Running Containerized Network Functions

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Why K8s in OSM?

- Applications based in micro-services
  - OSM is, in fact, already running in K8s, both distros and community installer

- Upcoming NFV use cases: 5G Core, uCPE/SD-WAN...

- K8s apps and clusters are essential ingredients for many Edge use cases
How K8s-based apps are modelled today

• K8s provides a huge number of high-level service objects, which are the core of its functionality:
  • Pod sets*: deployments (+replicasets), statefulsets
  • Services: clusterIP, NodePort, LoadBalancer
  • Storage: persistent volumes, persistent volume claims
  • …

• TWO ways to deploy a K8s app:
  • **Helm charts**: packaged format + indirect call to the K8s API via helm
  • **Juju charms and bundles**: packaged format + indirect call to the K8s API via Juju

(*) The concept “pod set” is not part of K8s terminology, but has been used here for convenience
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Requirements of K8s-based apps: a K8s cluster

• The K8s cluster:
  • Can be created in different ways:
    • Standalone: Openshift, Charmed K8s, Ericsson CCD, etc.
    • As part of a VIM: Vmware Cloud PKS, AWS, etc.
  • Can run on Bare Metal or on VMs running in a VIM
  • Once created, each cluster provides a K8s API, irrespective of the way it was created.

• Specific versions of K8s or CNI plugins might be required
K8s support in OSM
From K8s apps to xNF Model-driven (like everything in OSM)

- NF composition specified in the VNF descriptor
  - Deployment Units:
    - Virtual (VDU) = VM
    - Physical (PDU) = Physical Node
    - Kubernetes (KDU) = K8s app

- Modelling in the VNF descriptor:
  - KDU based on helm charts or juju bundles

```yaml
-+-ro kdu* [name]
  | ++-ro name        string
  | ++-ro description string
  | ++-ro (kdu-model)
  | | ++-:(helm-chart)
  | | | ++-ro helm-chart string
  | | | ++-(juju-bundle)
  | | | | ++-ro juju-bundle string
```

- K8s cluster requirements:

```yaml
+--rw k8s-cluster
  | ++--rw version* string
  | ++--rw cni* enumeration
  | ++--rw nets* [id]
  | | ++--rw id string
  | | | ++--rw external-connection-point-ref? -> ../../connection-point/name
```
Two steps are considered in OSM

<table>
<thead>
<tr>
<th>STEP #1. CREATION OF THE K8S CLUSTER</th>
<th>STEP #2. USE OF THE K8S CLUSTER</th>
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</thead>
<tbody>
<tr>
<td><strong>OPTIONS:</strong></td>
<td><strong>The full catalog of K8s objects is entirely incorporated in a future-proof manner:</strong></td>
</tr>
<tr>
<td>1. By an external platform, static</td>
<td>• Helm charts: +20,000 stable applications are already available for production</td>
</tr>
<tr>
<td>• Cluster is then registered into OSM administratively</td>
<td>• Juju bundles: fairly powerful for inter-object configurations</td>
</tr>
<tr>
<td>2. By using external standalone platform API</td>
<td>• OSM also supports hybrid cases, which are required for real VNFs (e.g. 5G Core)</td>
</tr>
<tr>
<td>• Covered by plugin model (Rel EIGHT)</td>
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<tr>
<td>3. By using “enriched” APIs in some VIMs</td>
<td></td>
</tr>
<tr>
<td>• Covered by plugin model (Rel EIGHT)</td>
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</tr>
<tr>
<td>4. Created by OSM as a regular NS</td>
<td></td>
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</tbody>
</table>

Ready in Release SEVEN!
Life cycle management of KDU is managed through OSM NBI

Full K8s app lifecycle operations:
- install
- upgrade
- rollback
- delete

OSS/BSS

Or-Vi (IaaS API)

K8s API
Hands-on

Instantiating KNFs and running implicit primitives
OSM K8s cluster preparation

Installation: K8s cluster installation guide

Your Kubernetes cluster needs to meet the following requirements:

- Kubernetes Loadbalancer, to expose your KNFs to the network
- Kubernetes default Storageclass, to support persistent volumes.
Association of K8s cluster to VIM
A K8s cluster is expected to be connected

K8s cluster deployed inside a VIM

```
VIM

K8S Cluster Single/Multi node

net1 vim-net
```

```
osm k8scluster-add --creds kubeconfig.yaml \
    --version '1.15' \
    --vim openstack-site-hackfestXX \
    --k8s-nets '{"net1": "osm-ext"}' \
    cluster-XX
```
We will follow this guide: https://osm.etsi.org/docs/user-guide/05-osm-usage.html#using-kubernetes-based-vnfs-knfs

• Add a K8s cluster
• Onboard KNF and NS packages
• Instantiate and check status
• Running implicit primitives
• Terminate NS
Hands-on session
Adding a K8s cluster

• Information to create the cluster:
  • Version: 1.15
  • VIM: openstack-site-hackfest-XX
  • K8s nets:
    • net1: osm-ext
  • Credentials file: kubeconfig.yaml

• Please check that the status of the k8s cluster shown with `osm k8scluster-list` and `osm k8scluster-show` is `ENABLED`. 
Hands-on session
Repos

- No need to add repos
Hands-on session
Instantiation config file

---

additionalParamsForVnf:
  - member-vnf-index: openldap

additionalParamsForKdu:
  - kdu_name: ldap

additionalParams:
  replicaCount: "2"
Hands-on session
Status

```
osm nf-list --ns <NS_NAME>|<NS_ID>
osm vnf-show <ID> --kdu ldap
```
Demo: Cluster creation using OSM packages
How to install a K8s cluster

You can follow this guide: https://osm.etsi.org/docs/user-guide/15-k8s-installation.html
How to install a K8s cluster using OSM packages

```
osm nfpkg-create k8s_jujumachine_vnf.tar.gz
osm nfpkg-create k8s_jujucontroller_vnf.tar.gz
osm nspkg-create k8s_juju_ns.tar.gz
osm ns-create --ns_name k8s-cluster \
   --nsd_name k8s_juju \
   --vim_account <VIM_ID> \
   --config_file k8s-cluster.yaml \
   --ssh_keys ${HOME}/.ssh/id_rsa.pub
```
How to install a K8s cluster using OSM packages

1. Jujucontroller VNF
   K8s installer based on Juju

2. Jujumachine VNF
   K8s machine

3. Jujumachine VNF
   K8s machine

4. Jujumachine VNF
   K8s machine

5. Jujumachine VNF
   K8s machine