Open Source Network Automation in 2022

FOSDEM 2022

Damien Garros, Christian Adell

Network to Code
Goals

Understand the context around Network Automation

Share a reference framework

Highlight challenges and trends

Mention some relevant OSS projects
Presenters

Damien Garros
Director of Architecture at NTC
@damgarros
https://github.com/dgarros

Christian Adell
Principal Architect at NTC
@chadell0
https://github.com/chadell
Introduction
Networking “planes”

**Management Plane**
**How to manage the Control or/and Data Plane**
Examples: CLI over SSH

**Control Plane**
**How data packets should be forwarded**
Examples: OSPF, BGP

**Data Plane**
**Actually forward the packets**
Examples: ASICs, OpenFlow, P4

OUR SESSION FOCUS
Traditional Network Management

- Proprietary NOS
- CLI Unstructured Data
- Manual Changes
Network Automation Drivers

- Data Model management
- Cloud Scale
- SDN
- HW disaggregation
  - Linux NOS
- DevOps
What is the adoption?
(some real) Use Cases

**Device Lifecycle**
Gather data and generate reports about device out of maintenance or running old/unsecure software.

**Telemetry Stack**
Extend visibility with real time data from multiple sources and enriched with metadata.

**Greenfield Site Builder**
Simplify and automate the generation of a new site based on a collection of standard design.

**Chatbot**
Integrate with IM to provide notification and accept commands/request to interact with the automation system.

**OS Upgrades**
Allow the safe upgrading of network devices, firewalls, wireless controllers, etc.

**Firewall Rule Automation**
Deployment of firewall rules from an ITSM tool or other automation system with a friendly end user interface.

**Data Population and Synchronization**
The definition of the intended state of your network could come from multiple places, but linking it together, understanding dependencies makes it easy to automate it.

**Configuration Provisioning and Backup**
Generate the full configuration of devices from the intended data, be able to push it to the devices and finally keep track of the configuration for accountability.

**Pre-Post Change Validation**
Quickly determine when the operational state is not as intended, or if there was a change from a previous state.

**Firewall Rule Automation**
Deployment of firewall rules from an ITSM tool or other automation system with a friendly end user interface.

**Configuration Compliance and Remediation**
Quickly determine where the configuration on the device deviates from standard configurations and automate the return to compliance of a non compliant configuration.

**Self Healing**
Based on other features, such as telemetry and configuration provisioning, advanced decision can be taken on the fly to mitigate network issues.

**Circuit Management**
Manage all circuits information, including maintenance information. Data can be leverage from a Telemetry Stack.
Typical Network Automation Framework
Network Infrastructure
Network Management Interfaces/Protocols

NetDevOps Survey (2020)
What connection methods / transports are being utilized as part of your network automation implementation?
Stats: 1.89 avg, max 6

CLI/SSH (Non-Netconf)
Netconf
HTTP/HTTPS (Non-Restconf)
Serial Console
Restconf
gNMI/gRPC
Not sure
Telnet
SNMP

https://dgarros.github.io/netdevops-survey/reports/2020

@networketcode

https://network.toCode()
Network Emulation

Decouple NOS from hardware to create development environments*

* we are focusing on managing, not on performance

netaim

VrNetLab

kne

HashiCorp Vagrant

CONTAINERlab

Boxen

docker

kubernetes
Source of Truth
Store and organize the **intended** state of the network

- Data Modeling
- Data Validation
- Traceability
- Atomic Changes
- Data Aggregation
how many models?

https://github.com/YangModels/yang
Telemetry & Analytics
Collect, enrich and store the network observed state

- Correlation of multiple data types/interfaces
- Streaming Telemetry
- Add business logic
- Metrics Convergence
Related Projects

- Fluentd
- Grafana Loki
- pyGNMI
- gNMIC
- PMACCT
- ncclient
- Telegraf
- InfluxDB
- Prometheus
- Thanos
- Nagios
- Zabbix
- MRTG

Get / Set / Subscribe / Collect

@networktocode
Automation Engine
Interact with the network, render and deploy configurations

- More scripts than apps
- Network Complexity
- Heterogenous environments
- Blast Radius impact
Related Projects

- Terraform
- HashiCorp
- Ansible
- SaltStack
- Jinja
- Netmiko
- Napalm
- Scrapli
- GNMILc
- pyATS
- capirca
- Batfish
- Nornir
Example
Firewall Automation

User Interactions

Mattermost

git

Source of Truth

nautobot

Telemetry and Analytics

CI/CD

Automation Engine

AWX

orchestration

Network Infrastructure
How to get started?

Prioritize: Start small, low risk, high value

Understand your current operations/workflow in detail

Simplify and normalize each step

Use it and learn from experience
Takeaways

Start first understanding your workflow and defining your intent.

There is no single turnkey solution.

Network Automation is not the exception.
What’s next?

(still) Modeling complexity

More apps than scripts

K8S style Operators

SoT v2

Continuous Deployment

AI/ML
Questions and (hopefully) Answers