Cisco Crosswork Hierarchical Controller Network Discovery and Data Requirements

A High Level View (W/O Adapter Details)

November 2022

Contents

Cisco's Crosswork Hierarchical Controller platform builds automation and analytics capabilities on top of its industry leading multi-domain, multi-vendor, and multi-layer network model. The model itself is constructed by the Crosswork Hierarchical Controller Discovery Engine. Not surprisingly, this is a data intensive exercise. This document outlines the model, the various data acquisition methods supported by Crosswork Hierarchical Controller, the type of information that is required and the value that Crosswork Hierarchical Controller brings with these types of information

The scope of this document is only for data model and discovery. Configuration, as part of service management is not included and is detailed in another document.

Crosswork Hierarchical Controller Data Model

Crosswork Hierarchical Controller abstracts the multi-layer, multi-vendor network model into its own model as depicted below (Figure 1). This model allows extensive representation of layered paths and unifies the vendor's proprietary model into a holistic and simple, yet detailed information model.

The model can be gradually built with acquired data. This document details, per network layer, the mandatory information that must be available and the extra information that adds more value.

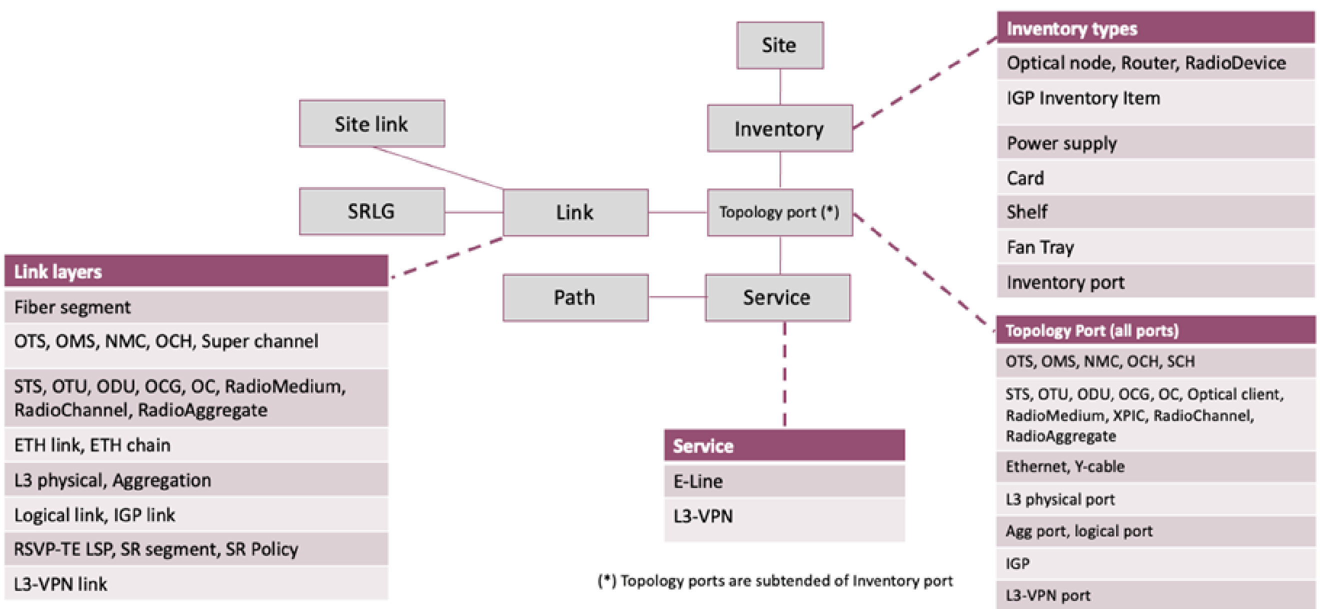

Figure 1.
Cisco Crosswork Hierarchical Controller Data Model

Network Layers

Crosswork Hierarchical Controller models all L0 to L3 links in its model and ensures consistency of these layers even with partial data acquired.

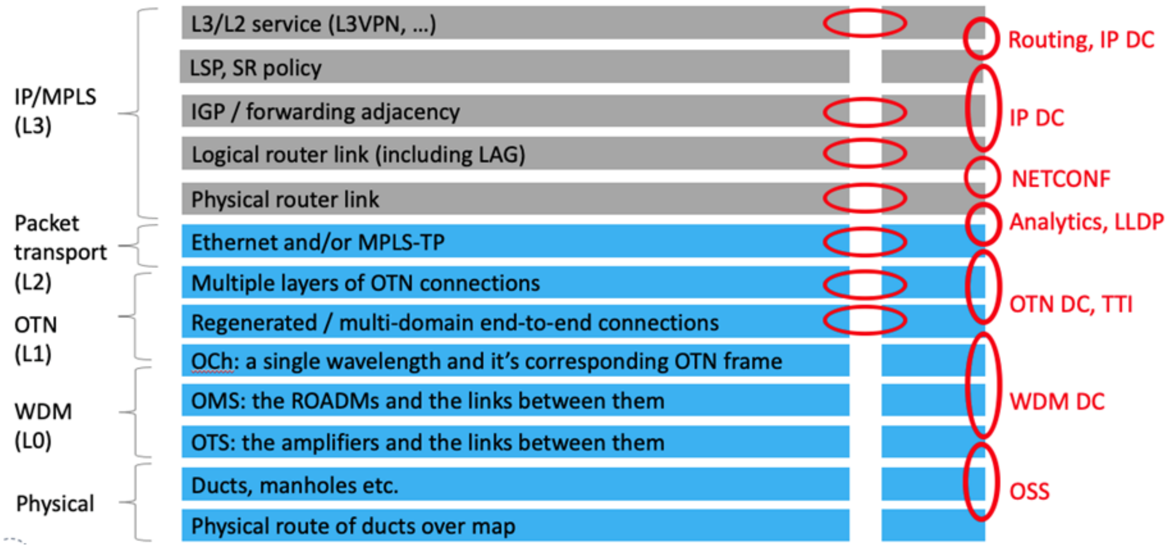

Figure 2.
Cisco Crosswork Hierarchical Controller Network Layers

Network Elements (NEs) are modeled as black boxes from a connections/topology perspective, internal connectivity between cards and shelves in the NE is not modeled. this is especially important for ROADMs as transponders/muxponders/WSS are typically modeled separately and the connections between them are exposed in accordance with IETF/ONF standards.

Crosswork Hierarchical Controller model does not include:

- Passive devices
- Empty slots/plugholes
- Internal shelf backplane connectivity
- Pre-provisioned (planned) but non-existent devices
- Optical multicast (drop & continue)

Model Extension Using Tags

Crosswork Hierarchical Controller allows full flexibility in enriching its information model with customer and business specific information. Such information can be a network domain, geographical region, resource role, owner, operator, or end customer. Having this information built into the model and available in applications can significantly improve the efficiency and benefits of Crosswork Hierarchical Controller as it better captures the operational and business logic of the Service Provider network.

Tags can be used to focus the view to objects of interest, filter resources by it, limit authorization of certain functions, analyze risks and vulnerabilities differently for distinct parts of the network. Tags are also used to affect path calculation, for example to constrain it to resources of a certain type or in a certain geography.

User can add specific tags to the model, per specific object or define tag generic to all objects, add values per tag and then associate objects (network elements, links, ports, services) to values in a dynamic manner.

For example, a network element can be associated with several tags:

- Location (tag name) = Boston (value)
- Region (tag name) = MA (value)
- Type (tag name) = core router (value)

Tags, as an integral part of the model, appear as attributes of objects, and can be used to filter network elements in 3D map, filter any object in applications, group objects as target for tests (Network Vulnerability) or filter by them in test results (Path Optimization).

Tags and their value, as well as association of objects to tags can be defined using APIs or SHQL. Consult with your Cisco representative and see the *Crosswork Hierarchical Controller Administration Guide*.

Data Acquisition

Service providers are currently engaged in network transformation initiatives aimed at enabling automation. As a result, the network and infrastructure management software systems are at various stages of development and there is a wide array of data sources. Crosswork Hierarchical Controller was designed to integrate in real network environments regardless of their evolutionary stage. Each integration methods comes with its pros and cons.

Network Management System Interface

Crosswork Hierarchical Controller can connect to the EMS/NMS for a network/vendor domain to retrieve information. The method depends on the protocols supported by the system:

- REST
- SOAP
- SQL
- Scheduled Report Export (sftp/ftp)

Advantages:

- Does not require direct network access (easier for service provider to provide access to NMS than provide network access).
- Can give access to metadata not stored on the network device.

Disadvantages:

- Low data resolution due to infrequent updates.
- Enabling certain types of data collection on NMS can create a load problem on NMS.
- NMS often only knows about devices that have been added to it.
- Immature northbound interface.

Real-Time Systems/SDN Controllers

When a service provider's network contains systems that support next-generation technologies and protocols such as SDN controllers and real-time telemetry systems, Crosswork Hierarchical Controller can interface with these systems to gather data:

- RESTCONF
- gRPC

- WebSocket
- Kafka

Advantages:

- Data is pushed to Crosswork Hierarchical Controller rather than Crosswork Hierarchical Controller pulling it.
- Data is real-time or near-real-time.
- Crosswork Hierarchical Controller can leverage any network configuration/provisioning APIs exposed by the system.

Assumptions

Crosswork Hierarchical Controller assumes the following about the data provided by the SDN controller:

- Each topology/link/termination point must provide the underlaying object (topology/links/TP).
- The domain controller should provide the full IP/MPLS or optical network layer topology – including all links and their termination points of different supporting layers and technologies inside an area. (Note that an abstract view of the topology that only provides PE and ASBR nodes is insufficient as it does not allow for multi-layer mapping, optimal global path computation and for alarms/performance management).
- Each link's termination point should be easily referred or connected to a port.
- If the termination point's network element is also provided, it should be easily referred or connected as part of Network Elements.
- Each link will hold a reference to its carrying/supporting layer for its path construction. In the event of more than one carrying path, a priority for each path is required.
- Controller should provide a command retrieving a single specific object by its unique ID.
- Information can be collected each 30 minutes and updated upon notifications.

Required Data

In a typical Crosswork Hierarchical Controller deployment, the system leverages a mix of the above data acquisition techniques based on which method is available for which data set. The data Crosswork Hierarchical Controller Discovery Engine requires can be broadly divided into three categories: Inventory, Configuration and State.

Per category, there are mandatory and optional datasets. Optional dataset, if provided, enriches analytics with useful information on network usage, better simulations, and more accurate failure impact analysis.

General Information

This is generic information about the network, which is required for IP and optical devices.

Sites with their geo location, devices, interfaces, and traffic statistics are all mandatory to build the network topology of the provided layers.

Additionally, the Crosswork Hierarchical Controller network model contains many optional datasets. it enables Crosswork Hierarchical Controller applications to provide better and more accurate results.

The level of detail that Crosswork Hierarchical Controller requires varies depends on whether it is direct device discovery or discovery via Network Management Systems (NMSs) or SDN controllers. The latter provides explicit topology in all layers while with direct device discovery, Crosswork Hierarchical Controller needs many configuration details to construct topology information.

Geographical Location

Crosswork Hierarchical Controller makes use of geographical information to provide a 3D visual map with sites, in their location and regions.

Once provided, Crosswork Hierarchical Controller uses the regional geographical information to assign sites to region and allows map and inventory filtering by region.

KML/KMZ of fiber paths, once provided, helps to estimate latency based on upper links mapping to fibers.

Physical Inventory

Physical inventory is part of the Crosswork Hierarchical Controller model, and although optional it is valuable.

It allows deeper analysis by Crosswork Hierarchical Controller applications:

- Shared resources as a risk, e.g. ,is there a risk of single failure when the service main and protection paths are on the same card or shelf.
- Inventory actual usage, are cards and shelves occupied? At what level?
- Transceiver's inventory helps to keep track of on-time replacements.
- Crosswork Hierarchical Controller do not model planned devices, shelves, and cards. Such inventory resources will be ignored in discovery. However, physical ports on an installed card are modelled, even if they are administratively down or have no configuration.

Table 1. Required Data

Required	Data
Mandatory	• Geo-location data for all routers and optical network elements (longitude, latitude) • Site membership for all routers and optical network elements with geo-location of the sites • Device unique name or ID (TID) • Vendor name • Device family • Device type • Ports – location (slot/card), type, speed, admin state, operational state • Link aggregation groups
Optional	• Regions (name, KML/KMZ data) • KML/KMZ data for all fiber paths • Device level attributes (device family, SW version, type, HW version, serial number, part number) • Shelves • Slots (type, location) • Cards (slot number, name, type (fan, power supply, line), serial number, part number, SW version, HW version, equipment state) • Transceivers (vendor, model number, part number, serial number, supported lambdas, tunable type, tuned lambdas, supported speed)

Cross Layers Mapping

Current solutions to retrieve network topology information are all partial.

Crosswork Hierarchical Controller is unique in its ability to discover links between physical router ports to Ethernet ports in optical devices, between two Ethernet physical ports, and between Muxponder/Transponder port to ROADM/Mux devices even when no topology information (like LLDP for ETH ports) is provided.

Crosswork Hierarchical Controller implements a patent-based algorithm that uses ports configuration, topology information, transient behavior, and correlates ports to ports, with no need for information from the EMS/NMS, controller, or OSS. Crosswork Hierarchical Controller adds these cross layers links to the model and uses them in the 3D map to show the network hierarchies.

To run this algorithm, Crosswork Hierarchical Controller needs the ports state, configuration, and performance counters, to be retrieved from both, optical and routers devices.

For ETH links, performance counters are the classic RMON MIB (RFC3577) counters for Rx/Tx frames and octets, drop packets, CRC errors, undersize, and oversize packets.

These counters are needed for first discovery and then continuously to keep the topology view up to date. Counters should be as cumulative (incremental) 15 minutes or 5 minutes intervals.

Performance counters timestamps need to be in the same time-zone across the whole network and the sampling time period of the whole network should overlap.

Info can be streamed online or can be retrieved in files or in batches read every few hours.

The data required for the cross-mapping function is detailed below.

Data completeness:

- Valid data streams
  - All candidate router ports
  - All candidate optical ports
- Site assignments and geo locations
  - All candidate nodes to have site assignment with accurate geo locations
- Clock, date, and time zone need to be correct

Definition of a valid data stream:

- Data type, one of:
  - 15-min binned values
  - 5, 10, or 15 minute accumulated value
- Counter type: Packet
  - Receive/RX
  - Transmit/TX
- Consistent sampling, no missing samples (no holes)
- Minimum 36 hours

Additional comments:

- Sample quality
  - Samples need to be spaced consistently, with the actual value captured at the marked time (e.g., cases where there is a collection job of one hundred devices one after the other with a single timestamp are low quality)
- Limitation examples

- Low traffic or max throughput links are harder to correlate
- Samples of cross layer links (port pairs)
    - A list of a few port pairs to use as an anchor for quality assessment of samples

For optical links, add/drop Rx and Tx power measurements for ports of type OTSiMC, NMC, and OCH-NC. The PM counters should be the instantaneous/current and historical bins.

Note: As there are variants of optical devices, colored and colorless, further attention must be paid to whether counters are from the add/drop port or from the aggregation port. We recommend having a direct discussion with the optical vendor upon integration.

Optical Network

Crosswork Hierarchical Controller models the optical network from Layer 0 to Layer 1, physical fiber lines to E-Line service, and handoff to routers.

The optical links and layers discovered and modelled in Crosswork Hierarchical Controller are detailed below.

Table 2. Cross Layer Mapping

Layer	Description
Fiber segment	Physical fiber line that spans from one passive fiber endpoint (manhole, splice etc.) to another and is used as a segment in fiber link.
Fiber	Chain of fiber segments that spans from optical device to another.
OTS	OTS is the physical link connecting between one line amplifiers (ILA or OLA) or ROADMs to another. One OTS can be created over a fiber link.
OMS	OMS is the link connecting between one ROADM and another. One OMS can be created over a chain of one or more OTS links.
NMC	A wavelength connection between two ROADMs over one or more OMS links, not connecting to client ports on Muxponder.
OCH	OCH is a wavelength connection spanning between one OEO device (transponder, muxponder, regen) and another. 40 or 80 or more OCH links can be created on top of OMS links or on NMC link when exist.
SCH	A super-channel is an evolution of DWDM in which multiple, coherent optical carriers are combined to create a unified channel of a higher data rate, and which is brought into service in a single operational cycle.
Radio Medium	Models the lowest L1 link between two Microwave devices.
Radio Channel	Specific Radio channel over Radio medium link.
Radio Aggregate	Logical aggregation of Radio channels as the underlay of Ethernet link between two Microwave devices.
OC/OCG	SONET/SDH links that span from one optical device to another and carry SONET/SDH lower bandwidth services, ride on top of OCH links and terminate in TDM client ports.
STS	Large and concatenated TDM circuit frame (such as STS-3c) into which ATM cells, IP packets, or Ethernet frames are placed. Rides on top of OC/OCG as optical carrier transmission rates.
OTU	OTU is the underlay link in OTN layer, used for ODU links. It rides on top of an OCH.

Layer	Description
ODU	ODU links are sub signals in OTU links, each OTU links can carry multiple ODU links, and ODU links can be divided into finer granularity ODU links recursively.
ETH link	ETH L2 link, spans from one ETH UNI port of an optical device to another, and rides on top of ODU or on ST.S
ETH chain	A link whose path is a chain of Ethernet links cross-subnet-connected (found using Crosswork Hierarchical Controller cross mapping algorithm). Eth-chain is a replacement for R_PHYSICAL link in cases where one side of the link is in devices out of the scope discovered by Crosswork Hierarchical Controller.

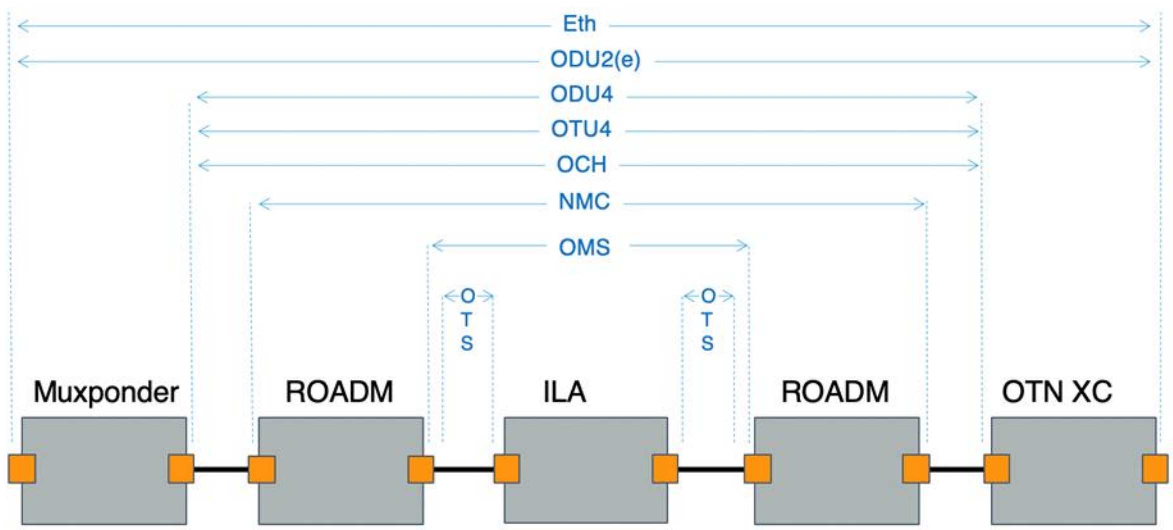

Figure 3.
Cisco Crosswork Hierarchical Controller Optical Network

Fiber Paths

Fiber segments and paths are modelled in Crosswork Hierarchical Controller and discovered from fiber management systems using files or APIs.

Fiber discovery is optional in the model. once provided, it can increase the value of Crosswork Hierarchical Controller applications:

- Fiber paths displayed in 3D map are with their geographical path, mapped to satellite or schematic map and can be seen in their exact physical location
- Shared risk analysis can go down to the fiber layer, with no need of manually configured SRLGs
- Calculated L1 latency based on fiber distance helps to optimize L1 connections by Path Optimization app
- Fiber SRLG application detects violations of fibers proximity policy rules and automatically generates SRLG to Crosswork Hierarchical Controller model and to other systems
- Fiber SRLG application allows checking a new path for OMS links to ensure that its fiber path do not cross a proximity violation point with other fibers

Table 3. Fiber Paths

Required	Data
Mandatory	• Fiber segments (ID, KML/KMZ, length) • Fiber paths (ID, endpoints segment IDs)
Optional	• Deployment type (buried, on-air) • Fiber state

OTS and OMS

OTS, as the physical link between line amplifiers to ROADMs, is optional in the model. once provided, it helps to understand the full path of OMS. This path is useful in several applications:

- Root cause analysis can detect the impacted upper links and service in case of OTS failure
- Shared risk analysis when multiple optical or IP links share the same OTS

OMS links are mandatory for discovery of an WDM optical network. it is the topology in use by wavelengths and Crosswork Hierarchical Controller builds the optical layer displayed in 3D map with OMS links between optical sites

OCH, SCH and NMC

OCH, wavelength, spans from one Muxponder to another and serves as the underlay for OTN or ZR and is mandatory to a proper discovery of optical network.

NMC, spans from ROADM to ROADM may exist in some of the deployments as the underlay for OCH. its discovery helps to fully map the wavelength to OMSs. NMC appears in Crosswork Hierarchical Controller model but so far was not discovered by any of the adapters.

Discovery of OCHs assignment to super channel is also important to know the capacity of the super channel and its sub channels.

Table 4. OCH, SCH and NMC

Category	Required	Data
Inventory	Mandatory	• Devices - Muxponders, ROADMs, ILAs, OLAs (list of all network elements, their allocation to a site, their vendor, type, name, loopback address, software version, etc.) • Shelves • OTS, OMS, OCH Ports (a list of ports per line card, their type, number of sub-ports, slot, and state, etc.) • Transceivers/pluggable ports (a list of pluggable optics per port, their type, serial number, vendor, number of sub-ports, slot, and state, etc.)
	Optional	• Cards (their type, serial number, slot in the chassis and state, etc.) • Utility cards (fans, power shelves and cards) • NMC termination points • ILA (Line Amplifiers)
Configuration	Mandatory	• Cross-connects • OMS links with main and protection paths • Links adjacencies (destination node, port, connected via fiber or cross-connect) • Subnetwork connections • OCH/OTSi connections with main and protection paths • Super channels

Category	Required	Data
		• Operational and admin state of all links
	Optional	• Fiber distance
State	Mandatory	• Port admin and operational states • Channel admin and operational states
Performance (Line Side)	Mandatory	• Span loss • Latency • Length • Rx/Tx power (historical 15 minutes bins)

OTN

OTU, as a server layer for various client signals, has 1:1 relation with its underlay OCH and spans over the line side of the network. The OCH may ride over multiple NMCs

This layer is mandatory in the model and is deduced by Crosswork Hierarchical Controller.

Client signals as E-Line or OTN line, spans from one Muxponder to another, rides on top of ODU0-4, as the high order trail in various rates, fixed or flexible (ODUk, ODUc, ODUFlex).

Cross connects between client ports to ODU signals must be provided. By then, ODU client link (which can be OTN line or E-Line service) is mapped as upper layer of server trail ODU.

Table 5. OTN

Category	Required	Data
Inventory	Mandatory	• Transponders/Muxponders • OUT, OC, ODU0-4 ports (a list of ports per line card, their type, number of sub-ports, slot, and state, etc.) • Transceivers/pluggable ports (a list of pluggable optics per port, their type, serial number, vendor, number of sub-ports, slot, and state, etc.) • Ethernet client ports inventory • STS/STM ports inventory
OTN Configuration	Mandatory	• ODU signals on OTU interface • TTI • SAPI/DAPI (for OTN cross-connects only) • ODU0-4 cross-connects • ODU connections
SONET/SDH Configuration	Mandatory	• J0 / TTI trace to identify SDH/OTN
State	Optional	• Port admin and operational states
Performance (Line Side)	Mandatory	• FEC/BER (enable/disable)
Performance (Client Side)	Mandatory for ETH ports	• Eth port counters (packets, octets, drops, CRC errors). These should be 15 or 5 minutes cumulative counters for all ETH ports. Network time (RTC) should be synced to the same time-zone • Latency

Microwave

Radio links between Microwave devices are modelled in Crosswork Hierarchical Controller as the underlay for Ethernet links.

This information can only be discovered from Radio EMS or NMS, using proprietary protocols or APIs.

Table 6. Microwave

Layer	Description
Radio Medium	The lowest layer Radio link
Radio Channel	All RF parameters of the Radio channel (power, modulation, polarization, protection type, bandwidth, frequency)
Radio Aggregate	The logical group of Radio channels

Ethernet and IP/MPLS

Crosswork Hierarchical Controller model supports all packet connectivity layers of routers and Ethernet switches. When discovering information directly from the device, Crosswork Hierarchical Controller makes use of the topology protocols (LLDP, IGP) and performance data to map layers and paths of links (see Cross Layers Mapping).

Any layer discovered on top of L3 topology, such as LSPs and VPNs are optional and once discovered, enables wide set of analysis and simulations by all Crosswork Hierarchical Controller applications.

Table 7. Ethernet and IP/MPLS

Layer	Description
L3 Physical	L3 physical (or R_Physical) is the physical link connecting two router ports. It may ride on top of an ETH link if the IP link is carried over the optical layer.
AGGREGATION LINK	Aggregation is Link Aggregation Group (LAG) where multiple ETH links are grouped to create higher BW and resilient link.
Logical Link, IGP, LSP	Logical link (or R_Logical) connects VLANs between two IP ports.
IGP	IGP is the link between two routers that carries IGP protocol messages. The link represents an IGP adjacency.
LSP (Tunnel)	LSP is the MPLS tunnel or Segment routing policy created between two routers over IGP links, with or without TE options.
SR Policy	A segment routing policy as a tunnel between two routers, over IGP links, with SID list.
L3-VPN Link	The connection between two sites of a specific L3-VPN (can be a chain of LSP connections or IGP path).

MPLS and SR Tunnels

Discovering TE tunnels contributes to getting optimal value from Crosswork Hierarchical Controller. Crosswork Hierarchical Controller discovers RSVP-TE LSPs and Segment routing policies, maps them to the IGP topology in the lower layer and to VPN services in the upper layer.

Crosswork Hierarchical Controller adds the discovered tunnels and policies with their bandwidth reservation information to the model and keep their path updated. It enables service path tracking, detection of increased latency, resiliency assurance, root-cause analysis, and failure simulation impact.

Crosswork Hierarchical Controller discovers the SR policy color, preference and SID list and models it above the IGP topology. Underneath SR policies, Crosswork Hierarchical Controller adds SR segments as a layer between IGP links to policies. SR segments represents shared paths between policies where each segment is a sub links between two segment IDs used by multiple policies.

LDP paths are not added to the model as a layer, but Crosswork Hierarchical Controller calculates LDP paths based on IGP metrics retrieved from the network. This calculation helps to simulate failure impact and predict network behavior, suggest optimizations, finds shared risk between two paths, and calculates resources for new services.

L3-VPN

Crosswork Hierarchical Controller can discover a full set of L3-VPN configuration, type (full mesh, hub-and-spoke) and state directly from routers and construct it into the network model and topology.

The required data to discover the L3-VPN includes:

- VRFs and their endpoints, the LSPs or IGP paths between VRFs, RD/RT and traffic direction role of each VRF with import/export rules.

Table 8. L3-VPN

Category	Required	Data
Configuration	Mandatory	• Router names, IP addresses • Physical interfaces (name, speed, MTU, MAC address) • Logical interfaces (interface ID, VLAN) • IGP interfaces, OSPF or ISIS (area, IP address, IGP metrics, TE metrics, peering IP address) • For ISIS – LSDP ID, ISIS level • Interface Properties (name, IP, capacity, description, etc.)
	Optional	• LLDP • TE LSP properties (ID, hold priority, setup priority, speed, technology, protection role) • Segment routing policy properties (color, preference, SID list) • MPLS-TE LSP actual paths • Configured SRLGs • L3 VRFs (RD/RT import/export rules, interfaces)
State	Mandatory	• ARP table • MAC Address tables • Interface operational state
	Optional	• Links latency • MPLS-TE LSP state (protection state) • RSVP bandwidth reservations • Interface admin state
Performance	Mandatory	• Eth Port counters (packets, octets, drops, CRC errors). These should be 15 or 5 minutes cumulative counters for all ETH ports. Network time (RTC) should be synced to the same time-zone
	Optional	• RSVP-TE LSP counters (packets, octets, drops)

Notifications

Crosswork Hierarchical Controller needs to receive notifications on changes in inventory and topology.

Each notification includes an indication of the type of event, the topology from which it originated, and the affected node, link, or termination point. Also, as a convenience to applications, additional data of the affected node, link, prefix, or termination point is included. While this makes notifications larger in volume than they need to be, it avoids the need for subsequent retrieval of context information that might have changed in the meantime.

Crosswork Hierarchical Controller can register to a WebSocket connection and receive notifications.

Event Types

Each notification must be one of the following types as described in this section.

Each event can be of an action type of add, remove, or update.

Inventory Event

This event is generated by an inventory item (HW).

It notifies of any action performed on the item or of any property change such as:

- Item installed
- Item removed
- Item changed operational status
- Item power down

Link Event

This event is generated by a link.

It notifies of any action or update on:

- New link was configured
- Operational status change
- Link was rerouted, path was changed

Service Provisioning

Crosswork Hierarchical Controller supports creation of new transport client services and photonic services.

Crosswork Hierarchical Controller abstracts the service model and provides users with a simple and intuitive user interface to provision new services.

It is assumed that the domain controller implicitly handles the creation/use of the underlay path (OTSiMC, OTN, MPLS-TP) as required to fulfil the service request.

The table below defines the required parameters per service type.

Table 9. Service Provisioning

Service type	Provisioning Parameters
OTSiMC (between ROADMs)	Service name Service ID Bandwidth Baud rate

Service type	Provisioning Parameters
	Frequency Protection option (1+1, 1+1+r) Endpoints Optimization goal (minimize path by admin cost, latency, or number of hops) Per path, for main, redundant, and restored paths: • Included nodes/links in path • Excluded nodes/links from path Disjoint from a path of an existing service
Photonic Services (OCH Trail between Transponders/Muxponders)	Service name Service ID Bandwidth Baud rate Frequency Protection option (1+1, 1+1+r) Endpoints Optimization goal (minimize path by admin cost, latency, or number of hops) Per path, for main, redundant, and restored paths: • Included nodes/links in path • Excluded nodes/links from path Disjoint from a path of an existing service
Circuit E-Line / OTN line	Service name Service ID ODU signal/ETH rate Protection option (1+1, 1+1+r) Endpoints Optimization goal (minimize path by admin cost, latency, or number of hops) Per path, for main, redundant, and restored paths: • Included nodes/links in path • Excluded nodes/links from path Disjoint from a path of an existing service
Packet E-Line	Service name Service ID Protection option (1+1, 1+1+r) Endpoints CIR/EIR VLAN IDs Optimization goal (minimize path by admin cost, latency, or number of hops)

Service type	Provisioning Parameters
	Per path, for main, redundant, and restored paths: • Included nodes/links in path • Excluded nodes/links from path Disjoint from a path of an existing service

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