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How to orchestrate 100K+ devices using LSA

Harish Ravichandran, Software Consulting Engineer

Shricharan Baskaran, Software Engineer
@shricharandigic

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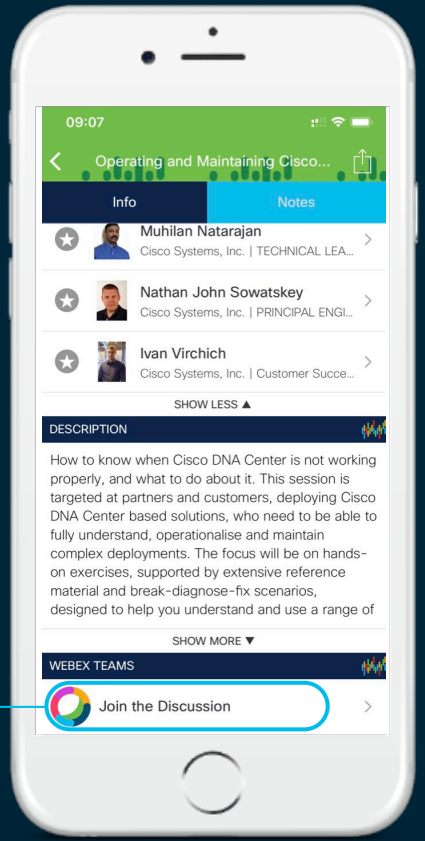
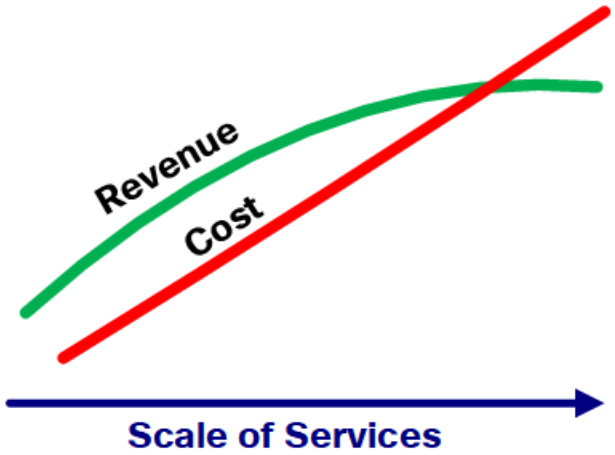


Agenda

- Why NSO?
- NSO Overview
- Working of NSO
- Why Layered Service Architecture?
- LSA Overview
- Working of LSA
- LSA Example
- Conclusion

Why NSO?

What we observe with traditional network management?



Why traditional network management fails?

- No well-defined protocols and data models
- Lack of atomicity
- Ordering problem
- Result: high cost and complexity

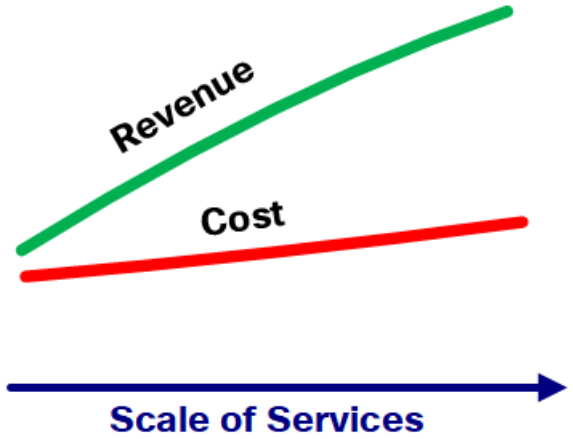
What is the solution?

- ✔ Network wide transactions
- ✔ Device, network and service models
- ✔ Standardized protocols
- ✔ Result: reduction in cost and complexity

What NSO could provide?

- ✔ Rapid deployment of provisioning and configuration management systems
- ✔ Time-to-market improvements
- ✔ Reduction in product development time
- ✔ Trouble-free scaling of new networks and services

What happens if we overcome those challenges?

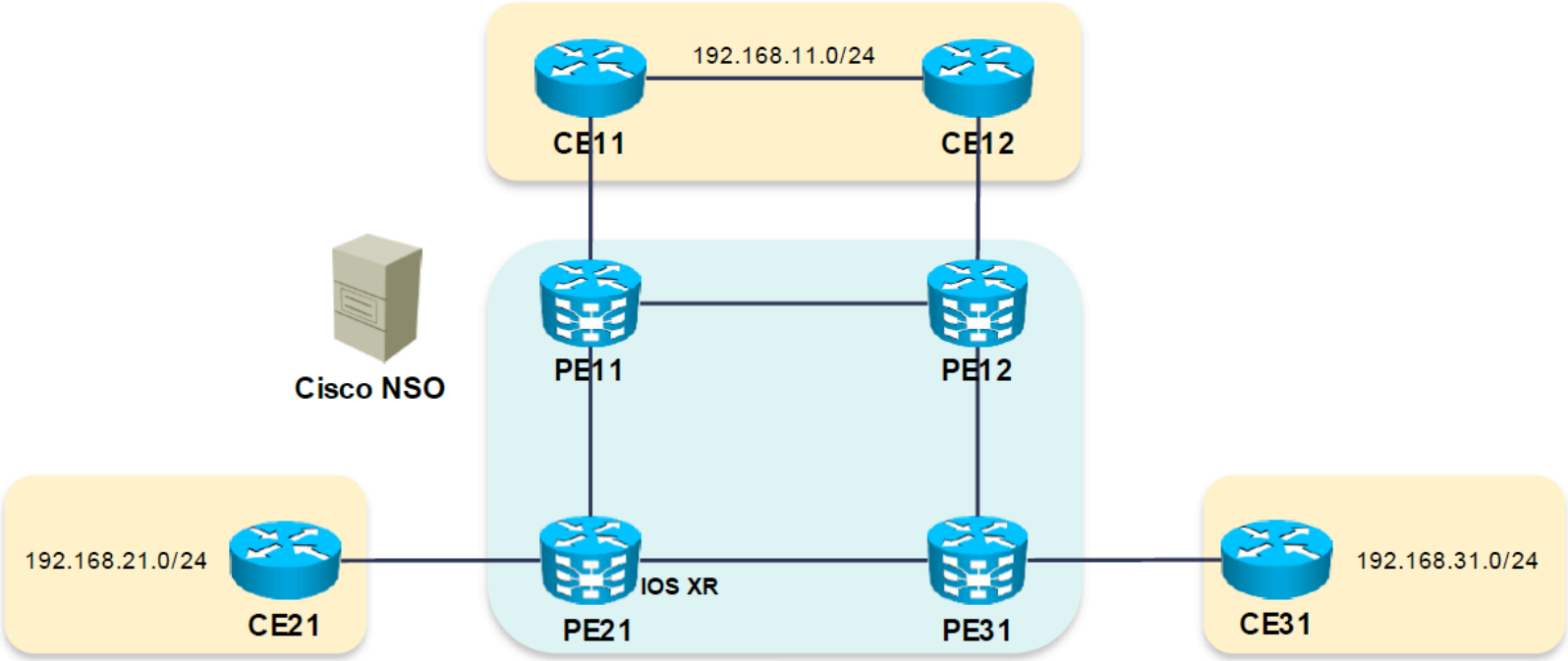


NSO Overview

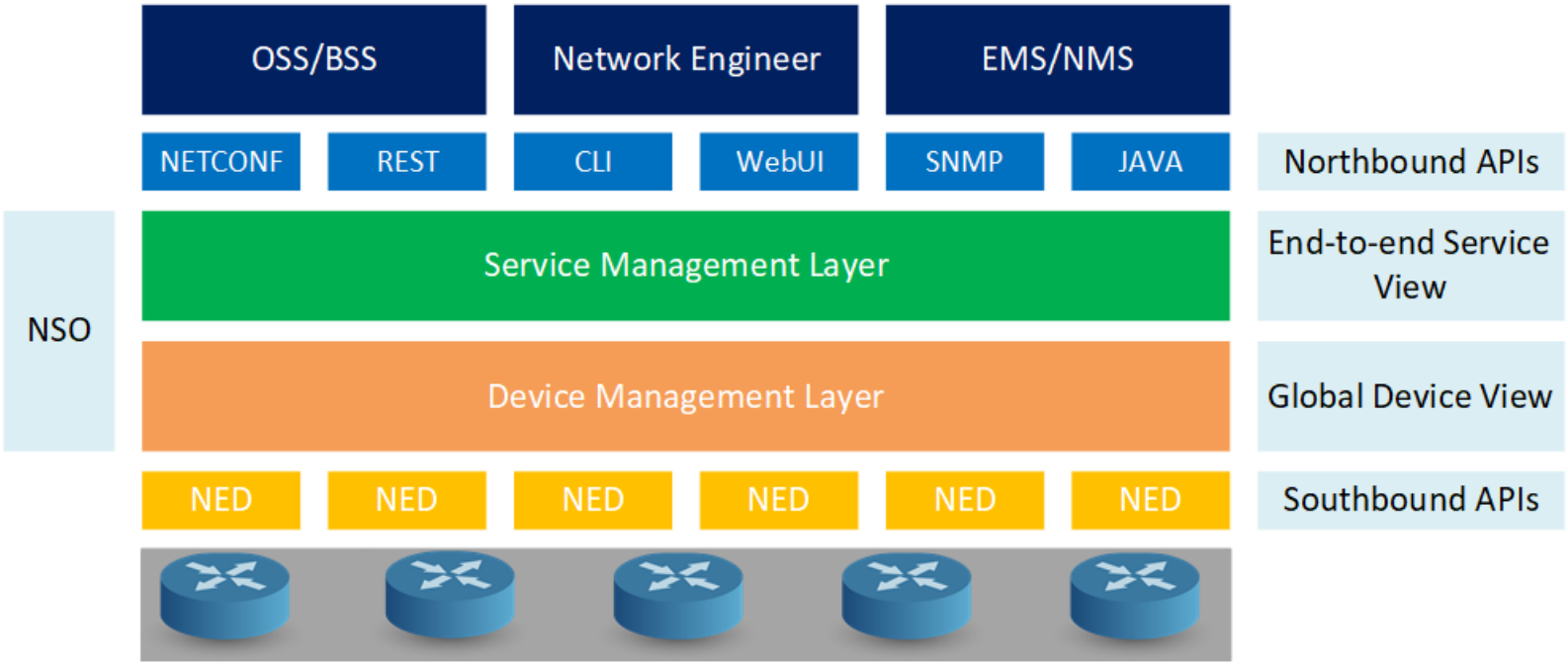
What is NSO?

- Multi-vendor service orchestration platform
- Multi-vendor service-layer SDN controller
- Supports traditional L2- L7 networking, virtual devices and OpenFlow
- Provides a single API and single UI
- Keep accurate copy of network configuration state
- Makes sure configuration is synchronized with the network

Service Orchestration



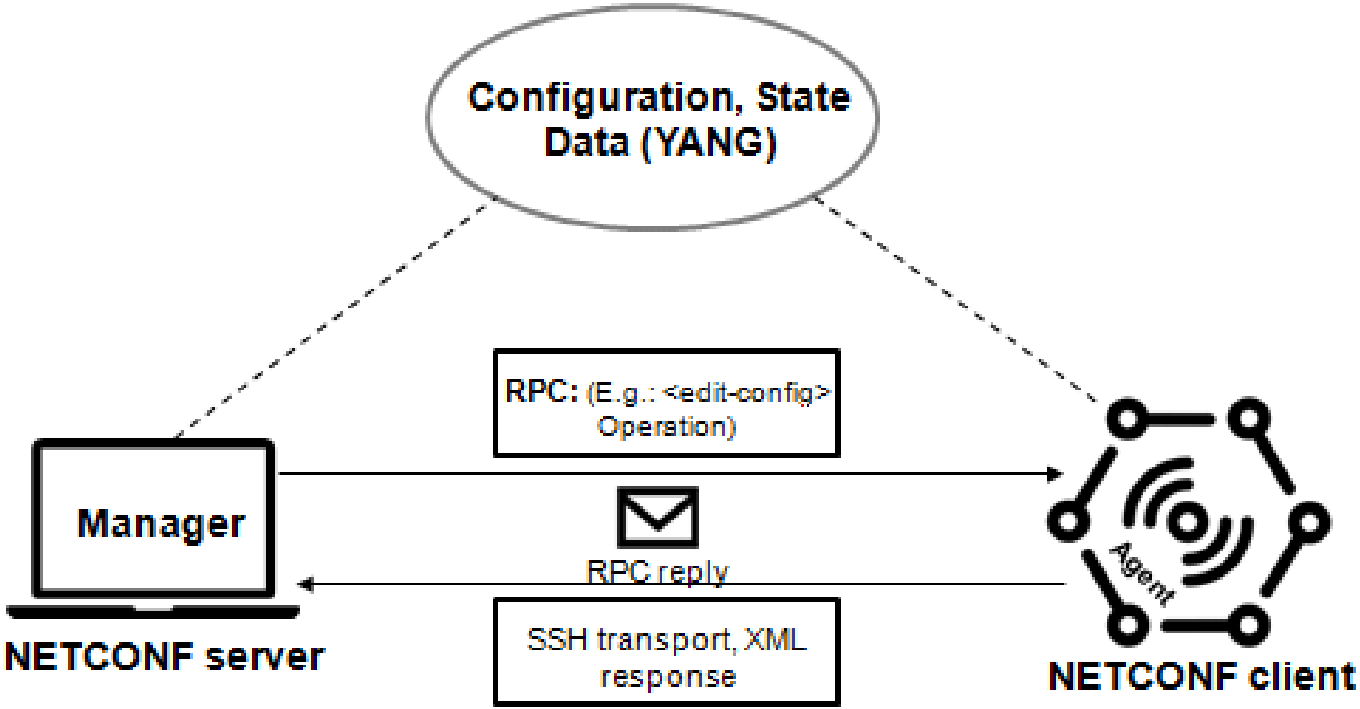
NSO Architecture



Things to know on NSO

- NETCONF
- Service Model
- Device Model
- Network Element Driver (NED)

NETCONF



Service Model

```
services l2vpn CE11-CE21

 pw-id  100121

 device1 PE11
 intf-number1 0/9
 remote-ip1 10.0.0.21

 device2 PE21
 intf-number2 0/0/0/9
 remote-ip2 10.0.0.11
!
```

Device Model

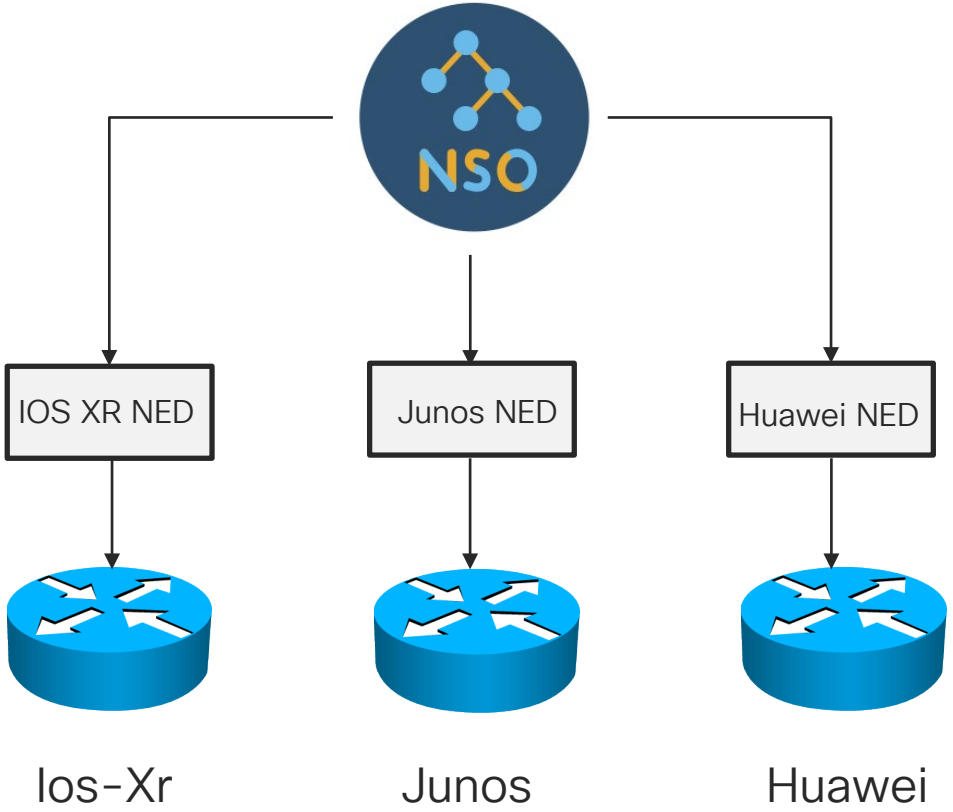
IOS

```
devices device PE11
 config
  ios:interface GigabitEthernet0/9
   no switchport
   xconnect 10.0.0.21 1001121 encapsulation mpls
    no mpls control-word
   exit
   no shutdown
  exit
 !
!
```

IOS XR

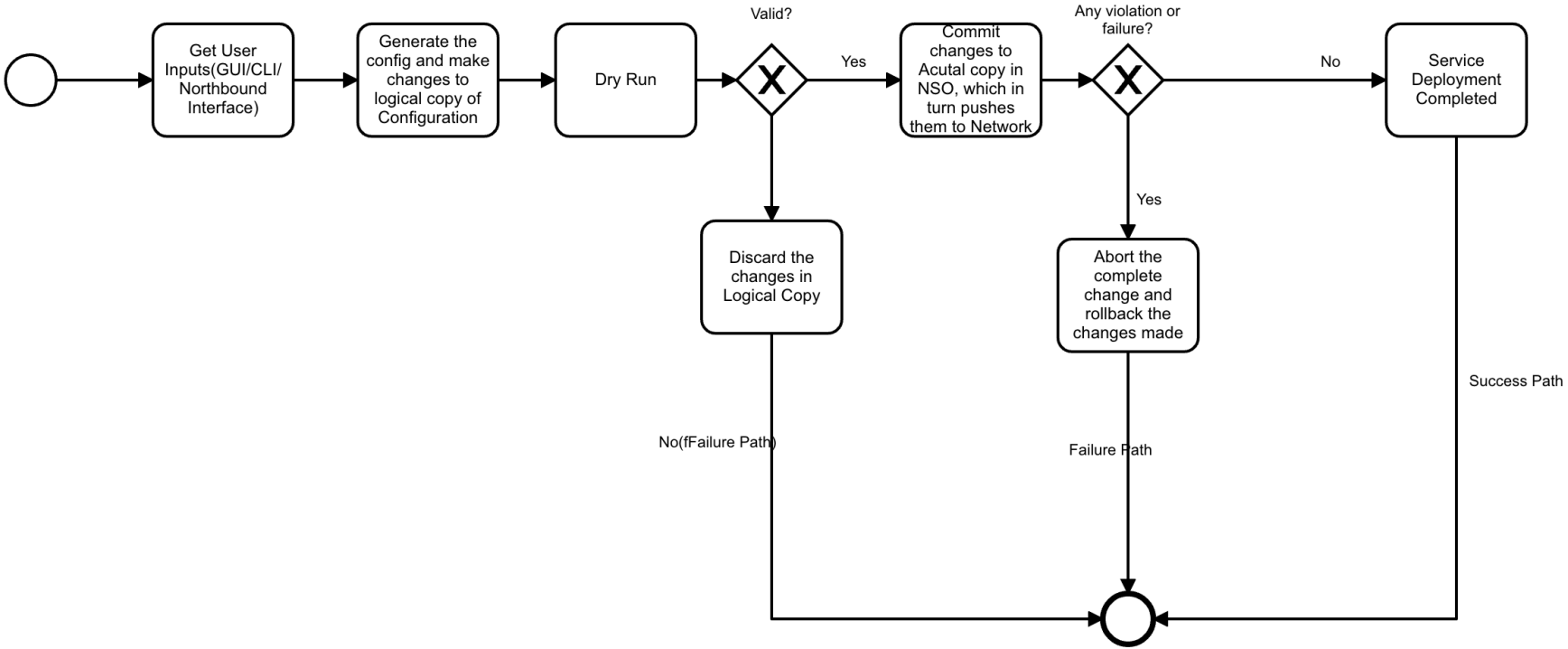
```
devices device PE21
 config
  cisco-ios-xr:interface GigabitEthernet 0/0/0/9
   no shutdown
   l2transport
   exit
  exit
 !
!
```

NED Model

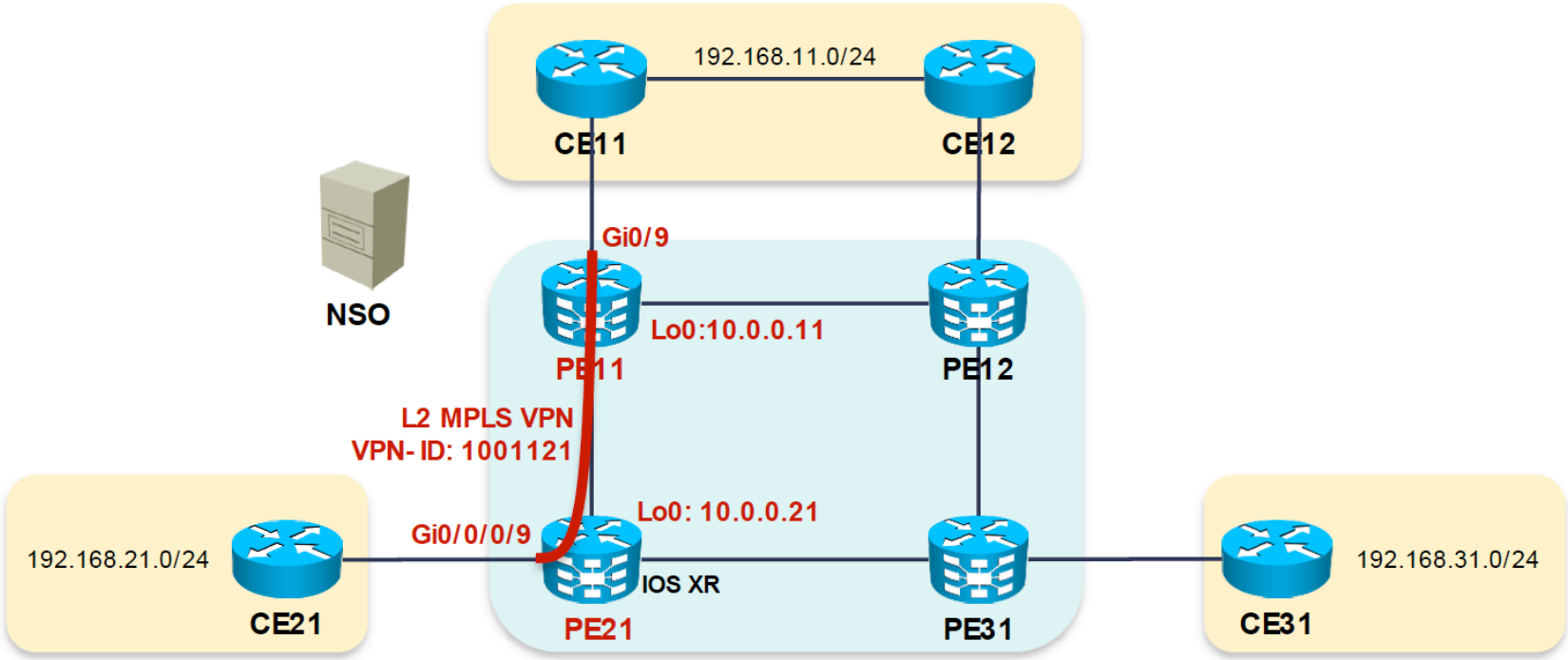


Working of NSO

Service Provisioning Flow



Example

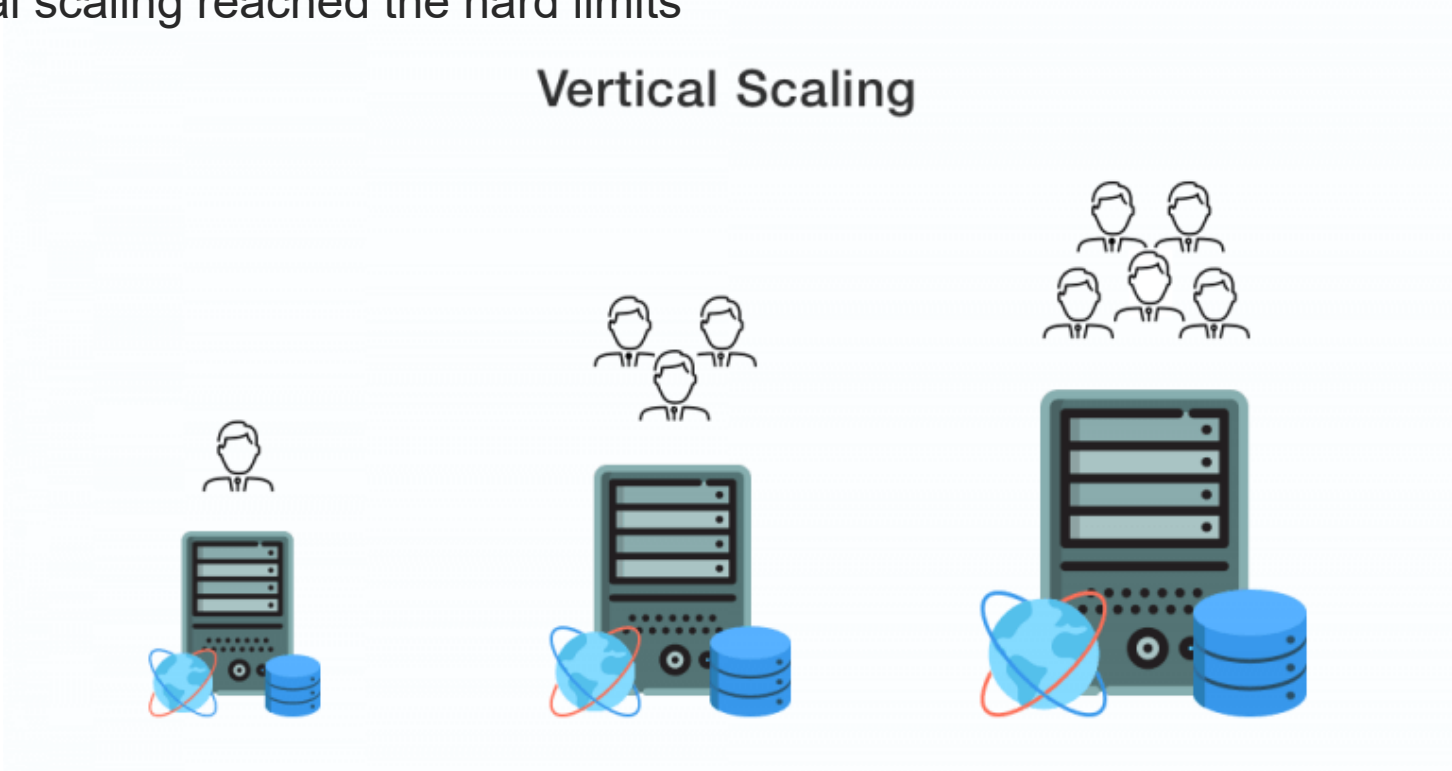


NSO Demo

Why Layered Service Architecture?

Why should I consider moving to LSA?

Vertical scaling reached the hard limits



Why should I consider moving to LSA?

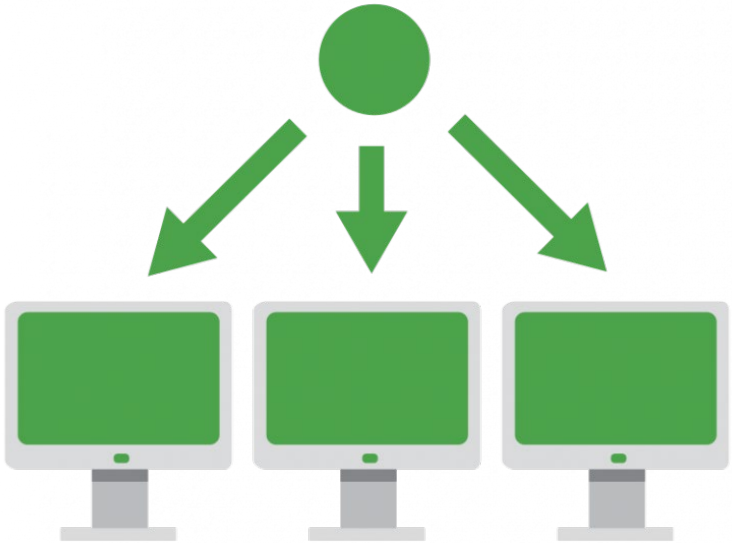
Massive deployments

Why should I consider moving to LSA?

Better handling of transactions

Why should I consider moving to LSA?

Gain very good parallelism

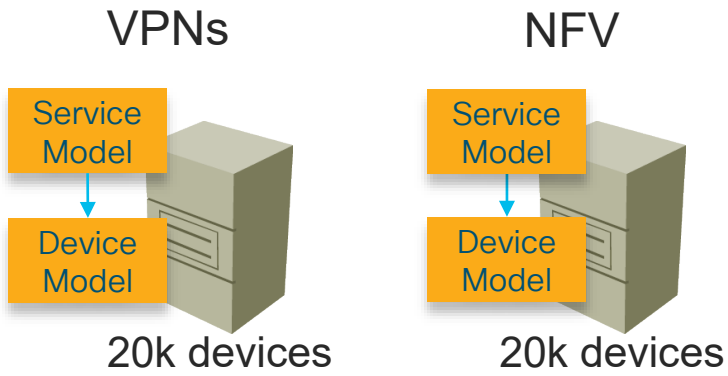


Scalability of NSO

Currently scale is handled through,

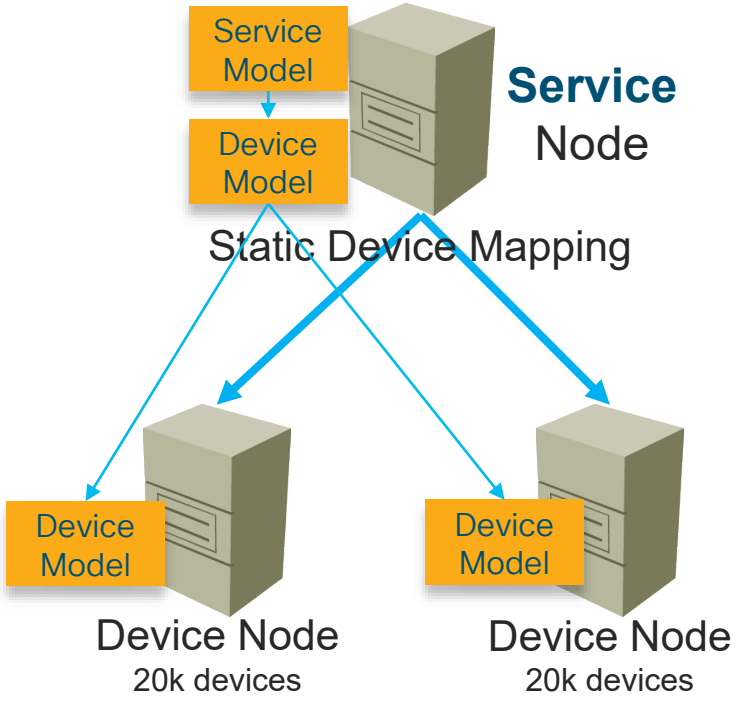
- ✔ Per-App NSO
- ✔ NSO Cluster
- ✔ NSO LSA

Horizontal Scaling
Per App NSO



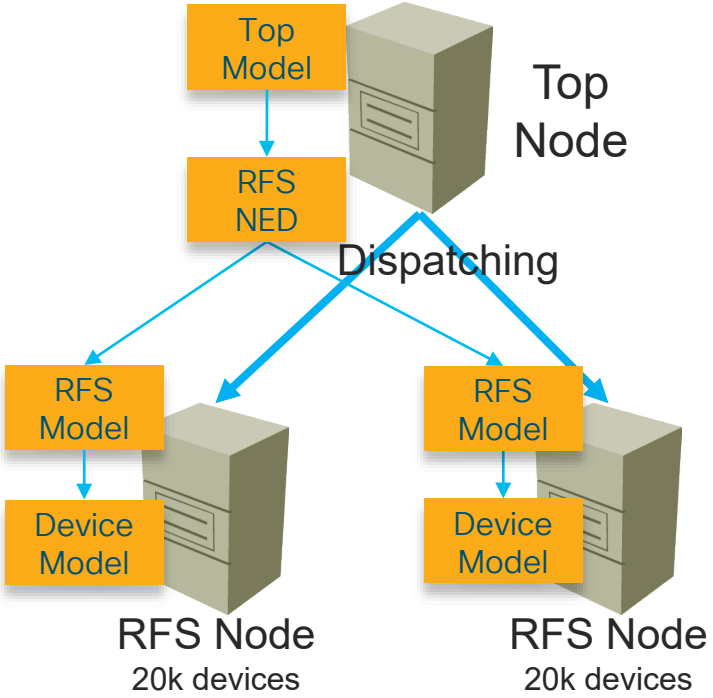
- Splitting the load based on application
- Limitations:
  - For end-to-end services touching multiple domains
  - Different NSOs may touch the same devices
  - Individual applications may still reach performance limits

Horizontal Scaling
NSO Cluster



- Device mappings need to be maintained
- Performance can be severely impacted by cluster functionality:
  - Every call to device data on service node results in a NETCONF RPC
  - Cluster caching should be enabled to improve performance but it will increase memory utilization

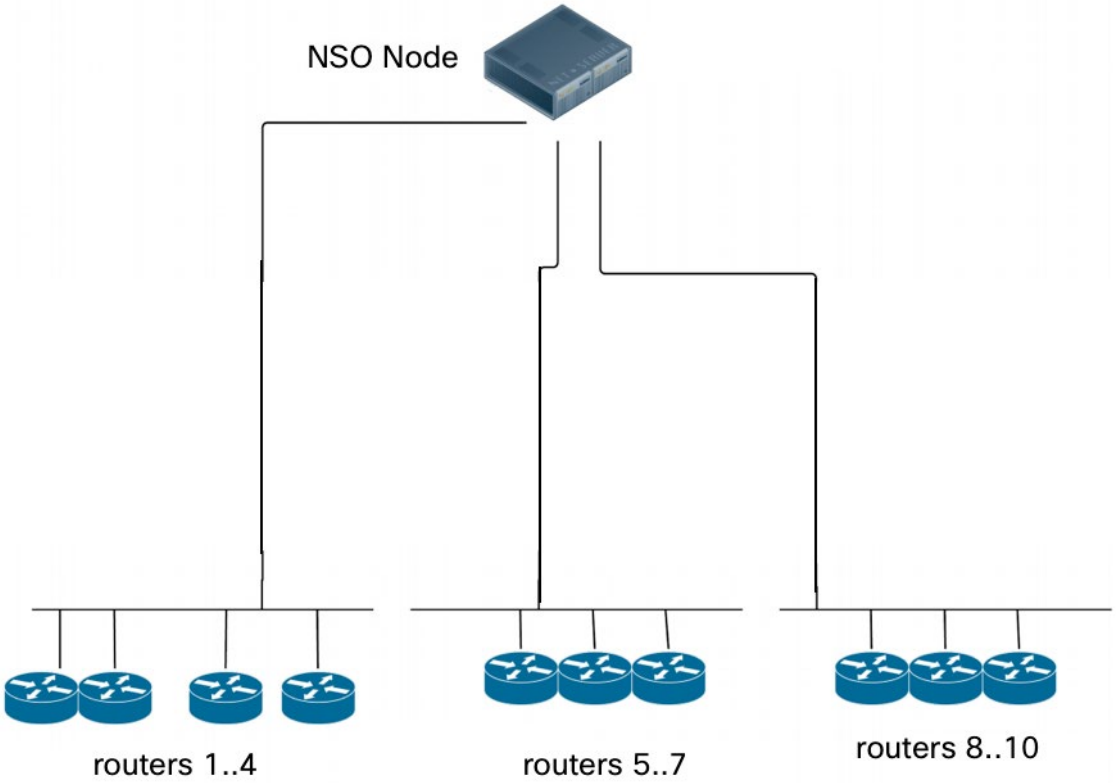
Horizontal Scaling
NSO with Layered Service Architecture (LSA)



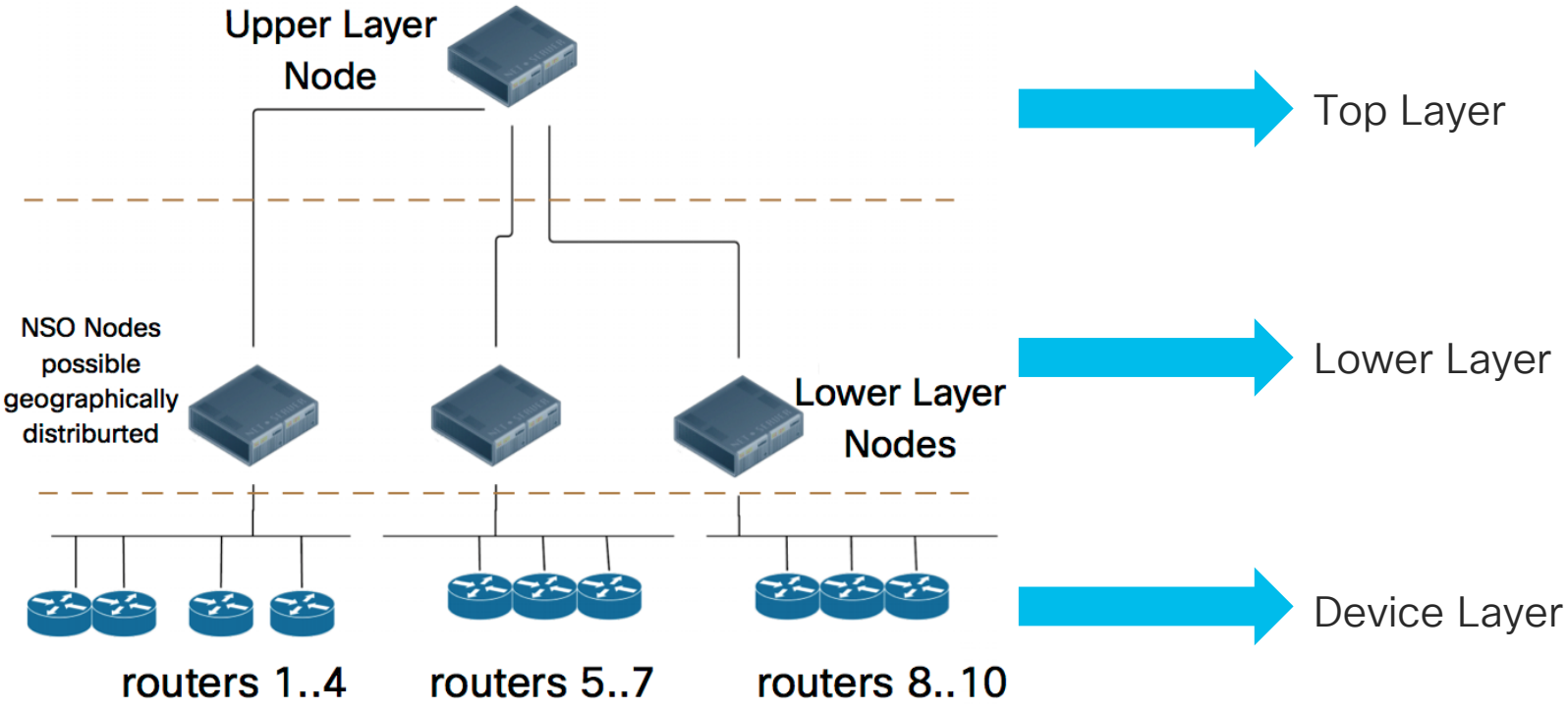
- Top node only sees a small number of devices (RFS nodes)
- Total number of devices has no impact on performance of the top node

LSA Overview

Standard NSO Example



LSA Example

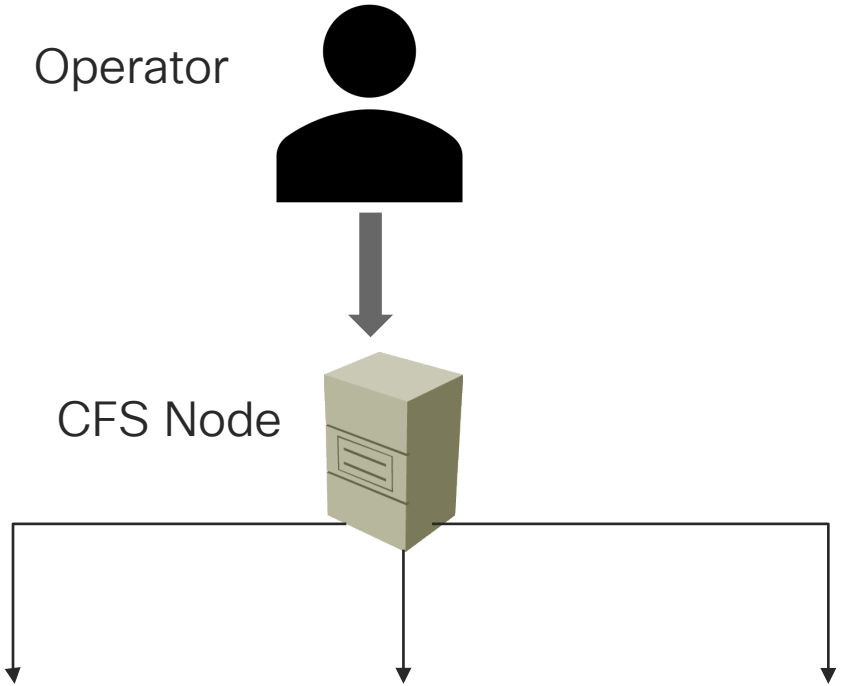


Working of LSA

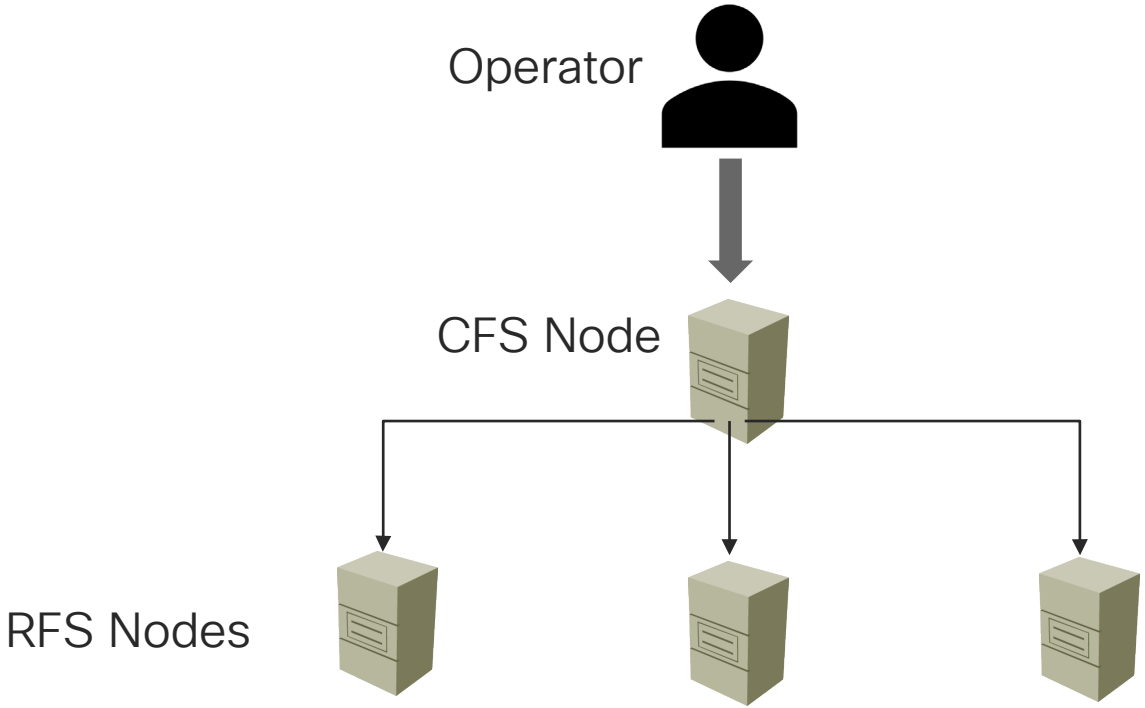
Things to know – LSA

- Customer Facing Node (CFS)
- Resource Facing Node (RFS)
- Dispatching
- Commit-Queue

Customer Facing Node (CFS)

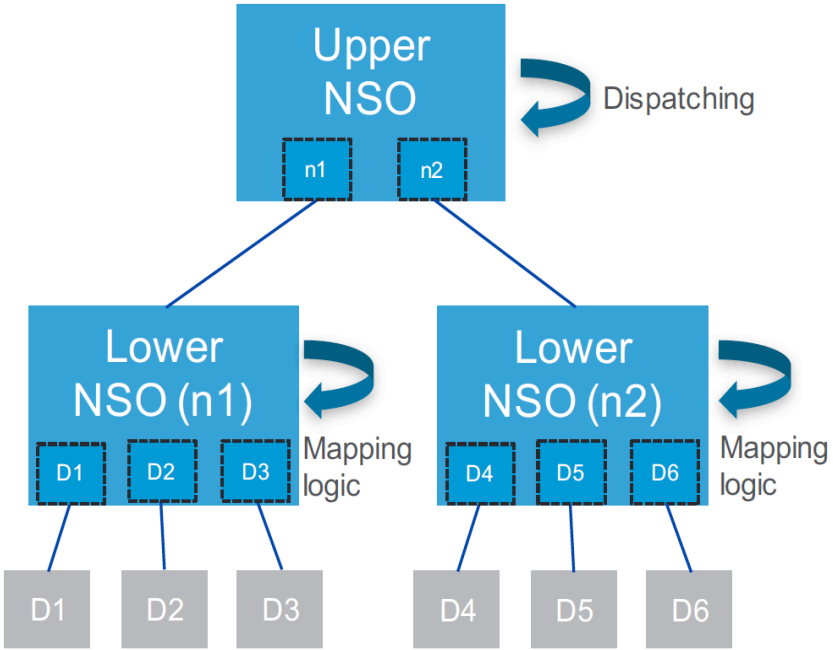


Resource Facing Node (RFS)



Dispatching

Mapping between CFS and RFS nodes

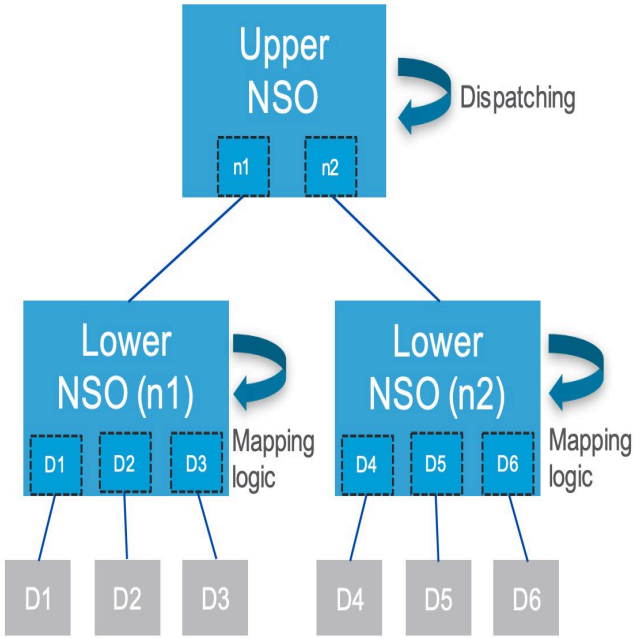


Commit Queue

- Commit-Queues handle NSO transactions in a QUEUE
- This enables NSO to behave as an ASYNC system

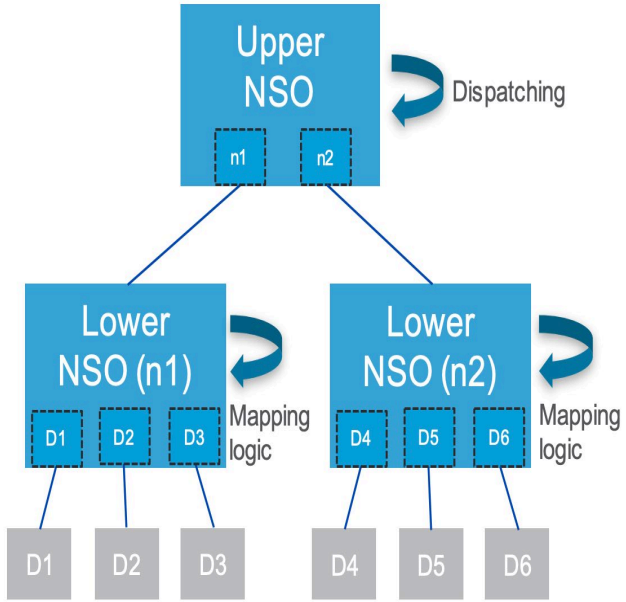
LSA Standard Mode

- No commit queues are enabled
- There is full transactional guarantees.
- Let's say you have a service spanning e.g devices D1, D2, D4 and D5. The lock is taken on the upper NSO and both lower NSOs for the duration of the transaction, including writing to the devices.
- In case a device fails, everything is rolled back.



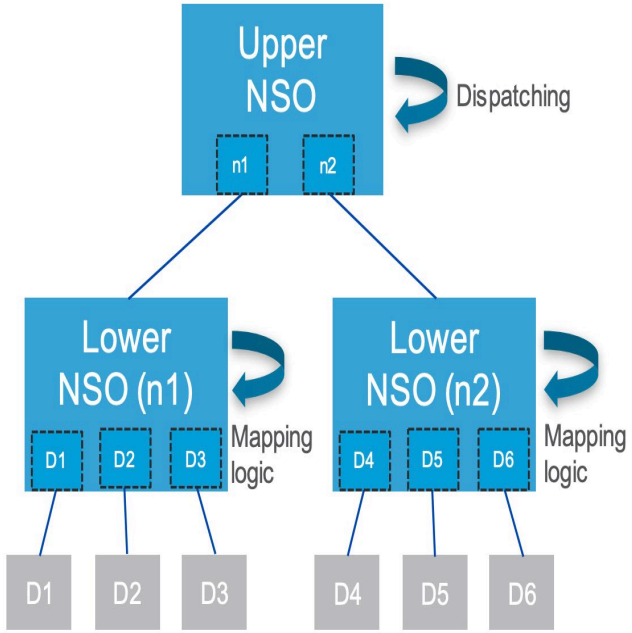
LSA Commit Queues to Lower NSO

- Enable commit queues between the upper NSO and the lower NSOs
- Transaction guarantees within the lower NSOs.
- So if device D5 fails, the transaction is rolled back in n2 but not in n1.



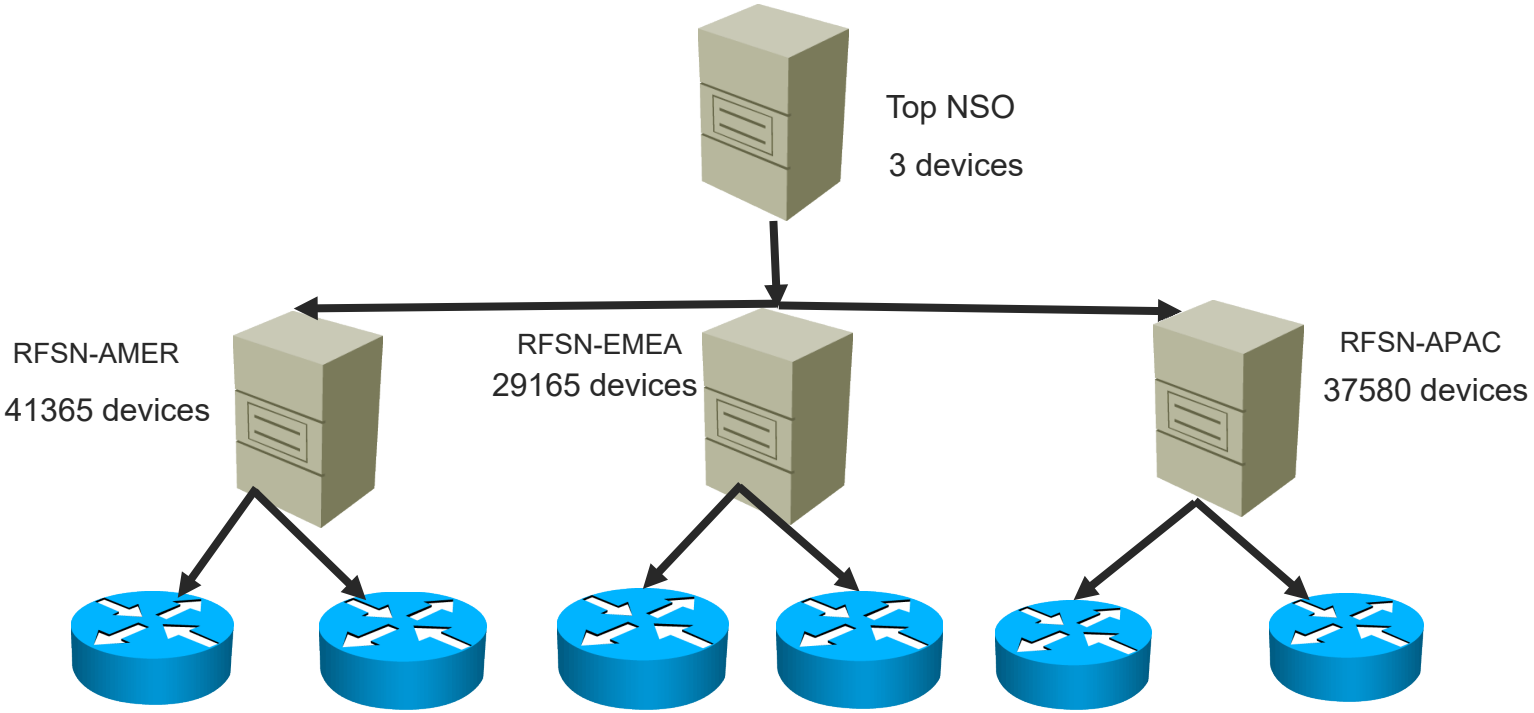
LSA Commit Queues to Devices

- Enable commit queues between the lower NSO and the devices.
- This achieves “full parallelism”.
- Please note that nothing is rolled back in case of a failed device.

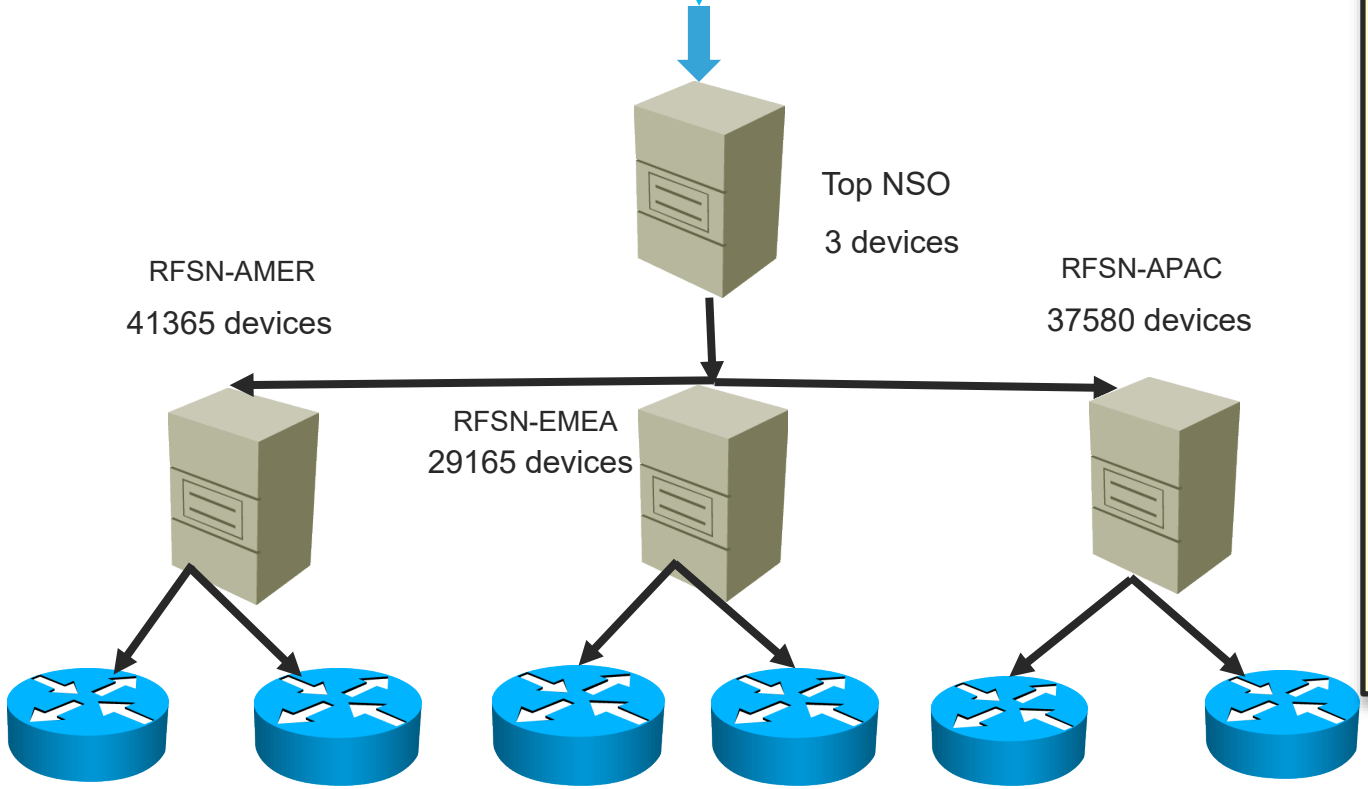


LSA Example

Deploy L3 VPN to Six Sites

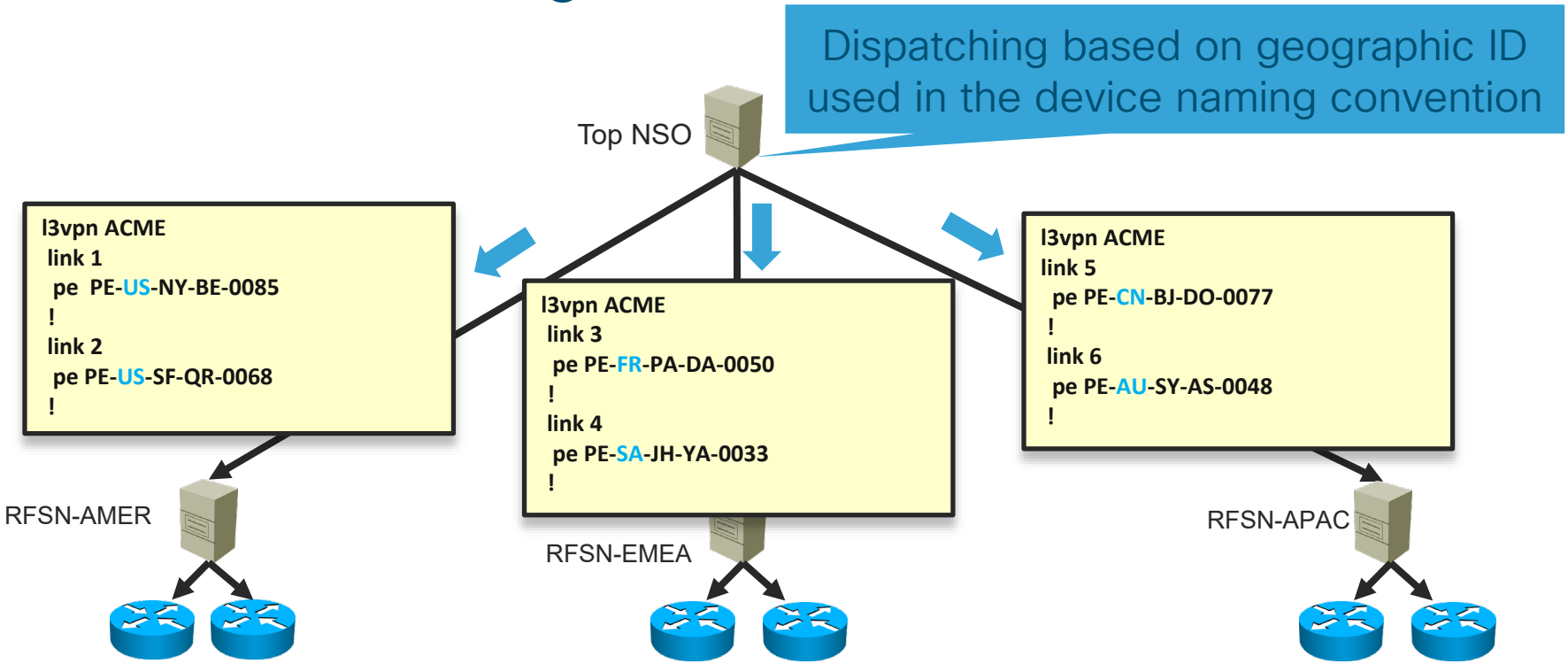


Deploy L3 VPN to Six Sites
Top Service Configuration

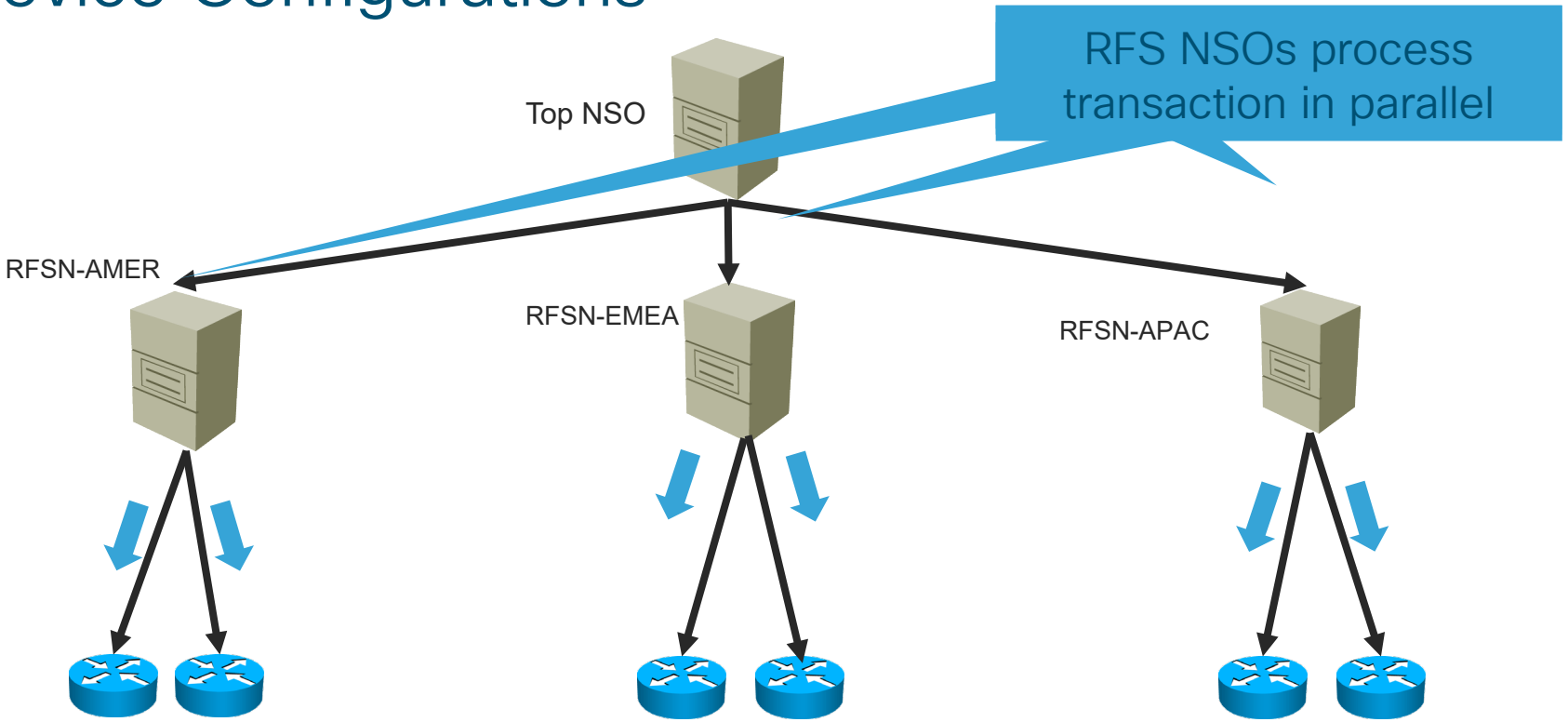



```
l3vpn ACME
link 1
pe PE-US-NY-BE-0085
 !
 link 2
  pe PE-US-SF-QR-0068
 !
 link 3
  pe PE-FR-PA-DA-0050
 !
 link 4
  pe PE-SA-JH-YA-0033
 !
 link 5
  pe PE-CN-BJ-DO-0077
 !
 link 6
  pe PE-AU-SY-AS-0048
 !
```

Deploy L3 VPN to Six Sites
RFS Service Configurations



Deploy L3 VPN to Six Sites Device Configurations



LSA Deployment types

- Green Field
- Existing monolithic application

LSA Design Guidelines

- ✔ Use LSA for virtually limitless scalability
- ✔ Make your top-level service model agnostic to device, platform, interface, and technology
- ✔ Devise the simplest dispatch method possible or at least one easy to maintain
- ✔ Implement integration with external systems at the top layer

  Multiple Upper NSO nodes for additional parallelism

Conclusion

"Reliance Jio added 160M subscribers in 18 months while supporting 10 times the internet capacity of the world's largest providers."

Reliance Jio

“Reliance Jio

"Cisco's model-driven approach to network automation and service orchestration is enabling Orange to drastically speed delivery of services across our entire lifecycles."

Christian Gacon, VP of Wireline Networks and Infrastructure, Orange

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Contacts

Harish Ravichandran (harravic@cisco.com)

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