ANSIBLE

AUTOMATION FOR NETWORK INFRASTRUCTURE

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Why Automation for Networks?


MANAGING NETWORKS
HASN’T CHANGED
IN 30 YEARS.

WHAT IS THE PRIMARY METHOD OF MAKING NETWORK CHANGES IN YOUR ENVIRONMENT?

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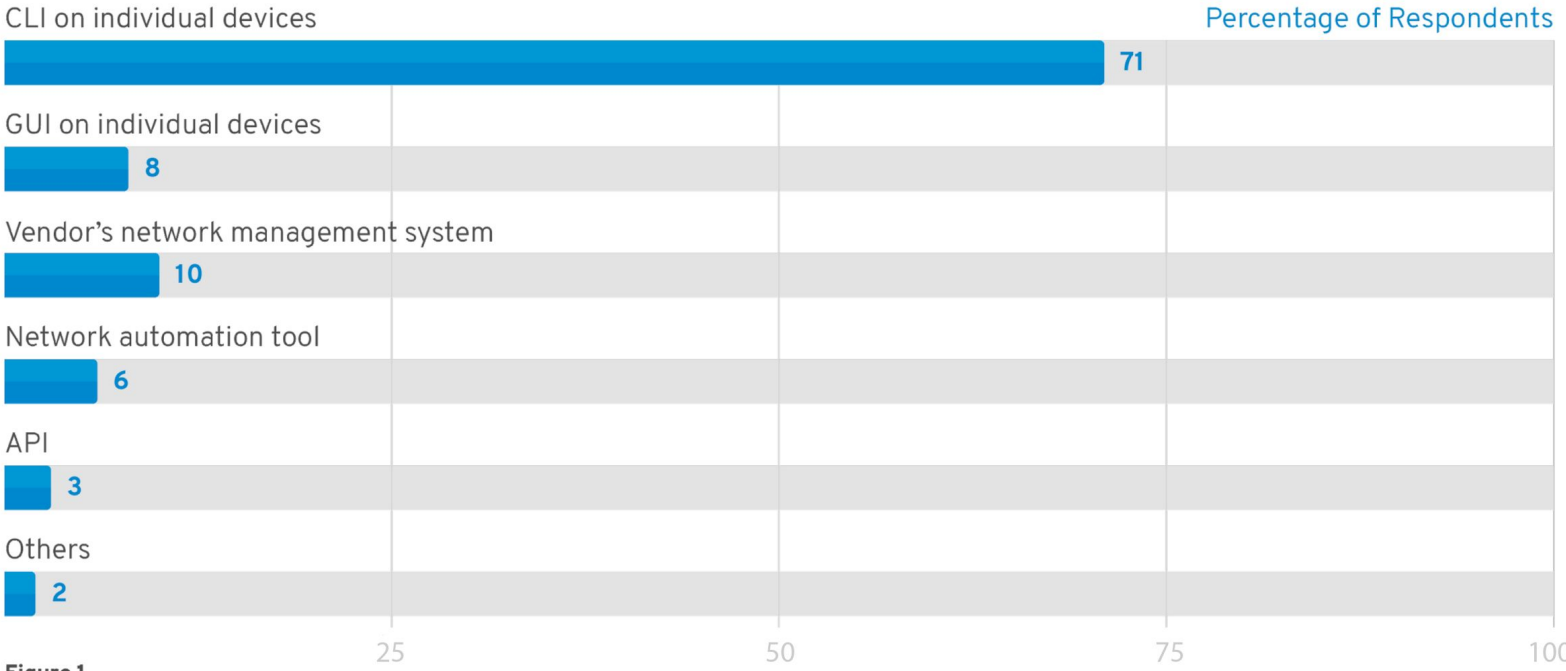

Figure 1
Primary Method for Making Network Changes

Source: Gartner, *Look Beyond Network Vendors for Network Innovation.* January 2018. Gartner ID: G00349636. (n=64)

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WHY HASN'T NETWORKING CHANGED?

PEOPLE

Domain specific skillsets

Vendor oriented experience

Siloed organizations

Legacy operational practices

PRODUCTS

Infrastructure-focused features

Baroque, CLI-only methodologies

Siloed technologies

Monolithic, proprietary platforms

BIGGEST CHALLENGE FOR ENTERPRISES: CULTURE!

Traditional Network Ops

- Legacy culture
- Risk averse
- Proprietary solutions
- Siloed from others
- “Paper” practices, MOPs
- “Artisanal” networks

Next-Gen Network Ops

- Community culture
- Risk aware
- Open solutions
- Teams of heroes
- Infrastructure as code
- Virtual prototyping / DevOps

WHY ANSIBLE FOR NETWORK AUTOMATION?

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Configure, validate, & ensure continuous compliance for physical network devices

BUILD
with Red Hat Ansible Engine

- Get automating quickly.
- Integrate multi-vendor configurations.
- Ideal for both existing and greenfield.

Automate discrete tasks

MANAGE
with Red Hat Ansible Engine

- Methodically track configuration drift.
- Make changes across any set of network devices.
- Validate that changes were successful.

Automate business processes

SCALE
with Red Hat Ansible Tower

- Ensure ongoing steadystate on a schedule.
- Use role-based access controls with specific teams.
- Integrate external third-party solutions with RESTful API.

Orchestrate & operationalize automation

RED HAT ANSIBLE Engine

RED HAT ANSIBLE Engine

RED HAT ANSIBLE Tower

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HOW ARE THEY GETTING THERE?

"Start small, Think big!"

Infrastructure as YAML

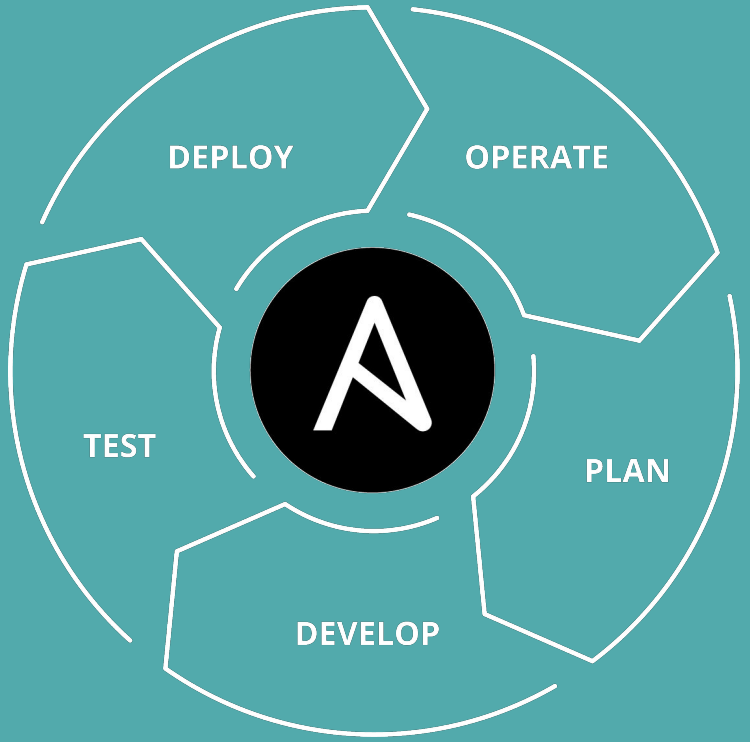
- Backups/restores can be automated
- Manage "golden" versions of configurations

Configuration management

- Changes can be incremental or wholesale
- Make it part of the process: agile, waterfall, etc.

Ensure an on-going steady-state

- Daily, weekly, monthly scheduled tasks
- State checking and validation



HOW ANSIBLE DOES WORK ?

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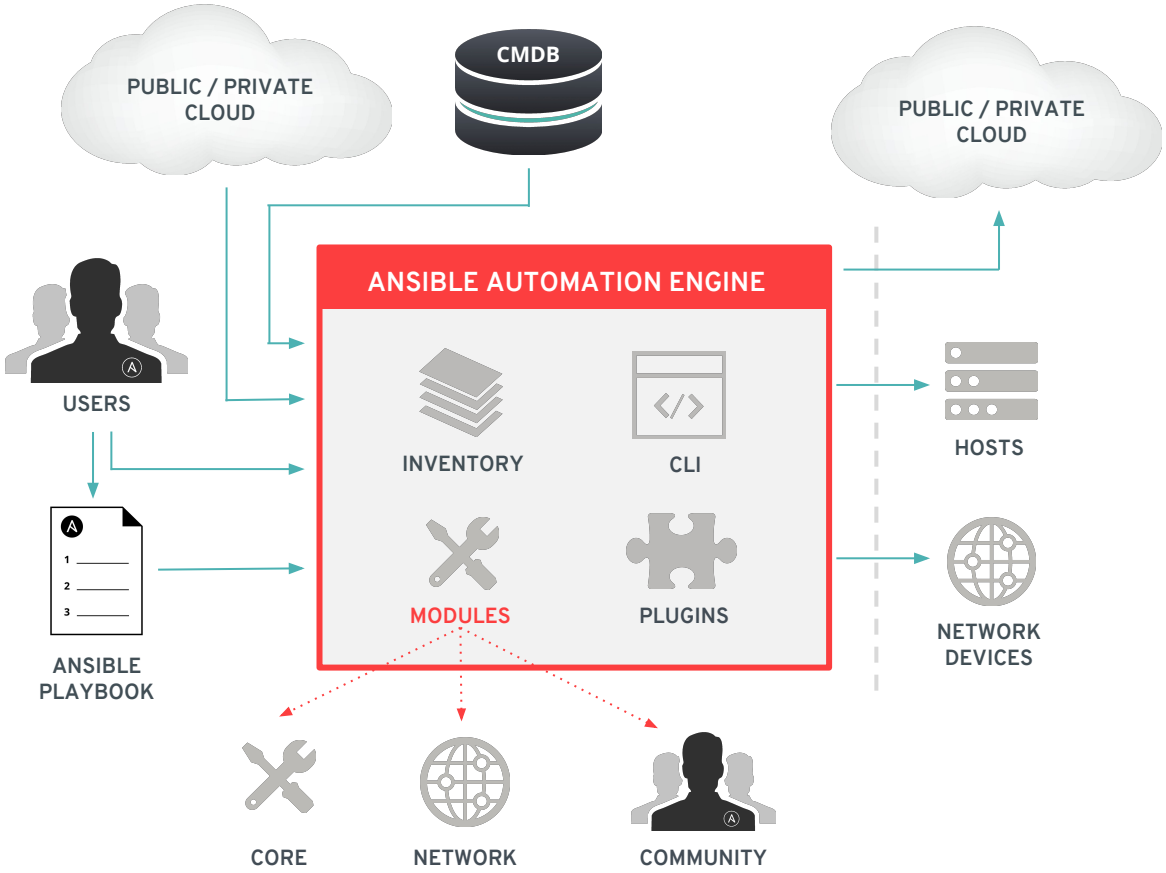

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HOW DOES NETWORK AUTOMATION WORK?

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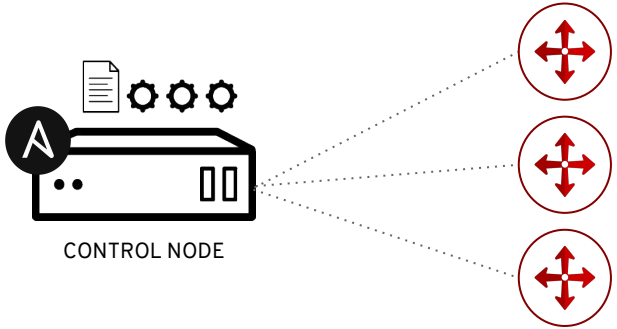
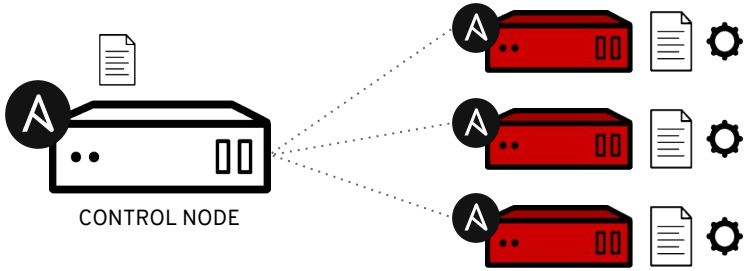
Module code is executed locally on the control node



NETWORKING DEVICES

Module code is copied to the managed node, executed, then removed



LINUX HOSTS

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ANSIBLE NETWORK AUTOMATION

50
Network Platforms

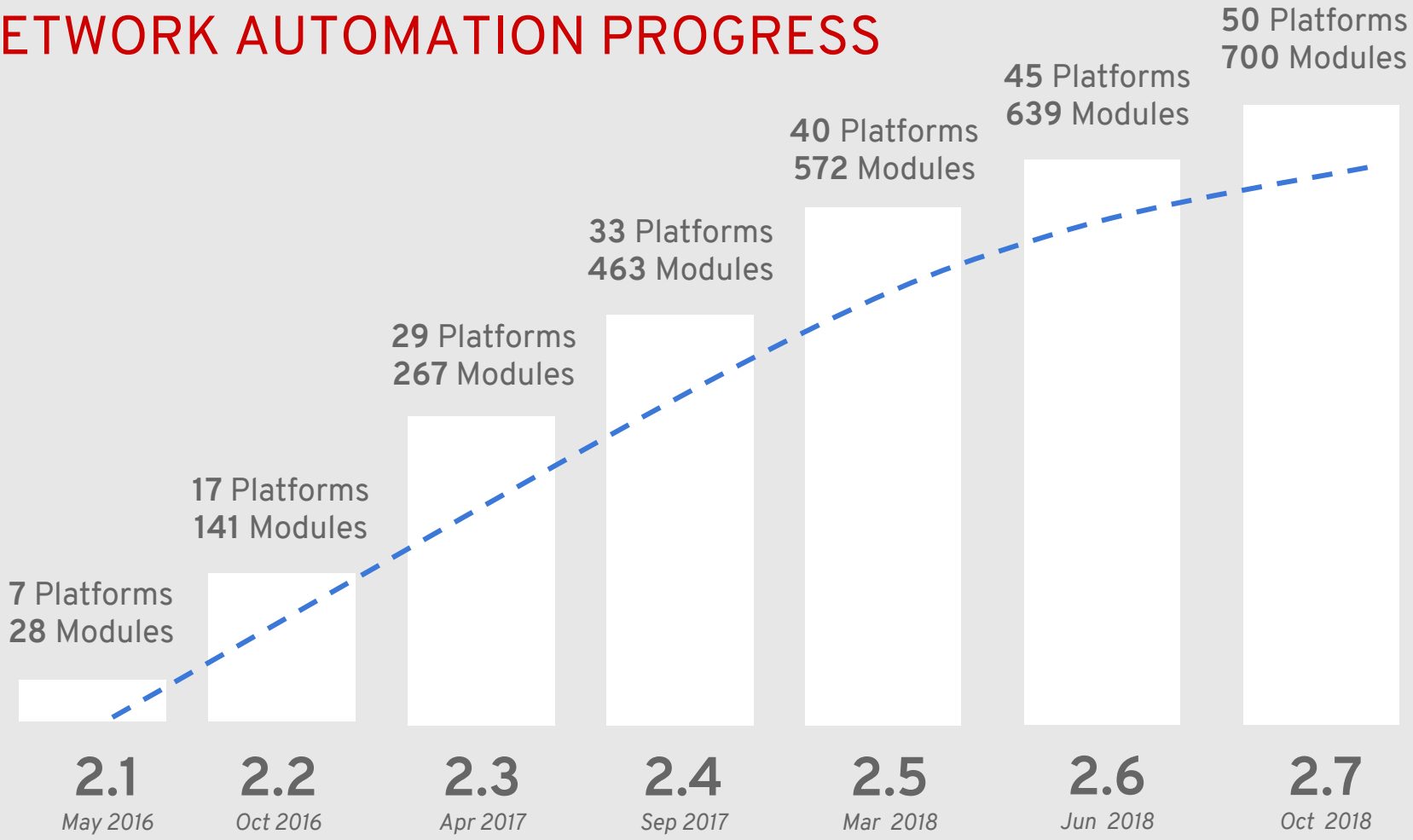
700+
Network Modules

12*
Galaxy Network Roles

ansible.com/for/networks
galaxy.ansible.com/ansible-network

Ansible Network modules comprise 1/3 of all modules that ship with Ansible Engine

NETWORK AUTOMATION PROGRESS



NETWORK MODULES: BUILT-IN DEVICE ENABLEMENT

A10

Apstra AOS

Arista EOS, CVP

Aruba Networks

AVI Networks

Big Switch Networks

Brocade Ironware

Cisco ACI, AireOS, ASA, Firepower, IOS, IOS-XR, Meraki, NSO, NX-OS

Citrix Netscaler

Cumulus Linux

Dell OS6, OS9, OS10

Exoscale

Extreme EX-OS, NOS, SLX-OS, VOSS

F5 BIG-IP, BIG-IQ

Fortinet FortIOS, FMGR

Huawei CloudEngine

Illumos

Infoblox NIOS

Juniper JunOS

Lenovo CNOS, ENOS

Mellanox ONYX

MikroTik RouterOS

Openswitch (OPX)

Ordnance

NETCONF

Netvisor

OpenSwitch

Open vSwitch (OVS)

Palo Alto PAN-OS

Nokia NetAct, SR OS

Ubiquiti EdgeOS

VyOS

RED HAT ANSIBLE NETWORK AUTOMATION

NETWORK MODULES

- **Developed, maintained, tested, and supported** by Red Hat, includes Ansible Engine, Ansible Tower
- **140+ supported modules** and growing*
- Red Hat **reports and fixes problems**
- **Networking Modules and Roles included**

*take special note of the specific supported platforms

INCLUDED SUPPORT:

Arista EOS

Cisco IOS

Cisco IOS XR

Cisco NX-OS

Infoblox NIOS

Juniper Junos

Open vSwitch

VyOS

PLAYBOOK EXAMPLE

```
- name: run multiple commands and evaluate the output
  hosts: cisco
  gather_facts: no
  connection: network_cli
  tasks:
  - name: show version and show interfaces
    ios_command:
      commands:
         - show version
         - show interfaces
      wait_for:
         - result[0] contains IOS
         - result[1] contains Loopback0
```

NETWORK MODULES

`*_command:`
Run command get/use output

`*_config:`
Make a change to the config with context

`*_facts:`
Get information (e.g. OS version, interfaces, etc.)

Ios

- ios_command - Run commands on remote devices running Cisco IOS
- ios_config - Manage Cisco IOS configuration sections
- ios_facts - Collect facts from remote devices running IOS
- ios_template (D) - Manage Cisco IOS device configurations over SSH

Iosxr

- iosxr_command - Run commands on remote devices running Cisco iosxr
- iosxr_config - Manage Cisco IOS XR configuration sections
- iosxr_facts - Collect facts from remote devices running IOS-XR
- iosxr_template (D) - Manage Cisco IOSXR device configurations over SSH

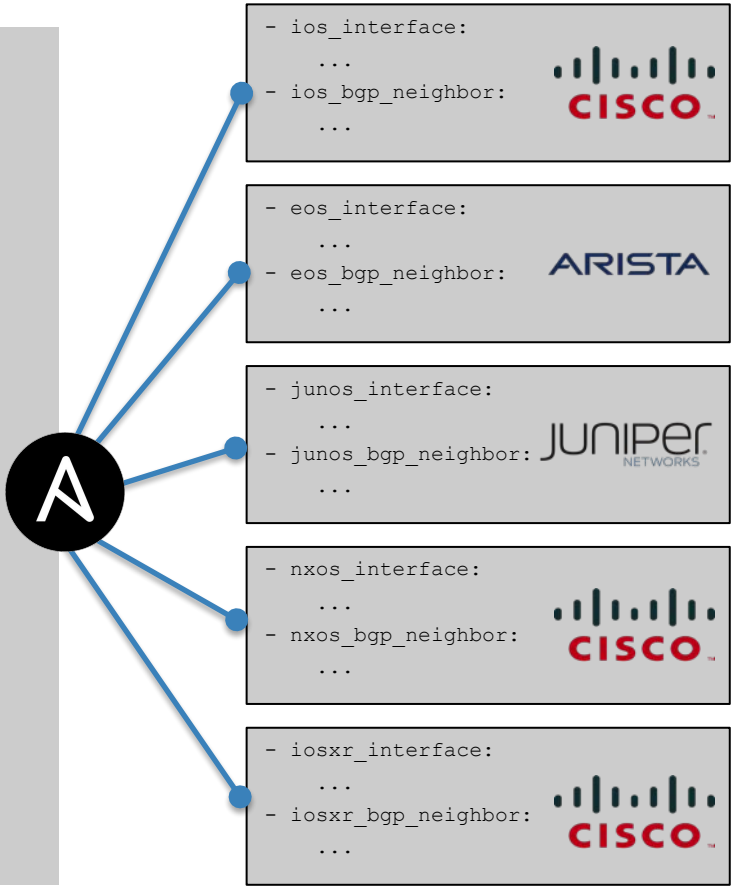
Junos

- junos_command - Execute arbitrary commands on a remote device running Junos
- junos_config - Manage configuration on devices running Juniper JUNOS
- junos_facts - Collect facts from remote device running Junos
- junos_netconf - Configures the Junos Netconf system service
- junos_package - Installs packages on remote devices running Junos
- junos_template (D) - Manage configuration on remote devices running Junos

PLATFORM AGNOSTIC MODULES

```
- name: configure network interface
  net_interface:
    name: "{{ if_name }}"
    description: "{{ if_description }}"
    enabled: yes
    mtu: 9000
    state: up

- name: configure bgp neighbors
  net_bgp_neighbor:
    peers: "{{ item.peer }}"
    remote_as: "{{ item.remote_as }}"
    update_source: Loopback0
    send_community: both
    enabled: yes
    state: present
```



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AGGREGATE RESOURCES

```
- name: configure vlans neighbor
  net_vlan:
    vlan_id: "{{ item.vlan_id }}"
    name: "{{ item.name }}"
    state: "{{ item.state | default('active') }}"
  with_items:
    - { vlan_id: 1, name: default }
    - { vlan_id: 2, name: Vl2 }
    - { vlan_id: 3, state: suspend }
```

```
- name: configure vlans neighbor
  net_vlan:
    aggregate:
      - { vlan_id: 1, name: default }
      - { vlan_id: 2, name: Vl2 }
      - { vlan_id: 3, state: suspend }
    state: active
    purge: yes
```

DECOUPLE IT!

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Definition

```
project_tag: foo
tenant_nets:
  - 192.133.157.0/24

fw_outside_ip: 192.133.159.73
fw_inside_ip: 192.133.159.137

vlan_data:
  - { vlan_id: 1, name: default }
  - { vlan_id: 2, name: Vl2 }
  - { vlan_id: 3, state: suspend }

interface_data:
  - { name: Ethernet0/1, mtu: 256, description: test-interface-1 }
  - { name: Ethernet0/2, mtu: 516, description: test-interface-2 }

port_data:
  - { desc: "mcp1.titan1", switch: "aa17-n9k-1", interface: "Ethern
  - { desc: "mcp1.titan1", switch: "aa17-n9k-2", interface: "Ethern
```

Implementation

```
- name: Creating aggregate of vlans
  nxos_vlan:
    aggregate: "{{ vlan_data }}"
    state: active
    purge: yes


- name: Add interface using aggregate
  nxos_interface:
    aggregate: "{{ interface_data }}"
    duplex: full
    speed: 100
    state: present
```

Define Once

Apply Many

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NETWORK ENGINE & NETWORK FUNCTIONS

NETWORK ENGINE

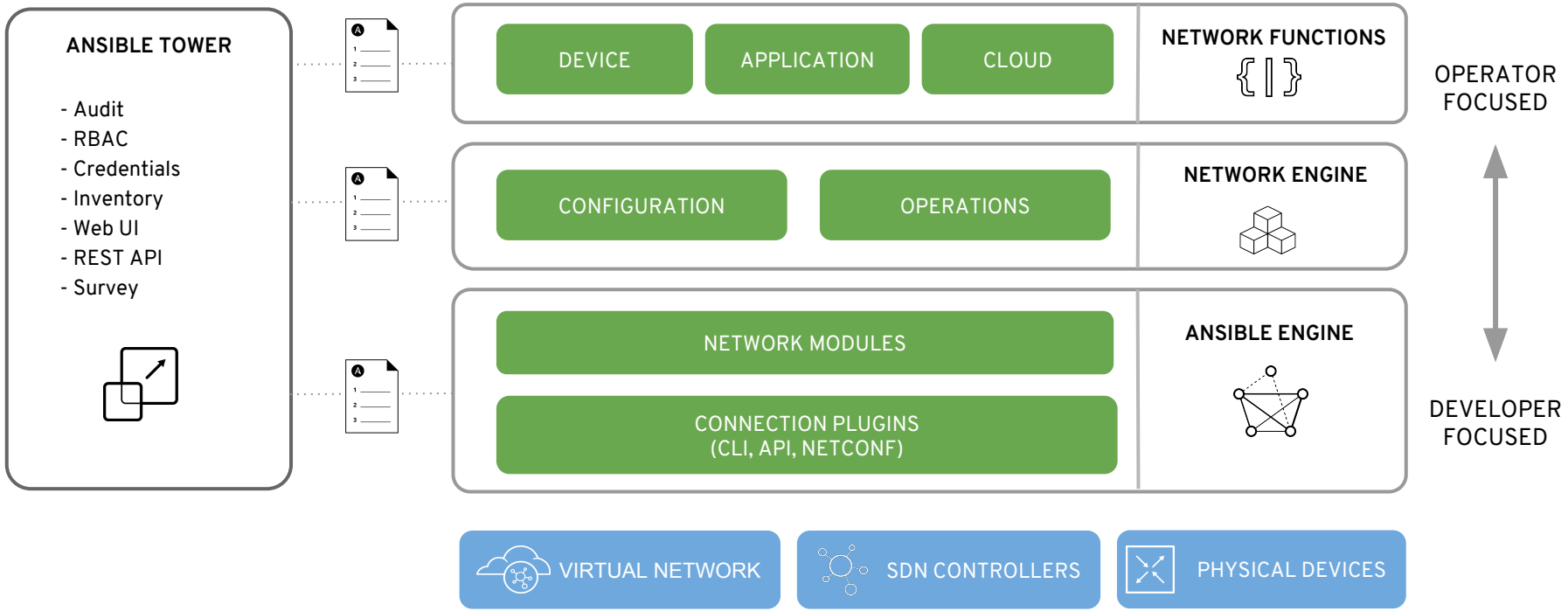
- Ansible Role decoupled from mainline development branch
- Incubate new capabilities and accelerate automation adoption
- Biweekly release cycle

NETWORK FUNCTIONS

- Data driven workflows for performing network operator tasks
- Extensible and adaptable for any platform, any device
- DIY => MIY

Deliver FRICTIONLESS network automation for SEAMLESS orchestration of workloads

ANSIBLE NETWORK STACK ARCHITECTURE



AUTOMATION USE CASE EXAMPLES

- **Information / Inventory Retrieval and Configuration**
  - Ad hoc or bulk, generate reports
  - Iteration over specific network segments, VLANs, VRFs
- **State Checking and Validation**
  - Compare running configs to desired configs
- **Run & Delegate discrete commands**
  - Manually, API via Tower, Scheduled via Tower

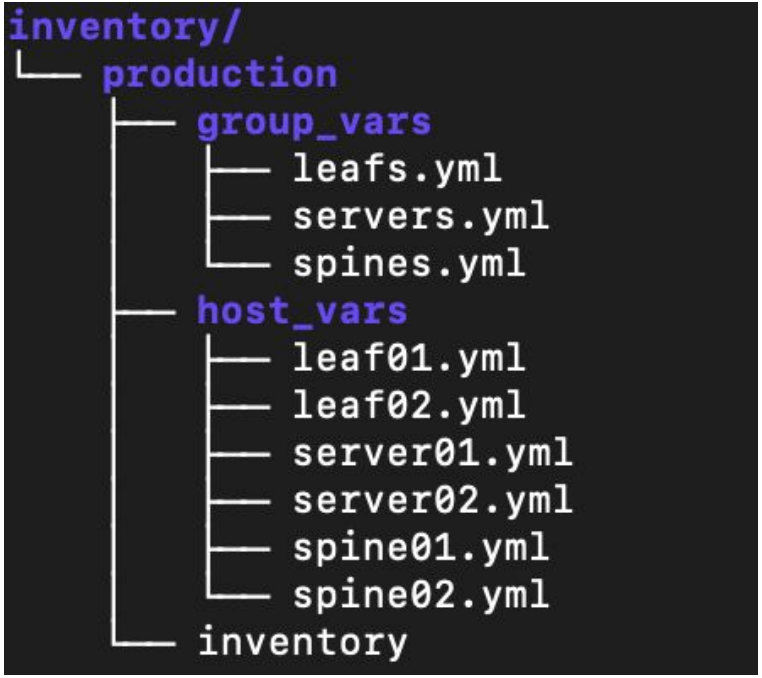
AUTOMATION USE CASE EXAMPLES

- **Continuous Compliance**
  - Combining stateful validation with schedules
  - Logging and Aggregation
  - Configuration backup

- **Integrations**
  - End to end automation
  - Zero touch provisioning using a callback

VERSION CONTROL YOUR TOPOLOGY & DATA MODEL

```
[leafs]
leaf01 ansible_host=10.16.10.11
leaf02 ansible_host=10.16.10.12

[leafs:vars]
ansible_network_os=vyos
ansible_user=my_vyos_user

[spines]
spine01 ansible_host=10.16.10.13
spine02 ansible_host=10.16.10.14

[spines:vars]
ansible_network_os=vyos
ansible_user=my_vyos_user

[network:children]
leafs
spines

[servers]
server01 ansible_host=10.16.10.15
server02 ansible_host=10.16.10.16

[datacenter:children]
leafs
spines
servers
```



NETWORK CI WORKFLOW