ANSIBLE

Introduction to Network Automation

Ganesh Nalawade

redhat

Ageda

- Ansible overview
- Ansible in Linux vs Network device
- Ansible Network connection types
- Network modules overview
- Demo
- Contributing to Ansible

Who am I

Ganesh Nalawade

* Principal Software Engineer at Ansible by Red Hat

* Work primarily as upstream developer in Ansible Networking

* Worked extensively on Network management plane developing software for on/box automation and programmability infra.

* Co Organiser for Ansible meetup group in Pune

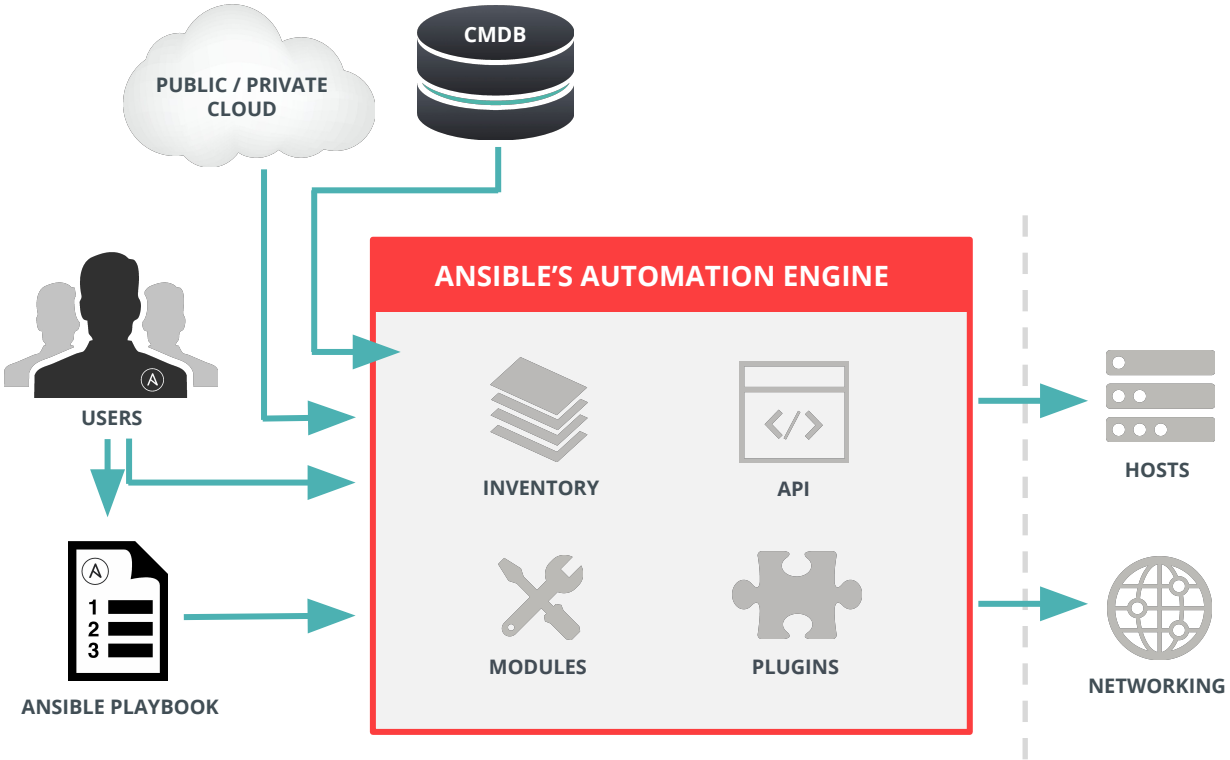
THE MOST POPULAR OPEN SOURCE AUTOMATION PLATFORM

Started in 2012
Goal: Unify provisioning, configuration, and application deployment

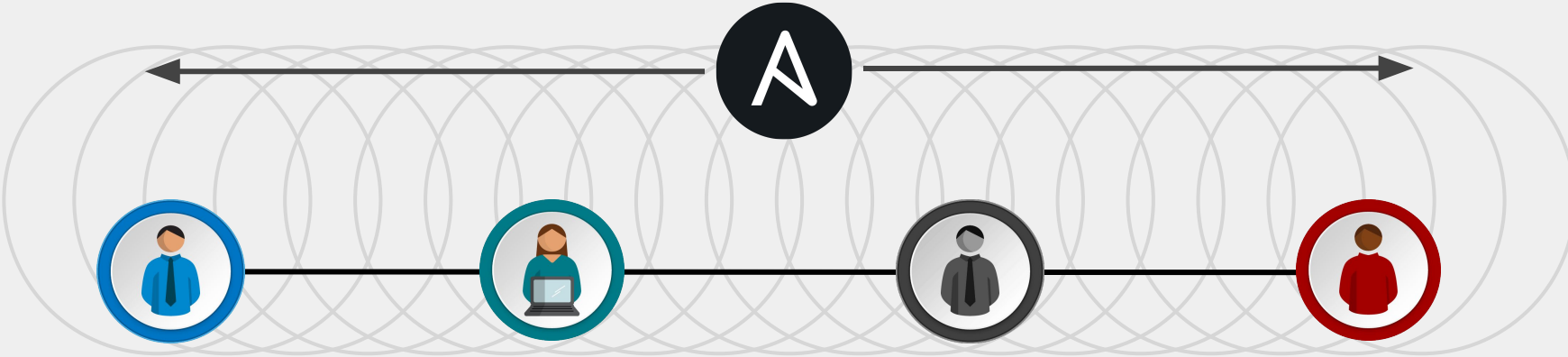
Result: Ansible — A python-based command line engine that interprets and executes YAML-based “playbooks” that contain one or more “plays” or tasks.

Five years later: 4,000+ contributors, 6,700 forks, 21,000 GitHub Stars
250,000 downloads a month
1000+ included modules (250+ networking), 34+ platforms

ANSIBLE UNDER THE HOOD



ANSIBLE IS THE UNIVERSAL LANGUAGE



BUSINESS DEV NETWORK IT OPERATIONS

HOW DOES NETWORK AUTOMATION WORK?

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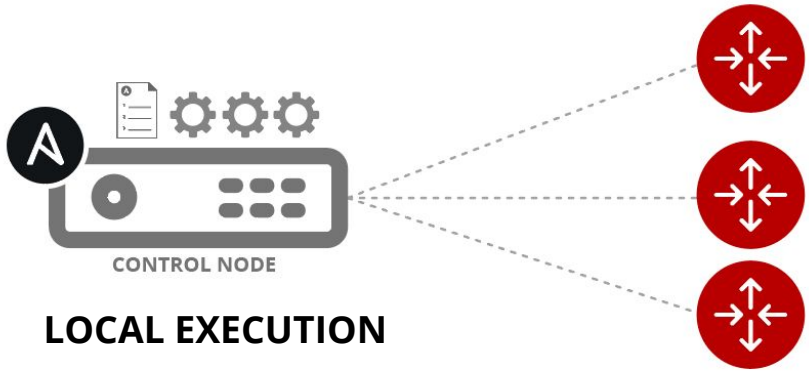
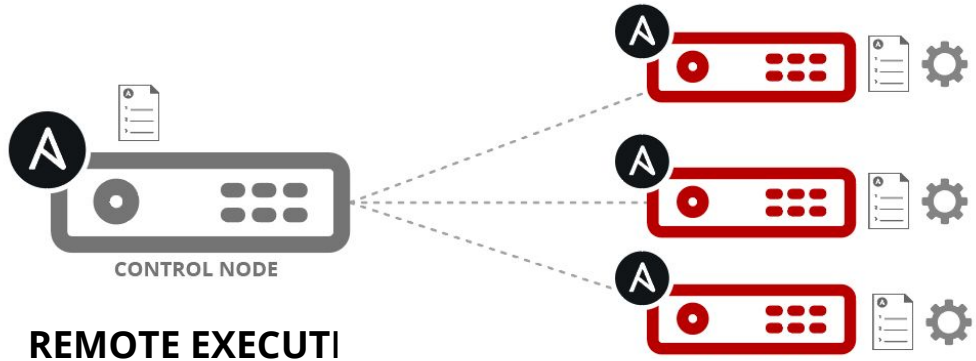
Module code is executed locally on the control node



LOCAL EXECUTION

NETWORKING DEVICES

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



REMOTE EXECUTI

LINUX/WINDOWS HOSTS

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What make network Automation difficult?

- Network device are traditionally closed system with vendor specific cli
- Configuration line are huge per system
- Configuration is not always equals to desired state or operational state
- Network engineers typically do not have a Sysadmin or programming background
- Network serve multiple applications

Cli config difference across vendors

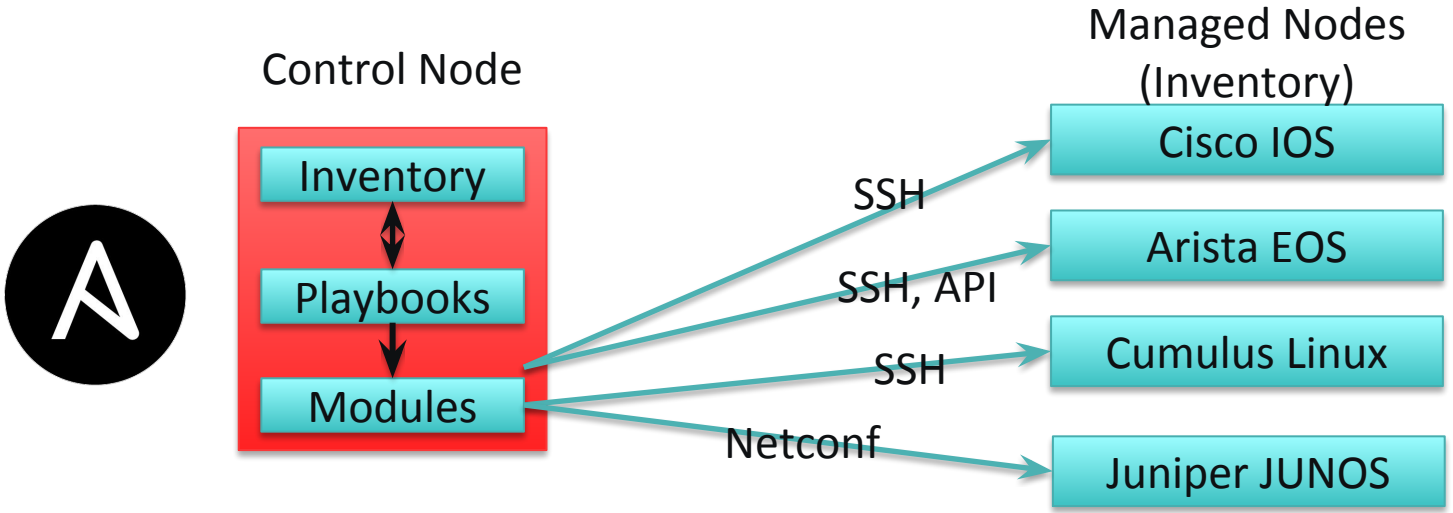
IOS

```
interface GigabitEthernet2
 description core
 ip address 192.168.2.3 255.255.255.0
 shutdown
!
```

Junos

```
interfaces {
    ge-0/0/2 {
        description core;
        disable;
        unit 0 {
            family inet {
                address 192.168.2.3/24;
            }
        }
    }
}
```

HOW DOES IT WORK?



Modules: Handles execution of remote system commands – required for most networking
Control Node: Any client system (server, laptop, VM) running Linux or Mac OSX
Requires: Python 2.6 or greater

Managed Nodes (Inventory): A collection of endpoints being managed via SSH or API.
Examples: Switches, Routers, Firewalls, Servers, VMs, Containers, Cloud Devices, etc.

Netconf: IETF management standard protocol

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- RPC based request response communication over ssh
- XML based encoding

  * Supports vendor specific data model

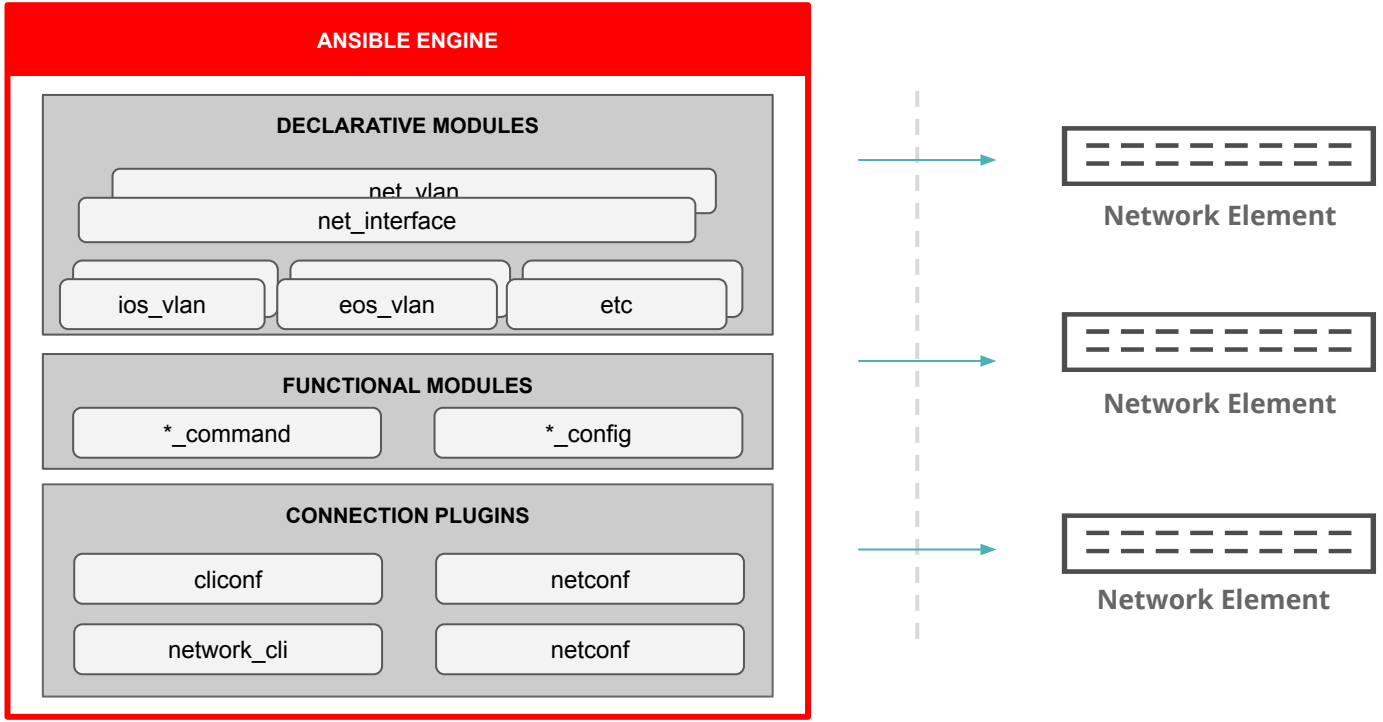
- Configuration RPC's

  * get-config, edit-config, copy-config, delete-config, lock, unlock

- Operational RPC's

  * get, Generally maps to cli "show" command

Ansible Network Overview



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

NETWORK MODULES: BASIC

`*_command:`
Run command get/use output

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

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

`*_template (D)`
Deploy Template: Apply J2 Template.
Deprecated in favor of *_config commands

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

PLAYBOOK EXAMPLE

```
---
- name: run multiple commands and evaluate the output
  hosts: ios01
  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
```

PLAYBOOK EXAMPLE – REAL WORLD

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```
---
- name: configure ios interface
  hosts: ios01
  connection: network_cli
tasks:
    - name: collect device running-config
      ios_command:
        commands: show running-config interface GigabitEthernet0/2
        provider: "{{ cli }}"
      register: config

    - name: administratively enable interface
      ios_config:
        lines: no shutdown
        parents: interface GigabitEthernet0/2
        provider: "{{ cli }}"
      when: '"shutdown" in config.stdout[0]'
```

PLAYBOOK EXAMPLE – REAL WORLD (CONT.)

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```
- name: verify operational status
  connection: network_cli
  ios_command:
    commands:
      - show interfaces GigabitEthernet0/2
      - show cdp neighbors GigabitEthernet0/2 detail
    waitfor:
      - result[0] contains 'line protocol is up'
      - result[1] contains 'iosxr03'
      - result[1] contains '10.0.0.42'
```

PLAYBOOK EXAMPLE – REAL WORLD (RESULTS)

```
(ansible)[network]$ ansible-playbook ios_interface.yaml

PLAY [configure ios interface] ************************************

TASK [collect device running-config] ******************************
ok: [ios01]

TASK [administratively enable interface] **************************
changed: [ios01]

TASK [verify operational status] **********************************
ok: [ios01]

PLAY RECAP ********************************************************
ios01                      : ok=3    changed=1    unreachable=0    failed=0
```

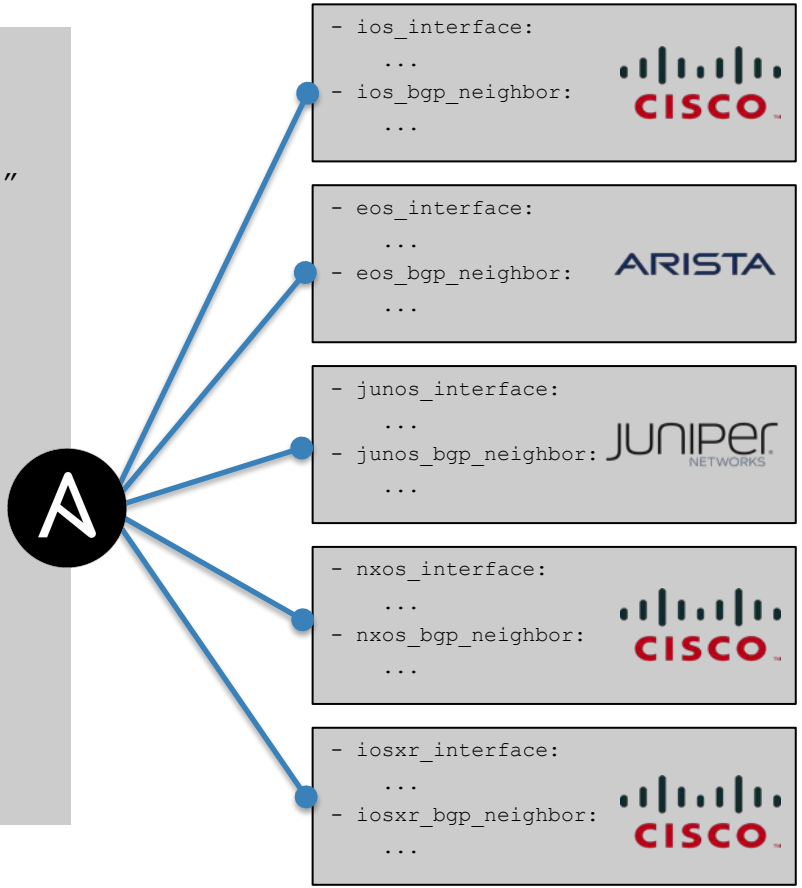
RESOURCE MODULES

```
---
- name: system node properties
  hosts: all

    tasks:
      - name: configure eos system properties
        eos_system:
          domain_name: ansible.com
          vrf: management
        when: network_os == 'eos'

      - name: configure nxos system properties
        nxos_system:
          domain_name: ansible.com
          vrf: management
        when: network_os == 'nxos'

      - name: configure ios system properties
        ios_system:
          domain_name: ansible.com
          lookup_enabled: yes
        when: network_os == 'ios'
```

- Per Platform Implementation
- Declarative by design
- Abstracted over the connection
- Makes platforms happy
- … Not so much for operators

MINIMUM VIABLE PLATFORM AGNOSTIC (MVPA)

```
- name: configure network interface
  net_interface:
    name: "{{ interface_name }}"
    description: "{{ interface_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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DECLARATIVE INTENT

Declared Configuration

Intended State

```
- name: configure interface
  net_interface:
    aggregate:
      name: GigabitEthernet0/2
      description: public interface configuration
      enabled: yes

      # check operational state
      state: connected
      tx_rate: ge(7Gbps)
      rx_rate: ge(2Gbps)
      delay: 30
      neighbors:
        - host: core-01
          port: Ethernet5/2/6
```

Demo

Contributing to Ansible

- Community groups
- IRC channels
- Google Groups:
  https://groups.google.com/forum/#!forum/ansible-project
  https://groups.google.com/forum/#!forum/ansible-devel
- Ansible galaxy

Thank You

Github/IRC: @ganeshrn

RED HAT ANSIBLE ENGINE NETWORKING ADD-ON

NETWORK MODULES

- **Developed, maintained, tested, and supported** by Red Hat
- **140+ supported modules** and growing*
- Red Hat **reports and fixes problems**
- **Networking modules included** with Ansible Engine offering, but **the Ansible Engine Networking Add-On** SKU purchase is **required** for full support

*take special note of the specific supported platforms

NETWORKING ADD-ON INCLUDED SUPPORT:

Arista EOS

Cisco IOS

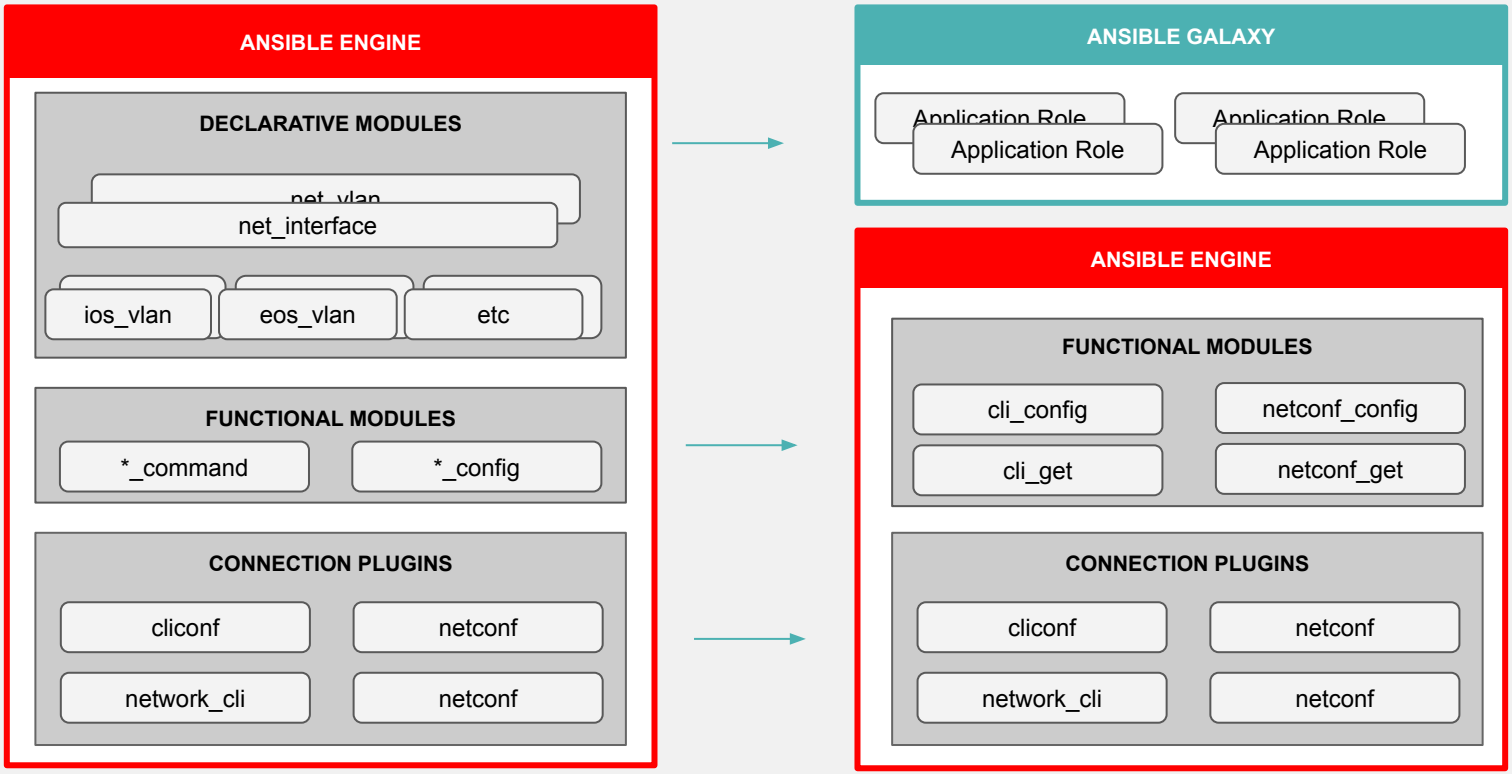
Cisco IOS XR

Cisco NX-OS

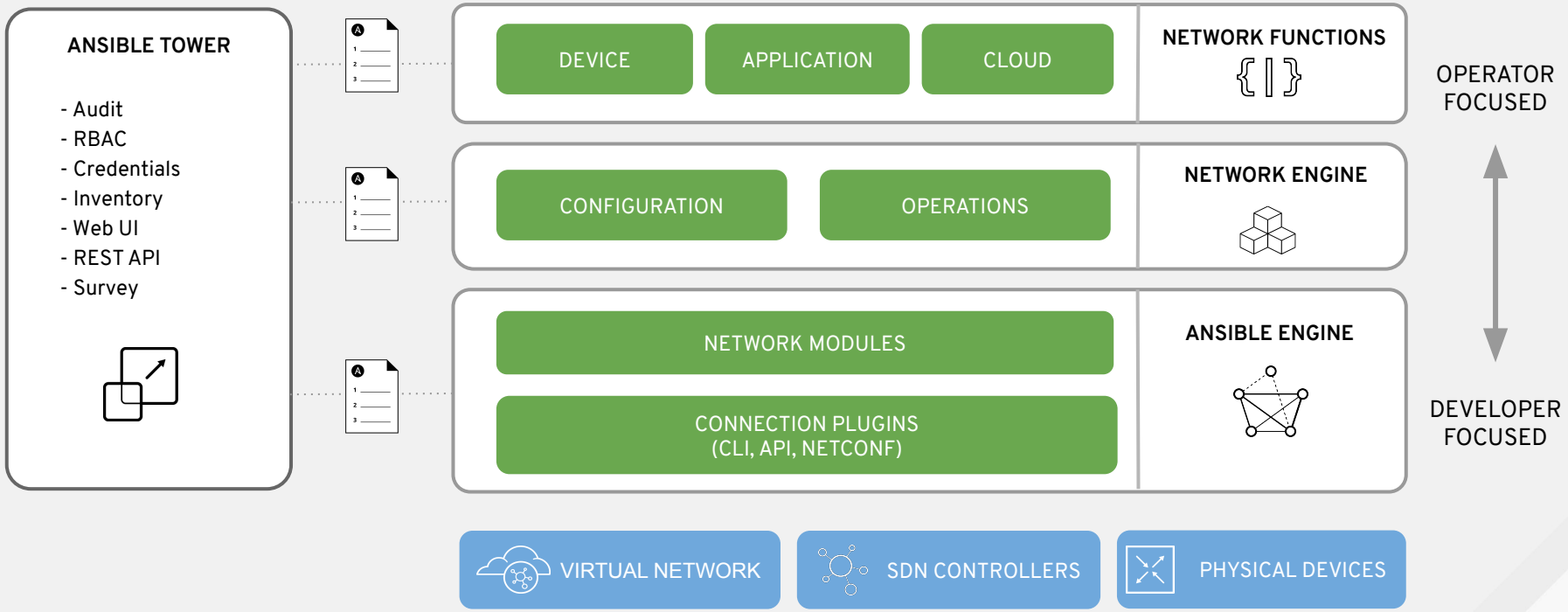
Juniper Junos

Open vSwitch

VyOS


ANSIBLE ENGINE
DECLARATIVE MODULES
net_vlan
net_interface
ios_vlan
eos_vlan
etc
FUNCTIONAL MODULES
*_command
*_config
CONNECTION PLUGINS
cliconf
netconf
network_cli
netconf
ANSIBLE GALAXY
Application Role
Application Role
Application Role
Application Role
ANSIBLE ENGINE
FUNCTIONAL MODULES
cli_config
netconf_config
cli_get
netconf_get
CONNECTION PLUGINS
cliconf
netconf
network_cli
netconf

ANSIBLE NETWORK STACK ARCHITECTURE



Application Roles

Transition away from “install everything” model

- Separation of content from engine *(starting post 2.5)*
- Maintain baseline device support and functional modules

App Store approach to integration

- Application roles initially hosted and managed at ***github.com/ansible-network***
- Roles are independently developed / managed / released
- Iterative Agile development methodology (release early, release often)
- Increase velocity of feature introduction
- Auto release roles based on PR merge and CI pass (ideally)

Create application role development strategy, environment & tooling *(as necessary)*

- Show customers “how its done” through value-add implementations
- Focus on ease of use, remove the choices

IRC:
#ansible, #ansible-devel, #ansible-meeting

Google groups:
ansible-devel@googlegroups.com
ansible-project@googlegroups.com

Freenode: ganeshrn
Github: ganeshrn

Persistent connection framework

junos_facts module

```
---
- name: Get junos facts
  hosts: junos
  connection: local
  tasks:
    - name: Collect facts for junos
      junos_facts:
        gather_subset: hardware
        config_format: text
      register: response

    - name: Print facts
      debug:
        var: response
```

junos_config module using line

```
---
- name: Run junos configuration command
  hosts: junos
  connection: local
  tasks:
    - name: Run configuration command
      junos_config:
        lines:
          - set system ntp server 1.1.1.1
          - set system services ftp
      register: response
```

junos_config module using src

```
---
- name: Run junos configuration command
  hosts: junos
  connection: local
  tasks:
    - name: Run configuration command
      junos_config:
        src: basic/junos_config.text

      register: response
```