Network Automation -Different Paths, Similar Results

Internet2, ESnet

Karl Newell - Internet2 Marc Körner - ESnet TNC 2024

Rennes, France June 2024







U.S. DEPARTMENT OF ENERGY Office of Science

ESnet



ESnet in numbers:

Thousands of miles of fiber cables, including transatlantic cables

380 locations with racks and equipment to track

346 Core links between routers

300 Customer facing Interfaces, 123 of which are 100G

Multi Platform environment with lots of interoperability needs



Why is Orchestration important for ESnet?

- Consistent and unified configurations
- Enhance network reliability, resiliency, and robustness
- Allows to manage a larger network
- Eliminate human errors
- Better use of human resources
- Planning safety





ESnet's NSO implementation in numbers

Service models: 33

Services instantiated:

- Devices: 325
- System: 155
- Port: 1705
- BBL: 199
- Bridge: 401
- Host: 161



- LSP: 151
- VPLS: 1
- L3-Interface: 923
- L3-Customer: 277
- L3-Peer: 252
- L3-Transit: 369



Lessons Learned

- Moving to Network Orchestration is a process which takes time and needs to grow
- Sync issues Source of Truth paradigm
- Very close cooperation between NETENG and SEG
- Don't underestimate the power of Orchestration







International Connectivity (NREN to NREN) via multiple partnerships and consortiums



Why Internet2 Chose NSO

- Configuration Orchestration
 - Multi-vendor support
 - Templates
 - Single config tree includes all devices
- System-wide transactions
- Coexistence with out of band changes
- Graceful evolution over time
- Command line interface

Orchestration Workflow



INTERNET®

Orchestration Workflow





Orchestration Workflow





NSO Stats

- 30+ service models (19+ edge service models)
- 4,000+ service instances
- 32,047 lines of NSO service config
 - resulting in 250,282 lines of device config

• 7.81 config compression ratio

- 2,250+ commits
- 717 git merges
- 7,000+ build pipelines



Lessons Learned

- Organizational support for network automation
- Iterative development
- Integration of network engineering and software development teams



Organizational support for network automation



Organizational support for network automation





Organizational support for network automation





Iterative development





Integration of network engineering and software development teams





Integration of network engineering and software development teams





Integration of network engineering and software development teams







Right Tools for the Job

- NSO is designed for network automation
- But NSO doesn't meet all of our needs so we use other tools as well
 - pyATS
 - Nornir
- Spreadsheets work
 - Especially coupled with scripting (Google Apps Script)



Discussion & Questions...





