Day 2 VNF Operations
David Garcia, Mark Beierl, Dominik Fleischmann (Canonical)
Go to the workspace

- Change directory

$ cp -a /home/ubuntu/examples/hd2 ~/
$ cd ~/hd2/
$ ls
01-base  02-relation
Focus on Virtualised NF operations

LXD Operators
Proxy Charm
Ops Code

OSM

PNF  PNF

VNF  VNF  VNF

Racks

VIM

KNF  KNF

Kubernetes
Cellular Data Path

OSM

Regional Datacentre

VIM + K8s

Magma Orchestrator (KNF)

Proxy Charm

Native Charm

Physical Router (PNF) - VyOS

Squid KNF

Magma vEPC vdu

Router

Web Cache

EPC (PGW)

Generic eNodeB +UE emulator vdu

SDN

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Magma vEPC

- Fixed VM image that pre-dates OSM and cannot be modified
  - Name: magma101_hf9
  - This image already has magma installed.
  - Requires a proxy charm because the image is static rather than being an installable app

- Proxy Charm:
  - Name: magmagw
  - Actions:
    - Add network
    - Add gateway
    - Delete gateway
    - Add hosts
    - Add test subscriber
    - Restart magma
    - Reset ID
Magma vEPC VNF-Configuration

- SSH access: this proxy charm will use SSH to the VM appliance image so that it can drive the workload there; this directive tells OSM to inject the SSH keys for the proxy charm LXD instance into the VM appliance on launch.

- Initial config primitive: Deployment operations

- Config primitive: Day-2 operations

```plaintext
vdu-configuration:
  juju:
    charm: magmagw
  config-access:
    ssh-access:
      required: true
  initial-config-primitive:
    [...]
  config-primitive:
    [...]
```
VNFD: Magma vEPC

- Initial config primitive:
  - Config: In proxy charms, the first primitive must be config, which will provide the credentials to the proxy charm so it can access the VDU

```yaml
vdu-configuration:
  [...]
  initial-config-primitive:
    - seq: '1'
      name: config
      parameter:
        - name: ssh-hostname
          value: <rw_mgmt_ip>
        - name: ssh-username
          value: magma
        - name: ssh-password
          value: magma
  [...]
config-primitive:
  [...]
```
VNFD: Magma vEPC

- Initial config primitive:
  - Reset id
  - Add network
  - Add gateway
  - Add hosts
  - Restart magma

vdu-configuration:

```yaml
[...]  
initial-config-primitive:
[...]  
- seq: '2'
  name: reset-id
- seq: '3'
  name: add-net
  parameter:
    - name: orch_ip
      value: <orch_ip>
    - name: orch_net
      value: <orch_net>
[...]
```
VNFD: Magma vEPC

- Initial config primitive:
  - Reset id
  - Add network
  - Add gateway
  - Add hosts
  - Restart magma

```json
vdu-configuration:
  [...]  
initial-config-primitive:
  [...]  
  - seq: '4'
    name: add-gw
    parameter:
      - name: agw_id
        value: <agw_id>
      - name: agw_name
        value: <agw_name>
      - name: orch_ip
        value: <orch_ip>
      - name: orch_net
        value: <orch_net>
  [...]  
```

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VNFD: Magma vEPC

- Initial config primitive:
  - Reset id
  - Add network
  - Add gateway
  - Add hosts
  - Restart magma

```json
vdu-configuration:
  ...
initial-config-primitive:
  ...
  - seq: '5'
    name: add-test-subscriber
    parameter:
      - name: orch_ip
        value: <orch_ip>
      - name: orch_net
        value: <orch_net>
  - seq: '6'
    name: add-hosts
    parameter:
      - name: orch_ip
        value: <orch_ip>
```
VNFD: Magma vEPC

• Initial config primitive:
  • Reset id
  • Add network
  • Add gateway
  • Add hosts
  • Restart magma

```python
vdu-configuration:
  [...]
initial-config-primitive:
  [...]
- seq: '6'
  name: add-hosts
  parameter:
    - name: orch_ip
      value: <orch_ip>
- seq: '7'
  name: restart-magma
config-primitive:
  [...]
```
VNFD: Magma vEPC

• Config primitive:
  • Add gateway
  • Delete gateway
  • Reset id
  • Restart magma

vdu-configuration:
  [...]
initial-config-primitive:
  [...]
config-primitive:
  - name: add-gw
    parameter:
      - name: agw_id
default-value: <agw_id>
      - name: agw_name
default-value: <agw_name>
      - name: orch_ip
default-value: <orch_ip>
      - name: orch_net
default-value: <orch_net>
  [...]

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Config primitive:
- Add gateway
- Delete gateway
- Reset id
- Restart magma

```
vdu-configuration:
  [...]  
initial-config-primitive:
  [...]  
config-primitive:
  [...]  
  - name: del-gw
    parameter:
      - name: agw_id
        default-value: <agw_id>
      - name: orch_ip
        default-value: <orch_ip>
      - name: orch_net
        default-value: <orch_net>
  - name: reset-id
  - name: restart-magma
```
EnodeB + UE emulator

OSM

Regional Datacentre

VIM + K8s

Magma Orchestrator (KNF)

Proxy Charm

Native Charm

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Generic eNodeB + UE emulator vdu

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Primitives in ENodeB + UE emulator
EnodeB and UE emulator

- Image: Based on Ubuntu (Bionic)
  - Name: srsLTEfauxRF_hf9
  - This image already has enodeB and UE installed.

- Native charm:
  - Name: enodeb
  - Actions:
    - Register
    - Attach UE
    - Unregister
    - Detach UE
    - Remove default gateway
EnodeB + UE Emulator

Native Charm

Workload VNF

OSM
VNFD: EnodeB + UE Emulator

- VDU Configuration: When the charm is not a proxy charm, it needs to be inside the vdu-configuration because it will be deployed inside the VM (=VDU)
  - Juju:charm:proxy = False: If proxy is False, it means we are working with a native charm
  - Initial config primitive:
    - Remove default gateway

```python
dict = {
    'juju': {
        'charm': 'enodeb',
        'proxy': False,
    },
    'config-access': {
        'ssh-access': {
            'required': True,
            'default-user': 'ubuntu',
        },
    },
    'initial-config-primitive': {
        'seq': '1',
        'name': 'remove-default-gw',
    },
    'config-primitive': [...]
}
```
VNFD: EnodeB + UE Emulator

- VDU Configuration:
  - Config primitive:
    - Attach UE
    - Detach UE

```yaml
vdu-configuration:
  [...]  
config-primitive:
  - name: attach-ue
    parameter:
      - name: usim-imsi
        data-type: STRING
      - name: usim-k
        data-type: STRING
      - name: usim-opc
        data-type: STRING
      - name: detach-ue
```
Introduction to Juju Relations

David Garcia (Canonical)
• When a relation is established, relationJoined event is triggered in both charms

• After relationJoined, relationChanged will be trigger

• Any time a charm writes into the relation_data, relationChanged event will be triggered in the other side of the relation

```python
def on_relation_joined(self, event):
    rel = self.model.get_relation("agw")
    if rel is None:
        event.defer()
        return
    if not self.state.ready:
        return
    rel.data[self.unit]["mme-addr"] = get_ip()

def on_relation_changed(self, event):
    rel = self.model.get_relation("agw")
    if rel is None:
        event.defer()
        return
    mme_addr = rel.data[event.unit].get("mme-addr")
    if mme_addr:
        ...
```
VNFD: Relation

- In the vnf configuration we need to specify the relations we want to add.
- The entities key is a two-element array that includes both endpoints of the relation.
- The id of the entity is the VDU id, and the endpoint is the name of the interface endpoint provided by the charm

```yaml
vnf-configuration:
  relation:
    - name: agw
      entities:
        - id: srsLTE-vdu
          endpoint: agw
        - id: magma-agw-vdu
          endpoint: agw
```
Let’s code!
Go to the workspace

- Change directory

$ cd 02-relation/  # Or the edited 01-base
$ ./build.sh

$ osm nsd-delete hackfest_magma-agw-enb_nsd
$ osm vnfd-delete hackfest_magma-agw-enb_vnfd

$ osm nfpkg-create hackfest_magma-agw-enb_vnfd
$ osm nspkg-create hackfest_magma-agw-enb_nsd

$ osm ns-create --ns_name magmaAGW_X \
   --nsd_name hackfest_magma-agw-enb_nsd \
   --config_file params.yaml \
   --ssh_keys ~/.ssh/id_rsa.pub \
   --vim_account etsi-openstack
Deployment parameters

- params.yml

```yaml
additionalParamsForVnf:
  - member-vnf-index: 'MagmaAGW+srsLTE'

additionalParams:
  agw_id: 'agw_01'
  agw_name: 'AGW1'
  orch_ip: '172.21.251.x' # change this to your assigned address
  orch_net: 'osmnet'
```
Wait until is deployed

- See network services:
  
  ```
  osm ns-list
  ```

- Show how charms progress:
  
  ```
  juju switch <ns_id>
  watch -c juju status --color
  ```
Check day-1 actions

- Show actions

  `juju show-action-status`
Execute day-2 actions

- Initiate radio:

  osm ns-action magmaAGW_X --vnf_name "MagmaAGW+srsLTE" --vdu_id srsLTE-vdu --action_name register --params '{mme-addr: "192.168.100.254", gtp-bind-addr: "192.168.100.10", s1c-bind-addr: "192.168.100.10"}'

- Attach UE Emulator:

  osm ns-action magmaAGW_X --vnf_name "MagmaAGW+srsLTE" --vdu_id srsLTE-vdu --action_name attach-ue --params '{usim-imsi: "722070000000008", usim-k: "c8eba87c1074edd06885cb0486718341", usim-opc: "17b6c0157895bcaae1efc1ce55033f5f"}'}
Checks

• Check MME logs

```
osm ns-list
ssh magma@<ip> # passwd=magma
tail -f /var/log/mme.log
```

• Magma Orch UI: admin@magma.test/password1234

```
VNFID=`osm vnf-list | grep orc8r | awk '{ print $2 }'`

osm vnf-show $VNFID --kdu orc8r > vnf-show.txt

MAGMAIP=`cat vnf-show.txt | grep nginx-proxy | grep "LoadBalancer" | awk '{ print $4 }'`

echo Magma web interface is https://$MAGMAIP
```
Clean up

- **Detach and unregister:**

  ```
osm ns-action magmaAGW_X --vnf_name "MagmaAGW+srsLTE" --vdu_id srsLTE-vdu --action_name detach-ue
  ```

- **Remove NS and packages:**

  ```
osm ns-delete magmaAGW_X
  ```