
cisco Live!
Let's go
#CiscoLive

The bridge to possible

Network Automation with Routed Optical Networking (RON) Architecture

Domenico Zini, Sr. Product Manager

BRKOPT-2637

“Simplicity
is the ultimate sophistication”

Leonardo Da Vinci

CTO of the Duke of Milan – 1482

Cisco Webex App

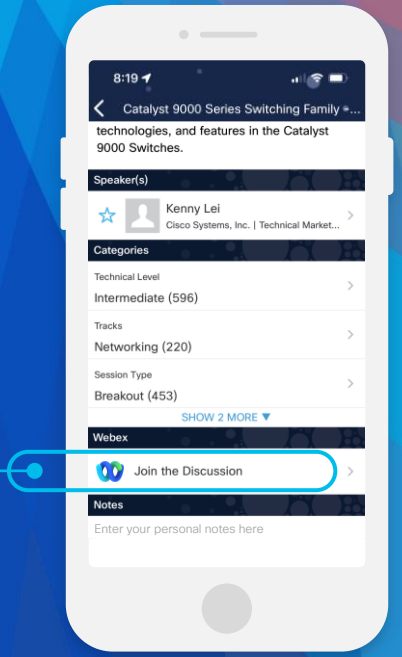
Questions?

Use Cisco Webex App to chat
with the speaker after the session

How

1. Find this session in the Cisco Live Mobile App
2. Click “Join the Discussion”
3. Install the Webex App or go directly to the Webex space
4. Enter messages/questions in the Webex space

Webex spaces will be moderated by the speaker until June 9, 2023.



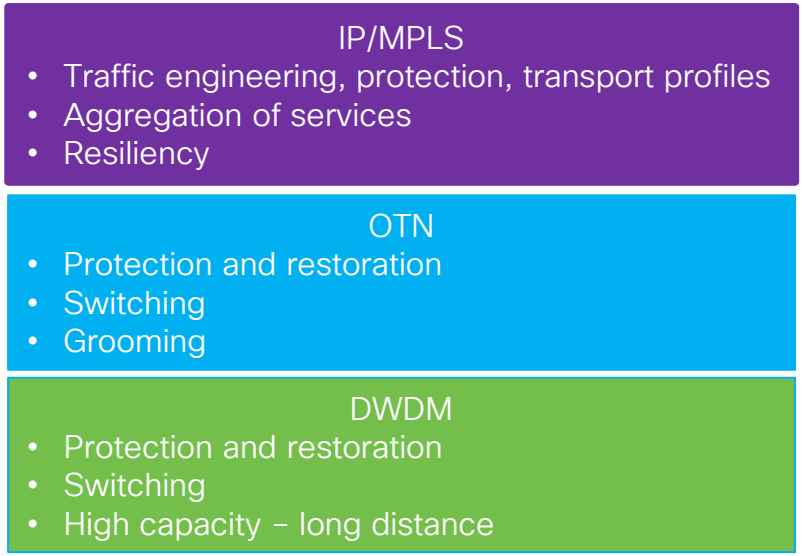
https://ciscolive.ciscoevents.com/ciscolivebot/#BRKOPT-2637

Agenda

- Routed Optical Network Architecture
- Crosswork Automation stack
- What automation tools to choose from the toolset
- Automation use cases

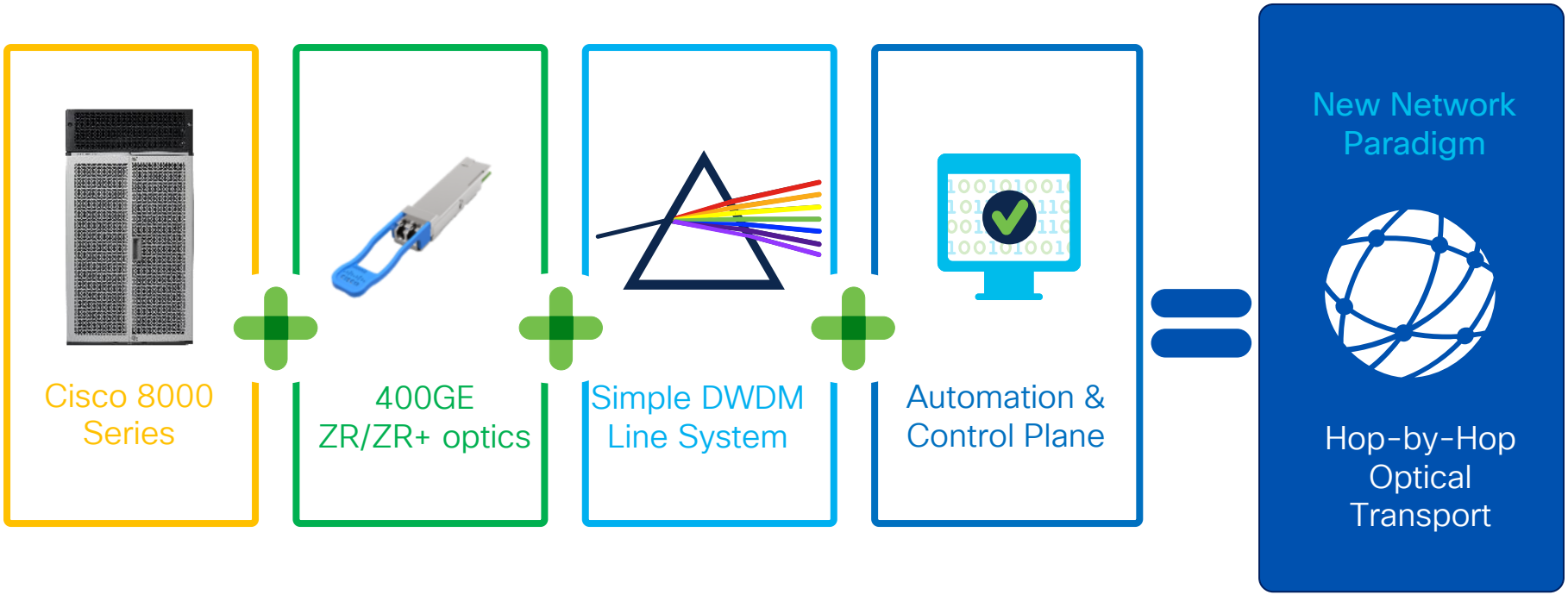
Classic Multi-layer architecture

Complexity breaks the economics



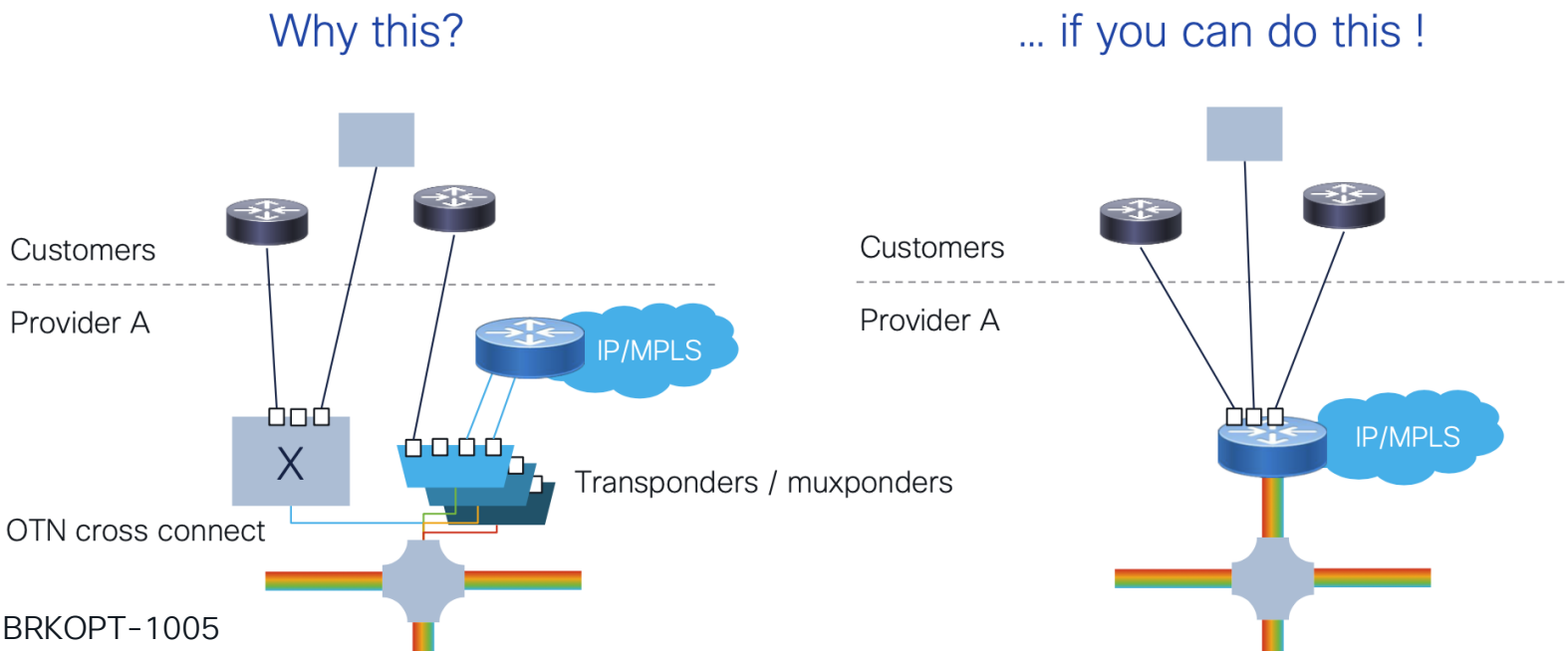
- Each layer originally designed and specialized to solve a specific problem
- Variations and complexity added to each layer
- Engineered independently: sub-optimal asset utilization (CAPEX)
- Operated independently: sub-optimal automation (OPEX)

Technology innovations drive a new network paradigm



A new network paradigm

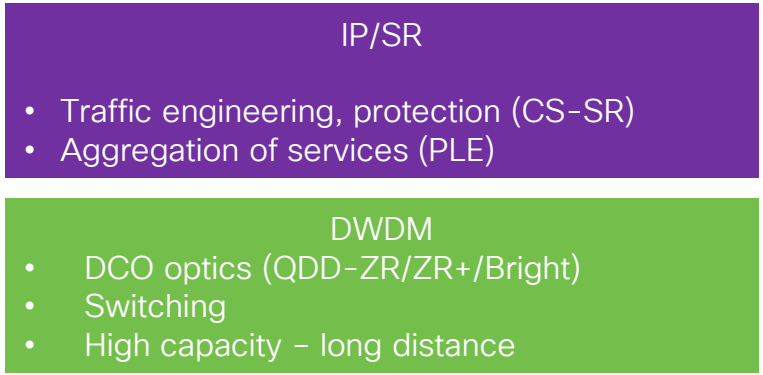
Routed Optical Networking



Source: BRKOPT-1005

Routed Optical Networking Architecture

Sophisticated with simplicity providing estimated total **TCO savings of 45%**

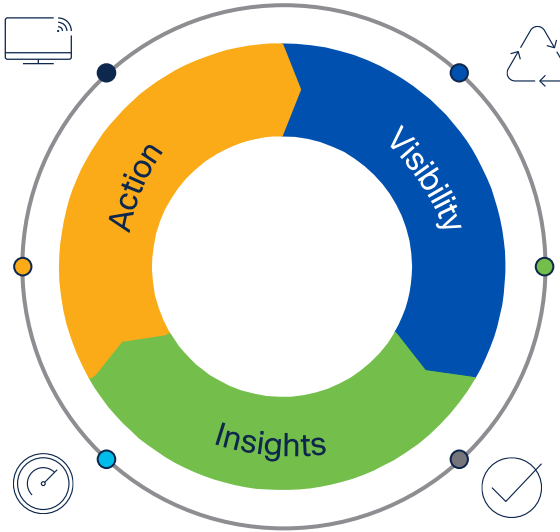


New architecture that brings many improvements

- Better assets utilization with IP and DCO
- Less Power consumption with less network devices
- Flexibility with IP and Capacity with Optical
- Integrated Services with Segment Routing

Crosswork Automation

Operationalizing mass-infrastructure networks



Workflow
Low-code automation workflow

Service provisioning
200+ customers, 170+ multi-vendor devices supported
All Top 10 SP's use NSO in production

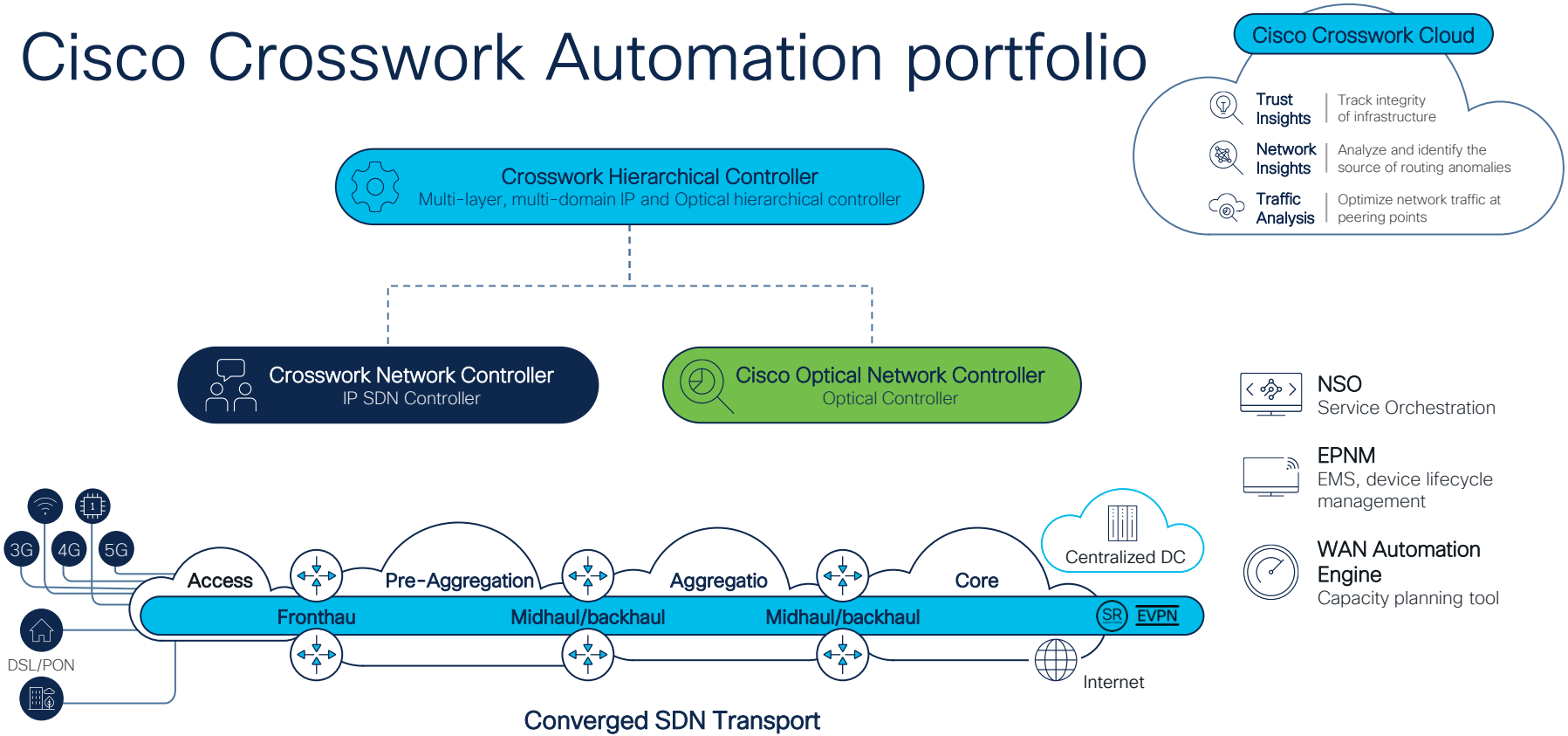
Planning
WAE today with evolution path to NG-WAE modernizing planning and providing better integration with SDN Controllers

Visualization
Multi-vendor, multi-layer single pane of glass with HCO Leading IP SDN Visibility with CNC

Optimization
SR and SRv6 path optimization leadership
#1 IP SDN Controller per top operators like VF

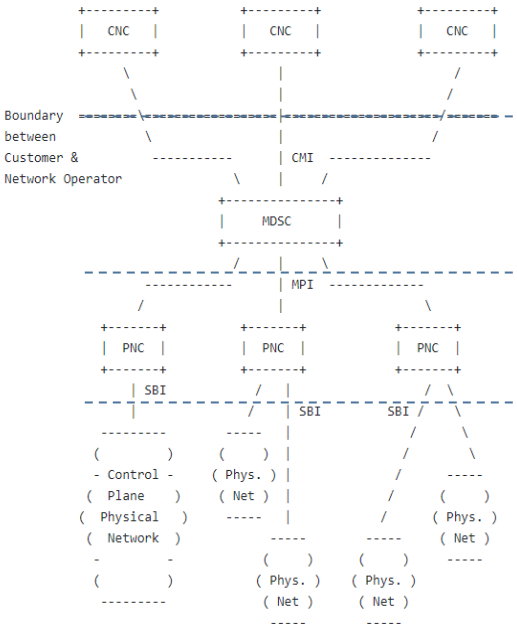
Service assurance
Service Assurance for IP services in CNC and IP/Optical in HCO. Accedian partnership for external probing and Vitria partnership for Alops

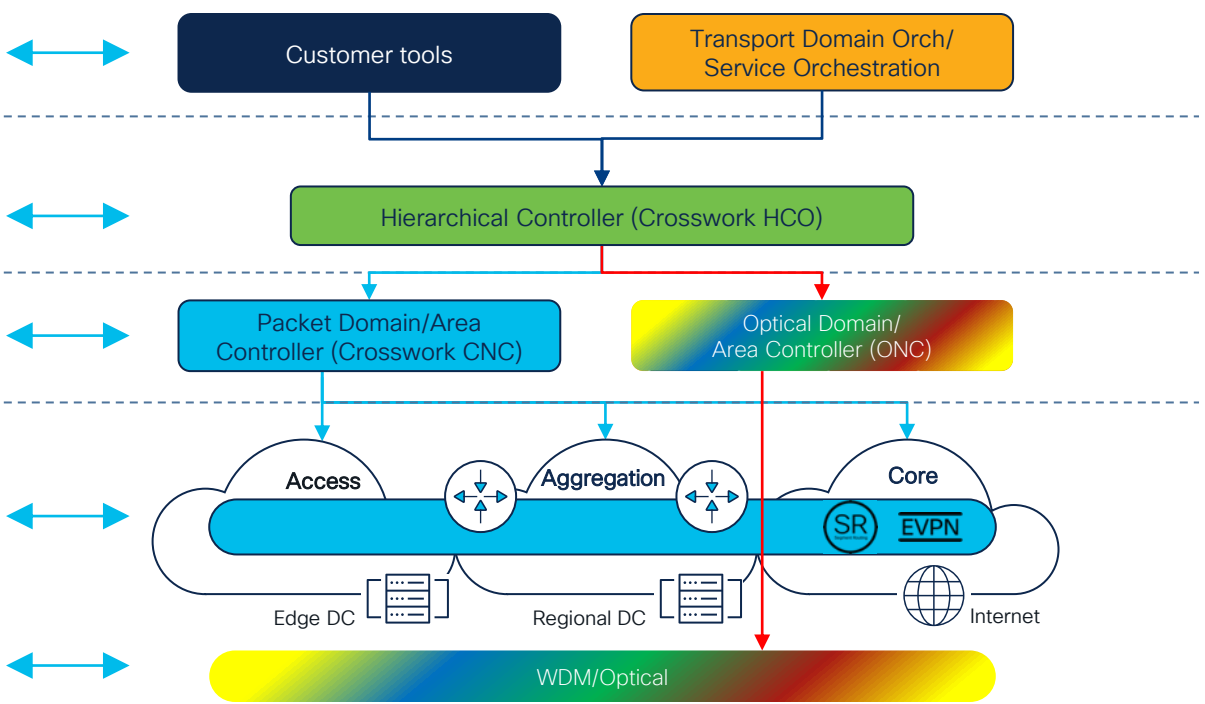
Cisco Crosswork Automation portfolio



ACTN Framework (RFC8453)

Architecture mapping



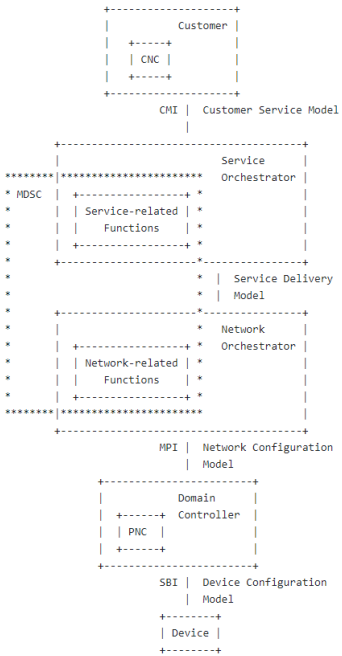


ACTN reference architecture

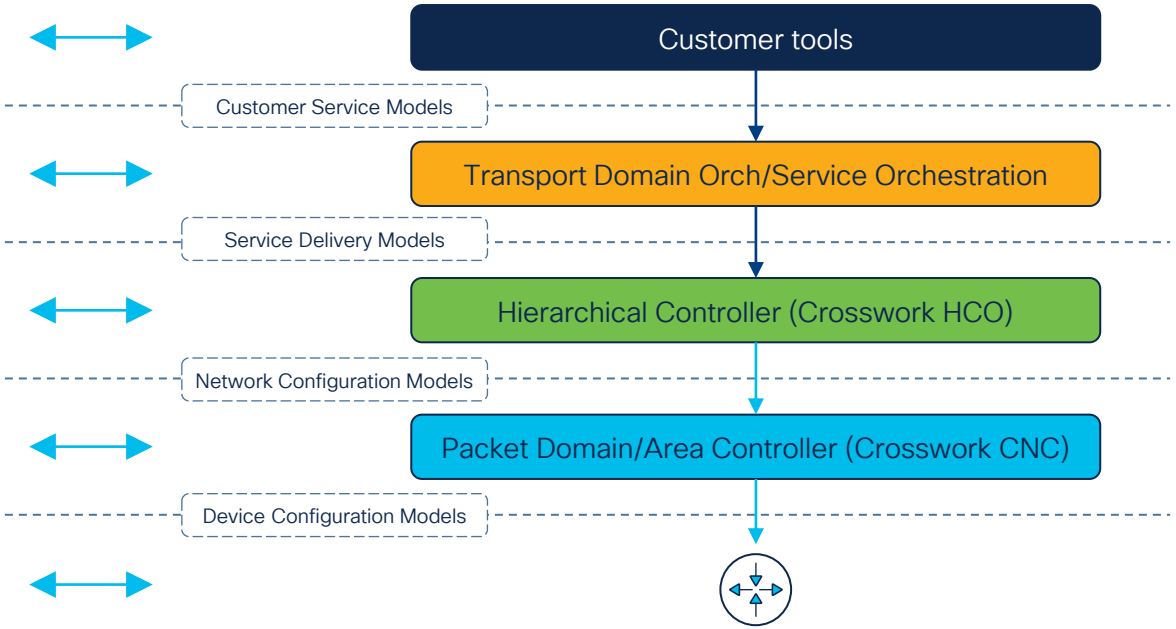
Crosswork reference architecture

ACTN Framework (RFC8453)

Architecture in the context of YANG service models

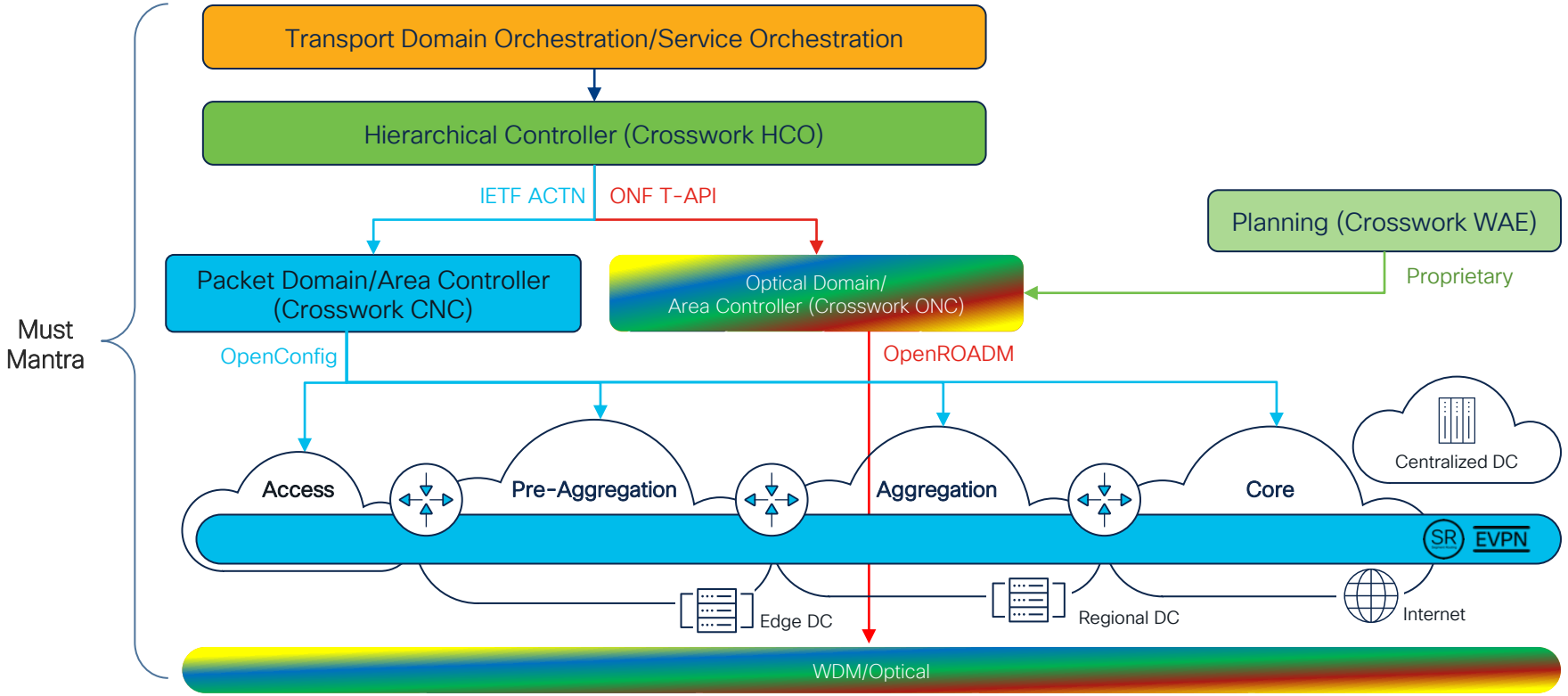


ACTN architecture in the context of YANG service models

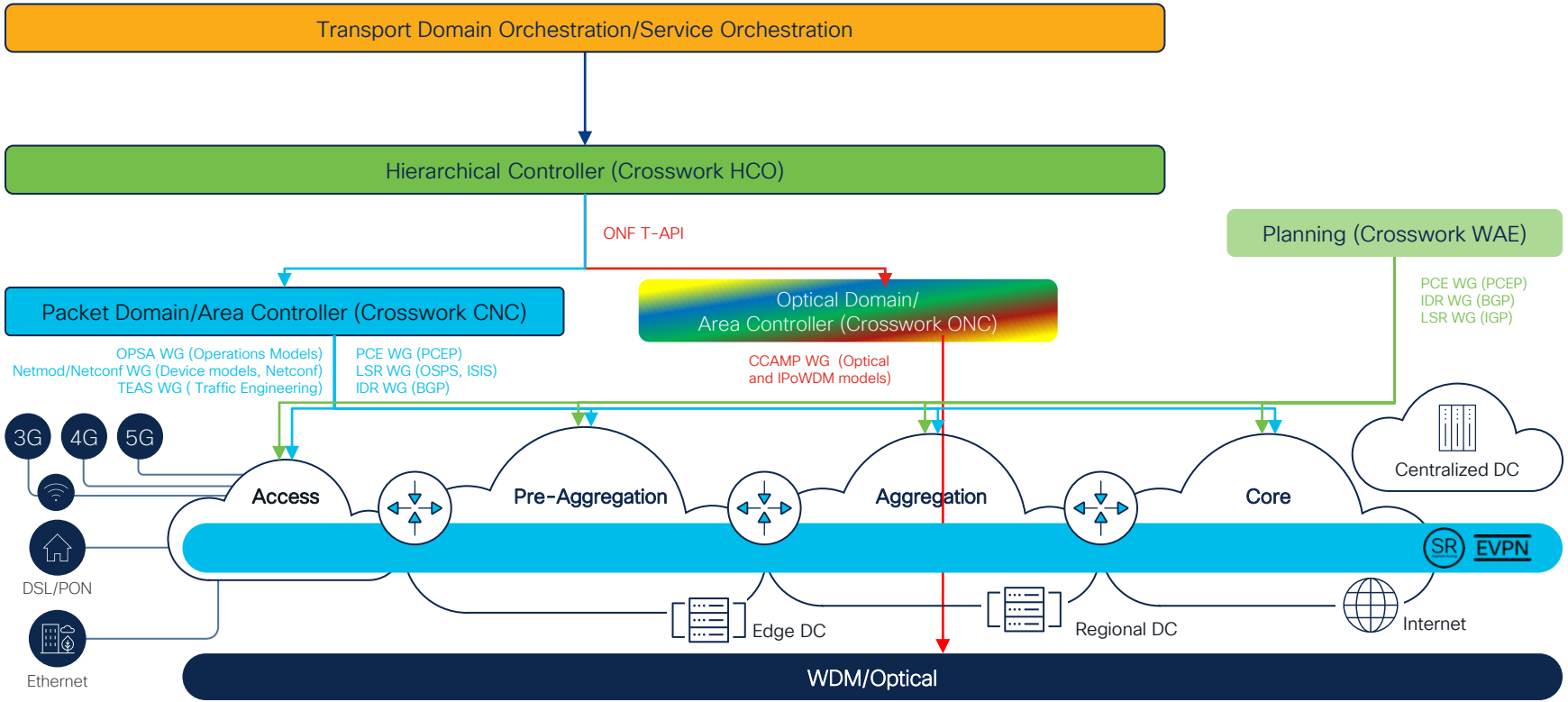


Crosswork reference architecture

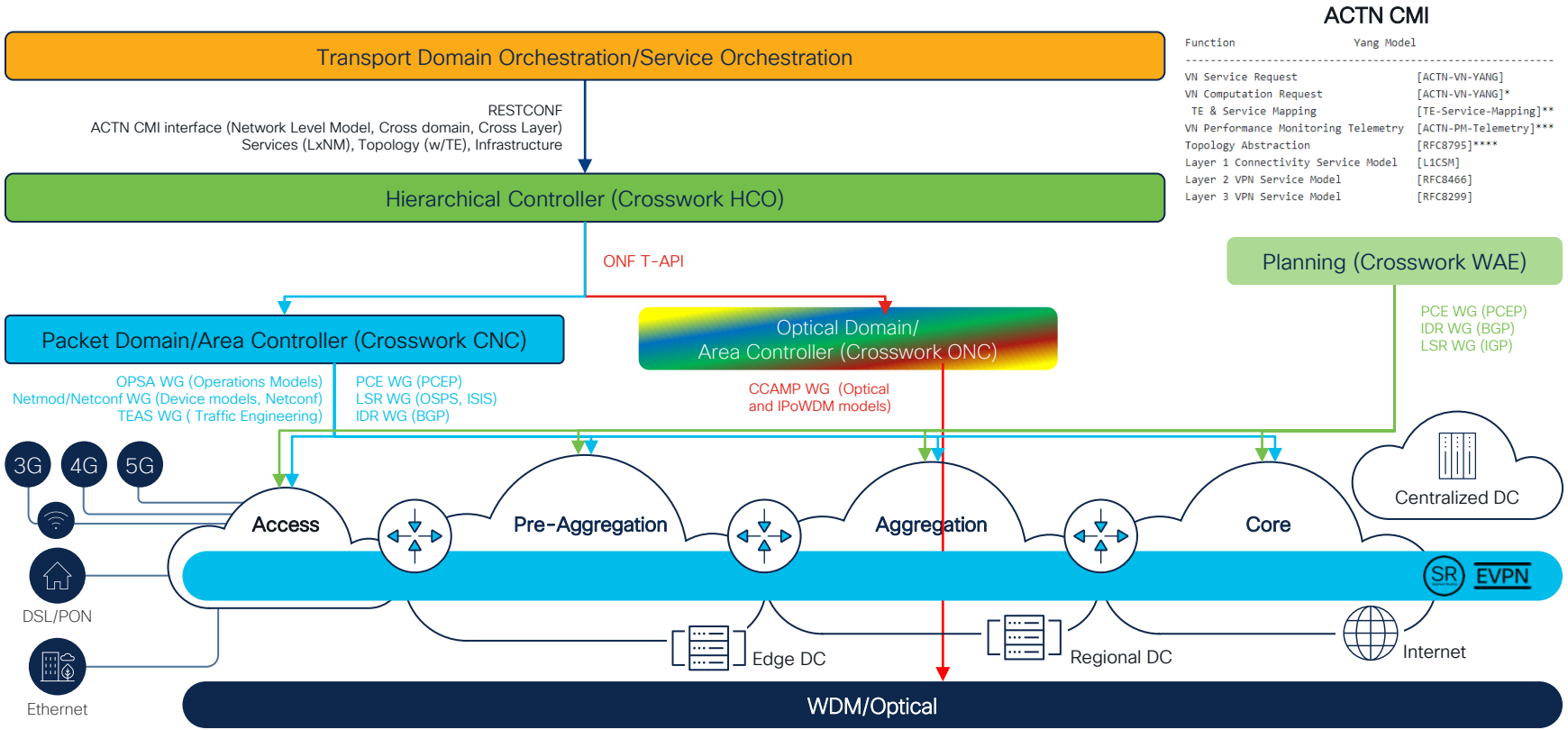
TIP and ONF T-API relevance in the Crosswork portfolio



Crosswork portfolio – Interfaces and protocols



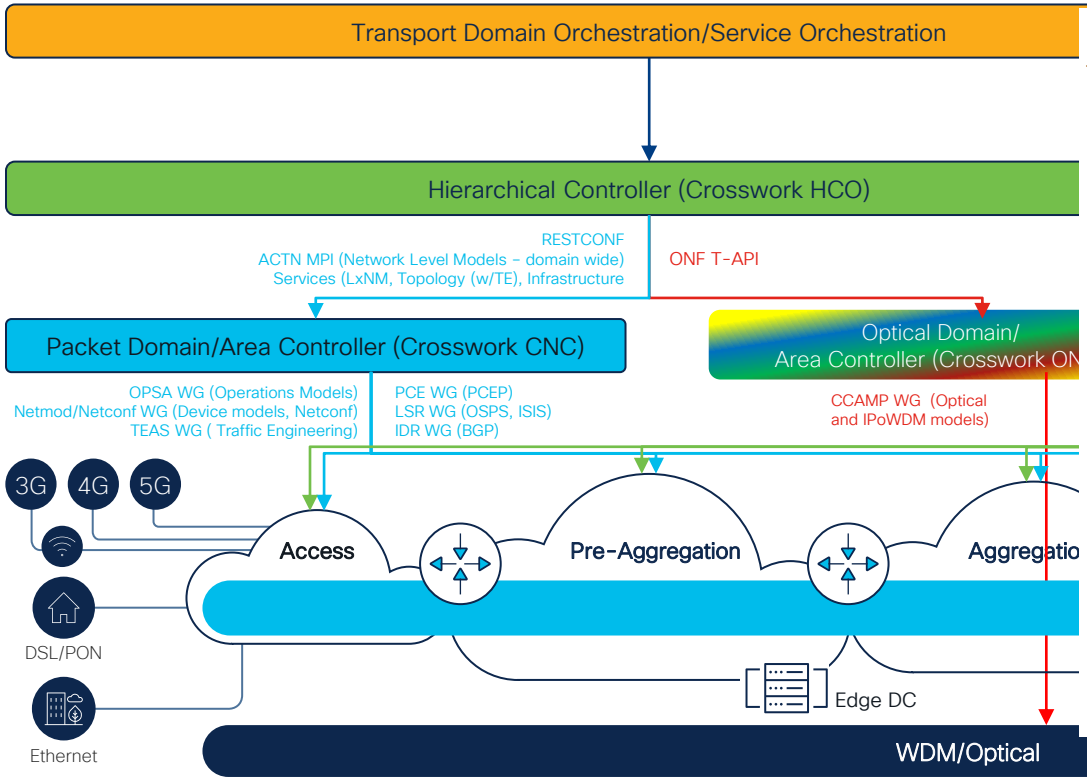
Crosswork portfolio – Interfaces and protocols



ACTN CMI

Function	Yang Model
VN Service Request	[ACTN-VN-YANG]
VN Computation Request	[ACTN-VN-YANG]*
TE & Service Mapping	[TE-Service-Mapping]**
VN Performance Monitoring Telemetry	[ACTN-PM-Telemetry]***
Topology Abstraction	[RFC8795]****
Layer 1 Connectivity Service Model	[L1CSM]
Layer 2 VPN Service Model	[RFC8466]
Layer 3 VPN Service Model	[RFC8299]

Crosswork portfolio – Interfaces and protocols

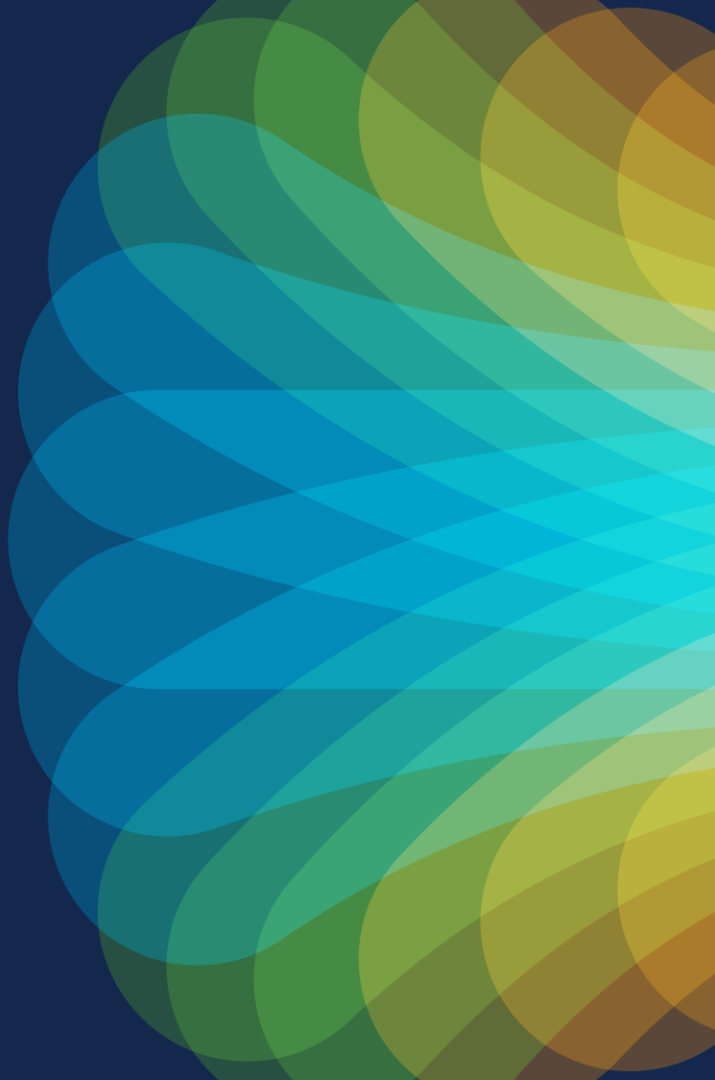


ACTN MPI

Function	Yang Model
Configuration Scheduling	[Schedule]
Path computation	[PATH_COMPUTATION-API]
Tunnel/LSP Provisioning	[TE-tunnel]
Topology Abstraction	[RFC8795]
Service Provisioning	[Client-signal]&[TE-tunnel]*
Client Topology Abstraction	[Client-topo]
OTN Topology Abstraction	[OTN-topo]
WSON Topology Abstraction	[RFC9094]
Flexi-grid Topology Abstraction	[Flexi-topo]
Microwave Topology Abstraction	[MW-topo]
Client Signal Description	[Client-signal]
OTN Tunnel Model	[OTN-Tunnel]
WSON TE Tunnel Model	[WSON-Tunnel]
Flexi-grid Tunnel Model	[Flexigrid-Tunnel]
Service Performance Monitoring	[client-pm]
Layer 2 VPNs	[L2nm]
Layer 3 VPNs	[L3nm]
MPLS-TE topo	[mpls-te-topo]
MPLS-TE Tunnel	[mpls-te-tunnel]
MPLS-TE SR	[mpls-te-sr]

RON Automation

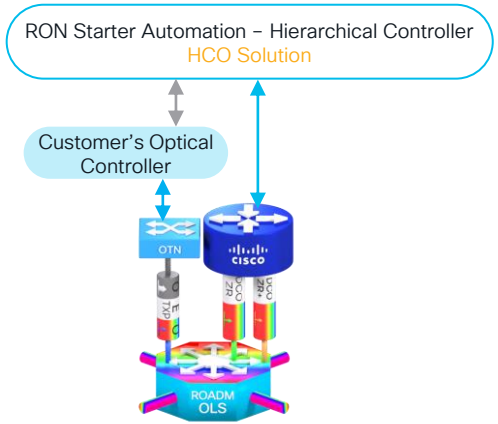
simple ingredients for RON



How the Crosswork tools help the architecture transition

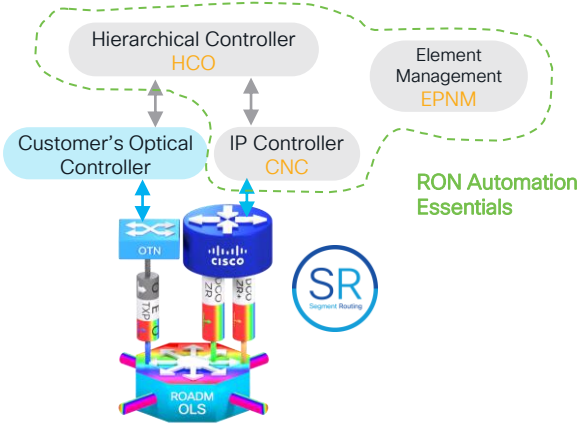
Phase 1
Integrating Transponders

- Introduce RON Starter Automation (Cisco-only Routers with ZR/ZR+)
- HCO-based Solution for ZR/ZR+ & Optical OLS
  - Single Pane of Glass Visualization
  - E2E Optical Circuit Assurance
  - E2E Optical Circuit Provisioning



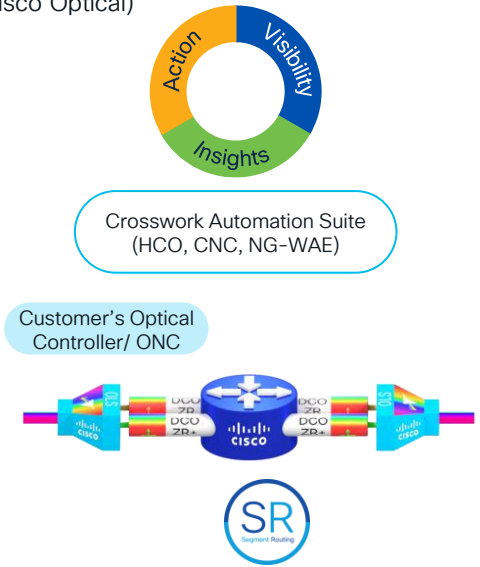
Phase 2
RON SDN Transition → SR Control Plane

- Introduce CNC & EPNM** to HCO
- Leverage RON Automation Essentials Bundle
- SDN Transformation to SR(v6) Control Plane
- CNC IP Path Optimization & Orchestration
- PLE Bandwidth Reservation
- EPNM** Element Management



Phase 3
Complete RON Transformation

- Complete Crosswork Automation Suite with EMS functions migration in CNC (+CONC for Cisco Optical)

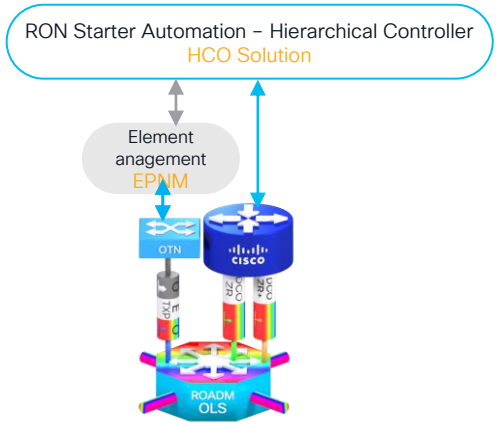


** will be integrated in CNC

Migration from existing Cisco Optical installations

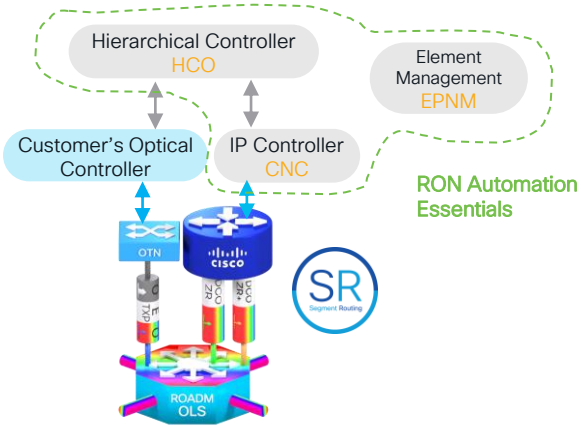
Phase 1
Integrating Transponders

- **keep EPNM and introduce RON starter automation**
- HCO-based Solution for ZR/ZR+ & EPNM for cisco Optical OLS
  - Single Pane of Glass Visualization
  - Optical and ZR/Zr+ Assurance
  - Optical Circuit Provisioning



Phase 2
RON SDN Transition → SR Control Plane

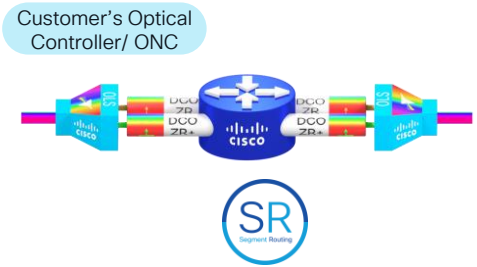
- **Introduce CNC Leverage RON Automation Essentials Bundle**
- SDN Transformation to SR(v6) Control Plane
- CNC IP Path Optimization & Orchestration
- PLE Bandwidth Reservation
- EPNM** Element Management



Phase 3
Complete RON Transformation

- **Complete Crosswork Automation Suite with EMS functions migration in CNC (+CONC for Cisco Optical)**

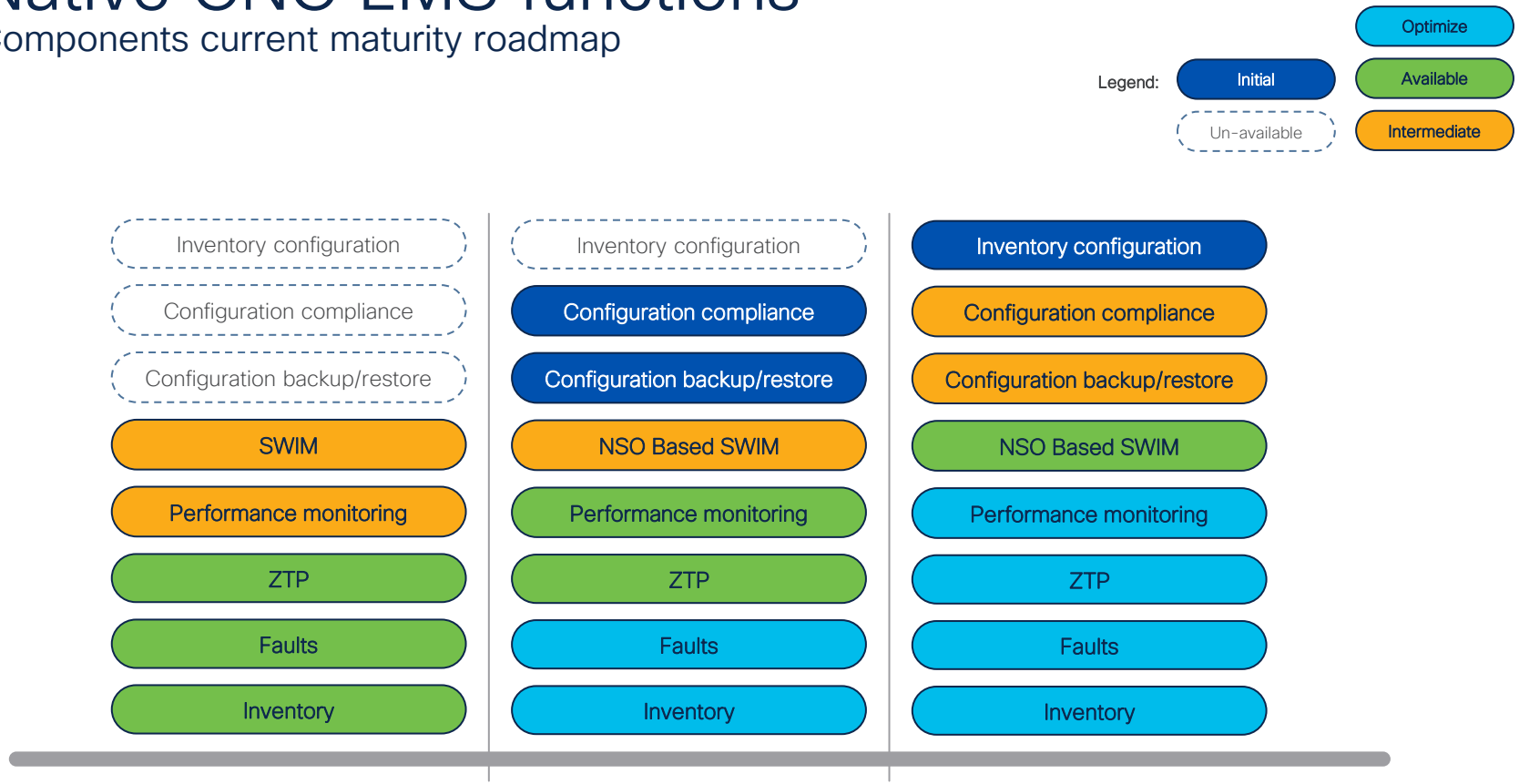
Crosswork Automation Suite
(HCO, CNC, NG-WAE)



** will be integrated in CNC

Native CNC EMS functions

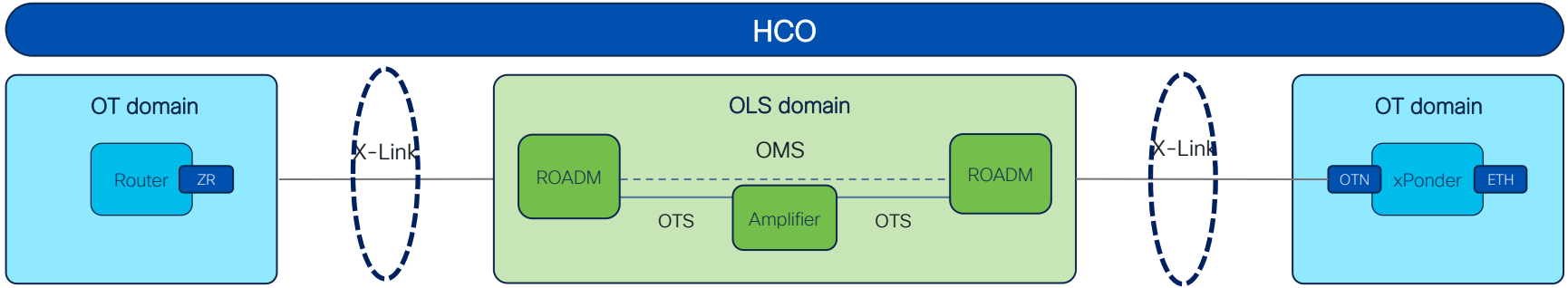
Components current maturity roadmap



Ron Automation Use Case

IP and Optical link (X-link) discovery

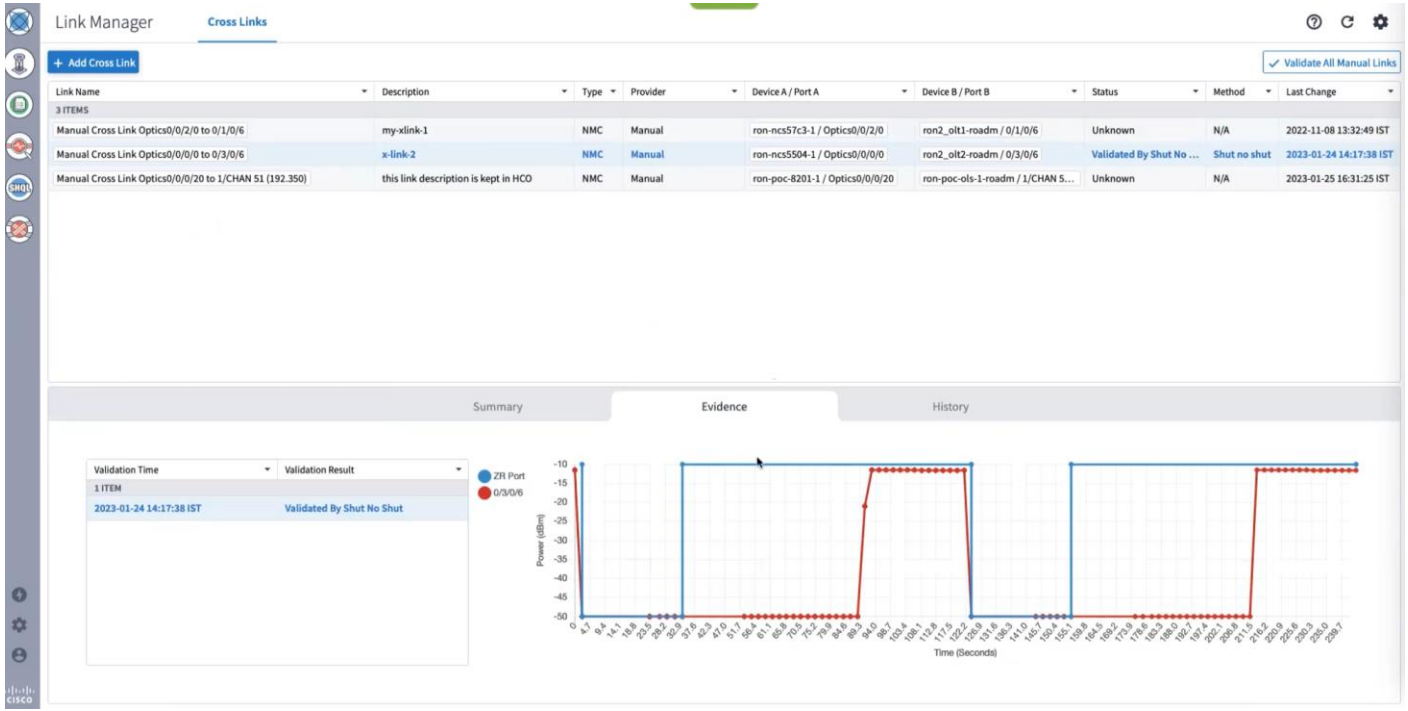
The X-Link connecting the Terminal to the Line system



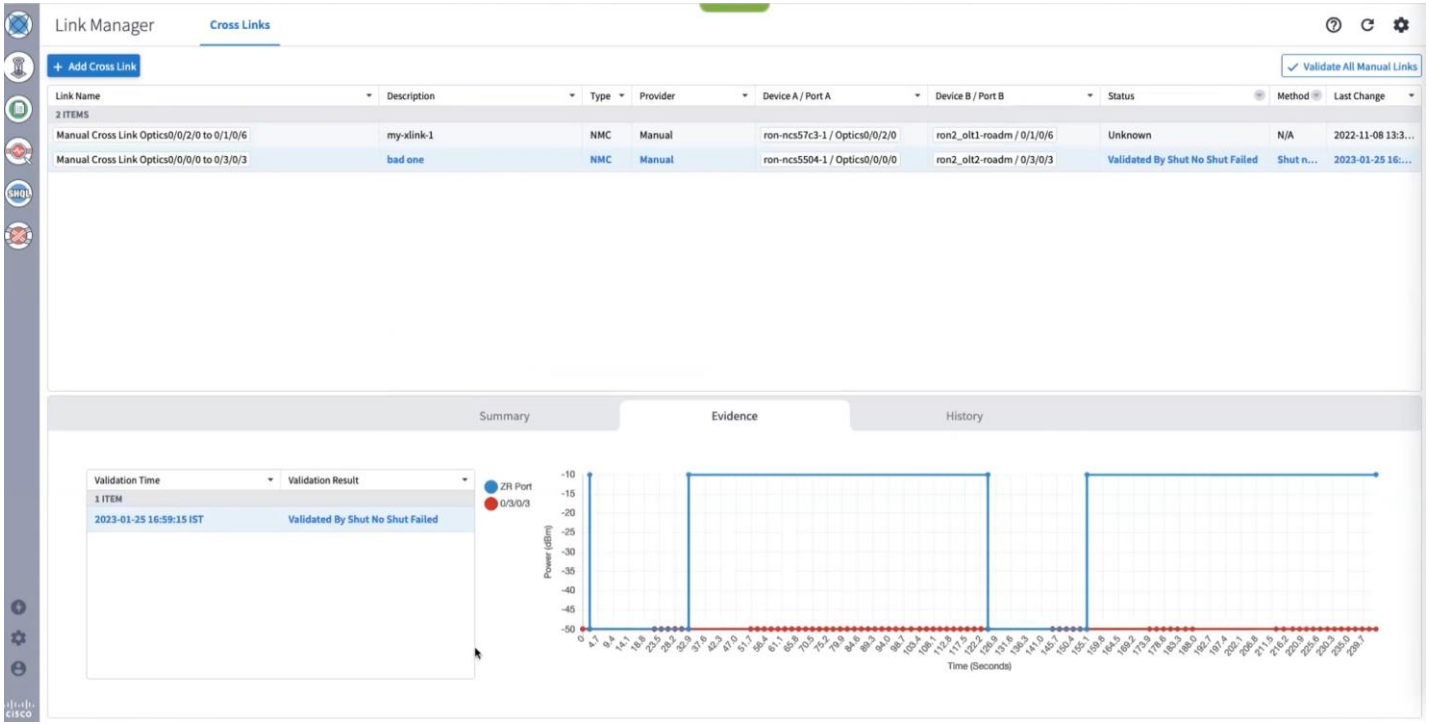
Discovery

- Discover the ZR-OLS cross-links

Optical X-Link Validation



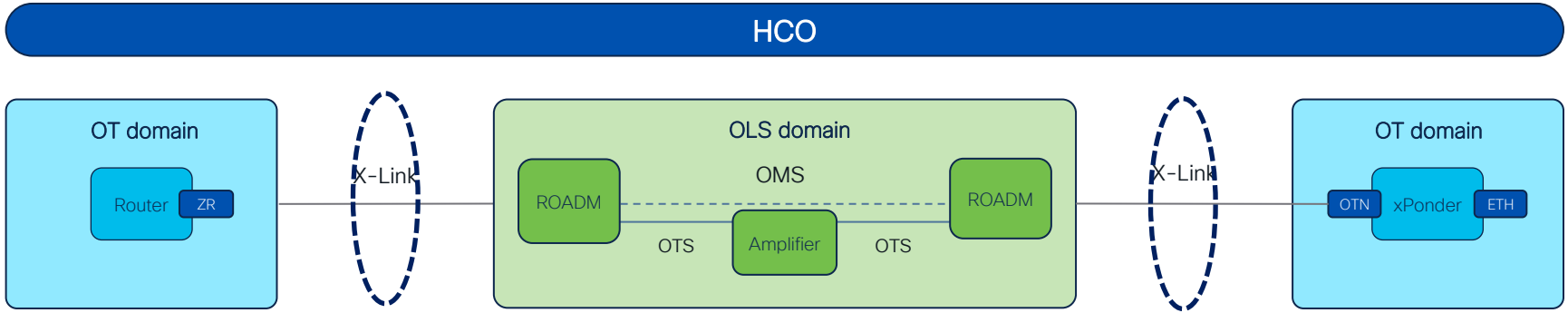
Optical X-Link Validation Failed



Ron Automation Use Case

IP link provisioning

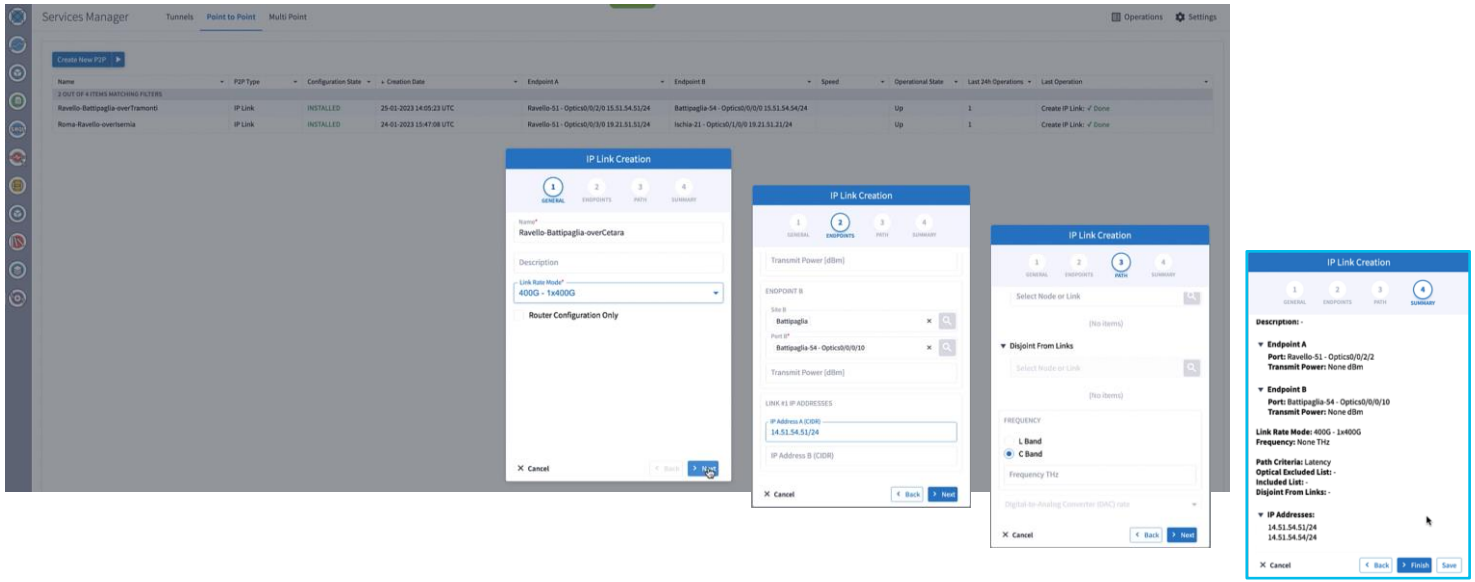
IP link provisioning



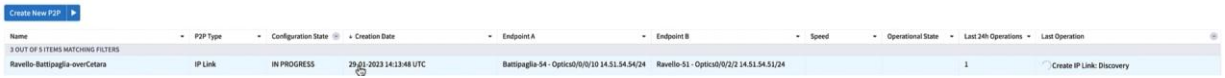
Provisioning

- Create new ZR+ link over OLS, validate ZR-OLS cross-links and provision OCH level and IP level

IP Link creation



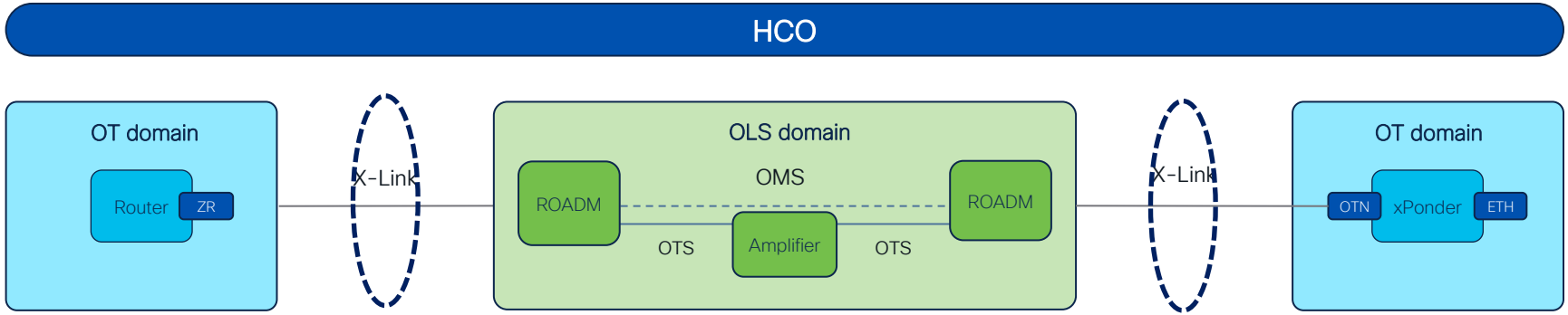
User inputs



Ron Automation Use Case

Multi-layer link assurance

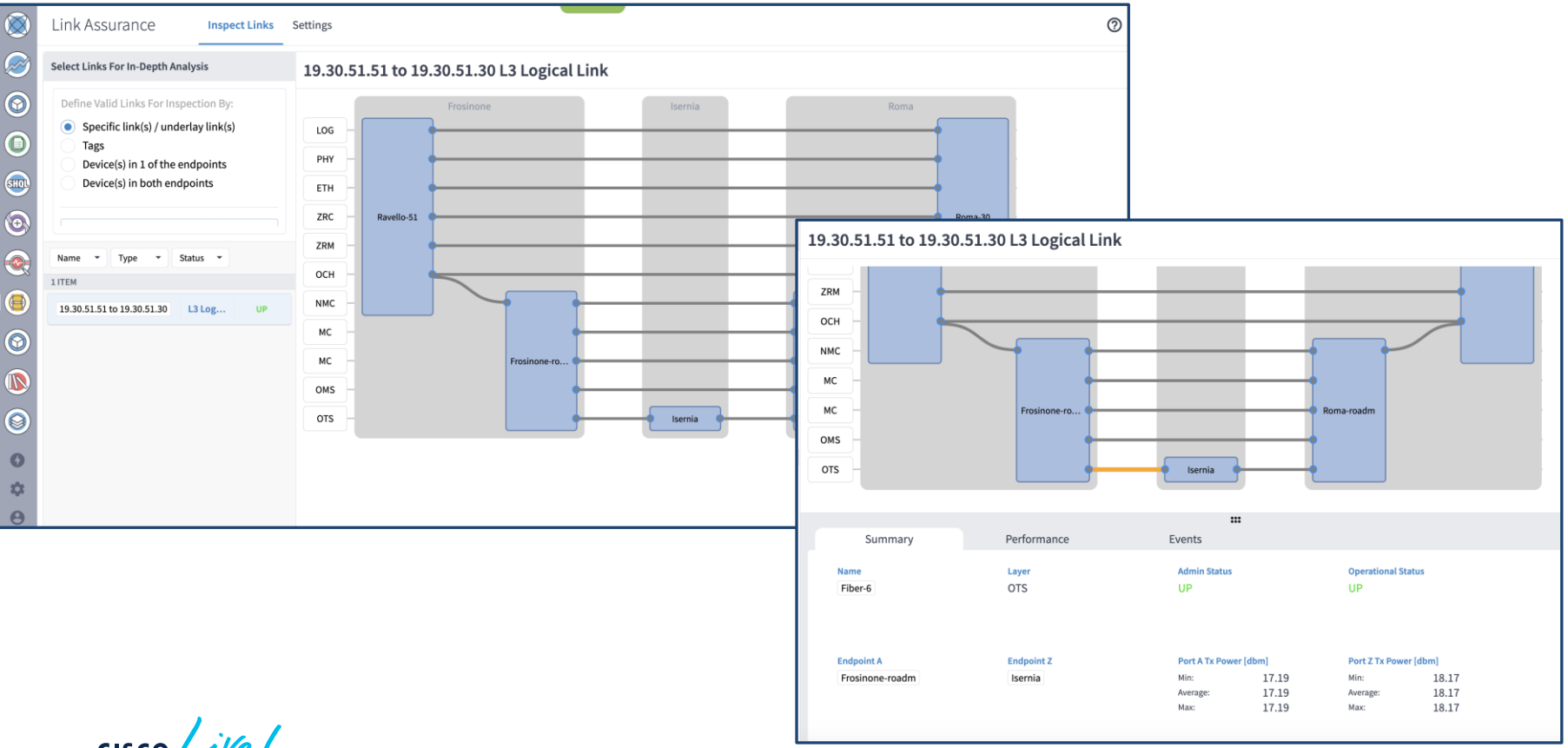
Multi-layer (RON) link assurance



Assurance

- ZR+ link assurance, navigate in layers to get L2, L1, L0 performance summary and graphs – find root cause throughout span
- Color span loss and TCAs on ports

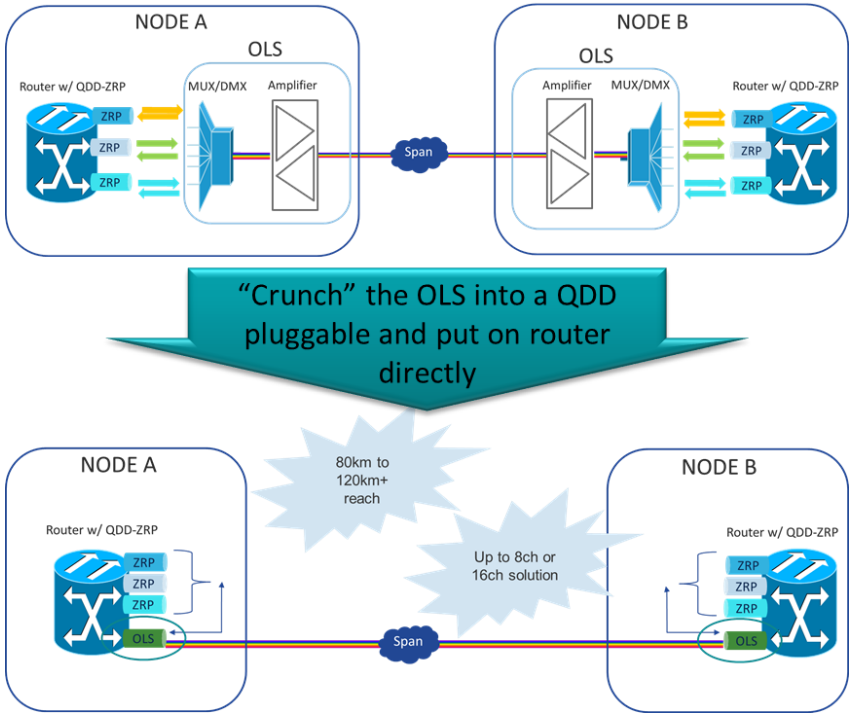
RON Link Assurance



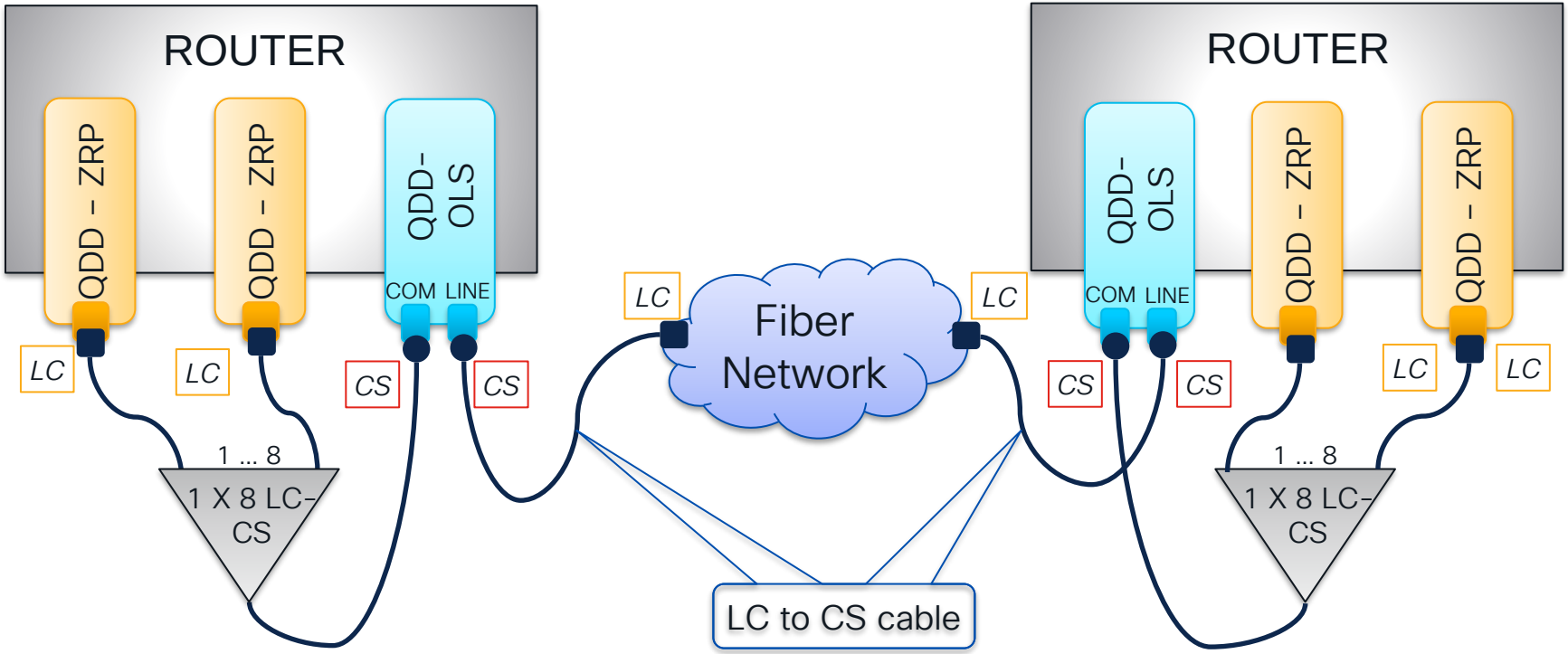
Ron Automation Use Case

Automate optical power control with QDD-OLS

What is QDD-OLS. The High-Level Solution

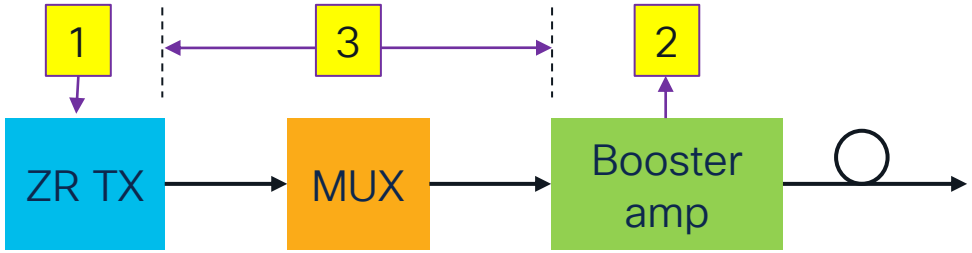


The solution in more details



Discover what type of (passive) MUX

1. Turn on the ZR at a WL with default power level
2. Measure the power at the input to the booster amp (the MUX is passive)
3. Based on the insertion loss identify if a MUX exists and what type of MUX
4. Turn off ZR untli RON link is requested

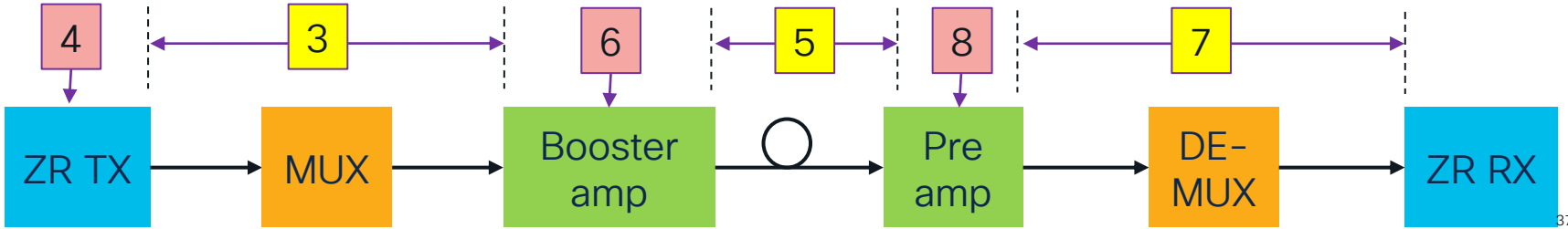


(*) For subsequent WLs it may be harder to measure power transition because other WLs are already up

Tune working set-point of lasers and amplifiers

4. Set the default ZR TX power and unlock the port
5. To obtain the line loss, measure input power at the pre-amp at the remote end (8) and compare to booster output power (6).
6. Set the desired gain in the local booster amp, based on the line loss
7. Calculate de-mux insertion loss by measuring the RX power at the remote ZR and comparing to the output power of the pre-amp (note that 3 should be identical to 7 unless there's a high insertion loss due to bad connector – need to alarm user)
8. Set the pre-amp gain based on de-mux insertion loss (7)

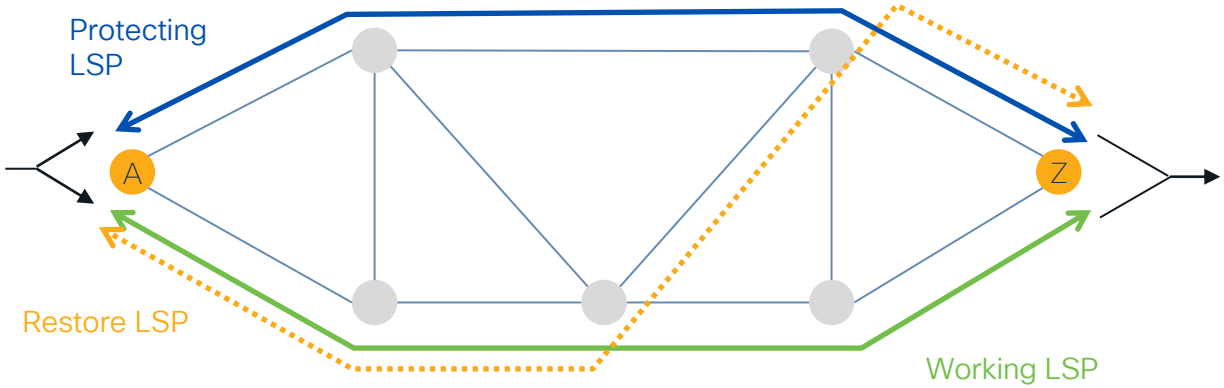
Repeat the process in the opposite direction (if 3 & 7 in the other direction are very different – alarm the user)



Ron Automation Use Case

Manage Private Line Emulation

What is Private Line Emulation aka PLE



Sub-wavelength / Private Line services	Dedicated E-Line	Switched E-Line

PLE
- Bit transparent and respectful of sync (DCR)
- Multiprotocol (Sonet/SDH, OTN, FC, Eth)

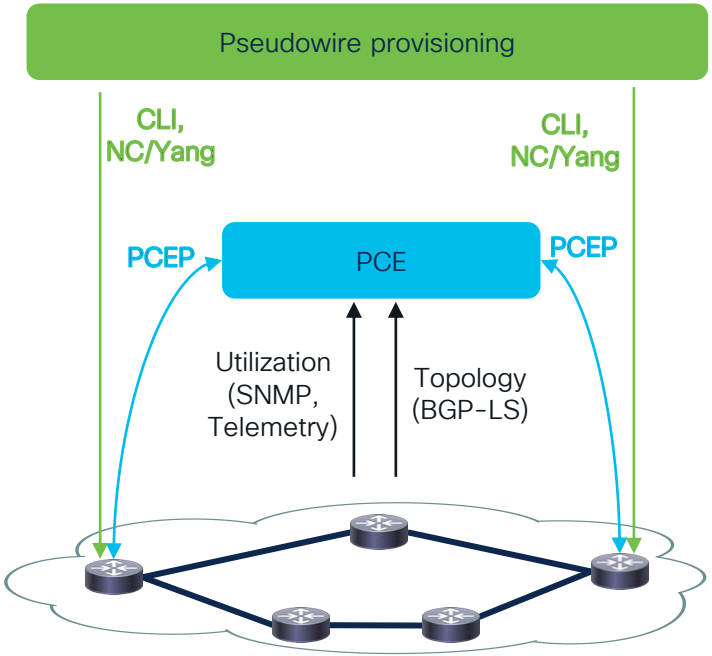
EVP-VPWS
- Ethernet only
- No special HW required

Circuit-style SR (CS-SR)
- Guaranteed bandwidth
- persistent, co-routed, bi-directional paths
- 1:1 End-to-end path protection and restoration

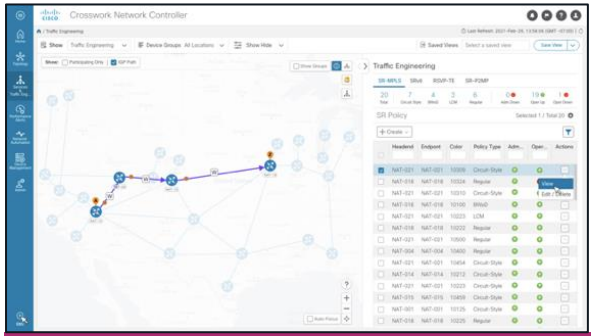
SR
- Scale and simplicity

CNC-based provisioning and bandwidth book-keeping

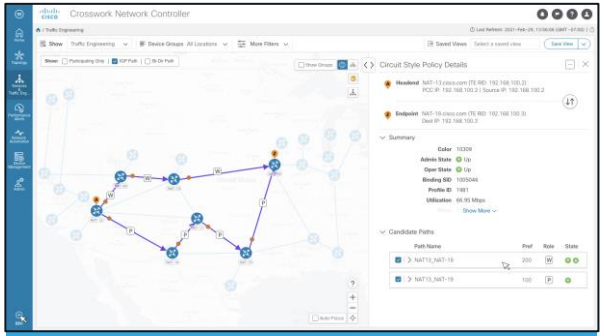
- PLE pseudowire has a distinct bandwidth requirement assigned
- Pseudowire is mapped to one (or more) CS-SR policy
- Headend router requests a path via PCEP from a central PCE
  - Bandwidth
  - Path constraints
- The path is encoded via a list of adjacency SIDs in the packet header
- The central PCE maintains a real time view of
  - the network topology (BGP-LS)
  - All path/bandwidth requests (PCEP)



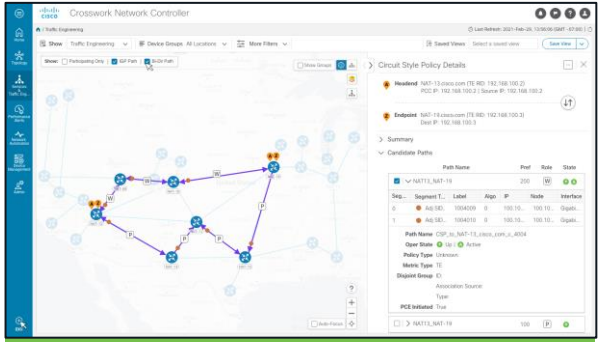
CNC-based visualization and assurance



CS SR-TE Policy Listing



CS policy details
Path Protection



CS Policy details
co-routed bidirectional

- Modern look and feel
- Seamless and consistent experience across various Crosswork application workflows
- Detailed information about CS SR Policies, Path Protection, Co-routed Bidirectional

Key Takeaways

Key Takeaways

- Why Routed Optical Network architecture is a game changer
  - Simpler network for Capex and Opex savings
- Crosswork automation Stack
  - The SW toolkit that glues all the tech advances in a powerful architecture
- What automation components are suited for the different scenarios
  - Transport and IP, Greenfield vs Brownfield
- RON automation use cases

Fill out your session surveys!

Attendees who fill out a minimum of four session surveys and the overall event survey will get **Cisco Live-branded socks** (while supplies last)!

Attendees will also earn 100 points in the **Cisco Live Challenge** for every survey completed.

These points help you get on the leaderboard and increase your chances of winning daily and grand prizes

Continue your education

- Visit the Cisco Showcase for related demos
- Book your one-on-one Meet the Engineer meeting
- Attend the interactive education with DevNet, Capture the Flag, and Walk-in Labs
- Visit the On-Demand Library for more sessions at www.CiscoLive.com/on-demand

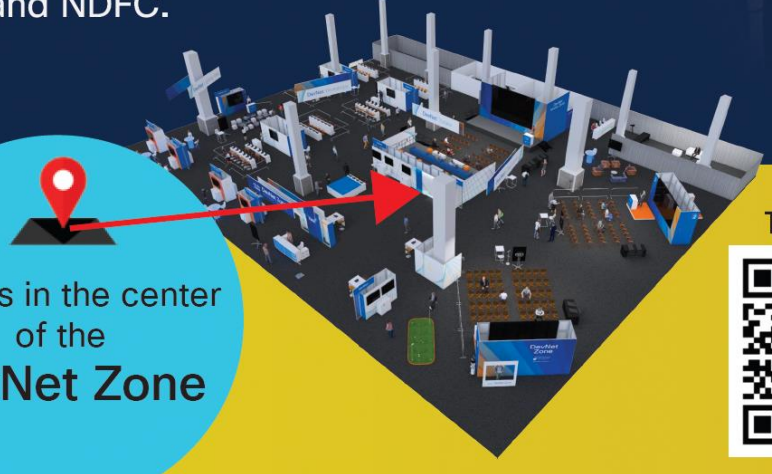
Cisco
Developer

Cisco
DSE Automation

Visit us at ‘Share Your Experience’

Booth #214 in the DevNet Zone

Win prizes by participating in hands-on activities about API quality, developer experience, and insights while working with Crosswork Network Controller, ACI and NDFC.



Find us in the center of the **DevNet Zone**

Take one of these survey and collect the prize at the booth

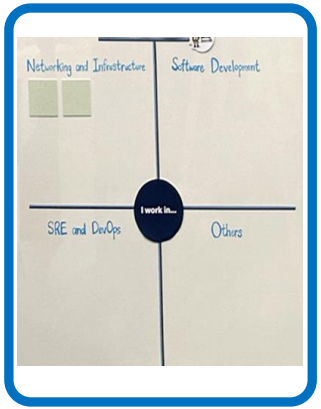
CNC

ACI

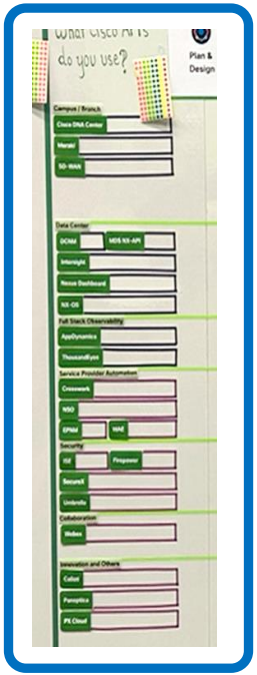
NDFC

Research Activities

Identify Participant Roles

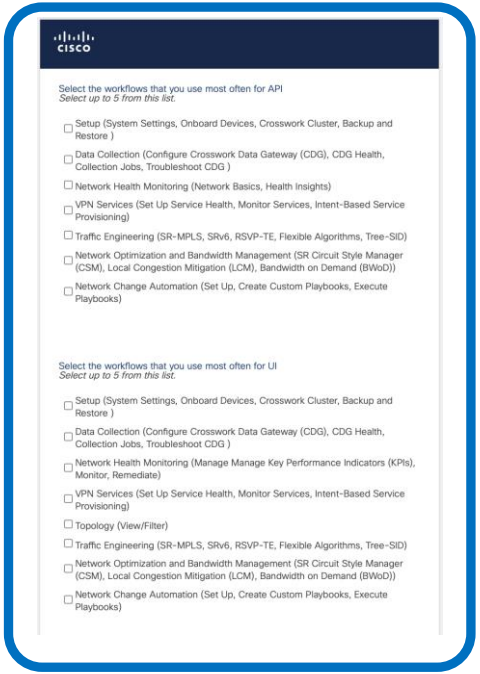


API Usage



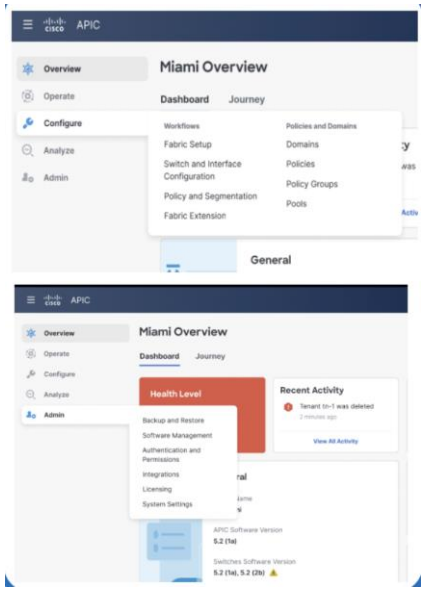
API Developer Support and Developer Documentations

Rank top 10 workflows while using API & UI



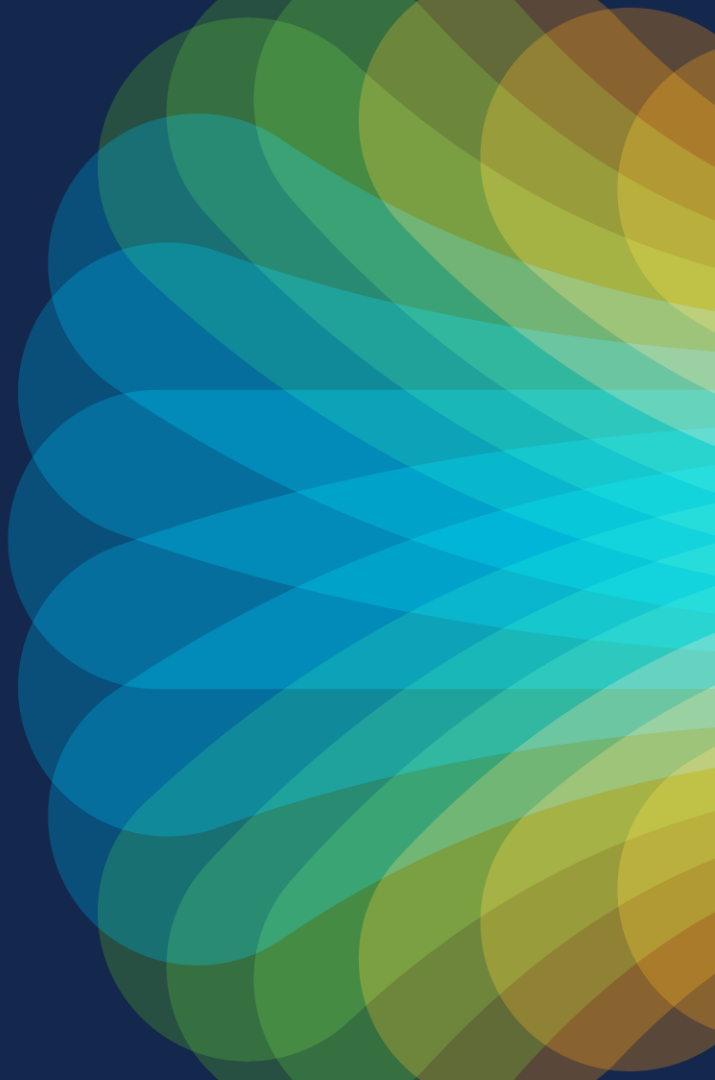
Crosswork Network Controller, ACI and NDFC

ACI Navigation Research



The bridge to possible

Thank you



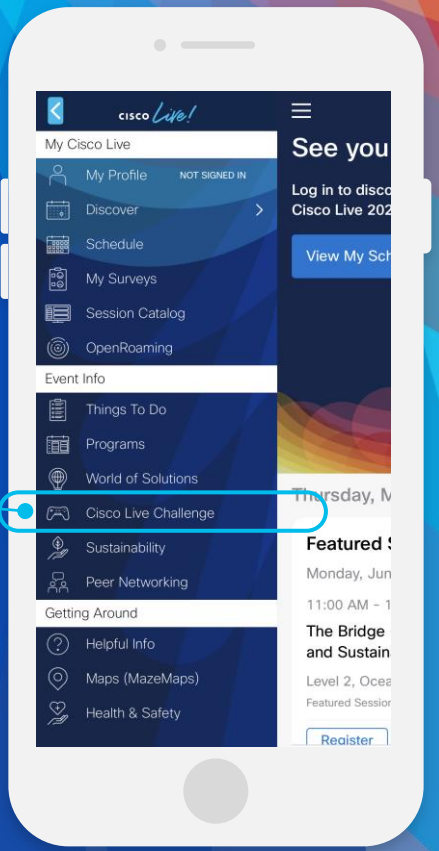
Cisco Live
Challenge

Gamify your Cisco Live experience!

Get points for attending this session!

How:

1. Open the Cisco Events App.
2. Click on 'Cisco Live Challenge' in the side menu.
3. Click on View Your Badges at the top.
4. Click the + at the bottom of the screen and scan the QR code:




cisco Live!
Let's go
#CiscoLive