Cisco WAN Automation Engine Release Notes, Release 7.1

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This document describes the features, limitations, and bugs for Cisco WAN Automation Engine (Cisco WAE) Release 7.1.

Contents

This document includes the following sections:

Introduction

Cisco WAN Automation Engine (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 are placed on it. This network model contains all relevant information about a network at a given time, 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 WAE platform is an open, programmable framework that interconnects software modules, communicates with the network, and provides APIs to interface with external applications.

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Note To find related WAE documentation, see the *Cisco WAE 7.1 Documentation Roadmap.*

New Features

This section lists new features for the following:

WAE Platform and System

A YANG model architecture and new network model building workflow has been introduced in Cisco WAE 7.1. Network models are built from configuring Network Interface Modules (NIMOs) instead of using the snapshot collection process used in prior WAE 6.x releases. For these reasons, all tools and procedures are new. To learn how to use WAE 7.1, see the *Cisco WAE 7.1 User Guide*.

The following table outlines some of the new features in WAE 7.1.

Feature	Description
Easier installation	Installation is simpler and faster than previous WAE releases.
Support for the YANG data model	WAE 7.1 adopts the YANG data modeling language for its configuration and operational data structure. In addition, WAE 7.1 provides a standard northbound API based on NETCONF/YANG and REST. See YANG Data Model, page 15.
Redesigned WAE UI	The WAE UI has been redesigned. There are three available interfaces: WAE CLI, WAE Expert Mode, and the WAE UI. For more information, see the "Overview" section in the *Cisco WAE 7.1 User Guide.*
Network interface modules (NIMOs)	The network model is a result of running NIMOs. Each NIMO is associated with one network model (which is similar to the -plan-file option in CLI tools). Each NIMO typically has a source and the resulting output is written to the network model (which is similar to the -out-file option in CLI tools). The output of one NIMO can be used as a source for another NIMO. Consolidation of multiple NIMOs is done using an aggregator.

Feature	Description
Agents	Agents are collections that produce a raw set of data output, which is then used as input to NIMOs to build the network model. • xtc—Connects to the REST interface of the XR Transport Controller (XTC) and retrieves the PCE topology. The topo-bgpls-xtc-nimo and lsp-pcep-xtc-nimo modules use the raw output to build their respective network model. • cfg-parse—Retrieves the router configurations through login or CLI, and then parses the router configurations and writes raw output to the database. The port-cfg-parse-nimo module uses the raw output for Layer 1 collection.
WAE Modeling Daemon (WMD)	WMD provides a near real-time representation (model) of the network in memory so that applications can get access to that model. For more information, see the "Overview" chapter in the *Cisco WAE User Guide.*
Bandwidth on Demand application	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 ofSR policiesto 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.
Bandwidth Optimization application	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.
Support for NSO layered service architecture (LSA)	The basic idea of LSA is to split a service into an upper layer and one or several lower level parts. This can be viewed as splitting the service into a customer-facing (CFS) and a resource-facing (RFS) part. The CFS code (upper-level) runs in one (or several) NSO cfs-nodes, and the RFS code (lower-level) runs in one of many NSO rfs-nodes. The rfs-nodes have each a portion of the managed devices mounted in their / devices tree and the cfs-nodes have the NSO rfs-nodes mounted in their /devices tree. For more information on NSO LSA, see the *NSO Layered Service Architecture* guide. For information on how to configure LSA for WAE, see the "WAE Administration" chapter in the *Cisco WAE User Guide*.

Feature	Description
Multi-layer collection	Multi-layer collection is supported. WAE collects and models the following information: • Topologies from DWDM networks that support Generalized Multiprotocol Label Switching (GMPLS) with non-User Network Interface (UNI) circuits • L1 circuit paths • L1 topology with and without amplifiers • Unprotected and restorable paths • Actual L1 circuit path hops • Feasibility metrics and limits • Inactive L1 links • L1 node and L1 link SRLGs • Site information • User properties • Configurable Lambda ID mapping options • Aging information and last seen date For more information, see the "Multi-Layer Collection" chapter in the *Cisco WAE User Guide*.
NetFlow data collection	Centralized and distributed NetFlow collection is supported using the external-executable-nimo. For more information, see the "NetFlow Data Collection" chapter in the *Cisco WAE User Guide*.
Deprecated CLIs	The following CLI options are deprecated: • -use-mate-convert-on-input-plan-files • -use-resolve-plan-on-closing If the plan file ends in .pln or .txt, it is converted automatically; the CLI option is no longer required.

WAE Design

The following features have been added or updated since WAE Design 6.4.x. For the latest WAE Design documentation, see the following URL:
https://www.cisco.com/c/en/us/support/routers/quantum-wan-automation-visibility-engine/products-user-guide-list.html

Feature	Description
Easier way to send patch files to WAE	The Send Patch dialog box provides the option to dry run a patch before deploying it. (Check **Dry Run** or set the Test Option to **Test Only**.) If the patch dry run succeeds, you can deploy the patch easily. (Click **Send Patch** in the status popup; return to the Send Patch dialog box with the patch preselected.)
SR TE Optimization tool enhancements	• SR TE Optimization tool now creates or optimizes segment lists so they avoid routing through specified objects (nodes, interfaces, L1 links, L1 nodes, or SRLGs). In previous releases, only the avoidance of nodes was supported. For example, if an L1 link is specified to be avoided, then all L3 circuits associated (directly or indirectly via port circuits) to L1 circuits using this L1 link will be avoided. Multiple avoidance constraints may be simultaneously specified. The following UI options are available under the Constraints area (**SR LSP Optimization > SR-TE Opt**): – Nodes – Interfaces – L1 Links – L1 Nodes – SRLGs • The SR TE Optimization tool allows for rerouting of existing LSPs. New rerouting LSP options available in the UI (**SR LSP Optimization > SR-TE BW Opt > Analysis** and **SR LSP Optimization > SR-TE BW Opt > Analysis).** Under LSPs: – Create new LSPs—If checked, new private SR LSPs with optimized routing can be created. If unchecked, new LSPs are not created. – Fix LSPs—Controls whether or not LSP routes can be modified. This constraint is useful if you want to reroute existing LSPs to mitigate congestion. The new CLI options are described in the New CLI Options section.
Improvements to the Tools menu	The Tools menu has been restructured by protocol. For example, the various Optimization options under the Tools menu have submenus that are based on common protocols.
Improvements to the View > Preferences dialog box	The View Preferences dialog box has these enhancements: • New scaling options for objects and fonts. Circuit and link widths in layouts are scaled according to the scale factors in the network plot. The valid range, in percentages, for scale factors is from 5 to 1000. • The option to choose a grey or multicolored palette for background maps in geographic layouts. • The option to choose a grey or white background for schematic plots. • A Reset button that lets you reset preferences to the default.
Option to plot P2MP LSPs	You can plot the routes of point-to-multipoint (P2MP) LSPs in a separate plot.

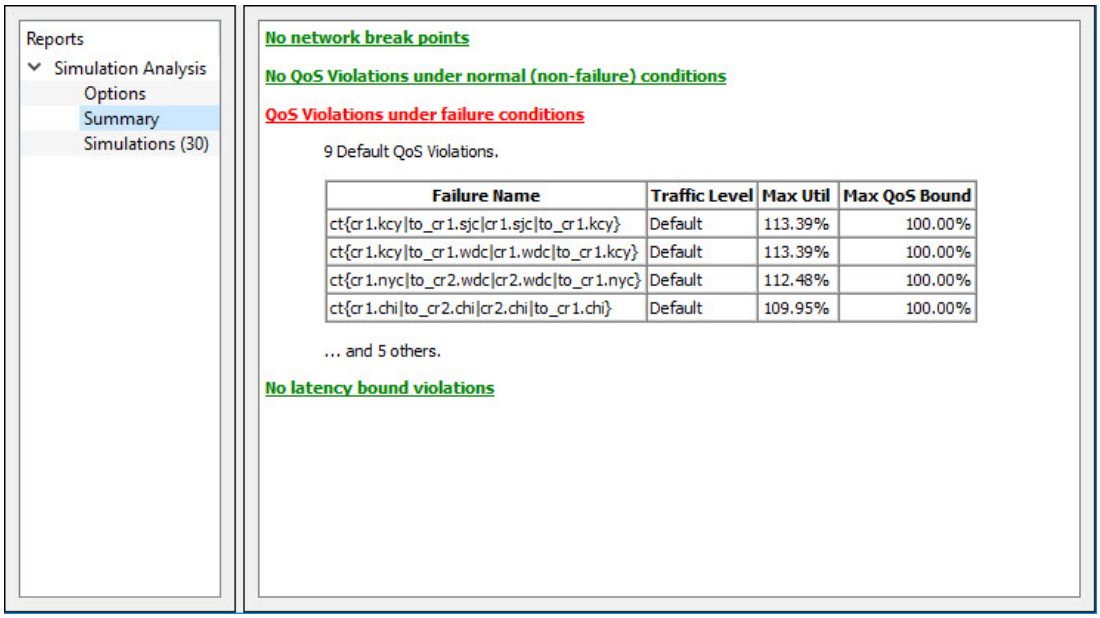
Feature	Description
Option to optimize the routing of L1 circuit paths	You can optimize the routing of L1 circuit paths by metric, delay, distance, or hop count. The L1 Circuit Path Optimization tool lets you find the shortest path while meeting disjointness requirements. You can find the shortest path with respect to: • L1 link metric • Delay of the L1 link • Distance of the L1 link • Hop count
Addition of unresolved hops for segment list hops	WAE Design allows unresolved hops to be stored for each segment list hop.
Option to compress segment lists	You can specify the maximum segment list length for specific LSPs. Any segment lists that exceed the maximum length are replaced by new LSPs, LSP paths, and segment lists. Newly created LSPs are set as segment list hops for other LSPs.
Option to visualize SID values on interfaces	You can configure the appearance of circuits and interfaces in network plots. You can choose to display the SID value as the interface text.
Option to show or hide L1 nodes in network plots	By default, L1 nodes are visible in the network plot. You can hide L1 nodes and their respective L1 links on a per-layout basis, though they still exist in the plan file and tables.
Option to set and position the display name of L1 nodes in network plots	By default, L1 node names appear above the object in a network plot; you can change this positioning.
Easier way of deleting associated L1 circuits or L1 ports	When you delete objects from link aggregation groups (LAGs), you have the option to delete any associated L1 circuits and L1 ports. • When you delete a circuit, you can check the **Delete associated L1 circuit(s)** check box. • When you delete a port circuit, you can check the **Delete associated L1 circuit(s)** check box. • When you delete an L1 circuit, you can check the **Delete associated L1 port(s)** check box.
Enhanced support for inter-AS LSPs	Simulation now supports inter-AS RSVP LSPs. Also, the following tools now support inter-AS RSVP LSPs: • RSVP-TE Optimization (**Tools > RSVP LSP Optimization > RSVP-TE Opt**) • LSP Disjoint Path Optimization (**Tools > LSP Optimization > LSP Disjoint Path Opt**)
Option to edit patches before sending them	You can edit a patch before sending it. To do this, choose **Tools > Patches > View**, open a patch file, and click **Edit Patch**. A dialog box opens, displaying the contents of the patch as XML text. You can save or discard the patch text edits. The tool warns you if you try to save invalid XML syntax. You can right-click in the patch text dialog and choose **Undo** to undo changes. Other standard text editing (cut, copy, paste, and so on) is also supported.

Feature	Description
Option to visualize L1 paths when plotting demands, LSPs, LSP paths, or P2MP LSPs	You can easily visualize multilayer L1 paths when plotting demands, LSPs, LSP paths, or P2MP LSPs. For example, in a complicated plot you can easily verify whether two LSPs are disjoint in terms of L1 links. To visualize L1 paths, do any of the following: • Right-click a demand and choose **Plot Demands** • Right-click an LSP and choose **Plot LSPs** • Right-click an LSP path and choose **Plot LSP Paths** • Right-click a P2MP LSP and choose **Plot P2MP LSPs** The plot window contains a drop-down list with the following options: • **L3**—Displays the path in terms of interfaces. • **L1**—Displays the path in terms of L1 links. – To better align the L1 links, WAE Design checks for L3-L1 links. If they do not exist, WAE Design checks for collocated L3/L1 nodes within sites. • **L3+L1**—Displays the L3 plot above and the L1 plot below. – WAE Design does not perform alignment between L3 and L1 nodes. When you click an L3 interface, the associated L1 links are highlighted automatically.
Update to WAE Design system requirements	For more information, see the "Cisco WAE Installation Requirements" chapter in the *Cisco WAE Installation Guide*.
Option to associate an existing demand to an existing private LSP	If a demand is associated with a private LSP, the demand can only route through that LSP, and the only demand that is permitted to cross that LSP is this demand. In the demand's Properties dialog box, you can associate an existing demand to an existing private LSP. (To open the Properties dialog box, right-click the demand and choose **Properties**.) The Private LSP drop-down list shows the private LSP that is currently associated with the selected demand. You can choose a different private LSP, or you can choose None to remove an associated LSP.
The following new features are not included in the latest WAE Design release documentation:	
L1 feasibility simulation calculation enhancement	L1 feasibility calculations now consider unidirectional parameters for L1 links (noise and noise sigma) and a margin for L1 circuits.
Capacity Planning Optimization tool enhancement	The Capacity Planning Optimization tool now accounts for costs and different capacity increments. The CLI options are described in the New CLI Options section.
Demand Deduction calculation enhancement	There is a new option that (through different calculation methods) can minimize computation time. The CLI option is described in the New CLI Options section.

Feature	Description
Option to report the L1 circuit paths through an L1 node	You can determine the number of L1 circuit paths through an L1 node under normal operation and in a worst-case simulation. The L1 Nodes table includes new columns: • Num L1 Circuit Paths—Number of L1 circuit paths with paths through the L1 node. • WC Num L1 Circuit Paths—Worst-case number of L1 circuit paths with paths through the L1 node. • WC Failures—Failures that cause the worst-case number of L1 circuit paths. The L1 Nodes context menu includes a new option: **Fail to WC** (worst case).
Option to see if an L1 node is shown in the current layout	The L1 Nodes table contains a new "Shown" column with values of true or false: • T (true)—The L1 node is shown in the current layout. • F (false)—The L1 node is not shown in the current layout.
Option to configure the number of route attempts on L1 paths	In earlier WAE Design releases, the number of attempted routes for L1 circuit paths was set to 5. In WAE Design 7.1 you can configure the number of attempted routes for L1 circuit paths. Increasing the number of attempted routes allows for more paths to be explored, thereby potentially reducing the number of unrouted L1 circuits. This increases the overall computation time. To configure the number of route attempts, choose **Edit > Network Options** and set the **Number of Attempts to Route L1 Circuit Paths** parameter.
Option to expand and collapse sites per layout	You can group nodes and sites and build a hierarchy of sites. In earlier WAE Design releases, site memberships were fixed for all layouts, per plan file: You could only have one set of site groups, which you had to visualize in the same way. In WAE Design 7.1 you can expand or collapse a site per layout. You can control the level of detail shown in individual layouts. You can collapse down to the node level at one site, but still keep other sites intact. For example, one layout could have "France" as the main focus, and other regions could be collapsed (U.S. sites grouped together under a single "USA" site). Another layout could have the opposite display: U.S. sites expanded, and the "France" site collapsed. To expand or collapse sites per layout, right-click a site and choose **Layout > Expand Site** or **Layout > Collapse Site**. When a site is expanded, its contents are shown (instead of the site itself). When a site is collapsed, the site itself is shown. This feature allows you to better scale a plot that contains many objects.
Option to ignore SSL errors in the Open/Save and from/to Design Archive dialog boxes	• T (true)—SSL errors are treated as warnings and server connections are allowed. • F (false)—A dialog box appears with information about the error and the user is given the option to proceed with the server connection. This is the default.

Feature	Description
Option to open plan file from WMD	**File > Open From > WAE Modeling Daemon** There is also an new icon on the Toolbar that can be used to open a plan file from WMD.
Improved display of the Simulation Analysis report	When you choose **Tools > Simulation Analysis** and run the analysis, the resulting report (Figure 1) shows: • Results displayed in table format for ease of use • Violations in red • Successes in green

Figure 1 WAE Design Simulation Analysis Report



Overview of Inter-AS and Inter-Area Support

The following table shows which WAE Design tools support inter-area and inter-AS functionality.

Tool	Supports Inter-Area?	Supports Inter-AS?
SR-TE Optimization	Yes	Yes
SR-TE Bandwidth Optimization	Yes	No
RSVP-TE Optimization	Yes	Yes
LSP Disjoint Path Optimization	Yes	Yes
Explicit LSP Paths Initializer	RSVP only (in terms of ABR hop creation)	No
Explicit P2MP LSP Paths Initializer	Yes	No
Explicit LSP Optimization	Yes	No

WAE Design Schema

Refer to the /opt/cariden/software/mate/current/docs/table_schema.html file for a complete reference.

Cisco WAE Live

The following features have been added or updated since WAE Live 6.4.x. For information on how to use WAE Live, see the Cisco WAE 6.4 Administration Guide and the Cisco WAE 6.4.1 User Guide.

Feature	Description
WAE Live installation	There are a few WAE Live installation changes which include the following: • WAE Live must be installed on a different machine than where the WAE 7.1 server software is installed. • If you have not used WAE Live on the system before, the default password for the user `admin` is "admin". • Updated WAE Live data store migration steps. For more information on installation, data migration, and system requirements, see the Cisco WAE 7.1 Installation Guide.
Collect plan files from the WAE 7.1 server	From **Settings > Data Source**, select the **7.1 Remote Archive** radio button and enter the WAE 7.1 server details.
Changes to WAE Live UI components	The following UI components have been removed: • System > User Access • System > Log Settings • Home > WAE Statistics The Database Info component has been moved under Home.

Cisco WAE Coordinated Maintenance

The installation steps for WAE Coordinated Maintenance has changed. For installation information, see the Cisco WAE 7.1 Installation Guide. For information on how to use WAE Coordinated Maintenance, see the Cisco WAE Coordinated Maintenance 1.2 User and Administration Guide.

CLI Changes

WAE CLI tools are located in <*wae-installation-directory*>/bin. For available CLI options and descriptions, execute the CLI tool with the -help option. If WAE Design is installed, the WAE Design CLI tools are located in /opt/cariden/software/mate/current/bin.

New CLI Tools

The following table describes new CLI tools in WAE 7.1.

CLI Tool	Description
WAE Design	
`compress_segment_lists`	Lets you specify the maximum segment list length for specific LSPs.
`l1_circuit_path_opt`	Optimizes the routing of L1 circuit paths by minimizing path length and respecting disjoint path requirements.
`send_patch`	Sends a patch file to WAE, applying it to the specified WAE network. The connection is made through SSH. If SSH keys cannot be used for authentication, you are prompted for a password.
`wae_get_plan`	Gets a network plan file from WAE. The connection is made through SSH. If SSH keys cannot be used for authentication, you are prompted for a password.

New CLI Options

The following table describes new CLI options in WAE 7.1.

CLI Option	Description
capacity_planning_opt	
`-opt-objective`	The optimization objective. It can be set to one of the following: • cap (the default)—The optimization objective is set to the minimization of total added capacity. • cost—The optimization objective is set to the minimization of total cost.
`-bw-increment-options`	Table with options on allowed capacity increments. The following are allowed columns in the Costs table: • Capacity • L3PortCost • L1PortCost • FeasibilityLimit The default is empty. This option is ignored if the -opt-objective is set to "cap".
compress_segment_lists	
`-lsps-table`	Optimize LSP paths of LSPs in the -lsps-table with segment lists that exceed the -max-sl-length. The default is "all."
`-max-sl-length`	The maximum length of segment lists associated with LSP paths of LSPs in the -lsps-table. The length must be at least 3; the default is 9.
`-remove-orphaned-sls`	If true (the default), remove segment lists that are not used by other LSP paths or SR FRRs as a result of the optimization. If false, do not remove orphaned segment lists.
`-lsp-tag`	Tag with this value any newly created and updated LSPs. The default is *SLOpt*.
dmd_deduct_tool	

CLI Option	Description
-computation-time	The computation time of the dmd_tool may be reduced by selecting one of the following values: 10 (the default), 20, 30, 40. Higher values aim to reduce computation time.
l1_circuit_path_opt	
-l1-circuit-paths-table	A file containing <L1CircuitPaths> table of L1 circuit paths to optimize. The default is "all."
-path-metric	The path length that the optimizer tries to minimize. Values are: • metric—(the default) Use L1 link metric. • delay—Use L1 link delay. • distance—Use L1 link distance. • hops—Use hop count.
-disjoint-path-constraints	Values are: • None—(the default) Impose no disjoint path constraints. • DisjointGroups—Create disjoint L1 circuit paths between L1 circuits in disjoint groups. • PrimSec—Create disjoint primary and secondary paths for L1 circuits.
-existing-hops	If set to “remove” (the default), existing L1 circuit path hops and actual L1 circuit path hops are removed. If set to “respect,” existing hops are respected.
-strict-l1link-priority	The priority of L1 link disjointness. Values are ignore, 1 (the default), 2, or 3.
-strict-l1node-priority	The priority of L1 node disjointness. Values are ignore (the default), 1, 2, or 3.
-strict-site-priority	The priority of site disjointness. Values are ignore (the default), 1, 2, or 3.
-strict-SRLG-priority	The priority of SRLG disjointness. Values are ignore (the default), 1, 2, or 3.
-l1-circuit-path-tag	Tag with this value any L1 circuit paths whose L1 circuit path hops have been updated. The default is *L1Opt*.
mate_plot	
-uniform-scaling	If true (the default), objects and fonts are uniformly scaled based on the -scale-objects option. If false, objects and fonts are scaled based on the -scale-l3-l1-nodes, -scale-circuits-l1-links, and scale-fonts options.
-scale-l3-l1-nodes	Relative size of L3 nodes and L1 nodes with respect to their size, in pixels, in the network plot (assuming the default to be View Preferences). The default is 100. Ignored if -uniform-scaling is set to true.
-scale-circuits-l1-links	Relative size of circuits and L1 links with respect to their size, in pixels, in the network plot (assuming the default to be View Preferences). The default is 100. Ignored if -uniform-scaling is set to true.
-scale-fonts	Relative size of fonts with respect to their size, in pixels, in the network plot (assuming the default to be View Preferences). The default is 100. Ignored if -uniform-scaling is set to true.
-map-palette	The color palette for the background map in Geographic layouts. Values are: • grey—(the default) Grey palette is used for background maps. • multi-color—Multi-color palette is used for background maps.
-icons	If true, the L3/L1 node and site icons are used for Design plot layouts. The default is false.

CLI Option	Description
-scale-objects <percentage>	Relative size of objects (sites, nodes, circuits, L1 nodes, L1 links, fonts) with respect to their size, in pixels, in the network plot (assuming the default to be View Preferences). The default is 100. Ignored if -uniform-scaling is set to false.
resolve_plan	
-segment-lists	If true (the default), resolve all segment list hops. For segment list hops, WAE tries to match the IP address or SID in the NetIntHop column to a node, interface, anycast group, or LSP in the following order of priority: 1. SID/IP entry in the Nodes table. If there are multiple matches, WAE chooses the lowest one and generates a warning. 2. SID/IP entry in the Interfaces table, where the node associated to the interface is the node corresponding to the previous hop (or to the LSP source node if this is the first hop). If the previous hop is an interface hop, the remote node of the interface is considered. 3. SID entry in the Anycast Groups table. 4. SID entry in the LSPs table.
send_patch	
-help <true/false>	Prints the help message.
-options-file <value>	Reads options from <*filename*>.
-version <true/false>	Prints the version string.
-no-global-options <true/false>	Prevents loading the global options file.
-suppress-progress <true/false>	Determines whether to suppress progress information. The default is true.
-verbosity <value>	Log verbosity, from 1 (lowest) to 60 (highest). The default is 30.
-log-file <value>	Copies of warnings and errors are saved in this file.
-simple-txt-out-file <true/false>	Determines whether to remove empty tables and columns from .txt format of -out-file if the parameter exists. The default is false.
-patch-file <value>	Input patch file that contains the patch to apply.
-wae-host <value>:	WAE server hostname. The default is localhost.
-wae-port <value>:	WAE server port. The default is 22.
-wae-user <value>	WAE user to log in as. The default is the current user.
-authGroup <AuthServerGroupName>	AuthServerGroupName specified in the authentication file used to read the credentials.
-auth-file <filename>	Authentication filename. The default is in the configuration path: $HOME/.cariden/etc, $CARIDEN_ROOT/etc, or $CARIDEN_HOME/etc. The default is auth.enc.
-dry-run <true/false>	If specified, do not apply the patch. Perform a dry-run instead, and return a message detailing what configuration changes would be implemented if the patch was applied. The default is false.
-reply-out-file <value>	Write the WAE reply to this file. If empty (the default), the reply is written to standard output.
-network-name <value>	WAE network to apply the patch. Overrides the name specified in the patch file. This option is required if the patch does not specify a network name.

CLI Option	Description
`-test-option <value>`	Test option: test-then-set (the default) or test-only.
`-error-option <value>`	What to do in case of an error. Valid values are rollback-on-error (the default), stop-on-error, and continue-on-error.
sr_te_bw_opt	
`-fix-lsps-table`	SR LSPs in the table should not be rerouted. The default is "all."
`-create-lsps`	If true (the default), new private SR LSPs with optimized routings can be created. If false, new LSPs cannot be created.
`-create-adj-segment-hops`	If false (the default), only node segment hops are created. If true, interface segment hops (adjacency hops) can be created.
sr_te_opt	
`-avoid-interfaces-table`	Creates segment list entries that route away from any interfaces. The default is none.
`-avoid-l1-links-table`	Creates segment list entries that route away from any L1 links. The default is none.
`-avoid-l1-nodes-table`	Creates segment list entries that route away from any L1 nodes. The default is none.
`-avoid-srlgs-table`	Creates segment list entries that route away from any SRLGs. The default is none.
wae_get_plan	
`-help <true/false>`	Prints the help message.
`-options-file <value>`	Reads options from <*filename*>.
`-version <true/false>`	Prints the version string.
`-no-global-options <true/false>`	Prevents loading the global options file.
`-suppress-progress <true/false>`	Determines whether to suppress progress information. The default is true.
`-verbosity <value>`	Log verbosity, from 1 (lowest) to 60 (highest). The default is 30.
`-log-file <value>`	Copies of warnings and errors are saved in this file.
`-simple-txt-out-file <true/false>`	Determines whether to remove empty tables and columns from .txt format of -out-file if the parameter exists. The default is false.
`-out-file <value>`	Output plan file from WAE.
`-network-name <value>`	WAE network for the plan file.
`-wae-host <value>`	WAE server hostname. The default is localhost.
`-wae-port <value>`	WAE server port. The default is 22.
`-wae-user <value>`	WAE user to log in as. The default is the current user.

New APIs

The following table describes new API features. WAE Design API documentation is located in $CARIDEN_HOME/docs/api/design.

Feature	Description
WAE Design APIs	
`getplan`	Lets you connect to a WAE 7.0 instance through a RESTCONF API call and get back a byte stream that contains the plan file.
`resolve_plan`	Lets you resolve differences in plan files that have configurations that are not matched or refer to objects outside the modeled network. The ability to resolve plan file differences is helpful when routing SR LSPs whose source and destination nodes are in different autonomous systems.
`send_patch`	Lets you send a patch in .xml format; a NETCONF RPC is sent in response. You can generate a dry run of the patch to test its validity before sending it. You can roll back the patch in case of an error.
WAE OPM API	
`OPM API`	Optimization and prediction modules (OPMs) provide a powerful Python API to manipulate network models. The OPM API lets you operate on the network without having to worry about device-specific properties. Even if the underlying routers are replaced by routers from a different vendor, the API calls remain exactly the same. The OPM APIs provide powerful what-if capabilities. For example, the OPM APIs let you answer the following questions: • What is the impact if I bring this router down for maintenance? • What happens if I increase the capacity of this circuit? • Can my network handle a data center backup now?

YANG Data Model

WAE 7.1 adopts the YANG data modeling language for its configuration and operational data structures. In addition, WAE 7.1 provides a standard northbound API based on NETCONF/YANG and REST.

YANG is a data modeling language used to describe configuration and operational data, remote procedure calls, and notifications for network devices. The salient features of YANG are:

- Human-readable format, easy to learn and represent
- Supports definition of operations
- Reusable types and groupings
- Data modularity through modules and submodules
- Supports the definition of operations (RPCs)
- Well-defined versioning rules
- Extensibility through augmentation

For details about YANG, refer to RFC 6020 and 6087

Documentation

To find descriptions of all related Cisco WAE documentation, see the *Cisco WAE 7.1 Documentation Roadmap.*

Note We sometimes update the documentation after original publication. Therefore, you should always review the documentation on Cisco.com for any updates.

Documentation Changes

- The *Cisco WAE Platform Configuration Guide* and the *Cisco WAE System Administration Guide* are deprecated; content is available in the new *Cisco WAE User Guide*.
- The *Cisco WAE Server Installation Guide* has been renamed to *Cisco WAE Installation Guide*. It includes system requirements and procedures for installing WAE Live and WAE Coordinated Maintenance.

Open Source

A list of open source software that is used in WAE can be found in *Open Source Software Used in Cisco WAN Automation Engine*.

Open Bugs

The following are descriptions of the resolved bugs in Cisco WAE Release 7.1. The bug IDs link you to the Cisco Bug Search tool.

Table 1 Open Bugs

Bug ID	Description
CSCvg80478	The URL redirect from HTTP port 8080 to 8443 fails. Workaround: Manually enter https://<*ip_address*>:8443.
CSCvg83828	LSP collection using NSO NEDs (lsp-config-nimo) does not collect named path hops due to an out of sync error.
CSCvh50411	Running the same external-executable-nimo more than once fails.
CSCvh20528	Sometimes WAE processes stop when the XATP module is disabled. Workaround: Issue the following commands in sequence and perform a commit after each step: 1. `wae components bw-on-demand config enable false` 2. `wae components xatp config enable false` 3. `wae components wmd config enable false` 4. `wae agents xtc xtc <network_name> disable xtc-host-ip <XTC_IP>`
CSCvh50648	The XTC Agent to Patch (XATP) module sends a patch that is not converted correctly when merged with the patch into WMD.
CSCvh52238	WMD starts even if it is disabled in the WAE configuration file. This occurs after loading a WAE configuration file where the WMD `enable` value is set to 'false'.

Table 1 Open Bugs (continued)

Bug ID	Description
CSCvh53464	The Bandwidth on Demand application connection fails because of an XTC "invalid request; no handler registered" error.
CSCvh53663	Old demands are not cleared when WMD runs demand mesh.
CSCvi70977	Installer shows a syntax error in the script.

Using the Cisco Bug Search Tool

You can use the Cisco Bug Search Tool to search for a specific bug or to search for all bugs in a release.

Step 1 Go to the Cisco Bug Search Tool.

Step 2 Enter your registered Cisco.com username and password, and click **Log In**.

The Bug Search page opens.

Note If you do not have a Cisco.com username and password, you can register here.

Step 3 Use any of these options to search for bugs, and then press Enter (Return) to initiate the search:

- To search for a specific bug, enter the bug ID in the Search For field.
- To search for bugs based on specific criteria, enter search criteria, such as a problem description, a feature, or a product name, in the Search For field.
- To search for bugs based on products, enter or select a product from the Product list. For example, if you enter “WAE,” you get several options from which to choose.
- To search for bugs based on releases, in the Releases list select whether to search for bugs affecting a specific release, bugs that were fixed in a specific release, or both. Then enter one or more release numbers in the Releases field.

Step 4 When the search results are displayed, use the filter tools to narrow the results. You can filter the bugs by status, severity, and so on.

To export the results to a spreadsheet, click **Export Results to Excel**.

Known Limitations

This section describes known limitations and restrictions for Cisco WAE.

WAE System

Startup

The `$CARIDEN_HOME` directory is not automatically added to `$PATH`. (Only `$CARIDEN_HOME/bin` is.) To start the WAE Design GUI from the command line when it is not under `$CARIDEN_HOME/bin`, you must specify its full path: `/opt/cariden/software/mate/current/mate`.

License Check Failures on Newer Linux Distributions

Some newer Linux distributions use a new way (using `biosdevname`) of naming hardware devices, including network interfaces. This causes some software that depends on the traditional naming (for example, `eth0`, `eth1`) to fail on license checks.

The workaround is to append `biosdevname=0` to the kernel line of the grub configuration file and reboot. (Syntax varies among distributions.)

After reboot, you should be able to use ifconfig to verify that the NICs are named `eth0` (or `eth1`, ...) instead of the `biosdevname` names (such as `p34p1`).

NetFlow Collection

NetFlow collection is not supported on Alcatel-Lucent devices.

WAE Optical Plug-In

The optical plug-in (optical-nimo) is supported on Oracle JRE 1.8 but not on OpenJDK JRE. Oracle JRE 1.8 is not packaged with WAE 7.1. You can download Oracle JRE 1.8 from Oracle's website.

If you are using a JRE other than Oracle JRE 1.8 for other Java programs and you want to use the optical plug-in, you must download Oracle JRE 1.8 and add the following lines to the beginning of the <*WAE_installation_directory*>/packages/optical-ctc-plugin/run.sh file:

```
#!/bin/bash
export JAVA_HOME=<path_to_JRE_installation_directory>
export PATH=$JAVA_HOME/bin:$PATH
```

WAE Design

- macOS Sierra 10.12 and later implements an additional security measure for applications that are not distributed through the App Store; this includes WAE Design.

  By default, WAE Design is in a quarantine state as shown by the following command on a terminal:

  ```
  xattr wae_design.app
  ```

  The command returns the following output for a quarantined application:

  ```
  com.apple.quarantine
  ```

  As a workaround, remove WAE Design from quarantine by entering the following command in the directory where WAE Design is installed:

  ```
  xattr -r -d com.apple.quarantine wae_design.app
  ```

You can now run WAE Design 7.1 from macOS Sierra 10.12 and later.

- If you are using macOS X 10.12 or later with the WAE Design GUI and the Parse Configs tool (**File > Get Plan from > Configs**), add the following lines in ~/.bash_profile:

```
launchctl setenv JAVA_HOME `/usr/libexec/java_home -v 1.8`
export JAVA_HOME=$(/usr/libexec/java_home -v 1.8)
```

FlexLM License Server

You cannot run the floating license server on a setup (Linux VM or actual host) that uses bonded virtual interfaces (that is, a setup with multiple interfaces that have the same MAC address but different IP addresses within a VM). If the WAE Design client tries to check out a license from a setup that uses bonded virtual interfaces, the license checkout fails with the error "No license found."

As a workaround, run the floating license server in a standard Linux VM or host.

WAE Collection

- Due to vendor MIB limitations, WAE cannot represent QoS traffic on interfaces that have more than one VLAN configured. If a network contains such interfaces, their queue traffic statistics are omitted from the collection. The total traffic on these interfaces is still measured. As a result, demands for every class of service estimated through Demand Deduction are less accurate. Estimates of traffic totals over all classes of services, however, are not affected.
- Due to lack of MIB support, SR tunnel type is not collected for Cisco IOS XR routers through SNMP.
- Collection of interface egress shaping rate for Alcatel-Lucent devices does not support LAG interfaces.
- Juniper MIBs do not support P2MP LSPs.
- OSPFv3 and IPv6 IS-IS databases cannot be collected.
- WAE cannot associate a GRE tunnel with the physical interface it uses to reach the tunnel destination because the IP-Tunnel MIB lacks this information.
- For Juniper routers: Signaled standby LSP option is not available from the standard MPLS-TE MIB. Only the active path option name is collected.
- For Cisco IOS XR routers:
  - IGP topology collected through topo-igp-nimo module:

    – IS-IS link-state database with TE extensions contains incorrect interface “admin-weights” (TE metric) on Intel-based routers.

    – IPv6 IS-IS link-state database does not contain IPv6 interface addresses or parallel interfaces. This information is only available when Cisco IOS XR supports IS-IS IPv6 TE extensions.
  - MAC Accounting is not supported.
  - The lsp-snmp-nimo module does not set the Standby value in the <LSPPaths> table for signaled backup paths or collect named affinities configured with affinity-maps.
- BGP peers:
  - The topo-bgp-nimo module does not build BGP pseudo-nodes among internal ASNs.

  - The topo-bgp-nimo module does not collect BGP peers under PE-CE VRFs.
- TE Extended Admin Groups (EAGs), also known as extended affinities, are only supported from Juniper and parse_configs.
- There is no support for building port circuits for LAG members that are not within the same IGP (inter-AS circuits).
- It is not possible to distinguish between physically connected and unconnected LAG ports that are down for LAG port matching.
- The topo-igp-nimo module cannot be used when routers have a large number of links that cannot fit into a single PDU.
- With segment routing, concurrent RSVP-TE and SR-TE paths are not supported on the same LSP.

Accessibility Features

For a list of accessibility features in Cisco WAE, visit Cisco's Voluntary Product Accessibility Template (VPAT) website, or contact accessibility@cisco.com.

All product documents except for images, graphics, and some charts are accessible. If you would like to receive the product documentation in audio format, braille, or large print, contact accessibility@cisco.com.
