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OSM-MR11 Hackfest

OAI 5G Core Onboarding Challenge – Team Eagle #1

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Outline

- Task 1: OAI deployment using Helm Chart
 - Single interface #eth0
 - Multiple interface #eth0 and #net1 using Multus
- Task 2: Charmed implementation for OAI NFs
- Task 3: Deployment descriptor implementation
- Demo
- Tasks 4, 5, and 6 – ongoing

Task 1 – single interface “eth0”

clone the oai-cn5g-fed

```
$ git clone -b helm-update https://gitlab.eurecom.fr/oai/cn5g/oai-cn5g-fed.git
```

Checking the consistencies – static IP, mcc and mnc values

```
ubuntu@hackfest-microk8s-1:~$ more ~/oai-cn5g-fed/charts/oai-amf/templates/deployment.yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: {{ .Chart.Name }}
  labels:
    {{- include "oai-amf.labels" . | nindent 4 }}
spec:
  replicas: {{ .Values.replicaCount }}
  selector:
    matchLabels:
      {{- include "oai-amf.selectorLabels" . | nindent 6 }}
  strategy:
    type: Recreate
  template:
    metadata:
      annotations:
        cni.projectcalico.org/ipAddrs: "[\"10.1.244.190\"]"
      labels:
        {{- include "oai-amf.selectorLabels" . | nindent 8 }}
    #{{- if .Values.multus.create }}
    #  annotations:
```

check the logs of SMF and UPF to see the session is configured properly

```
$ kubectl oai-smf-678bbc965f-whdr6 smf | grep 'Received N4 ASSOCIATION SETUP RESPONSE from an UPF'
$ kubectl logs oai-spgwu-tiny-6c4d68fd45-mpv5v spgwu | grep 'Received SX HEARTBEAT REQUEST' | wc -l
```

Task 1: single interface – “eth0” (contd.)

- Helm list and kubernetes pods

```
ubuntu@hackfest-microk8s-1:~$ helm list
NAME    NAMESPACE   REVISION   UPDATED             STATUS      CHART          APP VERSION
amf     default     1          2021-09-16 06:05:12.548617114 +0000 UTC deployed
mysql   default     1          2021-09-14 10:23:41.924286089 +0000 UTC deployed
nr-ue   default     1          2021-09-16 06:07:52.247657614 +0000 UTC deployed
nrf     default     1          2021-09-16 06:01:30.917256875 +0000 UTC deployed
smf     default     1          2021-09-16 06:06:08.676962935 +0000 UTC deployed
upf    default     1          2021-09-16 06:06:39.207998463 +0000 UTC deployed
ubuntu@hackfest-microk8s-1:~$ |
```

```
ubuntu@hackfest-microk8s-1:~$ kubectl -n default get pods
NAME                READY   STATUS    RESTARTS   AGE
mysql-86577dbd58-jsrm2   1/1    Running   0          2d19h
oai-smf-7dd779f9f9-2b2sq   2/2    Running   0          24h
oai-nrf-5bcd85fd69-j8g42   2/2    Running   0          24h
oai-spgwu-tiny-978c4cc85-zjs98   2/2    Running   0          24h
oai-amf-d89bbcf84-77wmt   2/2    Running   0          24h
oai-nr-ue-65957c8bb8-8gzvg   2/2    Running   3          24h
oai-gnb-c8bc86b99-qzsfm   2/2    Running   3          24h
ubuntu@hackfest-microk8s-1:~$ |
```

- Interfaces and ping test from nr-ue

```
root@oai-nr-ue-65957c8bb8-8gzvg:/opt/oai-nr-ue# route -n
Kernel IP routing table
Destination     Gateway         Genmask        Flags Metric Ref  Use Iface
0.0.0.0         169.254.1.1   0.0.0.0       UG     0      0      0 eth0
12.1.1.0        0.0.0.0       255.255.255.0 U      0      0      0 oaitun_ue1
169.254.1.1    0.0.0.0       255.255.255.255 UH    0      0      0 eth0
root@oai-nr-ue-65957c8bb8-8gzvg:/opt/oai-nr-ue# |
```

```
root@oai-nr-ue-65957c8bb8-8gzvg:/opt/oai-nr-ue# ping -c 4 google.fr
PING google.fr (142.251.36.3) 56(84) bytes of data.
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=1 ttl=108 time=56.2 ms
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=2 ttl=108 time=56.5 ms
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=3 ttl=108 time=55.5 ms
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=4 ttl=108 time=56.4 ms

--- google.fr ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3003ms
rtt min/avg/max/mdev = 55.530/56.197/56.554/0.395 ms
root@oai-nr-ue-65957c8bb8-8gzvg:/opt/oai-nr-ue# ^C
root@oai-nr-ue-65957c8bb8-8gzvg:/opt/oai-nr-ue# |
```

```
root@oai-nr-ue-65957c8bb8-8gzvg:/opt/oai-nr-ue# ping -I oaitun_ue1 google.fr
PING google.fr (142.251.36.3) from 12.1.1.129 oaitun_ue1: 56(84) bytes of data.
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=1 ttl=107 time=64.8 ms
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=2 ttl=107 time=74.1 ms
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=3 ttl=107 time=82.1 ms
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=4 ttl=107 time=80.1 ms
^C
--- google.fr ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3004ms
rtt min/avg/max/mdev = 64.870/75.352/82.188/6.737 ms
root@oai-nr-ue-65957c8bb8-8gzvg:/opt/oai-nr-ue# |
```

Task 1: using multus – “eth0” and “net1”

- Interfaces

```
root@oai-nr-ue-76755b9c4c-z5swr:/opt/oai-nr-ue# route -n
Kernel IP routing table
Destination      Gateway        Genmask        Flags Metric Ref  Use Iface
0.0.0.0          169.254.1.1   0.0.0.0        UG    0      0      0 eth0
12.1.1.0          0.0.0.0       255.255.255.0  U     0      0      0 oaitun_ue1
169.254.1.1      0.0.0.0       255.255.255.255 UH    0      0      0 eth0
192.168.18.0      0.0.0.0       255.255.255.0  U     0      0      0 net1
root@oai-nr-ue-76755b9c4c-z5swr:/opt/oai-nr-ue# |
```

N1

- Ping test

```
root@oai-nr-ue-76755b9c4c-z5swr:/opt/oai-nr-ue# ping -c 4 google.fr
PING google.fr (142.251.36.3) 56(84) bytes of data.
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=1 ttl=108 time=57.4 ms
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=2 ttl=108 time=56.7 ms
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=3 ttl=108 time=56.5 ms
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=4 ttl=108 time=58.0 ms

--- google.fr ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3005ms
rtt min/avg/max/mdev = 56.511/57.179/58.037/0.672 ms
root@oai-nr-ue-76755b9c4c-z5swr:/opt/oai-nr-ue# |
```

```
root@oai-nr-ue-76755b9c4c-z5swr:/opt/oai-nr-ue# ping -I oaitun_ue1 google.fr
PING google.fr (142.251.36.3) from 12.1.1.129 oaitun_ue1: 56(84) bytes of data.
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=1 ttl=107 time=63.2 ms
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=2 ttl=107 time=67.9 ms
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=3 ttl=107 time=66.0 ms
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=4 ttl=107 time=61.6 ms
^C
--- google.fr ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3003ms
rtt min/avg/max/mdev = 61.632/64.724/67.986/2.454 ms
root@oai-nr-ue-76755b9c4c-z5swr:/opt/oai-nr-ue# |
```

Demo: Task 1

see the pods

```
$ kubectl get pods
```

access the bash of nr-ue

```
$ kubectl -n oai-charm exec -it nr-ue-0 -c nr-ue bash
```

ping google

```
$ ping -c 4 google.com
```

for multus

```
$ kubectl get pods -n 5gtest
```

```
$ kubectl -n 5gtest exec -it oai-nr-ue-65957c8bb8-8gzvg -c nr-ue bash
```

Task 2: charmed deployment

- Namespace: `oai-charm`
- Juju status

```
ubuntu@hackfest-microk8s-1:~/oai-bundle$ juju status -m oai-charm
Model Controller Cloud/Region Version SLA Timestamp
oai-charm oai      microk8s/localhost 2.9.14 unsupported 11:44:09Z

App      Version Status Scale Charm   Store Channel Rev OS       Address          Message
amf      waiting  1     oai-amf local    0 kubernetes 10.152.183.17 waiting for units settled down
db       active   1     oai-db   local    0 kubernetes 10.152.183.88
gnb      waiting  0/1   oai-gnb  local    0 kubernetes 10.152.183.220 installing agent
nr-ue    waiting  0/1   oai-nr-ue local    0 kubernetes 10.152.183.240 installing agent
nrf      waiting  1     oai-nrf  local    0 kubernetes 10.152.183.64 installing agent
smf      waiting  1     oai-smf  local    0 kubernetes 10.152.183.61 installing agent
spgwu-tiny waiting  0/1   oai-spgwu-tiny local   0 kubernetes           installing agent

Unit      Workload Agent   Address        Ports  Message
amf/0*    blocked  executing 10.1.244.134      need nrf and db relations
db/0*    active   idle     10.1.244.172
gnb/0*    unknown  lost     10.1.244.165    agent lost, see 'juju show-status-log gnb/0'
nr-ue/0*  unknown  lost     10.1.244.171    agent lost, see 'juju show-status-log nr-ue/0'
nrf/0*    maintenance executing 10.1.244.177 patching StatefulSet for additional k8s permissions. Attempt 1/5
smf/0*    maintenance executing 10.1.244.142 (install) installing charm software
spgwu-tiny/0 waiting  allocating

ubuntu@hackfest-microk8s-1:~/oai-bundle$ |
```

```
ubuntu@hackfest-microk8s-1:~/oai-bundle$ juju status -m oai-charm
Model Controller Cloud/Region Version SLA Timestamp
oai-charm oai      microk8s/localhost 2.9.14 unsupported 11:49:53Z

App      Version Status Scale Charm   Store Channel Rev OS       Address          Message
amf      active   1     oai-amf local    0 kubernetes 10.152.183.17
db       active   1     oai-db   local    0 kubernetes 10.152.183.88
gnb      active   1     oai-gnb  local    0 kubernetes 10.152.183.220
nr-ue    active   1     oai-nr-ue local    0 kubernetes 10.152.183.240
nrf      active   1     oai-nrf  local    0 kubernetes 10.152.183.64
smf      active   1     oai-smf  local    0 kubernetes 10.152.183.96
spgwu-tiny active   1     oai-spgwu-tiny local   0 kubernetes 10.152.183.116

Unit      Workload Agent   Address        Ports  Message
amf/0*    active   idle     10.1.244.134
db/0*    active   idle     10.1.244.172
gnb/0*    active   idle     10.1.244.181
nr-ue/0*  active   idle     10.1.244.145
nrf/0*    active   idle     10.1.244.168
smf/0*    active   idle     10.1.244.179
spgwu-tiny/0* active   idle     10.1.244.166

ubuntu@hackfest-microk8s-1:~/oai-bundle$
```

Task 2: charmed deployment (contd.)

- nr-ue interfaces

```
root@nr-ue-0:/var/lib/juju# route -n
Kernel IP routing table
Destination     Gateway         Genmask        Flags Metric Ref  Use Iface
0.0.0.0          169.254.1.1   0.0.0.0        UG    0      0      0 eth0
12.1.1.0          0.0.0.0       255.255.255.0  U     0      0      0 oaitun_ue1
169.254.1.1      0.0.0.0       255.255.255.255 UH    0      0      0 eth0
root@nr-ue-0:/var/lib/juju# |
```

```
root@nr-ue-0:/var/lib/juju# ip -br a
lo                  UNKNOWN      127.0.0.1/8 :1/128
eth0@if240          UP          10.1.229.165/32 fe80::ac79:35ff:feae:95d4/64
oaitun_ue1          UNKNOWN      12.1.1.129/24 fe80::817c:1e:1b7:4c90/64
root@nr-ue-0:/var/lib/juju# |
```

- Ping test

```
root@nr-ue-0:/var/lib/juju# ping -I oaitun_ue1 google.fr
PING google.fr (142.251.36.3) from 12.1.1.129 oaitun_ue1: 56(84) bytes of data.
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=1 ttl=107 time=69.8 ms
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=2 ttl=107 time=70.4 ms
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=3 ttl=107 time=82.6 ms
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=4 ttl=107 time=112 ms
```

```
root@nr-ue-0:/var/lib/juju# ping -c 4 google.fr
PING google.fr (142.251.36.3) 56(84) bytes of data.
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=1 ttl=108 time=56.2 ms
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=2 ttl=108 time=55.8 ms
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=3 ttl=108 time=55.1 ms
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=4 ttl=108 time=55.3 ms
```

Demo: Task 2

see the pods

```
$ kubectl get pods -n oai-charm
```

access the bash of nr-ue-0

```
$ kubectl -n oai-charm exec -it nr-ue-0 -c nr-ue bash
```

ping google

```
$ ping -c 4 google.com
```

Task 3: deployment descriptors

- VNFD.yaml

```
vnfd:  
  df:  
    - id: default-df  
  ext-cpd:  
    - id: mgmt-ext  
      k8s-cluster-net: mgmtnet  
    id: oai-cn5g-cnf  
  k8s-cluster:  
    nets:  
      - id: mgmtnet  
  kdu:  
    - name: native-kdu  
      juju-bundle: bundle.yaml  
  mgmt-cp: mgmt-ext  
  product-name: oai-cn5g-cnf
```

- File Structure

```
Oai_vnfd  
  |- checksums.txt  
  |- juju-bundles  
    |- README.md  
    |- bundle.yaml  
    |- charms  
      |- amf.charm  
      |- db.charm  
      |- smf.charm  
      |- nr-ue.charm  
      |- spgwu-tiny.charm  
      |- nrf.charm  
      |- gnb.charm  
  |- oai_cn5g_cnf_vnfd.yaml
```

Task 3: Instantiation of NS from OSM to microk8s cluster



- OSM gui – NS state

A screenshot of the OSM GUI interface. The title bar says "NS Instances". There is a toolbar with a "New N" button and a search bar. Below is a table with columns: Name, Identifier, Nsd name, Operational Status, Config Status, Detailed Status, and Actions. A legend at the top indicates: init (orange), running / configured (green), failed (red), and scaling (blue). One entry is shown: "test-oai" with Identifier "32e72b5d-3f8d-4a90-89c1-32563cf945db" and Nsd name "oai-cn5g-ns". The Operational Status and Config Status are both green checkmarks, and the Detailed Status is "Done". Action buttons are available for each row.

Name	Identifier	Nsd name	Operational Status	Config Status	Detailed Status	Actions
test-oai	32e72b5d-3f8d-4a90-89c1-32563cf945db	oai-cn5g-ns	✓	✓	Done	

- Kubernetes pods (namespace: native-kdu-***)

```
ubuntu@hackfest-microk8s-1:~$ kubectl -n native-kdu-32e72b5d-3f8d-4a90-89c1-32563cf945db get pods
NAME                  READY   STATUS    RESTARTS   AGE
modeloperator-669757556f-2577r  1/1     Running   0          12h
gnb-0                  3/3     Running   7          12h
nr-ue-0                3/3     Running   7          12h
nrf-0                  3/3     Running   7          12h
amf-0                  3/3     Running   6          12h
spgwu-tiny-0           3/3     Running   5          12h
db-0                   2/2     Running   5          12h
smf-0                  3/3     Running   3          12h
ubuntu@hackfest-microk8s-1:~$ |
```

Task 3: Instantiation of NS from OSM to microk8s cluster



- Ping test from nr-ue

```
root@nr-ue-0:/opt/oai-nr-ue# ping -c 4 google.com
PING google.com (142.250.179.142) 56(84) bytes of data.
64 bytes from ams17s10-in-f14.1e100.net (142.250.179.142): icmp_seq=1 ttl=107 time=58.1 ms
64 bytes from ams17s10-in-f14.1e100.net (142.250.179.142): icmp_seq=2 ttl=107 time=58.4 ms
64 bytes from ams17s10-in-f14.1e100.net (142.250.179.142): icmp_seq=3 ttl=107 time=58.4 ms
64 bytes from ams17s10-in-f14.1e100.net (142.250.179.142): icmp_seq=4 ttl=107 time=58.3 ms

--- google.com ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3004ms
rtt min/avg/max/mdev = 58.105/58.337/58.497/0.227 ms
root@nr-ue-0:/opt/oai-nr-ue# |
```

Demo: Task 3

```
# access the bash of nr-ue-0
```

```
$ kubectl -n native-kdu-32e72b5d-3f8d-4a90-89c1-32563cf945db exec -it nr-ue-0 -c nr-ue bash
```

```
# ping google
```

```
$ ping -c 4 google.com
```

Tasks 4, 5, and 6

- Tried to deploy – it was deployed, but
 - Could not progress – due to OSM vm overloading issue

Issues faced!

- Why are the pods restarted automatically? – creates issues with configuration
- Folder_name problem in juju bundles – it only takes “juju-bundles”

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Q&A...

Thank You!