

**Lenovo**

# Lenovo XClarity Integrator Hardware Management Pack for Microsoft System Center Operations Manager Installation and User Guide



**Version 7.14.0**

**Note**

Before using this information and the product it supports, read the information in [Appendix D “Notices” on page 55](#).

**Twenty-fifth Edition (June 2023)**

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# Contents

|  |             |
|--|-------------|
| <b>Contents</b> . . . . .  | <b>i</b>    |
| <b>About this publication</b> . . . . .  | <b>.iii</b> |
| Conventions and terminology . . . . .  | iii         |
| Web resources . . . . .  | iii         |
| <b>Chapter 1. Overview.</b> . . . . .  | <b>1</b>    |
| Key features . . . . .   | 1           |
| Supported server models and scenarios . . . . .  | 3           |
| Advantages . . . . .   | 4           |
| Hardware and software requirements of the management server . . . . .  | 5           |
| Hardware requirements . . . . .  | 5           |
| Software requirements . . . . .  | 5           |
| The Lenovo Hardware folder in Operations Manager . . . . .   | 6           |
| Lenovo system groups in Operations Manager. . . . .  | 7           |
| <b>Chapter 2. Installing, uninstalling, or upgrading Lenovo XClarity Integrator Hardware Management Pack</b> . . . . . | <b>9</b>    |
| Installing Lenovo XClarity Integrator Hardware Management Pack . . . . .   | 9           |
| Installing Lenovo XClarity Integrator Hardware Management Pack fix patches . . . . .                                   | 11          |
| Migrating the data from the PostgreSQL database to the SQL server database . . . . .                                   | 11          |
| Viewing the database information . . . . .   | 11          |
| Uninstalling Lenovo XClarity Integrator Hardware Management Pack . . . . .   | 11          |
| Uninstalling Lenovo XClarity Integrator Service . . . . .  | 12          |
| Upgrading Lenovo XClarity Integrator Hardware Management Pack and Lenovo XClarity Integrator Service . . . . .         | 12          |
| <b>Chapter 3. Managing servers through XClarity Integrator Service</b> . . . . .                                       | <b>15</b>   |
| Configuring XClarity Integrator Service . . . . .  | 15          |
| Logging in to XClarity Integrator Service . . . . .  | 15          |
| Registering Operations Management Server. . . . .  | 16          |
| Changing password of XClarity Integrator Service . . . . .   | 16          |
| Restarting XClarity Integrator Service . . . . .   | 16          |
| Monitoring XClarity Integrator Service in the Operations Manager server . . . . .                                      | 17          |
| High Availability of XClarity Integrator Service . . . . .   | 17          |
| Discovering the BMC node . . . . .   | 17          |
| BMC node discovery and management. . . . .   | 18          |
| BMC node auto-discovery and management . . . . .   | 18          |
| Only managing the BMC of servers already managed by Operations Manager . . . . .                                       | 19          |
| Refreshing BMC node data . . . . .   | 19          |
| Monitoring the system health . . . . .   | 20          |
| Setting the power capping . . . . .  | 20          |
| Removing a BMC node . . . . .  | 21          |
| Removing one or more BMC nodes . . . . .   | 21          |
| <b>Chapter 4. Managing servers through XClarity Administrator</b> . . . . .  | <b>23</b>   |
| Configuring XClarity Administrator . . . . .   | 23          |
| Refreshing server inventory data . . . . .   | 24          |
| Monitoring the system health . . . . .   | 24          |
| Removing a server. . . . .   | 24          |
| <b>Chapter 5. Manage chassis through SNMP.</b> . . . . .   | <b>27</b>   |
| Configuring the SNMP agent . . . . .   | 27          |
| Configuring SNMPv1 Agent on the BladeCenter chassis . . . . .  | 27          |
| Configuring SNMP on the Flex System chassis . . . . .  | 28          |
| Discovering a chassis . . . . .  | 29          |
| Monitoring the chassis health . . . . .  | 30          |
| Monitoring the BladeCenter chassis health . . . . .  | 30          |
| Monitoring the Flex System chassis health . . . . .  | 31          |
| Obtaining the latest information for the chassis . . . . .   | 31          |
| Launching the AMM/CMM Web console . . . . .  | 32          |
| Starting or shutting down a blade server or a compute node . . . . .   | 32          |
| Removing a discovered chassis . . . . .  | 32          |
| <b>Chapter 6. Managing servers through IBM Platform Agent.</b> . . . . .   | <b>33</b>   |
| Discovering Windows on a Lenovo server. . . . .  | 33          |
| Monitoring the server health . . . . .   | 34          |
| Viewing the power data of the client System x servers . . . . .  | 34          |
| Setting the power capping . . . . .  | 35          |
| Setting the power threshold . . . . .  | 35          |
| Obtaining the latest information for the Lenovo servers . . . . .  | 35          |
| <b>Chapter 7. Working with XClarity Integrator Service security certificates</b> . . . . .                             | <b>37</b>   |

|   |           |
|---|-----------|
| Setting the BMC communication protocol . . . .                            | 37        |
| Generating and uploading the certificates. . . .                          | 37        |
| Regenerating the certificates. . . . .                                    | 38        |
| Regenerating the server certificate . . . . .                             | 38        |
| Regenerating the root certificate . . . . .                               | 38        |
| Downloading the certificates. . . . .                                     | 39        |
| Downloading the server certificate. . . . .                               | 39        |
| Downloading the root certificate . . . . .                                | 39        |
| <b>Chapter 8. Log data . . . . .</b>                                      | <b>41</b> |
| Logs for XClarity Integrator Service . . . . .                            | 41        |
| Setting the log level . . . . .   | 41        |
| Collecting the log files . . . . .  | 41        |
| Logs for Lenovo XClarity Integrator Hardware<br>Management Pack . . . . . | 41        |
| Setting the log level . . . . .   | 41        |
| Viewing the log in Windows Event Viewer . . . .                           | 42        |
| <b>Chapter 9. Troubleshooting . . . . .</b>                               | <b>43</b> |
| Troubleshooting by symptoms . . . . .                                     | 43        |

|   |    |
|---|----|
| Using Health Explorer to view and resolve<br>problems . . . . .       | 44 |
| Using Lenovo XClarity Forum and Lenovo XClarity<br>Ideation . . . . . | 45 |

**Appendix A. Accessibility  
features . . . . . 47**

**Appendix B. Best practices . . . . . 49**

|   |    |
|---|----|
| Determining the cause of an error . . . . . | 49 |
| Rediscovering all BladeCenters . . . . .    | 51 |
| Rediscovering a renamed server . . . . .    | 51 |

**Appendix C. System firewall  
settings. . . . . 53**

**Appendix D. Notices. . . . . 55**

|                          |    |
|--------------------------|----|
| Trademarks . . . . .     | 56 |
| Important notes. . . . . | 56 |

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## About this publication

This publication provides the instructions for installing Lenovo® XClarity Integrator Hardware Management Pack for Microsoft® System Center Operations Manager (hereinafter referred to as Lenovo XClarity Integrator Hardware Management Pack) into Microsoft System Center Operations Manager (hereinafter referred to as Operations Manager) and using its integrated features to manage the systems in your environment.

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## Conventions and terminology

Paragraphs that start with a bold **Note** or **Important** are notices with specific meanings that highlight key information.

**Note:** These notices provide important tips, guidance, or advice.

**Important:** These notices provide information or advice that might help you avoid inconvenient or difficult situations.

The following table describes some of the terms, acronyms, and abbreviations used in this document.

| Term, Acronym, or Abbreviation         | Definition   |
|--|--|
| BMC                                    | Baseboard Management Controller, which is a service processor that consolidates service processor functions and a video controller in a single chip.                           |
| CMM                                    | Chassis Management Module, which manages the Flex System chassis.  |
| AMM                                    | Advanced Management Module, which manages the BladeCenter® chassis.  |
| SNMP                                   | Simple Network Management Protocol.  |
| (Lenovo) XClarity® Integrator (LXCI)   | A tool suite that enables IT administrators to integrate the management features of the System x with Microsoft System Center.   |
| (Lenovo) XClarity Integrator Service   | The backend component of Lenovo XClarity Integrator, which provides the functionality for Lenovo XClarity Integrator to access and manage Lenovo servers.                      |
| (Lenovo) XClarity Administrator (LXCA) | A centralized, resource-management solution that simplifies infrastructure management, speeds responses, and enhances the availability of Lenovo server systems and solutions. |
| Operations Manager                     | The Microsoft System Center Operations Manager.  |
| Managed server or managed node         | A physical machine managed by Operations Manager.  |

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## Web resources

The following Web sites provide the resources for understanding, using, and troubleshooting the BladeCenter chassis, the Flex System chassis, the ThinkServer® servers, the ThinkSystem® servers, the ThinkAgile HX Series servers, the System x servers, and the system-management tools.

### **Lenovo Web site for Microsoft Systems Management Solutions for Lenovo servers**

This Web site locates the latest downloads for the XClarity Integrator offerings for Microsoft System Center Management Solutions:

- [Lenovo XClarity Integrator for Microsoft System Center Web site](#)

### **System Management with Lenovo XClarity Solutions**

This Web site provides an overview of the Lenovo XClarity solutions that integrate System x and Flex System hardware to provide system management capability:

- [System Management with Lenovo XClarity Solution Web site](#)

### **Lenovo XClarity Forum and Ideation**

The following Web sites provide the forum and ideation of all Lenovo XClarity products:

- [Lenovo XClarity Forum Web site](#)
- [Lenovo XClarity Ideation Web site](#)

### **Lenovo technical support portal**

This Web site assists you in locating support for hardware and software:

- [Lenovo Support Portal Web site](#)

### **Lenovo ServerProven**

This Web site obtains the information about hardware compatibility with Lenovo ThinkSystem servers, System x servers, BladeCenter servers, and Flex System servers:

- [Lenovo ServerProven Compatibility Web site](#)

### **Microsoft System Center Operations Manager Web site**

This Web site provides an overview of the Microsoft System Center Operations Manager:

- [Microsoft System Center Operations Manager Web site](#)

# Chapter 1. Overview

Lenovo XClarity Integrator Hardware Management Pack manages the health state of the ThinkSystem servers, the ThinkAgile HX Series servers, the System x servers, the ThinkServer servers, the BladeCenter chassis, and the Flex System chassis by using the enhanced features of Operations Manager. Lenovo XClarity Integrator Hardware Management Pack provides a view of your IT infrastructures and minimizes the down time caused by the hardware problems.

## Key features

Lenovo XClarity Integrator Hardware Management Pack has the following key features:

- Manage ThinkSystem, ThinkAgile, and System x servers through XClarity Integrator Service (out-of-band mode).
- Manage ThinkServer and SR635/655 through XClarity Administrator (out-of-band mode).
- Manage chassis through SNMP.
- Manage System x servers through IBM Platform Agent (in-band mode).

**Note:** IBM Platform Agent does not support managing the ThinkSystem servers and other BMC-based servers installed with the Windows 2016 operating system or later versions. Therefore, it is not recommended to use IBM Platform Agent to manage servers.

Lenovo XClarity Integrator Hardware Management Pack contains several management packs. The following table provides the names, IDs, and the corresponding major functions of the management packs.

Table 1. Lenovo Hardware Management Pack function list

| Lenovo Hardware Management Pack                        |                                      | Major functions   |  |   |                             |
|--|--------------------------------------|---|--|---|-----------------------------|
| Management pack name                                   | Management pack ID                   | Manage ThinkSystem, ThinkAgile, and System x servers through XClarity Integrator Service (out-of-band mode) | Manage ThinkServer and SR635/655 through XClarity Administrator (out-of-band mode) | Manage System x servers through IBM Platform Agent (in-band mode) | Manage chassis through SNMP |
| Lenovo Hardware Management Pack - Common Library       | Lenovo.HardwareMgmt-Pack.Common      | √   | √  | √   | √                           |
| Lenovo Hardware Management Pack - Hardware IDs Library | Lenovo.HardwareMgmt-Pack.HardwareIDs |   |  | √   |                             |
| Lenovo Hardware Management Pack - Relation Library     | Lenovo.HardwareMgmt-Pack.Relation.v2 |   |  | √   | √                           |

Table 1. Lenovo Hardware Management Pack function list (continued)

|   |   |   |   |   |   |
|---|---|---|---|---|---|
| Lenovo Hardware Management Pack - Flex Relation Library             | Lenovo. HardwareMgmt-Pack. RelationCMM.v2   |   |   | √ | √ |
| Lenovo Hardware Management Pack for ThinkSystem and System x        | Lenovo. HardwareMgmt-Pack. IMM2.v2          | √ |   |   |   |
| Lenovo Hardware Management Pack for BladeCenter Chassis and Modules | Lenovo. HardwareMgmt-Pack. BladeCenter.v2   |   |   |   | √ |
| Lenovo Hardware Management Pack for Flex System Chassis and Modules | Lenovo. HardwareMgmt-Pack. FlexSystem.v2    |   |   |   | √ |
| Lenovo Hardware Management Pack for Windows on Lenovo servers       | Lenovo. HardwareMgmt-Pack.xSystems          |   |   | √ |   |
| Lenovo Hardware Management Pack for ThinkServer and SR635/655       | Lenovo. ThinkServer. BMC.Module             |   | √ |   |   |
| Lenovo Hardware Management Pack for XClarity Integrator Service     | Lenovo.XClarity. Integrator. Service.Module | √ | √ |   |   |

**Notes:**

- Lenovo XClarity Integrator Hardware Management Pack for Windows on Lenovo servers is required for the BMC auto-discovery and management function.
- Lenovo XClarity Integrator Hardware Management Pack for BMC Auto Discovery Override is not included in the previous table. It will be generated in runtime.



## Supported server models and scenarios

The following table lists the Lenovo servers supported by Lenovo XClarity Integrator Hardware Management Pack.

Table 2. Supported Lenovo servers

| Series   | Server models   |   |   |
|--|---|---|---|
| Think-System   | <ul style="list-style-type: none"> <li>SD530 (7X20, 7X21, 7X22)</li> <li>SD630 V2 (7D1K)</li> <li>SE350 (7D1X, 7D27, 7Z46)</li> <li>SE450 (7D8T)</li> <li>SN550 (7X16)</li> <li>SN550 V2 (7Z69)</li> <li>SN850 (7X15)</li> <li>SR150 (7Y54)</li> <li>SR158 (7Y55)</li> <li>SR250 (7Y51, 7Y52, 7Y72, 7Y73)</li> <li>SR250 V2 (7D7R, 7D7Q, 7D7S)</li> <li>SR258 (7Y53)</li> <li>SR530 (7X07, 7X08)</li> <li>SR550 (7X03, 7X04)</li> <li>SR570 (7Y02, 7Y03)</li> </ul> | <ul style="list-style-type: none"> <li>SR590 (7X98, 7X99)</li> <li>SR630 (7X01, 7X02)</li> <li>SR630 V2 (7Z70, 7Z71)</li> <li>SR630 V3 (7D72, 7D73, 7D74)</li> <li>SR635 (7Y98, 7Y99)*</li> <li>SR635 V3 (7D9H, 7D9G)</li> <li>SR645 (7D2X, 7D2Y)</li> <li>SR645 V3 (7D9C, 7D9D)</li> <li>SR650 (7X05, 7X06)</li> <li>SR650 V2 (7Z72, 7Z73)</li> <li>SR650 V3 (7D75, 7D76, 7D77)</li> <li>SR655 (7Y00, 7Z01)*</li> <li>SR655 V3 (7D9E, 7D9F)</li> <li>SR665 (7D2V, 7D2W)</li> <li>SR665 V3 (7D9A, 7D9B)</li> <li>SR670 V2 (7Z22, 7Z23)</li> <li>SR850 (7X18, 7X19)</li> </ul> | <ul style="list-style-type: none"> <li>SR850 V2 (7D31, 7D32, 7D33)</li> <li>SR850 V3 (7D96, 7D97, 7D98)</li> <li>SR850P (7D2F, 7D2G, 7D2H)</li> <li>SR860 (7X69, 7X70)</li> <li>SR860 V2 (7Z59, 7Z60, 7D42)</li> <li>SR860 V3 (7D93, 7D94, 7D95)</li> <li>SR950 (7X11, 7X12, 7X13)</li> <li>ST250 (7Y45, 7Y46)</li> <li>ST250 V2 (7D8F, 7D8G, 7D8H)</li> <li>ST258 (7Y47)</li> <li>ST550 (7X09, 7X10)</li> <li>ST558 (7Y15, 7Y16)&amp;</li> <li>ST650 V2 / ST658 V2 (7Z74, 7Z75, 7Z76)&amp;</li> <li>ST650 V3 (7D7A, 7D7B, 7D7C)</li> </ul> |
| ThinkAgile   | <ul style="list-style-type: none"> <li>HX1020 (7D2T)</li> <li>HX1021 (7D1Z, 7D20, 7D29)</li> <li>HX1310/2310/3310 (8693)</li> <li>HX1320/2320/3320 (7X83)</li> <li>HX1321/2321/3321/7321 (7Y89, 7Z04)</li> <li>HX3510/5510/7510 (8695)</li> <li>HX3721/7721 (7Y88, 7Z03)</li> <li>HX1520/3520/5520/7520 (7X84)</li> </ul>   | <ul style="list-style-type: none"> <li>HX1521/3521/5521/7521 (7Y90, 7Z05)</li> <li>HX2710/3710 (8689)*</li> <li>HX2720/3720 (7X82)</li> <li>HX7520 (7Z44)</li> <li>HX7521 (7Z45)</li> <li>HX7820 (7Y95, 7Z08)</li> <li>HX7821 (7Y96, 7Z09)</li> <li>MX1020 (7D5S, 7D5T)</li> </ul>  | <ul style="list-style-type: none"> <li>MX1021 on SE350 (7D1B, 7D2U)</li> <li>MX3330 (7D19)</li> <li>MX3331 (7D67)</li> <li>MX3520 (7D5R)</li> <li>MX3530 (7D6B)</li> <li>MX3531 (7D66)</li> <li>MX Hybrid/All-Flash Certified Node on SR650 (7Z20)</li> </ul>   |
| System x   | <ul style="list-style-type: none"> <li>nx360 M5 (5465)</li> <li>nx360 M5 DWC (5467, 5468, 5469)</li> <li>sd350 M5 (5493)</li> <li>x240 M5 (2591, 9532)</li> <li>x240 Compute Node (7162, 2588)</li> <li>x280, x480, x880 X6 Compute Node (7196, 4258)</li> </ul>  | <ul style="list-style-type: none"> <li>x440 (7167, 2590)</li> <li>x3250 M6 (3633, 3943)</li> <li>x3500 M5 (5464)</li> <li>x3550 M4 (7914)</li> <li>x3550 M5 (5463, 8869)</li> <li>x3630 M4 (7158, 8103)</li> </ul>  | <ul style="list-style-type: none"> <li>x3650 M4 (7915)</li> <li>x3650 M5 (5462, 8871)</li> <li>x3750 M4 (8753)</li> <li>x3850 X6 (6241)</li> <li>x3950 X6 (6241)</li> </ul>   |
| Think-Server   | <ul style="list-style-type: none"> <li>RD350</li> <li>RD450</li> <li>RD550</li> </ul>   | <ul style="list-style-type: none"> <li>RD650</li> <li>RS160</li> </ul>  | <ul style="list-style-type: none"> <li>TD350</li> <li>TS460</li> </ul>  |
| Chassis  | <ul style="list-style-type: none"> <li>Blade Center E Chassis (8677)</li> <li>Blade Center H Chassis (8852)</li> <li>Blade Center S Chassis (8886)</li> </ul>   | <ul style="list-style-type: none"> <li>Flex System Enterprise Chassis (7893, 8721, 8724)</li> </ul>   |   |
| <p><b>Notes:</b></p> <ul style="list-style-type: none"> <li>Server models with the asterisk mark (*) indicate that Lenovo XClarity Administrator is required for server management.</li> <li>Server models with the ampersand (&amp;) are only available in China mainland.</li> </ul> |   |   |   |

The following table lists the IBM servers supported by Lenovo XClarity Integrator Hardware Management Pack.

Table 3. Supported IBM servers

| Series   | Server models   |  |  |
|----------|---|--|--|
| System x | <ul style="list-style-type: none"> <li>• HS23 (1929, 7875)</li> <li>• HS23E (8038, 8039)</li> <li>• iDataPlex dx360 M4 (7912)</li> <li>• nx360 M4 (5455)</li> <li>• x220 Compute Node (7906)</li> <li>• x222 Compute Node (7916)</li> <li>• x240 Compute Node (8737)</li> <li>• x440 Compute Node (7917)</li> </ul> | <ul style="list-style-type: none"> <li>• x880 X6 Compute Node (7903)</li> <li>• x3100 M4 (2582)</li> <li>• x3100 M5 (5457)</li> <li>• x3250 M4 (2583)</li> <li>• x3250 M5 (5458)</li> <li>• x3300 M4 (7382)</li> <li>• x3500 M4 (7383)</li> <li>• x3530 M4 (7160)</li> </ul> | <ul style="list-style-type: none"> <li>• x3550 M4 (7914)</li> <li>• x3630 M4 (7158)</li> <li>• x3650 M4 (7915)</li> <li>• x3650 M4 BD (5466)</li> <li>• x3650 M4 HD (5460)</li> <li>• x3750 M4 (8752)</li> <li>• x3850 X6/x3950 X6 (3837)</li> </ul> |
| Chassis  | <ul style="list-style-type: none"> <li>• Blade Center E Chassis (8677)</li> <li>• Blade Center H Chassis (8852)</li> </ul>  | <ul style="list-style-type: none"> <li>• Blade Center HT Chassis (8740, 8750)</li> <li>• Blade Center S Chassis (8886)</li> </ul>  |  |

The following table lists scenarios supported by Lenovo XClarity Integrator Hardware Management Pack.

Table 4. Supported scenarios

| Series           |             | Supported scenarios   |  |   |                             |
|------------------|-------------|---|--|---|-----------------------------|
|                  |             | Manage ThinkSystem, ThinkAgile, and System x servers through XClarity Integrator Service (out-of-band mode) | Manage ThinkServer and SR635/655 through XClarity Administrator (out-of-band mode) | Manage System x servers through IBM Platform Agent (in-band mode) | Manage chassis through SNMP |
| Le-<br>no-<br>vo | ThinkSystem | √   |  |   |                             |
|                  | ThinkAgile  | √   |  |   |                             |
|                  | System x    | √   |  | √   |                             |
|                  | ThinkServer |   | √  |   |                             |
|                  | Chassis     |   |  |   | √                           |
| IB-<br>M         | System x    | √   |  | √   |                             |
|                  | Chassis     |   |  |   | √                           |

**Note:** For the server models and machine types of each series, refer to [Table 2 “Supported Lenovo servers” on page 3](#) or [Table 3 “Supported IBM servers” on page 4](#).

## Advantages

The following are the advantages of Lenovo XClarity Integrator Hardware Management Pack.

- Easily determining the overall health status of servers.
- Monitoring the overall power consumption of the System x servers, the BladeCenter servers and the Flex System servers through the Power Data Chart, and generating the alerts when power consumption exceeds predefined thresholds.
- Monitoring the chassis modules health of the BladeCenter chassis in the Windows Health Explorer view.
- Remotely starting or shutting down a blade server or a compute node.

- Remotely shutting down the Windows operating system installed on a blade server or a compute node.
- Setting the maximum power capping and power threshold.
- Launching a CMM Web console of the BladeCenter chassis and the Flex System chassis.
- Discovering and managing BMC node automatically.
- Migrating the data from the PostgreSQL database to the SQL Server database.
- Configuring XClarity Integrator Service from Operations Manager.
- Supporting multiple Operations Managers in the same management group.

---

## Hardware and software requirements of the management server

This section describes how to determine whether a server is supported by Lenovo XClarity Integrator Hardware Management Pack as a management server. The management server shall meet the following hardware and software requirements. If the XClarity Integrator Service is installed on a separated system, the system should also meet the following hardware and software requirements.

### Hardware requirements

This topic lists the hardware requirements of the management server depending on the number of managed servers.

#### Up to manage 100 Lenovo servers

| Item            | Minimum configuration     | Recommended configuration |
|-----------------|---------------------------|---------------------------|
| Processor       | 4-core 2.66 GHz processor | 4-core 2.66 GHz processor |
| Memory          | 8 GB                      | 8 GB                      |
| Free disk space | 20 GB                     | 40 GB                     |
| Network card    | 100 MBPS                  | 10 GBPS                   |

#### Up to manage 300 Lenovo servers

| Item            | Minimum configuration     | Recommended configuration |
|-----------------|---------------------------|---------------------------|
| Processor       | 4-core 2.66 GHz processor | 8-core 2.66 GHz processor |
| Memory          | 8 GB                      | 16 GB                     |
| Free disk space | 20 GB                     | 40 GB                     |
| Network card    | 100 MBPS                  | 10 GBPS                   |

#### Up to manage 500 Lenovo servers

| Item            | Minimum configuration     | Recommended configuration |
|-----------------|---------------------------|---------------------------|
| Processor       | 4-core 2.66 GHz processor | 8-core 2.66 GHz processor |
| Memory          | 16 GB                     | 32 GB                     |
| Free disk space | 20 GB                     | 40 GB                     |
| Network card    | 100 MBPS                  | 10 GBPS                   |

### Software requirements

This topic lists the software requirements of the management server.

- Microsoft .NET Framework v3.5

- Microsoft .NET Framework v4.5 or later versions
- PowerShell 3.0 or later versions
- Chrome: 114.0.5735.134 or later versions (Recommended)
- Firefox: 114.0.2 or later versions (Recommended)
- Edge: 114.0.1823.51 or later versions (Recommended)
- To use the SQL server database as the database in XClarity Integrator Service, ensure that the SQL server meets the following requirements:
  - Version: SQL server 2008 R2 SP3 or later version
  - Authentication mode: SQL Server and Windows Authentication mode
  - Disk size: 10 GB free size for 100 managed servers, 30 GB free size for 500 managed servers
  - CPU and memory: Four-core 2.66 GHz processors and 16 GB memory are recommended.

**Note:** To connect to a remote SQL server, install the SQL feature “Client Tools Connectivity” on the local server where the XClarity Integrator Service is to be installed. Otherwise, an error message is displayed, indicating that this feature is not installed. This feature is available in the **Feature Selection** step of the SQL server setup wizard.

- To use the PostgreSQL database as the database in XClarity Integrator Service, ensure that the PostgreSQL server meets the following requirements:
  - Version: 9.2, 9.3, 9.4, 9.5, 9.6, 10.6, or 11.1
  - Disk size: 10 GB free size for 100 managed servers, 30 GB free size for 500 managed servers
  - CPU and memory: Four-core 2.66 GHz processors and 16 GB memory are recommended.

## Supported versions of Operations Manager

The following versions of Operations Manager are supported:

- Microsoft System Center Operations Manager 2022
- Microsoft System Center Operations Manager 2019
- Microsoft System Center Operations Manager 2016

## Supported Windows operating systems for the management server

The following Windows operating systems are supported for the management server:

- Windows Server 2016
- Windows Server 2019
- Windows Server 2022

---

## The Lenovo Hardware folder in Operations Manager

Lenovo XClarity Integrator Hardware Management Pack adds the Lenovo Hardware folder to Operations Manager. This folder provides the active alerts, task status, and aggregate targets for all discovered Lenovo servers and hardware components.

The Lenovo Hardware folder contains the following folders:

### 1. **Lenovo ThinkSystem and System x:**

This folder contains the summary views of active alerts and the general status of all Lenovo ThinkSystem, ThinkAgile HX Series, and System x BMC nodes. The **Hardware Components** subfolder includes the summary views of Cooling Device, Disk Drive, Fibre Channel, Firmware/VPD, InfiniBand, Network Adapter, Numeric Sensor, PCI Device, Physical Memory, Processor, and RAID Controller for Lenovo BMC-based servers (excluding the ThinkServer servers).

### 2. **Flex System Chassis and Modules:**

This folder contains the active alerts, task status, and general status of all Flex System chassis. The **Hardware Components** subfolder includes the summary views of Compute Nodes, Fan Logic Modules, I/O Modules, Management Modules, Power Modules, Rear LED Modules, and Storage Modules.

### 3. **BladeCenter Chassis and Modules:**

This folder contains the active alerts, task status, and general status of all BladeCenter chassis. The **Hardware Components** subfolder includes the summary views of Advanced Management Modules, Blade servers, Chassis, Cooling Modules, I/O Modules, Media Modules, Power Modules, and Storage Modules.

#### 4. **Windows on Lenovo servers:**

This folder contains the summary views of the Lenovo ThinkSystem, ThinkAgile HX Series, and System x servers installed with the Windows operating system. The **Hardware Components** subfolder under this folder includes the summary views of Cooling Devices, Management Controllers, Network Adapters, Physical Memory, Physical Processors, Power Supplies, Storage (Generic), Storage (ServeRAID-8x/7x/6x), Storage (ServeRAID BR or Integrated RAID), Storage (ServeRAID MR or MegaRAID), Temperature Sensors, Voltage Sensors, and Unclassified Hardware.

#### 5. **Lenovo XClarity Integrator Service:**

This folder contains the summary view of Lenovo XClarity Integrator Service.

#### 6. **ThinkServer and SR635/655 (Lenovo XClarity Administrator required):**

This folder contains the summary view of active alerts and the general status of all Lenovo ThinkServer and SR635/655 servers. The **Hardware Components** subfolder under this folder includes the summary views of Cooling Device, Disk Drive, Fibre Channel, Firmware/VPD, InfiniBand, Numeric Sensor, PCI Device, Physical Memory, and Processor for the servers.

**Note:** Cache on the SCOM console may cause the folders to be displayed in an incorrect order. In this case, run the following command to clear the cache:

```
..\ Console\Microsoft.EnterpriseManagement.Monitoring.Console.exe /clearcache
```

---

## Lenovo system groups in Operations Manager

Lenovo XClarity Integrator Hardware Management Pack defines some Lenovo system groups in Operations Manager. You can find the groups by selecting **Authoring → Groups**.

- **Lenovo Windows System Group:** This group includes the servers installed with the Windows operating system.
- **Lenovo ThinkSystem and System x Group:** This group includes the System x servers, ThinkSystem servers, and ThinkAgile HX Series servers.
- **Lenovo ThinkServer and SR635/655 Group:** This group includes the ThinkServer and SR635/655 servers.
- **Lenovo Flex System Chassis Group:** This group includes the Flex System chassis.
- **Lenovo BladeCenter Chassis Group:** This group includes the BladeCenter chassis.



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## Chapter 2. Installing, uninstalling, or upgrading Lenovo XClarity Integrator Hardware Management Pack

This section describes how to install, upgrade, and uninstall Lenovo XClarity Integrator Hardware Management Pack.

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### Installing Lenovo XClarity Integrator Hardware Management Pack

The following procedure describes how to install Lenovo XClarity Integrator Hardware Management Pack.

#### Before you begin

Before installing Lenovo XClarity Integrator Hardware Management Pack, ensure that:

- Current user has administrator privilege.
- The firewall does not block the network ports of XClarity Integrator Service (default value: 9500). For more information, refer to [Appendix C “System firewall settings” on page 53](#).
- If you plan to install XClarity Integrator Service on separate systems, make sure the system and Operations Manager are in the same domain.

To successfully install Lenovo XClarity Integrator Hardware Management Pack, ensure that the management packs for Operations Manager meet the version requirements listed in the following table.

Table 5. Version requirements for the management packs of Operations Manager

| Management packs name      | Management packs ID                          | Management packs    |
|----------------------------|--|---------------------|
| Health Library             | System.Health.Library                        | 6.0.5000.0 or above |
| System Library             | System.Library                               | 6.0.5000.0 or above |
| Performance Library        | System.Performance.Library                   | 6.0.5000.0 or above |
| SNMP Library               | System.Snmp.Library                          | 6.0.6278.0 or above |
| Data Warehouse Library     | Microsoft.SystemCenter.Datawarehouse.Library | 6.0.6278.0 or above |
| System Center Core Library | Microsoft.SystemCenter.Library               | 6.0.5000.0 or above |
| Network Device Library     | System.NetworkManagement.Library             | 7.0.8107.0 or above |
| Windows Core Library       | Microsoft.Windows.Library                    | 6.0.5000.0 or above |

#### Procedure

- Step 1. Download the Lenovo XClarity Integrator Hardware Management Pack installer from the [XClarity Integrator download page](#).
- Step 2. Double-click the installer. The welcome screen is displayed.
- Step 3. Read the license agreement, select the **I accept both the Lenovo and the non-Lenovo terms** check box, and click **Next**.
- Step 4. Select the components to be installed:
  - **Lenovo Hardware Management Pack for Microsoft SCOM**

This component includes the Management Pack and other supported tools, and it should be installed on every SCOM server and every SCOM console you plan to work on.

**Note:** Lenovo Hardware Management Pack and SCOM should be installed on the same server.

- **Lenovo XClarity Integrator Service**

Lenovo XClarity Integrator Service is included in this component. It can be installed on the SCOM server or on a separated Windows operating system.

**Note:** Only one XClarity Integrator Service instance is needed in a management group.

Step 5. Install the package according to the prompts on the installation wizard.

Step 6. Install the Hardware Management Pack if it is selected in step 4.

Step 7. Install XClarity Integrator Service if it is selected in step 4. Set the password and network port (default value: 9500) of XClarity Integrator Service. Then, configure the database.

- **SQL server database**

On the SQL server configuration page, enter the SQL server name and port, provide a Windows authentication or SQL server login account, and then click **Next**. The SQL server name can be a computer name or IP address. The default port is 1433.

**Notes:**

- Before installing XClarity Integrator Service, ensure that you enable Windows authentication and SQL server authentication on the SQL server.
- During the database configuration, a Windows authentication or SQL server login account is mandatory, so that you can create a database and a new login account through XClarity Integrator Service to manage the database on the SQL server. Ensure that the account provided has enough privileges to log in to the SQL server, and to create databases and user accounts on the SQL server. Login credentials of the new account are saved in the Lenovo XClarity Integrator Service configuration file.
- To connect to a remote SQL server, install the SQL feature “Client Tools Connectivity” on the local server where the XClarity Integrator Service is to be installed. Otherwise, an error message is displayed, indicating that this feature is not installed. This feature is available in the **Feature Selection** step of the SQL server setup wizard.

- **PostgreSQL database**

On the PostgreSQL configuration page, enter the PostgreSQL username, password, and port. Then, click **Next**.

**Notes:**

- Before configuring the PostgreSQL database, ensure that a local PostgreSQL database is installed on the same server installed with XClarity Integrator Service.
- If you are using a PostgreSQL database, and want to change to a SQL server database on the same Windows operating system, you can migrate the data from the PostgreSQL database to the SQL server database. Refer to [“Migrating the data from the PostgreSQL database to the SQL server database” on page 11](#).

Step 8. Import the management packs to Operations Manager based on the prompts in the installation wizard.

**Notes:**

- The management packs will be upgraded automatically.
- If the importing process failed, remove the old management packs from the Operation Manager and import the new management packs manually. By default, the management packs are in the folder %Program Files%\Lenovo \Lenovo Hardware Management Pack\Management Packs.

Step 9. Click **Finish**.

Step 10. Restart the Operations Manager console if you have it opened during the setup.



## Installing Lenovo XClarity Integrator Hardware Management Pack fix patches

The fix patches are available on the Data Center Support Web site for supporting new hardware and fixing critical issues. The fix patches cannot be installed separately.

### Before you begin

Before installing the fix patches, ensure that a complete XClarity Integrator Hardware Management Pack is installed and upgraded to the applicable version.

### Procedure

- Step 1. Download the fix patches from <https://datacentersupport.lenovo.com/cn/en/documents/Invo-manage>.
- Step 2. Double-click the installer, and follow the wizard to complete the installation.

**Note:** If the Hardware Management Pack and XClarity Integrator Service are installed on two different servers, the fix patches should be installed on both servers.

## Migrating the data from the PostgreSQL database to the SQL server database

The following procedure describes how to migrate the data from the PostgreSQL database to the SQL server database.

Ensure that the PostgreSQL database and XClarity Integrator Service are installed on the same Windows system.

### Procedure

- Step 1. Uninstall the existing XClarity Integrator Service that is using the PostgreSQL database.
- Step 2. Install the new XClarity Integrator Service that is using the SQL server database.
- Step 3. Log in to XClarity Integrator Service. Refer to “[Logging in to XClarity Integrator Service](#)” on page 15.
- Step 4. Click **Migrate Data** on the left side of the page.
- Step 5. Click **Migrate Data**.
- Step 6. Click **OK**. The migration process starts.
- Step 7. Click **OK** again after the migration process is finished.

### Notes:

- Do not uninstall the PostgreSQL database or delete the XClarity Integrator Service configuration file before the data migration is completed.
- The old data in the SQL server database is overwritten with the migrated data after the migration process.

## Viewing the database information

The following procedure describes how to view the database information.

### Procedure

- Step 1. Log in to XClarity Integrator Service. Refer to “[Logging in to XClarity Integrator Service](#)” on page 15.
- Step 2. To view the database information, click the **Database Information** tab in the left navigation pane.

---

## Uninstalling Lenovo XClarity Integrator Hardware Management Pack

The following procedure describes how to uninstall Lenovo XClarity Integrator Hardware Management Pack.

## Before you begin

Before uninstalling Lenovo XClarity Integrator Hardware Management Pack from the management server, ensure that the management server installed with Lenovo XClarity Integrator Hardware Management Pack is in the maintenance mode.

### Procedure

- Step 1. On the Windows operating system, click **Control Panel → Uninstall a program**, the **Uninstall or change a program** page opens.
- Step 2. Right-click **Lenovo Hardware Management Pack**, and click **Uninstall**.
- Step 3. Delete Lenovo Management Packs from Operations Manager. Skip this step if you want to upgrade the Lenovo XClarity Integrator Hardware Management Pack to a new version.

---

## Uninstalling Lenovo XClarity Integrator Service

The following procedure describes how to uninstall Lenovo XClarity Integrator Service.

### Before you begin

Before uninstalling Lenovo XClarity Integrator Service, ensure that the management server installed with Lenovo XClarity Integrator Service is in the maintenance mode.

### Procedure

- Step 1. On the Windows operating system, click **Control Panel → Uninstall a program**, the **Uninstall or change a program** page opens.
  - Step 2. Right-click **Lenovo XClarity Integrator Service**, and click **Uninstall**.
- Note:** For Lenovo XClarity Integrator Hardware Management Pack v7.3.0 or earlier versions, the application name is “Lenovo XClarity Integrator Unified Service”.
- Step 3. Right-click **PostgreSQL database**, and click **Uninstall**.
  - Step 4.

**Note:** Skip this step if you want to upgrade to a new version.

If necessary, delete all data permanently by doing the following:

- a. Delete the database files.
  - For SQL server database, delete the %hostname%LXCIDB database from the SQL server.
  - For PostgreSQL database, delete the %USERPROFILE%\postgresql\_data folder on Windows 2012 or an earlier version, or delete the %SystemDrive%\ProgramData\Lenovo\postgresql\_data folder on Windows 2016 or a later version.
- b. Delete the application folder %SystemDrive%\Program Files (x86)\Lenovo\Lenovo XClarity Integrator XClarity Integrator Service.
- c. Delete the configuration files from the folder %SystemDrive%\ProgramData\Lenovo\LXCI\UUS.

---

## Upgrading Lenovo XClarity Integrator Hardware Management Pack and Lenovo XClarity Integrator Service

The following procedure describes how to upgrade Lenovo XClarity Integrator Hardware Management Pack and Lenovo XClarity Integrator Service.

### Before you begin

- Before upgrading Lenovo XClarity Integrator Hardware Management Pack, ensure that the management server installed with Lenovo XClarity Integrator Hardware Management Pack is in the maintenance mode.
- Before upgrading Lenovo XClarity Integrator Service, ensure that the configuration file %SystemDrive%\ProgramData\Lenovo\LXCI\UUS\global.conf exists and the database for Lenovo XClarity Integrator Service works.

**Note:** Only Lenovo XClarity Integrator Hardware Management Pack v7.3.0 and later versions support one-click upgrade through the installer. For versions earlier than 7.3.0, you should uninstall Lenovo XClarity Integrator Hardware Management Pack and Lenovo XClarity Integrator Service before clicking the installer for upgrade.

## Procedure

Step 1. Double-click the installer.

The upgrade screen is displayed if a previous version of Lenovo XClarity Integrator Hardware Management Pack (7.3.0 or later) or Lenovo XClarity Integrator Service (3.3.0 or later) exists on the management server.

### Notes:

- If no previous version of Lenovo XClarity Integrator Hardware Management Pack or Lenovo XClarity Integrator Service is detected, the wizard will enter the installation mode. For detailed information about the installation mode, refer to [“Installing Lenovo XClarity Integrator Hardware Management Pack” on page 9](#).
- If a previous version of Lenovo XClarity Integrator Hardware Management Pack (earlier than 7.3.0) or Lenovo XClarity Integrator Service (earlier than 3.3.0) is detected, an error message will be displayed and the wizard steps to the finish screen directly.

Step 2. Click **Upgrade**.

A page with selected features to upgrade is displayed, which cannot be configured.

### Notes:

- If only a previous version of Lenovo XClarity Integrator Hardware Management Pack (7.3.0 or later) exists, by default, the check box of **Lenovo Hardware Management Pack for Microsoft SCOM** is selected and disabled, and the check box of **Lenovo XClarity Integrator Service** is not selected and disabled.
- If only a previous version of Lenovo XClarity Integrator Service (3.3.0 or later) exists, by default, the check box of **Lenovo Hardware Management Pack for Microsoft SCOM** is not selected and disabled, and the check box of **Lenovo XClarity Integrator Service** is selected and disabled.
- If previous versions of both Lenovo XClarity Integrator Hardware Management Pack (7.3.0 or later) and Lenovo XClarity Integrator Service (3.3.0 or later) exist, by default, the check boxes of **Lenovo Hardware Management Pack for Microsoft SCOM** and **Lenovo XClarity Integrator Service** are selected and disabled.

Step 3. Click **Next**.

Step 4. Follow the instructions on the wizard to complete the upgrade.

Step 5. Click **Finish**.



---

## Chapter 3. Managing servers through XClarity Integrator Service

Lenovo XClarity Integrator Hardware Management Pack supports to manage the BMC-based servers through XClarity Integrator Service in out-of-band mode, including the System x servers, the ThinkSystem servers, the ThinkAgile HX Series servers, the BladeCenter servers, and the Flex System servers.

Lenovo XClarity Integrator Hardware Management Pack provides the following functions:

- Discovering and managing the BMC-based servers
- Monitoring the health of the BMC-based servers and displaying the events and alerts
- Retrieving and displaying the information of the BMC-based servers
- Managing power capping
- Providing an option for deleting the BMC-based servers
- Supporting multiple Operations Managers in the same management group

### Before you begin

Before you begin, ensure that:

- The target BMC node is connected to port 5988 (HTTP) or port 5989 (HTTPS) through CIM protocol, or connected to port 443 through Redfish protocol.
- There are four services of Lenovo XClarity Integrator Service:
  - Lenovo XClarity Integrator Management Webservice
  - Lenovo XClarity Integrator Monitor
  - Lenovo XClarity Integrator Server
  - Lenovo XClarity Integrator Service Starter
- The firewall does not block the network port of XClarity Integrator Service (default value: 9500) from BMC node to XClarity Integrator Service, and from Operations Manager/Console to XClarity Integrator Service.

### Supported server models

Refer to the “Manage ThinkSystem, ThinkAgile, and System x servers through XClarity Integrator Service (out-of-band mode)” column of [Table 4 “Supported scenarios” on page 4](#).

---

## Configuring XClarity Integrator Service

To monitor the BMC-based servers, you shall configure XClarity Integrator Service first. This section describes how to configure XClarity Integrator Service. For more information, refer to [Lenovo XClarity Integrator Service Installation Guide](#).

## Logging in to XClarity Integrator Service

The following procedure describes how to log in to the Lenovo XClarity Integrator Service.

### Procedure

- Step 1. Click **Start Menu → Lenovo XClarity Integrator → Lenovo XClarity Integrator Management**.
- Step 2. Do one of the following:
  - Log in with the user name and password of XClarity Integrator Service, which are generated during the installation.
  - Log in to XClarity Integrator Service from Operations Manager console.
    1. Open the Operations Manager console.
    2. In the left navigation pane, click **Monitoring → Windows Computers**.

3. In the **Task** pane, click **(Lenovo) XClarity Integrator Management**.
4. Log in by using the user name and password of XClarity Integrator Service, which are generated during the installation.

## Registering Operations Management Server

The following procedure describes how to register Operations Management Server.

To work with Operations Management Server, you should register the Management Server in XClarity Integrator Service.

Once a Management Server is registered, XClarity Integrator Service automatically lists all Management Servers in the same management group. XClarity Integrator Service connects to one Management Server at a time. If the connected Management Server stops responding, XClarity Integrator Service automatically connects to another online Management Server.

### Procedure

- Step 1. Log in to XClarity Integrator Service. See [“Logging in to XClarity Integrator Service” on page 15](#).
- Step 2. In the **Lenovo XClarity Integrator Management** window, click **Management Server** in the left pane.
- Step 3. Do one of the following:
  - If XClarity Integrator Service is installed on the same Windows operating system as the Management Server, the Management Server is automatically registered. Other Management Servers in the same management group are listed in the table.
  - If XClarity Integrator Service is installed on different Windows system as the Management Server, click **Register** button to register a Management Server.
- Step 4. Select the Management Server, and click **Credentials** to edit the credentials if needed.
- Step 5. The Management Server connected to XClarity Integrator Service is marked as **current**. If you want to connect to another Management Server, you can select the Management Server and click **current**.
- Step 6. Click **Refresh** to see the latest Management Server status.

**Note:** Do not connect to same management group from different XClarity Integrator Services if there are multiple XClarity Integrator Services.

## Changing password of XClarity Integrator Service

The following procedure describes how to change the password of XClarity Integrator Service.

### Procedure

- Step 1. Log in to XClarity Integrator Service. Refer to [“Logging in to XClarity Integrator Service” on page 15](#).
- Step 2. On the **Lenovo XClarity Integrator Service** window, click **Change Password** in the top-right corner.
- Step 3. Input the existing password and the new password.

**Note:** The new password must conform to the password rules.

- Step 4. Click **Change**.

## Restarting XClarity Integrator Service

The following procedure describes how to restart XClarity Integrator Service.

To restart Lenovo XClarity Integrator Service, restart the following four services:

- Lenovo XClarity Integrator Management Webservice
- Lenovo XClarity Integrator Monitor
- Lenovo XClarity Integrator Server
- Lenovo XClarity Integrator Service Starter

---

## Monitoring XClarity Integrator Service in the Operations Manager server

The following procedure describes how to monitor XClarity Integrator Service in the Operations Manager server.

### Before you begin

Before monitoring XClarity Integrator Service in the Operations Manager server, ensure that:

- The Lenovo XClarity Integrator hardware management packs have been imported into the Operations Manager server.
- The Operations Manager server has been registered with XClarity Integrator Service.

### Procedure

- Step 1. Log in to the Operations Manager console.
- Step 2. In the left navigation pane, click **Monitoring** → **Lenovo Hardware** → **Lenovo XClarity Integrator Service**.
- Step 3. View the status of XClarity Integrator Service connected to the Operations Manager server.

---

## High Availability of XClarity Integrator Service

If you have the high availability (HA) requirement on XClarity Integrator Service, Windows or VMWare HA technology is recommended. The following procedure describes how to support XClarity Integrator Service HA with Windows HA technology.

### Procedure

- Step 1. Prepare the Windows HA environment, and set up two hosts with Hyper-v, FailOver Cluster. Ensure that the two hosts share the same storage.
- Step 2. Create a Windows virtual machine on the shared storage.
- Step 3. Install XClarity Integrator Service separately on the virtual machine.
- Step 4. Configure and register Operations Manager on the XClarity Integrator Service.

#### Notes:

- If the host needs to be maintained, the virtual machine with XClarity Integrator Service installed can be migrated to another host.
- If the host stops responding with errors, the virtual machine with XClarity Integrator Service installed will restart on another host automatically.
- Refer to Windows/VMWare HA technology for detailed information about how to set up the HA environment.

---

## Discovering the BMC node

After configuring XClarity Integrator Service, you can discover the BMC node. This section describes how to discover the BMC node.

## BMC node discovery and management

The following procedure describes how to discover and manage the BMC node from the management server.

### Procedure

- Step 1. Log in to the Operations Manager console.
- Step 2. In the left navigation pane, click **Monitoring → Windows Computers**.
- Step 3. Click **(Lenovo) Discover/Manage BMC** in the **Task** pane on the right. The **BMC Discovery and Management** page opens.
- Step 4. Log in to XClarity Integrator Service. Generally, XClarity Integrator Service and Operations Manager are installed on the same server.
- Step 5. Fill in the following fields:
  - **Host:** This is the address of Lenovo XClarity Integrator Service.
  - **Port:** This is the port number of Lenovo XClarity Integrator Service, which is set during the installation. The default value is 9500.
  - **Password:** This is the password of Lenovo XClarity Integrator Service, which is set during the installation.
- Step 6. If a certificate warning is displayed, click **Next** to trust this certificate.

#### Notes:

- If you do not trust the certificate, an alert stating that there is a problem with the Web site security certificate will be displayed. Click **Continue** to skip this alert.
- Local administrator privilege is required to trust this certificate.

- Step 7. From the BMC discovery list, select a BMC node to be discovered, type the address or the address range in the **IP Address** field, and click **Add → OK**.

**Note:** The discovery process may take several minutes.

- Step 8. Select a BMC node to be managed, and click **Manage**.
- Step 9. Input the user name and password in the prompt window, and click **OK**.

**Note:** If you input the wrong user name or password for two times, the account will be locked for a period of time.

- Step 10. Click **Monitor → Lenovo Hardware → Lenovo ThinkSystem and System x → Lenovo ThinkSystem and System x BMC**. The new BMC node is displayed in Operations Manager.

**Note:** It may take several minutes.

## BMC node auto-discovery and management

Lenovo XClarity Integrator Hardware Management Pack can discover and manage the BMC node automatically when the target server is managed by Operations Manager.

### Notes:

- BMC node auto-discovery and management are not accessible to the Flex System servers and the BladeCenter servers.
- In an IPv6-only environment, BMC node auto-discovery and management are only accessible to the ThinkSystem servers. For the supported Lenovo ThinkSystem server models, refer to [“Supported server models and scenarios” on page 3](#).
- By default, the BMC node auto-discovery and management function is disabled.

### Before you begin



Before using the BMC node auto-discovery and management function, ensure that:

- PowerShell 3.0 or a later version, and .NET 4.5 or a later version are installed on the target server.
- The server is managed by Operations Manager.
- The BMC node is connected, and **IPMI over KCS Access** is enabled on the BMC node.
- A local account is allowed on BMC.
- The BMC node auto-discovery and management function is enabled.

### Enabling or disabling BMC node auto-discovery and management

- Step 1. Log in to XClarity Integrator Service. Refer to [“Logging in to XClarity Integrator Service” on page 15](#).
- Step 2. On the **Lenovo XClarity Integrator Service** window, click **BMC Management Settings** in the left panel.
- Step 3. Select or clear the check box of **Automatically discover the BMC of servers already managed by SCOM**, and then click **Save**. If the BMC node auto-discovery fails, alerts will be reported on the related Windows servers. To view the alerts, click **Lenovo Hardware → Windows on Lenovo servers**.

#### Notes:

- If the network port of XClarity Integrator Service has been changed, you shall change the UUServerIP value and the UUSPort value. The value can be changed in the “Lenovo.HardwareMgmtPack.AutoOOB.Discovery” Object Discovery program in Operations Manager.
- By default, the auto-discovery and authentication interval is four hours (14400 seconds). You can change the interval in the `Lenovo.HardwareMgmtPack.AutoOOB.Discovery` if necessary.
- Do not override the UUSCert value and the UUSPbKey value.
- The BMC node auto-discovery does not work when only LDAP authentication is enabled on the target BMC node or the local account is disabled.
- During the BMC node auto-discovery, a new credential will be created in the BMC node, including a random password for XClarity Integrator Service.

## Only managing the BMC of servers already managed by Operations Manager

By default, XClarity Integrator Service can be used to manage any supported Lenovo server independent of Operations Manager. After you select the check box of **Only manage the BMC of servers already managed by SCOM**, XClarity Integrator Service will only manage the servers that are being managed by Operations Manager. To enable or disable this function, do as follows:

#### Procedure

- Step 1. Log in to XClarity Integrator Service. Refer to [“Logging in to XClarity Integrator Service” on page 15](#).
- Step 2. On the **Lenovo XClarity Integrator Service** window, click **BMC Management Settings** in the left panel.
- Step 3. Select or clear the check box of **Only manage the BMC of servers already managed by SCOM**, and then click **Save**.

**Note:** Once you select this check box, XClarity Integrator Service will automatically stop managing any server that is unknown to Operations Manager.

---

## Refreshing BMC node data

The BMC node data can be synchronized to Operations Manager automatically.

XClarity Integrator Service collects BMC inventory data every 24 hours by default. You can change the interval value (`Cim_collect_interval`) in `%SystemDrive%\ProgramData\Lenovo\LXCI\UUS\global.conf` on the Windows operating system with XClarity Integrator Service installed. The collected BMC inventory data is

synchronized to Operations Manager automatically. You also can refresh the BMC data in Operations Manager manually by doing the following:

### Procedure

- Step 1. Click **Monitoring → Windows Computers**.
- Step 2. Click **(Lenovo) Refresh BMC** in the **Task** pane.

---

## Monitoring the system health

This section describes how to monitor the health of the BMC-based servers and their hardware components.

The following hardware components are supported for health state monitoring:

- BMC system
- Processor
- Cooling Device
- Physical Memory
- Disk Drive

**Note:** Lenovo Management Pack monitors events/alerts from BMC. These events/alerts cannot be monitored if they are generated before BMC is managed.

### Procedure

- Step 1. Log in to the Operations Manager console.
- Step 2. In the left navigation pane, click **Monitoring → Lenovo Hardware → Lenovo ThinkSystem and System x**.
- Step 3. To view the overall status of the BMC-based servers, select the **Lenovo ThinkSystem and System x BMC** view.
- Step 4. To view the critical or warning alerts associated with the hardware, click **Active Alerts**. To learn more about the alerts, refer to [“Using Health Explorer to view and resolve problems” on page 44](#).
- Step 5. To view the hardware component information, select the hardware component that you want to check.

### Notes:

- The **Lenovo System x and ThinkSystem → Hardware Components** folder includes the views of Cooling Devices, Disk Drive, Fibre Channel, Firmware/VPD, InfiniBand, Network Adapter, Numeric Sensors, PCI Device, Physical Memory, Processors, and RAID Controller.
- Separate monitor is defined for Cooling Devices, Disk Drive, Physical Memory and Processor. For other components, even though the monitoring status is **Non-monitored** in the component view, they are actually under monitoring. When the events/alerts from BMC of these hardware components are received, they will be generated and be displayed in **Active Alerts** view.
- If the related hardware issue is resolved, the server health state will be reset automatically and the related alerts will be cleared automatically.

---

## Setting the power capping

The following procedure describes how to set a maximum power capping value for the BMC-based servers.

### Procedure

- Step 1. Log in to the Operations Manager console.
- Step 2. In the left navigation pane, click **Monitoring → Lenovo Hardware → Lenovo ThinkSystem and System x**, and click the **Lenovo ThinkSystem and System x BMC** view.

- Step 3. Select the server that you want to set the power capping value.
  - Step 4. Click **(Lenovo) Power Management** in the **Task** pane on the right. The **Power Capping Management** dialog box opens.
  - Step 5. Input a new power capping value, and click **OK** to save this value.
- 

## Removing a BMC node

The following procedure describes how to remove a BMC node.

### Procedure

- Step 1. Log in to the Operations Manager console.
  - Step 2. In the left navigation pane, click **Monitoring** → **Lenovo Hardware** → **Lenovo ThinkSystem and System x**.
  - Step 3. Click **Lenovo ThinkSystem and System x BMC**, select a BMC node, and click **(Lenovo) Remove BMC** in the **Task** pane on the right.
- 

## Removing one or more BMC nodes

The following procedure describes how to remove one or more BMC nodes.

### Procedure

- Step 1. Log in to the Operations Manager console.
- Step 2. In the left navigation pane, click **Monitoring** → **Windows Computers**.
- Step 3. Click **(Lenovo) Discover/Manage BMC** in the **Task** pane on the right. The **BMC Discovery** page opens.
- Step 4. Select one or more BMC nodes and click **Unmanage**.



---

## Chapter 4. Managing servers through XClarity Administrator

Lenovo XClarity Integrator Hardware Management Pack supports to manage the ThinkServer, SR635/655, and HX2710/3710 (8689) servers through XClarity Administrator in out-of-band mode.

Lenovo XClarity Integrator Hardware Management Pack provides the following functions:

- Discovering the ThinkServer, SR635/655, and HX2710/3710 (8689) servers through XClarity Administrator
- Monitoring the health of the ThinkServer, SR635/655, and HX2710/3710 (8689) servers and displaying the events and alerts
- Retrieving and displaying the information of the ThinkServer, SR635/655, and HX2710/3710 (8689) servers
- Providing an option for deleting the BMC node

### Before you begin

Before managing the ThinkServer, SR635/655, and HX2710/3710 (8689) servers, ensure that the target ThinkServer, SR635/655, or HX2710/3710 (8689) server is managed by XClarity Administrator.

**Note:** You should not register XClarity Administrator in XClarity Integrator if there is no ThinkServer, SR635/655, or HX2710/3710 (8689) server in your Operations Manager environment.

### Supported servers

Refer to the “Manage ThinkServer and SR635/655 through XClarity Administrator (out-of-band mode)” column of [Table 4 “Supported scenarios” on page 4](#).

---

## Configuring XClarity Administrator

To monitor the ThinkServer and SR635/655 servers, you shall configure XClarity Administrator first. The ThinkServer and SR635/655 servers managed by Lenovo XClarity Administrator will be automatically discovered in Operations Manager after the configuration.

### Procedure

- Step 1. Log in to the Operations Manager console.
- Step 2. In the left navigation pane, click **Monitoring** → **Windows Computers**.
- Step 3. Click **(Lenovo) XClarity Administrator** in the **Task** pane on the right. The **Registered Lenovo XClarity Administrator** page opens.
- Step 4. Click **Register**. Input the IP address, user name, password, and port for XClarity Administrator. Then, click **OK**. Do one of the following:
  - **Use an existing account:**
    1. Ensure that this account has the role group lxc-supervisor or the combination of lxc-operator, lxc-fw-admin, lxc-hw-admin and lxc-os-admin.
    2. Ensure that this account can access the servers if Resource Access Control is enabled on XClarity Administrator.
  - **Create a new account by connecting with this administrative account:**
    1. A unique user name (LXCIUSER-xxxx) with a strong random password will be created in XClarity Administrator and it will be used for all communication.
    2. Ensure that this new account can access the servers if Resource Access Control is enabled.
- Step 5. If the **View Certificate** page is displayed, click **Trust this certificate**. The new account is created.

**Note:** Do not choose this option if XClarity Administrator is using an external LDAP for authentication.

**Notes:**

- If you create a new account, ensure that the specified XClarity Administrator account has supervisor privilege, and the roles of “lxc-operator”, “lxc-fw-admin”, “lxc-hw-admin”, and “lxc-os-admin” are in XClarity Administrator.
- You can download XClarity Administrator certificate from XClarity Administrator, and click **Manage trusted certificates** → **Add** to add XClarity Administrator certificate to XClarity Integrator Service manually.

---

## Refreshing server inventory data

The ThinkServer, SR635/655, and HX2710/3710 (8689) server inventory data can be synchronized to Operations Manager automatically.

By default, XClarity Integrator Service collects server inventory data every 60 minutes, you can change the interval value (LXCA\_collect\_interval) in %SystemDrive%\ProgramData\Lenovo\LXCI\UUS\global.conf on the Windows operating system with XClarity Integrator Service installed. The collected server inventory data is synchronized to Operations Manager automatically. You also can refresh the inventory data in Operations Manager manually by doing the following:

**Procedure**

- Step 1. Click **Monitoring** → **Windows Computers**.
- Step 2. Click **(Lenovo) Refresh BMC** in the **Task** pane.

---

## Monitoring the system health

This section describes how to monitor the health of the ThinkServer, SR635/655, and HX2710/3710 (8689) servers and their hardware components.

**Procedure**

- Step 1. Log in to the Operations Manager console.
- Step 2. In the left navigation pane, click **Monitoring** → **Lenovo Hardware** → **ThinkServer and SR635/655**.
- Step 3. To view the overall status of the servers, select the **ThinkServer and SR635/655 BMC** view.
- Step 4. To view the critical or warning alerts associated with your hardware, click **Active Alerts**. To learn more about the alerts, refer to [“Using Health Explorer to view and resolve problems” on page 44](#).
- Step 5. To view the hardware component information, select the hardware component that you want to check.

**Notes:**

- The **ThinkServer and SR635/655** → **Hardware Components** folder includes the views of Cooling Devices, Disk Drive, Fibre Channel, Firmware/VPD, InfiniBand, Numeric Sensors, PCI Device, Physical Memory, and Processors.
- These hardware components are marked with “Not monitored” in the component view, but they are actually under health monitoring. When the events of these hardware components are received from XClarity Administrator, alerts will be generated and be displayed in **Active Alerts** view.
- If the related hardware issue is resolved, the server health state will be reset automatically and the related alerts need to be cleared manually.

---

## Removing a server

The following procedure describes how to remove a ThinkServer, SR635/655, or HX2710/3710 (8689) server from Operations Manager.

**Note:** Remove the ThinkServer, SR635/655, or HX2710/3710 (8689) server from XClarity Administrator first before you remove the server from Operations Manager.

**Procedure**

- Step 1. Log in to the Operations Manager console.
- Step 2. In the left navigation pane, click **Monitoring** → **Lenovo Hardware** → **ThinkServer and SR635/655**.
- Step 3. Click the **ThinkServer and SR635/655 BMC** view, select a server, and click **(Lenovo) Remove BMC** in the **Task** pane on the right.





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## Chapter 5. Manage chassis through SNMP

Lenovo XClarity Integrator Hardware Management Pack supports to manage the chassis (including the BladeCenter chassis and the Flex System chassis) and chassis modules through SNMP.

Lenovo XClarity Integrator Hardware Management Pack provides the following functions:

- Discovering and authenticating the Chassis Management Module (CMM)
- Monitoring the health of the chassis and chassis modules, and displaying the events or alerts
- Retrieving and displaying information for the chassis
- Remotely starting or shutting down a blade server or a compute node
- Remotely shutting down the Windows operating system installed on a blade server or a compute node

### Before you begin

Before managing the chassis, ensure that SNMP is configured correctly on the chassis.

### Supported chassis

Refer to the “Manage chassis through SNMP” column of [Table 4 “Supported scenarios” on page 4](#).

---

## Configuring the SNMP agent

To monitor the chassis and chassis modules, configure the SNMP agent first. The BladeCenter chassis support SNMPv1 Agent only, while the Flex System chassis support both SNMPv1 Agent and SNMPv3 Agent.

**Note:** SNMPv1 Agent does not support IPv6.

## Configuring SNMPv1 Agent on the BladeCenter chassis

The following procedure describes how to configure SNMPv1 Agent on the BladeCenter chassis.

### Procedure

- Step 1. Log in to the AMM Web console of the BladeCenter chassis. Refer to [“Launching the AMM/CMM Web console” on page 32](#).
- Step 2. Click **MM Control** → **Port Assignments** to ensure that the setting of SNMP Agent is 161 and the setting of SNMP Traps is 162.

**Note:** Use the default SNMP ports of 161 for agent (queries/polling) and 162 for trapping. It is important for SNMP port settings to be consistent. Otherwise, Operations Manager cannot discover the BladeCenter chassis.

- Step 3. Click **MM Control** → **Network Protocols** → **Simple Network Management Protocol (SNMP)**, and complete the following steps:
  - a. Select **Enabled for SNMP Traps, SNMPv1 agent**.
  - b. Input the following information for all Operations Managers programs that manage the BladeCenter chassis:
    - In the **Community name** field, input the community name that assigned to the BladeCenter chassis through which SNMP communicates.
    - From the **Fully Qualified Hostnames or IP Addresses** list, input the Operations Manager address.

- c. From the **Access type** list, select **Set**. **Set** is the access type required for enabling the management tasks. A task example is remotely starting or shutting down a blade server through the Operations Manager console.

**Notes:**

- If you do not intend to allow this type of task through the Operations Manager console, you can lower the access type to **Get**. At a minimum, the **Get** access type must be set for the Operations Manager server to perform the SNMP queries, and receive the SNMP traps from the BladeCenter.
- Ensure that the values of SNMPv1 Agent account in the SCOM discovery wizard are consistent with those set in Operations Manager. Otherwise, Operations Manager cannot discover the BladeCenter chassis.

Step 4. Configure the SNMP event recipients and the BladeCenter chassis.

- a. Click **MM Control → Alerts**. In the right pane, under **Remote Alert Recipients**, click **not used** link to configure the alert recipient.

**Note:** Depending on the firmware level, the menu might vary slightly.

- b. In the new Remote Alert Recipient window, change the status from **Disabled** to **Enabled**.
- c. In the **Name** field, input a descriptive name for the management server for Operations Manager that will be used in managing the BladeCenter chassis.
- d. From the **Notification method** list, select **SNMP over LAN**.
- e. Click **Save**.

Step 5. Configure the monitored alerts.

- a. Click **MM Control → Alerts**.
- b. From the context menu, click **Monitor Alerts**.
- c. Select the alerts to be sent, and click **Save**.

## Configuring SNMP on the Flex System chassis

The following procedure describes how to configure SNMP on the Flex System chassis, including SNMPv1 Agent and SNMPv3 Agent.

### Procedure

Step 1. Log in to the CMM Web console. Refer to [“Launching the AMM/CMM Web console” on page 32](#).

Step 2. Click **Mgt Module Management → Network → Port Assignments** to ensure that the setting of SNMP Agent is 161 and the setting of SNMP Traps is 162.

**Note:** To change the SNMP settings, select **Enable SNMPv1 Agent** or **Enable SNMPv3 Agent**. Refer to [“Configuring SNMPv1 Agent” on page 29](#) and [“Configuring SNMPv3 Agent” on page 29](#).

Step 3. Configure the SNMP event recipients and the Flex System chassis.

- a. Click **Events → Event Recipients → Create → Create SNMP Recipient**.
- b. In the **Descriptive name** field, input a name.
- c. From the **Status** list, select the **Enable this recipient** check box.
- d. From the **Events to receive** list, select the **Use the global settings** check box or the **Only receive critical alerts** check box, and click **OK** to return to the **Event Recipients** page.

**Note:** If you select the **Use the global settings** check box, you shall click **Global Settings** on the **Event Recipients** page to change the settings, and click **OK** to apply the changes.

## Configuring SNMPv1 Agent

The following procedure describes how to configure SNMPv1 Agent on the Flex System chassis.

### Procedure

- Step 1. Click **Mgt Module Management** → **Network** → **SNMP**, and select the **Enable SNMPv1 Agent** check box.
- Step 2. Click **Traps**, and select the **Enable SNMP Traps** check box.
- Step 3. Select **Communities**, and input the following information:
  - a. In the **Community name** field, input the name that assigned to the Flex System chassis.
  - b. From the **Access type** list, select **Set**.
  - c. From the **Fully Qualified Hostnames or IP Addresses** list, select appropriate address.

### Notes:

- By default, the Chassis Module Security Policies level is “Secure”. At this level, SNMPv1 Agent cannot be enabled. To enable SNMPv1 Agent, click **Mgt Module Management** → **Security** → **Security Policies** → **Legacy** → **Apply**.
- Ensure that the values of SNMPv1 Agent account in the SCOM discovery wizard are consistent with those set in Operations Manager. Otherwise, Operations Manager cannot discover the Flex System chassis.

## Configuring SNMPv3 Agent

The following procedure describes how to configure SNMPv3 Agent on the Flex System chassis. You shall create a new user account before using SNMPv3 Agent or use the default user account.

### Procedure

- Step 1. Click **Mgt Module Management** → **User Accounts**, select an existing user account from the list or create a new SNMPv3 user account.
- Step 2. Double-click a user name to open the **User Properties** page. Then, click the **General** tab and set a user password for the new account.
- Step 3. Click **SNMPv3**, and input the following information:
  - a. From the **Authentication Protocol** list, select **Hash-based Message Authentication Code (HMAC) – Secure Hash Algorithm (SHA)**.
  - b. Select the **Use a privacy protocol** check box.
  - c. From the **Encryption Method** list, select **Advanced Encryption Standard (AES)**.
  - d. In the **Privacy password** field and the **Confirm privacy password** field, input the authentication key.
  - e. Change the access type to **Set**.
  - f. In the **IP address or host name for traps** field, input the Operations Manager IP address.
- Step 4. Click **OK**.

---

## Discovering a chassis

The following procedure describes how to discover a chassis.

### Procedure

- Step 1. Log in to the Operations Manager console.
- Step 2. In the left navigation pane, click **Administration** → **Network Management** → **Discovery Rules** → **Discover Network Device** to start the **Network Device Discovery Wizard**.

- Step 3. On the **General Properties** page, do the following:
- In the **Name** field, input the name of the discovery rule.
  - Select a management or gateway server.
  - Select a resource pool.
- Note:** If there are several servers, ensure that all servers in the resource pool are installed with Lenovo XClarity Integrator Hardware Management Pack.
- Click **Next**.
- Step 4. On the **Discovery Method** page, select **Explicit Discovery**, and click **Next**.
- Step 5. On the **Default Accounts** page, click **Next**. The **Devices** page opens.
- Step 6. On the **Devices** page, click **Add**. The **Add a Device** dialog box opens.
- Step 7. In the **Add a Device** dialog box, do the following:
- In the **Name or IP address** field, input the IP address of the chassis.
  - From the **Access Mode** list, select **SNMP**.
  - Keep the port number as the default value 161.
  - Select the appropriate SNMP version.
  - Do one of the following:
    - To select the existing account, click **SNMP V3 Run As account** or **SNMP V1 or V2 Run As account**.
    - To add a new account, click **Add SNMP V3 Run As account** or **Add SNMP V1 or V2 Run As account**.
- Note:** Ensure that the values of SNMPv1 Agent account or SNMPv3 Agent account are consistent with those set in the chassis account.
- Click **OK** to return to the **Network Device Discovery Wizard**.
- Step 8. Click **Next**. Then, set the time for running the discovery rule, and click **Save**. If a window opens and prompts you to distribute the accounts, click **Yes**.
- Step 9. Click **Discovery Rule → Run**.
- Step 10. Wait for a while, and click **Network Management → Network Devices**. The discovered chassis is displayed.

---

## Monitoring the chassis health

This section describes how to monitor the health of chassis and chassis modules.

### Monitoring the BladeCenter chassis health

The following procedure describes how to monitor the health of the BladeCenter chassis and chassis modules.

#### Procedure

- Log in to the Operations Manager console.
- In the left navigation pane, click **Monitoring → Lenovo Hardware → BladeCenter Chassis and Modules**.
- To view the overall status of the BladeCenter chassis, select the **BladeCenter Chassis** view.
- To view the critical or warning alerts associated with the hardware, click **Active Alerts**. To learn more about the alerts, refer to [“Using Health Explorer to view and resolve problems” on page 44](#).

Step 5. To view the chassis module information, click **Hardware Components**, and select the chassis module that you want to check.

The views in the **Hardware Components** subfolder include:

- Blade servers
- Chassis
- Cooling Modules
- I/O Modules
- Advanced Management Modules (AMM)
- Media Modules
- Power Modules
- Storage Modules

## Monitoring the Flex System chassis health

The following procedure describes how to monitor the health of the Flex System chassis and chassis modules.

### Procedure

- Step 1. Log in to the Operations Manager console.
- Step 2. In the left navigation pane, click **Monitoring → Lenovo Hardware → Flex System Chassis and Modules**.
- Step 3. To view the overall status of the Flex System chassis, select the **Flex System Chassis** view.
- Step 4. To view the critical or warning alerts associated with the hardware, click **Active Alerts**. To learn more about the alerts, refer to [“Using Health Explorer to view and resolve problems” on page 44](#).
- Step 5. To view the chassis module information, click **Hardware Components**, and select the chassis module that you want to check.

The views in the **Hardware Components** subfolder include:

- Compute Nodes
- Cooling Modules
- Fan Logic Modules
- I/O Modules
- Chassis Management Modules (CMM)
- Power Modules
- Rear LED Modules
- Storage Modules

---

## Obtaining the latest information for the chassis

The following procedure describes how to obtain the latest information for the chassis, including the inventory and status of chassis and chassis modules.

The information of the chassis will be automatically refreshed every four hours. To refresh the information manually, do the following:

### Procedure

- Step 1. Log in to the Operations Manager console.
- Step 2. In the left navigation pane, click **Monitoring → Lenovo Hardware**.
- Step 3. Do one of the following:
  - Click **BladeCenter Chassis and Modules → BladeCenter Chassis**, and select a BladeCenter chassis in the **BladeCenter Chassis** pane.

- Click **Flex System Chassis and Modules** → **Flex System Chassis**, and select a Flex System chassis in the **Flex System Chassis** pane.

Step 4. Click **(Lenovo) Refresh this Chassis Modules** in the **Task** pane on the right. Then, the latest information for the chassis will be displayed.

---

## Launching the AMM/CMM Web console

The Advanced Management Module (AMM) is a module that enables you to configure and manage the BladeCenter chassis, while the Chassis Management Module (CMM) is a module that you use to configure and manage the Flex System chassis. The following procedure describes how to launch the AMM/CMM Web console.

### Procedure

Step 1. Log in to the Operations Manager console.

Step 2. In the left navigation pane, click **Monitoring** → **Lenovo Hardware**.

Step 3. Do one of the following:

- For the BladeCenter chassis, click the **BladeCenter Chassis and Modules** folder, and select the **BladeCenter Chassis** view.
- For the Flex System chassis, click the **Flex System Chassis and Modules** folder, and select the **Flex System Chassis** view.

Step 4. Select a BladeCenter chassis or a Flex System chassis.

Step 5. Depending on your chassis, click **Lenovo BladeCenter Chassis Management Web Console** or **Lenovo Flex System Chassis Management Web Console** in the **Task** pane on the right.

---

## Starting or shutting down a blade server or a compute node

The following procedure describes how to start or shut down a blade server or a compute node, and how to shut down the Windows operating system installed on a blade server or a compute node.

### Procedure

Step 1. Log in to the Operations Manager console.

Step 2. In the left navigation pane, click **Monitoring** → **Lenovo Hardware**.

Step 3. Do one of the following:

- For the BladeCenter chassis, click the **BladeCenter Chassis and Modules** folder, and click the **Blade servers** view under the **Hardware Components** subfolder.
- For the Flex System chassis, click the **Flex System Chassis and Modules** folder, and click the **Compute Nodes** view under the **Hardware Components** subfolder.

Step 4. Select a blade server or a compute node.

Step 5. According to your needs, click the corresponding task button.

---

## Removing a discovered chassis

The following procedure describes how to remove a discovered chassis from the chassis list.

### Procedure

Step 1. Log in to the Operations Manager console.

Step 2. In the left navigation pane, click **Administration** → **Network Management** → **Network Devices**.

Step 3. In the results pane, select a chassis to be removed.

Step 4. Click **Delete**. The chassis and its chassis modules will be removed.

---

## Chapter 6. Managing servers through IBM Platform Agent

Lenovo XClarity Integrator Hardware Management Pack enables you to use IBM Platform Agent to manage the Lenovo servers installed with the Windows operating system in in-band mode. The Lenovo servers include the System x servers, the BladeCenter servers, and the Flex System servers.

### Notes:

- IBM Platform Agent does not support the ThinkSystem servers.
- IBM Platform Agent does not support the ThinkServer servers.
- IBM Platform Agent does not support Windows 2016 or later versions.
- IBM Platform Agent is out of support.
- It is recommend managing servers through XClarity Integrator Service.

### Before you begin

Before managing the Lenovo servers, ensure that:

- One of the following Windows operating systems is installed on the target server: Windows 2012, or Windows 2012 R2.

**Note:** Windows 2016 or a later version is not supported.

- The target server is managed by Operations Manager.
- IBM Platform Agent v.6.3.3 or later is installed on the target server. You can download Platform Agent from [IBM Fix Central](#). For more information, refer to [IBM Systems Director online documentation](#). The command for silent installation is `dir6.3.7_platformagent_windows.exe /s /a silent`.
- IBM Remote Supervisor Adapter II (RSA-II Daemon) v5.4.6 or later is installed on the target server.

**Notes:** The RSA-II Daemon for the Windows operating system is available at:

- [RSA-II Daemon v5.46 for Microsoft Windows IA32](#)
- [RSA-II Daemon v5.44 for Microsoft Windows Server 2003/2008 \(x64\)](#)

### Supported server models

Refer to the “Manage System x servers through IBM Platform Agent (in-band mode)” column of [Table 4 “Supported scenarios” on page 4](#).

---

## Discovering Windows on a Lenovo server

The following procedure describes how to discover a Lenovo server using the **Microsoft System Center Operations Manager Discovery Wizard** (hereinafter referred to as the **Discovery Wizard**). The **Discovery Wizard** deploys Lenovo XClarity Integrator Hardware Management Pack to the discovered server.

### Procedure

- Step 1. Log in to the Operations Manager console.
- Step 2. Click **Administration** → **Device Management** → **Agent Managed** → **Discovery Wizard**. The **Computer and Device Management Wizard** starts.
- Step 3. Click **Discovery Type** → **Windows computers**, and click **Next**.
- Step 4. Select the **Advanced discovery** check box.
- Step 5. Select **Servers and Clients** from the **Computer and Device Classes** list, and select a Lenovo server to be added.
- Step 6. Select the **Verify discovered computers can be contacted** check box, and click **Next**.
- Step 7. Select the **Browse for, or type-in computer names** check box.

- Step 8. Click **Browse** to detect the Lenovo server or manually type the Lenovo server name in the input box, and click **Next**.
- Step 9. On the **Administrator Account** page, do one of the following:
- To select an existing server, select the **Use selected Management Server Action Account** check box, and click **Next**.
  - To add a new server, select the **Other user account** check box, and type the new Lenovo server name.
- Step 10. Click **Discover** to start the discovery process. When the discovery process is completed, the discovery results are displayed on the **Summary** page.
- Note:** The discovery time depends on the number of Lenovo servers in the network.
- Step 11. On the **Summary** page, click **Finish**. The **Agent Management Task Status** page opens.
- Step 12. Click **Monitoring** → **Task Status** to check the management task status. The Lenovo server is discovered when the status is changed from **Queued** to **Success**.

---

## Monitoring the server health

This section describes how to monitor the health of the Lenovo servers and the hardware components, including fans, memory, management controllers, network adapters, power supplies, processors, storage, temperature sensors, and voltage sensors.

### Procedure

- Step 1. Log in to the Operations Manager console.
- Step 2. In the left navigation pane, click **Monitoring** → **Lenovo Hardware** → **Windows on Lenovo servers**.
- Step 3. To view the overall status of the Lenovo servers, select one of the following views:
- **Windows on Lenovo servers:** This view provides the hardware status of all Lenovo servers.
  - **All Windows on Lenovo server Group:** This view lists the health indicators in the first column of the system dashboard and the hardware components dashboard.
- Step 4. To view the critical or warning alerts associated with your hardware, click the **Windows on Lenovo servers** folder and click **Active Alerts**. To learn more about the alerts, refer to [“Using Health Explorer to view and resolve problems” on page 44](#).
- Step 5. To view the hardware component information, click the **Hardware Components** folder and select the hardware component that you want to check.

**Note:** The undiscoverable hardware components cannot be monitored or managed.

---

## Viewing the power data of the client System x servers

The following procedure describes how to view the power data of the client System x servers in Lenovo System x Power Data Chart. This chart is only available on the System x servers.

### Before you begin

Ensure that the Windows operating system is installed on more than one managed System x servers.

### Procedure

- Step 1. Log in to the Operations Manager console.
- Step 2. In the left navigation pane, click **Monitoring** → **Lenovo Hardware** → **Windows on Lenovo servers** → **Lenovo server Power Data Chart**.
- Step 3. Select the **Show** check box. The Power Data Chart is displayed.



**Note:** The power data displayed as a straight line means the power consumption is steady in a given period of time.

---

## Setting the power capping

The following procedure describes how to set a maximum power capping value for the Lenovo servers.

### Before you begin

Before setting a maximum power capping value, ensure that:

- The target server has power capping functions.
- User Access Control (UAC) is shut down on the target server.

### Procedure

- Step 1. Log in to the Operations Manager console.
- Step 2. In the left navigation pane, click **Monitoring** → **Lenovo Hardware** → **Windows on Lenovo servers**, and click the **Windows on Lenovo servers** view.
- Step 3. Select the server that you want to set the power capping value.

**Note:** You can view the current power capping values of **CappingCapable**, **CappingEnabled**, **PowerMax**, **PowerMin**, and **PowerCap** of a server in **Detail View**.

- Step 4. Click **(Lenovo) Set Power Capping** in the **Task** pane on the right. The **Run the task on these targets** pane is displayed.
- Step 5. Input a new power capping value and click **Override**.
- Step 6. Click **Run**. The task status window opens and indicates whether the value is overridden.

---

## Setting the power threshold

The following procedure describes how to set a warning or critical power threshold for the Lenovo servers.

### Procedure

- Step 1. Log in to the Operations Manager console.
- Step 2. In the left navigation pane, click **Monitoring** → **Lenovo Hardware** → **Windows on Lenovo servers**, and click the **Windows on Lenovo servers** view.
- Step 3. Select the server that you want to set the power threshold.

**Note:** You can view the current threshold values and the monitoring capacity property of the server in **Detail View**.

- Step 4. Click **(Lenovo) Set/Unset Power Threshold** in the **Task** pane on the right. The **Run the task on these targets** pane is displayed.
- Step 5. Input a new power threshold value, and click **Override**.

**Note:** If you input a blank or zero, the threshold will be reset to its default value.

- Step 6. Click **Run**. The task status window opens and indicates whether the value is overridden.

---

## Obtaining the latest information for the Lenovo servers

The following procedure describes how to obtain the latest information for the Lenovo servers, including the inventory and status of servers and hardware components.

The information of the Lenovo servers will be automatically refreshed every four hours. To refresh the information manually, do the following:

### **Procedure**

- Step 1. Log in to the Operations Manager console.
- Step 2. In the left navigation pane, click **Monitoring → Windows Computers**.
- Step 3. Click **(Lenovo) Refresh Windows Computer** in the **Task** pane on the right. The latest information is displayed.

---

## Chapter 7. Working with XClarity Integrator Service security certificates

XClarity Integrator Service supports HTTPS protocol for inbound and outbound communication. By default, XClarity Integrator Service uses the self-generated certificates that signed and issued by an internal certificate authority (CA). This section describes how to set, generate, regenerate, and download the certificates.

**Note:** By default, XClarity Integrator Service 7.6.0 and later versions support only Transport Layer Security (TLS) 1.2.

---

### Setting the BMC communication protocol

The following procedure describes how to set the BMC communication protocol.

#### Before you begin

Ensure that the HTTPS protocol is enabled on all BMC nodes if you only want to use the HTTPS protocol to communicate with BMC nodes.

**Note:** If you do not select the **Only use HTTPS protocol to communicate with BMC nodes** check box, the HTTPS protocol and the HTTP protocol will be tried in sequence.

#### Procedure

- Step 1. Log in to XClarity Integrator Service. Refer to [“Logging in to XClarity Integrator Service” on page 15](#).
- Step 2. Click **Security Settings** in the left navigation pane. The **Security Settings** page opens.
- Step 3. Click the **Security Settings** tab.
- Step 4. Select the **Only use HTTPS protocol to communicate with BMC nodes** check box.
- Step 5. Click **Save**.

---

### Generating and uploading the certificates

When generating the customized server certificate in XClarity Integrator Service, you shall provide the certificate bundle that contains the entire CA signing chain.

#### Procedure

- Step 1. Log in to XClarity Integrator Service. Refer to [“Logging in to XClarity Integrator Service” on page 15](#).
- Step 2. Connect a server to XClarity Integrator Service.

**Note:** If the server certificate is not signed by a trusted international third party, a security message will be displayed. To avoid this security message, select the **Trust the certificate permanently** check box, and click **Next**.

- Step 3. Generate the Certificate Signing Request (CSR) for XClarity Integrator Service.
  - a. Click **Security Settings**. The **Security Settings** page opens.
  - b. Click **Server Certificate**.
  - c. Click **Generate Certificate Signing Request (CSR)**.
  - d. Fill in all fields in the **Generate Certificate Signing Request (CSR)** page: Country, State or Province, City or Locality, Organization, Organization Unit (optional), and Common Name.

**Note:** You can allow XClarity Integrator Service to generate the common name automatically by keeping the default value **Generated by LXCI**.

- e. Select the correct host name. If a wrong name is selected, the server cannot connect to XClarity Integrator Service.
- f. Click **Generate CSR File**. The CSRs will be downloaded automatically.

Step 4. Send all CSRs to your trusted CA.

The trusted CA will assign a certificate bundle for each CSR. The certificate bundle contains the customized certificates and the complete CA chain of trust. The certificate should be in the Base64 encoding format.

Step 5. Upload the customized certificates and the generated server certificates to XClarity Integrator Service.

- a. Click **Server Certificate** on the **Security Settings** page.
- b. Click **Upload Certificate** to upload the certificate file (with the .cer extension).

**Notes:**

- The customized certificates shall contain the complete certificate chain, including the root certificates and the intermediate certificates.
- The uploading priority of the certificates is: server certificates, intermediate certificates, and root certificates.

---

## Regenerating the certificates

If the existing certificate is invalid or the certificate version is not the latest, you can regenerate a new server certificate or a root certificate for XClarity Integrator Service to replace the old one.

### Regenerating the server certificate

The following procedure describes how to regenerate the new server certificate for XClarity Integrator Service.

#### Procedure

- Step 1. Log in to XClarity Integrator Service. Refer to [“Logging in to XClarity Integrator Service” on page 15](#).
- Step 2. Click **Security Settings**. The **Security Settings** page opens.
- Step 3. Click **Server Certificate**.
- Step 4. Click **Regenerate Server Certificate**.
- Step 5. Fill in all fields in the **Regenerate Server Certificate** page: Country, State or Province, City or Locality, Organization, Organization Unit (optional), and Common Name.

**Note:** You can allow XClarity Integrator Service to generate the common name automatically by keeping the default value **Generated by LXCI**.

- Step 6. Select a correct host name. If a wrong name is selected, the server cannot connect to XClarity Integrator Service.
- Step 7. Click **Regenerate Certificate**.

### Regenerating the root certificate

The following procedure describes how to regenerate the new root certificate for XClarity Integrator Service.

#### Procedure

- Step 1. Log in to XClarity Integrator Service. Refer to [“Logging in to XClarity Integrator Service” on page 15](#).
- Step 2. Click **Security Settings**. The **Security Settings** page opens.
- Step 3. Click **Certificate Authority**.
- Step 4. Click **Regenerate Certificate Authority Root Certificate**.
- Step 5. Read the information and click **OK**.

**Notes:**

- If the customized certificates are invalid, XClarity Integrator Service will generate the new certificates and replace the old certificates with these new ones automatically.
- If the customized certificates are valid, XClarity Integrator Service will only regenerate a new root certificate.

---

## Downloading the certificates

You can download the server certificate and the root certificate.

### Downloading the server certificate

The following procedure describes how to download the server certificate.

**Procedure**

- Step 1. Log in to XClarity Integrator Service. Refer to [“Logging in to XClarity Integrator Service” on page 15](#).
- Step 2. Click **Security Settings**. The **Security Settings** page opens.
- Step 3. Click **Server Certificate**.
- Step 4. Click the **Download Certificate** tab.
- Step 5. Click **Download Certificate**.

### Downloading the root certificate

The following procedure describes how to download a root certificate.

**Procedure**

- Step 1. Log in to XClarity Integrator Service. Refer to [“Logging in to XClarity Integrator Service” on page 15](#).
- Step 2. Click **Security Settings**. The **Security Settings** page opens.
- Step 3. Click **Certificate Authority**.
- Step 4. Click **Download Certificate Authority Root Certificate**.



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## Chapter 8. Log data

This section provides instructions on how to set the log level and how to collect or view logs.

---

### Logs for XClarity Integrator Service

You can collect the log files and set the log level for XClarity Integrator Service.

#### Setting the log level

The following procedure describes how to set the log level for XClarity Integrator Service.

##### Procedure

- Step 1. Log in to XClarity Integrator Service. Refer to [“Logging in to XClarity Integrator Service” on page 15](#).
- Step 2. Click **Service Data** in the left navigation pane.
- Step 3. Click the drop-down menu to set the log level:
  - **Error level:** Recording error messages only.
  - **Warning level:** Recording warning and error messages.
  - **Information level:** Recording error, warning, and information messages.
  - **Debug level:** Recording error, warning, information, and debug messages.

#### Collecting the log files

The following procedure describes how to collect the log files for XClarity Integrator Service.

##### Procedure

- Step 1. Log in to XClarity Integrator Service. Refer to [“Logging in to XClarity Integrator Service” on page 15](#).
- Step 2. Click **Service Data** in the left navigation pane.
- Step 3. Click **Collect Log → Download Log**. The logs for XClarity Integrator Service are downloaded.

---

### Logs for Lenovo XClarity Integrator Hardware Management Pack

You can set the log level, and view the log of Lenovo XClarity Integrator Hardware Management Pack.

#### Setting the log level

The following procedure describes how to set the log level for Lenovo XClarity Integrator Hardware Management Pack.

##### Procedure

- Step 1. On the Windows operating system, open the REG key HKEY\_LOCAL\_MACHINE\SOFTWARE\Lenovo\Lenovo SCOM MP\Debug in the **regedit.exe** program.
- Step 2. In the REG key, double-click **Level**, and input one of the following values based on your needs:
  - Error level: Level = 1
  - Warn level: Level = 3
  - Information level: Level = 5
  - Debug level: Level = 7

**Note:** Ensure that the value type of the “Level” value is “String”.

## Viewing the log in Windows Event Viewer

The following procedure describes how to view the logs for Lenovo XClarity Integrator Hardware Management Pack in Windows Event Viewer.

### Procedure

- Step 1. On the Windows operating system, launch Windows Event Viewer.
- Step 2. Click **Applications and Services Logs → Operations Manager**. The logs of Lenovo XClarity Integrator Hardware Management Pack are displayed.
- Step 3. In the **Actions** pane on the right, click **Filter Current Log**.
- Step 4. Select the **Health Service Script** check box and the **Lenovo.EventLogSource** check box from the **Event sources** drop-down list. The logs of Lenovo XClarity Integrator Hardware Management Pack are displayed in the window.

**Note:** Only the **Lenovo.EventLogSource** check box is displayed in the **Event sources** drop-down list when there are LXCI Management Pack events.



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## Chapter 9. Troubleshooting

This section provides information to assist you with troubleshooting issues that you may have with Lenovo XClarity Integrator Hardware Management Pack.

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### Troubleshooting by symptoms

This topic provides information about basic troubleshooting and diagnostic methods to help you solve problems that might occur in the servers installed with Lenovo XClarity Integrator Hardware Management Pack. If you cannot diagnose and correct a problem by using the following information, refer to [“Using Health Explorer to view and resolve problems” on page 44](#) or [“Using Lenovo XClarity Forum and Lenovo XClarity Ideation” on page 45](#).

| Symptom   | Action   |
|---|--|
| XClarity Integrator Service cannot connect to Operations Manager.   | <ol style="list-style-type: none"><li>1. Ensure that the credential is correct.</li><li>2. Ensure that the firewall allows XClarity Integrator Service → Operations Manager (port 5724)</li><li>3. Ensure that the SDK service is running on Operations Manager.</li></ol>   |
| BMC cannot be discovered in XClarity Integrator Service.  | <ol style="list-style-type: none"><li>1. Ensure that the BMC IP address can be connected.</li><li>2. Ensure that the firewall allows XClarity Integrator Service → BMC (SLP port 427).</li></ol>   |
| BMC cannot be authenticated in XClarity Integrator Service.   | <ol style="list-style-type: none"><li>1. Ensure that the BMC account is correct to log in to BMC Web page.</li><li>2. Ensure that “REST Over HTTPS” or “CIM Over HTTPS” is enabled on the target BMC.</li><li>3. Restart BMC and authenticate it again.</li></ol>  |
| Event/alert cannot be received from BMC. There is an alert on BMC Web page, but no alert raised in Operations Manager.        | <ol style="list-style-type: none"><li>1. Ensure that BMC is authenticated in XClarity Integrator Service.</li><li>2. Ensure that the alert is generated after the authentication of BMC.</li><li>3. Ensure that the firewall allows BMC → XClarity Integrator Service (port 9500).</li><li>4. Ensure that the Operation Manager connection status is online in XClarity Integrator Service Web page.</li></ol> |
| The status of some BMC hardware components is displayed as <b>Not monitored</b> in Operations Manager.                        | The hardware components are actually monitored. See <a href="#">“Monitoring the system health” on page 20</a> .  |
| There is no BMC IP address in XClarity Integrator Service and Operations Manager  | <ol style="list-style-type: none"><li>1. Ensure that the BMC IP address is not changed.</li><li>2. Discover and authenticate the BMC again.</li></ol>  |
| The discovered chassis installed with Windows Server 2012 is displayed in the <b>Network Devices Pending Management</b> view. | <ol style="list-style-type: none"><li>1. Start Operations Manager.</li><li>2. Start the inbound and outbound rules, and restart the discovery rule.</li></ol> <p><b>Note:</b> By default, some rules might be disabled.</p> <ol style="list-style-type: none"><li>3. Wait until the rules are converted to the scheduled task in the Operations Manager console.</li></ol>                                     |

| Symptom  | Action   |
|--|--|
| AMM/CMM Web console cannot be opened from the Operations Manager console on a server installed with Windows Server 2012. | <ol style="list-style-type: none"> <li>1. Click <b>Server Manager</b> → <b>Configure this local server</b>. The <b>Local Server Configuration</b> page opens.</li> <li>2. Click <b>On</b> in the <b>Properties</b> pane. The <b>Internet Explorer Enhanced Security Configuration</b> dialog box opens. <p><b>Note:</b> If a member of the local administrator group also logs in, click <b>Off</b>. Then you can continue to use Internet Explorer Enhanced Security Configuration.</p> </li> <li>3. Click <b>OK</b> to apply the changes.</li> </ol> |
| The error “Could not locate automation class named IBM.SystemsManagement.SCOMHelper.SCOMServer” is displayed.            | <p>Do one of the following:</p> <ul style="list-style-type: none"> <li>• Select a resource pool, which only includes the servers installed with Lenovo XClarity Integrator Hardware Management Pack.</li> <li>• Create a new resource pool, which only includes the servers installed with Lenovo XClarity Integrator Hardware Management Pack.</li> </ul>   |

## Using Health Explorer to view and resolve problems

The following procedure describes how to view, learn about, and resolve the alerts using Health Explorer.

### Procedure

Step 1. Log in to the Operations Manager console.

Step 2. In the left navigation pane, click **Monitoring** → **Lenovo Hardware**.

Step 3. Do one of the following depending on your server models:

- For the Lenovo Windows servers, click the **Windows on Lenovo servers** view under the **Windows on Lenovo servers** folder.
- For the ThinkSystem and System x servers, click the **Lenovo ThinkSystem and System x BMC** view under the **Lenovo ThinkSystem and System x** folder.
- For the ThinkServer servers, click the **ThinkServer and SR635/655 BMC** view under the **ThinkServer and SR635/655** folder.
- For the BladeCenter chassis, click the **BladeCenter Chassis** view under the **BladeCenter Chassis and Modules** folder.
- For the Flex System chassis, click the **Flex System Chassis** view under the **Flex System Chassis and Modules** folder.

**Note:** By default, all failed monitors are displayed in an expanded view when Health Explorer opens.

Step 4. Select an alert, and double-click **State** to open Health Explorer. All basal-level health monitors that display the errors will be displayed in the **Health Explorer** page.

Step 5. Do one of the following depending on your needs:

- To view the latest state change events, click **State Change Events**.
- To view the explanations and solutions of the alert, click **Knowledge**. If necessary, perform the steps in the **Knowledge** page to resolve the error and reset the health sensor.

**Note:** You can also view the **Knowledge** page by clicking the **Active Alerts** view in the Operations Manager console or the link on the **Product Knowledge** tab.

- To view the alert properties, double-click the alert. Alert Properties is displayed on the **General** tab.

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## Using Lenovo XClarity Forum and Lenovo XClarity Ideation

The following procedure describes how to post questions, suggestions or ideas using Lenovo XClarity Forum and Lenovo XClarity Ideation.

### Procedure

- Step 1. Log in to the Operations Manager console.
- Step 2. In the left navigation pane, click **Monitoring** → **Windows Computers**.
- Step 3. From **Windows Computer Tasks**, to post questions, click the **Lenovo XClarity Forum** task; to post suggestions or ideas, click the **Lenovo XClarity Forum** or **Lenovo XClarity Ideation** task.
- Step 4. Follow the instructions on the screen.



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## Appendix A. Accessibility features

Accessibility features help users who have a physical disability, such as restricted mobility or limited vision, to use information technology products successfully.

Lenovo strives to provide products with usable access for everyone, regardless of age or ability.

Lenovo XClarity Integrator Hardware Management Pack supports the accessibility features of the integrated systems-management software. For the specific information about accessibility features and keyboard navigation, refer to your system management software documentation.

Lenovo XClarity Integrator Hardware Management Pack topic collection and its related publications are accessible for the Lenovo Home Page Reader. You can operate all features by using the keyboard instead of the mouse.

You can view the publications for Lenovo XClarity Integrator Hardware Management Pack in Adobe Portable Document Format (PDF) using the Adobe Acrobat Reader. You can access the PDFs from Lenovo XClarity Integrator Hardware Management Pack download site.

### **Lenovo and accessibility**

For more information about the commitment of Lenovo accessibility, refer to [Lenovo Accessibility Web site](#).



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## Appendix B. Best practices

The topics in this section provide suggested methods for completing tasks.

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### Determining the cause of an error

Use the following diagnostic procedure to identify and solve problems that might occur in a managed environment.

#### Procedure

- Step 1. Log in to the Operations Manager console.
- Step 2. Click **Monitoring**.
- Step 3. To view the status of all of your managed systems that have Windows operating systems installed, click **Lenovo Hardware → Windows on Lenovo servers**.
- Step 4. Check the health of the systems displayed in the top results pane. All newly discovered objects are in a healthy state by default. The Health check monitoring task updates the status of an object at regular intervals, according to the default interval setting. You can configure the monitoring frequency by using the **override-controlled** parameters. For more information about the **override-controlled** parameter, refer to Microsoft System Center Operations Manager documentation.
- Step 5. Select a system that shows a *Critical* or *Warning* state.
- Step 6. Determine whether the error is related to the hardware or software.
  - **Hardware-related failures:** Check the Lenovo Hardware Components of the **All Windows on Lenovo server Group** pane to select the system. Scroll to the right to view all of the component status and data. You can personalize this view.

This pane contains state views based on the class of the hardware component basis. The purpose of this view is to provide access to detailed properties of each component instance. Look for additional system information in the **Detail View** pane.
  - **Software-related failures:** Check the Windows Computer in the **All Windows on Lenovo server Group** pane. This pane contains state views and information on a per-software-component-class basis. Select a system that has either a *Critical* or *Warning* health state.

The purpose of these views is to provide access to detailed properties of each component instance. The **Detail View** shows all instances of the system software with a health state for each of the four health aspects.
- Step 7. To obtain more information and details about a failure, access the hardware information of the desired BladeCenter module or hardware system component by clicking **BladeCenter Chassis and Modules**.
- Step 8. Optional: If you already know that a power supply component failed, for example, select the related view, **Lenovo BladeCenter Power Modules**, to determine the problem with the power supply.
- Step 9. Click a **Critical** power module and review its related data.
- Step 10. Review the information and data presented in the **Detail View** pane. Check all instances of the module type and each of its four health aspects.
- Step 11. Right-click the selected module, and click **open → Health Explorer**.
- Step 12. Select the alert, and look at the information on the **State Change Events** page.
- Step 13. Depending on the type of alert you have, you can click **View Alert** for more information.

Step 14. Click the **Knowledge** tab to read the **Knowledge** page and one or more Knowledge Articles that relate to your alert.

**Important:** In addition to the health information available for each object, related information might be available from other objects that are health-related from different perspectives. For example, a blade server that is monitored in-band through its platform agent shows a health state, but the BladeCenter chassis management module also shows a health state for the blade server.

Other BladeCenter chassis modules might affect the blade server health, such as a power supply that provides power to the blade server. Similarly, the health of a blade server from the management module perspective might include the health and other information about the operating system running on the blade server.

For instance, the following BladeCenter simple network management protocol (SNMP) alert has an event description field of *1.3.6.1.4.1.2.6.158.3.1.1.8* and an event ID of *1.3.6.1.4.1.2.6.158.3.1.1.14*. Convert the decimal event ID value to a hexadecimal number to look up the message in the *Advanced Management Module Message Guide*.

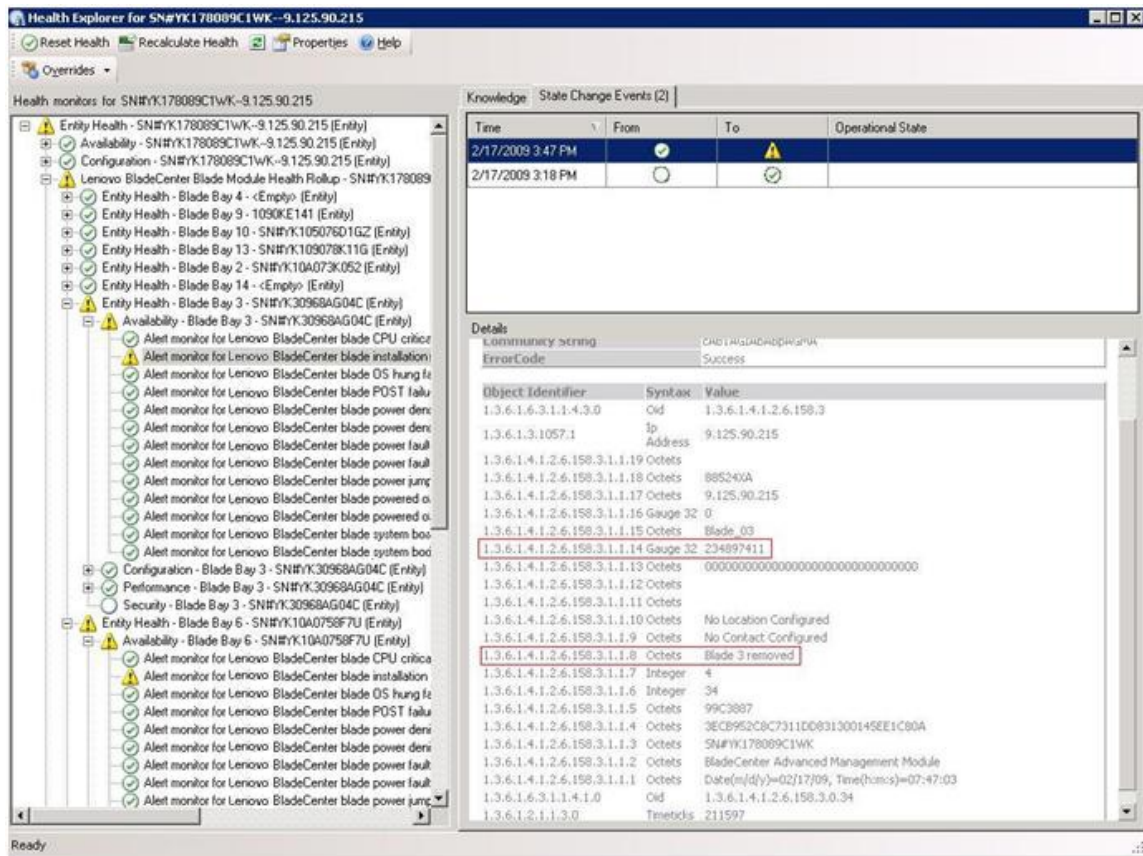


Figure 1. System x Windows Management Instrumentation (WMI) event

For a System x WMI event, the **Details** pane includes the event ID and a description.



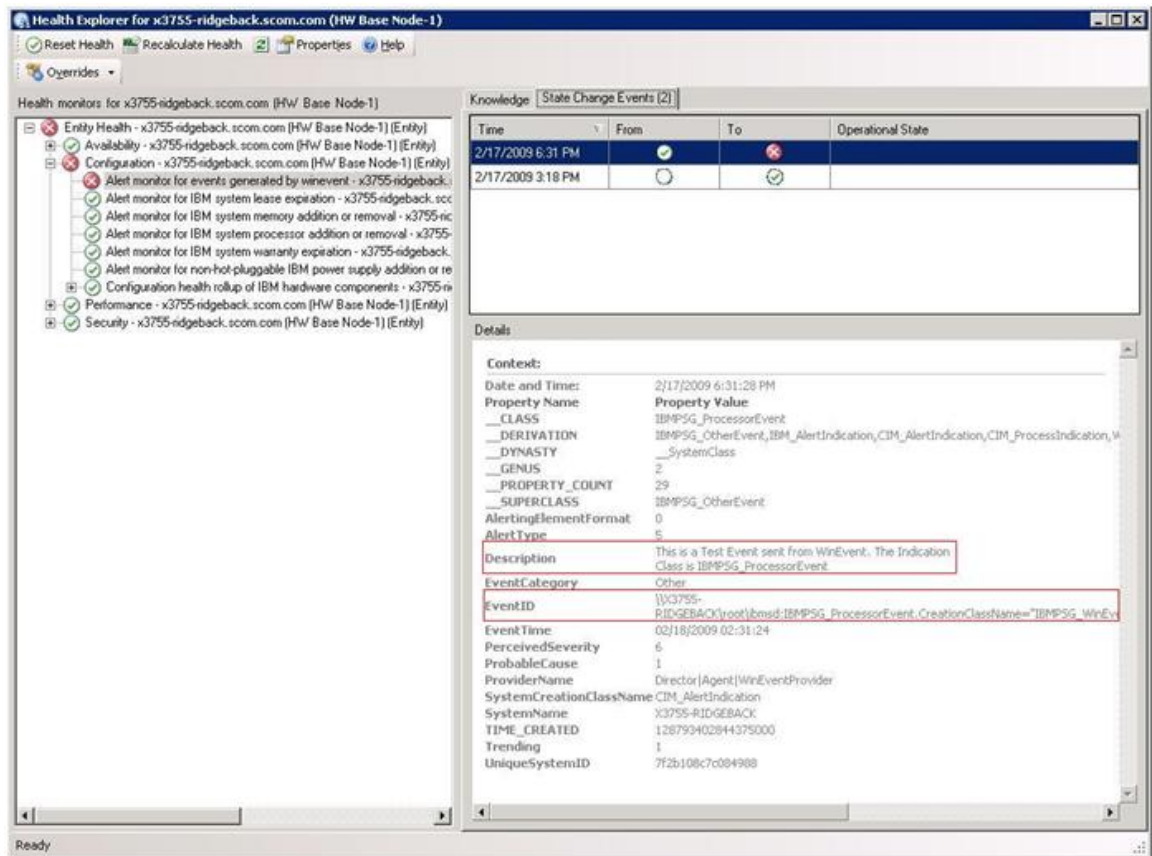


Figure 2. Example of the State Change Events tab detail information

## Rediscovering all BladeCenters

The BladeCenter monitor stalls when the same version of Lenovo XClarity Integrator Hardware Management Pack is deleted and re-imported.

### Procedure

- Step 1. Log in to the Operations Manager console.
- Step 2. Click **Administration → Device Management → Network Devices**.
- Step 3. Note the IP addresses listed in the **Network Devices** view of the results pane. You will need this information for the discovery network device information later.
- Step 4. Select the **IP Address** of the BladeCenter you want to rediscover, and in the **Actions** pane, select **Delete**.
- Step 5. Use the noted IP address to limit the scope of Network Devices and rediscover the BladeCenter.

## Rediscovering a renamed server

When a Windows server is renamed, the Windows server instance entry monitored by the Operations Manager becomes grayed out. This is an indication that the Windows server is no longer being monitored by the Operations Manager.

To rediscover and monitor a renamed server, first delete the original server name from the **Operations Manager Agent Managed server** list, and then rediscover the renamed server by using the following procedure.

## Procedure

- Step 1. Log in to the Operations Manager console.
- Step 2. Click **Administration** → **Device Management** → **Agent Managed**.

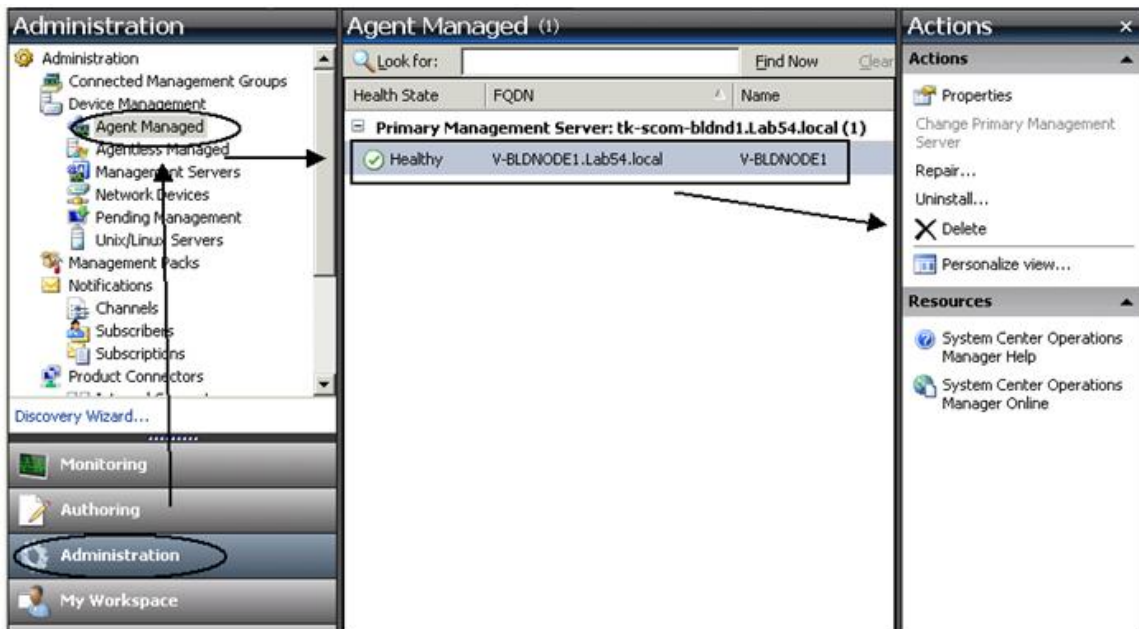


Figure 3. Deleting a renamed server

- Step 3. Select the original name listed in the **Agent Managed** view of the results pane. This entry has the original name before it was renamed.
- Step 4. Click **Delete** in the **Actions** pane located on the right side of the Operations Manager console. This action removes the renamed server from the view.
- Step 5. Add the new server name.

## Appendix C. System firewall settings

This section describes how to set firewall exceptions.

The following table list the ports used by Hardware Management Pack for SCOM.

Table 6. Ports used by Lenovo XClarity Integrator Hardware Management Pack for Microsoft System Center Operations Manager

| Source        |                            |                                    | Target    |                   |              | Protocol   | Notes  |
|---------------|----------------------------|------------------------------------|-----------|-------------------|--------------|------------|--|
| Port          | Location                   | Component                          | Port      | Location          | Component    |            |  |
| Not specified | LXCI                       | LXCI Service                       | TCP 5724  | Management server | SDK service  | N/A        | Connect to Operations Manager SDK service.                         |
| Not specified | Management server BMC node | Lenovo Hardware MP BMC node        | TCP 9500* | LXCI              | LXCI Service | HTTPS      | You can change the port when installing LXCI.                      |
| Not specified | Managed host               | Lenovo Hardware MP                 | TCP 9500* | LXCI              | LXCI Service | HTTPS      | It is required for BMC auto discovery.                             |
| Not specified | LXCI                       | LXCI Service (localhost/127.0.0.1) | TCP 5432* | LXCI              | PostgreSQL   | N/A        | The port can be changed when the PostgreSQL database is installed. |
| Not specified | LXCI                       | LXCI Service                       | TCP 5988  | BMC node          | BMC node     | HTTP, CIM  | It is not required when Redfish protocol is used.                  |
| Not specified | LXCI                       | LXCI Service                       | TCP 5989  | BMC node          | BMC node     | HTTPS, CIM | The BMC HTTP/HTTPS ports are changeable in BMC portal.             |
| Not specified | LXCI                       | LXCI Service                       | UDP 427   | BMC node          | BMC node     | SLP        | SLP is used to discover BMC.                                       |
| Not specified | Management server          | Lenovo Hardware MP                 | TCP 161   | Chassis           | CMM/AMM      | SNMP       | You can change the ports in CMM portal.                            |
| Not specified | Management server          | Lenovo Hardware MP                 | TCP 162   | Chassis           | CMM/AMM      | SNMP Traps |  |

**Note:** The ports marked with an asterisk (\*) are registered by LXCI. The others are only used to access specific services in LXCI.



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## Important notes

Processor speed indicates the internal clock speed of the microprocessor; other factors also affect application performance.

When referring to processor storage, real and virtual storage, or channel volume, KB stands for 1 024 bytes, MB stands for 1 048 576 bytes, and GB stands for 1 073 741 824 bytes.

When referring to hard disk drive capacity or communications volume, MB stands for 1 000 000 bytes, and GB stands for 1 000 000 000 bytes. Total user-accessible capacity can vary depending on operating environments.

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