



LexmarkTM

Markvision Enterprise

Version 4.4

Administrator's Guide

September 2024

www.lexmark.com

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Change history

September 2024

Added information on the following:

- Supported printer models
- Upgrading to MVE 4.4
- Understanding variable settings
- Importing files to the resource library
- Configuring email settings
- Understanding ports and protocols

January 2023

- Added information on Markvision™ Enterprise (MVE) configuration and workflow for ADFS.
- Updated the information on accessing the security dashboard.
- Added the Database access chapter.

August 2022

- Added information on the following:
 - Enrollment over Secure Transport (EST) protocol as defined in RFC 7030
 - Security Dashboard
 - Automatic assignment of keywords during discovery
 - Support for e-mail over SSL/TLS
 - Support for Windows Server 2022
- Updated information on the following:
 - Supported printer models
 - Managing certificates using Microsoft CA through Microsoft Certificate Enrollment Web Services (MSCEWS)
 - Configuring OpenXPki CA server
 - Managing MVE configurations

March 2022

- Updated information on the supported printer models.
- Added information on creating a client certificate.

May 2021

- Updated information on the following:
 - Supported printer models
 - Managing Microsoft Certificate Authority (CA)
 - Configuring MVE for automated certificate management
 - Configuring Microsoft Enterprise CA with Network Device Enrollment Service (NDES)

- Added information on the following:
 - Managing certificates using Microsoft CA through Microsoft Certificate Enrollment Web Services (MSCEWS)
 - Creating SSL Certificate for Certificate Enrollment Policy Web Service (CEP) and Certificate Enrollment Web Service (CES) servers
 - Authentication methods for CEP and CES
 - Named device certificate

November 2020

- Updated information on the following:
 - Supported printer models
 - Supported databases
- Added information on the following:
 - Managing and deploying configurations
 - Backing up and restoring the database
 - Managing certificates using OpenXPKI and Microsoft Certificate Authority
- Added support for the following:
 - Managing and deploying configurations to a group of printer models
 - Creating custom database names

February 2020

- Updated information on the following:
 - Supported printer models
 - Supported servers
 - Supported databases
 - Valid MVE upgrade path
- Added information on the following:
 - Instructions for best practices
 - Instructions on managing automated certificates
 - Default advanced security components and their settings
 - Other ways in securing printers
 - Sample scenarios

June 2019

- Updated information on the following:
 - Footnotes added to printer models that require certificates
 - Assigning dbo rights when setting up the database
 - Valid upgrade path when upgrading to version 3.4
 - Files that are needed when backing up and restoring the database
 - LDAP server authentication settings
 - Certificate validity status, dates, and time zone parameters are added to the search rule settings

- Configuring the permissions and function access controls in the printer security settings
- Selecting a firmware file from the resource library when updating the printer firmware
- Selecting the start date, start and pause time, and days of the week when updating the printer firmware
- Managing configurations
- Added information on the following:
 - Understanding printer security states
 - Configuring advanced security components
 - Creating an advanced security component from a printer
 - Generating a printable version of the configuration settings
 - Uploading a printer fleet certificate authority
 - Removing user information and references
 - Understanding permissions and function access controls
 - Troubleshooting steps when enforcement of configurations with multiple applications fails
 - Troubleshooting steps when an Admin user has forgotten the password

August 2018

- Updated information on the following:
 - Supported printer models
 - Setting up the database
 - Upgrading to MVE 3.3
 - Frequently asked questions
 - Creating an action
 - Creating a schedule
- Added information on the following:
 - Setting up a run-as domain user account
 - Exporting logs
 - Troubleshooting steps when MVE does not recognize secured printers

July 2018

- Updated information on upgrading to MVE 3.2.

April 2018

- Updated information on the following:
 - Supported printer models
 - Setting up the database
 - Backing up and restoring database files
 - The URL for accessing MVE
 - Understanding variable settings
- Added information on the following:
 - Configuring printer certificates
 - Stopping tasks

- Updating printer firmware

September 2017

- Updated information on the following:
 - System requirements
 - Communication between MVE and Lexmark™ Forms Printer 2580, 2581, 2590, and 2591 models
 - Manual dropping of Microsoft SQL Server databases
 - Backing up and restoring database files
 - Required security settings for function access controls when deploying firmware and solution files to printers
 - Support for licenses when deploying applications
 - Printer alerts and their associated actions
 - Printer state automatic recovery
 - Events and keywords assignment

June 2017

- Initial document release for MVE 3.0.

Overview

Understanding Markvision Enterprise

Markvision Enterprise (MVE) is a web-based printer management utility software designed for IT professionals.

With MVE, you can manage a large fleet of printers in an enterprise environment efficiently by doing the following:

- Find, organize, and track a fleet of printers. You can audit a printer to collect printer data such as status, settings, and supplies.
- Create configurations and assign them to printers.
- Deploy firmware, printer certificates, certificate authority (CA), and applications to the printers.
- Monitor printer events and alerts.

This document provides information on how to configure, use, and troubleshoot the application.

This document is intended for administrators.

Getting started

Best practices

This topic outlines the recommended steps to use MVE in managing your fleet effectively.

1 Install MVE in your environment.

- a** Create a server using the latest Windows Server environment.

Related content:

[Web server requirements](#)

- b** Create a domain user account that does not have administrator access.

Related content:

[Setting up a run-as user](#)

- c** Create a Microsoft SQL Server database, set up encryption, and then give the new user account access to the databases.

Related content:

- [Database requirements](#)
- [Setting up the database](#)

- d** Install MVE using the domain user account and the SQL server with Windows Authentication.

Related content:

[Installing MVE](#)

2 Set up MVE, and then discover and organize your fleet.

- a** Sign the server certificate.

Related content:

- [Signing the MVE certificate](#)
- [Setting up MVE to manage certificates automatically](#)

- b** Set up the LDAP settings.

Related content:

- [Enabling LDAP server authentication](#)
- [Installing LDAP certificates](#)

- c** Connect to an e-mail server.

Related content:

[Configuring e-mail settings](#)

- d** Discover your fleet.

Related content:

[Discovering printers](#)

- e** Schedule audits and status updates.

Related content:

- [Auditing printers](#)
- [Updating printer status](#)

- f** Set up basic settings, such as contact names, locations, asset tags, and time zones.
- g** Organize your fleet. Use keywords, such as locations, to categorize the printers.

Related content:

- [Assigning keywords to printers](#)
- [Creating a saved search](#)

3 Secure your fleet.

- a** Secure printer access using the default advanced security components.

Related content:

- [Securing printers using the default configurations](#)
- [Understanding permissions and function access controls](#)
- [Other ways to secure your printers](#)

- b** Create a secured configuration that includes certificates.

Related content:

- [Creating a configuration](#)
- [Importing files to the resource library](#)

- c** Enforce the configuration on your current fleet.

Related content:

- [Assigning configurations to printers](#)
- [Enforcing configurations](#)

- d** Schedule enforcements and conformance checks.

Related content:

- [Creating a schedule](#)

- e** Add configurations to discovery profiles to secure new printers.

Related content:

- [Creating a discovery profile](#)

- f** Sign printer certificates.

Related content:

- [Signing the MVE certificate](#)

4 Keep your firmware up to date.

Related content:

- [Updating the printer firmware](#)

5 Install and configure applications.

Related content:

- [Creating a configuration](#)
- [Importing files to the resource library](#)

6 Monitor your fleet.

Related content:

- [Creating a saved search](#)

System requirements

MVE is installed as a web server and can be accessed from a web browser on any computer on the network. MVE also uses a database to store information about the printer fleet. The following lists are the requirements for the web server, database, and user system:

Web server requirements

| | |
|------------------------|---|
| Processor | At least 4-core CPU (3GHz clock speed) that uses Hyper-Threading Technology (HTT) |
| RAM | At least 12GB |
| Hard disk drive | At least 120GB free disk space |

Note: MVE, Cloud Agent, Lexmark Document Distributor (LDD), and Device Deployment Utility (DDU) cannot be run on the same server.

Supported servers

- Windows Server 2022 Standard Edition
- Windows Server 2019
- Windows Server 2016 Standard Edition

Note: MVE supports virtualization for the supported servers in a premise-based environment.

Database requirements

Supported databases

- Firebird® database (built-in)
- Microsoft SQL Server 2019

Note: The recommended minimum database size is 60GB to allocate 20MB for FRAMEWORK, and 4.5MB for MONITOR and QUARTZ. For more information, see [“Setting up the database” on page 19](#).

User system requirements

Supported web browsers

- Microsoft Edge
- Mozilla Firefox (latest version)
- Google Chrome™ (latest version)
- Apple Safari (latest version)

Screen resolution

At least 1280 x 768 pixels

Supported languages

- Brazilian Portuguese
- English
- French

- German
- Italian
- Simplified Chinese
- Spanish

Supported printer models

- Lexmark B2236²
- Lexmark B2338², B2442², B2546², B2650², B2865¹
- Lexmark B3440², B3442²
- Lexmark C2132
- Lexmark C2240², C2325², C2425², C2535²
- Lexmark C2335²
- Lexmark C3224²
- Lexmark C3326²
- Lexmark C3426²
- Lexmark C4150², C6160², C9235²
- Lexmark C4342², C4352²
- Lexmark C746, C748
- Lexmark C792
- Lexmark C925¹, C950
- Lexmark C9600
- Lexmark C9655²
- Lexmark CS310, CS410, CS510
- Lexmark CS317, CS417, CS517
- Lexmark CS331²
- Lexmark CS421², CS521², CS622²
- Lexmark CS431²
- Lexmark CS531², CS632²
- Lexmark CS720², CS725²
- Lexmark CS727², CS728²
- Lexmark CS730²
- Lexmark CS735²
- Lexmark CS737²
- Lexmark CS820², CS827²
- Lexmark CS921², CS923², CS927²
- Lexmark CS943²
- Lexmark CS960²
- Lexmark CS963²
- Lexmark CX310, CX410, CX510
- Lexmark CX317, CX417, CX517

- Lexmark CX331²
- Lexmark CX421², CX522², CX622², CX625²
- Lexmark CX431²
- Lexmark CX532²
- Lexmark CX625²
- Lexmark CX635²
- Lexmark CX725²
- Lexmark CX728²
- Lexmark CX730²
- Lexmark CX735²
- Lexmark CX737²
- Lexmark CX820², CX825², CX827², CX830², CX833², CX860²
- Lexmark CX920², CX921², CX922², CX923², CX924², CX927²
- Lexmark CX930², CX931²
- Lexmark CX942², CX943², CX944²
- Lexmark CX960², CX961², CX962², CX963²
- Lexmark M1140, M1145, M3150
- Lexmark M1242², M1246², M3250², M5255², M5265², M5270²
- Lexmark M3350²
- Lexmark M5155, M5163, M5170
- Lexmark M5255², M5265², M5270²
- Lexmark MB2236²
- Lexmark MB2338², MB2442², MB2546², MB2650², MB2770²
- Lexmark MB3442²
- Lexmark MC2325², MC2425², MC2535², MC2640²
- Lexmark MC3224²
- Lexmark MC3326²
- Lexmark MC3426²
- Lexmark MS310, MS312, MS315, MS410, MS415, MS510, MS610
- Lexmark MS317, MS417, MS517
- Lexmark MS321², MS421², MS521², MS621², MS622²
- Lexmark MS331², MS431²
- Lexmark MS531², MS631², MS632²
- Lexmark MS617, MS817, MS818
- Lexmark MS710, MS711, MS810, MS811, MS812
- Lexmark MS725², MS821², MS822², MS823², MS824², MS825², MS826²
- Lexmark MS911
- Lexmark MX310, MX410, MX510, MX511, MX610, MX611
- Lexmark MX317, MX417, MX517
- Lexmark MX321², MX421², MX521², MX522², MX622²
- Lexmark MX331², MX431²

- Lexmark MX432²
- Lexmark MX532², MX632²
- Lexmark MX617, MX717, MX718
- Lexmark MX6500
- Lexmark MX710, MX711, MX810, MX811, MX812
- Lexmark MX721², MX722², MX725², MX822², MX824², MX826²
- Lexmark MX910, MX911, MX912
- Lexmark MX931²
- Lexmark MX953²
- Lexmark T650¹, T652¹, T654¹, T656¹
- Lexmark X651¹, X652¹, X654¹, X656¹, X658¹
- Lexmark X746, X748, X792
- Lexmark X925, X950, X952, X954
- Lexmark XC2130, XC2132
- Lexmark XC2235², XC2240², XC4240²
- Lexmark XC2326
- Lexmark XC2335²
- Lexmark XC2326
- Lexmark XC4342², XC4352²
- Lexmark XC4140², XC4150², XC6152², XC8155², XC8160²
- Lexmark XC8300
- Lexmark XC8355²
- Lexmark XC9225², XC9235², XC9245², XC9255², XC9265²
- Lexmark XC9325², XC9335²
- Lexmark XC9445², XC9455², XC9465²
- Lexmark XC960
- Lexmark XC9625², XC9635², XC9645², XC9655²
- Lexmark XM1135, XM1140, XM1145, XM3150
- Lexmark XM1242², XM1246², XM3250²
- Lexmark XM3142², XM3146²
- Lexmark XM3350²
- Lexmark XM5163, XM5170, XM5263, XM5270
- Lexmark XM5365², XM5370²
- Lexmark XM7155, XM7163, XM7170, XM7263, XM7270
- Lexmark XM7355², MX7365², MX7370²
- Lexmark XM9145, XM9155, XM9165
- Lexmark XM9335²
- Lexmark XM9655²

¹ A printer certificate update is required. In this release, the Java platform security and performance update remove support for some certificate-signing algorithms, such as MD5 and SHA1. This change prevents MVE from working with some printers. For more information, see the [help information documentation](#).

² SNMPv3 support must be enabled on the printer.

³ If an advanced security password is set on the printer, then MVE cannot support the printer.

Setting up the database

You can use either Firebird or Microsoft SQL Server as the back-end database. The following table can help you decide on what database to use.

| | Firebird | Microsoft SQL Server |
|----------------------------|---|--|
| Server installation | Must be installed on the same server as MVE. | Can be run from any server. |
| Communication | Locked down to only localhost. | Communicates over a static port or a dynamic named instance. SSL/TLS communication with a secured Microsoft SQL server is supported. |
| Performance | Shows performance issues with large fleets. | Shows the best performance for large fleets. |
| Database size | Default database sizes are 6MB for FRAMEWORK, and 1MB for MONITOR and QUARTZ. The FRAMEWORK table grows at 1KB for each printer record that is added. | Default database sizes are 20MB for FRAMEWORK, and 4.5MB for MONITOR and QUARTZ. The FRAMEWORK table grows at 1KB for each printer record that is added. |
| Configuration | Configured automatically during installation. | Requires preinstallation setup. |

If you are using Firebird, then the MVE installer installs and configures Firebird with no other configuration required.

If you are using Microsoft SQL Server, then before installing MVE, do the following:

- Allow the application to run automatically.
- Set the network libraries to use TCP/IP sockets.
- Create the following databases:

Note: The following are default database names. You can also provide custom database names.

- FRAMEWORK
- MONITOR
- QUARTZ

- If you are using a named instance, then set the Microsoft SQL Server Browser service to start automatically. Otherwise, set a static port on the TCP/IP sockets.
- Create a user account with dbowner rights to all three databases that MVE uses to connect to and set up the database. If the user is a Microsoft SQL Server account, then enable the Microsoft SQL Server and the Windows Authentication modes on the Microsoft SQL Server.

Note: Uninstalling MVE that is configured to use Microsoft SQL Server does not drop the created tables or databases. After uninstalling, the FRAMEWORK, MONITOR, and QUARTZ databases must be dropped manually.

- Assign the dbo rights to the database user, and then set the dbo schema as the default schema.

Setting up a run-as user

During installation, you can specify MVE to execute either as a local system account or as a domain user account. Executing MVE as a run-as domain user account provides a more secure installation. The domain user account has limited privileges compared to a local system account.

| | Run-as domain user account | Run-as local system |
|---|--|--|
| Local system permissions | <ul style="list-style-type: none"> File all access to the following: <ul style="list-style-type: none"> – <code>\$MVE_INSTALL/tomcat/logs</code> – <code>\$MVE_INSTALL/tomcat/temp</code> – <code>\$MVE_INSTALL/tomcat/work</code> – <code>\$MVE_INSTALL/apps/library</code> – <code>\$MVE_INSTALL/apps/dm-mve/picture</code> – <code>\$MVE_INSTALL/./mve_truststore*</code> – <code>\$MVE_INSTALL/jre/lib/security/cacerts</code> – <code>\$MVE_INSTALL/apps/dm-mve/WEB-INF/ldap</code> – <code>\$MVE_INSTALL/apps/dm-mve/download</code> Where <code>\$MVE_INSTALL</code> is the installation directory. Windows privilege: LOGON_AS_A_SERVICE | Administrator permissions |
| Database connection authentication | <ul style="list-style-type: none"> Windows Authentication with Microsoft SQL Server SQL Authentication | SQL Authentication |
| Configuration | A domain user must be configured before installation. | Configured automatically during installation |

If you set up MVE as a run-as domain user account, then create the user on the same domain as the MVE server.

Installing MVE

- 1 Download the executable file into a path that does not contain any spaces.
- 2 Run the file as an administrator, and then follow the instructions on the computer screen.

Notes:

- Passwords are hashed and stored securely. Make sure that you remember your passwords, or store them in a secure location because passwords cannot be decrypted once stored.
- If you are connecting to the Microsoft SQL Server using Windows Authentication, then no connection verification occurs during installation. Make sure that the user designated to execute the MVE windows service has a corresponding account in the Microsoft SQL Server instance. The designated user must have dbowner rights to the FRAMEWORK, MONITOR, and QUARTZ databases.

Installing MVE silently

Database settings for silent installation

| Setting | Description | Value |
|--|---|---|
| --help | Shows the list of valid options. | |
| --version | Shows the product information. | |
| --unattendedmodeui <unattendedmodeui> | The user interface for unattended mode. | Default: none Allowed: <ul style="list-style-type: none"> • none • minimal • minimalWithDialogs |
| --optionfile <optionfile> | The installation option file. | Default: |
| --debuglevel <debuglevel> | The debug information level of verbosity. | Default: 2 Allowed: <ul style="list-style-type: none"> • 0 • 1 • 2 • 3 • 4 |
| --mode <mode> | The installation mode. | Default: win32 Allowed: <ul style="list-style-type: none"> • win32 • unattended |
| --debugtrace <debugtrace> | The debug file name. | Default: |
| --installer-language <installer-language> | The language selection. | Default: en Allowed: <ul style="list-style-type: none"> • en • es • de • fr • it • pt_BR • zh_CN |
| --encryptionKey <encryptionKey> | The encryption key. | Encryption key: Default: |
| --prefix <prefix> | The installation directory. | Default: C:\Program Files |

| Setting | Description | Value |
|--|---|---|
| <code>--mveLexmark_runas</code> <code><mveLexmark_runas></code> | The run-as user options. | Default: LOCAL_SYSTEM Allowed: <ul style="list-style-type: none"> • LOCAL_SYSTEM • SPECIFIC_USER |
| <code>--serviceRunAsUsername</code> <code><serviceRunAsUsername></code> | The run-as user name. | User name: Default: |
| <code>--serviceRunAsPassword</code> <code><serviceRunAsPassword></code> | The run-as user password. | Password: Default: |
| <code>--mveLexmark_database</code> <code><mveLexmark_database></code> | The database type. | Default: Allowed: <ul style="list-style-type: none"> • FIREBIRD • SQL_SERVER |
| <code>--firebirdUsername</code> <code><firebirdUsername></code> | The Firebird database user name. | User name: Default: |
| <code>--firebirdPassword</code> <code><firebirdPassword></code> | The Firebird database password. | Password: Default: |
| <code>--firebirdFWDbName</code> <code><firebirdFWDbName></code> | The Firebird database name for FRAMEWORK. | Database names: Default: FRAMEWORK |
| <code>--firebirdMNDbName</code> <code><firebirdMNDbName></code> | The Firebird database name for MONITOR. | Default: MONITOR |
| <code>--firebirdQZDbName</code> <code><firebirdQZDbName></code> | The Firebird database name for QUARTZ. | Default: QUARTZ |
| <code>--databaseIPAddress</code> <code><databaseIPAddress></code> | The database IP address or host name. | IP address or host name: Default: |
| <code>--databasePort</code> <code><databasePort></code> | The database port number. | Port number: Default: |
| <code>--instanceName</code> <code><instanceName></code> | The instance name. | Instance name: Default: |
| <code>--instanceIdentifier</code> <code><instanceIdentifier></code> | The instance. | Default: databasePort Allowed: <ul style="list-style-type: none"> • databasePort • instanceName |
| <code>--databaseUsername</code> <code><databaseUsername></code> | The database user name. | User name: Default: |
| <code>--databasePassword</code> <code><databasePassword></code> | The database password. | Password: Default: |

| Setting | Description | Value |
|--|---|---|
| -- <code>sqlServerAuthenticationMethod</code> <code><sqlServerAuthenticationMethod></code> | The Microsoft SQL server authentication method. | Default: <code>sqlServerDbAuthentication</code> Allowed: <ul style="list-style-type: none"> • <code>sqlServerDbAuthentication</code> • <code>sqlServerWindowsAuthentication</code> |
| -- <code>fWDbName</code> <code><fWDbName></code> | The database name for FRAMEWORK. | Database names: Default: FRAMEWORK |
| -- <code>mNDbName</code> <code><mNDbName></code> | The database name for MONITOR. | Default: MONITOR |
| -- <code>qZDbName</code> <code><qZDbName></code> | The database name for QUARTZ. | Default: QUARTZ |
| -- <code>mveAdminUsername</code> <code><mveAdminUsername></code> | The administrator user name. | User name: Default: admin |
| -- <code>mveAdminPassword</code> <code><mveAdminPassword></code> | The administrator password. | Password: Default: |

Accessing MVE

To access MVE, use the login credentials that you created during installation. You can also set up other login methods, such as LDAP, Kerberos, or other local accounts. For more information, see [“Setting up user access” on page 29](#).

- 1 Open a web browser, and then type **`https://MVE_SERVER/mve/`**, where **`MVE_SERVER`** is the host name or IP address of the server hosting MVE.
- 2 If necessary, accept the disclaimer.
- 3 Enter your credentials.
- 4 Click **Log In**.

Notes:

- After logging in, make sure that you change the default administrator password that was used during installation. For more information, see [“Changing your password” on page 24](#).
- If MVE is idle for more than 30 minutes, then the user is logged out automatically.

Changing the language

- 1 Open a web browser, and then type **`https://MVE_SERVER/mve/`**, where **`MVE_SERVER`** is the host name or IP address of the server hosting MVE.
- 2 If necessary, accept the disclaimer.
- 3 On the upper-right corner of the page, select a language.

Changing your password

- 1** Open a web browser, and then type **https://MVE_SERVER/mve/**, where **MVE_SERVER** is the host name or IP address of the server hosting MVE.
- 2** If necessary, accept the disclaimer.
- 3** Enter your credentials.
- 4** Click **Log In**.
- 5** On the upper-right corner of the page, click your user name, and then click **Change password**.
- 6** Change the password.

Maintaining the application

Upgrading to MVE 4.4

Notes:

- Due to issues with Oracle licensing, MVE 4.0 has been revoked. As a result, you cannot upgrade directly from version 3.x to version 4.x. Instead, you must perform a clean installation of the necessary 4.x version.
- If you are already using any 4.x version, you can directly upgrade to 4.4.

Before you begin the upgrade, back up the database, application, and properties files. If necessary, provide custom database names.

Warning—Potential Damage: When you upgrade MVE, the database is changed. Do not restore a database backup which was created from a previous version.

Note: Any upgrade or uninstallation creates a risk of unrecoverable data loss. You can use the backup files to restore the application to its previous state in case the upgrade fails. For more information, see [“Backing up and restoring the database” on page 25](#).

Do the following:

- 1 Download the executable file to a temporary location.
- 2 Run the installer as an administrator, and then follow the instructions on the computer screen.

Note: After upgrading, make sure to clear the browser cache before accessing the application again.

Backing up and restoring the database

Note: There is potential data loss when performing backup and restore procedures. Make sure to perform the steps properly.

Backing up the database and application files

We recommend backing up your database regularly.

- 1 Stop the Firebird service and the Markvision Enterprise service.
 - a Open the Run dialog box, and then type **services.msc**.
 - b Right-click **Firebird Guardian - DefaultInstance**, and then click **Stop**.
 - c Right-click **Markvision Enterprise**, and then click **Stop**.
- 2 Browse to the folder where Markvision Enterprise is installed.
For example, **C:\Program Files**
- 3 Back up the application and database files.

Backing up the application files

Copy the following files to a safe repository:

- Lexmark\mve_encryption.jceks
- Lexmark\mve_truststore.p12
- Lexmark\Markvision Enterprise\apps\dm-mve\WEB-INF\classes\database.properties
- Lexmark\Markvision Enterprise\apps\dm-mve\WEB-INF\classes\encryption.properties
- Lexmark\Markvision Enterprise\apps\dm-mve\WEB-INF\classes\platform.properties
- Lexmark\Markvision Enterprise\apps\library
- Lexmark\Markvision Enterprise\apps\mve-data-service\WEB-INF\classes\database.properties
- Lexmark\Markvision Enterprise\apps\mve-data-service\WEB-INF\classes\encryption.properties
- Lexmark\Markvision Enterprise\jre\lib\security\cacerts
- Lexmark\Markvision Enterprise\tomcat\conf\server.xml

Note: Make sure that these files are properly stored. Without the encryption keys in the mve_encryption.jceks file, data stored in an encrypted format in the database and on the file system cannot be recovered.

Backing up the database files

Do either of the following:

Note: The following files are using the default database names. These instructions also apply to customized database names.

- If you are using a Firebird database, then copy the following files to a safe repository. These files must be backed up regularly to avoid data loss.
 - Lexmark\Markvision Enterprise\firebird\security2.fdb

If you are using custom database names, then update the following:

- Lexmark\Markvision Enterprise\apps\dm-mve\WEB-INF\classes\database.properties
- Lexmark\Markvision Enterprise\apps\mve-data-service\WEB-INF\classes\database.properties
- Lexmark\Markvision Enterprise\apps\mve-data-service\WEB-INF\classes\application.yml
- Lexmark\Markvision Enterprise\firebird\aliases.conf
- Lexmark\Markvision Enterprise\firebird\data\QUARTZ.FDB
- Lexmark\Markvision Enterprise\firebird\data\MONITOR.FDB
- Lexmark\Markvision Enterprise\firebird\data\FRAMEWORK.FDB
- If you are using Microsoft SQL Server, then create a backup for FRAMEWORK, MONITOR, and QUARTZ. For more information, contact your Microsoft SQL Server administrator.

4 Restart the Firebird service and the Markvision Enterprise service.

- a Open the Run dialog box, and then type **services.msc**.
- b Right-click **Firebird Guardian - DefaultInstance**, and then click **Restart**.
- c Right-click **Markvision Enterprise**, and then click **Restart**.

Restoring the database and application files

Warning—Potential Damage: When you upgrade MVE, the database may be changed. Do not restore a database backup that was created from a previous version.

- 1 Stop the Markvision Enterprise service.

For more information, see [step 1](#) of “[Backing up the database and application files](#)” on page 25.

- 2 Browse to the folder where Markvision Enterprise is installed.

For example, **C:\Program Files**

- 3 Restore the application files.

Replace the following files with the files that you saved during the backup process:

- Lexmark\mve_encryption.jceks
- Lexmark\mve_truststore.p12
- Lexmark\Markvision Enterprise\apps\dm-mve\WEB-INF\classes\database.properties
- Lexmark\Markvision Enterprise\apps\dm-mve\WEB-INF\classes\encryption.properties
- Lexmark\Markvision Enterprise\apps\dm-mve\WEB-INF\classes\platform.properties
- Lexmark\Markvision Enterprise\apps\library
- Lexmark\Markvision Enterprise\apps\mve-data-service\WEB-INF\classes\database.properties
- Lexmark\Markvision Enterprise\apps\mve-data-service\WEB-INF\classes\encryption.properties
- Lexmark\Markvision Enterprise\jre\lib\security\cacerts
- Lexmark\Markvision Enterprise\tomcat\conf\server.xml

Note: You can restore a database backup to a new MVE installation only if the new MVE installation is the same version.

- 4 Restore the database files.

Do either of the following:

- If you are using a Firebird database, then replace the following files that you saved during the backup process:

Note: The following files are using the default database names. This instruction also applies to customized database names.

- Lexmark\Markvision Enterprise\firebird\security2.fdb

If you are using custom database names, then the following files are also restored:

- Lexmark\Markvision Enterprise\apps\dm-mve\WEB-INF\classes\database.properties
- Lexmark\Markvision Enterprise\apps\mve-data-service\WEB-INF\classes\database.properties
- Lexmark\Markvision Enterprise\apps\mve-data-service\WEB-INF\classes\application.yml
- Lexmark\Markvision Enterprise\firebird\aliases.conf
- Lexmark\Markvision Enterprise\firebird\data\QUARTZ.FDB
- Lexmark\Markvision Enterprise\firebird\data\MONITOR.FDB
- Lexmark\Markvision Enterprise\firebird\data\FRAMEWORK.FDB
- If you are using Microsoft SQL Server, then contact your Microsoft SQL Server administrator.

- 5 Restart the Markvision Enterprise service.

For more information, see [step 4](#) of “[Backing up the database and application files](#)” on page 25.

Updating the installer settings after installation

The Markvision Enterprise Password Utility lets you update the Microsoft SQL Server settings that have been configured during installation without reinstalling MVE. The utility also lets you update the run-as user domain account credentials, such as user name and password. You can also use the utility to create another Admin user if you forget your previous Admin user credentials.

- 1** Browse to the folder where Markvision Enterprise is installed.
For example, **C:\Program Files**
- 2** Launch the **mvepwdutility-windows.exe** file in the Lexmark\Markvision Enterprise\ directory.
- 3** Select a language, and then click **OK > Next**.
- 4** Follow the instructions on the computer screen.

Setting up user access

Overview

MVE lets you add internal users directly to the MVE server or use the user accounts registered in an LDAP server. For more information on adding internal users, see [“Managing users” on page 30](#). For more information on using LDAP user accounts, see [“Enabling LDAP server authentication” on page 31](#).

When adding users, roles must be assigned. For more information, see [“Understanding user roles” on page 29](#).

During authentication, the system checks the user credentials of the internal users present in the MVE server. If MVE cannot authenticate the user, then it tries to authenticate the user in the LDAP server. If the user name exists in both the MVE server and the LDAP server, then the password in the MVE server is used.

Understanding user roles

MVE users can be assigned to one or more roles. Depending on the role, users can perform the following tasks:


- **Admin**—Access and perform tasks in all menus. They also have administrative privileges, such as adding users to the system or configuring the system settings. Only users with an Admin role can stop any running task no matter what user type started it.
- **Printers**
 - Manage discovery profiles.
 - Set the printer states.
 - Perform an audit.
 - Manage categories and keywords.
 - Schedule an audit, data export, and printer discovery.
- **Configurations**
 - Manage configurations, including importing and exporting configuration files.
 - Upload files to the resource library.
 - Assign and enforce configurations to printers.
 - Schedule a conformance check and configurations enforcement.
 - Deploy files to printers.
 - Update the printer firmware.
 - Generate printer certificate signing requests.
 - Download printer certificate signing requests.
- **Event Manager**
 - Manage actions and events.
 - Assign events to printers.
 - Test actions.
- **Service Desk**
 - Update the printer status.
 - Reboot printers.

- Run a conformance check.
- Enforce configurations to printers.

Notes:

- All users in MVE can view the printer information page, and manage saved searches and views.
- For more information on assigning user roles, see [“Managing users” on page 30](#).

Managing users

- 1 Click  on the upper-right corner of the page.
- 2 Click **User**, and then do any of the following:

Add a user

- a Click **Create**.
- b Type the user name, user ID, and password.
- c Select the roles.

Note: For more information, see [“Understanding user roles” on page 29](#).

- d Click **Create User**.

Edit a user

- a Select a user ID.
- b Configure the settings.
- c Click **Save Changes**.

Delete users

- a Select one or more users.
- b Click **Delete**, and then confirm deletion.


Note: A user account is locked out after three consecutive failed login attempts. Only an Admin user can reactivate the user account. If the Admin user is locked out, then the system reactivates it automatically after five minutes.

Enabling LDAP server authentication

LDAP is a standards-based, cross-platform, extensible protocol that runs directly on top of TCP/IP. It is used to access specialized databases called directories.

To avoid maintaining multiple user credentials, you can use the company LDAP server to authenticate user IDs and passwords.

As a prerequisite, the LDAP server must contain user groups that correspond to the required user roles. For more information, see [“Understanding user roles” on page 29](#).

- 1 Click  on the upper-right corner of the page.
- 2 Click **LDAP**, and then select **Enable LDAP for authentication**.
- 3 In the LDAP server hostname field, type the IP address or the host name of the LDAP server where the authentication occurs.

Note: If you want to use encrypted communication between the MVE server and the LDAP server, then use the fully qualified domain name (FQDN).
- 4 Specify the server port number according to the encryption protocol selected.
- 5 Select the encryption protocol.
 - **None**
 - **TLS**—A security protocol that uses data encryption and certificate authentication to protect the communication between a server and a client. If this option is selected, then a START_TLS command is sent to the LDAP server after the connection is established. Use this setting if you want a secure communication over port 389.
 - **SSL/TLS**—A security protocol that uses public-key cryptography to authenticate the communication between a server and a client. Use this option if you want a secured communication from the start of the LDAP bind. This option is typically used for port 636 or other secured LDAP ports.
- 6 Select the binding type.
 - **Simple**—The MVE server produces the specified credentials to the LDAP server to use the LDAP server lookup facility.
 - a Type the bind user name.
 - b Type the bind password, and then confirm the password.
 - **Kerberos**—To configure the settings, do the following:
 - a Type the bind user name.
 - b Type the bind password, and then confirm the password.
 - c Click **Choose File**, and then browse to the krb5.conf file.
 - **SPNEGO**—To configure the settings, do the following:
 - a Type the service principal name.
 - b Click **Choose File**, and then browse to the krb5.conf file.
 - c Click **Choose File**, and then browse to the Kerberos keytab file.

This option is used only for configuring the Simple and Protected GSSAPI Negotiation Mechanism (SPNEGO) to support the Single Sign-On functionality.

7 From the Advanced Options section, configure the following:

- **Search Base**—The base distinguished name (DN) of the root node. In the LDAP community server hierarchy, this node must be the ancestor of the user node and group node. For example, **dc=mvetest,dc=com**.
Note: When specifying the root DN, make sure that only **dc** and **o** are part of the root DN. If **ou** or **cn** is the ancestor of the user and group nodes, then use **ou** or **cn** in the user and group search bases.
- **User search base**—The node in the LDAP community server where the user object exists. This node is under the root DN where all the user nodes are listed. For example, **ou=people**.
- **User search filter**—The parameter for locating a user object in the LDAP community server. For example, **(uid={0})**.

Examples of allowed multiple conditions and complex expressions

| Log in using | In the User search filter field, type |
|---------------------------|--|
| Common name | (CN={0}) |
| Login name | (sAMAccountName={0}) |
| User Principal Name | (userPrincipalName={0}) |
| Telephone number | (telephoneNumber={0}) |
| Login name or common name | ((sAMAccountName={0}) (CN={0})) |

Note: Only the **{0}** and **{1}** patterns can be used. If **{0}** is used, then MVE searches for the LDAP user DN. If **{1}** is used, then MVE searches for the MVE user login name.

- **Search User base object and whole subtree**—The system searches all the nodes under the user search base.
- **Group search base**—The node in the LDAP community server containing the user groups that correspond to the MVE roles. This node is under the root DN where all the group nodes are listed. For example, **ou=group**.
- **Group search filter**—The parameter for locating a user within a group that corresponds to a role in MVE.

Note: The only valid pattern is **{0}**, which means that MVE searches for the MVE user login name.

- **Group role attribute**—Type the LDAP attribute for the full name of the group. An LDAP attribute has a specific meaning and defines a mapping between the attribute and a field name. For example, the LDAP attribute **cn** is associated with the Full Name field. The LDAP attribute **commonname** is also mapped to the Full Name field. Generally, this attribute must be left to the default value of **cn**.
- **Search User base object and whole subtree**—The system searches all the nodes under the group search base.

8 From the LDAP Groups to MVE Role Mapping section, type the names of the LDAP groups that correspond to the MVE roles.

Notes:


- For more information, see [“Understanding user roles” on page 29](#).
- You can assign one LDAP group to multiple MVE roles. You can also type more than one LDAP group in a role field, using the vertical bar character (|) to separate multiple groups. For example, to include the **admin** and **assets** groups for the Admin role, type **admin|assets** in the LDAP groups for Admin role field.

- If you want to use only the Admin role and not the other MVE roles, then leave the fields blank.

9 Click **Save Changes**.

Installing LDAP server certificates

To establish an encrypted communication between the MVE server and the LDAP server, MVE must trust the LDAP server certificate. In the MVE architecture, when MVE is authenticating with an LDAP server, MVE is the client and the LDAP server is the peer.

- 1 Click  on the upper-right corner of the page.
- 2 Click **LDAP**, and then configure the LDAP settings. For more information, see [“Enabling LDAP server authentication” on page 31](#).
- 3 Click **Test LDAP**.
- 4 Enter a valid LDAP user name and password, and then click **Start Test**.
- 5 Examine the certificate for validity, and then accept it.

Adding a root CA certificate in the Java truststore

Some MVE LDAP configurations use a load balancer or a virtual IP (VIP) to redirect LDAPS requests. In these cases, the root CA certificate of the domain must be installed and trusted in the MVE Java truststore.

- 1 Import the root CA certificate, and then confirm that the certificate is trusted.
- 2 Back up your database and application files.
- 3 Stop the MVE service.
- 4 Run the command prompt as an administrator, and then type the following:

```
"C:\Program Files\Lexmark\Markvision Enterprise\jre\bin\keytool.exe" -import  
-trustcacerts -alias EnterpriseRootCA -file C:\temp\EnterpriseRootCA.cer -  
keystore "C:\Program Files\Lexmark\Markvision Enterprise\jre\lib\security  
\cacerts"
```
- 5 When prompted to enter the keystore password, type **changeit**.
- 6 When prompted whether to trust the certificate, type **yes**.

Notes:

- If the process is successful, then a **Certificate was added to keystore** message appears.
- If the file-level permissions for the cacerts file do not allow you to update the file, then an access-denied message appears. You can either update the permissions for the file or run the command prompt as an administrator who has the permission to update the file.

- 7 Restart the MVE service.

Discovering printers

Creating a discovery profile

Use a discovery profile to find printers in your network and add them to the system. In a discovery profile, do either of the following to include or exclude a list of IP addresses or host names:

- Add entries one at a time.
- Import entries using a TXT or CSV file.

You can also assign and enforce a configuration automatically to a compatible printer model. A configuration must contain printer settings, applications, licenses, firmware, and CA certificates that can be deployed to the printers.

- 1 From the Printers menu, click **Discovery Profiles > Create**.
- 2 From the General section, type a unique name and description for the discovery profile, and then configure the following:
 - **Timeout**—How long the system waits for a printer to respond
 - **Retries**—The number of times the system attempts to communicate with a printer.
 - **Automatically manage discovered printers**—Newly discovered printers are set to a Managed state automatically, and the New state is skipped during discovery.
- 3 From the Addresses section, do either of the following:

Add the addresses

a Select **Include** or **Exclude**.

b Type the IP address, host name, subnet, or IP address range.

Addresses

Examples: 10.20.xx.xx, myprinter.domain.com, 2001:dbx::x:x
 2001:dbx::x:x

Search Address/Range

| <input type="checkbox"/> | Address/Range | Include/Exclude |
|--------------------------|----------------------------|-----------------|
| <input type="checkbox"/> | 10.195.x.x-10.195.x.xx.xxx | Include |

Add only one entry at a time. Use the following formats for the addresses:

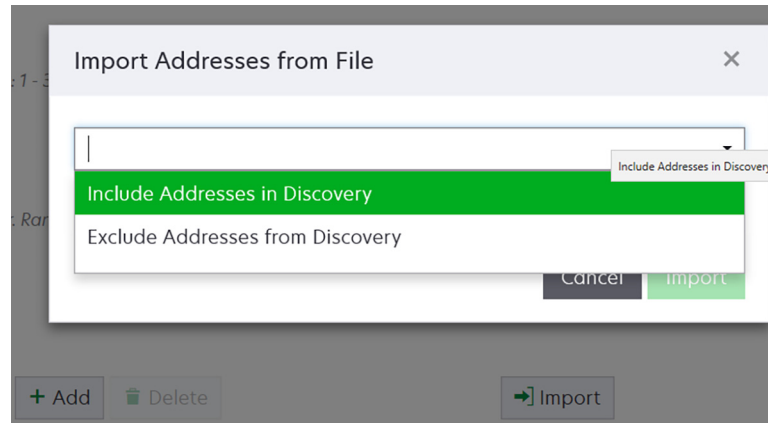
- **10.195.10.1** (single IPv4 address)
- **myprinter.example.com** (single host name)
- **10.195.10.3-10.195.10.255** (IPv4 address range)
- **10.195.*.*** (wildcards)
- **10.195.10.1/22** (IPv4 Classless Inter-Domain Routing or CIDR notation)
- **2001:db8:0:0:0:0:2:1** (full IPv6 address)
- **2001:db8::2:1** (collapsed IPv6 address)

Note: If separate discovery profiles are created for the IPv6 and the IPv4 address for the same printer, then the last discovered address is shown. For example, if a printer is discovered using IPv6, and is discovered again using IPv4, then only the IPv4 address is shown in the printer list.

- c Click **Add**.

Import the addresses

- a Click **Import**.
- b Select whether to include or exclude IP addresses during the discovery.



- c Browse to the text file that contains a list of addresses. Each address entry must be placed on a separate line.

Sample text file

```
10.195.10.1
myprinter.example.com
10.195.10.3-10.195.10.255
10.195.*.*
10.195.10.1/22
2001:db8:0:0:0:0:2:1
2001:db8::2:1
```

- d Click **Import**.

- 4 From the SNMP section, select **Version 1**, **Version 2c** or **Version 3**, and then set the access permissions.

Note: To discover printers using SNMP version 3, create a username and password in the printer Embedded Web Server, and then restart the printer.

Navigate to the discovery profile page, and rediscover the printer using the appropriate credentials. Enter any of the following information:

- Read/write username
- Read/write password

Note: If using read-only credentials, enter the details in the Read/Write Username and Read/Write Password fields.

- Authentication level
- Authentication hash
- Privacy algorithm

- Privacy password

Note: To default to the read/write password, leave the privacy password field empty.

- Context name

Note: If a connection cannot be established, then rediscover the printers. For more information, see the *Embedded Web Server Administrator's Guide*.

- 5 If necessary, from the Enter Credentials section, select the authentication method that the printers are using, and then enter the credentials.

Note: This feature lets you establish communication with secured printers during discovery. The correct credentials must be provided to perform tasks on the secured printers, such as audit, status update, and firmware update.

- 6 If necessary, from the Assign Configurations section, associate a configuration with a printer model. For information on creating a configuration, see [“Creating a configuration” on page 68](#).
- 7 If necessary, from the Assign Keywords section, associate a keyword with a printer model during discovery. For information on assigning keywords to printers, see [“Assigning keywords to printers” on page 65](#)

Notes:

- All the printers discovered through this profile are assigned with the new keywords.
- The new keywords are added to the existing list of keywords that are already assigned to a printer.

- 8 Click **Save Profile** or **Save and Run Profile**.

Note: A discovery can be scheduled to occur regularly. For more information, see [“Creating a schedule” on page 141](#).

Managing discovery profiles

- 1 From the Printers menu, click **Discovery Profiles**.
- 2 Do any of the following:

Edit a profile

- a Select a profile, and then click **Edit**.
- b Configure the settings.
- c Click **Save Profile** or **Save and Run Profile**.

Copy a profile

- a Select a profile, and then click **Copy**.
- b Configure the settings.
- c Add the IP addresses. For more information, see [“Add the addresses” on page 34](#).
- d Click **Save Profile** or **Save and Run Profile**.

Delete a profile

- a Select one or more profiles.
- b Click **Delete**, and then confirm deletion.

Run a profile

- a** Select one or more profiles.
- b** Click **Run**. Check the discovery status from the Tasks menu.

Sample scenario: Discovering printers

Company ABC is a large manufacturing company occupying a nine-story building. The company just bought 30 new Lexmark printers, distributed among the nine floors. As the IT personnel, you must add these new printers to MVE. The printers are already connected to the network, but you do not know all the IP addresses.

You want to secure the following new printers in the Accounting department.

10.194.55.60
10.194.56.77
10.194.55.71
10.194.63.27
10.194.63.10

Sample implementation

- 1** Create a discovery profile for the printers in the Accounting department.
- 2** Add the five IP addresses.
- 3** Create a configuration that secures the specified printers.
- 4** Include the configurations in the discovery profile.
- 5** Save and run the profile.
- 6** Create another discovery profile for the rest of the printers.
- 7** Include the IP addresses using a wildcard. Use the following: **10.194.*.***
- 8** Exclude the five printer IP addresses in the Accounting department.
- 9** Save, and then run the profile.

Managing the security dashboard

Overview

The Security dashboard lets you view the health of the device security settings. It is a visual representation of various security settings, such as, ports, protocols, disk encryption status, device administrator accounts, and default certificate status. It provides visibility to the security posture of your fleet, which helps administrators to identify and fix the settings which are out of compliance.

Accessing the security dashboard

- 1 From the MVE web portal, click **Dashboard**.

Note: The security dashboard is the default landing page for Admin users.

- 2 Click either of the following widgets:

- **Device Security Information**
- **Device Conformance Check**

Showing or hiding the security dashboard

- Modify the dashboard.display parameter in the platform.properties file to hide or show the Security Dashboard.
- You can find the platform.properties file in `\Installation Location\Markvision Enterprise\apps\dm-mve\WEB-INF\classes`, where *Installation Location* is the installation folder of MVE.
- The default value of this parameter is True. If you enter an incorrect value or leave the field blank for this parameter, then the dashboard is displayed.
- To disable the dashboard, set the dashboard.display parameter to **False**.
- After you modify the parameter, restart the MVE service.

Managing Device Security Information

This widget summarizes the security view of the fleet.

- 1 Click any bar of the chart to go to the Device Security Information window.
- 2 Hover your mouse over the bars to view the following details:
 - Port number
 - Number of associated printers
 - Whether the printer settings are open/enabled
- 3 Click **Print** to get a printable format of the detailed view.

Notes:

- The Device Security Information window provides the user with a drill-down feature.
- Clicking any bar item in the chart enables the user to navigate to a filtered view of the printer listing page. For more information, see [“Viewing the printer list” on page 40](#).

Managing Device Conformance Check

This widget summarizes the detailed view of the conformance check of the fleet.

- 1** Click any section of the pie chart to go to the Device Conformance Check window.
- 2** From the left pane, apply the Date Range filter.
Note: Default range is 7 days.
- 3** Click **Print** to get a printable format of the detailed view.

Notes:

- The Device Conformance Check window provides the user with a drill-down feature.
- Clicking any section of the pie chart enables the user to navigate to a filtered view of the printer listing page. For more information, see [“Viewing the printer list” on page 40](#).

Viewing printers

Viewing the printer list

The Printer Listing page is the default landing page when you access MVE. The table shows the list of the printers that are added in MVE.

- 1 From the Printers menu, click **Printer Listing**.
- 2 From the Printer Listing page, do any of the following:
 - To search for specific printers, do any of the following:
 - Use the search box to search for an IP address, host name, system name, or serial number.

Tasks ▾

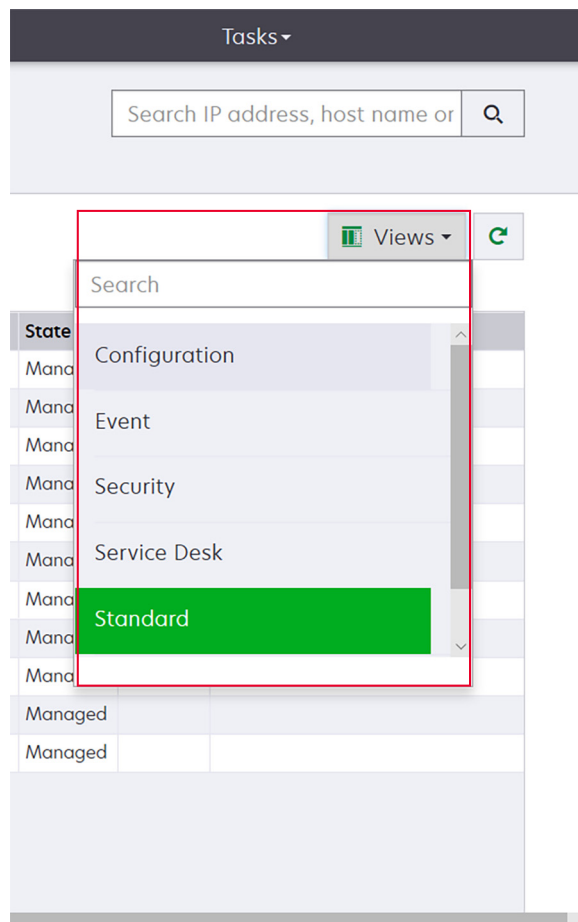
Search IP address, host name or

Q

Views ▾

| State | Keyword | |
|---------|---------|--|
| Managed | | |
| Managed | | |
| Managed | | |
| Managed | | |
| Managed | | |
| Managed | | |
| Managed | | |
| Managed | | |
| Managed | | |
| Managed | | |
| Managed | | |
| Managed | | |

- Change the printer listing view. For more information, see [“Changing the printer listing view” on page 46](#).



Note: If you are using the search box, then the application searches for all the printers in the system. The selected filters and saved searches are ignored. If you run a saved search, then the criteria specified in the saved search are used. The selected filters and the IP address or host name typed in the search box are ignored. You can also use the filters to narrow down the current search results.

- Use the filters.

The screenshot shows the 'All Printers' interface. On the left, there are filter sections: 'Keywords' (No keywords: 4), 'Subnets' (157184.205.*: 4, 10.195.7*: 3, 10.194.29*: 1, 10.195.0*: 1, 10.195.6*: 1), 'Supply Status Severity' (Unknown supply status: 4), 'Printer Status Severity' (Unknown printer status: 4), 'Configuration Conform...' (1), and 'Model Names'. On the right, there are buttons for 'Printer', 'Configure', 'Assign', and 'Security'. Below these, it says '4 total items' and shows a table of printers.

| IP Address | Model | Contact Name |
|----------------|------------------|--------------|
| 157184.205.135 | Lexmark B2236dw | |
| 157184.205.186 | Lexmark CX922de | |
| 157184.205.212 | Lexmark CX725 | |
| 157184.205.250 | Lexmark MX611dhe | |

- Run a saved search. For more information, see [“Running a saved search” on page 49.](#)

The screenshot shows the 'All Printers' interface with the 'Run Saved Search' dropdown menu open. The menu lists various search categories: All Printers, Managed (Changed) Printers, Managed Printers, Managed (Found) Printers, Managed (Missing) Printers, Managed (Normal) Printers, New Printers, Retired Printers, Unmanaged Printers, and C2lite. The background shows the same printer list as the previous screenshot.

- To sort the printers, from the printer list table, click any column header. The printers are sorted according to the selected column header.
- To view more information about the printers, resize the columns. Place your cursor over the vertical border of the column header, and then drag the border to the left or to the right.

Viewing the printer information

To see the complete list of information, make sure that an audit is performed on the printer. For more information, see [“Auditing printers” on page 61](#).

1 From the Printers menu, click **Printer Listing**.

2 Click the IP address of the printer.

3 View the following information:

- **Status**—The status of the printer.
- **Supplies**—The supply details and remaining supply percentage.
- **Identification**—The printer network identification information.

Note: The time zone information is available only in some printer models.

- **Dates**—The date the printer is added to the system, the discovery date, and the most recent audit date.
- **Firmware**—The printer firmware properties and code levels.
- **Capabilities**—The printer features.
- **Memory Options**—The hard disk size and user flash free space.
- **Input Options**—The settings for the available trays.
- **Output Options**—The settings for the available bins.
- **eSF Applications**—The information about the installed Embedded Solutions Framework (eSF) applications on the printer.
- **Printer Statistics**—The specific values for each of the printer properties.
- **Change Details**—The information about the changes in the printer.

Note: This information is available only in printers that are in a Managed (Changed) state. For more information, see [“Understanding printer life cycle states” on page 47](#).

- **Printer Credentials**—The credentials used in the configuration assigned to the printer.
- **Printer Certificate**—The properties of the following printer certificates:
 - **Default**
 - **HTTPS**
 - **802.1x**
 - **IPSec**

Notes:

- This information is available only in some printer models.
- An Expiring Soon validity status indicates the expiry date, as set in the Certificate Authority section under System Configuration.
- **Configuration Properties**—The properties of the configuration assigned to the printer.
- **Active Alerts**—The printer alerts that are waiting to be cleared.
- **Assigned Events**—The events assigned to the printer.

Exporting printer data

MVE lets you export the printer information that is available in your current view.

- 1 From the Printers menu, click **Printer Listing**.
- 2 Select one or more printers.
- 3 Click **Printer > Export data**.

Notes:

- The exported data is saved in a CSV file.
- Exporting data can be scheduled to occur regularly. For more information, see [“Creating a schedule” on page 141](#).

Managing views

The Views feature lets you customize the information that is shown in the printer listing page.

- 1 From the Printers menu, click **Views**.
- 2 Do any of the following:

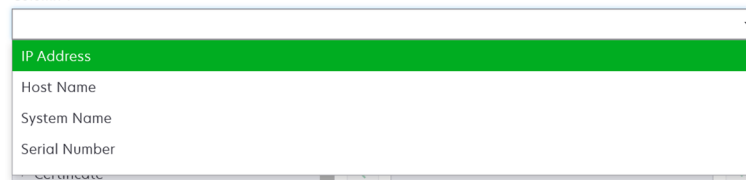
Create a view

- a Click **Create**.
- b Type a unique name for the view and its description.
- c From the View Columns section, in the Column 1 menu, select the identifier column.

View Columns

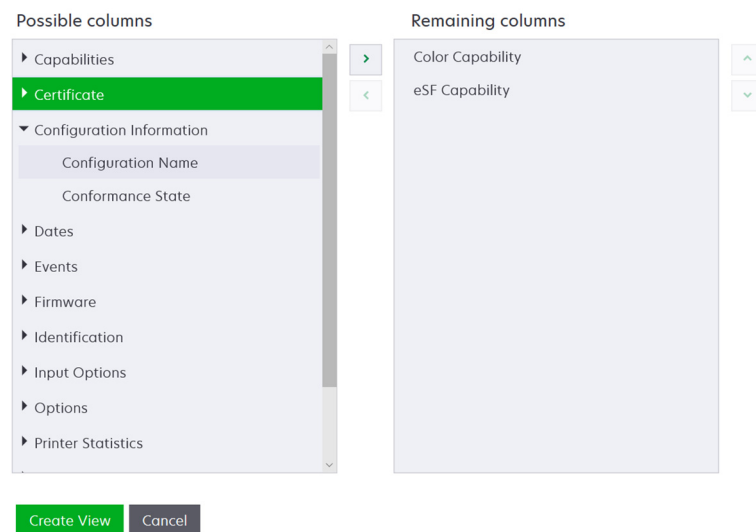
Select the information you want to view for each printer.

Column 1



A screenshot of a web application interface showing a dropdown menu for 'Column 1'. The dropdown is open, displaying a list of options: 'IP Address', 'Host Name', 'System Name', and 'Serial Number'. The 'IP Address' option is highlighted with a green background. Below the dropdown, there is a 'Create' button.

- d From the Possible columns section, expand a category, select the information that you want to show as a column, and then click >.



- **Capabilities**—Shows whether the selected features are supported on the printer.
- **Certificate**—Shows the printer certificate creation date, enrolment status, expiration date, renewal date, revision number, certificate subject, validity, and signing status.
- **Configuration Information**—Shows configuration-related printer information, such as conformance, configuration name, and state.
- **Dates**—Shows the last audit, last conformance check, last discovery, and the date the printer was added to the system.
- **Events**—Shows event-related printer information.
- **Firmware**—Shows firmware-related information, such as the firmware version.
- **Identification**—Shows information about the printer, such as the IP address, host name, and serial number.
- **Input Options**—Shows information about the input options, such as the tray size and media type.
- **Options**—Shows information about the printer options, such as hard disk and flash drive.
- **Printer Statistics**—Shows information about the printer usage, such as the number of printed or scanned pages, and total number of faxed jobs.
- **Solutions**—Shows the eSF applications installed on the printer, and their version numbers.
- **Status**—Show the printer and supplies status.
- **Supplies**—Shows supplies-related information.
- **Printer Ports**—Shows ports-related information.

Note: An **Unknown** option in the port value means that either the port does not exist on the printer or MVE cannot retrieve the port.

- **Printer Security Options**—Shows TLS and Cipher information.

- e Click **Create View**.

Edit a view

- Select a view.
- Click **Edit**, and then edit the settings.

- c** Click **Save Changes**.

Copy a view

- a** Select a view.
- b** Click **Copy**, and then configure the settings.
- c** Click **Create View**.

Delete views

- a** Select one or more views.
- b** Click **Delete**, and then confirm deletion.

Set a default view

- a** Select a view.
- b** Click **Set As Default**.

The following views are system-generated, and cannot be edited or deleted:

- Configuration
- Printer List
- Event
- Security
- Service Desk
- Standard

Changing the printer listing view

For more information, see [“Managing views” on page 44](#).

- 1** From the Printers menu, click **Printer Listing**.
- 2** Click **Views**, and then select a view.

Filtering printers using the search bar

Note the following when using the search bar to search for printers.

- To search for an IP address, make sure to type the complete IP address or range.

For example:

- 10.195.10.1
- 10.195.10.3-10.195.10.255
- 10.195.*.*
- 2001:db8:0:0:0:0:2:1

- If the search string is not a full IP address, then the printers are searched according to their host name, system name, or serial number.
- The underscore character (_) can be used as a wildcard character.

Managing keywords

Keywords let you create custom tags and assign them to printers.

- 1 From the Printers menu, click **Keywords**.
- 2 Do either of the following:
 - Add, edit, or delete a category.
Note: Categories group keywords together.
 - Add, edit, or delete a keyword.

For information on assigning keywords to printers, see [“Assigning keywords to printers” on page 65](#).

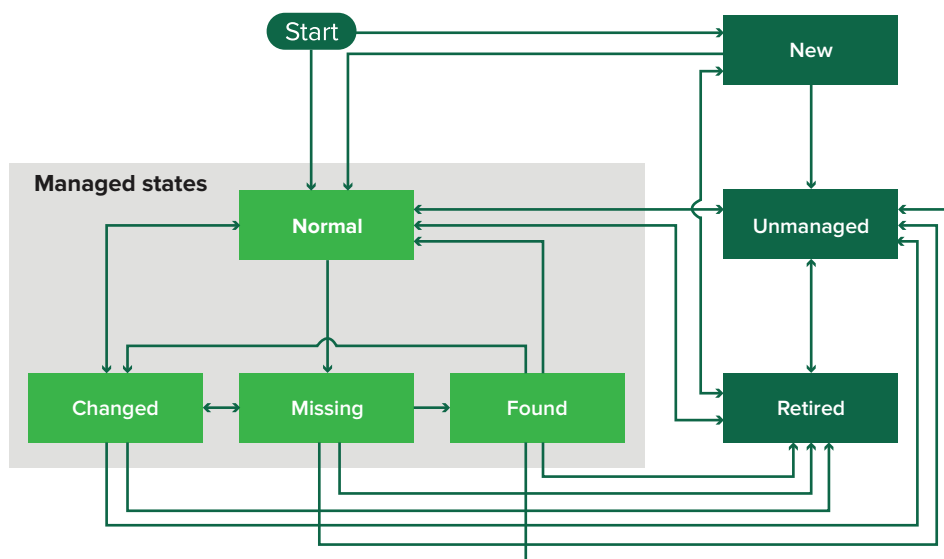
Using saved searches

Understanding printer life cycle states

System-generated saved searches show the printers in the following printer life cycle states:

- **All Printers**—All printers in the system.
- **Managed Printers**—Printers that appear can be in any of the following states:
 - Managed (Normal)
 - Managed (Changed)
 - Managed (Missing)
 - Managed (Found)
- **Managed (Changed) Printers**—Printers in the system whose following properties were changed at the last audit:
 - Property tag
 - Host name
 - Contact name
 - Contact location
 - Memory size
 - Duplex
 - Supplies (excluding levels)
 - Input options
 - Output options
 - eSF applications
 - Default printer certificate
- **Managed (Found) Printers**—Printers that were reported as missing, but have now been found.
- **Managed (Missing) Printers**—Printers that the system was unable to communicate with.
- **Managed (Normal) Printers**—Printers in the system whose properties have remained the same since the last audit.
- **New Printers**—Printers that are newly discovered and are not set to a Managed state automatically.

- **Retired Printers**—Printers marked as no longer active in the system.
- **Unmanaged Printers**—Printers marked for exclusion from activities performed in the system.



| Beginning state | Ending state | Transition |
|---------------------------|-------------------------------|--|
| Start | Normal | Discovered. ¹ |
| Start | New | Discovered. ² |
| Any | Normal, Unmanaged, or Retired | Manual (Missing does not change to Normal). |
| Retired | Normal | Discovered. ¹ |
| Retired | New | Discovered. ² |
| Normal, Missing, or Found | Changed | New address when discovered. |
| Normal | Changed | Audit properties do not match the database properties. |
| Normal, Changed, or Found | Missing | Not found on audit or update status. |
| Changed | Normal | Audit properties match the database properties. |
| Missing | Found | Discovered, audit, or update status. |
| Found | Normal | Discovered, audit, or update status. |

¹ The "Automatically manage discovered printers" setting is enabled in the discovery profile.

² The "Automatically manage discovered printers" setting is disabled in the discovery profile.

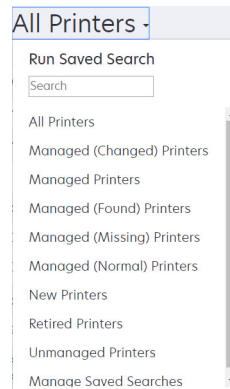
Running a saved search

A saved search is a saved set of parameters that returns the latest printer information that meets the parameters.

You can create and run a customized saved search, or run the default system-generated saved searches. The system-generated saved searches show the printers in their life cycle states. For more information, see

[“Understanding printer life cycle states” on page 47.](#)

- 1 From the Printers menu, click **Printer Listing**.
- 2 In the drop-down menu, select a saved search.



Creating a saved search

Using filters

- 1 From the Printers menu, click **Printer Listing**.
- 2 On the left side of the page, select the filters.
Note: The selected filters are listed above the search results header.
- 3 Click **Save**, and then type a unique name for your saved search and its description.
- 4 Click **Create Saved Search**.

Using the Saved Search page

- 1 From the Printers menu, click **Saved Searches > Create**.
- 2 From the General section, type a unique name for your saved search and its description.
- 3 From the Rules and Rule Groups section, in the Match menu, specify whether the search results must match all or any of the rules.
- 4 Do either of the following:

Add a rule

- a Click **Add Rule**.
- b Specify the parameter, operation, and value for your search rule. For more information, see [“Understanding search rules settings” on page 50](#).

The screenshot shows a dialog box for adding a search rule. At the top, there are two buttons: '+ Add Rule' (highlighted with a red box) and '+ Add Rule Group'. Below these is a form with three fields: 'Asset Tag' (a dropdown menu), 'Begins With' (a dropdown menu), and 'Value' (a text input field). To the right of the 'Value' field is a small 'x' button. At the bottom of the dialog, there are three buttons: 'Create Saved Search' (highlighted in green), 'Create and Run Saved Search', and 'Cancel'.

Add a rule group

A rule group may contain a combination of rules. If the Match menu is set to **ANY rules and rule groups**, then the system searches for printers that match all the rules in the rule group. If the Match menu is set to **ALL rules and rule groups**, then the system searches for printers that match any of the rules in the rule group.

- a Click **Add Rule Group**.
- b Specify the parameter, operation, and value for your search rule. For more information, see [“Understanding search rules settings” on page 50](#).
- c To add another rule, click **Add Rule**.

The screenshot shows a dialog box for adding a rule group. At the top, there are two buttons: '+ Add Rule' and '+ Add Rule Group' (highlighted with a red box). Below these is a section titled 'Match ANY of the following rules in this group.' with a close button 'x'. Under this section, there is a '+ Add Rule' button (highlighted with a red box) and a list of three rules. Each rule has three fields: 'Asset Tag' (dropdown), 'Begins With' (dropdown), and 'Value' (text input). To the right of each rule's 'Value' field is a small 'x' button. At the bottom of the dialog, there are three buttons: 'Create Saved Search' (highlighted in green), 'Create and Run Saved Search', and 'Cancel'.

- 5 Click **Create Saved Search** or **Create and Run Saved Search**.

Understanding search rules settings

Search for printers using one or more of the following parameters:

| Parameter | Description |
|---|--|
| Asset Tag | The value of the asset tag setting on the printer. |
| Certificate Creation Date ¹ | The date that the certificate was created. |
| Certificate Enrollment Status ¹ | The enrollment status of the certificate. |
| Certificate Expiration Date ¹ | The date that the certificate expires. |
| Certificate Renewal Date ¹ | The date that the certificate is renewed. |

| Parameter | Description |
|---|---|
| Certificate Revision Number ¹ | The revision number of the certificate. |
| Certificate Signing Status ¹ | The status of the certificate. |
| Certificate Validity Status ¹ | The validity of the certificate. Note: An Expiring Soon status indicates that the certificate expires within 30 days. |
| Color Capability | The printer prints in color or in black and white. |
| Configuration | The configuration name assigned to the printer. |
| Configuration Conformance | The conformance status of the printer against the assigned configuration. |
| Contact Location | The value of the contact location setting on the printer. |
| Contact Name | The value of the contact name setting on the printer. |
| Copy | The printer supports the copy function. |
| Date: Added to System | The date that the printer was added to the system. |
| Date: Last Audited | The date that the printer was last audited. |
| Date: Last Conformance Check | The date that the printer configuration conformance was last checked. |
| Date: Last Discovered | The date that the printer was last discovered. |
| Disk Encryption | The printer is configured for disk encryption. |
| Disk Wiping | The printer is configured for disk wiping. |
| Duplex | The printer supports two-sided printing. |
| eSF Capability | The printer supports managing eSF applications. |
| eSF Information | The information about the eSF application installed on the printer, such as name, state, and version. |
| Event Name | The name of the assigned events. |
| Fax Name | The value of the fax name setting on the printer. |
| Fax Number | The value of the fax number setting on the printer. |
| Fax Receive | The printer supports receiving fax. |
| Firmware Information | The information about the firmware installed on the printer. <ul style="list-style-type: none"> • Name—The name of the firmware. For example, Base or Kernel. • Version—The printer firmware version. |
| Host Name | The printer host name. |
| IP Address | The printer IP address. Note: You can use an asterisk in the last three octets to search for multiple entries. For example, 123.123.123.* , 123.123.*.* , 123.*.*.* , 2001:db8::2:1 , and 2001:db8:0:0:0:0:2:1 . |
| Keyword | The assigned keywords. |
| Lifetime Page Count | The lifetime page count value of the printer. |
| MAC Address | The printer MAC address. |

| Parameter | Description |
|-----------------------------------|---|
| Maintenance Counter | The value of the printer maintenance counter. |
| Manufacturer | The printer manufacturer name. |
| Marking Technology | The marking technology that the printer supports. |
| MFP Capability | The printer is a multifunction product (MFP). |
| Model | The printer model name. |
| Modular Serial Number | The modular serial number. |
| Printer Status | The printer status. For example, Ready , Paper Jam , Tray 1 Missing . |
| Printer Status Severity | The value of the most severe status present on the printer. For example, Unknown , Ready , Warning , or Error . |
| Profile | The printer supports profiles. |
| Scan to E-mail | The printer supports Scan to E-mail. |
| Scan to Fax | The printer supports Scan to Fax. |
| Scan to Network | The printer supports Scan to Network. |
| Secure Communication State | The printer security or authentication state. |
| Serial Number | The printer serial number. |
| State | The current printer state in the database. |
| Supply Status | The printer supplies status. |
| Supply Status Severity | The value of the most severe supply status present on the printer. For example, Unknown , OK , Warning , or Error . |
| System Name | The printer system name. |
| Time Zone | The time zone of the region where the printer is located. |
| TLI | The value of the TLI setting on the printer. |

¹Certificate-related parameters are applicable for the following device certificates:

- **Default**
- **HTTPS**
- **802.1x**
- **IPSec**

Use the following operators when searching for printers:

- **Exactly Matches**—A parameter is equivalent to a specified value.
- **Is Not**—A parameter is not equivalent to a specified value.
- **Contains**—A parameter contains a specified value.
- **Does Not Contain**—A parameter does not contain a specified value.
- **Begins With**—A parameter begins with a specified value.
- **Ends With**—A parameter ends with a specified value.
- **Date**
 - **Older than**—A parameter to search days before the days specified.
 - **Within last**—A parameter to search within days specified before today.

- **Within the next**—A parameter to search within days specified after today.

Note: To search for printers that have parameters with empty values, use `_EMPTY_OR_NULL_`. For example, to search for printers that have empty Fax Name, in the Value field, type `_EMPTY_OR_NULL_`.

Managing saved searches

- 1 From the Printers menu, click **Saved Searches**.

- 2 Do any of the following:

Edit a saved search

- a Select a saved search, and then click **Edit**.

Note: System-generated saved searches cannot be edited. For more information, see [“Understanding printer life cycle states” on page 47](#).

- b Configure the settings.
- c Click **Save Changes** or **Save and Run**.

Copy a saved search

- a Select a saved search, and then click **Copy**.
- b Configure the settings.
- c Click **Create Saved Search** or **Create and Run Saved Search**.

Delete saved searches

- a Select one or more saved searches.

Note: System-generated saved searches cannot be deleted. For more information, see [“Understanding printer life cycle states” on page 47](#).

- b Click **Delete**, and then confirm deletion.

Sample scenario: Monitoring the toner levels of your fleet

As the IT personnel of Company ABC, you must organize the printer fleet to monitor them easily. You want to monitor the toner usage of the printers to determine whether the supplies need replacement.

Sample implementation

- 1 Create a saved search that retrieves the printers whose supplies have errors or warnings.

Sample rule for your saved search

Parameter: **Supply Status Severity**

Operation: **Is Not**

Value: **Supplies OK**

- 2 Create a view that shows the supply status, capacity, and level for each printer.

Sample columns to show in your supplies view

Supply Status

Black Cartridge Capacity

Black Cartridge Level
Cyan Cartridge Capacity
Cyan Cartridge Level
Magenta Cartridge Capacity
Magenta Cartridge Level
Yellow Cartridge Capacity
Yellow Cartridge Level

- 3** Run the saved search while using the view.

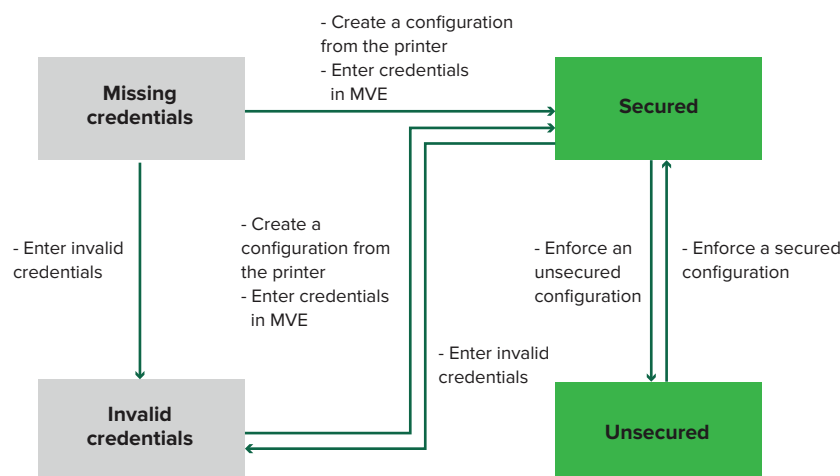
Note: The information shown in the printer listing view is based on the last audit. Perform an audit and status update to get the current printer status.

Securing printer communications

Understanding printer security states

During discovery, the printer can be in any of the following security states:

- **Unsecured**—MVE does not need credentials to communicate with the device.
- **Secured**—MVE needs credentials and they were provided.
- **Missing credentials**—MVE needs credentials but they were not provided.
- **Invalid credentials**—MVE needs credentials but incorrect credentials were provided.



A printer is in the Invalid credentials state when the credentials are found to be invalid during discovery, audit, status update, conformance check, or configuration enforcement.

The printer is in an Unsecured state only when it does not require credentials during discovery.

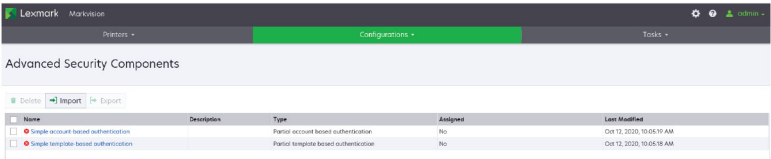
To change the status from Unsecured to Secured, enforce a secured configuration.

To move a printer from the Missing credentials or Invalid credentials state, enter the credentials in MVE manually or create a configuration from the printer.

Securing printers using the default configurations

On some printer models, there is no default administrator user. The Guest user has open access and is not logged in. This setup grants the user access to all printer permissions and access controls. MVE handles this risk through default configurations. After a fresh installation, two advanced security components are created automatically. Each component contains the default security settings and preconfigured local administrator account. You can use these security components when creating a configuration, and then deploy and enforce the configuration to the new printers.

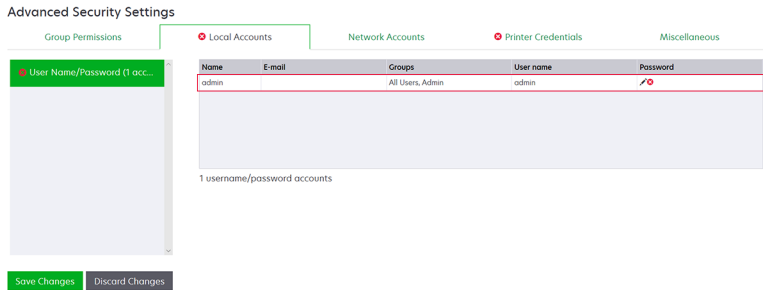
From the Configurations menu, click **All Advanced Security Components**.



| Name | Description | Type | Assigned | Last Modified |
|--------------------------------------|---------------------------------------|------|----------|---------------------------|
| Simple account based authentication | Partial account based authentication | No | No | Oct 12, 2020, 10:05:19 AM |
| Simple template based authentication | Partial template based authentication | No | No | Oct 12, 2020, 10:05:19 AM |

Simple account-based authentication

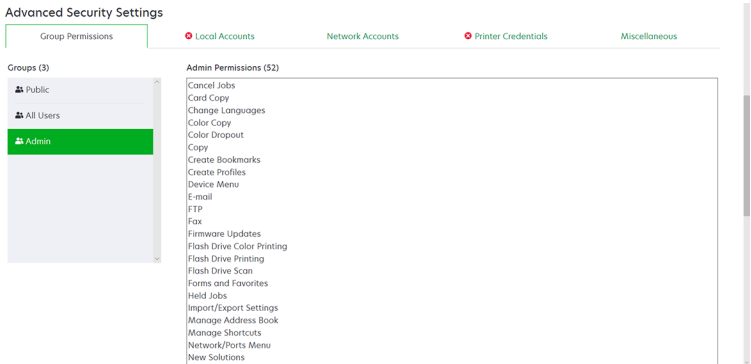
This security component contains a User Name/Password Local Account called **admin**.



| Name | E-mail | Groups | User name | Password |
|-------|--------|------------------|-----------|----------|
| admin | | All Users, Admin | admin | |

1 username/password accounts

The **admin** account is a member of the Admin Group, whose permissions include function access controls and permissions to secure the printer and restrict public access. For more information, see [“Understanding permissions and function access controls” on page 58](#).



| Groups (3) | Admin Permissions (52) |
|------------|----------------------------|
| Public | Cancel Jobs |
| All Users | Card Copy |
| Admin | Change Languages |
| | Color Copy |
| | Color Dropout |
| | Copy |
| | Create Bookmarks |
| | Create Profiles |
| | Device Menu |
| | E-mail |
| | FTP |
| | Fax |
| | Firmware Updates |
| | Flash Drive Color Printing |
| | Flash Drive Printing |
| | Flash Drive Scan |
| | Forms and Favorites |
| | Held Jobs |
| | Import/Export Settings |
| | Manage Address Book |
| | Manage Shortcuts |
| | Network/Ports Menu |
| | New Solutions |

Before adding this component to a configuration, make sure to set the **admin** password and the printer credentials.

Local Accounts

Network Accounts

Printer Credentials

Miscellaneous

| Name | E-mail | Groups | User name | Password |
|-------|--------|------------------|-----------|----------|
| admin | | All Users, Admin | admin | |

Advanced Security Settings

Group Permissions

Local Accounts

Network Accounts

Printer Credentials

Select the appropriate authentication method and enter the credentials. These credentials will be used by Markvision to communicate with the set configuration is assigned.

Authentication method

Password

Save Changes

Discard Changes

Simple template-based authentication

This security component contains a security template called Admin Password Protected that is configured with a Password Local Account.

Local Accounts

Network Accounts

Printer Credentials

Security Templates

Access Controls

Miscellaneous

Password (1 accounts)

| Name | Admin Password | Password |
|----------------|----------------|----------|
| Admin Password | Yes | |

Advanced Security Settings

Local Accounts

Network Accounts

Printer Credentials

Security Templates

Access Controls

Miscellaneous

| Template Name | Authentication Setup | Authorization Setup | Group Authorization Setup |
|--------------------------|----------------------|---------------------|---------------------------|
| Admin Password Protected | Admin Password | | |

This security template is applied to the following access controls:

- Firmware Updates
- Remote Management
- Security Menu remotely

The remaining access controls are set to **No Security**. However, you can always set the other administrative printer menus to use the security template for more protection. For more information on the access controls, see [“Understanding permissions and function access controls” on page 58](#).

Before adding this component to a configuration, make sure to set the password and the printer credentials.

Advanced Security Settings

Local Accounts

Network Accounts

Printer Credentials

Security Templates

Access Controls

Miscellaneous

Password (1 accounts)

| Name | Admin Password | Password |
|----------------|----------------|----------|
| Admin Password | Yes | |

Advanced Security Settings

Local Accounts

Network Accounts

Printer Credentials

Security Templates

Select the appropriate authentication method and enter the credentials. These credentials will be used by Markvision configuration is assigned.

Authentication method

Password

Save Changes

Discard Changes

Understanding permissions and function access controls

Printers can be configured to restrict public access to administrative menus and device management features. In newer printer models, permissions to access printer functions can be secured through different types of authentication methods. In older printer models, a security template can be applied to a function access control (FAC).

To communicate with these secured printers and manage them, MVE requires certain permissions or FACs, depending on the printer model.

The following table explains what printer management functions can be managed in MVE and what permissions or FACs are required.

Note that MVE requires the authentication credentials when Remote Management is secured. If other administrative menus and device management permissions or FACs are secured, then Remote Management must also be secured. Otherwise, MVE cannot perform the functions.

These permissions and function access controls are predefined in MVE as default advanced security components, and can readily be used in a configuration. For more information, see [“Securing printers using the default configurations” on page 56](#).

If you are not using the default advanced security components, then make sure that these permissions and function access controls are configured in the printer manually. For more information, see [“Configuring printer security” on page 58](#).

| Permissions or FACs | Description |
|--|--|
| Remote Management | The ability to read and write settings remotely. If any other permissions or FACs listed in this table are secured, then Remote Management must also be secured. |
| Firmware Updates | The ability to update firmware from any method. |
| Apps Configuration | The ability to install or remove applications from the printer and send application settings files to the printer. |
| Import / Export All Settings or Configuration File Import / Export | The ability to send configuration files to the printer. |
| Security Menu or Security Menu Remotely | The ability to manage login methods and configure printer security options. |

To secure newer printer models in MVE, disable public access for the Remote Management and Security Menu permissions. For older printer models, apply a security template to the Remote Management FAC.

Configuring printer security

- 1 From the Printers menu, click **Printer Listing**.
- 2 Click the IP address of the printer, and then click **Open Embedded Web Server**.
- 3 Click **Settings** or **Configuration**.
- 4 Depending on your printer model, do either of the following:
 - Click **Security** > **Login Methods**, and then do the following:

For newer printer models

- a From the Security section, create a login method.
 - b Click **Manage Group/Permissions** or **Manage Permissions** beside the login method.
 - c Expand **Administrative Menus**, and then select **Security Menu**.
 - d Expand **Device Management**, and then select the following permissions:
 - **Remote Management**
 - **Firmware Updates**
 - **Apps Configuration**
 - **Import / Export All Settings**
 - e Click **Save**.
 - f From the Public section, click **Manage Permissions**.
 - g Expand **Administrative Menus**, and then clear **Security Menu**.
 - h Expand **Device Management**, and then clear **Remote Management**.
 - i Click **Save**.
- Click **Security > Security Setup** or **Edit Security Setup**, and then do the following:


For older printer models

- a From the Advanced Security Setup section, create a building block and a security template.
- b Click **Access Controls**, and then expand **Administrative Menus**.
- c In the Security Menu Remotely menu, select the security template.
- d Expand **Management**, and then select the security template for the following function access controls:
 - **Apps Configuration**
 - **Remote Management**
 - **Firmware Updates**
 - **Configuration File Import / Export**
- e Click **Submit**.

Securing printer communications on your fleet

- 1 Discover a secured printer. For more information, see [“Discovering printers” on page 34](#).

Notes:

- A printer is secured when  appears next to it. For information on securing a printer, see the [help document](#).
- For more information on printer security states, see [“Understanding printer security states” on page 55](#).

- 2 Create a configuration from a printer. For more information, see [“Creating a configuration from a printer” on page 71](#).
- 3 Assign the configuration to your fleet. For more information, see [“Assigning configurations to printers” on page 62](#).
- 4 Enforce the configuration. For more information, see [“Enforcing configurations” on page 62](#). A padlock symbol appears next to the secured printer.

Other ways to secure your printers

For more information on configuring printer security settings, see the *Embedded Web Server Administrator's Guide* for your printer.

Check your printers for the following settings:

- Disk encryption is enabled.
- The following ports are restricted:
 - TCP 79 (Finger)
 - TCP 21 (FTP)
 - UDP 69 (TFTP)
 - TCP 5001 (IPDS)
 - TCP 9600 (IPDS)
 - TCP 10000 (Telnet)
- The default cipher list is the OWASP Cipher String 'B.'

Managing printers

Restarting the printer

- 1 From the Printers menu, click **Printer Listing**.
- 2 Click the IP address of the printer.
- 3 Click **Restart Printer**.

Viewing the printer Embedded Web Server

The Embedded Web Server is a software built into the printer that provides a control panel for configuring the printer from any web browser.

- 1 From the Printers menu, click **Printer Listing**.
- 2 Click the IP address of the printer.
- 3 Click **Open Embedded Web Server**.

Auditing printers

An audit collects information from any printers in the Managed state, and then stores the information in the system. To make sure that the information in the system is current, perform an audit regularly.

- 1 From the Printers menu, click **Printer Listing**.
- 2 Select one or more printers.
- 3 Click **Printer > Audit**.

Note: An audit can be scheduled to occur regularly. For more information, see [“Creating a schedule” on page 141](#).

Updating printer status

The Update Status feature lets you update the printer status and supplies information. To make sure that the printer status and supplies information is current, update the status regularly.

- 1 From the Printers menu, click **Printer Listing**.
- 2 Select one or more printers.
- 3 Click **Printer > Update status**.

Note: A status update can be scheduled to occur regularly. For more information, see [“Creating a schedule” on page 141](#).

Setting the printer state

For more information on the printer states, see [“Understanding printer life cycle states” on page 47](#).

- 1 From the Printers menu, click **Printer Listing**.
- 2 Select one or more printers.
- 3 Click **Printer**, and then select one of the following:
 - **Set state to managed**—The printer is included in all activities that can be performed in the system.
 - **Set state to unmanaged**—The printer is excluded in all activities that can be performed in the system.
 - **Set state to retired**—The printer is removed from the network. The system retains the printer information, but does not expect to see the printer on the network again.

Assigning configurations to printers

Before you begin, make sure that a configuration for the printer is created. Assigning a configuration to a printer allows the system to run conformance checks and enforcements. For more information, see [“Creating a configuration” on page 68](#).

- 1 From the Printers menu, click **Printer Listing**.
- 2 Select one or more printers.
- 3 Click **Configure > Assign configurations**.
- 4 From the Configuration section, select a configuration.

Note: If the system is set to **Use Markvision to manage device certificates**, then select **Trust the selected devices**. This confirmation is the way for the user to verify that the printers are real devices and not spoofed.
- 5 Click **Assign Configurations**.

Unassigning configurations

- 1 From the Printers menu, click **Printer Listing**.
- 2 Select one or more printers.
- 3 Click **Configure > Unassign configurations**.
- 4 Click **Unassign Configurations**.

Enforcing configurations

MVE runs a conformance check against the printer. If some settings are out of conformance, then MVE changes those settings on the printer. MVE runs a final conformance check after changing the settings. Updates that require the printer to reboot, such as firmware updates, may require a second enforcement to complete.

Before you begin, make sure that a configuration is assigned to the printer. For more information, see [“Assigning configurations to printers” on page 62](#).

- 1 From the Printers menu, click **Printer Listing**.
- 2 Select one or more printers.
- 3 Click **Configure > Enforce configurations**.

Notes:

- If the printer is in an error state, then some settings may not be updated.
- For MVE to deploy firmware and solution files to a printer, the Firmware Updates function access control must be set to **No Security**. If security is applied, then the Firmware Updates function access control must use the same security template as the Remote Management function access control. For more information, see [“Deploying files to printers” on page 63](#).
- An enforcement can be scheduled to occur regularly. For more information, see [“Creating a schedule” on page 141](#).

Checking the printer conformance with a configuration

During a conformance check, MVE checks the printer settings, and verifies whether they match the assigned configuration. MVE does not make changes to the printer during this operation.

Before you begin, make sure that a configuration is assigned to the printer. For more information, see [“Assigning configurations to printers” on page 62](#).

- 1 From the Printers menu, click **Printer Listing**.
- 2 Select one or more printers.
- 3 Click **Configure > Check conformance**.

Notes:

- You can view the results in the task status page.
- A conformance check can be scheduled to occur regularly. For more information, see [“Creating a schedule” on page 141](#).

Deploying files to printers

You can deploy the following files to the printer:

- **CA Certificates**—CER or PEM files that are added to the printer trust store.
- **Configuration bundle**—ZIP files that are exported from a supported printer or obtained directly from Lexmark.
- **Firmware update**—An FLS file that is flashed to the printer.

Note: We do not recommended downgrading the firmware due to potential failure risks. Certain firmware versions can lead to a downgrade in printer firmware.

- **Generic file**—Any file that you want to send to the printer.
 - **Raw socket**—Sent over port 9100. The printer treats it like any other print data.
 - **FTP**—Send files over FTP. This deployment method is not supported on secured printers.

- **Printer certificate**—A signed certificate that is installed on the printer as the default certificate.
- **Universal Configuration File (UCF)**—A configuration file exported from a printer.
 - **Web service**—The HTTPS web service is used when the printer model supports it. Otherwise, the printer uses the HTTP web service.
 - **FTP**—Send files over FTP. This deployment method is not supported on secured printers.

- 1 From the Printers menu, click **Printer Listing**.
- 2 Select one or more printers.
- 3 Click **Configure > Deploy file to printers**.
- 4 Click **Choose File**, and then browse to the file.
- 5 Select a file type, and then select a deployment method.
- 6 Click **Deploy File**.

Notes:

- For MVE to deploy firmware and solution files to a printer, the Firmware Updates function access control must be set to **No Security**. If security is applied, then the Firmware Updates function access control must use the same security template as the Remote Management function access control.
- A file deployment can be scheduled to occur regularly. For more information, see [“Creating a schedule” on page 141](#).

Updating the printer firmware

- 1 From the Printers menu, click **Printer Listing**.
- 2 Select one or more printers.
- 3 Click **Configure > Update firmware to printers**.
- 4 Select a firmware file from the resource library, or click **Choose File**, and then browse to the firmware file.

Notes:

- For more information on adding firmware files to the library, see [“Importing files to the resource library” on page 74](#).
 - We do not recommended downgrading the firmware due to potential failure risks. Certain firmware versions can lead to a downgrade in printer firmware.
- 5 If necessary, to schedule the update, select **Define update window**, and then select the start date, start and pause time, and days of the week.

Note: The firmware is sent to the printers within the specified start time and pause time. The task is paused after the pause time, and then resumes at the next start time until it is completed.
 - 6 Click **Update Firmware**.

Note: For MVE to update the printer firmware, the Firmware Updates function access control must be set to **No Security**. If security is applied, then the Firmware Updates function access control must use the same security template as the Remote Management function access control. In this case, MVE must manage the printer securely. For more information, see [“Securing printer communications” on page 55](#).

Uninstalling applications from printers

MVE can uninstall only applications that have been added to the system in the Package Builder format. For more information on uploading applications to the system, see [“Importing files to the resource library” on page 74](#).

- 1 From the Printers menu, click **Printer Listing**.
- 2 Select one or more printers.
- 3 Click **Configure > Uninstall Apps from printers**.
- 4 Select the applications.
- 5 Click **Uninstall Apps**.

Assigning events to printers

Assigning events to printers lets MVE perform the associated action whenever one of the associated alerts occurs on the assigned printer. For more information on creating events, see [“Managing printer alerts” on page 131](#).

Note: Events can be assigned only to unsecured printers.

- 1 From the Printers menu, click **Printer Listing**.
- 2 Select one or more printers.
- 3 Click **Assign > Events**.
- 4 Select one or more events.

Note: If some of the selected printers already have the event assigned to them, then a dash in the check box appears. If you leave it as a dash, then the event does not change. If you select the check box, then the event is assigned to all the selected printers. If you clear the check box, then the event is unassigned from the printers it was previously assigned to.

- 5 Click **Assign Events**.

Assigning keywords to printers

Assigning keywords to printers lets you organize your printers. For more information on creating keywords, see [“Managing keywords” on page 47](#).

- 1 From the Printers menu, click **Printer Listing**.
- 2 Select one or more printers.
- 3 Click **Assign > Keywords**.
- 4 If necessary, in the View menu, select a category.


5 Select one or more keywords.

Note: Keywords are listed following a category. If some of the selected printers already have the keyword assigned to them, then a dash in the check box appears. If you leave it as a dash, then the keyword is not assigned or unassigned to the selected printers. If you select the check box, then the keyword is assigned to all the selected printers. If you clear the check box, then the keyword is unassigned from the printers it was previously assigned to.

6 Click **Assign Keywords**.

Entering credentials to secured printers

Secured printers can be discovered and enrolled. To communicate with these printers, you can either enforce a configuration or enter the credentials in MVE directly.

Note: A printer is secured when a  appears next to it.

To enter the credentials, do the following:

- 1** From the Printers menu, click **Printer Listing**.
- 2** Select one or more secured printers.
- 3** Click **Security > Enter Credentials**.
- 4** Select the authentication method, and then enter the credentials.
- 5** Click **Enter Credentials**.

Note: Enrolled printers that are secured but do not have the correct credentials saved in MVE are tagged as Missing credentials under the Communications filter. After the correct credentials are entered, the printers are tagged as Secured.

Configuring default printer certificates manually

When not using the automated certificate management feature, MVE can help facilitate the process of signing the default printer certificate on a fleet of printers. MVE gathers the certificate-signing requests from the fleet, and then deploys the signed certificates to the proper printers after they are signed.

A system administrator must do the following:

- 1** Generate the printer certificate-signing requests.
 - a** From the Printers menu, click **Printer Listing**.
 - b** Select one or more printers.
 - c** Click **Security > Generate printer certificate signing requests**.
- 2** Wait for the task to finish, and then download the printer certificate-signing requests.
 - a** From the Printers menu, click **Printer Listing**.
 - b** Click **Security > Download printer certificate signing requests**.
- 3** Use a trusted CA to sign the certificate-signing requests.

- 4 Save the signed certificates in a ZIP file.

Note: All the signed certificates must be in the root location of the ZIP file. Otherwise, MVE cannot parse the file.

- 5 From the Printers menu, click **Printer Listing**.
- 6 Select one or more printers.
- 7 Click **Configure > Deploy file to printers**.
- 8 Click **Choose File**, and then browse to the ZIP file.
- 9 In the File type menu, select **Printer Certificates**.
- 10 Click **Deploy File**.

Removing printers

- 1 From the Printers menu, click **Printer Listing**.
- 2 Select one or more printers.
- 3 Click **Printer**.
- 4 If necessary, to remove the printer certificate, select **Delete associated device certificate(s)**.

Note: If MVE is managing the device certificates, then removing the printer certificate deletes the default certificate from the printer. The printer then generates a new self-signed certificate.

- 5 Do either of the following:
 - To retain the printer information, click **Retire Printer**.
 - To remove the printer from the system, click **Delete Printer**.

Managing configurations

Overview

MVE uses configurations to manage the printers in your fleet.

A configuration is a collection of settings that can be assigned and enforced to a printer or a group of printer models. Within a configuration, you can modify printer settings and deploy applications, licenses, firmware, and printer certificates.

You can create a configuration that is composed of the following:

- Basic printer settings
- Advanced security settings
- Color print permissions

Note: This setting is available only in configurations for supported color printers.

- Printer firmware
- Applications
- CA certificates
- Resource Files

Using configurations, you can do the following to manage the printers:

- Assign a configuration to printers.
- Enforce the configuration to the printers. The settings that are specified in the configuration are applied to the printers. The firmware, applications, printer certificate, application files (.fls), and CA certificates are installed.
- Check whether the printers are in conformance against a configuration. If a printer is out of conformance, then the configuration can be enforced to the printer.

Note: Configuration enforcement and conformance checking can be scheduled to occur regularly.

- If the printer supports the configuration settings but the values are not applicable, then the printer shows as out of conformance.

Creating a configuration

A configuration is a collection of settings that can be assigned and enforced to a printer or a group of printers. Within a configuration, you can modify printer settings and deploy applications, licenses, firmware, and CA certificates to printers.

- 1 From the Configurations menu, click **All Configurations > Create**.
- 2 Type a unique name for the configuration and its description.
- 3 In the Setting list, do one or more of the following:
 - From the Basic tab, select one or more settings, and then specify the values. If the value is a variable setting, then enclose the header with `${ }`. For example, `${Contact_Name}`. To use a variable setting

file, select the file from the Use variable setting data file menu, or import the file. For more information, see [“Understanding variable settings” on page 72](#).

Settings

● Basic Advanced Security Color Print Permissions Firmware Apps Certificates Resource Files

Use variable setting data file

None Import

☒ Show only included settings

Show settings for All models

View All settings Filter by setting name

| Setting | Category | Value |
|--|----------|----------|
| <input checked="" type="checkbox"/> Contact Location | General | Demo CFM |

- Select one or more settings, and then specify the values. If the value is a variable setting, then enclose the header with `${ }`. For example, `${Contact_Name}`. To use a variable setting file, select the file from the Use variable setting data file menu, or import the file. For more information, see [“Understanding variable settings” on page 72](#).

● Basic Advanced Security Color Print Permissions Firmware Apps Certificates Resource Files

Use variable setting data file

ConfigVariableTest- new.csv (Imported Aug 31, 2022 2:23:39) Import

☒ Show only included settings

Show settings for All models

View All settings Filter by setting name

| Setting | Category | Value |
|--|----------|-----------------------------------|
| <input checked="" type="checkbox"/> Asset Tag | General | <code>\${ASSET_TAG}</code> |
| <input checked="" type="checkbox"/> Contact Location | General | <code>\${CONTACT_LOCATION}</code> |
| <input checked="" type="checkbox"/> Contact Name | General | <code>\${CONTACT_NAME}</code> |

- If one or more certificates are added to this configuration, you can select any of the certificates from the **Value** drop-down menu.
- From the Advanced Security tab, select an advanced security component.

Notes:

- To create an advanced security component, see [“Creating an advanced security component from a printer” on page 71](#).
- You can manage the advanced security settings only when creating a configuration from a selected printer. For more information, see [“Creating a configuration from a printer” on page 71](#).
- From the Color Print Permissions tab, configure the settings. For more information, see [“Configuring the color print permissions” on page 73](#).

Note: This setting is available only in configurations for supported color printers.

- From the Firmware tab, select a firmware file. If multiple versions of the same firmware are present in a configuration, only the higher firmware version is considered during conformance and enforcement. To import a firmware file, see [“Importing files to the resource library” on page 74](#).

Note: We do not recommended downgrading the firmware due to potential failure risks. Certain firmware versions can lead to a downgrade in printer firmware.

- From the Apps tab, select one or more applications to deploy. For more information, see [“Creating an applications package” on page 73](#).

Note: MVE does not support deploying applications with trial licenses. You can deploy only free applications or applications with production licenses.

- From the Certificates tab, select one or more certificates to deploy. To import a certificate file, see [“Importing files to the resource library” on page 74](#).

Note: Select **Use Markvision to manage device certificates** for MVE to assess missing, invalid, revoked, and expired certificates, and then replace them automatically.

Select either of the following options:

- **Default Device Certificate**
- **Named Device Certificate**

Note: By default, a user can add 10 named certificates per MVE installation and 5 named certificates per MVE configuration.

Note: For more information, see [“Configuring MVE for automated certificate management” on page 78](#).

- From the Resource Files tab, select any of the following file types to deploy:
 - **Application file (.fls)**
 - **Configuration bundle (.zip)**
 - **Universal configuration file (.ucf)**

Notes:

- Any option under the resource tab is not conformance checked.
- We do not recommend using multiple UCF and configuration bundles in a single configuration.
- This method is not applicable to UCF files when configuring scan to network on legacy printers. UCF files must be deployed using the **Deploy file to printer** action.

4 Click **Create Configuration**.

Note: The following list shows the deployment sequence in a configuration:

- **CA Certificates**
- **Application Files**
- **Solution Packages**
- **Advanced Security**
- **Device Certificates**
- **Basic Settings**
- **UCF and configuration bundle**
- **Firmware**

Creating a configuration from a printer

The following components are not included:

- Printer firmware
- Applications
- Certificates

To add the firmware, applications, and certificates, edit the configuration in MVE.

- 1 From the Printers menu, click **Printer Listing**.
- 2 Select the printer, and then click **Configure > Create configuration from printer**.
- 3 If necessary, select **Include advanced security settings** to create an advanced security component from the selected printer.
- 4 If the printer is secured, then select the authentication method, and then enter the credentials.
- 5 Type a unique name for the configuration and its description, and then click **Create Configuration**.
- 6 From the Configurations menu, click **All Configurations**.
- 7 Select the configuration, and then click **Edit**.
- 8 If necessary, edit the settings.
- 9 Click **Save Changes**.

Sample scenario: Cloning a configuration

Fifteen Lexmark MX812 printers were added to the system after discovery. As the IT personnel, you must apply the settings of the existing printers to the newly discovered printers.

Note: You can also clone a configuration from a printer, and then enforce the configuration to a group of printer models.

Sample implementation

- 1 From the existing printers list, select a Lexmark MX812 printer.
- 2 Create a configuration from the printer.
Note: To secure the printers, include the advanced security settings.
- 3 Assign, and then enforce the configuration to the newly discovered printers.

Creating an advanced security component from a printer

Create an advanced security component from a printer to manage the advanced security settings. MVE reads all the settings from that printer, and then creates a component that includes the settings. The component can be associated to multiple configurations for printer models that have the same security framework.

- 1 From the Printers menu, click **Printer Listing**.
- 2 Select the printer, and then click **Configure > Create advanced security component from printer**.
- 3 Type a unique name for the component and its description.

4 If the printer is secured, then select the authentication method, and then enter the credentials.

5 Click **Create Component**.

Note: When you create and enforce a configuration with an advanced security component that contains local accounts, the local accounts are added to the printers. Any existing local accounts that are preconfigured in the printer are retained.

Generating a printable version of the configuration settings

1 Edit a configuration or advanced security component.

2 Click **Printer-friendly version**.

Understanding dynamic settings

- These settings include 802.1x Device Certificate, HTTPS Device Certificate, and IPSec Device Certificate which are listed under the Basic tab of a configuration.
- The options for each of these settings are populated with the certificates selected in the Certificate tab.
- When you clone, export, or import a configuration, the preselected values of these settings are cleared. You must select the values manually.

Understanding variable settings

Variable settings let you manage settings across your fleet that are unique to each printer, such as host name or asset tag. When creating or editing a configuration, you can select a CSV file to be associated with the configuration.

Sample CSV format:

```
IP_ADDRESS,Contact_Name,Address,Disp_Info
1.2.3.4,John Doe,1600 Penn. Ave., Blue
4.3.2.1,Jane Doe,1601 Penn. Ave., Red
2.3.6.5,"Joe, Jane and Douglas",1601 Penn. Ave.,Yellow
2.3.6.7,"Joe, Jane and Douglas",1600 Penn. Ave.,He is 6'7" tall
```

In the header row of the variable file, the first column is a unique printer identifier token. The token must be one of the following:

- **HOSTNAME**
- **IP_ADDRESS**
- **SYSTEM_NAME**
- **SERIAL_NUMBER**

Each subsequent column in the header row of the variable file is a user-defined replacement token. This token must be referenced within the configuration using the \${HEADER} format. It is replaced with the values in the subsequent rows when the configuration is enforced. Make sure that the tokens do not contain any spaces.

You can import the CSV file containing the variable settings when creating or editing a configuration. For more information, see [“Creating a configuration” on page 68](#).

Note: To be able to use the HOSTNAME token, you must perform an audit to ensure that the DNS Host Name field is populated with a value on the printer details page.

Configuring the color print permissions

MVE lets you restrict color printing for host computers and specific users.

Note: This setting is available only in configurations for supported color printers.

- 1 From the Configurations menu, click **All Configurations**.
- 2 Create or edit a configuration.
- 3 From the Color Print Permissions tab, do either of the following:

Configure the color print permissions for host computers

- a In the View menu, select **Host computers**, and then select **Include color print permissions for host computers**.
- b Click **Add**, and then type the host computer name.
- c To let the host computer print in color, select **Allow color printing**.
- d To let users that log in to the host computer print in color, select **Override user permission**.
- e Click **Save and Add** or **Save**.

Configure the color print permissions for users

- a In the View menu, select **Users**, and then select **Include color print permissions for users**.
- b Click **Add**, and then type the user name.
- c Select **Allow color printing**.
- d Click **Save and Add** or **Save**.

Creating an applications package

- 1 Log in to Package Builder at iss.lexmark.com/cdp/package-builder.
- 2 From the Packages page, click **Create package**.
- 3 From the Create Package page, enter the package name.
- 4 Click **Add Product**, select a product, and then click **Add Product**.
- 5 If necessary, select **Redeem an activation code for licensed product**.
- 6 Click **Create Package**.
- 7 Download the package by doing either of the following:
 - Click the package name, and then click **Download**.
 - In the Download Package column, click **Download**.

Notes:

- MVE does not support deploying applications with trial licenses. You can deploy only free applications or applications with production licenses. If you need activation codes, then contact your Lexmark representative.
- To add the applications to a configuration, import the applications package to the resource library. For more information, see [“Importing files to the resource library” on page 74](#).

Importing or exporting a configuration

Before you begin importing a configuration file, make sure that it is exported from the same version of MVE.

- 1 From the Configurations menu, click **All Configurations**.
- 2 Do either of the following:
 - To import a configuration file, click **Import**, browse to the configuration file, and then click **Import**.
 - To export a configuration file, select a configuration, and then click **Export**.

Notes:

- When you export a configuration, the passwords are excluded. After importing, manually add the passwords.
- UCF, configuration bundles, and application files are not part of an exported configuration.

Importing files to the resource library

The resource library is a collection of firmware files, CA certificates, and application packages that are imported to MVE. These files can be associated with one or more configurations.

- 1 From the Configurations menu, click **Resource Library**.
- 2 Click **Import > Choose File**, and then browse to the file.
Note: Only firmware files (FLS), application files (FLS), application packages or configuration bundles (ZIP), CA certificates (PEM), and universal configuration files (UCF) can be imported.
- 3 Click **Import Resource**.

Please remember the following important information when importing CA certificates—

If a CA certificate is exported from Windows in DER-encoded binary format, which is the first option in the export list (see the following screenshot), MVE fails to import it. MVE requires a PEM-formatted certificate, which is Base64-encoded text and appears as the second option in the list.

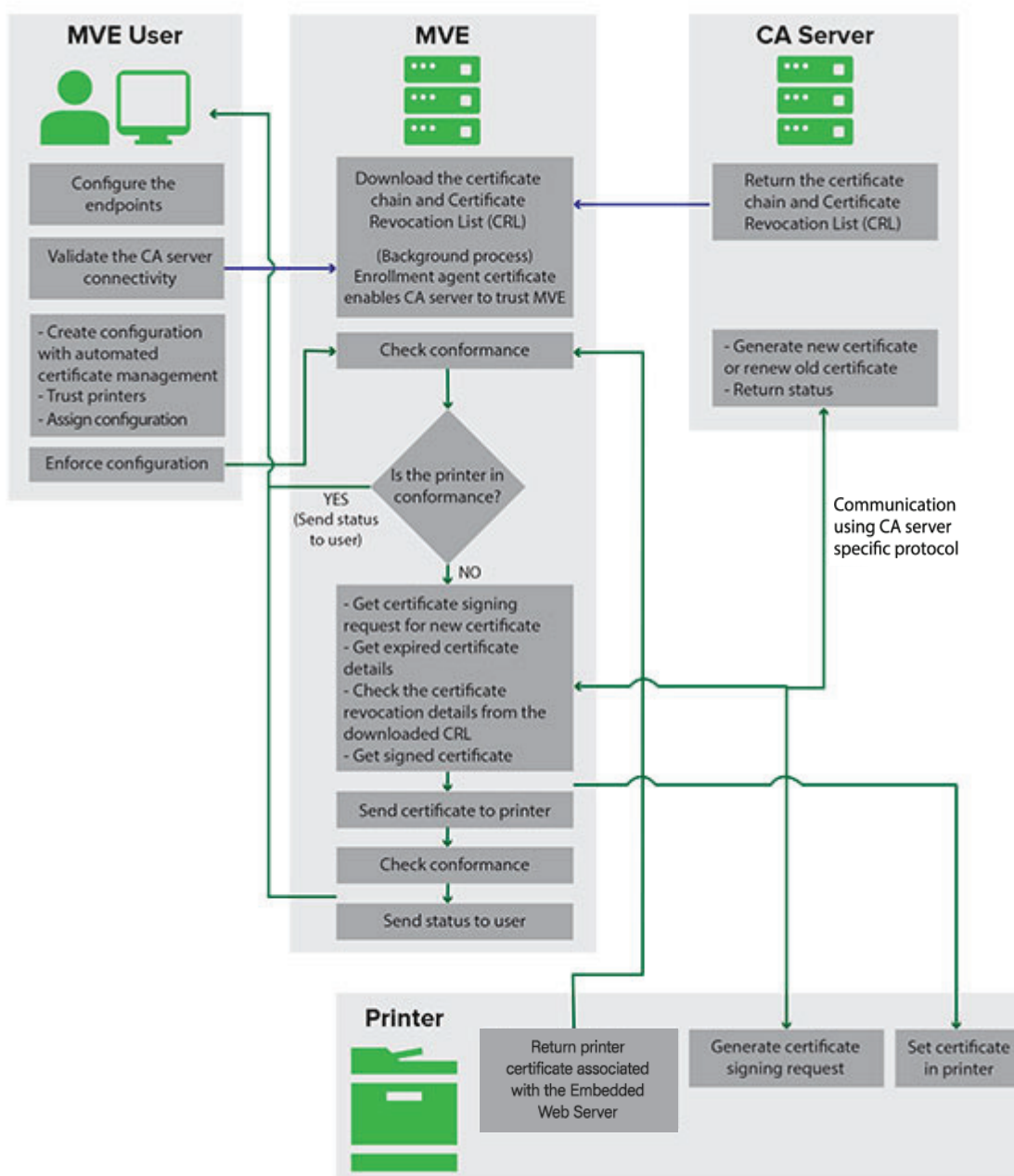


Managing certificates

Setting up MVE to manage certificates automatically

Understanding the automated certificate management feature

You can configure MVE to manage printer certificates automatically, and then install them to the printers through configuration enforcement. The following diagram describes the end-to-end process of the automated certificate management feature.



The certificate authority endpoints, such as the CA server and server address, must be defined in MVE.

The following CA servers are supported:

- **OpenXPKI CA**—Users can use either of the following protocols:

- Secure Certificate Encryption Protocol (SCEP)
- EST Connector

Notes:

- EST is the recommended way to connect to the OpenXPKI server.
- For more information on configuring OpenXPKI CA using EST protocol, see [“Managing certificates using OpenXPKI Certificate Authority through EST” on page 114](#)
- For more information on configuring OpenXPKI CA using SCEP protocol, see [“Managing certificates using OpenXPKI Certificate Authority through SCEP” on page 98](#)

- **Microsoft CA Enterprise**—Users can use either of the following protocols

- Secure Certificate Encryption Protocol (SCEP)
- Microsoft Certificate Enrollment Web Services (MSCEWS)

Notes:

- MSCEWS is the recommended way to connect to the Microsoft CA Enterprise server.
- For more information on configuring Microsoft CA using MSCEWS protocol, see [“Managing certificates using Microsoft Certificate Authority through MSCEWS” on page 87](#)
- For more information on configuring Microsoft CA using SCEP protocol, see [“Managing certificates using Microsoft Certificate Authority through SCEP” on page 80](#)

The connection between MVE and the CA servers must be validated. During validation, MVE communicates with the CA server to download the certificate chain and the Certificate Revocation List (CRL). The enrollment agent certificate or test certificate is also generated. This certificate enables the CA server to trust MVE.

For more information on defining the endpoints and validation, see [“Configuring MVE for automated certificate management” on page 78](#).

A configuration that is set to **Use Markvision to manage device certificates** must be assigned and enforced to the printer.

For more information, see the following topics:

- [“Creating a configuration” on page 68](#)
- [“Enforcing configurations” on page 62](#)

During enforcement, MVE checks the printer for conformance.

For Default Device Certificate

- The certificate is validated against the certificate chain downloaded from the CA server.
- If the printer is out of conformance, a Certificate Signing Request (CSR) is raised for the printer.

For Named Device Certificate


- The certificate is validated against the certificate chain downloaded from the CA server.
- MVE creates a self-signed named device certificate on the device.
- If the printer is out of conformance, a CSR is raised for the printer.

Notes:

- MVE communicates with the CA server using the configured protocols.

- The CA server generates the new certificate, and then MVE sends the certificate to the printer.
- If a named certificate exists in the printer, then a new named certificate is not created, but a CSR is raised for the printer.

Configuring MVE for automated certificate management

1 Click  on the upper-right corner of the page.

2 Click **Certificate Authority > Use Certificate Authority Server**.

Note: The Use Certificate Authority Server button appears only when configuring the certificate authority for the first time, or when the certificate is deleted.

3 Configure the server endpoints.

- **CA Server**—The Certificate Authority (CA) server that generates the printer certificates. You can select either of the following:

- **OpenXPKI CA**
- **Microsoft CA- Enterprise**

Note: User can also configure a CA server which supports the **Enrollment over Secure Transport (EST)** protocol.

- The CA server must implement the EST protocol as defined in RFC 7030.

Note: Any deviation from the specification may result in an invalid setup.

- EST is the recommended protocol to connect to the OpenXPKI CA server.

Note: Microsoft CA Enterprise server does not support the EST protocol.

- **CA Server Address**—The IP address or host name of your CA server. This field is only applicable for SCEP and EST protocols.

Note: Type any of the following:

- For MSCA server (using SCEP): <Server IP Address or Hostname>/certsrv/mscep/mscep.dll
- For OpenXPKI server (using SCEP): <Server IP Address or Hostname>/scep/scep
- For EST, type any of the following:
 - https://172.87.95.240
 - https://estserver.com
 - estserver.com

- **CA Server Label (Optional)**— If the user creates a new realm, the same realm name must be put in this field.

- **CEP Server Address**— This field is only applicable for the MSCEWS protocol.

Note: Type any of the following:

- For Username and Password Authentication:
https://democep.com/ADPolicyProvider_CEP_UsernamePassword/service.svc/CEP
- For Windows Integrated Authentication:
https://democep.com/ADPolicyProvider_CEP_Kerberos/service.svc/CEP
- For Client Certificate Authentication:
https://democep.com/ADPolicyProvider_CEP_Certificate/service.svc/CEP

- **CA Server Hostname**—The host name of your CA server.
Note: For example, for MSCEWS protocol, user may select **democa.lexmark.com**
- **CES Server Hostname**—The host name of your CES server.
Note: For example, for MSCEWS protocol, user may select **democes.lexmark.com**
- **Challenge Password**—Challenge Password is required to assert the identity of MVE to the CA server. This password is only required for OpenXPki CA. It is not supported in Microsoft CA Enterprise.

Note: Depending on your CA server, you must configure the server authentication mode. Do either of the following:

- If you select **EST** protocol, then from the **CA Server Authentication Mode** menu, select any of the following:
 - **Username and Password Authentication**
 - **Client Certificate Authentication**
- If you select **MSCEWS** protocol, then from the **CA Server Authentication Mode** menu, select any of the following:
 - **Username and Password Authentication**
 - **Client Certificate Authentication**
 - **Windows Integrated Authentication**
- **SCEP** protocol only supports the **Challenge Password** authentication mode.

Note: Depending on your CA server, see any of the sections:

- [“Managing certificates using OpenXPki Certificate Authority through SCEP” on page 98](#)
- [“Managing certificates using Microsoft Certificate Authority through SCEP” on page 80](#)
- [“Managing certificates using Microsoft Certificate Authority through MSCEWS” on page 87](#)
- [“Managing certificates using OpenXPki Certificate Authority through EST” on page 114](#)

4 Click **Save Changes and Validate** > **OK**.

Notes:

- The **Discard Changes** option only works if the changes are not yet saved or saved and validated.
- User cannot recover data from an invalid configuration as MVE does not store the last valid state of any configuration. MVE only stores one single certificate configuration at a time, which may or may not be valid.

Notes:

- The connection between MVE and the CA servers must be validated. During validation, MVE communicates with the CA server to download the certificate chain and the Certificate Revocation List (CRL). The enrollment agent certificate or test certificate is also generated. This certificate enables the CA server to trust MVE.
- You can select one or multiple CEP templates when using MSCEWS protocol. Do the following:
 - After clicking **Save Changes and Validate**, the CEP Template Selection window appears.
 - Select one or more from the available templates.
 - The Use Certificate Authority Server dialog fetches the certificate revocation list.
 - A dialog confirms that certificate validation is successful.
 - You can see the selected CEP templates in the CA server configuration page.

Note: When you enforce this configuration to any device, a certificate is created according to the selected template.

5 Navigate back to the System Configuration page, and then review the CA certificate.

Note: You can also download or delete the CA certificate.

Configuring Microsoft Enterprise CA with NDES

Overview

In the following deployment scenario, all permissions are based on permissions set on certificate templates that are published in the domain controller. The certificate requests sent to the CA are based on certificate templates.

For this setup, make sure that you have the following:

- A machine hosting the subordinate CA
- A machine hosting the NDES service
- A domain controller

Required users

Create the following users in the domain controller:

- Service Administrator
 - Named as **SCEPAdmin**
 - Must be a member of the **local admin** and **Enterprise Admin** groups
 - Must be logged locally when the installation of NDES role is triggered
 - Has **Enroll permission** for the certificate templates
 - Has **Add template permission** on CA
- Service Account
 - Named as **SCEPSvc**
 - Must be member of the local **IIS_IUSRS** group
 - Must be a domain user and has **read** and **enroll** permissions on the configured templates
 - Has **request** permission on CA
- Enterprise CA Administrator
 - Named as **CAAdmin**
 - Member of **Enterprise Admin** group
 - Must be a part of the **local admin** group

Managing certificates using Microsoft Certificate Authority through SCEP

This section provides instructions on the following:

- Configuring Microsoft Enterprise Certificate Authority (CA) using Microsoft Network Device Enrollment Service (NDES)
- Create a root CA server

Note: The Windows Server 2016 operating system is used for all setups in this document.

Overview

The root CA server is the main CA server in any organization, and is the top of the PKI infrastructure. The root CA authenticates the subordinate CA server. This server is generally kept in offline mode to prevent any intrusion and to secure the private key.

To configure the root CA server, do the following:

- 1 Make sure that the root CA server is installed. For more information, see [“Installing the root CA server” on page 81](#).
- 2 Configure the Certification Distribution Point and Authority Information Access settings. For more information, see [“Configuring the Certification Distribution Point and Authority Information Access settings” on page 84](#).
- 3 Configure the CRL accessibility. For more information, see [“Configuring CRL accessibility” on page 85](#).

Installing the root CA server

- 1 From Server Manager, click **Manage > Add Roles and Feature**.
- 2 Click **Server Roles**, select **Active Directory Certificate Services** and all its features, and then click **Next**.
- 3 From the AD CS Role Services section, select **Certification Authority**, and then click **Next > Install**.
- 4 After installation, click **Configure Active Directory Certificate Services on the destination server**.
- 5 From the Role Services section, select **Certification Authority > Next**.
- 6 From the Setup Type section, select **Standalone CA**, and then click **Next**.
- 7 From the CA Type section, select **Root CA**, and then click **Next**.
- 8 Select **Create a new private key**, and then click **Next**.
- 9 From the Select a cryptographer provider menu, select **RSA#Microsoft Software Key Storage Provider**.
- 10 From the Key length menu, select **4096**.
- 11 In the hash algorithm list, select **SHA512**, and then click **Next**.
- 12 In the Common name for this CA field, type the hosting server name.
- 13 In the Distinguished name suffix field, type the domain component.

Sample CA name configuration

Machine Fully Qualified Domain Name (FQDN): **test.dev.lexmark.com**

Common Name (CN): **TEST**

Distinguished name suffix: **DC=DEV, DC=LEXMARK, DC=COM**

- 14 Click **Next**.
- 15 Specify the validity period, and then click **Next**.

Note: Generally, the validity period is 10 years.

- 16 Do not change anything in the database locations window.
- 17 Complete the installation.

Configuring Microsoft Enterprise CA with NDES

Overview

In the following deployment scenario, all permissions are based on permissions set on certificate templates that are published in the domain controller. The certificate requests sent to the CA are based on certificate templates.

For this setup, make sure that you have the following:

- A machine hosting the subordinate CA
- A machine hosting the NDES service
- A domain controller

Required users

Create the following users in the domain controller:

- Service Administrator
 - Named as **SCEPAdmin**
 - Must be a member of the **local admin** and **Enterprise Admin** groups
 - Must be logged locally when the installation of NDES role is triggered
 - Has **Enroll permission** for the certificate templates
 - Has **Add template permission** on CA
- Service Account
 - Named as **SCEPSvc**
 - Must be member of the local **IIS_IUSRS** group
 - Must be a domain user and has **read** and **enroll** permissions on the configured templates
 - Has **request** permission on CA

Configuring subordinate CA server

Overview

The subordinate CA server is the intermediate CA server and is always online. It generally handles the management of certificates.

To configure the subordinate CA server, do the following:

- 1 Make sure that the subordinate CA server is installed. For more information, see [“Installing the subordinate CA server” on page 83](#).
- 2 Configure the Certification Distribution Point and Authority Information Access settings. For more information, see [“Configuring the Certification Distribution Point and Authority Information Access settings” on page 84](#).
- 3 Configure the CRL accessibility. For more information, see [“Configuring CRL accessibility” on page 85](#).

Installing the subordinate CA server

- 1 From the server, log in as a **CAAdmin** domain user.
- 2 From Server Manager, click **Manage > Add Roles and Feature**.
- 3 Click **Server Roles**, select **Active Directory Certificate Services** and all its features, and then click **Next**.
- 4 From the AD CS Role Services section, select **Certification Authority** and **Certificate Authority Web Enrollment**, and then click **Next**.
Note: Make sure that all the features of Certificate Authority Web Enrollment are added.
- 5 From the Web Server Role (IIS) Role Services section, retain the default settings.
- 6 After installation, click **Configure Active Directory Certificate Services on the destination server**.
- 7 From the Role Services section, select **Certification Authority** and **Certificate Authority Web Enrollment**, and then click **Next**.
- 8 From the Setup Type section, select **Enterprise CA**, and then click **Next**.
- 9 From the CA Type section, select **Subordinate CA**, and then click **Next**.
- 10 Select **Create a new private key**, and then click **Next**.
- 11 From the Select a cryptographer provider menu, select **RSA#Microsoft Software Key Storage Provider**.
- 12 From the Key length menu, select **4096**.
- 13 In the hash algorithm list, select **SHA512**, and then click **Next**.
- 14 In the Common name for this CA field, type the host server name.
- 15 In the Distinguished name suffix field, type the domain component.

Sample CA name configuration

Machine Fully Qualified Domain Name (FQDN): **test.dev.lexmark.com**

Common Name (CN): **TEST**

Distinguished name suffix: **DC=DEV, DC=LEXMARK, DC=COM**

- 16 In the Certificate Request dialog box, save the request file, and then click **Next**.
- 17 Do not change anything in the database locations window.
- 18 Complete the installation.
- 19 Sign the CA request of the root CA, and then export the signed certificate in PKCS7 format.
- 20 From the subordinate CA, open **Certification Authority**.
- 21 From the left panel, right-click the CA, and then click **All Tasks > Install CA Certificate**.
- 22 Select the signed certificate, and then start the CA service.

Configuring the Certification Distribution Point and Authority Information Access settings

Note: Configure the Certification Distribution Point (CDP) and Authority Information Access (AIA) settings for Certificate Revocation List (CRL).

- 1 From Server Manager, click **Tools > Certification Authority**.
- 2 From the left panel, right-click the CA, and then click **Properties > Extensions**.
- 3 In the Select extension menu, select **CRL Distribution Point (CDP)**.
- 4 In the certificate revocation list, select the **C:\Windows\system32** entry, and then do the following:
 - a Select **Publish CRLs to this location**.
 - b Clear **Publish Delta CRLs to this location**.
- 5 Delete all other entries except for **C:\Windows\system32**.
- 6 Click **Add**.
- 7 In the Location field, add **http://serverIP/CertEnroll/<CAName><CRLNameSuffix><DeltaCRLAllowed>.crl**, where **serverIP** is the IP address of the server.

Note: If your server is reachable by using the FQDN, then use the **<ServerDNSName>** instead of the server IP address.
- 8 Click **OK**.
- 9 Select **Include in the CDP extension of issued certificates** for the created entry.
- 10 In the Select extension menu, select **Authority Information Access (AIA)**.
- 11 Delete all other entries except for **C:\Windows\system32**.
- 12 Click **Add**.
- 13 In the Location field, add **http://serverIP/CertEnroll/<ServerDNSName>_<CAName><CertificateName>.crt**, where **serverIP** is the IP address of the server.

Note: If your server is reachable by using the FQDN, then use the **<ServerDNSName>** instead of the server IP address.
- 14 Click **OK**.
- 15 Select **Include in the AIA extension of issued certificates** for the created entry.
- 16 Click **Apply > OK**.

Note: If necessary, restart the certification service.
- 17 From the left panel, expand the CA, right-click **Revoked Certificates**, and then click **Properties**.
- 18 Specify the value for CRL publication interval and for Publish Delta CRLs Publication interval, and then click **Apply > OK**.
- 19 From the left panel, right-click **Revoked Certificates**, click **All Tasks**, and then publish the New CRL.

Configuring CRL accessibility

Note: Before you begin, make sure that Internet Information Services (IIS) Manager is installed.

- 1 From IIS Manager, expand the CA, and then expand **Sites**.
- 2 Right-click **Default Web Site**, and then click **Add Virtual Directory**.
- 3 In the Alias field, type **CertEnroll**.
- 4 In the Physical path field, type **C:\Windows\System32\CertSrv\CertEnroll**.
- 5 Click **OK**.
- 6 Right-click **CertEnroll**, and then click **Edit Permissions**.
- 7 From the Security tab, remove any write access except for the system.
- 8 Click **OK**.

Configuring the NDES server

- 1 From the server, log in as an **SCEPAdmin** domain user.
- 2 From Server Manager, click **Manage > Add Roles and Feature**.
- 3 Click **Server Roles**, select **Active Directory Certificate Services** and all its features, and then click **Next**.
- 4 From the AD CS Role Services section, clear **Certification Authority**.
- 5 Select **Network Device Enrollment Service** and all its features, and then click **Next**.
- 6 From the Web Server Role (IIS) Role Services section, retain the default settings.
- 7 After installation, click **Configure Active Directory Certificate Services on the destination server**.
- 8 From the Role Services section, select **Network Device Enrollment Service**, and then click **Next**.
- 9 Select the **SCEPSvc** service account.
- 10 From the CA for NDES section, select either **CA name** or **Computer name**, and then click **Next**.
- 11 From the RA Information section, specify the information, and then click **Next**.
- 12 From the Cryptography for NDES section, do the following:
 - Select the appropriate signature and encryption key providers.
 - From the Key length menu, select the same key length as the CA server.
- 13 Click **Next**.
- 14 Complete the installation.

You can now access the NDES server from a web browser as an SCEPSvc user. From the NDES server, you can view the CA certificate thumbprint, the enrollment challenge password, and the validity period of the challenge password.

Accessing the NDES server

Open a web browser, and then type **http://NDESServerIP/certsrv/mscep_admin**, where **NDESServerIP** is the IP address of the NDES server.

Configuring NDES for MVE

Note: Before you begin, make sure that the NDES server is working properly.

Creating a certificate template

- 1 From the subordinate CA (certserv), open **Certification Authority**.
- 2 From the left panel, expand the CA, right-click **Certificate Templates**, and then click **Manage**.
- 3 In Certificate Templates Console, create a copy of **Web Server**.
- 4 From the General tab, type **MVEWebServer** as the template name.
- 5 From the Security tab, give the **SCEPAdmin** and **SCEPSvc** users the appropriate permissions.
Note: For more information, see [“Required users” on page 82](#).
- 6 From the Subject Name tab, select **Supply in the request**.
- 7 From the subordinate CA (certserv), open **Certification Authority**.
- 8 From the Extensions tab, select **Application Policies > Edit**.
- 9 Click **Add > Client Authentication > OK**.
- 10 From the left panel, expand the CA, right-click **Certificate Templates**, and then click **New > Certificate Template to Issue**.
- 11 Select the newly created certificates, and then click **OK**.

You can now access the templates using the CA web enrollment portal.

Accessing the templates

- 1 Open a web browser, and then type **http://CAserverIP/certsrv/certrqxt.asp**, where **CAserverIP** is the IP address of the CA server.
- 2 In the Certificate template menu, view the templates.

Setting certificate templates for NDES

- 1 From your computer, launch the registry editor.
- 2 Navigate to **HKEY_LOCAL_MACHINE > SOFTWARE > Microsoft > Cryptography > MSCEP**.
- 3 Configure the following, and then set them to **MVEWebServer**:
 - EncryptionTemplate
 - GeneralPurposeTemplate
 - SignatureTemplate
- 4 Give the SCEPSvc user full permission to MSCEP.
- 5 From IIS Manager, expand the CA, and then click **Application Pools**.
- 6 From the right panel, click **Recycle** to restart the SCEP application pool.
- 7 From IIS Manager, expand the CA, and then expand **Sites > Default Web Site**.
- 8 From the right panel, click **Restart**.

Disabling Challenge Password in Microsoft CA server

- 1 From your computer, launch the registry editor.
- 2 Navigate to **HKEY_LOCAL_MACHINE > SOFTWARE > Microsoft > Cryptography > MSCEP**.
- 3 Set EnforcePassword to **0**.
- 4 From IIS Manager, expand the CA, click **Application Pools**, and then select **SCEP**.
- 5 From the right panel, click **Advanced Settings**.
- 6 Set Load User Profile to **True**, and then click **OK**.
- 7 From the right panel, click **Recycle** to restart the SCEP application pool.
- 8 From IIS Manager, expand the CA, and then expand **Sites > Default Web Site**.
- 9 From the right panel, click **Restart**.

When opening the NDES from web browser, you can now only view the CA thumbprint.

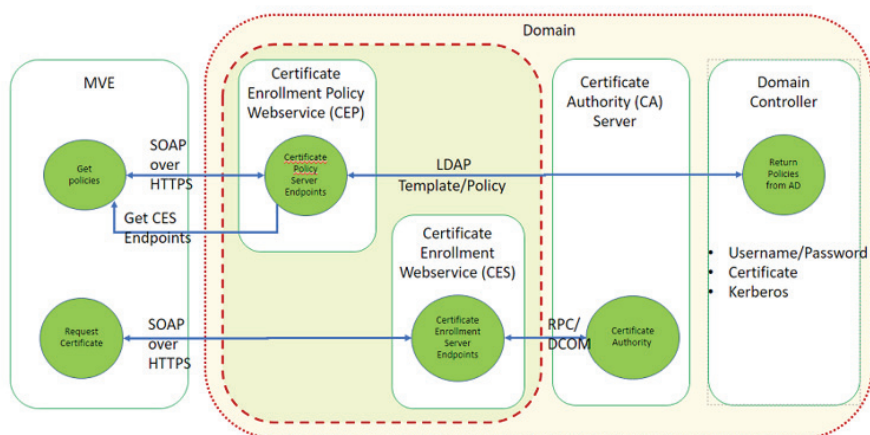
Managing certificates using Microsoft Certificate Authority through MSCEWS

This section provides information on configuring Certificate Enrollment Policy Web Service (CEP) and Certificate Enrollment Web Service (CES). As Microsoft recommends installing CEP and CES in two different machines, we are following the same in this document. We refer to these web services as CEP server and CES server, respectively.

Note: The user must have a preconfigured Enterprise Certificate Authority (CA) and a domain controller.

System requirements

The Windows Server 2012 R2 and onwards operating system is used for all setups in this section. The following installation requirements and capabilities apply to both CEP and CES, unless otherwise specified.



Create the following types of accounts in the domain controller:

- Service Administrator: Named as **CEPAdmin** and **CESAdmin**
 - This user must be a part of the **local admin group** in the respective CEP and CES servers.
 - This user must be a member of the **Enterprise Admin** group.
- Service Account: Named as **CEPSvc** and **CESSvc**
 - This user must be a part of the **local IIS_IUSRS** group.
 - Requires **Request Certificates** permission on the CA for the respective **CEPSvc** and **CESSvc**.

Network connectivity requirements

- Network connectivity requirements are a key part of deployment planning, particularly for scenarios where the CEP and CES are hosted in a perimeter network.
- All client connectivity to both services occurs within an HTTPS session, so only HTTPS traffic is allowed between the client and the web services.
- CEP communicates with Active Directory Domain Services (AD DS), using standard Lightweight Directory Access Protocol (LDAP) and secure LDAP (LDAPS) ports (TCP 389 and 636 respectively).
- CES communicates with CA using Distributed Component Object Model (DCOM).

Notes:

- By default, DCOM uses random ephemeral ports.
- CA can be configured to reserve a specific range of ports to simplify firewall configuration.

Creating SSL certificates for CEP and CES servers

CES and CEP must use Secure Sockets Layer (SSL) for communication with clients (by using HTTPS). Each service must have a valid certificate that has an Enhanced Key Usage (EKU) policy of server authentication in the local computer certificate store.

- 1 Install the IIS service in the server.
- 2 Log in to the CEP server, and then add the Root CA certificate in the Trusted Root Certification Authority store.
- 3 Launch the IIS Manager Console and then, select **Server Home**.
- 4 From the main view section, open **Server Certificates**.
- 5 Click **Actions > Create Certificate Request**.
- 6 In the Distinguished Name Properties window, provide the necessary information and then, click **Next**.
- 7 In the Cryptographic Service Provider Properties dialog, select the bit length, and then click **Next**.
- 8 Save the file.
- 9 Get the file signed by the CA that you are planning to use for CEP and CES.
Note: Make sure that Server Authentication EKU is enabled in the signed certificate.
- 10 Copy the signed file back to the CEP server.
- 11 From the IIS Manager Console, select **Server Home**.
- 12 From the Main View section, open **Server Certificates**.

- 13** Click **Actions > Complete Certificate Request**.
- 14** In Specify Certificate Authority Response window, select the signed file.
- 15** Type a name, and then in the Certificate Store menu, select **Personal**.
- 16** Complete the certificate installation.
- 17** From IIS Manager Console, select the default website.
- 18** Click **Actions > Bindings**.
- 19** In the Site Bindings dialog, click **Add**.
- 20** In the Add Site Binding dialog, set Type to **https**, and then from the SSL certificate, browse for the newly created certificate.
- 21** From the IIS Manager Console, select **Default Web Site**, and then open the SSL settings.
- 22** Enable Require SSL and set Client certificates to **Ignore**.
- 23** Restart IIS.

Note: Follow the same process for CES server.

Creating certificate templates

The user must create a certificate template for the certificate enrollment. Do the following to copy from an existing certificate template:

- 1** Log in to the Enterprise CA with CA administrator credentials.
- 2** Expand the CA, right-click **Certificate Templates**, and then click **Manage**.
- 3** In the Certificate Templates Console, right-click **Web Server Certificate Template**, and then click **Duplicate Template**.
- 4** From the General tab of the template, name the template **MVEWebServer**.
- 5** In the Security tab, give the CA administrator **Read**, **Write**, and **Enroll** permissions.
- 6** Give **Read** and **Enroll** permissions to the authenticated users.
- 7** In the Subject Name tab, select **Supply** in the request.
- 8** In the General tab, set the certificate validity period.
- 9** If you plan to use this certificate template for issuing a **802.1X Certificate** for printers, then do the following:
 - a** From the **Extensions** tab, select **Application Policies** from the list of extensions included in this template.
 - b** Click **Edit > Add**.
 - c** In Add Application Policy dialog box, select **Client Authentication**.
 - d** Click **OK**.
- 10** In the Certificate Template Properties dialog box, click **OK**.
- 11** In the CA window, right-click **Certificate Templates**, and then click **New > Certificate template**.
- 12** Select **MVEWebServer**, and then click **OK**.

Understanding authentication methods

CEP and the CES support the following authentication methods:

- Windows-integrated authentication, also known as **Kerberos Authentication**
- Client certificate authentication, also known as **X.509 Certificate Authentication**
- **Username and Password Authentication**

Windows-integrated authentication

Windows-integrated authentication uses Kerberos to provide an uninterrupted authentication flow for devices connected to the internal network. This method is preferred for internal deployments because it uses the existing Kerberos infrastructure within AD DS. It also requires minimal changes to certificate client computers.

Note: Use this authentication method if you need clients to access *only* the web service while connected directly to your internal network.

Client certificate authentication

This method is preferred over user name and password authentication because it is more secure. It does not require a direct connection to the corporate network.

Notes:

- Use this authentication method if you plan to provide clients with digital X.509 certificates for authentication.
- This method enables the web services available on the Internet.

User name and password authentication

The user name and password method is the simplest form of authentication. This method is typically used for servicing clients who are not directly connected to the internal network. It is a less secure authentication option than client certificate authentication, but it does not require provisioning a certificate.

Note: Use this authentication method when you can access the web service on the internal network or over the Internet.

Delegation requirements

Delegation enables a service to impersonate a user or computer account to access resources throughout the network.

Delegation is required for the CES server when all the following scenarios apply:

- CA and CES are not residing on the same computer.
- CES can process initial enrollment requests, as opposed to only processing certificate renewal requests.
- The authentication type is set to **Windows-integrated authentication** or **Client certificate authentication**.

Delegation is not required for the CES server in the following scenarios:

- CA and CES are residing on the same computer.
- User name and password is the authentication method.

Notes:

- Microsoft recommends running CEP and CES as domain user accounts.
- Users must create an appropriate service principal name (SPN) before configuring delegation on the domain user account.

Enabling delegation

- 1 To create an SPN for a domain user account, use the **setspn** command as follows:

```
setspn -s http/ces.msca.com msca\CESSvc
```

Notes:

- The account name is CESSvc.
- CES is running on a computer with a fully qualified domain name (FQDN) of **ces.msca.com** in the msca.com domain.

- 2 Open the CESSvc domain user account in the domain controller.
- 3 From the Delegation tab, select **Trust this user for delegation to specified services only**.
- 4 Select the appropriate delegation based on the authentication method.

Notes:

- If you select Windows-integrated authentication, then configure delegation to use **Kerberos only**.
- If the service is using client certificate authentication, then configure delegation to use any authentication protocol.
- If you plan to configure multiple authentication methods, then configure delegation to use any authentication protocol.

- 5 Click **Add**.
- 6 In the Add Services dialog, select **Users** or **Computers**.
- 7 Type your CA server host name, and then click **Check Names**.
- 8 From the Add Services dialog, select either of the following services to delegate:
 - Host service (HOST) for that CA server
 - Remote Procedure Call System Service (RPCSS) for that CA server

- 9 Close the domain user properties dialog.

For CEP domain users using Windows-integrated authentication, do the following:

- 1 To create an SPN for a domain user account, use the **setspn** command as follows:

```
setspn -s http/cep.msca.com msca\CEPSvc
```

Note: The account name is CEPSvc.

- 2 Open the CEPSvc domain user account in the domain controller.
- 3 From the Delegation tab, select **Do not trust this user for delegation**.

Configuring windows-integrated authentication

To install CEP and CES, use Windows PowerShell.

Configuring CEP

The **Install-AdcsEnrollmentPolicyWebService** cmdlet configures the Certificate Enrollment Policy Web Service (CEP). It is also used to create other instances of the service within an existing installation.

- 1 Log in to the CEP server using CEPAdmin user name, and then launch PowerShell in administrative mode.
- 2 Run the command **Import-Module ServerManager**.
- 3 Run the command **Add-WindowsFeature Adcs-Enroll-Web-Pol**.
- 4 Run the command **Install-AdcsEnrollmentPolicyWebService -AuthenticationType Kerberos -SSLCertThumbprint "sslCertThumbPrint"**.
Note: Replace <sslCertThumbPrint> with the thumbprint of the SSL certificate created for the CEP server, after deleting the spaces between the thumbprint values.
- 5 Complete the installation either by selecting either **Y** or **A**.
- 6 Launch the IIS Manager Console.
- 7 In the Connections pane, expand the web server that is hosting CEP.
- 8 Expand **Sites**, expand **Default Web Site**, and then click the appropriate installation virtual application name, **ADPolicyProvider_CEP_Kerberos**.
- 9 In the virtual application called **Home**, double-click the application settings, and then double-click **FriendlyName**.
- 10 Type a name under Value, and then close the dialog.
- 11 Double-click **URI**, and then copy **Value**.

Notes:

- If you want to configure another authentication method on the same CEP server, then you must change the ID.
- This URL is used in MVE or any client application.

- 12 From the left pane, click **Application Pools**.
- 13 Select **WSEnrollmentPolicyServer**, and then from the right pane, click **Actions > Advanced Settings**.
- 14 Select the identity field under Process Model.
- 15 In the Application Pool Identity dialog box, select the custom account, and then type **CEPSvc** as the domain user name.
- 16 Close all dialog boxes, and then recycle IIS from the right pane of the IIS Manager Console.
- 17 From PowerShell, type **iisreset** to restart IIS.

Configuring CES

The **Install-AdcsEnrollmentWebService** cmdlet configures the Certificate Enrollment Web Service (CES). It is also used to create other instances of the service within an existing installation.

- 1 Log in to the CES server using **CESAdmin** as user name, and then launch PowerShell in administrative mode.
- 2 Run the command **Import-Module ServerManager**.
- 3 Run the command **Add-WindowsFeature Adcs-Enroll-Web-Svc**.

- 4 Run the command **Install-AdcsEnrollmentWebService -ApplicationPoolIdentity -CAConfig "CA1.contoso.com\contoso-CA1-CA" -SSLCertThumbprint "sslCertThumbPrint" -AuthenticationType Kerberos**.

Notes:

- Replace *<sslCertThumbPrint>* with the thumbprint of the SSL certificate created for the CES server, after deleting the spaces between the thumbprint values.
- Replace **CA1.contoso.com** with your CA computer name.
- Replace **contoso-CA1-CA** with your CA common name.

- 5 Complete the installation by selecting either **Y** or **A**.
- 6 Launch the IIS Manager Console.
- 7 In the Connections pane, expand the web server that is hosting CES.
- 8 Expand **Sites**, expand **Default Web Site**, and then click the appropriate installation virtual application name: **contoso-CA1-CA_CES_Kerberos**.
- 9 From the left pane, click **Application Pools**.
- 10 Select **WSEnrollmentServer**, and then from the right pane, click **Actions > Advanced Settings**.
- 11 Select the identity field under Process Model.
- 12 In the **Application Pool Identity** dialog, select the custom account, and then type **CESSvc** as the domain user name.
- 13 Close all dialogs, and then recycle IIS from the right pane of IIS Manager Console.
- 14 From PowerShell, type **iisreset** to restart IIS.
- 15 For CESSvc domain users, enable delegation. For more information, see [“Enabling delegation” on page 91](#).

Configuring client certificate authentication

Configuring CEP

The **Install-AdcsEnrollmentPolicyWebService** cmdlet configures CEP. It is also used to create other instances of the service within an existing installation.

- 1 Log in to the CEP server using CEPAdmin user name, and then launch PowerShell in administrative mode.
- 2 Run the command **Import-Module ServerManager**.
- 3 Run the command **Add-WindowsFeature Adcs-Enroll-Web-Pol**.
- 4 Run the command **Install-AdcsEnrollmentPolicyWebService -AuthenticationType Certificate -SSLCertThumbprint "sslCertThumbPrint"**.

Note: Replace *<sslCertThumbPrint>* with the thumbprint of the SSL certificate created for the CEP server, after deleting the spaces between the thumbprint values.

- 5 Complete the installation by selecting either **Y** or **A**.
- 6 Launch the IIS Manager Console.

- 7 In the Connections pane, expand the web server that is hosting CEP.
 - 8 Expand **Sites**, expand **Default Web Site**, and then click the appropriate installation virtual application name **ADPolicyProvider_CEP_Certificate**.
 - 9 In the virtual application called **Home**, double-click the application settings, and then double-click **FriendlyName**.
 - 10 Type a name under Value and close the dialog.
 - 11 Double-click **URI**, and then copy **Value**.
- Notes:**
- If you want to configure another authentication method on the same CEP server, then you must change the ID.
 - This URL is used in MVE or any client application.
- 12 From the left pane, click **Application Pools**.
 - 13 Select **WSEnrollmentPolicyServer**, and then from the right pane, click **Actions > Advanced Settings**.
 - 14 Select the identity field under Process Model.
 - 15 In the Application Pool Identity dialog box, select the custom account, and then type **CEPSvc** as the domain user name.
 - 16 Close all dialog boxes, and then recycle IIS from the right pane of the IIS Manager Console.
 - 17 From PowerShell, type **iisreset** to restart IIS.

Configuring CES

The **Install-AdcsEnrollmentWebService** cmdlet configures the Certificate Enrollment Web Service (CES). It is also used to create other instances of the service within an existing installation.

- 1 Log in to the CES server using **CESAdmin** as user name, and then launch PowerShell in administrative mode.
- 2 Run the command **Import-Module ServerManager**.
- 3 Run the command **Add-WindowsFeature Adcs-Enroll-Web-Svc**.
- 4 Run the command **Install-AdcsEnrollmentWebService -ApplicationPoolIdentity -CAConfig "CA1.contoso.com\contoso-CA1-CA" -SSLCertThumbprint "sslCertThumbPrint" -AuthenticationType Certificate**.

Notes:

- Replace *<sslCertThumbPrint>* with the thumbprint of the SSL certificate created for the CES server, after deleting the spaces between the thumbprint values.
 - Replace **CA1.contoso.com** with your CA computer name.
 - Replace **contoso-CA1-CA** with your CA common name.
 - If you have already configured one authentication method in the host, then remove **ApplicationPoolIdentity** from the command.
- 5 Complete the installation either by selecting **Y** or **A**.
 - 6 Launch the IIS Manager Console.
 - 7 In the Connections pane, expand the web server that is hosting CEP.

- 8 Expand **Sites**, expand **Default Web Site**, and then click the appropriate installation virtual application name: **contoso-CA1-CA_CES_Certificate**.
- 9 From the left pane, click the **Application Pools**.
- 10 Select **WSEnrollmentServer**, and then from the right pane, click **Actions > Advanced Settings**.
- 11 Select the identity field under Process Model.
- 12 In the Application Pool Identity dialog, select the custom account, and then type **CESSvc** as the domain user name.
- 13 Close all dialogs, and then recycle IIS from the right pane of the IIS Manager Console.
- 14 From PowerShell, type **iisreset** to restart IIS.
- 15 For CESSvc domain user, enable delegation. For more information, see [“Enabling delegation” on page 91](#).

Creating a client certificate

- 1 From any domain user account, open **certlm.msc**.
- 2 Click **Certificates > Personal > Certificates > All Tasks > Request New Certificate**.
- 3 Click **Next**.
- 4 Click **Active Directory Enrollment > Client access**.
Note: Do the following if you do not want to use **Active Directory Enrollment** options:
 - a Click **Configured by You > Add New**.
 - b Enter the Enrollment Policy Server URI as CEP server address for either Username_Password or Kerberos Authentication.
 - c Select Authentication type as **Windows Integrated**.
 - d Click **Validate Server**.
 - e After successful validation, click **Add**.
 - f Click **Next**.
 - g Select any template.
- 5 Click **Details > Properties**.
- 6 Click **Enroll**.
- 7 In the Subject tab, provide a fully qualified domain name (FQDN).
- 8 In the Private Key tab, select **Make private key exportable**.
- 9 Click **Apply > Enroll**.

After enrolling the client certificate, do the following to export the client certificate in PFX format.

- 1 Click **Certificate > All Tasks > Export**.
- 2 Click **Next > Yes, export the private key**.
- 3 Click **Next**.
- 4 Type the password provided by the client.

- 5 Click **Next**.
- 6 Specify the file name in the Certificate Export dialog box.
- 7 Click **Next > Finish**.

Configuring username-password authentication

Configuring CEP

The **Install-AdcsEnrollmentPolicyWebService** cmdlet configures the Certificate Enrollment Policy Web Service (CEP). It is also used to create other instances of the service within an existing installation.

- 1 Log in to the CEP server using CEPAdmin user name, and then launch PowerShell in administrative mode.
- 2 Run the command **Import-Module ServerManager**.
- 3 Run the command **Add-WindowsFeature Adcs-Enroll-Web-Pol**.
- 4 Run the command **Install-AdcsEnrollmentPolicyWebService -AuthenticationType UserName -SSLCertThumbprint "sslCertThumbPrint"**.
Note: Replace <sslCertThumbPrint> with the thumbprint of the SSL certificate created for the CEP server, after deleting the spaces between the thumbprint values.
- 5 Complete the installation by selecting either **Y** or **A**.
- 6 Launch the IIS Manager Console.
- 7 In the Connections pane, expand the web server that is hosting CEP.
- 8 Expand **Sites**, expand **Default Web Site**, and then click the appropriate installation virtual application name: **ADPolicyProvider_CEP_UsernamePassword**.
- 9 In the virtual application called **Home**, double-click the application settings, and then double click **FriendlyName**.
- 10 Type a name under **Value** and close the dialog.
- 11 Double-click **URI**, and then copy **Value**.

Notes:

- If you want to configure another authentication method on the same CEP server, then you must change the ID.
- This URL is used in MVE or any client application.

- 12 From the left pane, click **Application Pools**.
- 13 Select **WSEnrollmentPolicyServer**, and then from the right pane, click **Actions > Advanced Settings**.
- 14 Select the identity field under Process Model.
- 15 In the Application Pool Identity dialog box, select the custom account, and then type **CEPSvc**.
- 16 Close all dialog boxes, and then recycle IIS from the right pane of the IIS Manager Console.
- 17 From PowerShell, type **iisreset** to restart IIS.

Configuring CES

The **Install-AdcsEnrollmentWebService** cmdlet configures the Certificate Enrollment Web Service (CES). It is also used to create other instances of the service within an existing installation.

- 1 Log in to the CES server using **CESAdmin** as user name, and then launch PowerShell in administrative mode.
- 2 Run the command **Import-Module ServerManager**.
- 3 Run the command **Add-WindowsFeature Adcs-Enroll-Web-Svc**.
- 4 Run the command **Install-AdcsEnrollmentWebService -ApplicationPoolIdentity -CAConfig "CA1.contoso.com\contoso-CA1-CA" -SSLCertThumbprint "sslCertThumbPrint" -AuthenticationType UserName**.

Notes:

- Replace *<sslCertThumbprint>* with the thumbprint of the SSL certificate created for the CES server, after deleting the spaces between the thumbprint values.
 - Replace **CA1.contoso.com** with your CA computer name.
 - Replace **contoso-CA1-CA** with your CA common name.
 - If you have already configured one authentication method in the host, then remove **ApplicationPoolIdentity** from the command.
- 5 Complete the installation by selecting either **Y** or **A**.
 - 6 Launch the IIS Manager Console.
 - 7 In the Connections pane, expand the web server that is hosting CES.
 - 8 Expand **Sites**, expand **Default Web Site**, and then click the appropriate installation virtual application name: **contoso-CA1-CA_CES_UsernamePassword**.
 - 9 From the left pane, click **Application Pools**.
 - 10 Select **WSEnrollmentServer**, and then from the right pane, click **Actions > Advanced Settings** under Actions.
 - 11 Select the identity field under Process Model.
 - 12 In the Application Pool Identity dialog, select the custom account, and then type **CESsvc** as the domain user name.
 - 13 Close all dialogs, and then recycle IIS from the right pane of IIS Manager Console.
 - 14 From PowerShell, type **iisreset** to restart IIS.

Managing certificates using OpenXPki Certificate Authority through SCEP

This section provides instructions on how to configure OpenXPki CA version 2.5.x using Simple Certificate Enrollment Protocol (SCEP).

Notes:

- Make sure that you are using the Debian 8 Jessie operating system.
- For more information on OpenXPki, go to www.openxpki.org.

Configuring OpenXPki CA

Installing OpenXPki CA

- 1 Connect the machine using PuTTY or another client.
- 2 From the client, run the **sudo su -** command to go to the root user.
- 3 Enter the root password.
- 4 In **nano /etc/apt/sources.list**, change the source for installing the updates.
- 5 Update the file. For example:

```
#
# deb cdrom:[Debian GNU/Linux 8.11.1 _Jessie_ - Official amd64 CD Binary-1
20190211-02:10]/ jessie local main
# deb cdrom:[Debian GNU/Linux 8.11.1 _Jessie_ - Official amd64 CD Binary-1
20190211-02:10]/ jessie local main

deb http://security.debian.org/ jessie/updates main
deb-src http://security.debian.org/ jessie/updates main

# jessie-updates, previously known as 'volatile'
# A network mirror was not selected during install. The following entries
# are provided as examples, but you should amend them as appropriate
# for your mirror of choice.
#
deb http://ftp.debian.org/debian/jessie-updates main
deb-src http://ftp.debian.org/debian/jessie-updates main
deb http://ftp.us.debian.org/debian/jessie main
```
- 6 Save the file.
- 7 Run the following commands:
 - **apt-get update**
 - **apt-get upgrade**
- 8 Update the CA certificate lists in the server using **apt-get install ca-certificates**.
- 9 Install **en_US.utf8 locale** using **dpkg-reconfigure locales**.
- 10 Select the **en_US.UTF-8 UTF-8** locale, and then make it the default locale for the system.

Note: Use the Tab and spacebar keys for selecting and navigating the menu.

- 11 Check the locales that you have generated using **locale -a**.

Sample output

```
C
C.UTF-8
en_IN
en_IN.utf8
en_US.utf8
POSIX
```

- 12 Copy the fingerprint of the OpenXPki package using **nano /home/Release.key**. For this instance, copy the key in **/home**.
- 13 Type **9B156AD0 F0E6A6C7 86FABE7A D8363C4E 1611A2BE 2B251336 01D1CDB4 6C24BEF3** as the value.
- 14 Run the following command:
- ```
gpg --print-md sha256 /home/Release.key
```
- 15 Add the package using the **wget https://packages.openxpki.org/v2/debian/Release.key -O - | apt-key add -** command.
- 16 Add the repository to your source list (jessie) using **echo "deb http://packages.openxpki.org/v2/debian/jessie release" > /etc/apt/sources.list.d/openxpki.list**, and then **aptitude update**.
- 17 Install MySQL and Perl MySQL binding using **aptitude install mysql-server libdbd-mysql-perl**.
- 18 Install apache2.2-common using **aptitude install apache2.2-common**.
- 19 In **nano /etc/apt/sources.list**, install the fastcgi module to speed up the user interface.
- Note:** We recommend using **mod\_fcgid**.
- 20 Add the **deb http://http.us.debian.org/debian/jessie main** line in the file, and then save it.
- 21 Run the following commands:
- ```
apt-get update
aptitude install libapache2-mod-fcgid
```
- 22 Enable the fastcgi module using **a2enmod fcgid**.
- 23 Install the OpenXPki core package using **aptitude install libopenxpki-perl openxpki-cgi-session-driver openxpki-i18n**.
- 24 Restart the Apache® server using **service apache2 restart**.
- 25 Check whether the installation is successful using **openxpkiadm version**.
- Note:** If the installation is successful, then the system shows the version of the installed OpenXPki. For example, **Version (core): 2.5.5**.
- 26 Create the empty database, and then assign the database user using **mysql -u root -p**.

Notes:

- This command must be typed in the client. Otherwise, you cannot enter the password.
- Type the password for the MySQL. For this instance, **root** is the MySQL user.
- **openxpki** is the user on which OpenXPki is installed.

```
CREATE DATABASE openxpki CHARSET utf8;
CREATE USER 'openxpki'@'localhost' IDENTIFIED BY 'openxpki';
GRANT ALL ON openxpki.* TO 'openxpki'@'localhost';
flush privileges;
```

If the MySQL service is not running, then run **/etc/init.d/mysql start** to start the service.

27 Type **quit** to exit from MySQL.

28 Store the used credentials in **/etc/openxpki/config.d/system/database.yaml**.

Sample file content

```
debug: 0
type: MySQL
name: openxpki
host: localhost
port: 3306
user: openxpki
passwd: openxpki
```

Note: Change **user** and **passwd** to match the MySQL user name and password.

29 Save the file.

30 For empty database schema, run **zcat /usr/share/doc/libopenxpki-perl/examples/schema-mysql.sql.gz | \mysql -u root --password --database openxpki** from the provided schema file.

31 Enter the password for the database.

Configuring OpenXPki CA using default script

Note: The default script configures only the default realm, **ca-one**. The CDP and CRLs are not configured.

- 1** Unzip the sample script for installing the certificate using **gunzip -k /usr/share/doc/libopenxpki-perl/examples/sampleconfig.sh.gz**.
- 2** Run the script using **bash /usr/share/doc/libopenxpki-perl/examples/sampleconfig.sh**.
- 3** Confirm the setup using **openxpkiadm alias --realm ca-one**.

Sample output

```
=== functional token ===
scep (scep):
Alias      : scep-1
Identifier: YsBNZ7JYTbx89F_-Z4jn_RPFFWo
NotBefore  : 2015-01-30 20:44:40
NotAfter   : 2016-01-30 20:44:40

vault (datasafe):
Alias      : vault-1
Identifier: lZILS1l6Km5aIGS6pA7P7azAJic
NotBefore  : 2015-01-30 20:44:40
NotAfter   : 2016-01-30 20:44:40

ca-signer (certsign):
Alias      : ca-signer-1
Identifier: Sw_IY7AdoGUp28F_cFEhbtI9pE
NotBefore  : 2015-01-30 20:44:40
NotAfter   : 2018-01-29 20:44:40

=== root ca ===
```

```
current root ca:
Alias      : root-1
Identifier: fVrqJAlpotPaisOAsnxa9cglXCc
NotBefore : 2015-01-30 20:44:39
NotAfter  : 2020-01-30 20:44:39
```

```
upcoming root ca:
  not set
```

4 Check whether the installation is successful using **openxpkictl start**.

Sample output

```
Starting OpenXPKI...
OpenXPKI Server is running and accepting requests.
DONE.
```

5 Do the following to access the OpenXPKI server:

- a** From a web browser, type **http://ipaddress/openxpki/**.
- b** Log in as **Operator**. The default password is **openxpki**.

Note: The Operator login has two preconfigured operator accounts, **raop** and **raop2**.

6 Create one certificate request, and then test it.

Configuring OpenXPKI CA manually

Overview

Note: Before you begin, make sure that you have a basic knowledge on creating OpenSSL certificates.

To configure OpenXPKI CA manually, create the following:

- 1** Root CA certificate. For more information, see [“Creating a root CA certificate” on page 103](#).
- 2** CA signer certificate, signed by the root CA. For more information, see [“Creating a signer certificate” on page 103](#).
- 3** Data vault certificate, self-signed. For more information, see [“Creating a vault certificate” on page 104](#).
- 4** SCEP certificate, signed by the signer certificate.

Notes:

- When selecting the signature hash, use either SHA256 or SHA512.
- Changing the public key size is optional.

For this instance, we are using the **/etc/certs/openxpki_ca-one/** directory for certificate generation. However, you can use any directory.

Creating an OpenSSL configuration file

1 Run the following command:

```
nano /etc/certs/openxpki_ca-one/openssl.conf
```

Note: If your server is reachable using the fully qualified domain name (FQDN), then use the DNS of the server instead of its IP address.

Sample file

```

# x509_extensions          = v3_ca_extensions
# x509_extensions          = v3_issuing_extensions
# x509_extensions          = v3_datavault_extensions
# x509_extensions          = v3_scep_extensions
# x509_extensions          = v3_web_extensions
# x509_extensions          = v3_ca_reqexts # not for root self-signed, only for issuing
## x509_extensions         = v3_datavault_reqexts # not required self-signed
# x509_extensions          = v3_scep_reqexts
# x509_extensions          = v3_web_reqexts

[ req ]
default_bits               = 4096
distinguished_name         = req_distinguished_name

[ req_distinguished_name ]
domainComponent            = Domain Component
commonName                 = Common Name

[ v3_ca_reqexts ]
subjectKeyIdentifier       = hash
keyUsage                   = digitalSignature, keyCertSign, cRLSign

[ v3_datavault_reqexts ]
subjectKeyIdentifier       = hash
keyUsage                   = keyEncipherment
extendedKeyUsage           = emailProtection

[ v3_scep_reqexts ]
subjectKeyIdentifier       = hash

[ v3_web_reqexts ]
subjectKeyIdentifier       = hash
keyUsage                   = critical, digitalSignature, keyEncipherment
extendedKeyUsage           = serverAuth, clientAuth

[ v3_ca_extensions ]
subjectKeyIdentifier       = hash
keyUsage                   = digitalSignature, keyCertSign, cRLSign
basicConstraints           = critical,CA:TRUE
authorityKeyIdentifier     = keyid:always,issuer

[ v3_issuing_extensions ]
subjectKeyIdentifier       = hash
keyUsage                   = digitalSignature, keyCertSign, cRLSign
basicConstraints           = critical,CA:TRUE
authorityKeyIdentifier     = keyid:always,issuer:always
crlDistributionPoints       = URI:http://FQDN of the server/CertEnroll/MYOPENXPKI.crl
authorityInfoAccess         = caIssuers;URI:http://FQDN of the server/CertEnroll/MYOPENXPKI.crt

[ v3_datavault_extensions ]
subjectKeyIdentifier       = hash
keyUsage                   = keyEncipherment
extendedKeyUsage           = emailProtection
basicConstraints           = CA:FALSE
authorityKeyIdentifier     = keyid:always,issuer

[ v3_scep_extensions ]
subjectKeyIdentifier       = hash
basicConstraints           = CA:FALSE
authorityKeyIdentifier     = keyid,issuer

[ v3_web_extensions ]
subjectKeyIdentifier       = hash
keyUsage                   = critical, digitalSignature, keyEncipherment
extendedKeyUsage           = serverAuth, clientAuth
basicConstraints           = critical,CA:FALSE
subjectAltName             = DNS:stloopenxpki.lexmark.com
crlDistributionPoints       = URI:http://FQDN of the server/CertEnroll/MYOPENXPKI_ISSUINGCA.crl
authorityInfoAccess         = caIssuers;URI:http://FQDN of the
server/CertEnroll/MYOPENXPKI_ISSUINGCA.crt

```

- 2 Change the IP address and CA certificate name with your setup information.
- 3 Save the file.

Creating a password file for certificate keys

- 1 Run the following command:

```
nano /etc/certs/openxpki_ca-one/pd.pass
```
- 2 Type your password.
- 3 Save the file.

Creating a root CA certificate

Note: You can create a self-signed root CA certificate or generate a certificate request, and then get it signed by the root CA.

Run the following commands:

Note: Replace the key length, signature algorithm, and certificate name with the appropriate values.

- 1

```
openssl genrsa -out /etc/certs/openxpki_ca-one/ca-root-1.key -passout file:/etc/certs/openxpki_ca-one/pd.pass 4096
```
- 2

```
openssl req -new -key /etc/certs/openxpki_ca-one/ca-root-1.key -subj /DC=COM/DC=LEXMARK/DC=DEV/DC=CA-ONE/CN=MYOPENXPKI_ROOTCA -out /etc/certs/openxpki_ca-one/ca-root-1.csr
```
- 3

```
openssl req -config /etc/certs/openxpki_ca-one/openssl.conf -extensions v3_ca_extensions -x509 -days 3560 -in /etc/certs/openxpki_ca-one/ca-root-1.csr -key /etc/certs/openxpki_ca-one/ca-root-1.key -out /etc/certs/openxpki_ca-one/ca-root-1.crt -sha256
```

Creating a signer certificate

Note: Replace the key length, signature algorithm, and certificate name with the appropriate values.

- 1 Run the following command:

```
openssl genrsa -out /etc/certs/openxpki_ca-one/ca-signer-1.key -passout file:/etc/certs/openxpki_ca-one/pd.pass 4096
```
- 2 Change the subject in the request with your CA information using

```
openssl req -config /etc/certs/openxpki_ca-one/openssl.conf -reqexts v3_ca_reqexts -new -key /etc/certs/openxpki_ca-one/ca-signer-1.key -subj /DC=COM/DC=LEXMARK/DC=DEV/DC=CA-ONE/CN=MYOPENXPKI_ISSUINGCA -out /etc/certs/openxpki_ca-one/ca-signer-1.csr
```

.
- 3 Get the certificate signed by the root CA using

```
openssl x509 -req -extfile /etc/certs/openxpki_ca-one/openssl.conf -extensions v3_issuing_extensions -days 3650 -in /etc/certs/openxpki_ca-one/ca-signer-1.csr -CA /etc/certs/openxpki_ca-one/ca-root-1.crt -CAkey /etc/certs/openxpki_ca-one/ca-root-1.key -CAcreateserial -out /etc/certs/openxpki_ca-one/ca-signer-1.crt -sha256
```

.

Creating a vault certificate

Notes:

- The vault certificate is self-signed.
- Replace the key length, signature algorithm, and certificate name with the appropriate values.

1 Run the following command:

```
openssl genrsa -out /etc/certs/openxpki_ca-one/vault-1.key -passout
file:/etc/certs/openxpki_ca-one/pd.pass 4096
```

2 Change the subject in the request with your CA information using `openssl req -config /etc/certs/openxpki_ca-one/openssl.conf -reqexts v3_datavault_reqexts -new -key /etc/certs/openxpki_ca-one/vault-1.key -subj /DC=COM/DC=LEXMARK/DC=DEV/DC=CA-ONE/DC=STLOPENXPKI_INTERNAL/CN=MYOPENXPKI_DATAVAULT -out /etc/certs/openxpki_ca-one/vault-1.csr.`

3 Run the following command:

```
openssl req -config /etc/certs/openxpki_ca-one/openssl.conf -extensions
v3_datavault_extensions -x509 -days 3560 -in /etc/certs/openxpki_ca-
one/vault-1.csr -key /etc/certs/openxpki_ca-one/vault-1.key -
out /etc/certs/openxpki_ca-one/vault-1.crt
```

Creating an SCEP certificate

Note: The SCEP certificate is signed by the signer certificate.

Run the following commands:

Note: Replace the key length, signature algorithm, and certificate name with the appropriate values.

1 `openssl genrsa -out /etc/certs/openxpki_ca-one/scep-1.key -passout file:/etc/certs/openxpki_ca-one/pd.pass 4096`

2 `openssl req -config /etc/certs/openxpki_ca-one/openssl.conf -reqexts v3_scep_reqexts -new -key /etc/certs/openxpki_ca-one/scep-1.key -subj /DC=COM/DC=LEXMARK/DC=DEV/DC=CA-ONE/CN=MYOPENXPKI_SCEPCA -out /etc/certs/openxpki_ca-one/scep-1.csr`

3 `openssl x509 -req -extfile /etc/certs/openxpki_ca-one/openssl.conf -extensions v3_scep_extensions -days 900 -in /etc/certs/openxpki_ca-one/scep-1.csr -CA /etc/certs/openxpki_ca-one/ca-signer-1.crt -CAkey /etc/certs/openxpki_ca-one/ca-signer-1.key -CAcreateserial -out /etc/certs/openxpki_ca-one/scep-1.crt -sha256`

Copying the key file and creating a symlink

1 Copy the key files to `/etc/openxpki/ca/ca-one/`.

Note: The key files must be readable by OpenXPki.

```
cp /etc/certs/openxpki_ca-one/ca-signer-1.key /etc/openxpki/ca/ca-one/
```

```
cp /etc/certs/openxpki_ca-one/vault-1.key /etc/openxpki/ca/ca-one/
```



```
cp /etc/certs/openxpki_ca-one/scep-1.key /etc/openxpki/ca/ca-one/
```

2 Create the symlink.

Note: Symlinks are aliases used by the default configuration.

```
ln -s /etc/openxpki/ca/ca-one/ca-signer-1.key /etc/openxpki/ca/ca-one/ca-signer-1.pem
```

```
ln -s /etc/openxpki/ca/ca-one/scep-1.key /etc/openxpki/ca/ca-one/scep-1.pem
```

```
ln -s /etc/openxpki/ca/ca-one/vault-1.key /etc/openxpki/ca/ca-one/vault-1.pem
```

Importing certificates

Import the root certificate, signer certificate, vault certificate, and SCEP certificate into the database with the appropriate tokens.

Run the following commands:

```
1 openxpkiadm certificate import --file /etc/certs/openxpki_ca-one/ca-root-1.crt
```

```
2 openxpkiadm certificate import --file /etc/certs/openxpki_ca-one/ca-signer-1.crt --realm ca-one --token certsign
```

```
3 openxpkiadm certificate import --file /etc/certs/openxpki_ca-one/scep-1.crt --realm ca-one --token scep
```

```
4 openxpkiadm certificate import --file /etc/certs/openxpki_ca-one/vault-1.crt --realm ca-one --token datasafe
```

```
5 Check whether the import is successful using openxpkiadm alias --realm ca-one.
```

Sample output

```
=== functional token ===
scep (scep):
Alias      : scep-1
Identifier: YsBNZ7JYTbx89F_-Z4jn_RPFFWo
NotBefore  : 2015-01-30 20:44:40
NotAfter   : 2016-01-30 20:44:40
```

```
vault (datasafe):
Alias      : vault-1
Identifier: lZILS1l6Km5aIGS6pA7P7azAJic
NotBefore  : 2015-01-30 20:44:40
NotAfter   : 2016-01-30 20:44:40
```

```
ca-signer (certsign):
Alias      : ca-signer-1
Identifier: Sw_IY7AdoGUp28F_cFEhbtI9pE
NotBefore  : 2015-01-30 20:44:40
NotAfter   : 2018-01-29 20:44:40
```

```
=== root ca ===
current root ca:
Alias      : root-1
Identifier: fVrqJAlpotPais0Asnxa9cg1XCc
NotBefore  : 2015-01-30 20:44:39
NotAfter   : 2020-01-30 20:44:39
```

```
upcoming root ca:
not set
```

Starting OpenXPKI

- 1 Run the **openxpkictl start** command.

Sample output

```
Starting OpenXPKI...
OpenXPKI Server is running and accepting requests.
DONE.
```

- 2 Do the following to access the OpenXPKI server:
 - a From a web browser, type **http://ipaddress/openxpki/**.

Note: Instead of **ipaddress**, you can also use the FQDN of the server.
 - b Log in as **Operator**. The default password is **openxpki**.

Note: The Operator login has two preconfigured operator accounts, **raop** and **raop2**.
- 3 Create one certificate request, and then test it.

Generating CRL information

Note: If your server is reachable using the FQDN, then use the DNS of the server instead of its IP address.

- 1 Stop the OpenXPKI service using **Openxpkictl stop**.
- 2 In **nano /etc/openxpki/config.d/realm/ca-one/publishing.yaml**, update the **connectors: cdp** section to the following:

```
class: Connector::Builtin::File::Path
LOCATION: /var/www/openxpki/CertEnroll/
file: "[% ARGS.0 %].crl"
content: "[% pem %]"
```

- a In **nano /etc/openxpki/config.d/realm/ca-one/profile/default.yaml**, update the following:

- **crl_distribution_points:** section


```
critical: 0
uri:
  - http://FQDN of the server/CertEnroll/[% ISSUER.CN.0 %].crl
  - ldap://localhost/[% ISSUER.DN %]
```
- **authority_info_access:** section


```
critical: 0
ca_issuers: http://FQDN of the server/CertEnroll/MYOPENXPKI.crt
ocsp: http://ocsp.openxpki.org/
```

Change the IP address and CA certificate name according to your CA server.

- b In **nano /etc/openxpki/config.d/realm/ca-one/crl/default.yaml**, do the following:

- If necessary, update **nextupdate** and **renewal**.
- Add **ca_issuers** to the following section:


```
extensions:
  authority_info_access:
    critical: 0
    # ca_issuers and ocsp can be scalar or list
    ca_issuers: http://FQDN of the server/CertEnroll/MYOPENXPKI.crt
    #ocsp: http://ocsp.openxpki.org/
```

Change the IP address and CA certificate name according to your CA server.

- 3 Start the OpenXPKI service using **Openxpkictl start**.

Configuring CRL accessibility

- 1 Stop the Apache service using **service apache2 stop**.
- 2 Create a **CertEnroll** directory for **crl** in the **/var/www/openxpki/** directory.
- 3 Set **openxpki** as the owner of this directory, and then configure the permissions to let Apache read and execute, and other services to read only.

```
chown openxpki /var/www/openxpki/CertEnroll
chmod 755 /var/www/openxpki/CertEnroll
```

- 4 Add a reference to the Apache alias.conf file using **nano /etc/apache2/mods-enabled/alias.conf**.
- 5 After the **<Directory "/usr/share/apache2/icons">** section, add the following:

```
Alias /CertEnroll/ "/var/www/openxpki/CertEnroll/"
<Directory "/var/www/openxpki/CertEnroll">
    Options FollowSymLinks
    AllowOverride None
    Require all granted
</Directory>
```

- 6 Add a reference in the **apache2.conf** file using **nano /etc/apache2/apache2.conf**.
- 7 Add the following in the **Apache2 HTTPD server** section:

```
<Directory /var/www/openxpki/CertEnroll>
    Options FollowSymLinks
    AllowOverride None
    Allow from all
</Directory>
```

- 8 Start the Apache service using **service apache2 start**.

Enabling the SCEP service

- 1 Stop the OpenXPKI service using **openxpkictl stop**.
- 2 Install the **openca-tools** package using **aptitude install openca-tools**.
- 3 Start the OpenXPKI service using **openxpkictl start**.

Test the service using any client, such as **certnanny** with **SSCEP**.

Note: SSCEP is a command line client for SCEP. You can download SSCEP from <https://github.com/cernanny/sscep>.

Enabling the Signer on Behalf (enrollment agent) certificate

For automatic certificate requests, we are using the Signer on Behalf certificate feature of OpenXPki.

- 1 Stop the OpenXPki service using **openxpkictl stop**.
- 2 In **nano /etc/openxpki/config.d/realm/ca-one/scep/generic.yaml**, from the **authorized_signer:** section, add a rule for the subject name of the signer certificate.

```
rule1:
    # Full DN
    subject: CN=Markvision_.*
```

Notes:

- In this rule, any certificate CN starting with **Markvision_** is the Signer on Behalf certificate.
- The subject name is set in MVE for generating the Signer on Behalf certificate.
- Review the space and indention in the script file.
- If the CN is changed in MVE, then add the updated CN in OpenXPki.
- You can specify only one certificate as Signer on Behalf, and then specify the full CN.

- 3 Save the file.
- 4 Start the OpenXPki service using **openxpkictl start**.

Enabling automatic approval of certificate requests in OpenXPki CA

- 1 Stop the OpenXPki service using **openxpkictl stop**.
- 2 In **nano /etc/openxpki/config.d/realm/ca-one/scep/generic.yaml**, update the **eligible:** section:

Old content

```
eligible:
  initial:
    value@: connector:scep.generic.connector.initial
    args: "[% context.cert_subject_parts.CN.0 %]"
    expect:
      - Build
      - New
```

New content

```
eligible:
  initial:
    value: 1
    # value@: connector:scep.generic.connector.initial
    # args: "[% context.cert_subject_parts.CN.0 %]"
    # expect:
    #   - Build
    #   - New
```

Notes:

- Review the space and indention in the script file.
- To approve certificates manually, comment **value: 1**, and then uncomment the other lines that are previously commented.

- 3 Save the file.
- 4 Start the OpenXPki service using `openxpkictl start`.

Creating a second realm

In OpenXPki, you can configure multiple PKI structures in the same system. The following topics show how to create another realm for MVE named **ca-two**.

Copying and setting the directory

- 1 Copy the `/etc/openxpki/config.d/realm/ca-one` sample directory tree to a new directory (`cp -avr /etc/openxpki/config.d/realm/ca-one /etc/openxpki/config.d/realm/ca-two`) within the realm directory.
- 2 In `/etc/openxpki/config.d/system/realms.yaml`, update the following section:

Old content

```
# This is the list of realms in this PKI
# You only need to enable the realms which are visible on the server

ca-one:
  label: Verbose name of this realm
  baseurl: https://pki.example.com/openxpki/

#ca-two:
#   label: Verbose name of this realm
#   baseurl: https://pki.acme.org/openxpki/
```

New content

```
# This is the list of realms in this PKI
# You only need to enable the realms which are visible on the server

ca-one:
  label: CA-ONE
  baseurl: https://pki.example.com/openxpki/

ca-two:
  label: CA-TWO
  baseurl: https://pki.example.com/openxpki/
```

- 3 Save the file.

Creating certificates

The following instructions show how to generate the signer certificate, vault certificate, and SCEP certificate. The root CA signs the signer certificate, and then the signer certificate signs the SCEP certificate. The vault certificate is self-signed.

- 1 Generate, and then sign the certificates. For more information, see [“Configuring OpenXPki CA manually” on page 101](#).

Note: Change the certificate common name so that the user can easily distinguish between different certificates for different realms. You may change **DC=CA-ONE** to **DC=CA-TWO**. The certificate files are created in the `/etc/certs/openxpki_ca-two/` directory.

- 2 Copy the key files to `/etc/openxpki/ca/ca-two/`.

Note: The key files must be readable by OpenXPki.

```
cp /etc/certs/openxpki_ca-two/ca-signer-1.key /etc/openxpki/ca/ca-two/
cp /etc/certs/openxpki_ca-two/vault-1.key /etc/openxpki/ca/ca-two/
cp /etc/certs/openxpki_ca-two/scep-1.key /etc/openxpki/ca/ca-two/
```

3 Create the symlink. Also, create a symlink for the root CA certificate.

Note: Symlinks are aliases used by the default configuration.

```
ln -s /etc/openxpki/ca/ca-one/ca-root-1.crt /etc/openxpki/ca/ca-two/ca-root-1.crt
ln -s /etc/openxpki/ca/ca-two/ca-signer-1.key /etc/openxpki/ca/ca-two/ca-signer-1.pem
ln -s /etc/openxpki/ca/ca-two/scep-1.key /etc/openxpki/ca/ca-two/scep-1.pem
ln -s /etc/openxpki/ca/ca-two/vault-1.key /etc/openxpki/ca/ca-two/vault-1.pem
```

4 Import the signer certificate, vault certificate, and SCEP certificate into the database with the appropriate tokens for **ca-two**.

```
openxpkiadm certificate import --file /etc/certs/openxpki_ca-two/ca-signer-1.crt --realm ca-two --issuer /etc/openxpki/ca/ca-two/ca-one-1.crt --token certsign

openxpkiadm certificate import --file /etc/certs/openxpki_ca-two/scep-1.crt --realm ca-two --token scep

openxpkiadm certificate import --file /etc/certs/openxpki_ca-two/vault-1.crt --realm ca-two --token datasafe
```

5 Check whether the import is successful using **openxpkiadm alias --realm ca-two**.

Sample output

```
=== functional token ===
scep (scep):
Alias      : scep-1
Identifier: YsBNZ7JYTbx89F_-Z4jn_RPFFWo
NotBefore  : 2015-01-30 20:44:40
NotAfter   : 2016-01-30 20:44:40

vault (datasafe):
Alias      : vault-1
Identifier: lZILS1l6Km5aIGS6pA7P7azAJic
NotBefore  : 2015-01-30 20:44:40
NotAfter   : 2016-01-30 20:44:40

ca-signer (certsign):
Alias      : ca-signer-1
Identifier: Sw_IY7AdoGUp28F_cFEhbtI9pE
NotBefore  : 2015-01-30 20:44:40
NotAfter   : 2018-01-29 20:44:40

=== root ca ===
current root ca:
Alias      : root-1
Identifier: fVrqJAlpotPaisOAsnxa9cg1XCc
NotBefore  : 2015-01-30 20:44:39
NotAfter   : 2020-01-30 20:44:39

upcoming root ca:
not set
```

In this instance, the root CA information is the same for **ca-one** and **ca-two**.

6 If you changed the certificate key password during certificate creation, then update **nano /etc/openxpki/config.d/realm/ca-two/crypto.yaml**.

7 Generate the CRLs for this realm. For more information, see [“Generating CRL information” on page 106](#).

- 8 Publish the CRLs for this realm. For more information, see [“Configuring CRL accessibility” on page 107](#).
- 9 Restart the OpenXPki service using **openxpkictl restart**.

Sample output

```
Stopping OpenXPki
Stopping gracefully, 3 (sub)processes remaining...
DONE.
Starting OpenXPki...
OpenXPki Server is running and accepting requests.
DONE.
```

- 10 Do the following to access the OpenXPki server:
 - a From a web browser, type **http://ipaddress/openxpki/**.
 - b Log in as **Operator**. The default password is **openxpki**.

Note: The Operator login has two preconfigured operator accounts, **raop** and **raop2**.

Configuring SCEP endpoint for multiple realms

The default realm SCEP endpoint is **http://<ipaddress>/scep/scep**. If you have multiple realms, then configure a unique SCEP endpoint (different configuration file) for each realm. In the following instructions, we use two PKI realms, **ca-one** and **ca-two**.

- 1 Copy the default configuration file in **cp /etc/openxpki/scep/default.conf /etc/openxpki/scep/ca-one.conf**.
Note: Name the file as **ca-one.conf**.
- 2 In **nano /etc/openxpki/scep/ca-one.conf**, change the realm value to **realm=ca-one**.
- 3 Create another configuration file in **cp /etc/openxpki/scep/default.conf /etc/openxpki/scep/ca-two.conf**.
Note: Name the file as **ca-two.conf**.
- 4 In **nano /etc/openxpki/scep/ca-two.conf**, change the realm value to **realm=ca-two**.
- 5 Restart the OpenXPki service using **openxpkictl restart**.

The SCEP endpoints are the following:

- **ca-one**—**http://ipaddress/scep/ca-one**
- **ca-two**—**http://ipaddress/scep/ca-two**

If you want to differentiate between login credentials and default certificate templates for different PKI realms, then you may need advanced configuration.

Enabling multiple active certificates with same subject to be present at a time

By default, in OpenXPki only one certificate with the same subject name can be active at a time. But when you are enforcing multiple Named Certificates, multiple active certificates with the same subject name must be present at a time.

- 1 In **/etc/openxpki/config.d/realm/REALM NAME/scep/generic.yaml**, from the **policy** section, change the value of **max_active_certs** from **1** to **0**.

Notes:

- REALM NAME is the name of the realm. For example, **ca-one**.
- Review the space and indentation in the script file.

2 Restart the OpenXPKI service using **openxpkictl restart**.

Setting the default port number for OpenXPKI CA

By default, Apache listens in port number 80. Set the default port number for OpenXPKI CA to avoid conflicts.

1 In **/etc/apache2/ports.conf**, add or modify a port. For example, **Listen 8080**.

2 In **/etc/apache2/sites-enabled/000-default.conf**, add or modify the **VirtualHost** section to map new port. For example, **<VirtualHost *:8080>**.

3 Restart the Apache server using **systemctl restart apache2**.

To check the status, run **netstat -tlnp | grep apache**. The OpenXPKI SCEP URL is now **http://ipaddress:8080/scep/ca-one**, and the web URL is **http://ip address:8080/openxpki**.

Rejecting certificate requests without Challenge Password in OpenXPKI CA

By default, OpenXPKI accepts requests without checking the challenge password. The certificate request is not rejected, and the CA and CA administrator determine whether to approve or reject the request. To avoid potential security concerns, disable this feature so that any certificate requests that contain invalid passwords are rejected immediately. In MVE, Challenge Password is required only when generating the enrollment agent certificate.

1 In **etc/openxpki/config.d/realm/REALM NAME/scep/generic.yaml**, from the **policy** section, change the value of **allow_man_authn** from **1** to **0**.

Notes:

- REALM NAME is the name of the realm. For example, **ca-one**.
- Review the space and indentation in the script file.

2 Restart the OpenXPKI service using **openxpkictl restart**.

Adding client authentication EKU in certificates

1 In **/etc/openxpki/config.d/realm/REALM NAME/profile/I18N_OPENXPKI_PROFILE_TLS_SERVER.yaml**, from the **extended_key_usage:** section, change the value of **client_auth:** to **1**.

Notes:

- REALM NAME is the name of the realm. For example, **ca-one**.
- Review the space and indentation in the script file.

2 Restart the OpenXPKI service using **openxpkictl restart**.

Getting the full certificate subject when requesting through SCEP

By default, OpenXPKI reads only the CN of the subject of the requesting certificate. The rest of the information, such as country, locality, and DC, are hard-coded. For example, if a certificate subject is **C=US, ST=KY, L=Lexington, O=Lexmark, OU=ISS, CN=ET0021B7C34AEC.dhcp.dev.lexmark.com**, then after signing the certificate through SCEP, the subject is changed to **DC=Test Deployment, DC= OpenXPKI, CN=ET0021B7C34AEC.dhcp.dev.lexmark.com**.

Note: REALM NAME is the name of the realm. For example, **ca-one**.

- 1 In `/etc/openxпки/config.d/realm/REALM NAME/profile/I18N_OPENXPKI_PROFILE_TLS_SERVER.yaml`, from the **enroll** section, change the value of **dn** to the following:

```
CN=[% CN.0 %][% IF OU %][% FOREACH entry = OU %],OU=[% entry %][% END %][% END %][% IF O
%][% FOREACH entry = O %],O=[% entry %][% END %][% END %][% IF L %],L=[% L.0 %][% END %]
[% IF ST %],ST=[% ST.0 %][% END %][% IF C %],C=[% C.0 %][% END %][% IF DC %][% FOREACH
entry = DC %],DC=[% entry %][% END %][% END %][% IF EMAIL %][% FOREACH entry = EMAIL
%],EMAIL=[% entry %][% END %][% END %]
```

- 2 Save the file.
- 3 Create a file titled **l.yaml** in the `/etc/openxпки/config.d/realm/REALM NAME/profile/template` directory.
- 4 Add the following:

```
id: L
label: L
description: I18N_OPENXPKI_UI_PROFILE_L_DESC
preset: L
type: freetext
width: 60
placeholder: Kolkata
```

- 5 Save the file.
- 6 Create a file titled **st.yaml** in the `/etc/openxпки/config.d/realm/REALM NAME/profile/template` directory.
- 7 Add the following:

```
id: ST
label: ST
description: I18N_OPENXPKI_UI_PROFILE_ST_DESC
preset: ST
type: freetext
width: 60
placeholder: WB
```

- 8 Save the file.

Note: OpenXPKI must own both files and must be readable, writable, and executable.

- 9 Restart the OpenXPKI service using **openxpkictl restart**.

Revoking certificates and publishing CRL

- 1 Access the OpenXPKI server.
 - a From a web browser, type **http://ipaddress/openxпки/**.
 - b Log in as **Operator**. The default password is **openxпки**.

Note: The Operator login has two preconfigured operator accounts, **raop** and **raop2**.

- 2 Click **Workflow Search > Search now**.
- 3 Click a certificate to revoke, and then click the certificate link.

- 4 From the Action section, click **revocation request**.
- 5 Type the appropriate values, and then click **Continue > Submit request**.
- 6 On the next page, approve the request. The certificate revocation is waiting for the next CRL publish.
- 7 From the PKI Operation section, click **Issue a certificate revocation list (CRL)**.
- 8 Click **Enforce creation of revocation lists > Continue**.
- 9 From the PKI Operation section, click **Publish CA/CRL**.
- 10 Click **Workflow Search > Search now**.
- 11 Click the revoked certificate with a **certificate_revocation_request_v2** type.
- 12 Click **Force wake up**.

In the new CRL, you can find the serial number and the revocation reason of the revoked certificate.

Managing certificates using OpenXPki Certificate Authority through EST

This section helps user to configure OpenXPki CA version 3.x.x using EST protocol..

Notes:

- Make sure that you are using the Debian 10 Buster operating system.
- For more information on OpenXPki, go to www.openxpki.org.

Configuring OpenXPki CA

Installing OpenXPki CA

- 1 Connect the machine using PuTTY or another client.
- 2 From the client, run the **sudo su -** command to go to the root user.
- 3 Enter the root password.
- 4 In **nano /etc/apt/sources.list**, change the source for installing the updates.
- 5 Update the file. For example:

```
#
# deb cdrom:[Debian GNU/Linux testing _Buster_ - Official Snapshot amd64 DVD Binary-1
20190527-04:04]/ buster contrib main
# deb cdrom:[Debian GNU/Linux testing _Buster_ - Official Snapshot amd64 DVD Binary-1
20190527-04:04]/ buster contrib main

deb http://security.debian.org/debian-security buster/updates main contrib
deb-src http://security.debian.org/debian-security buster/updates main contrib

# buster-updates, previously known as 'volatile'
# A network mirror was not selected during install. The following entries
# are provided as examples, but you should amend them as appropriate
# for your mirror of choice.
#
deb http://ftp.debian.org/debian/ buster-updates main
```

```
deb-src http://ftp.debian.org/debian/ buster-updates main
deb http://ftp.us.debian.org/debian/ buster main
```

- 6 Save the file.
- 7 Run the following commands:
 - **apt-get update**
 - **apt-get upgrade**
- 8 Update the CA certificate lists in the server using **apt-get install ca-certificates**.
- 9 Install **en_US.utf8 locale** using **dpkg-reconfigure locales**.
- 10 Select the **en_US.UTF-8 UTF-8** locale, and then make it the default locale for the system.
Note: Use the Tab and spacebar keys for selecting and navigating the menu.
- 11 Check the locales that you have generated using **locale -a**.

Sample output

```
C
C.UTF-8
en_IN
en_IN.utf8
en_US.utf8
POSIX
```

- 12 Copy the fingerprint of the OpenXPki package using **nano /home/Release.key**. For this instance, copy the key in **/home**.
- 13 Type **55D89776 006F632B E0196E3E D2495509 BAFDDC74 22FEAAD2 F055074E 0FE3A724** as the value.
- 14 Run the following command:
gpg --print-md sha256 /home/Release.key
- 15 Add the package using the **wget https://packages.openxpki.org/v3/debian/Release.key -O - | apt-key add -** command.
- 16 Add the repository to your source list (buster) using **echo " deb http://packages.openxpki.org/v3/debian/ buster release"**
> **/etc/apt/sources.list.d/openxpki.list**, and then **apt update**.
- 17 Install MySQL and Perl MySQL binding using **apt install mariadb-server libdbd-mariadb-perl**.
- 18 Install apache2.2-common using **apt install apache2**.
- 19 In **nano /etc/apt/sources.list**, install the fastcgi module to speed up the user interface.
Note: We recommend using **mod_fcgid**.
- 20 Add the **deb http://http.us.debian.org/debian/ buster main** line in the file, and then save it.
- 21 Run the following commands:
apt-get update
apt install libapache2-mod-fcgid
- 22 Enable the fastcgi module using **a2enmod fcgid**.

23 Install the OpenXPki core package using **apt install libopenxpki-perl openxpki-cgi-session-driver openxpki-i18n**.

24 Restart the Apache server using **service apache2 restart**.

25 Check whether the installation is successful using **openxpkiadm version**.

Note: If the installation is successful, then the system shows the version of the installed OpenXPki. For example, **Version (core): 3.18.2**.

26 Create the empty database, and then assign the database user using **mariadb -u root -p**.

Notes:

- This command must be typed in the client. Otherwise, you cannot enter the password.
- Type the password for the MySQL. For this instance, **root** is the MySQL user.
- **openxpki** is the user on which OpenXPki is installed.

```
CREATE DATABASE openxpki CHARSET utf8;
CREATE USER 'openxpki'@'localhost' IDENTIFIED BY 'openxpki';
GRANT ALL ON openxpki.* TO 'openxpki'@'localhost';
flush privileges;
```

If the MySQL service is not running, then run **/etc/init.d/mysql start** to start the service.

27 Type **quit** to exit from MySQL.

28 Store the used credentials in **/etc/openxpki/config.d/system/database.yaml**.

Sample file content

```
main:
debug: 0
type: MariaDB
name: openxpki
host: localhost
port: 3306
user: openxpki
passwd: openxpki
```

Note: Change **user** and **passwd** to match the MariaDB user name and password.

29 Save the file.

30 For empty database schema, run **zcat /usr/share/doc/libopenxpki-perl/examples/schema-mariadb.sql.gz | \ mysql -u root --password --database openxpki** from the provided schema file.

31 Type the password for the database.

Configuring OpenXPki CA using the default script

Note: The default script configures only the default realm, **ca-one**. The CDP and CRLs are not configured.

- 1 Run the script using **bash /usr/share/doc/libopenxpki-perl/examples/sampleconfig.sh**.
- 2 Confirm the setup using **openxpkiadm alias --realm democa**.

Sample output

```
=== functional token ===
scep (scep):
Alias      : scep-1
Identifier: YsBNZ7JYTbx89F_-Z4jn_RPFFWo
NotBefore  : 2015-01-30 20:44:40
NotAfter   : 2016-01-30 20:44:40

vault (datasafe):
Alias      : vault-1
Identifier: lZILS1l6Km5aIGS6pA7P7azAJic
NotBefore  : 2015-01-30 20:44:40
NotAfter   : 2016-01-30 20:44:40

ca-signer (certsign):
Alias      : ca-signer-1
Identifier: Sw_IY7AdoGUp28F_cFEhbtI9pE
NotBefore  : 2015-01-30 20:44:40
NotAfter   : 2018-01-29 20:44:40

=== root ca ===
current root ca:
Alias      : root-1
Identifier: fVrqJAlpotPaisOAsnxa9cg1XCc
NotBefore  : 2015-01-30 20:44:39
NotAfter   : 2020-01-30 20:44:39

upcoming root ca:
  not set
```

- 3 Check whether the installation is successful using **openxpkictl start**.

Sample output

```
Starting OpenXPki...
OpenXPki Server is running and accepting requests.
DONE.
```

- 4 Do the following to access the OpenXPki server:
 - a From a web browser, type **http://ipaddress/openxpki/**.
 - b Add the user name and their corresponding passwords in a **userdb.yaml** file. To add the user name and the password, do the following:
 - Check out to **/home/pkiadm**, and then **nano userdb.yaml**.
 - Paste the following:

```
estRA:
  digest: "{ssh256}somePassword"
  role: RA Operator
```

Note: In this instance, estRA refers to the user name. To generate the password, type **openxpkiadm hashpwd**. When a message asking for the password and a ssh256 encrypted password appears, copy and paste it to the digest of any user.

Note: The available roles in the Operator login are RA Operator, CA Operator, and user.

- 5 Enter the user name and password.
- 6 Create one certificate request, and then test it.

Configuring OpenXPki CA manually

Overview

Note: Before you begin, make sure that you have a basic knowledge on creating OpenSSL certificates.

To configure OpenXPki CA manually, create the following:

- 1 Root CA certificate. For more information, see [“Creating a root CA certificate” on page 103](#).
- 2 CA signer certificate, signed by the root CA. For more information, see [“Creating a signer certificate” on page 103](#).
- 3 Data vault certificate, self-signed. For more information, see [“Creating a vault certificate” on page 104](#).
- 4 Web certificate, signed by the signer certificate. For more information, see [“Setting up the webserver” on page 121](#).

Notes:

- When selecting the signature hash, use either SHA256 or SHA512.
- Changing the public key size is optional.

For version 3.10 or later, you can manage the keys directly using the `openxpkiadm` alias command:

- Run `mkdir -p /etc/openxpki/local/keys` to create the directory. The default location of the directory is `/etc/openxpki/local/keys`.
- Run `openxpkictl start` to start the server.

For this instance, we are using the `/etc/certs/openxpki_democa/` directory for certificate generation. However, you can use any directory.

Creating an OpenSSL configuration file

The OpenSSL configuration file contains X.509 extensions for generating and signing certificate requests.

- 1 Run the following command:

```
nano /etc/certs/openxpki_democa/openssl.conf
```

Note: If your server is reachable using the fully qualified domain name (FQDN), then use the DNS of the server instead of its IP address.

Sample file

```
# x509_extensions          = v3_ca_extensions
# x509_extensions          = v3_issuing_extensions
# x509_extensions          = v3_datavault_extensions
# x509_extensions          = v3_scep_extensions
# x509_extensions          = v3_web_extensions
# x509_extensions          = v3_ca_reqexts # not for root self-signed, only for issuing
## x509_extensions         = v3_datavault_reqexts # not required self-signed
# x509_extensions          = v3_scep_reqexts
# x509_extensions          = v3_web_reqexts

[ req ]
default_bits               = 4096
```

```

distinguished_name      = req_distinguished_name

[ req_distinguished_name ]
domainComponent         = Domain Component
commonName              = Common Name

[ v3_ca_reqexts ]
subjectKeyIdentifier    = hash
keyUsage                = digitalSignature, keyCertSign, cRLSign

[ v3_datavault_reqexts ]
subjectKeyIdentifier    = hash
keyUsage                = keyEncipherment
extendedKeyUsage        = emailProtection

[ v3_scep_reqexts ]
subjectKeyIdentifier    = hash

[ v3_web_reqexts ]
subjectKeyIdentifier    = hash
keyUsage                = critical, digitalSignature, keyEncipherment
extendedKeyUsage        = serverAuth, clientAuth

[ v3_ca_extensions ]
subjectKeyIdentifier    = hash
keyUsage                = digitalSignature, keyCertSign, cRLSign
basicConstraints        = critical,CA:TRUE
authorityKeyIdentifier  = keyid:always,issuer

[ v3_issuing_extensions ]
subjectKeyIdentifier    = hash
keyUsage                = digitalSignature, keyCertSign, cRLSign
basicConstraints        = critical,CA:TRUE
authorityKeyIdentifier  = keyid:always,issuer:always
crlDistributionPoints   = URI:https://FQDN of your system/openxpki/CertEnroll/MYOPENXPki.crl
authorityInfoAccess     = caIssuers;URI:https://FQDN of your system/download/MYOPENXPki.crt

[ v3_datavault_extensions ]
subjectKeyIdentifier    = hash
keyUsage                = keyEncipherment
extendedKeyUsage        = emailProtection
basicConstraints        = CA:FALSE
authorityKeyIdentifier  = keyid:always,issuer

[ v3_scep_extensions ]
subjectKeyIdentifier    = hash
basicConstraints        = CA:FALSE
authorityKeyIdentifier  = keyid,issuer

[ v3_web_extensions ]
subjectKeyIdentifier    = hash
keyUsage                = critical, digitalSignature, keyEncipherment
extendedKeyUsage        = serverAuth, clientAuth
basicConstraints        = critical,CA:FALSE
subjectAltName          = DNS:FQDN of est server
crlDistributionPoints   = URI:https://FQDN of your
system/openxpki/CertEnroll/MYOPENXPki_ISSUINGCA.cr
authorityInfoAccess     = caIssuers;URI:https://FQDN of your
system/download/MYOPENXPki_ISSUINGCA.crt

```

2 Replace the IP address and CA certificate name with your setup information.

3 Save the file.

Creating a password file for certificate keys

1 Run the following command:

```
nano /etc/certs/openxpki_democa/pd.pass
```

2 Type your password.

- 3 Save the file.

Creating a root CA certificate

You can create a self-signed root CA certificate, or generate a certificate request and then get it signed by the root CA.

Note: Replace the key length, signature algorithm, and certificate name with the appropriate values.

- 1 Run the following command:

```
openssl genrsa -out /etc/certs/openxpki_democa/ca-root-1.key -passout  
file:/etc/certs/openxpki_democa/pd.pass 4096
```

- 2 Replace the subject in the request with your CA information using `openssl req -new -key /etc/certs/openxpki_democa/ca-root-1.key -out /etc/certs/openxpki_democa/ca-root-1.csr`.
- 3 Get the certificate signed by the root CA using `openssl req -config /etc/certs/openxpki_democa/openssl.conf -extensions v3_ca_extensions -x509 -days 3560 -in /etc/certs/openxpki_democa/ca-root-1.csr -key /etc/certs/openxpki_democa/ca-root-1.key -out /etc/certs/openxpki_democa/ca-root-1.crt -sha256`.
- 4 Go to `/etc/certs/openxpki_democa/` where `ca-root-1.crt` is saved.
- 5 Run the following command:

```
openxpkiadm certificate import --file ca-root-1.crt
```

Creating a signer CA certificate

Note: Replace the key length, signature algorithm, and certificate name with the appropriate values.

- 1 Run the following command:

```
openssl genrsa -out /etc/certs/openxpki_democa/ca-signer-1.key -passout  
file:/etc/certs/openxpki_democa/pd.pass 4096
```

- 2 Replace the subject in the request with your CA information using `openssl req -config /etc/certs/openxpki_democa/openssl.conf -reqexts v3_ca_reqexts -new -key /etc/certs/openxpki_democa/ca-signer-1.key -subj /DC=COM/DC=LEXMARK/DC=DEV/DC=CA-ONE/CN=MYOPENXPKI_ISSUINGCA -out /etc/certs/openxpki_democa/ca-signer-1.csr`.
- 3 Get the certificate signed by the root CA using `openssl x509 -req -extfile /etc/certs/openxpki_democa/openssl.conf -extensions v3_issuing_extensions -days 3650 -in /etc/certs/openxpki_democa/ca-signer-1.csr -CA /etc/certs/openxpki_democa/ca-root-1.crt -CAkey /etc/certs/openxpki_democa/ca-root-1.key -CAcreateserial -out /etc/certs/openxpki_democa/ca-signer-1.crt -sha256`.
- 4 Run the following command:

```
openxpkiadm alias --realm democa --token certsign --file ca-signer-1.crt --  
key ca-signer-1.key
```


Creating a vault certificate

Notes:

- The vault certificate is self-signed.
- Replace the key length, signature algorithm, and certificate name with the appropriate values.

1 Run the following command:

```
openssl req -new -x509 -keyout vault.key -out vault.crt -days 1100 -
config /etc/certs/openxpki_democa/openssl.conf
```

2 Change the subject in the request with your CA information using **openxpkiadm certificate import --file vault.crt**.

3 Run the following command:

```
openxpkiadm alias --realm democa --token datasafe --file vault.crt --key
vault.key
```

Note: Provide the necessary values, but keep **/CN=DataVault** as the subject.

Creating a web certificate

1 Run the following command:

```
openssl genrsa -out /etc/certs/openxpki_democa/web-1.key -passout
file:/etc/certs/openxpki_democa/pd.pass 4096
```

2 Replace the subject in the request with your CA information using **openssl req -config /etc/certs/openxpki_democa/openssl.conf -reqexts v3_web_reqexts -new -key /etc/certs/openxpki_democa/web-1.key -subj /DC=COM/DC=LEXMARK/DC=DEV/DC=CA-ONE/CN=FQDN of your system -out /etc/certs/openxpki_democa/web-1.csr**.

3 Run the following command:

```
openssl x509 -req -extfile /etc/certs/openxpki_democa/openssl.conf -
extensions v3_web_extensions -days 900 -
in /etc/certs/openxpki_democa/web-1.csr -CA /etc/certs/openxpki_democa/ca-
signer-1.crt -CAkey /etc/certs/openxpki_democa/ca-signer-1.key -
CAcreateserial -out /etc/certs/openxpki_democa/web-1.crt -sha256
```

Setting up the webserver

1 Run the following commands:

```
a2enmod ssl rewrite headers
a2ensite openxpki
a2dissite 000-default default-ssl
mkdir -m755 -p /etc/openxpki/tls/chain
cp /etc/certs/openxpki_democa/ca-root-1.crt /etc/openxpki/tls/chain/
cp /etc/certs/openxpki_democa/ca-signer-1.crt /etc/openxpki/tls/chain/
c_rehash /etc/openxpki/tls/chain/
mkdir -m755 -p /etc/openxpki/tls/endentity
mkdir -m700 -p /etc/openxpki/tls/private
```

```

cp /etc/certs/openxpki_democa/web-1.crt /etc/openxpki/tls/ententity/openxpki.crt
cat /etc/certs/openxpki_democa/ca-signer-1.crt
>> /etc/openxpki/tls/ententity/openxpki.crt
openssl rsa -in /etc/certs/openxpki_democa/web-1.key -passin
file:/etc/certs/openxpki_democa/pd.pass -
out /etc/openxpki/tls/private/openxpki.pem
chmod 400 /etc/openxpki/tls/private/openxpki.pem

```

2 Restart the Apache service using **apache2 restart**.

3 Run the following command to check the successful import of the files:

```
openxpkiadm alias --realm democa
```

Sample output

```

=== functional token ===
ca-signer (certsign):
  Alias      : ca-signer-2
  Identifier: XjC6MPbsnyfLZkI9Poi9vm4Z5rk
  NotBefore  : 2022-04-06 10:03:01
  NotAfter   : 2032-04-03 10:03:01

vault (datasafe):
  Alias      : vault-2
  Identifier: G8ekluAsskGVC0N-jZhB2n9kvdm
  NotBefore  : 2022-04-06 09:53:57
  NotAfter   : 2025-04-10 09:53:57

scep (scep):
  not set

ratoken (cmcra):
  not set

=== root ca ===
current root ca:
  Alias      : root-2
  Identifier: prTHU5vCfcJuCnQWyb5wUknvXQM
  NotBefore  : 2022-04-06 09:40:27
  NotAfter   : 2032-01-04 09:40:27

```

Making the certificate key password available to OpenXPki

1 Change the value in the **nano /etc/openxpki/config.d/system/crypto.yaml** file.

2 Uncomment the cache: **daemon** under **secret: default**:

```

secret:
  default:
    label: Global Secret group
    export: 0
    method: literal
    value: root
    cache: daemon

```

Starting OpenXPki

- 1 Run the **openxpkictl start** command.

Sample output

```
Starting OpenXPki...
OpenXPki Server is running and accepting requests.
DONE.
```

- 2 Access the OpenXPki server:

- a From a web browser, type **http://ipaddress/openxpki/**.
- b Add the user names and corresponding passwords in a **userdb.yaml** file:
 - Check out to **/home/pkiadm** and then to **nano userdb.yaml**.
 - Paste the following:

```
estRA:
  digest: "{sha256}somePassword"
  role: RA Operator
```

Note: Here estRA refers to the user name.

- To generate the password, type **openxpkiadm hashpwd**. A message showing the password and an sha256 encrypted password appears.
- Copy the password, and then paste it in the digest of any user.

Note: The Operator login has two preconfigured available roles: RA Operator, CA Operator, and user.

- 3 Type the user name and password.
- 4 Create one certificate request, and then test it.

Generating CRL information

Note: If your server is reachable using the FQDN, then use the DNS of the server instead of its IP address.

- 1 Stop the OpenXPki service using **openxpkictl stop**.
- 2 In **nano /etc/openxpki/config.d/realm/democa/publishing.yaml**, update the **connectors: cdp** section to the following:

```
class: Connector::Builtin::File::Path
LOCATION: /var/www/openxpki/CertEnroll/
file: "[% ARGS.0 %].crl"
content: "[% pem %]"
```

- a In **nano /etc/openxpki/config.d/realm/democa/profile/default.yaml**, update the following:

- **crl_distribution_points:** section


```
critical: 0
uri:
  - https://FQDN of the est/openxpki/CertEnroll/[% ISSUER.CN.0 %].crl
  - ldap://localhost/[% ISSUER.DN %]
```
- **authority_info_access:** section


```
critical: 0
ca_issuers: http://FQDN of the est/download/MYOPENXPki.crt
ocsp: http://ocsp.openxpki.org/
```

Change the IP address and CA certificate name according to your CA server.

Note: The `authority_info_access` (AIA) path is saved in the Download folder, but you can set the location according to your preference.

b In `nano /etc/openxpki/config.d/realm/democa/crl/default.yaml`, do the following:

- If necessary, update **nextupdate** and **renewal**.
- Add **ca_issuers** to the following section:

```
extensions:
  authority_info_access:
    critical: 0
    # ca_issuers and ocsp can be scalar or list
    ca_issuers: https://FQDN of the est/download/MYOPENXPki.crt
    #ocsp: http://ocsp.openxpki.org/
```

Change the IP address and CA certificate name according to your CA server.

3 Start the OpenXPki service using **openxpkictl start**.

Publishing CRL information

After creating the CRLs, you must publish them to be accessed by all.

1 Stop the Apache service using **service apache2 stop**.

2 Create a **CertEnroll** directory for the CRL in the `/var/www/openxpki/` directory.

3 Set **openxpki** as the owner of this directory, and then configure the permissions to let Apache read and execute, and other services to read only.

```
chown openxpki /var/www/openxpki/CertEnroll
```

```
chmod 755 /var/www/openxpki/CertEnroll
```

4 Add a reference to the Apache `alias.conf` file using **nano /etc/apache2/mods-enabled/alias.conf**.

5 After the `<Directory "/usr/share/apache2/icons">` section, add the following:

```
Alias /CertEnroll/ "/var/www/openxpki/CertEnroll/"
<Directory "/var/www/openxpki/CertEnroll">
  Options FollowSymLinks
  AllowOverride None
  Require all granted
</Directory>
```

6 Add a reference in the `apache2.conf` file using **nano /etc/apache2/apache2.conf**.

7 Add the following in the **Apache2 HTTPD server** section:

```
<Directory /var/www/openxpki/CertEnroll>
  Options FollowSymLinks
  AllowOverride None
  Allow from all
</Directory>
```

8 Start the Apache service using **service apache2 start**.

Enabling automatic approval of certificate requests in OpenXPki CA

- 1 Stop the OpenXPki service using `openxpkictl stop`.
- 2 In `/etc/openxpki/config.d/realm/democa/est/default.yaml`, update the **eligible:** section:

Old content

```
eligible:
  initial:
    value@: connector:scep.generic.connector.initial
    args: "[% context.cert_subject_parts.CN.0 %]"
    expect:
      - Build
      - New
```

New content

```
eligible:
  initial:
    value: 1
    # value@: connector:scep.generic.connector.initial
    # args: "[% context.cert_subject_parts.CN.0 %]"
    # expect:
    #   - Build
    #   - New
```

Notes:

- Review the space and indention in the script file.
- To approve certificates manually, comment **value: 1**, and then uncomment the other lines that are previously commented.

- 3 Save the file.
- 4 Start the OpenXPki service using `openxpkictl start`.

Changing details to enable ca-certs download

- 1 Run the following command:
`nano /usr/lib/cgi-bin/est.fcgi`
- 2 Replace `my $mime = "application/pkcs7-mime; smime-type=certs-only";` with `my $mime = "application/pkcs7-mime";`.
- 3 Start the OpenXPki service using `openxpkictl`.

Creating a second realm

In OpenXPki, you can configure multiple PKI structures in the same system. The following topics show how to create another realm for MVE named **democa-two**.

Copying and setting the directory

- 1 Create a directory, namely **democa2**, for the second realm inside `/etc/openxpki/config.d/realm`.
- 2 Copy the `/etc/openxpki/config.d/realm/ca-one` sample directory tree to a new directory (`cp -r /etc/openxpki/config.d/realm.tpl/* /etc/openxpki/config.d/realm/democa2`) within the realm directory.

3 In `/etc/openxpki/config.d/system/realms.yaml`, update the following section:

Old content

```
# This is the list of realms in this PKI
# You only need to enable the realms which are visible on the server

democa:
  label: Verbose name of this realm
  baseurl: https://pki.example.com/openxpki/

#democa2:
#   label: Verbose name of this realm
#   baseurl: https://pki.acme.org/openxpki/
```

New content

```
# This is the list of realms in this PKI
# You only need to enable the realms which are visible on the server

democa:
  label: Example.org Demo CA
  baseurl: https://pki.example.com/openxpki/

democa2:
  label: Example.org Demo CA2
  baseurl: https://pki.example.com/openxpki/
```

4 Save the file.

Configuring EST endpoint for multiple realms

You can configure the EST endpoint with a tuple composed of the authority portion of the URI and the optional label (for example, `www.example.com:80` and `arbitraryLabel1`). In the following instructions, we use two PKI realms, **democa** and **democa2**.

1 Copy the default configuration file in `cp /etc/openxpki/est/default.conf /etc/openxpki/est/democa.conf`.

Note: Name the file as **democa.conf**.

2 In `nano /etc/openxpki/est/democa.conf`, change the realm value to **realm=democa**.

Note: According to your needs, you may need to uncomment the corresponding lines for the **simpleenroll**, **simplereenroll**, **csrattrs**, and **cacerts** sections. Keep the environment sections commented. Do the same for **default.conf**.

3 Create another configuration file in `cp /etc/openxpki/est/default.conf /etc/openxpki/est/democa2.conf`.

Note: Name the file as **democa2.conf**.

4 In `nano /etc/openxpki/est/democa2.conf`, change the realm value to **realm=democa2**.

Note: According to your needs, you may need to uncomment the corresponding lines for the **simpleenroll**, **simplereenroll**, **csrattrs**, and **cacerts** sections. Keep the environment sections commented.

5 Copy the **default.yaml** file in the following locations:

- `cp /etc/openxpki/config.d/realm/democa/est/default.yaml`
- `/etc/openxpki/config.d/realm/democa/est/democa.yaml`

Note: Name the file as **democa.yaml**.

6 Copy the **default.yaml** file in the following locations:

- **cp /etc/openxpkc/config.d/realm/democa2/est/default.yaml**
- **/etc/openxpkc/config.d/realm/democa2/est/democa2.yaml**

Note: Name the file as **democa2.yaml**.

7 Restart the OpenXPKI service using **openxpkictl restart**.

Select the following URLs to open the EST server corresponding to a realm via a web browser:

- **democa**—**http://ipaddress/est/democa**
- **democa2**—**http://ipaddress/est/democa2**

If you want to differentiate between login credentials and default certificate templates for different PKI realms, then you may need advanced configuration.

Creating a signer certificate

The following instructions show how to generate a signer certificate in the second realm. You can use the same root and vault certificates as those in the first realm.

1 Create an OpenSSL configuration file in **nano /etc/certs/openxpkc_democa2/openssl.conf**.

Note: Change the certificate common name so that the user can easily distinguish between different certificates for different realms. The certificate files are created in the **/etc/certs/openxpkc_democa2/** directory.

2 Go to the directory of the vault certificate in the first realm, and then import the certificate from the first realm.

3 Run the following code:

```
openxpkiadm alias --realm democa2 --token datasafe --file vault.crt
```

Creating a password file for certificate keys

1 Run the following command:

```
nano /etc/certs/openxpkc_democa2/pd.pass
```

2 Type your password.

3 Create a signer certificate. For more information, see [“Creating a signer certificate” on page 103](#).

4 Check whether the import is successful using **openxpkiadm alias --realm democa2**.

Note: If you changed the key password of the certificate during certificate creation, update **nano /etc/openxpkc/config.d/realm/democa2/crypto.yaml**.

5 Generate the CRLs for the second realm. For more information, see [“Generating CRL information” on page 106](#).

Note: Make sure that you use the correct CA certificate name according to the realm.

6 Publish the CRLs for this realm. For more information, see [“Publishing CRL information” on page 124](#).

7 Restart the OpenXPKI service using **openxpkictl restart**.

Sample output

```
Stopping OpenXPKI
Stopping gracefully, 3 (sub)processes remaining...
```

```
DONE.
Starting OpenXPKI...
OpenXPKI Server is running and accepting requests.
DONE.
```

Enabling multiple active certificates with the same subject to be present at a time

By default, in OpenXPKI only one certificate with the same subject name can be active at a time. But when you are enforcing multiple Named Certificates, multiple active certificates with the same subject name must be present at a time.

- 1 In `/etc/openxпки/config.d/realm/REALM NAME/est/< REALM NAME >.yaml`, from the **policy** section, change the value of **max_active_certs** from **1** to **0**.

Notes:

- REALM NAME is the name of the realm. For example, **ca-one**.
- Review the space and indentation in the script file.

- 2 Restart the OpenXPKI service using **openxpkictl restart**.

Setting the default port number for OpenXPKI CA

By default, Apache listens in port number 443 for https. Set the default port number for OpenXPKI CA to avoid conflicts.

- 1 In `/etc/apache2/ports.conf`, modify the 443 port to any other port. For example:

Old content

```
Listen 80

<IfModule ssl_module>
    Listen 443
</IfModule>

<IfModule mod_gnutls.c>
    Listen 443
</IfModule>
```

New content

```
Listen 80

<IfModule ssl_module>
    Listen 9443
</IfModule>

<IfModule mod_gnutls.c>
    Listen 9443
</IfModule>
```

- 2 In `/etc/apache2/sites-available/openxpki.conf`, add or modify the **VirtualHost** section to map a new port. For example, **<VirtualHost *:443>** to **<VirtualHost *:9443>**.
- 3 In `/etc/apache2/sites-available/default-ssl.conf`, add or modify the **VirtualHost_default** section to map a new port. For example, change **<VirtualHost *:443>** to **<VirtualHost *:9443>**.

- 4 Restart the Apache server using **systemctl restart apache2**.

Note: If it asks for the **SSL/TLS** passphrase, then type the password while adding the TLS web server certificate in the EST server.

- 5 In **tinddopenxpkweb01.dhcp.dev.lexmark.com:9443 (RSA)**, enter the passphrase for the **SSL/TLS** keys.

To check the status, run **netstat -tlnp | grep apache**. The OpenXPki SCEP URL is now **https://ipaddress**, and the web URL is **FQDN:9443/openxpk**.

Enabling basic authentication

- 1 Run the following command:

```
apt -y install apache2-utils
```

- 2 Create a user account that has access to the server. Enter the following details:

```
htpasswd -c /etc/apache2/.htpasswd <username>
New password:
Re-type new password:
Adding password for user <username>
```

- 3 Go to directory **cd /etc/apache2/sites-enabled/**.

- 4 In **nano openxpk.conf**, add the following lines in **<VirtualHost *: 443 block>**:

```
#HTTPS BASIC AUTH FOR LABELS
Location /.well-known/est/*/simpleenroll
    AuthType Basic
    AuthName "estrealm"
    AuthUserFile /etc/apache2/.htpasswd
    require valid-user
</Location>
#HTTPS BASIC AUTH FOR NO LABEL
<Location /.well-known/est/simpleenroll>
    AuthType Basic
    AuthName "estrealm"
    AuthUserFile /etc/apache2/.htpasswd
    require valid-user
</Location>
```

- 5 Add **ErrorDocument 401 %{unescape:%00}** before **SSLEngine** in the same virtual Host block.

Example

```
ServerAlias *
DocumentRoot /var/www/
ErrorDocument 401 %{unescape:%00}
SSLEngine On
```

- 6 Restart the **apache2 service** using **service apache2 restart**.

Note: Basic authentication works using the above user name and password.

Enabling Client Certificate Authentication

- 1 Go to the following directory: **cd /etc/apache2/sites-enabled/**.

- 2 For the required host in **nano openxpk.conf**, add **SSLVerifyClient require**.

For example, if you are using port 443, modify the **VirtualHost** section to:

```
<VirtualHost *:443>
SSLVerifyClient require
</VirtualHost>
```

- 3 Remove the **SSLVerifyClient optional_no_ca** command.
- 4 Save the file, and then type **quit** to exit from MySQL.
- 5 Go to the following directory: **cd /etc/openxpki/config.d/realm/democa/est.**
- 6 Open **default.yaml** and **democa.yaml**.

Note: If the label is different, then change the YAML file.

- 7 Run the following command:
vi default.yaml
- 8 In the **authorized_signer** section, add the following:

```
authorized_signer:
rule2:
    subject: CN=,.
```

For example, if your client certificate subject name is **test123**, then add the following in the **authorized_signer** section:

```
authorized_signer:
rule1:
    # Full DN
    subject: CN=.:pkiclient,.
rule2:
    subject: CN=test123,.*
```

- 9 Save the file, and then type **quit** to exit MySQL.
- 10 Restart the OpenXPKI service using **openxpkictl restart**.
- 11 Restart the Apache service using **service apache2 restart**.

What causes the SAN mismatch error that prevents the system from fetching the CRL?

The SAN mismatch error may occur when you are enabling the CRL information. This error indicates that the IP or host name does not match the value of the SAN in the web certificate. To avoid getting this error, use the FQDN in the path of the CRL instead of the IP. You can also configure the web certificate and use the FQDN of your system in the SAN field.

Why are the ca-signer-1 and vault-1 tokens offline?

If the System Status page shows that your ca-signer-1 and vault-1 tokens are offline, then do the following:

- 1 In **/etc/openxpki/config.d/realm/realm name/crypto.yaml**, change the corresponding key value.
- 2 Restart the OpenXPKI service.

Managing printer alerts

Overview

Alerts are triggered when a printer requires attention. Actions let you send customized e-mails or run scripts when an alert occurs. Events define which actions are executed when specific alerts are active. To register for alerts from a printer, create actions and then associate them with an event. Assign the event to the printers that you want to monitor.

Note: This feature is not applicable to secured printers.

Creating an action

An action is either an e-mail notification or an event viewer log. Actions assigned to events are triggered when a printer alert occurs.

- 1 From the Printers menu, click **Events & Actions > Actions > Create**.
- 2 Type a unique name for the action and its description.
- 3 Select an action type.

E-mail

Note: Before you begin, make sure that the e-mail settings are configured. For more information, see [“Configuring email settings” on page 143](#).

- a In the Type menu, select **E-mail**.
- b Type the appropriate values in the fields. You can also use the available placeholders as the entire or part of the subject title, or as part of an e-mail message. For more information, see [“Understanding action placeholders” on page 132](#).

The screenshot shows a web form for creating an action. At the top, there's a 'Type' dropdown menu with 'E-mail' selected. Below it are several text input fields: 'From (Optional)' with 'admin@mycompany.com', 'To' with 'scott.summers@mycompany.com', and 'CC (Optional)' which is empty. There are also dropdown menus for 'Subject (Optional)' and 'Body'. The 'Subject' dropdown has 'alert.type' selected, and the 'Body' dropdown has 'alert.name' selected. The 'Body' text area contains the placeholder text '\${alert.type}\${alert.location}\${alert.name}'. At the bottom of the form are two buttons: 'Create Action' (green) and 'Cancel' (grey).

- c Click **Create Action**.

Log event

- a In the Type menu, select **Log event**.
- b Type the event parameters. You can also use the available placeholders in the drop-down menu. For more information, see [“Understanding action placeholders” on page 132](#).

General

Name

New Action - 2019-12-09T14:08:02+08:00

Description (Optional)

Type

Log event

Event parameters (Optional)

\$(alert.type)

Maximum length for field is 255

Create Action Cancel

About

alert.type
alert.location
alert.state
alert.name
configurationItem.manufacturer
configurationItem.contactLocation

- c Click **Create Action**.

Understanding action placeholders

Use the available placeholders in the subject title or e-mail message. Placeholders represent variable elements, and are replaced with actual values when used.

- **\$(eventHandler.timestamp)**—The date and time that MVE processed the event. For example, **Mar 14, 2017 1:42:24 PM**.
- **\$(eventHandler.name)**—The name of the event.
- **\$(configurationItem.name)**—The system name of the printer that triggered the alert.
- **\$(configurationItem.address)**—The MAC address of the printer that triggered the alert.
- **\$(configurationItem.ipAddress)**—The IP address of the printer that triggered the alert.
- **\$(configurationItem.ipHostname)**—The host name of the printer that triggered the alert.
- **\$(configurationItem.model)**—The model name of the printer that triggered the alert.
- **\$(configurationItem.serialNumber)**—The serial number of the printer that triggered the alert.
- **\$(configurationItem.propertyTag)**—The property tag of the printer that triggered the alert.
- **\$(configurationItem.contactName)**—The contact name of the printer that triggered the alert.
- **\$(configurationItem.contactLocation)**—The contact location of the printer that triggered the alert.
- **\$(configurationItem.manufacturer)**—The manufacturer of the printer that triggered the alert.
- **\$(alert.name)**—The name of the alert that is triggered.
- **\$(alert.state)**—The state of the alert. It can be active or cleared.
- **\$(alert.location)**—The location within the printer where the triggered alert occurred.
- **\$(alert.type)**—The severity of the triggered alert, such as **Warning** or **Intervention Required**.

Managing actions

1 From the Printers menu, click **Events & Actions > Actions**.

2 Do any of the following:

Edit an action

- a Select an action, and then click **Edit**.
- b Configure the settings.
- c Click **Save Changes**.

Delete actions

- a Select one or more actions.
- b Click **Delete**, and then confirm deletion.

Test an action

- a Select an action, and then click **Test**.
- b To verify the test results, see the tasks logs.

Notes:

- For more information, see [“Viewing logs” on page 139](#).
- If you are testing an e-mail action, then verify if the e-mail was sent to the recipient.

Creating an event

You can monitor alerts in your printer fleet. Create an event, and then set an action to execute when the specified alerts occur. Events are not supported in secured printers.

1 From the Printers menu, click **Events & Actions > Events > Create**.

2 Type a unique name for the event and its description.

3 From the Alerts section, select one or more alerts. For more information, see [“Understanding printer alerts” on page 134](#).

4 From the Actions section, select one or more actions to execute when the selected alerts are active.

Note: For more information, see [“Creating an action” on page 131](#).

5 Enable the system to execute selected actions when alerts are cleared on the printer.

6 Set a grace period before executing any selected actions.

Note: If the alert is cleared during the grace period, then the action is not executed.

7 Click **Create Event**.

Understanding printer alerts

Alerts are triggered when a printer requires attention. The following alerts can be associated with an event in MVE:

- **Automatic Document Feeder (ADF) jam**—A paper is jammed in the ADF and must be physically removed.
 - Scanner ADF Exit Jam
 - Scanner ADF Feeder Jam
 - Scanner ADF Inverter Jam
 - Scanner ADF Paper Cleared
 - Scanner ADF Paper Missing
 - Scanner ADF PreRegistration Jam
 - Scanner ADF Registration Jam
 - Scanner Alert - Replace All Originals if Restarting Job
- **Door or cover open**—A door is open on the printer and must be closed.
 - Check Door/Cover - Mailbox
 - Door Open
 - Cover Alert
 - Cover Closed
 - Cover Open
 - Cover Open Or Cartridge Missing
 - Duplex Cover Open
 - Scanner ADF Cover Open
 - Scanner Jam Access Cover Open
- **Incorrect media size or type**—A job is printing and requires certain paper to be loaded in a tray.
 - Incorrect Envelope Size
 - Incorrect Manual Feed
 - Incorrect Media
 - Incorrect Media Size
 - Load Media
- **Memory full or error**—The printer is running low on memory and must apply changes.
 - Complex Page
 - Files Will Be Deleted
 - Insufficient Collation Memory
 - Insufficient Defrag Memory
 - Insufficient Fax Memory
 - Insufficient Memory
 - Insufficient Memory - Held Jobs May Be Lost
 - Insufficient Memory For Resource Save
 - Memory Full
 - PS Memory Shortage

- Scanner Too Many Pages - Scan Job Canceled
- Resolution Reduction
- **Option malfunction**—An option attached to the printer is in an error state. Options include input options, output options, font cards, user flash cards, disks, and finishers.
 - Check Alignment/Connection
 - Check Duplex Connection
 - Check Finisher/Mailbox Installation
 - Check Power
 - Corrupted Option
 - Defective Option
 - Detach Device
 - Duplex Alert
 - Duplex Tray Missing
 - External Network Adapter Lost
 - Finisher Alert
 - Finisher Door Or Interlock Open
 - Finisher Paper Wall Open
 - Incompatible Duplex Device
 - Incompatible Input Device
 - Incompatible Output Device
 - Incompatible Unknown Device
 - Incorrect Option Installation
 - Input Alert
 - Input Configuration Error
 - Option Alert
 - Output Bin Full
 - Output Bin Nearly Full
 - Output Configuration Error
 - Option Full
 - Option Missing
 - Paper Feed Mechanism Missing
 - Print Jobs On Option
 - Reattach Device
 - Reattach Output Device
 - Too Many Inputs Installed
 - Too Many Options Installed
 - Too Many Outputs Installed
 - Tray Missing
 - Tray Missing During Power On
 - Tray Sensing Error
 - Uncalibrated Input

- Unformatted Option
- Unsupported Option
- Reattach Input Device
- **Paper jam**—A paper is jammed in the printer and must be physically removed.
 - Internal Paper Jam
 - Jam Alert
 - Paper Jam
- **Scanner error**—The scanner has a problem.
 - Scanner Back Cable Unplugged
 - Scanner Carriage Locked
 - Scanner Clean Flatbed Glass/Backing Strip
 - Scanner Disabled
 - Scanner Flatbed Cover Open
 - Scanner Front Cable Unplugged
 - Scanner Invalid Scanner Registration
- **Supplies error**—A printer supply has a problem.
 - Abnormal Supply
 - Cartridge Region Mismatch
 - Defective Supply
 - Fuser Unit Or Coating Roller Missing
 - Invalid Or Missing Left Cartridge
 - Invalid Or Missing Right Cartridge
 - Invalid Supply
 - Priming Failure
 - Supply Alert
 - Supply Jam
 - Supply Missing
 - Toner Cartridge Eject Handle Pulled
 - Toner Cartridge Not Installed Correctly
 - Uncalibrated Supply
 - Unlicensed Supply
 - Unsupported Supply
- **Supplies or consumable empty**—A printer supply must be replaced.
 - Input Empty
 - Life Exhausted
 - Printer Ready for Maintenance
 - Scheduled Maintenance
 - Supply Empty
 - Supply Full
 - Supply Full or Missing

Note: The printer sends the alert as an error and a warning. If one of these alerts is triggered, then its associated action occurs twice.

- **Supplies or consumable low**—A printer supply is running low.

- Early Warning
- First Low
- Input Low
- Life Warning
- Nearly Empty
- Nearly Low
- Supply Low
- Supply Nearly Full

- **Uncategorized alert or condition**

- Color Calibration Failure
- Data Transmission Error
- Engine CRC Failure
- External Alert
- Fax Connection Lost
- Fan Stall
- Hex Active
- Insert Duplex Page and Press Go
- Internal Alert
- Internal Network Adapter Needs Service
- Logical Unit Alert
- Offline
- Offline for Warning Prompt
- Operation Failed
- Operator Intervention Alert
- Page Error
- Port Alert
- Port Communication Failure
- Port Disabled
- Power Saver
- Powering Off
- PS Job Timeout
- PS Manual Timeout
- Setup Required
- SIMM Checksum Error
- Supply Calibrating
- Toner Patch Sensing Failed
- Unknown Alert Condition
- Unknown Configuration

- Unknown Scanner Alert Condition
- User(s) Locked Out
- Warning Alert

Managing events

- 1** From the Printers menu, click **Events & Actions > Events**.
- 2** Do either of the following:

Edit an event

- a** Select an event, and then click **Edit**.
- b** Configure the settings.
- c** Click **Save Changes**.

Delete events

- a** Select one or more events.
- b** Click **Delete**, and then confirm deletion.

Viewing task status and history

Overview

Tasks are any printer management activities performed in MVE, such as printer discovery, audit, and configurations enforcement. The Status page shows the status of all currently running tasks and the tasks run in the last 72 hours. Information on the currently running tasks is entered into the log. Tasks older than 72 hours can be viewed only as individual log entries in the Log page, and can be searched using the task IDs.

Viewing the task status

From the Tasks menu, click **Status**.

Note: The task status is updated in real time.

Stopping tasks

- 1 From the Tasks menu, click **Status**.
- 2 From the Currently Running Tasks section, select one or more tasks.
- 3 Click **Stop**.

Viewing logs

- 1 From the Tasks menu, click **Logs**.
- 2 Select task categories, task types, or a time period.

Notes:

- Use the search field to search for multiple Task IDs. Use commas to separate multiple Task IDs or a hyphen to indicate a range. For example, **11, 23, 30-35**.
- To export the search results, click **Export to CSV**.

Clearing logs

- 1 From the Tasks menu, click **Log**.
- 2 Click **Clear Log**, and then select a date.
- 3 Click **Clear Log**.

Exporting logs

- 1 From the Tasks menu, click **Log**.
- 2 Select task categories, task types, or a time period.

3 Click **Export to CSV**.

Scheduling tasks

Creating a schedule

- 1 From the Tasks menu, click **Schedule > Create**.
- 2 From the General section, type a unique name for the scheduled tasks and its description.
- 3 From the Task section, do one of the following:

Schedule an audit

- a Select **Audit**.
- b Select a saved search.

Schedule a conformance check

- a Select **Conformance**.
- b Select a saved search.

Schedule a printer status check

- a Select **Current Status**.
- b Select a saved search.
- c Select an action.

Schedule a configuration deployment

- a Select **Deploy File**.
- b Select a saved search.
- c Browse to the file, and then select the file type.
- d If necessary, select a deployment method or protocol.

Note: When deploying firmware, we do not recommend downgrading to an earlier version due to potential failure risks. Certain firmware versions can lead to a downgrade in printer firmware.

Schedule a discovery

- a Select **Discovery**.
- b Select a discovery profile.

Schedule a configuration enforcement

- a Select **Enforcement**.
- b Select a saved search.

Schedule a certificate validation

Select **Validate Certificate**.

Note: During validation, MVE communicates with the CA server to download the certificate chain and the Certificate Revocation List (CRL). The enrollment agent certificate is also generated. This certificate enables the CA server to trust MVE.

Schedule a view export

- a Select **View Export**.
- b Select a saved search.
- c Select a view template.
- d Type the list of email addresses where the exported files are sent.

4 From the Schedule section, set the date, time, and frequency of the task.

5 Click **Create Scheduled Task**.

Managing scheduled tasks

1 From the Tasks menu, click **Schedule**.

2 Do either of the following:

Edit a scheduled task

- a Select a task, and then click **Edit**.
- b Configure the settings.
- c Click **Edit Scheduled Task**.


Note: The Last Run information is removed when a scheduled task is edited.

Delete a scheduled task

- a Select a task, and then click **Delete**.
- b Click **Delete Scheduled Task**.

Performing other administrative tasks

Configuring general settings


- 1 Click  on the upper-right corner of the page.
- 2 Click **General**, and then select a host name source.
 - **Printer**—The system retrieves the host name from the printer.
 - **Reverse DNS Lookup**—The system retrieves the host name from the DNS table using the IP address.
- 3 Set the alert reregistration frequency.

Note: Printers may lose the alert registration state when changes are made, such as rebooting or updating the firmware. MVE attempts to recover the state automatically on the next interval set in the alert reregistration frequency.
- 4 Configure the following system log settings:
 - **System log cleanup start time**—The time when the cleanup of system or task logs starts.
 - **System log retention period (weeks)**—The number of weeks that system logs are stored in the database.

Note: Entries stored in the database for more than 52 weeks are removed.
 - **System log archive**—Allows the system to archive the system logs and the encoded entries on the file system. The destination and format of the archive files are defined in the log4j2.xml file.
- 5 Click **Save Changes**.

Configuring email settings

Enable SMTP configuration to let MVE send data export files and event notifications through email.


- 1 Click  on the upper-right corner of the page.
- 2 Click **E-mail**, and then select **Enable E-mail SMTP configuration**.
- 3 Type the SMTP mail server and port.
- 4 Select the proper encryption.

Notes:

 - For SSL encryption, select port 465. This encryption is equivalent to **Required**, which is available only in MFPs.
 - For TLS/STARTTLS encryption, select port 587. This encryption is equivalent to **Negotiate**, which is available only in MFPs.
- 5 Type the email address of the sender.
- 6 If a user must log in before emailing, then select **Login required**, and then type the user credentials.
- 7 Click **Save Changes**.

Adding a login disclaimer


You can configure a login disclaimer to be shown when users log in with a new session. Users must accept the disclaimer before they can access MVE.


- 1 Click  on the upper-right corner of the page.
- 2 Click **Disclaimer**, and then select **Enable disclaimer prior to login**.
- 3 Type the disclaimer text.
- 4 Click **Save Changes**.

Signing the MVE certificate

Secure Socket Layer (SSL) or Transport Layer Security (TLS) is a security protocol that uses data encryption and certificate authentication to protect server-client communication. In MVE, TLS is used to protect the sensitive information shared between the MVE server and the web browser. The protected information can be printer passwords, security policies, MVE user credentials, or printer authentication information, such as LDAP or Kerberos.

TLS enables the MVE server and the web browser to encrypt the data before sending it, and then decrypt it after it is received. SSL also requires the server to present the web browser with a certificate that proves that the server is who it claims to be. This certificate is either self-signed or signed using a trusted third-party CA. By default, MVE is configured to use a self-signed certificate.

- 1 Download the certificate signing request.
 - a Click  on the upper-right corner of the page.
 - b Click **TLS > Download**.
 - c Select **Certificate signing request**.


Note: The certificate signing request includes Subject Alternative Names (SANs).
- 2 Use a trusted CA to sign the certificate signing request.
- 3 Install the CA-signed certificate.
 - a Click  on the upper-right corner of the page.
 - b Click **TLS > Install Signed Certificate**.
 - c Upload the CA-signed certificate, and then click **Install Certificate**.
 - d Click **Restart MVE Service**.

Note: Restarting the MVE service reboots the system, and the server may be unavailable for the next few minutes. Before restarting the service, make sure that no tasks are currently running.


Removing user information and references

MVE is compliant with the data protection rules under General Data Protection Regulation (GDPR). MVE can be configured to apply the right to be forgotten and remove private user information from the system.


Removing users

- 1 Click  on the upper-right corner of the page.
- 2 Click **User**, and then select one or more users.
- 3 Click **Delete** > **Delete Users**.

Removing user references in LDAP

- 1 Click  on the upper-right corner of the page.
- 2 Click **LDAP**.
- 3 Remove any user-related information in the search filters and binding settings.

Removing user references in the e-mail server

- 1 Click  on the upper-right corner of the page.
- 2 Click **E-mail**.
- 3 Remove any user-related information, such as user credentials used for authenticating with the e-mail server.

Removing user references in the task logs

For more information, see [“Clearing logs” on page 139](#).

Removing user references in a configuration

- 1 From the Configurations menu, click **All Configurations**.
- 2 Click the configuration name.
- 3 From the Basic tab, remove any user-related values from the printer settings, such as contact name and contact location.

Removing user references in an advanced security component

- 1 From the Configurations menu, click **All Advanced Security Components**.
- 2 Click the component name.
- 3 From the Advanced Security Settings section, remove any user-related values.

Removing user references in saved searches

- 1 From the Printers menu, click **Saved Searches**.
- 2 Click a saved search.
- 3 Remove any search rule that uses any user-related values, such as contact name and contact location.

Removing user references in keywords

- 1** From the Printers menu, click **Printer Listing**.
- 2** Unassign user-related keywords from the printers.
- 3** From the Printers menu, click **Keywords**.
- 4** Remove any keyword that uses user-related information.

Removing user references in events and actions

- 1** From the Printers menu, click **Events & Actions**.
- 2** Remove any actions that contain e-mail references to users.

Managing SSO

Overview

Active Directory Federation Services (ADFS) is an identity access solution that provides client computers with Single Sign-On (SSO) access to protected applications or services. Users can access these applications or services even when their accounts and applications are in completely different networks or organizations.

ADFS uses Security Assertion Markup Language (SAML) authentication and Claims-based Access Control (CBAC) authorization to ensure security across applications using the federated identity.

You must establish encrypted communication between the MVE and ADFS servers. To do so, ADFS must trust the MVE server. ADFS also contains user groups from the Active Directory (AD) server that must correspond to the required MVE user roles.

When you set up the ADFS server, the following information is required from the MVE application:

- Relying party trust identifier—**`https://mve-host/mve/saml`**
- Relying party SAML 2.0 SSO Service URL or Endpoint—**`https://mve-host/mve/adfs/saml`**

Note: In the URLs, **`mve-host`** is the IP address or FQDN of the MVE server.


Setting the claim-issuance policy for GroupRule

- 1 From the AD FS window, click **Relying Party Trusts**, and then right-click the applicable relying-party trust.
- 2 Click **Edit Claim Issuance Policy**, and then **Add Rule**.
- 3 From the Claim rule template list, select **Send LDAP Attributes as Claims**.
- 4 In the Claim rule name field, type **GroupRule**.
- 5 From the Attribute store list, select **Active Directory**.
- 6 Set LDAP attribute to **Token-Groups - Unqualified Names**, and then set Outgoing Claim Type to **MVEGroup**.
- 7 Click **Finish**.

Setting the claim-issuance policy for Name ID

- 1 From the AD FS window, click **Relying Party Trusts**, and then right-click the applicable relying-party trust.
- 2 Click **Edit Claim Issuance Policy**, and then **Add Rule**.
- 3 From the Claim rule template list, select **Send LDAP Attributes as Claims**.
- 4 In the Claim rule name field, type **Name ID**.
- 5 From the Attribute store list, select **Active Directory**.
- 6 Set LDAP attribute to **SAM-Account-Name**, and then set Outgoing Claim Type to **Name ID**.
- 7 Click **Finish**.

Enabling ADFS Server authentication

- 1 Click  on the upper-right corner of the page.
- 2 Click **ADFS**, and then select **Enable ADFS for authentication**.
- 3 In the SSO URL (Required) field, type the SSO URL that is published by the ADFS server as an identity provider.
- 4 In the ADFS Groups to MVE Role Mapping section, enter the ADFS group names that correspond to the MVE roles.
- 5 Click **Save Changes**.

Accessing MVE by way of ADFS

When you enable ADFS, and then access MVE, the ADFS login page automatically opens. Perform the authentication on the ADFS page before you are redirected to the MVE home page.

- 1 Open a web browser, and then type **https://MVE_SERVER/mve/**, where **MVE_SERVER** is the host name or IP address of the server hosting MVE.
- 2 When the ADFS login page opens, enter your ADFS credentials, and then click **Sign in**.

Notes:

- If users encounter issues when accessing MVE by way of ADFS, then administrators can log in to MVE using their localhost credentials and resolve the issue.
- If ADFS is not configured in the MVE server, then the default MVE login page is displayed for both localhost and non-localhost users. In this case, the users must log in to MVE using the accounts that are configured in the MVE server.

Logging out from MVE

If you accessed MVE using ADFS, then the Log out button does not appear on the MVE home page. The MVE session ends only if you close the MVE page or the MVE session is idle for more than 30 minutes. If you try to access the MVE URL after 30 minutes of inactivity, then you are redirected to the ADFS login page.

Note: If you accessed MVE using your localhost MVE credentials, then the Log out button still appears on the MVE home page.

Frequently asked questions

Markvision Enterprise FAQ

Why can I not choose multiple printers in the supported models list when creating a configuration?

Configuration settings and commands differ between printer models.

Can other users access my saved searches?

Yes. All users can access saved searches.

Where can I find the log files?

You can find the installation log files in the hidden directory of the user installing MVE. For example, **C:\Users\Administrator\AppData\Local\Temp\mveLexmark-install.log**.

You can find the *.log application log files in the **installation_dir\Lexmark\Markvision Enterprise\tomcat\logs** folder, where **installation_dir** is the installation folder of MVE.

What is the difference between host name and reverse DNS lookup?

A host name is a unique name assigned to a printer on a network. Each host name corresponds to an IP address. Reverse DNS lookup is used to determine the designated host name and domain name of a given IP address.

Where can I find reverse DNS lookup in MVE?

Reverse DNS lookup can be found in the general settings. For more information, see [“Configuring general settings” on page 143](#).

How do I manually add rules to the Windows firewall?

Run the command prompt as an administrator, and then type the following:

```
firewall add allowedprogram "installation_dir/Lexmark/Markvision  
Enterprise/tomcat/bin/tomcat9.exe" "Markvision Enterprise Tomcat"  
firewall add portopening UDP 9187 "Markvision Enterprise NPA UDP"  
firewall add portopening UDP 6100 "Markvision Enterprise LST UDP"
```

Where **installation_dir** is the installation folder of MVE.

How do I set up MVE to use a different port than port 443?

- 1 Stop the Markvision Enterprise service.
 - a Open the Run dialog box, and then type **services.msc**.
 - b Right-click **Markvision Enterprise**, and then click **Stop**.

- 2 Open the ***installation_dir*\Lexmark\Markvision Enterprise\tomcat\conf\server.xml** file.

Where ***installation_dir*** is the installation folder of MVE.

- 3 Change the **Connector port** value to another unused port.

```
<Connector port="443" protocol="org.apache.coyote.http11.Http11NioProtocol"
sslImplementationName="org.apache.tomcat.util.net.jsse.JSSEImplementation"
SSLEnabled="true" scheme="https" secure="true" clientAuth="false"
compression="on" compressableMimeType="text/html,text/xml,text/plain,text/css,
text/javascript,application/javascript,application/json" maxThreads="150"
maxHttpHeaderSize="16384" minSpareThreads="25" enableLookups="false"
acceptCount="100" connectionTimeout="120000" disableUploadTimeout="true"
URIEncoding="UTF-8" server="Apache" sslEnabledProtocols="TLSv1,TLSv1.1,TLSv1.2"
sslProtocol="TLS" keystoreFile="C:/Program Files/Lexmark/Markvision Enterprise/
../mve_truststore.p12" keystorePass="markvision" keyAlias="mve" keyPass="markvision"
keystoreType="PKCS12" ciphers="TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA256,
TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA,TLS_RSA_WITH_AES_128_CBC_SHA256,
TLS_RSA_WITH_AES_128_CBC_SHA"/>
```

- 4 Change the **redirectPort** value to the same port number used as the connector port.

```
<Connector port="9788" maxHttpHeaderSize="16384" maxThreads="150" minSpareThreads="25"
enableLookups="false" redirectPort="443" acceptCount="100" connectionTimeout="120000"
disableUploadTimeout="true" compression="on" compressableMimeType="text/html,text/xml,
text/plain,text/css,text/javascript,application/javascript,application/json"
URIEncoding="UTF-8" server="Apache"/>
```

- 5 Restart the Markvision Enterprise service.

- a Open the Run dialog box, and then type **services.msc**.
- b Right-click **Markvision Enterprise**, and then click **Restart**.

- 6 Access MVE using the new port.

For example, open a web browser, and then type **https://MVE_SERVER:port/mve**.

Where **MVE_SERVER** is the host name or IP address of the server hosting MVE, and **port** is the connector port number.

How do I customize the ciphers and TLS versions that MVE uses?

- 1 Stop the Markvision Enterprise service.

- a Open the Run dialog box, and then type **services.msc**.
- b Right-click **Markvision Enterprise**, and then click **Stop**.

- 2 Open the ***installation_dir*\Lexmark\Markvision Enterprise\tomcat\conf\server.xml** file.

Where ***installation_dir*** is the installation folder of MVE.

- 3 Configure the ciphers and TLS versions.

For more information on the configuration, see the [Apache Tomcat SSL/TLS configuration instructions](#).

For more information on the protocols and cipher values, see the [Apache Tomcat SSL support information documentation](#).

- 4 Restart the Markvision Enterprise service.

- a Open the Run dialog box, and then type **services.msc**.
- b Right-click **Markvision Enterprise**, and then click **Restart**.

How do I manage CRL files when using Microsoft CA Enterprise?

- 1 Obtain the CRL file from the CA server.

Notes:

- For Microsoft CA Enterprise, the CRL is not automatically downloaded through SCEP.
- For more information, see the *Microsoft Certificate Authority Configuration Guide*.

- 2 Save the CRL file in the ***installation_dir*\Lexmark\Markvision Enterprise\apps\library\crl** folder, where ***installation_dir*** is the installation folder of MVE.

- 3 Configure the certificate authority in MVE.


Note: This process is only applicable SCEP protocol is used.

Troubleshooting

User has forgotten the password

Reset the user password

You need administrative rights to reset the password.

- 1 Click  on the upper-right corner of the page.
- 2 Click **User**, and then select a user.
- 3 Click **Edit**, and then change the password.
- 4 Click **Save Changes**.

If you have forgotten your own password, then do either of the following:

- Contact another Admin user to reset your password.
- Contact Lexmark Customer Support Center.

Admin user has forgotten the password

Create another Admin user, and then delete the previous account

You can use the Markvision Enterprise Password Utility to create another Admin user.

- 1 Browse to the folder where Markvision Enterprise is installed.
For example, **C:\Program Files**
- 2 Launch the **mvepwdutility-windows.exe** file in the Lexmark\Markvision Enterprise\ directory.
- 3 Select a language, and then click **OK > Next**.
- 4 Select **Add User Account > Next**.
- 5 Enter the user credentials.
- 6 Click **Next**.
- 7 Access MVE, and then delete the previous Admin user.

Note: For more information, see [“Managing users” on page 30](#).

Page does not load

This problem may occur if you have closed the web browser without logging out.

Try one or more of the following:

Clear the cache, and delete the cookies in your web browser

Access the MVE login page, and then log in using your credentials

Open a web browser, and then type **`https://MVE_SERVER/mve/login`**, where **`MVE_SERVER`** is the host name or IP address of the server hosting MVE.

Cannot discover a network printer

Try one or more of the following:

Make sure that the printer is turned on

Make sure that the power cord is securely plugged into the printer and into a properly grounded electrical outlet

Make sure that the printer is connected to the network

Restart the printer

Make sure that TCP/IP is enabled on the printer

Make sure that the ports used by MVE are open, and SNMP and mDNS are enabled

For more information, see [“Understanding ports and protocols” on page 195](#).

Contact your Lexmark representative

Incorrect printer information

Perform an audit

For more information, see [“Auditing printers” on page 61](#).

MVE does not recognize a printer as a secured printer

Make sure that the printer is secured

Make sure that mDNS is turned on and is not blocked

Delete the printer, and then rerun the printer discovery

For more information, see [“Discovering printers” on page 34](#).

Enforcement of configurations with multiple applications fails in the first attempt but succeeds in the subsequent attempts

Increase the timeouts

- 1 Browse to the folder where Markvision Enterprise is installed.

For example, **C:\Program Files**

- 2 Navigate to the Lexmark\Markvision Enterprise\apps\dm-mve\WEB-INF\classes folder.

- 3 Using a text editor, open the *platform.properties* file.

- 4 Edit the **cdcl.ws.readTimeout** value.

Note: The value is in milliseconds. For example, 90000 milliseconds is equal to 90 seconds.

- 5 Using a text editor, open the *devCom.properties* file.

- 6 Edit the **1st.responseTimeoutsRetries** values.

Note: The value is in milliseconds. For example, 10000 milliseconds is equal to 10 seconds.

For example, **1st.responseTimeoutsRetries=10000 15000 20000**. The first connection retry is after 10 seconds, the second connection retry is after 15 seconds, and the third connection retry is after 20 seconds.

- 7 If necessary, when you are using LDAP GSSAPI, then create a *parameters.properties* file.

Add the following setting: **1st.negotiation.timeout=400**

Note: The value is in seconds.

- 8 Save the changes.

Enforcement of configurations with printer certificate fails

Sometimes, no new certificate is issued during enforcement.

Increase the number of enrolment retries

Add the following key in the **platform.properties** file:

```
enrol.maxEnrolmentRetry=10
```

The retry value must be greater than five.

OpenXPKI Certificate Authority

Certificate issuance failed using the OpenXPKI CA server

Make sure that the “signer on behalf” key in MVE matches the authorized signer key in the CA server

For example:

If the following is the **ca.onBehalf.cn** key in the **platform.properties** file in MVE,

```
ca.onBehalf.cn=Markvision_SQA-2012-23AB.lrdc.lexmark.ds
```

then the following must be the **authorized_signer** key in the **generic.yaml** file in the CA server.

```
rule1:
    # Full DN
    Subject: CN=Markvision_SQA-2012-23AB.lrdc.lexmark.ds
```

For more information on configuring the OpenXPKI CA server, see the *OpenXPKI Certificate Authority Configuration Guide*.

An internal server error occurs

Install the en_US.utf8 locale

- 1 Run the **dpkg-reconfigure locales** command.
- 2 Install the **en_US.utf8** (locale -a | grep en_US) locale.

The login prompt does not appear

When accessing <http://yourhost/openxpki/>, you get only the Open Source Trustcenter banner, without a login prompt.

Enable fcgid

Run the following commands:

- 1 **a2enmod fcgid**
- 2 **service apache2 restart**

A nested connector without class error occurs

An **EXCEPTION: Nested connector without class (scep.scep-server-1.connector.initial)** error at /usr/share/perl5/Connector/Multi.pm line 201 appears.

Update scep.scep-server-1

In `/etc/openxpki/config.d/realm/REALM/scep/generic.yaml`, replace **scep.scep-server-1** with **scep.generic**.

Note: Replace **REALM** with the name of your realm. For example, when using the default realm, use **ca-one**.

```
eligible:
  initial:
    value@: connector:scep.generic.connector.initial
```

Cannot manually approve certificates

The Manual Approve button does not appear when approving certificates manually.

Update scep.scep-server-1

In `/etc/openxpki/config.d/realm/REALM/scep/generic.yaml`, replace **scep.scep-server-1** with **scep.generic**.

Note: Replace **REALM** with the name of your realm. For example, when using the default realm, use **ca-one**.

```
eligible:
  initial:
    value@: connector:scep.generic.connector.initial
```

A Perl error occurs when approving enrollment requests

Update scep.scep-server-1

In `/etc/openxpki/config.d/realm/REALM/scep/generic.yaml`, replace **scep.scep-server-1** with **scep.generic**.

Note: Replace **REALM** with the name of your realm. For example, when using the default realm, use **ca-one**.

```
eligible:
  initial:
    value@: connector:scep.generic.connector.initial
```

The **ca-signer-1** and **vault-1** tokens are offline

The System Status page shows that the **ca-signer-1** and **vault-1** tokens are offline.

Try one or more of the following:

Change the certificate key password

In `/etc/openxpki/config.d/realm/ca-one/crypto.yaml`, change the certificate key password.

Create correct symlinks and copy the key file

For more information, see [“Copying the key file and creating a symlink” on page 104](#).

Make sure that the key file is readable by OpenXPki

Database access

Differences in supported databases data types

MVE supports Firebird and Microsoft SQL Server. The following table shows the Firebird data types used in MVE and their corresponding data types in Microsoft SQL Server.

| Firebird data types | Microsoft SQL Server data types |
|---|---------------------------------|
| BIGINT | Bigint |
| VARCHAR(x) | varchar(x) |
| TIMESTAMP | Datetime |
| INTEGER | Int |
| SMALLINT/ TINYINT* | Bit |
| BLOB SUB_TYPE 0 | varbinary(1024) |
| *This data type is required for Microsoft SQL Server. | |

FRAMEWORK tables and field names

This document lists and explains most of the tables in the FRAMEWORK database and describes the fields that each table contains. The tables and columns in the database are subject to change from one release to the next.

Printer

The following tables deal with the logical representation of a physical printer.

CONFIG_ITEM

The CONFIG_ITEM table represents the ITIL configuration items (CI) of the printer. It shows the state of the CI and time stamps of its creation, initial management, last discovery, and other actions. The table does not represent any physical portion of a printer; it is simply an abstract representation of the device.

| Field Name | Data Type | Description |
|-------------------------|--------------|---|
| CI_ID | BIGINT | Primary key. |
| CI_STATE | VARCHAR(255) | The current state of the CI. The options are NEW, MANAGED, MISSING, FOUND, CHANGED, UNMANAGED, and RETIRED. |
| CREATION_DATE | TIMESTAMP | The date when the CI first entered the system. |
| INITIAL_MANAGEMENT_DATE | TIMESTAMP | The date when the CI first entered the MANAGED state or substate. |

| Field Name | Data Type | Description |
|--------------------------------|---------------|--|
| LAST_AUDIT_DATE | TIMESTAMP | The date of the last audit attempted on the CI (whether or successful or not). |
| PRINTER_ID | BIGINT | The foreign key to NETWORK_PRINTER.PRINTER_ID. |
| LAST_DISCOVERY_DATE | TIMESTAMP | The date when the last discovery was attempted on the CI (whether successful or not). |
| LAST_SUCCESSFUL_AUDIT_DATE | TIMESTAMP | The date of the last successful audit of the CI. |
| LAST_SUCCESSFUL_DISCOVERY_DATE | TIMESTAMP | The date of the last successful discovery of the CI. |
| DEFAULT_CERT_COMMON_NAME | VARCHAR(255) | The name of the default certificate. |
| DEFAULT_CERT_ISSUER_NAME | VARCHAR(255) | The name of the issuer of the certificate. |
| DEFAULT_CERT_SIGNING_STATUS | VARCHAR(255) | The certificate signing status of the printer. The options are SIGNED, INVALID_CERT, NO_CA, and UNKNOWN. |
| DEFAULT_CERT_VALID_FROM | TIMESTAMP | The starting date of the validity of the certificate. |
| DEFAULT_CERT_VALID_TO | TIMESTAMP | The last date of the validity of the certificate. |
| DEFAULT_CERTIFICATE | VARCHAR(8190) | The default certificate. |
| DEFAULT_CERT_SERIAL_NUMBER | VARCHAR(255) | The serial number of the default certificate. |

NETWORK_ADAPTER

This table represents the network adapter (also known as the print server) of a physical printer.

| Field name | Data type | Description |
|-------------------|--------------|--|
| ADAPTER_TYPE | VARCHAR(31) | Always INA (internal network adapter). |
| ADAPTER_ID | BIGINT | The primary key. |
| FIRMWARE_REVISION | VARCHAR(255) | The current network firmware revision. |
| MANUFACTURER | VARCHAR(255) | N/A. |
| MODEL_NAME | VARCHAR(255) | N/A. |
| SERIAL_NUMBER | VARCHAR(50) | N/A. |
| SYSTEM_NAME | VARCHAR(255) | N/A. |

*This data type is required for Microsoft SQL Server.

| Field name | Data type | Description |
|--------------------------|--------------------|---|
| RETRIES | INTEGER | The number of times to retry communicating with a printer. |
| SNMP_READ_COMMUNITY_NAME | VARCHAR(255) | The SNMP community name for reading. |
| TIMEOUT | BIGINT | The number of milliseconds to wait for a particular communication attempt with a printer to succeed. |
| CONTACT_LOCATION | VARCHAR(255) | N/A. |
| CONTACT_NAME | VARCHAR(255) | N/A. |
| DOMAIN_NAME_SUFFIX | VARCHAR(191) | The domain name suffix associated with this network adapter (for example, foo.lexmark.com). Combine with HOSTNAME to get the fully qualified domain name (FQDN). |
| HOSTNAME | VARCHAR(63) | The host name associated with this network adapter. MVE can be configured to retrieve the host name from DNS or from the network adapter itself. Combine with DOMAIN_NAME_SUFFIX to get the fully qualified domain name (FQDN). |
| IP_ADDRESS | VARCHAR(15) | The integer representation of the IP address of this network adapter. Deprecated. |
| IP_ADDRESS_INT | INTEGER | The integer representation of the IP address of this network adapter. |
| IP_ADDRESS_SUBNET | INTEGER | The integer representation of the subnet on which this network adapter resides. |
| MAC_CANONICAL | VARCHAR(12) | The MAC address of the network adapter, in canonical format. |
| PORTS | INTEGER | The number of ports that the network adapter supports. Always 1. |
| RAND_MAC | SMALLINT/ TINYINT* | The flag indicating whether the current value of MAC_CANONICAL was randomly generated. |
| CREDENTIAL_REQUIRED | SMALLINT/ TINYINT* | The flag indicating whether a credential is necessary to communicate with the associated printer. |
| CREDENTIAL_PASSWORD | BLOB SUB_TYPE 0 | This value is encrypted and not available for use outside MVE. |

*This data type is required for Microsoft SQL Server.

| Field name | Data type | Description |
|---|--------------------|--|
| CREDENTIAL_PIN | BLOB SUB_TYPE 0 | This value is encrypted and not available for use outside MVE. |
| CREDENTIAL_REALM | VARCHAR(64) | The credential realm, if set. |
| CREDENTIAL_USERNAME | VARCHAR(255) | The credential username, if set. |
| PORT_CONFIG_LST_TCP_OPEN | SMALLINT/ TINYINT* | The flag indicating whether this port on the associated printer is open. |
| PORT_CONFIG_LST_UDP_OPEN | SMALLINT/ TINYINT* | The flag indicating whether this port on the associated printer is open. |
| PORT_CONFIG_MDNS_OPEN | SMALLINT/ TINYINT* | The flag indicating whether this port on the associated printer is open. |
| PORT_CONFIG_NPA_TCP_OPEN | SMALLINT/ TINYINT* | The flag indicating whether this port on the associated printer is open. |
| PORT_CONFIG_NPA_UDP_OPEN | SMALLINT/ TINYINT* | The flag indicating whether this port on the associated printer is open. |
| PORT_CONFIG_RAW_PRINT_OPEN | SMALLINT/ TINYINT* | The flag indicating whether this port on the associated printer is open. |
| PORT_CONFIG_SNMP_OPEN | SMALLINT/ TINYINT* | The flag indicating whether this port on the associated printer is open. |
| PORT_CONFIG_XML_TCP_OPEN | SMALLINT/ TINYINT* | The flag indicating whether this port on the associated printer is open. |
| PORT_CONFIG_XML_UDP_OPEN | SMALLINT/ TINYINT* | The flag indicating whether this port on the associated printer is open. |
| SECURE_COMMUNICATION_STATE | VARCHAR(255) | The state of the communication. The options are UNSECURED, MISSING_CREDENTIALS, and SECURED. |
| USER_PASSWORD | Blob sub_type 0 | The username portion of the credentials. |
| SNMP_USERNAME | VARCHAR(32) | The user name used for SNMPv3 communications. |
| SNMP_PASSWORD | VARCHAR(255) | This value is encrypted and not available for use outside MVE. |
| SNMP_MIN_AUTHENTICATION_LEVEL | Varchar(50) | The minimum authentication level used for SNMPv3 communications. |
| SNMP_AUTHENTICATION_HASH | VARCHAR(50) | The hash authentication used for SNMPv3 communications. |
| SNMP_PRIVACY_ALGORITHM | VARCHAR(50) | The privacy algorithm used for SNMPv3 communications. |
| LOGIN_METHOD | VARCHAR(256) | The authentication method used to log in to the printer. |
| *This data type is required for Microsoft SQL Server. | | |

| Field name | Data type | Description |
|---|--------------|---|
| LOGIN_METHOD_NAME | VARCHAR(256) | If LOGIN_METHOD is either LDAP or LDAP+GSSAPI, then this field shows the name of the authentication method. |
| TRACING_SERIAL_NUMBER | VARCHAR(64) | The authentication method used to trace the serial number. |
| *This data type is required for Microsoft SQL Server. | | |

NETWORK_PRINTER

This table represents the actual printer portion of the physical printer.

| Field Name | Data Type | Description |
|---|--------------------|--|
| PRINTER_ID | BIGINT | The primary key. |
| MANUFACTURER | VARCHAR(255) | The company that actually made the printer. May differ from DISPLAY_MANUFACTURER. |
| MODEL_NAME | VARCHAR(255) | The model name of the printer. |
| SERIAL_NUMBER | VARCHAR(50) | The serial number of this printer. |
| SYSTEM_NAME | VARCHAR(255) | The name used to identify the device. |
| COPY | SMALLINT/ TINYINT* | The flag indicating whether the printer supports copying. |
| DUPLEX | SMALLINT/ TINYINT* | The flag indicating whether the printer supports two-sided printing. |
| ESF | SMALLINT/ TINYINT* | The flag indicating whether the printer supports eSF applications. |
| MARKING_TECHNOLOGY | VARCHAR(255) | The type of marking technology used by the printer (for example, electrophotographic). |
| MEMORY | BIGINT | The amount of memory, in bytes. |
| PROFILE | SMALLINT/ TINYINT* | The flag indicating whether this printer supports profiles. |
| RECEIVE_FAX | SMALLINT/ TINYINT* | The flag indicating whether this printer supports receiving faxes. |
| SCAN_TO_EMAIL | SMALLINT/ TINYINT* | The flag indicating whether this printer supports scanning to email. |
| SCAN_TO_FAX | SMALLINT/ TINYINT* | The flag indicating whether this printer supports scanning to fax. |
| SCAN_TO_NETWORK | SMALLINT/ TINYINT* | The flag indicating whether this printer supports scanning to a network. |
| *This data type is required for Microsoft SQL Server. | | |

| Field Name | Data Type | Description |
|---|--------------------|--|
| SPEED | VARCHAR(255) | The number of sheets that the paper can print per minute. |
| DISPLAY_MANUFACTURER | VARCHAR(255) | The name that appears on the outside of the printer. For example, MANUFACTURER could be LEXMARK, but DISPLAY_MANUFACTURER could be Dell. |
| FAMILY_ID | INTEGER | The NPA family ID. |
| INITIAL_DISCOVERY_TIMESTAMP | TIMESTAMP | When the printer was first discovered. |
| LIFETIME_PAGE_COUNT | BIGINT | The lifetime page count. |
| MAINTENANCE_COUNTER | BIGINT | The maintenance counter. |
| ADAPTER_PORT | INTEGER | The port on which this printer is connected to its associated network adapter. For now, the data is always 1. |
| PROPERTY_TAG | VARCHAR(255) | The asset, brass, or property tag. |
| ADAPTER_ID | BIGINT | The foreign key to NETWORK_ADAPTER.ADAPTER_ID. |
| RAND_SN | SMALLINT/ TINYINT* | The flag indicating whether the current value of SERIAL_NUMBER was randomly generated. |
| DEV_STATUS_REG_COUNTER | INTEGER | The number of device status registrations. |
| SCANNER_SERIAL_NUMBER | VARCHAR(12) | For modular MFPs, the serial number of the scan head. |
| DISK_ENCRYPTION | VARCHAR(8) | The frequency at which disk encryption is enabled. |
| DISK_WIPING | VARCHAR(8) | The frequency at which disk wiping is enabled. |
| COLOR | SMALLINT/ TINYINT* | The flag indicating whether the printer prints in color. |
| PRINTER_STATUS_SUMMARY | SMALLINT/ TINYINT* | The indicator of the most severe status message that is present on the printer. |
| SUPPLY_STATUS_SUMMARY | SMALLINT/ TINYINT* | The indicator of the most severe supply status message that is present on the printer. |
| TLI | VARCHAR(255) | The Top Level Indicator (TLI) of the printer model. |
| FAX_STATION_NAME | VARCHAR(255) | The value of the fax name setting on the printer. |
| *This data type is required for Microsoft SQL Server. | | |

| Field Name | Data Type | Description |
|---|--------------|--|
| FAX_STATION_NUMBER | VARCHAR(255) | The value of the fax number setting on the printer. |
| SCANNER_SERIAL_NUMBER | VARCHAR(50) | The serial number of the scanner of the printer. |
| TIME_ZONE | VARCHAR(255) | The ID for different time zones supported by the printer. |
| MODULAR_SERIAL_NUMBER | VARCHAR(255) | The modular serial number. |
| TRACING_SERIAL_NUMBER | VARCHAR(64) | The authentication method that is used to trace the serial number. |
| *This data type is required for Microsoft SQL Server. | | |

PRINTER_CURRENT_STATUS

This table represents the printer status when data was collected. There is a row in this table for each status condition on a given printer, all pointing to the same PRINTER_ID.

| Field Name | Data Type | Description |
|-----------------|--------------|---|
| STATUS_ID | BIGINT | The primary key. |
| STATUS_MESSAGE | VARCHAR(255) | The text for this status (for example, Tray 1 Low). |
| STATUS_SEVERITY | VARCHAR(255) | The severity of this status (for example, Warning). |
| STATUS_TYPE | VARCHAR(255) | The type of this status (for example, Printer or Supply). |
| PRINTER_ID | BIGINT | The foreign key to NETWORK_PRINTER.PRINTER_ID. |

PRINTER_ESF_APPS

This table represents the installed eSF applications on printers when data was collected. There is a row in this table for each eSF application currently installed on a given printer, all pointing to the same PRINTER_ID.

| Field Name | Data Type | Description |
|----------------|--------------|--|
| APPLICATION_ID | BIGINT | The primary key. |
| NAME | VARCHAR(255) | The application name. |
| STATE | VARCHAR(255) | The current state. |
| VERSION | VARCHAR(255) | The current version. |
| PRINTER_ID | BIGINT | The foreign key to NETWORK_PRINTER.PRINTER_ID. |

PRINTER_INPUT_OPTIONS

This table represents installed input options on printers when data was collected. There is a row in this table for each input option currently installed on a given printer, all pointing to the same PRINTER_ID.

| Field Name | Data Type | Description |
|-----------------|--------------|--|
| INPUT_OPTION_ID | BIGINT | The primary key. |
| NAME | VARCHAR(255) | The name of the input option (for example, Multipurpose Tray). |
| PRINTER_ID | BIGINT | The foreign key to NETWORK_PRINTER.PRINTER_ID. |

PRINTER_INPUT_TRAYS

This table represents input trays associated with an input option. There is a row in this table for each input tray associated with a given input option, all pointing to the same INPUT_OPTION_ID.

| Field Name | Data Type | Description |
|-----------------|--------------|--|
| INPUT_OPTION_ID | BIGINT | The foreign key to PRINTER_INPUT_OPTIONS.INPUT_OPTION_ID. |
| CAPACITY | BIGINT | The maximum number of sheets that the tray can hold. |
| FEED_TYPE | VARCHAR(255) | Manual or Auto. |
| FORM_SIZE | VARCHAR(255) | The current paper size (for example, Letter). |
| FORM_TYPE | VARCHAR(255) | The current paper type (for example, Plain Paper). |
| TYPE | VARCHAR(255) | The type of input tray (for example, Multipurpose Feeder). |

PRINTER_OPTIONS

This table represents installed options on printers when data was collected. There is a row in this table for each option currently installed on a given printer, all pointing to the same PRINTER_ID. Typically, the option is a storage device.

| Field Name | Data Type | Description |
|------------|--------------|--|
| OPTION_ID | BIGINT | The primary key. |
| FREESPACE_ | BIGINT | The amount of space remaining on the storage device. |
| NAME | VARCHAR(255) | The name of the printer option (for example, DISK). |
| SIZE_ | BIGINT | The total amount of space. |
| PRINTER_ID | BIGINT | The foreign key to NETWORK_PRINTER.PRINTER_ID. |

PRINTER_OUTPUT_BINS

This table represents output bins associated with an output option. There is a row in this table for each output bin associated with a given output option, all pointing to the same OUTPUT_OPTION_ID.

| Field name | Data type | Description |
|------------------|--------------------|---|
| OUTPUT_OPTION_ID | BIGINT | The foreign key to PRINTER_OUTPUT_OPTIONS.OUTPUT_OPTION_ID. |
| BINDING | SMALLINT/ TINYINT* | The flag indicating whether this bin supports binding. |
| BURSTING | SMALLINT/ TINYINT* | The flag indicating whether this bin supports bursting. |
| CAPACITY | BIGINT | The maximum number of sheets that the bin can hold. |
| COLLATION | SMALLINT/ TINYINT* | The flag indicating whether this bin supports collation. |
| FACE_DOWN | SMALLINT/ TINYINT* | The flag indicating whether paper is loaded facedown in this bin. |
| FACE_UP | SMALLINT/ TINYINT* | The flag indicating whether paper is loaded faceup in this bin. |
| LEVEL_SENSING | SMALLINT/ TINYINT* | The flag indicating whether this bin supports paper-level sensing. |
| PUNCHING | SMALLINT/ TINYINT* | The flag indicating whether this bin supports hole punching. |
| SECURITY | SMALLINT/ TINYINT* | The flag indicating whether this bin supports security. |
| SEPARATION | SMALLINT/ TINYINT* | The flag indicating whether this bin supports separation. |
| STITICHING | SMALLINT/ TINYINT* | The flag indicating whether this bin supports stitching. |
| TYPE | VARCHAR(255) | The type of printer output bin (for example, Standard Bin, Bin 5, etc.) |

*This data type is required for Microsoft SQL Server.

PRINTER_OUTPUT_OPTIONS

This table represents installed output options on printers. There is a row in this table for each output option currently installed on a given printer, all pointing to the same PRINTER_ID.

| Field Name | Data Type | Description |
|------------------|--------------|---|
| OUTPUT_OPTION_ID | BIGINT | The primary key. |
| NAME | VARCHAR(255) | The name of the option (for example, Integrated Hopper, Mailbox, and Finisher). |

| Field Name | Data Type | Description |
|------------|-----------|--|
| PRINTER_ID | BIGINT | The foreign key to NETWORK_PRINTER.PRINTER_ID. |

PRINTER_STATISTICS

This table contains information gathered from the meters and counters data of the printer. Each row represents data for an individual printer. Depending on the printer model with which the record is associated, not all columns apply.

| Field Name | Data Type | Description |
|------------------------|--------------|---|
| STATISTICS_ID | BIGINT | The primary key. |
| COVG_LAST_JOB_BLACK | BIGINT | The black toner coverage of the last print job. |
| COVG_LIFETIME_BLACK | BIGINT | The black toner coverage of lifetime print jobs. |
| CART_PAGES_PRINT_BLACK | BIGINT | The count of the printed pages that used black toner cartridge. |
| BLACK_TONER_LEVEL | VARCHAR(255) | The current supply level of the black toner cartridge. |
| PHOTO_COND_LEVEL_K | VARCHAR(255) | The current supply level of the photoconductor (black). |
| BLANK_SAFE_SIDE_COPY | BIGINT | The count of the blank safe sides from a copy. |
| BLANK_SAFE_SIDE_FAX | BIGINT | The count of the blank safe sides from a fax. |
| BLANK_SAFE_SIDE_PRINT | BIGINT | The count of the blank safe sides from a print. |
| PAPER_CHANGE | BIGINT | The count of paper change events. |
| COVER_OPEN | BIGINT | The count of cover open events. |
| COVG_LAST_JOB_CYAN | BIGINT | The cyan toner coverage of the last print job. |
| COVG_LIFETIME_CYAN | BIGINT | The cyan toner coverage of lifetime print jobs. |
| CART_PAGES_PRINT_CYAN | BIGINT | The count of the printed pages that used the cyan toner cartridge. |
| CYAN_TONER_LEVEL | VARCHAR(255) | The current supply level of the cyan toner cartridge. |
| CYAN_TONER_STATUS | VARCHAR(255) | The supply status for the cyan cartridge (for example, Intermediate). |
| YELLOW_TONER_STATUS | VARCHAR(255) | The supply status for the yellow cartridge (for example, Intermediate). |

| Field Name | Data Type | Description |
|---------------------------------|--------------|--|
| MAGENTA_TONER_STATUS | VARCHAR(255) | The supply status for the magenta cartridge (for example, Intermediate). |
| BLACK_TONER_STATUS | VARCHAR(255) | The supply status for the black cartridge (for example, Intermediate). |
| PHOTO_COND_LEVEL_C | VARCHAR(255) | The current supply level of the photoconductor (cyan). |
| DEVICE_INSTALL_DATE | TIMESTAMP | The time stamp of the first installation of the printer. |
| FUSER_CURRENT_LEVEL | VARCHAR(255) | The current supply level of the fuser. |
| IMG_SAFE_SIDE_COPY | BIGINT | The count of imaged printed sides of a copy job. |
| IMG_SAFE_SIDE_FAX | BIGINT | The count of imaged printed sides of a fax job. |
| IMG_SAFE_SIDE_PRINT | BIGINT | The count of imaged printed sides of a print job. |
| LAST_FAX_JOB_DATE | TIMESTAMP | The time stamp of the last fax job. |
| LAST_PRINTED_JOB_DATE | TIMESTAMP | The time stamp of the last print job. |
| LAST_SCAN_JOB_DATE | TIMESTAMP | The time stamp of the last scan job. |
| COVG_LAST_JOB_MAGENTA | BIGINT | The magenta toner coverage of the last job. |
| COVG_LIFETIME_MAGENTA | BIGINT | The magenta toner coverage of lifetime jobs. |
| CART_PAGES_PRINT_MAGENTA | BIGINT | The count of the printed pages that used the magenta toner cartridge. |
| MAGENTA_TONER_LEVEL | VARCHAR(255) | The current supply level of the magenta toner cartridge. |
| PHOTO_COND_LEVEL_M | VARCHAR(255) | The current supply level of the photoconductor (magenta). |
| MAINT_KIT_LEVEL | VARCHAR(255) | The current supply level of the maintenance kit. |
| MEDIA_SIZE_TYPE_MONO_SIDE_SAFE | BIGINT | The mono printed sides (safe). |
| MEDIA_SIZE_TYPE_COLOR_SIDE_SAFE | BIGINT | The color printed sides (safe). |
| SUPPLY_EVENTS | BIGINT | The count of other supply events. |
| PAPER_JAMS | BIGINT | The count of paper jam events. |
| PAPER_LOAD | BIGINT | The count of paper load events. |
| PRINT_SHEET_USE_PICKED | BIGINT | The printed sheets (picked). |
| PRINT_SIDE_USE_PICKED | BIGINT | The printed sides (picked). |
| POR | BIGINT | The count of Power-On Resets. |

| Field Name | Data Type | Description |
|-----------------------------|--------------|--|
| PRINT_AND_HOLD_JOB | BIGINT | The count of print-and-hold jobs. |
| SAFE_SHT_COPY | BIGINT | The printed sheets (safe) from copy jobs. |
| SAFE_SHT_FAX | BIGINT | The printed sheets (safe) from fax jobs. |
| SAFE_SHT_PRINT | BIGINT | The printed sheets (safe) from print jobs. |
| SCAN_PAPER_JAMS | BIGINT | The count of scanner jams. |
| PRINTED_FROM_PRINT_AND_HOLD | BIGINT | The count of printed print-and-hold jobs. |
| PRINTED_FROM_USB | BIGINT | The count of prints from USB. |
| TRANS_BELT_LEVEL | VARCHAR(255) | The current supply level of the transfer belt. |
| USB_DIRECT_JOB | BIGINT | The count of USB insertions. |
| WASTE_TONER_LEVEL | VARCHAR(255) | The current level of the waste toner bottle. |
| COVG_LAST_JOB_YELLOW | BIGINT | The yellow toner coverage of the last job. |
| COVG_LIFETIME_YELLOW | BIGINT | The yellow toner coverage of lifetime jobs. |
| CART_PAGES_PRINT_YELLOW | BIGINT | The count of the printed pages that used the yellow toner cartridge. |
| YELLOW_TONER_LEVEL | VARCHAR(255) | The current supply level of the yellow toner cartridge. |
| PHOTO_COND_LEVEL_Y | VARCHAR(255) | The current level of the photoconductor (yellow). |
| IMG_SAFE_SIDE_PRINT_MONO | BIGINT | The count of imaged mono printed sides (safe) from print jobs. |
| IMG_SAFE_SIDE_PRINT_COLOR | BIGINT | The count of imaged color printed sides (safe) from print jobs. |
| IMG_SAFE_SIDE_COPY_MONO | BIGINT | The count of imaged mono printed sides (safe) from copy jobs. |
| IMG_SAFE_SIDE_COPY_COLOR | BIGINT | The count of imaged color printed sides (safe) from copy jobs. |
| IMG_SAFE_SIDE_FAX_MONO | BIGINT | The count of imaged mono printed sides (safe) from fax jobs. |
| IMG_SAFE_SIDE_FAX_COLOR | BIGINT | The count of imaged color printed sides (safe) from fax jobs. |
| FAX_JOB_RECV | BIGINT | The count of received fax jobs. |
| FAX_JOB_SENT | BIGINT | The count of sent fax jobs. |

| Field Name | Data Type | Description |
|------------------------|--------------|---|
| FAX_PAGE_RECV | BIGINT | The count of received fax pages. |
| FAX_PAGE_SENT | BIGINT | The count of sent fax pages. |
| SCAN_COPY | BIGINT | The count of scans from copy jobs. |
| SCAN_FAX | BIGINT | The count of scans from fax. |
| SCAN_LOCAL | BIGINT | The count of local scans. |
| SCAN_NET | BIGINT | The count of scans to network. |
| SCAN_FLAT | BIGINT | The count of scans from the scanner glass flatbed. |
| SCAN_ADF_SIMPLEX | BIGINT | The count of scans from the ADF (simplex). |
| SCAN_ADF_DUPLEX | BIGINT | The count of scans from the ADF (duplex). |
| SCAN_USB_DIRECT | BIGINT | The count of scans directly to USB. |
| USB_DIRECT_INSERT | BIGINT | The count of USB insertions. |
| CART_INST_DATE_CYAN | TIMESTAMP | The time stamp of the cyan cartridge installation. |
| CART_INST_DATE_YELLOW | TIMESTAMP | The time stamp of the yellow cartridge installation. |
| CART_INST_DATE_MAGENTA | TIMESTAMP | The time stamp of the magenta cartridge installation. |
| CART_INST_DATE_BLACK | TIMESTAMP | The time stamp of the black cartridge installed. |
| PRINTER_ID | BIGINT | The foreign key to NETWORK_PRINTER.PRINTER_ID. |
| MAINT_KIT_STATUS_100K | VARCHAR(255) | The 100K maintenance kit level. |
| MAINT_KIT_STATUS_160K | VARCHAR(255) | The 160K maintenance kit level. |
| MAINT_KIT_STATUS_200K | VARCHAR(255) | The 200K maintenance kit level. |
| MAINT_KIT_STATUS_300K | VARCHAR(255) | The 300K maintenance kit level. |
| MAINT_KIT_STATUS_320K | VARCHAR(255) | The 320K maintenance kit level. |
| MAINT_KIT_STATUS_480K | VARCHAR(255) | The 480K maintenance kit level. |
| MAINT_KIT_STATUS_600K | VARCHAR(255) | The 600K maintenance kit level. |

PRINTER_SUPPLIES

This table represents supplies in printers. There is a row in this table for each supply in a given printer, all pointing to the same PRINTER_ID. Depending on the type, not all columns apply.

| Field Name | Data Type | Description |
|---|--------------------|--|
| SUPPLY_ID | BIGINT | The primary key. |
| CAPACITY | BIGINT | The maximum sheet capacity of the supply. |
| COLOR | VARCHAR(255) | The color of the supply (for example, Black, Cyan, or NULL). |
| NAME | VARCHAR(255) | The name of the supply (for example, Black Toner, Fuser, and Waste Bottle). |
| SMART_CARTRIDGE_PREBATE | SMALLINT/ TINYINT* | The flag indicating whether this supply is a smart cartridge prebate. |
| SMART_CARTRIDGE_REFILLED | SMALLINT/ TINYINT* | The flag indicating whether this supply is a smart cartridge refill. |
| SMART_CARTRIDGE_SERIAL_NUMBER | VARCHAR(255) | The smart cartridge serial number. |
| TYPE | VARCHAR(255) | The type of supply (for example, Toner, Transfer Belt, Fuser, Container, or Imaging Unit). |
| PRINTER_ID | BIGINT | The foreign key to NETWORK_PRINTER.PRINTER_ID. |
| PERCENT_FULL | BIGINT | The calculated remaining percentage of the supply. |
| *This data type is required for Microsoft SQL Server. | | |

CHANGED_SETTINGS

This table contains information about settings that changed between the last two audits.

| Field Name | Data Type | Description |
|--------------|--------------|--|
| ID | BIGINT | The primary key. |
| CI_ID | BIGINT | Refers to CONFIG_ITEM.ID. |
| SETTING_NAME | VARCHAR(255) | The name of the setting that changed. |
| CHANGE_TYPE | VARCHAR(255) | The type of change. The options are ADD, UPDATE, and REMOVE. |

PRINTER_PORTS

This table contains information about the status of the printer TCP/UDP ports.

| Field name | Data type | Description |
|------------------|-----------|-----------------------|
| PRINTER_PORTS_ID | BIGINT | The primary key. |
| PRINTER_ID | BIGINT | Refers to PRINTER.ID. |

| Field name | Data type | Description |
|------------|--------------|---|
| TCP21 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| UDP69 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| TCP79 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| TCP80 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| UDP137 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| UDP161 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| UDP162 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| TCP515 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| TCP631 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| TCP5001 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| UDP5353 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| TCP8000 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| TCP9100 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| TCP9200 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| UDP9200 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| UDP9300 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| UDP9301 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| UDP9302 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| TCP9400 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| TCP9500 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| TCP9501 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |

| Field name | Data type | Description |
|------------|--------------|---|
| TCP9600 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| UDP9700 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| TCP9000 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| TCP5000 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| TCP443 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| TCP4000 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| UDP6100 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| TCP6100 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| TCP65002 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| TCP65004 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| TCP65004 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| TCP65001 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| TCP65003 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |

PRINTER_SECURITY-OPTIONS

This table contains information related to the security details of the printer.

| Field Name | Data Type | Description |
|-----------------------|--------------|--|
| PRINTER_SECURITY_ID | BIGINT | The primary key. |
| PRINTER_ID | BIGINT | Refers to PRINTER.ID. |
| OWASP_CIPHER_CATEGORY | VARCHAR(500) | The list of cipher categories supported by the device. |
| TLS10 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |
| TLS11 | VARCHAR(255) | The options are OFF, ON, UNKNOWN, and NONE. |

Keywords

The following tables deal with MVE keywords.

ASSIGNED_KEYWORDS

This table represents the keywords assigned to their respective CIs and printers.

| Field Name | Data Type | Description |
|------------|-----------|---|
| KEYWORD_ID | BIGINT | The composite primary key, and the foreign key to KEYWORD.KEYWORD_ID. |
| CI_ID | BIGINT | The composite primary key, and the foreign key to CONFIGURATION_ITEM.CI_ID. |

KEYWORD

This table represents all the keywords defined in the system.

| Field Name | Data Type | Description |
|---------------|--------------|--|
| KEYWORD_ID | BIGINT | The primary key. |
| KEYWORD_VALUE | VARCHAR(255) | The keyword name. |
| CATEGORY_ID | BIGINT | The foreign key to KEYWORD_CATEGORY.CATEGORY_ID. |

KEYWORD_CATEGORY

This table lists all the categories defined in the system. It is used for grouping keywords together.

| Field Name | Data Type | Description |
|----------------|--------------|--------------------|
| CATEGORY_ID | BIGINT | The primary key. |
| CATEGORY_VALUE | VARCHAR(255) | The category name. |

Configurations

The following tables deal with MVE's configurations.

CONFIGURATION

This table represents a printer configuration at the highest level, including the printer name, model, and whether it can be assigned.

| Field name | Data type | Description |
|---|--------------------|--|
| CONFIGURATION_ID | BIGINT | The primary key. |
| CONFIGURATION_NAME | VARCHAR(255) | The configuration name. |
| ASSIGNABLE | SMALLINT/ TINYINT* | The flag indicating whether the configuration is assignable. |
| DESCRIPTION | VARCHAR(4000) | A user-entered description of the configuration. |
| LAST_MODIFIED | TIMESTAMP | The time stamp of the last edit of the configuration. |
| MANAGING_DEV_CERTIFICATE | BOOLEAN | The default Boolean value. This field indicates whether this configuration manages the device certificate automatically. |
| *This data type is required for Microsoft SQL Server. | | |

CONFIGURATION_COMPONENT

This table represents one component of a configuration.

| Field name | Data type | Description |
|----------------------------|-----------------|---|
| CONFIGURATION_COMPONENT_ID | BIGINT | The primary key. |
| COMPONENT_TYPE | VARCHAR(255) | The component type. The options are DEVICE_SETTINGS, SECURITY_CAESAR1, SECURITY_CAESAR2, ESF, and FIRMWARE. |
| CREDENTIAL_PASSWORD | BLOB SUB_TYPE 0 | The encrypted credential password, if set. |
| CREDENTIAL_PIN | BLOB SUB_TYPE 0 | The encrypted credential PIN, if set. |
| CREDENTIAL_REALM | VARCHAR(255) | The credential realm, if set. |
| CREDENTIAL_USERNAME | VARCHAR(255) | The credential user name, if set. |
| COMPONENT_NAME | VARCHAR(255) | The component name. |
| LICENSE_TYPE | VARCHAR(255) | The license type of the configuration component. The options are PRODUCTION, TRIAL, and FACTORY. |
| LOGIN_METHOD | VARCHAR(256) | The authentication method used to log in to the printer. |
| MERGE_DATA_PATH | VARCHAR(255) | The file location of a variable settings file. |
| FLASH_FILE_SHA1 | VARCHAR(255) | The SHA1 hash of the flash file for a firmware component. |

| Field name | Data type | Description |
|-------------------|---------------|---|
| LOGIN_METHOD_NAME | VARCHAR(256) | If the LOGIN_METHOD is either LDAP or LDAP+GSSAPI, then this field shows the name of the particular login method. |
| DESCRIPTION | VARCHAR(4000) | This field shows the description if it is added in a component. |
| LAST_MODIFIED | TIMESTAMP | The time stamp of the last modification. |
| ASSIGNABLE | Boolean | The value is true if the component is assigned to a printer. Otherwise, the value is false. |
| PRE_POPULATED | Boolean | Added to identify pre-populated Advanced Security Components. |

CONFIGURATION_COMPONENTS

This table contains information about different components related to different configurations, if selected.

| Field Name | Data Type | Description |
|----------------------------|--------------|--|
| CONFIGURATION_ID | BIGINT | The foreign key to CONFIGURATION.CONFIGURATION_ID. |
| CONFIGURATION_COMPONENT_ID | BIGINT | The foreign key to CONFIGURATION_COMPONENT.CONFIGURATION_COMPONENT_ID. |
| COMPONENT_TYPE | VARCHAR(255) | Added to discriminate among Device Setting Component and eight other components. |

ASSIGNED_CONFIGURATIONS

This table shows which configurations are assigned to which CIs and printers.

| Field Name | Data Type | Description |
|-----------------------|--------------|--|
| CI_ID | BIGINT | The composite primary key, and the foreign key back to CONFIGURATION_ITEM.CI_ID. |
| CONFIGURATION_ID | BIGINT | Composite primary key, and the foreign key back to CONFIGURATION.CONFIGURATION_ID. |
| COMPLIANCE_STATE | VARCHAR(255) | The current conformance state for the configuration. |
| LAST_COMPLIANCE_CHECK | TIMESTAMP | Time stamp of the last conformance check was run. |

FAILED_COMPONENT

This table includes all components that have a setting out of conformance.

| Field Name | Data Type | Description |
|---------------------|-------------------|---|
| FAILED_COMPONENT_ID | BIGINT | The primary key. |
| CI_ID | BIGINT | The foreign key back to ASSIGNED_CONFIGURATIONS.CI_ID. |
| CONFIGURATION_ID | BIGINT (not null) | The foreign key back to ASSIGNED_CONFIGURATIONS.CONFIGURATION_ID. |
| COMPONENT_TYPE | VARCHAR(255) | The type of the failed component. |
| COMPONENT_NAME | VARCHAR(255) | The name of the failed component. |

FAILED_COMPONENT_SETTINGS

This table includes all settings that are out of conformance and their values.

| Field Name | Data Type | Description |
|---|-------------------------------|--|
| TYPE | SMALLINT/ TINYINT*, Default 0 | Added to discriminate conformance failure reasons among Discrepancy, Inapplicable, Unsupported, Resource not in Library, and Unable to Merge Token Settings. |
| FAILED_COMPONENT_ID | BIGINT (not null) | The foreign key back to FAILED_COMPONENT.FAILED_COMPONENT_ID. |
| SETTING_NAME | VARCHAR(255) | The name of the failed setting. |
| PRINTER_VALUE | dropNotNullConstraint | Can be a null value. |
| COMPONENT_VALUE | dropNotNullConstraint | Can be a null value. |
| *This data type is required for Microsoft SQL Server. | | |

FLASHFILE

This table represents information about MVE Firmware library resources.

| Field Name | Data Type | Description |
|---------------|--------------|---|
| ID | BIGINT | The primary key. |
| FILENAME | VARCHAR(256) | The file name and location within the MVE repository. |
| SHA1 | VARCHAR(255) | The SHA1 hash of the flash file. |
| DISPLAY_NAME | VARCHAR(255) | A version identifier of the flash file. |
| DATE_IMPORTED | TIMESTAMP | The date when the flash file was imported. |

| Field Name | Data Type | Description |
|-------------|--------------|------------------------------------|
| DESCRIPTION | VARCHAR(255) | The description of the flash file. |

FLASH_NET_IDS

This table stores the NETFLASH ID found at the top of each flash file in the Resource Library.

| Field Name | Data Type | Description |
|------------|--------------|------------------|
| FLASHNETID | BIGINT | The primary key. |
| NET_ID | VARCHAR(255) | The NETFLASH ID. |

CERTIFICATES

This table represents information about the MVE CA certificate library resources.

| Field Name | Data Type | Description |
|----------------------|---------------|---|
| CERTIFICATE_ID | BIGINT | The primary key. |
| NAME | VARCHAR(255) | The user-friendly name of a CA certificate. |
| PEM_CERTIFICATE | BLOB | The PEM representation of a CA certificate. |
| DATE_IMPORTED | TIMESTAMP | The date when the CA certificate was imported to MVE. |
| PEM_CERTIFICATE_SHA2 | VARCHAR (64) | SHA2 hash of this CA certificate. |
| DESCRIPTION | VARCHAR (255) | Description of the CA certificate. |

CERTIFICATE_COMP_CERTIFICATES

This table shows the linking of certificate in the Resource Library to a configuration component, and thus to a configuration.

| Field Name | Data Type | Description |
|----------------------------|-----------|---|
| CONFIGURATION_COMPONENT_ID | BIGINT | The foreign key back to CONFIGURATION_COMPONENT.CONFIGURATION_COMPONENT_ID. |
| CERTIFICATE_ID | BIGINT | The foreign key back to CERTIFICATES.CERTIFICATE_ID. |

COMPONENT_SETTINGS

This table represents settings contained within a given configuration component. There is a row in this table for each setting associated with the configuration component, all pointing to the same CONFIGURATION_COMPONENT.CONFIGURATION_COMPONENT_ID. The values are encrypted and not available outside of MVE.

| Field Name | Data Type | Description |
|----------------------------|---------------|--|
| SETTING_ID | BIGINT | The primary key. |
| SETTING_NAME | VARCHAR(255) | The name of the setting. |
| SETTING_VALUE | VARCHAR(1280) | The encrypted setting value. |
| CONFIGURATION_COMPONENT_ID | BIGINT | The foreign key to CONFIGURATION_COMPONENT.CONFIGURATION_COMPONENT_ID. |
| DISCRIMINATOR | VARCHAR(255) | The options are SIMPLE_SETTING and TABULAR_SETTING. |
| TABULAR_SETTING_VALUE_ID | BIGINT | The foreign key to COMPONENT_TAB_SETTING_VALUE.TABULAR_SETTING_VALUE_ID. |

COMPONENT_TAB_TABLE

This table represents Color Print Permission tables included in configurations.

| Field name | Data type | Description |
|------------|--------------|--|
| TABLE_ID | BIGINT | The primary key. |
| TABLE_TYPE | VARCHAR(255) | The options are HOST_TABLE and USER_TABLE. |

COMPONENT_TAB_ROW

This table represents a row from the Color Print Permissions tables. Values are encrypted and cannot be used outside MVE.

| Field Name | Data Type | Description |
|---|--------------------|--|
| TABLE_ID | BIGINT | The foreign key to COMPONENT_TAB_TABLE.TABLE_ID |
| HOST_NAME | VARCHAR(255) | The value of the Host Name setting in the hosts table. |
| USER_NAME | VARCHAR(255) | The value of the User Name setting in the users table. |
| ALLOWED_TO_PRINT_COLOR | SMALLINT/ TINYINT* | The value of the Allow Color Printing setting for both host and user tables. |
| USER_PERMISSION_OVERRIDDEN | SMALLINT/ TINYINT* | The value of the Overrides User Permission setting in the host table. |
| *This data type is required for Microsoft SQL Server. | | |

COMPONENT_TAB_SETTING_VALUE

This table shows the correlation of Color Print Permissions tables to components, and thus to configurations.

| Field Name | Data Type | Description |
|--------------------------|-----------|---|
| TABULAR_SETTING_VALUE_ID | BIGINT | The foreign key to COMPONENT_SETTINGS.TABULAR_SETTING_VALUE_ID. |
| TABLE_ID | BIGINT | The foreign key to COMPONENT_TAB_TABLE.TABLE_ID. |

CC_SUPPORTED_MODEL_BACKUP

| Field Name | Data Type | Description |
|-----------------|--------------|--|
| ID | BIGINT | The primary key. |
| SUPPORTED_MODEL | VARCHAR(255) | Used for creating a backup from CONFIGURATION and CONFIGURATION_COMPONENT for Device Setting Components. |

ESF_COMP_PRODUCTS

| Field Name | Data Type | Description |
|----------------------------|--------------|---|
| CONFIGURATION_COMPONENT_ID | BIGINT | The foreign key references. Table: CONFIGURATION_COMPONENT Column: CONFIGURATION_COMPONENT_ID |
| PART_NUMBER | VARCHAR(255) | The product part number of the solution component. |

VCCFILE

| Field Name | Data Type | Description |
|---------------|--------------|---|
| ID | BIGINT | The primary key. |
| FILENAME | VARCHAR(255) | The uploaded file name. |
| DISPLAY_NAME | VARCHAR(255) | The VCC file name displayed in MVE. |
| DATE_IMPORTED | TIMESTAMP | The time stamp of the upload of the file. |
| SHA1 | VARCHAR(255) | The file content hash. |
| DESCRIPTION | VARCHAR(255) | The description of the VCC file. |

UCFFILE

| Field Name | Data Type | Description |
|---------------|--------------|---|
| ID | BIGINT | The primary key. |
| FILENAME | VARCHAR(255) | The uploaded file name. |
| DISPLAY_NAME | VARCHAR(255) | The UCF file name displayed in MVE. |
| DATE_IMPORTED | TIMESTAMP | The time stamp of the upload of the file. |
| SHA1 | VARCHAR(255) | The file content hash. |
| DESCRIPTION | VARCHAR(255) | The description of the UCF file. |

UCF_VCC_RESOURCE_FILES

This table contains information on the status of the printer TCP/UDP ports.

| Field Name | Data Type | Description |
|----------------------------|--------------|---|
| RESOURCE_ID | BIGINT | The primary key. |
| SHA1 | VARCHAR(255) | The file content hash. |
| RESOURCE_TYPE | VARCHAR(255) | The type of resource file. The options are UCF_FILE, VCC_FILE, and APP_FLS. |
| CONFIGURATION_COMPONENT_ID | VARCHAR(255) | The foreign key of the ID of the CONFIGURATION_COMPONENT table. |

Discovery profiles

The following tables are used to track the discovery profiles of MVE.

DISCOVERY_PROFILE

| Field Name | Data Type | Description |
|-------------------------------|--------------|--|
| ID | BIGINT | The primary key. |
| NAME | VARCHAR(255) | The user-supplied name for the profile. |
| RETRIES | INTEGER | The number of times to retry communicating with a printer. |
| SNMP_READ_COMMUNITY_NAME | VARCHAR(255) | The SNMP community name to use when reading. |
| TIMEOUT | BIGINT | The number of milliseconds to wait for a particular communication attempt with a printer to succeed. |
| SNMP_USERNAME | VARCHAR(32) | The user name for SNMP communication. |
| SNMP_PASSWORD | VARCHAR(32) | The password for SNMP communication. |
| SNMP_MIN_AUTHENTICATION_LEVEL | VARCHAR(255) | The minimum authentication level for SNMP. |
| SNMP_AUTHENTICATION_HASH | VARCHAR(50) | The hash used for SNMP authentication. |

| Field Name | Data Type | Description |
|------------------------|-------------|--------------------------------------|
| SNMP_PRIVACY_ALGORITHM | VARCHAR(50) | The algorithm used for SNMP privacy. |

DISCOVERY_PROFILE_CI

This table contains the CI-specific pieces of the discovery profile.

| Field Name | Data Type | Description |
|---|--------------------|--|
| CI_DP_ID | BIGINT | The primary key, and the foreign key to DISCOVERY_PROFILE.ID. |
| AUTOMANAGE | SMALLINT/ TINYINT* | The flag indicating whether CIs discovered using this profile must be automatically managed. |
| DESCRIPTION | VARCHAR(4000) | The user-provided description of the discovery profile. |
| LAST_RUN | TIMESTAMP | Time stamp of the last run of the profile. |
| CREDENTIAL_USERNAME | VARCHAR(255) | The credential user name, if set. |
| CREDENTIAL_REALM | VARCHAR(64) | The credential realm, if set. |
| LOGIN_METHOD | VARCHAR(256) | The authentication method used to log in to the printer. |
| LOGIN_METHOD_NAME | VARCHAR(256) | The name of the authentication method if LOGIN_METHOD is either LDAP or LDAP+GSSAPI. |
| CREDENTIAL_PASSWORD | BLOB | This value is encrypted and not available for use outside MVE. |
| CREDENTIAL_PIN | BLOB | This value is encrypted and not available for use outside MVE. |
| ASSIGN_KEYWORD_IDS | VARCHAR(512) | The assigned keywords in a discovery profile. |
| *This data type is required for Microsoft SQL Server. | | |

EXCLUDE_PROFILE_ITEM

This table represents the Exclude list for a profile. Each excluded item has a row in this table.

| Field Name | Data Type | Description |
|----------------------|--------------|---|
| DISCOVERY_PROFILE_ID | BIGINT | The composite primary key, and the foreign key to DISCOVERY_PROFILE.ID. |
| VALUE_ | VARCHAR(255) | The composite primary key. This field defines what items to exclude. |

INCLUDE_PROFILE_ITEM

This table represents the Include list for a profile. Each included item has a row in this table.

| Field Name | Data Type | Description |
|----------------------|--------------|---|
| DISCOVERY_PROFILE_ID | BIGINT | The composite primary key, and the foreign key to DISCOVERY_PROFILE.ID. |
| VALUE_ | VARCHAR(255) | The composite primary key. This field defines what items to include. |

DISCOVERY_PROFILE_MODEL_CONFIG

This table represents the Assign Configurations portion of a discovery profile.

| Field Name | Data Type | Description |
|----------------------|--------------|--|
| ID | BIGINT | The primary key. |
| MODEL | VARCHAR(255) | The model name of the printers to which the configuration is assigned. |
| DISCOVERY_PROFILE_ID | BIGINT | The foreign key to DISCOVERY_PROFILE.ID. |
| CI_CONFIGURATION_ID | BIGINT | The foreign key to CONFIGURATION.CONFIGURATION_ID. |

ESF

ESF_APPLICATION

This table contains all the eSF applications in all deployable eSF packages. There may be many eSF applications in each deployable package.

| Field name | Data type | Description |
|-----------------|--------------|---|
| ESF_APP_ID | BIGINT | The primary key. |
| ESF_DP_ID | BIGINT | The foreign key back to ESF_DEPLOYABLE_PACKAGE.ESF_DP_ID. |
| APP_ID | VARCHAR(255) | The application ID of the eSF applications. |
| VERSION | VARCHAR(255) | The eSF application version. |
| DESCRIPTION_URI | VARCHAR(255) | The URI description to the ESF application. |
| FLS_URI | VARCHAR(255) | The URI to the flash file. |

ESF_APPLICATION_LOCALE

This table contains the name and description of each eSF application in all languages supported by MVE.

| Field Name | Data Type | Description |
|-------------------|--------------|---|
| ESF_APP_LOCALE_ID | BIGINT | The primary key. |
| ESF_APP_ID | BIGINT | The foreign key to ESF_APPLICATION.ESF_APP_ID. |
| LOCALE | VARCHAR(255) | The two-character language code. |
| NAME | VARCHAR(255) | The name of the eSF application in the language indicated by LOCALE. |
| DESCRIPTION | VARCHAR(510) | The description of the eSF application in the language indicated by LOCALE. |

ESF_COMP_DEPLOYABLE_PACKAGE

This table contains one row for each deployable package in use by an MVE configuration.

| Field Name | Data Type | Description |
|------------------|--------------|--|
| ESF_COMPONENT_ID | BIGINT | The foreign key to CONFIGURATION_COMPONENT.CONFIGURATION_COMPONENT_ID. |
| ESF_DP_ID | VARCHAR(255) | The foreign key to ESF_DEPLOYABLE_PACKAGE.ESF_DP_ID. |

ESF_DEPLOYABLE_PACKAGE

This table represents all the deployable packages uploaded to the MVE library.

| Field Name | Data Type | Description |
|---|--------------------|---|
| ESF_DP_ID | BIGINT | The primary key. |
| NAME | VARCHAR(255) | The name of the deployable package. |
| PART_NUMBER | VARCHAR(255) | The part number of the deployable package. |
| PART_REVISION | VARCHAR(255) | The part revision of the deployable package. |
| LICENSE_REQUIRED | SMALLINT/ TINYINT* | The flag indicating whether a license is required for the deployable package. |
| URI | VARCHAR(255) | The URI of the deployable package. |
| DATE_IMPORTED | TIMESTAMP | The date when the deployable package was imported. |
| VERSION | VARCHAR(255) | The version of the deployable package. |
| DESCRIPTION | VARCHAR(255) | The description of the deployable package. |
| *This data type is required for Microsoft SQL Server. | | |

ESF_DEPLOYABLE_PACKAGE_LOCALE

This table contains the name and description for each deployable package in all languages supported by MVE.

| Field Name | Data Type | Description |
|------------------|---------------|---|
| ESF_DP_LOCALE_ID | BIGINT | The primary key. |
| ESF_DP_ID | BIGINT | The foreign key to ESF_DEPLOYABLE_PACKAGE.ESF_DP_ID. |
| LOCALE | VARCHAR(255) | The two-character language code. |
| NAME | VARCHAR(255) | The name of the deployable package in the language indicated by LOCALE. |
| DESCRIPTION | VARCHAR(2048) | The increased description length, from 510 to 2048 characters. |

ESF_DP_SUPPORTED_MODELS

This table contains one row for each model supported by a deployable package in the MVE library.

| Field Name | Data Type | Description |
|-----------------|--------------|--|
| ESF_DP_ID | BIGINT | The foreign key back to ESF_DEPLOYABLE_PACKAGE.ESF_DP_ID. |
| SUPPORTED_MODEL | VARCHAR(255) | The model name of printer supported by the deployable package. |

ESF_LICENSE

This table represents the licenses for eSF applications available in the MVE library.

| Field Name | Data Type | Description |
|---|--------------------|--|
| ESF_LICENSE_ID | BIGINT | The primary key. |
| PRINTER_SERIAL | VARCHAR(255) | The serial number of the printer to which the license is tied. |
| PART_NUMBER | VARCHAR(255) | The part number of the package to which the license is tied. |
| PART_REVISION | VARCHAR(255) | The part revision of the package to which the license is tied. |
| LICENSE_TYPE | VARCHAR(255) | The options are TRIAL and PRODUCTION. |
| FILE_NAME | VARCHAR(255) | The file name of the license binary. |
| DEPLOYED | SMALLINT/ TINYINT* | The flag indicating whether the license has been deployed. |
| *This data type is required for Microsoft SQL Server. | | |

RAWESFAPPPFILE

This table represents the raw eSF application file details available in the MVE library.

| Field Name | Data Type | Description |
|---------------|--------------|--|
| ID | BIGINT | The primary key. |
| FILENAME | VARCHAR(255) | The name of the package file. |
| DISPLAY_NAME | VARCHAR(255) | The display name of the package file. |
| DATE_IMPORTED | TIMESTAMP | The time stamp of the import of the package. |
| SHA1 | VARCHAR(255) | The SHA1 hash of the package. |
| DESCRIPTION | VARCHAR(255) | The description of the package. |
| APP_ID | VARCHAR(255) | The application ID of the package. |
| VERSION | VARCHAR(255) | The version of the package. |

APP_FLS_RESOURCE_FILES

This table represents the association of eSF applications file available in the MVE library with configuration.

| Field Name | Data Type | Description |
|----------------------------|--------------|---|
| RESOURCE_ID | BIGINT | The primary key. |
| SHA1 | VARCHAR(255) | The SHA1 hash of the package. |
| RESOURCE_TYPE | VARCHAR(255) | The type of the Resource File. The options are UCF_FILE, VCC_FILE, and APP_FLS. |
| CONFIGURATION_COMPONENT_ID | BIGINT | The foreign key with the ID column of CONFIGURATION_COMPONENT. |

Certificate management

The following represents the list of certifications to be verified.

ENROLLMENT_STATUS

The following table lists the issued certificates.

| Field Name | Data Type | Description |
|---------------------------|---------------|--|
| ENROLLMENT_STATUS_ID | BIGINT | The primary key. |
| CERTIFICATE_ENROL_STATUS | VARCHAR(255) | The certificate enrollment status. The options are Issued, Pending, and Failed. |
| CERT_ENROL_TRANSACTION_ID | VARCHAR(2048) | The pending certificate response for EST. Sometimes, this field shows the transaction ID for certificate enrollment. |
| CERT_SUBJECT_IDENTITY | VARCHAR(255) | The subject identity of the certificate. |
| CERT_SERIAL_NUMBER | VARCHAR(255) | The serial number of the certificate issued. |
| PRINTER_ID | BIGINT | The reference printer. |
| DEFAULT_CERT_REVISION_NO | VARCHAR(255) | The revision number of the certificate that is renewed. |
| DEFAULT_CERT_RENEWAL_DATE | VARCHAR(255) | The renewal date of the certificate. |
| CERTIFICATE_FRIENDLY_NAME | VARCHAR(255) | The friendly name of the certificate. |
| CERTIFICATE_USED_FOR | VARCHAR(255) | The association of the named certificate. The options are DEFAULT, HTTPS, WIRELESS, IPSEC, and UNASSIGNED. |

CA_CERT_REVOCATION_COMP_LIST

The following table lists information about the revoked certificates.

| Field Name | Data Type | Description |
|---------------------|--------------|--|
| ID | BIGINT | The unique identifier. |
| SERIAL_NUMBER | VARCHAR(255) | The serial number of the certificate present in the revocation list primary key. |
| CERTIFICATE_SUBJECT | VARCHAR(255) | The subject of the revoked certificate. |
| REVOCATION_DATE | TIMESTAMP | The date when the certificate is revoked. |
| ISSUER | VARCHAR(255) | The issuer of the revoked certificate. |
| REVOCATION_REASON | VARCHAR(255) | The revocation reason. |

NAMED_CERTIFICATE_SETTINGS

The following table lists the name and association of named certificate.

| Field Name | Data Type | Description |
|-----------------|--------------|---|
| CERT_SETTING_ID | BIGINT | The unique identifier. |
| FRIENDLY_NAME | VARCHAR(255) | The friendly name of the named certificate. |

| Field Name | Data Type | Description |
|----------------------------|--------------|--|
| CERT_USED_FOR | VARCHAR(255) | The association of the named certificate. The options are DEFAULT, HTTPS, WIRELESS, IPSEC, and UNASSIGNED. |
| CONFIGURATION_COMPONENT_ID | BIGINT | The foreign key associated with ID of the CONFIGURATION_COMPONENT table. |
| TEMPLATE_ID | BIGINT | The ID of the associated template. |

PRINTER_CERTIFICATE

The following table represents the details of the named certificate.

| Field Name | Data Type | Description |
|----------------------------|---------------|---|
| CERTIFICATE_ID | BIGINT | The unique identifier. |
| CERTIFICATE_FRIENDLY_NAME | VARCHAR(255) | The friendly name of the certificate. |
| CERTIFICATE_COMMON_NAME | VARCHAR(255) | The common name of the certificate. |
| CERTIFICATE_ISSUER_NAME | VARCHAR(255) | The name of the issuer of the certificate. |
| CERTIFICATE_SIGNING_STATUS | VARCHAR(255) | The signing status of the certificate. The options are SIGNED, INVALID_CERT, NO_CA, REVOKED, and UNKNOWN. |
| CERTIFICATE_VALID_FROM | TIMESTAMP | The time when the certificate started to be valid. |
| CERTIFICATE_VALID_TO | TIMESTAMP | The time when the certificate is no longer valid. |
| CERTIFICATE_SIGNATURE | VARCHAR(8190) | The signature of the certificate. |
| CERTIFICATE_SERIAL_NUMBER | VARCHAR(255) | The serial number of the certificate. |
| TYPE | VARCHAR(255) | The type of the certificate. The options are DEFAULT, HTTPS, WIRELESS, IPSEC, and UNASSIGNED. |
| PRINTER_ID | BIGINT | The foreign key associated with ID of CONFIGURATION_COMPONENT table. |

ENROLLED_CERTIFICATE_TYPE

The following table shows the relationship between certificate and enrollment status.

| Field Name | Data Type | Description |
|----------------------|--------------|---|
| TYPE_ID | BIGINT | The unique identifier. |
| ENROLLMENT_STATUS_ID | BIGINT | The foreign key of the ID column of ENROLLMENT_STATUS table. |
| TYPE | VARCHAR(255) | The type of the certificate. The options are DEFAULT, HTTPS, WIRELESS, IPSEC, and UNASSIGNED. |

CA_TEMPLATE

The following table shows the details of the templates selected when setting up the MSCA server using the MSCEWS protocol.

| Field Name | Data Type | Description |
|---------------|--------------|---|
| TEMPLATE_ID | BIGINT | The unique identifier for templates for MSCA Server with MSCEWS (cannot be null). |
| TEMPLATE_NAME | VARCHAR(255) | The name of templates in the CEP server. |
| TEMPLATE_OID | VARCHAR(255) | The corresponding SNMP MIB path. |

Authentication and authorization

The following tables are used for the user authentication and authorization mechanism of MVE.

MASTER_ROLE

This table contains all the roles supported by MVE.

| Field name | Data type | Description |
|------------|--------------|-----------------------|
| ID | BIGINT | The primary key. |
| ROLE_NAME | VARCHAR(255) | The name of the role. |

USERS

This table lists all the internal user accounts of MVE.

| Field name | Data type | Description |
|---|--------------------|--|
| ID | BIGINT | The primary key. |
| USER_NAME | VARCHAR(15) | The user-supplied user name. |
| USER_PASS | VARCHAR(1024) | The user-supplied password. |
| ENABLED | SMALLINT/ TINYINT* | The flag indicating whether this account is enabled. |
| NAME | VARCHAR(255) | The user's full name. |
| LAST_LOGIN | TIMESTAMP | The time stamp of the last login attempt. |
| LOGIN_ATTEMPT | BIGINT | The current number of attempts made at a successful login. |
| REFRESH_TOKEN | VARCHAR(1024) | The authentication token when the user logs in. |
| *This data type is required for Microsoft SQL Server. | | |

USER_ROLE

This table describes the association of users to roles.

| Field name | Data type | Description |
|------------|-------------|--|
| ID | BIGINT | The primary key. |
| USER_NAME | VARCHAR(15) | The foreign key back to USERS.USER_NAME. |

| Field name | Data type | Description |
|------------|-------------|--|
| ROLE_NAME | VARCHAR(30) | The foreign key back to MASTER_ROLE.ROLE_NAME. |

Security settings

The following tables describe security settings in a configuration. The security configuration information is encrypted for data safety, unavailable outside of MVE, and not useful in the scope of this document. So the details of the following tables are omitted.

- SEC_ACCESS_CONTROL
- SEC_AUTH_GROUP
- SEC_BUILDING_BLOCK
- SEC_BUILDING_BLOCK_SETTINGS
- SEC_COMPONENT_MISC_SETTINGS
- SEC_INTERNAL_ACCOUNT
- SEC_INTERNAL_ACCOUNT_GROUPS
- SEC_INTERNAL_ACCOUNT_SETTINGS
- SEC_SECURITY_TEMPLATE
- SEC_SECURITY_TEMPLATE_BBS
- SEC_SECURITY_TEMPLATE_GROUPS
- CAESAR2_LOCAL_ACCOUNTS
- CAESAR2_MISC_SETTINGS
- CAESAR2_KRB_SETUP
- CAESAR2_COMP_LOCAL_ACCTS
- CAESAR2_LOCAL_ACCOUNT_GROUPS
- CAESAR2_GROUPS
- CAESAR2_COMP_GROUPS
- CAESAR2_GROUP_PERMISSIONS
- CAESAR2_KRB_SETUP_PERMISSIONS
- CAESAR2_COMP_PUBLIC_PERMS
- CAESAR2_LDAP_SETUPS
- CAESAR2_COMP_LDAP_SETUPS
- CAESAR2_LDAP_SEARCH_OBJECTS
- CAESAR2_LDAP_SETUP_GROUPS
- CAESAR2_LDAP_SERVER_INFO
- CAESAR2_LDAP_DEVICE_CREDS
- CAESAR2_SOLUTION_ACCTS
- CAESAR2_LDAP_ADDRESS_BOOKS
- CAESAR2_LDAP_SEARCH_ATTRS
- CAESAR2_COMP_SOLN_ACCTS
- CAESAR2_SOLUTION_ACCT_GROUPS

CAESAR2_MISC_SETTINGS

| Field Name | Data Type | Description |
|---|--------------------|--|
| MINIMUM_PASSWORD_LENGTH | SMALLINT/ TINYINT* | Added new miscellaneous setting under Advanced Security Component. |
| PROTECTED_FEATURES | VARCHAR(255) | |
| PRINT_PERMISSION_PRINT | VARCHAR(255) | |
| PRINT_PERMISSION_BROWSER | VARCHAR(255) | |
| PRINT_PERMISSION_CONTROL_PANEL | VARCHAR(255) | |
| *This data type is required for Microsoft SQL Server. | | |

Views and data export

The following tables describe information on Views in MVE and fields included in each view.

DATA_EXPORT_TEMPLATE

This table contains information on Views in MVE.

| Field Name | Data Type | Description |
|---|--------------------|---|
| DATA_EXPORT_ID | BIGINT | The primary key. |
| NAME | VARCHAR(255) | The name of the view. |
| DEFAULT_TEMPLATE | SMALLINT/ TINYINT* | Whether the template is the default template to be shown when initially logged in, only one view can have this value set to True . |
| LANGUAGE_CODE | VARCHAR(255) | Deprecated. |
| INCLUDE_HEADER | SMALLINT/ TINYINT* | Deprecated. |
| WRAP_FIELDS | SMALLINT/ TINYINT* | Deprecated. |
| DESCRIPTION | VARCHAR(4000) | The description of the view. |
| IS_SYSTEM | SMALLINT/ TINYINT* | This field indicates whether the template is in system view, which cannot be edited or deleted. |
| IDENTIFIER_FIELD | VARCHAR(255) | The identifier field chosen for this view. |
| *This data type is required for Microsoft SQL Server. | | |

DATA_EXPORT_FIELDS

This table contains the fields included in each view.

| Field Name | Data Type | Description |
|----------------|--------------|---|
| FIELD_INDEX | Integer | The primary key. |
| FIELD | VARCHAR(255) | The name of the field to be included in the view. |
| DATA_EXPORT_ID | BIGINT | The foreign key to DATA_EXPORT_TEMPLATE.DATA_EXPORT_ID. |

Event manager

The following tables deal with information related to creating and managing events.

ALERT

This table contains all the alerts that MVE supports.

| Field name | Data type | Description |
|------------|--------------|---|
| ID | BIGINT | The primary key |
| NAME | VARCHAR(255) | The textual name of the alert. For example, "Supply Alert." |
| SEVERITY | VARCHAR(255) | For example, "ERROR." |
| CATEGORY | VARCHAR(255) | For example, "SUPPLIES." |

ASSIGNED_EVENTS

This table links events with their assigned Configuration Items.

| Field name | Data type | Description |
|--------------------------|--------------|---|
| CI_ID | BIGINT | The composite primary key. Refers to CONFIG_ITEM.CI_ID. |
| EVENT_ID | BIGINT | The composite primary key. Refers to EVENT.EVENT_ID. |
| EVENT_REGISTRATION_STATE | VARCHAR(255) | The options are REGISTERED and NOT_REGISTERED. |

DESTINATION

This table represents an action within the Event Manager module.

| Field name | Data type | Description |
|------------------|---------------|---|
| ID | BIGINT | The primary key. |
| DESTINATION_TYPE | VARCHAR(31) | The type of destination, currently either email or shell command. Depending on the type, not all columns apply. |
| NAME | VARCHAR(255) | The user-supplied name of the destination. |
| EMAIL_BODY | VARCHAR(255) | The email body text. |
| EMAIL_CC | VARCHAR(255) | The email CC list. |
| EMAIL_FROM | VARCHAR(255) | The email From text. |
| EMAIL_SUBJECT | VARCHAR(255) | The email Subject text. |
| EMAIL_TO | VARCHAR(255) | The email to text. |
| COMMAND_PATH | VARCHAR(255) | The full path to the command. |
| COMMAND_PARAMS | VARCHAR(255) | Any parameters to send to the command. |
| DESCRIPTION | VARCHAR(4000) | An optional user description of the action. |
| LAST_MODIFIED | Timestamp | The date of the last edit of the action. |

EVENT

This table contains user-created events, which consist of a name, a description, and a collection of alerts to include.

| Field name | Data type | Description |
|---|--------------------|--|
| NAME | VARCHAR(255) | The user-supplied name of the event. |
| DESCRIPTION | VARCHAR(255) | The user-supplied description of the event. |
| EVENT_ID | BIGINT | The primary key. |
| TRIGGER_DESTINATIONS | VARCHAR(255) | The trigger destinations of the event. The options are on_active_only and on_active_and_clear. |
| GRACE_PERIOD_ENABLED | SMALLINT/ TINYINT* | The flag indicating whether a grace period is enabled. |
| GRACE_PERIOD_MINUTES | INTEGER | The number of minutes for the grace period. |
| LAST_MODIFIED | TIMESTAMP | The time of the last edit of the event. |
| *This data type is required for Microsoft SQL Server. | | |

EVENT_ALERTS

This table links an event to the collection of alerts it includes.

| Field name | Data type | Description |
|------------|-----------|--|
| EVENT_ID | BIGINT | The composite primary key. Refers to EVENT.EVENT_ID. |
| ALERT_ID | BIGINT | The composite primary key. Refers to ALERT.ALERT_ID. |

EVENT_DESTINATIONS

This table links an event to an associated action.

| Field name | Data type | Description |
|----------------|-----------|--|
| EVENT_ID | BIGINT | The composite primary key. Refers to EVENT.EVENT_ID. |
| DESTINATION_ID | BIGINT | The composite primary key. Refers to DESTINATION.DESTINATION_ID. |

PRINTER_EVENT_ACTIVE_CONDITIONS

This table represents the active conditions or alerts for printers with events that trigger that condition or alert. Multiple conditions have their corresponding rows, all pointing to the same PRINTER_ID.

| Field name | Data type | Description |
|---------------------|--------------|---|
| ACTIVE_CONDITION_ID | BIGINT | The primary key. |
| LOCATION | VARCHAR(255) | For example, "Tray 1." |
| MESSAGE | VARCHAR(255) | For example, "Tray Missing." |
| TYPE | VARCHAR(255) | For example, "Intervention Required." |
| CI_ID | BIGINT | Refers to CONFIG_ITEM.ID. |
| DESTINATION_TASK_ID | VARCHAR(80) | The foreign key back to SYSTEM_LOG.TASK_ID. |

Miscellaneous

The following tables provide useful storage but do not fit into any of the previous table categories.

APPLICATION_SETTINGS

This table currently holds all the MVE system settings. The values are encrypted and not available outside of MVE.

| Field name | Data type | Description |
|---------------|---------------|-----------------------|
| ID | BIGINT | The primary key. |
| SETTING_KEY | VARCHAR(255) | The preference name. |
| SETTING_VALUE | VARCHAR(8190) | The preference value. |

BOOKMARK

This table contains all saved searches of MVE. They are currently stored as BLOB, so they cannot be edited outside of MVE.

| Field name | Data type | Description |
|-----------------|--------------------|--|
| ID | BIGINT | The primary key. |
| DEFAULT_SEARCH | SMALLINT/ TINYINT* | The flag indicating whether this bookmark is one of the defaults that come with MVE. |
| NAME | VARCHAR(255) | The user-supplied name of the bookmark. |
| SEARCH_CRITERIA | BLOB SUB_TYPE 0 | The binary representation of the bookmark. |
| DESERIALIZABLE | SMALLINT/ TINYINT* | Indicates whether the saved search is deserializable. |
| DESCRIPTION | VARCHAR(4000) | An optional user-entered description of the saved search. |

*This data type is required for Microsoft SQL Server.

Liquibase and Hibernate Tables

Liquibase and Hibernate are third-party libraries that MVE uses to help maintain the database. The following tables are used by these libraries. These tables do not contain any significant printer data so their contents are not detailed here.

- DATABASECHANGELOG
- DATABASECHANGELOGLOCK
- All tables whose names begin with **HT_**.
- HIBERNATESEQUENCE

SMTP_CONFIGURATION

This table contains configuration for the Simple Mail Transfer Protocol (SMTP), which allows MVE users to send emails.

| Field name | Data type | Description |
|---|--------------------|---|
| ID | BIGINT | The primary key. |
| FROM_ADDRESS | VARCHAR(255) | The email address of the sender. |
| LOGIN_ID | VARCHAR(255) | The user ID for the SMTP server. |
| LOGIN_PASSWORD | VARCHAR(255) | The password associated with the user ID for the SMTP server. |
| LOGIN_REQ | SMALLINT/ TINYINT* | The flag indicating whether the SMTP server requires a login. |
| SMTP_PORT | BIGINT | The port of the SMTP server. |
| SMTP_SERVER | VARCHAR(255) | The host name or IP address of the SMTP server. |
| SMTP_ENABLE | SMALLINT/ TINYINT* | The flag indicating whether SMTP is enabled. |
| EMAIL_ENCRYPTION | VARCHAR(64) | Refers to the supported encryption types., default is null. |
| *This data type is required for Microsoft SQL Server. | | |

SYSTEM_LOG

This table contains all of the system log messages that are produced as MVE carries out its tasks. This table can get very large.

| Field name | Data type | Description |
|------------|---------------|--|
| LOG_ID | BIGINT | The primary key. |
| TIMESTAMP_ | TIMESTAMP | The time when the message was logged. |
| TASKID | BIGINT | The task instance that generated the message. |
| TASKNAME | VARCHAR(50) | The task that generated the message. |
| LEVEL_ | INTEGER | The options are DEBUG, INFO, etc. |
| MESSAGE_ | VARCHAR(8000) | The actual log message. |
| USER_NAME | VARCHAR(255) | The username of the user who performed the action. |
| IP_ADDRESS | VARCHAR(50) | The client IP address. |

Quartz DB

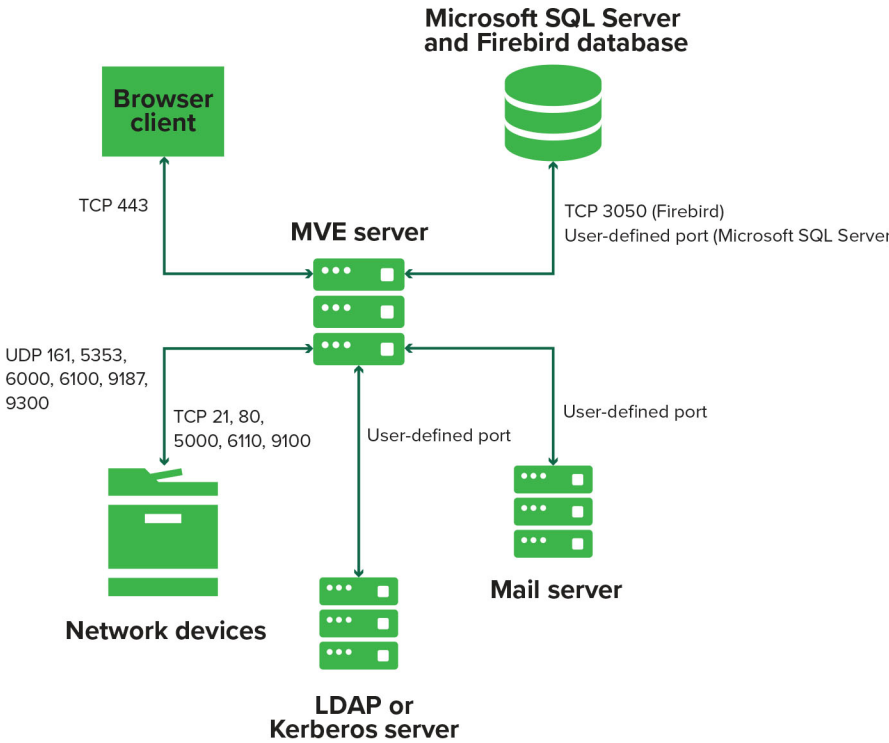
QRTZ_FIRED_TRIGGERS

| Field name | Data type | Description |
|------------|-----------|--|
| SCHED_TIME | BIGINT | A new column added for Scheduled Time. |

Appendix

Understanding ports and protocols

MVE uses different ports and protocols for several types of network communication, as shown in the following diagram:



Notes:

- The ports must be open or active for MVE to function properly. Make sure that all the printer ports are enabled.
- Some communications require an ephemeral port, which is an allocated range of available ports on the server. When a client requests a temporary communication session, the server assigns a dynamic port to the client. The port is valid only for a short duration and can become available for reuse when the previous session expires.

Server-to-printer communication

Ports and protocols used during communication from the MVE server to network printers

| Protocol | MVE server | Printer | Used for |
|---|------------|----------|--|
| Network Printing Alliance Protocol (NPAP) | UDP 9187 | UDP 9300 | Communicating with Lexmark network printers |
| XML Network Transport (XMLNT) | UDP 9187 | UDP 6000 | Communicating with some Lexmark network printers |

| Protocol | MVE server | Printer | Used for |
|---|--|------------------------------------|---|
| Lexmark Secure Transport (LST) | UDP 6100 Ephemeral Transmission Control Protocol (TCP) port (handshaking) | UDP 6100 TCP 6110 (handshaking) | Communicating securely with some Lexmark network printers |
| Multicast Domain Name System (mDNS) | Ephemeral User Datagram Protocol (UDP) port | UDP 5353 | Discovering Lexmark network printers and determining the security capabilities of printers Note: This port is required to allow MVE to communicate with secured printers. |
| Simple Network Management Protocol (SNMP) | Ephemeral UDP port | UDP 161 | Discovering and communicating with Lexmark and third-party network printers |
| File Transfer Protocol (FTP) | Ephemeral TCP port | TCP 21 | Deploying files |
| Hypertext Transfer Protocol (HTTP) | Ephemeral TCP port | TCP 80 | Deploying files or enforcing configurations |
| Hypertext Transfer Protocol over SSL (HTTPS) | Ephemeral TCP port | TCP 443 | Deploying files or enforcing configurations |
| RAW | Ephemeral TCP port | TCP 9100 | Deploying files or enforcing configurations |

Printer-to-server communication

Port and protocol used during communication from network printers to the MVE server

| Protocol | Printer | MVE server | Used for |
|-------------|----------|------------|---------------------------------|
| NPAP | UDP 9300 | UDP 9187 | Generating and receiving alerts |

Server-to-database communication

Ports used during communication from the MVE server to databases

| MVE server | Database | Used for |
|---------------------------|--|---|
| Ephemeral TCP port | User-defined port. The default port is TCP 1433. | Communicating with an SQL Server database |
| Ephemeral TCP port | TCP 3050 | Communicating with a Firebird database |

Client-to-server communication

Port and protocol used during communication from the browser client to the MVE server

| Protocol | Browser client | MVE server |
|---|----------------|------------|
| Hypertext Transfer Protocol over SSL (HTTPS) | TCP port | TCP 443 |

Server-to-mail-server communication

Port and protocol used during communication from the MVE server to a mail server

| Protocol | MVE server | SMTP server | Used for |
|--|--------------------|---|---|
| Simple Mail Transfer Protocol (SMTP) [Encryption = None] | Ephemeral TCP port | User-defined port. The default port is TCP 25. | Providing email functionality for receiving alerts from printers and scheduled view export emails related to printer data |
| Simple Mail Transfer Protocol (SMTP) [Encryption = SSL] | Ephemeral TCP port | User-defined port. The default port is TCP 465. | Providing email functionality for receiving alerts from printers and scheduled view export emails related to printer data over SSL |
| Simple Mail Transfer Protocol (SMTP) [Encryption = TLS/STARTTLS] | Ephemeral TCP port | User-defined port. The default port is TCP 587. | Providing email functionality for receiving alerts from printers and scheduled view export emails related to printer data over TLS/STARTTLS |

Server-to-LDAP-server communication

Ports and protocols used during communication from the MVE server to an LDAP server involving user groups and authentication functionality

| Protocol | MVE server | LDAP server | Used for |
|---|--------------------|---|--|
| Lightweight Directory Access Protocol (LDAP) | Ephemeral TCP port | User-defined port. The default port is TCP 389. | Authenticating MVE users using an LDAP server |
| Lightweight Directory Access Protocol over TLS (LDAPS) | Ephemeral TCP port | User-defined port. The default port is TCP 636. | Authenticating MVE users using an LDAP server over TLS |
| Kerberos | Ephemeral UDP port | User-defined port. The default port is UDP 88. | Authenticating MVE users using Kerberos |

Enabling automatic approval of certificate requests in Microsoft CA

By default, all CA servers are in pending mode and you must manually approve each signed certificate request. Since this method is not feasible for bulk requests, enable the automatic approval of signed certificates.

- 1 From Server Manager, click **Tools > Certification Authority**.
- 2 From the left panel, right-click the CA, and then click **Properties > Policy Module**.
- 3 From the Request Handling tab, click **Follow the settings in the certificate template if applicable**, and then click **OK**.

Note: If **Set the certificate request status to pending** is selected, then you must manually approve the certificate.

- 4 Restart the CA service.

Revoking certificates

Note: Before you begin, make sure that the CA server is configured for CRLs and that they are available.

- 1** From the CA server, open **Certification Authority**.
- 2** From the left panel, expand the CA, and then click **Issued Certificates**.
- 3** Right-click a certificate to revoke, and then click **All Tasks > Revoke Certificate**.
- 4** Select a reason code and the date and time for revocation, and then click **Yes**.
- 5** From the left panel, right-click **Revoked Certificates**, and then click **All Tasks > Publish**.

Note: Make sure that the certificate that you revoked is in Revoked Certificates.

You can see the revoked certificate serial number in the CRL.

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Glossary

| | |
|--------------------------|---|
| action | An e-mail notification or a command-line operation. Actions assigned to events are triggered when a printer alert occurs. |
| audit | The task of collecting printer data such as printer status, supplies, and capabilities. |
| configuration | A collection of settings that can be assigned and enforced to a printer or a group of printer models. Within a configuration, you can modify printer settings and deploy applications, licenses, firmware, and CA certificates to the printers. |
| discovery profile | A profile that contains a set of parameters used to find printers on a network. It may also contain predefined configurations that can be assigned and enforced to printers automatically during the discovery. |
| event | Defines which actions are executed when specific alerts are active. |
| keyword | A custom text assigned to printers that you can use to search for those printers within the system. When you filter a search using a keyword, only printers that are tagged with the keyword are shown. |
| secured printer | A printer that is configured to communicate through an encrypted channel, and requires authentication to access its functions or applications. |
| token | An identifier that represents printer data values for variable settings in a configuration. |
| variable settings | A set of printer settings containing dynamic values that can be integrated into a configuration. |

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