



Cisco WAE 7.2.1 Installation Guide

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CHAPTER 1

Cisco WAE Overview

- [Cisco WAE Overview, on page 1](#)
- [Cisco WAE Applications, on page 1](#)

Cisco WAE Overview

The Cisco WAN Automation Engine (WAE) platform is an open, programmable framework that interconnects software modules, communicates with the network, and provides APIs to interface with external applications.

Cisco WAE provides the tools to create and maintain a model of the current network through the continual monitoring and analysis of the network and the traffic demands that is placed on it. At a given time, this network model contains all relevant information about a network, including topology, configuration, and traffic information. You can use this information as a basis for analyzing the impact on the network due to changes in traffic demands, paths, node and link failures, network optimizations, or other changes.

The Cisco WAE platform has numerous use cases, including:

- Traffic engineering and network optimization—Compute TE LSP configurations to improve the network performance, or perform local or global optimization.
- Demand engineering—Examine the impact on network traffic flow of adding, removing, or modifying traffic demands on the network.
- Topology and predictive analysis—Observe the impact to network performance of changes in the network topology, which is driven either by design or by network failures.
- TE tunnel programming—Examine the impact of modifying tunnel parameters, such as the tunnel path and reserved bandwidth.
- Class of service (CoS)-aware bandwidth on demand—Examine existing network traffic and demands, and admit a set of service-class-specific demands between routers.

Cisco WAE Applications

Cisco WAE applications work with the Cisco WAE platform software, providing greater insight into your network.

- Cisco WAE Design—The WAE Design GUI provides graphical layouts of the network, showing views of different regions and layers, as well as utilizations and routings. It lets you model, simulate, and analyze

failures, changes, and impact of traffic growth, as well as optimize your network for maximum efficiency. Simulation tools let you perform interactive what-if simulations by:

- Failing objects
- Modifying the network topology
- Creating and changing traffic demands (which simulate traffic flows)
- Modifying routing configurations

For installation instructions, see the [Cisco WAE Design GUI Installation Guide](#).

- Cisco WAE Live—Cisco WAE Live provides immediate and easy access to both current and historical network data. Combined, the Explore, Analytics, and Map tools offer a flexible and interactive means of finding summarized aggregate views or quickly narrowing the search on network data to only relevant details.

For installation instructions, see [Install Cisco WAE Live, on page 19](#).

- Bandwidth on Demand—The Bandwidth on Demand (BWoD) application utilizes the near real-time model of the network offered by WMD to compute and maintain paths for SR policies with bandwidth constraints delegated to WAE from XTC. In order to compute the shortest path available for a SR policy with a bandwidth constraint and ensure that path will be free of congestion, a Path Computation Element (PCE) must be aware of traffic loading on the network. The WAE BWoD application extends the existing topology-aware PCE capabilities of XTC by allowing delegation of bandwidth-aware path computation of SR policies to be sub-delegated to WAE through a new XTC REST API. Users may fine-tune the behavior of the BWoD application, affecting the path it computes, through selection of application options including network utilization threshold (definition of congestion) and path optimization criteria preferences.

For information about enabling, configuring, and properly shutting down the BWoD application, see the "Automation Applications" chapter in the [Cisco WAE User Guide](#).

- Bandwidth Optimization—The Bandwidth Optimization application is an approach to managing network traffic that focuses on deploying a small number of LSPs to achieve a specific outcome in the network. Examples of this type of tactical traffic engineering are deploying LSPs to shift traffic away from a congested link, establishing a low-latency LSP for priority voice or video traffic, or deploying LSPs to avoid certain nodes or links. WAE provides the Bandwidth Optimization application to react and manage traffic as the state of the network changes.

For information about enabling, configuring, and properly shutting down the Bandwidth Optimization application, see the "Automation Applications" chapter in the [Cisco WAE User Guide](#).



CHAPTER 2

Cisco WAE Installation Requirements

Cisco WAE requirements vary depending on which components are installed together. This section provides general guidelines and minimum requirements for individual components installed on a single server, unless otherwise specified.

This section contains the following topics:

- [Cisco WAE Server Requirements, on page 3](#)
- [Required Software Packages, on page 4](#)
- [NetFlow Requirements, on page 4](#)
- [Optical Collection Agents, on page 6](#)
- [Collection from Network Service Orchestrator, on page 6](#)
- [Device Scale Support, on page 6](#)
- [Cisco WAE Design Requirements, on page 6](#)
- [WAE Live Requirements, on page 8](#)
- [Supported Web Browsers, on page 8](#)
- [Cisco WAE Ports, on page 9](#)

Cisco WAE Server Requirements

You can install Cisco WAE on a server that meets the following requirements.

| Operating System | Software | CPU | Memory | Hard Drive |
|------------------|---|------------------------------------|--------|--------------|
| Linux-x86_64 | CentOS and RHEL 7.6 with latest patches | 8+ cores Recommended : 16+ Core | 64 GB | 300 - 400 GB |

Important Notes

- Cisco WAE software is qualified on CentOS 7.6 and Red Hat Enterprise Linux 7.6.
- Other CentOS Red Hat Enterprise Linux versions should work, but has not been tested.
- Only Linux distributions available in English are supported.
- Modify the `/etc/security/limits.conf` file by adding or updating the following lines to make sure your hardware supports sufficient number of threads for starting poller:

```
[user] soft stack 8192
[user] soft nproc 257805
[user] soft nofile 1000000
```

Where `[user]` is the userid which starts the WAE process.

Required Software Packages

| Software | Version |
|------------------------|---|
| JDK/JRE | Oracle or OpenJDK 1.8.0_102 64-bit Note Java environment variables must be configured correctly and JRE_HOME must point to a valid JRE/JDK 1.8 installation. Download the JRE package from the Oracle distribution site. For example: <ul style="list-style-type: none"> Linux: Enter the following command: <pre>admin@system1 ~ # export JRE_HOME=<JDK/JRE_installation_path></pre> |
| Perl | 5.16.3 |
| fontconfig | 2.13.0 |
| Python | 2.7.5 |
| python-paramiko.noarch | 2.1.1 |
| python-lxml | 3.2.1 |
| python-requests | 2.18.4 |
| redhat-lsb | 4.0.7 This is required for the License Server. For more information, see the " WAE Design Floating License Server " chapter in the Cisco WAE Design GUI Installation Guide . |
| Supervisor | 3.1.4 and above |

NetFlow Requirements

NetFlow Collection - (Exclusive) Memory size and CPU per server

| Centralized NetFlow (WAE YANG runtime server) | | |
|--|--------|-----|
| | Memory | CPU |
| | | |

| Centralized NetFlow (WAE YANG runtime server) | | |
|---|---------------|-----------------|
| Collector Server | 32 GB | |
| flow_get | 4 GB | |
| TOTAL | 36 GB | 8+ Cores |
| Distributed NetFlow (Server where the agent resides) | | |
| | Memory | CPU |
| Collector Server | 32 GB | |
| flow_cluster_agent | 4 GB | |
| TOTAL | 36 GB | 8+ Cores |
| Distributed NetFlow (WAE YANG runtime server) | | |
| | Memory | CPU |
| flow_cluster_broker | 2 GB | |
| flow_cluster_master | 2 GB | |
| flow_cluster_ias flow_cluster_dmd | 4 GB | |
| TOTAL | 8 GB | 8+ Cores |

**Note**

- One flow collection server is required per 100 Mbps of flow export bandwidth.
- Only English Linux is supported.
- Qualified on CentOS 7.6 and Red Hat Enterprise Linux 7.6.
- Flow collection requires Linux Kernel 2.6.32 or greater.
- The memory requirement listed above per collection server instance is based on the assumption of an approximate figure of 100 Mbit/s of NetFlow traffic.

Optical Collection Agents

| Vendor | Supported Node Version | Software |
|----------------------------------|---|--|
| Cisco | Cisco Network Convergence System (NCS) 2000 Series Routers, Releases 10.9, 11.0 | Cisco Evolved Programmable Network Manager 3.0.3 |
| Cisco Transport Controller (CTC) | Cisco Network Convergence System (NCS) 2000 Series Routers, Releases 10.7, 10.8 | NA |

Collection from Network Service Orchestrator

| Software/Driver | Version |
|------------------------------|--|
| IOS NED | 6.38 |
| IOS-XR NED | 7.16 |
| Junos NED | 4.5.13 |
| Network Service Orchestrator | 4.7.6.1 |
| Traffic Engineering | Contact your Cisco WAE representative. |

Device Scale Support

The following number of devices are supported:

| Feature | Devices |
|------------|------------------------------|
| Planning | 3,000 nodes |
| Automation | 300 nodes 3000 interfaces |

Cisco WAE Design Requirements

WAE Design is a 64-bit installation on all supported operating systems.

| Operating System | Software | CPU | Memory |
|------------------|---|---------------------|-------------------------------------|
| Linux-x86_64 | CentOS and RHEL 7.6 with latest patches | Intel or AMD 2+ GHz | Minimum: 8 GB Recommended: 16 GB |

| Operating System | Software | CPU | Memory |
|------------------|--|---------------------|-------------------------------------|
| Windows (64-bit) | Windows Server 2008 R2 Edition Windows 10 | Intel or AMD 2+ GHz | Minimum: 8 GB Recommended: 16 GB |
| macOS x86_64 | 10.8.5 to 10.15.2 | Intel or AMD 2+ GHz | Minimum: 8 GB Recommended: 16 GB |

| Software | Version |
|----------|--|
| JDK/JRE | <p>Configuration parsing inside WAE Design requires JRE Version 1.8.0_102 (64-bits) downloaded from the Oracle Java SE 8 Downloads page.</p> <ul style="list-style-type: none"> Windows (64-bit): <ul style="list-style-type: none"> Set JRE_HOME (Control Panel > System > Advanced > Environment Variables) to point to the path of the JRE installation, for example: <code>Files\Java\jre1.8.0_102</code>. Linux: <ul style="list-style-type: none"> The session that launches WAE Design should include in its environment: <pre>JRE_HOME=<JRE_installation_path></pre> Mac: <ul style="list-style-type: none"> Add the following line into <code>~/bash_profile</code>: <pre>export JRE_HOME=\$(/usr/libexec/jre_home -v 1.8)</pre> For MacOS X 10.12 or later, also add following line in <code>~/bash_profile</code>: <pre>launchctl setenv JRE_HOME ` /usr/libexec/jre_home -v 1.8 `</pre> |
| Perl | A Perl (5.10+) installation is required for certain WAE Design features. |
| Python | A Python installation is required for certain WAE Design features. See Required Software Packages, on page 4 . |

Important Notes

- A standalone WAE Design system does not require the use of WAE Collector.
- Only Linux distributions available in English are supported.
- A Perl (5.10+) installation is required for some WAE features. See [Required Software Packages, on page 4](#).
- A Python installation is required for some WAE features. See [Required Software Packages, on page 4](#).

WAE Live Requirements



Note WAE Live must be installed on a separate server than the WAE server.

| Requirement | ~1000 Node Network | ~2000 Node Network |
|----------------------------|---------------------|----------------------|
| Supported operating system | CentOS 7.6 | CentOS 7.6 |
| CPU | 8 cores, 16 threads | 16 cores, 32 threads |
| Memory | 24 GB | 48 GB |
| Disk speed | 200 MBs | 320 MBs |
| Disk size | 3 TB | 10 TB |
| Number of network objects | 100,000 | 500,000 |



- Note**
- Only Linux distributions available in English are supported.
 - Other CentOS Red Hat Enterprise Linux versions should work, but has not been tested.

Kernel Parameters

| Kernel Parameters | Value |
|------------------------------------|---------------|
| SHMALL | 4294967296 |
| SHMMAX | 4398046511104 |
| SHMMNI | 4096 |
| SEMMNS | 32000 |
| SEMMSL | 250 |
| SEMOPM | 32 |
| Maximum number of file descriptors | 65535 |

Supported Web Browsers

| Browser | Version |
|---------------|-------------|
| Google Chrome | 62 or later |

| Browser | Version |
|-------------------|---|
| Firefox | 56 or later |
| Internet Explorer | 11 or later |
| Note | Not supported on WAE Live or WAE Coordinated Maintenance. |

Cisco WAE Ports

| Port | Protocol | Type | Description |
|-----------------------|----------|------------------------|-------------------------------|
| *:4000 | UDP | Listening | Cisco WAE Server |
| *:8080 | TCP | Listening | Cisco WAE Server |
| *:8443 | TCP | Listening | Cisco WAE Server, Live Server |
| 2022 - 2023 | TCP | Listening and outgoing | Cisco WAE Server |
| *:2024 | TCP | Listening | Cisco WAE Server |
| 4569 | TCP | Listening and outgoing | Cisco WAE Server |
| 4570 | TCP | Listening | Cisco WAE Server HA |
| 8080 | TCP | Outgoing | XTC collection |
| 127.0.0.1:9901 - 9902 | TCP | Listening | SNMP polling |
| 164 | UDP | Outgoing | SNMP-based NIMOs |
| 22 | TCP | Outgoing | Collection via Telnet |
| 23 | TCP | Outgoing | Collection via SSH |
| *:2181 | TCP | Listening | Message broker |
| *:9092 - 9094 | TCP | Listening | Message broker |
| *:9000 | TCP | Listening | Optical plug-in |
| 8161 | TCP | Listening | NetFlow JMS OOB |
| 61616 | TCP | Listening | NetFlow JMS IB |
| 9090 | TCP | Listening | NetFlow HTTP |
| 2100 | UDP | Listening | NetFlow |
| 179 | TCP | Listening | NetFlow BGP |

| Port | Protocol | Type | Description |
|---|----------|-----------|---|
| *:8843 | TCP | Listening | Cisco WAE Coordinated Maintenance (standalone or as part of WAE Server) |
| See "Configuring License Server Ports" in the Cisco WAE Design GUI Installation Guide . | TCP | Listening | License Server |



CHAPTER 3

Install Cisco WAE

This section contains the following topics:

- [Install and Configure Supervisor, on page 11](#)
- [Verify WAE Image, on page 12](#)
- [Install Cisco WAE, on page 13](#)
- [Install Cisco WAE License, on page 14](#)
- [Start and Stop Cisco WAE, on page 14](#)
- [Upgrade from Cisco WAE 7.1.x to WAE 7.2.1, on page 15](#)
- [Update Packages or Templates, on page 15](#)
- [Troubleshoot a Cisco WAE Installation, on page 16](#)

Install and Configure Supervisor

Install and configure supervisor before installing WAE.



Note The following configuration steps work only when supervisor is installed using yum. If supervisor is installed using any other method, it has to be configured to run **supervisorctl** as a non root user.

Step 1 Install supervisor and verify.

```
sudo yum install -y epel-release
sudo yum install -y supervisor
supervisord -version
3.1.4
```

Step 2 Create directories with write permissions for the OS user running WAE.

```
sudo mkdir -p /opt/supervisor/run
sudo mkdir -p /opt/supervisor/log
sudo chown -R [USER-NAME]:[GROUP-NAME] /opt/supervisor
```

Step 3 Update supervisor configuration to not run as a root user.

Point the pid file to `/opt/supervisor/run/supervisor.pid` and user as the OS user running WAE.

Open `/etc/supervisord.conf` as root and edit.

- In the `[unix_http_server]` section:
 - Change `;file=/var/run/supervisor/supervisor.sock` to `file=/opt/supervisor/run/supervisor.sock`
 - Change `;chown=nobody:nogroup` to `chown=[USER-NAME]:[GROUP-NAME]`
 - In the `[supervisord]` section:
 - Change `;logfile=/var/log/supervisor/supervisord.log` to `logfile=/opt/supervisor/log/supervisord.log`.
 - Change `;pidfile=/var/run/supervisord.pid` to `pidfile=/opt/supervisor/run/supervisord.pid`
 - Change `;minfds=1024` to `minfds=1000000`
 - Change `;minprocs=200` to `minprocs=257805`
- Note** Do not set the user under the `[supervisord]` section.
- In the `[supervisorctl]` section:
 - Change `;serverurl=unix:///var/run/supervisor/supervisor.sock` to `serverurl=unix:///opt/supervisor/run/supervisor.sock`

Step 4 Start Supervisor.

```
sudo systemctl start supervisord
supervisorctl status all
```

Step 5 Enable supervisor to start during system startup.

```
sudo systemctl enable supervisord
sudo systemctl status supervisord
```

Verify WAE Image

Step 1 Download the Cisco WAE 7.2.1 software package from [Cisco Download Software](#) site.

Step 2 The certificate and digital signature are both embedded in the downloaded file - `wae-linux-v7.2.1.signed.bin`.

Step 3 Run the self-extracting signed binary. This extracts the Release Binary and validates using the signature file.

Verification of signed image

```
[admin@wae-vm-21 workspace.signed]$ ./wae-linux-v7.2.1.signed.bin
Unpacking...
Verifying signature...
Downloading CA certificate from http://www.cisco.com/security/pki/certs/crcam2.cer ...
Successfully downloaded and verified crcam2.cer.
Downloading SubCA certificate from http://www.cisco.com/security/pki/certs/innerspace.cer ...
Successfully downloaded and verified innerspace.cer.
Successfully verified root, subca and end-entity certificate chain.
Successfully fetched a public key from WAE-CCO_RELEASE.cer.
Successfully verified the signature of wae-linux-v7.2.1.bin using WAE-CCO_RELEASE.cer
```

Step 4 The generated `wae-linux-v7.2.1.bin` is the Linux installer for WAE.

Install Cisco WAE

Before you begin

- If one does not yet exist, create a UNIX user (assigned to a group). You must be this UNIX user to run installation.
- Make sure supervisor is installed and configured. See [Install and Configure Supervisor, on page 11](#).
- Download and verify the digitally signed Cisco WAE 7.2.1 image. See [Verify WAE Image, on page 12](#).
- Make sure Java-8 is installed on the system and `JAVA_HOME` environment variable is pointing to `jdk-1.8`.
- Make sure that `requests.auth` python package is installed for the BW-OPT application to function in WAE.
- For migrating the existing 7.1.x configurations to 7.2.1 please go through the README file provided with “*Cisco WAE upgrade script for migrating configurations from WAE 7.1.x to WAE 7.2.1*” package from CCO.

Step 1 Stop WAE if running.

Step 2 Change permission of the install file using the command:

```
chmod +x wae-linux-v7.2.1.bin
```

Step 3 Run the installer specifying the target directory.

```
./wae-linux-v7.2.1.bin <wae-dir>
```

Step 4 Setup environment and create a runtime directory specifying the path.

```
cd <wae-dir>
source waerc
wae-setup --dest <target-runtime-dir>
```

Step 5 You are prompted to set the Cisco WAE admin password.

```
WAE admin password:
Confirm password:
```

Step 6 After installing and setting up wae (i.e. after running `wae-setup`), create a soft link to the `wae.ini` file from inside `/etc/supervisord.d/` and add WAE config to supervisor.

```
sudo ln -sf <target-runtime-dir>/wae.ini /etc/supervisord.d/
```

Note Execute this step only after supervisor is installed and configured.

Step 7 Update supervisor configuration.

```
supervisorctl update
```

Step 8 Start WAE process

```
supervisorctl start wae:*
wae:zookeeper: started
wae:waectl: started
```

```
wae:kafka: started
wae:wae-monitor: started
```

- Note**
- `wae:waectl` is the WAE program.
 - `wae:kafka` and `wae:zookeeper` are required for traffic collection.
 - `wae:wae-monitor` is the monitoring service.
 - `wae:logrotate` is for log rotation.

Step 9 Check status of WAE process

```
supervisorctl status
wae:kafka RUNNING pid 1540, uptime 28 days, 14:03:40
wae:logrotate RUNNING pid 1178, uptime 28 days, 15:10:11
wae:wae-monitor RUNNING pid 11520, uptime 0:00:12
wae:waectl RUNNING pid 1177, uptime 28 days, 15:10:11
wae:zookeeper RUNNING pid 1736, uptime 28 days, 14:03:39
```

- Note** To stop all WAE process, use the command:
- ```
supervisorctl stop wae:*
```

## Install Cisco WAE License

A license is required to use all the features in Cisco WAE. If you have questions about obtaining a license, contact your Cisco support representative or system administrator.

Cisco WAE supports both Cisco Smart Licensing and traditional licensing. If you would like to convert from a traditional license to Smart Licensing, see your Cisco WAE account representative. For information on the differences between the two types of licensing, refer to the [Cisco Smart Licensing Overview](#) on Cisco.com.

For information on Cisco Smart Licensing, see "Smart Licensing" chapter in *Cisco WAE User Guide*.

To install a traditional license, complete the following steps:

- Step 1** Run the `license_install` tool, passing it the name of the license file (.lic extension). By default, the tool merges the features that are granted by the new license with those features in an existing license.

```
license_install -file <path>/<license_name>.lic
```

- Step 2** When prompted, enter the number that is associated with the directory in which you want to install the license.

## Start and Stop Cisco WAE

From the Cisco WAE run-time directory, enter the relevant Cisco WAE CLI command to start or stop Cisco WAE services:

- Start WAE

```

supervisorctl start wae:*
wae:zookeeper: started
wae:waectl: started
wae:kafka: started
wae:wae-monitor: started

```

- Stop WAE

```

supervisorctl stop wae:*

```

## Upgrade from Cisco WAE 7.1.x to WAE 7.2.1

You can use the Cisco WAE upgrade script utility to migrate configurations from WAE 7.1.x to WAE 7.2.1.

### Before you begin

Download the Cisco WAE upgrade script for migrating configurations from WAE 7.1.x to WAE 7.2.1 package from [Cisco Download Software](#) site.

**Step 1** To take a backup of the 7.1.x configuration, login to the machine where 7.1.x is installed, and run `wae_upgrade` script with `-export` option.

```

./wae_upgrade.sh -export -install-dir <WAE_7.1.x_INSTALL_DIR> -run-dir <WAE_7.1.x_RUN_DIR> -cfg-dir
<dir_to_save_exported_config>

```

Where:

```

-install-dir indicates the directory where 7.1.x WAE is installed
-run-dir indicates the directory where the run time for 7.1.x WAE resides
-cfg-dir indicates the folder where the 7.1.x config is to be backed up

```

**Step 2** To restore the 7.1.x configuration to 7.2.1, login to the machine where 7.2.1 is installed, and run `wae_upgrade` script with `-import` option.

```

./wae_upgrade.sh -import -install-dir <WAE_7.1.x_INSTALL_DIR> -run-dir <WAE_7.1.x_RUN_DIR> -cfg-dir
<dir_to_import_saved_config>

```

Where:

```

-install-dir indicates the directory where 7.2.1 WAE is installed
-run-dir indicates the directory where the run time for 7.2.1 WAE resides
-cfg-dir indicates the folder where the 7.1.x config is already backed up.

```

## Update Packages or Templates

If any packages or templates are updated or added in the `<wae_run_time_directory>/packages` directory, you must do one of the following:

- Restart Cisco WAE by running a package reload command.

```

wae --with-package-reload

```

- Request a package reload using the Cisco WAE CLI.

```

request packages reload

```

For example, you must perform a package reload when edit the `wae.conf` file.

## Troubleshoot a Cisco WAE Installation

To check the status of Cisco WAE, enter `supervisorctl status`.

Cisco WAE comes with standard logging features in the YANG run time. Cisco WAE logs to multiple log files in the `<wae-run-time>/logs` directory.

The LDAP authentication logs are logged in `[wae-run-time]/logs/wae-ldap-auth.log` file. The tool located in `[wae-install-dir]/lib/exec/test-java-ssl-conn` is useful to test SSL connectivity for java applications like LDAP Authentication and EPNM notifications which provide useful information to debug certification issues.

The most useful log is `<wae-run-time>/logs/ncs-java-vm.log`. Most Cisco WAE packages log to this file. Some Cisco WAE packages also log to `<wae-run-time>/logs/ncs-python-vm-<package-name>.log`. The following example shows Python-VM based logs:

```
[wae@wae logs]$ pwd
/home/wae/wae-run/logs
[wae@host logs]$ ls -ltr ncs-python-vm*
-rw-rw-r-- 1 wae wae 0 Feb 26 07:50 ncs-python-vm-cisco-wae-opm-tte.log
-rw-rw-r-- 1 wae wae 0 Feb 26 07:50 ncs-python-vm-cisco-wae-get-plan.log
-rw-rw-r-- 1 wae wae 0 Feb 26 07:50 ncs-python-vm-cisco-wae-dmdmesh-creator-nimo.log
-rw-rw-r-- 1 wae wae 0 Feb 26 07:50 ncs-python-vm-cisco-wae-layout-nimo.log
-rw-rw-r-- 1 wae wae 0 Feb 26 07:50 ncs-python-vm-cisco-wae-opm-load-plan.log
-rw-rw-r-- 1 wae wae 0 Feb 26 07:50 ncs-python-vm-cisco-wae-dmddeduct-nimo.log
-rw-rw-r-- 1 wae wae 0 Feb 26 07:50 ncs-python-vm-cisco-wae-archive.log
-rw-rw-r-- 1 wae wae 2238 Feb 26 07:50 ncs-python-vm.log
-rw-rw-r-- 1 wae wae 270 Feb 26 08:20 ncs-python-vm-nso_wae_nodes_insert.log
```

By default, the log level is set to INFO. You can configure logging in the following ways:

- Define the log level of various logs in the run-time directory `wae.conf` file. For information about the `wae.conf` file, see the *Cisco WAE User Guide*.
- Use the Expert Mode to set logging capabilities for some network interface modules (NIMOs). For example, you can set logging capabilities such as topology NIMOs and the `lsp-snmp-nimo` module. For information about the Expert Mode, see the [Cisco WAE User Guide](#).
- Use the Cisco WAE CLI to define the log level for various NIMO components. To define the log level, enter the following command at the command line:

```
admin@wae% set java-vm java-logging logger <nimo-component> level <level-x>
```

Level types are `level-info`, `level-debug`, and `level-all`. The logs are saved to `ncs-java-vm.log` and can be used for troubleshooting.

The following table lists basic NIMO components.

| NIMO Component          | Description                   |
|-------------------------|-------------------------------|
| com.cisco.wae           | General debugging             |
| com.cisco.wae.nimo.topo | Topology-based NIMO debugging |

| <b>NIMO Component</b>                | <b>Description</b>                      |
|--------------------------------------|-----------------------------------------|
| com.cisco.wae.nimo.lspconfig         | LSP configuration through NED debugging |
| com.cisco.wae.nimo.lsp               | LSP debugging                           |
| com.cisco.wae.nimo.snmptrafficpoller | SNMP traffic poller debugging           |
| com.cisco.cisco.wae.aggr             | Aggregation debugging                   |
| com.cisco.wae.nimo.optical           | Optical NIMO debugging                  |







## CHAPTER 4

# Install Cisco WAE Live

---

This section contains the following topics:

- [Verify WAE Live Image, on page 19](#)
- [Install Cisco WAE Live, on page 20](#)
- [Upgrade from Cisco WAE Live 7.1.x to Cisco WAE Live 7.2.1 , on page 21](#)
- [Migrate WAE 6.4.10+ Live Data to WAE Live 7.1.x, on page 21](#)
- [Cisco WAE Live Data Store, on page 25](#)
- [Install the Cisco WAE Live License, on page 31](#)

## Verify WAE Live Image

---

**Step 1** Download the Cisco WAE Live 7.2.1 software package from [Cisco Download Software](#) site.

**Step 2** The certificate and digital signature are both embedded in the downloaded file -  
WAE-Live-7.2.1-Linux\_x86-64.signed.bin.

**Step 3** Run the self-extracting signed binary. This extracts the Release Binary and validates using the signature file.

Verification of signed image

```
[admin@wae-vm-21 workspace.signed]$./WAE-Live-7.2.1-Linux_x86-64.signed.bin
Unpacking...
Verifying signature...
Downloading CA certificate from http://www.cisco.com/security/pki/certs/crcam2.cer ...
Successfully downloaded and verified crcam2.cer.
Downloading SubCA certificate from http://www.cisco.com/security/pki/certs/innerspace.cer ...
Successfully downloaded and verified innerspace.cer.
Successfully verified root, subca and end-entity certificate chain.
Successfully fetched a public key from WAE-CCO_RELEASE.cer.
Successfully verified the signature of WAE-Live-7.2.1-Linux_x86-64.bin using WAE-CCO_RELEASE.cer
```

**Step 4** The generated WAE-Live-7.2.1-Linux\_x86-64.bin is the Linux installer for WAE.

---

# Install Cisco WAE Live

## Before you begin

- Cisco WAE Live cannot be installed on the same machine where the Cisco WAE 7.2.1 server software is installed.
- Confirm that the Cisco WAE Live server requirements are met (see [WAE Live Requirements, on page 8](#)).
- Do not install Cisco WAE Live as a root user.
- Confirm that you have a Cisco WAE 7.2.1 Live license on the server.
- Install JDK or JRE (OpenJDK 10.2 is recommended ) and set the environment variable via `export JAVA_HOME` or `JRE_HOME`.  
For example, if OpenJdk 10.2 is installed to `/usr/local/jdk-10.2`,  
`export JAVA_HOME=/usr/local/jdk-10.2`
- WAE Live is installed in `$CARIDEN_ROOT/software/live`. For example: `/opt/wae/software/live` or `/opt/cariden/software/live`.
- If you plan to migrate Cisco WAE Live 6.4.9 or older data, first upgrade to Cisco WAE Live 6.4.10. Then, enter the same installation directory that was used in Cisco WAE Live 6.4.x when prompted to install Cisco WAE Live 7.2.1. For example, if `$CARIDEN_ROOT` is defined as `/opt/cariden` in Cisco WAE Live 6.4.x, then confirm that `$CARIDEN_ROOT` in Cisco WAE 7.2.1 is also defined as `/opt/cariden`.

- 
- Step 1** Navigate to and download the Cisco WAE Live package from the [Cisco Download Software](#) site.
- Step 2** Log in to the server, copy the Cisco WAE Live package `<WAE-Live-7.2.1-Linux_x86-64.bin>` to a local directory, and start a bash shell.
- Step 3** Install the Cisco WAE Live package.  
`# bash <WAE-Live-7.2.1-Linux_x86-64.bin>`
- Step 4** If prompted, install the required software packages using the yum command.
- Step 5** Follow the installation prompts.
- Step 6** After installation, set environment variables and source `~/profile` to get the necessary settings.  
`# source ~/.profile`
- Step 7** Install Cisco WAE Live data store. For more information, see [Install WAE Live Data Store, on page 25](#).
- Step 8** Start Cisco WAE Live services.  
`# wae-live-start`

**Note** The data store must be configured before starting Cisco WAE Live.

- Step 9** Start one of the supported browsers and enter `https://server-ip:8443`, where *server-ip* is the IP address of the server on which you have WAE Live installed. The default password for the **admin** user is "admin". The default password for the **user** user is "user". You will be prompted to change the default login credentials upon first login.
- 

## Upgrade from Cisco WAE Live 7.1.x to Cisco WAE Live 7.2.1

### Before you begin

You must have Cisco WAE 7.1 or later installed to perform this upgrade. For Cisco WAE 6.4.x installations, see [Migrate WAE 6.4.10+ Live Data to WAE Live 7.1.x, on page 21](#).

---

- Step 1** Stop the web server and mld.

```
wae-live-stop
```

- Step 2** Install Cisco WAE Live 7.2.1. For more information, see [Install Cisco WAE Live, on page 20](#).

- Step 3** Stop mld if it is running.

```
mld -action stop
```

- Step 4** Execute the upgrade.

```
mld -action upgrade
```

- Step 5** Start the web server and mld.

```
wae-live-start
```

---

## Migrate WAE 6.4.10+ Live Data to WAE Live 7.1.x

### Before you begin

- *You can only migrate data from WAE 6.4.10 or later to WAE 7.1.x.* If you have an earlier WAE 6.x release installed, you must upgrade to at least WAE 6.4.10 before proceeding with the WAE 7.1.x upgrade.
- WAE Live 7.1.x and data store must be installed on a different machine than WAE 6.4.x. For installation steps, see [Install Cisco WAE Live, on page 20](#). In addition, the WAE Live 7.1.x installation directory and data store (mld) options must use the same directory path and mld options that was used for the WAE 6.4.x installation. For example, if WAE 6.4.10 was installed on `/opt/cariden`, then you must also install WAE Live 7.1.x in `/opt/cariden` in another server. mld parameters, such as CPUs, memory, storage, and so forth, must also have the same values. To view existing mld parameters, you can look in the `config.xml` file.
- The WAE Live 7.1.x data store must be installed before doing this procedure. For data store installation instructions, see [Install WAE Live Data Store, on page 25](#).
- You must continue to use the same WAE 6.4.x user ID (UID) and group ID (GID) after upgrading to WAE 7.1.x.

**Step 1** From the WAE Live 7.1.x server, stop the web server.

```
embedded_web_server -action stop
```

**Step 2** From the WAE Live 6.4.x Live server, do the following:

a) Stop the web server.

```
service wae-web-server stop
```

b) Back up the WAE Live data store. For example:

```
ml_backup -I 0
```

**Step 3** From the WAE Live 7.1.x server:

a) Back up the WAE Live data store. For example:

```
ml_backup -I 0
```

b) Edit parameters in `$CARIDEN_ROOT/software/mld/current/scripts/sqlhosts.ml`.

**Example:**

On the WAE Live 6.4.x server, `sqlhosts.ml` has the following:

```
ml_remote onsoctcp 172.131.130.112 9089
mltcp onsoctcp 127.0.0.1 9088
ml onipcshm 127.0.0.1 dummy
```

On the WAE Live 7.1.x server, change the `sqlhosts.ml` file to the following:

```
ml_remote onsoctcp <Live71_mld_IP_address> <Live71_port>
mltcp onsoctcp 127.0.0.1 9088
ml onipcshm 127.0.0.1 dummy
```

**Step 4** Confirm that the data store directory (attribute in `config.xml`) is the same. If there are missing files on the WAE 7.1.x server, then create zero size files with the same name using the `touch` command.

**Example:**

On the WAE Live 6.4.10 server:

```
[cariden@wodl114 archives]$ cd $CARIDEN_ROOT/software/mld/current/data/
[cariden@wodl114 data]$ ls -la

total 63591328

drwxr-xr-x 2 cariden caridenstaff 4096 Dec 5 12:55 .
drwxr-xr-x 10 cariden caridenstaff 4096 Dec 5 12:35 ..
-rw----- 1 cariden caridenstaff 2147483648 Dec 5 13:01 catdbs001
.
-rw----- 1 cariden caridenstaff 4294967296 Dec 5 14:31 sbospace000
```

```

-rw----- 1 cariden caridenstaff 2147483648 Dec 5 14:54 tempdbs000
-rw----- 1 cariden caridenstaff 2147483648 Dec 5 14:54 tempdbs001
-rw----- 1 cariden caridenstaff 4294967296 Dec 5 14:54 tsdbs000
-rw----- 1 cariden caridenstaff 4294967296 Dec 5 14:54 tsdbs001
-rw----- 1 cariden caridenstaff 4294967296 Dec 5 14:31 tsdbs002000
-rw----- 1 cariden caridenstaff 4294967296 Dec 5 14:31 tsdbs002001

```

**Example:**

On the WAE Live 7.1.x server, the missing files are `tsdbs002000` and `tsdbs002001`:

```

$CARIDEN_ROOT/software/mld/current/data
[cariden@wodl1113 data]$ ls -la
total 46814024
drwxr-xr-x 2 cariden caridenstaff 4096 Dec 5 01:56 .
drwxr-x--- 10 cariden caridenstaff 143 Dec 5 01:44 ..
-rw----- 1 cariden caridenstaff 2147483648 Dec 5 22:52 catdbs001
.
-rw----- 1 cariden caridenstaff 4294967296 Dec 5 22:50 sbspace000
-rw----- 1 cariden caridenstaff 2147483648 Dec 5 22:52 tempdbs000
-rw----- 1 cariden caridenstaff 2147483648 Dec 5 22:52 tempdbs001
-rw----- 1 cariden caridenstaff 4294967296 Dec 5 22:52 tsdbs000
-rw----- 1 cariden caridenstaff 4294967296 Dec 5 22:52 tsdbs001

```

You would then create zero size files so that WAE Live 7.1.x has the same contents as WAE Live 6.4.10.

```

touch tsdbs002000
touch tsdbs002001
chmod go-r tsdbs002000
chmod go-r tsdbs002001

```

**Step 5** Copy the Live 6.4.x data store backup file to the Live 7.1.x server.

**Example:**

```

scp $CARIDEN_ROOT/software/mld/current/backups/fullbackups/hostABC_1_L0
user@live71:$CARIDEN_ROOT/software/mld/current/backups/fullbackups/

```

**Step 6** Rename the copied WAE 6.4.x data store backup file to the WAE 7.1.x backup file.

**Example:**

If WAE Live 7.1.x backup file is named `host456_1_L0`, then

```

mv $CARIDEN_ROOT/software/mld/current/backups/fullbackups/hostABC_1_L0
$CARIDEN_ROOT/software/mld/current/backups/fullbackups/host456_71_L0

```

**Step 7** Stop WAE 7.1.x mld and restore the data store backup.

```
mld -action stop
ml_restore -directory $CARIDEN_ROOT/software/mld/current/backups/fullbackups
```

**Step 8** Run a sanity check. This process may take awhile.

```
mld -sanity all
```

**Step 9** Restart mld.

```
mld -action restart
```

**Step 10** From the WAE Live 6.4.x server, do the following:

a) Check the config.xml file to see if the following attributes are set to specific directories. If not, it is specified under the MLData attribute and the default path is \$CARIDEN\_ROOT/data/mldata/:

- AppData
- Backup
- Map.ArchivePath
- ReportData

If these attributes are set, copy the data from the respective directory to the same directory in the WAE Live 7.1.x server.

b) If the preceding attributes are not set, then use the tar command to pack all the respective directories and copy mldata.tar to the same directory on the WAE Live 7.1.x server.

**Example:**

```
tar -cvf mldata.tar appdata/ archives/ customdata/ jobs/ plans/ reports/
```

Copy mldata.tar to the WAE Live 7.1.x server:

```
scp mldata.tar <WAE_71_host>:$CARIDEN_ROOT/data/mldata/.
```

On the WAE Live 7.1.x server, navigate to where the MLdata property values are located. For example:

```
cd $CARIDEN_ROOT/data/mldata/
tar -xvf mldata.tar
```

**Step 11** From the WAE Live 6.4.x server, copy the following contents from \$CARIDEN\_ROOT/etc to the same path in WAE Live 7.1.x:

- a) \$CARIDEN\_ROOT/etc/config/config.xml
- b) \$CARIDEN\_ROOT/etc/matelive
- c) \$CARIDEN\_ROOT/etc/user\_manager

**Example:**

```
tar -cvf etc.tar config/ matelive/ user_manager/
config/
config/config.xml
config/config.xml.bak
matelive/
user_manager/
```

```
user_manager/auth.db.properties
user_manager/auth.db.script

scp etc.tar <WAE_64x_host>:$CARIDEN_ROOT/etc/.
```

From WAE Live 7.1.x server, copy the \$CARIDEN\_ROOT/etc directory.

```
cd $CARIDEN_ROOT/etc
tar -xvf etc.tar
```

**Step 12** Start the WAE Live 7.1.x web server and data store:

```
wae-live-start
```

---

## Cisco WAE Live Data Store

This section describes how to install, upgrade, back up, and restore a Cisco WAE Live data store. It also describes how to purge data using the `mld_purge` tool.

If the defaults were used during installation, `$CARIDEN_HOME` is the same as `/opt/cariden/software/live/current`.

## Install WAE Live Data Store

The following procedure describes how to install the Cisco WAE Live Data Store using `mld_tool`. The `mld` tool installs both the `mld` server and an empty data store directory.

### Before you begin

- For better performance, create a separate ext2 partition for the directory that is specified with the `-datastore` option.
- Understand what type of production environment you want to create.



---

### Note

- After the data store is created, it is difficult to modify any of the installation options (including the user name).
  - A 'demo' data store is just for pilot purpose. If you start with 'demo', then you must recreate the data store when it is time to move to production and the data in 'demo' data store will be lost.
- 
- The `-demo` or `-storage`, `-cpu` and `-memory` options are required. For more information on the `mld` command and options, see [mld Options, on page 26](#).

**Step 1** If WAE Live is running, stop the web server:

```
wae-live-stop
```

**Step 2** Enter appropriate mld command to install the data store. For mld commands and options see [mld Options, on page 26](#).

Example 1: To be prompted through installation and obtain sizing recommendations:

```
mld -installchk
```

Example 2: To install mld with a demo data store size:

```
mld -action install -demo true
```

Example 3: To install a small mld server into \$CARIDEN\_ROOT/data/matelive, reserve 2 CPUs, reserve 542 GB of disk storage and allocate 2.2 GB (2200 MB) of memory:

```
mld -action install -mldata $CARIDEN_ROOT/data/matelive -cpus 2 -storage 1:1:540 -memory 200:55:2000
```

**Step 3** Start mld and the web server:

```
wae-live-start
```

## mld Options

| Option                                                                                                                                   | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Default                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| -version                                                                                                                                 | Displays the data store version.                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                  |
| -action                                                                                                                                  | <p><code>install</code> —Installs a new mld server and data store, and start the mld server.</p> <p><code>upgrade</code> —Updates an existing mld server and start the mld server.</p> <p><code>start</code> —Alternative way to start the mld server.</p> <p><code>stop</code> —Alternative way to stop the mld server.</p> <p><code>status</code> —Alternative way to show the status of the mld server.</p> <p><code>restart</code> —Alternative way to stop and then restart the mld server.</p> | <p>Default installation directory</p> <p>\$CARIDEN_ROOT/software/mld/current</p> |
| -installchk                                                                                                                              | Prompts you through installation and gives sizing recommendations.                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                  |
| <p><b>Use only with -action install</b></p> <p>(If an option is not given, the installation performs the same tasks as -installchk.)</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                  |
| -demo true                                                                                                                               | <p>Installs a demo data store.</p> <p><b>Note</b> If both -demo and -storage options are used, -demo takes precedence.</p>                                                                                                                                                                                                                                                                                                                                                                           |                                                                                  |



| Option                                                                            | Description                                                                                                                                                                                                                                                                                                                                                      | Default                                             |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| <code>-storage &lt;n:n:n&gt;</code>                                               | Allocates the disk and memory based on the anticipated data store size, where <n:n:n> is data:indices:timeseries in GB. For details and recommended values, use <code>-installchk</code> and <code>-verbose</code> options.<br><br><b>Note</b> If the data store is larger than the demo size, this option is required when using <code>-action install</code> . |                                                     |
| <code>-memory &lt;n:n:n&gt;</code>                                                | Allocates the requested memory of the data store, where <n:n:n> is data:indices:timeseries in MB. For details and recommended values, use <code>-installchk</code> and <code>-verbose</code> options.                                                                                                                                                            |                                                     |
| <code>-mldata &lt;directory&gt;</code>                                            | Specifies directory where all application data is stored. This directory includes the data store, report output, and other application data.                                                                                                                                                                                                                     | <code>\$(CARIDEN_ROOT)/data/mldata</code>           |
| <code>-datastore &lt;directory&gt;</code>                                         | Specifies directory where the data store is initialized.<br><br>Once set, this directory cannot be changed. You can, however, use symbolic links.                                                                                                                                                                                                                | <code>\$(CARIDEN_ROOT)/data/mldata/datastore</code> |
| <code>-cpus &lt;#&gt;</code>                                                      | Reserves the number of CPUs for the data store and the mld server.                                                                                                                                                                                                                                                                                               | Half of the total CPUs                              |
| <b>Use only with <code>-action install</code> or <code>-action upgrade</code></b> |                                                                                                                                                                                                                                                                                                                                                                  |                                                     |
| <code>-mld &lt;directory&gt;</code>                                               | Specifies directory where the mld server is installed.<br><br>Once set, this directory cannot be changed. You can, however, use symbolic links.                                                                                                                                                                                                                  | <code>\$(CARIDEN_ROOT)/software/mld/current</code>  |
| <code>-backup &lt;directory&gt;</code>                                            | Specifies directory for saving data store backups.                                                                                                                                                                                                                                                                                                               | <code>\$(CARIDEN_ROOT)/data/mldata/backup</code>    |

## Back Up the Data Store

Cisco WAE Live backs up the time-series derived data from plan files. It does not back up transaction logs or other WAE Live data, such as application data and report data.

The required amount of space for backups depend on the installation size and how long a system has been running.

### Best Practices

- Perform the backup to a different disk drive, or copy the backup to a different physical device after you finish the backup.

- Perform backups outside of peak traffic hours.
- Set up a backup directory that is on a different physical disk when you first install the mld server and data store. Doing so sets the default backup directory for all backups.

```
mld -action install -backup <backup_directory>
```

- The backup process makes a copy of the data store, but it does not back up other Cisco WAE Live data, such as application data and report data. Therefore, with some regularity, copy this other data to a safe location, such as to a different physical disk.
- Perform a full backup at least weekly or monthly, with numerous incremental backups in between them.
- Rather than running manual backups, call `m1_backup` from a cron job.
- Perform only 1 backup at a time so that their schedules do not overlap. Running simultaneous backups are not supported. Ensure that there is at least 1 hour between each backup. After it completes, verify that the backup was completed within the hour.

## Backup Steps



**Caution** If you delete the previous mld installation directory, you may delete all the data. To check the current location, enter the following command: `mld -diag -c | egrep ROOTPATH`

The `m1_backup` tool enables you to perform multiple levels of backups to save disk space. An OS file system backup cannot be used to restore the data store. Use the `m1_backup` tool to perform a complete backup to use for data store restoration.

You can execute `m1_backup` to run a manual backup at any time. However, the first time you use backup levels, you must perform backups in this sequence.



**Note** Keep both the data store and the web server running.

| Sequence | Enter                                                       | Description                                                                    |
|----------|-------------------------------------------------------------|--------------------------------------------------------------------------------|
| 1        | <code>m1_backup</code><br>or<br><code>m1_backup -L 0</code> | Level 0—Back up everything.                                                    |
| 2        | <code>m1_backup -L 1</code>                                 | Level 1—Back up everything since the most recent Level 0 backup was performed. |
| 3        | <code>m1_backup -L 2</code>                                 | Level 2—Back up everything since the most recent Level 1 backup was performed. |



**Note** For larger systems that frequently run plan file processes, less incremental Level 1 and Level 2 backups are available in between Level 0 backups. The following error appears when a Level 1 or Level 2 backup is not available:

```
Archive failed - The existing level-0 backup for DBspace rootdbs is too old to allow any incremental backup.
```

When this error appears, run a Level 0 backup.

To run a backup using all defaults, enter `m1_backup`. The tool uses the default backup directory, and creates a full backup.

- To override the default backup directory, use the `-directory` option. The default backup directory is `$CARIDEN_ROOT/data/mldata/backup`.
- To set a different backup level, use the `-L` option.

The following example sets the backup directory to `$CARIDEN_ROOT/data/waelive/backups` and backs up only data that is new since the last level 0 backup was run. This assumes that you ran `m1_backup` one time using the default level of 0.

```
m1_backup -directory /data/waelive/backups -L 1
```

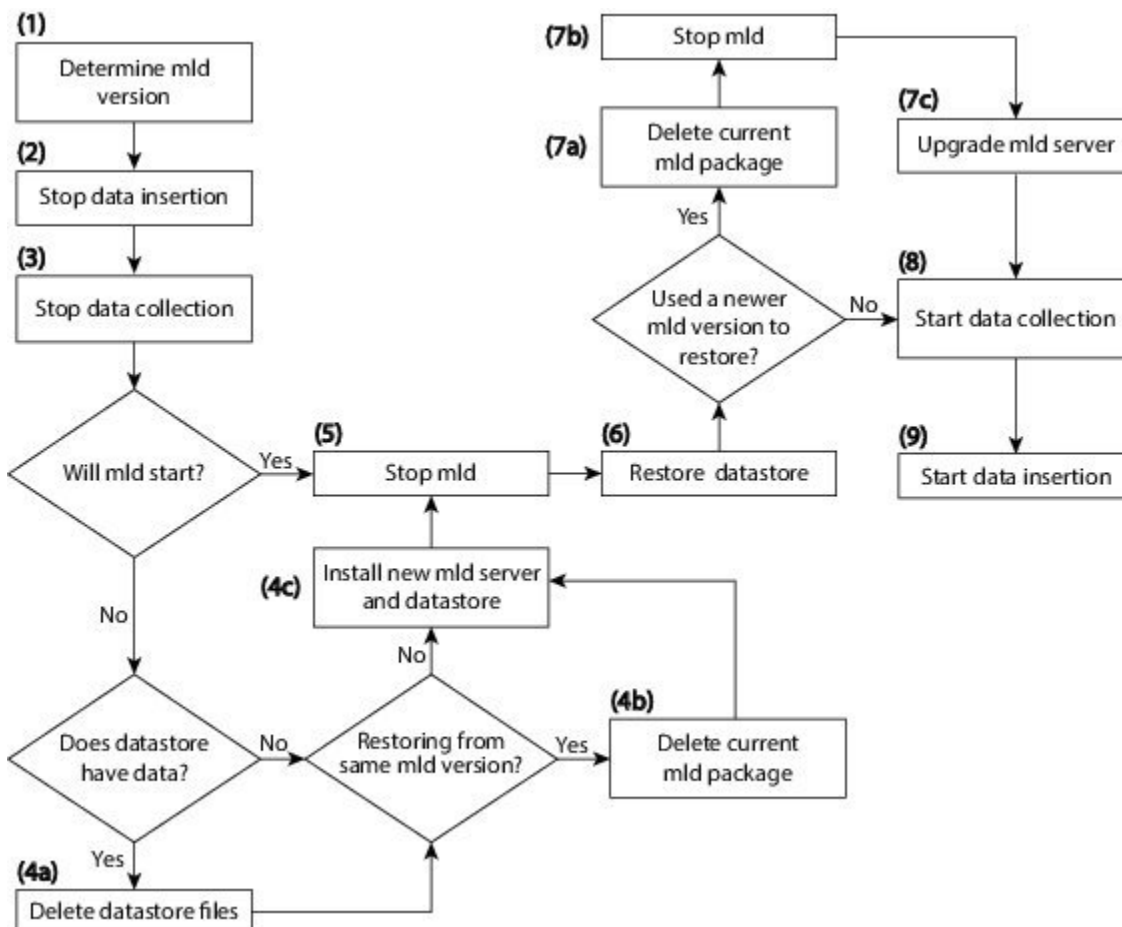
## Restore the Data Store

Note the following before attempting to restore the data store:

- To restore a data store, you must have a backup of it. For information about backing up the data store, see the [Backing Up the Data Store](#) section.
- Ensure you have a proper disk and disk space. For example, if your data was corrupted, you would need a new disk. If the restoration is due to a space issue, then add more space to the existing disk.
- If you have a single device configuration, the collection of data will be interrupted during the restoration of a WAE Live data store.
- If the backup data store resides on a different device, confirm that the following prerequisites are met:
  - The username and user ID (uid) of both devices must be the same.
  - The backup data store name uses a hostname as a portion of its name. This hostname portion of the backup data store name must be changed to be the same as the hostname on the device to which it is being restored.

**Example:** The backup data store name is `akdobi.acme.com_1_L0`. The hostname on the device on which the data store is being restored is `akgudei.acme.com`. In this case, change the backup data store name to `akgudei.acme.com_1_L0`.

Figure 1: Data Store Restoration Workflow



## Delete Data from the Data Store

The `ml_purge` tool removes all data prior to the specified timestamp.

### Before you begin

Before running `ml_purge`, confirm that there are no insertions running (`ml_insert_ctl -status`). Insertions might fail due to locks created by `ml_purge` while it is in operation. You might need to pause the scheduler to prevent scheduled insertions (`ml_insert_ctl -disable-scheduler`).

To run `ml_purge`:

```
ml_purge <timestamp>
```

where `<timestamp>` is in the following UTC format: `year-month-day T hour:minutes`. For example:

```
ml_purge 2017-01-31T00:00
```

# Install the Cisco WAE Live License

Cisco WAE Live supports Cisco Smart Licensing and traditional licensing. Use one of the following procedures based on the license type.

## Install Traditional License

### Before you begin

Confirm you have the Cisco WAE Live license on your server.

- 
- Step 1** If Cisco WAE Live is not running, start it.
- ```
# embedded_web_server -action start
```
- Step 2** Start the Cisco WAE Live UI in a supported browser: `https://<server_IP>:8443`. The default username is "admin" and the password is "admin".
- Step 3** Choose **System > Licenses**.
- Step 4** Click **Upload Traditional License**.
- Step 5** Click **Select Licenses**.
- Step 6** Browse to the location or enter the name of the license file (.lic extension), and click **Open**.
- Step 7** Click **Upload License**.
- Step 8** Restart Cisco WAE Live.
- ```
embedded_web_server -action restart
```
- 

## Install Smart License

### Before you begin

Confirm you have the Cisco smart license on WAE server.

- 
- Step 1** If Cisco WAE Live is not running, start it.
- ```
# embedded_web_server -action start
```
- Step 2** Start the Cisco WAE Live UI in a supported browser: `https://<server_IP>:8443`. The default username is "admin" and the password is "admin".
- Step 3** Choose **System > Licenses**.
- Step 4** Click **Enable Smart Software Licensing**.
- Step 5** Provide WAE Server Name or IP address, Port, Username and Password, and click **Enable**.

Step 6 Restart Cisco WAE Live.

```
# embedded_web_server -action restart
```

What to do next

You can begin using Cisco WAE Live and collect plan files. To collect plan files from Cisco WAE 7.2.x, go to **Settings > Data Source** and click the 7.2 Remote Archive option. Enter the appropriate Cisco WAE 7.2.x network and server details. For information about using Cisco WAE Live, see the [Cisco WAE Live User Guide](#).



CHAPTER 5

Security

- [Core Security Concepts, on page 33](#)
- [Install Certificates, on page 35](#)

Core Security Concepts

If you are an administrator and are looking to optimize the security of your product, you should have a good understanding of the following security concepts.

HTTPS

Hypertext Transfer Protocol Secure (HTTPS) uses Secure Sockets Layer (SSL) or its subsequent standardization, Transport Layer Security (TLS), to encrypt the data transmitted over a channel. Several vulnerabilities have been found in SSL, so now supports TLS only.



Note TLS is loosely referred to as SSL often, so we will also follow this convention.

SSL employs a mix of privacy, authentication, and data integrity to secure the transmission of data between a client and a server. To enable these security mechanisms, SSL relies upon certificates, private-public key exchange pairs, and Diffie-Hellman key agreement parameters.

SSL Certificates

SSL certificates and private-public key pairs are a form of digital identification for user authentication and the verification of a communication partner's identity. Certificate Authorities (CAs), such as VeriSign and Thawte, issue certificates to identify an entity (either a server or a client). A client or server certificate includes the name of the issuing authority and digital signature, the serial number, the name of the client or server that the certificate was issued for, the public key, and the certificate's expiration date. A CA uses one or more signing certificates to create SSL certificates. Each signing certificate has a matching private key that is used to create the CA signature. The CA makes signed certificates (with the public key embedded) readily available, enabling anyone to use them to verify that an SSL certificate was actually signed by a specific CA.

In general, setting up certificates involve the following steps:

1. Generating an identity certificate for a server.

2. Installing the identity certificate on the server.
3. Installing the corresponding root certificate on your client or browser.

The specific tasks you need to complete will vary, depending on your environment.

1-Way SSL Authentication

This authentication method is used when a client needs assurance that it is connecting to the right server (and not an intermediary server), making it suitable for public resources like online banking websites. Authentication begins when a client requests access to a resource on a server. The server on which the resource resides then sends its server certificate (also known as an SSL certificate) to the client in order to verify its identity. The client then verifies the server certificate against another trusted object: a server root certificate, which must be installed on the client or browser. After the server has been verified, an encrypted (and therefore secure) communication channel is established. At this point, the server prompts for the entry of a valid username and password in an HTML form. Entering user credentials after an SSL connection is established protects them from being intercepted by an unauthorized party. Finally, after the username and password have been accepted, access is granted to the resource residing on the server.



Note A client might need to store multiple server certificates to enable interaction with multiple servers.



To determine whether you need to install a root certificate on your client, look for a lock icon in your browser's URL field. If you see this icon, this generally indicates that the necessary root certificate has already been installed. This is usually the case for server certificates signed by one of the bigger Certifying Authorities (CAs), because root certificates from these CAs are included with popular browsers.

If your client does not recognize the CA that signed a server certificate, it will indicate that the connection is not secure. This is not necessarily a bad thing. It just indicates that the identity of the server you want to connect has not been verified. At this point, you can do one of two things: First, you can install the necessary root certificate on your client or browser. A lock icon in your browser's URL field will indicate the certificate was installed successfully. And second, you can install a self-signed certificate on your client. Unlike a root certificate, which is signed by a trusted CA, a self-signed certificate is signed by the person or entity that created it. While you can use a self-signed certificate to create an encrypted channel, understand that it carries an inherent amount of risk because the identity of the server you are connected with has not been verified.

Install Certificates

This section contains information about installing security certificates on the Cisco WAE server, Cisco WAE Coordinated Maintenance, and Cisco WAE Live.

Install a Certificate for the Cisco WAE Server

Cisco WAE comes with a default certificate. Because this certificate is not from a “trusted CA”, the browser shows an unsecured connection warning. This is the expected behavior. The warning can be removed by applying an appropriate Certificate Authority (CA) issued certificate.

Step 1 Create a private server key and store it in a secure location. For example:

```
# openssl genrsa -out server.key 2048
```

Step 2 Create the Certificate Signing Request (CSR). The CSR is used by CA to create a certificate that identifies your website as secure. For example:

```
# openssl req -sha256 -new -key server.key -out server.csr
```

Step 3 Submit the CSR to the Certificate Authority to obtain your Certificate (for example, server.crt).

Step 4 Modify the `<WAE_installation_directory>/wae.conf` by changing `<key-file/>` and `<cert-file/>` elements to point to the location of the server.key and server.crt files.

Step 5 Restart the Cisco WAE server.

```
# supervisorctl stop wae:*
# supervisorctl start wae:*
```

Install a Certificate for Cisco WAE Live

Cisco WAE Live includes a default certificate that causes the browser to indicate that the certificate is not trusted. This is the expected behavior. The warning can be removed by applying an appropriate CA issued certificate.

To install a CA certificate for Cisco WAE Live, do the following:

Before you begin



Note This procedure is only applicable for Cisco WAE Live 7.1.1 and later.

- You must be an administrator with Cisco WAE user privileges to perform this task.
- Modify the path to add access to the Java keytool by adding the following line to the user .profile or .bash_profile file. For example:

```
# export PATH=$PATH:$CARIDEN_HOME/lib/ext/jre/1.8.0/bin/
```



Note The previous example is applicable if your shell is sh, ksh, or bash. Use equivalent commands for other shells.

- Log out and in again, or enter the following command using the appropriate profile filename.

```
# source ~/.profile
```

Step 1 In order to obtain a certificate from the Certificate Authority (CA) of your choice, you have to create a Certificate Signing Request (CSR). To create a CSR follow these steps:

- a) Delete the default certificate. For example:

```
# keytool -delete -alias tomcat -keystore $CARIDEN_HOME/lib/web/apache-tomcat-8.5.15/conf/keystore
```

- b) Create a local self-signed Certificate. For example:

```
# keytool -genkey -alias tomcat -keyalg RSA -keystore
$CARIDEN_HOME/lib/web/apache-tomcat-8.5.15/conf/keystore
```

- c) Create the CSR. For example:

```
# keytool -certreq -keyalg RSA -alias tomcat -file certreq.csr -keystore
$CARIDEN_HOME/lib/web/apache-tomcat-8.5.15/conf/keystore
```

- d) Submit the CSR to a Certificate Authority to obtain your certificate.

- e) (Optional) Restart Cisco WAE Live to use the new certificate immediately.

```
# embedded_web_server -action stop
# embedded_web_server -action start
```

Step 2 Install the certificate.

- a) Download a Chain Certificate (also called a Root Certificate) from the CA you obtained the certificate from.

- b) Import the Chain Certificate into the keystore.

```
# keytool -import -alias root -keystore $CARIDEN_HOME/lib/web/apache-tomcat-8.5.15/conf/keystore
-trustcacerts -file <filename_of_the_chain_certificate>
```

- c) Import the new certificate.

```
# keytool -import -alias tomcat -keystore $CARIDEN_HOME/lib/web/apache-tomcat-8.5.15/conf/keystore
-file <your_certificate_filename>
```

- d) Restart Cisco WAE Live.

```
# embedded_web_server -action stop
# embedded_web_server -action start
```

Install a Certificate for the LDAP Server

Cisco WAE supports authentication and authorization of foreign users using Lightweight Directory Access Protocol (LDAP).

To use LDAPS protocol, get the SSL certificate and add it to a keystore.

Step 1 Save the self signed certificate to cert.pem file using the following command:

```
# openssl s_client -connect <ldap-host>:<ldap-ssl-port> </dev/null 2>/dev/null | sed -n
'/^-----BEGIN/,/^-----END/ { p }' > cert.pem
```

Step 2 Get the default key-store path by running the following command from WAE_RUN directory.

```
# $WAE_ROOT/lib/exec/test-java-ssl-conn <ldap-host> <ldap-ssl-port> 2>1 | grep "trustStore is:"
```

Running the above command helps you find the directory from where certs are picked up. It may be a directory similar to:

```
trustStore is: /usr/lib/jvm/java-1.8.0-openjdk-1.8.0.102-4.b14.el7.x86_64/jre/lib/security/cacerts
```

Step 3 Import cert into default key-store using following command:

```
# sudo keytool -import -keystore <default-key-store-path> -storepass changeit -noprompt -file cert.pem
```

Install a Certificate for the EPN-M Server

Install the certificate when using the Cisco Evolved Programmable Network Manager (Cisco EPN Manager) agent for L1 collection.

Step 1 Save the self signed certificate to cert.pem file using the following command:

```
# openssl s_client -connect <epnm-host>:<epnm-port> </dev/null 2>/dev/null | sed -n
'/^-----BEGIN/,/^-----END/ { p }' > cert.pem
```

Step 2 Get the default key-store path using the following command. Typically the default key-store path is /etc/pki/java/cacerts for CentOS 7 with open-jdk

```
# $WAE_ROOT/lib/exec/test-java-ssl-conn <epnm-host> <epnm-port> 2>1 | grep "trustStore is:"
```

Step 3 Import cert into default key-store using following command:

```
# sudo keytool -import -keystore <default-key-store-path> -storepass changeit -noprompt -file cert.pem
```



CHAPTER 6

Next Steps

The following topics describe the next steps you perform to get started with Cisco WAE. You access the WAE UI, WAE Expert Mode, or WAE CLI to perform operations. For detailed information, see the *Cisco WAE User Guide*.

- [Log In to Cisco WAE, on page 39](#)
- [Build a Network Model, on page 41](#)

Log In to Cisco WAE

This section describes how to log in to the available Cisco WAE interfaces: Cisco WAE UI, Expert Mode, and the Cisco WAE CLI. For more information about these interfaces, see the [Cisco WAE User Guide](#).

Log In to the Cisco WAE UI

Follow these steps to log in to the Cisco WAE web UI.

Before you begin

Confirm that all the appropriate services are running. All services automatically start after installation. For information about how to start or stop Cisco WAE, see [Start and Stop Cisco WAE, on page 14](#).

-
- Step 1** Start one of the supported browsers. See [Cisco WAE Installation Requirements, on page 3](#).
- Step 2** In the browser's address bar, enter `https://server-ip:8443`, where *server-ip* is the IP address of the server where Cisco WAE installed.
- The Cisco WAE user interface displays the **Login** window.
- Step 3** Enter the web UI username and password. The default credentials are:
- Username: admin
 - Password: Admin@123
- Step 4** Click **Login**.
- The home page appears and you can now use the web UI.
-

What to do next

After you log in to Cisco WAE, you can start a network topology collection to create a network model. For information about creating a network model, see the [Cisco WAE User Guide](#).

Log In to the Expert Mode

You must log in to the WAE UI before accessing the Expert Mode.

Before you begin

Confirm that all the appropriate services are running. All services automatically start after installation. For information about how to start or stop Cisco WAE, see [Start and Stop Cisco WAE, on page 14](#).

-
- Step 1** Start one of the supported browsers. See [Cisco WAE Installation Requirements, on page 3](#).
- Step 2** In the browser's address bar, enter `https://server-ip:8443`, where *server-ip* is the IP address of the server where Cisco WAE is installed.
- The Cisco WAE UI displays the **Login** window.
- Step 3** Enter the Cisco WAE UI username and password. The default credentials are:
- Username: admin
 - Password: Admin@123
- Step 4** Click **Login**.
- The home page appears and you can now use the web UI.
- Step 5** In the top-right corner of the Cisco WAE UI, click the tool icon to access the Expert Mode.
-

What to do next

After you log in to Cisco WAE, you can start a network topology collection to create a network model. See the [Cisco WAE User Guide](#).

Log In to the WAE CLI

To log in to the WAE CLI:

-
- Step 1** Navigate to the WAE run-time directory and enter `wae_cli`.

```
# wae_cli -u admin
admin@wae#
```

Note You can enter `wae_cli --help` to view all the WAE CLI options.

- Step 2** (Optional) To enable configuration operations, switch to the configuration mode.

```
admin@wae# config
admin@wae%#
```

Example

For example:

```
waerun# wae_cli -u admin
admin@wae# config
admin@wae%#
```

Build a Network Model

This topic gives a high-level description of tasks that are necessary to build a network model. For more detailed information, see the [Cisco WAE User Guide](#).

1. Configure device authgroups, SNMP groups, and network profile access.
2. (Optional) Configure agents. This step is required only for collecting XTC, LAG and port interface, or multilayer information.
3. Configure an aggregated network and sources with a topology NIMO.
4. Configure additional collections such as demands, traffic, layout, inventory, and so on.
5. Schedule when to run collections.
6. Configure the archive file system location and interval at which plan files are periodically stored.
7. (Optional) View plan files in Cisco WAE applications.



CHAPTER 7

Uninstall Cisco WAE

- [Uninstall Cisco WAE, on page 43](#)

Uninstall Cisco WAE

This procedure describes how to remove a Cisco WAE installation.



Note You can have more than one instance of Cisco WAE installed. When going through the uninstallation procedure, make sure you are removing the correct Cisco WAE installation and run-time directories.

Step 1 To stop all WAE process, use the command:

```
# supervisorctl stop wae:*
```

Step 2 Navigate to the parent directory and remove the Cisco WAE installation and run-time directories.

```
# rm -rf <wae_installation_directory>
# rm -rf <wae_run_time_directory>
```

Example

For example:

```
# supervisorctl stop wae:*
# cd
# rm -rf waeinstall
# rm -rf waerun
```

