DEPLOYING NFV: BEST PRACTICES

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INTRODUCTION TO NFV

Introduction to NFV

What is NFV?

- NFV or Network Functions Virtualization:
  - Decoupling of network functions from underlying physical network infrastructure
  - Move of traditional network functions usually deployed in proprietary hardware to software running in virtual machines (VM) on general-purpose hardware or cloud infrastructure

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Introduction to NFV

Why the increase in the adoption of NFV?

- Legacy infrastructure is the reason!
  - High costs
  - Lack of flexibility
  - Scalability issues
  - Slow innovation
  - Vendor lock-in
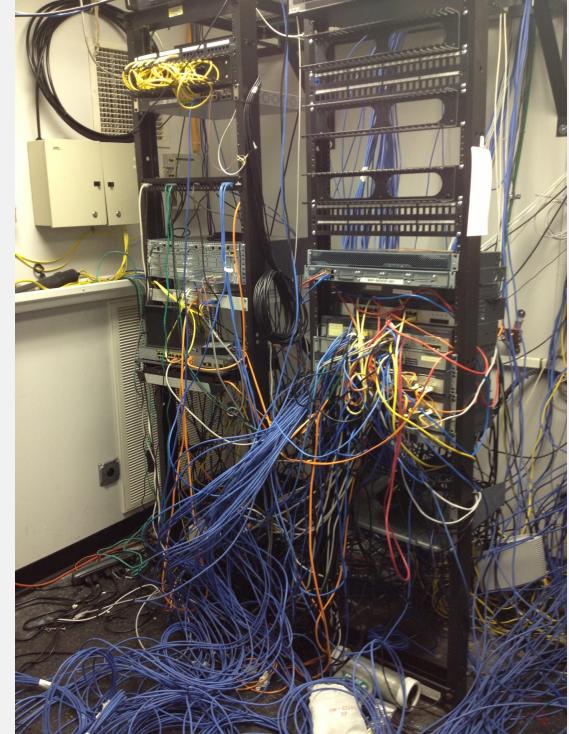
Introduction to NFV

NFV Benefits

- Lower costs:
    - Reduce CapEx
    - Reduce OpEx
- Increases flexibility:
    - Management automation
    - Reusable infrastructure
- Empowers innovation
- Easy to scale
- Faster Time-to-Market

Introduction to NFV

NFV, Open Source, and Red Hat!

83 %

of telco operators demand or prefer open systems for their networks

95 %

of telco operators see open source as a positive attribute for NFV solutions

Red Hat, Open Source and the Telco Industry

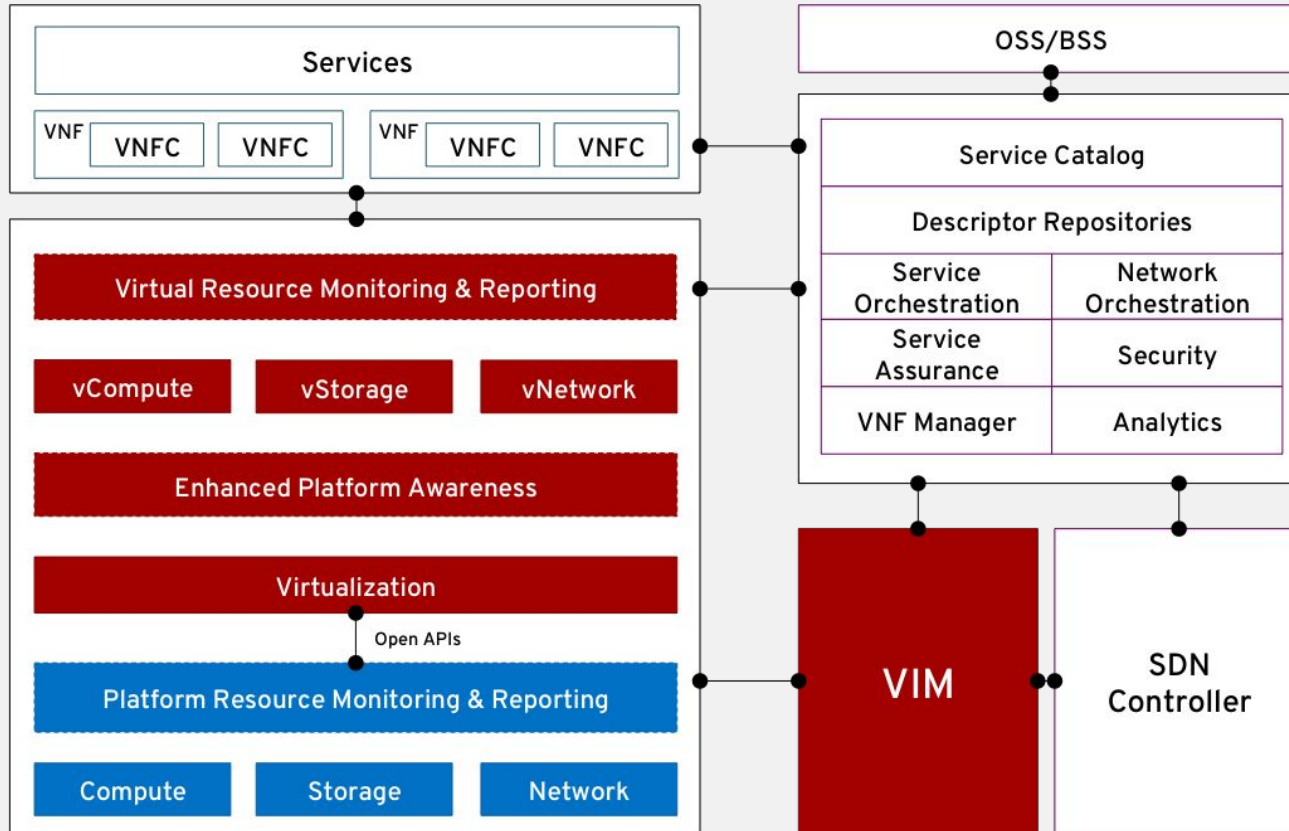Open platform for network programmability for SDN and NFV

Open Source IaaS cloud platform

Linux® kernel development, innovation, and expansion

Source: Doyle Research, "Open Networking Drives NFV Innovation for the Telecom Industry," December 2014.

NFV Architecture

Services

| VNF | VNFC | VNFC | VNF | VNFC | VNFC |

Virtual Resource Monitoring & Reporting

vCompute   vStorage   vNetwork

Enhanced Platform Awareness

Virtualization

Open APIs

Platform Resource Monitoring & Reporting

Compute   Storage   Network

OSS/BSS

Service Catalog

Descriptor Repositories

Service Orchestration	Network Orchestration
Service Assurance	Security
VNF Manager	Analytics

VIM

SDN Controller

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OPENSTACK IN NFV

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OpenStack as NFVi

Advantages of OpenStack vs Traditional Virtualization

- Modular components
- Multi-tenancy
- Pluggable storage and networking
- Rich APIs
- Vibrant community

Virtualized Infrastructure Manager

Individual modular OpenStack components collectively deliver a set of capabilities necessary to meet VIM requirements:

- Controls and manages compute, networking and storage resources
  - Allocation and release of individual resources
  - Mapping of physical resources to virtual
  - Secure way of resource sharing across multiple tenants
  - Quota management and enforcement
- Provides platform resiliency with Highly Available control plane
- Exposes APIs to enable orchestration across services and domains
- Provides mechanisms to collect fault and performance data for physical and virtual resources

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SDN Options

- Neutron as an SDN provider
    - Support for VLAN, VxLAN, and GRE overlays
    - Open source, supported by upstream, utilizes upstream components
    - QoS and performance optimization
    - Fully integrated into OpenStack development and maintenance tools and cycles
- Commercial SDN Implementations
    - Vendor-dependent
    - Might utilize proprietary components
    - Require integration with NFVi deployment tools
    - Different development cycles from other NFVi components
    - Might provide specialized features
   - Potential faster feature implementation and customizations support

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Storage Options

- CEPH
  - Open source
  - Utilizes COTS x86 hardware and standard Ethernet and IP connectivity
  - Supported as a backend for all OpenStack storage components: Cinder, Glance, Swift, Nova ephemeral
  - Built-in redundancy
- Commercial Storage Implementations
  - Vendor-dependent
  - Might utilize proprietary components and hardware
  - Specialized connectivity requirements
  - Require integration with NFVi deployment tools
  - Different development cycles from other NFVi components
  - Might provide specialized features

Performance Considerations

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Optimized Platform

End-to-end service performance achieved through individual component performance optimization and platform-aware service placement

- Support for Compute intensive workloads with Enhanced Platform Awareness (EPA)
    - Huge pages
        - Allow the use of larger page sizes (2M, 1GB) providing guests with predictable memory access
    - CPU pinning
        - Allows assignment of vCPU cores, and the associated emulator threads, to dedicated CPU cores
    - Thread affinity
    - NUMA awareness
- Support Data-plane intensive workloads with network optimization capabilities
    - Direct device assignments to virtual machines with SR-IOV and PCI-passthrough
    - DPDK-enabled OVS
    - Network QoS
    - Hardware acceleration
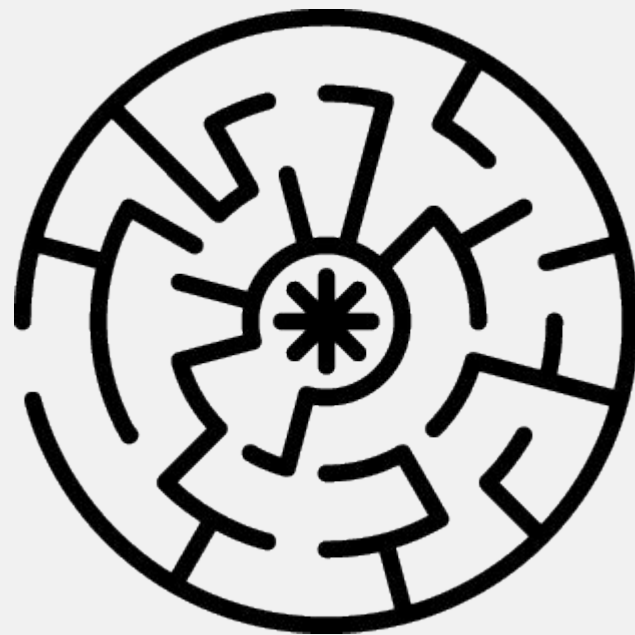
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Monitoring and Troubleshooting Tools

- Open Source options
  - Elasticsearch
  - Fluentd
  - Kibana
  - Nagios
- Integration with existing tools
  - SNMP
  - syslog
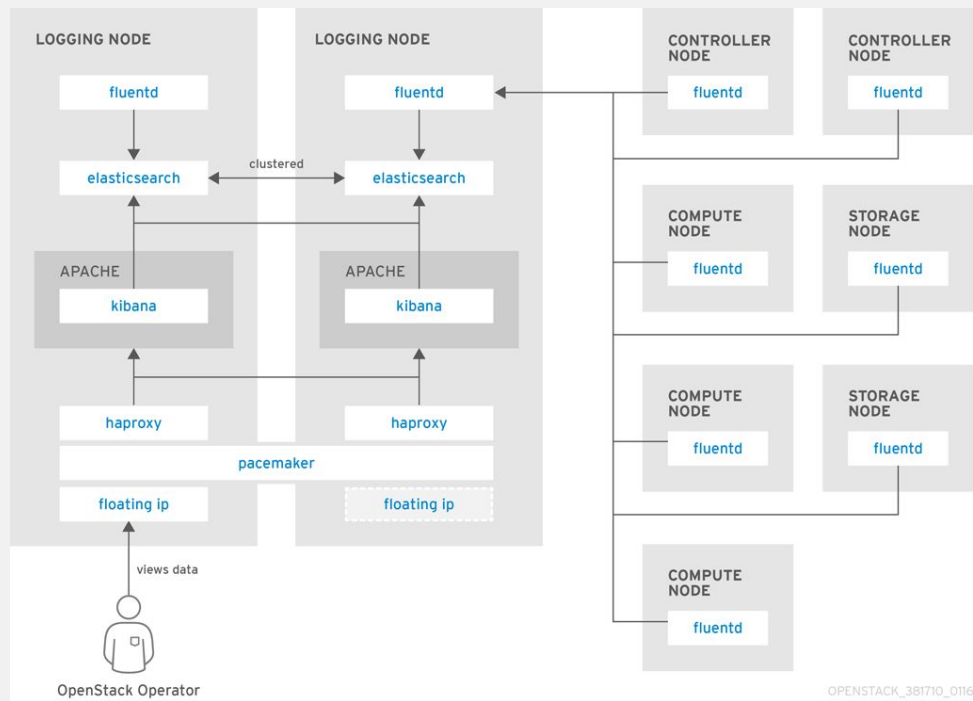
Sample NFV Use Cases

- Virtual Evolved Packet Core (vEPC)
- Virtual IP Multimedia Subsystem (vIMS)
- Virtual Content Delivery
- vRouter/vSwitch
- vIDS/IPS
- Virtual Customer Premise Equipment (vCPE)
- Gi-LAN Virtualization
- vRAN/CRAN
- CORD
- Virtual everything (vDHCP, vDNS, vLB, vFW, vNAT, etc.)

Putting it all together with Red Hat

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Red Hat OpenStack Platform
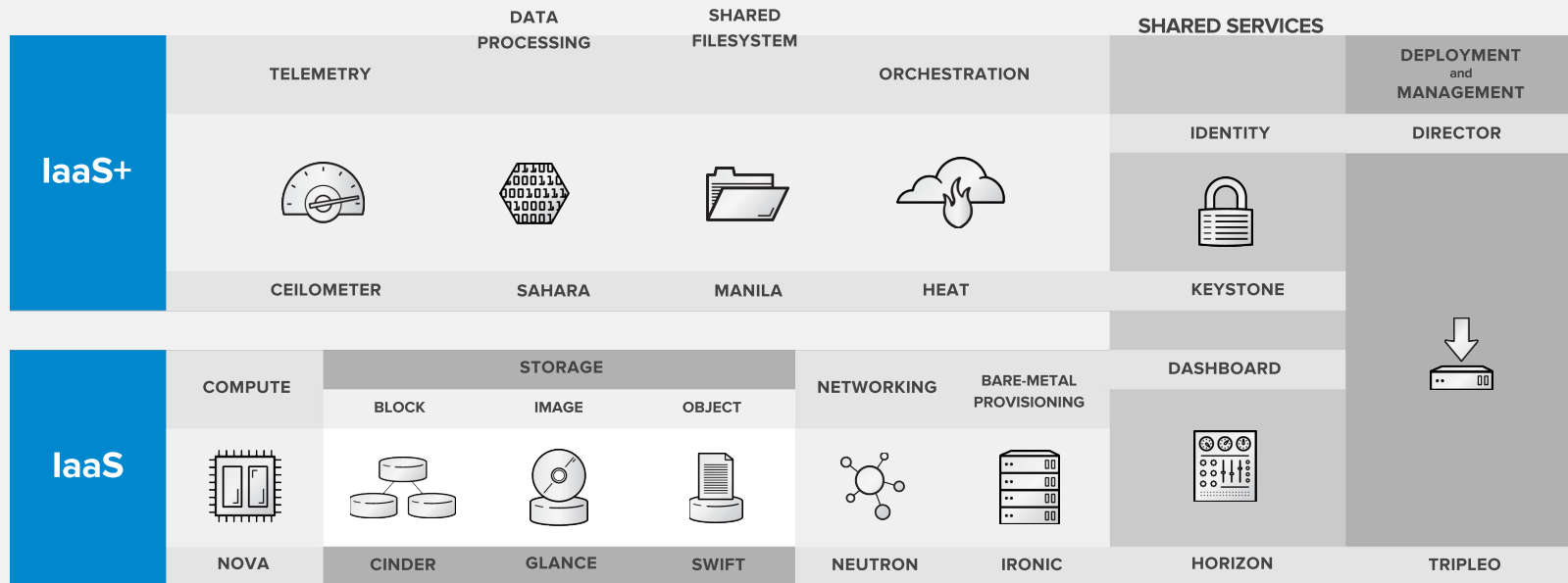
Red Hat OpenStack NFV Features

- High Availability for Platform and Instances
- Composable Roles
- Enhanced Platform Awareness
  - NUMA Awareness
  - CPU Pinning
  - Huge Pages
- SR-IOV GA (Director Support)
- OVS-DPDK GA (Director Support)
  - OVS 2.6
  - DPDK 16.11
- ODL Tech Preview
- RT-KVM Tech Preview
- Hyper Converged Infrastructure (HCI)
- Nova Device Role Tagging
- VLAN Aware VMs (OVS Support) Tech Preview

Red Hat Ceph Storage
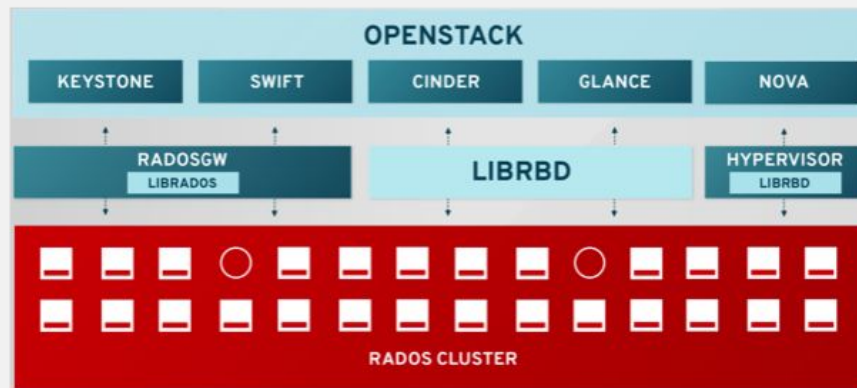
COMPLETE STORAGE FOR OPENSTACK

- Bundled with Red Hat OpenStack Platform
- Director integration for deploying Ceph 2.0
    - Automated deployment with added validation checks
    - Automated deployment for Ceph Object storage in OSP director
    - Management of Ceph major release upgrades with added validation checks
    - Ceph best practice optimized deployment guides
- Deeply integrated with modular architecture and components for ephemeral and persistent storage
    - Nova, Cinder, Manila, Glance, Keystone, Swift
- Speed – instant booting and back-ups
- Optimized for Database as a Service with MySQL workloads

Red Hat CloudForms

- OpenStack Integration for Day 2
  - Manage multiple clouds with one pane of glass
    - Node Management: Stop/Start/Add/Remove for nodes
    - Synchronise with CloudForms Tenants: create, update, delete tenants
    - Support for Domains, Region and Host Aggregate
    - Provisioning: from Volumes, Snapshots, Instances to Volume
    - Cinder Backup/Restore from various back-ends
    - Create, delete snapshot volumes
    - CloudForms Dashboards and Topology view
    - Inventory and represent network topology of OSP infrastructure
    - Out-of-the-box reports focusing on OSP infrastructure
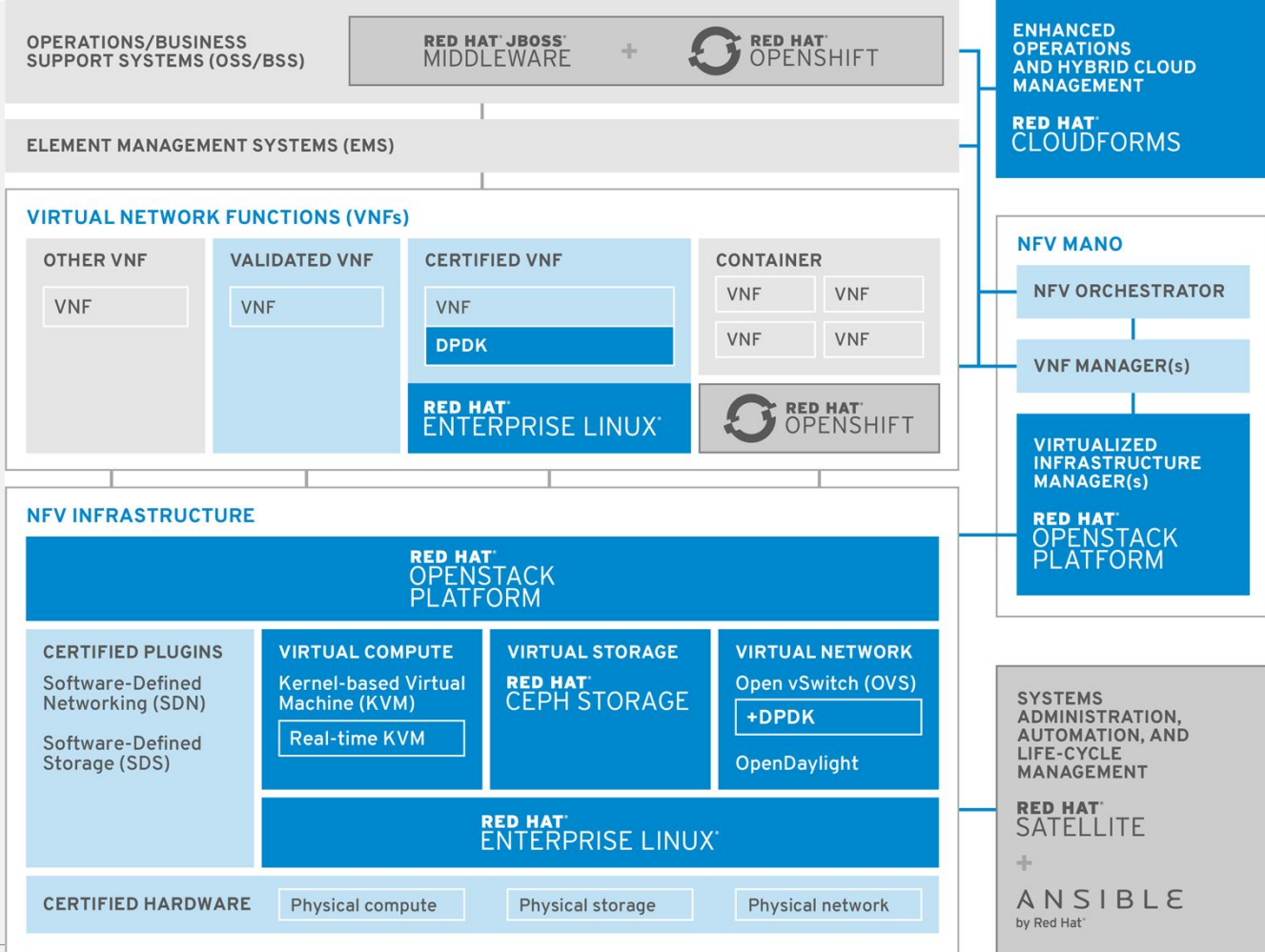
Automation with Red Hat Ansible

- SIMPLE
  - Human readable automation
  - No special coding skills needed
  - Tasks executed in order
- POWERFUL
  - App deployment
  - Configuration management
  - Workflow orchestration
- AGENTLESS
  - Agentless architecture
  - Uses OpenSSH and WinRM
  - No exploits or updates
- Uses YAML format - a simple, human-readable, and familiar way to blueprint the infrastructure
- Full stack automation (HW, OS, IaaS, VMs, Guest OS, Containers, Applications)
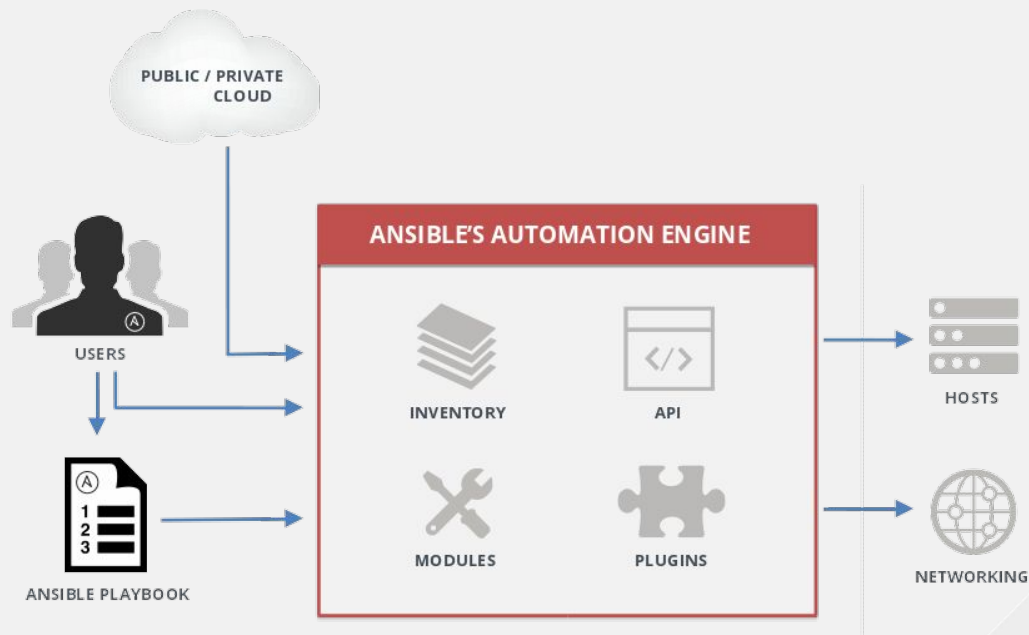
Operational Tools

- Full support of Clients for Availability Monitoring (Sensu) and Common Logging (fluentd)
  - Director provides composable service templates for deployment of Sensu monitoring agent and Fluentd configured as a log collector for OpenStack services.
- Reference implementation guide for an Operational Tool server stack
  - The opstools-ansible project is a set of Ansible playbooks
    - Enable operators to install and configure the server-side Operational Tools for availability monitoring, centralized logging, and performance monitoring.
    - Will be distributed and maintained by an upstream channel
    - Component packages will be installed directly from third-party repositories.