



The bridge to possible

# Expand your Automation Journey with new Cisco NSO Use Cases and Features

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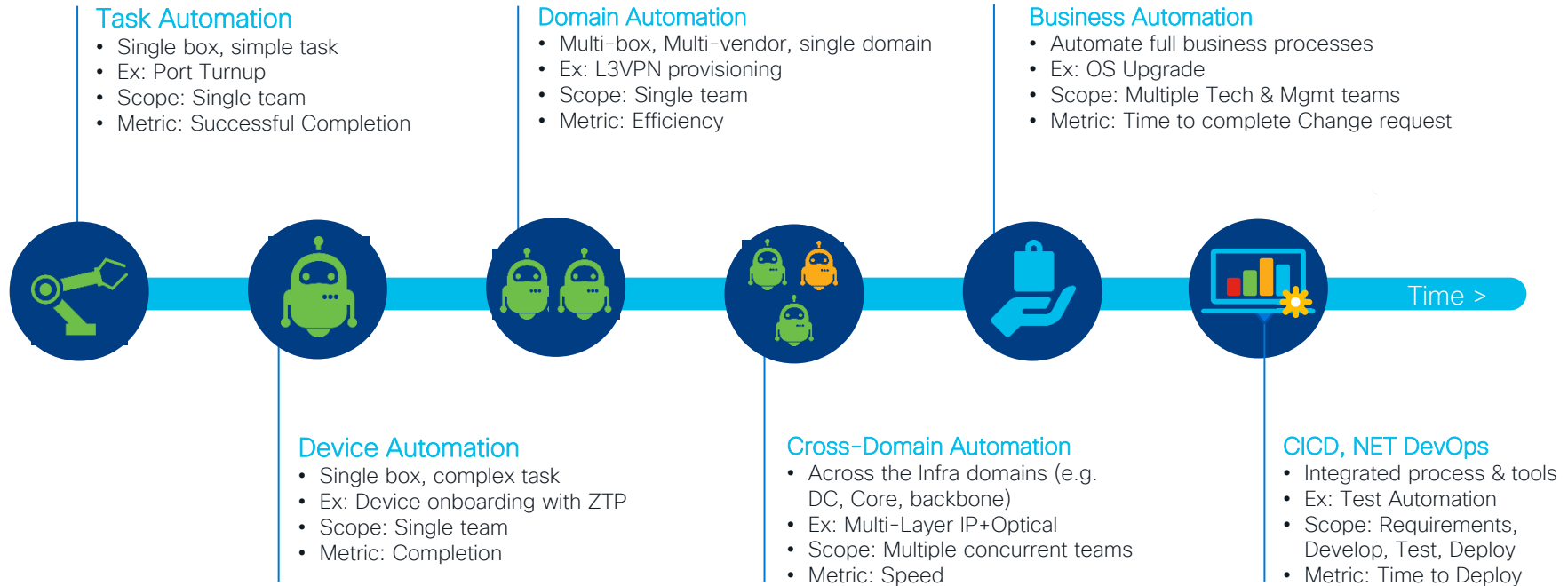




# Agenda

- Automation Journey
- Where can your NSO Journey take you?
- New features/capabilities and use-cases
- Conclusion

# Automation Journey: Scope & Use Cases



# Example Customer Use Cases with NSO

## Automation - Engineering

Device Onboarding (ZTP)

Golden Configs (day1/2)

Services (intra-domain)

Services (multi-domain)

NFV - Service chains

SD-WAN automation

Transport SDN management

## Automation - Operations

OS Upgrade

Golden Config Compliance

Pre/Post checks

Migration (Network/Services)

Closed-loop automation

Firewall ACL management

Security Policy management

# Expand Your Automation Journey with New Cisco NSO Use Cases and Features



# NSO Roadmap (Platform + CFP)

## Shipping

### Version 6.0

Release Sep-2022

- Parallelized transaction handling
- NSO insights manager
- NSO Developer studio

### Core Function Packs

- T-SDN 4.1 (CNC 4.1, Sep-2022)
- RON-L1 2.0 (Sep-2022)
- CNF Solution 1.1 (Dec-2022)

## Committed

### Version 6.1

Release Sep-2023

- NSO in containers
- HA for container environment
- Single-sign on

### CFPs

- CNFO Solution 1.1(2HCY23)
- T-SDN FP Bundle (CNC) 5.0 1HCY23

## Incubating

- Developer tools

### FPs

- ZTP

## CTO long term focus areas

- Improving platform and service performance (transactional speed and deployment scale)
- Increasing usability of tools (out of box experience, developer experience)
- Interoperability
- Improving observability (logs, metrics and traces)

# The New Automation Features & Use-cases

- NSO 6.0 performance enhancements (mass scale automation)
- Cloud Native Networking – The new CNF Core Function Pack
- Transport SDN – The T-SDN Core Function Pack and uplift to CNC
- Automated Assurance – Performance Monitoring/Service Assurance use-case with Accedian integration



# NSO 6.0 – Ready for Mass Scale Automation

## WHAT

NSO 6.0 brings up to **9X** performance improvement for optimized apps AND **3X** performance boost to existing code

## WHY

NSO is now used in some of the world's largest SP networks.

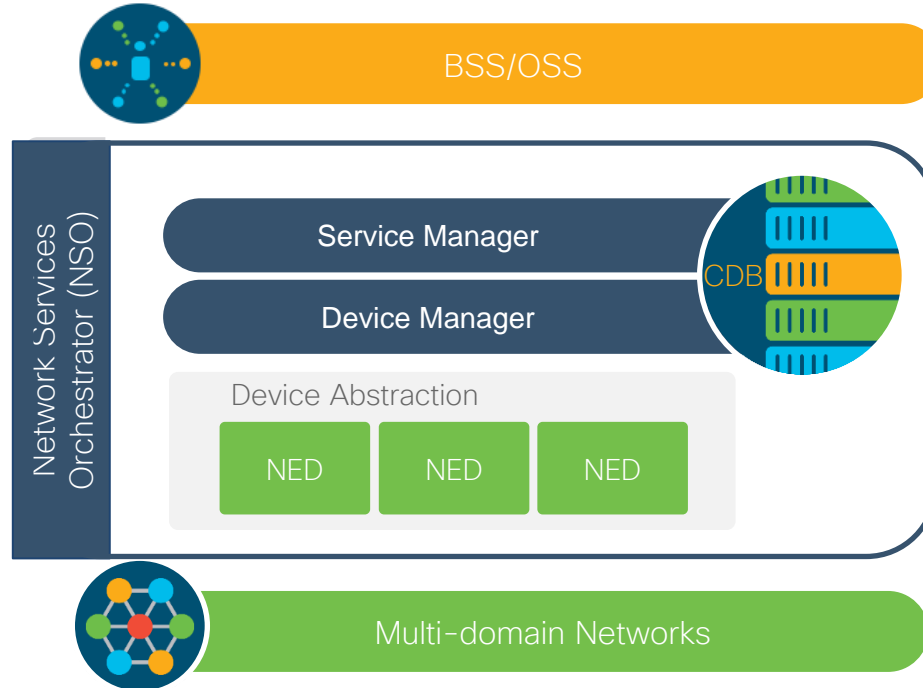
Maintaining ease-of-use at mass-scale required a performance boost!

## HOW

NSO Core Engine re-architected:

- Parallelized transaction handling
- Parallel service actions and lock-less dry-runs

# NSO Architecture

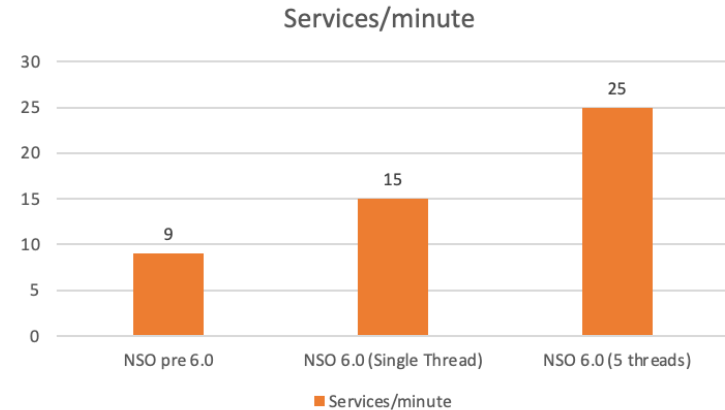
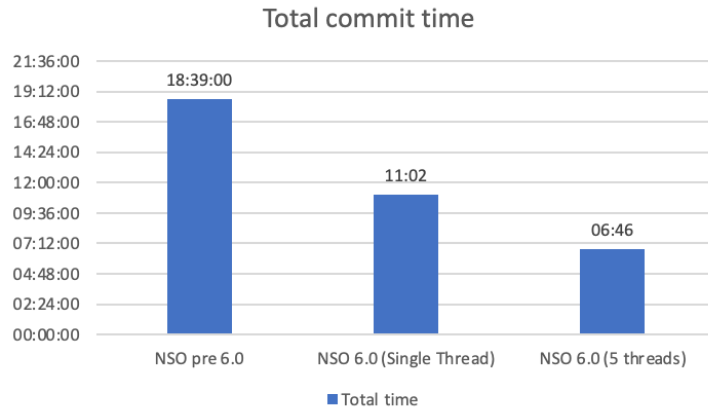


# Performance gains in NSO 6

- 1 Service Creation
- 2 Commit Dry-Run &  
Service Check-Sync



# Creating 10k Services



# Parallelized transaction handling

- Kept the NSO programming model
  - ACID transactions
  - FASTMAP Services
- Reduced the locking time needed for atomicity
- Moved to optimistic transactions
  - *Trust, but verify*
  - Check if we **should** have locked
- Greatly increased throughput for concurrent transactions

# Running services in parallel

## NSO before 6.0



## NSO 6.0

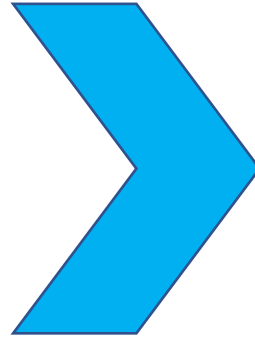
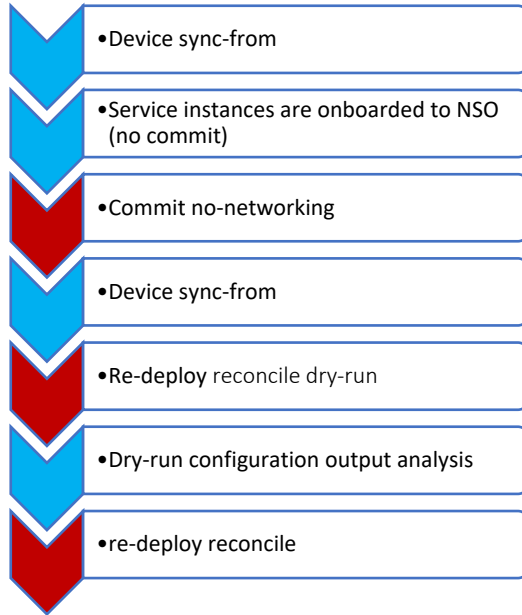


time

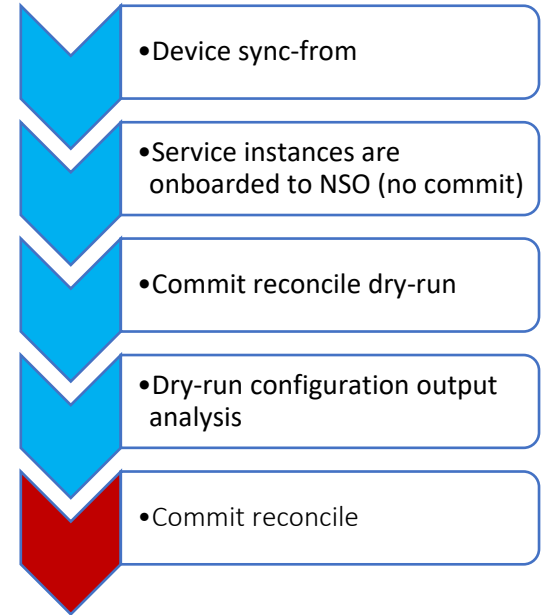
■ service   ■ validation   ■ critical section   ■ lock wait

# Example Brownfield Service Import

## NSO 5.6



## NSO 6



Non locking



Locking

# Example Brownfield Service Import





# NSO for Cloud Native Networking

## WHAT

New CNF-O/M capability enhances NSO to orchestrate the full life-cycle of containers/container-based network functions in k8s.

## WHY

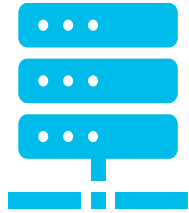
Some network functions and applications are container based (e.g., 5G Core). Now this can be done with NSO, alongside all other orchestration and automation tasks.

## HOW

NSO CNF Orchestration Solution:

- Kubernetes management
- CNF day0 & day-to-day operations
- Generalized HELM chart support
- Helm & Kubectl Operational commands support
- Multi-vendor

# The Network Function Landscape



Physical Devices

Physical Network Functions  
(PNFs)



Virtual Machines

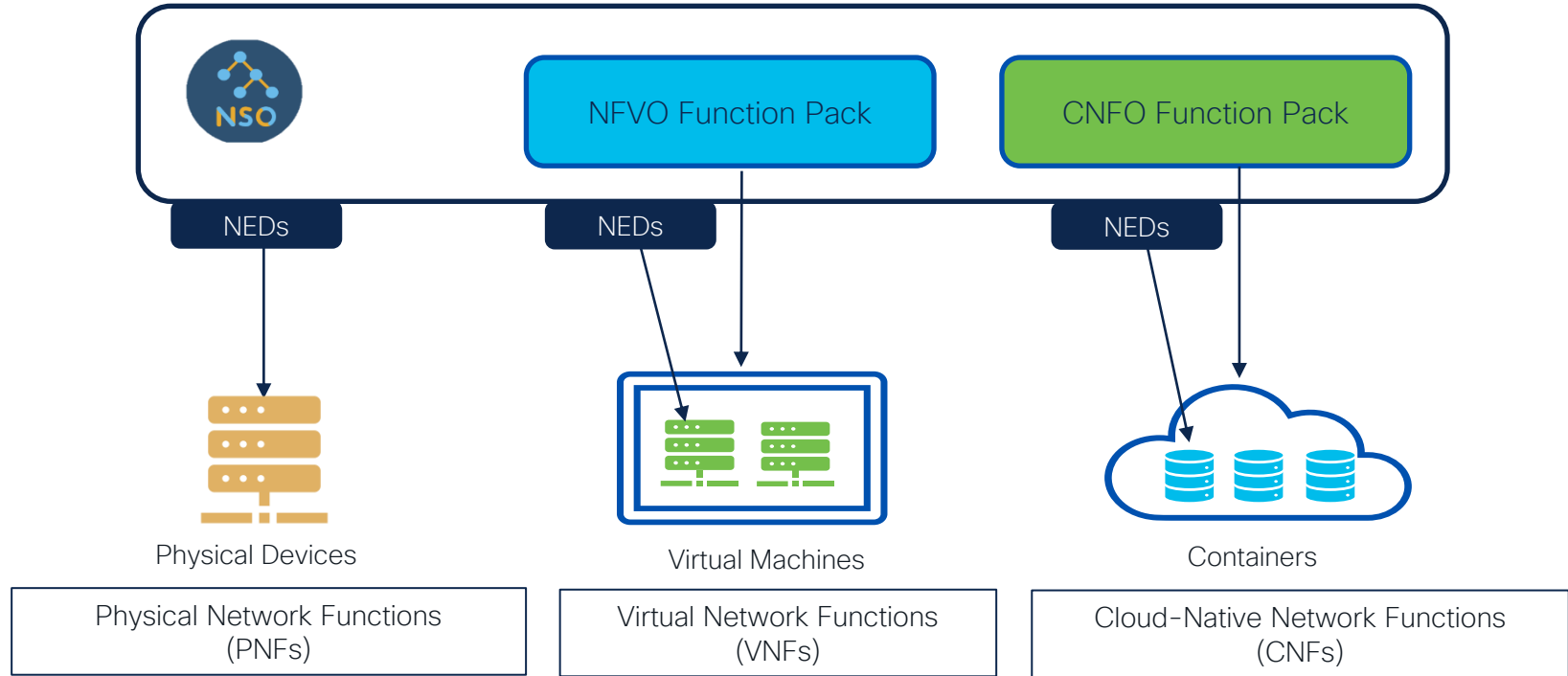
Virtual Network Functions  
(VNFs)



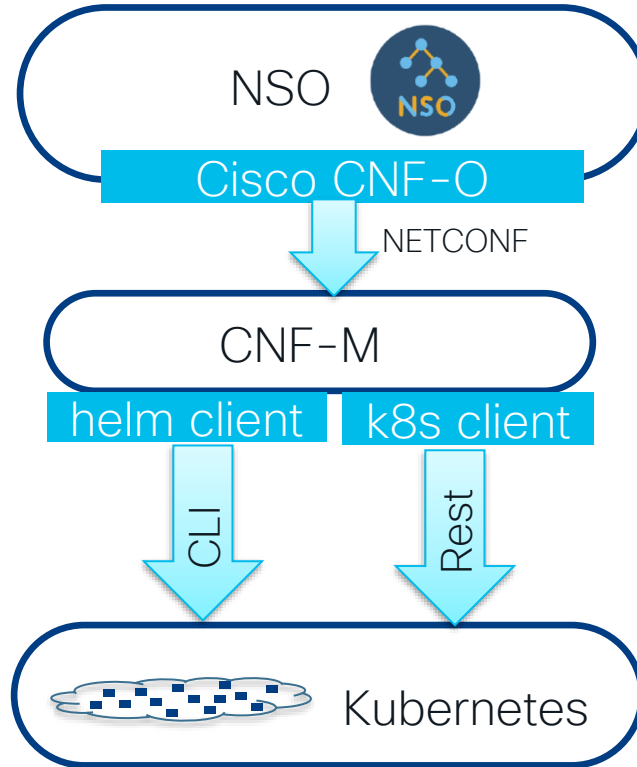
Containers

Cloud-Native Network Functions  
(CNFs)

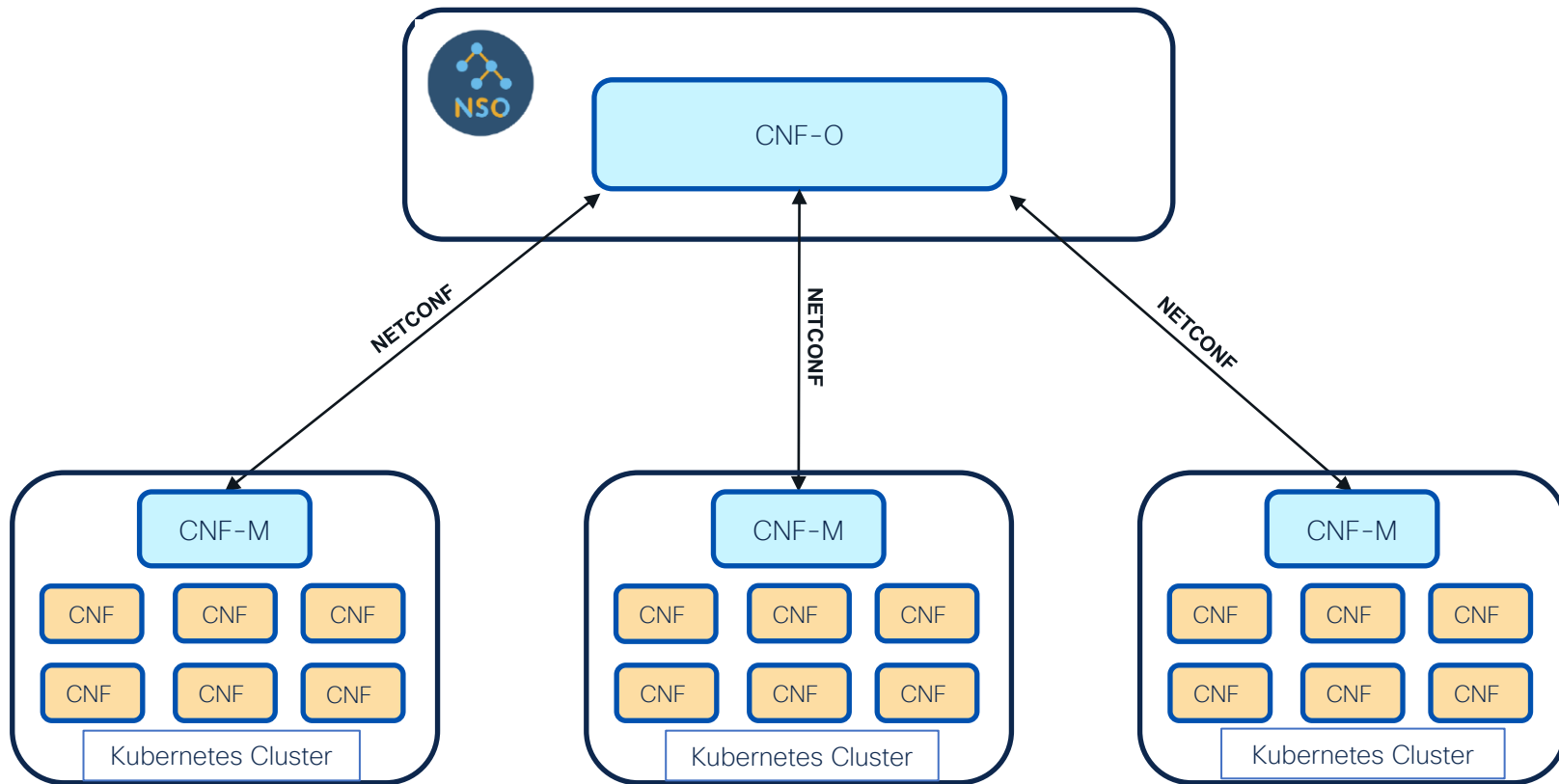
# Orchestrate from One Place



# Introducing NSO – Model Driven Helm



# CNF Automation Architecture



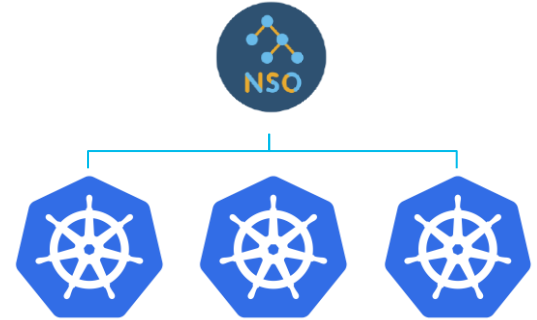
# NSO CNF-O Capabilities



Container  
Life-cycle management



Helm chart  
management



Multi-cluster  
management

# NSO CNF-O What do you get?

- ✓ Containers as part of your E2E NSO services
- ✓ Get all NSO features for your containers
- ✓ Orchestrate across hybrid environments
- ✓ Coordinate values over multiple HELM charts

# Transport SDN

## WHAT

Out-of-the-box implementation of transport and service provisioning use-cases like L2VPN and L3VPN over Segment Routing TE policies.

## WHY

Advanced Transport use-cases using PCE and Segment Routing are complex to implement. IETF has standardized VPN service models in YANG (L2SM/L3SM).

## HOW

Implemented via NSO T-SDN and CNC function packs:

- VPN Service function pack
- IETF-TE function pack
- SR-TE Core function pack

Foundation in Crosswork Network Controller (CNC).



# Capabilities and Use-cases

## *Marrying Service Provisioning with Transport Provisioning*

### • Capabilities

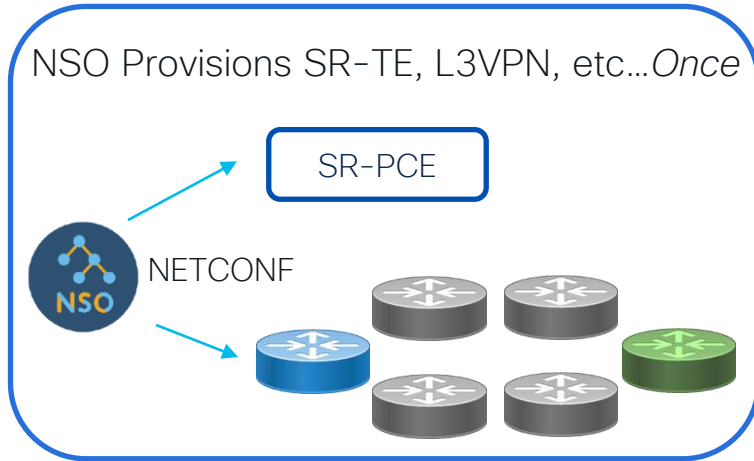
- VPN Service Function Packs
  - IETF L2SM, L3SM
- IETF-TE Function Packs (RSVP-TE)
  - P2P Dynamic and Explicit Path
  - Local and PCE computation
- SR-TE Core Function Pack – PCC Init based
  - ODN, SR, SRv6 TE SR Policy...

### • Use cases:

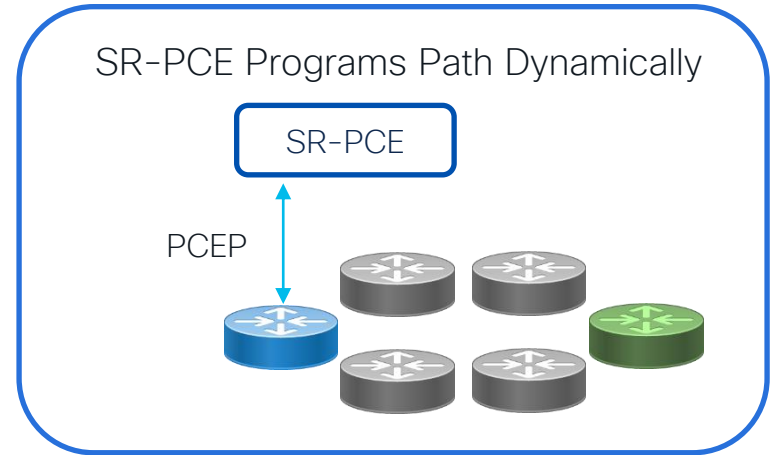
- Low latency service
- Path protection/disjoint path
- Customer specific path
- Circuit style services (TDMoIP, PLE etc.)
- Network slicing

# Workflow: NSO as Out of Band Orchestrator

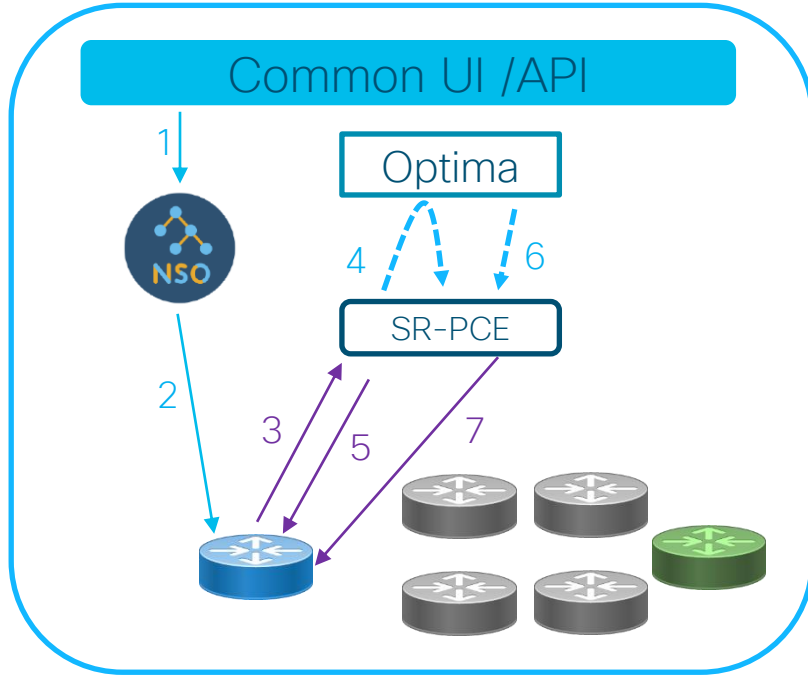
## Provision



## Operate



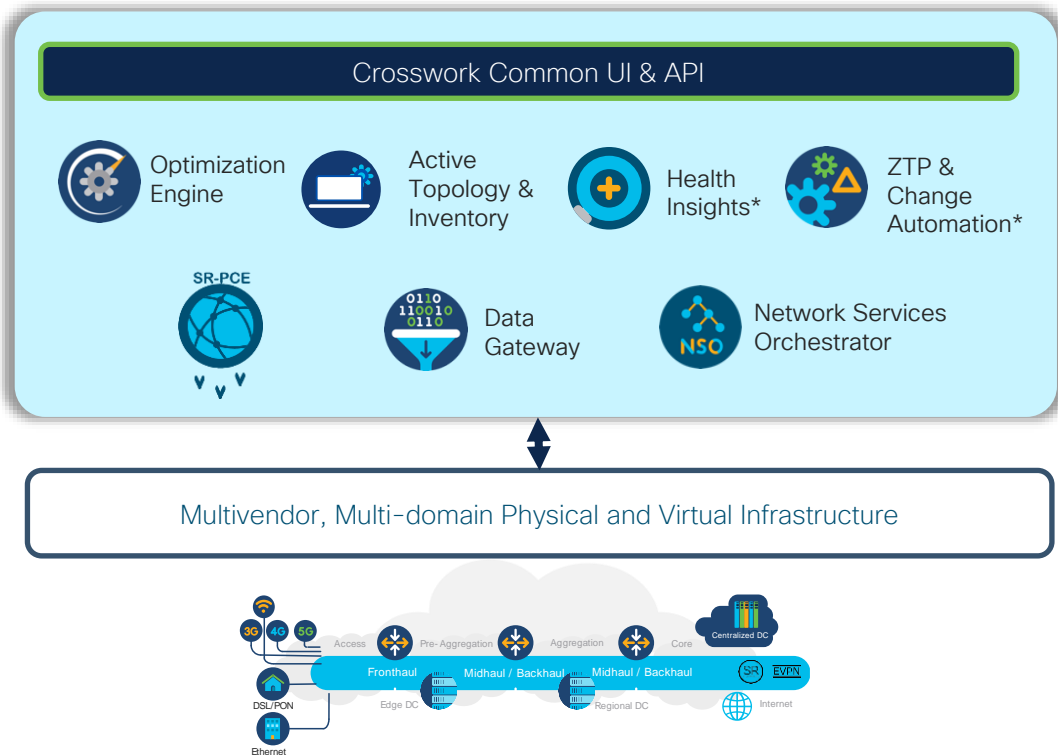
# NSO and SR-PCE/Optima Workflow



1. User requests service with SLA (e.g., bandwidth, latency) from Common UI
2. NSO configures service and SR-TE policy at headend
3. Headend requests path from SR-PCE via PCEP
4. (If request involves bandwidth, SR-PCE gets path from Optima)
5. SR-PCE sends path to headend via PCEP
6. (If request involves bandwidth and the path needs to change, Optima pushes new path to SR-PCE)
7. SR-PCE updates headend via PCEP for path changes

# Crosswork Network Controller 4.0

Turnkey solution for deploying and operating IP transport networks



Service Provisioning

Service-Oriented Transport Provisioning

Bandwidth Optimization

Real-time Network Optimization

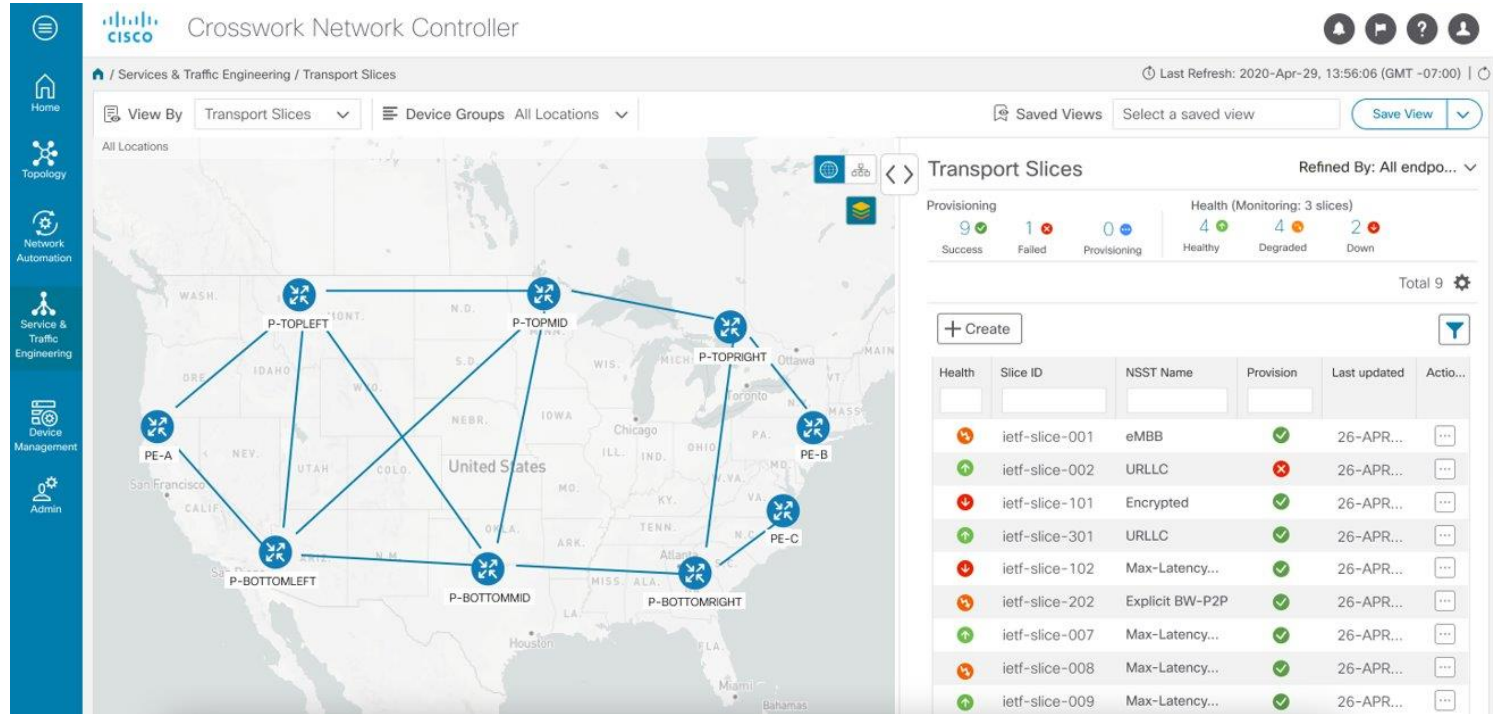
Topology & Inventory

Datalytics (Closed loop control based on performance telemetry)

Network Maintenance

Initial Setup – Secure ZTP (Day-0)

# Transport Slicing Visualization



# Automated Assurance

## WHAT

NSO orchestrates both network services AND associated assurance systems like Accedian Skylight.

## WHY

Automated monitoring of service SLAs and customer experience is becoming critically important in today's networks and lays the foundation for Network As A Service.

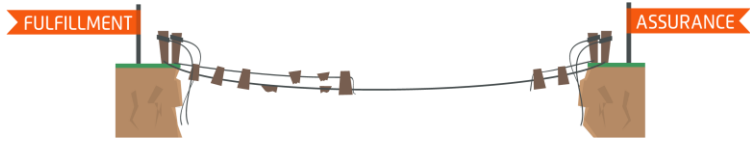
## HOW

Cisco Automated Assurance:

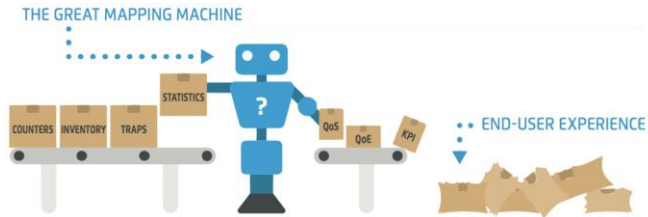
- NSO is the central orchestrator
- Accedian Skylight for active testing
- Activation testing (Birth certificate) for new service instances

# Service Assurance Challenges

## Fulfillment and Assurance disconnected



## Fear the Great Mapping Machine!



## Sub-optimal activation testing

DO  
NOTHING



SIMPLE  
PING



FIELD  
EFFORTS



## Limited insight of true end-user experience



# Skylight performance analytics

## Synthetic monitoring and analysis

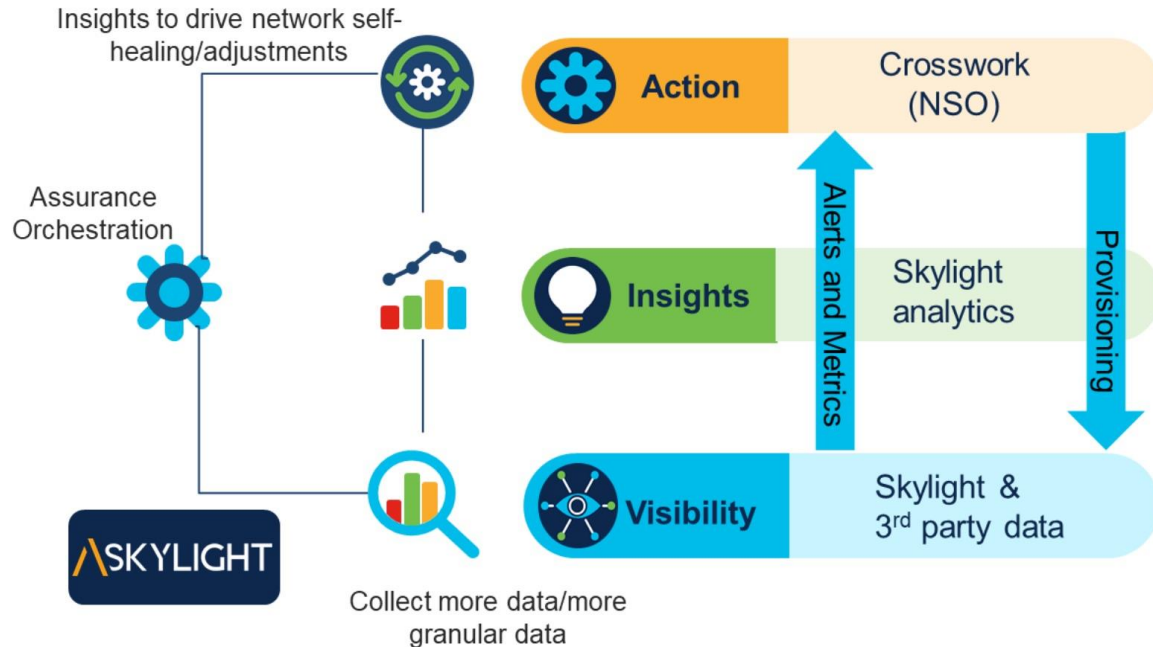




# Skylight performance analytics

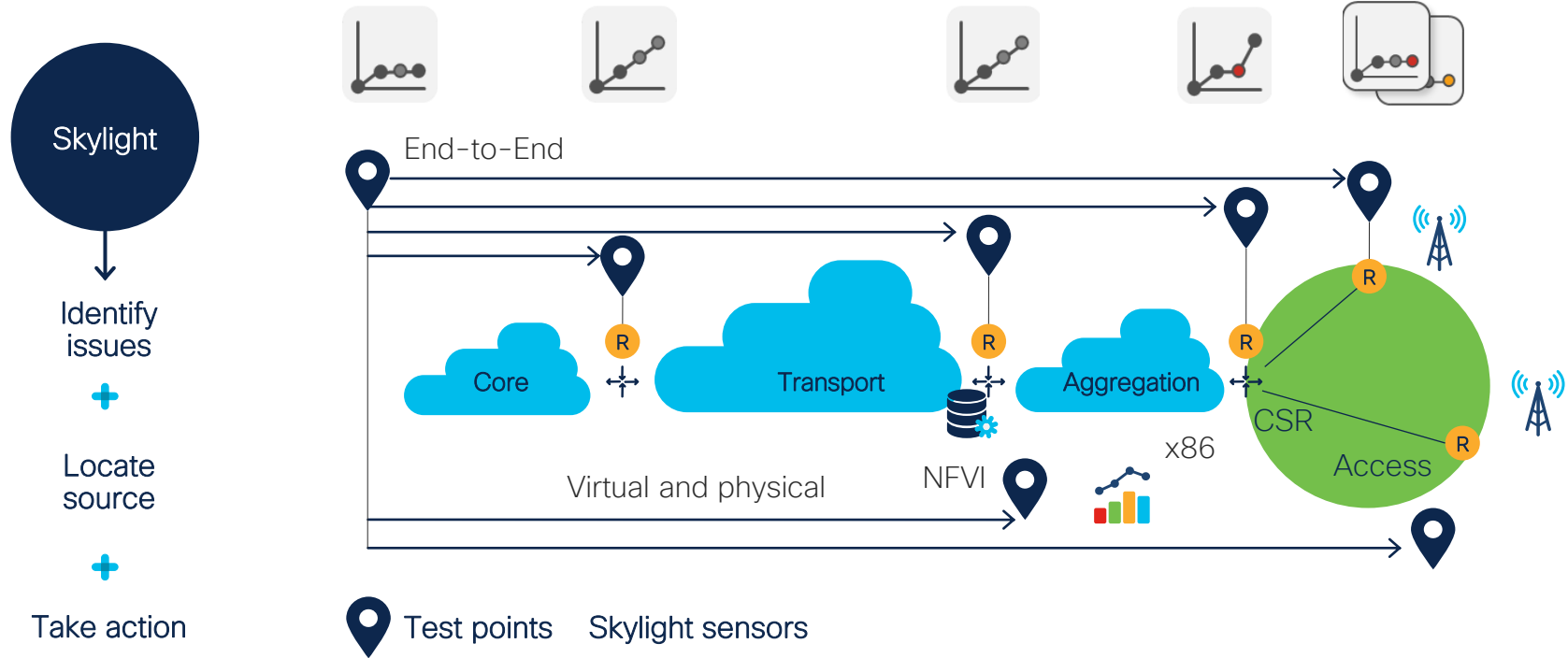
## Synthetic monitoring and analysis

### Skylight provides insights to Cisco Crosswork to drive action



# Scalable instrumentation

All key points of interest along the service path required for comprehensive service assurance



# Summary: Expand your Automation Journey based on NSO New Features & Use-Cases



## NSO 6.x - Mass Scale Networks

- Up to 9X performance improvement
- Enables new mass scale automation use-cases
- Better platform characteristics



## Cloud Native Networking

- All NSO features for containers
- Use containers in your E2E NSO services
- Orchestrate physical, virtual and container network functions



## Transport SDN

- Advanced network control use-cases
- Real-time network optimization
- Turnkey solutions across operations lifecycle w. CNC



## Orchestrated Assurance

- Close the loop between fulfilment and assurance
- Advanced network performance probing and analytics
- Accedian partnership

# 5G

## 5G Service Delivery and Assurance

- Brings all key elements together:
- Mass-scale
- Cloud native networking
- Transport SDN and slicing
- SLA Assurance

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# Thank you

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