

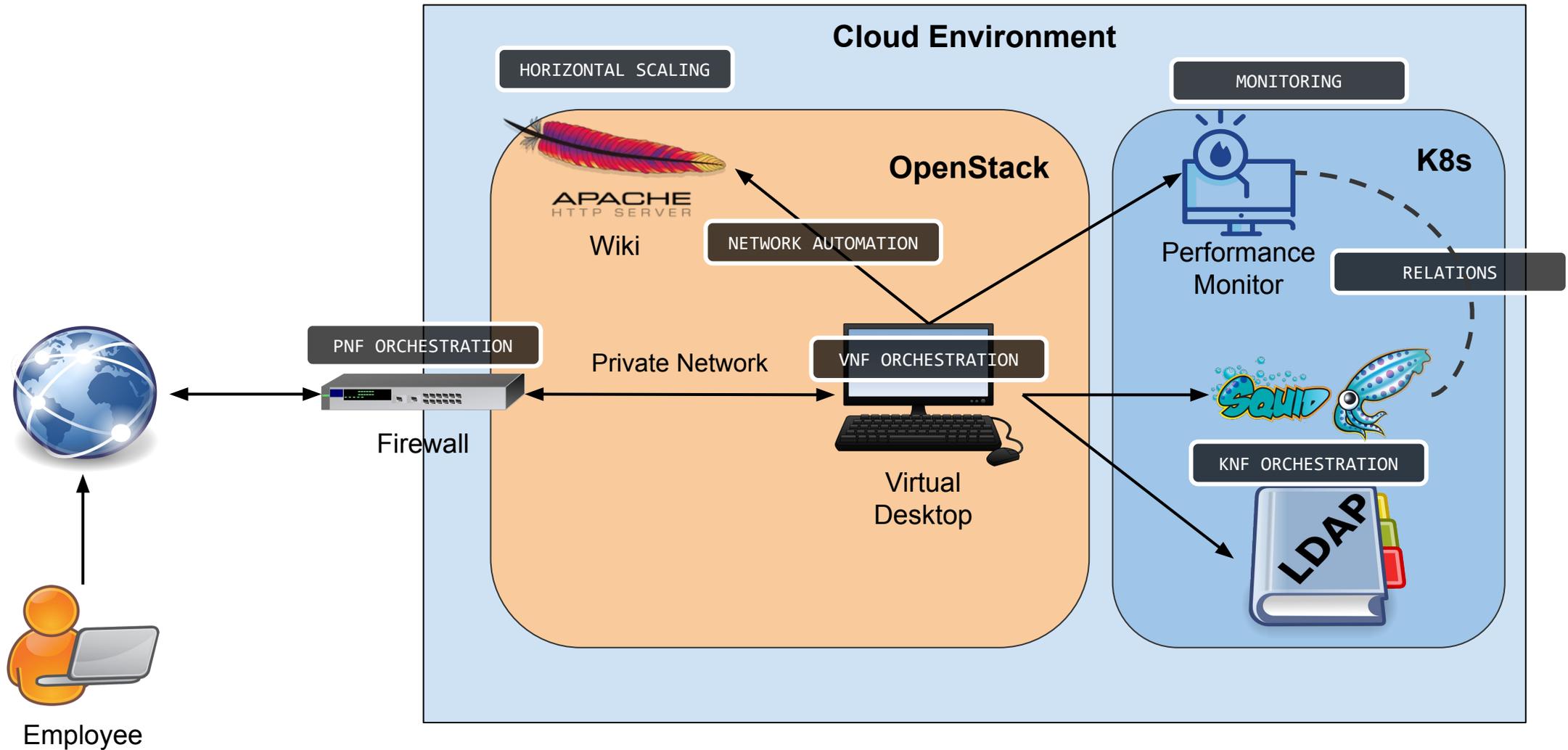
Open Source  
**MANO**

# OSM Primitives for PNFs

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# The Big Picture



# PNF vs VNF

## PNF

Higher unit cost  
Bulky  
Fragile  
Needs care



## VNF

Low unit cost  
Compact  
Recyclable  
Needs no care



<https://www.linkedin.com/pulse/technology-analogy-physical-virtual-network-functions-milind-kulkarni/>

# PNF - Bare Metal?

## Physical Network Function

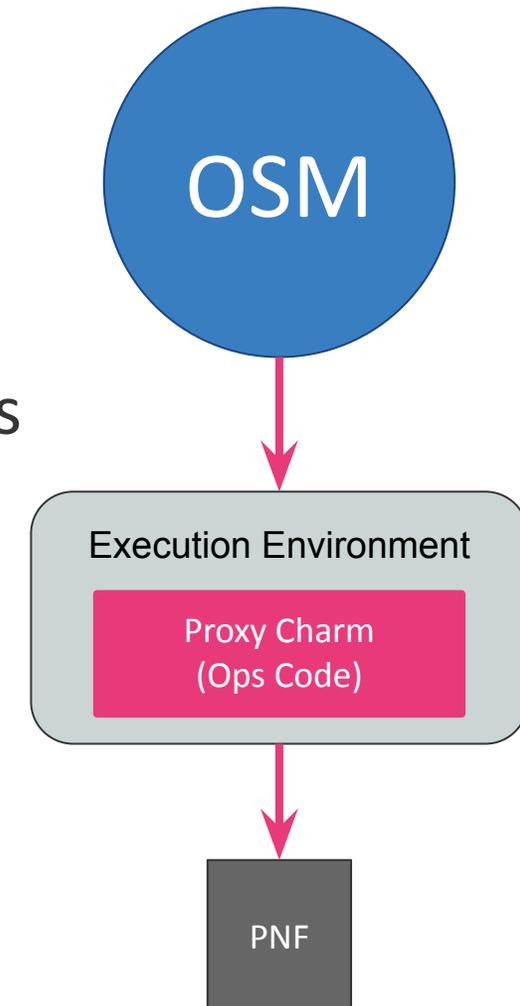
- Implementation of a NF via a tightly coupled software and hardware system
- PNF refers to a function that is fixed
  - Purpose built to provide a specific function - hardware appliance
- PNF does not always mean bare metal
  - Can be unmanaged software in VM
- VNF does not always mean running in VM or Container
  - OpenStack Ironic allows for management of bare metal like a VM

- PNF
  - Physical network function. It refers to the endpoint that provides a networking function
- PDU
  - Physical deployment unit. It refers to the “instance” of the appliance that will be incorporated to a Network Service instance
- HNF
  - Hybrid network function: Network function composed of both physical and virtual elements.

In OSM, there are no fundamental differences between a VNF, a PNF or a Hybrid Network Function (HNF)

# How do we Manage a PNF

- OSM must be given information about the PNF
  - Register a PNF as a logical entity with IP and other info
- Use in standard network function package descriptors
  - Network service and virtual network function descriptors
  - Templates that tell OSM about the PNF
- On Network Service deployment
  - OSM does not launch any VM or container
  - OSM creates an execution environment for the PNF
  - All actions execute in this environment



# VyOS Overview

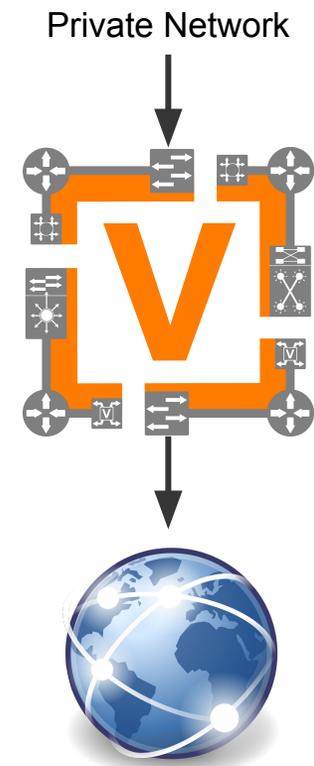
<https://www.vyos.io/products/>



- Runs on physical and virtual platforms alike: small x86 boards, big servers, KVM, Xen, VMware, Hyper-V, and more
- Completely free and open source, with documented internal APIs and build procedures
- Scriptable CLI
- Ansible playbooks for configuration

# VyOS Firewall

- Acts as default gateway for Private Network
- Masquerades all outgoing traffic
- Acts as point of presence on internet
- Forwards traffic from internet to specific hosts on private network



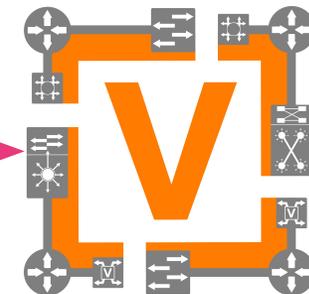
# How a Primitive Runs

1. Execute action



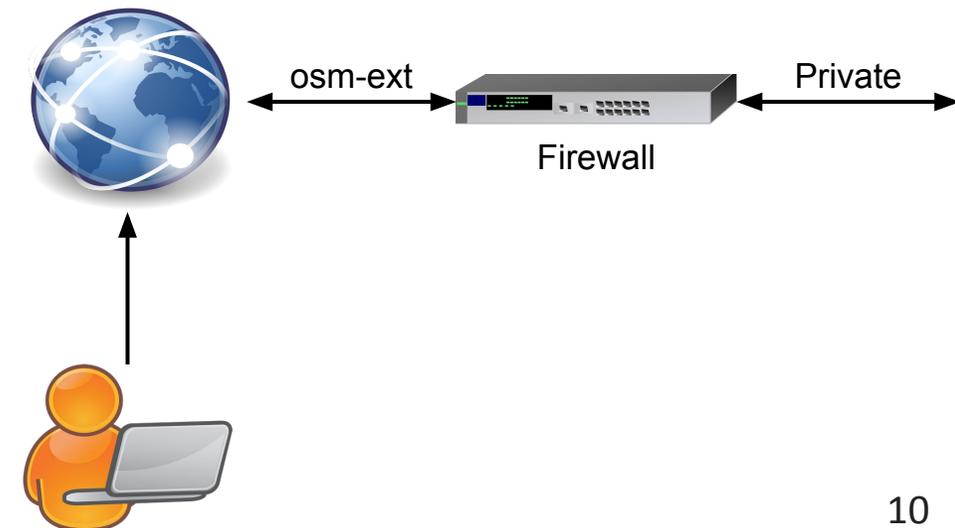
2. Run VyOS ansible playbook task

3. Ansible network commands via ssh



# What did the IT Department do?

- OpenStack has two networks:
  - osm-ext - reachable by you, from the 'internet'
  - Private - the private subnet for your services
    - Default route is the firewall
    - Only accessible via the firewall
- Manual Deployment of VyOS
  - Interface on each network
  - No rules configured
  - IP address is 172.21.19.<HFID>
  - osm / osm2021



# Shared Scripts

Code is shared in your account, under Hackfest

```
osm_instructor_5@osm-jumphost:~$ ls -al Hackfest/
total 44
drwxr-xr-x  9 osm-jumphost ubuntu-template 4096 Mar  4 20:16 .
drwxr-xr-x 20 osm-jumphost ubuntu-template 4096 Mar  5 16:40 ..
drwxr-xr-x  2 osm-jumphost ubuntu-template 4096 Mar  4 20:16 HD1.2-Preparation
drwxr-xr-x  2 osm-jumphost ubuntu-template 4096 Mar  4 18:10 HD1.5-Checkpoint
drwxr-xr-x  2 osm-jumphost ubuntu-template 4096 Mar  5 16:40 HD1.7-PNF
drwxr-xr-x  2 osm-jumphost ubuntu-template 4096 Mar  5 13:17 HD2.1-VNF-Primitives
drwxr-xr-x  2 osm-jumphost ubuntu-template 4096 Mar  4 18:11 HD2.2-Scaling
drwxr-xr-x  2 osm-jumphost ubuntu-template 4096 Mar  4 18:11 HD2.4-CNF-Helm
drwxr-xr-x  2 osm-jumphost ubuntu-template 4096 Mar  4 18:11 HD2.5-CNF-Juju
-rw-r--r--  1 osm-jumphost ubuntu-template 5465 Mar  3 12:49 kube.yaml
```

# Building the Package

```
cd ~/osm-packages
```

```
~/Hackfest/HD1.7-PNF/firewall-build.sh
```

```
osm_instructor_5@osm-jumphost:~/osm-packages$ ~/Hackfest/HD1.7-PNF/firewall-build.sh
=====
Building operator charms
=====
Already using interpreter /usr/bin/python3
Using base prefix '/usr'
New python executable in /home/osm_instructor_5/osm-packages/hackfest_firewall_pnf/charms/vyos-config-src/venv/bin/python3
Not overwriting existing python script /home/osm_instructor_5/osm-packages/hackfest_firewall_pnf/charms/vyos-confi
```

# Breaking it down: Build Charm

```
cd hackfest_firewall_pnf/charms/vyos-config-src
virtualenv -p python3 venv
source venv/bin/activate
pip install -r requirements-dev.txt
pip install charmcraft
./venv/bin/charmcraft build
cd -
cd hackfest_firewall_pnf/charms
mkdir -p vyos-config/
cp -r vyos-config-src/build/* vyos-config/
cd -
```

# Breaking it down: Cleanup

```
osm nsd-delete hackfest_firewall_pnf_ns  
osm vnfd-delete hackfest_firewall_pnf  
osm pdu-delete router01  
rm -v hackfest_firewall_pnf*.tar.gz
```

# Breaking it down: Creating Packages

```
osm package-build hackfest_firewall_pnf
osm package-build hackfest_firewall_pnf_ns
```

```
osm upload-package hackfest_firewall_pnf.tar.gz
osm upload-package hackfest_firewall_pnf_ns.tar.gz
```

# Telling OSM About the PDU

- Need to tell OSM some information
  - Name
  - Type
  - Interfaces with IP addresses

```
VIMID=`osm vim-list | grep osm_ | \
    awk '{ print $4 }'`
osm pdu-create --descriptor_file \
    firewall-pdu.yaml \
    --vim_account $VIMID
```

```
name: router01
description: VyOS Router
type: gateway
shared: false
interfaces:
  - name: gateway_public
    ip-address: 172.21.19.95
    mgmt: true
    vim-network-name: osm-ext
  - name: vnf_internal
    ip-address:
192.168.239.250
    mgmt: false
    vim-network-name: private
```

# Launch Service

```
cd ~/osm-packages
```

```
~/Hackfest/HD1.7-PNF/firewall-launch.sh
```

```
=====
Launching network service with VIMID bf5f184c-8ce0-4959-99d9-598582483b80
=====
dd336fb8-283d-4ae6-9d36-bb3d370d6399
=====
Done
=====
```

# What is Happening

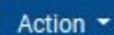
- OSM
  - Creates an entry for this network service
  - Creates an environment for operations to run

## NS Instances

 Init  running / configured  failed

Entries 10 



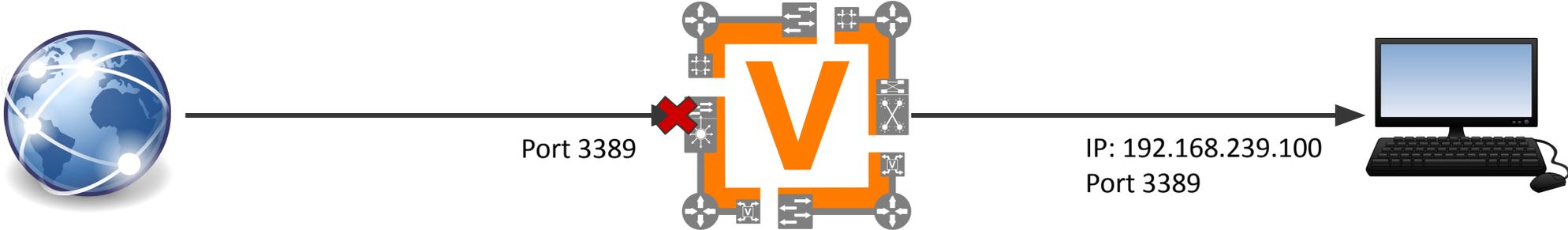
Name	Identifier	Nsd name	Operational Status	Config Status	Detailed Status	Actions
<input type="text" value="Name"/>	<input type="text" value="Identifier"/>	<input type="text" value="Nsd name"/>	<input type="text" value="Select"/>	<input type="text" value="Select"/>	<input type="text" value="Detailed Status"/>	
firewall	1901efc0-d62f-4ae2-adb0-003ee99d29b3	hackfest_firewall_pnf_ns			Done	   

# Watch Progress

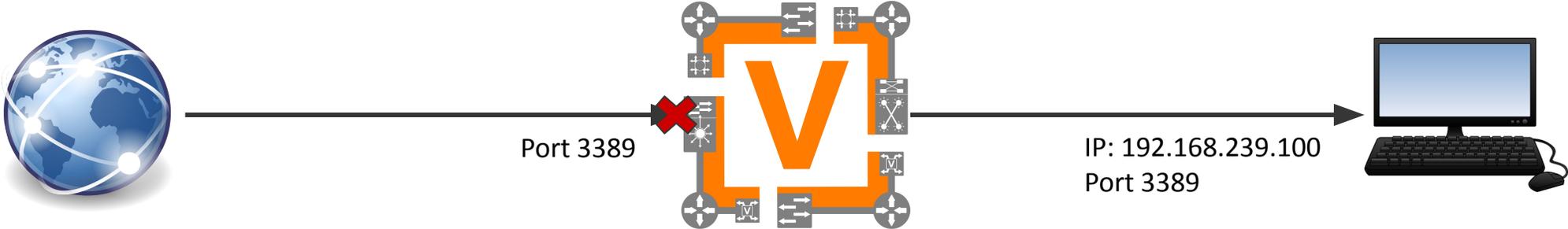
```
~/Hackfest/HD1.7-PNF/firewall-watch-progress.sh
```

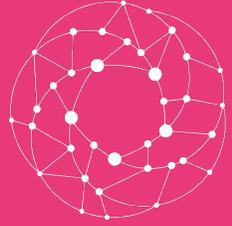
```
| admin-status           | "ENABLED"  
| deploymentStatus      | null  
| configurationStatus    | [  
|                         |   "status": "READY"  
| vcaStatus              | {  
|                         |   "meter_statuses": {},  
|                         |   "status": {  
|                         |     "status": "active",  
|                         |     "agent_status": {  
|                         |       "status": "executing",  
|                         |       "workload_status": {  
|                         |         "status": "active",  
|                         |       "agent_status": {  
|                         |         "status": "started",  
|                         |       "instance_status": {  
|                         |         "status": "running",
```

# Operations: Add Port Forward



# Operations: Delete Port Forward

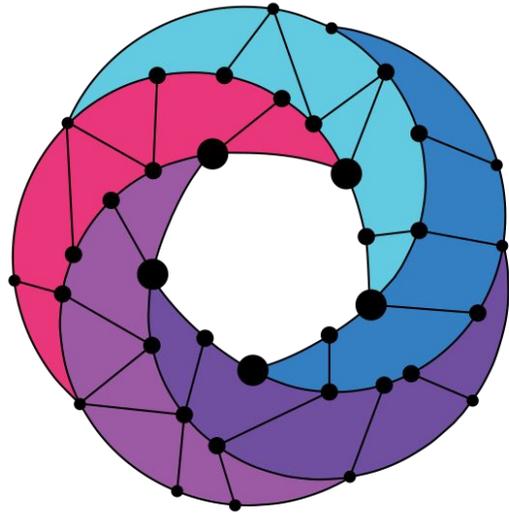




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MANO

- What is a PNF?
- How does OSM model PNFs?
- How does a PNF model get launched?
- How do actions get performed?

Discuss



# Open Source MANO

Find us at:

[osm.etsi.org](https://osm.etsi.org)  
[osm.etsi.org/wikipub](https://osm.etsi.org/wikipub)