

# Don't miss the operations piece

Crosswork HCO

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*“Design is the silent  
ambassador of your brand.”*

Paul Rand

# Agenda



- Crosswork HCO in a nutshell
- HCO in Crosswork Architecture
- Typical use cases
- HCO Applications
- Getting the value with SHQL
- The joint solution of NSO & HCO

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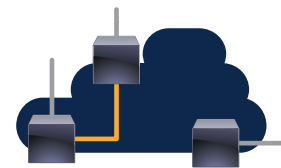


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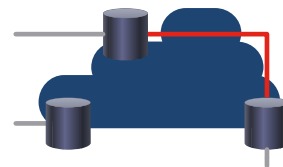
- Transport networks are a patchwork of technologies, domains, layers, and vendor turfs
- Most still rely on a siloed, highly manual, and error-prone operational apparatus
- Current network data is fiendishly difficult to collect, correlate, and utilize



IP Aggregation NW



Metro Optical Vendor A

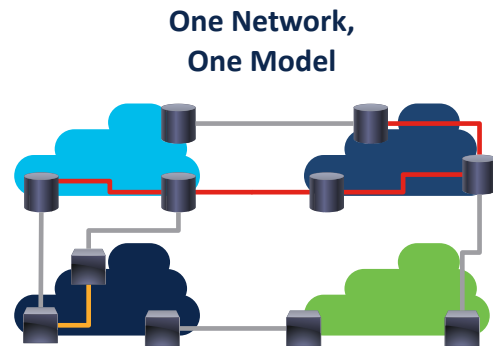


IP Core Network



LH Optical Vendor B

- Automatically acquire domain-specific network data
- Normalize into network structure
- Understand how domains in one layer are connected
- Understand how layers are connected to each other
- Analyze the network to identify issues
- Visualize it
- Automate it



## Complete

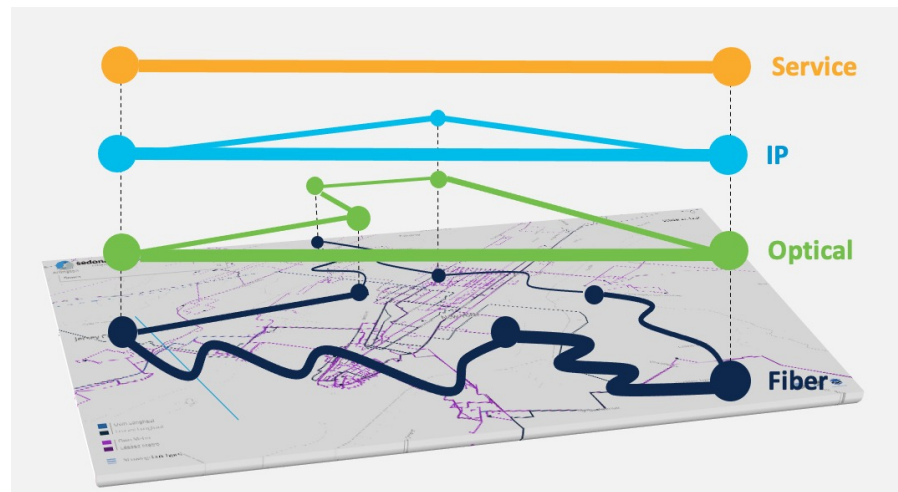
Multilayer, multivendor, and multidomain topology, traffic, and services (SDN and legacy)

## Current

automatically and ongoingly discovered – directly from the network

## Correlated

dynamically deducing cross-domain connectivity



## Multi-layer view

A 3D view of IP & Optical  
Transport across multiple domains

## Inventory

Devices, cards, ports,  
pluggables, shelves

## Assurance

Link and service assurance with  
RCA and L0-L3 PM analysis

## Analytics

Tools to simulate failures,  
shared risks, failure root causes

## Provisioning

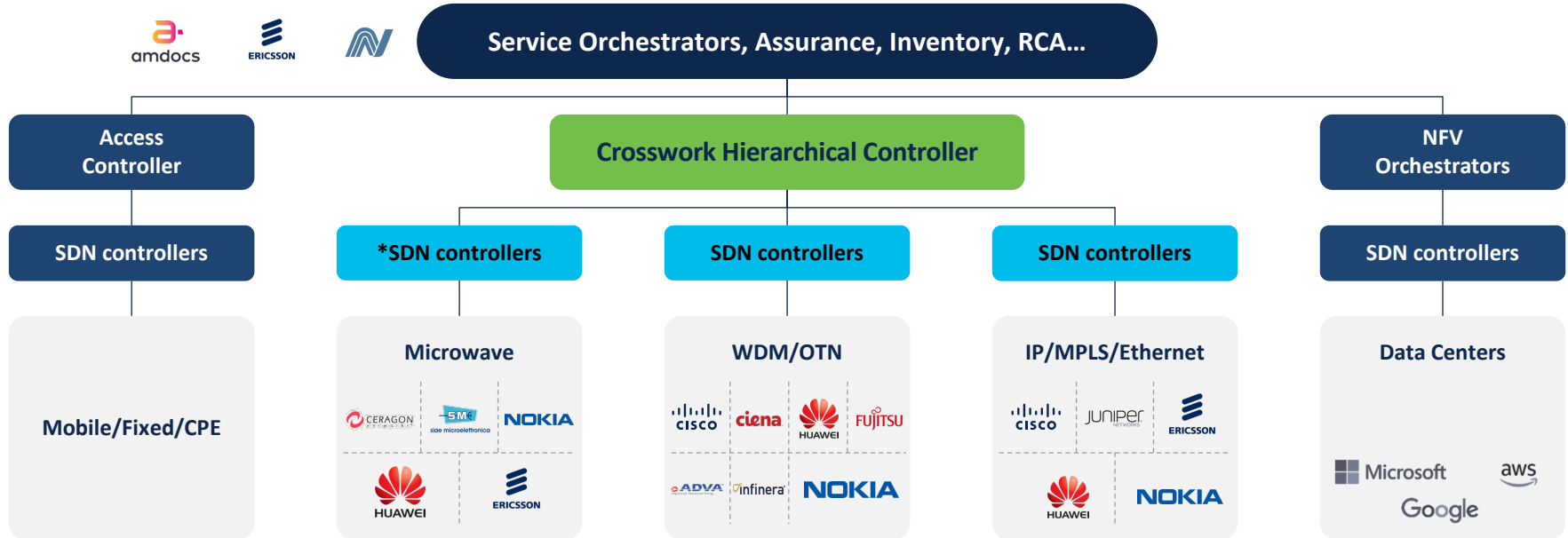
CRUD of optical services and  
IP VPNs across domains



# Automating SP transport network

Across layers, vendors, and domains

Next-Gen OSS



Crosswork Hierarchical Controller pre-integrated with most of the vendors

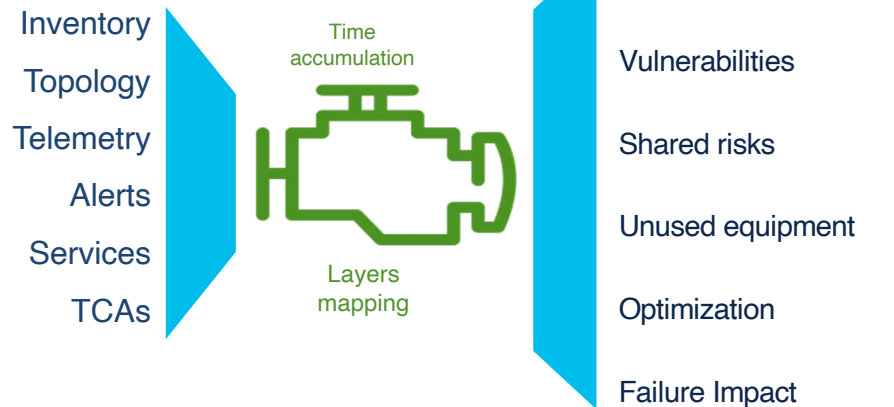
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# Analytics

HCO collects data from multiple sources and turns it into intelligence



# Assurance

Root Cause Analysis, show  
services impacted by  
failure in any later

## Root Cause Analysis

INFO  
This application finds the failed lower layer links that are the root cause of a link failure.

Root Cause  
1 ITEM

▼ SD1BKL01-1-1-5&8<->SD1SL001-1-2-5&8

► LSP

▼ L3 Physical

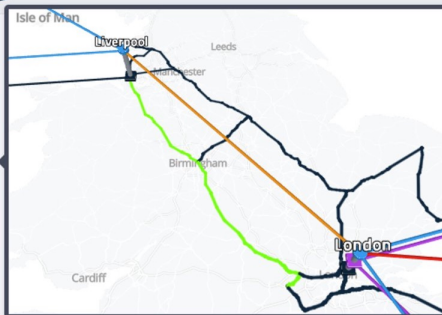
CR1.BKL-TenGigE0/0/0/3<->CR2.DUS-TenGigE0/0/0/0  
CR1.BKL-TenGigE0/0/0/2<->CR2.SQY-TenGigE0/0/0/2  
CR1.BKL-TenGigE0/0/0/1<->CR2.MAN-TenGigE0/0/0/1  
CR1.BKL-TenGigE0/0/0/0<->CR2.LIV-TenGigE0/0/0/1

► ETH

▼ OCH

SD1BKL01-1-3-1<->SD1CAM01-1-8-1  
SD1BKL01-1-10-1<->SD1DUS01-1-4-1  
SD1BKL01-1-7-1<->SD1LIV01-1-6-1  
SD1BKL01-1-5-1<->SD1WES01-1-6-1  
SD1BKL01-1-9-1<->SD1SQY01-1-5-1  
SD1BKL01-1-8-1<->SD1MAN01-1-6-1

This optical (OMS) link is the root cause...



...for all these IP link failures

# Assurance

## Service and TE tunnels performance

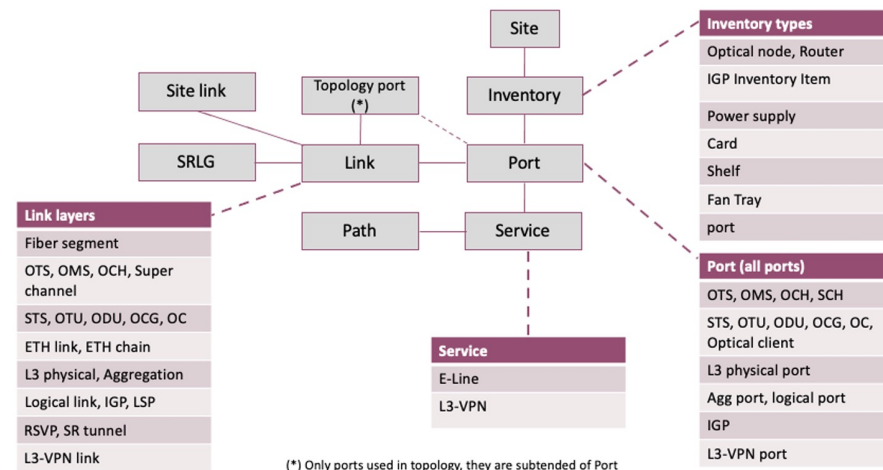
### Correlates between topology layers to performance info:

- Show utilization of all LSPs between site A to site B
- Show utilization of all LSPs between site A to site B or between router A to router B
- Sum traffic of all LSPs over specific IP link
- Compare traffic of all LAG members to find imbalance



# Active Inventory

## Unified, real-time view of multiple vendors' inventory



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3D and metro  
view of multi-  
layer topologies



Inventory  
search &  
tabular reports



Simulate  
failures and  
assess impact



Simulate and  
find network  
vulnerabilities



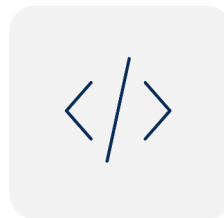
Analyze IGP  
path and PCE  
for new paths



RCA for impacted  
services upon  
failure



Service and  
network  
performance



Design, save and  
run SHQL queries  
as reports



History and time  
machine analysis  
across layers



Provision new  
optical and IP  
services



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## Problem

- Raw network data model too complex for BI tools
- Costly OSS development due to need to ingest complex network models



## Solution

### Sedona Hierarchical Query Language (SHQL)

Extract complex network data, in a simple, flat structure

- Navigation up and down the layers
- Transform from one object type to another
- Integrated time machine

“All core routers”:

```
inventory_item[.type = "ROUTER" and .name contains "CR"]
```

“All ports of Cisco edge routers”:

```
inventory_item[.type = "ROUTER" and .name contains "ER" and .vendor = "Cisco"] | port
```

“All logical links going to/from site FRA”:

```
site[.name contains "FRA"] | inventory_item | port | link [.layer = "R_LOGICAL"]
```

“All WDM links that are down and affect an LSP that is down”:

```
link[.layer = "LSP" and .operStatus = "DOWN"] | downward | port |  
link[.layer = "OMS" and .operStatus = "DOWN"]
```

# Example – find if there are shared OMSs between two LSPs

SHQL

Get first LSP

Get all OMSs where LSP traverses through

Get second LSP

Get all OMSs where LSP traverses through

Get all OMSs that exist in both lists

Saved Queries

link[.name="CR2.DUS:CR2.BIL:lsp\_0"] | downward | link[.layer="OMS"] as p; link[.name="CR2.DUS:CR1.BIL:lsp\_0"] | downward | link[.layer="OMS"] as w; link[.guid in p and .guid in w]

RESULTS (9)

OMS Link (9)

| Guid                          | Layer | Name                          | OperStatus | PathGroupType | Paths                            | PortA                         |
|-------------------------------|-------|-------------------------------|------------|---------------|----------------------------------|-------------------------------|
| 9 ITEMS                       |       |                               |            |               |                                  |                               |
| LI/oms/022fa130aca541bb/38... | OMS   | SD1GIR01/1-3-5&8 to SD1PAM... | UP         | SINGLE_PATH   | [{'guid': 'PA/oms/022fa130aca... | PO/oms/022fa130aca541bb/3...  |
| LI/oms/b0bd0180e1c79218/8...  | OMS   | SD1BCN01/1-2-5&8 to SD1MA...  | UP         | SINGLE_PATH   | [{'guid': 'PA/oms/b0bd0180e1...  | PO/oms/b0bd0180e1c79218/...   |
| LI/oms/b0bd0180e1c79218/0...  | OMS   | SD1BCN01/1-5-5&8 to SD1GIR... | UP         | SINGLE_PATH   | [{'guid': 'PA/oms/b0bd0180e1...  | PO/oms/b0bd0180e1c79218/...   |
| LI/oms/990aae8f0fc12944/38... | OMS   | SD1STU01/1-3-5&8 to SD1ZU...  | UP         | SINGLE_PATH   | [{'guid': 'PA/oms/990aae8f0fc... | PO/oms/990aae8f0fc12944/38... |
| LI/oms/738790a2aca5de20/0...  | OMS   | SD1MAR01/1-5-5&8 to SD1MIL... | UP         | SINGLE_PATH   | [{'guid': 'PA/oms/738790a2ac...  | PO/oms/738790a2aca5de20/0...  |

# What can you do with SHQL

## Layer relations

Find all links used by or riding on other links (fiber to L3-VPN)

## Time machine

Use every query with time stamp to get past information

## Shared risks

Find if any specific links/connections share the same resource

## RCA

Find the failed resource that causes above layer links/connections to fail

## Reports

Any inventory and topology report (site survey, capacity, maintenance)

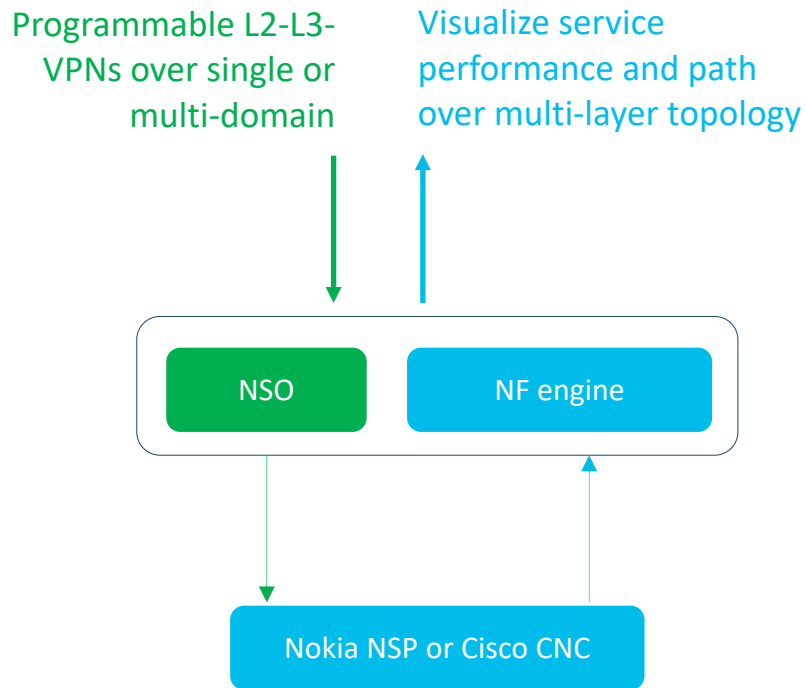
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HCO uses NSO for IP VPNs

Leverage the value of HCO  
for IP provisioning use  
cases



# A phased approach for the best-of-breed solution

- Single VM (NSO as a container)
- Seamless deployment of NSO
- Flex UI natively in HCO
- Synced HA between product

