Automating the service chain

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Agenda

- The new service chain
- NSO and service chain tooling
- Next steps
A long time ago...like 1999
Today

Content and SaaS providers

SP data center

Agg and peering

Edge
The service chain is expanding beyond the core

- The service delivery and distribution models are shifting in response to scale and customer experience
- Traffic is increasing but coming from different places

*Where traffic will be originating in 2021 (source: Cisco VNI)*
New service chain: distributed, uniform, automated

- Network functions and resources deployed anywhere
- Cross domain, end-to-end service orchestration for predictable deployment and lifecycle management
- Centralized, end-to-end monitoring of infrastructure and services
- Abstracted infrastructure layer for service developers/owners
What we know about successful projects...

People, tooling and process need to work together
Common challenges today

<table>
<thead>
<tr>
<th>Integration complexity</th>
<th>Service creation</th>
<th>Operational readiness</th>
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<tr>
<td>Time, costs and risks of acting as an SI to assess, assemble, integrate service delivery stack</td>
<td>Designing, building and maintain a CI/CD pipeline across service development and infrastructure operations teams</td>
<td>Tooling and instrumentation for observability and analytics SRE-style skill sets Org alignment and adherence to CI/CD and DevOps processes</td>
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What do your stakeholders think?

Infra Operations | I need to increase responsiveness and still lower opex

Service Automation | I am on the front line for customer experience

Service Developer | I need to out-innovate the competition

Business Owner | I don’t care about the tech, show me how you can drive growth
What do you need your tools to do?

**Task Automation**
- Single box, simple task
- Ex: Port Turnup
- Scope: Single team
- Trigger: Manual
- Metric: Successful Completion

**Domain Automation**
- Multi-box, Multi-vendor, single domain
- Ex: L3VPN provisioning
- Scope: Single team
- Trigger: Domain-specific tooling
- Metric: Efficiency

**Device Automation**
- Single box, complex task
- Ex: ZTP
- Scope: Single team
- Trigger: Manual
- Metric: Completion

**Business Automation**
- Automate full business processes
- Scope: Tech and LoB teams
- Ex: Auto-scaling services
- Trigger: Business process toolchain
- Metric: Flexibility

**Cross-Domain Automation**
- Ex: Multi-Layer IP+Optical
- Scope: Multiple concurrent teams
- Trigger: Workflow tool chain
- Metric: Speed
Automation needs elasticity on three axes

More things
Accommodate expanding scope and complexity

More people
Appropriate access and controls across the service stack

More places
Span the service delivery chain
Cisco NSO is a bridge

Between people that build services and ones that operate infrastructure

Across different domains and vendors

Over both physical and virtual infrastructure
NSO Architecture

Model-driven, end-to-end service lifecycle and customer experience focused
Seamless integration with northbound tooling
Loosely-coupled and modular architecture leveraging open APIs and standard protocols
Orchestration across multi-domain and multi-layer for network-wide, centralized policy and services
Ariel is tired of you blaming the network

- Task automation, device automation, domain automation...maybe cross-domain automation
- Benchmarked against CSPs for flexibility, responsiveness and OpEx
- Dealing with multiple technologies, vendors and generations
One tool to rule them all

Multivendor abstraction through NEDs
Single datastore for all network elements under management
Multiple interfaces including CLI, REST, Java, Python
Templates and compliance reporting
NEDs tame multi-vendor complexity

- Abstracts underlying protocol and data-models
- Normalizes error-handling across vendors
- Eliminates the device adapter problem
- Removes complex device logic from the service logic

NED
Computes the ordered sequence of device-specific commands to go from current to desired state
Industry’s broadest multivendor support

Over 170 NEDs and growing – custom NEDs available
Help now, help more later

**Today:**
Network CLI

- Immediate benefits with familiar approach
- 2 fully functional CLI options
- Strict separation of operational and config data
- Perform operations on groups of devices
- Full AAA integration
- Database-style two-phase commit on changes

**Tomorrow:**
Network API

- Adopt over time as comfort and skills grow
- Python or Java are an good place to start
- Multiple language bindings available
- Eventually integrate your own toolchain
CDB: What’s really going on?

- In memory with journaled backend
- Runs in main process memory
- YANG is native schema language
- Automatic versioning of YANG modules
- Managed through NSO interfaces
- Addressable via query API
- Globally scalable

CDB: authoritative source of configuration and operational data
ABC: Always be converging

Stateful convergence: NSO strives to ensure infra is in the state apps and services expect

- FastMap
- Reactive Fastmap
  - Insurance against the unexpected (i.e. VMs started/moved/destroyed or topology changes)
  - Calculates the minimum diff to drive towards intent
  - Makes changes where it can and continually re-evaluates what still needs to be done

Infra in expected state
Predicatable service behavior
Improved CX
Faster, simpler compliance

- Infra and ops teams create device configuration templates
- Templates make it easy to manage a single device or group of devices
- NSO can generate “diff” between template and current device config
- Template can be re-applied to device or template can be updated from device
- Process can be packaged into a compliance report (plain text, XML, HTML)
Erik is the infrastructure maestro/chief cat herder

- Cross-domain automation, business process automation
- Gets the first call when CX starts to deteriorate
- Tasked with making disparate infrastructure behave as a cohesive whole
- Don’t mess with his toolchain
Build resilient, cross-domain workflows

Surety from database-style all-or-nothing transactions
Detailed insight into interaction between services and underlying infra
Loose coupling between service and infra simplifies delivery
Transactions and models = no more “ooops”

- Provides a two-phase commit protocol to address distributed network atomicity
- Dry-run and rollback capabilities for changes
- Implements full ACID properties
- Uses YANG as native schema language
Layered Services Architecture: Speed and scale

**Upper Node**
Provisioned automation across lower node boundaries
Ex. cross-domain, -geography, -org

**Lower Nodes**
Organized around customer defined boundaries
Ex. technology domain, service type, geography, organizational unit

- Nearly unlimited horizontal scale-out
- Automate across domains and boundaries
- Improved performance through parallel service execution
- Supports rolling, granular upgrades, and canary tests

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Enabling end-to-end service chain automation
Automaton is a team sport
Agnetha doesn’t want to think about infra

• She’s focused on developing new products and services more quickly than the competition
• Dealing with infra teams has traditionally been a point of friction
• “It worked fine in dev”
Normalizing and abstracting infra for developers

- Intent-Based Tools
- DevOps CI/CD Pipeline
- OSS/BSS Systems
- Scripts and Applications
- Service Orchestration
A better way to develop services

- Allows “black box” service design decoupled from implementation details
- Designed for rapid iteration of services
- Minimizes code for lifecycle management
- Integrated development and package management tools
Ani sees infrastructure as a means to an end

• She’s worried about growth and the competition
• She cares about what it can do, not how you built it
• Bottom line: how can our infra improve CX?
• Ani is a profit center—its good to be her friend
Where to start?
Network Automation Delivery Model

- Codification of a decade of experience and wisdom
- A guide on how to successfully adopt automation in your organization
- Two phases: getting started and scaling your efforts
- Includes a chronological guide and topic-based insights

Start here

developer.cisco.com/docs/network-automation-delivery-model
Quite honestly, this is a lot of work with a steep learning curve. A big bang isn’t the answer – it is a journey, started with viable business cases rather than building future infrastructure.

Enterprise-focused CSP from developed Asia–Pacific

Automation is like a staircase, each project builds upon the ones before it to increase scope and capabilities of the whole over time.
Closing thought: there is no “right” path

- Focus on automating technical domains for operations efficiency
- Lowers OpEx but may not improve business agility
- Focus on automating business process to improve customer experience
- Encourages one-off solutions, doesn’t improve operational agility

Reality is probably crooked!
Learn more about NSO

- cisco.com/nso

More info on NSO and the ecosystem

- developer.cisco.com/nso

Download a free copy of NSO and get access to developer resources

- NSO Developer Hub

NSO community for developers and users