
cisco Live!
GO BEYOND
#CiscoLiveAPJC

Automation: Key to Modernised Operations by Crosswork Network Controller

Simplify Operations with Crosswork in Action !!!

Sujay Murthy, Technical Marketing Engineer- Technical Leader

BRKSPG-2551

Cisco Webex App

https://ciscolive.ciscoevents.com/ciscolivebot/#BRKSPG-2551

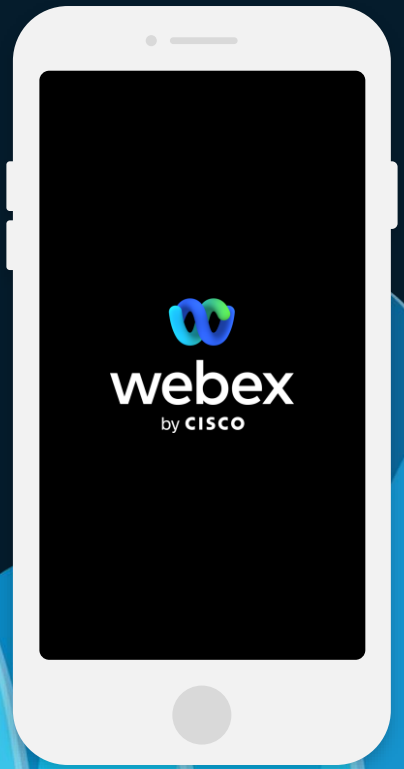
Questions?

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 November 15, 2024.

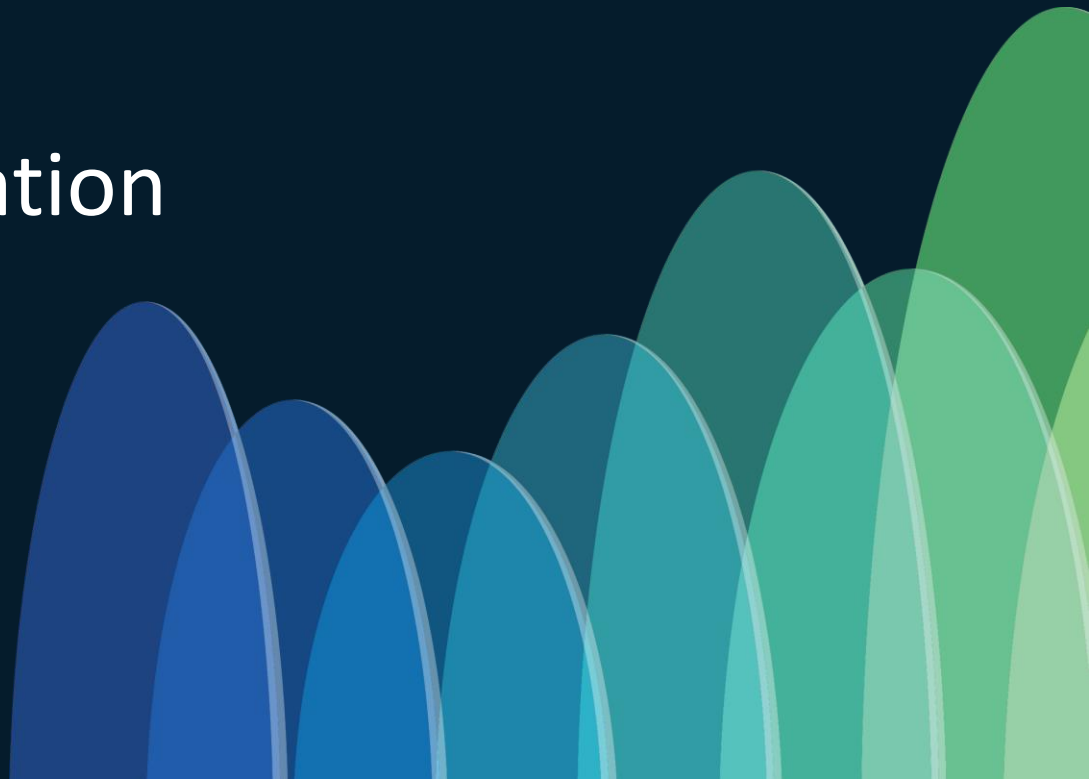


cisco Live!

Agenda

- Overview
  - Crosswork Overview
  - Crosswork Network Controller Components (CNC)
    - Element Management Function (EMF)
    - Topology Visualisation
    - Traffic Engineering
    - Service Provisioning
    - Service Health
  - Demos
- Conclusion

Crosswork Automation Portfolio

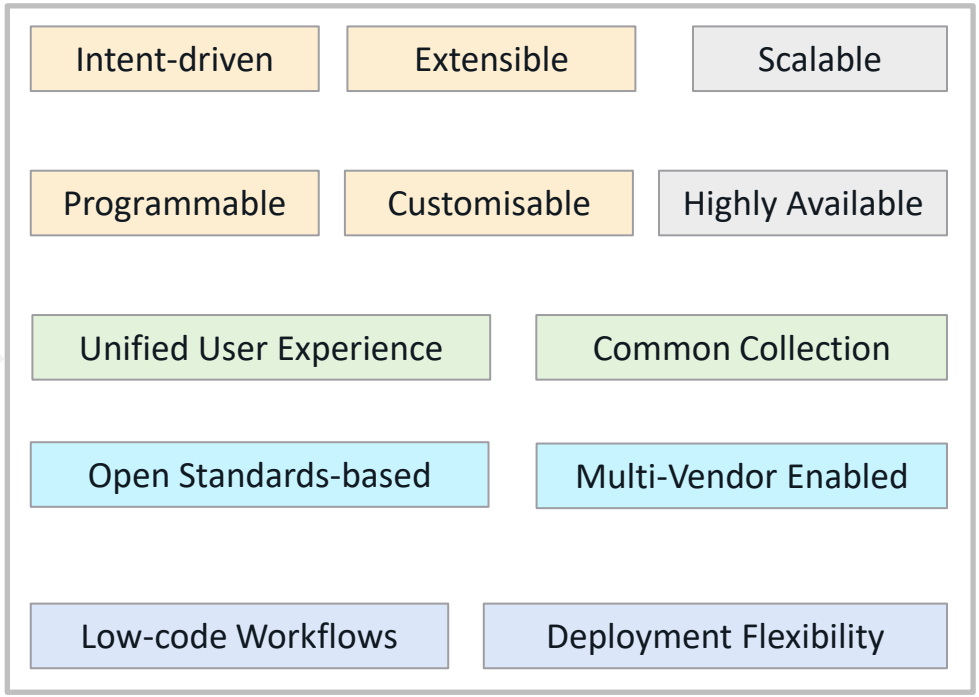


cisco Live!

Demands of Next-Generation Automation Solution

Challenges

- Increasing Infrastructure Complexity and Scale
- Proliferation of services and traffic types
- Multiple tools, fragmented observability
- Lack of Cohesive Automation framework and tools
- Limited in-house software expertise



Focus on Outcome-driven Automation

Crosswork Network Automation Pillars

Automate processes by bringing together visibility, insights and actions in a closed loop

Visibility
Verify and monitor customer experience

Insights
Correlate data, identify trends and patterns

Action
Automate processes to create a nimble organisation

Crosswork Porfolio - New Capabilities

Portfolio Overview

Cisco Crosswork Cloud

- **Trust Insights** — Track integrity of infrastructure
- **Network Insights** — Analyse and identify the source of routing anomalies
- **Traffic Analysis** — Optimise network traffic at peering points

New

- ✓ Industry's broadest multi-vendor support
- ✓ RON Automation Starter
- ✓ Multi-Layer Orchestration

New

- ✓ 5G Transport Slicing & RON
- ✓ Sustainability Dashboard
- ✓ Integration of EMS capabilities
- ✓ CNC Service Health + Provider Connectivity Assurance Integration

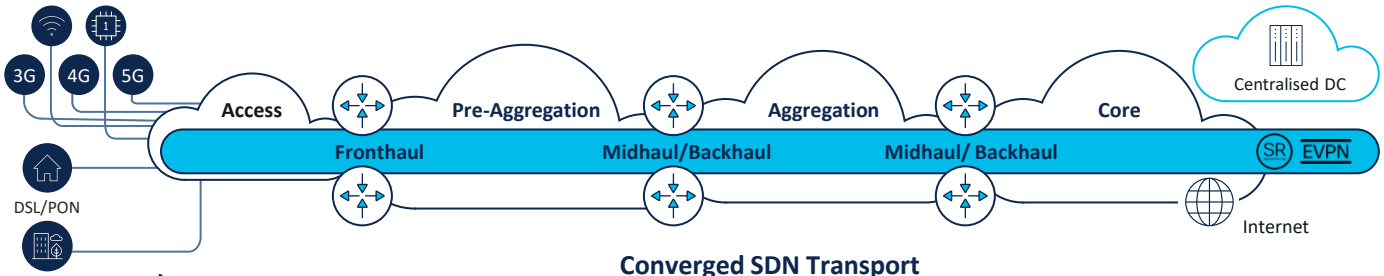
Crosswork Hierarchical Controller
Multi-layer, multi-domain IP and Optical hierarchical controller

Crosswork Network Controller
IP SDN Controller

Cisco Optical Network Controller
Optical Controller

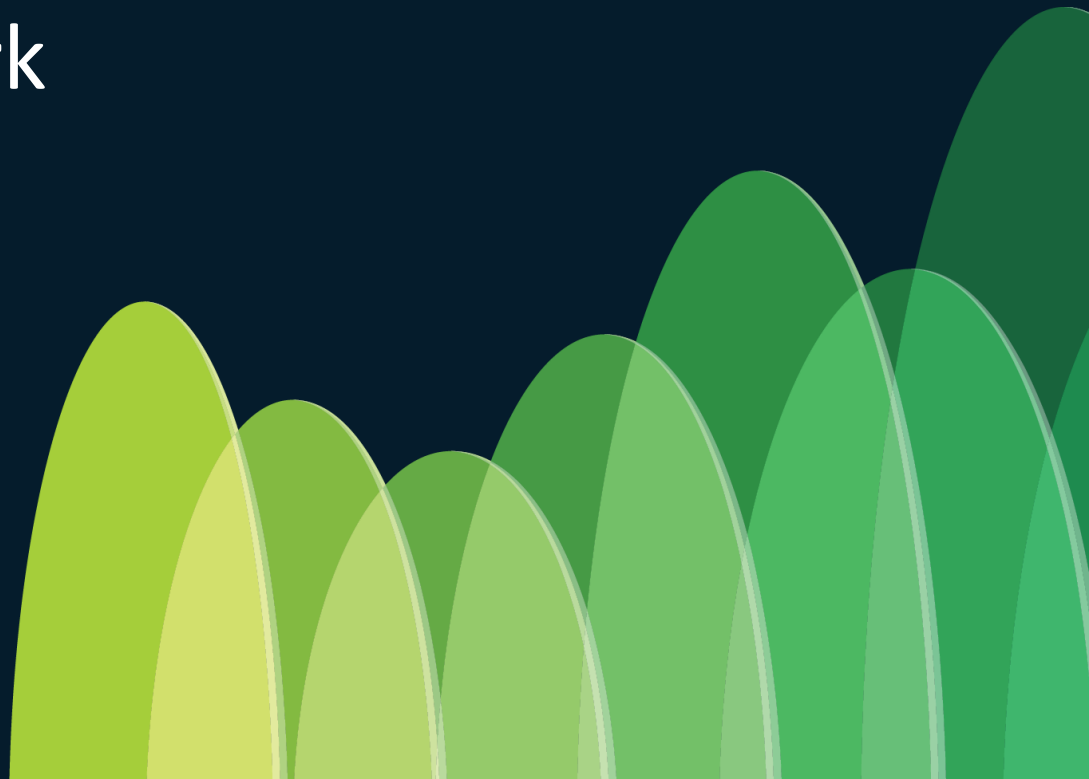
New

- **NSO** — ✓ AI ChatBot Support
- **Crosswork Planning** — ✓ Predictive-AI capacity planning
- **Crosswork Workflow** — ✓ Fleet Upgrade, Device Onboarding & Golden Config Packages



Converged SDN Transport

Crosswork Network Controller (CNC)



Crosswork Network Controller

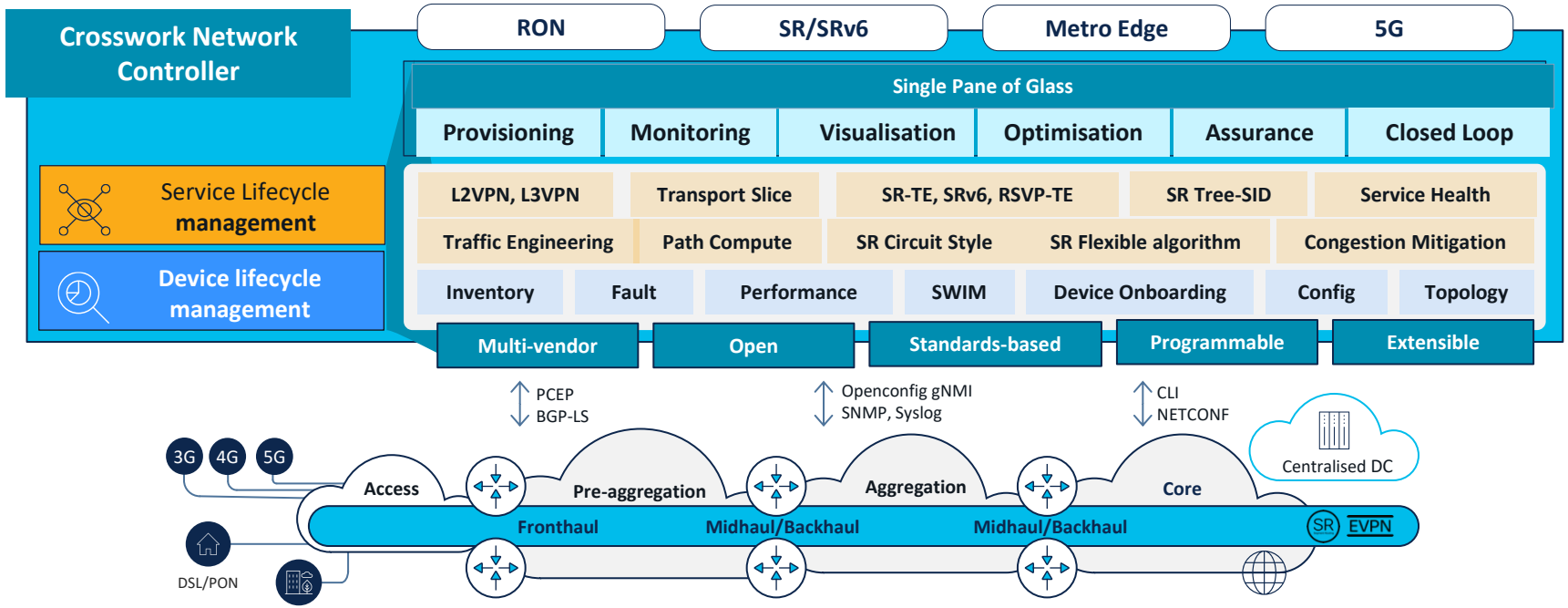
Integrated service and device management for IP Transport networks

Accelerate migration to next-generation solution

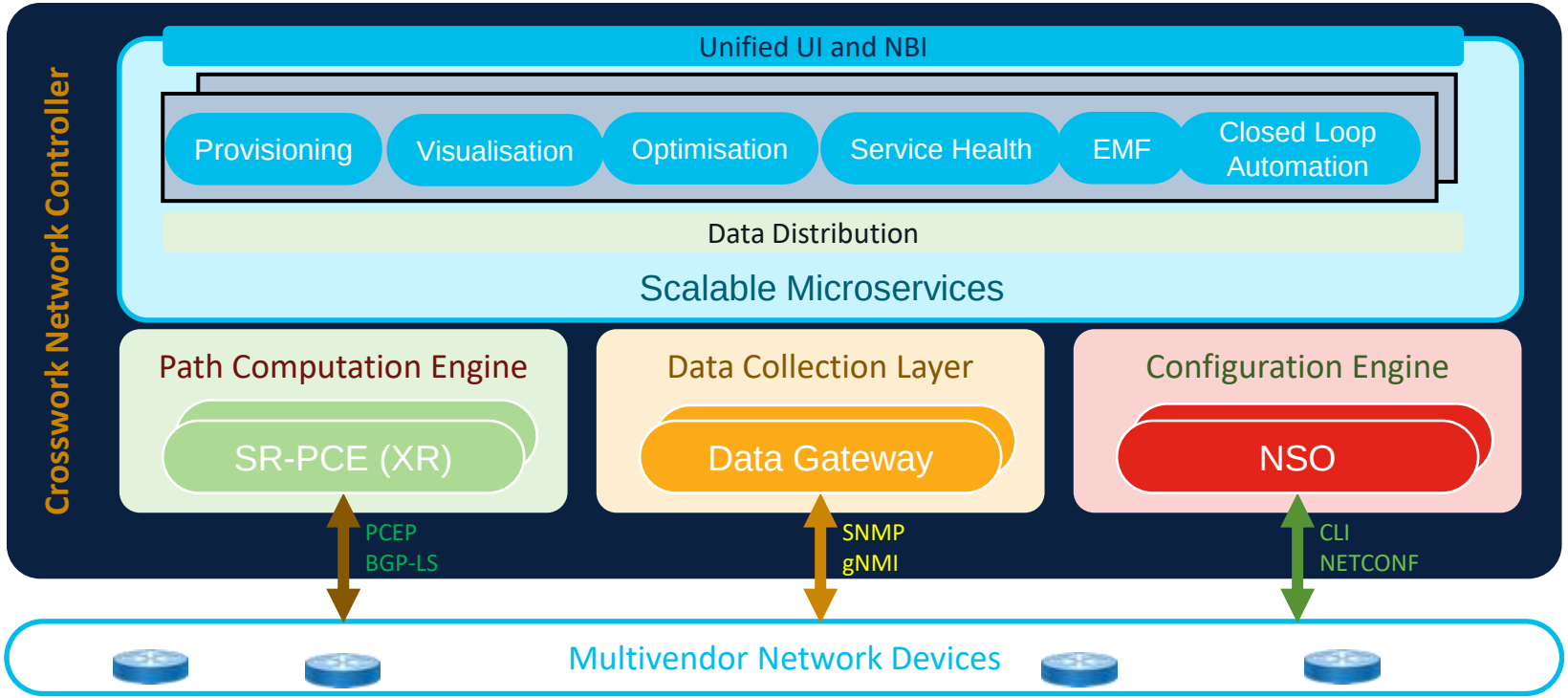
Rapid service delivery with stringent SLA

Enhanced end-user service experience

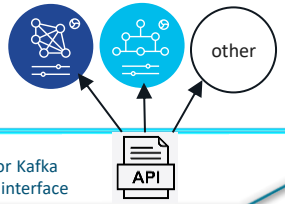
Boost operational agility



High-level Architecture of Cisco IP Controller
Crosswork Network Controller (CNC)



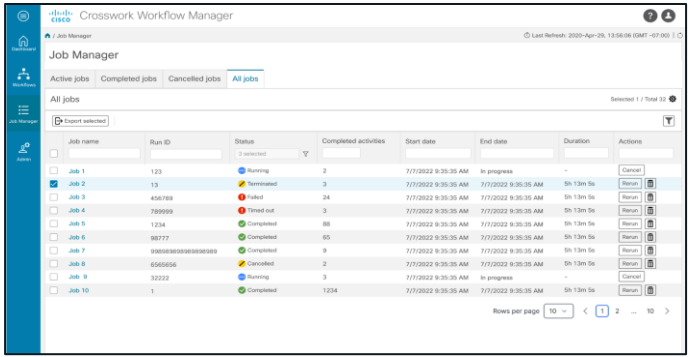
Crosswork Workflow Manager & Router Automation Kit



Crosswork Workflow Manager 1.2

Swagger APIs and/or Kafka consumer/producer interface

Operations UI



Execution Engine & Platform

Single VM, multi-POD infrastructure

Event Handling Framework for interface with external brokers

- **Kafka**
- **AMQP**

Workflow Catalog

Router Automation Kit*

Device Onboarding

Fleet Upgrades

Golden Config

Custom Workflows

Programming environment

Activity monitoring

Library functions

Form Designer

SDK for building custom adapters

XDK for auto-generating adapter activities

Adapter Catalog

- NSO Adapter
- REST — REST Adapter (demo for Netbox, Webex, & CNC onboarding)
- SMTP — SMTP Adapter (allowing workflows to send email notifications)
- DB — PostgreSQL, MySQL
- CLI (SSH) — CLI Adapter
- Other — AWS adapter (Used only for demo)

* Router Automation Kit is a set of three pre-built use cases available as a package on CWM providing out-of-the-box fundamentals for key router life cycle operations.

Demo Agenda

1. **Topology Visualisation :**
   a) Device Inventory
   b) Alarms + Events
   c) Topology View
2. **Traffic Engineering**
   a) SR-MPLS
   b) Flex-Algo
   c) SRv6
   d) Tree SID
   e) RSVP-TE
3. **Service Provisioning:**
   a) L3VPN over SR MPLS ODN – SR PM
   b) L3VPN over SRv6 locator
   c) L2VPN over Circuit Style -SR - Failover Paths
4. **Service Health**
   a) Monitoring Key metrics
   b) External Probes (PCA aka Accedian)
   c) Historical Trending

Element Management use-cases in CNC

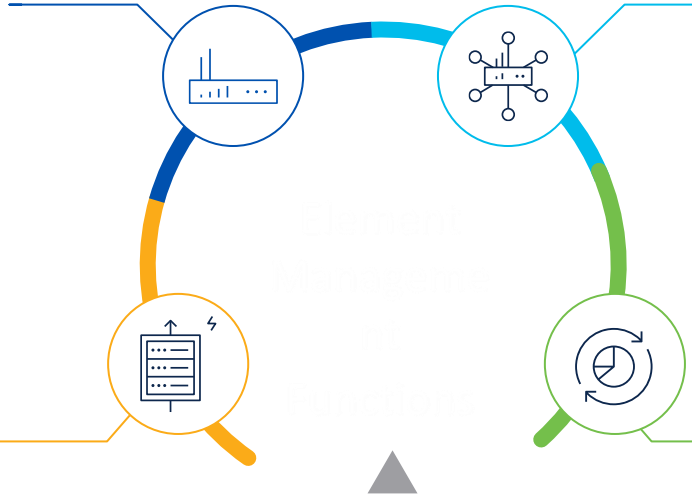
*Future/Roadmap deliverable

Device inventory management

Device Onboarding/Operations
Zero Touch Provisioning
Deep Inventory Visualisation
*Underlay Configuration**
Connectivity Topology

Device Image and config management

Automated Image Upgrade (SWIM)
*Configuration/PSIRT/OS/License Compliance**
*Configuration Backup and Restore**



Device Fault management

Realtime Fault Monitoring
Fault API and Notification
Fault Status Topology Overlay
Fault lifecycle (Ack, Un-Ack, Notes)

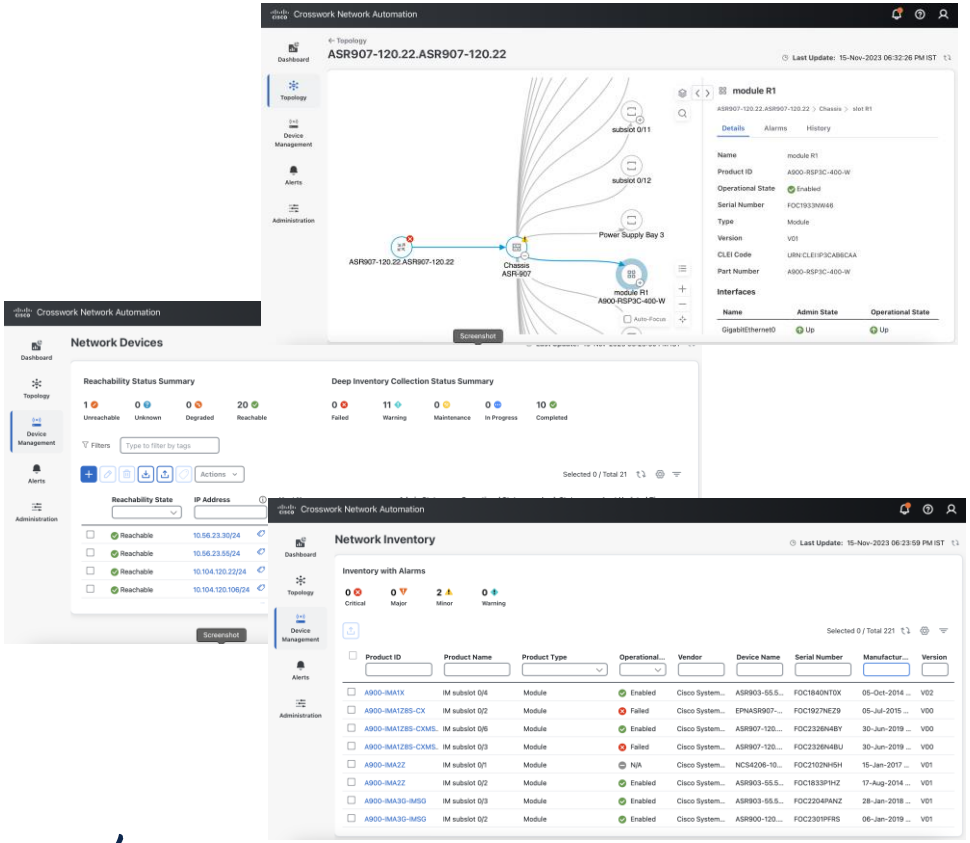
Device Performance management

Device, Pluggable and Interface health and energy relevant metrics
Device Metric Threshold Crossing Alerting
Realtime and Historical Device KPI Trends
Metric Rest API

Element management functions

Device Lifecycle Management Functions

Inventory Management



Challenges:

- Poor visibility into the network infrastructure
- Inaccurate data and Inventory
- Establishing required inventory v/s Current

Solution:

- Network wide Inventory view
- Detailed Device Inventory Visualisation
- Active Inventory Change notifications
- Localised status monitoring

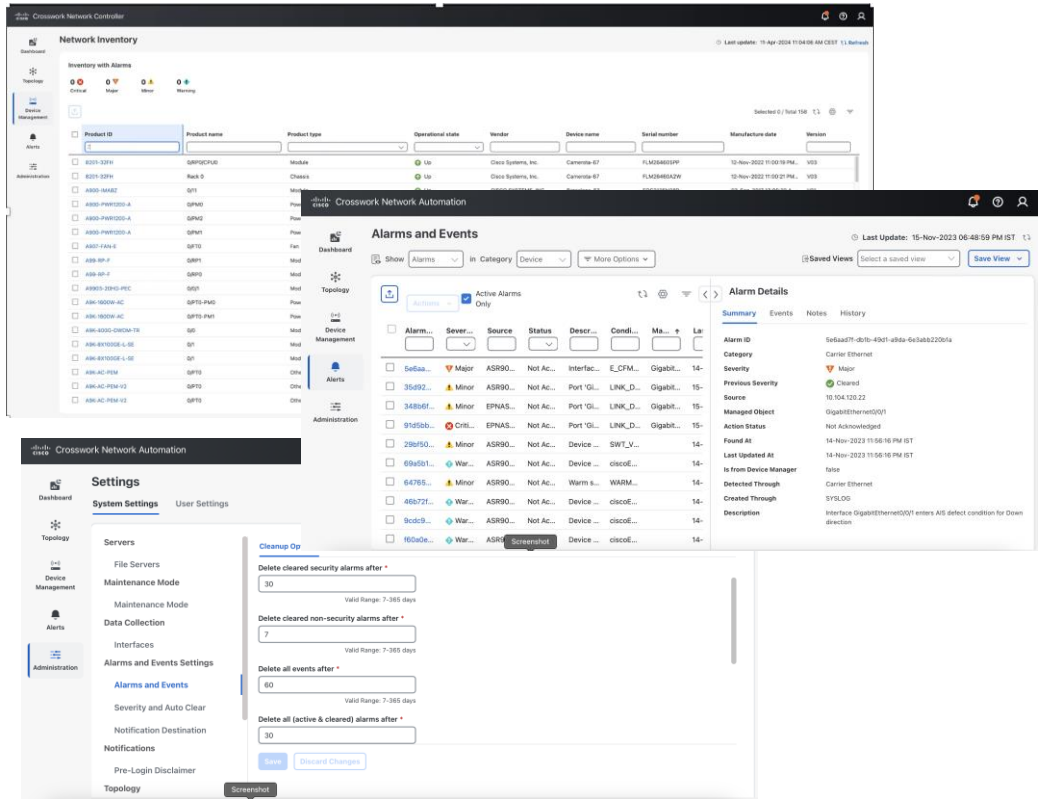
Outcome:

- Near real-time Inventory visibility
- Improved Inventor manageability and operator productivity

*All Third party device support is certified by CX

Device Lifecycle Management Functions

Fault Management



Challenges:

- Inadequate insights on infrastructure status
- Increased downtime due to sub-optimal attempt to resolve infrastructure issues

Solution:

- Standards based active device fault monitoring
- Network wide device alarms/events Visualisation
- Fault based inventory status updates
- Physical topology Fault reporting

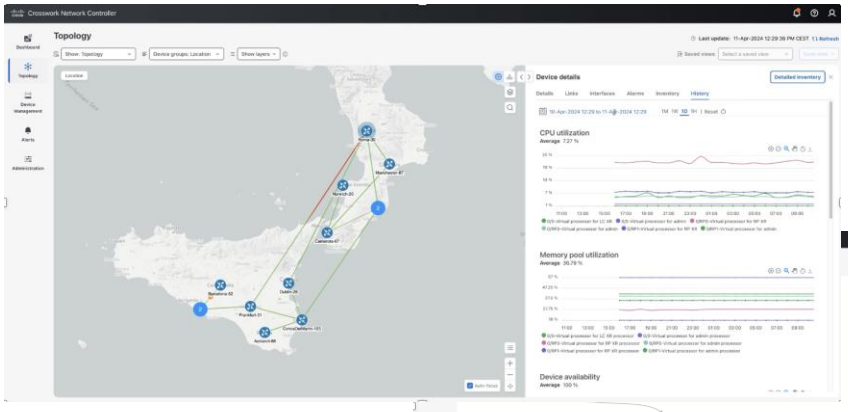
Outcome:

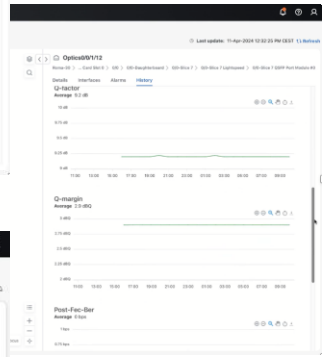
- Reduction in Time to Detect inventory issues and remediation
- Enhanced user experience and operator efficiency

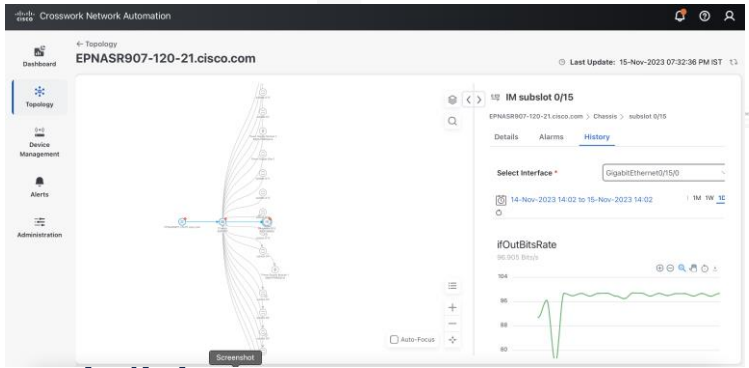
*All Third party device support is certified by CX

Device Lifecycle Management Functions

Performance Management







Challenges:

- Longer Outage due to poor insights into Network Infrastructure health
- Customer need for pre-emptive maintenance and not reactive

Solution:

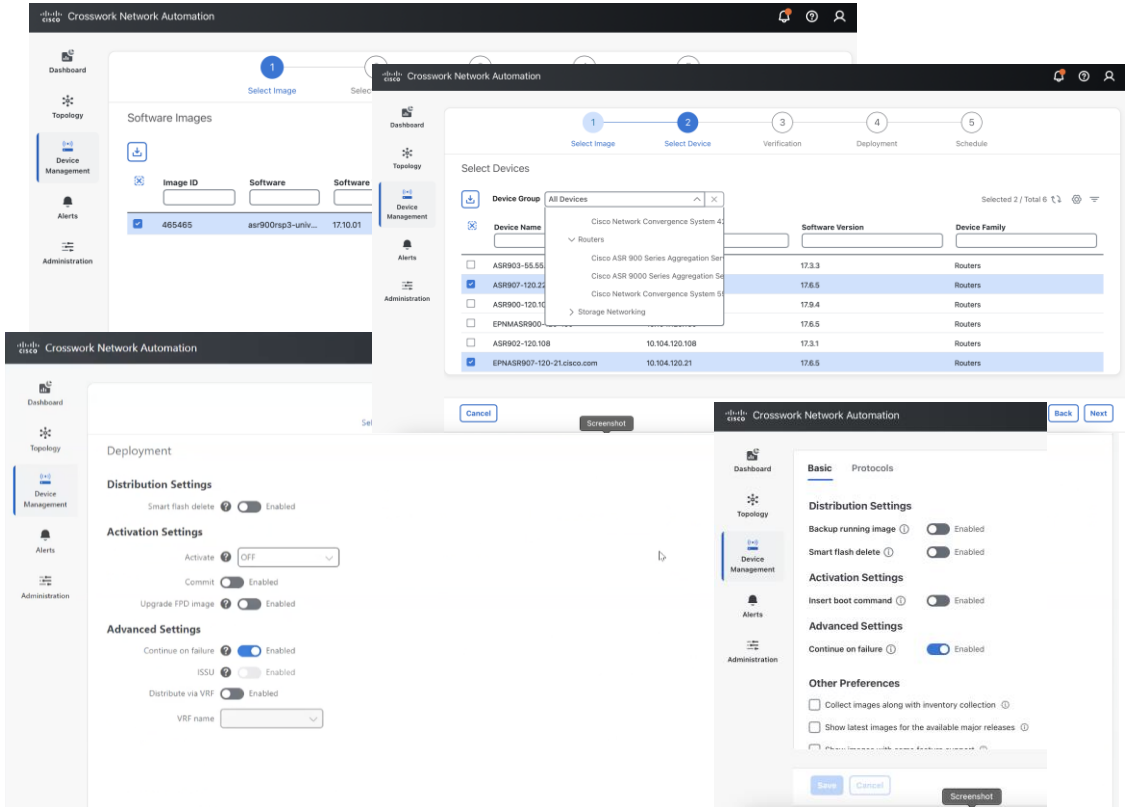
- Proactive network health monitoring
- Metrics trend Visualisation and threshold alerting
- Network wide Metrics Visualisation and reporting

Outcome:

- Increased network infrastructure availability - metric based alerts prevents the issues from occurring
- Improved user experience and operator productivity

Device Lifecycle Management Functions

Software Image Management



Challenges:

- Manual procedures, prone to error
- Longer lead time required for upgrade

Solution:

- Automated Image Dependency check and upgrade
- On demand and Scheduled Image Update including SMU
- Seamless UI for Image Upgrade across XR/XE device types

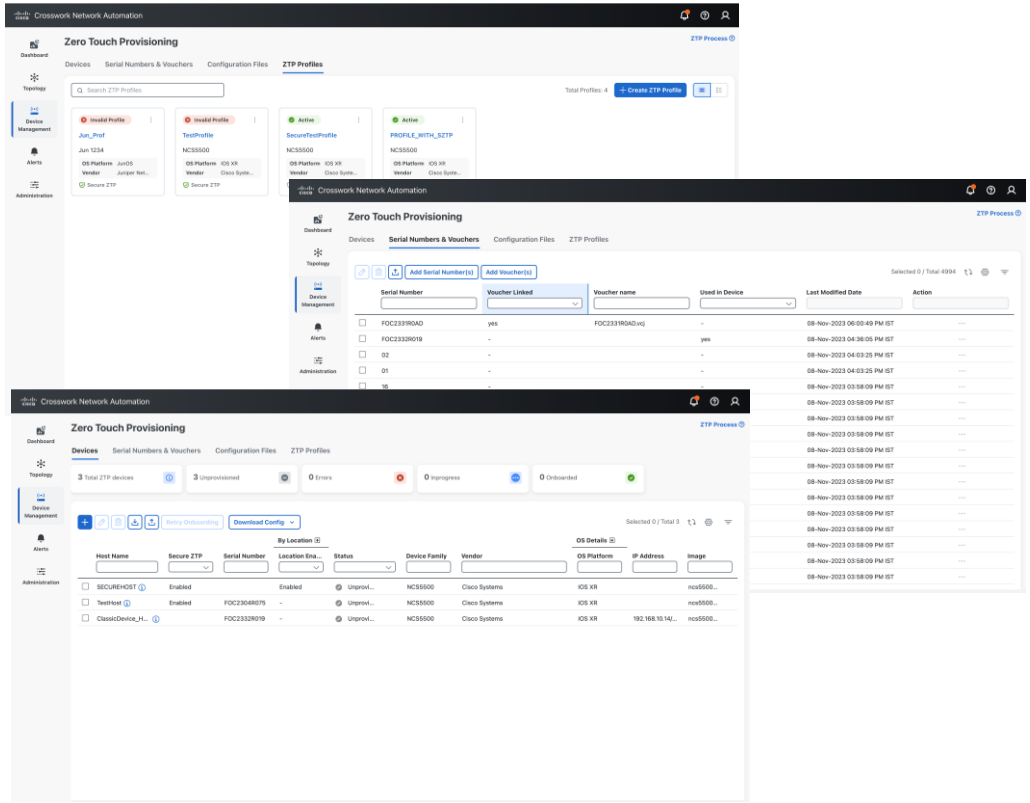
Outcome:

- Reduced Time to HW issue resolution
- Increased Device Uptime and Improved operator productivity

*Please refer documentation for supported devices. Not all devices are supported with ISSU/FPD

Device Lifecycle Management Functions

Zero Touch Device Onboarding



Challenges:

- Non-trivial process to Zero Touch Device Onboarding
- Complexity in supported modes to onboarding based on device types

Solution:

- Intuitive UI providing required ecosystem for Zero Touch Onboarding
- Seamless enabling of multiple ZTP modes
- Unified Image and Day0 Config repository

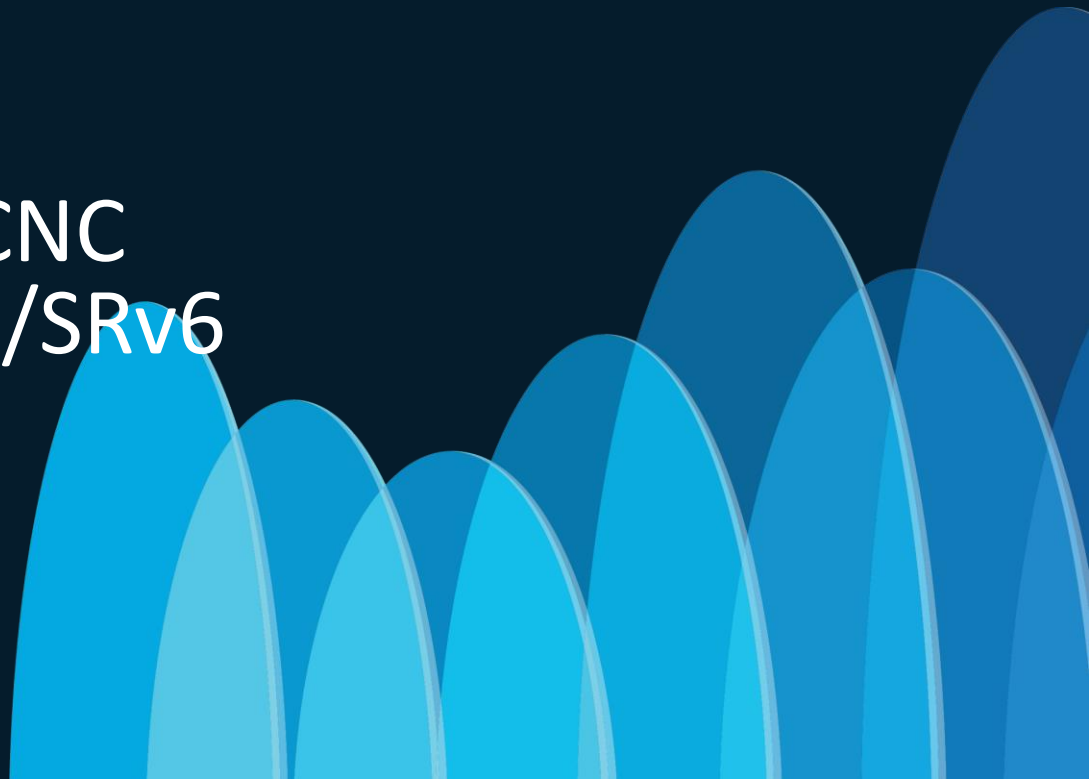
Outcome:

- Reduced Device-Downtime requiring S/W Upgrade
- Improved operator experience and productivity

Demo:Topology Visualisation

a. Device Inventory
b. Alarms + Events
c. Topology View

Segment Routing Enablement with CNC SR-MPLS/ Tree-SID/SRv6



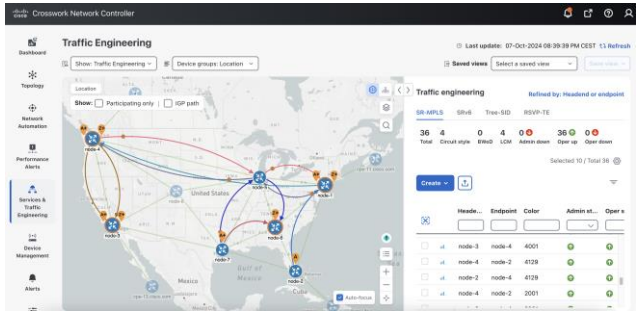
cisco Live!

SR/SRv6 Unlocked with Crosswork Automation

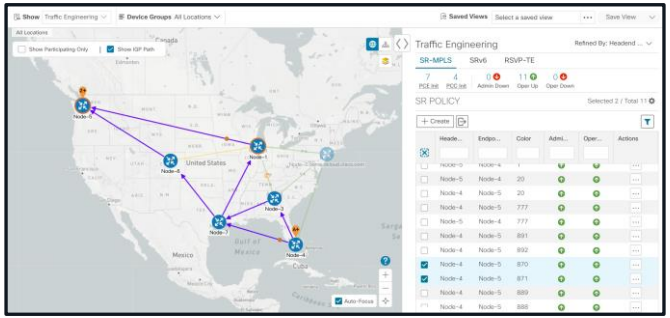
SR/SRv6 Innovations			Automation Value Proposition
Service Creation at Hyper Scale		SR/SRv6 Network Visualisation	Automated Service & Transport Provisioning
		Real-time Low Latency path	
Advanced Traffic Engineering (TE)		Disjoint Paths Tree SID	TE with Simplicity and Scale
		Intent-based Automated Steering	Granular TE control and SLAs
Centralised Path Compute (PCE)		IGP Flexible Algorithms	Operational Simplification
Enhanced OAM & Telemetry		Intent-based Network Slicing	
		Service Awareness + Infrastructure Visibility	Improved service health and End-user Experience

Real-Time Network Visualisation

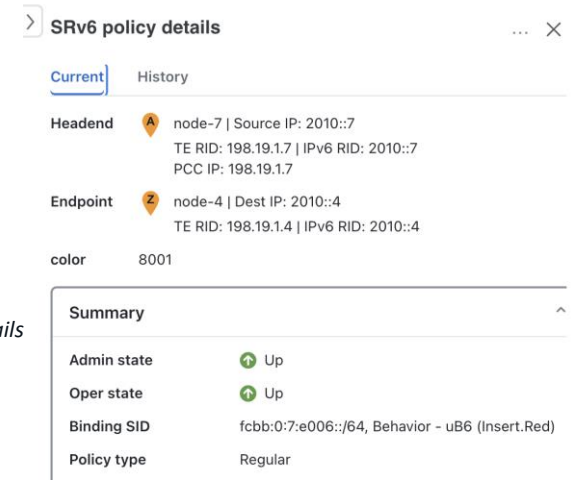
Visibility, Insights and Control



SRv6 Policies



ECMP Paths Visualisation



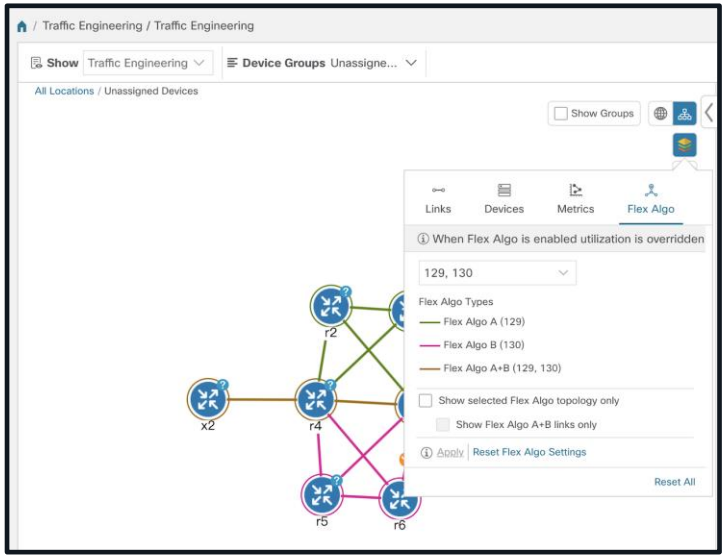
Policy Details

Candidate Path details

Enhanced Traffic Engineering with FlexAlgo

End-to-end fine grained policy control

Dynamic Traffic Engineering



Flexible Path Control

Challenges:

- Inability to scale with end-to-end, fine-grained control over the myriad 5G services with distinct policy requirements

Solution:

- Flexibility to define and assign new SR segments (prefix SIDs) with specific Optimisation objective and constraints:
  - Minimise igp-metric or delay or te-metric
  - Avoid SRLG or affinity
- CNC to offer provisioning, Visualisation and Optimisation

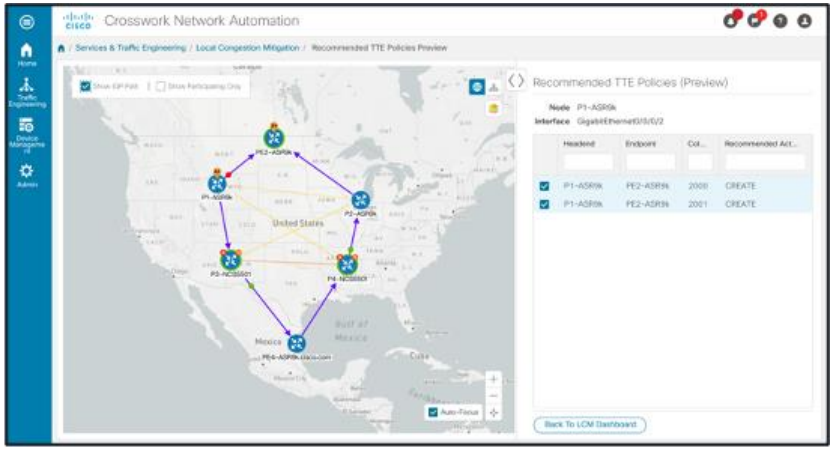
Outcome:

- Enhanced TE control with SID list customisation
- Operational Flexibility and control to meet SLA intent
- Custom fit 5G network slices to specific applications

Local Congestion Mitigation (LCM)

Quickly mitigate network congestion

Dynamic Traffic Engineering



Preserved Service Intent

Challenges:

- Dynamic network state with risk of congestion leading to degraded service levels and user-experience

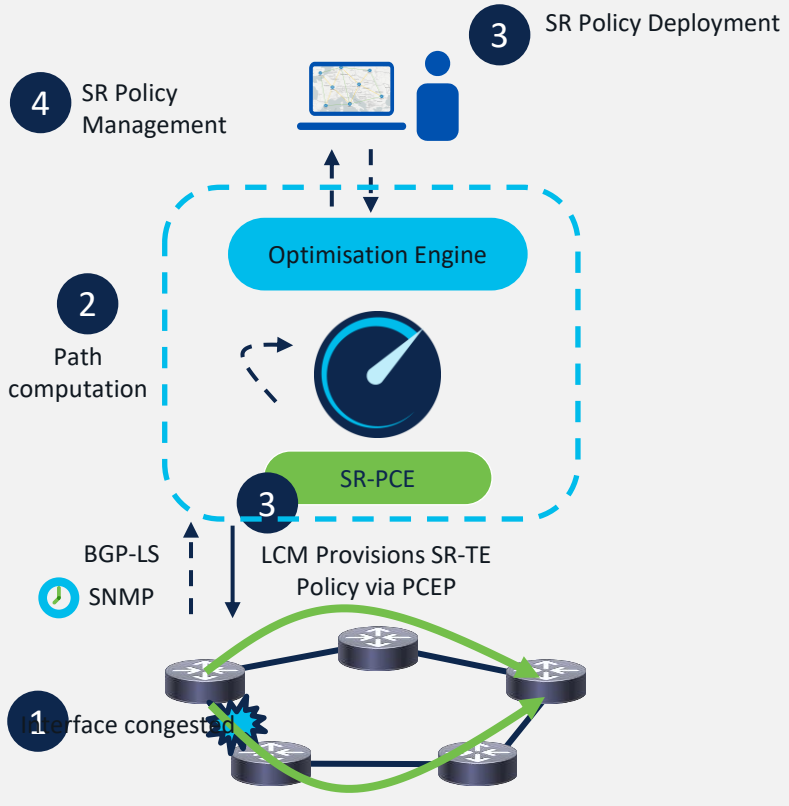
Solution:

- Congestion handling in a Localised manner using tactical SR-TE policies
- Automated path recommendation to divert best effort traffic
- User approval for path acceptance and automated provisioning
- Traffic steered on shortest path around congestion points

Outcome:

- Rapid handling of congestion with user control
- Minimised impact to service levels
- Optimal utilisation of network capacity

Local Congestion Mitigation – Workflow



1

Congestion Detection

LCM detects congestion by comparing interface utilisation against interface thresholds

2

Path Computation

LCM determines minimum amount of traffic to divert from congested interface and computes paths of local and detour SR policies.

3

Tactical SR Policy Deployment

Recommendations presented to user, user provides confirmation. SR policies deployed via SR-PCE

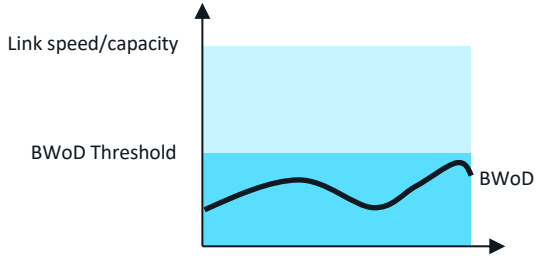
4

SR Policy Management

Based on changing network traffic and topology, LCM recommends further actions for user confirmation.

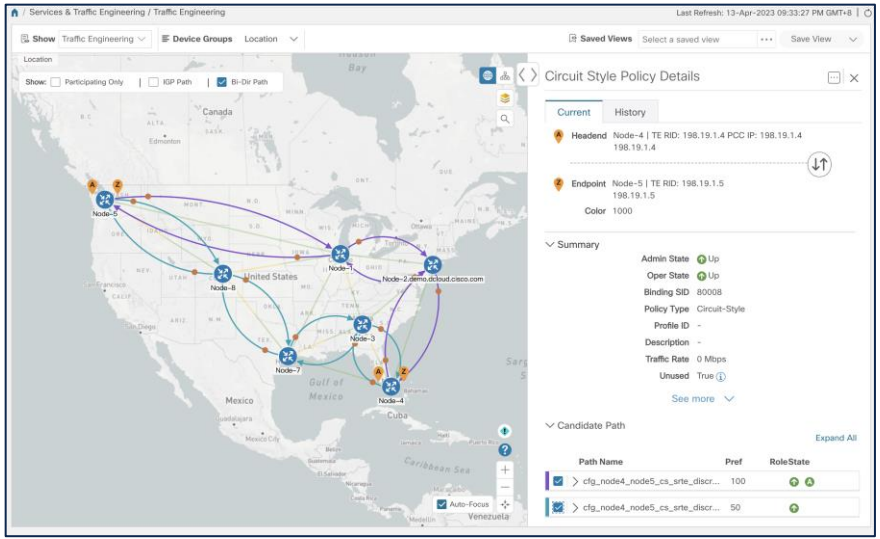
Bandwidth on Demand (BWoD)

- Provides **bandwidth constrained path computation** for SR-TE policies.
- Compute paths considering
  - **Requested and/or Measured Bandwidth** along path
  - **Available Bandwidth** for BWoD SR-TE policies on links
  - **BWoD utilisation < BWoD threshold**



- Continues to monitor and manage path of BWoD SR policies, analysing link utilisation as topology changes.
  - When current paths results in links with total BWoD utilisation above threshold,
  - Attempt to reOptimise paths to reduce BWoD utilisation below threshold.
- Positioned for soft bandwidth guarantee type services

SR-TE Circuit Style Provisioning and Visualisation



Challenges:

- Deliver bandwidth-guarantee services with path protection over Segment Routing
- Leverage the Segment Routing infrastructure to carry any kind of services including OTN, TDM, CEM

Solution:

- Pre-book some bandwidth in the network to be used by these Circuit-Style policies
- Use the SDN Controller for bandwidth bookkeeping and path computation
- Use the SDN Controller to compute bi-directional, co-routed paths with path protection (under 50ms)

Outcome:

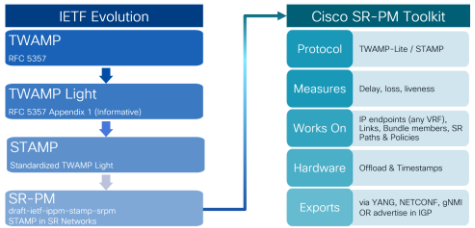
- One unified Segment Routing infrastructure can be used to carry any kind of services, including the most demanding one

SR-TE Policy Monitoring

SR Policy verification with SR Performance Monitoring (SR- PM)

SR-PM: A TWAMP based tool

Through SP-PM we can gain visibility into policy, link and IP end point health. SR-PM is standard based and as such it can interact with any responder.

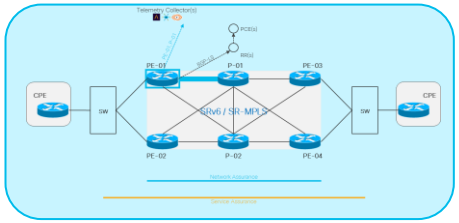


Link Health Monitoring via SR-PM

Measure the distance between PE-01 and P-01 (optical distance via HW timestamping)

Behaviors:

1. Provide min, max, avg, variance, loss via telemetry
2. ***Update IGP*** with min for routing decisions (SRTE, Flex-Algo)



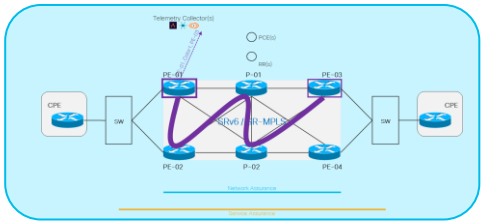
API for metric integration external OSS system

Policy Monitoring via SR-PM

Measure delay for specific SR-TE policy

Behaviors:

1. Provide min, max, avg, variance, loss via telemetry
2. Endpoints any TWAMP reflector**

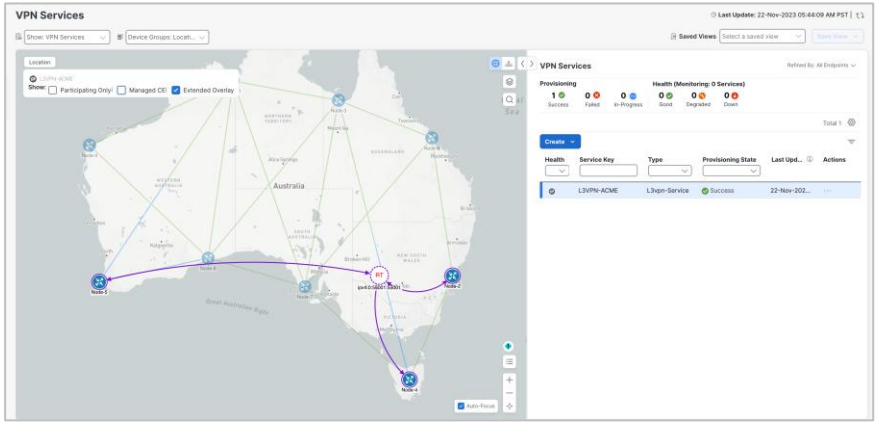


Demo: Traffic Engineering

a. SR-MPLS
b. Flex-Algo
c. SRv6
d. TREE-SID
e. RSVP-TE

Service & Transport Provisioning

Intent-based Automation



SR Policy SLA Objectives and Constraints	
Objective	Latency/IGP/TE Metric Minimisation
Constraints	Affinities, Disjoint Paths, Bandwidth

Rapid Time-To-Value

Challenges:

- Cumbersome and time-consuming service provisioning
- Missing transport and service context linkage and visibility, satisfy service specific performance objectives, such as low latency

Solution:

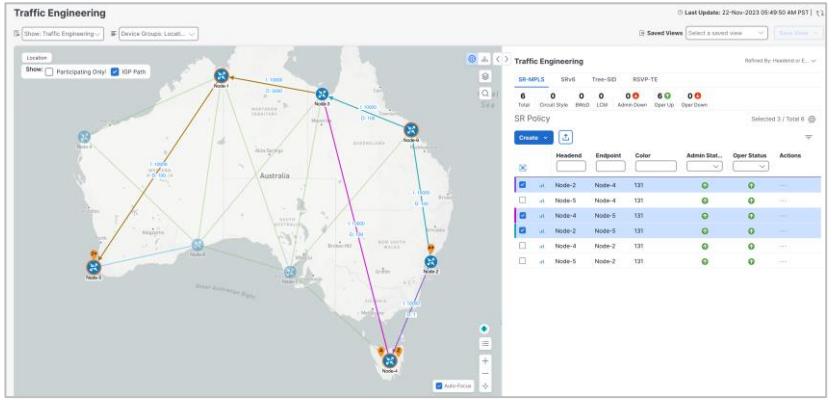
- Intent-based automated provisioning
- Customisable service intent with explicit SLA definitions
- Service Topology Visualisation with actionable operational context (Health, Path changes, etc)

Outcome:

- Rapid Time to Value with provisioning reduced from weeks to minutes

Real-time Network Optimisation

Closed loop Automation



SR Policy SLA Objectives and Constraints	
Objective	Latency/IGP/TE Metric Minimisation
Constraints	Affinities, Disjoint Paths, Bandwidth

Preserved Service Intent

Challenges:

- Manual re-Optimisation based on network changes is not scalable and poses risk to target SLAs

Solution:

- Define policy intent once
- Automatically detect topology changes
- Real-time re-computation of paths in violation of ‘Optimisation metric’ aka intent
- Optimised path is automatically provisioned

Outcome:

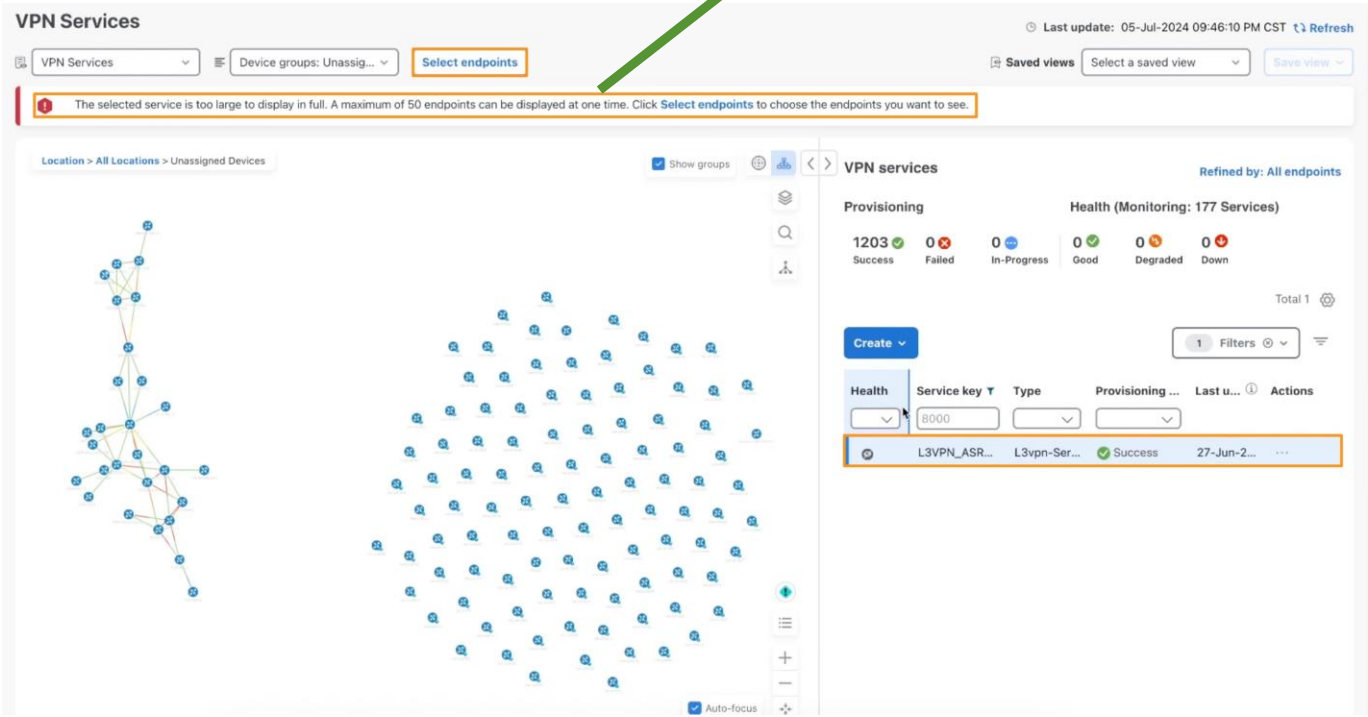
- Preserved service policy Intent and associated SLAs
- Enhanced operational agility with real time action
- Optimal utilisation of network capacity

What is a large VPN?
(for CNC 7.0)

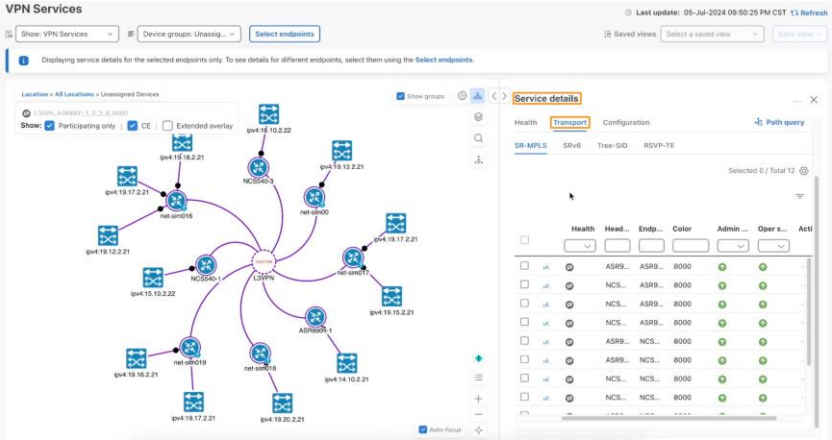
- VPN with a large number of endpoints
- Service intent data:
  - > 2MB (can grow up to 20MB)
- Max VPN nodes (PEs) per VPN:
  - 50 to 5000
- Max UNIs (PE-CE interfaces) per VPN:
  - 50 to 20000
- Max UNIs per VPN node:
  - 1 to 100

Large VPN Visualisation

No default layout, Endpoint selection is required

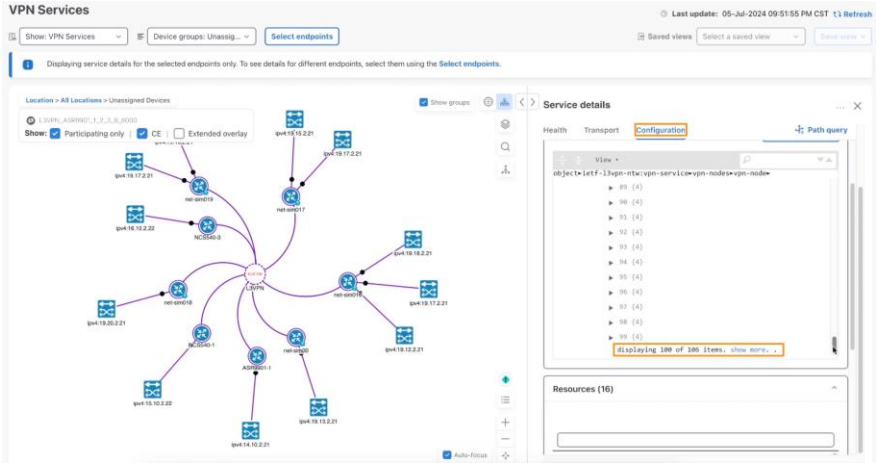


Large VPN Visualisation



- ✓ **The ”Transport” tab under services details show the Traffic Engineering policies associated to the selected Endpoints**

- ✓ **Pagination is now enabled on the “Configuration” tab to make it easier to read the configuration of the whole VPN**



Demo: Service Provisioning

a. L3VPN over SR MPLS ODN + SR PM
b. L3VPN over SRv6 locator
c. L2VPN over Circuit Style -SR - Failover Paths

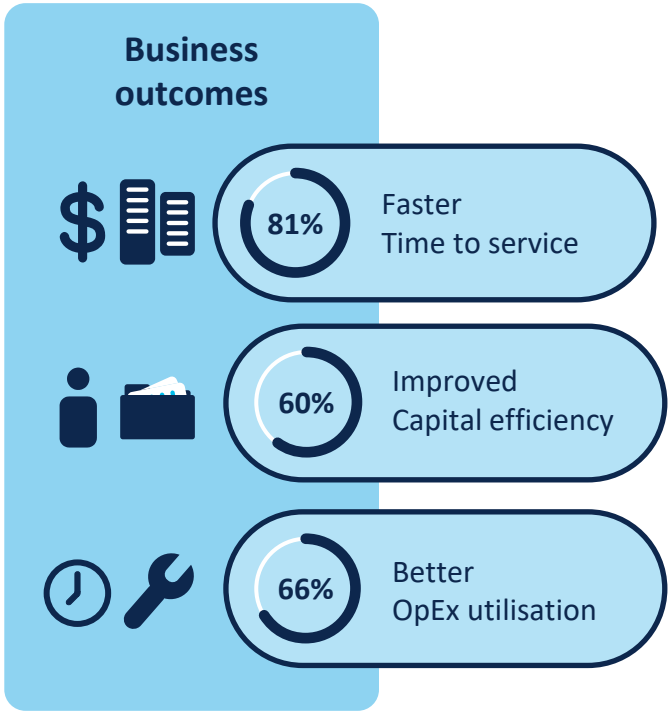
CNC SRv6 support* (6.0/7.0)

	Visualisation	Provisioning	SH Monitoring
SRv6 Network discovery	✓	NA	NA
FlexAlgo Visualisation	✓	NA	NA
SRv6-TE ODN (IETF L2VPN EVPN VPWS)	✓	✓	Roadmap
SRv6-TE Policy (IETF L2VPN EVPN VPWS)	✓	✓	Roadmap
SRv6-TE ODN (IETF L3VPN)	✓	✓	✓
SRv6-TE Policy (IETF L3VPN)	✓	✓	Roadmap
SRv6 Locator (IETF L2VPN EVPN VPWS)	Locator Visualisation Roadmap	✓	Roadmap
SRv6 Locator (IETF L3VPN)	Locator Visualisation Roadmap	✓	Roadmap
Bandwidth Optimisation	Roadmap	Roadmap	Roadmap
Circuit-Style over SRV6	Roadmap	Roadmap	Roadmap

*XR only. Please contact Crosswork team for XE support

SR/SRv6 and Automation: A Winning Combination

Simplicity unlocks Speed, Speed creates Advantage



Source: ACG

Accelerate Time To Market

- Rapid Service, transport and slice provisioning
- Reinforced differentiation with granular TE control and SLAs
- Faster introduction of new services with model-based approach

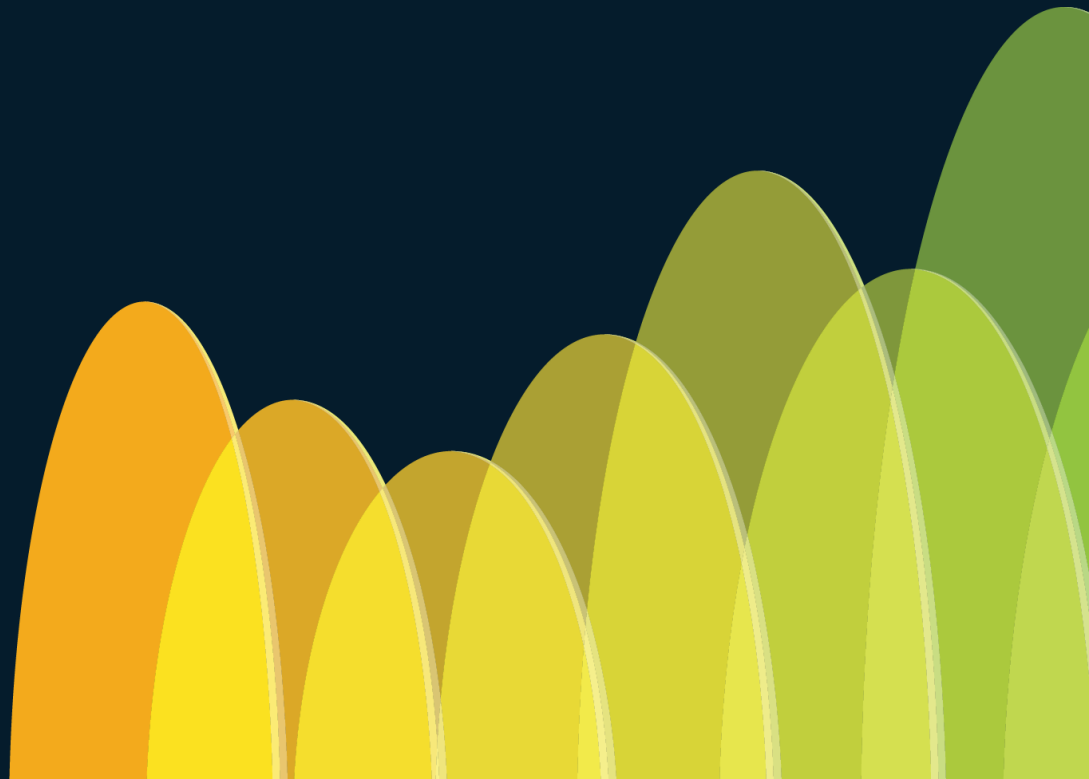
Improve Service Delivery and End-user Experience

- Preserved service policy intent and SLAs
- Effective mitigation of network congestion
- Optimal utilisation of network resource with real-time Optimisation

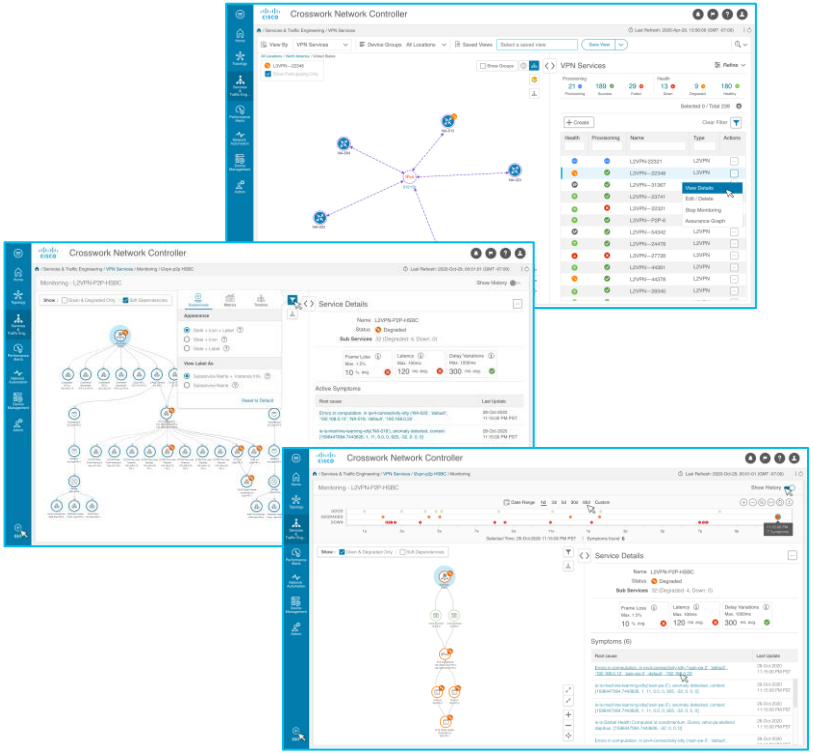
Boost Operational Agility

- Automated changes Minimising configuration errors
- Abstraction of complexity in a heterogenous environment
- Enhanced productivity with unified UI and workflows

Service Health



Service Health Monitoring



Challenges:

- Decoupled Service Provisioning and monitoring
- Disconnect between customer service experience and network health

Solution:

- End-to-end service health monitoring
- Proactive causality models
- Linkage between service and underlying components

Outcome:

- Reduction in Time to Detect service issues and remediation
- Improved user experience and operator productivity

Crosswork Network Controller- Service Health

Assure Each IP Network & Service Construct- based on IETF RFC 9417

Slice health

Slice

Slice Health based on subtending transport service health

Service health

VPN Service

IETF: Service Assurance for Intent Based Networking Architecture

Data Plane Verification through probing

Transport policy health

Transport

Policy verification with SR-PM: a TWAMP based tool

Infrastructure health

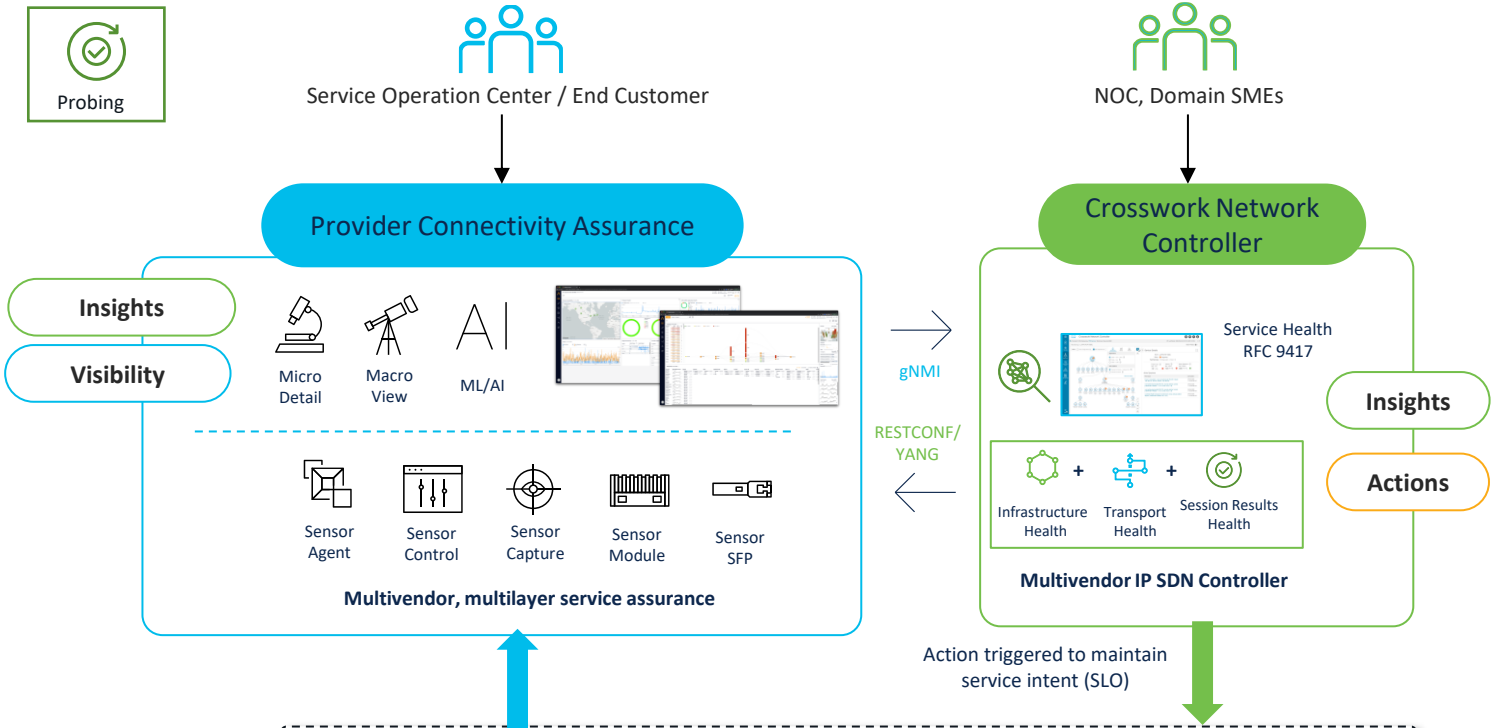
Infrastructure

Visibility & Monitoring: Device Inventory, Fault, Performance Metrics

Model Driven Telemetry

Deliver Your Service with Confidence

Limited Availability



Demo: Service Health

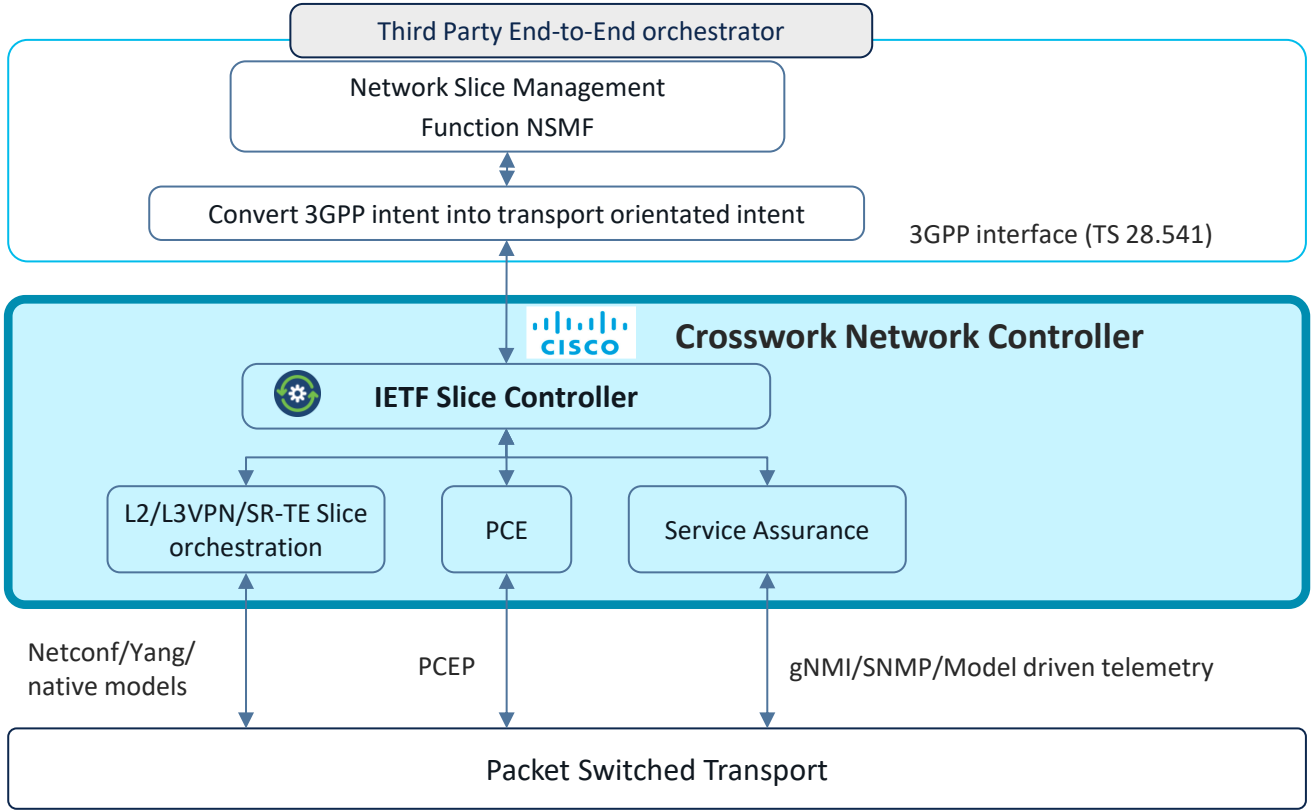
a. Monitoring Key metrics
b. External Probes (PCA)
c. Historical Trending

Transport Slicing

Services with SLA

cisco Live!

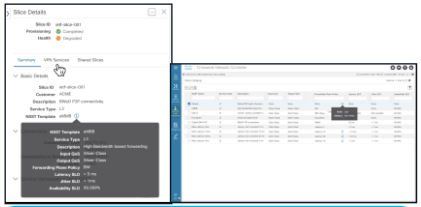
CNC as IETF NBI Slice Controller



Transport Slicing Automation Made Easy

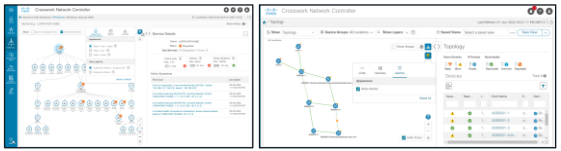
Transport slice SLA assurance

- Proactive SLA monitoring per Slice
- SLA breach notification/reporting
- Service Centric approach to monitoring
- Slice intent to infra telemetry tie
- Active probing with infrastructure monitoring correlation



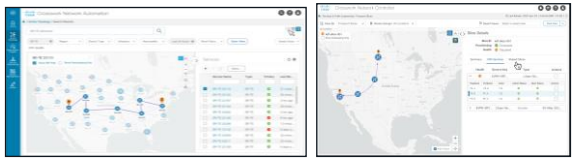
Transport slice orchestration

- Intent-based slice definition
- Abstracted Slice model based on IETF model



Transport slice Optimisation

- Optimise slice based on service intent
- Path computation per slice based on SLA

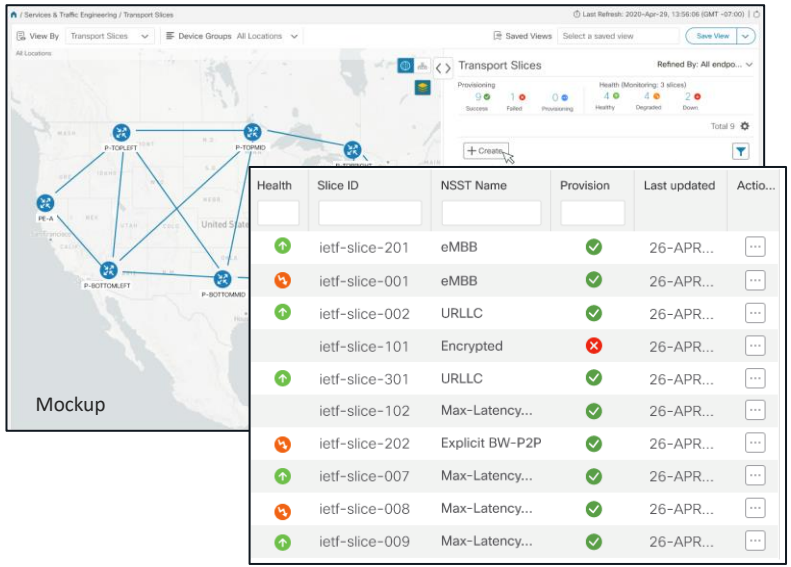


Transport slice Visualisation

- Overlay maps
- Slice details: Type, Template, VPNs, Transport

Transport Slicing Automation

Simplify Slice Lifecycle Management



Challenges

- Automation of slice lifecycle functions
- Ensure delivery of distinct SLA/SLO requirements

Solution

- Service catalog with templates for common slice types
- Utilise existing CNC capabilities: Provisioning, Monitoring, Traffic engineering and closed loop Optimisation

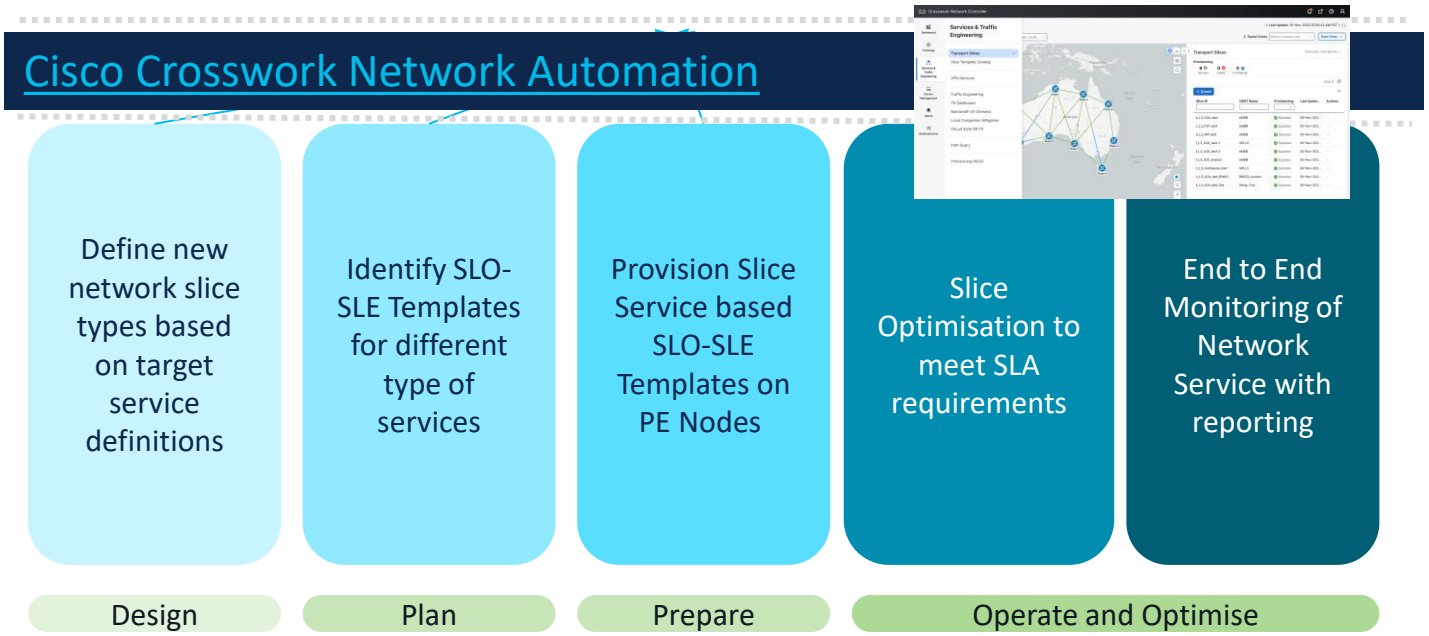
  L2VPN/L3VPN, SR TE, SRv6, FlexAlgo
- Leverage Circuit-Style Capabilities for bandwidth reservations
- SLA monitoring with QoS* and End-to-End network measurements
- Open, standards-based NBI (IETF slide YANG model)

Outcome

- Simplified deployment of 5G services with designated SLA
- New revenue stream can be enabled via Differentiated service offering

*In Planning

Transport Network Slice Lifecycle



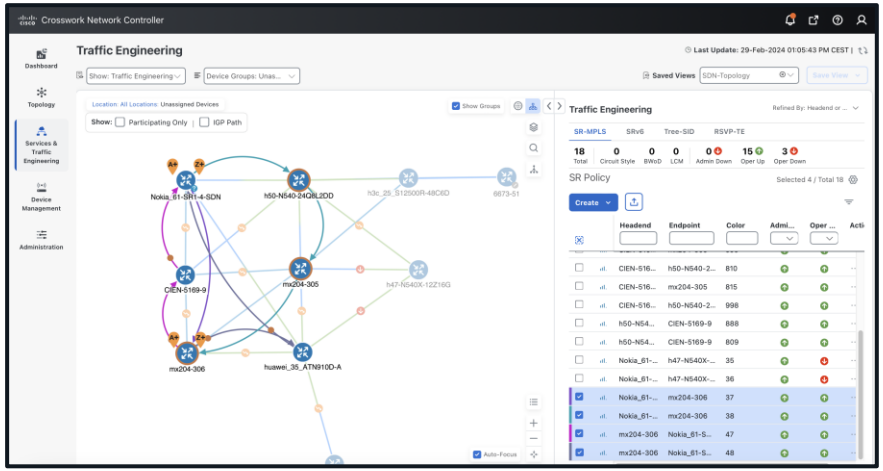
CNC Transport SDN Interop

cisco Live!

EANTC 2024 Interop - SDN

Cisco's strongest participation and top successful results with Crosswork Network Controller

- Only Vendor Controller to participate across the board
  - ✓ PCEP / SRTE / BGP-LS
  - ✓ Netconf/YANG VPN Provisioning - IETF L2NM/L3NM/Route-Policy
  - ✓ Streaming Telemetry/gNMI with OpenConfig
  - ✓ Service Health Visualisation - IETF 9417
  - ✓ Transport Slicing- following IETF Network Slice Service Yang model
  - ✓ CNC participated with multivendor SR-MPLS and SRv6 network.
  - ✓ CNC onboarded and managed Multivendor Network nodes.



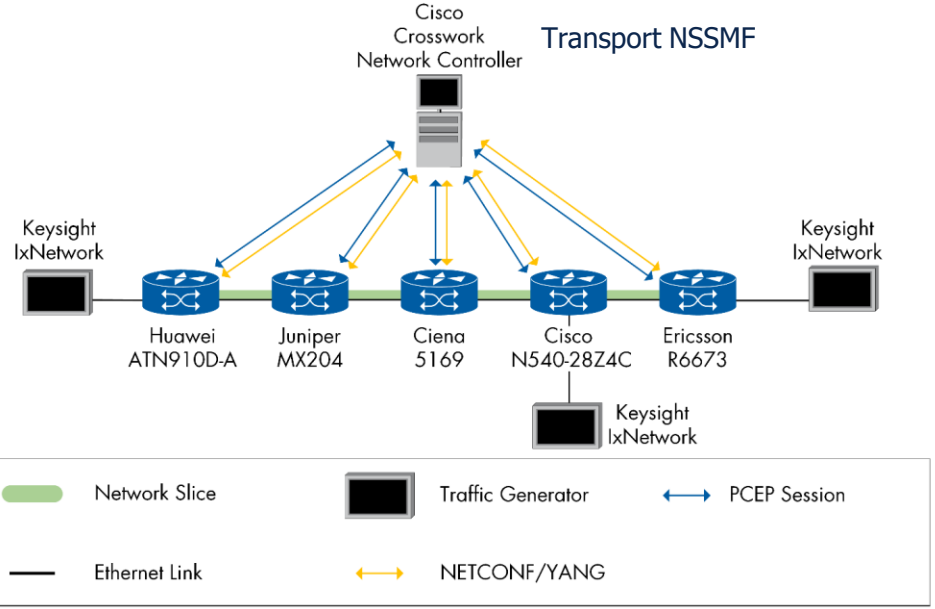
For details, please refer to:

[EANTC 2024 Multivendor SDN Interoperability Report]

CISCO NOKIA JUNIPER NETWORKS HUAWEI ciena ERICSSON H3C

SDN – Cisco Highlights – Transport Slicing

- CNC
  - First Time verification of CNC Transport slicing service across Multivendor Nodes.
  - Test Case covers orchestration and Visualisation of Multi vendor Transport Slice using IETF Network Slice NBI Yang Model* for :
    - Preparation of Transport Slice Service
    - Commissioning of Transport Slice Intent
    - Visualisation of Transport Slice Service

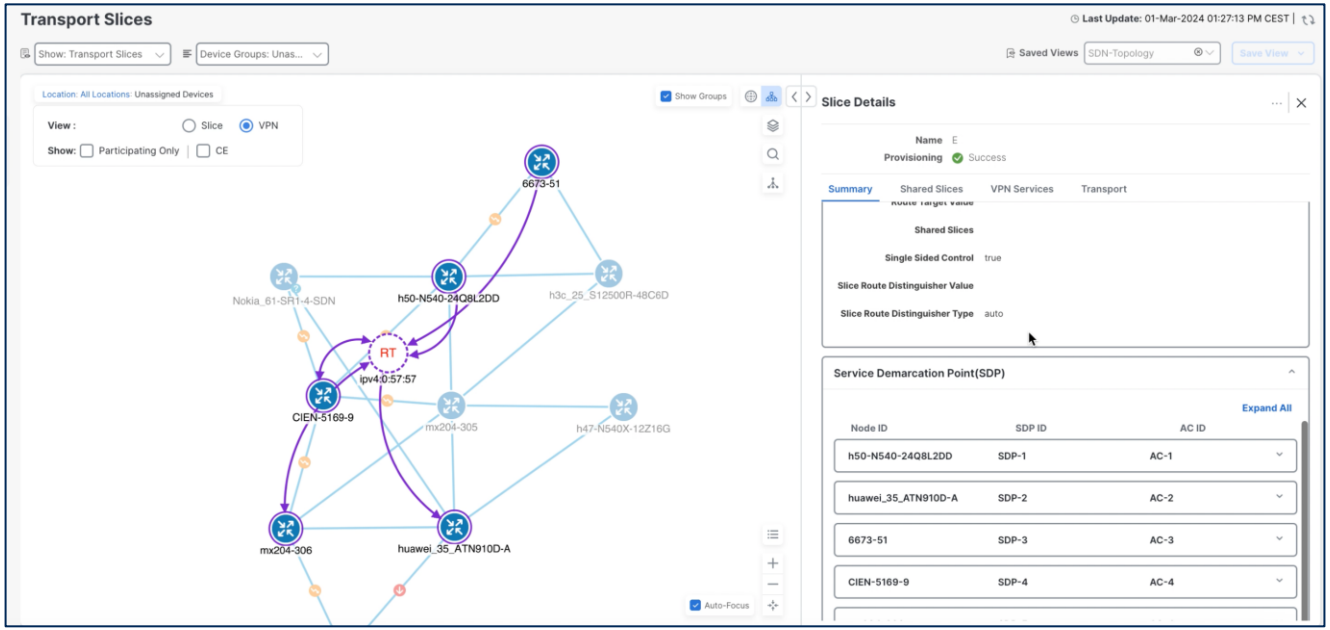


For more details refer to below Report and Recording:

EANTC 2024 Multivendor SDN Interoperability Report

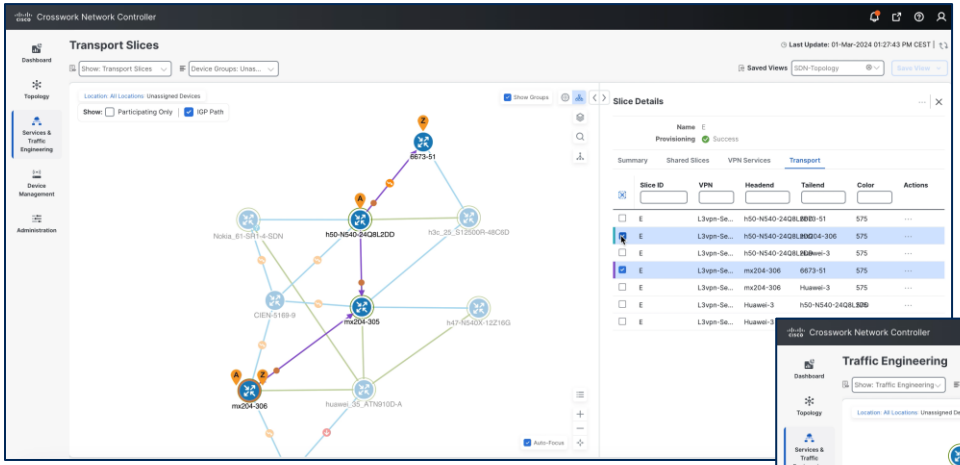
SDN Transport Slicing - EANTC Multi-Vendor Interop Showcase at MPLS SDN 2024

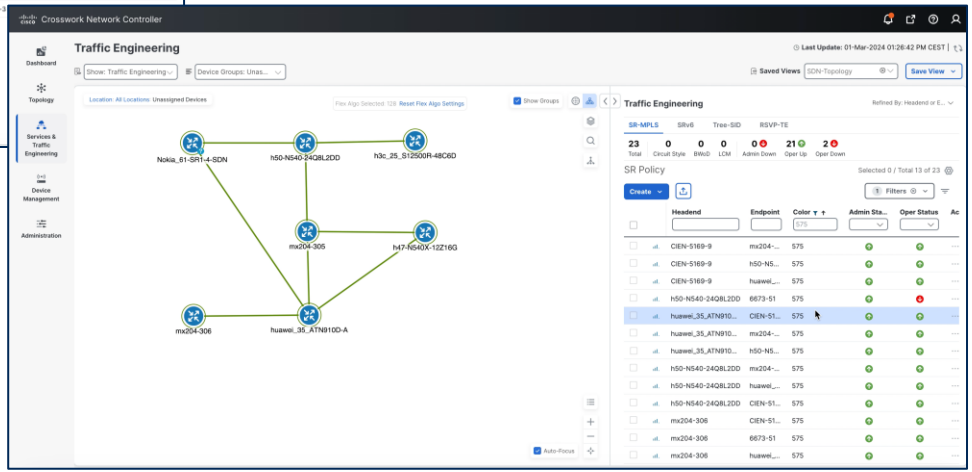
SDN – CNC6.0 Transport Slice Service



- Test sequence: provisioning, Visualisation and end to end traffic validation for Slice Service.

SDN – CNC6.0 Transport Slice Service – SR Interop





Segment Routing Interop with Multivendor nodes

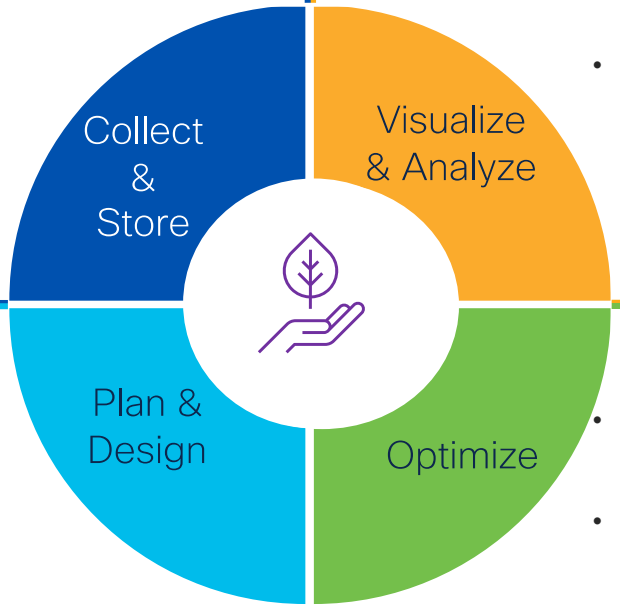
Enabling Future Use Cases

cisco Live!

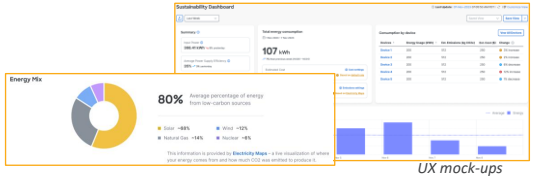
Sustainability
Use case

POC

- Collect network energy attributes:
  - ✓ Per Node
  - ✓ Per PSU
  - ✓ Per Port
- Store Attributes for trending analysis



- Visualise energy consumption from a network level view
- Drill down deeper to Visualise energy consumption for each layer/component

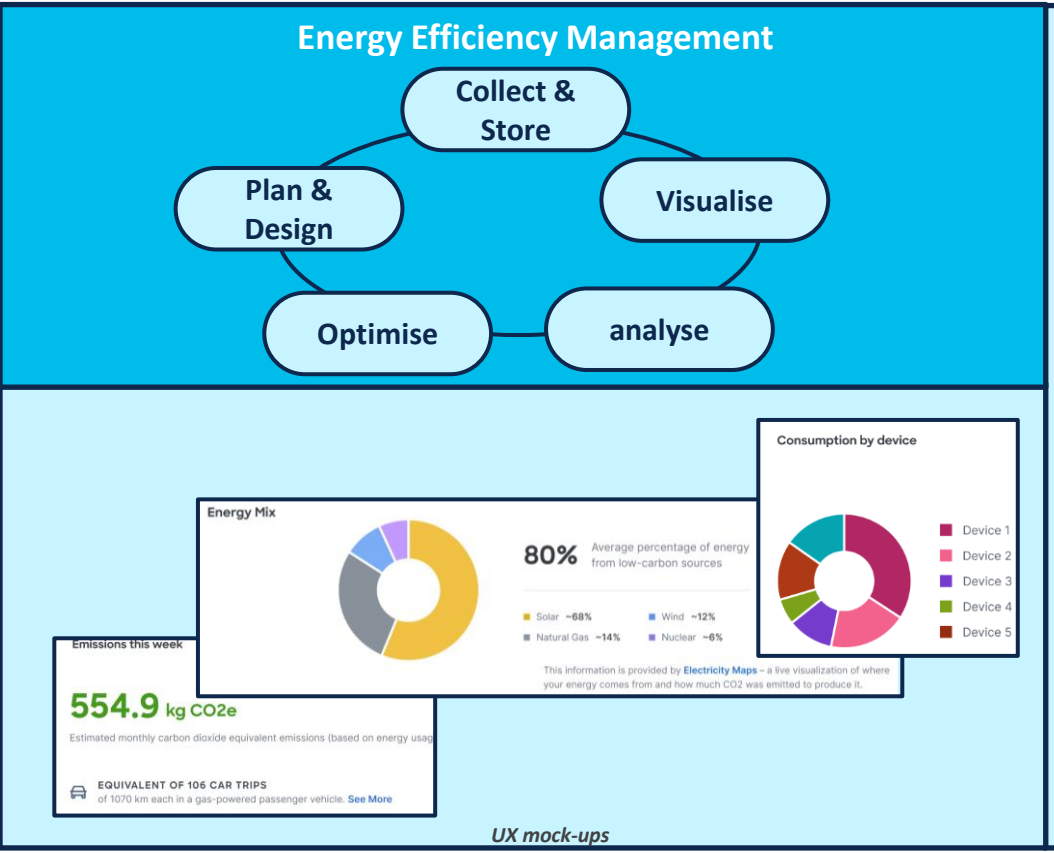


UX mock-ups

- Given forecasted traffic and resilience requirements, recommend energy-Optimised topology design and dimensioning

- Based on current network state, provide recommendations to increase efficiency
- Automatically implement remediation measures configuring the network

Energy Efficiency: Automation Functional Blocks



UX mock-ups

Collect & Store

Device environmental data such as power, PSU efficiency, and temperature

Topology, SR Policy, VPN, and traffic info

Visualise

Power consumption, carbon emissions, efficiency, and cost over time

Carbon emissions are dependent on the power source (such as coal, hydraulic). Devices can be explicitly mapped to power sources or mapped automatically based on location.

analyse

Gain advanced sustainability insights at different levels such as carbon footprint per VPN/ SR policy/ device

Get notifications (alarms and warnings)

Optimise

Minimise power consumption and increase efficiency by automating actions - such as path Optimisation based on energy/carbon metrics, component shut-down recommendations

Plan & Design

Energy/carbon efficient network designs considering resilience requirements and forecasted traffic growth

Crosswork Network Controller (CNC)

Crosswork Planning

Sustainability Automation Journey:
Where are we now?

Crosswork Network Controller (CNC)

CNC PoCs:

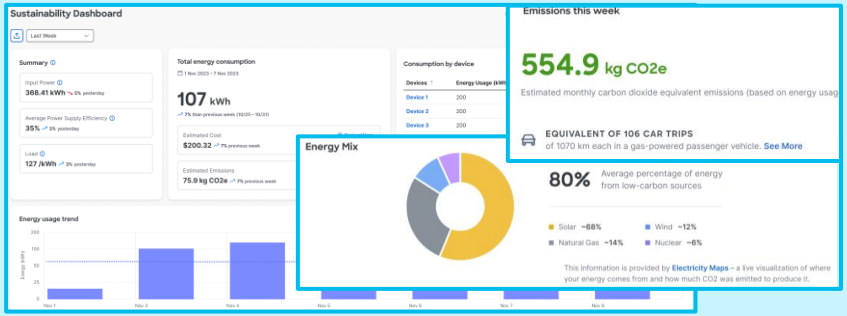
- Collect and store sustainability data over time
  - Device input/output power, PSU load, temperature
- Gain insights on sustainability data over time
- Augment topology Visualisation

WAE / Crosswork Planning

WAE PoCs:

- Recommendation of energy-Optimised “low-demand” topology
- De-activation of over-provisioned capacity during “low-demand” period - preserving resiliency and node adjacencies

Baseline Functions:



UX mock-ups

- XR alignment (collection KPIs, Optimisation knobs)
- Augmentation of network models with sustainability metrics
- Inclusion of power calculator functionality on the network simulation level
- UX studies

Sites/Facilities Power Usage Effectiveness

- Power usage effectiveness (PUE) is a metric used to determine the energy efficiency of an operational site/facility (PoP, Street Cabinet,..).
- PUE is determined by dividing the total amount of power entering a data site/facility by the power used to run the IT/Networking equipment within it.
- Most of SP operational facilities are power with -48VDC. And one of the root cause of low PUE.

CNC – Energy Savings Dashboard

1. True Input Power per PSU (unit: W) – Measured value

2. True Output Power per PSU (unit: W) – Measured value

3. Load per PSU (unit: %) – Derived value as the ratio of true output power to PSU capacity

Load per PSU Calculation - Unit %

```
RP/0/RP0/CPU0:R10#show environment power
Mon Jan 29 11:15:41.597 PST
================================================================================
CHASSIS LEVEL POWER INFO: 0
================================================================================
  Total output power capacity (Group 0 + Group 1) :    2000W +     2000W
   Total output power required                    :    1007W
   Total power input                              :     290W
   Total power output                             :     174W

Power Group 0:
================================================================================
   Power       Supply         ------Input----    ------Output---      Status
   Module      Type            Volts     Amps    Volts     Amps
================================================================================
   0/PM0       PSU2KW-ACPI     207.0     0.6     12.1      5.5       OK

Total of Group 0:              124W/0.6A         66W/5.5A

Power Group 1:
================================================================================
   Power       Supply         ------Input----    ------Output---      Status
   Module      Type            Volts     Amps    Volts     Amps
================================================================================
   0/PM1       PSU2KW-ACPI     207.5     0.8     12.0      9.0       OK

Total of Group 1:              166W/0.8A         108W/9.0A
```

Total Output Power Capacity – 2000W + 2000W = 4000W

Total Power Output (Volts * Amps)
Group 0 = 12.1 * 5.5 = 66.55 W
Group 1 = 12.0 * 9.0 = 108.0 W

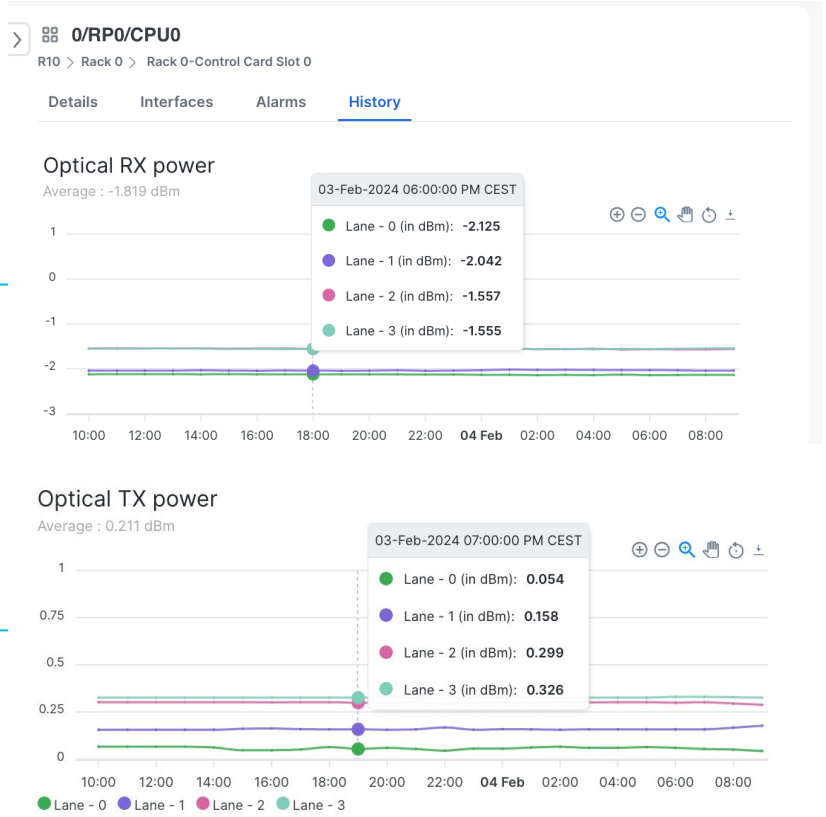
Load (Unit %) = Total Power Output / Total Output Power Capacity

$$\frac{(66.55 + 108)}{4000} \times 100 = \mathbf{4.3635\%}$$

Optical TX/RX Power

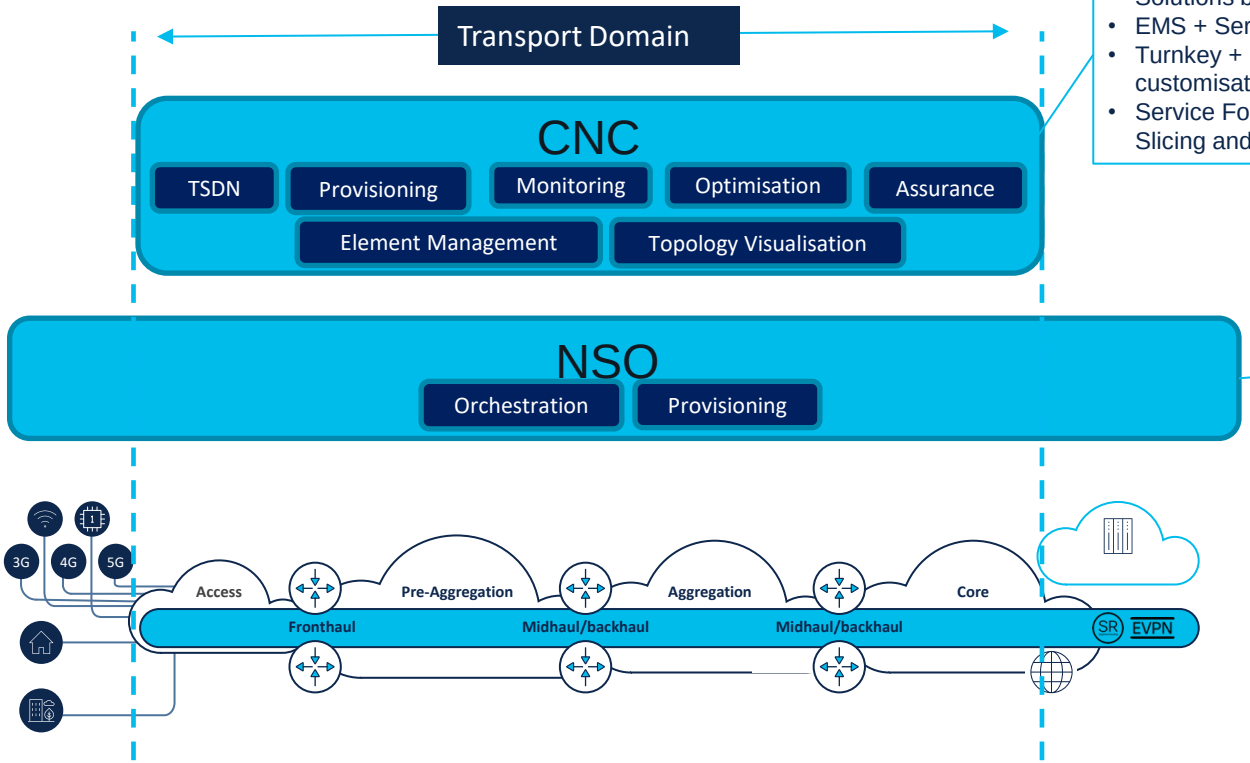
Generated from SNMP entSensor Table

```
RP/0/RP0/CPU0:R10#show controllers HundredGigE0/0/0/24
Sun Feb  4 00:07:24.763 PST
Operational data for interface HundredGigE0/0/0/24:

State:
   Administrative state: enabled
   Operational state: Up
   LED state: Green On

Phy:
   Media type: fiber over 4 lane optics (short reach)
   Optics:
      Vendor: CISCO-AVAGO
      Part number: AFBR-89CDDZ-CS1
      Serial number: AVF2124G2C8
      Wavelength: 850 nm
   Digital Optical Monitoring:
      Transceiver Temp: 33.289 C
      Transceiver Voltage: 3.325 V

      Alarms key: (H) Alarm high, (h) Warning high
                  (L) Alarm low, (l) Warning low
        Wavelength   Tx Power        Rx Power      Laser Bias
      Lane  (nm)   (dBm)   (mW)    (dBm)   (mW)     (mA)
      --  -----  ------  ------  ------  ------  ------
      0   n/a    0.1   1.0151   -2.1  0.6102   7.494
      1   n/a    0.2   1.0363   -2.0  0.6276   7.494
      2   n/a    0.3   1.0720   -1.6  0.6965   7.494
      3   n/a    0.3   1.0834   -1.6  0.6974   7.494
```



CNC and NSO
Better Together

NSO and CNC Better Together



Buyer type / Expectations:

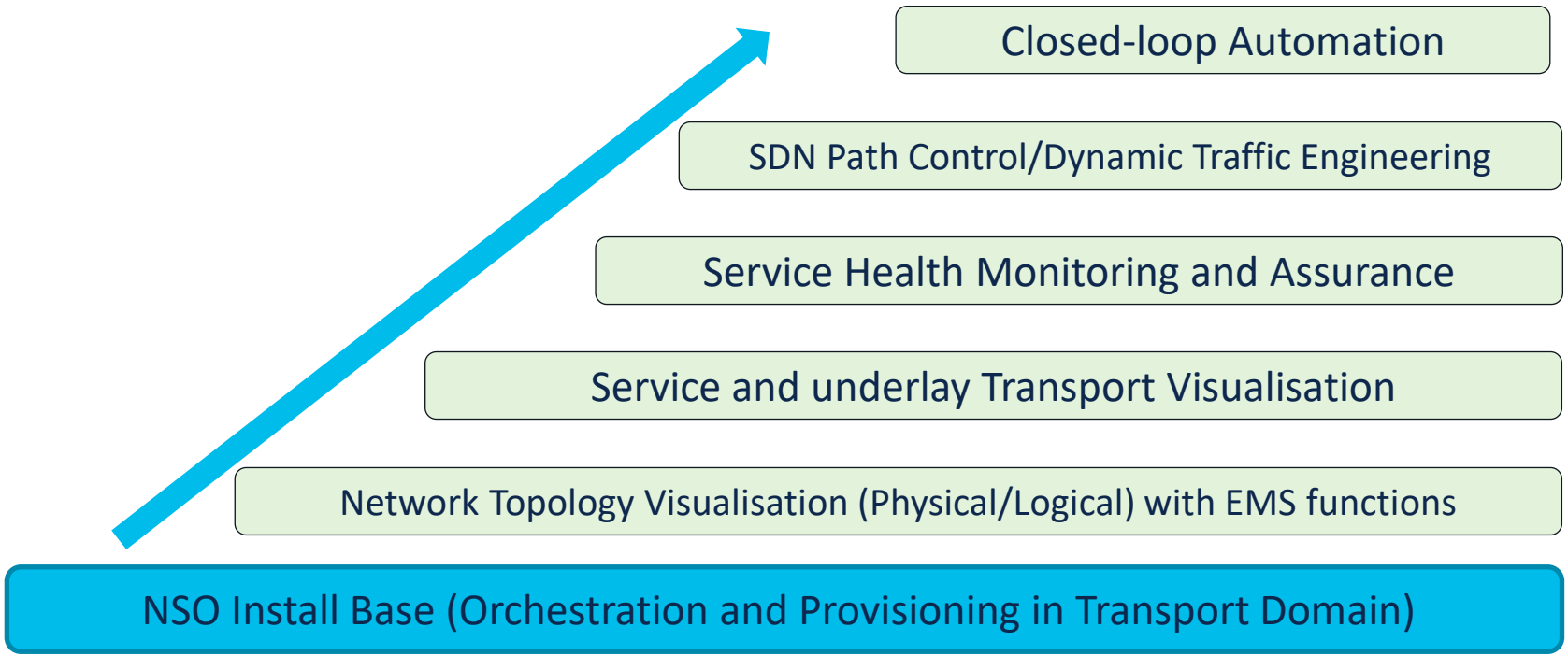
- Solutions buyer – IP SDN Controller
- EMS + Service lifecycle Management
- Turnkey + Ease of Extensibility & customisation
- Service Focus: L2VPN/ L3VPN/Transport Slicing and variants (PLE, DIA in

Buyer type / Expectations:

- Automation DIY
- Mix & match “LEGO” from different vendors/legacy mix
- DevOps centric etc.
- Want to control architecture inhouse
- Service Focus: Unrestricted

Incremental CNC Value for NSO Install Base

Advancing End-to-End Network Automation and Assurance



Automation Outcomes and Benefits

Agility is Essential in Operationalising Mass-infrastructure Networks

Accelerate Time To Market 	• Rapid Service, transport and service provisioning • Reinforced differentiation with granular TE control and SLAs • Faster introduction of new services with model-based approach
Improve Service Delivery 	• Preserved service policy intent and SLAs • Effective mitigation of network congestion • Optimal utilisation of network resource with real-time Optimisation
Boost Operational Agility 	• Automated changes Minimising configuration errors • Abstraction of complexity in a heterogenous environment • Enhanced productivity with unified UI and workflows

Conclusion: Automation Outcomes and Benefits

Agility is Essential in Operationalising Mass-infrastructure Networks

Automation is Key to drive Operational Agility

Call to Action !!!

- Improve Service Delivery and End-User Experience
- Engage in POC/Demos to validate CNC Use cases
- Participate in upcoming Early Field Trial for CNC 7.1 to validate Use cases

Winning Together !!!

cisco Live!

Keynote Deep Dives

Wednesday
10:30am –11:30am

Experiences Amplified: How AI Can Fuel Better Employee and Customer Experiences

Level 1
Room 106

Smart, Secure, Seamless: Transforming Experiences with Next-Generation Networking

Level 2
Room 204

Harness a Bold New Era: Transform Data Centre and Service Provider Connectivity

Level 2
Room 203

Securing User to Application and Everything in Between

Level 2
Melbourne Room 2

Unlocking Digital Resilience through Unified Observability

The HUB
Centre Stage

Complete Your Session Evaluations

Complete a minimum of 4 session surveys and the Overall Event Survey to claim a **Cisco Live T-Shirt**.

Complete your surveys in the **Cisco Live mobile app**.

Continue your education

- Visit the Cisco Stand for related demos
- Book your one-on-one Meet the Expert 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
Thank you
cisco Live!
#CiscoLiveAPJC


cisco Live!
GO BEYOND
#CiscoLiveAPJC