EPN Manager

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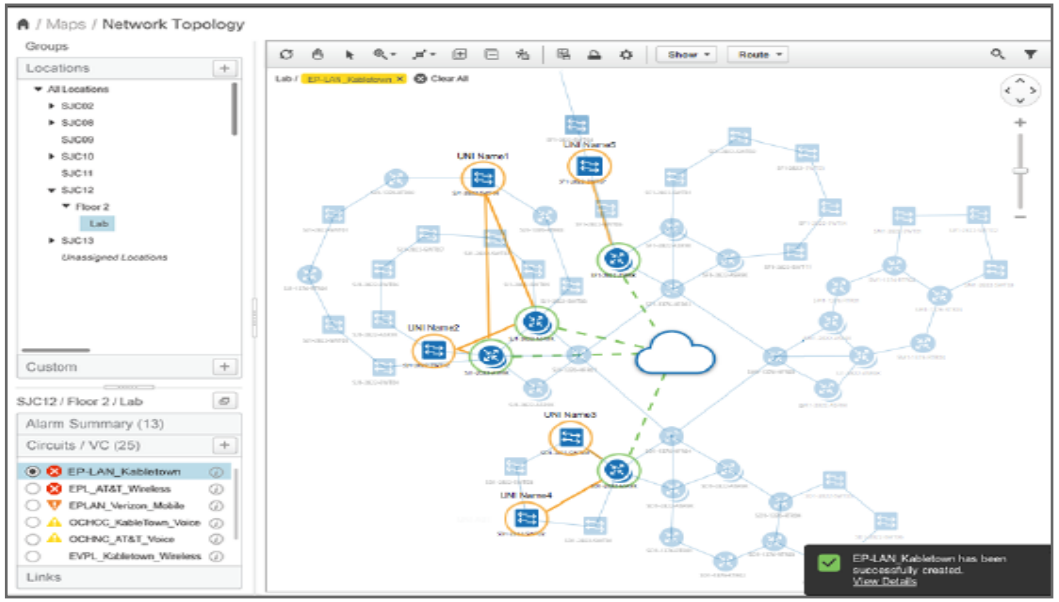
EPN Manager – Integrated, multi-domain, multi-layer EMS/NMS

- “One” EMS/NMS covering network management lifecycle
- “One” GUI covering end-to-end task flows across provisioning, assurance, and device management
- Model-based framework allowing frequent network management content (device drivers, network feature support) updates and customization
- Out of the box workflows for Services provisioning and assurance
- Initial focus on Carrier Ethernet, L3VPN and Optical Transport



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Roadmap Rev 21

Introduction to EPN-M

- What is Evolved Programmable Network Manager (EPN-M)

- Unified network management platform for service provider architecture
- Optical and Carrier Ethernet (March 2015)
- SP Wi-Fi and Data Center (October 2015)
- Evolving for other SP technologies – Small Cell, Mobility, Cable

Allows you to manage multiple networks in a single box

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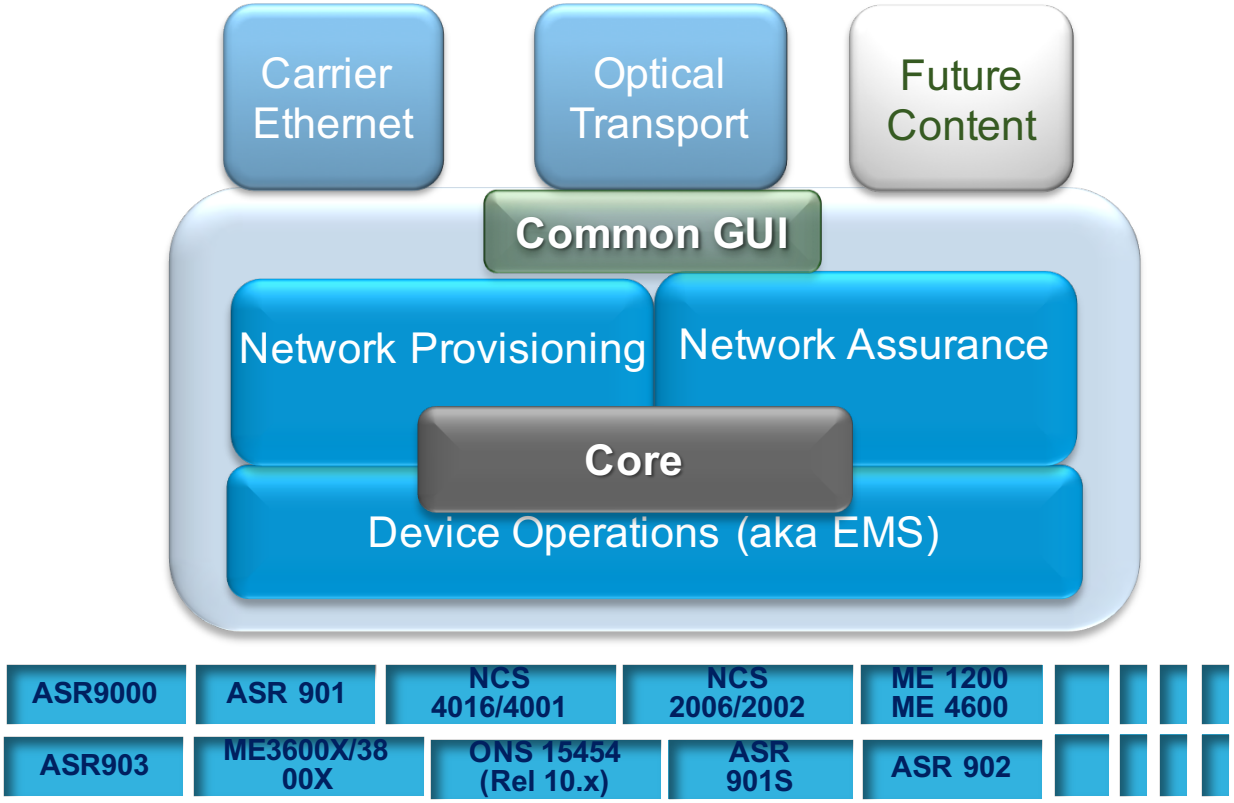
Architecture Highlights



- Converged EMS & NMS
- Single User Experience
- Single Runtime Environment
- Small Footprint
- Single Database
- Common Model Shared across Applications
- Reconciliation between Provisioning and Assurance
- OVA Install
- Feature Extensibility
- SDK and Tooling capabilities

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Multi Layer Multi Domain Convergence
Management for Converged Service Provider Networks

Metro Ethernet

- E-Lan : E-Line : E-Tree
- E-Access : E-Transit
- QinQ and INNI
- L3 MPLS VPN
- RAN Backhaul
- Autonomic Networking

Optical

- Dense Wavelength Division Multiplexing (DWDM) Optical Channel (OCH) Circuit
- Optical Transport Network (OTN) Circuit
- Packet + Optical

SP Wi-Fi

- Controllers
- Access Points
- Outdoor Wireless
- Meraki
- Content Visibility via AVC support

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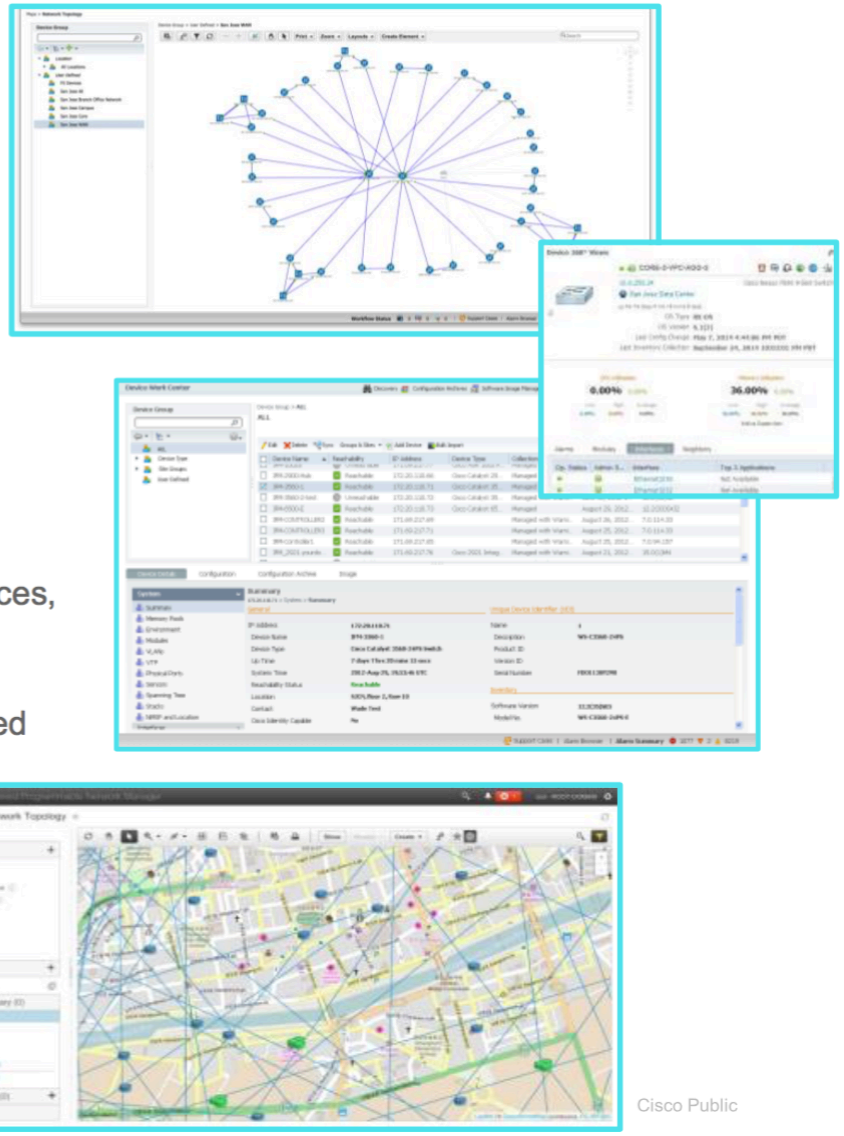
Lifecycle

End-to-End Lifecycle Management

Lifecycle

- **Centralized lifecycle management** - discovery, inventory, configuration, SWIM, and service assurance
- **Advanced troubleshooting** of wired and wireless infrastructure issues
- **Rapid device** support through Device Packs for new Cisco® devices, routers, switches, controllers, access points.
- **Customizable configuration templates** based on Cisco validated designs and guided workflows
- **Cisco Unified Access™ management and client tracking**
  - Seamless integration with Cisco Identity Services Engine (ISE) for simplified troubleshooting
  - Seamless integration with Cisco Mobility Services Engine (MSE) for location-based services, rogue detection, etc.



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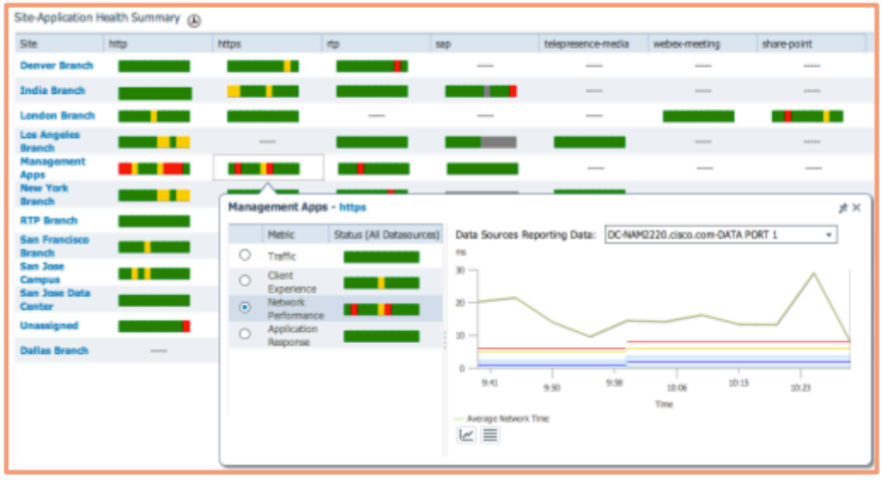
Assurance

Application Experience and End User Experience

Assurance

- **End-to-end visibility** for service-aware networking by applications, services, and end users
- **Out-of-the-box support** for Cisco® advanced technologies, including AVC 2.0, NetFlow, Flexible NetFlow, NBAR2, Performance Agent, Medianet, and more
- **Service health dashboard** allows quick health check on your business-critical applications
- **Simplified troubleshooting** of applications and client access issues



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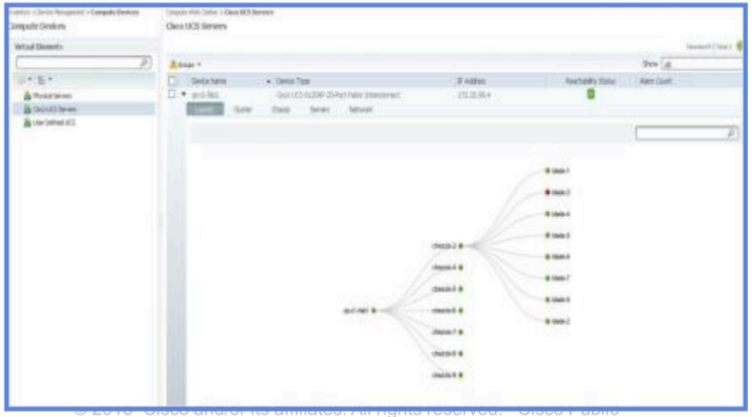
UCS Server Management

Bridging Network and Compute

UCS Server Management

- **Extends One Management** – Visibility of infrastructure and assurance from Branches all the way through campus and data center
- **Cisco UCS B and C series** – Discovery, inventory of compute infrastructure and mapping that back to the network elements of the data center
- **Fault and Root cause analysis** – Identify and isolate the source of the problem. Help pin point the issues to the right network or compute elements. Understand the impact of network problems onto the compute infrastructure. Remediate the issues at its source
- **Availability and Performance** – Monitor the availability status of the UCS physical servers. Provides visibility to the UCS ports health status and performance
- **Server 360 Degree view** – Concise and easy to consume server details accessible from any where in the product. Allows for quick troubleshooting



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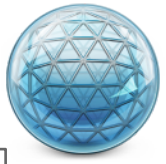
EPNM 1.2 for Network Transport



One Framework

- Common Core/Admim
- Common MTOSI/RESTConf
- Common html GUI
- Common Topology
- Fulfillment:
  - Device/Network Provisioning
  - Discovery & Reconciliation
- Assurance
  - Device & Network/Service testing
  - Faults
  - Performance data reporting
- Access:
  - RBAC
  - By network domain (multi-tenancy)
- Programming Guide

Network Transport

- Optical Transport
  - OCH(DWDM)/OTN
- IP WAN:
  - MEF 2.0 Services
    - E-Line, E-LAN, E-TREE, E-ACCESS
  - MPLS to the Edge plus Ethernet Access
    - G.8032
    - ICCP-SM
  - L3VPN
    - ASR9K as PE

Key Device Drivers

- ASR9001, 9004, 9006, 9010, 9912, 9922, 9000v, 9000v2
- ASR 901
- ASR 901S
- ASR 902
- ASR 903
- ASR 920
- ME3600X
- ME3800X
- NCS2002, 2006, 2015
- NCS4009, 4016

EPN Manager 1.2 – Optical Transport (L0/L1)

- OCH (Optical Channel Circuits) – Deploy via TL1
  - **OCHNC** - *circuits establish connectivity between two optical nodes on a specified C-band wavelength*
  - **OCHCC** - *OCHCC circuits extend the OCHNC to create an optical connection from the source client port to the destination client port of the TXP/MXP cards*
  - **OCH-Trail** - *OCH trail circuits transport the OCHCCs*
- OTN (Optical Transport Network) – Deploy via IOS CLI
  - **ODU UNI** – end to end OTN circuits (ODU0, ODU2, ODU3, ODU4 multiplex hierarchy)
  - **ODU Tunnel** – it is the implicit tunnel that supports the UDU UNI (it can be created alone to support open ended connections)

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EPN Manager 1.2 – Carrier Ethernet and L3VPN Virtual Connections (L2/L3/L4)

- Supported VC configuration in EPN Manager 1.2
  - E-Line (EPL/EVPL) MPLS to the Edge
  - E-Line (EPL/EVPL) Ethernet Access: local access, G.8032, ICCP-SM
  - E-Lan (EP-Lan/EVP-Lan) MPLS to the Edge – VPLS/H-VPLS with redundant PW
  - E-Lan (EP-Lan/EVP-Lan) Ethernet Access: VPLS based with G.8032 or ICCP-SM
  - E-Tree (EP-Tree/EVP-Tree) MPLS to the Edge
  - E-Access (EP-Access/EVP-Access) MPLS to the Edge
  - L3VPN: ASR9K as PE device

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EPN Manager 1.2 – QoS and Connectivity Verification Options

- Options included with EPN Manager provisioning, discovery, and assurance applications:
  - Quality of Service
    - Bandwidth profiles
    - Classification and admission criteria
    - Policy enforcement
    - EMS-level (per device) QoS policy discovery and configuration application
  - Ethernet OAM
    - ELMI
    - Link OAM
    - CCM (end-to-end connectivity)
    - Y.1731

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EPN Manager 1.2 – Resource Readiness and On-boarding

- Device existence and inventory discovery
- Network service discovery
- Templates
  - Device Set up – SNMP, Trap, Access Security (e.g. TACACS) config etc
  - Troubleshooting – incl., CFM Ping, Trace etc.
- Model Based Configuration for BGP, OSPF, ISIS including Remote LFA, BGP 3107…

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Cisco EPN Manager: Differentiating Categories

Features	Good Vision	Good Table Stakes
• Web-based HTML client* • Multilayer view/circuit trace* • 360 view* • Future: RAN backhaul scenarios • Future: “multilayer” performance reporting • Future: Dynamic, geographic map, 3D multi-layer and map view.	• Packet and optical convergence • Integration of design/plan (MATE) + optimize (WAE) + NMS (EPN Manager) • Long term: unified multilayer platform for CE, Optical, Cable, Mobility, SP-Wifi, data center and more • Long term: Unified Multilayer Initiative (SDN controller dependency)	•Single product experience •Single product, fast deployment •MTOSI NBI •REST API •Modular and model-driven architecture •GUI-based provisioning with fewer clicks •Geo background map integration •Carbon toolkit to demo NBI

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EPNM 1.2 Features

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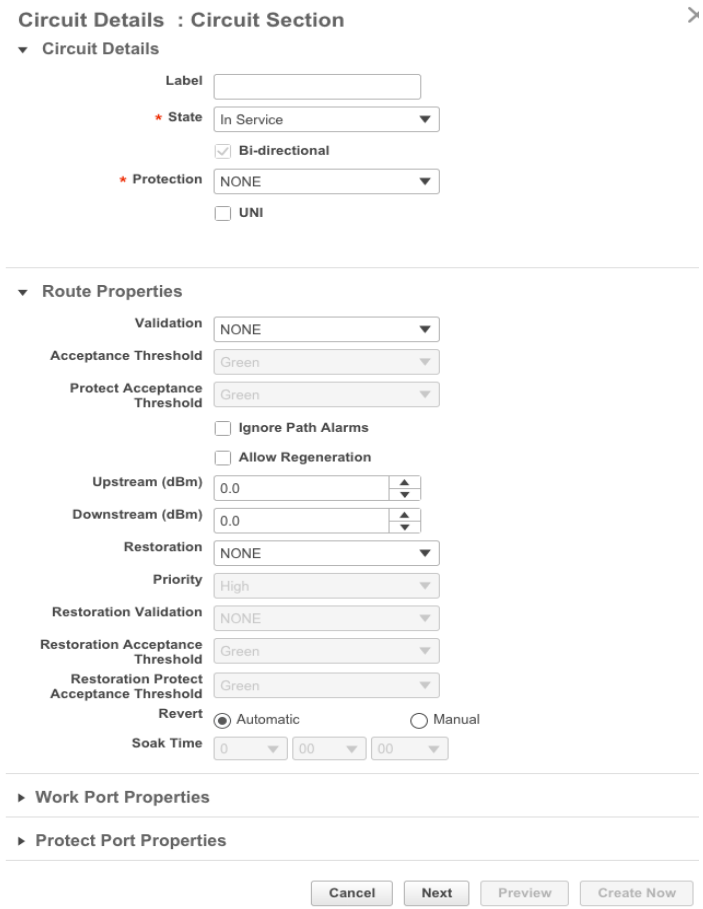
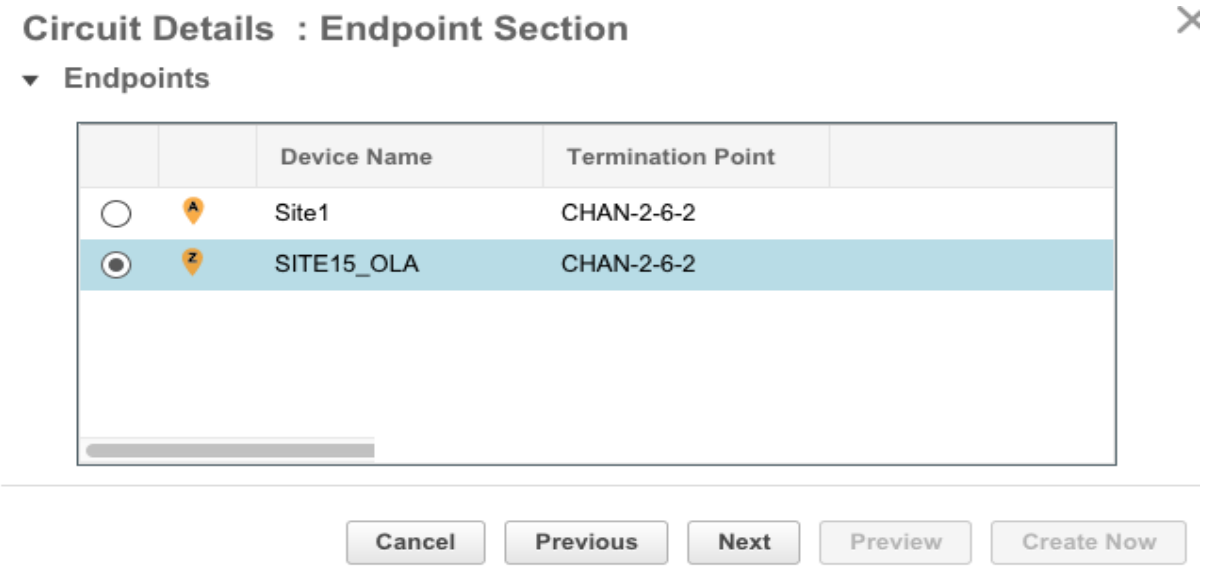
OCH & OTN Circuit Provisioning

One Platform



Task flow driven procedure

Graphical and Textual selection



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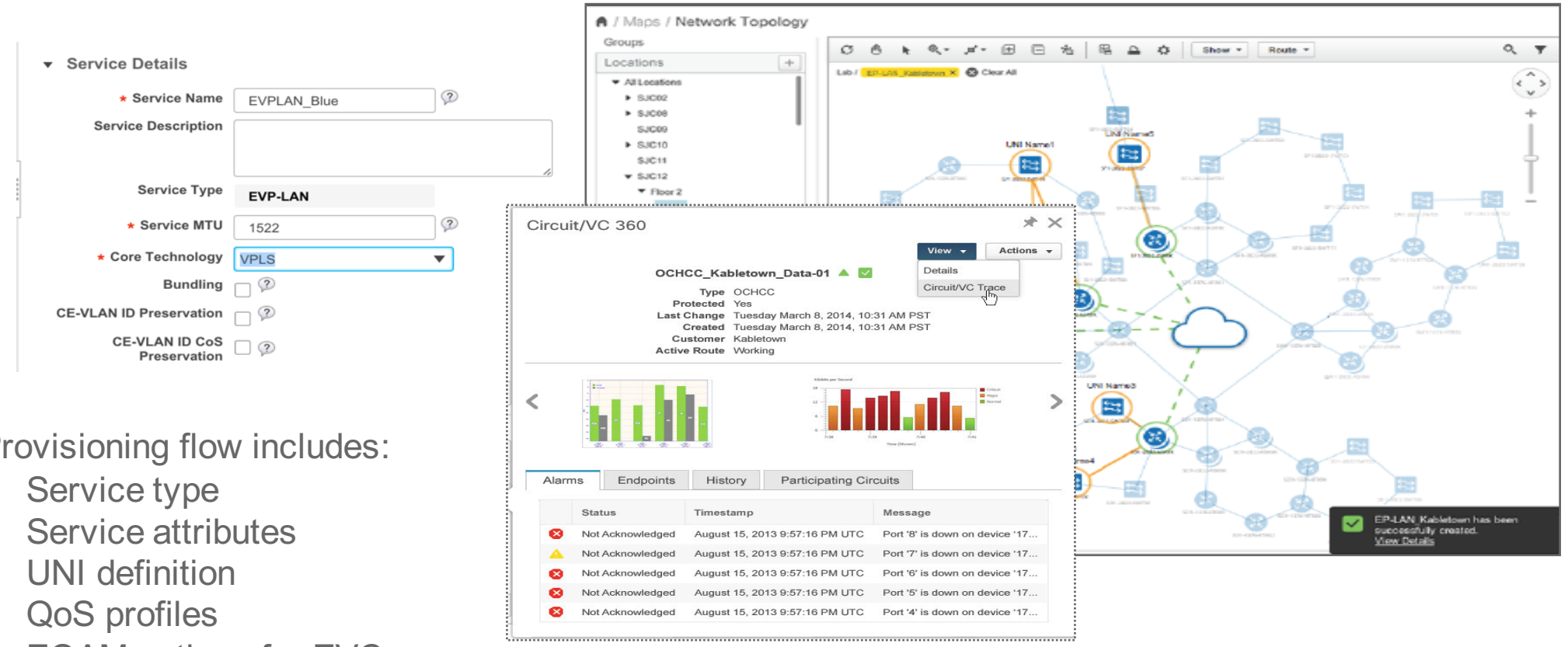
MEF 2.0 CE and L3 MPLS VPN Provisioning

One Platform



Provisioning flow includes:

- Service type
- Service attributes
- UNI definition
- QoS profiles
- EOAM options for EVCs

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Roadmap Rev 21

Chassis View

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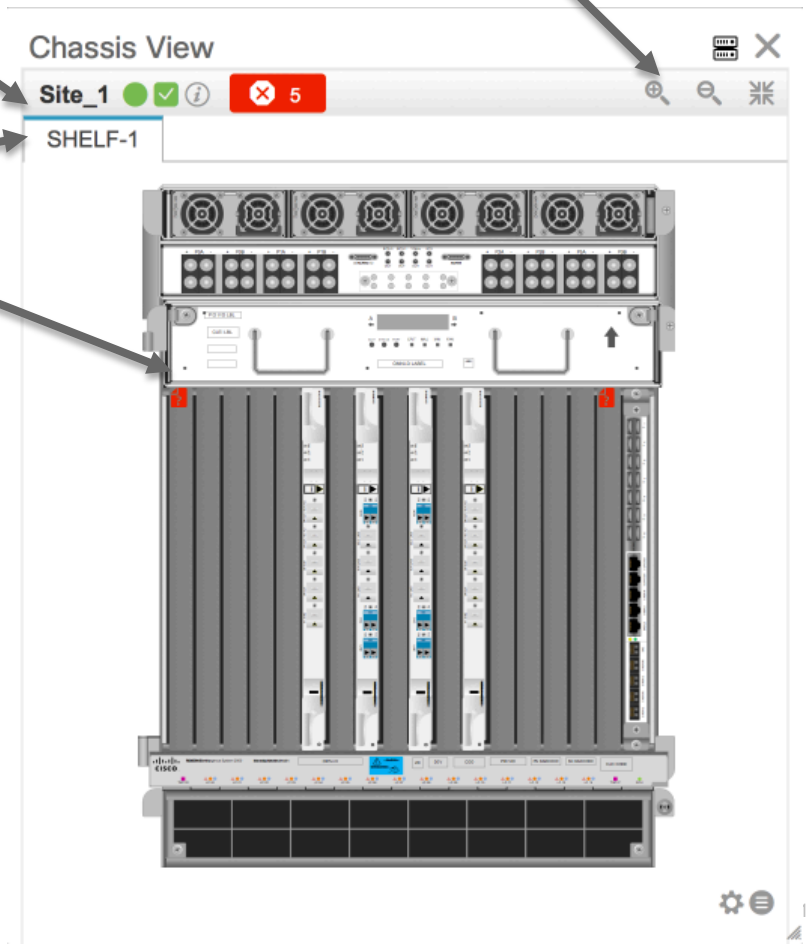
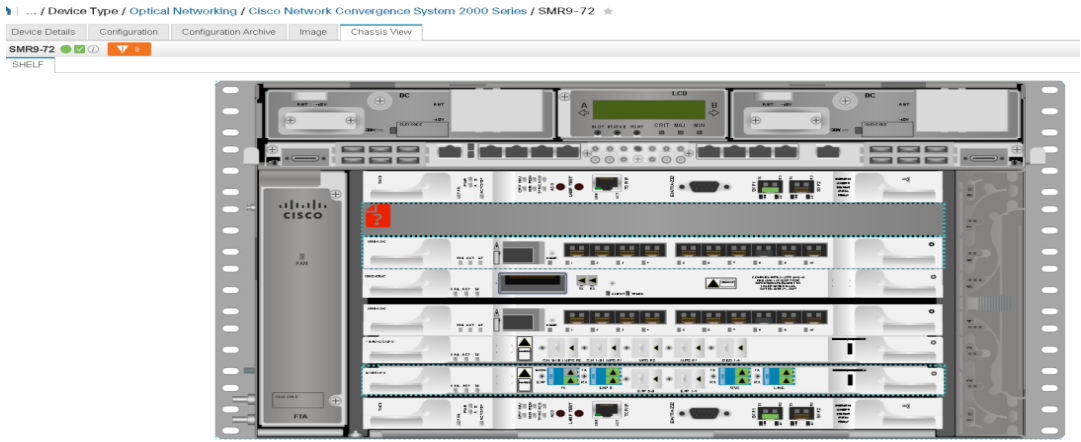
Chassis View

Zooming and Panning make it easy to desired details.

- Node information bar updates to show overview
- Each shelf shows in a separate tab with the shelf ID for a label.
- Equipment that isn't implemented yet shows an icon.
- Hovering gives you the equipment details.
- Clicking on the equipment gives you a zoomed view.
- Any equipment alarms will overlay icons on the image.
- Card state, including pre-provisioned, shows on image.



Chassis View (NCS 2006)



From Network Devices Table
-> click on ‘CV’ icon

From the Device Details page
-> click on ‘Chassis View’ tab

Supported chassis: NCS 2002, NCS 2006, NCS 2015, NCS 4009, NCS 4016

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Inventory Reporting

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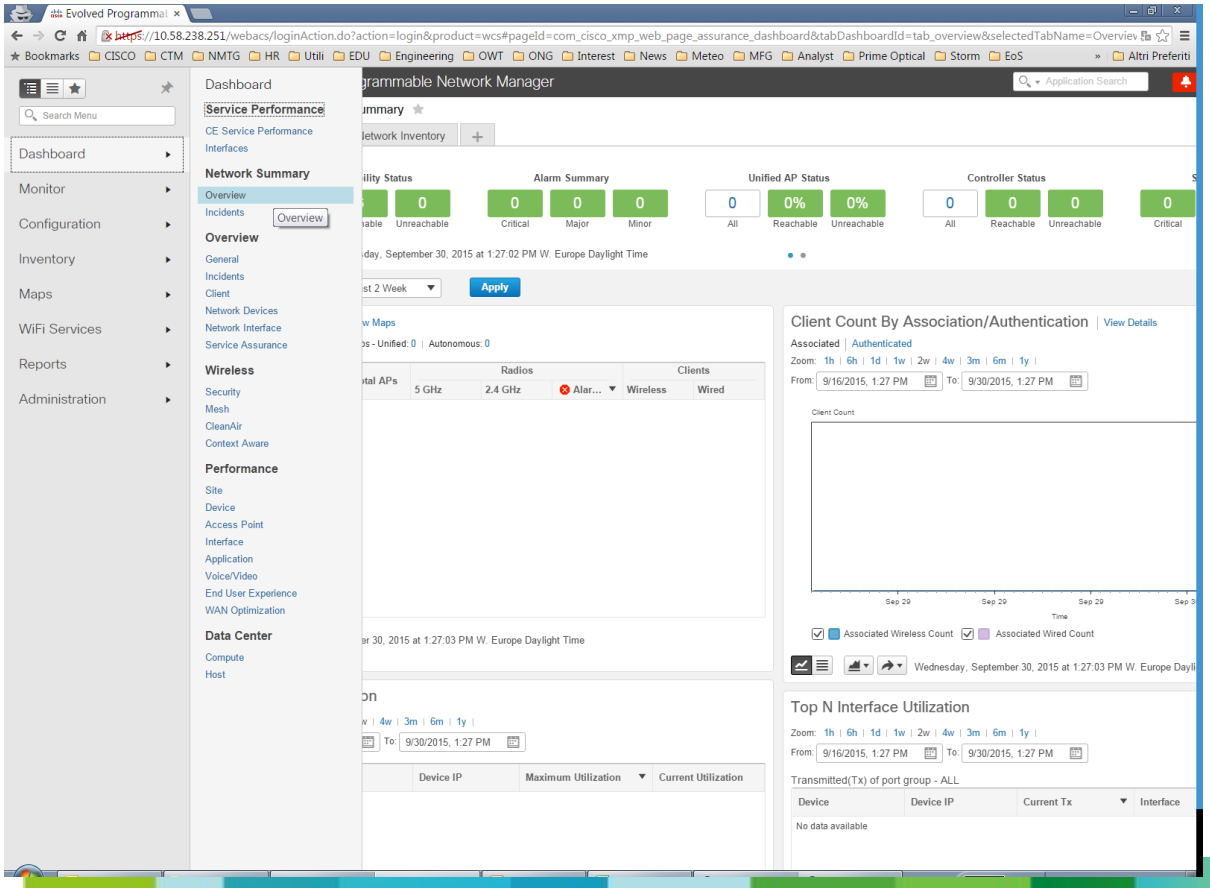
Accessible from the dashboard



Dashborad -> Network Summary -> Overview

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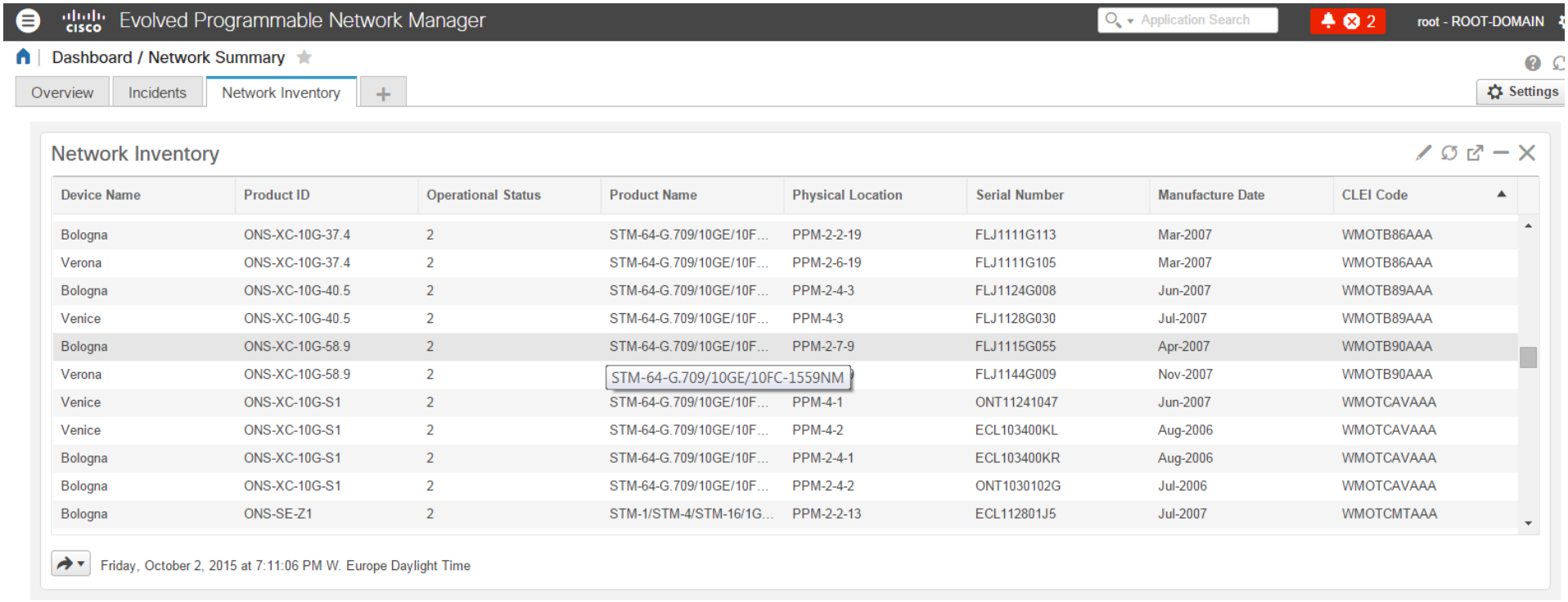
Inventory report with manuifacturing date



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Circuit Management

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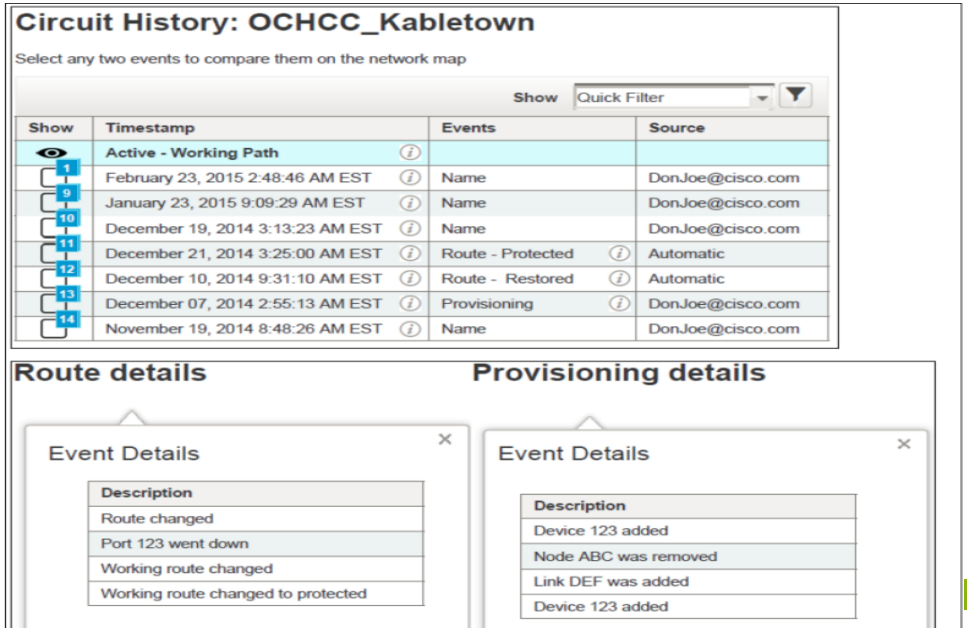
Circuit History

- Why do we need it?
  - History allows us to take a snapshot of a service for future reference.
  - Based on history, the user will be able to track a service and find out what happened to it and when.



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Performance Management

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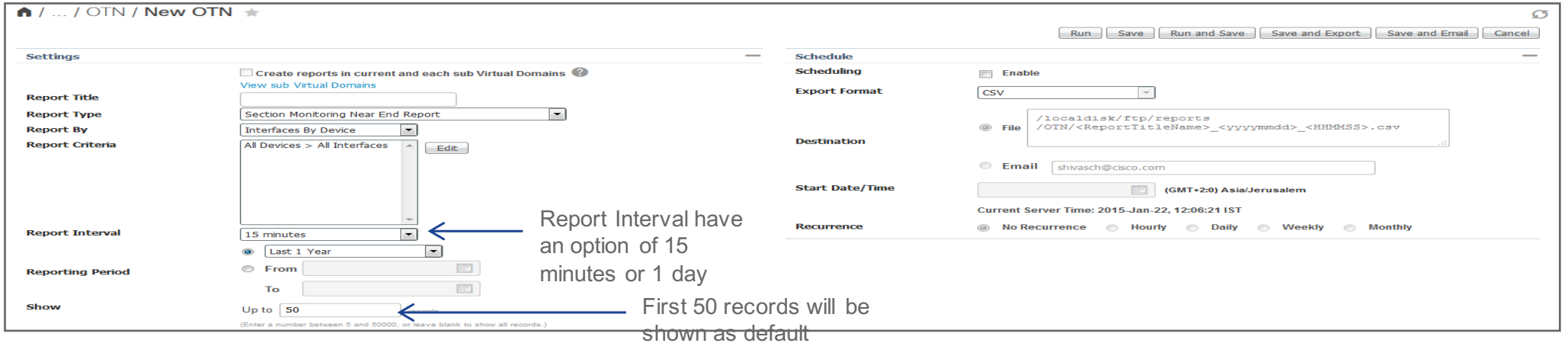
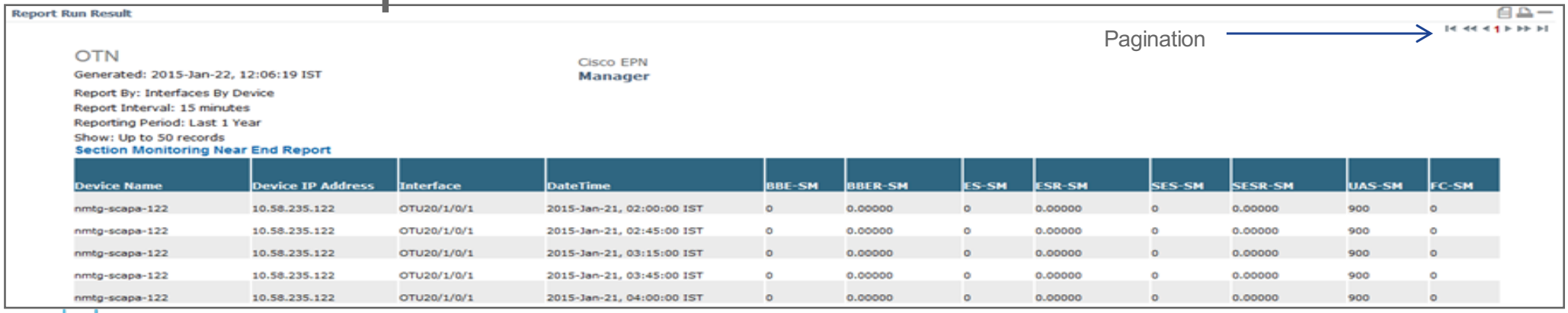
Example of Tabular Optical Reports



Report Interval have an option of 15 minutes or 1 day

First 50 records will be shown as default

Tabular Output



Device Name	Device IP Address	Interface	DateTime	BBE-SM	BBER-SM	ES-SM	ESR-SM	SES-SM	SESR-SM	UAS-SM	FC-SM
nmtg-scapa-122	10.58.235.122	OTU20/1/0/1	2015-Jan-21, 02:00:00 IST	0	0.00000	0	0.00000	0	0.00000	900	0
nmtg-scapa-122	10.58.235.122	OTU20/1/0/1	2015-Jan-21, 02:45:00 IST	0	0.00000	0	0.00000	0	0.00000	900	0
nmtg-scapa-122	10.58.235.122	OTU20/1/0/1	2015-Jan-21, 03:15:00 IST	0	0.00000	0	0.00000	0	0.00000	900	0
nmtg-scapa-122	10.58.235.122	OTU20/1/0/1	2015-Jan-21, 03:45:00 IST	0	0.00000	0	0.00000	0	0.00000	900	0
nmtg-scapa-122	10.58.235.122	OTU20/1/0/1	2015-Jan-21, 04:00:00 IST	0	0.00000	0	0.00000	0	0.00000	900	0

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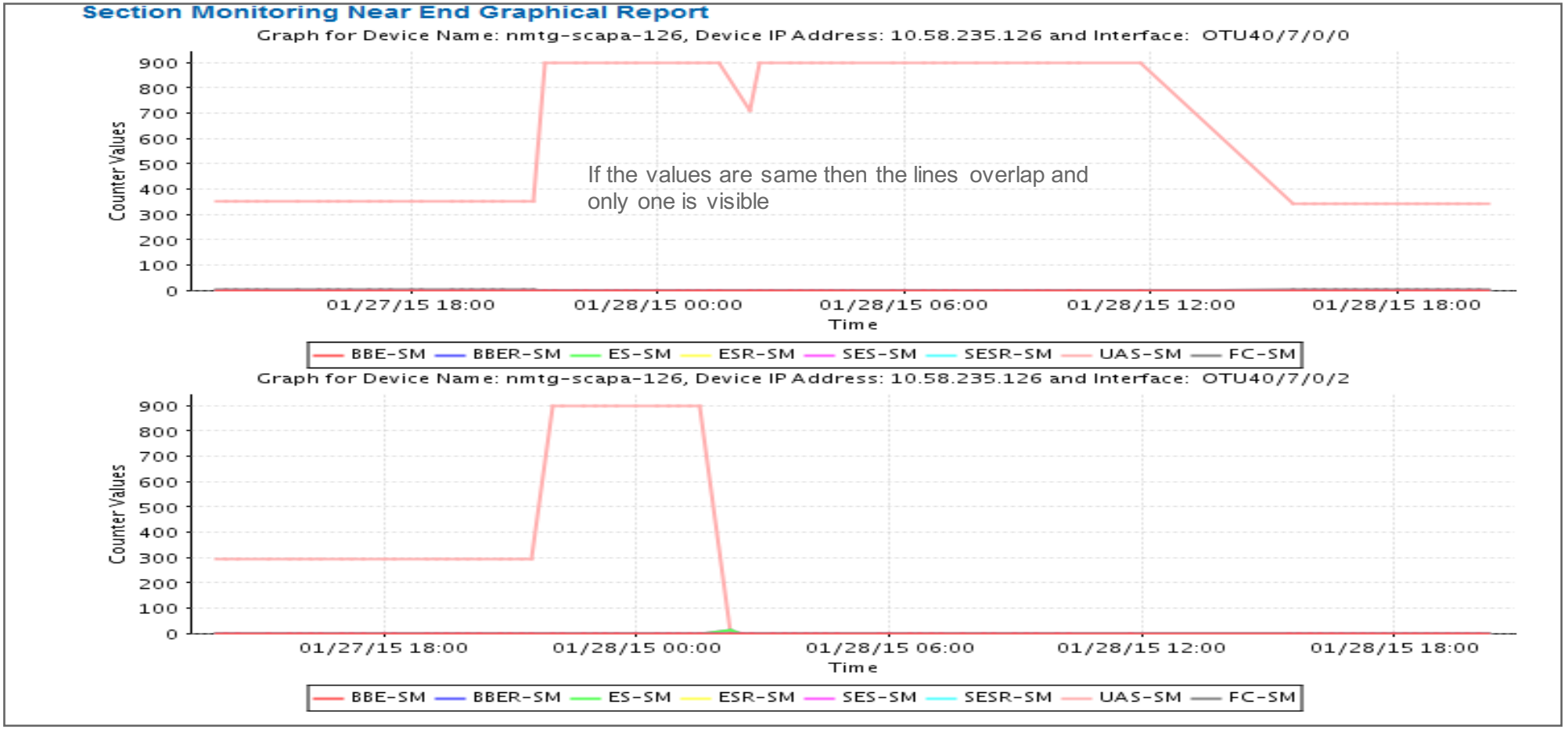
Example Graphical Optical Report Output



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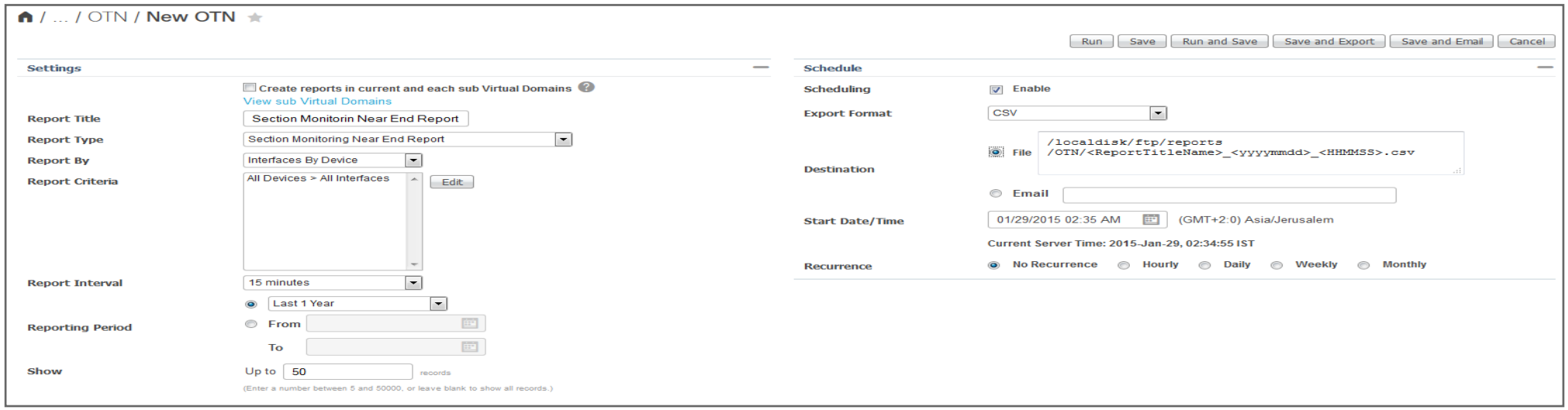
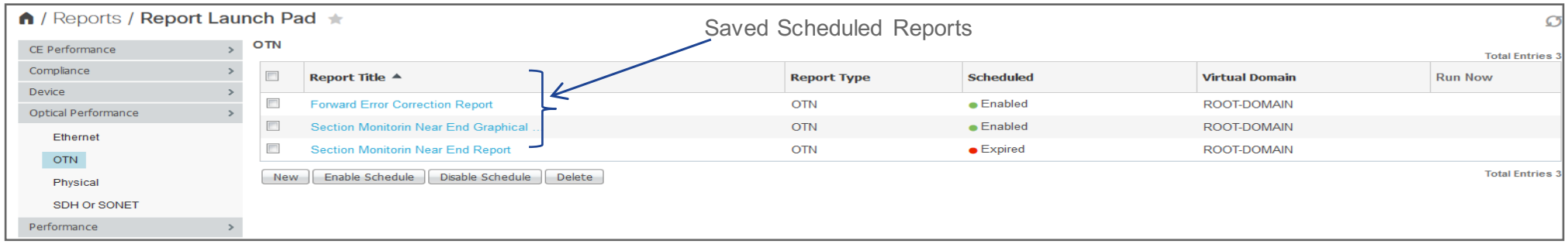
Report Scheduling





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Geo Map

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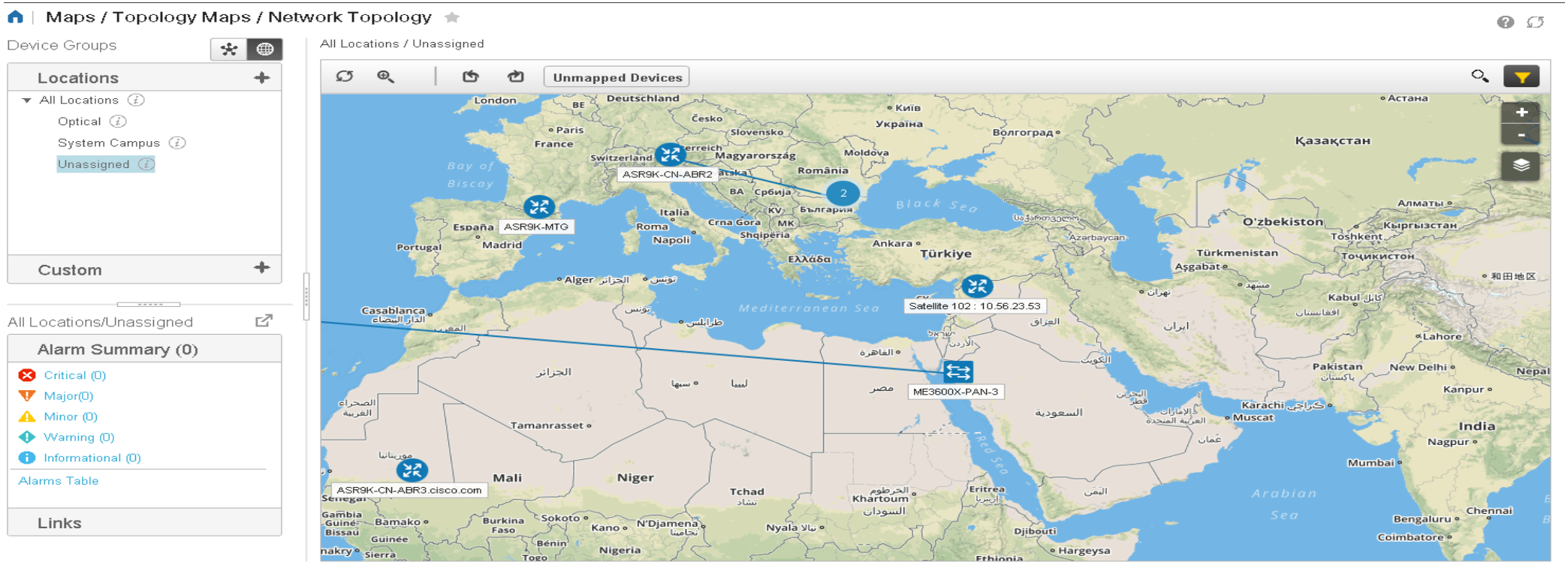
Geographical Map



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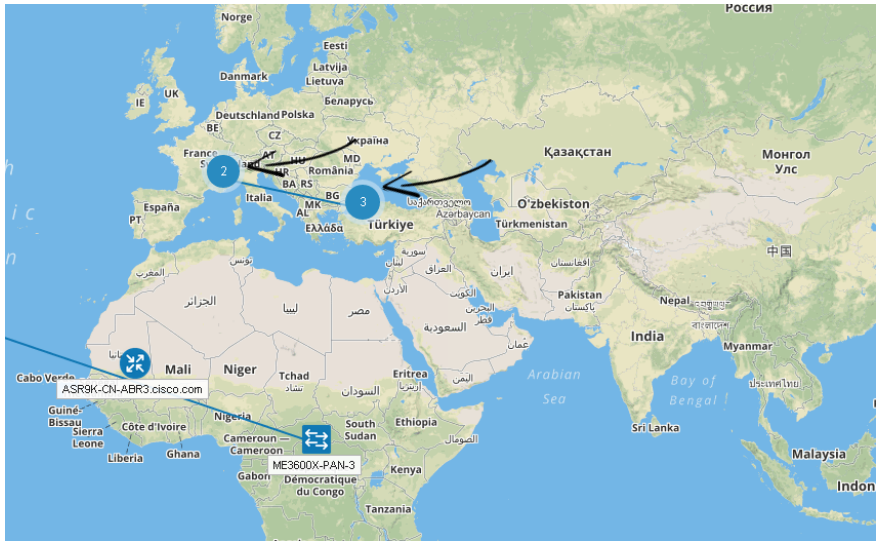
Geo Device “Clusters”

- A device “cluster” is formed when two or more devices are located close to one another on the map.
- The cluster is represented on the geo map by a circle with a number in its center, indicating the number of devices in the cluster.
- Zoom in to see the individual devices on the map.
- If devices location is too close (less than 5-8 meters) then even on max zoom level there will be a cluster.
- Alarms are shown on clusters based on highest severity of all its devices.



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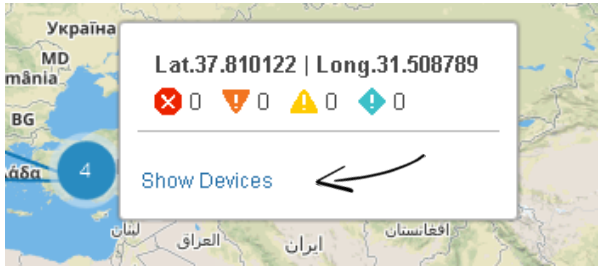
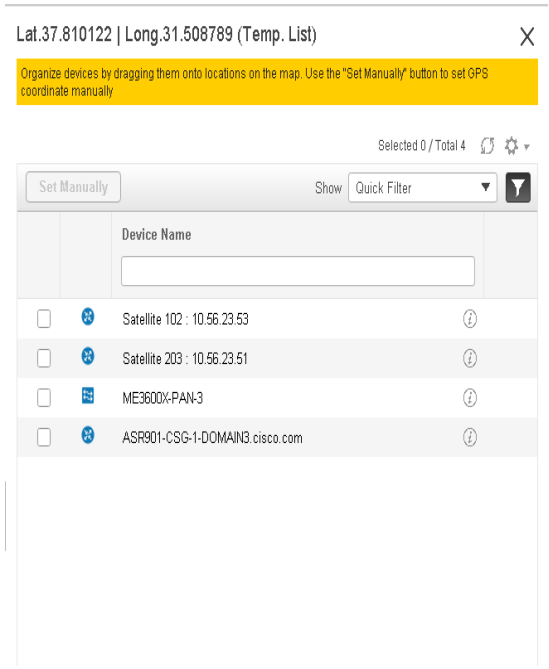
Show Devices

- To see the list of devices which are part of the same “cluster”, select the cluster -> Show Devices
- The list of devices will appear to the right.
- You can now change the location of devices in this cluster, by either drag & drop to a new location, or set the location manually.
- Note: This list is a snapshot list, so it will not update if you edit the location of a device.





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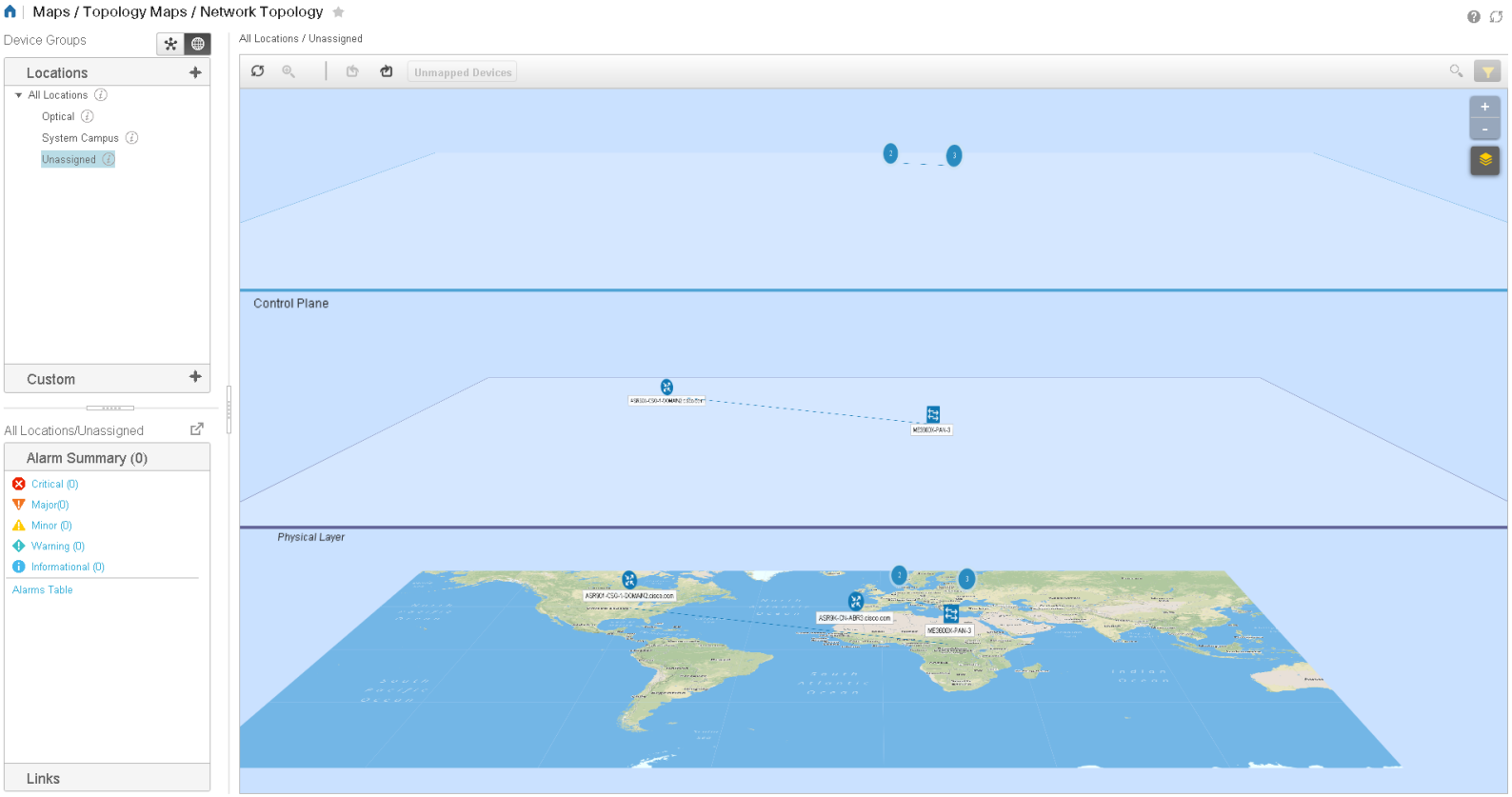
Link Layers View



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Multi Layer Trace

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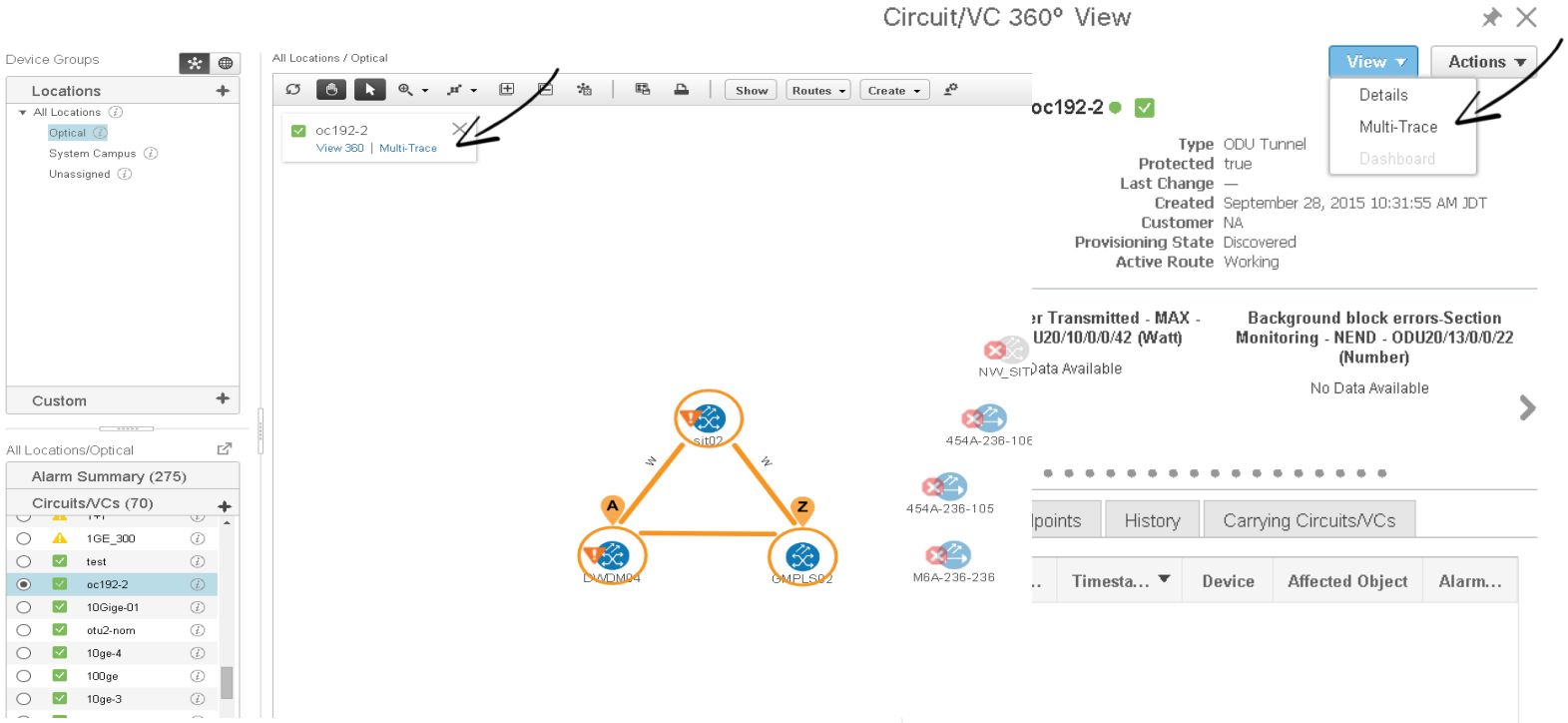
Multi Layer Trace – recap

- The EPN Manager Multi Later Circuit Trace supports only Optical Circuits
- Launched from Circuit 360 and Circuit Overlay



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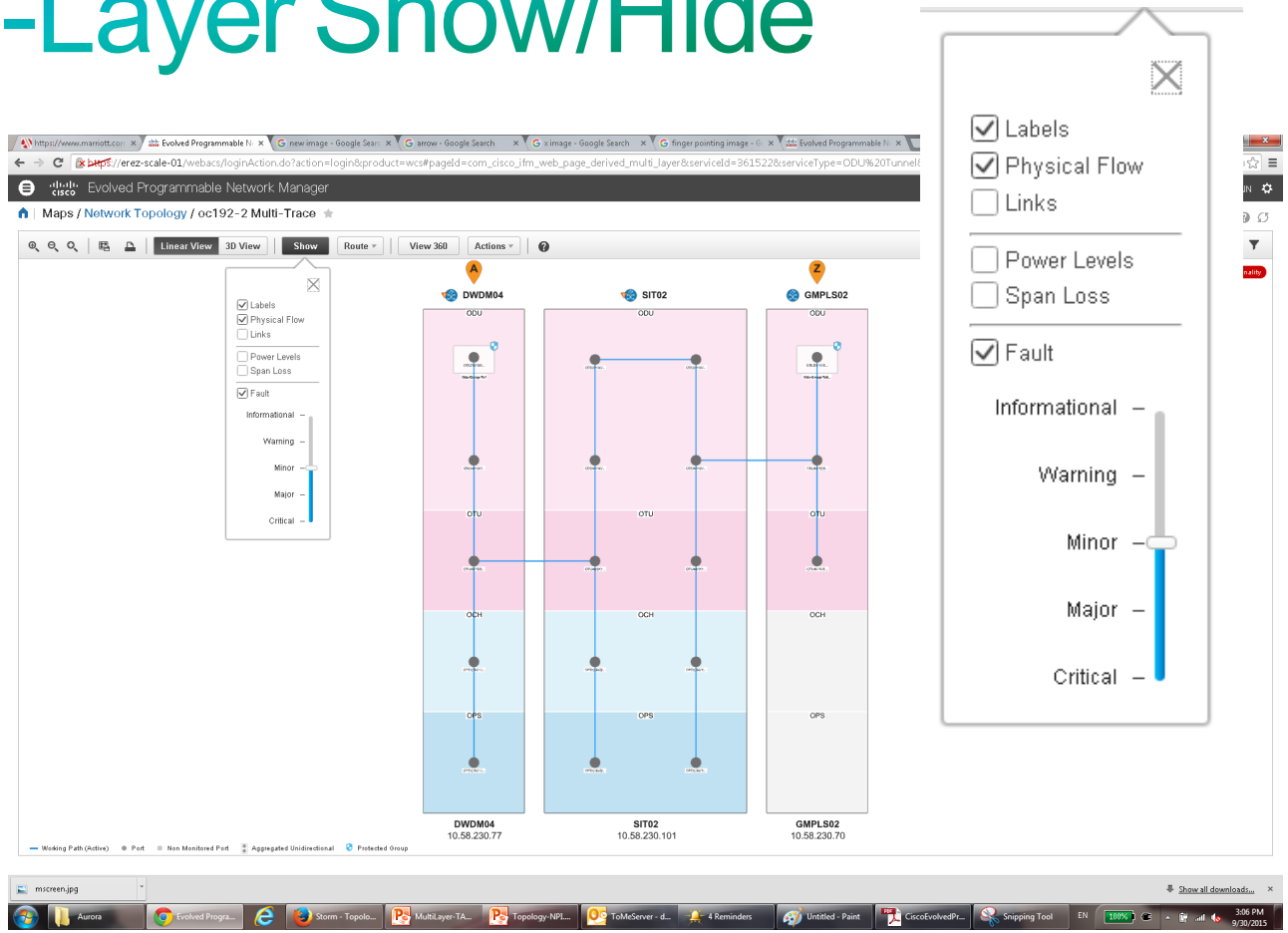
Multi-Layer Show/Hide

- Labels
- Physical Flow
- Links
- Power Level
- Span Loss
- Faults



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NBI

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MTOSI North Bound Interface

- MTOSI Interface
  - SOAP Web Services
  - Standard based
    - MTOSI 3.0 (TMF 864)
    - WSDL 1.1
    - SOAP 1.1
    - XML Schema 1.0

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RestConf North Bound Interface

- Restconf Interface
  - Designed to have “parity” with MTOSI API for Physical Inventory and Optical Service Retrieval
  - Carrier Ethernet is out of scope for Bora (EPNM 1.2)
  - Standards based
    - RESTCONF Protocol (draft-ietf-netconf-restconf-06)
    - HTTP 1.1
- Key Features – read-only access to the following
  - Physical Inventory
  - Optical Link Inventory
  - Optical Circuit Inventory
    - Optical Channel (OCH)
    - Optical Transport Network (OTN)

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Packet-related Features Update

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Cisco EPN Manager 1.2 Carrier Ethernet and L3 VPN Support

One Integrated Framework

- EMS/Core/MTOSI
- UI/UX Baseline
- Topology
- Network/Service Provisioning
- Service Discovery
- Network Assurance
  - Service Testing/Validation (RFC 2544/Y.1564)
  - Faults
  - Performance©

4 Types of Carrier Ethernet Services

- MEF 2.0 Services including EOAM and QOS configuration
- E-Line, E-LAN, E-TREE, E-ACCESS
  - MPLS to the Edge
  - Ethernet Access

L3VPN

- ASR9K as PE
- BGP as PE-CE protocol

Supported Devices

- ASR9K
- ASR 901/903
- ASR 901S
- ASR 902/920
- ASR 907
- ME3600X, ME3800X

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EPNM 1.2 (Bora): What is new?

Device Configuration

- LAG Support
- OSPF Configuration
- IS-IS Configuration

Inventory/Topology

- Interface 360 View
- Geographical maps

L3VPN Support

- VRFs on ASR9K
- VPN, RT And RD management
- Discovery and Provisioning for L3VPNs
- BGP as PE-CE protocol
- QOS Profile management

Provisioning

- Service Promotion
- Port filtering when provisioning

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Interface 360 & Link 360

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Interface 360 View

- Interface 360 gives a quick look of port/interface attributes, metrics and status of device interfaces. It is divided into the following 3 sections.
- Summary data – This section provides the information about Port type, name, adjacent port, layer rate, status, description etc.
- Performance data -This section shows graphs reflecting various aspects of the interface performance
- Tabs data – This section provides a detailed information of Alarms, Interfaces and circuit/VCs.

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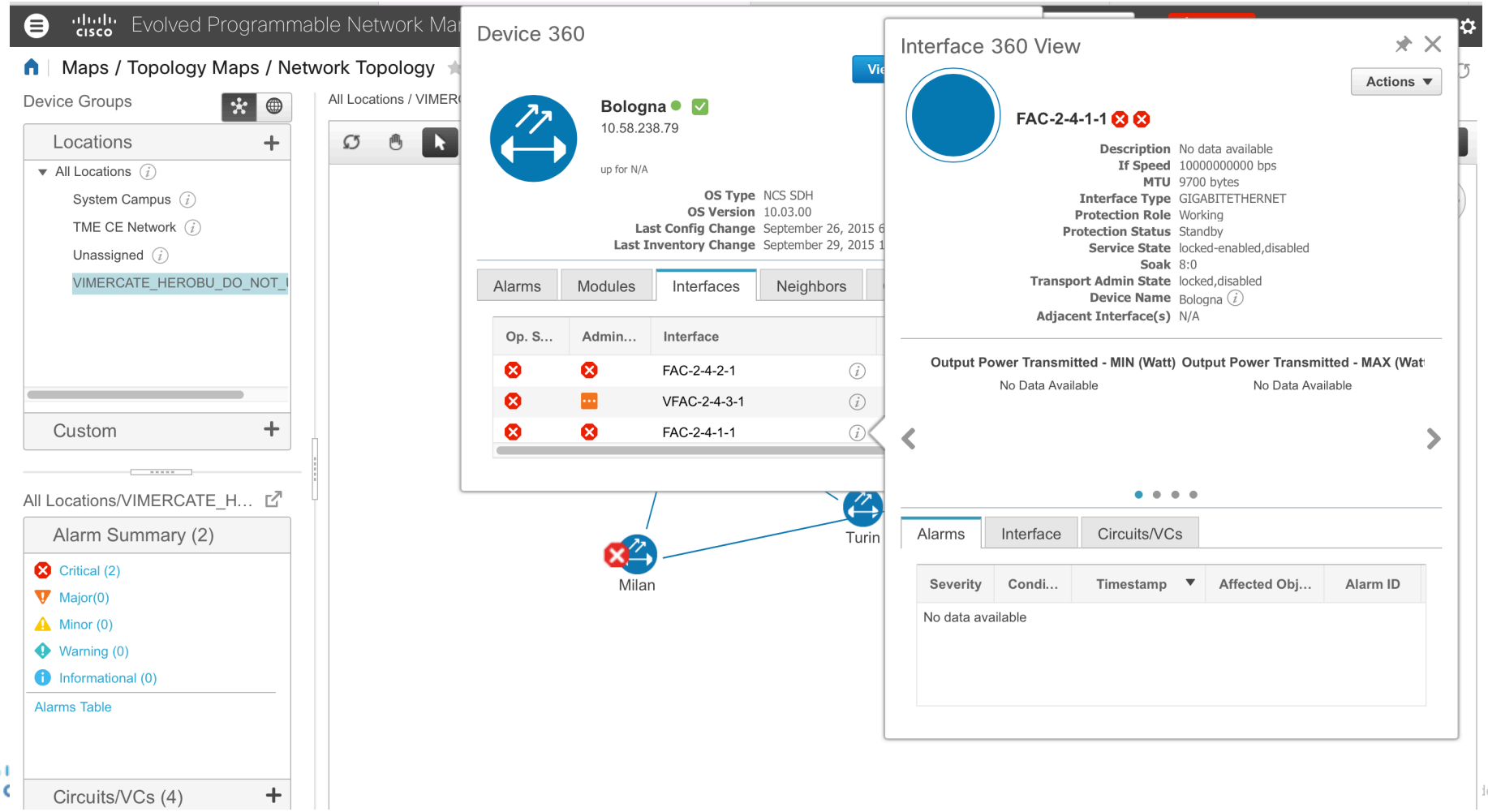
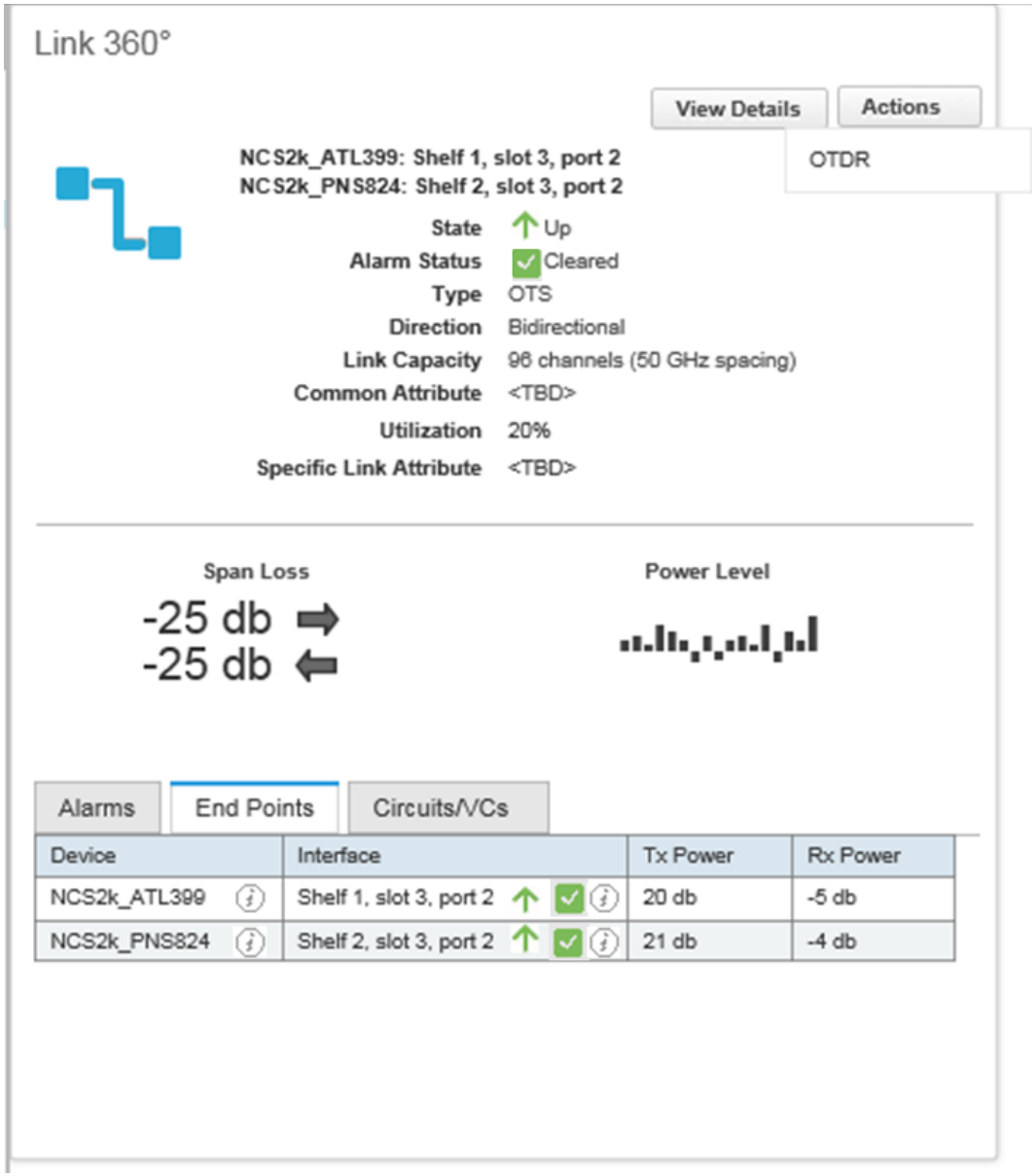
Interface 360





- Link 360 basics (for OTS and Ethernet)
- Alarms and endpoints of the link
- OTDR launch point
- Circuits using the link
- Utilization/Capacity information
- Aggregated Link State
- Endpoint power levels
- Charts/Graphs to provide additional info
- Additional information and control of Loopbacks
- Additional link type support
- Port name redesigned to resemble CTC
- Expand Link 360 to cover patchcords
- Free text Link label

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Bandwidth Utilization

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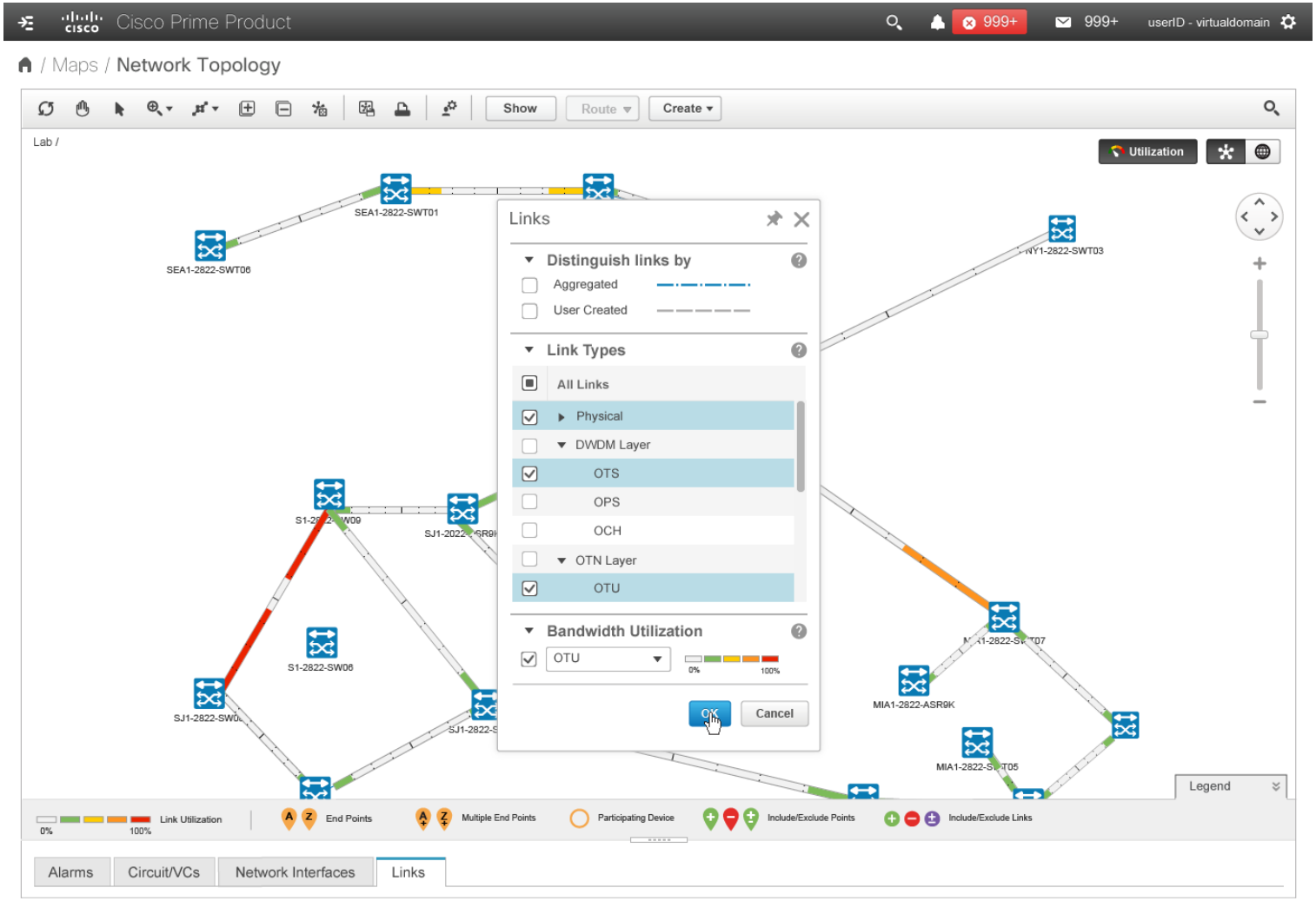
Bandwidth Utilization Graphical Display

OTS:

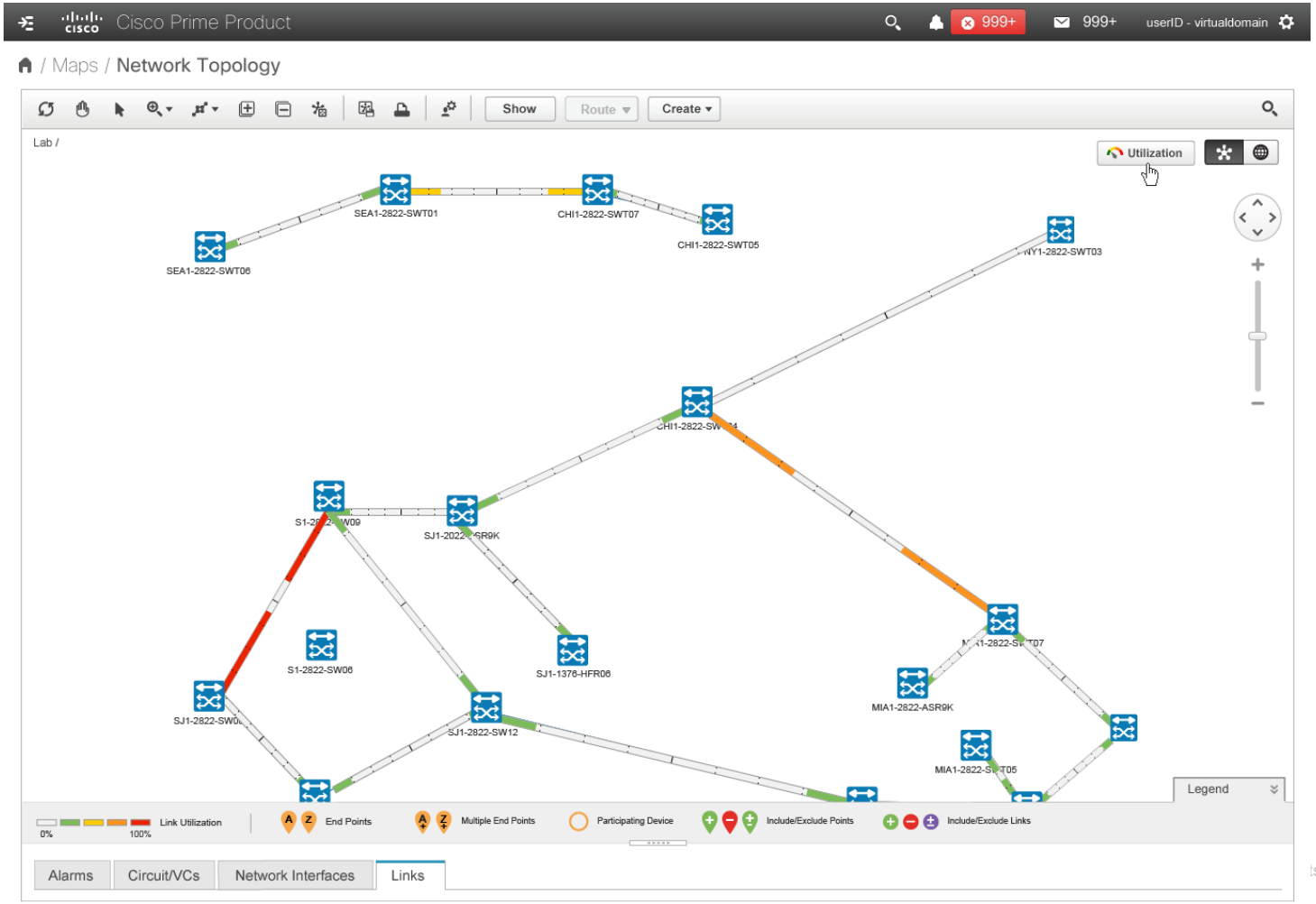
- Capacity of link expressed in number of channel (12.5 or 50 Ghz wide) that can be configured
- Utilization expressed in percentage and in number of channels used.

OTU:

- Capacity in Gb (for OTN)
- Utilization In percentage of capacity (for OTN)



Bandwidth Utilization Graphical Display



EPN-M Vision

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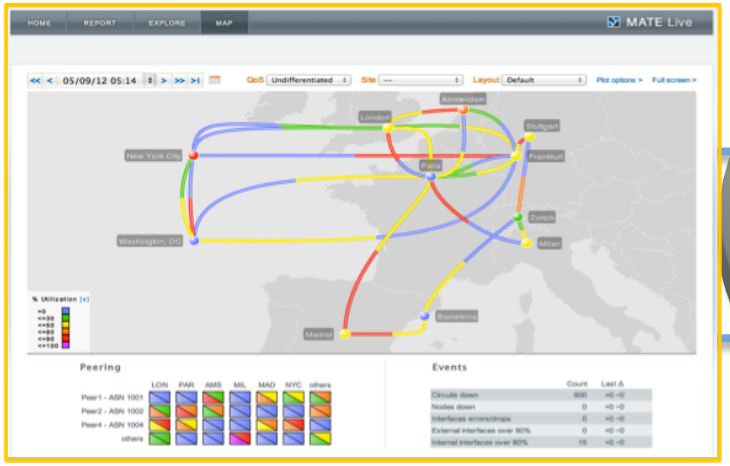
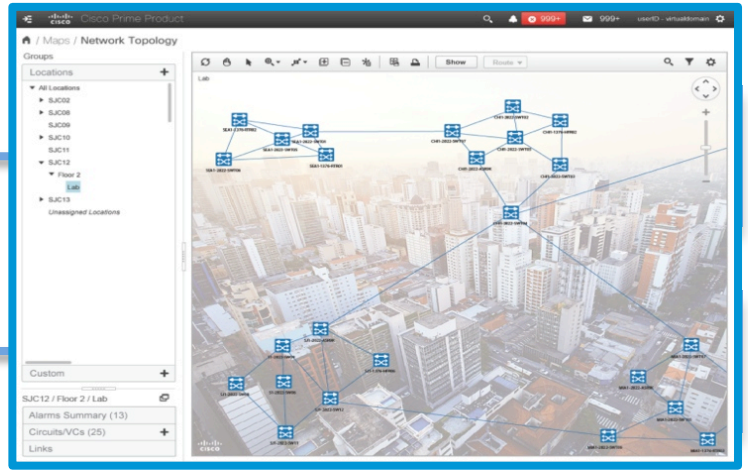
The Way to Multilayer Service Lifecycle Management

WAN Automation Engine



EPN Manager



NETCONF
YANG

IETF

SDN Controllers

Virtual

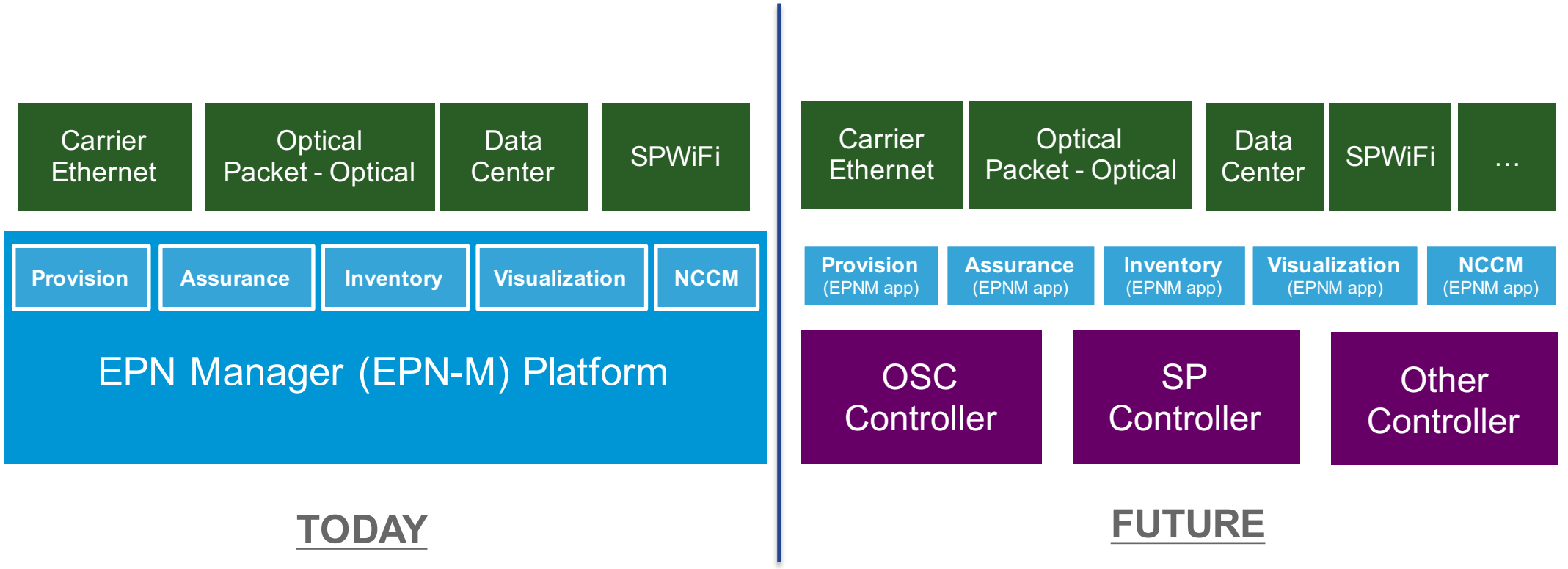
Physical

Compute Storage Network

Evolved Programmable Network

Cisco or 3rd Party

EPN Manager NfV/SDN Strategy



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