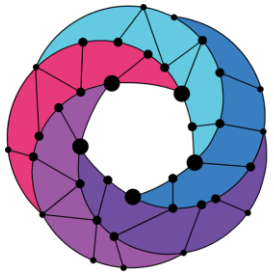


Open Source MANO by ETSI

OSM usage

Gerardo García (Telefónica, OSM TSC Chair)

OSM Training Seminar - SLICES

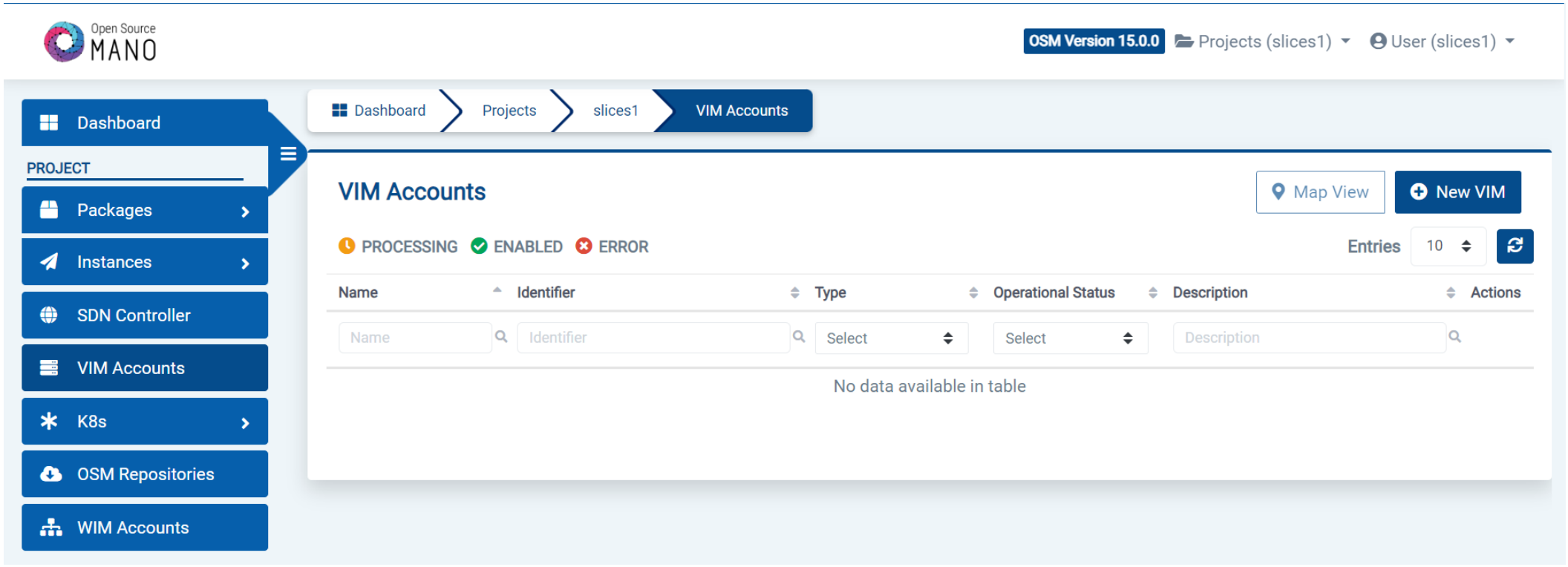
13/02/2024

Open Source MANO

Registering VIM accounts

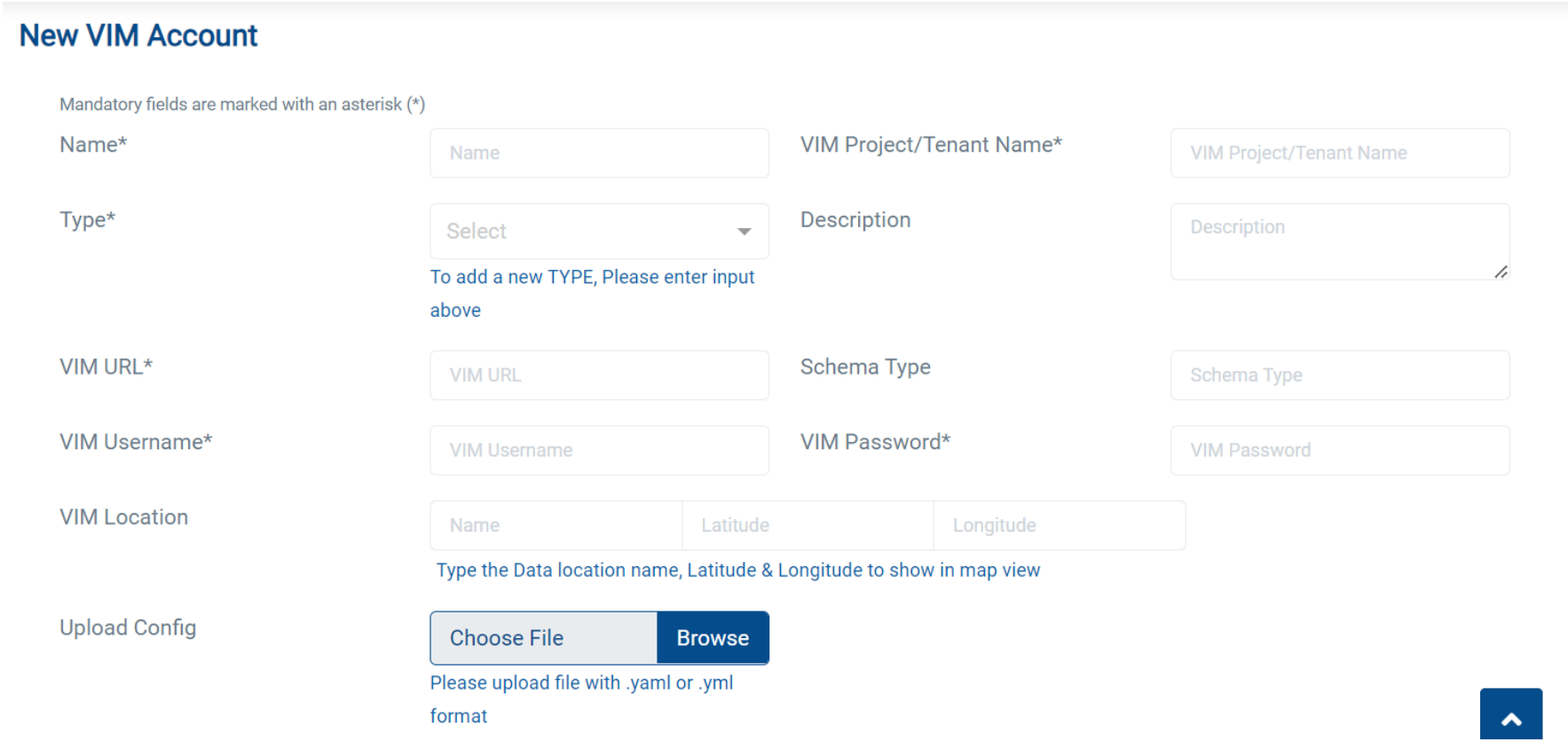
Registering VIMs/Clouds

- With the GUI



Registering VIMs/Clouds

- With the GUI



Registering VIMs/Clouds

- With the client:

```
osm vim-create --name etsi-vim-slicesX --account_type openstack \
     --auth_url http://172.21.247.1:5000/v3 \
     --user slicesX --password "slicesXFeb24!" --tenant slicesX\
     --description "ETSI VIM" \
     --config '{management_network_name: osm-ext,
                dataplane_physical_net: physnet2}'
```

Exercise

- Register a VIM account
  - Name: etsi-vim-slicesX
  - Type: openstack
  - Auth URL: http://172.21.247.1:5000/v3
  - User, password and tenant/project: the ones in the Google Spreadsheet
  - Description: "ETSI VIM"
  - Config params:
    - management_network_name: osm-ext
    - dataplane_physical_net: physnet2

VIM monitoring

- Airflow:
  - Osm-slices-1: http://172.21.249.14:11193 (admin, admin)
  - Osm-slices-2: http://172.21.249.74:17641 (admin, admin)
  - Osm-slices-3: http://172.21.242.242:5873 (admin, admin)
  - Osm-slices-4: http://172.21.249.60:16206 (admin, admin)

- Prometheus dashboard:
  - Osm-slices-1: http://172.21.249.14:9091
  - Osm-slices-2: http://172.21.249.74:9091
  - Osm-slices-3: http://172.21.242.242:9091
  - Osm-slices-4: http://172.21.249.60:9091
  - Check metric: osm_vim_status

Registering K8s clusters

Exercise

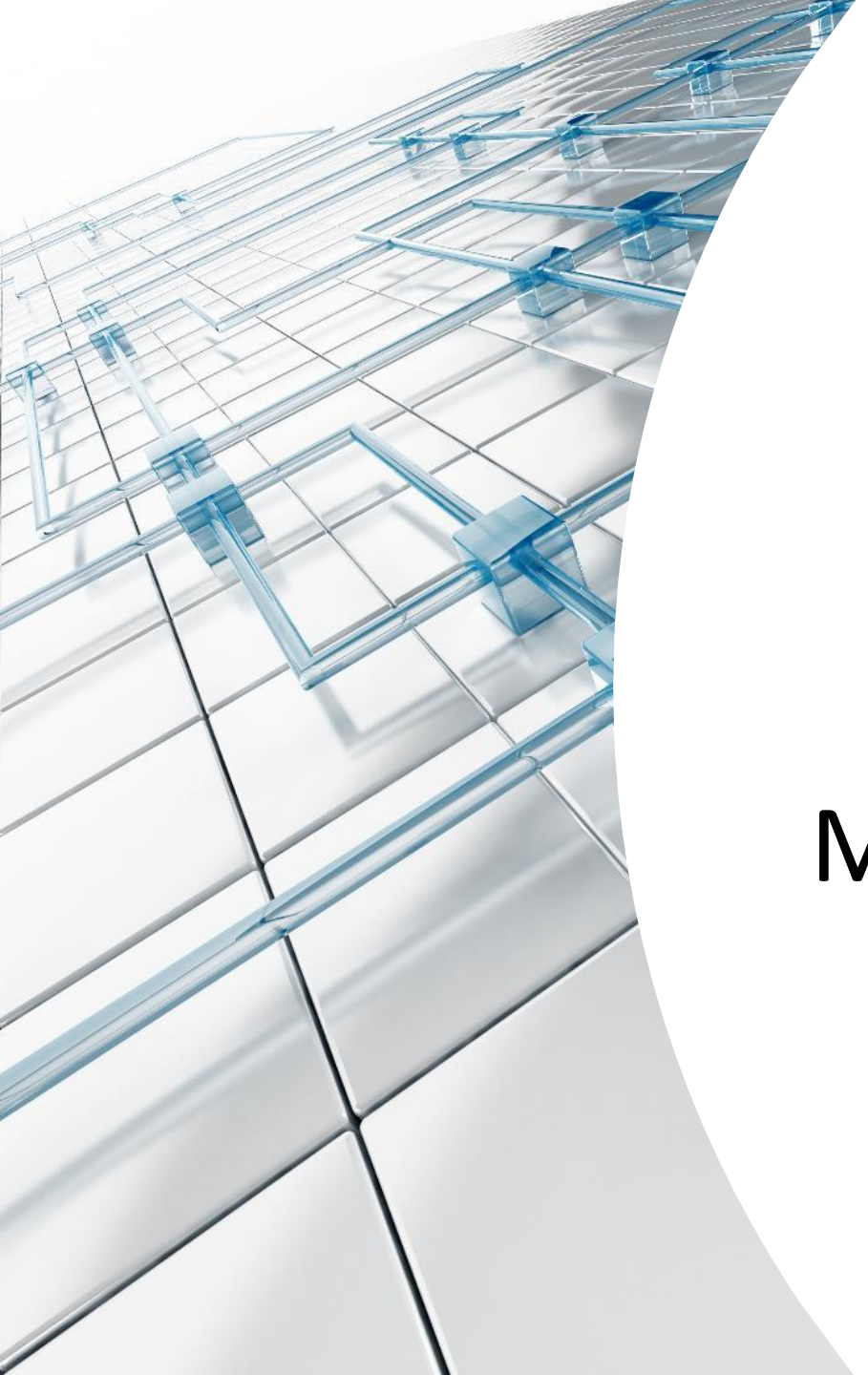
- Register a K8s cluster with the client

```
osm k8scluster-add --creds whitemist-kubeconfig.yaml \
                   --version "v1.26" \
                   --vim etsi-vim-slicesX \
                   --k8s-nets "{net1: osm-ext}" \
                   --description "K8s cluster" \
                   --skip-jujubundle \
                   k8scluster-slicesX
```

Create your own Kubernetes cluster

The simplest way is to create a VM and install K3s like this:

```
curl -sfL https://get.k3s.io | sh -
sudo k3s kubectl get node
mkdir .kube
sudo mv /etc/rancher/k3s/k3s.yaml .kube/config
sudo chown $USER:$USER .kube/config
```



Open Source MANO

Modeling NF and NS

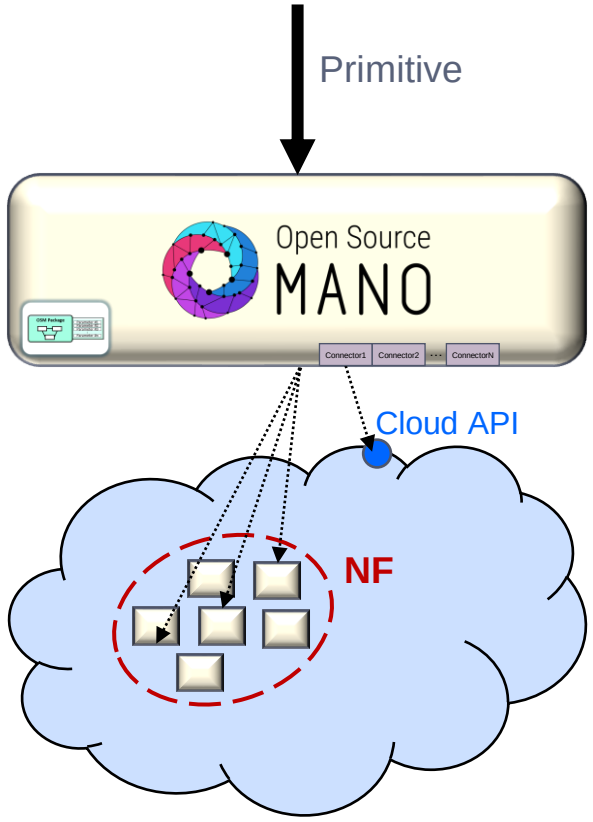
OSM provides a platform to create Networks as a Service and to manage them conveniently later…

OSM manages the low-level setup for Network Functions, so that they are ready for use.

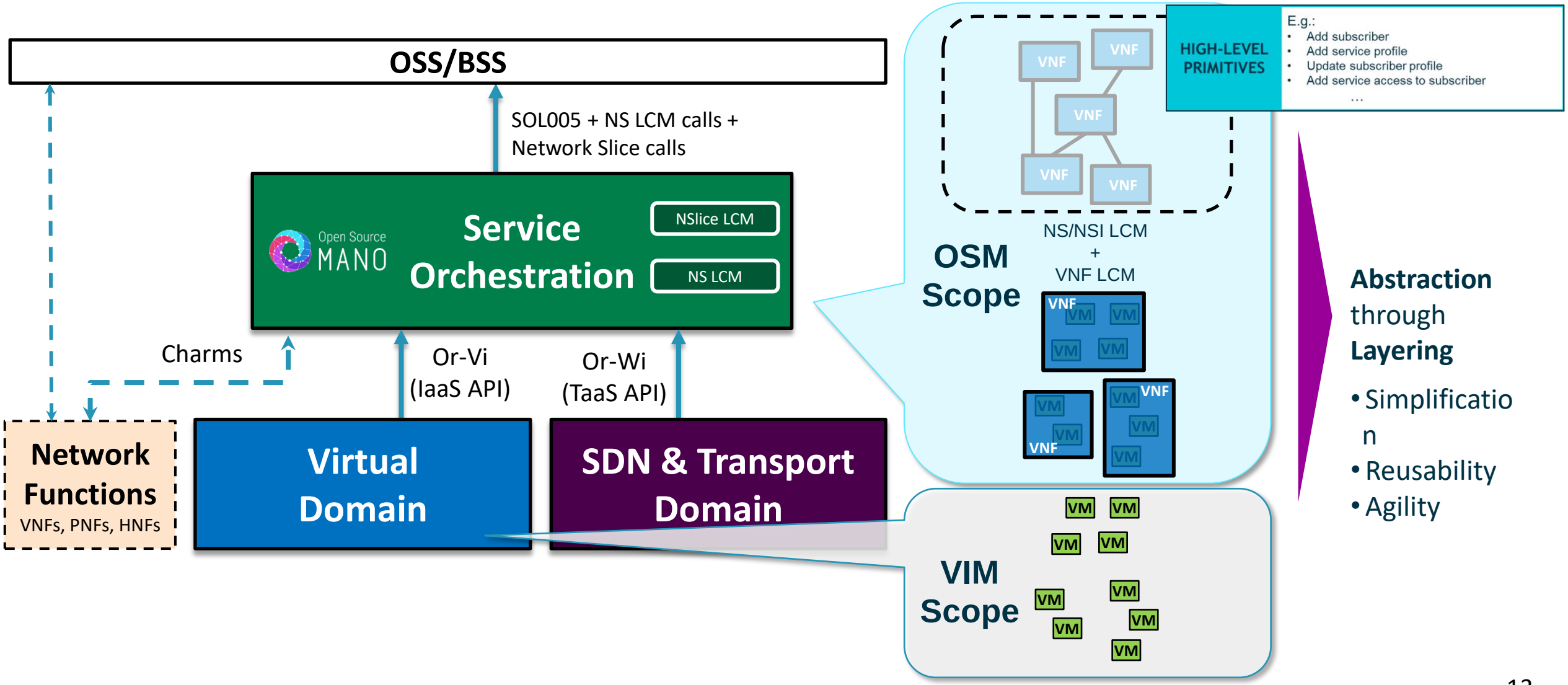
- It covers in 100% the role of a kind of **specialized PaaS for Network Functions**, with 2 key features:
  1. **Complex connectivity** setup, including EPA and underlay scenarios.
  2. Solve **inter-NF relations**.

- Returns: **NS/NF ready for its use and properly connected**:
  - Exposes **the "function" and its lifecycle, not its components**.
  - Presented as a whole (i.e., abstracts from low-level details of the NF).
  - Easy (standardized) access to NF's lifecycle operations, via ***primitives***.

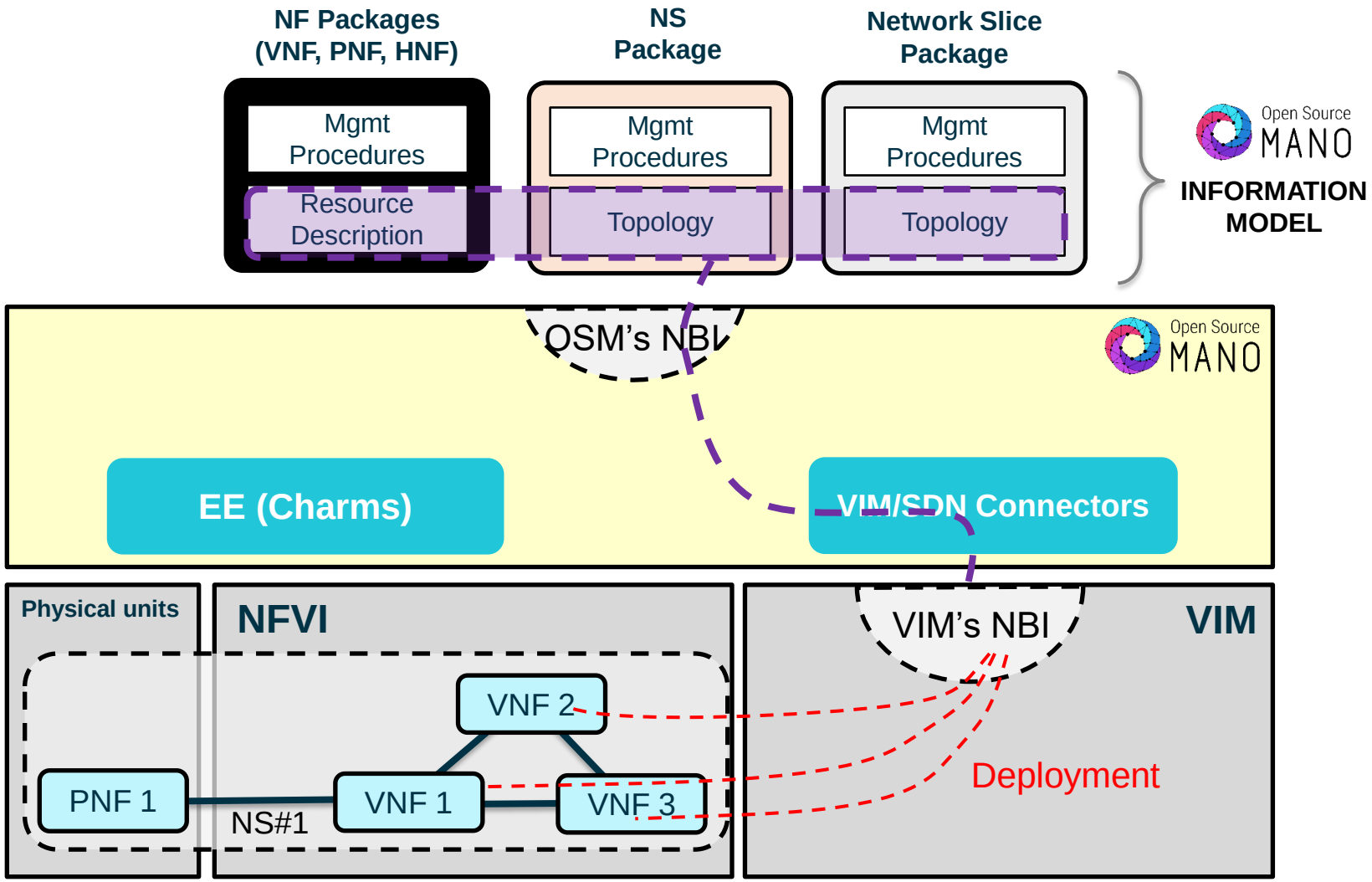
- This follows well-known paradigms in **IT** and **public clouds**.



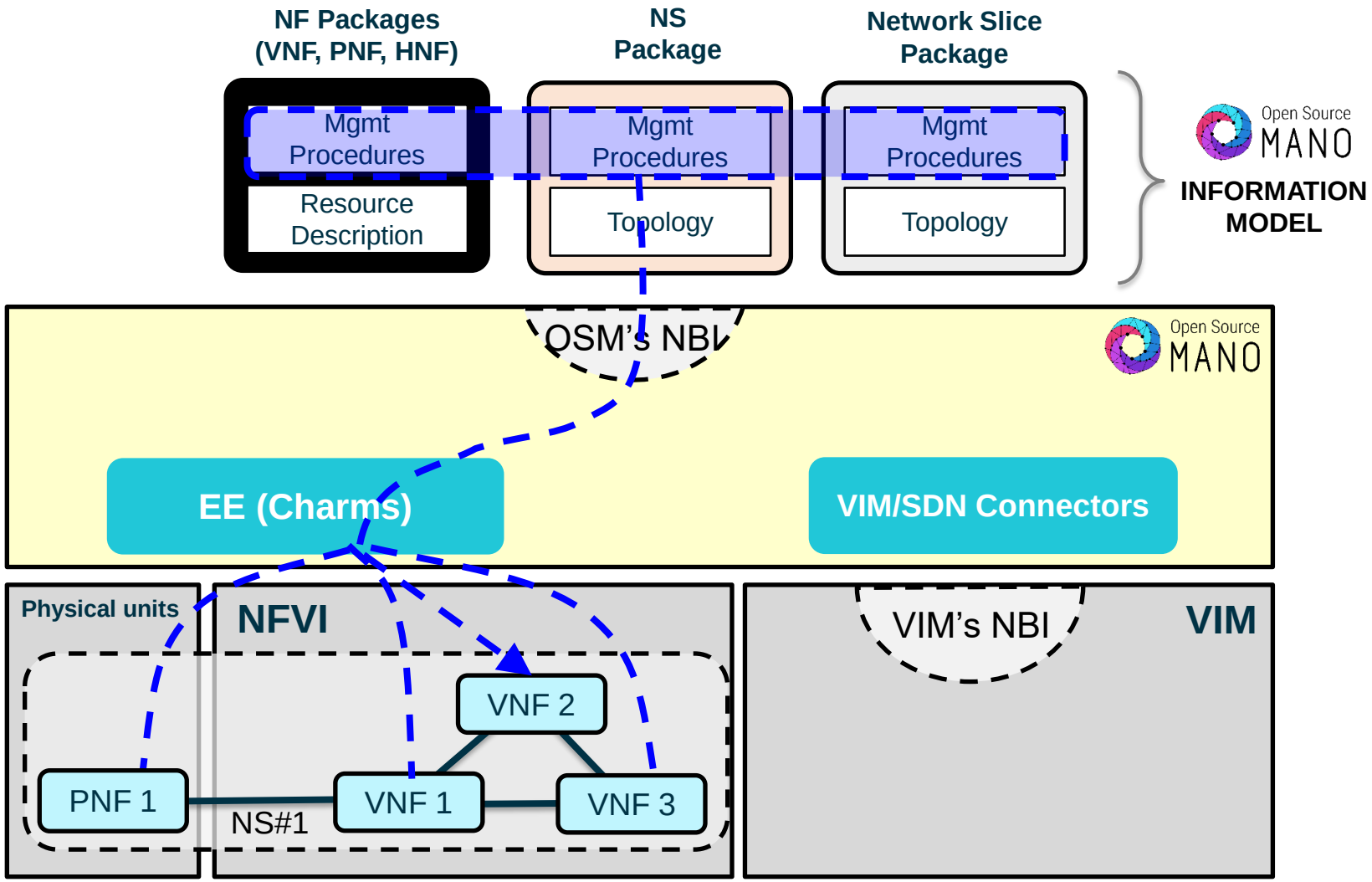
OSM provides a platform to create Networks as a Service (NaaS) and to manage them conveniently



Packages embed resource description and operational procedures

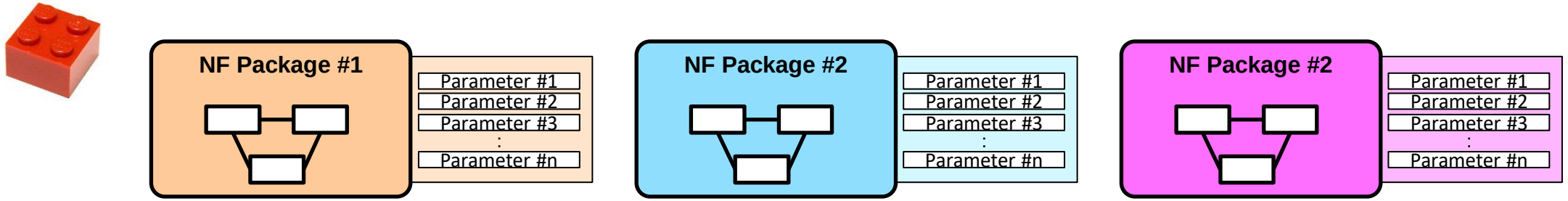


Packages embed resource description and operational procedures



All in OSM is model-driven to make VNFs and NS as portable and reusable as possible

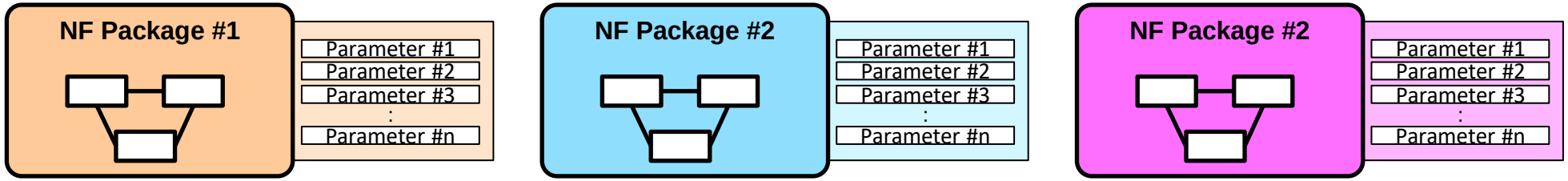
(V)NF PACKAGES:



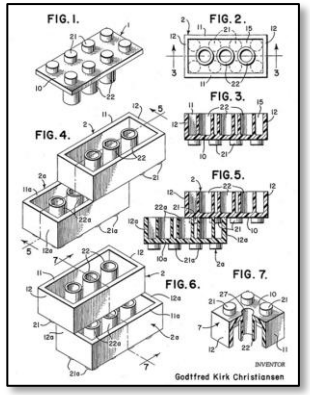
- **Provided by the vendor**, fully describe their own product:
  - Topology
  - Parametrized
  - Actions for Day-0, Day-1, and Day-2
- **Doesn't** need to know any detail about :
  - The target infrastructure
  - Other components that will be part of the scenario

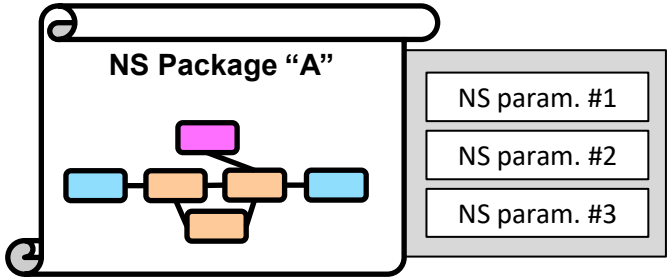
All in OSM is model-driven to make VNFs and NS as portable and reusable as possible

(V)NF PACKAGES:



NS PACKAGES / SLICE PACKAGES:





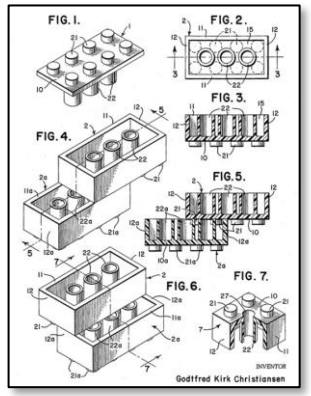
- Describes how to combine a set of NF packages to create a specific scenario.
- Parametrized.
- Have actions for Day-0, Day-1, and Day-2.

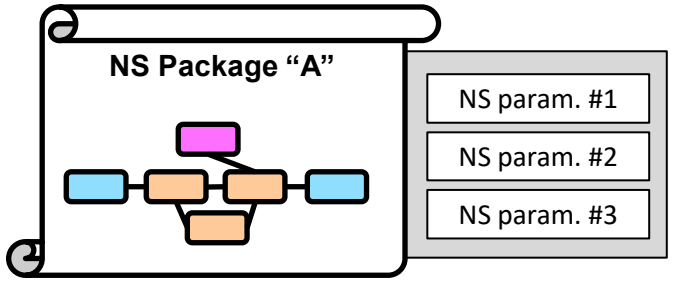
Slice Packages work similarly, but using NS as building blocks(*)

(*) NS instances play the role of Slice Subnets of a given slice. Some of them may be shared by more than one slice instance. This is taken into account by OSM, so a slice is more sophisticated than just a "NS of NS".

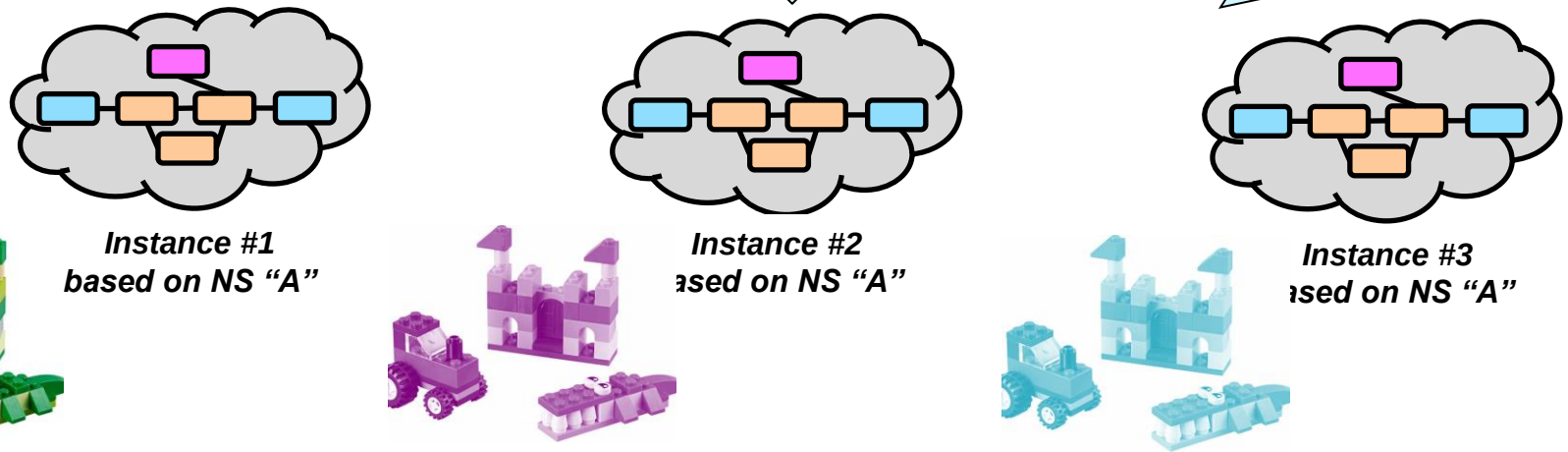
All in OSM is model-driven to make VNFs and NS as portable and reusable as possible

NS PACKAGES / SLICE PACKAGES:





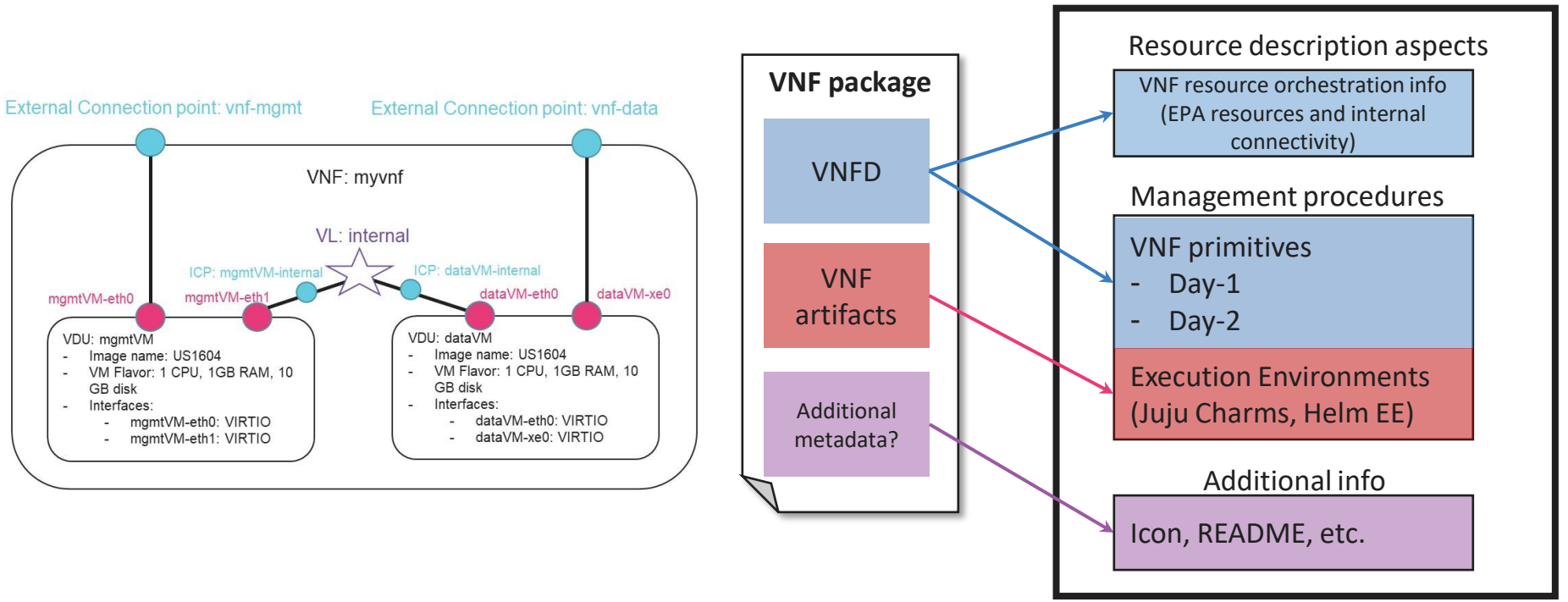
DEPLOYED INSTANCES:



Upon instantiation, you just need to decide:

- The target VIM (or VIMs)
- Values for the parameters (IP addresses, keys, etc.)

Modeling NF
VNF package vs VNF descriptor



Modeling NF
VNF descriptor

Open Source MANO

Descriptors are written in YAML and contain:

- Topology description (VDU, internal VLD, Connection Points)
- Scaling-groups
- Monitoring params
- Reference to day-0 configuration file
- Execution environment list (e.g. charms, monitoring environments)
- Day-1 primitives (sequence)
- Day-2 primitives

```
vnfd:
  description: Virtual Desktop Computer
  ext-cpd:
  - id: virtual-pc-private-ext
    int-cpd:
      cpd: eth0-int
      vdu-id: virtual-pc
  id: hackfest_virtual-pc_vnf
  mgmt-cp: virtual-pc-mgmt-ext
  product-name: hackfest_virtual-pc_vnf
  sw-image-desc:
  - id: ubuntu20.04
    image: ubuntu20.04
  vdu:
  - cloud-init-file: virtual-pc_init
    description: virtual-pc
    id: virtual-pc
    int-cpd:
    - id: eth0-int
      virtual-network-interface-requirement:
      - name: eth0
        virtual-interface:
          type: PARAVIRT
    - id: eth1-int
  version: '1.0'
  virtual-compute-desc:
  - id: virtual-pc-vdu-compute
    virtual-cpu:
      num-virtual-cpu: 8
    virtual-memory:
      size: 32.0
  virtual-storage-desc:
  - id: virtual-pc-vdu-storage
```

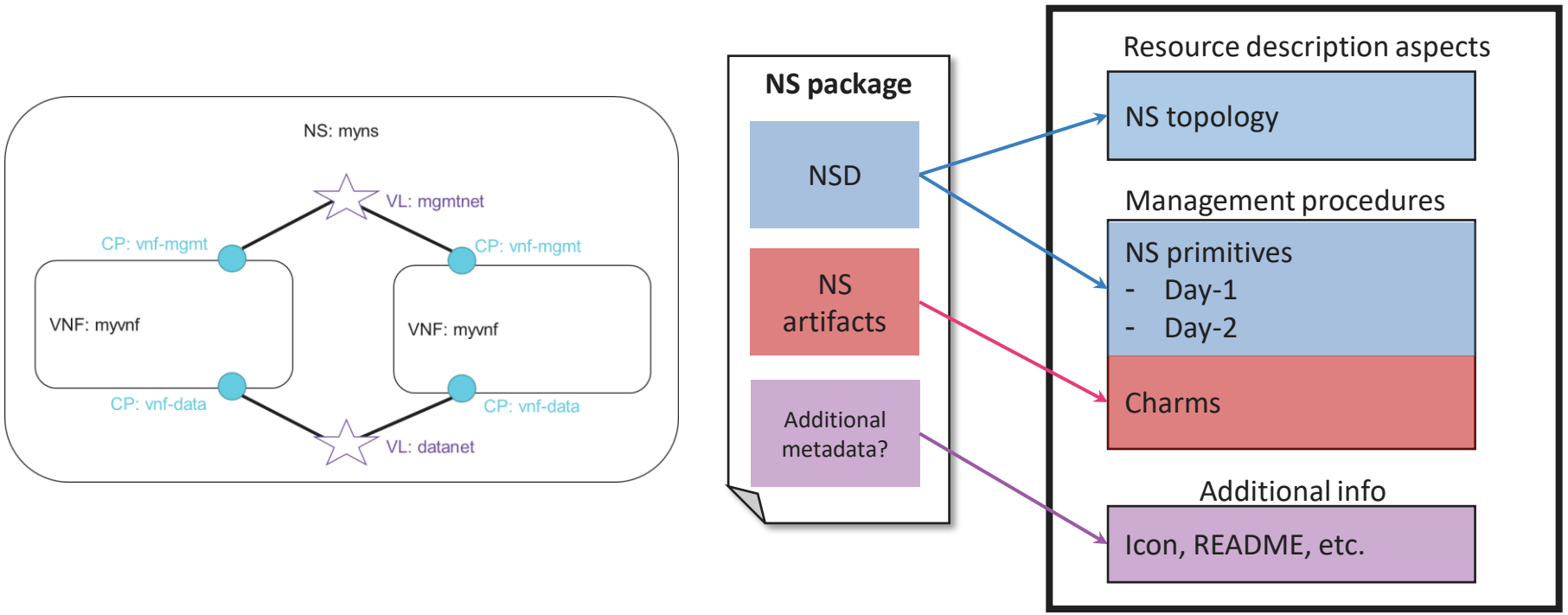
Modeling NF
CNF descriptor

CNF descriptors must contain:

- List of KDU (and their associated helm-chart or juju-bundle)
- K8s cluster requirements

```
vnfd:
  description: CNF with single KDU
  df:
  - id: default-df
  ext-cpd:
  - id: mgmt-ext
    k8s-cluster-net: mgmtnet
  id: openldap_knf
  k8s-cluster:
    nets:
    - id: mgmtnet
  kdu:
  - name: ldap
    helm-chart: stable/openldap
  mgmt-cp: mgmt-ext
  product-name: openldap_knf
  provider: Telefonica
  version: '1.0'
```

Modeling NS
NS package vs NS descriptor

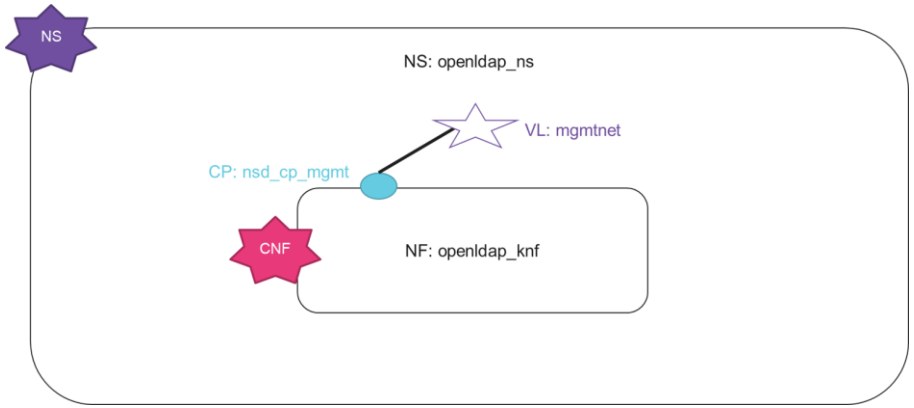


Modeling NF
NS descriptor

Open Source MANO

Descriptors are written in YAML and contain:

- Topology description (NF, VL)

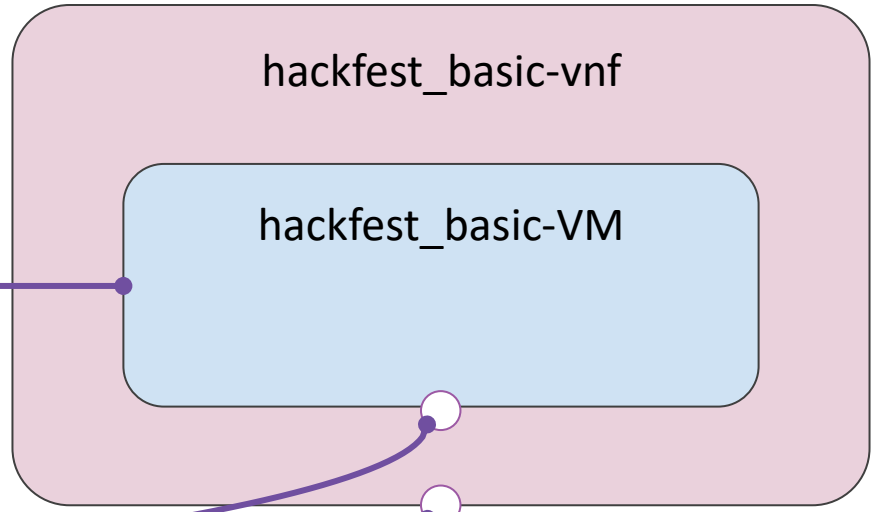



```
nsd:
  nsd:
  - description: Simple NS with a single VNF and a
single VL
    df:
    - id: default-df
      vnf-profile:
      - id: vnf
        virtual-link-connectivity:
        - constituent-cpd-id:
          - constituent-base-element-id: vnf
            constituent-cpd-id: vnf-cp0-ext
          virtual-link-profile-id: mgmtnet
        vnfd-id: hackfest_basic-vnf
    id: hackfest_basic-ns
    name: hackfest_basic-ns
    version: 1.0
    virtual-link-desc:
    - id: mgmtnet
      mgmt-network: true
    vnfd-id:
    - hackfest_basic-vnf
```

VNFD for hackfest_basic_vnf – Part 1

```
vnfd:
  description: A basic VNF descriptor w/ one VDU
  df:
  - id: default-df
    instantiation-level:
    - id: default-instantiation-level
      vdu-level:
      - number-of-instances: 1
        vdu-id: hackfest_basic-VM
      vdu-profile:
      - id: hackfest_basic-VM
        min-number-of-instances: 1
  ext-cpd:
    - id: vnf-cp0-ext
      int-cpd:
        cpd: vdu-eth0-int
        vdu-id: hackfest_basic-VM

  id: hackfest_basic-vnf
  mgmt-cp: vnf-cp0-ext
  product-name: hackfest_basic-vnf
```

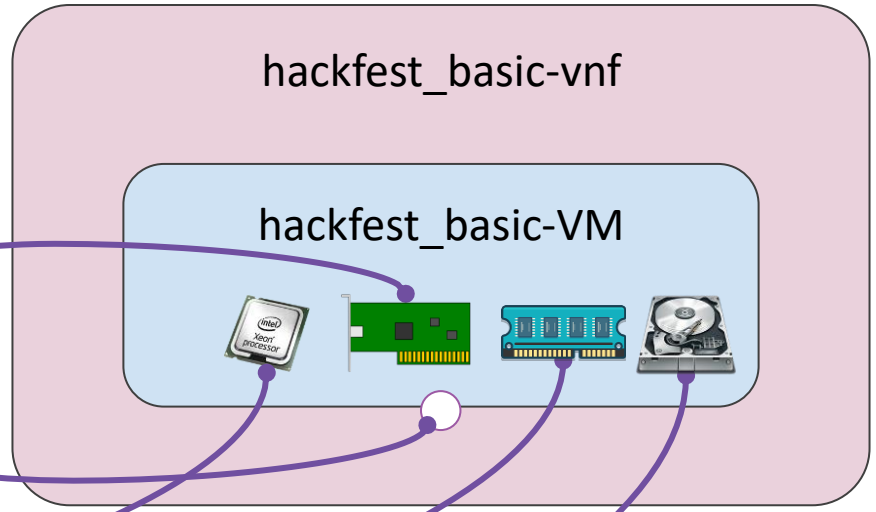


https://osm.etsi.org/gitlab/vnf-onboarding/osm-packages/-/blob/master/hackfest_basic_vnf/hackfest_basic_vnfd.yaml

VNFD for hackfest_basic_vnf – Part 2

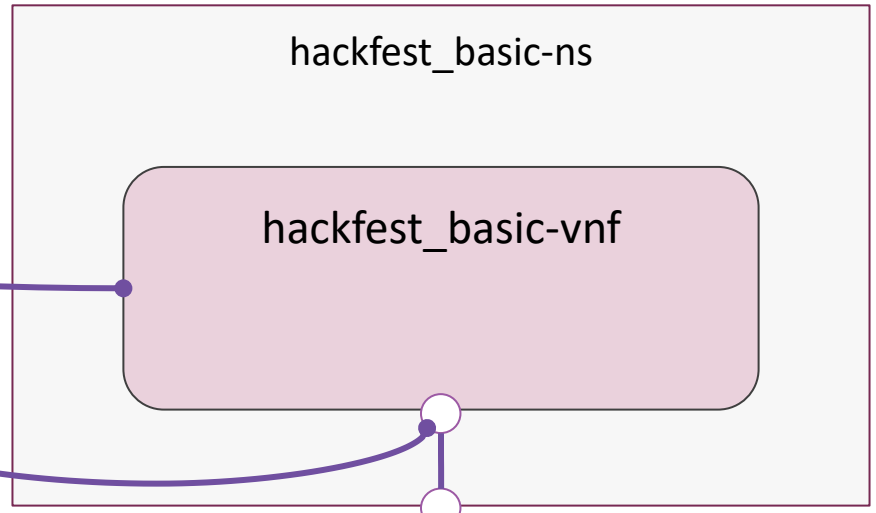
```
vdu:
- id: hackfest_basic-VM
  name: hackfest_basic-VM
  sw-image-desc: ubuntu20.04
  virtual-compute-desc: hackfest_basic-VM-compute
  virtual-storage-desc:
  - hackfest_basic-VM-storage
  int-cpd:
  - id: vdu-eth0-int
    virtual-network-interface-requirement:
    - name: vdu-eth0
      virtual-interface:
        type: PARAVIRT

virtual-compute-desc:
- id: hackfest_basic-VM-compute
  virtual-cpu:
    num-virtual-cpu: 1
  virtual-memory:
    size: 1.0
virtual-storage-desc:
- id: hackfest_basic-VM-storage
  size-of-storage: 10
```



NSD for hackfest_basic_ns

```
nsd:
  nsd:
  - description: Simple NS with a single VNF and a single VL
  df:
  - id: default-df
    vnf-profile:
    - id: vnf
      vnfd-id: hackfest_basic-vnf
      virtual-link-connectivity:
      - constituent-cpd-id:
        - constituent-base-element-id: vnf
          constituent-cpd-id: vnf-cp0-ext
        virtual-link-profile-id: mgmtnet
    id: hackfest_basic-ns
    name: hackfest_basic-ns
    version: 1.0
    virtual-link-desc:
      - id: mgmtnet
        mgmt-network: true
    vnfd-id:
    - hackfest_basic-vnf
```



https://osm.etsi.org/gitlab/vnf-onboarding/osm-packages/-/blob/master/hackfest_basic_ns/hackfest_basic_nsd.yaml

Adding NF and NS packages

Reference: OSM packages

- Gitlab: https://osm.etsi.org/gitlab/vnf-onboarding/osm-packages

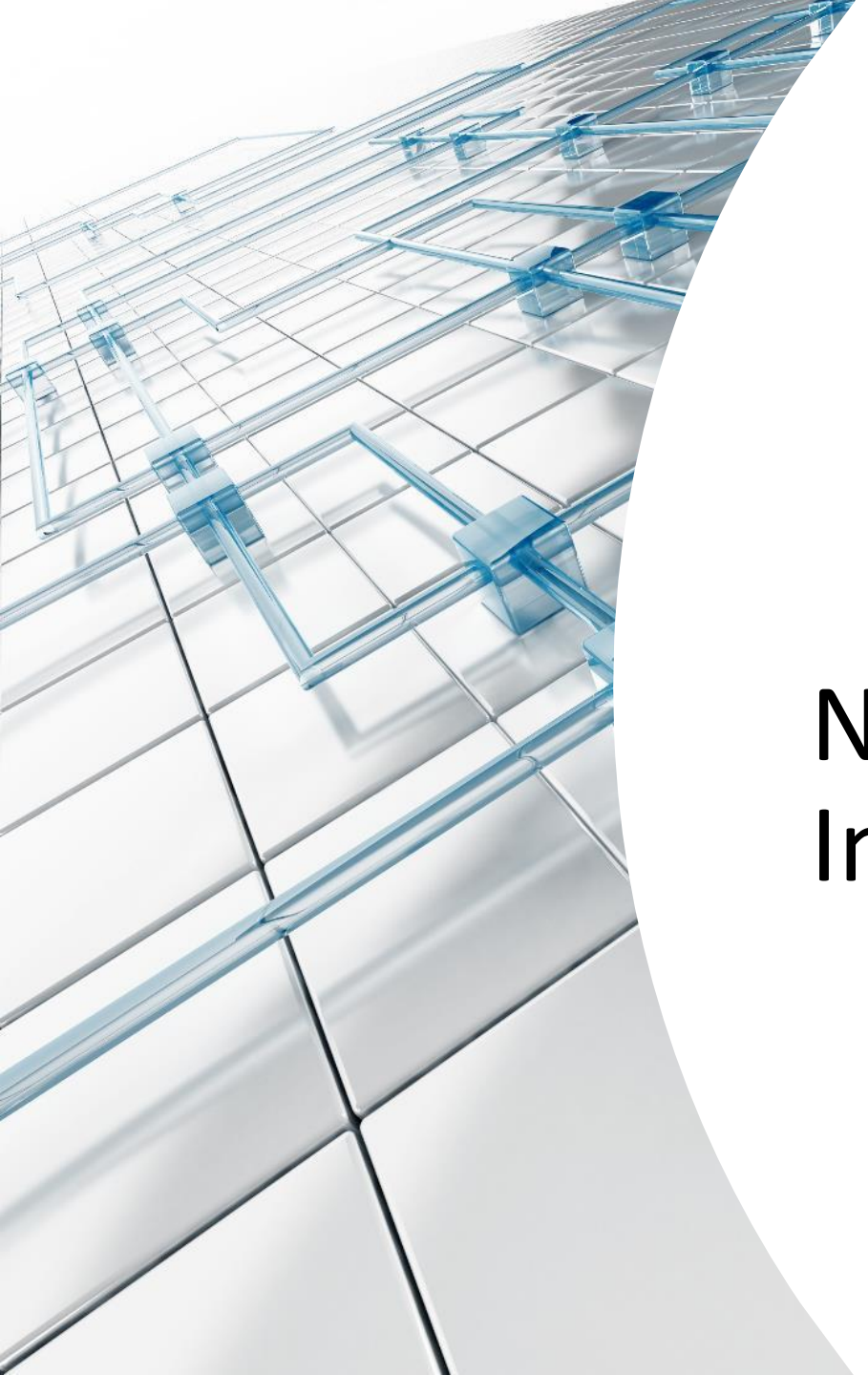
```
git clone --recursive https://osm.etsi.org/gitlab/vnf-onboarding/osm-packages.git
```

Exercise

- Use OSM client to upload hackfest_basic_vnf package
- Use OSM client to upload hackfest_basic_ns package
- Use OSM GUI to upload hackfest_basic_metrics_vnf package
- Use OSM GUI to upload hackfest_basic_metrics_ns package

Solution (with OSM client)

```
git clone --recursive https://osm.etsi.org/gitlab/vnf-onboarding/osm-packages.git
cd osm-packages
# Optional validation and build
# osm package-validate hackfest_basic_vnf
# osm package-validate hackfest_basic_ns
# osm package-build hackfest_basic_vnf
# osm package-build hackfest_basic_ns
osm nfpkg-create hackfest_basic_vnf
osm nspkg-create hackfest_basic_ns
```



NS instantiation and operation
Instantiation and termination

Exercise

- Launch a NS instance of hackfest_basic_ns
- Check VMs created in Openstack
- Check VNF reachability
- Terminate the NS instance

Solution (with OSM client)

```
# Launch instance
osm ns-create --ns_name hfbasic --nsd_name hackfest_basic-ns \
              --vim_account etsi-vim-slicesX \
              --ssh_keys ~/.ssh/id_rsa.pub \
              --config '{vld: [ {name: mgmtnet, vim-network-name: osm-ext} ] }’

# Check VMs were created in Openstack
openstack server list

# Find mgmt IP address of the VNF
osm vnf-list
osm vnf-show <VNF_ID>

# Check VNF reachability
ssh ubuntu@<IP_ADDRESS>

# Terminate instance
osm ns-delete hfbasic
```

NS instantiation and operation
Working with CNF

Working with CNF

```
# Add packages
osm vnfpkg-create  openldap_knf
osm nspkg-create openldap_ns

# Launch NS
osm ns-create --ns_name ldap --nsd_name openldap_ns --vim_account etsi-vim-slicesX
--config '{vld: [ {name: mgmtnet, vim-network-name: osm-ext}],
additionalParamsForVnf: [ {member-vnf-index: openldap, additionalParamsForKdu: [
{kdu_name: ldap, additionalParams: {service: {type: LoadBalancer }, adminPassword:
admin}} ] } ] }'

# Check number of replicas
osm vnf-show <VNF_ID> --kdu ldap | yq -r .config.replicaCount
```

Working with CNF

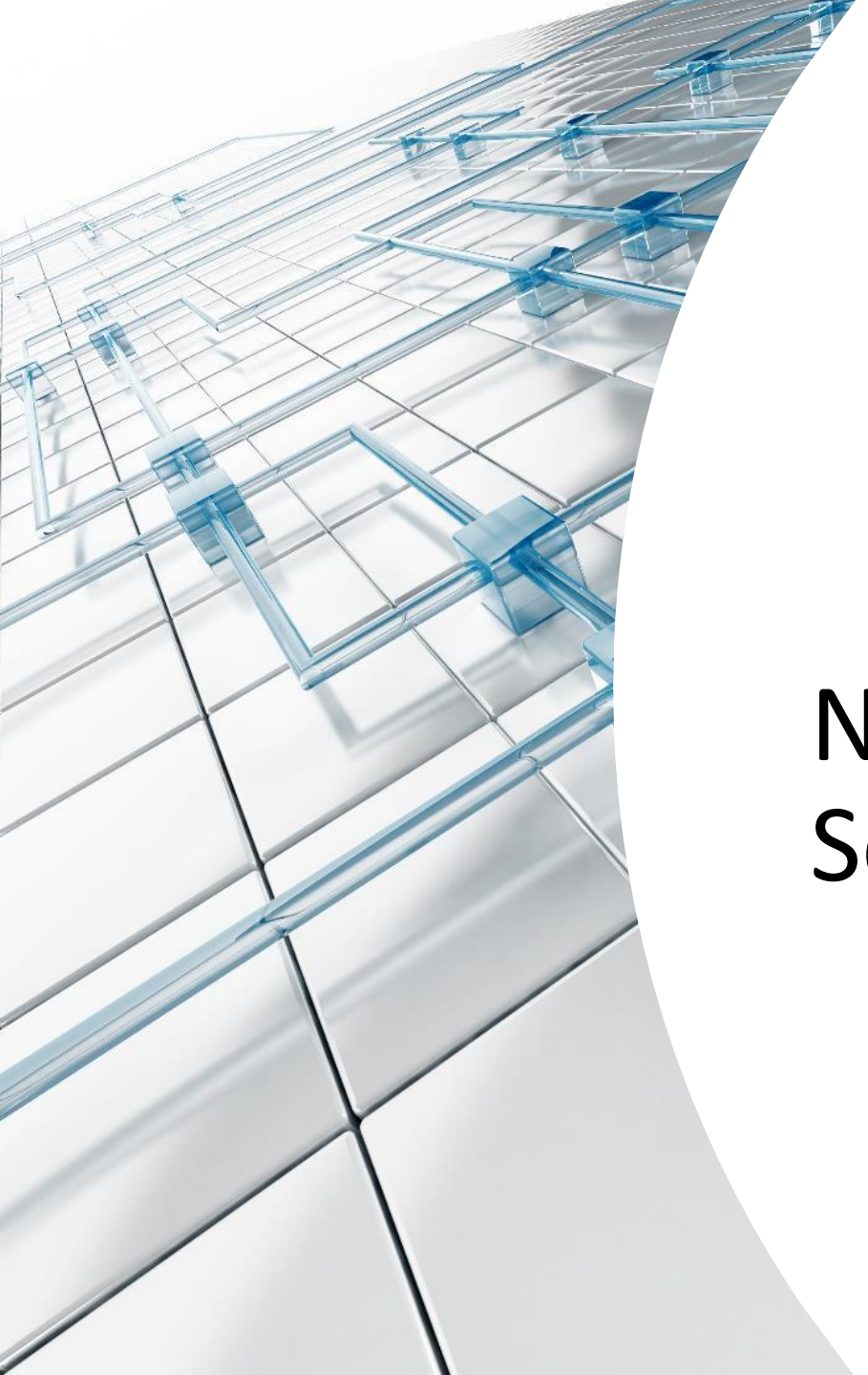
```
# Upgrade CNF
osm ns-action --action_name upgrade --vnf_name openldap --kdu_name ldap --params
'{"replicaCount":"3",}' ldap

# Check number of replicas
osm vnf-show <VNF_ID> --kdu ldap | yq -r .config.replicaCount

# Rollback CNF
osm ns-action --action_name rollback --vnf_name openldap --kdu_name ldap ldap

# Check number of replicas
osm vnf-show <VNF_ID> --kdu ldap | yq -r .config.replicaCount

# Terminate NS
osm ns-delete ldap
```



NS instantiation and operation Scaling

Scaling scenario

```
# Add packages
osm nfpkg-create hackfest_basic_metrics_vnf
osm nspkg-create '/robot-systest/osm-packages/hackfest_basic_metrics_ns

# Launch NS
osm ns-create --ns_name manual_scaling_test --nsd_name hackfest_basic-ns-metrics --
vim_account etsi-vim-slicesX --config '{vld: [ {name: mgmtnet, vim-network-name: osm-ext} ]
}' --ssh_keys ~/.ssh/id_rsa.pub

# Scale out
osm vnf-scale --scaling-group vdu_autoscale --scale-out manual_scaling_test vnf

# Scale in
osm vnf-scale --scaling-group vdu_autoscale --scale-in manual_scaling_test vnf

# Terminate NS
osm ns-delete manual_scaling_test
```

NS instantiation and operation Auto-healing

Auto-healing scenario

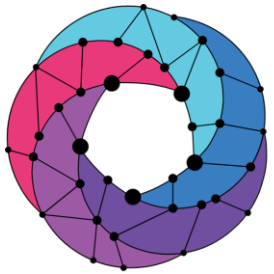
```
# Add packages
osm vnfpkg-create  autoheal_vnf
osm nspkg-create autoheal_ns

# Launch NS
osm ns-create --ns_name heal_test --nsd_name autoheal_nsd --vim_account etsi-vim-slicesX --
config '{vld: [ {name: mgmt, vim-network-name: osm-ext} ] }' --ssh_keys ~/.ssh/id_rsa.pub

# Force error in VM
openstack server set --state error <OPENSTACK_VM_ID>

# Wait for VM to be auto-healed
osm ns-op-list

# Terminate NS
osm ns-delete heal_test
```



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osm.etsi.org
osm.etsi.org/docs/user-guide
osm.etsi.org/wikipub