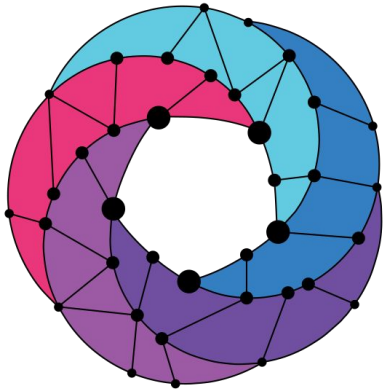


Open Source
MANO

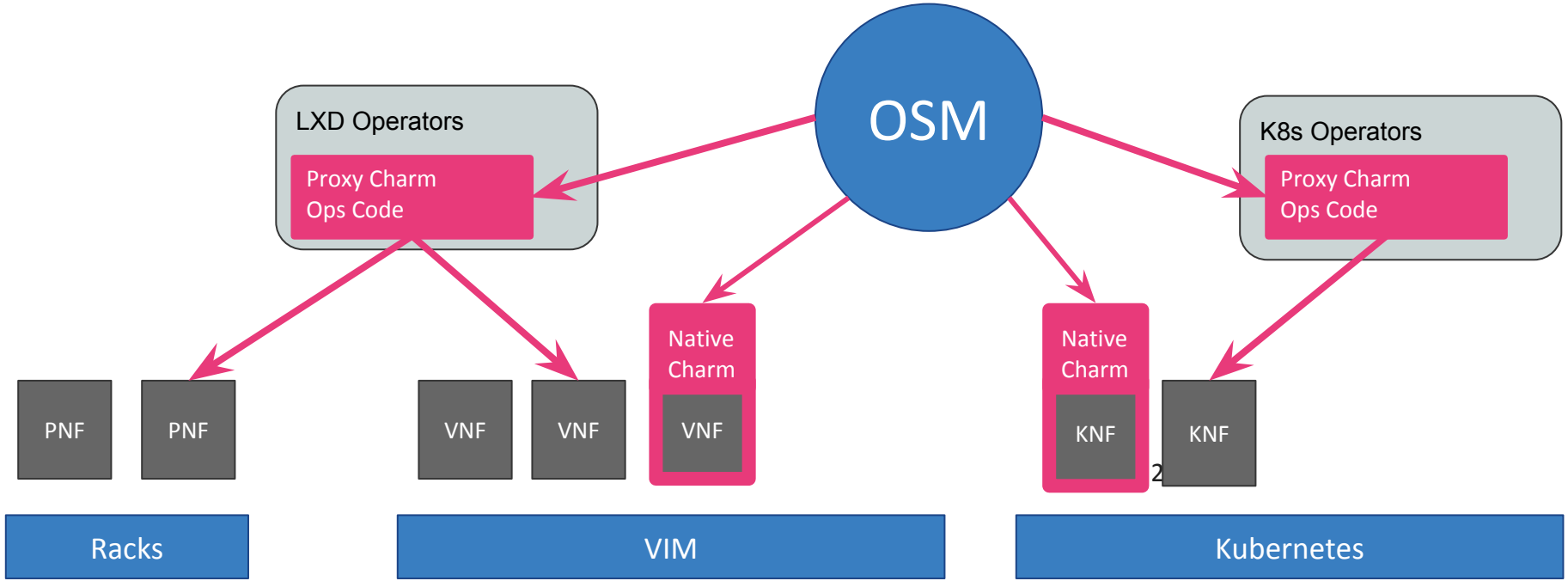
OSM#9 Hackfest

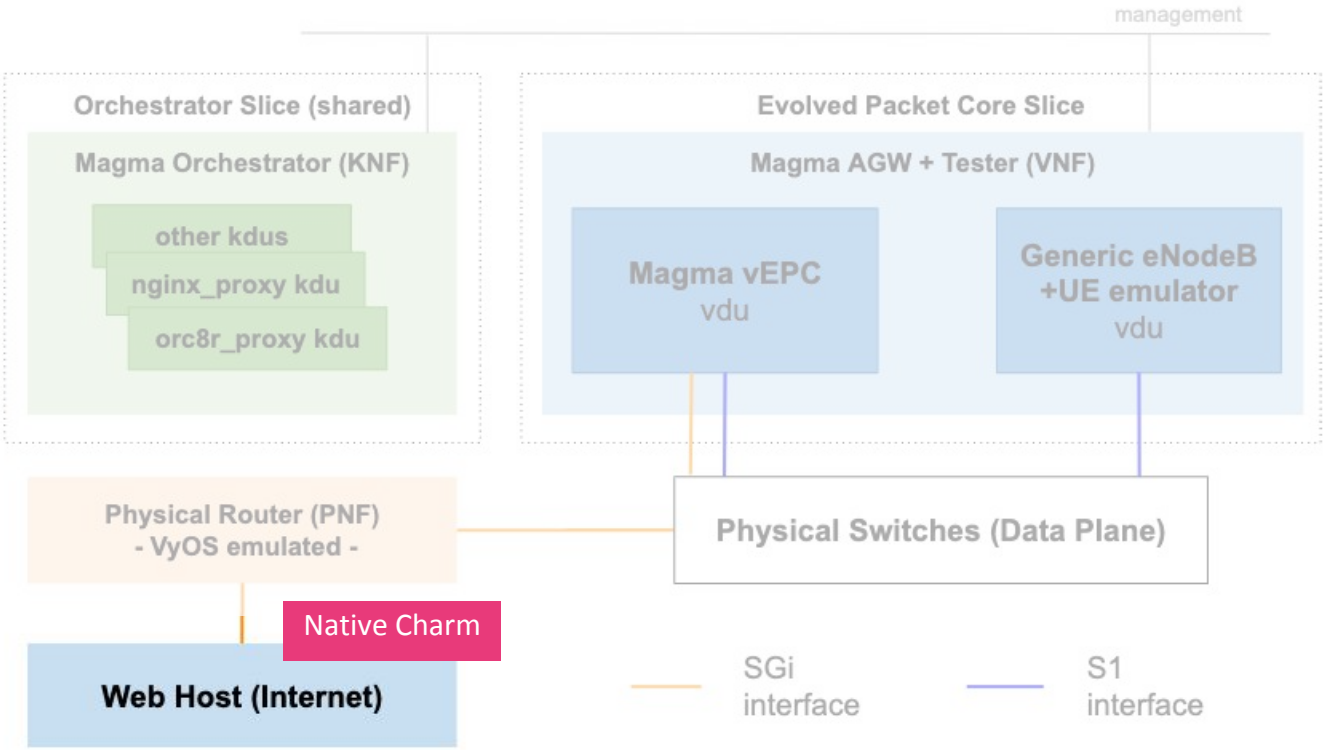
Day 1-2 CNF Operations

Dominik Fleischmann, David Garcia, Mark Beierl (Canonical)

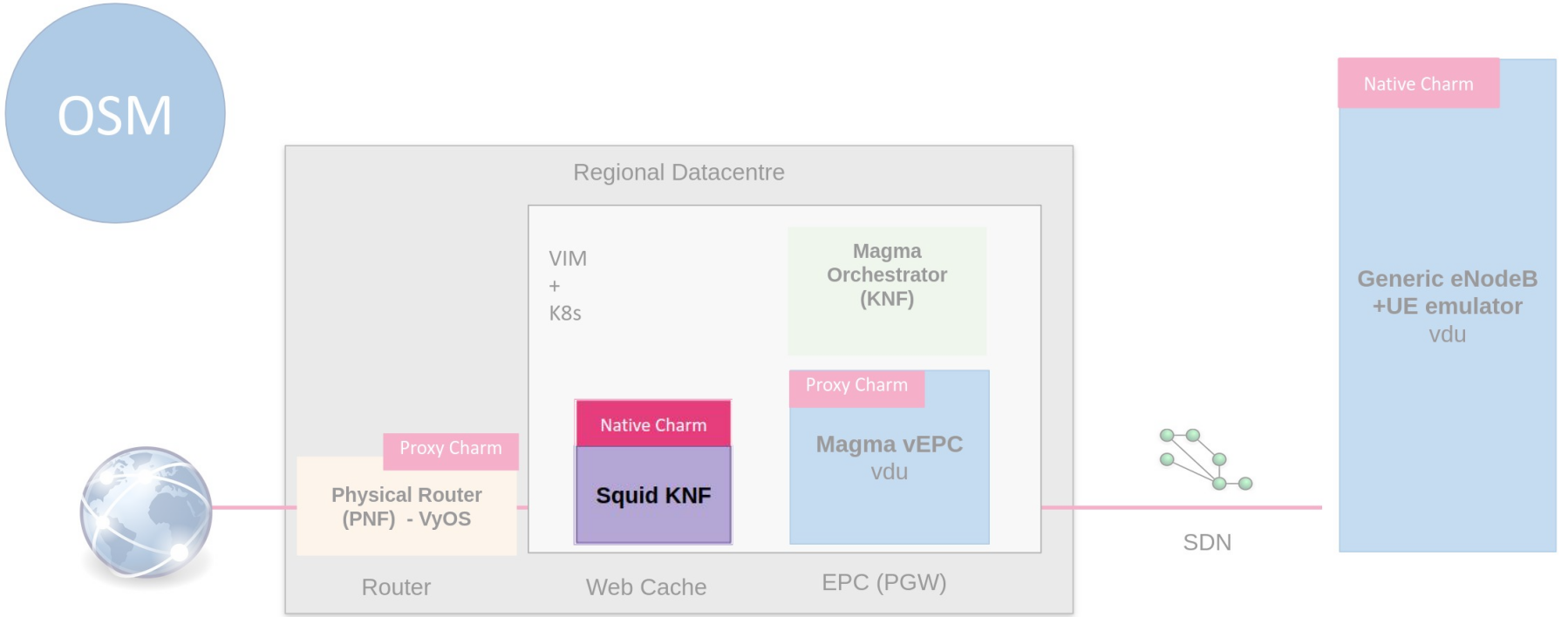
ETSI

OSM drives NFs through Charm Ops Code

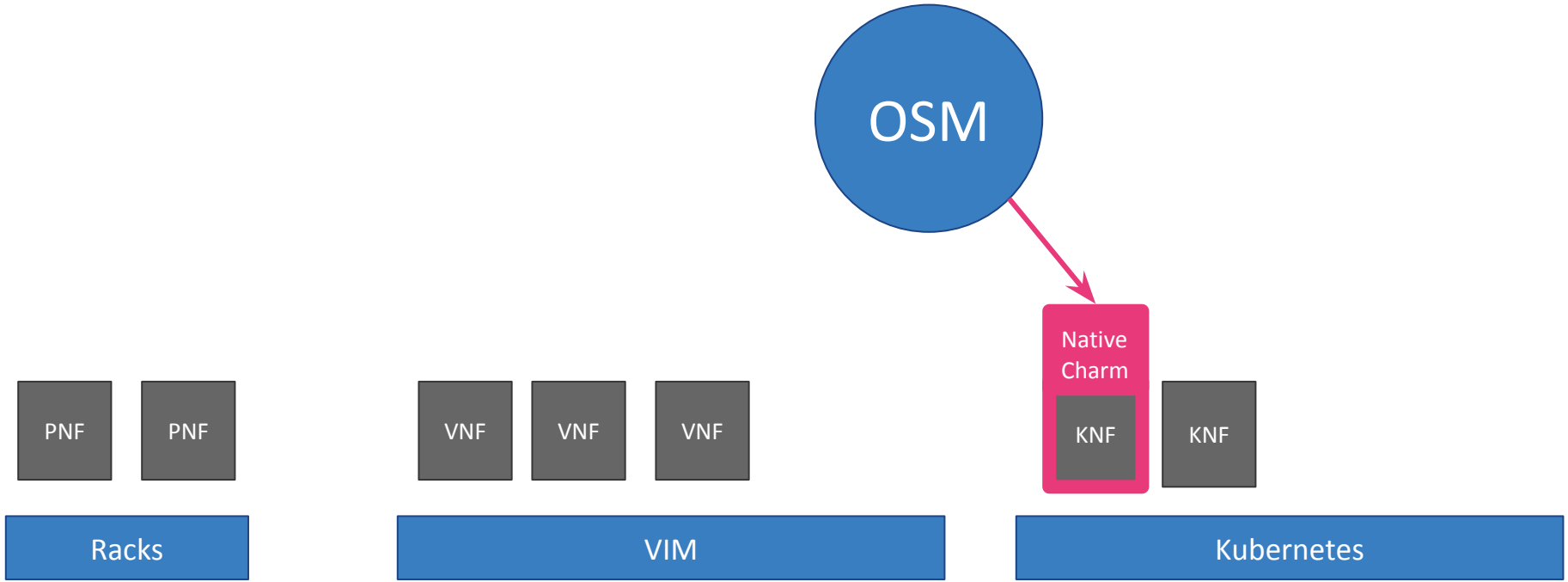



management
Orchestrator Slice (shared)
Magma Orchestrator (KNF)
other kdus
nginx_proxy kdu
orc8r_proxy kdu
Evolved Packet Core Slice
Magma AGW + Tester (VNF)
Magma vEPC
vdu
Generic eNodeB
+UE emulator
vdu
Physical Router (PNF)
- VyOS emulated -
Physical Switches (Data Plane)
Native Charm
Web Host (Internet)
SGi
interface
S1
interface

Cellular Data Path



OSM drives NFs through Charm Ops Code



Application Model in YAML

The Juju VCA in OSM provides a universal modelling language.

A YAML ‘bundle’ describes the app architecture of the KNF.

```
bundle: kubernetes
applications:
  mariadb-k8s:
    charm: cs:~juju/mariadb-k8s-2
    scale: 1
  mediawiki-k8s:
    charm: cs:~juju/mediawiki-k8s-3
    scale: 1
relations:
- - mariadb-k8s:server
  - mediawiki-k8s:db
```

Charms are ‘operations packages’ for apps

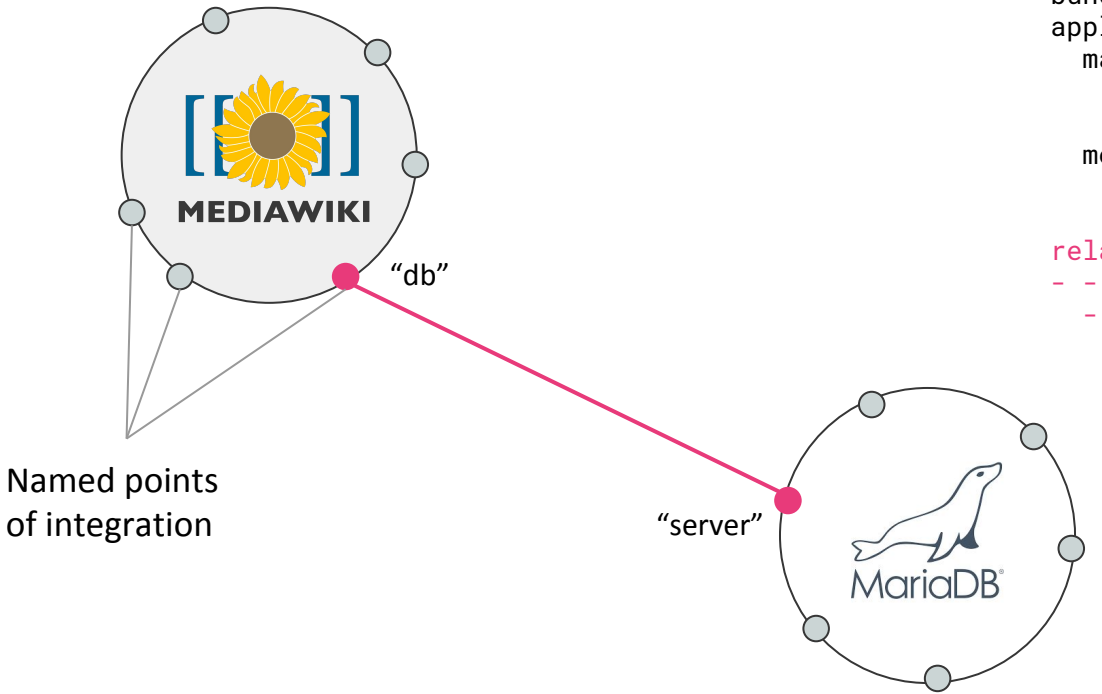
A charm is a package of ops code for a KNF app component.

Charms are reusable and composable. So the ‘mariadb’ charm might be used in many CNFs and many VNFds.

Charms are written in Python for best results.

```
bundle: kubernetes
applications:
  mariadb-k8s:
    charm: cs:~juju/mariadb-k8s-2
    scale: 1
  mediawiki-k8s:
    charm: cs:~juju/mediawiki-k8s-3
    scale: 1
relations:
- - mariadb-k8s:server
  - mediawiki-k8s:db
```

Model includes integration between charms




```
bundle: kubernetes
applications:
  mariadb-k8s:
    charm: cs:~juju/mariadb-k8s-2
    scale: 1
  mediawiki-k8s:
    charm: cs:~juju/mediawiki-k8s-3
    scale: 1
relations:
- - mariadb-k8s:server
  - mediawiki-k8s:db
```

Charms package lifecycle and action scripts

Lifecycle scripts

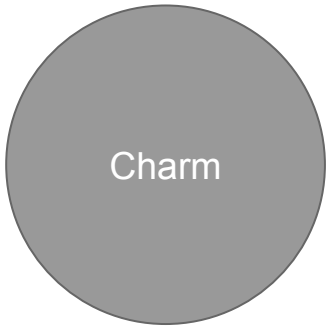
- install
- config
- update
- remove
- scale

Integration scripts

- relate-mysql
- relate-ldap
- relate-proxy
- relate-...

"Action" scripts are OSM Primitives

"action: backup"
"action: restore"
"action: scan-viruses"
"action: health-check"
"action: add-repo"
"action: ..."
"action: ..."
"action: ..."



These are your operations primitives.

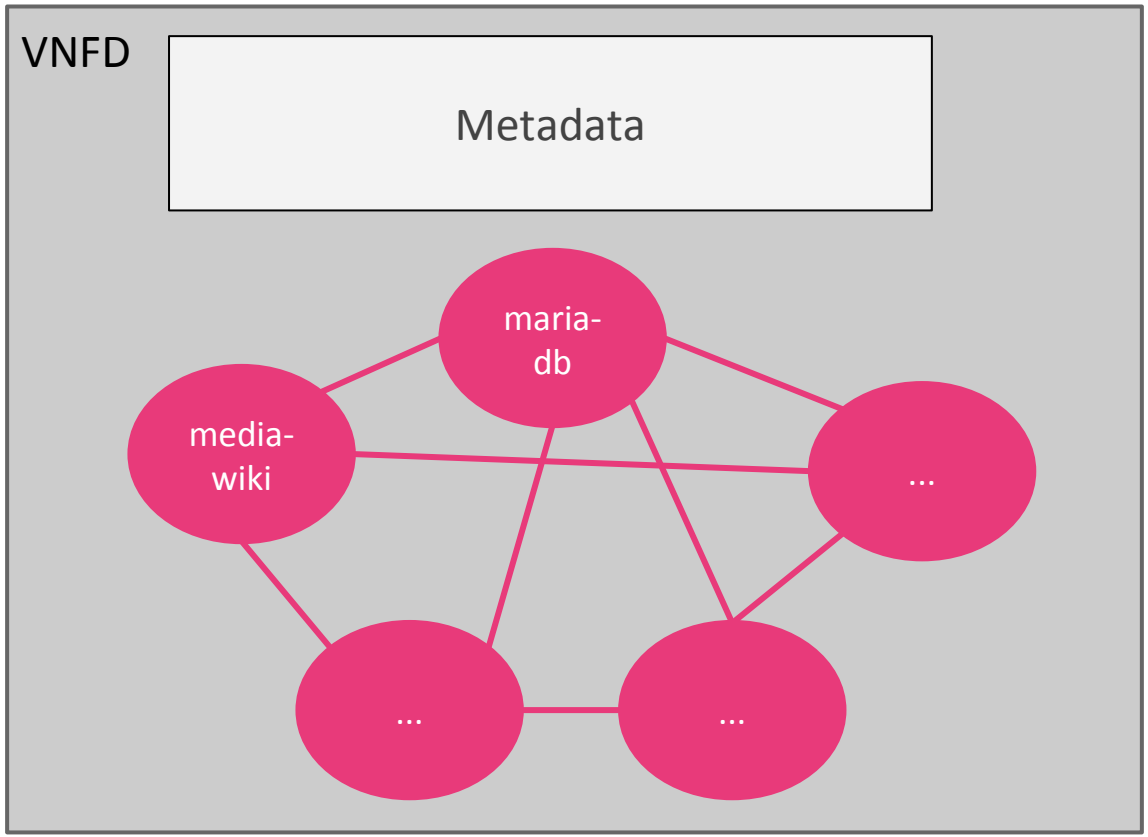
Charms describe Action Parameters

Each Action is a script, usually in Python or Bash.

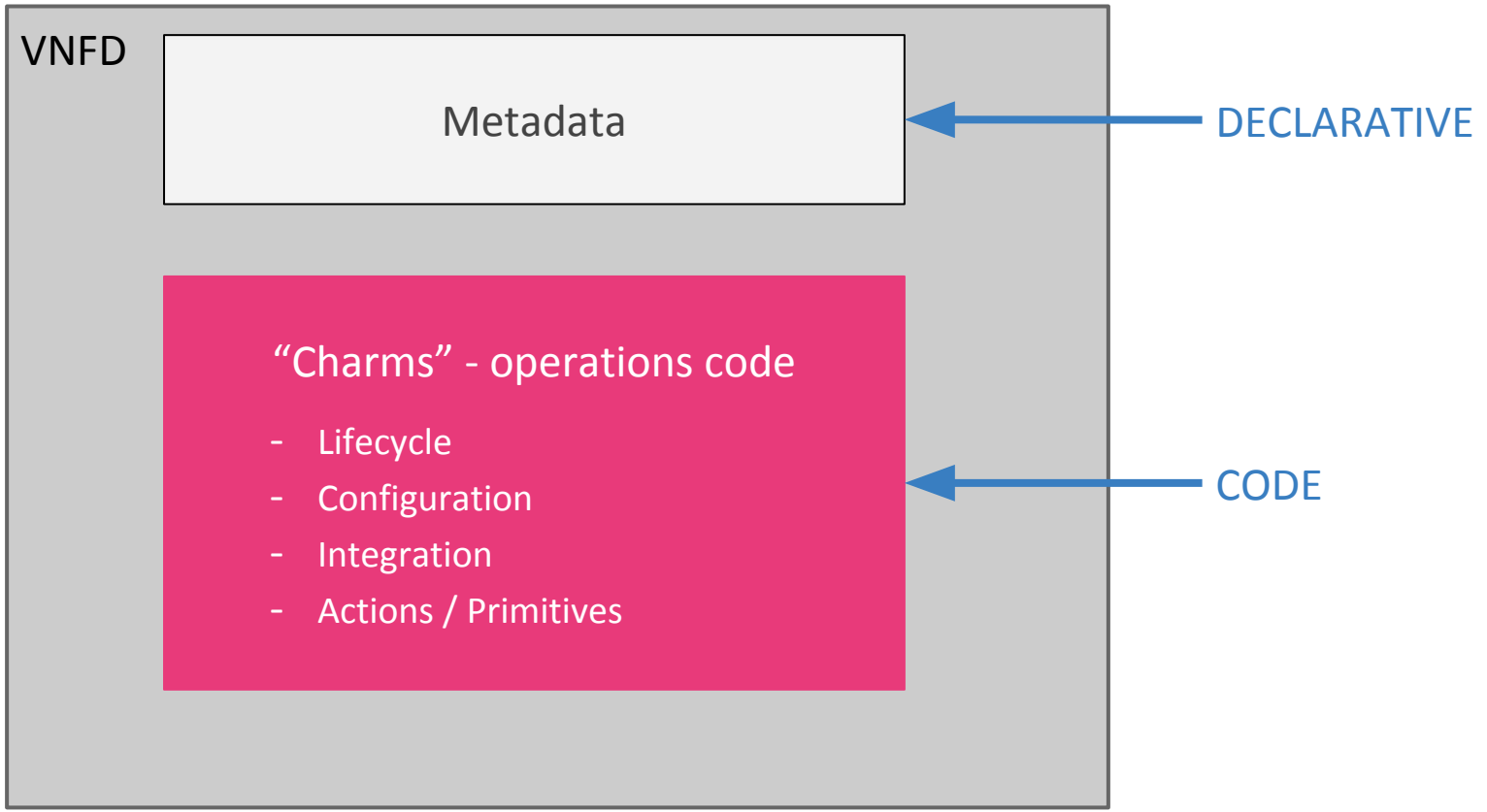
Charm metadata describes the action parameters.

```
backup:
  description: "Do a mariadb backup"
  params:
    target:
      description: "The unit in which it should be
performed the action. (ANY, PRIMARY, SECONDARY)"
      type: string
      default: "ANY"
    path:
      description: "Path for the backup inside the unit"
      type: string
      default: "/data"
restore:
  description: "Restore from a MariaDB Backup"
  params:
    path:
      description: "Path for the backup inside the unit"
      type: string
      default: "/data"
```

One VNF is many apps and integration



VNFD

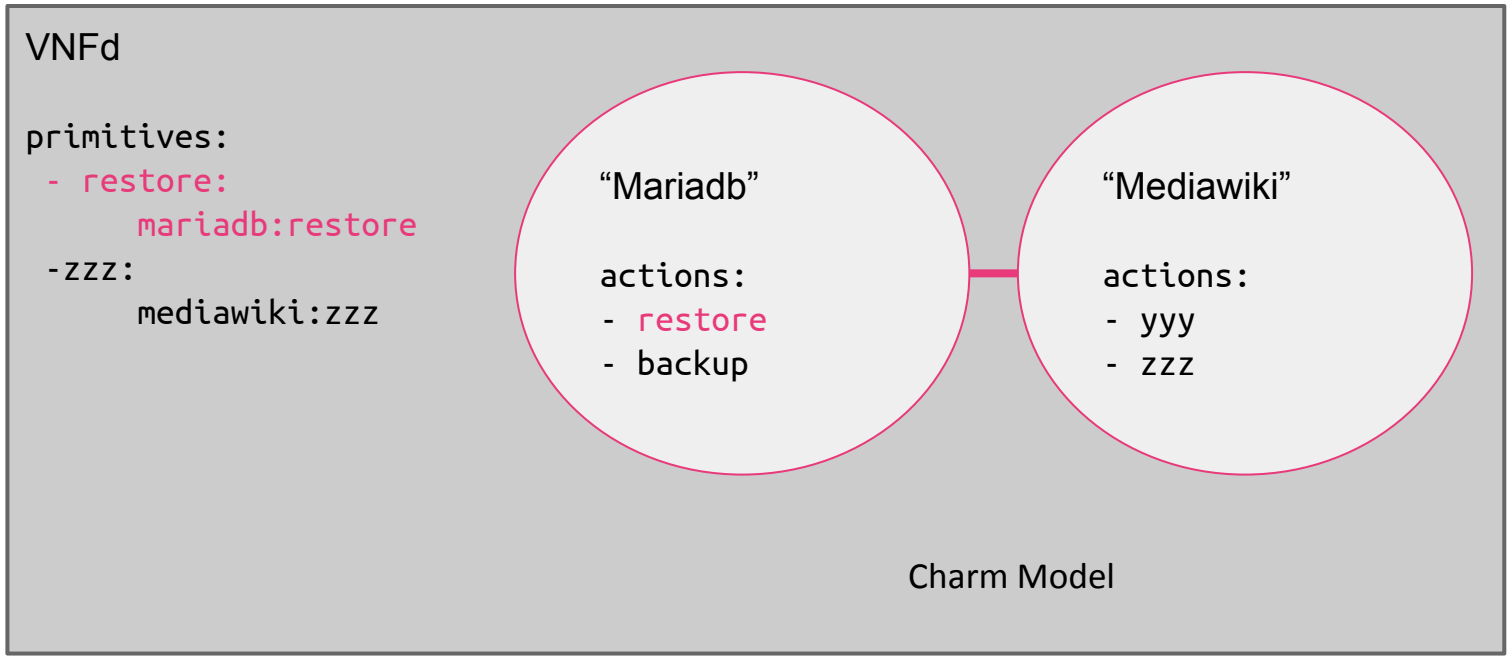


VNFD wraps up a bundle of charms

The Kubernetes Deployment Unit is defined with a Bundle that can include many charms for different application components.

```
vnfd-catalog:
    vnfd:
    -   id: squid-vnf
        name: squid-vnf
        connection-point:
        -   name: mgmtnet
        mgmt-interface:
            cp: mgmt
        kdu:
        -   name: mediawiki-kdu
            juju-bundle: bundle.yaml
            kdu-configuration:
                config-primitive:
                -   name: backup
          ...
```

VNFds map OSM Primitives to Charm Actions



VNFds map OSM Primitives to Charm Actions

Primitives are declared as a list in the VNFd kdu-configuration section

```
kdu:
-   name: mediawiki-kdu
    juju-bundle: bundle.yaml
    kdu-configuration:
        config-primitive:
        -   name:restore
            parameter:
            -   name: application-name
                data-type: STRING
                default-value: mariadb
            -   name: path
                data-type: STRING
                default-value: ""
```

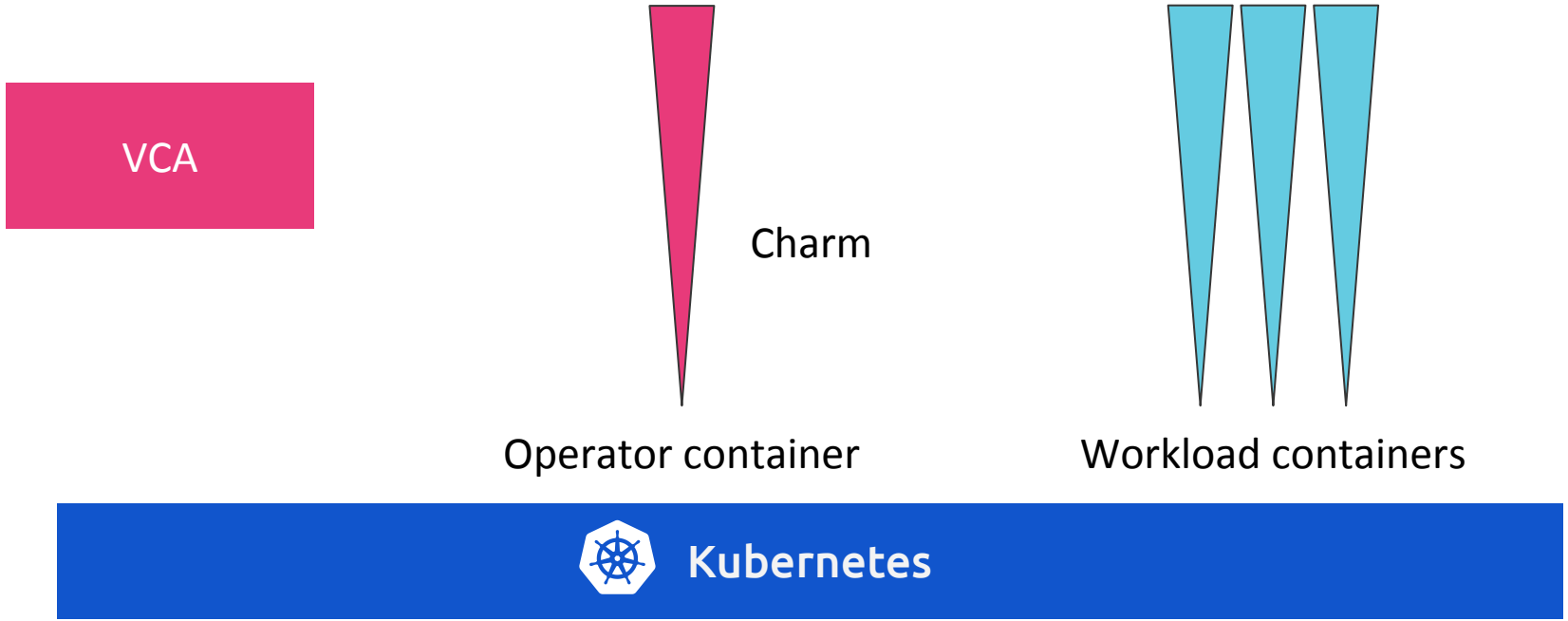
VNFds map OSM Primitives to Charm Actions

The application-name specifies which charm is providing the actual action for the primitive.

The VNFd can provide default action parameter values.

```
kdu:
-   name: mediawiki-kdu
    juju-bundle: bundle.yaml
    kdu-configuration:
        config-primitive:
        -   name:restore
            parameter:
            -   name: application-name
                data-type: STRING
                default-value: mariadb
            -   name: path
                data-type: STRING
                default-value: ""
```

KNF charms run in their own container on K8s



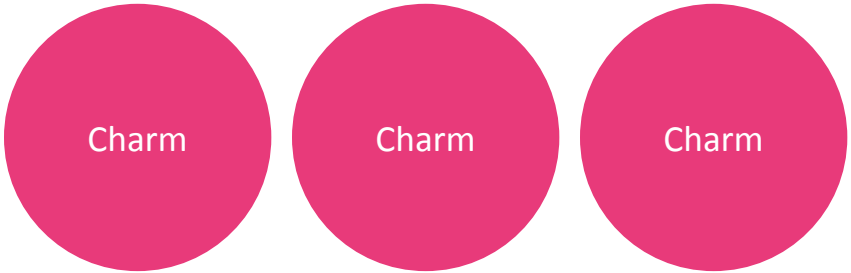
So, you need to provide...

VNFD Metadata

- Bundle
- Primitive mapping

Bundle

- Charms
- List of integrations



- Action scripts
- Metadata describing action parameters

Open Source
MANO

Example KNF

A Web Proxy using Squid

YAML Bundle of Squid

The model bundle will always be located in the juju-bundles folder of our package.

The Web Proxy model is very simple, it has a single charm, which is squid.

```
description: Squid Bundle
bundle: kubernetes
applications:
  squid:
    charm: '../charms/squid'
    scale: 1
```

Charms on Kubernetes

A CNF Charm is almost identical to the charms for VNF and PNF workloads.

`series: kubernetes` in charm metadata says that it runs on K8s.

```
name: squid
summary: Charm for Squid on k8s
maintainers:
    - Dominik Fleischmann <dominik.fleischmann@canonical.com>
description: |
    A charm that will deploy Squid on Kubernetes
tags:
    - misc
series:
    - kubernetes
deployment:
    type: stateful
    service: loadbalancer
storage:
    docker:
        type: filesystem
        location: /srv/docker/squid
    spool:
        type: filesystem
        location: /var/spool/squid
```

The ‘install’ hook on K8s uses pod spec

Charms running on Kubernetes generate a pod spec to run their application.

```
def make_pod_spec(self):
     config = self.framework.model.config
     ports = [{"name": "squid", "containerPort": config["port"],
               "protocol": "TCP"}]

     spec = {
         "containers": [{
             "name": self.framework.model.app.name,
             "image": config["image"],
             "ports": ports,
         }],
     }
     return spec


 def _apply_spec(self, spec):
     # Only apply the spec if this unit is a leader
     if self.framework.model.unit.is_leader():
         self.framework.model.pod.set_spec(spec)
         self.state.spec = spec
```

Squid charm has two Actions

Charm metadata describes the action parameters.

```
addurl:
    description: "Add squid config"
    params:
        url:
            description: "URL that will be allowed"
            type: string
            default: ""
deleteurl:
    description: "Delete allowed URL squid config"
    params:
        url:
            description: "URL that will stop to be allowed"
            type: string
            default: ""
```

Operations code (bash)

Actions can be written in bash for very simple cases.

```
#!/bin/bash

URL=`action-get url`

if ! grep -Fxq "http_access allow allowedurls"
/etc/squid/squid.conf
then
    sed  -i '/^# And finally deny all .*/i http_access allow
allowedurls\n' /etc/squid/squid.conf
fi

sed -i "/^http_access allow allowedurls.*/i acl allowedurls
dstdomain \.$URL" /etc/squid/squid.conf

kill -HUP `cat /var/run/squid.pid`
```

Operations code (python)

It is common to write actions in Python using the standard Operator Framework.

```
def on_deleteurl_action(self, event):
     """Handle the deleteurl action."""
     url = event.params["url"]

     line_to_delete = "acl allowedurls dstdomain .{}".format(url)
     line_deleted = False

     with open("/etc/squid/squid.conf", "r") as f:
         lines = f.readlines()
     with open("/etc/squid/squid.conf", "w") as f:
         for line in lines:
             if line_to_delete not in line:
                 f.write(line)
             else:
                 line_deleted = True

     if line_deleted:
         event.set_results({"output": "URL deleted succesfully"})
         subprocess.check_output("kill -HUP `cat /var/run/squid.pid`",
                                 shell=True)
     else:
         event.fail("No URL was deleted")
```

VNFds for Squid

This will be the kdu section

For our Squid KNF.

It states our bundle and the primitives that will be exposed to OSM.

```
kdu:
-   name: squid-kdu
    juju-bundle: bundle.yaml
    kdu-configuration:
        config-primitive:
        -   name: addurl
            parameter:
            -   name: application-name
                data-type: STRING
                default-value: squid
            -   name: url
                data-type: STRING
                default-value: ""
        -   name: deleteurl
            parameter:
            -   name: application-name
                data-type: STRING
                default-value: squid
            -   name: url
                data-type: STRING
                default-value: ""
```

KNF Network Service descriptor

- `hackfest_squid_cnf_ns`
- Same structure as a descriptor for a VNF based NS.

Getting our KNF Package

Open Source MANO

Execute the following commands:

```
git clone --recurse-submodules -j8
https://osm.etsi.org/gitlab/vnf-onboarding/osm-packages.git

cd osm-packages/magma

tar -czf hackfest_squid_cnf.tar.gz hackfest_squid_cnf

tar -czf hackfest_squid_cnf_ns.tar.gz hackfest_squid_cnf_ns
```

Instantiate our KNF

Open Source MANO

Execute the following commands:

```
osm upload-package hackfest_squid_cnf.tar.gz

osm upload-package hackfest_squid_cnf_ns.tar.gz

osm ns-create --ns_name webcache --nsd_name squid-cnf-ns --vim_account
hackfest --config '{vld: [ {name: mgmtnet, vim-network-name: sgi} ]}'
```

Testing our KNF

Check the status of our deployment with `osm ns-list`

If it is in a READY state execute the following commands:

```
NSID=`osm ns-list | grep webcache | awk '{ print $4 }'`

PROXY_IP=`kubectl --kubeconfig ~/kube.yaml get services -n
squid-kdu-$NSID | grep 'squid ' | awk '{print $4}'`

export https_proxy=http://$PROXY_IP:3128

curl https://google.com
```

The curl command should fail with the “HTTP code 403” error.

Execute Operations

With the CNF being deployed, execute the following command:

```
osm ns-action webcache --vnf_name squid-vnf --kdu_name squid-kdu
--action_name addurl --params '{application-name: squid, url:
google.com}'
```

Check the status of the execution with:

```
osm ns-op-list webcache
```

Now this curl command should return the correct output:

```
curl https://google.com
```

Execute Operations

With the CNF being deployed, execute the following command:

```
osm ns-action squid-cnf --vnf_name squid-vnf --kdu_name squid-kdu
--action_name deleteurl --params '{application-name: squid, url:
google.com}'
```

Check the status of the execution with:

```
osm ns-op-list webcache
```

Now this curl command should give you a “HTTP code 403” error again:

```
curl https://google.com
```