The Three Stages of Automation

Stage #1: The Network API
Today’s Presenters

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Cisco Systems

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Technology Director, Cloud Solutions and Platform Group
Cisco Systems
Today's Agenda

1. Introducing the Three Stages of Automation
2. Deep Dive on Stage #1 *The Network API*
3. Using NSO as the Network API
4. Demo Time!
5. Wrap-up and Q&A
Key Market Trend Observations

Execution at the speed of software

• Networks provides well-known utility abstractions
• Agility, DevOps, NFV, SDN drives new expectations

Changing customer behavior and new expectations

• Everything on demand
• New services with a press of a button

Rapidly changing business models

• Cloud services, virtualization, programmable networks
• New value chains including OTT Co-opetition

All of this requires successful, flexible automation. But complexity has destroyed many automation initiatives.
## Departmental Pain Points

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<td>Develop your own services</td>
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**Change Requirements**

**Current Situation**

- **People**
  - Walled-off departments, lacking software skills

- **Process**
  - Waterfall operations for network operation and services

- **Technology**
  - Rigid, built for single purpose, proprietary

**Target Model**

- **People**
  - Cross-functional teams with software skills

- **Process**
  - DevOps approach across tools development and operations

- **Technology**
  - Network abstractions built for DevOps with modern technologies

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Devops Virtual Cycle

- Market Requirements
- Operational Requirements
- Service Requests

Development
Testing
Production

Network Operations
Devops Virtual Cycle (Today’s Focus)
Don’t Forget the Leaders in Network Automation
Resource Rebalancing - Commoditization

- Networking is well known, stable abstractions
- Modern software practices gives us reusability
- The competitive edge is in the services
## Transition Towards Automation

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**Day-to-day management of rapidly growing, complex networks**

**Challenges**
- Error-prone manual tasks
- Growing backlog
- Virtualization is coming

**Network API**
Utilize a single interface to all network devices

**Provisions services and manages service quality in networks**

**Challenges**
- No service insight
- Lack of automation
- Quality issues in delivery

**Service Abstraction**
Leverage one central API for all services

**Challenges**
- Implementation time
- Cost of change
- Lack of tooling

**Transformation**
Develop your own services
Challenge Mapping

Device Configuration Tasks
- Many protocols, encodings - opaque backups
- Changes are fire and forget

Failure rate increases with change rate
Challenge Mapping

Device Configuration Tasks
- Many protocols, encodings - opaque backups
- Changes are fire and forget

Growing Backlog
- Change management without data normalization
- Automation through replaying of tasks, not abstractions

Failure rate increases with change rate

Missed deadlines for changes – won’t fit maintenance window
Quick System Overview

- Model-driven end-to-end service lifecycle and customer experience in focus
- Seamless integration with existing and future OSS/BSS environment
- Loosely-coupled and modular architecture leveraging open APIs and standard protocols
- Orchestration across multi-domain and multi-layer for centralized policy and services across entire network
Feature Mapping #1

Device Configuration
Multivendor Abstraction Through NEDs

A NED abstracts

- Underlying protocol and data-models
- Error-handling

The NED computes the ordered sequence of device-specific commands to go:

- from current configuration state
- to desired configuration state

Key benefits include: removes the device adapter problem. Removes complex device logic from the service logic
The Industry’s Broadest Multivendor Support

Over 100 Supported NEDs – Customization Available

<table>
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<tr>
<th>Cisco</th>
<th>Juniper Networks</th>
<th>Alcatel-Lucent</th>
<th>Citrix</th>
<th>Infinera</th>
<th>Huawei</th>
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<td>Avaya</td>
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<td>Overture</td>
<td>Vyatta</td>
<td>F5 Networks</td>
<td>Riverbed</td>
<td>Brocade</td>
<td>Allied Telesis</td>
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The Configuration Data Store

**Built for speed at scale:**
- In memory with journaled backend
- YANG is native schema language
- …including when, must, XPath, etc

**Highly available**
- 1:N hot-standby
- Synchronous and asynchronous slaves
- Slave chaining

**Fully integrated**
- Managed through NSO interfaces
- Runs in main process memory
- Automatic versioning of YANG modules
Network-wide CLI

- Two flavors of CLI including all main interaction idioms including control-commands, command-line editing
- Strict separation between operational data and configuration data
- Range and group operations for performing configuration changes on sets of devices
- Full AAA (NACM) integration provides policies on both models and instance data
- Leverages the two-phase commit engine in NSO to provide all-or-nothing changes including explicit validation stages

```
admin@ncs(config-endpoint-c2)# commit
Commit complete.
admin@ncs(config-endpoint-c2)#
admin@ncs# show running-config devices device pe2
devices device pe2
  address 127.0.0.1
  port 10030
  authgroup default
device-type cli ned-id cisco-ios-xr
state admin-state unlocked
config
cisco-ios-xr:hostname PE1
cisco-ios-xr:vrf volvo
  address-family ipv4 unicast
    import route-target
      65001:1
    exit
  export route-target
    65001:1
  exit
exit
exit
cisco-ios-xr:interface MgmtEth 0/0/CPU0/0
exit
exit
cisco-ios-xr:interface TenGigE 0/3/0/0
  shutdown
exit
exit
cisco-ios-xr:interface TenGigE 0/3/0/1
  shutdown
admin@ncs(config-endpoint-c2)#
```
Feature Mapping #2
Growing Backlog
Templates and Compliance Reporting

- Engineering teams create device templates from device configuration
- Device templates are then manually applied to groups of devices, reporting diffs
- This process can then be packaged into a compliance report to produce reports (plain text, XML, HTML)
APIs and Language Bindings

- Remember: the northbound APIs are all clients to the same YANG-based datastore
- Many customers start (and build trust) using the CLI, but gradually introduces e.g. REST for scripting trivial tasks
- Choice of technology tightly related to team background, specific use cases and more
Demo Time
Demo Setup

- CLI
- JSON-RPC
- REST
- NSO
- CDB
- XE (CLI)
- NETCONF
- IOS-XE
- Juniper
Wrap-up and Q&A
Operators Voted
Cisco Leads Industry In Lifecycle Service Orchestration

### LSO and OSS Leaders

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Cisco</td>
<td>52%</td>
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<tr>
<td>Ciena (Blue Planet)</td>
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<tr>
<td>Ericsson</td>
<td>28%</td>
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<td>Accenture</td>
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<td>IBM</td>
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### OSS Vendors Deployed Today

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Source: SDxCentral 2017 Next-Gen OSS and the Rise of LSO Report

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What You Gain with Cisco Network Services Orchestrator, Enabled by Tail-f

• Agility throughout service lifecycle
  - Strict YANG model-driven solution
  - Auto-rendered business logic results in 90% less code
  - Effortlessly re-deployment of updated service and device models
  - DevOps for differentiation

• Full automation
• Robust and proven in tier-1 deployments
• Industry’s broadest multivendor support
• Relevant in today’s and tomorrow’s networks
NSO DevNet – Key Highlights

The one place to use for sharing, finding and collaborating on NSO public knowledge!

- Light start through DevNet content page and Learning-Labs
- Constant news and updates to help you keep up to date
- Large searchable content pool
- Cisco customers, partners and employees all have access
- Got a question, ask! We will help ensure a fast response
- Easy to share and find public content
- Code sharing through public GitHub

developer.cisco.com/site/ns0
Next Webinar in the *Three Stages* Series

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- **January 10**
- **February**
- **March**
Questions?
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