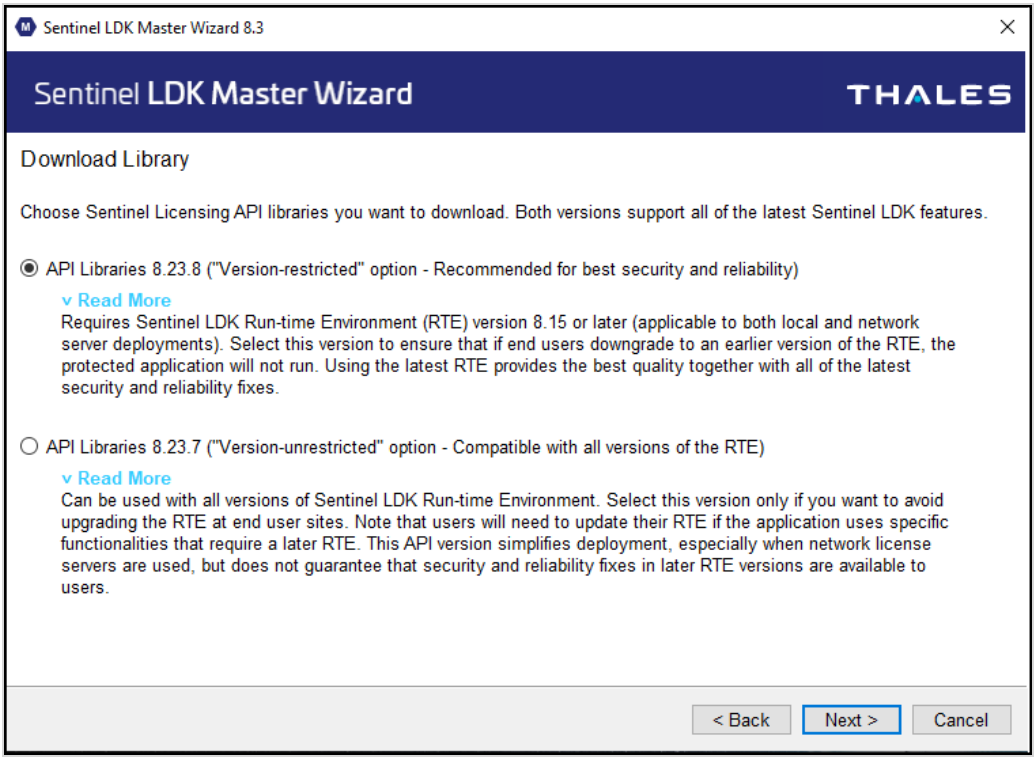
   The following screen is displayed:



9. Select the desired method for introducing your Vendor key. For more information, see "Methods of Introducing a Vendor Key" on page 52.

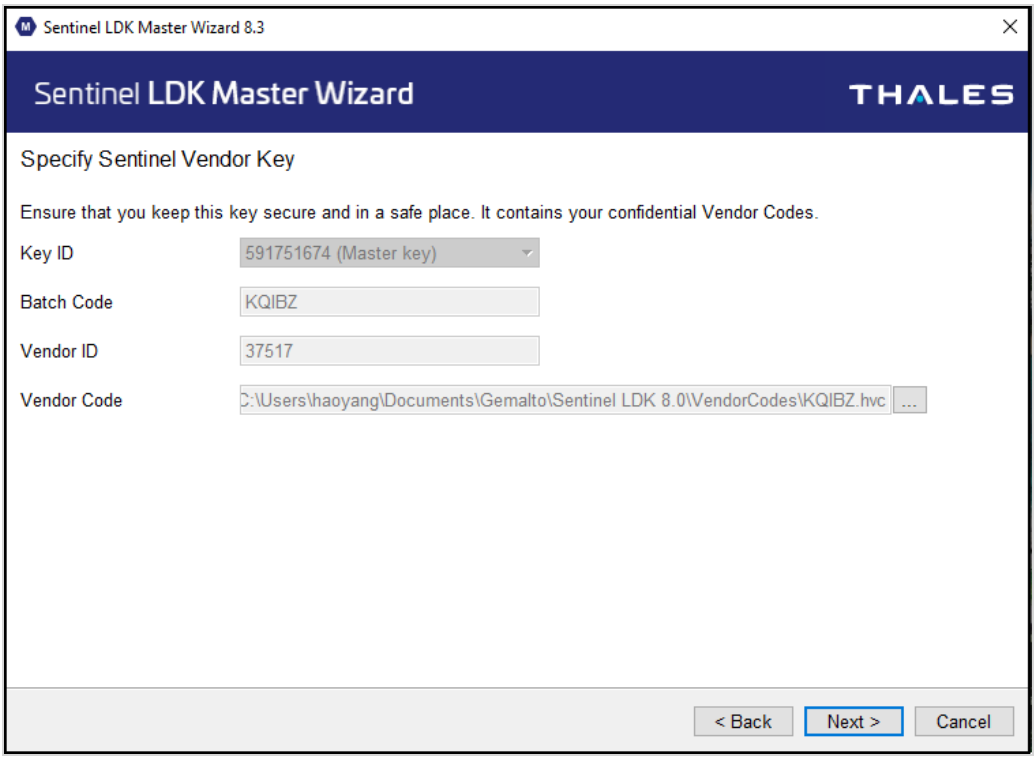
10. Click **Next**. (If you chose the "Extract" method above, the wizard asks you to browse to and select your MWP file.)

The following screen is displayed:



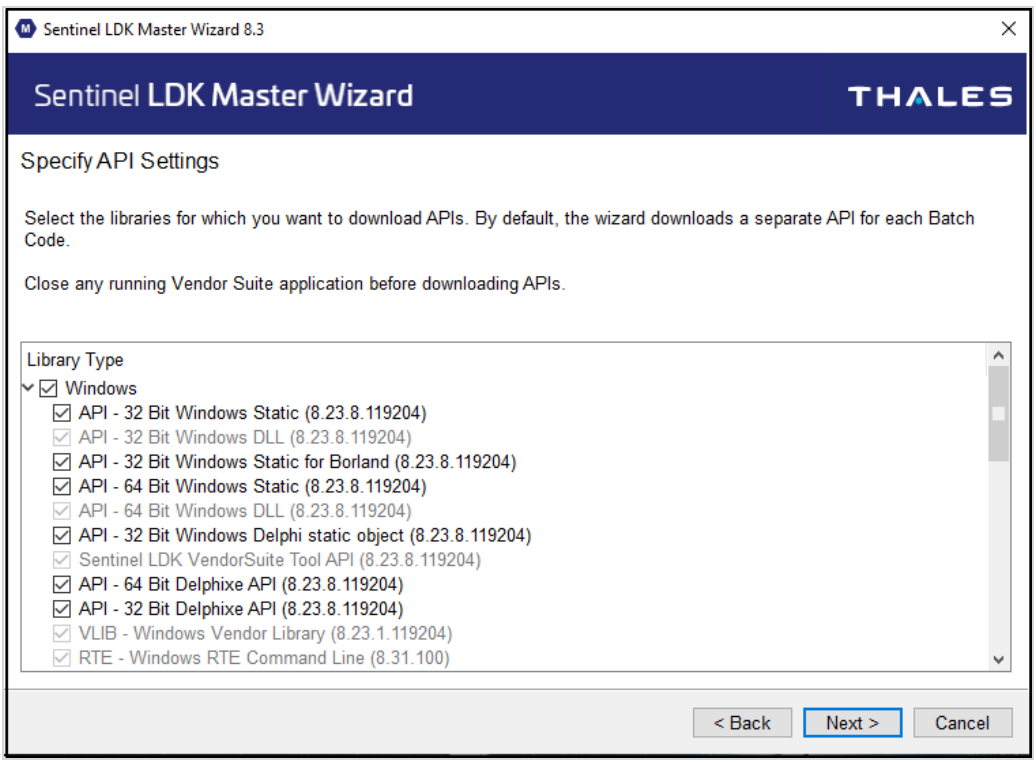
11. Select the **version-restricted** or **version-unrestricted** option (see "Selecting the Version-Enforcement Option" on page 52). Click **Next**.

The following screen is displayed:



12. Ensure that the Key ID for the relevant Vendor key is displayed. Click **Next**.

The following screen is displayed:



13. Select the libraries for which you want to generate APIs and select the Run-time Environment installers that you want to download and configure (some items are selected by default and cannot be cleared).

> **NOTE** The Specify API Settings screen is always displayed and the selected items downloaded each time you run the Master Wizard. Ignore these items if you do not need them on the machine where you are running the wizard.

14. Click **Next**.

- The generated APIs are downloaded to the following directory, under the appropriate subdirectory:

  %userProfile%\Documents\Thales\Sentinel LDK 9.0\API\Licensing\

- The configured Run-time Environment installers are downloaded to:

  %userProfile%\Documents\Thales\Sentinel LDK 9.0\Redistribute\Runtime\

15. Click **Finish** to close the wizard.

For additional information on Vendor Codes, see "Understanding Sentinel LDK Software Protection and Licensing" in the Sentinel LDK Software Protection and Licensing Guide.

CHAPTER 4: Configuring High Availability for Cloud Licensing

Sentinel LDK supports configuring a vendor-hosted cloud license server for high availability.

Sentinel LDK License Manager servers in the vendor's data center can be configured to store licenses in a common external trusted license storage (a MySQL database cluster).

> **NOTE** Sentinel LDK License Manager servers are referred to as *license servers* in this document.

You can set up two or more active license servers. The load balancer spreads out the traffic of the workload among the license server machines. All of the License Managers handle license requests simultaneously.

This section describes how to configure Sentinel LDK to support high availability for cloud licensing hosted by the vendor.

> **NOTE**
>
> - The purpose of this section is to demonstrate one method for implementing high availability, using NGINX. Using the functionality provided by Sentinel LDK, you can use the same tools and methods or you can use other tools and methods to accomplish the same goal.
> - If you are working with the active-passive configuration for multiple License Managers, see the High Availability Configuration Guide available from here.

Overview

Vendor-hosted cloud licensing provides vendors with a simplified method of distributing and managing software licenses for their protected applications. However, this method also obligates the vendor to ensure that the Sentinel LDK License Manager server (referred to below as *license server*) for the hosted cloud licenses are available at all times.

To support high availability for license servers, multiple license servers are typically used. A load balancer distributes license requests among the license servers to ensure that all requests are processed without delay. In the event one of the license servers fails, the remaining license servers provide high availability without causing any downtime or loss of licenses. Some of solutions for redundant license servers use 2-out-of-3 licensing concept to limit license abuse.

Challenges with Redundant License Manager Schemes

Traditional on-premises redundant License Manager schemes face the following challenges:

- License seat management

  If the license is a network license, the failover system must be able to handle distribution of network seats between the primary and secondary License Manager dynamically, and the system must be able to prevent license abuse by unscrupulous customers.

- License persistent data sync

  If the license contains persistent data such as an execution counter, and the counter is exhausted in one License Manager, the failover system must be able to cope with this when switching to an alternate License Manager.

- License activation/update

  Traditionally, each License Manager must be capable of handling, activating and updating the licenses that it manages.

The License Manager provided by default by Sentinel LDK stores licenses in a "secure storage". This type of storage can be accessed and updated only by the specific License Manager that is used to create it. As a result, this type of License Manager is not suited for use with a failover system. It is not possible to synchronize license data among License Managers that use secure storage.

Trusted License Storage Solution

With Sentinel LDK 8.3 and later, a License Manager can be configured to support "trusted license storage". Licenses are stored in an external MySQL data base. This type of storage can be accessed and updated by multiple License Managers. As a result:

- You can set up a MySQL database cluster to serve as a trusted license storage. MySQL allows you to back up and restore the database without clone protection issues. The database cluster can provide database backup and failover and ensure uninterrupted access to the license information.
- You can set up multiple License Managers to support high availability. All the License Managers can use the same trusted license storage.

This solution poses none of the challenges described above for traditional on-premises redundant License Managers. Sentinel LDK License Managers can be configured to support active-passive (backup) or active-active high availability deployment.

This feature is available for subscription vendors. The trusted license storage (MySQL) is adapted to enable high availability.

Your License Managers are installed on multiple machines. This setup significantly reduces the possibility that a single point of failure will disrupt the availability of licenses to your customers.

Using a MySQL database for cloud license storage provides the following advantages:

- The License Manager is much faster at startup as V2C files do not need to be preprocessed.

- Only the database has state, removing the need for any kind of storage on the license server machines.
- Performance on write operations is improved because the operations don't requires the security features.

This document describes how you can configure your license servers to ensure high availability.

Migrating Licenses to the Trusted License Storage

When you configure a license server machine with existing licenses for high availability, the licenses are automatically migrated to the trusted license storage (MySQL database).

Migration only occurs if the MySQL database is empty when it is first connected to the License Manager.

The original licenses remain in the secure storage on the license server machine, but they are no longer accessed or maintained by the License Manager.

> **NOTE** After moving from a local database (SQLite) to the trusted license storage (MySQL database), performance becomes dependent on the network performance and MySQL server performance.

Prerequisites

The following prerequisites must be satisfied in order to configure or use high availability for Sentinel LDK:

- You must have the Cloud License module in your Sentinel LDK Master License.
- The Pool of New SL Keys (Feature ID 3) and SL Pool of Seats (Feature ID 4) must be subscription-based or perpetual (and not metered).
- The cloud license server machines must be Linux machines.
- For the active-active configuration, the Run-time Environment on each cloud license server must be version 8.41 or later.

> **NOTE** If your Master License does not satisfy the prerequisites listed above: You can still evaluate high availability for cloud licensing by using a MySQL database for cloud license storage with the DEMOMA Batch Code.

Machine Requirements

Machines requirement depend on actual workload (for example, the number of clients that you wants to support).

If you are using Google Cloud Platform and Kubernetes, all the resources can be adjusted on demand.

Thales suggests an initial configuration as follows:

- NGINX machine: 2 CPUs and 1 GB RAM
- Each License Manager Service machine: 2 CPUs and 2 GB RAM
- MySQL machine: 4 GB RAM

The solution described in this document is compatible with deployment using Kubernetes and with Google native load balancer.

Limitations

> SL Legacy licenses are not supported on the MySQL database.

> When high availability is implemented, clients' machines are not able to report the number of currently-available network seats. As a result:

- In Admin Control Center, the Products page > **Available** column always reports the total number of network seats defined, ignoring the number of seats in use.
- In Sentinel Licensing API, the **currentlogins** field in the **hasp_get_sessioninfo()** request always reports 0.

Requests to Sentinel Admin API (directed to the server) can be use to retrieve the effective numbers of seats in use.

Detaching/Rehosting Licenses

When using cloud License Managers with MySQL trusted storage:

> The following actions *are not* supported:

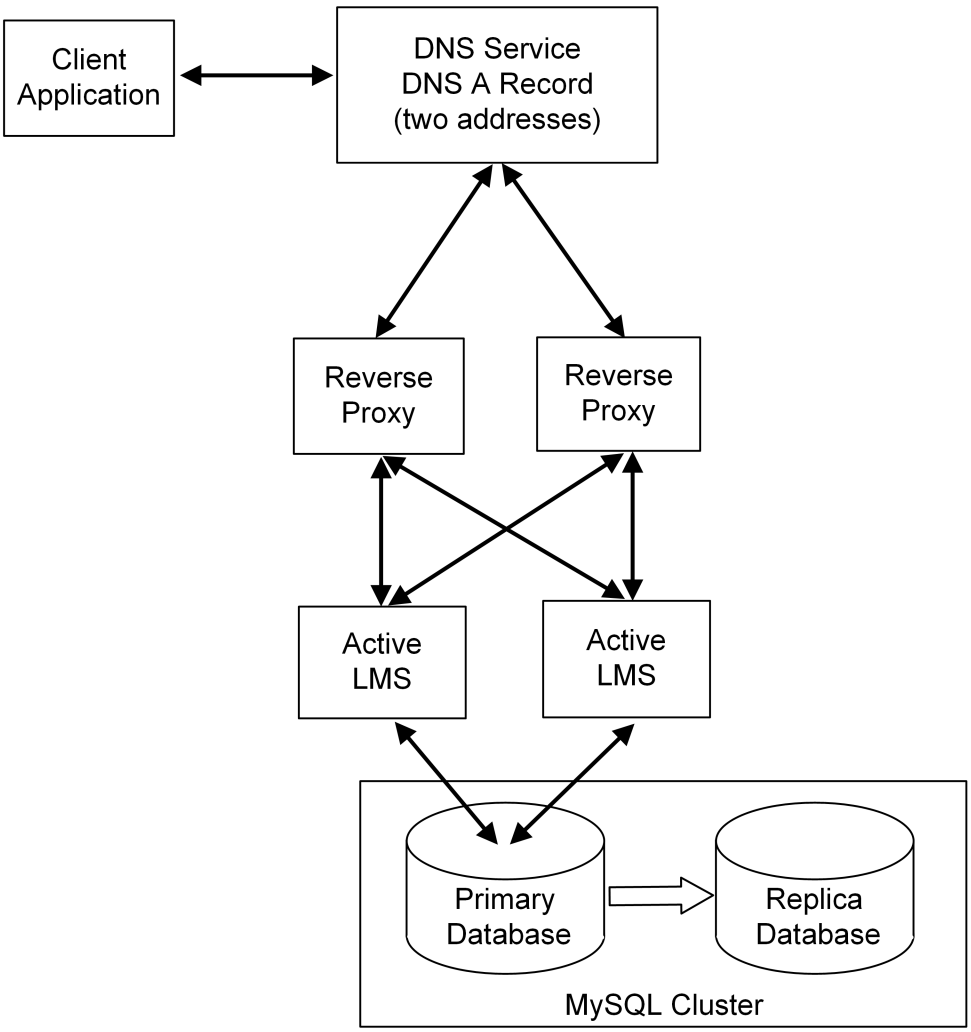
- Rehosting from trusted storage to secure storage
- Detaching licenses to trusted storage

> The following actions *are* supported:

- Rehosting from one trusted storage to another trusted storage
- Rehosting from secure storage to trusted storage. (However, this does not result in a usable license unless the license is cloud-enabled.)
- Detaching licenses from trusted storage to secure storage (client)

High-Level Architecture

The following diagram provides a high-level overview of the architecture for high availability for cloud licensing.



The elements in this diagram are described below.

Client Application

The client (protected) application integrates with the Sentinel LDK Licensing API. You can configure the Licensing API (or License Manager) INI file to set **serveraddr** with the DNS address.

The Licensing API (or License Manager) always attempts to contact all of the available License Managers in parallel, and it uses the one that responds.

The Licensing API for cloud licensing uses HTTP with a proprietary cryptographic algorithm. This protocol is similar to TLS-PSK.

DNS Service

When two license manager services bring redundancy capability, the load balancer (NGINX) itself can still leave a single point of failure. High availability for the load balancer layer can be improved using one of the following options:

- Using DNS with single floating IP address

  Floating IP is a static public IPv4 address that can be attached to both reverse proxy instances. It directs traffic to one instance at the time and can be switched between multiple instances immediately. For this option, the DNS record only needs to contain one static IP address.

- Using DNS with multiple IP addresses

  You can create a DNS “A” record to store multiple IP addresses of reverse proxy instances.

Reverse Proxy

The reverse proxy should be configured as active-active mode. As a result, license requests will be redirected to one of License Managers based on the load balancing policy. For example, round-robin or least-connected load balancing can be used. If one of the License Managers is down, a "retry login" mechanism implementation is not required in the client application code for active-active deployment.

The reverse proxy can perform an active health check via the following License Manager health check end point: **/sentinel/ldk/v1/healthz**

When a load balancer is used, it should be configured to use the same License Manager service instance for a given client or session. For more information, see "Requirements for the License Server Machines" on page 68.

Load Balancer Policy

Sentinel Licensing API is not a stateless API. When using this API, you must configure a sticky session policy in the load balancer or reverse proxy to ensure that a client request is redirected to a specific network server for the duration of a session.

In general, cloud licensing supports three sticky session policies:

- IP hash – The IP address of the client is used to determine which server receives the request.
- Consistent hash – The client generates a unique ID. Sentinel LicensingAPI has a special HTTP header (**X-LDK-Instance**).
- Session cookies – The load balancer assigns a unique cookie ID back to client, and the next request from the client carries this cookie back to the load balancer.

License Manager Service (LMS)

The high-availability solution is only valid for an LMS based on trusted license storage. To enable this type of storage, you must first set environment variables or use the License Manager INI file to enable the License Managers to connect to the MySQL database. Next, you use Sentinel LDK-EMS or the Sentinel License

Generation API to generate an authorization file, and apply the file to one of the License Manager instance. This enables the License Managers to use the MySQL database as a trusted license storage.

The "Implementation" below section demonstrates how to set up active-active license servers using Docker Compose and NGINX to handle License Manager failover.

MySQL Cluster

Machine on which a MySQL database or database cluster for license storage resides. The vendor has complete control over this database and is responsible for the security of the database. This machine serves as the trusted license storage unit.

Note that with trusted license storage, the database is readable and accessible by the vendor, but the internal blobs in the database are still encrypted with the Vlib secrets.

Summary of Differences Between Active-Active and Active-Passive Configuration

The table that follows summarizes considerations when you are changing from the active-passive configuration to the active-active configuration.

	Active-Passive	Active-Active
Client Application	Retry must be implemented.	Retry is not required.
DNS	Use a DNS with a single floating IP address. *Or* Configure your DNS record as failover type (active-passive) to return only one healthy IP address at a time to avoid potential license abuse.	Configure the DNS record as active-active type with two IP addresses of reverse proxy.
Reverse Proxy	Reverse proxy should be configured for active-passive mode.	Reverse proxy should be configured for active-active mode.
License Manager Service	Run-time Environment on each cloud license server must be version 8.31 or later.	Run-time Environment on each cloud license server must be version 8.41 or later.
MySQL Cluster	There is no difference between active-active and active-passive configuration.	

Implementation

This section describes the procedure required to set up high-availability license server machines.

(A license server is a machine on which Sentinel LDK License Manager service is installed.)

Note the following:

- Each machine referred to in this section can be a physical machine or virtual machine.
- The Batch Codes referred to in this section are the Batch Code that you are using for cloud licensing.

("Deploying a CL Server in Kubernetes on GCP" on page 77 describes how to deploy a cloud license server machine in Kubernetes on Google Cloud Platform.)

Requirements for the License Server Machines

The following are the requirements for Sentinel LDK License Manager when configured for high availability:

- When a load balancer is used, it should be configured to use the same License Manager service (*LMS*) instance for a given client or session. When the LMS instance used changes within a login session, the client API requires additional communications to re-establish new secure channels with the new LMS instance. This occurs transparently, but it requires a certain amount of time, and it should be avoided for optimal performance.
- The machine time of all the license server machines in the cluster must be synchronized. If the time on one of the license server machines is ahead of the others, the LMS on that machine will kill all the other LMS sessions.
- The initial start of the first LMS in the cluster must have creation rights on the MySQL database. Creation right are required to create new tables.
- For the active-active configuration, you must enable a sticky session load balancing policy.
- The VLIB version must be in sync with the LMS version. Older VLIBs are not supported. If the versions do not match, no license is loaded and an appropriate error is logged.

  For a list of supported VLIB versions and the matching LMS versions, see the Sentinel LDK Release Notes.

NOTE

- Sentinel Licensing API returns the error HASP_CLOUD_STORAGE_BUSY when conflicting requests cannot be handled in a timely manner. This error is not expected to occur unless an unexpected deadlock condition in the database is reached or the license server machine is in starvation. The client can detect this special condition by checking for this error.
- In Admin Control Center 8.41 and later, the access to remote LMs is always disabled. The configuration panel **Access to Remote License Managers** is not present.

Setting Up the License Server Machines

To set up high-availability license server machines:

1. Configure the DNS Service and Reverse Proxy in your data center to satisfy the requirements described in "High-Level Architecture" on page 65.
2. Install MySQL on a machine that will serve as the database server for trusted license storage.

   It is not necessary to create a license storage database on the server. The license storage database will be created automatically as described later in this procedure.

   > **NOTE**
   > > You will have complete control over this database and are responsible for the security of the database.
   > > If necessary, you can reduce the load on the MySQL database by relaxing ACID compliance. For details, see "Configuring MySQL for Relaxed Durability" on page 80.

3. Set up the license server machines.

   Set up the two license server machines to serve as the active license servers using either of the methods described below.

   > **NOTE** You can use an existing license server machine for one of the machines. Any licenses already present on the license server machine will be automatically migrated to the trusted license storage in the MySQL database. For details, see "Migrating Licenses to the Trusted License Storage" on page 63.

   - Using a generated RTE installer

     i. Obtain the Run-time Environment Installer that is generated by the Master Wizard when you introduce your Vendor keys. For more information, see "Introducing Your Sentinel Vendor Keys to Sentinel LDK" on page 50 .

     ii. install the Sentinel LDK Run-time Environment (RTE) on the two machines that will serve as the active license server machines.

     If you are using multiple Batch Codes, copy the Vlibs for any additional Batch Codes to the **/var/hasplm** directory on each machine.

   - Using a Docker image

     A Docker image that contains an installed Sentinel LDK Run-time Environment is available.

     i. Download the Docker image from https://hub.docker.com/u/thalesgroupsm.

     (The Dockerfile used to build this Docker image can be viewed in "Dockerfile Listing" on page 76.)

ii. Import the downloaded Docker image on the two machines that will serve as the active license server machines. Use the following command on each machine:

docker image import sentinel-ldk-rte.tar *imagename:version*

iii. Copy your Vendor libraries for all Batch Codes to the **/var/hasplmin** directory on each license server machine.

4. Configure each license server machine.

On each license server machine, configure the options described below.

You can specify options:

- As entries in the **hasplm.ini** file. (Recommended method)
- Defined as environment variables on the machine. (Use this option when working with Docker.)
- In the **mysql.cnf** configuration file.

  In the **mysql.cnf** configuration file, the **[sentinel_ldk]** section is read. The **[client]** section is also read, as with any generic MySQL client application. (Specify the location of the **mysql.cnf** file in the **hasplm.ini** file.) For typical high availability configuration, the use of a CNF file is not required, as the other options that available for the **hasplm.ini** file are typically enough.

> **NOTE** When you perform the initial startup of the LMS on the two license server machines (later in this procedure), the configuration parameters that you specified in the **hasplm.ini** file are copied to the MySQL database. Once this occurs, the configuration parameters in the MySQL database take precedence over parameter values in the **hasplm.ini** file. Any changes that you make to the configuration parameters using the Admin API or Admin Control Center are written directly to the database; no changes are written to the **hasplm.ini** file.

The table below describes the available configuration options as **hasplm.ini** entries and as environment variables.

Note that the four environment variables **database_mysql_host, ...user, ...password, ...port** and the environment variable **database_mysql_cnf** are alternative ways to configure the same MySQL options. The variable **database_mysql_cnf** is more powerful as it allows you to configure additional options, such as SSL support.

File Entry or Environment Variable	Notes
database HASPLM_DATABASE	Specify the value: **mysql** (This entry is required even if using the MySQL CNF file.)
database_mysql_host HASPLM_DATABASE_MYSQL_HOST	The host machine where MySQL is located.

File Entry or Environment Variable	Notes
database_mysql_user HASPLM_DATABASE_MYSQL_USER	User name for the MySQL account to use to connect to the database.
database_mysql_password HASPLM_DATABASE_MYSQL_PASSWORD	Password for the above MySQL account.
database_mysql_port HASPLM_DATABASE_MYSQL_PORT	Port on the database server for connecting to the database. Default: 3306
database_mysql_database HASPLM_DATABASE_MYSQL_DATABASE	Name of the MySQL database to create. Default is **sentinel_ldk**. This is similar to the **database** option in **my.cnf**. However, when this option specified in the **hasplm.ini file**, the database is created automatically if it does not yet exist. The same option in **my.cnf** causes the connection to fail if the specified database does not exist.
database_mysql_library	Path of the MySQL client library. Default for Linux is: **libmariadb.so.3** In Linux: Install the **libmariadb.so.3** using the distribution package manager.
database_mysql_cnf HASPLM_DATABASE_MYSQL_CNF only needed for mysql file.	Path of the MySQL configuration file. The default is **my.cnf** in the standard MySQL search directories. In this file the **[sentinel_ldk]** section is read. The **[client]** section is also read, as in any generic MySQL client application. This entry is only required if you are using the MySQL configuration file to configure high availability. Note that the use of the MySQL configuration file is not strictly required for normal use, as the options in the License Manager INI file are typically enough to handle the required configuration.

File Entry or Environment Variable	Notes
cloud_portal HASP_CLOUD_PORTAL	Whether Sentinel Admin Control Center should display a message that Sentinel LDK Cloud Portal is being used to manage client identities for this LMS. If yes, assign the value **1** to this variable; otherwise, assign the value **0** or do not define this variable. **Notes:** > The message is only displayed afer Sentinel LDK Cloud Portal has been used at least once to create client identities. > Setting the value to 1 for this variable does not block Sentinel Admin Control Center from being used to manage client identities. However, Thales recommends that you not use Sentinel Admin Control Center to to manage client identities once Sentinel LDK Cloud Portal has been implemented.
rate_token_max	Maximum number of tokens in the bucket for rate limiting. This is also the starting value for the number of tokens in the bucket. Default: 0 If rate_token_max or rate_token_period_ms is 0, rate limiting is disabled.
rate_token_period_ms	Interval (in milliseconds) at which a new token is added to the bucket for rate limiting. For example, a value of 1000 means that a new token is added every second. Default: 0

A typical **hasplm.ini** file would contain the following:

```
database = mysql
database_mysql_host = 192.168.1.235
database_mysql_user = root
database_mysql_password = Password1!
database_mysql_port = 3306
```

A typical **my.cn**f file would contain the following:

```
[mysqld]
port = 3306

[sentinel_ldk]
port = 3306
```



```
password = Password1!
user = root
server = 192.168.1.235
```

5. Start the LMS on both license server machines.

   > **NOTE** At this point, if one of the license server machines contains existing licenses, the licenses are migrated to the trusted license storage in the MySQL database. For details, see "Migrating Licenses to the Trusted License Storage" on page 63.

6. Generate fingerprint files.

   On one of the active license server machines, use Admin Control Center to generate a fingerprint file (for each Batch Code) for the machine:

   a. Start Admin Control Center on the machine.

   b. In the navigation pane, click **Sentinel Keys**.

   c. On the Sentinel Keys page, identify the entry at the top of the list for the relevant Batch Code. The **Location** column contains **Local**.

   d. Click the **Fingerprint** button in the entry. The **fingerprint_*batchCode*.C2V** file is generated.

7. Create trusted storage authorization files.

   For each Batch Code, use the relevant fingerprint file generated above to generate a trusted storage authorization V2C file using one of the following methods:

   - Using Sentinel LDK-EMS: For details, see Sentinel LDK–EMS Configuration Guide.
   - Using Sentinel License Generation API: For details, see Sentinel License Generation API Reference.

8. Apply the trusted storage authorization files.

   Using Admin Control Center on the active license server machine, apply the trusted storage authorization V2C file for each Batch Code:

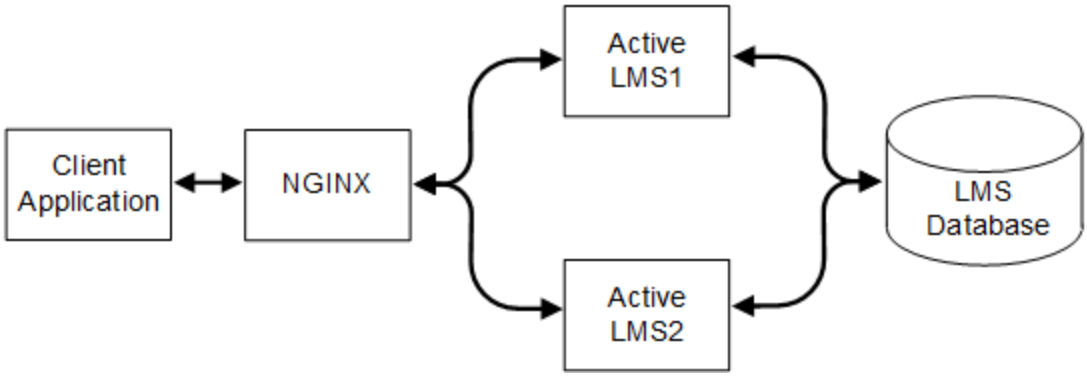
   a. Select **Update/Attach** from the navigation pane in Admin Control Center.

   b. Click **Select File** and apply the relevant V2C files.

9. Configure the web server.

   This step demonstrates how you can use Docker Compose and NGINX to set up the active license server machines.

   This demonstration uses two LMS instances (**lms1** and **lms2**) as active license server machines.



Configure NGINX and Docker Compose as follows:

- The content of **nginx.conf** should be similar to the following:

```
user  nginx;

events {
    worker_connections   1000;
}

http {
    upstream server_lms {
        ip_hash;      #load balacning policy
        #By dedfault, it is active-active setup.
        server lms1:1947;
        server lms2:1947;
        #commented part is for active-passive setup.
        #server lms1:1947 weight=1 max_fails=3  fail_timeout=10s;
        #server lms2:1947 weight=1 max_fails=3  fail_timeout=10s backup;
    }

        server {
              listen 80;          #Runtime API wil go through http.
              listen 443 ssl;     #ACC can be accessed by https
              ssl_certificate     /etc/nginx/certs/nginx-selfsigned.crt;
              ssl_certificate_key /etc/nginx/certs/nginx-selfsigned.key;

              location / {
                proxy_pass http://server_lms;
                proxy_set_header  Host  $host;
                proxy_set_header  X-Real-IP  $remote_addr;
                proxy_set_header  X-Forwarded-For $proxy_add_x_forwarded_for;
          }
        }
}
```

- The content of **docker-compose.yml** should be similar to the following:

```
version: "3"

services:
  lms_database:
    image: mysql:5.7
```



```
    container_name: lms_database
    volumes:
      - lms_db_data:/var/lib/mysql
    restart: always
    environment:
      MYSQL_ROOT_PASSWORD: root!
      MYSQL_DATABASE: lms
      MYSQL_USER: lms
      MYSQL_PASSWORD: Password1!

  lms1:
    depends_on:
      - lms_database
    build: .
    container_name: lms1
    restart: always
    #hostname: lms1
    environment:
      HASPLM_DATABASE: mysql
      HASPLM_DATABASE_MYSQL_HOST: lms_database
      HASPLM_DATABASE_MYSQL_USER: root
      HASPLM_DATABASE_MYSQL_PASSWORD: root!
      HASPLM_DATABASE_MYSQL_PORT: 3306
    volumes:
      - ./haspvlib_x86_64_37517.so:/var/hasplm/haspvlib_x86_64_37517.so
      - ./hasplm.ini:/etc/hasplm/hasplm.ini
    depends_on:
      - lms_database

  lms2:
    depends_on:
      - lms_database
    build: .
    container_name: lms2
    #restart: always
    #hostname: lms2
    environment:
      HASPLM_DATABASE: mysql
      HASPLM_DATABASE_MYSQL_HOST: lms_database
      HASPLM_DATABASE_MYSQL_USER: root
      HASPLM_DATABASE_MYSQL_PASSWORD: root!
      HASPLM_DATABASE_MYSQL_PORT: 3306
    volumes:
      - ./haspvlib_x86_64_37517.so:/var/hasplm/haspvlib_x86_64_37517.so
      - ./hasplm.ini:/etc/hasplm/hasplm.ini
    depends_on:
      - lms_database

  nginx:
    image: nginx:latest
    volumes:
      - ./nginx.conf:/etc/nginx/nginx.conf:ro
      - ./nginx-selfsigned.crt:/etc/nginx/certs/nginx-selfsigned.crt:ro
      - ./nginx-selfsigned.key:/etc/nginx/certs/nginx-selfsigned.key:ro

    depends_on:
      - lms1
```



```
      - lms2
    ports:
      - "80:80"
      - "443:443"
```

10. Confirm the setup as follows:

a. Run **docker-compose up**.

b. Open Admin Control Center of the LMS exposed by NGINX and determine the computer name on the Diagnostics page. The computer name should be the name of the active license server machine.

c. Run **docker-compose kill lms1** to stop the **lms1** service.

After 10 seconds, NGINX will transfer all the requests to **lms2**.

d. Check the computer name again. The name should have changed from **lms1** to **lms2**.

Dockerfile Listing

The Dockerfile listed below was used to build the Docker image described earlier in this guide.

```
#base image
FROM ubuntu:20.04

MAINTAINER LDK-Team "ldk-team@thalesgroup.com"

#working directory
WORKDIR /lms

#expose ports
EXPOSE 1947
EXPOSE 80

COPY aksusbd_8.52-1_amd64.deb /lms

RUN apt-get update && \
#libmariadb.so.3 serves as database client library and is required for LM
# to connect to MySQL
        apt-get install -y libmariadb3 && \
        dpkg -x aksusbd_8.52-1_amd64.deb / && \
        groupadd lms_group && \
        useradd -g lms_group lms_user  && \
        chown -R lms_user:lms_group /var/hasplm && \
        chown -R lms_user:lms_group /etc/hasplm && \
        chmod +x /usr/sbin/hasplmd_x86_64

#user with less privilege
USER lms_user

#option "-f" makes the service a foreground process instead of a
# background process
ENTRYPOINT ["/usr/sbin/hasplmd_x86_64","-f"]
```


Deploying a CL Server in Kubernetes on GCP

This topic describes how to deploy a cloud License Manager service in a Docker container using a MySQL database to Kubernetes on GCP (Google Cloud Platform).

Prerequisites

The following is required for deploying a cloud license server on GCP:

- A console that is able to access Google Cloud Platform
- Cloud database instance for MySQL 5. 7, with a user account created for Sentinel LDK License Manager service. (MySQL Docker can also be used for this purpose)

Database Initialization for the LMS (Sentinel LDK License Manager Service)

- If the database user has full access to the database, the database and tables can be created automatically by the LMS.
- If the database user only has the read/write rights to update the data in tables, but no rights to create the database and tables, the deployment user should create the database and tables for the LMS manually. Use the file **sentinel_ldk_table.sql** to perform initialization.

Deployment

> **NOTE** The procedure that follows describes how to implement an LMS in Docker on GCP. If you want to expose the LMS directly on the cloud platform, consider the security enhancements required to protect the service deployed on Kubernetes according to your security requirements.

To deploy the License Manager Service in a Docker container on Kubernetes:

1. Enter the following to create a VLIB configmap on Kubernetes with a vendor library:
   kubectl create configmap haspvlib --from-file=./haspvlib_x86_64_37517.so

   The vendor library should be located in the path */var/hasplm* in Docker.
2. Enter the following to create the LMS initialization configmap:

   kubectl create configmap hasplmini --from-file=./hasplm.ini

   The **hasplm.ini** file should be located in the path */etc/hasplm* in Docker.

   > **NOTE** The trusted IP address should be set to **0.0.0.0/0** in **hasplm.ini**. This enables the LMS to be accessed by the Load Balancer.

LMS Docker reads the following **configmap** file at startup. Once any LMS configuration is updated, all configuration information is saved to the MysQL database. Once that occurs, the configuration information in database is used instead of the information in the **configmap** file.

```
[SERVER]
listen_also = 1
requestlog = 1
loglocal = 1
logremote = 1
logadmin = 1
errorlog = 1
rotatelogs = 1
pidfile = 1
passacc = 1
accessfromremote = anyone

accremote = 1
adminremote = 1

[REMOTE]
broadcastsearch = 0

[EMS]
emsurl = http://localhost:8080
emsurl = http://127.0.0.1:8080

[TRUST]
trusted_ip = 0.0.0.0/0
```

3. Create the LMS deployment **yaml** file. The **yaml** file shows:
   - How to deploy the LMS Docker image.
   - How to implement the LivenessProbe and ReadinessProbe for the LMS.
   - How to load the **hasplm.ini** and vendor library with **configmap** on Kubernetes.

   NOTE The replicas should be set to 1 when deploying LMS Docker on Kubernetes.

```
apiVersion: apps/v1
kind: Deployment
metadata:
   name: lms
   labels:
     name: lms
spec:
   replicas: 1
   selector:
     matchLabels:
       app: lms
   template:
     metadata:
       labels:
         app: lms
     spec:
```



```
      containers:
      - name: lms
        image: thalesgroupsm/sentinel_ldk_rte
        #should be set to "Always" when deploying with Kubernetes
        imagePullPolicy: IfNotPresent
        livenessProbe:
          httpGet:
            path: /sentinel/ldk/v1/healthz
            port: 1947
          initialDelaySeconds: 120
          timeoutSeconds: 30
          periodSeconds: 10
          successThreshold: 1
          failureThreshold: 3
        readinessProbe:
          httpGet:
            path: /sentinel/ldk/v1/readyz
            port: 1947
          initialDelaySeconds: 120
          timeoutSeconds: 30
          periodSeconds: 10
          successThreshold: 1
          failureThreshold: 3
        ports:
         - containerPort: 1947
        volumeMounts:
        - name: hasplmcfgfile
          mountPath: /etc/hasplm/hasplm.ini
          subPath: hasplm.ini
        - name: haspvlibfile
          mountPath: /var/hasplm/haspvlib_x86_64_37517.so
          subPath: haspvlib_x86_64_37517.so
        env:
        - name:  HASPLM_DATABASE
          value: mysql
        - name:  HASPLM_DATABASE_MYSQL_HOST
          value: mysql
        - name:  HASPLM_DATABASE_MYSQL_PASSWORD
          value: root!
        - name:  HASPLM_DATABASE_MYSQL_USER
          value: root
        - name:  HASPLM_DATABASE_MYSQL_PORT
          value: "3306"
      volumes:
      - name: hasplmcfgfile
        configMap:
          name: hasplmini
      - name: haspvlibfile
        configMap:
          name: haspvlib
```

4. Create the LMS **yaml** file. It is up to you to decide how to expose the LMS to the public IP address. The **yaml** file below shows how to expose the LMS in the load balancer.


```
apiVersion: v1
kind: Service
metadata:
  name: lms
  labels:
    app: lms
spec:
  type: LoadBalancer
  ports:
    - port: 1947
      targetPort: 1947
      protocol: TCP
  selector:
    app: lms
```

5. Run the following to deploy the LMS:

   kubectl apply -f lms_deployment.yaml -f lms_svc.yaml

   The LMS can be accessed with the following URL:

   http://<IP_exposed_by_the_LoadBalancer>:1947

Configuring MySQL for Relaxed Durability

This section describes how to configure MySQL to improve its performance and thus, the License Manager performance. This configuration is optional, but may be useful if performance becomes an issue.

The default MySQL configuration is ACID-compliant - that is, it satisfies the requirements for Atomicity, Consistency, Isolation and Durability. To ensure the durability requirement, MySQL enforces a sync to disk after each SQL transaction.

With a high server load, this requirement has a strong impact on performance. You can consider configuring MySQL to relax the durability requirement, to have only one sync to disk per second. The consequence of relaxing the durability requirement is as follows:

> Negative impact: In the event the MySQL server fails, the database may lose transactions that occurred during the last second. For example, a license detach may be not recorded, and the user may get a free detach.

> Positive impact: Transactions that require a write to the database may complete up to 10 times faster.

To test the relaxed durability configuration at runtime:

> Run the following SQL snipset:

```
SET GLOBAL innodb_flush_log_at_trx_commit=0;
SET GLOBAL sync_binlog=0;
```


To restore the default configuration:

> Run:

```
SET GLOBAL innodb_flush_log_at_trx_commit=1;
SET GLOBAL sync_binlog=1;
```

To make the relaxed durability configuration permanent:

1. Add the following to **/etc/mysql/mysql.cnf**:

```
[mysqld]
innodb_flush_log_at_trx_commit=0
sync_binlog=0
```

2. Restart MySQL with:

```
sudo systemctl restart mysql
```


CHAPTER 5: Deploying Sentinel LDK Cloud Portal

This section describes how to deploy Sentinel LDK Cloud Portal on a server (referred to in this section as the *cloud portal server*).

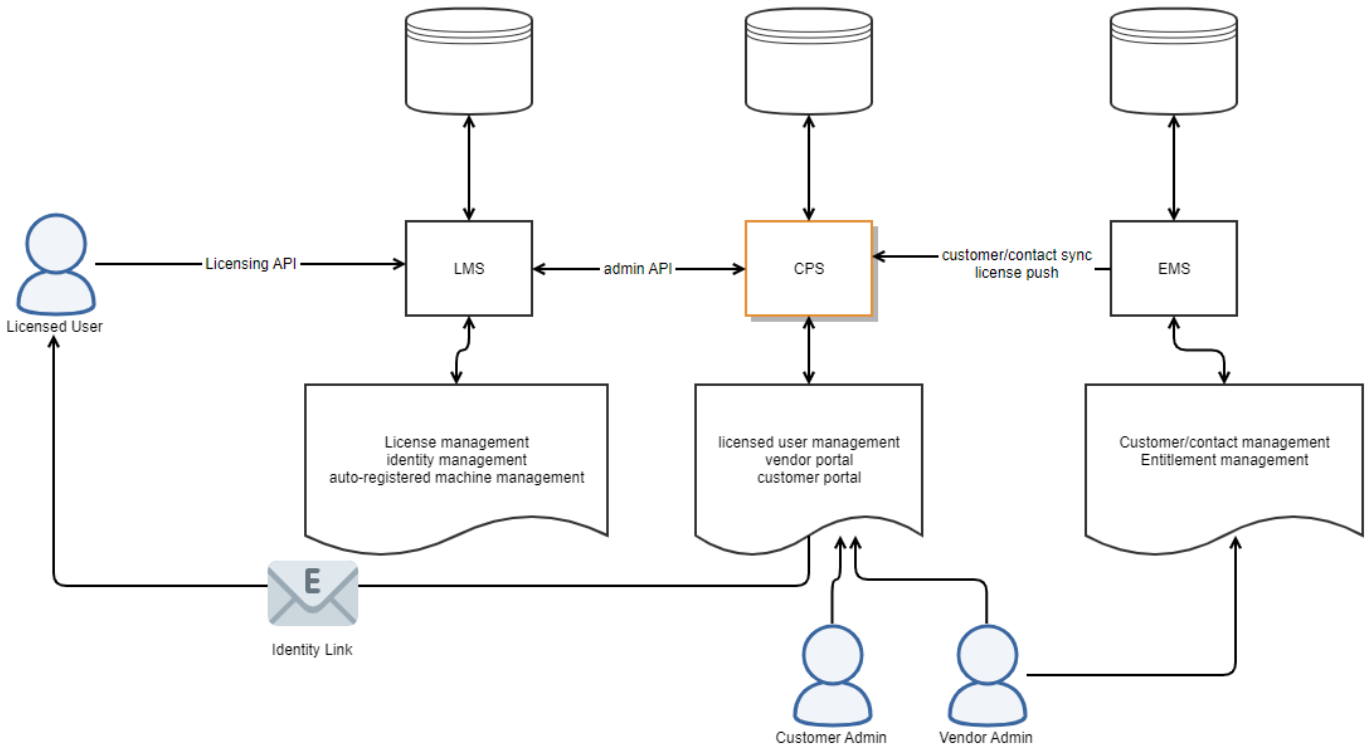
Sentinel LDK Cloud Portal is deployed as a Docker image on the cloud portal server.

> This section is only relevant for vendors who are working with Sentinel LDK-EMS and who want to use Sentinel LDK Cloud Portal to manage cloud licensing.

In this section:

High-Level Architecture

The following diagram provides a high-level overview of the architecture for Sentinel LDK Cloud Portal.



Requirements for Deploying Sentinel LDK Cloud Portal

The following are the requirements for Sentinel LDK Cloud Portal:

> Sentinel LDK license server (referred to as the *license server*) must exist.

- Sentinel LDK Run-time Environment 9.12 or later must be installed on the license server. Thales recommends that you deploy the Sentinel LDK Run-time Environment Docker image from Docker Hub (https://hub.docker.com/r/thalesgroupsm/sentinel_ldk_rte).
- The license server and the cloud portal server must be deployed in the same environment (for example, both in GCP or both in AWS).

> Sentinel LDK-EMS server 9.0 or later (hosted by the vendor or by Thales)

> MySQL database server (version 8.0 or later)

> You must be working with Docker version 20 or later.

NOTE The CloudPortal service is released as a Docker image. HTTPS support should be configured in the proxy server or the load balancer.

Before Setting Up the Cloud Portal Server

1. Install MySQL on a machine that will serve as the database server for the cloud portal database, or you can use cloud MySQL directly.

Note the following:

- If the database user has full access to the database, the database and tables will be created by Sentinel Cloud Portal automatically.
- If the database user only has read/write rights to update the data in tables, but no right to create the database and tables, the deployment user should create the database and tables for Sentinel LDK Cloud Portal manually. Use the SQL script file to perform initialization.

2. Configure the cloud portal server.

   On the cloud portal server, configure the parameters described below.

Environment Variable	Notes
CPS_BACKEND_DB_HOST	The host machine where MySQL is located.
CPS_BACKEND_DB_USER	User name for the MySQL account to use to connect to the database.
CPS_BACKEND_DB_PASSWORD	Password for the above MySQL account.
CPS_BACKEND_DB_NAME	Name of the MySQL database to create.
CPS_SWAGGER_ENABLED	Whether the Sentinel LDK Cloud Portal REST API should be enabled. Possible values are: > **true** > **false** (Default)
LMS_HOST	The host machine where LMS is located.
LMS_PASSWORD	Password for the above LMS instance. **Note**: By default, there is no user name for the LMS user account. Sentinel LDK Cloud Portal does not support the use of an LMS user account for which a user name has been defined.
LMS_PORT	LMS port for the above LMS instance.

3. Deploy the Docker image for Sentinel LDK Cloud Portal.

   a. You can get the latest docker imager from Docker Hub:
   https://hub.docker.com/u/thalesgroupsm/sentinel_ldk_cloudportal

   b. Use the following command on the cloud portal server:

```
docker run thalesgroupsm/sentinel_ldk_cloudportal:9.0.1
```

Deployment Via Docker Compose

This procedure demonstrates how you can use Docker Compose to set up the cloud portal server. Note that the following docker-compose example already contains an integrated cloud licensing server and MySQL server.

1. Download your vendor library using Sentinel LDK Master Wizard.

   Copy your vendor library to the same folder that contains **docker-compose.yml**.

   For example, for vendor ID 37517, copy **haspvlib_x86_64_37517.so** to the folder.

2. Set up the **docker-compose.yml** file with contents similar to the following:

```
version: '3.3'

services:
  cps_lms_db:
    image: mysql:8.0
    command: mysqld --general-log=1 --general-log-file=/var/log/mysql/general-log.log
    container_name: cps_lms_db
    command: ["mysqld", "--default-authentication-plugin=mysql_native_password"]
    volumes:
      - lms_db_data:/var/lib/mysql
    restart: always
    environment:
      MYSQL_ROOT_PASSWORD: root!
      MYSQL_DATABASE: lms
      MYSQL_USER: lms
      MYSQL_PASSWORD: Password1!
    healthcheck:
      test: mysqladmin ping -h 127.0.0.1 -u $$MYSQL_USER --password=$$MYSQL_PASSWORD
      interval: 10s
      retries: 3

  cps_backend_db:
    container_name: cps_backend_db
    image: mysql:8.0
    volumes:
      - cps_backend_db_data:/var/lib/mysql
    restart: always
    command: ["mysqld", "--default-authentication-plugin=mysql_native_password"]
    environment:
      MYSQL_ROOT_PASSWORD: admin
      MYSQL_DATABASE: cloudportaldb
    healthcheck:
```



```
    test: mysqladmin ping -h 127.0.0.1 -u $$MYSQL_USER --password=$$MYSQL_PASSWORD
    interval: 10s
    retries: 3

cps_lms:
  depends_on:
    - cps_lms_db
  container_name: cps_lms
  image: thalesgroupsm/sentinel_ldk_rte:9.12
  restart: always
  volumes:
    - type: bind
      source: ./hasplm.ini
      target: /etc/hasplm/hasplm.ini
    - type: bind
      source: ./haspvlib_x86_64_37517.so
      target: /var/hasplm/haspvlib_x86_64_37517.so
  environment:
    HASPLM_DATABASE: mysql
    HASPLM_DATABASE_MYSQL_HOST: cps_lms_db
    HASPLM_DATABASE_MYSQL_USER: root
    HASPLM_DATABASE_MYSQL_PASSWORD: root!
    HASPLM_DATABASE_MYSQL_PORT: 3306
  healthcheck:
    test: ["CMD", "curl", "-X GET", "http://127.0.0.1:1947/sentinel/ldk/v1/healthz"]
    interval: 50s
    timeout: 10s
    retries: 3
  hostname: cps_lms
  ports:
    - "80:1947"

cps_backend:
  container_name: cps_backend
  depends_on:
    - cps_lms
    - cps_backend_db
    - cps_lms_db
  image: thalesgroupsm/sentinel_ldk_cloudportal:9.0.1
  ports:
    - "8080:8181"
  restart: always
  environment:
    CPS_BACKEND_DB_HOST: cps_backend_db
    CPS_BACKEND_DB_USER: root
    CPS_BACKEND_DB_PASSWORD: admin
    CPS_BACKEND_DB_NAME: cloudportaldb
    CPS_SWAGGER_ENABLED: true
    LMS_HOST: cps_lms
    LMS_PASSWORD: Aa123456
    LMS_PORT: 80
  healthcheck:
    test: ["CMD", "curl", "-X GET", "http://127.0.0.1:8181/cps/api/v1/healthz"]
    interval: 50s
    timeout: 10s
    retries: 3
```



```
volumes:
  lms_db_data: {}
  cps_backend_db_data: {}
```

3. The password for logging in to Sentinel LDK Cloud Portal as the vendor administrator is contained in the **hasplm.ini** file for Sentinel LDK Cloud Portal. This file is located in the same folder as **docker-compose.yml**.

   The default password **Aa123456** is encoded in the **adminpassword** parameter as seen below:

```
[SERVER]
adminpassword = 4cn/eL9O60ebqMXfji8OOA==:fNwzohDT4A83ZFm2tVupnw==
listen_also = 1
requestlog = 1
loglocal = 1
logremote = 1
logadmin = 1
errorlog = 1
rotatelogs = 1
pidfile = 1
passacc = 1
accessfromremote = secure
cloud_portal = 1
accremote = 1
adminremote = 1

[REMOTE]
broadcastsearch = 0
```

   The password should be changed for security reasons as follows:

   a. Start Sentinel Admin Control Center (ACC) on a local machine.

   b. Change the ACC administrator password to the password that you want for Sentinel LDK Cloud Portal.

   c. Open the configuration file (**hasplm.ini**) for Admin License Manager on the same machine. The pathname of the configuration file is as follows:

      – For Windows x64: %CommonProgramFiles(x86)%\Aladdin Shared\HASP\hasplm.ini

      – For Windows x86: %CommonProgramFiles%\Aladdin Shared\HASP\hasplm.ini

   d. In **hasplm.ini** file for the Admin License Manager, copy the line that contains **adminpassword**. This line contains the encoded form of your password.

   e. Paste the line into the **hasplm.ini** file for Sentinel LDK Cloud Portal, over the existing **adminpassword** line.

   f. In **docker-compose.yml**, change the following line to contain the new password:

```
LMS_PASSWORD: Aa123456
```

4. Run **docker compose up**.

5. Open the cloud portal web portal by cloud portal service exposed IP:


```
http://<IP_exposed>:8080
```

6. Open the LMS web portal by LMS service exposed IP:

   (If you want to enable https, you need to configure LMS https first.)

   ```
   http://<IP_exposed>
   ```

   To log in to the Sentinel Cloud Vendor Portal, use:

   ```
   http://<IP_exposed>:8080/admin
   ```

   To log in to the Sentinel Cloud Customer Portal, use:

   ```
   http://<IP_exposed>:8080/customer
   ```

   To view Swagger (if you have enabled Swagger), use:

   ```
   http://<IP_exposed>:8080/doc
   ```

7. Configure Sentinel Admin Control Center on the license server machine to issue a warning against using Admin Control Center to manage client identities. The warning is activated in Sentinel Admin Control Center once Sentinel LDK Cloud Portal has been used at least once to create client identities. For details, see the cloud-portal parameter.

   Do either of the following on the license server machine:

   - Add the following configuration parameter in **hasplm.ini**:

     ```
     cloud_portal=1
     ```

   - Set the following environment variable:

     ```
     HASPLM_CLOUD_PORTAL=1
     ```

Deployment in Google Cloud Platform

This section shows how to deploy the cloud portal service to Kubernetes on Google Cloud Platform (GCP).

Before You Begin

> You must have GCP console to use GCP to access your Kubernetes cluster.

> Create a cloud database instance for MySQL 8 on GCP, using the user account created for Cloud Portal database.

Deploying the Docker Image for Sentinel LDK Cloud Portal

> **NOTE** The steps in this section describe how to deploy Sentinel LDK Cloud Portal docker image on GCP. If you want to expose the Cloud Portal service directly on a cloud platform, consider security enhancements to protect the service deployed on Kubernetes according to your security requirements.

1. Create the Cloud Portal deployment YAML file. The YAML file below shows how to deploy the Cloud Portal docker image, how to implement the LivenessProbe for Cloud Portal service, and the ENV to set the database connection .

   Note that the YAML file contains the definitions of the required environment variables (described in "Before Setting Up the Cloud Portal Server" on page 84). Modify these definitions as required.

   cloudportal_deployment.yaml

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: cloudportal-backend
  labels:
    name: cloudportal-backend
spec:
  replicas: 2
  selector:
    matchLabels:
      app: cloudportal-backend
  template:
    metadata:
      labels:
        app: cloudportal-backend
    spec:
      containers:
      - name: cloudportal-backend
        image: thalesgroupsm/sentinel_ldk_cloud_portal:9.0.1
        #should be set "Always" when deployed with kubernetes
        imagePullPolicy: Always
        livenessProbe:
          httpGet:
            path: /cps/api/v1/healthz
            port: 8181
          initialDelaySeconds: 30
          timeoutSeconds: 30
          periodSeconds: 10
          successThreshold: 1
          failureThreshold: 3
        ports:
          - containerPort: 8181
        env:
          - name: CPS_BACKEND_DB_HOST
            value: mysql       #host name of the database
          - name: CPS_BACKEND_DB_USER
            value: root        #user name of the database
          - name: CPS_BACKEND_DB_PASSWORD
```



```
            value: root!       #password of db user
          - name: CPS_BACKEND_DB_NAME
            value: cloudportaldb       #database name of database
          - name: LMS_HOST
            value: LMSURL      # LMS HOST URL
          - name: LMS_PASSWORD
            value: password    # Password for LMS webportal
          - name: LMS_PORT
            value: "LMS PORT"  # Service port for LMS instance
      hostname: cloudportalbackend
```

2. Create the Cloud Portal service YAML file. You must decide the way to expose the Cloud Portal service to external. The **cloudportal_svc.yaml** file below provides an example of how to expose the Cloud Portal service in LoadBalancer.

   cloudportal_svc.yaml

```
apiVersion: v1
kind: Service
metadata:
  name: cloudportal-backend
  labels:
    app: cloudportal-backend
spec:
  type: LoadBalancer
  ports:
  - port: 80
    targetPort: 8181
    protocol: TCP
  sessionAffinity: ClientIP
  selector:
    app: cloudportal-backend
```

3. Deploy the Cloud Portal service by running:

```
kubectl apply -f cloudportal_deployment.yaml -f cloudportal_svc.yaml
```

   Sentinel LDK Cloud Portal can be accessed with the URL: **http://<exposed ip by loadbancer>:80**

Configuration Updates After Deployment

1. The default username/password of the vendor administrator in Sentinel LDK Cloud Portal is **admin/admin**. Change the password immediately.
2. After logging in to Sentinel LDK Cloud Portal, configure **Outgoing Email Settings**.
3. Configure Sentinel LDK-EMS **Produce and Push** and related parameters as described in Sentinel LDK–EMS Configuration Guide to connect to the Sentinel LDK Cloud Portal service.

CHAPTER 6: Installing Sentinel LDK Run-time Environment

This section describes how to install Sentinel LDK Run-time Environment on the following platforms.

Installing Sentinel LDK Run-time Environment for Mac

This section describes how to install the Sentinel LDK Run-time Environment on a machine with a Mac operating system, and explains how to modify the behavior of the daemons.

For information on supported platforms for Sentinel LDK Run-time Environment, see the Sentinel LDK Release Notes .

In this section:

Installing Sentinel LDK Run-time Environment

Follow the instructions below to install the Sentinel LDK Run-time Environment on a machine with a Mac operating system.

To install the Sentinel LDK Run-time Environment:

1. Go the Sentinel LDK *MacOS* directory on your Mac machine. For more information see the Sentinel LDK Getting Started Guide for Mac.
2. Open */MacOS/Redistribute*, and double-click *Sentinel_Runtime.dmg*.
3. Double-click the *Install Sentinel Runtime Environment* disk image icon. The installer wizard is launched.
4. Follow the instructions of the installer wizard until the installation is complete.

Following successful installation, the Sentinel LDK Run-time Environment is automatically launched. The first time that you run Admin Control Center and submit configuration changes, **hasplmd** creates configuration files in */private/etc/hasplm/*.

Installed Files

After you run the installation, verify that the following files have been installed on your hard drive:

- /usr/local/sentinel/aksusbd (support for Sentinel HL (HASP configuration) keys and HASP HL keys)
- /usr/local/sentinel/hasplmd (Sentinel License Manager daemon)
- /Library/LaunchDaemons/com.aladdin.aksusbd.plist
- /Library/LaunchDaemons/com.aladdin.hasplmd.plist

Modifying the Behavior of the Daemons

Behavior of the daemons can be modified by changing the switches used to start the daemons. Modification requires the following steps:

- Terminating the daemons
- Determining the switches to use
- Saving the modifications
- Restarting the daemons

To terminate the daemons:

1. Ensure that you have Administrator privileges.
2. Launch */Applications/Utilities/Terminal*.
3. Change the directory to: */Library/LaunchDaemons/*
4. At the command prompt, enter the following commands:

   ```
   sudo launchctl unload com.aladdin.hasplmd.plist
   ```

   ```
   sudo launchctl unload com.aladdin.aksusbd.plist
   ```

   (When prompted, enter your administrator password.)

   The daemons stop running.

To determine which switches to use:

Use the table that follows to determine which command line switches to use to set the behavior of the **aksusbd** and **hasplmd** daemons.

Daemon	Command	Description
Both	-f	Forces the daemon to work in the foreground. Required for launchd startup.
Both	-h, --help	Displays a list of available commands
Both	-l <level>	Specifies the level of log messages. The values are: 0 - Errors only 1 - Normal 2 - Verbose 3 - Ultra verbose
Both	v	Displays aksusbd and API versions OR Displays hasplmd version
aksusbd	-d <milliseconds>	Specifies the delay after connecting a Sentinel HL (HASP configuration) key or HASP HL key, before it can be accessed the first time (range 0–2000)
aksusbd	-q <entries>	Specifies the length of the work queue (default 64)
aksusbd	-u <mask>	Specifies the permission bits for the special socket file. Default is 666 (access for all users)
aksusbd	-s <file>	Specifies the communication socket name
hasplmd	-s, -start	Starts the Sentinel License Manager daemon
hasplmd	-u <user>	Launches daemon with owner as user to enhance security

To save the selected switches:

After determining which switches you want to employ, do the following to save the switches in the **.plist** files so that they will be used each time the daemons are launched when the system is restarted:

> Either edit the relevant **.plist** files using a text editor OR use the /Developer/Applications/Utilities/Property List Editor (part of the Xcode Developer Tools) to do the following:

a. Add the modifications for **aksusbd** to */Library/LaunchDaemons/com.aladdin.aksusbd.plist*.

b. Add the modifications for **hasplmd** to */Library/LaunchDaemons/com.aladdin.hasplmd.plist*.

Ensure that the **-f** switch is included in both daemons.

To restart the daemons:

After saving the selected switches, do the following to restart the daemons:

1. Ensure that you have Administrator privileges.
2. Launch */Applications/Utilities/Terminal*.
3. Change the directory to: */Library/LaunchDaemons/*
4. At the command prompt, enter the following commands

```
sudo launchctl load com.aladdin.aksusbd.plist
```

```
sudo launchctl load com.aladdin.hasplmd.plist
```

(Enter your Administrator password when prompted.)

The daemons are restarted.

> **NOTE** The Run-time Environment daemons are launched automatically when the system is restarted.

Installing Sentinel LDK Run-time Environment for Linux

This section describes how to install Sentinel LDK Run-time Environment v.9.12.1 on a computer with a Linux operating system.

For information on supported platforms for Sentinel LDK Run-time Environment, see the Sentinel LDK Release Notes.

In this section:

Installing Sentinel LDK Run-time Environment

> **NOTE** When installing Sentinel LDK Run-time Environment on an end user's machine: To support your application on both 32-bit and 64-bit architectures, ensure that you provide both 32-bit and 64-bit customized Vendor libraries with the Run-time Environment installer. These libraries are contained in the following files:
>
> > haspvlib_<vendorID>.so
>
> > haspvlib_x86_64_<vendorID>.so
>
> > haspvlib_armhf_<vendorID>.so
>
> > haspvlib_arm64_<vendorID>.so

To install the Sentinel LDK Run-time Environment using RPM or DEB:

1. Go the Sentinel LDK *Linux* directory on your Linux machine. For more information, see the Sentinel LDK Getting Started Guide for Linux.
2. Disconnect your Sentinel HL key (if any) from the machine.
3. Open a terminal window and navigate to *Linux/Redistribute/Runtime*.
4. As root, enter the following command:
   - For RedHat, SUSE, or CentOS 32-bit ARM systems:

```
rpm -i aksusbd-9.12-1.armv7hl.rpm
```

- For RedHat, SUSE, or CentOS 64-bit ARM systems:

```
rpm -i aksusbd-9.12-1.aarch64.rpm
```

- For RedHat, SUSE, or CentOS 64-bit Intel systems:

```
rpm -i aksusbd-9.12-1.x86_64.rpm
```

- For Ubuntu or Debian 32-bit ARM systems:

```
dpkg -i aksusbd_9.12-1_armhf.deb
```

- For Ubuntu or Debian 64-bit ARM systems:

```
dpkg -i aksusbd_9.12-1_arm64.deb
```

- For Ubuntu or Debian 64-bit Intel systems:

```
dpkg -i aksusbd_9.12-1_amd64.deb
```

> **NOTE** All install/uninstall commands must be executed with **root** rights. In Ubuntu, prefix the commands with the **sudo** command; in other distributions, use the **su** utility to become root in the terminal window.

The Sentinel LDK Run-time Environment is launched.

5. Reconnect the Sentinel HL key.

> **NOTE** At this point, for older HASP HL keys, the firmware on the HL key may be automatically upgraded. During the upgrade process, the key will blink continuously. *Do not remove the key while it is blinking.* If you remove the key too soon, the key may no longer be visible in Admin Control Center. If the key is not visible, or if the upgrade does not occur, see "Upgrading HASP HL Key Firmware" on page 99.

To install the Sentinel LDK Run-time Environment from a script:

(Use this procedure if the distribution does not support RPM or DEB.)

1. Go the Sentinel LDK *Linux* directory on your Linux machine. For more information, see the Sentinel LDK Getting Started Guide for Linux.
2. Disconnect your Sentinel HL key (if any) from the machine.
3. Copy the package **Linux/Redistribute/Runtime/aksusbd-9.12.1.tar.gz** to a local directory.
4. Open a terminal window in the local directory.
5. Enter the following command to uncompress the package containing the Run-time Environment installer:

```
tar zxvf aksusbd-9.12.1.tar.gz
```


6. Enter the following command to change to the directory containing the installer:

```
cd aksusbd-9.12.1
```

7. As **root**, enter the command: `./dinst`

   The Sentinel LDK Run-time Environment is launched.

8. Reconnect the Sentinel HL key.

> **NOTE** At this point, for older HASP HL keys, the firmware on the HL key may be automatically upgraded. During the upgrade process, the key will blink continuously. *Do not remove the key while it is blinking.* If you remove the key too soon, the key may no longer be visible in Admin Control Center. If the key is not visible, or if the upgrade does not occur, see "Upgrading HASP HL Key Firmware" on page 99.

Uninstalling Run-time Environment v.1.14 or Earlier

An existing installation of the Run-time Environment v.1.14 or earlier cannot be upgraded and must therefore be uninstalled. (Run-time Environment v.1.15 or later *can* be upgraded.)

Before installing the new Run-time Environment, enter the following command to uninstall an existing Run-time Environment v.1.14 or earlier (if present):

- For RedHat: `rpm -e aksusbd-redhat`
- For SUSE: `rpm -e aksusbd-suse`

If the existing Run-time Environment was installed using the Run-time Environment installation script (**dinst**), remove this installation by entering following command as **root** from within the script package: **./dunst**

Installed Files

After you run the installation, verify that the following files are installed:

- */usr/sbin/aksusbd* and */usr/sbin/aksusbd _x86_64*

  32-bit and 64-bit support for Sentinel HL (HASP configuration) keys and HASP HL keys, and support for low-level access to the Sentinel License Manager daemon.

- */etc/init.d/aksusbd* or */etc/init.d/aksusbd_x86_64*

  32-bit or 64-bit startup script for Sentinel License Manager daemon. This file is not installed for Linux systems that use **systemd**. The file is installed only for old systems that use **sysv**.

- */usr/sbin/hasplmd* and */usr/sbin/hasplmd_x86_64*

  32-bit and 64-bit Sentinel License Manager daemons

- */etc/udev/rules.d/80-hasp.rules*

  Rules for */udev*

Following successful installation, the Sentinel LDK Run-time Environment is automatically launched. The first time that you run Admin Control Center and submit configuration changes, **hasplmd** creates a **hasplm.ini** configuration file in **/etc/hasplm**. In addition, log files are created in **/var/hasplm/**.

Uninstalling Sentinel LDK Run-time Environment

To uninstall Sentinel LDK Run-time Environment v.1.15 or later, when installed using RPM or DEB:

- For RedHat, SUSE, or CentOS: As root, enter the command:

```
rpm -e aksusbd
```

- For Debian or Ubuntu: Enter the command:

```
dpkg -r aksusbd
```

  For some earlier Ubuntu systems, it may be necessary to specify that this is an i386 package. Enter the command:

```
dpkg -r aksusbd:i386
```

To uninstall Sentinel LDK Run-time Environment when installed using “dinst”:

- As root, open a terminal window and enter the command:

```
./dunst
```


The **dunst** script can be found in the directory containing the **dinst** script, described in "Installing Sentinel LDK Run-time Environment" on page 95.

Upgrading HASP HL Key Firmware

The Firmware for older HASP HL keys has been modified to support future planned security enhancements in Sentinel LDK. Sentinel LDK automatically upgrades the Firmware on HASP HL keys from v.3.21 to the latest version (v.3.25). This occurs:

- when a HASP HL key with v.3.21 Firmware is connected to a computer where the Run-time Environment is being updated to v.1.15.
- when a customer connects a HASP HL key with v.3.21 Firmware to a computer where the Run-time Environment v.1.15 has been previously installed.

(You can determine the Firmware version of your HL key by viewing the key on the Sentinel Keys page of the Admin Control Center.)

For HL keys with Firmware earlier than version 3.21, the upgrade does not occur automatically. Customers can upgrade the Firmware to version 3.25 by applying the Firmware Update V2C. This is located on the machine where Sentinel LDK Vendor Suite is installed, in the directory:

%ProgramFiles(x86)\Thales\Sentinel LDK\Redistribute\Firmware Update\HASP HL

During the Firmware upgrade, the relevant key will start to blink. Do not remove the key while it is blinking. If you remove the key too soon, the key may no longer be visible in Admin Control Center.

NOTE In the event the key is no longer visible using the Linux Run-time Environment, do the following on a Windows computer:

1. Install Sentinel LDK Run-time Environment.
2. Connect the HL key.
3. Run the application **FirmwareUpdate.exe**. This is located in the directory described above.

The HL key is upgraded to v.3.25 Firmware and will now be visible in the Linux Admin Control Center.

Installing Sentinel LDK Run-time Environment for Windows

Sentinel LDK Run-time Environment may be required:

- at the vendor's site, to perform many activities using Sentinel LDK-EMS. In this case, the Run-time Environment is typically installed by the Sentinel LDK installer.
- at the customer's site, to perform online activation of SL AdminMode keys using the Sentinel LDK-EMS Customer Portal.
- at the customer's site, for your protected applications to run. Depending on the type of protection key provided, the Run-time Environment may be required at the site.

For more information, see the Sentinel LDK Software Protection and Licensing Guide.

This section describes how you can install the Run-time Environment when it is required for your protected application (and it has not been installed automatically from the Customer Portal).

For information on supported platforms for Sentinel LDK Run-time Environment, see the Sentinel LDK Release Notes.

The following utilities are available for installing the Sentinel LDK Run-time Environment at the end user's site:

- A stand-alone GUI installer (HASPUserSetup.exe)
- A command line installer that you can integrate into your software installer (haspdinst.exe)

These utilities recognize the operating system in use and install the correct Run-time environment.

> **NOTE** Administrator privileges are required to install the Sentinel LDK Run-time Environment.

In this section:

HASPUserSetup.exe Utility

HASPUserSetup.exe is a GUI-based installation program to independently install the Sentinel LDK Run-time Environment. Following installation, the file is located in:

%ProgramFiles(x86)%\Thales\Sentinel LDK\\Redistribute\Runtime Environment\Setup

To launch the utility, double-click HASPUserSetup.exe and follow the wizard instructions.

> **NOTE** The HASPUserSetup.exe utility automatically installs the Run-time Environment with or without legacy drivers, as required. If you need to force installation of legacy drivers, use the "haspdinst.exe Utility" below. For more information, see the description of legacy drivers in the Sentinel LDK Software Protection and Licensing Guide.

haspdinst.exe Utility

haspdinst.exe is a command-line utility that installs the Sentinel LDK Run-time Environment. Following installation, the file is located in:

%ProgramFiles(x86)%\Thales\Sentinel LDK\Redistribute\Runtime Environment\cmd Install

> **NOTE** By default, the haspdinst.exe utility automatically installs the Run-time Environment with or without legacy drivers, as required. If necessary, you can force installation of legacy drivers using the relevant switch described in "Additional haspdinst.exe Utility Switches" below. For more information, see the description of legacy drivers in the Sentinel LDK Software Protection and Licensing Guide.

To install or upgrade the Sentinel LDK Run-time Environment:

> Type `haspdinst -i` in the command line. The installation or upgrade process is performed automatically. A message is displayed informing you that the Sentinel LDK Run-time Environment was successfully installed.
>
> Immediately after the Run-time Environment (7.100 or later) is installed or upgraded, any V2C file contained in the same folder is applied to the relevant protection key on the machine.

To remove the Sentinel LDK Run-time Environment:

> Type `haspdinst -r` in the command line. A message is displayed informing you that the Sentinel LDK Run-time Environment was successfully removed.

Additional haspdinst.exe Utility Switches

The following table lists additional switches that can be used with the haspdinst.exe utility.

Switch	Description
-info	Displays the installation status
-h or -?	Displays a list of the available commands
-kp	Enables the installation program to 'kill' all processes accessing the Run-time Environment

Switch	Description
-cm	Sets the installation program to display only critical messages (for example, instructions to reboot)
-fr	Sets the installation program to remove Sentinel LDK Run-time Environment by force, leaving the run-time in a non-functioning state
-ld	Forces installation of the Run-time Environment with legacy drivers. For details, see the Sentinel LDK Software Protection and Licensing Guide. For example: `haspdinst -i -ld`
-fi	Sets the installation program to ignore other running Windows processes
-nomsg	Sets program to display no messages
-chkllm	If used in conjunction with the `-i` or `-r` switch, checks for active License Manager sessions and prompts the user to continue or to abort the operation.
-fss	Silently stops “HASP Loader” and “Server” services (if they are active), performs the requested operation, and then restarts the services.

Multiple Installations on a Single End User’s Computer

The Sentinel LDK Run-time Environment installer utilities contain an automatic mechanism that prevents more than one copy of the Run-time Environment from being installed on a single computer, even if multiple protected applications are installed on the computer.

The Run-time Environment installer utilities employ a counter that keeps track of the number of protected applications installed on a given computer.

For each installation after the first, the installer simply increments the counter instead of actually installing an additional copy of the Run-time Environment. Similarly, the counter is decremented each time the Run-time Environment is uninstalled.

The Run-time Environment is not actually uninstalled until the last protected application is uninstalled.

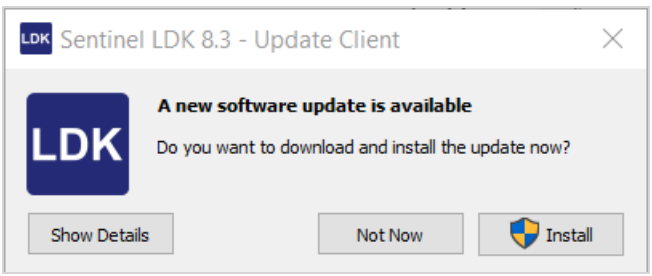
CHAPTER 7: Installing Software Updates

On the Windows machine where Sentinel Vendor Suite or Sentinel LDK-EMS is installed, the Sentinel LDK software manager checks to determine whether a later version of the software is available from Thales servers. This helps to ensure that you are aware of important updates and that you are always working with the latest version of Sentinel LDK.

An update may consist of a new version of Sentinel LDK or an update to individual components or documents.

Each day, the software manager checks for the availability of any updates to the installed components of Sentinel LDK. The check takes place at the same time of day that the components were installed. Only one update notification is delivered on any given day.

If the software manager determines that an update is available, a message window similar to the following is displayed:



The title of the window identifies the component of Sentinel LDK to which the update applies, followed by "Update Client".

For more information regarding the update, click **Show Details**. A window similar to the following is displayed:

This window lists details of the update.

At this point, you can choose to:

> Click **Install** to download and install the updated version.

> **NOTE** Before you click this option, be sure to close any active Sentinel LDK applications.

> Click **Not Now** (or just close the window) to postpone the update. The notification will be displayed again the next day.

> Click **Ignore Update**. You will not receive any more notifications regarding this specific update.

CHAPTER 8: Modifying and Uninstalling Sentinel LDK Components

This section describes how to add Sentinel LDK-EMS or Sentinel LDK Vendor Suite to an existing installation of Sentinel LDK, and how to uninstall Sentinel LDK components from your computer.

Modifying the Installed Sentinel LDK Components

After installing one of the two major Sentinel LDK components, you may want to add the second component on the same machine. For example, you may have installed only the Sentinel LDK-EMS launcher, and now you want to add the Vendor Suite on the same machine (or vice versa).

To add the second component on the same machine as the first component:

1. Run the **setup** procedure from the Sentinel LDK Installation directory and select the **Modify** option.

   > **NOTE** *Do not* use the **Change > Modify** option that is available from the Programs and Features window in the Control Panel.

2. From the Installation Options screen, select the Sentinel LDK component to add.
3. Complete the installation process as described earlier in this guide.

Uninstalling Sentinel LDK Vendor Suite

This section describes how to completely uninstall the current version of Sentinel LDK Vendor Suite from your computer. To uninstall earlier versions of Sentinel LDK or Sentinel HASP, see the appropriate version of the Sentinel LDK Installation Guide.

To completely uninstall Sentinel LDK Vendor Suite from your computer:

1. Ensure that all Sentinel LDK components are not active.
2. On the computer where you want to uninstall Sentinel LDK, open the **Programs and Features** window from the Control Panel.

3. Remove the following:
   - Sentinel LDK
   - Sentinel Runtime
   - Sentinel LDK Vendor Suite

Uninstalling Sentinel LDK-EMS (On-Premises)

If you installed Sentinel LDK-EMS on premises, remove Sentinel LDK-EMS as described below.

> **NOTE** This procedure does not remove the Sentinel LDK-EMS database.

To completely uninstall Sentinel LDK-EMS from your computer:

1. Ensure that Tomcat is not active.
2. Open the **Programs and Features** window from the Control Panel.
3. Remove Sentinel LDK-EMS.

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Version 1.1.1t

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smali/baksmali

Version 2.2.4

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LibJpeg8

Version: 8.4.0

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JSMN 1.1.0

Version: 1.1.0

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