



>>>network.toCode()

# Open Source Network Automation in 2022

FOSDEM 2022

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Network to Code



## >>> Goals

Understand the context around Network Automation

Share a reference framework

Highlight challenges and trends

Mention some relevant OSS projects

## >>> Presenters



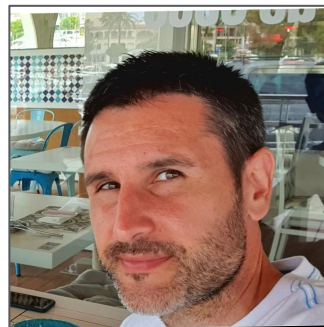
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Principal Architect at NTC



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# >>> Introduction

### 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

## >>> Traditional Network Management

Proprietary  
NOS

CLI  
Unstructured  
Data

Manual  
Changes

## >>> Network Automation Drivers

Data Model  
management

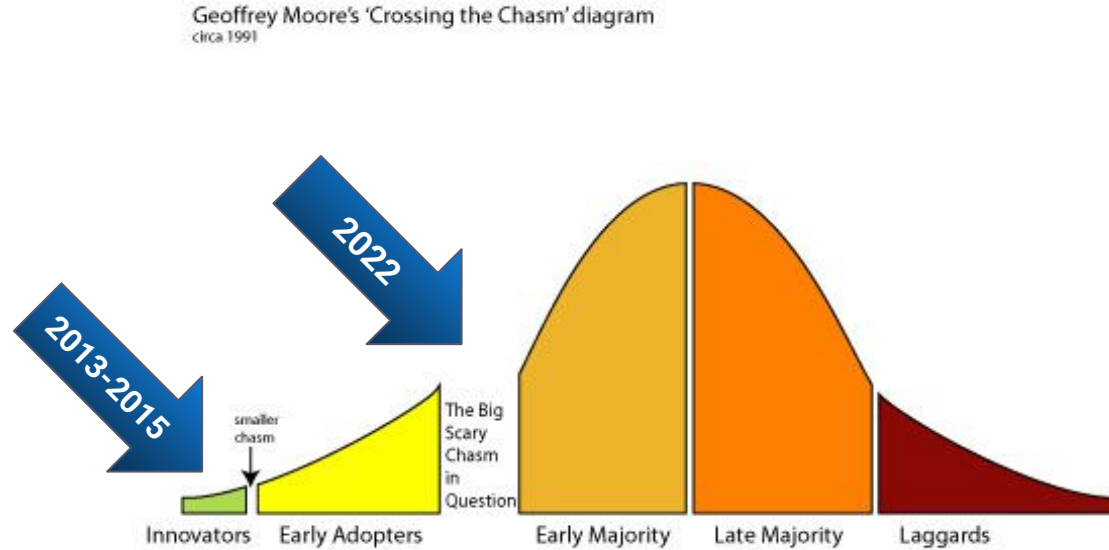
Cloud Scale

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



## OS Upgrades

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



## 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.



## Telemetry Stack

Extend visibility with real time data from multiple sources and enriched with metadata



## Firewall Rule Automation

Deployment of firewall rules for from an ITSM tool or other automation system with a friendly end user interface.



## Pre-Post Change Validation

Quickly determine when the operational state is not as intended, or if there was a change from a previous state.



## Greenfield Site Builder

Simplify and automate the generation of a new site based on a collection of standard design.



## 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 easy to automate it.



## 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



## Chatbot

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



## Self Healing

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



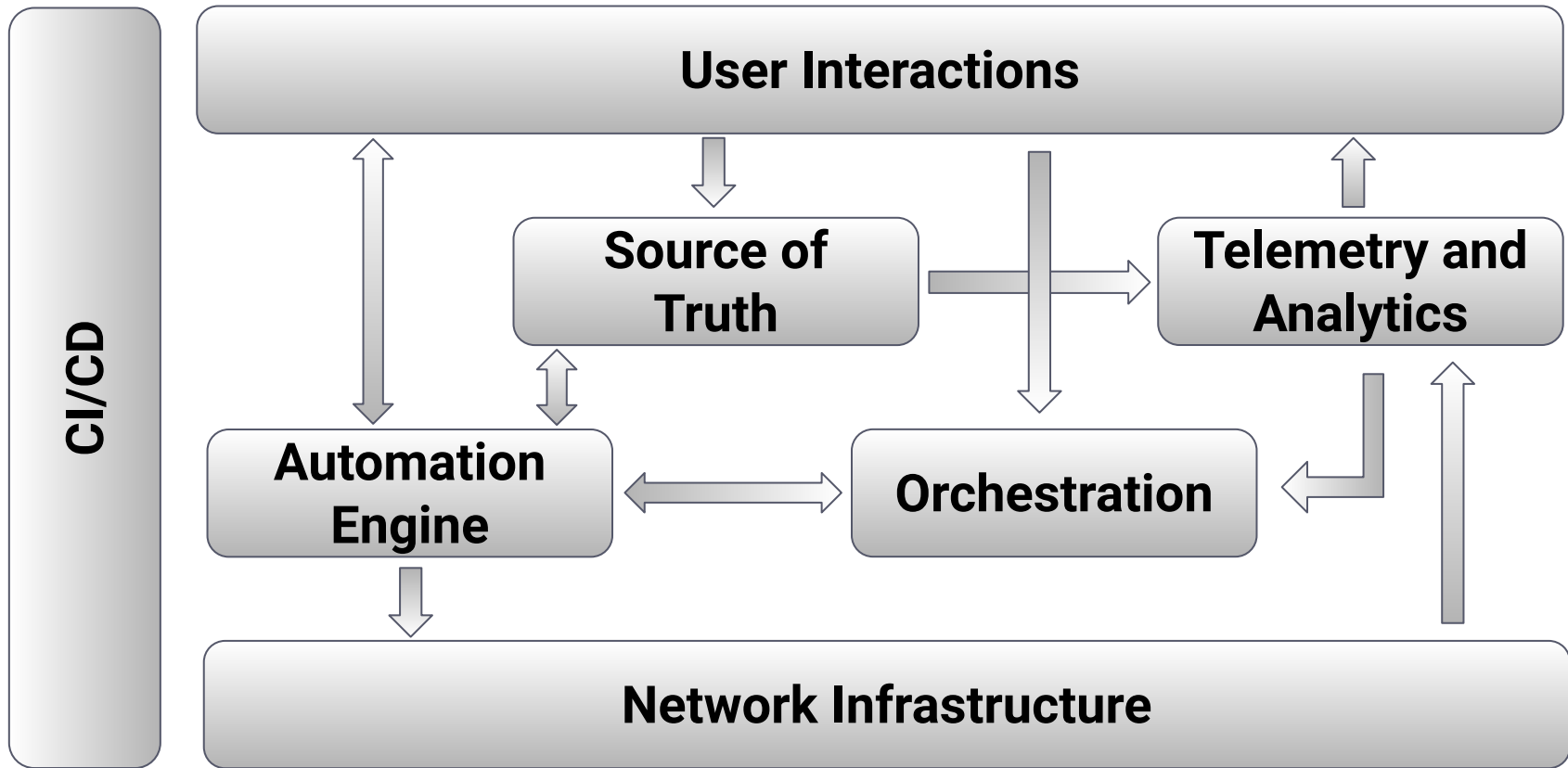
## Circuit Management

Manage all circuits information, including maintenance information. Data can be leverage from a Telemetry Stack.

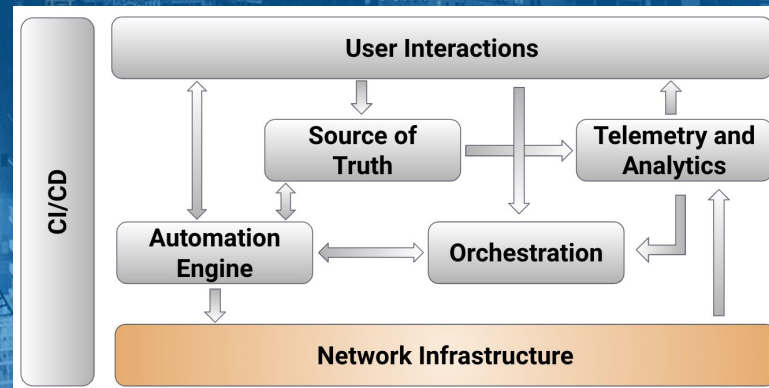




# >>> Typical Network Automation Framework



# >>> Network Infrastructure



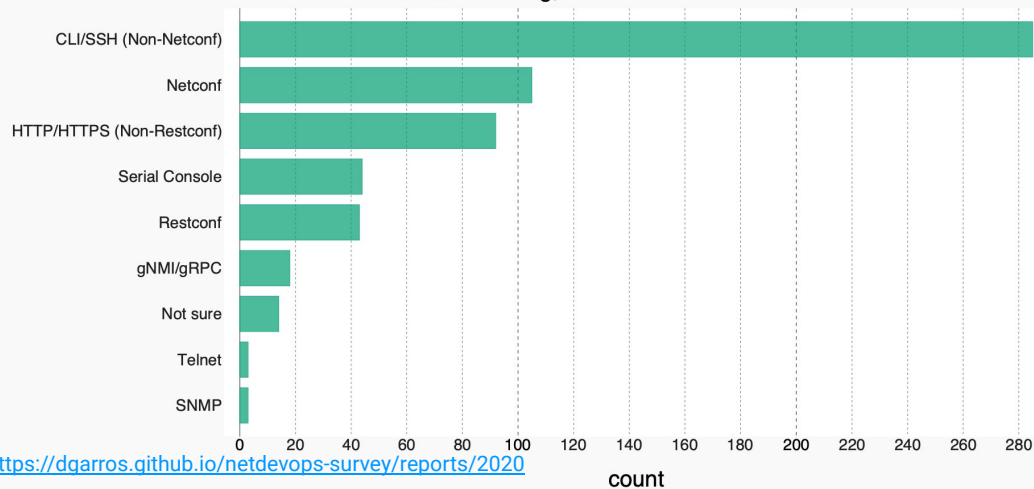


# >>> Network Management Interfaces/Protocols

NetDevOps Survey (2020)

What connection methods / transports are being utilized as part of your network automation implementation?

Stats: 1.89 avg, max 6



gNMI

NETCONF

RESTCONF

CLI  
over SSH

SNMP

TRENDS

Custom  
APIs

Linux  
Shell

Decouple NOS from hardware to  
create **development** environments\*

*\* we are focusing on **managing**, not on performance*

netsim



HashiCorp  
**Vagrant**



CONTAINERlab

VrNetLab

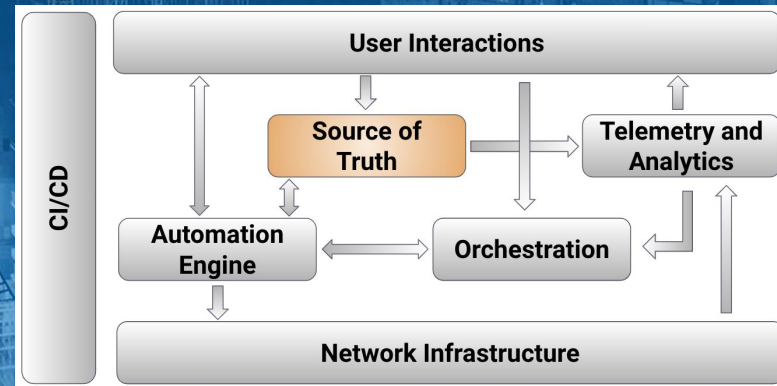
kne



**kubernetes**



# >>> Source of Truth





Store and organize the **intended** state of the network

Data  
Modeling

Data  
Validation

Traceability

Atomic  
Changes

Data  
Aggregation

**YANG  
Catalog**



nipap

**django**



d01t

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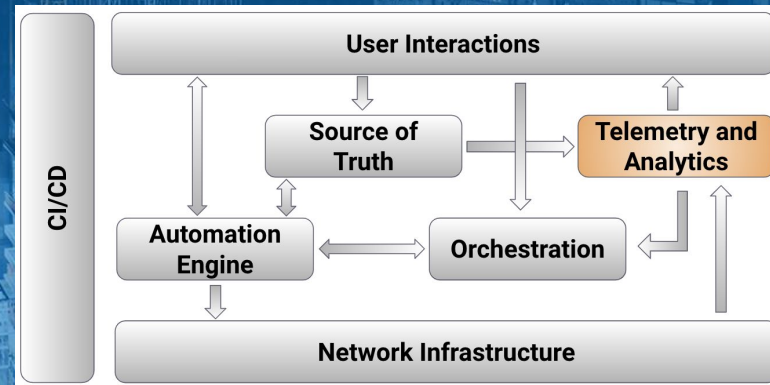
# how many models?

<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



Get / Set / Subscribe / Collect

ncclient



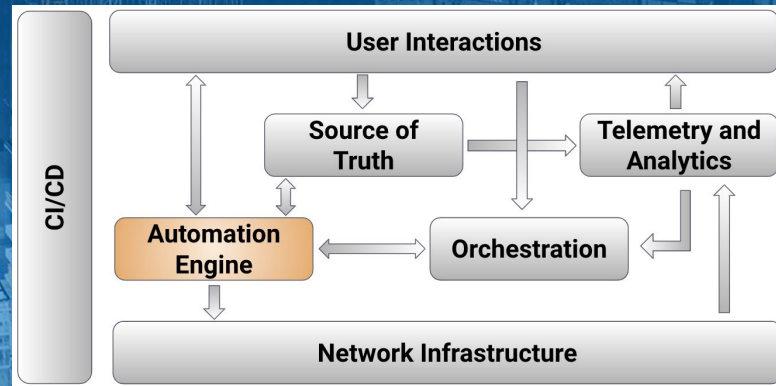
Thanos



MRTG



# >>> Automation Engine





## Interact with the network, render and deploy configurations

More scripts  
than apps

Network  
Complexity

Heterogenous  
environments

Blast Radius  
impact

## >>> Related Projects



Hier Conf



Get / Set / Subscribe / Collect

campirca



Napalm

ncclient



Batfish



Nornir

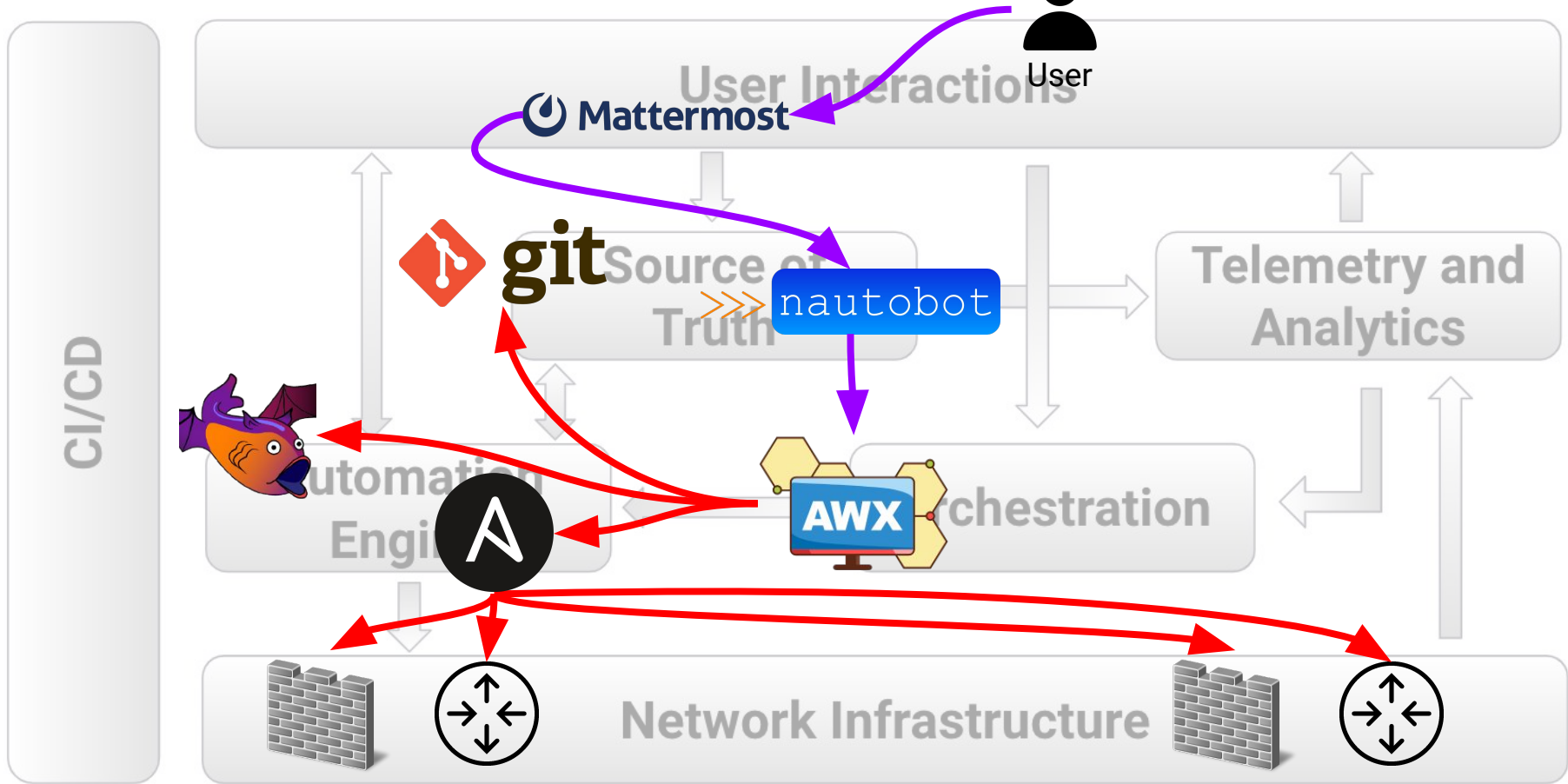






>>> Example

## >>> Firewall Automation







>>> Wrap Up

## >>> 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

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

SoT v2

More apps  
than scripts

Continuous  
Deployment

K8S style  
Operators

AI/ML

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# Questions and (hopefully) Answers