Cisco Crosswork Optimization Engine 5.0 Release Notes

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Cisco Crosswork Optimization Engine 5.0 Release Notes

This document provides information about Cisco Crosswork Optimization Engine, including product overview, new features and functionality, compatibility information, and known issues and limitations.

Change History

The following table describes information that has been added or changed since the initial release of this document.

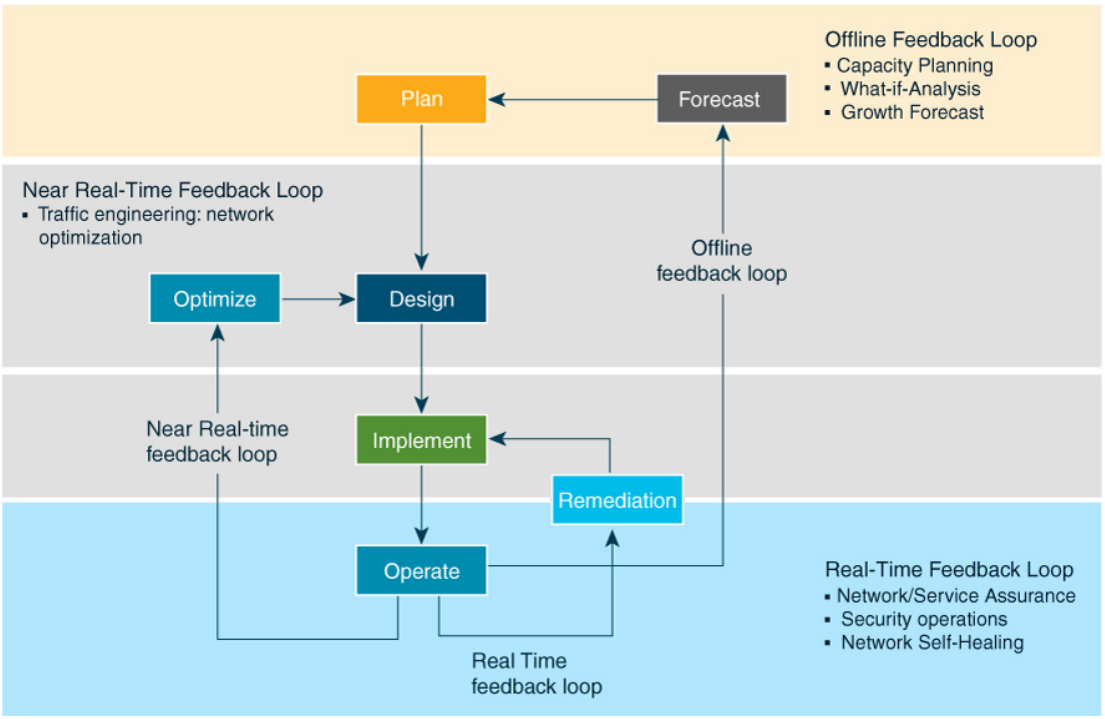
Date	Description
September 27, 2023	Cisco IOS XR Version 7.9.2 (SR-PCE and PCC) support has been added. For more details, see Compatibility Information, on page 10.

Overview

Network operators are facing challenges to support the exponential growth of network traffic while addressing the pressure to efficiently run network operations. They need a toolset to help automate bandwidth optimization and efficiently steer traffic with little operator intervention. Cisco Crosswork Optimization Engine fulfills this need by providing real-time network optimization capabilities that allow operators to effectively maximize network utility as well as increase service velocity.

Looking at the following figure, Cisco Crosswork Optimization Engine is built to fulfill the need for a closed-loop optimization loop as described under “Near Real-Time Feedback Loop”. Through Cisco Crosswork Optimization Engine, the operator is able to define the optimization intent, implement the intent, and continuously monitor, track, and react to maintain the original intent.

Figure 1: Network Resolution Lifecycle



Real-time Visibility

To run their network effectively, end-to-end visibility is important to any network operator. Cisco Crosswork Optimization Engine not only provides this visibility, but also the ability to visualize the network across different layers and the relationship between each layer. Cisco Crosswork Optimization Engine leverages IETF-standard BGP-LS protocol to discover IP network automatically, including the following features:

- Real-time visibility: Provides the network operator with a true representation of the actual topology
- Hierarchical topology view: Enables operators to define the different levels of granularity in the topology visualization

Simplified SR-TE Policy and RSVP-TE Tunnel Lifecycle Management

Cisco Crosswork Optimization Engine also provides an easy to use UI and API to manage and monitor the TE tunnel lifecycle. The UI and API enables the network operator to perform the following tasks:

- Visualize SR-TE (SR-MPLS and SRv6) policies and RSVP-TE tunnels.
- Create, modify, and remove SR-MPLS policies and RSVP-TE tunnels using an intuitive workflow
- Continuously track SR-MPLS policies and RSVP-TE tunnels and use dynamic path computations to maintain SLA objectives
- Preview an SR-MPLS policy or RSVP-TE tunnel before deploying it to the network

Extensibility through Feature Packs

Crosswork Optimization Engine feature packs to help tackle bandwidth management, network congestions, and prevent over capacity utilization. A user defines the bandwidth optimization intent and the tools implement the intent, and continuously monitor, track, and react to maintain the original intent. A user can also define network congestion thresholds and configure whether to have the tool automatically remediate congestion or provide mitigation suggestions the operator can choose to act upon.

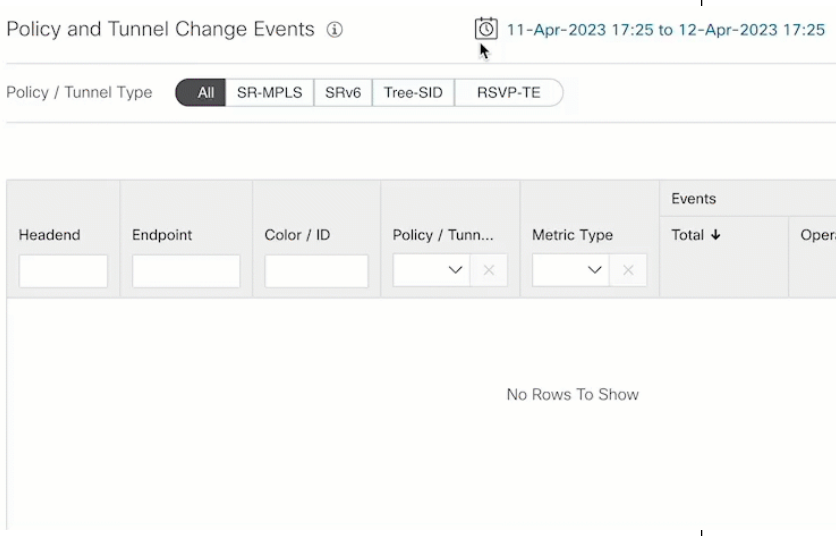
Due to licensing or the configuration of the role associated with your user account, you may not be able to access all of the features and functions. For licensing and ordering information, work with your Cisco Partner or Cisco Sales representative.

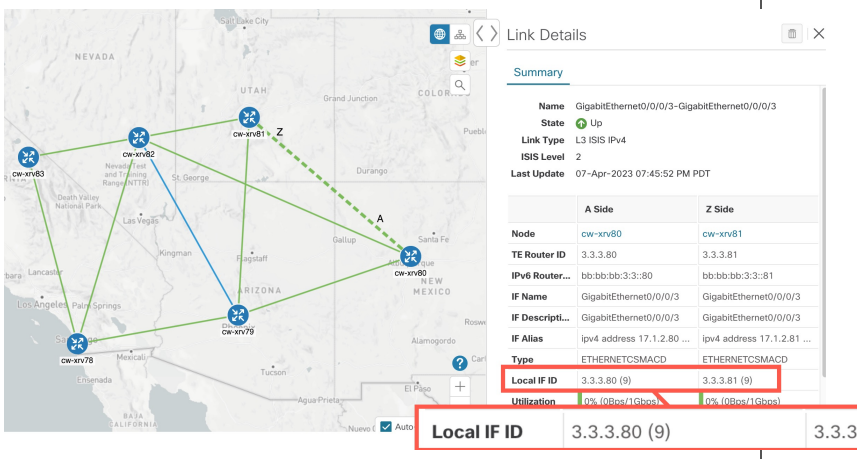
What's New

This section lists new features and changes delivered in Cisco Crosswork Optimization Engine 5.0. For system requirements information, see the Cisco Crosswork Network Controller 5.0 Installation Guide.

Table 1: New Features and Functionality in Cisco Crosswork Optimization Engine 5.0

Feature	What's New?
SR Circuit Style Manager (CSM)	CSM is a new feature pack that provides a bandwidth-aware Path Computation Element (PCE) to compute Circuit Style SR-TE policy paths that you can visualize in your network. Circuit Style enables segment routed transport tailored for circuit-oriented services over a packet based network through the use of bi-directional, co-routed, path protected SR-TE policies. Circuit Style SR-TE policies are typically used for high priority services, such as crucial monetary transactions or important live video feed, which *require committed bandwidth with fast and fail-safe connections*. CSM ensures dynamic Circuit Style SR-TE policies are provisioned along paths that meet strict bandwidth requirements while at the same time respecting any additional user configured constraints such as latency minimization and disjointness. Centralized bandwidth accounting in the CSM feature pack allows the user to monitor resource reservation levels and quickly identify hot spots where available bandwidth in the circuit style bandwidth pool is low. The ability to visualize Circuit Style SR-TE policies in your network topology enables easy verification of Circuit Style SR-TE policy configurations, details, and path states. With a few clicks you can view Active and Protect paths, operational status, reserved bandwidth pool size and monitor path failover behavior for individual Circuit Style SR-TE policies.
Segment Routing Tree Segment Identifier (Tree-SID)	In addition to being able to visualize Tree-SID policies, you now have the ability to provision *static* Tree-SID policies in the UI (**Traffic Engineering** or **Services & Traffic Engineering** > **Tree-SID** tab > **Create**). **Note** If there are any PCEs running Cisco IOS versions that are not supported in the network, Tree-SID visualization will not work. To view Cisco IOS versions that are supported in this release, see Compatibility Information, on page 10.

Feature	What's New?
Traffic Engineering Dashboard	• In the **Policies and Tunnels Under Traffic Threshold Range** dashlet (**Traffic Engineering** or **Services & Traffic Engineering > TE Dashboard**), you can now define a traffic threshold range with a minimum and maximum value. • On certain dashlets in the TE Dashboard there is a new 1H time range and a new calendar icon. You can use the new calendar icon to set a date and time range. 
Home Dashboard	Ability to add or remove TE dashlets.
SRv6	You can now visualize PCC-initiated SRv6 explicit policies including the segment list information.

Feature	What's New?
IPv4 Unnumbered Interface	IPv4 unnumbered interfaces allow you to enable IP processing on a serial interface without assigning it an explicit IP address. The IP unnumbered interface can "borrow" the IP address of another interface already configured on the router, which conserves network and address space. IPv4 unnumbered interface information (when available) is now displayed as either an index or a combination of the TE Router ID and the index in device, link, and topology details. For example:  You can also view unnumbered interface information in the segment list of SR Policy Candidate Path information.

Feature	What's New?
UI and Topology	

Feature	What's New?

	Multiple UI and topology map updates have been made, including the following:
	• You can now search within the topology map. This feature allows you to quickly locate devices based on the following criteria:
	  • Civic Location (for example, San Jose)
	  • Host/Device name (for example, NAT-01)
	  • IP address (for example, 121.10.10.1.1)
	• Import and Export geographical objects using Keyhole Markup Language (KML) format:
	  • Using the Crosswork Network Controller UI, you can import and export KML files to exam, change, or add device geographical information and see the updates in the UI map. For example, you may use the export function to download your device's data in KML format to your system, exam and/or change the device details, and upload it into a map generator (such as Google Maps) to view your updated device information and coordinates outside of Crosswork Network Controller. You can then use the import function to upload the updated, or browse for a new, KML file back into Crosswork Network Controller. If changes were made, they will now appear in the geographical map after it refreshes. When using the import function, Crosswork Network Controller also provides a sample KML template. The sample KML template provides information on where to identify devices and their coordinates, an optional device name, and the IP address (IPv4 or IPv6) of a device with corresponding coordinates. This template can be used on your system before importing back into Crosswork Network Controller.
	• Enhanced L2 link information:
	  • The Link Type text in the Link Details Summary page now indicates discovery method: L2 Ethernet (CDP) or L2 Ethernet (LLDP). Link discovery can be configured in **Administration > System Settings** tab > **Topology: Discovery**.
	  • Utilization information (virtual interfaces display rate only)
	  • Updated utilization tooltip
	• The Dashboard now includes Circuit Style, Hop Count, and an Unknown category details
	• A History view has been added to the Traffic Engineering page
	• Two new columns are added to the Link Details table: Delay and Jitter

Feature	What's New?
	• New search icon added in the topology screen • Enhanced device group feature • New import and export feature using KML format is added in the topology screen • Various table enhancements (inline buttons, borders, hover states, show/hide columns, and so on) • Enhanced filtering in columns and added a check box in drop-down popovers to allow multiple selections • Updated titles for consistency for parameters, pages, and menus
Bandwidth Optimization	This feature pack has been removed.

Alarms and Events	• New and updated alarms and events for the following:
	  • Tree-SID policy state and path changes.
	  • Several topology changes (for example: ISIS or OSPF link down, LLDP or CDP link down, node deletion, duplicate IP address detection, and so on)
	  • Changes in LSP operational states (for example: state down, deleted, and updated)
	• Ability to track and clear alarms.

IP source address logs	The source IP addresses can now be captured in audit log files (Administration > AAA > Settings > Source IP). Captures the last source IP address that initiated an operation. For more information on audit logs, see the See the "Manage System Health" chapter (under *Collect Audit Information*) in the Cisco Crosswork Network Controller 5.0 Administration Guide.
High Availability (HA)	The following components support a two instances running on different nodes, functioning in *active-active* mode with one minute failover: • optima-pce-dispatcher • optima-traffic-mapper • optima-restconf-v2 • optima-ui-service The following components support a two instances running on different nodes, functioning in *active-warm standby* mode with one minute failover: • optima-lcm • optima-csm

Feature	What's New?

Crosswork Optimization Engine PCE and Cisco IOS XR feature parity	• PCE now supports all four protection types in Crosswork:
	  • protected-only (new for this release)
	  • unprotected-preferred (new for this release)
	  • protected-preferred
	  • unprotected-only
	• The backend process of selecting a PCE for a PCE-initiated disjoint path has been simplified to enhance performance

gNMI interface data collection	Interface state and statistics collection over gNMI is supported (**Administration > System Settings** tab > **Data Collection: Interfaces**). See the "Manage System Access and Security" chapter (under *Configure System Settings > Configure the Interface Data Collection*) in the Cisco Crosswork Network Controller 5.0 Administration Guide.

APIs	The following API features are new or have been updated:
	• Get all Tree-SID policies
	• Get single Tree-SID policy (based on unique key)
	• Create, update, and delete notifications
	• Dashboard API
	• IGP path API returns an ordered list of interfaces from source to destination node
	• RESTCONF northbound support for RSVP-TE tunnels:
	  • RSVP-TE topology (*already supported*)
	  • RSVP-TE tunnels update notifications (operational data)
	  • RSVP-TE tunnels model for operational data
	  • RSVP-TE tunnels update notifications (configuration data)
	  • RSVP-TE PCE-initiated provisioning (create/modify/delete)
	  • RSVP-TE tunnel preview (dryrun)
	• Provisioning UI extensions
	• Optimization and Prediction Model Remote Procedure Call (OPM RPC) service hardening
	For more information, see the Cisco Crosswork Network Automation API Documentation on Cisco DevNet.

Cisco Crosswork Network Controller Information Center	New documentation portal with direct links to topics within functional areas.

Compatibility Information

The following table details Crosswork Optimization support for IOS Versions, SR-PCE, and Cisco devices. A later table indicates compatibility with Cisco Crosswork applications, NSO Function Packs, and browsers.

Cisco IOS Support

SR-PCE Cisco IOS XR Version 7.9.1 and 7.9.2 with SMU CSCwe80392 works with Crosswork Optimization Engine 5.0 features. Other listed PCC versions are supported, but may not support all Crosswork Optimization Engine features because of PCC version limitations.

Note oftware Maintenance Updates (SMUs) are required for both PCC/Headend and SR-PCE versions indicated in the table. To download the Cisco IOS XR versions and updates, see the IOS XR Software Maintenance Updates (SMUs) document. The correct SMUs to download will have "Optima" or the bug ID appended to the filename. For example: **`asr9k-x64-6.6.3.Optima.tar`** or **`xrv9k-7.3.1.CSCvy63506.tar`**.

Table 2: Crosswork Optimization Engine 5.0 Support for SR-PCE 7.9.1 and 7.9.2 (with SMU CSCwe80392) by Cisco IOS Version and Headend Router Type

Cisco IOS XR or XE Version	Cisco ASR 9000 (32-bit)	Cisco ASR 9901 (64-bit)	Cisco XRv 9000[1]	Cisco 8000 series	Cisco NCS 5500 series	Cisco NCS 540 series[2]	Cisco NCS 560 series	Cisco ASR 920	Cisco ASR 903 RSP 3
6.5.3	✓+ SMU	✓+ SMU	✓+ SMU	✗	✓+ SMU	✗	✗	NA	NA
6.6.3	✓+ SMU	✓+ SMU	✓+ SMU	✗	✓+ SMU	✓+ SMU	✓+ SMU	NA	NA
6.7.2	✓	✗	✗	✗	✗	✗	✗	NA	NA
7.0.2	✗	✓	✓	✗	✓	✓	✓	NA	NA
7.1.2	✗	✓	✓	✗	✓	✓	✓	NA	NA
7.2.1	✗	✓	✓	✗	✓	✓	✓	NA	NA
7.3.1	✗	✓	✓	✗	✓	✓	✓	NA	NA
7.3.2	✗	✓	✓	✗	✓	✓	✓	NA	NA
7.4.1	✗	✓	✓	✗	✓	✓	✓	NA	NA
7.4.2	✗	✓	✓	✗	✓	✓	✓	NA	NA

Cisco IOS XR or XE Version	Cisco ASR 9000 (32-bit)	Cisco ASR 9901 (64-bit)	Cisco XRv 9000[1]	Cisco 8000 series	Cisco NCS 5500 series	Cisco NCS 540 series[2]	Cisco NCS 560 series	Cisco ASR 920	Cisco ASR 903 RSP 3
7.5.2	✗	✓	✓	✓	✓	✓	✓	NA	NA
7.6.1	✗	✓	✓	✗	✓	✓	✓	NA	NA
7.7.1	✗	✓	✓	✓	✓	✓	✓	NA	NA
7.7.2	✗	✓	✓	✓	✓	✓	✓	NA	NA
7.8.1 + SMU (CSCvc9705)	✗	✓	✓	✓	✓	✓	✓	NA	NA
7.8.2	✗	✓	✓	✓	✓	✓	✓	NA	NA
7.9.1	✗	✓	✓	✓	✓	✓	✓	NA	NA
7.9.2	✗	✓	✓	✓	✓	✓	✓	NA	NA
17.4.1[3]	NA	NA	NA	NA	NA	NA	NA	✓	✗
17.5.1	NA	NA	NA	NA	NA	NA	NA	✓	✓
17.6.3	NA	NA	NA	NA	NA	NA	NA	✓	✗
17.7.1	NA	NA	NA	NA	NA	NA	NA	✓	✓
17.8.1	NA	NA	NA	NA	NA	NA	NA	✓	✓

1 The SR-PCE may be deployed on XRv9000 (VM or appliance).
2 The SMU is available via the Cisco NCS 540-ACC-SYS Router or Cisco NCS 540x-ACC-SYS Router Software Download Center.
3 Supports only PCE- initiated SR-TE policy deployment.

Note

- Segment Routing Traffic Matrix (SRTM) is only available in Cisco ASR 9000 devices.
- RSVP-TE tunnel PCE deployment (HA) is not supported on IOS XR 6.5.3 + SMU.
- SRv6 and Visualizing Native Path (Path Query) features are supported from PCC IOS XR 7.3.2 or later.
- Local Congestion Mitigation is supported from:
  - PCC IOS XR 7.3.2 and above for NCS 5500, NCS 560, and NCS 540
  - PCC IOS XR 7.4.1 (ASR 9000)
  - PCC IOS XR 7.5.2 and 7.7.1 for Cisco 8000
  - PCC IOS XE 17.05.1 or 17.05.1 (ASR 920/903 RSP 3)

Cisco Crosswork Application, NSO Function Pack, and Browser Support

The following table lists software versions that have been tested and are known to be compatible with Cisco Crosswork Optimization Engine. For *complete* installation requirements, see the *Cisco Crosswork Network Controller 5.0 Installation Guide*.

Hardware/Software	Supported Version
Cisco Crosswork Infrastructure	Version 5.0
Cisco Crosswork Data Gateway	Version 5.0
Function Packs	These function packs are only required when using Cisco Crosswork Optimization Engine within the Cisco Crosswork Network Controller solution. They are not required when using Cisco Crosswork Optimization Engine as a standalone application. • Cisco Crosswork NSO Telemetry Traffic Collector Function Pack 5.0 Installation Guide • Cisco Network Services Orchestrator DLM Service Pack 5.0 Installation Guide
Browsers	• Google Chrome—100 or later • Mozilla Firefox—100 or later

Scale Support

The following number of devices, and SR-TE policies and RSVP-TE tunnels are supported. Scale support numbers only apply to Cisco Crosswork solution applications.

Note These scale numbers have been qualified on a 5 node cluster system setup with 10 CDG VMs (each with 2.5 K devices attached) and 8 SR-PCE pairs (16 SR-PCEs total).

Table 3: Scale Support

Feature	Scale Support
Devices	25,000
Total Interfaces[4]	500,000[5]
SR-TE policies and RSVP-TE tunnels	150,000
IGP links	200,000

[4] This is the total number of interfaces that Cisco Crosswork can receive and process.
[5] This number has been validated with a total collection load of 650,000 interface entries across 25,000 devices (with 150,000 entries filtered out in the CDGs based on interface type). The number of CDG VMs can be increased to support higher collection loads.

Networking Technology Support

The following is the networking support information for SR-PCE 7.9.1.

- Supported Features
- Unsupported Features

Table 4: Supported Features

Category	Details	Notes
SR	SR-MPLS PCE-initiated policies	Policies that are provisioned or discovered by Crosswork.
SR	PCC-initiated policies and ODN policies	Policies that are discovered by Crosswork.
SR	Explicit path SR-TE policies	PCC-initiated (SID list with labeled SID list with addresses), PCE reported, PCE-initiated.
SR	Dynamic path SR-TE policies	PCC computed/PCE reported, PCE delegated
SR	Single consistent Segment Routing Global Block (SRGB) configured on routers throughout domain covered by Crosswork	—

Category	Details	Notes
SR	Prefix SID	Regular/Strict Node SIDs + FA. Includes SRv6 Locators
SR	Adjacency SID	B-flag (protected/unprotected), P-flag (Persistent). Includes SRv6 Locators
SR	Egress Peer Engineering (EPE) PeerAdjacency SIDs, PeerNode SIDs	• EPE must be configured on both end of eBGP link to appear in Crosswork. • EPE PeerAdjacency SIDs and PeerNode SIDs are represented as individual links in the Crosswork UI between the corresponding Autonomous Systems border routers (ASBR). EPE PeerNode SIDs are identified by the Border Gateway Protocol Router ID (BGP RID) Loopbacks as the A and Z side link interfaces. • Lables for both types of EPE SIDs, are shown as adjacency SIDs in the Crosswork UI.
SR	SR policy optimization objective min-metric (IGP, TE, and Latency)	PCE-init provisioning, PCC-init discovery
SR	SR policy path constraints (affinity and disjointness, protected segments)	Only 2 SR-MPLS policies per disjoint group or sub-id are supported. Disjoint Types - link, node, srlg, srlg-node
SR	Binding SID for explicit or dynamic policies	Discovered for PCC-init/PCE-init, configurable for PCE-init
SR	Profile ID (Discovered and configurable for PCE-init)	Used for applying features on PCC to PCE-init policies

Category	Details	Notes
SR	Flex-Algo (SR-MPLS/SRv6)	• Discover / Visualize node Flex Algo participation • Discover / Visualize Flex Algo Definitions • SR policy IGP path respecting Flex Algo associated with prefix SIDs • Display pruned topology participating in FlexAlgo • Preview / Provision PCE-init SRTE policy with SID-Algo constraint
SR	Discovery/Visualization of multiple candidate paths	—
SR	Binding SIDs as Segment List Hops for SR policies	Discovery / visualization of PCC-init
SR	Tree-SID	Visualization / Provisioning (PCE-init)
SR	SR policies with Loopback IPs (Prefixes) other than TE router ID for headend/endpoint and prefix SIDs in segment list	Prefix (node) SIDs associated with specific IGP domain / area
SR	Maximum SID Depth (MSD)	• Per-node Base MPLS imposition MSD discovered via IGP/BGP-LS • Per-node MSD discovered via PCEP session info • Per-policy MSD
SR	Global Max Latency	Configured on PCE and applied to all PCE delegated SRTE policies with latency metric
SR	Inter-domain SRTE policies (inter-IGP domain, inter-AS)	PCE delegated, BWoD

Category	Details	Notes
SR	Node SID reuse across different IGP domains	Recommended to not reuse node SIDs in adjacent IP domains. Interdomain explicit path policies with a label-only hop that is a node SID used in adjacent domains may be unresolvable if hop after ABR hop.
SR	Dynamic Circuit Style	Path computation and BW reservation through COE Circuit Style Feature Pack
RSVP	PCE-initiated tunnels (Provisioned by Crosswork, discovered by Crosswork), PCC-initiated tunnels (discovered by Crosswork)	—
RSVP	ERO strict hops, ERO loose hops (PCC-init only)	—
RSVP	FRR protection on Crosswork provisioned tunnels	—
RSVP	Path optimization objective min-metric (IGP|TE|Latency)	—
RSVP	Path constraints (affinity, disjointness)	Only 2 RSVP tunnels per disjoint group / sub-id
RSVP	Binding Label (explicit | dynamic)	—
RSVP	Signaled Bandwidth	—
RSVP	Setup / Hold Priority	—
RSVP	Path Protection (partial support)	Paths discovered as independent tunnels if multiple paths are up. Cisco XR only reports active path. Other vendors may report all active paths.
PCEP	PCEP Session discovery	Each PCEP session a PCC has with a PCE along with its details is displayed as part of node details
SR-IGP	Visualizing native SR-IGP path	Path Query OAM feature to use traceroute on device to report actual SR-IGP multi-paths to destination node ***(SR-MPLS only)***
IPv4/IPv6	Dual Stack IPv4 / IPv6	Nodes can be IPv4, IPv6 or IPv4/IPv6 capable

Category	Details	Notes
IPv4	Unnumbered Interfaces (partial)	Topology discovery, SR policies with unnumbered IF hops discovery/provisioning, LCM policy support
IPv6	IPv6 Link Local Interfaces	Discovery of IPv6 link local interfaces as part of topology and as a hop in an SRv6 TE policy
IPv6	IPv6 Router ID	Nodes with IPv6 and IPv6 Router ID only with support for SRv6 only

Table 5: Unsupported Features and Limitations

Category	Description	Notes
SR	Provisioning multiple candidate paths via Crosswork	—
SR	Per-Flow Policies (PFP)	PFP (ODN or manually configured) not supported in PCEP. This PFP is the mapping of forward class to PDP with matching color and EP. Underlying PDP is reported as normal.
SR	Multiple segment lists per candidate path	This configuration is not supported in Crosswork. These segment lists will not be discovered if configured on a PCC. • Discover multiple segment lists (with weights) per policy (TopoSvc, PCE, PCC) • Provision multiple segment lists (with weights) per policy (UI, PCED, PCE, PCC) • Visualize including showing IGP paths (UI, OE) • Compute paths of policies with multiple segment lists for LCM (OE, LCM)
SR	Anycast SIDs	—

Category	Description	Notes
SR	Hop count metric type for policies	Cisco Crosswork does not support provisioning with this metric type and does not discover this metric type if configured on the PCC.
SR	SR policy provisioned (SR-PCE initiated) with IPv6 endpoints or hops	—
SR	SR-MPLS policy optimization objective min-metric with margin	Not supported for policies provisioned by Cisco Crosswork. Margin is not discovered for PCC-initiated policies.
SR	SR-MPLS policy constraints (resource exclusion or metric bound)	Not supported for policies provisioned by Cisco Crosswork. Constraints are not discovered for PCC-initiated policies.
SR	Heterogeneous SRGBs	Different SRGBs configured on nodes are not supported. SRGB must be configured to ensure proper discovery and visualization of SR policy paths.
SR	Egress Peer Engineering (EPE) Peer Set SIDs	No discovery
SR	Routers that are not SR-capable	All nodes assumed SR capable when computing SR policy IGP paths. LCM and BWoD SR policy path computation will not exclude non-SR capable nodes in IGP path.
SRv6	Provisioning of SRv6 policies is not supported.	PCE-Init provisioning not supported in XR.
SRv6	Traffic collection on SRv6 policies is not currently supported.	Requires telemetry (gNMI) for policy counters (no SNMP support)
SRv6	SRv6 is not supported on Bandwidth on Demand,Local Congestion Mitigation, and SR Circuit Style Manager feature packs.	—
IGP	ISIS Overload bit	Affects IGP paths for all policies and PCE path computation (BWoD, LCM). PCE reports but does not process.
IGP	OSPF MADJ Interfaces	No support for discovering OSPF Multi-area adjacencies

Category	Description	Notes
IGP	Multiple IGP instances on same interface	Single interface that participates in multiple IGP instances are not supported.
IGP	ASLA Delay / TE Metric	Crosswork does not collect or consider ASLA delay and TE metric in Flex Algo topology computations and SRTE policy IGP paths. Legacy link delay and TE metric are used instead
RSVP	Configuring loose hop Explicit Route Object (ERO) in Crosswork	Only strict hops can be configured. If strict hops are not configured for every hop along the path and those hops are not remote interface IPs or loopbacks, unexpected behavior may occur
RSVP	Named tunnels configured on PCCs	Required for Juniper RSVP HEs
RSVP	Tunnels with Loopback IPs other than TE router ID for headend/endpoint and path hops	—
RSVP	Display of active FRR protected path in UI	Cisco Crosswork will discover an FRR tunnels which are displayed in UI but will not associate an actively protected tunnel with the FRR tunnel. Path in UI will not include FRR protected path when protection is active.
RSVP	P2MP tunnels	—
RSVP	Path protected RSVP LSPs	No association between paths discovered.
LDP	Local Congestion Mitigation (LCM) in Mixed SR/LDP networks	LCM will not work in a mixed SR/LDP network with PEs that are LDP only. LDP traffic destined to the LDP-only egress PE attempted to be steered into Autoroute LCM tactical polices will be blackholed
IPv4	IPv4 Unnumbered Interfaces	BWoD, Circuit Style Support, and RSVP
IPv4/IPv6	Secondary IP addresses for interfaces	Not supported. Unpredictable behavior if discovered.

Category	Description	Notes
IPv4/IPv6	Overlapping IP addresses in different IGP domains	IP addresses for IGP interfaces and nodes (router-ids) are assumed to be unique across all domains
IPv6	IPv6 Router ID	SR & RSVP not supported (SRv6 only)

Upgrade Crosswork Optimization Engine Feature Packs

If you have enabled feature packs (LCM or BWoD) in Crosswork Optimization Engine 4.1 and want to upgrade to Crosswork Optimization Engine 5.0, you must perform the following tasks prior to upgrading:

LCM

- From the LCM **Configuration** page:
  1. Set the **Delete Tactical SR Policies when Disabled** option to **False**. This task must be done prior to disabling LCM so that tactical polices deployed by LCM remain in the network after the upgrade.
  2. Set the **Enable** option to **False**. If LCM remains enabled, there is a chance that tactical policies may be deleted after the upgrade.
  3. Note all options (Basic and Advanced) in the LCM **Configuration** page so that you can confirm the same configuration has been migrated after the upgrade.
- Export the current list of interfaces managed by LCM (**Traffic Engineering > Local Congestion Mitigation > Export** icon). Confirm the interfaces are valid by reimporting the CSV file without errors. For more information, see "Add Individual Interface Thresholds" in the Cisco Crosswork Optimization Engine 5.0 User Guide.
- After the upgrade, wait until the **Traffic Engineering** page shows all the nodes and links before enabling LCM

Note:

After the system is stable and before enabling domains for LCM, confirm that the migration of previously monitored interfaces has completed and that each domain has the expected configuration options.

1. Navigate to **Administration > Alarms > All > Events** and enter **LCM** to filter the **Source** column.
2. Look for the following event: "Migration complete. All migrated LCM interfaces and policies are mapped to their IGP domains". If this message does not appear wait for the **Congestion Check Interval** period (set in the LCM **Configuration** page), then restart LCM (**Administration > Crosswork Manager > Optimization Engine > optima-lcm > ... > Restart**).
3. Wait until the optima-lcm service changes from Degraded to Healthy state.
4. For each domain, navigate to the **Configuration** page and verify the options have been migrated successfully. If the domain configurations are incorrect, restart LCM (**Administration > Crosswork Manager > Optimization Engine > optima-lcm > ... > Restart**).
5. Check the **Events** page for the event mentioned above and the **Configuration** page to verify the options.

Note

- If the confirmation message does not appear or domain configuration options are incorrect, then contact Cisco Technical support and provide them with showtech information and the exported Link Management CSV file.
- You can also manually add missing interfaces that were previously monitored or update domain configuration options *after* the system is stable.

BWoD

- Set the **Enable** option to **False**. If BWoD remains enabled, there is a chance that tactical policies may be deleted after the upgrade.
- Note all options (Basic and Advanced) in the BWoD **Configuration** page so that you can confirm the same configuration has been migrated after the upgrade.
- After the upgrade, wait until the **Traffic Engineering** page shows all the nodes and links before enabling BWoD.

Product Documentation

The following table lists the guides that Cisco provides for Cisco Crosswork Optimization Engine.

Visit the Cisco Crosswork Network Controller Information Center to find direct links to topics within functional areas. You also can access all Cisco Crosswork Optimization Engine end user documentation at https://www.cisco.com/c/en/us/support/cloud-systems-management/crosswork-optimization-engine/model.html.

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

Table 6:

Documentation Title	What is Included
Cisco Crosswork Optimization Engine 5.0 Release Notes	This document
Cisco Crosswork Network Controller 5.0 Installation Guide	Shared installation guide for all the Cisco Crosswork applications and their common infrastructure. Covers: • System requirements • Installation prerequisites • Installation instructions • Upgrade instructions

Documentation Title	What is Included
Cisco Crosswork Network Controller 5.0 Administration Guide	Shared administration guide for all the Cisco Crosswork applications and their common infrastructure. Covers: • Managing clusters and data gateway • Data collection • High availability • Backup and restore • Onboard and manage devices • Zero touch provisioning • Set up maps • Managing users, access and security • Maintain system health
Cisco Crosswork Optimization Engine 5.0 User Guide	• Getting started • Setting up and monitoring the network • Monitoring SR-TE (SRv6 and SR-MPLS) policies and RSVP-TE tunnels • Provisioning SR-MPLS policies and RSVP-TE tunnels • Mitigating network congestion • Defining and maintaining intent-based bandwidth requirements
Open Source Software Used in Cisco Crosswork Optimization Engine	Lists of licenses and notices for open source software used in Cisco Crosswork Optimization Engine.
API Documentation	Advanced users can extend the Cisco Crosswork functionality using the APIs. API documentation is available on Cisco Devnet.

Related Product Documentation

You can access documentation for all Cisco Crosswork products at https://www.cisco.com/c/en/us/support/cloud-systems-management/crosswork-network-automation/tsd-products-support-series-home.html

Known Issues and Limitations

The following section details the known issues and limitations for Cisco Crosswork Optimization.

TE Dashboard

- Traffic Utilization is not supported on Tree-SID and SRv6 policies.
- You cannot view the IGP path on the historical data when an event is selected.
- The metric type for BWoD policies are not visible on the TE Dashboard.
- Hop count metric and BWoD type are not shown in the TE Dashboard under metric/policy type.
- State and Path change events are not visible in the Historic tab of a policy until you zoom in by 5 to 6 clicks.

IPv4 Unnumbered Interfaces

- Bandwidth on Demand and SR Circuit Style Manager feature packs will not factor in IPv4 unnumbered interfaces.
- Tree-SID policies are not supported.
- RSVP-TE PCE-initiated tunnels are not supported.

Tree-SID

- Only static Tree-SID policies can be created via the UI. Also, you can only update and delete static Tree-SID policies that have been created via the UI.
- Tree-SID policies are only supported on devices running Cisco IOS XR software.
- PCE HA is not supported if the static Tree-SID policy was configured manually on the device (not via the UI).
- Tree-SID policies are not deleted from the UI when the SR-PCE in HA mode is down.
- IPv4 Unnumbered interfaces are not supported.
- Tree-SID policies are not supported in Label Switch Multicast (LSM) routing. In cases where LSM is enabled, IGP updates and traffic utilization data are not supported.
- LCM will not operate in portions of the network carrying Tree-SID LSPs.
- On Cisco 8000 Series Routers, only static Tree-SID policies with leaf role are supported.
- The RestConf API is not supported.
- Tree-SID policy details do not show IPv6 router ID or SRv6 core information.

SR-MPLS

- In the SR-MPLS provisioning screen and while previewing an SR-MPLS policy with an IPv6 address, a parsing error is displayed instead of correct error message: "Request Failed. Endpoint address is IPv6, IPv6 provisioning is not supported yet."
- Updating the SID constraint on an existing policy is not allowed by the SR-PCE. The modification screen gives a successful update message, instead of a warning message that it is not allowed.

APIs

- The Topology API cannot discover and report IPv6 Link-Local style links.
- The Dashboard Export API cannot export CSV files to an external location. It can only export to /mnt/cw_glusterfs/bricks/rscoean/export.

BWoD

- BWoD gets disabled when SR Policy Traffic field has 'Measured' selected and Policy Violation field has 'Strict Network' selected.

Bugs

If you encounter problems while working with Cisco Crosswork, please check this list of open bugs (.xlsx file). Each bug ID in the list links to a more detailed description and workaround. You can use the Cisco Bug Search Tool to search for bugs.

1. Go to the Cisco Bug Search Tool.
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.

3. To search for all Cisco Crosswork bugs, from the Product list select **Cloud and Systems Management** > **Routing and Switching Management** > **Cisco Crosswork Network Automation** and enter additional criteria (such as bug ID, problem description, a feature, or a product name) in the Search For field. Examples: "Optimization Engine" or "CSCwc62479".
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.

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

Security

Cisco takes great strides to ensure that all our products conform to the latest industry recommendations. We firmly believe that security is an end-to-end commitment and are here to help secure your entire environment. Please work with your Cisco account team to review the security profile of your network.

For details on how we validate our products, see Cisco Secure Products and Solutions and Cisco Security Advisories.

If you have questions or concerns regarding the security of any Cisco products, please open a case with the Cisco Customer Experience team and include details about the tool being used and any vulnerabilities it reports.

Accessibility Features

For a list of accessibility features in Cisco Crosswork Optimization Engine, visit https://www.cisco.com/c/en/us/about/accessibility/voluntary-product-accessibility-templates.html (VPAT) website, or contact accessibility@cisco.com.



Note The Cisco Crosswork Optimization Engine VPAT document listed for 4.0 applies to this release.

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

Obtain Additional Information and Submit a Service Request

Information about Cisco products, services, technologies, and networking solutions is available from various online sources.

- Sign up for Cisco email newsletters and other communications at:

  https://www.cisco.com/offer/subscribe

- Visit the Cisco Customer Experience website for the latest technical, advanced, and remote services to increase the operational reliability of your network. Go to:

  https://www.cisco.com/c/m/en_us/customer-experience

- Obtain general networking, training, and certification titles from Cisco Press publishers at:

  http://www.ciscopress.com

- To submit a service request, visit Cisco Support.

Support and Downloads

The Cisco Support and Downloads website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies.

Access to most tools on the Cisco Support and Downloads website requires a Cisco.com user ID and password.

For more information:

https://www.cisco.com/c/en/us/support/index.html

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