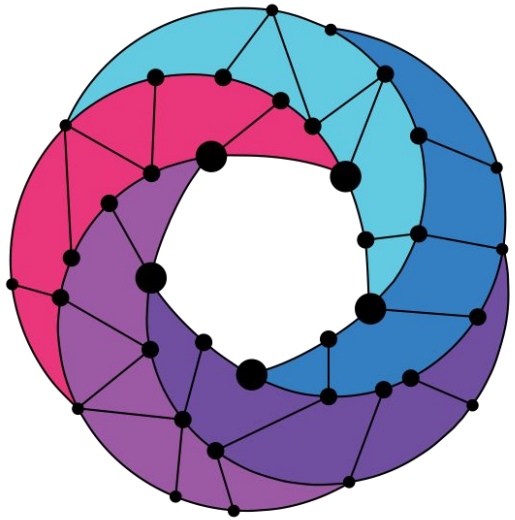


Open Source
MANO

OSM MR Hackfest – Hack 1
OSM Architecture & Installation

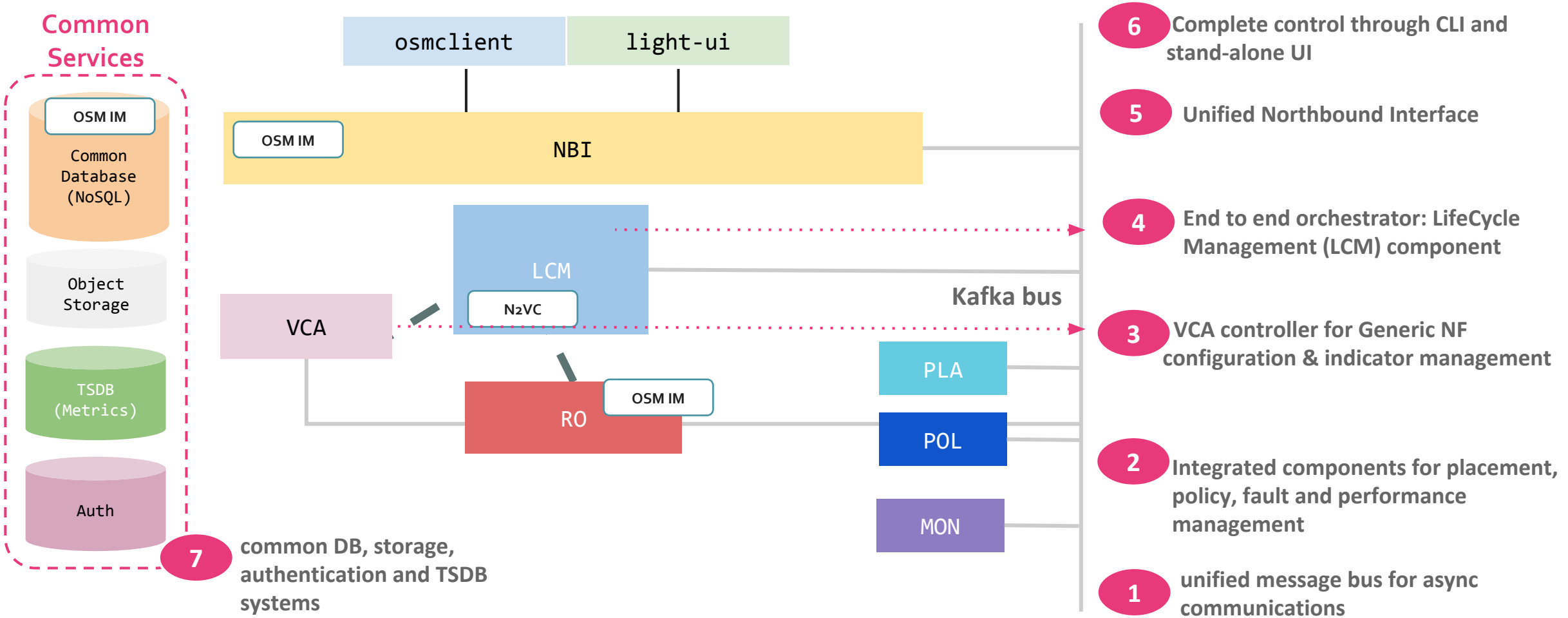
Gianpietro Lavado (Whitestack)
Cyndi Alarcón (Whitestack)
Francisco Rodriguez (Indra)

ETSI

Open Source MANO

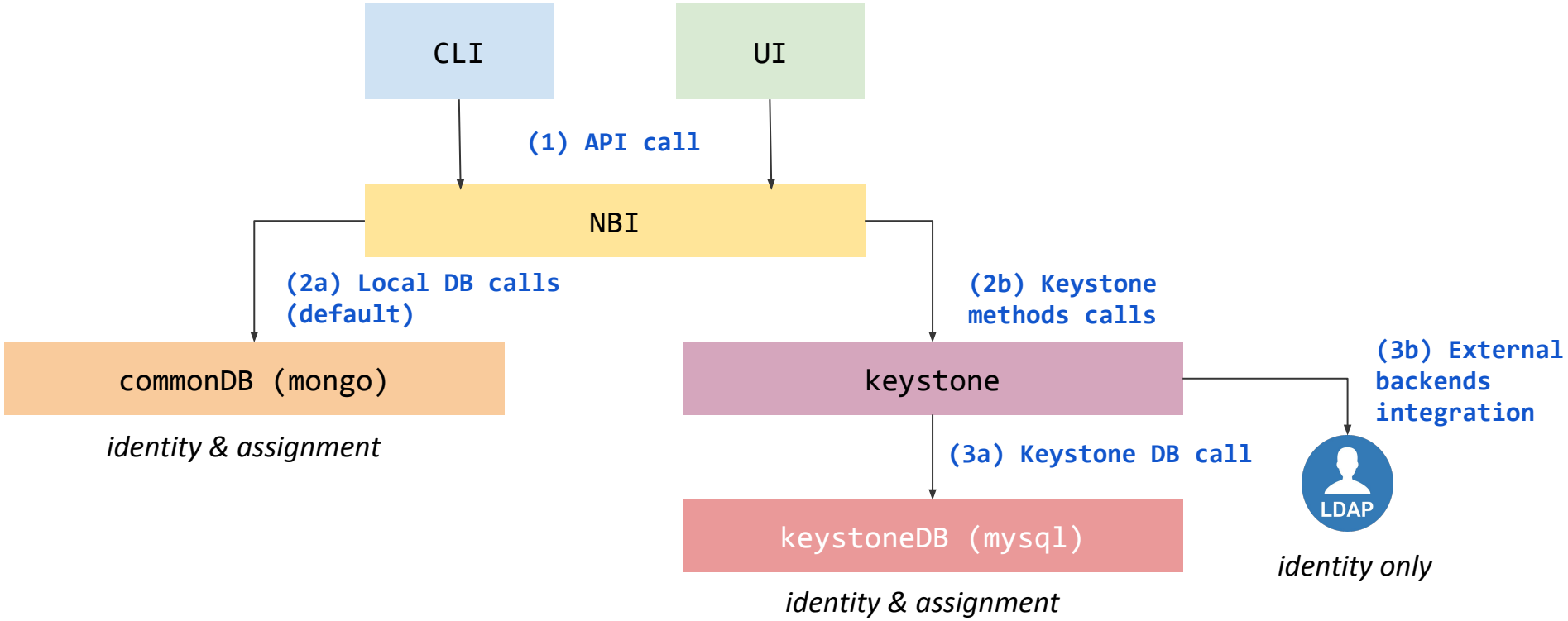
OSM Architecture Review

OSM Architecture overview



Identity & Assignment Operations

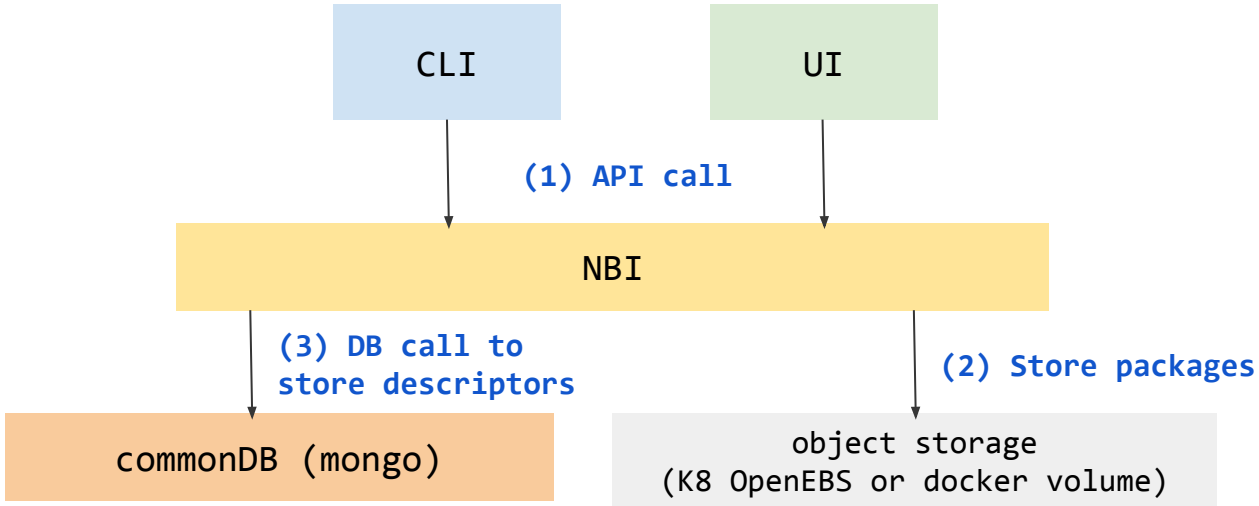
When dealing with the creation, modification or deletion of users, projects and roles, the interacting components vary according to the selected backend.



Uploading Packages

When reading, uploading, modifying and deleting a Network Slice Template, Network Service Package or VNF Package, the following components interact.

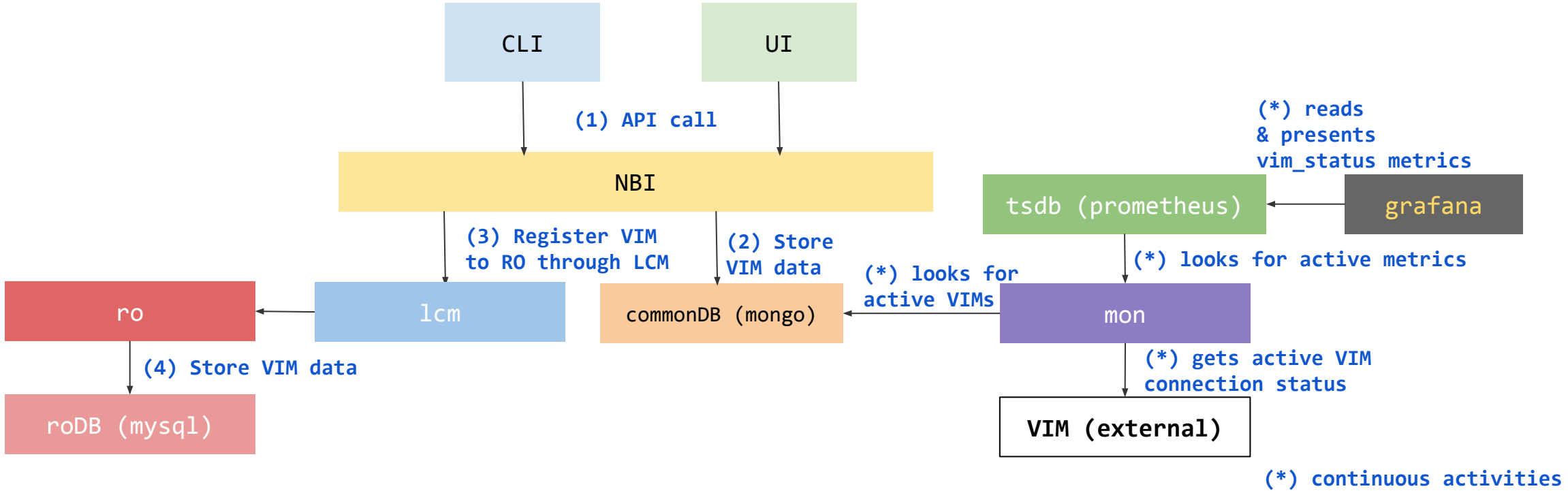
CLI Example: osm vnfpkg-create myvnfpackage.tar.gz



Adding VIM/SDNC Sessions

When registering new sessions with VIMs or SDN Controllers, the following components interact.

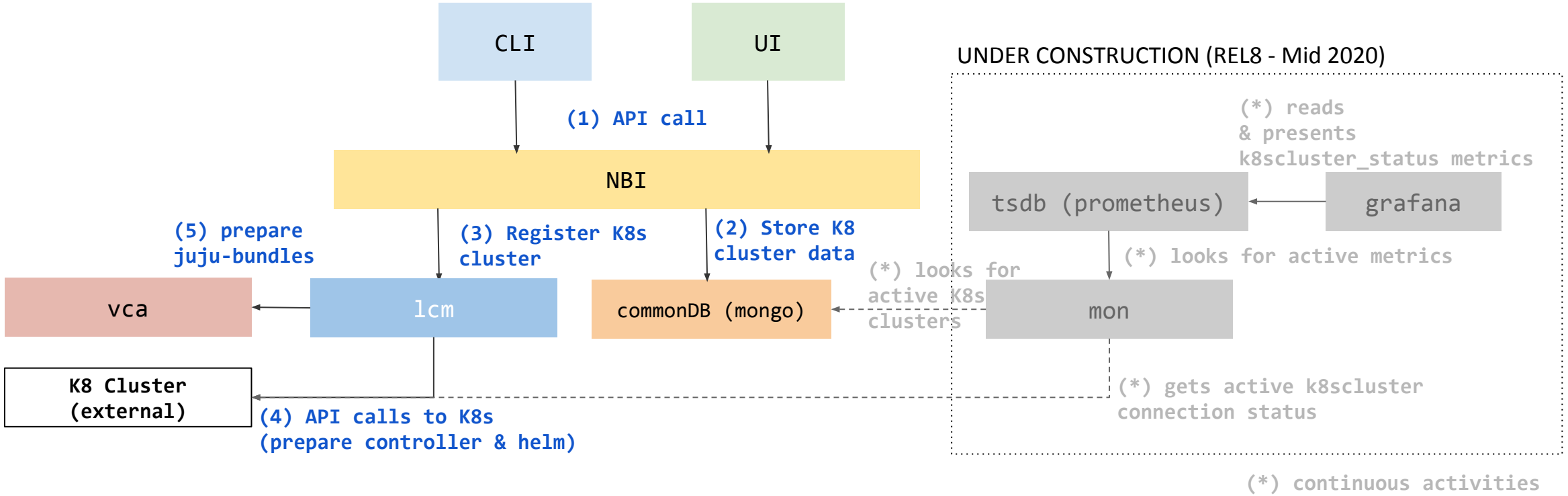
CLI Example: osm vim-create --name myVIM --user myuser --password myprecious --auth_url http://172.21.7.5:5000/v3 --tenant mytenant --account_type openstack



Adding a K8 Cluster

When registering new sessions with Kubernetes clusters, the following components interact.

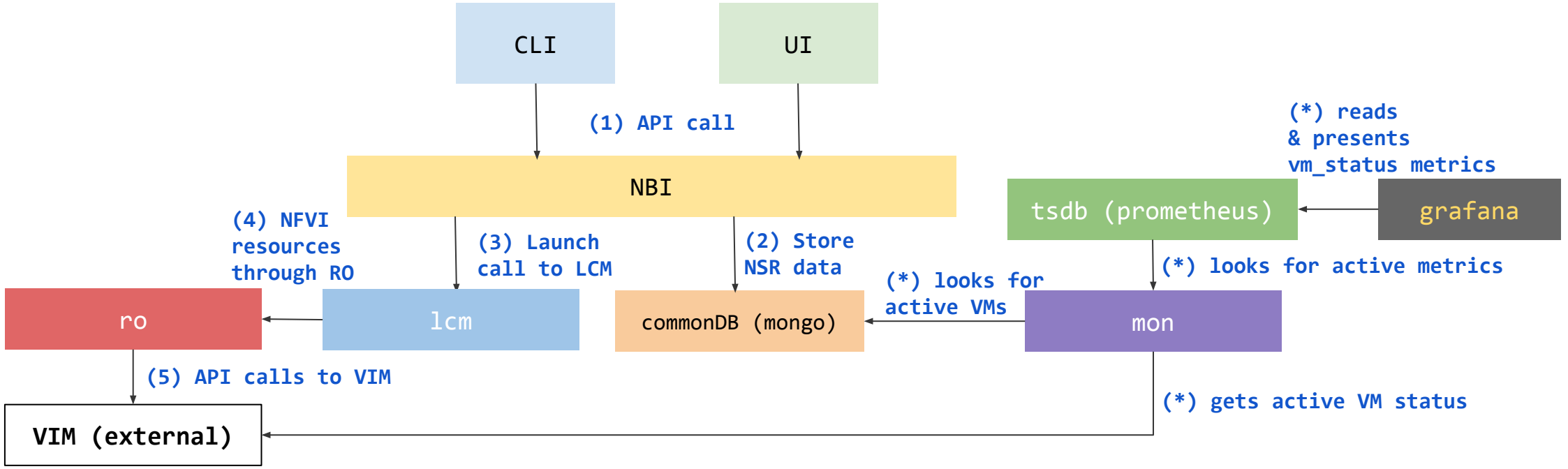
CLI Example: osm k8scluster-add --creds myCredentials.yaml --version '1.15' --vim myVIM --description "My K8s cluster" --k8s-nets '{"net1": "myVIMnet"}' myK8Cluster



VNF Instantiation

When launching a new instance of a Network Service or Slice Instance (n x VNFs), the following components interact.

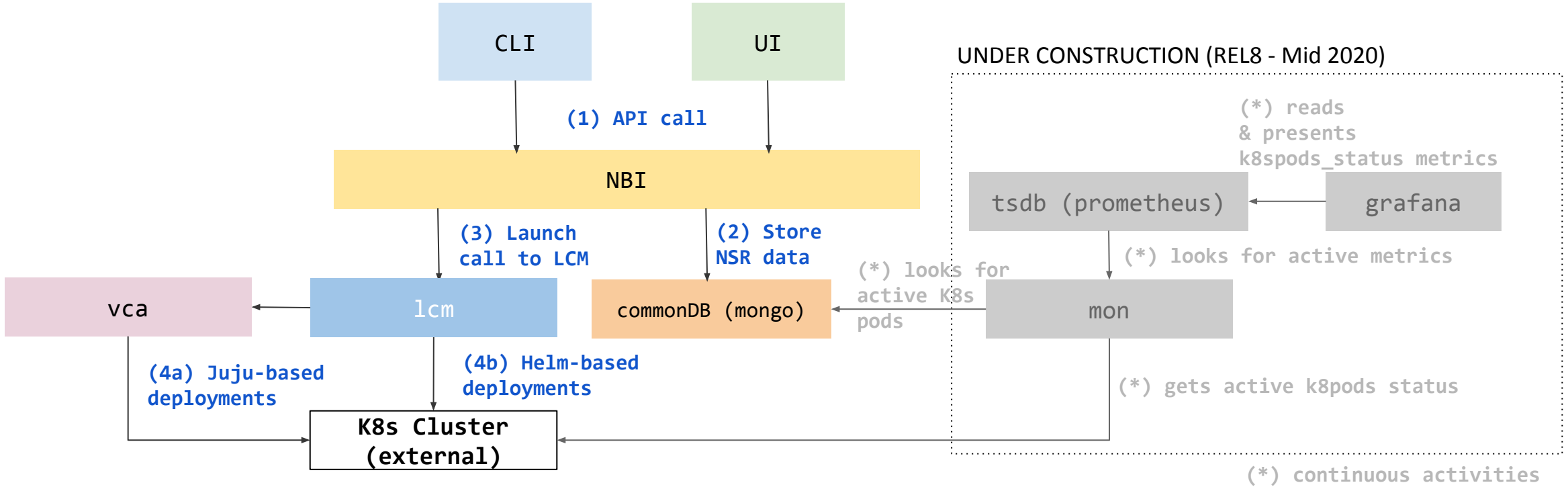
CLI Example: osm ns-create --ns_name myNS --nsd_name myNSD --vim_account myVIM



KNF Instantiation

When launching a new instance of a Network Service or Slice Instance (n x VNFs), the following components interact.

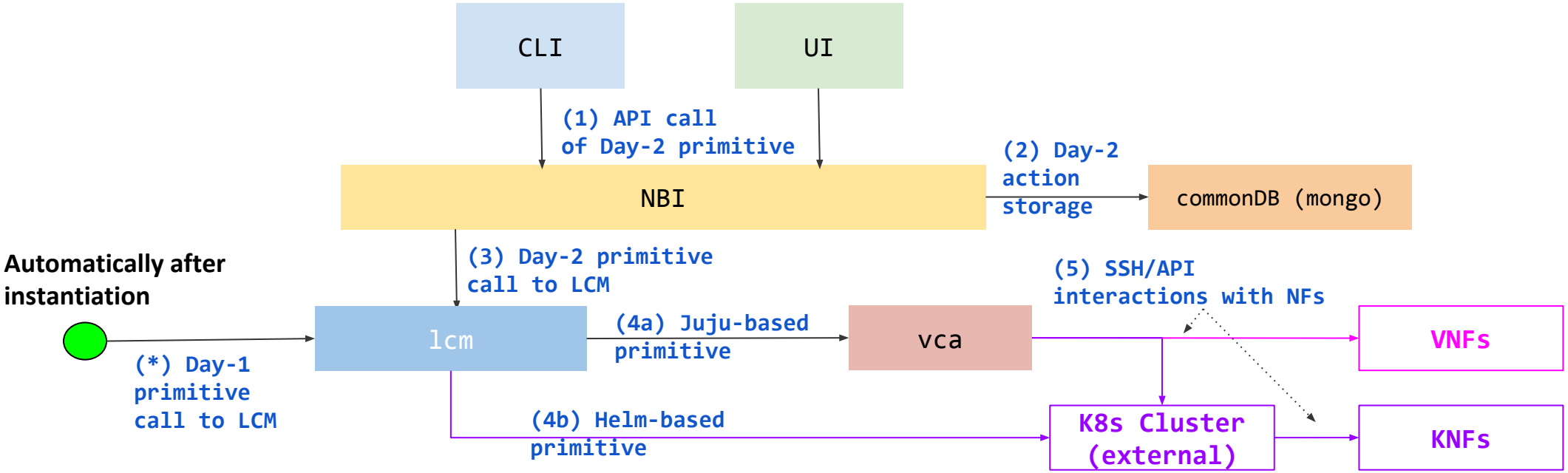
CLI Example: osm ns-create --ns_name myNS --nsd_name myNSD --vim_account myVIM



Instantiating with Primitives

When launching a new instance of a Network Service or Slice Instance (n x VNFs), with Day-1/2 automation, direct interaction with the NF is needed, so the following components interact.

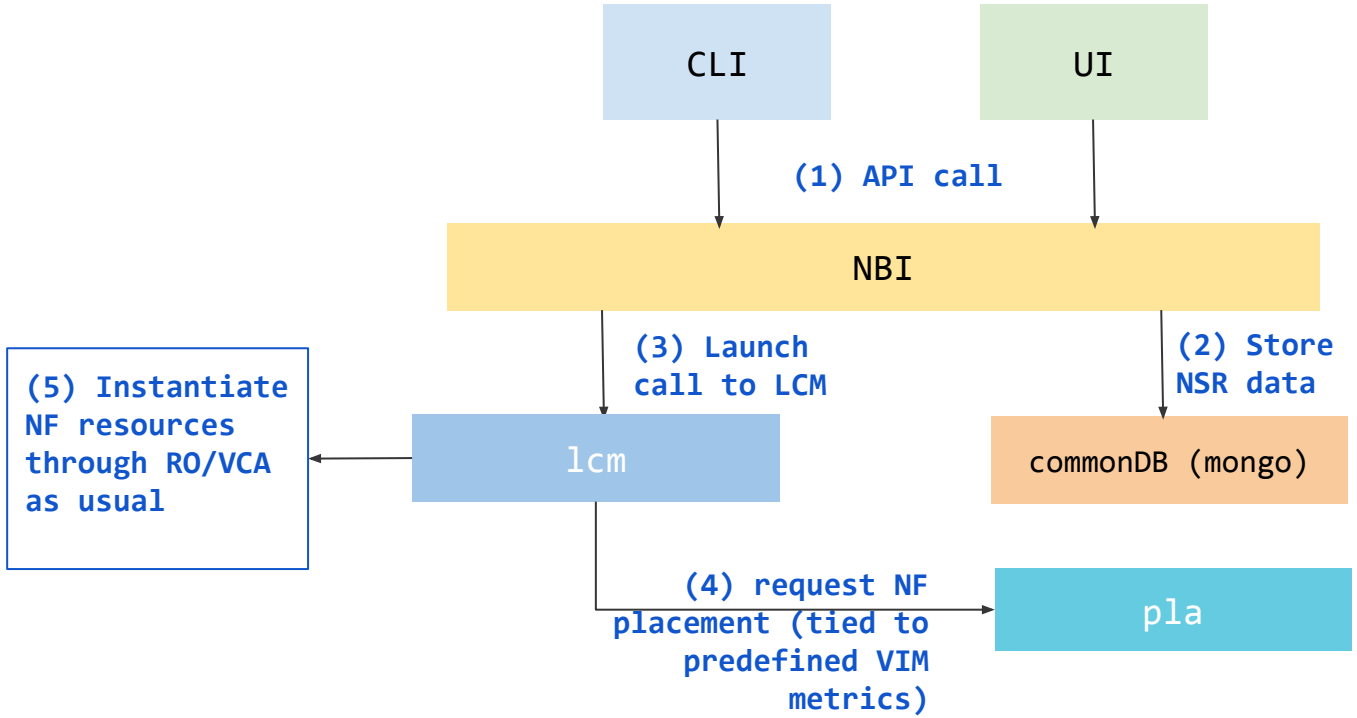
CLI Example of Day-2 primitive: osm ns-action myNS --vnf_name 1 --action_name myAction



Instantiating with Placement

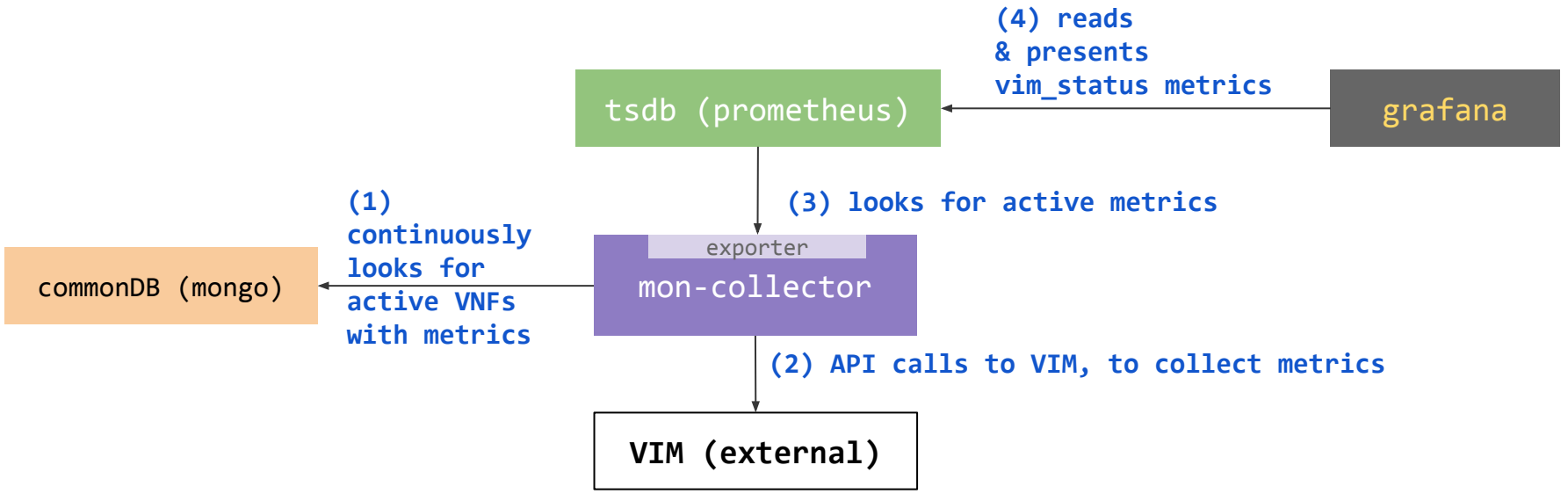
When launching a new instance of a Network Service or Slice Instance (n x VNFs), with placement support, the following components interact.

CLI Example: osm ns-create --ns_name myNS --nsd_name myNSD --vim_account myVIM --config '{placement-engine: PLA, placement-constraints: {…}}'



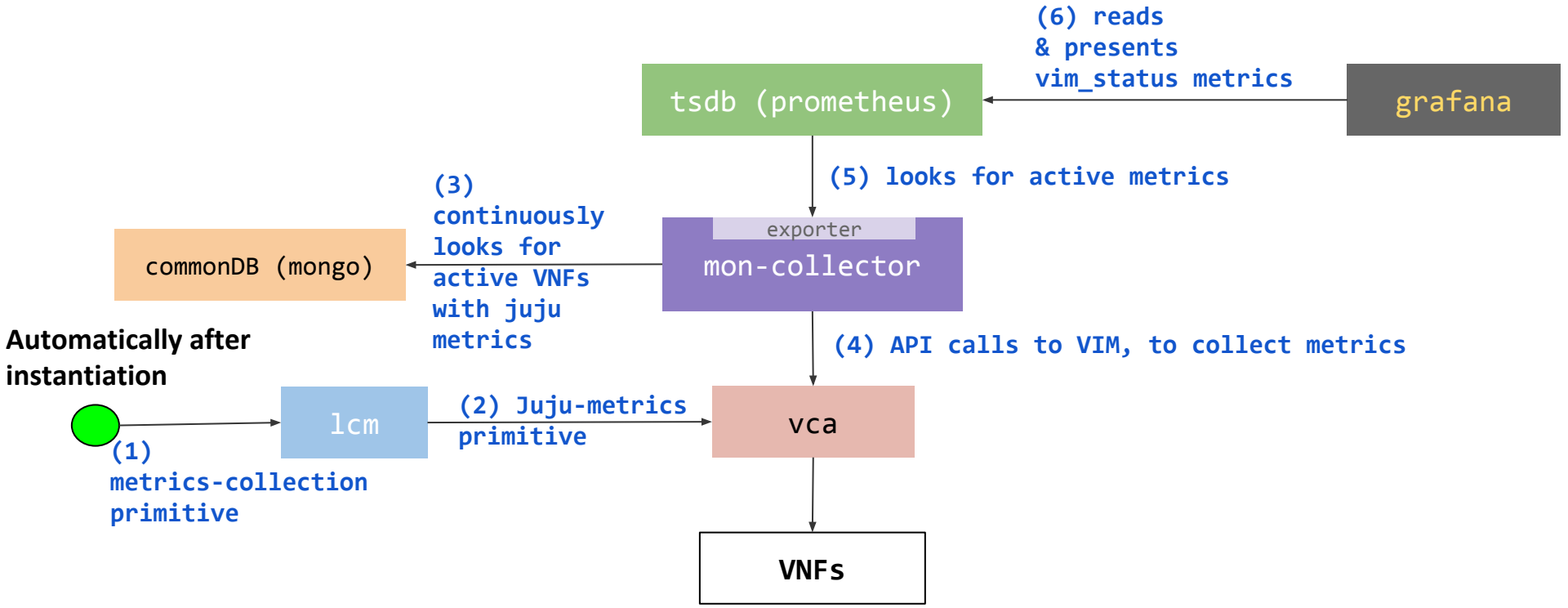
Collecting VNF Metrics (NFVI)

When launching a new instance of a Network Service or Slice Instance (n x VNFs) which is described with the collection of VNF Metrics that come from infrastructure (NFVI), the following components interact.



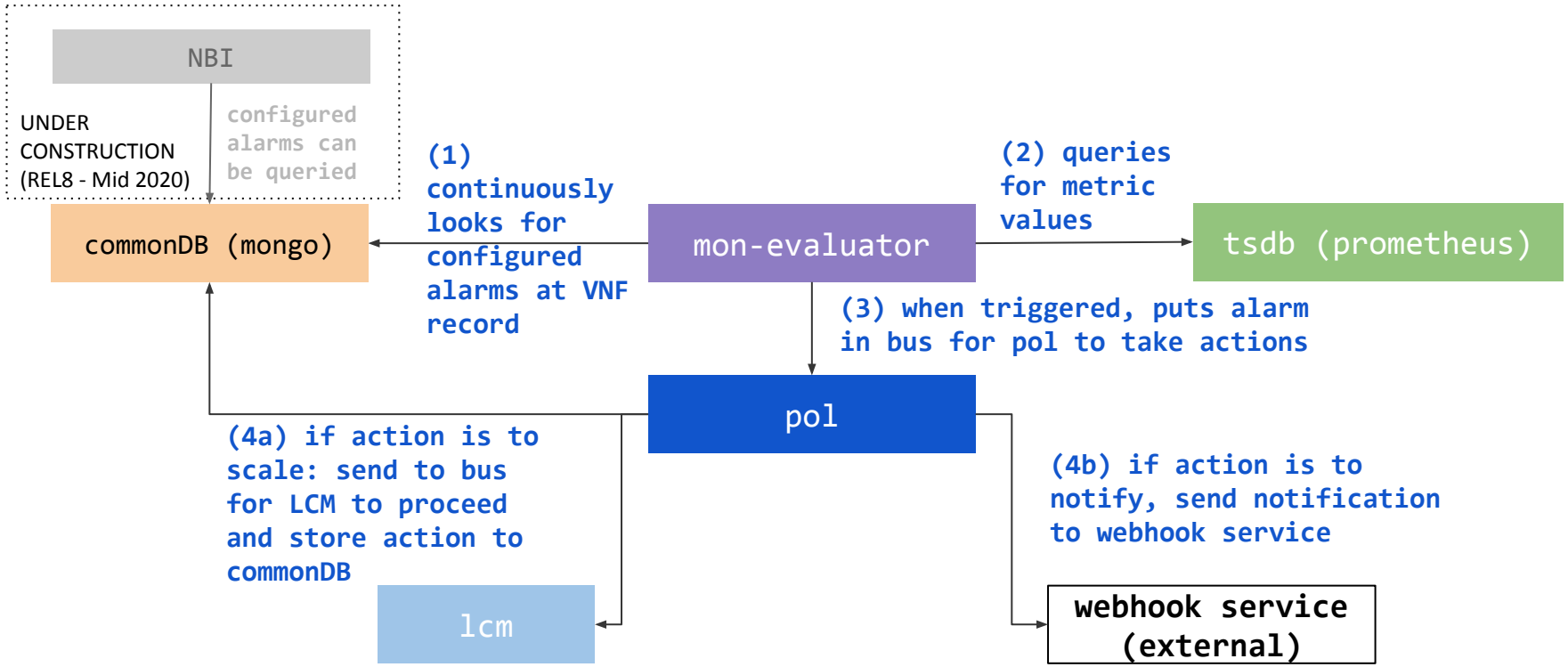
Collecting VNF Metrics (VNF)

When launching a new instance of a Network Service or Slice Instance (n x VNFs) which is described with the collection of VNF Metrics that come from the VNF itself, the following components interact.



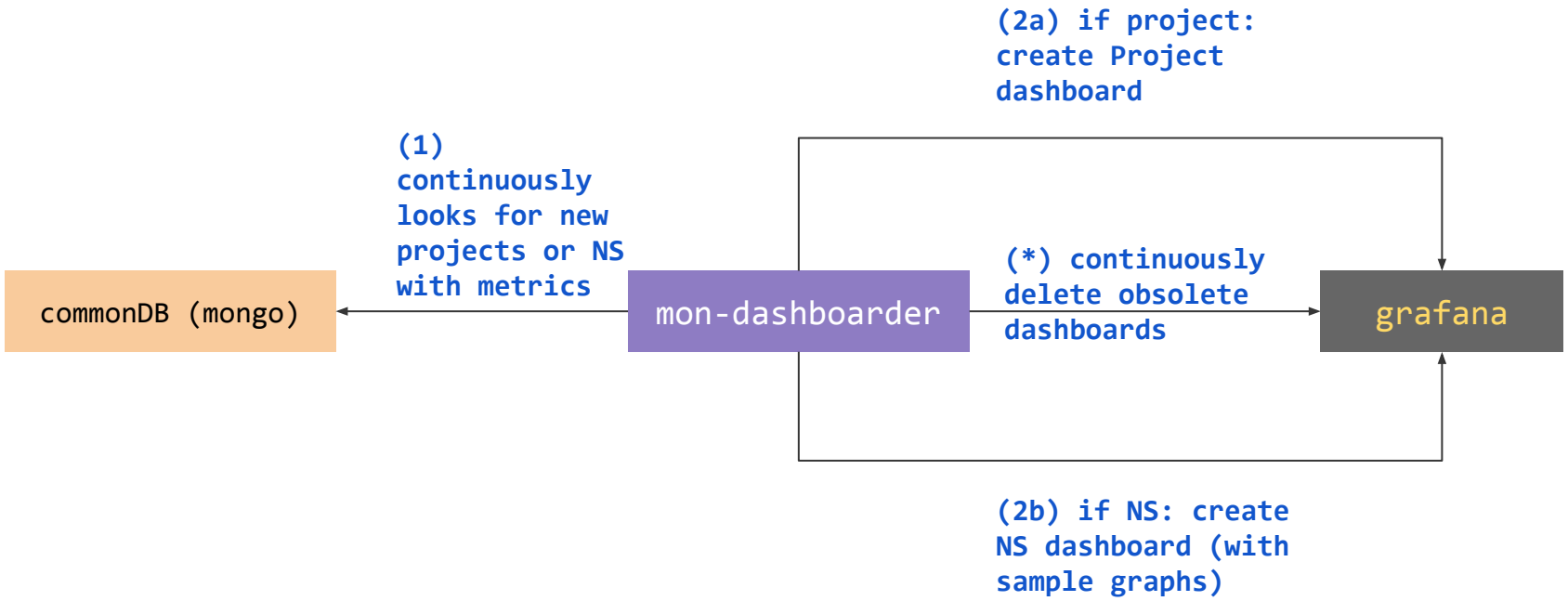
Alarms & AutoScaling

When configuring alarms associated to scaling actions or just webhook notifications (through the VNFD), the following components interact.



Automatic Dashboards

When creating Projects or Network Services, Grafana dashboards are created automatically and the following elements interact.

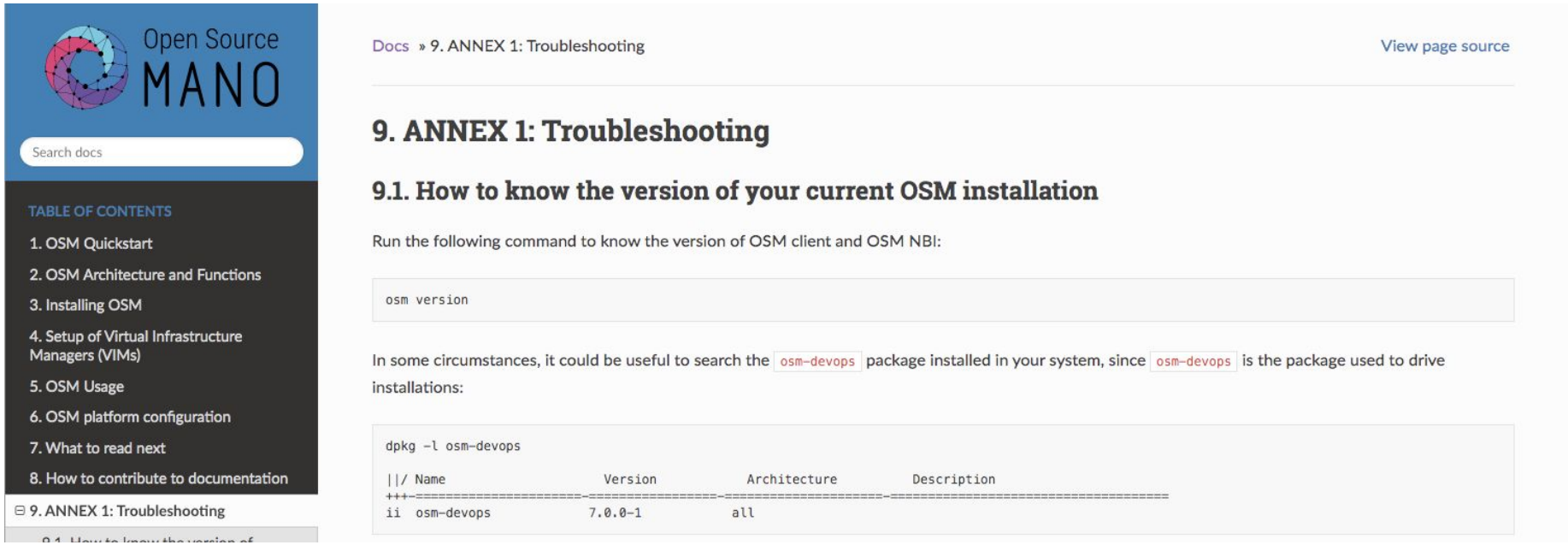


Troubleshooting OSM

A general approach for OSM Troubleshooting is to first look for error messages in “show” commands, as in:

```
osm ns-show [ns]
osm vim-show [vim]
```

Besides that, knowing which components interact for each operation, you can troubleshoot by looking at the logs of each component. All troubleshooting tips are being documented in the user guide, here:
https://osm.etsi.org/docs/user-guide/09-troubleshooting.html



Open Source MANO

OSM Installation methods

OSM Installation methods

1. OSM can be installed in a single server or VM with the following requirements:

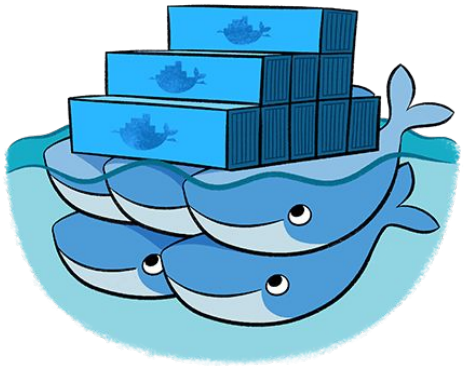
	CPU	RAM	DISK	NIC	Internet	SO
MINIMUM	2	4GB	20GB	1	Yes	Ubuntu18.04 (64-bit variant required)
RECOMMENDED	2	8GB	80GB	1	Yes	Ubuntu18.04 (64-bit variant required)

2. Once you have prepared the host with the previous requirements, all you need to do is:

```
wget https://osm-download.etsi.org/ftp/osm-7.0-seven/install_osm.sh
chmod +x install_osm.sh
```

OSM Installation methods

OSM R7 can be installed using these main options:



Docker Swarm

```
./install_osm.sh
```

kubernetes

```
./install_osm.sh -c k8s
```

```
./install_osm.sh -c charmed
```

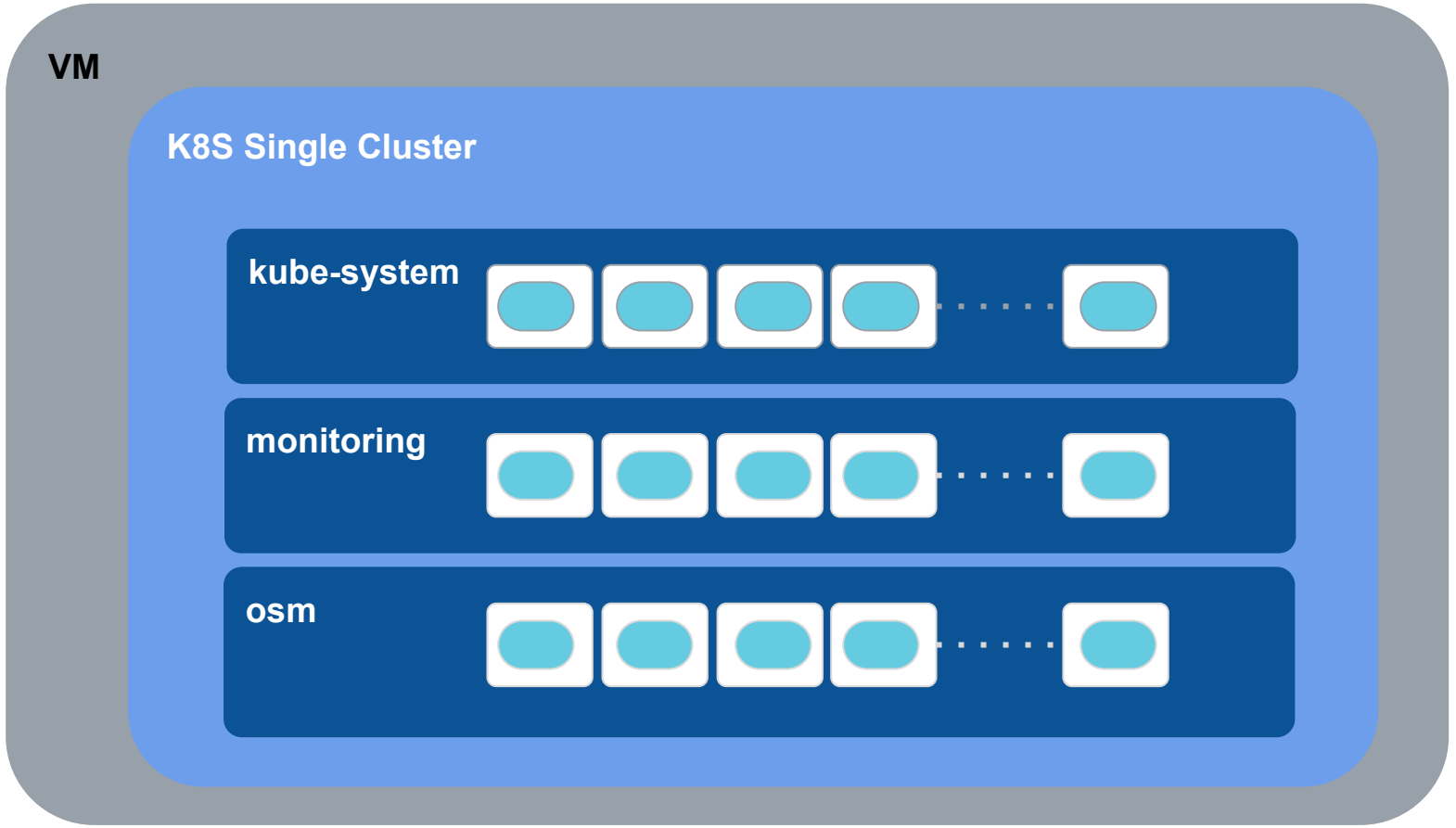
For more information go to https://osm.etsi.org/docs/user-guide/01-quickstart.html#installing-osm

Open Source MANO

Hands-on: OSM Installation over Kubernetes

Hands-on: OSM Installation over Kubernetes

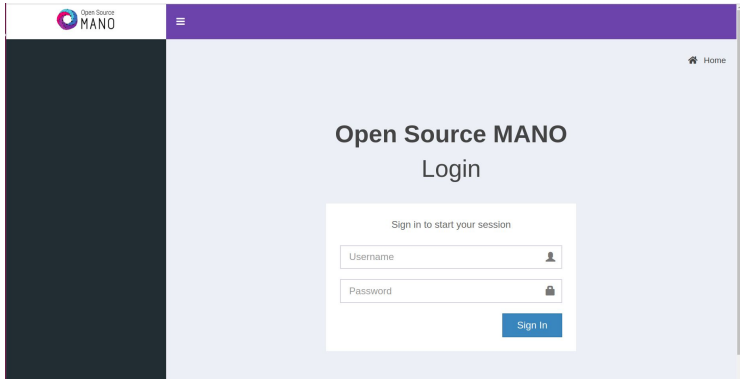
Scenario



Where:

- Namespace
- Pod
- Container

OSM GUI



Hands-on: OSM Installation over Kubernetes

1. Take a tenant from http://bit.ly/OSMHF

2. Check the IP of your VM at http://172.21.247.1/project/instances/, then access it through SSH
   user: ubuntu
   Password: osm4u

3. Now, let's follow the user-guide at:
   https://osm.etsi.org/docs/user-guide/01-quickstart.html#installing-osm

```
wget https://osm-download.etsi.org/ftp/osm-7.0-seven/install_osm.sh
```

4. Make the installer executable

```
chmod +x install_osm.sh
```

Hands-on: OSM Installation over Kubernetes

5. Run the installer with -c k8s flag

```
./install_osm.sh -c k8s
```

6. You will be asked to confirm the installation of the following components:

```
The installation will do the following
        1. Install and configure LXD
        2. Install juju
        3. Install docker CE
        4. Disable swap space
        5. Install and initialize Kubernetes
        as pre-requirements.
        Do you want to proceed (Y/n)? Y
```

Hands-on: OSM Installation over Kubernetes

Open Source MANO

7. When installation is finished, execute the following commands to check k8s installation:

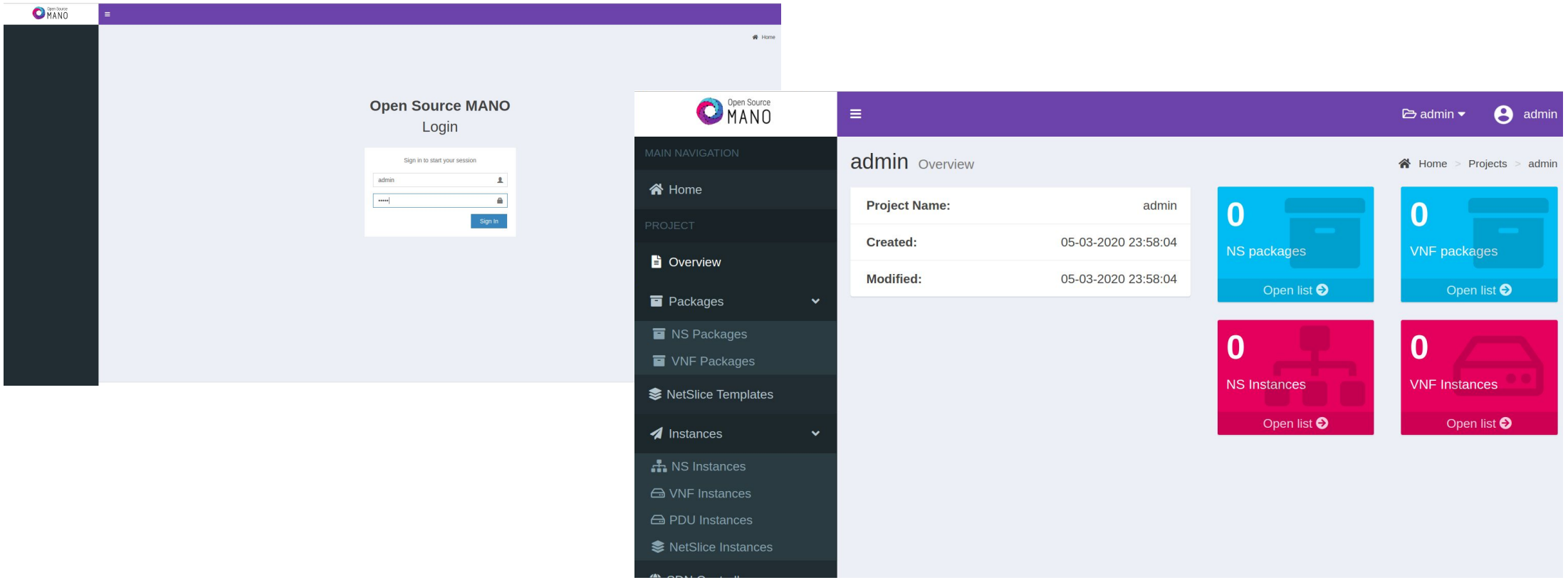
```
kubectl get nodes
kubectl get namespaces
kubectl get pods --all-namespaces
kubectl get all -n kube-system
kubectl get all -n osm
kubectl describe pod light-ui-xyz -n osm
```

8. Test the OSM client:

```
osm --help
osm user-list
```

Hands-on: OSM Installation over Kubernetes

9. Go to OSM GUI at http://<VM-IP> and access with admin/admin



Open Source MANO

Hands-on: OSM System Monitoring

Do not do this yet

The usual way to go

```
./install_osm.sh -c k8s --k8s_monitor
```

Access dashboard: `http://<osm-host>:3000`

Kubernetes health

OSM component status

OSM component resource consumption

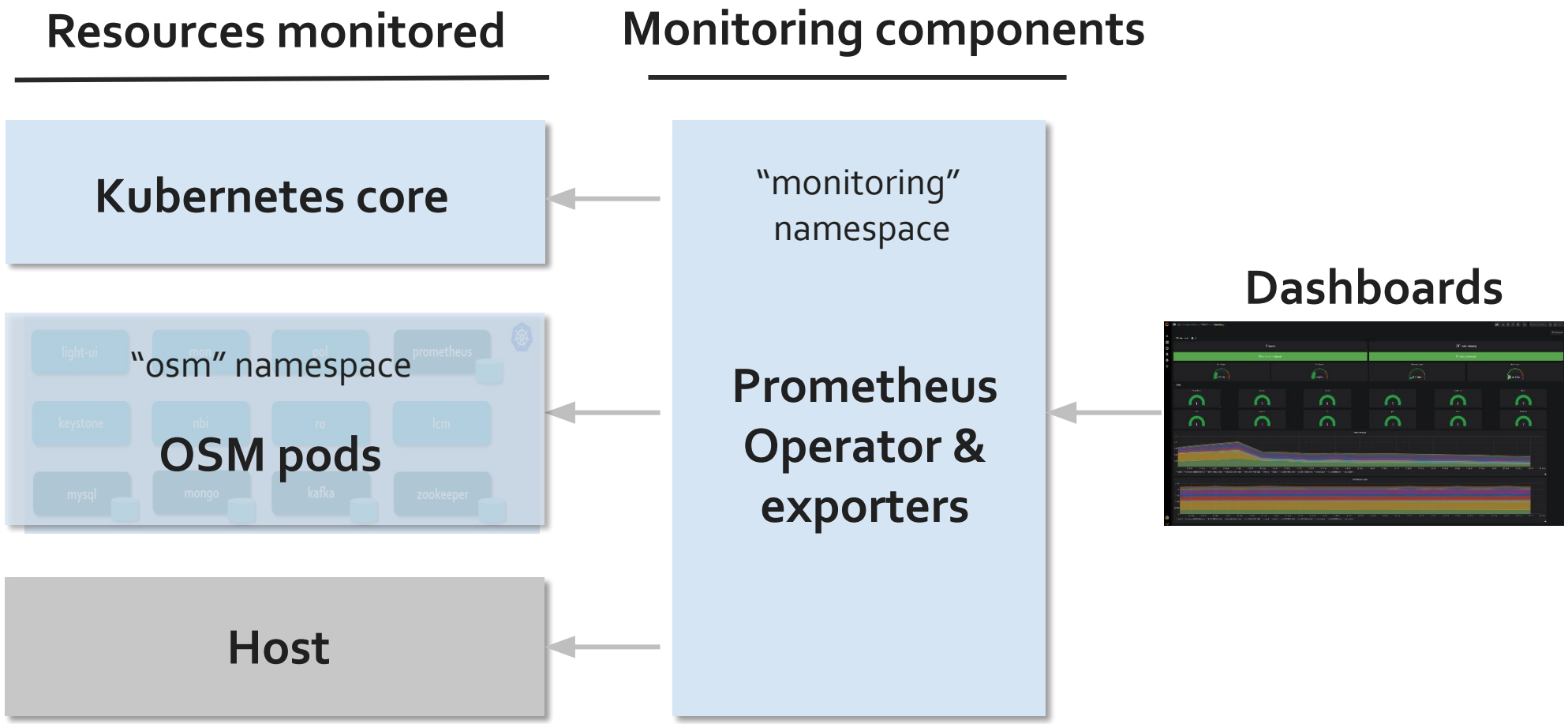
Getting the latest release candidate

- Note1 : We are assuming you did not include the switch “–k8s_monitor” in the previous installation. Otherwise please do now installers/uninstall-k8s-monitoring.sh after step 2
- Note 2: We are assuming you used the switch “-c k8s”

STEPS

1. `git clone "https://osm.etsi.org/gerrit/osm/devops"`
2. `cd ~/devops/`
3. `git pull "https://osm.etsi.org/gerrit/osm/devops" refs/changes/72/8372/10`
4. `cd ~/devops/installers/`
5. `./full_install_osm.sh -o k8s_monitor -D $HOME/devops`

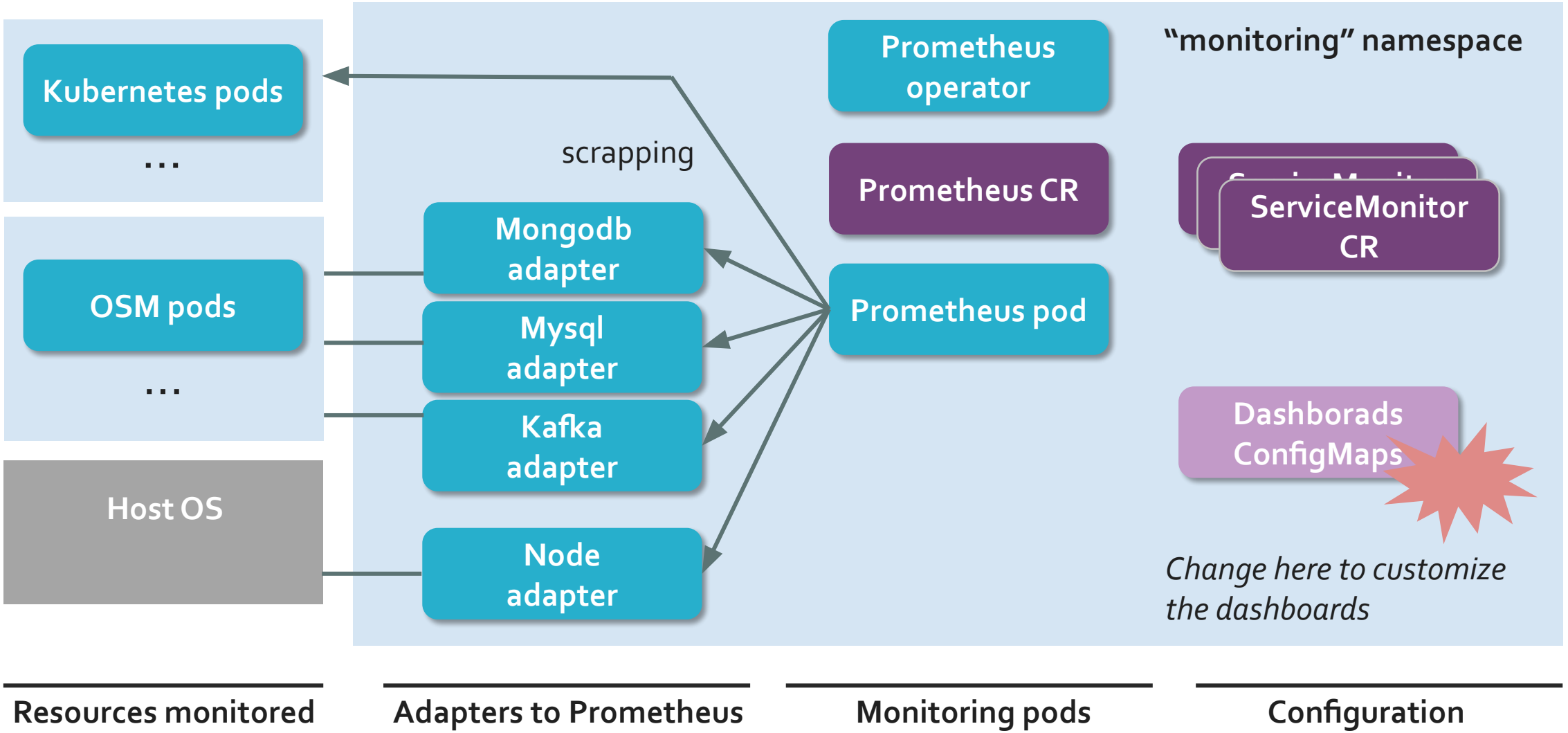
What is installed



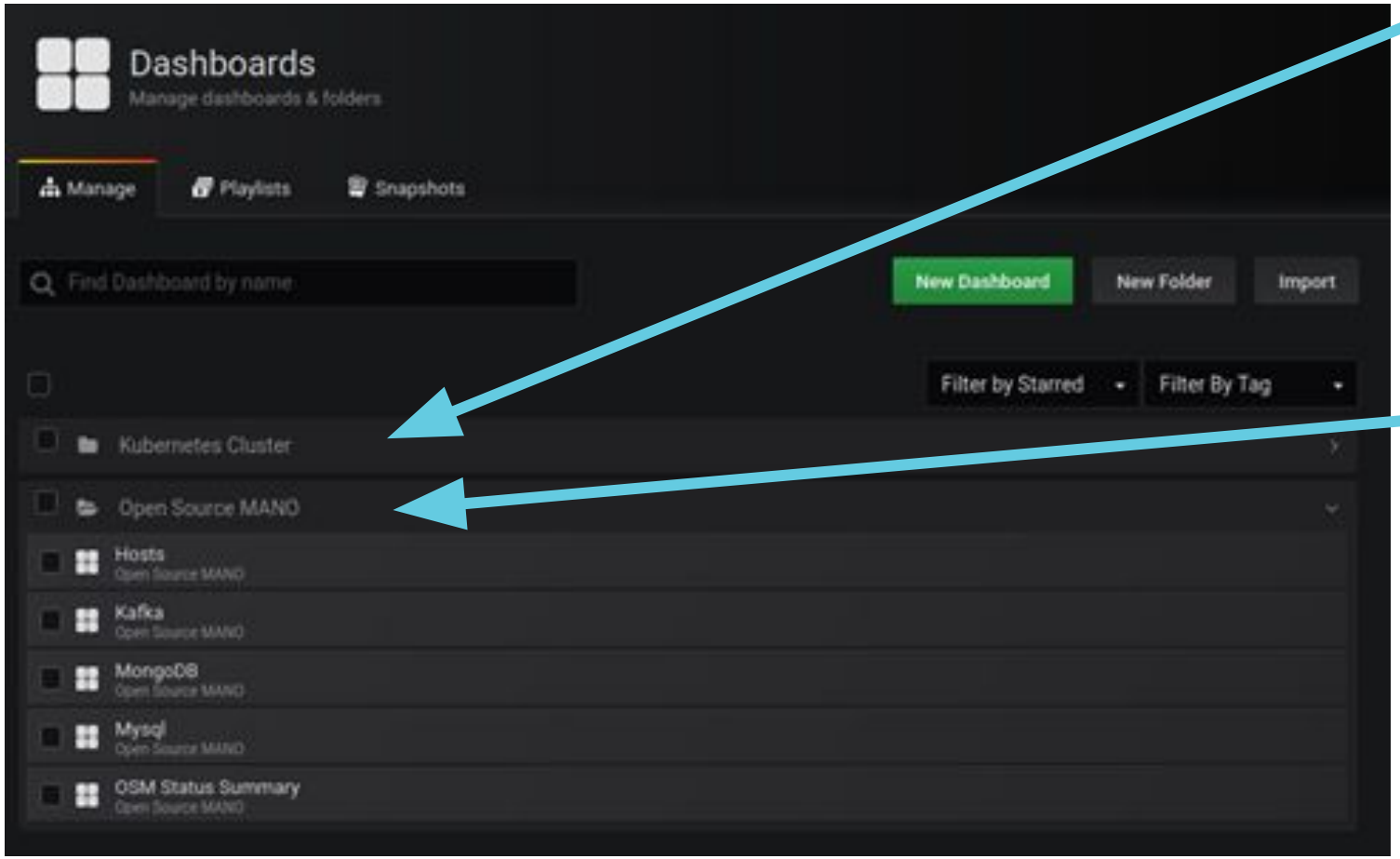
Monitoring OSM

- Available in the k8s deployment of OSM.
- There is a similar feature for the docker swarm (classic) deployment of OSM (not to be discussed here)
- Aimed at monitoring OSM infrastructure, NOT the VNF/NS deployed
- Implementation based on Prometheus operator (Helm chart), plus some Prometheus exporters (node, Kafka, mysql, mongodb), in “monitoring” namespace

More implementation details



http://ip-address>:3001 (admin:prom-operator)

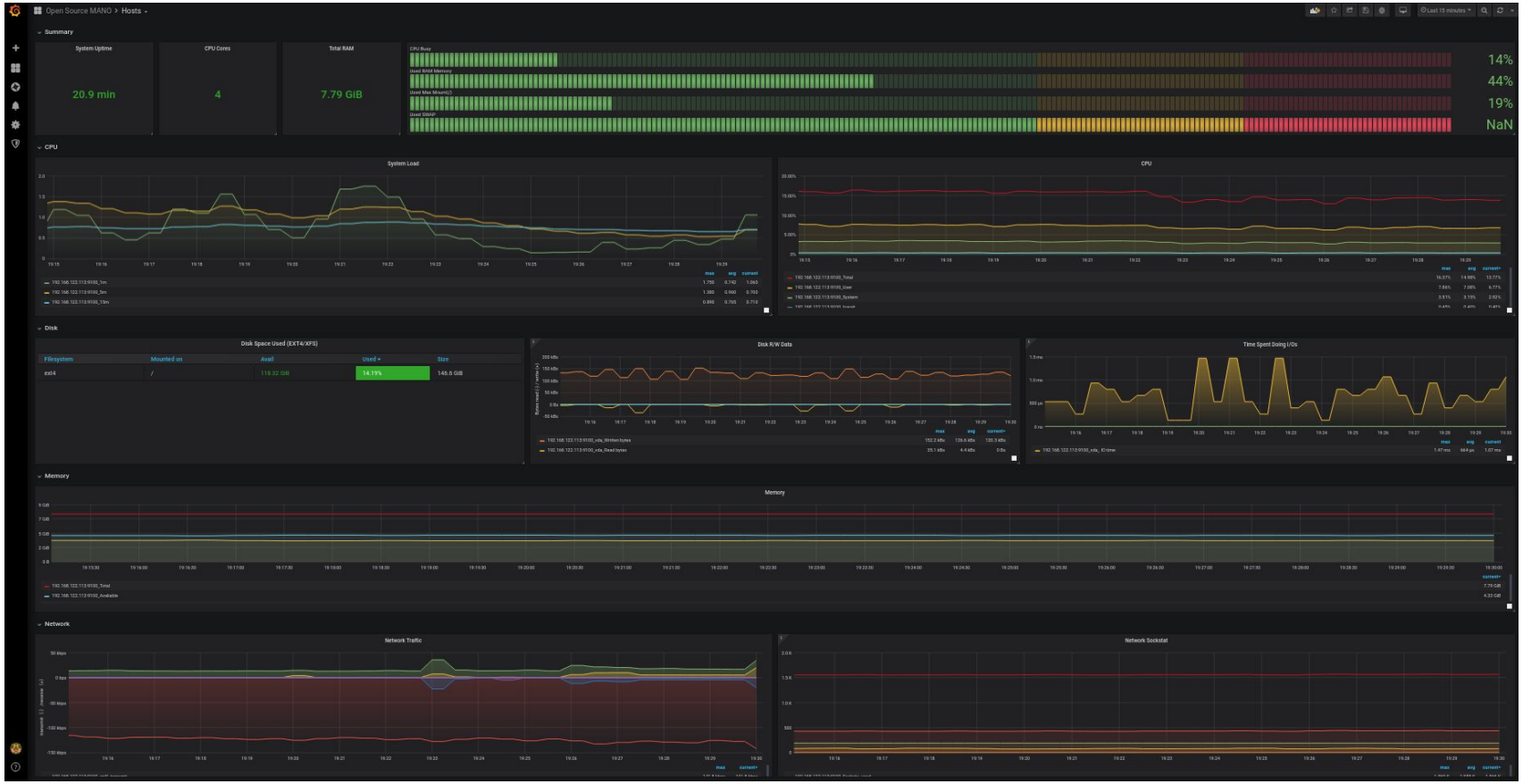


- *Kubernetes cluster* upstream dashboards in Prometheus operator helm chart
- *Open Source MANO* Specific dashboards for OSM
  - OSM Status summary
  - Hosts
  - Kafka, mongodb, mysql

OSM Status summary

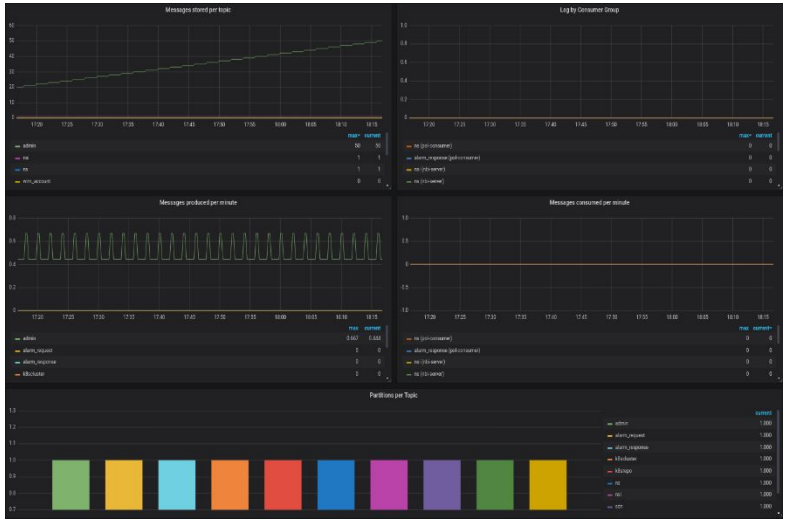
- Failed pods / Failed nodes (if any)
- K8s resources requested
- OSM components status (up/down)
- CPU/Memory per OSM component

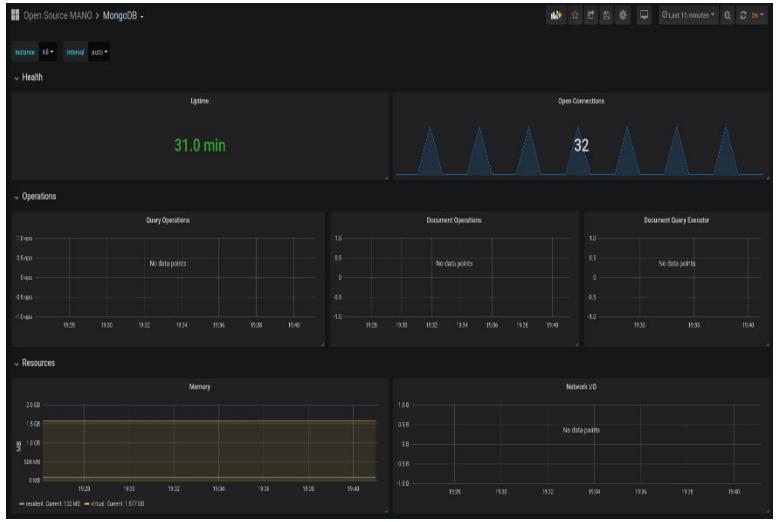
Hosts status

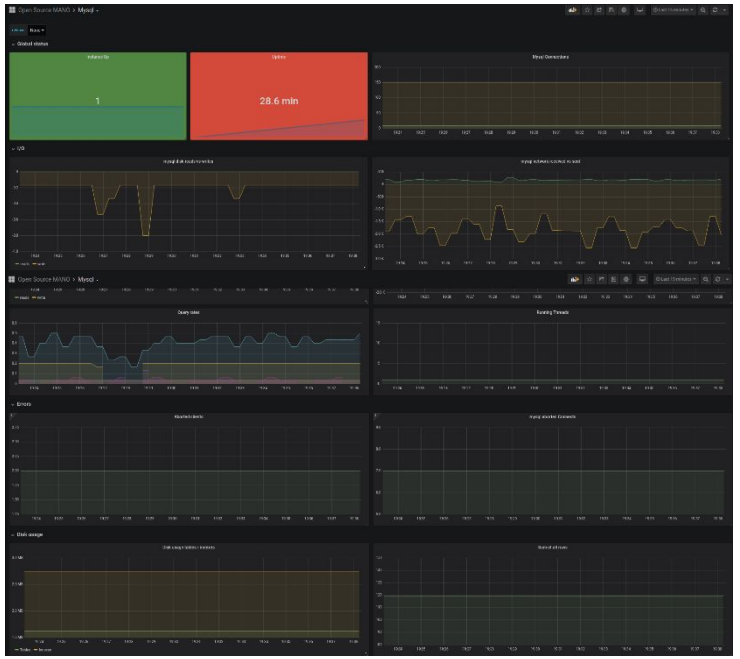


- Summary (uptime, used memory, CPU, disk)
- CPU usage
- Disk usage
- Memory usage
- Network usage

Mongo, mysql and Kafka dashboards







Kafka
Messages produced/consumed
Lag by consumer group
Partitions per topic

Mongodb
Connections
Document operation stats
Network operations

Mysql
Connections
Disk occupation (indexes, tables)
Network operations

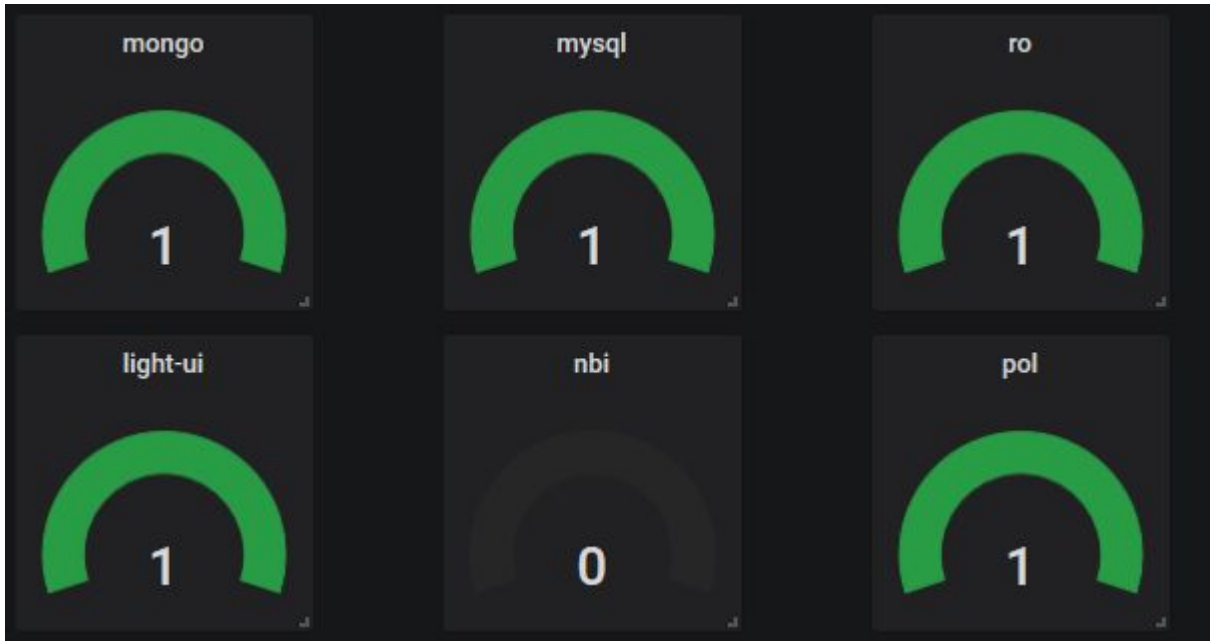
Inspecting the “monitoring” namespace

- See all the objects deployed in the monitoring namespace
  - `kubectl --namespace monitoring get all`
- In particular, the dashboards are stored as configmaps
  - `kubectl --namespace monitoring get configmap`
- Servicemonitors specify what is to be scrapped by Prometheus
  - `kubectl --namepsace monitoring get servicemonitor`

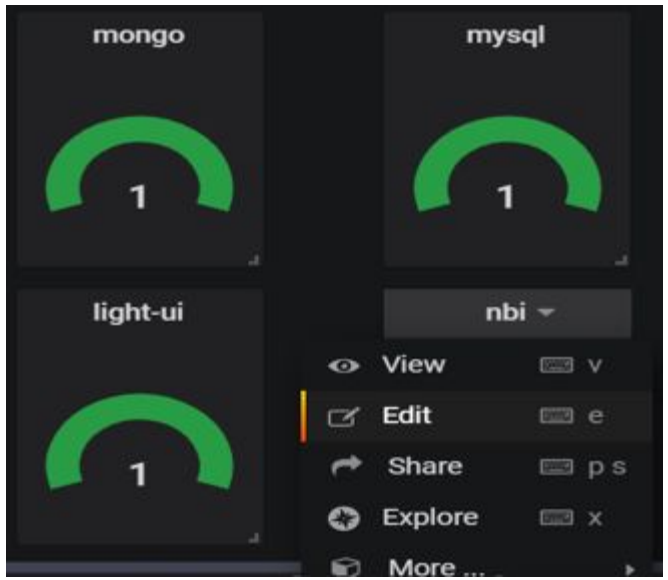
Let’s play a little

Force no pods running nbi

```
kubectl scale --namespace osm --replicas=0
deployment/nbi
```



We are going to improve the dashboard



Go to Edit ->Visualization

Coloring: Activate “value”

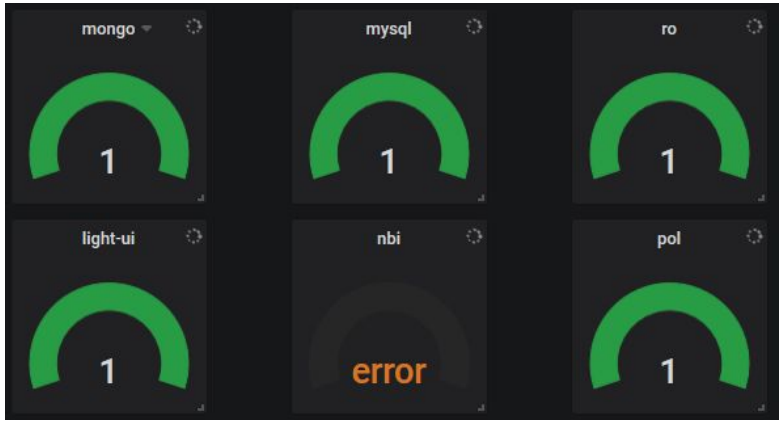
Gauge: Deactivate “show”

Value Mappings: Set value mappings

null -> error

0 -> error

1 -> ok



And make the change persistent

- Get the summary dashboard configmap definition to your computer

  `scp ubuntu@<ip-addr>:/home/ubuntu/devops/installers/k8s/summary-dashboard.yaml .`

- In grafana, “export” → “json”, and copy in the data contents of the .yaml file defining the configmap
- Upload the modified file
  - `scp summary-dashboard.yaml ubuntu@<ip-addr>:/home/ubuntu/devops/installers/k8s`
- Update the dashboard
  - `kubectl -n monitoring apply -f summary-dashboard.yaml`

Open Source MANO

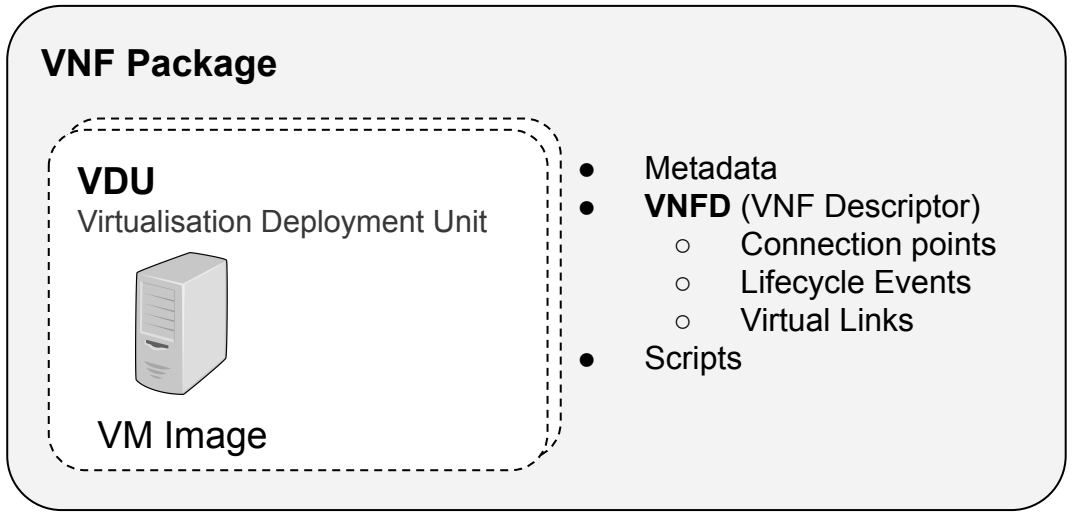
OSM Packages overview

What is a package in NFV?

Open Source MANO

Packages contain the information that orchestrators need to launch a network service.
The are basically two types of packages.

The VNF Package



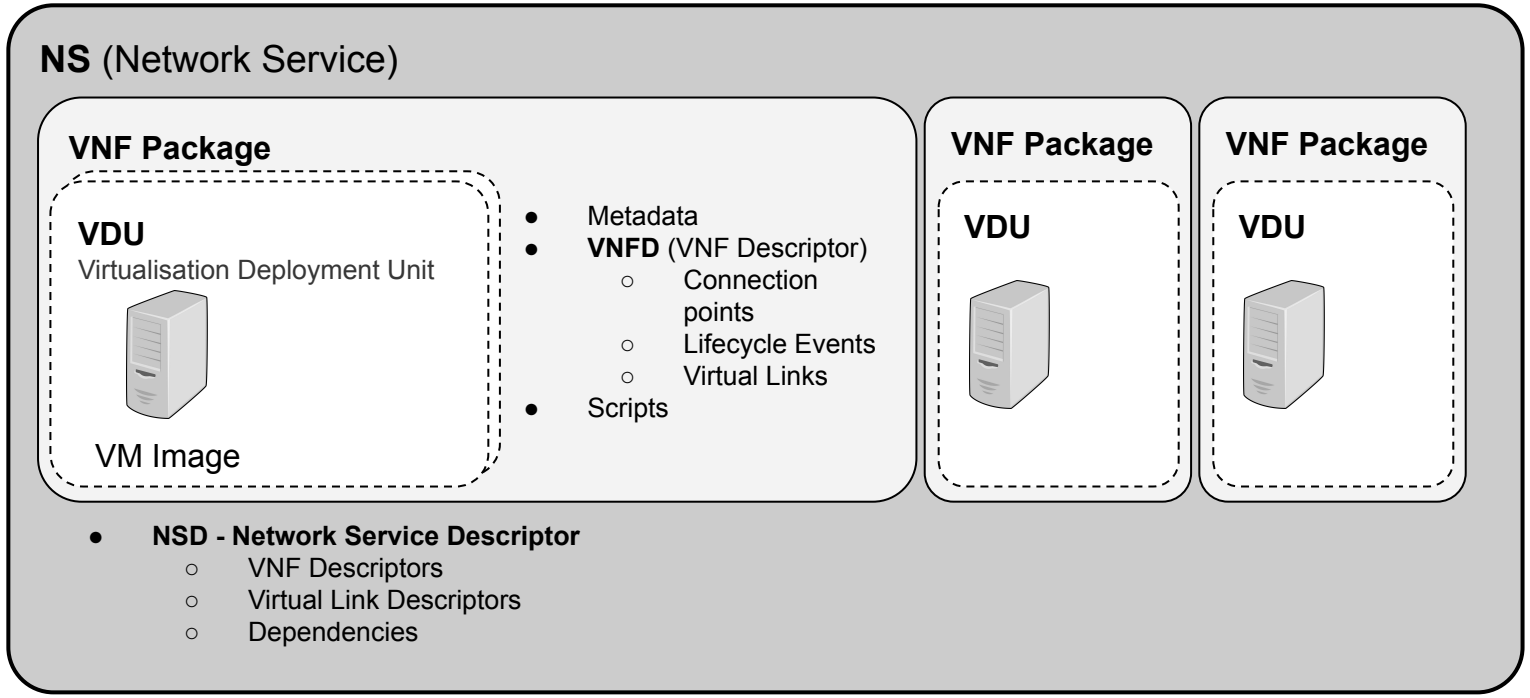
- It contains the characteristics of the VNF, for example:
  - The software image(s) it needs.
  - Compute resources.
  - Network connections between its components (Internal Virtual Links)
  - Performance requirements.
  - Automation scripts.
- Its main element is the VNF Descriptor (VNFD)
- It is built and provided by the VNF vendor.
- This applies in a similar way to new conceptual kinds of Network Functions (NFs), like a Physical NF (PNF), a Containerized NF (CNF), a Kubernetes-based NF (KNF), and Hybrid Network Package (HNF), etc.

What is a package in NFV?

Open Source MANO

Packages contain the information that orchestrators need to launch a network service.
The are basically two types of packages.

The Network Service Package

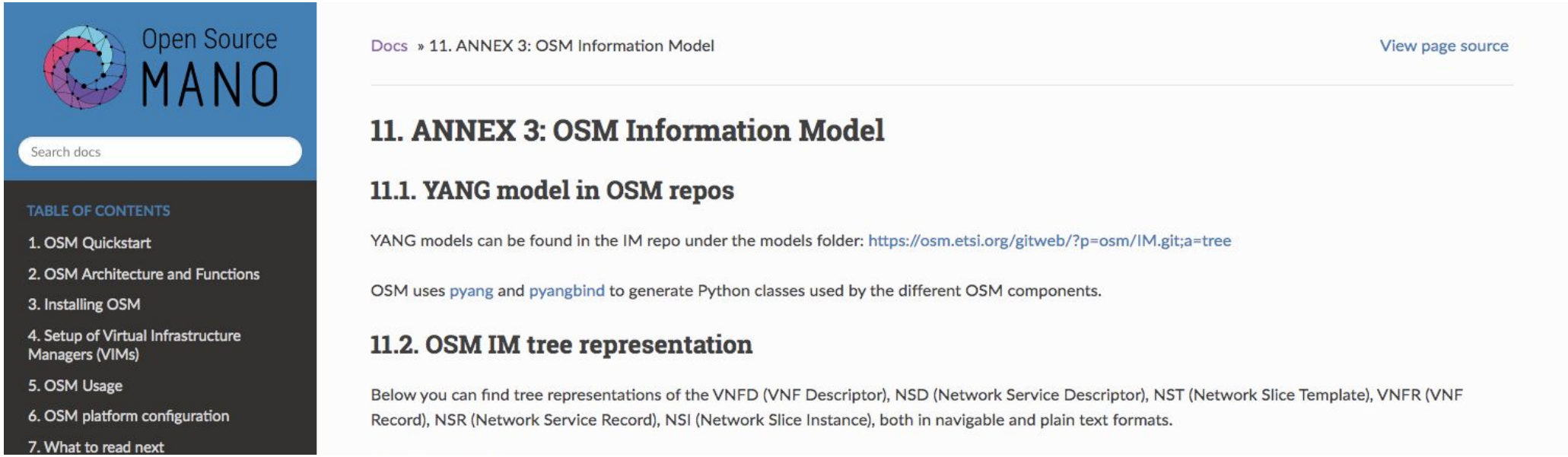


- It contains the characteristics of the Network Service, for example:
  - The VNF(s) it needs.
  - Network connections between VNFs (external Virtual Links)
- Its main element is the NS Descriptor (NSD)
- It is built by the operator from VNFs that conform the Network Service that needs to be provided.

Packages in OSM

Package descriptors in OSM are modeled in an increasing alignment to ETSI NFV standards (SOL006) Everything that can be put in a descriptor to model a VNF or NS, is present at OSM's Information Model, maybe the richest model of the NFV MANO industry.

Visit this link to navigate the model: https://osm.etsi.org/docs/user-guide/11-osm-im.html



Packages in OSM

The NS Package is the one actually being launched in OSM.
It requires constituent VNF Packages to be present in the system.

```
nsd:nsd-catalog:
    nsd:
    -   id: hackfest_basic-ns
        name: hackfest_basic-ns
        short-name: hackfest_basic-ns
        description: Simple NS with a single VNF and a single VL
        version: '1.0'
        logo: osm.png
        constituent-vnfd:
        -   vnfd-id-ref: hackfest_basic-vnf
            member-vnf-index: '1'
        vld:
        -   id: mgmtnet
            name: mgmtnet
            short-name: mgmtnet
            type: ELAN
            mgmt-network: 'true'
            vnfd-connection-point-ref:
            -   vnfd-id-ref: hackfest_basic-vnf
                member-vnf-index-ref: '1'
                vnfd-connection-point-ref: vnf-cp0
```

Network Service “hackfest_basic-ns”

It needs VNF “hackfest_basic-vnf” to be present

It will put the VNF in a new network called ‘mgmtnet’

Packages in OSM

The VNF Package is the one describing a given Network Function.
It requires VIM/NFVIs to support whatever characteristic is being required through its descriptor.

```
vnfd:vnfd-catalog:
    vnfd:
    -   id: hackfest_basic-vnf
        name: hackfest_basic-vnf
        short-name: hackfest_basic-vnf
        version: '1.0'
        description: A basic VNF descriptor w/ one VDU
        logo: osm.png
        connection-point:
        -   name: vnf-cp0
            type: VPORT
        vdu:
        -   id: hackfest_basic-VM
            name: hackfest_basic-VM
            image: ubuntu1604
            alternative-images:
            -   vim-type: aws
                image: ubuntu/images/hvm-ssd/ubuntu-artful-17.10-amd64-server-20180509
            count: '1'
            vm-flavor:
                vcpu-count: '1'
                memory-mb: '1024'
                storage-gb: '10'
            interface:
            -   name: vdu-eth0
                type: EXTERNAL
                virtual-interface:
                    type: PARAVIRT
                external-connection-point-ref: vnf-cp0
        mgmt-interface:
            cp: vnf-cp0
```

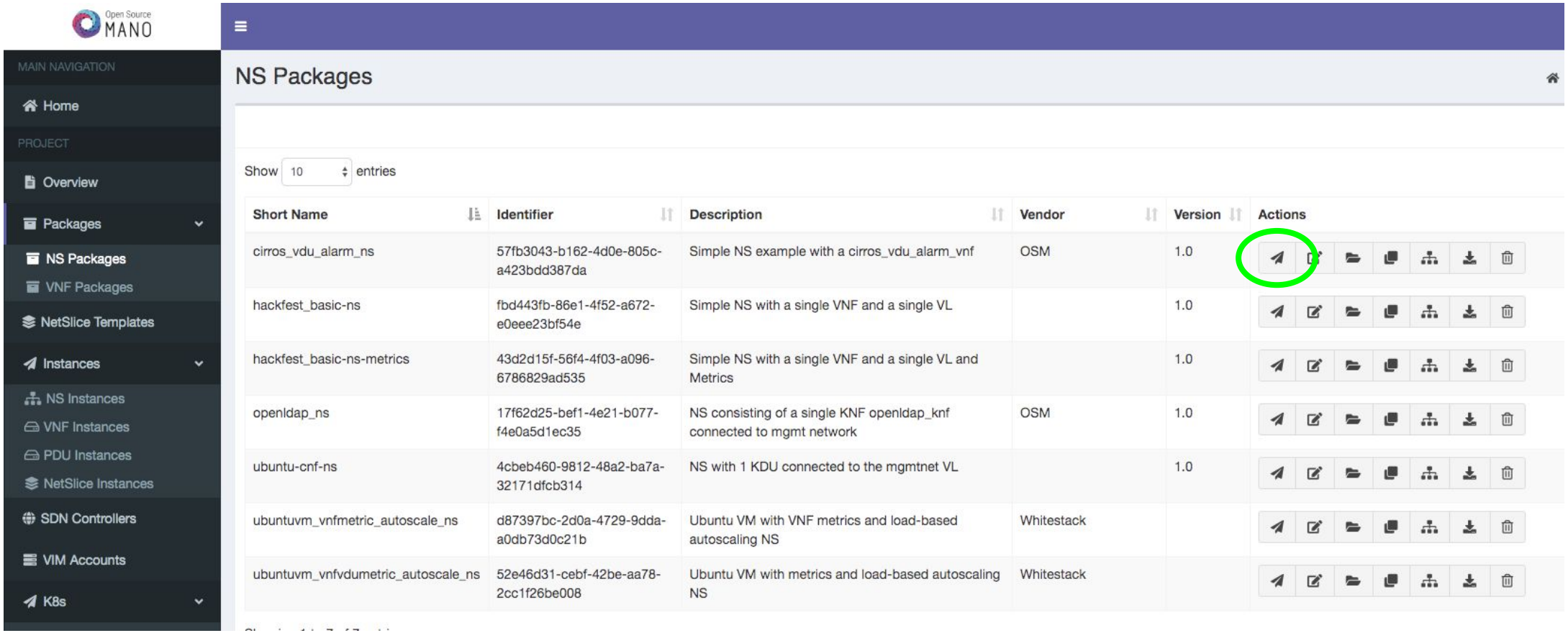
VNF “hackfest_basic-vnf”

It has one VDU (VM) that requires an image called ‘ubuntu1604’, and a flavor with 1 vCPU, 1GB RAM and 10GB of storage.

It has one interface, exposed to the Network Service as external Connection Point “vnf-cp0”

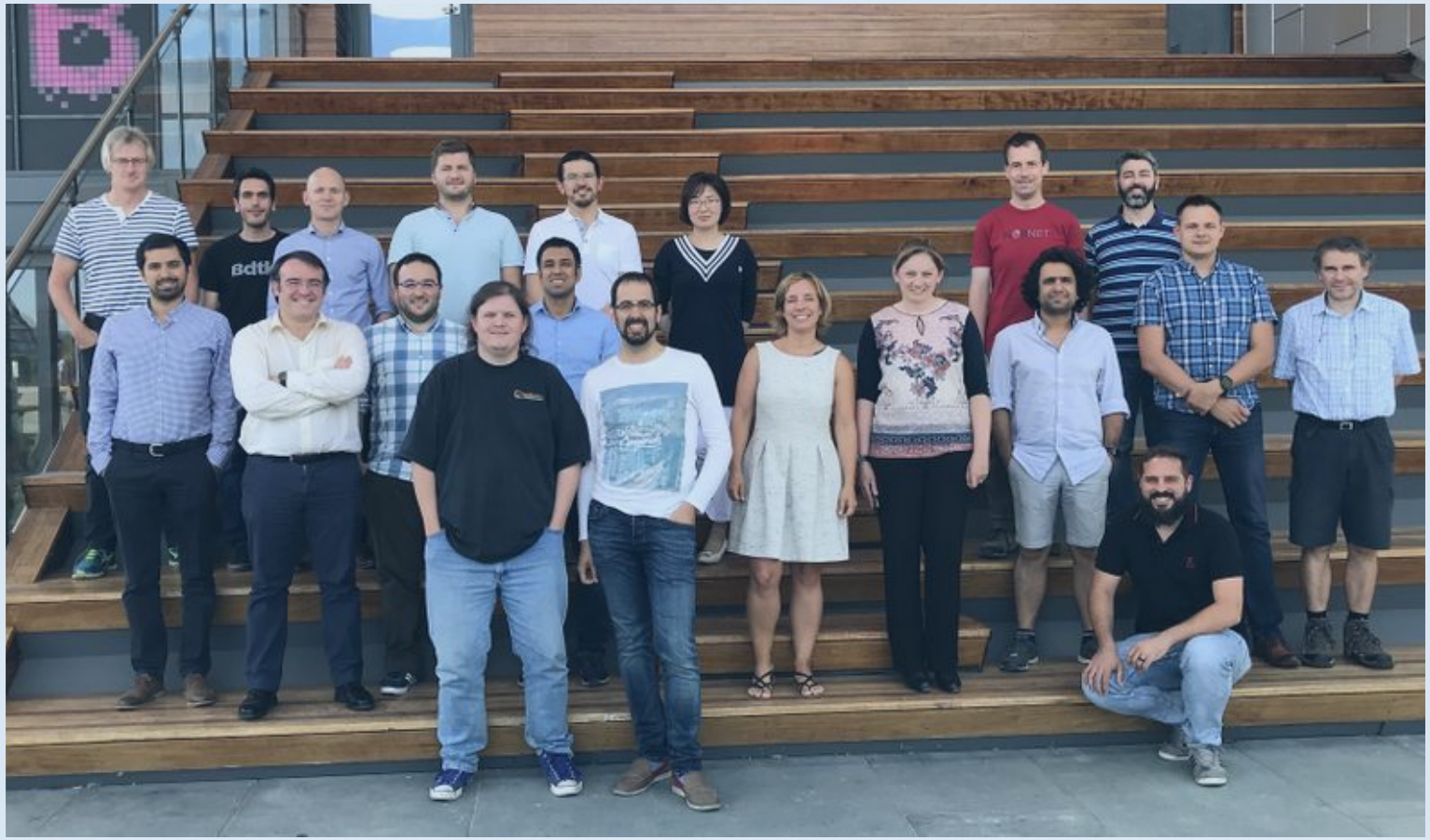
Packages in OSM

Once NS Packages and their constituent VNF Packages are present in the system, and at least a VIM is registered, a Network Service can be launched.



Open Source MANO

Hands-on: Integrating a VIM & Instantiating a basic Network Service



Hands-on: Integrating a VIM

1. Create a VIM in OSM vía CLI

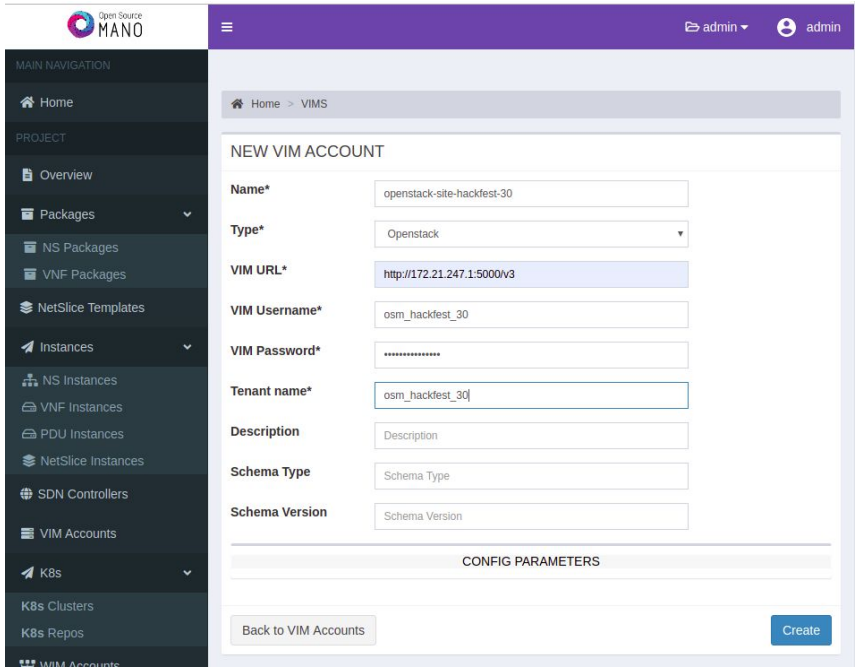
```
osm vim-create --name openstack-site-hackfest-x --user osm_hackfest_x --password
<Pass> --auth_url http://<VIM-IP>:5000/v3 --tenant osm_hackfest_x --account_type
openstack --config='{security_groups: default}'
```

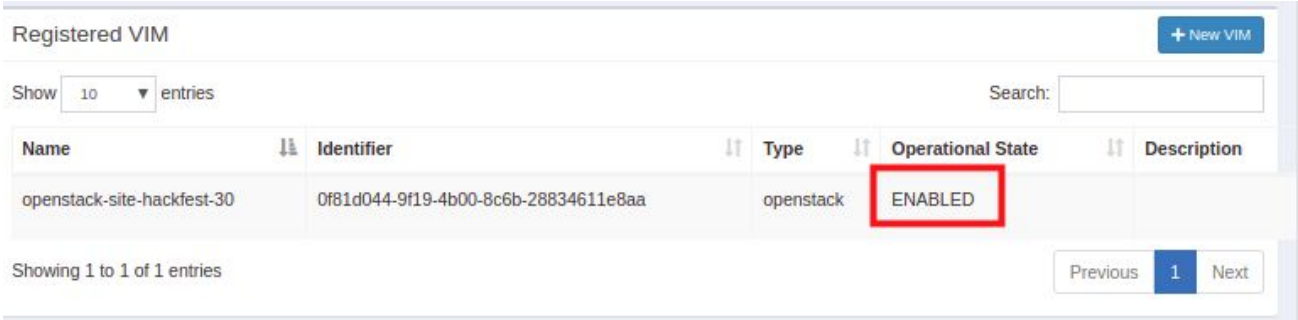
2. Validate the VIM creation . The status should be ENABLED

```
osm vim-list
osm vim-show openstack-site-hackfest-x
```

Hands-on: Integrating a VIM

1. Create a VIM in OSM vía GUI
2. Go to VIM accounts -> add new VIM
   - Name: openstack-site-hackfest-**x**
   - Type: Openstack
   - VIM URL: http://**<VIM-IP>**:5000/v3
   - VIM Username: osm_hackfest_**x**
   - VIM Password: ******
   - Tenant name: osm_hackfest_**x**
3. Click in Create button
4. Validate the VIM creation .
   The status should be ENABLED

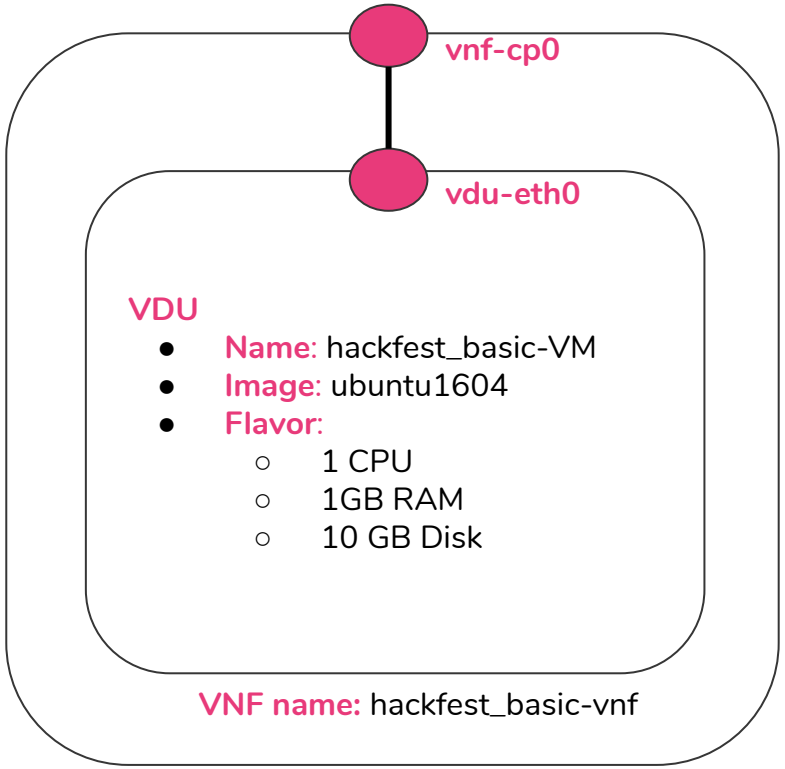




Hands-on: Launching your first NS

Open Source MANO

VNFD Descriptor and Diagram

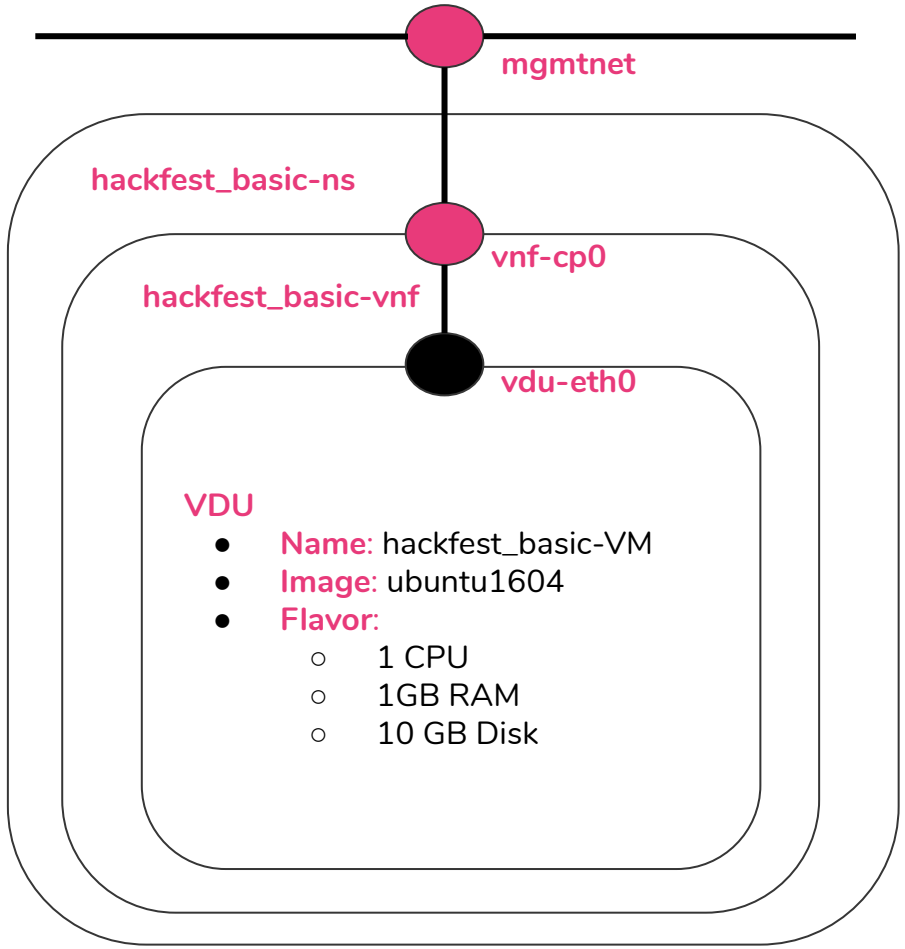



```
vnfd:vnfd-catalog:
  vnfd:
  - connection-point:
    - name: vnf-cp0
      type: VPORT
    description: A basic VNF descriptor w/ one VDU
    id: hackfest_basic-vnf
    logo: osm.png
    mgmt-interface:
      cp: vnf-cp0
    name: hackfest_basic-vnf
    short-name: hackfest_basic-vnf
    vdu:
    - alternative-images:
      - image: ubuntu/images/hvm-ssd/ubuntu-artful-17.10-amd64-server-20180509
        vim-type: aws
      count: '1'
      id: hackfest_basic-VM
      image: ubuntu1604
      interface:
      - external-connection-point-ref: vnf-cp0
        name: vdu-eth0
        type: EXTERNAL
        virtual-interface:
          type: PARAVIRT
      name: hackfest_basic-VM
      vm-flavor:
        memory-mb: '1024'
        storage-gb: '10'
        vcpu-count: '1'
    version: '1.0'
```

Hands-on: Launching your first NS

Open Source MANO

NSD Descriptor and Diagram




```
nsd:nsd-catalog:
  nsd:
  - constituent-vnfd:
    - member-vnf-index: '1'
      vnfd-id-ref: hackfest_basic-vnf
    description: Simple NS with a single VNF and a single VL
    id: hackfest_basic-ns
    logo: osm.png
    name: hackfest_basic-ns
    short-name: hackfest_basic-ns
    version: '1.0'
    vld:
    - id: mgmtnet
      mgmt-network: 'true'
      name: mgmtnet
      short-name: mgmtnet
      type: ELAN
      vnfd-connection-point-ref:
      - member-vnf-index-ref: '1'
        vnfd-connection-point-ref: vnf-cp0
        vnfd-id-ref: hackfest_basic-vnf
```

Hands-on: Launching your first NS

Open Source MANO

1. Download the nsd and vnfd packages

```
wget http://osm-download.etsi.org/ftp/osm-5.0-five/6th-hackfest/packages/hackfest_basic_vnf.tar.gz
wget http://osm-download.etsi.org/ftp/osm-5.0-five/6th-hackfest/packages/hackfest_basic_ns.tar.gz
```

2. Create the NSD and VNFD in OSM

```
osm vnfd-create hackfest_basic_vnf.tar.gz
osm nsd-create hackfest_basic_ns.tar.gz
```

3. Create an SSH key

```
ssh-keygen
```

4. Create the Network Service in OSM

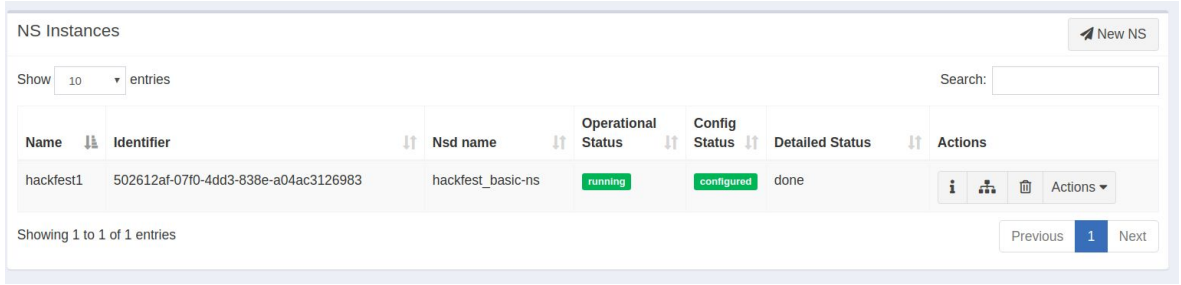
```
osm ns-create --ns_name hackfest1 --nsd_name hackfest_basic-ns --vim_account openstack-site-hackfest-x
--ssh_keys .ssh/id_rsa.pub --config '{vld: [ {name: mgmtnet, vim-network-name: osm-ext} ] }'
```

Hands-on: Launching your first NS

5. Validate NS creation in OSM vía CLI

```
osm ns-list
osm ns-show hackfest1
```

6. Validate NS creation in OSM vía GUI
   - Go to Instances -> NS Instances



7. Access to the VM created in Openstack VIM

```
ssh -i .ssh/id_rsa ubuntu@<MGMT_IP>
```

8. Delete NS , NSD and VNFD

```
osm ns-delete hackfest1
osm vnfd-delete hackfest_basic_vnf
osm nsd-delete hackfest_basic_ns
```

Bonus Hands-on: Creating VNF & NS Descriptors

1. Create the VNF Descriptor

```
osm package-create  vnf hackfest-basic
```

2. Create the NS Descriptor

```
osm package-create  ns  hackfest-basic
```

3. Build the packages

```
osm package-build hackfest-basic_vnf
osm package-build hackfest-basic_ns
```

4. Upload NFD and NDS to OSM

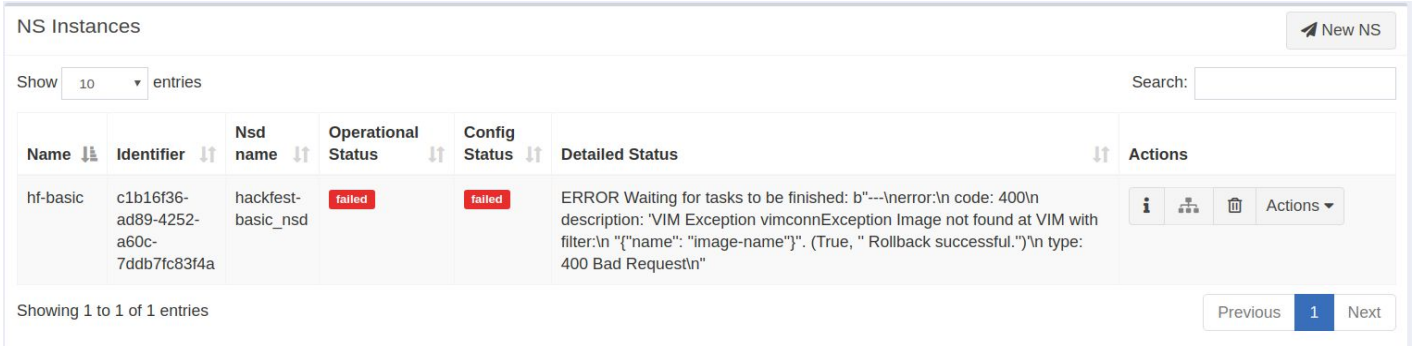
```
osm vnfd-create hackfest-basic_vnf.tar.gz
osm nsd-create hackfest-basic_ns.tar.gz
```

Bonus Hands-on: Creating VNF & NS Descriptors

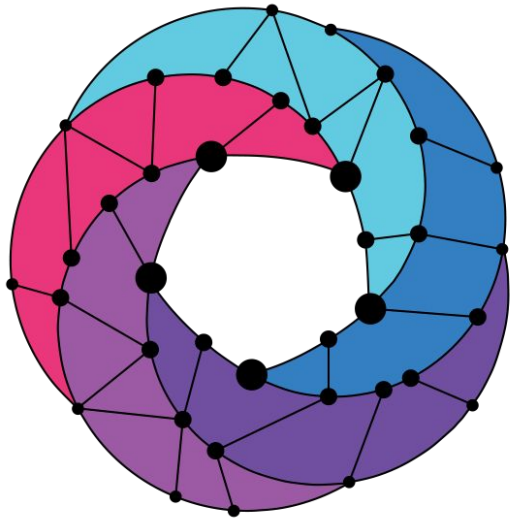
5. Create the Network Service

```
osm ns-create  --ns_name hf-basic  --nsd_name hackfest-basic_nsd  --vim_account openstack-site-hackfest-x
--ssh_keys ~/.ssh/id_rsa.pub  --config '{vld: [ {name: mgmt, vim-network-name: osm-ext} ] }'
```

6. Validate NS creation in OSM vía GUI
   - Go to Instances -> NS Instances



7. Compare the VNFD of this example with the previous Hands-On, find the difference and fix it



Open Source MANO

Find us at:

osm.etsi.org
osm.etsi.org/wikipub