

# Open Source MANO

Team 04 [  ]

OAI-OSM Hackfest  
Authors:

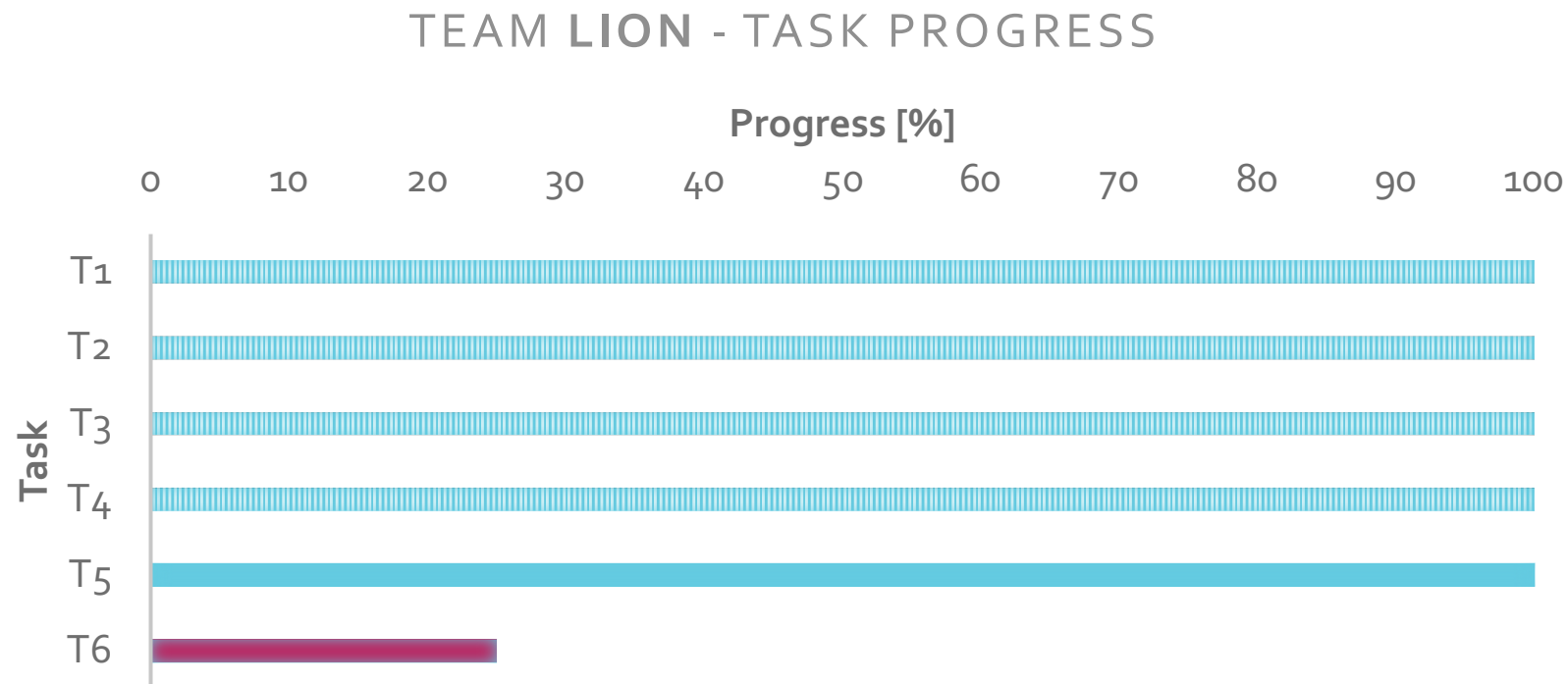
Dimitris Giannopoulos, Jsree Nirmal, Ramy Amer,  
Satish Kumar, Sergio Barrachina-Muñoz, Sondre

# The problem in a nutshell

- Deploy and orchestrate **OAI** network functions with **OSM**
- **Tasks:**
  - **T1:** test OAI deployment
  - **T2:** implement charms for OAI network functions
  - **T3:** implement deployment descriptors for OAI NFs
  - **T4:** automate a configuration parameter change
  - **T5:** scale-up operation by deploying additional gNB RF SIM
  - **T6:** automate an upgrade of AMF

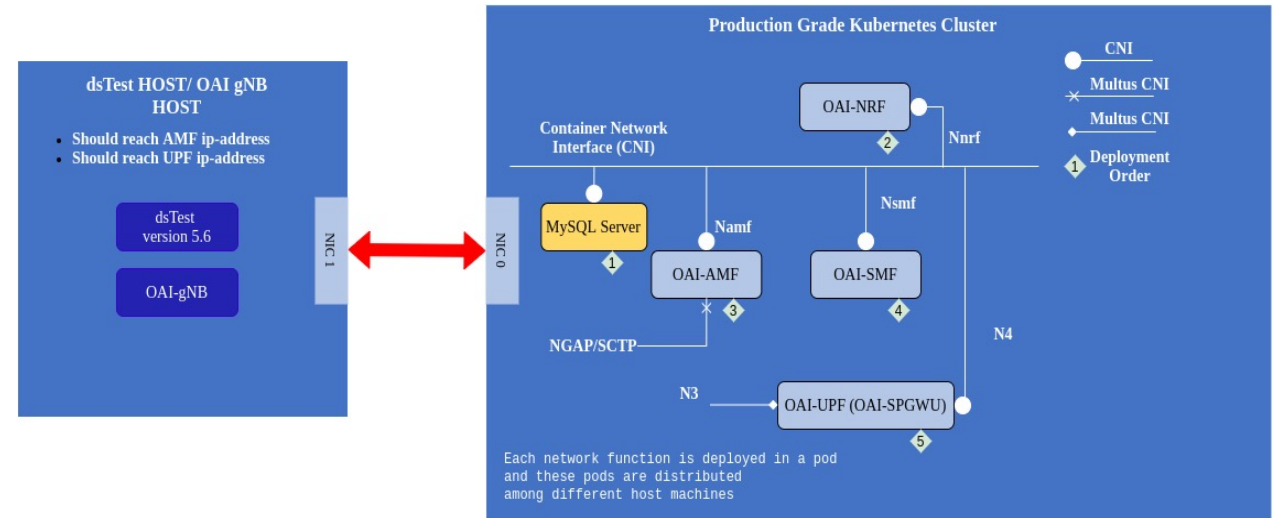
# Team Lion achievements

- Most tasks are completed 😎
- Some issues in *Task 4* 😓



# T1: Deploy OAI on k8s using helm chart

- Key Modifications:
  - Copy kubeconfig file to home directory to run hem and kubectl command.
  - Disabled multus in all the charts.
  - Allocated static IP from calico for AMF and gNB
  - Updated configuration and image version values.yaml.



# T1: Deploy OAI on k8s using helm chart

- List of k8s pods after deployment

```
[ubuntu@hackfest-microk8s-4:~/satish/oai-cn5g-fed/charts$ kubectl get pods -n oai -o wide
```

NAME	READY	STATUS	RESTARTS	AGE	IP	NODE	NOMINATED NODE	READINESS GATES
mysql-86577dbd58-9pnv9	1/1	Running	0	21m	10.1.254.136	hackfest-microk8s-4	<none>	<none>
oai-nrf-5bcd85fd69-2v6cj	2/2	Running	0	18m	10.1.254.181	hackfest-microk8s-4	<none>	<none>
oai-amf-6bb75c8967-6dssd	2/2	Running	0	11m	10.1.254.194	hackfest-microk8s-4	<none>	<none>
oai-smf-7dd779f9f9-vqgpm	2/2	Running	0	8m17s	10.1.254.160	hackfest-microk8s-4	<none>	<none>
oai-spgwu-tiny-978c4cc85-v7x6r	2/2	Running	0	6m2s	10.1.254.182	hackfest-microk8s-4	<none>	<none>
oai-gnb-6b76f464-kkh2p	2/2	Running	0	2m4s	10.1.254.195	hackfest-microk8s-4	<none>	<none>
oai-nr-ue-65475d5d4d-l89b4	2/2	Running	0	14s	10.1.254.176	hackfest-microk8s-4	<none>	<none>

```
ubuntu@hackfest-microk8s-4:~/satish/oai-cn5g-fed/charts$
```

# T1: Deploy OAI on k8s using helm chart

- Log after mysql deployment:

```
2021-09-17T09:07:15.092850Z 0 [Note] Skipping generation of SSL certificates as certificate files are present in data directory.
2021-09-17T09:07:15.093228Z 0 [Warning] CA certificate ca.pem is self signed.
2021-09-17T09:07:15.093256Z 0 [Note] Skipping generation of RSA key pair as key files are present in data directory.
2021-09-17T09:07:15.093589Z 0 [Note] Server hostname (bind-address): '*'; port: 3306
2021-09-17T09:07:15.093753Z 0 [Note] IPv6 is available.
2021-09-17T09:07:15.093785Z 0 [Note] - '::' resolves to '::';
2021-09-17T09:07:15.093804Z 0 [Note] Server socket created on IP: '::'.
2021-09-17T09:07:15.096084Z 0 [Warning] Insecure configuration for --pid-file: Location '/var/run/mysqld' in the path is accessible to all OS users. Consider choosing a different directory.
2021-09-17T09:07:15.101713Z 0 [Note] Event Scheduler: Loaded 0 events
2021-09-17T09:07:15.101953Z 0 [Note] mysqld: ready for connections.
Version: '5.7.30' socket: '/var/run/mysqld/mysqld.sock' port: 3306 MySQL Community Server (GPL)
ubuntu@hackfest-microk8s-4:~/satish/oai-cn5g-fed/charts$
```

# T1: Deploy OAI on k8s using helm chart

- Log after NRF deployment:

```
Now setting these variables '@INSTANCE@ @NRF_API_VERSION@ @NRF_INTERFACE_HTTP2_PORT_FOR_SBI@ @NRF_INTERFACE_NAME_FOR_SBI@ @NRF_INTERFACE_PORT_FOR_SBI@ @PID_DIRECTORY@'
Done setting the configuration
[2021-09-17T11:09:37.943567] [nrf] [nrf_app] [start] Options parsed
[2021-09-17T11:09:37.943825] [nrf] [nrf_app] [info ] ==== EURECOM NRF vBranch: HEAD Abrev. Hash: f41182f Date: Thu Jul 22 13:37:02 2021 +0200 ====
[2021-09-17T11:09:37.943833] [nrf] [nrf_app] [info ] Configuration NRF:
[2021-09-17T11:09:37.943835] [nrf] [nrf_app] [info ] - Instance .....: 0

[2021-09-17T11:09:37.943836] [nrf] [nrf_app] [info ] - PID dir .....: /var/run

[2021-09-17T11:09:37.943837] [nrf] [nrf_app] [info ] - SBI Interface:
[2021-09-17T11:09:37.943838] [nrf] [nrf_app] [info ]     Interface name .....: eth0
[2021-09-17T11:09:37.943840] [nrf] [nrf_app] [info ]     IPv4 Addr .....: 10.1.254.181
[2021-09-17T11:09:37.943841] [nrf] [nrf_app] [info ]     Port .....: 80
[2021-09-17T11:09:37.943842] [nrf] [nrf_app] [info ]     HTTP2 port .....: 9090
[2021-09-17T11:09:37.943843] [nrf] [nrf_app] [info ]     API version.....: v1
[2021-09-17T11:09:37.943848] [nrf] [nrf_app] [start] Starting...
[2021-09-17T11:09:37.944044] [nrf] [nrf_app] [start] Started
[2021-09-17T11:09:37.944712] [nrf] [sbi_srv] [info ] HTTP1 server started
ubuntu@hackfest-microk8s-4:~/satish/oai-cn5g-fed/charts$
```

# T1: Deploy OAI on k8s using helm chart

- Log after AMF deployment

```
[2021-09-17T11:17:36.279349] [AMF] [amf_app] [info ] |-----|
[2021-09-17T11:17:36.279352] [AMF] [amf_app] [info ] |-----gNBs' information-----|
[2021-09-17T11:17:36.279354] [AMF] [amf_app] [info ] |   Index   |   Status   |   Global ID   |   gNB Name   |   PLMN   |
[2021-09-17T11:17:36.279355] [AMF] [amf_app] [info ] |   -       |   -       |   -       |   -       |   -       |
[2021-09-17T11:17:36.279356] [AMF] [amf_app] [info ] |-----|
[2021-09-17T11:17:36.279358] [AMF] [amf_app] [info ] |-----|
[2021-09-17T11:17:36.279359] [AMF] [amf_app] [info ] |-----|
[2021-09-17T11:17:36.279360] [AMF] [amf_app] [info ] |-----UEs' information-----|
[2021-09-17T11:17:36.279362] [AMF] [amf_app] [info ] | Index |   5GMM state   |   IMSI   |   GUTI   | RAN UE NGAP ID | AMF UE ID | PLMN | Cell ID |
[2021-09-17T11:17:36.279363] [AMF] [amf_app] [info ] |-----|
[2021-09-17T11:17:36.279365] [AMF] [amf_app] [info ] |-----|
[2021-09-17T11:17:56.279449] [AMF] [amf_app] [info ] |-----|
[2021-09-17T11:17:56.279502] [AMF] [amf_app] [info ] |-----|
[2021-09-17T11:17:56.279509] [AMF] [amf_app] [info ] |-----gNBs' information-----|
[2021-09-17T11:17:56.279512] [AMF] [amf_app] [info ] |   Index   |   Status   |   Global ID   |   gNB Name   |   PLMN   |
[2021-09-17T11:17:56.279514] [AMF] [amf_app] [info ] |   -       |   -       |   -       |   -       |   -       |
[2021-09-17T11:17:56.279516] [AMF] [amf_app] [info ] |-----|
[2021-09-17T11:17:56.279518] [AMF] [amf_app] [info ] |-----|
[2021-09-17T11:17:56.279520] [AMF] [amf_app] [info ] |-----|
[2021-09-17T11:17:56.279522] [AMF] [amf_app] [info ] |-----UEs' information-----|
[2021-09-17T11:17:56.279524] [AMF] [amf_app] [info ] | Index |   5GMM state   |   IMSI   |   GUTI   | RAN UE NGAP ID | AMF UE ID | PLMN | Cell ID |
[2021-09-17T11:17:56.279526] [AMF] [amf_app] [info ] |-----|
[2021-09-17T11:17:56.279529] [AMF] [amf_app] [info ] |-----|
```



# T1: Deploy OAI on k8s using helm chart

- Log after SMF deployment

```
[2021-09-17T11:22:34.733000] [spgww] [spgww_app] [info ] Response from NRF, JSON data:
{"capacity":100,"fqdn":"oai-spgwu-tiny-svc","heartBeatTimer":10,"ipv4Addresses":["10.1.254.182"],"json_data":{},"nfStatus":"REGISTERED","nfType":"UPF","priority":1,"sNssais":[{"sd":"1","sst":1}],"upfInfo":{"s":{},"t":{},"v":{}}}
[2021-09-17T11:22:34.733179] [spgww] [spgww_app] [start] Started
[2021-09-17T11:22:34.733207] [spgww] [spgww_app] [start] Started
[2021-09-17T11:22:35.690897] [spgww] [spgww_sx ] [info ] TIME-OUT event timer id 1
[2021-09-17T11:22:39.690901] [spgww] [spgww_sx ] [info ] TIME-OUT event timer id 2
[2021-09-17T11:22:44.733220] [spgww] [spgww_app] [info ] TIME-OUT event timer id 4
[2021-09-17T11:22:44.733284] [spgww] [spgww_app] [info ] Send NF Update to NRF
[2021-09-17T11:22:44.734858] [spgww] [spgww_sx ] [info ] handle_receive(16 bytes)
[2021-09-17T11:22:44.734915] [spgww] [spgww_sx ] [info ] Received SX HEARTBEAT REQUEST
[2021-09-17T11:22:44.784449] [spgww] [spgww_app] [info ] Response from NRF, HTTP Code: 204
[2021-09-17T11:22:44.784488] [spgww] [spgww_app] [info ] Got successful response from NRF
[2021-09-17T11:22:54.733441] [spgww] [spgww_app] [info ] TIME-OUT event timer id 5
[2021-09-17T11:22:54.733532] [spgww] [spgww_app] [info ] Send NF Update to NRF
[2021-09-17T11:22:54.734507] [spgww] [spgww_app] [info ] Response from NRF, HTTP Code: 204
[2021-09-17T11:22:54.734525] [spgww] [spgww_app] [info ] Got successful response from NRF
[2021-09-17T11:22:54.735639] [spgww] [spgww_sx ] [info ] handle_receive(16 bytes)
[2021-09-17T11:22:54.735696] [spgww] [spgww_sx ] [info ] Received SX HEARTBEAT REQUEST
[2021-09-17T11:23:04.733626] [spgww] [spgww_app] [info ] TIME-OUT event timer id 7
[2021-09-17T11:23:04.733683] [spgww] [spgww_app] [info ] Send NF Update to NRF
[2021-09-17T11:23:04.734669] [spgww] [spgww_app] [info ] Response from NRF, HTTP Code: 204
[2021-09-17T11:23:04.734687] [spgww] [spgww_app] [info ] Got successful response from NRF
[2021-09-17T11:23:04.736321] [spgww] [spgww_sx ] [info ] handle_receive(16 bytes)
[2021-09-17T11:23:04.736356] [spgww] [spgww_sx ] [info ] Received SX HEARTBEAT REQUEST
[2021-09-17T11:23:14.733784] [spgww] [spgww_app] [info ] TIME-OUT event timer id 9
[2021-09-17T11:23:14.733832] [spgww] [spgww_app] [info ] Send NF Update to NRF
[2021-09-17T11:23:14.734652] [spgww] [spgww_app] [info ] Response from NRF, HTTP Code: 204
[2021-09-17T11:23:14.734678] [spgww] [spgww_app] [info ] Got successful response from NRF
[2021-09-17T11:23:14.736896] [spgww] [spgww_sx ] [info ] handle_receive(16 bytes)
[2021-09-17T11:23:14.736947] [spgww] [spgww_sx ] [info ] Received SX HEARTBEAT REQUEST
```

```
ubuntu@hackfest-microk8s-4:~/satish/oai-cn5g-fed/charts$
```

# T1: Deploy OAI on k8s using helm chart

- Log from AMF after gNB and UE deployment

```
[2021-09-17T11:28:36.286437] [AMF] [amf_app] [info ] |-----|
[2021-09-17T11:28:36.286441] [AMF] [amf_app] [info ] |-----gNBs' information-----|
[2021-09-17T11:28:36.286443] [AMF] [amf_app] [info ] |   Index   |   Status   |   Global ID   |   gNB Name   |   PLMN   |
[2021-09-17T11:28:36.286449] [AMF] [amf_app] [info ] |     1     | Connected  |     0xe000    |   gnb-rfsim   | 208, 95  |
[2021-09-17T11:28:36.286452] [AMF] [amf_app] [info ] |-----|
[2021-09-17T11:28:36.286454] [AMF] [amf_app] [info ] |-----|
[2021-09-17T11:28:36.286456] [AMF] [amf_app] [info ] |-----UEs' information-----|
[2021-09-17T11:28:36.286458] [AMF] [amf_app] [info ] |-----|
[2021-09-17T11:28:36.286460] [AMF] [amf_app] [info ] | Index | 5GMM state | IMSI | GUTI | RAN UE NGAP ID | AMF UE ID | PLMN | Cell ID |
[2021-09-17T11:28:36.286466] [AMF] [amf_app] [info ] |     1 | 5GMM-REGISTERED | 208950000000031 | | 1037432706 | 1 | 208, 95 | 14680064 |
[2021-09-17T11:28:36.286469] [AMF] [amf_app] [info ] |-----|
[2021-09-17T11:28:36.286471] [AMF] [amf_app] [info ] |-----|
```

# T1: Deploy OAI on k8s using helm chart

- Testing UE connection with gNB -> UPF -> Internet
- Login into UE k8s pods. Then, checked route and internet connectivity form tunnel interface.

```
[ubuntu@hackfest-microk8s-4:~/satish/oai-cn5g-fed/charts$ kubectl exec -it oai-nr-ue-65475d5d4d-l89b4 -n oai bash
kubectl exec [POD] [COMMAND] is DEPRECATED and will be removed in a future version. Use kubectl exec [POD] -- [COMMAND] instead.
Defaulted container "nr-ue" out of: nr-ue, tcpdump
[root@oai-nr-ue-65475d5d4d-l89b4:/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-65475d5d4d-l89b4:/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=65.5 ms
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=2 ttl=107 time=69.2 ms
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=3 ttl=107 time=84.9 ms
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=4 ttl=107 time=73.8 ms
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=5 ttl=107 time=79.5 ms
64 bytes from ams15s44-in-f3.1e100.net (142.251.36.3): icmp_seq=6 ttl=107 time=61.4 ms
```

- Implement charms for OAI network functions - example <https://github.com/charmed-osm/oai-bundle>
- Team04 went through OAI network functions, understood juju charms and deployed them
- In the demo, we followed the same steps as OSM demo to deploy the OAI network functions

```
ubuntu@hackfest-team-4:~/OSM-MR11_Hackfest_Lion/OSM/vnfd/oai-5gc-src/juju-bundles$ ./build.sh
```



# Task2 Cont.

- Juju status

```
ubuntu@hackfest-team-4:~/OSM-MR11_Hackfest_Lion/OSM/vnfd$ juju status
Model                                Controller  Cloud/Region  Version  SLA      Timestamp
oai-kdu-e213d349-2a5a-453a-b9a9-dd29b841df79  osm-vca    61ab0671-4086-43bb-91a2-ba2aba72e9e6/default  2.9.9    unsupported  06:33:21Z

App      Version  Status  Scale  Charm          Store  Channel  Rev  OS          Address          Message
amf      active   1       1      oai-amf        local          0      kubernetes  10.152.183.63
db       active   1       1      oai-db         local          0      kubernetes  10.152.183.12
gnb      active   1       1      oai-gnb        local          0      kubernetes  10.152.183.233
nr-ue    active   1       1      oai-nr-ue      local          0      kubernetes  10.152.183.65
nrf      active   1       1      oai-nrf        local          0      kubernetes  10.152.183.58
smf      active   1       1      oai-smf        local          0      kubernetes  10.152.183.121
spgww-tiny  active   1       1      oai-spgww-tiny local          0      kubernetes  10.152.183.161

Unit          Workload  Agent  Address          Ports  Message
amf/0*        active    idle   10.1.254.168
db/0*         active    idle   10.1.254.178
gnb/0*        blocked   idle   10.1.254.148     need amf and spgww relations
nr-ue/0*      blocked   idle   10.1.254.141     need gnb relation
nrf/0*        active    idle   10.1.254.133
smf/0*        blocked   idle   10.1.254.190     need nrf and amf relations
spgww-tiny/0* blocked   idle   10.1.254.143     need nrf and smf relations
```

# Task2 Cont.

- juju status

```
ubuntu@hackfest-team-4:~/OSM-MR11_Hackfest_Lion/OSM/vnfd$ juju status
Model                                Controller  Cloud/Region  Version  SLA          Timestamp
oai-kdu-e213d349-2a5a-453a-b9a9-dd29b841df79  osm-vca    61ab0671-4086-43bb-91a2-ba2aba72e9e6/default  2.9.9    unsupported  06:33:21Z

App      Version  Status  Scale  Charm          Store  Channel  Rev  OS          Address          Message
amf              active    1  oai-amf        local              0  kubernetes  10.152.183.63
db              active    1  oai-db         local              0  kubernetes  10.152.183.12
gnb              active    1  oai-gnb        local              0  kubernetes  10.152.183.233
nr-ue           active    1  oai-nr-ue      local              0  kubernetes  10.152.183.65
nrf              active    1  oai-nrf        local              0  kubernetes  10.152.183.58
smf              active    1  oai-smf        local              0  kubernetes  10.152.183.121
spgwwu-tiny     active    1  oai-spgwwu-tiny local              0  kubernetes  10.152.183.161

Unit          Workload  Agent  Address      Ports  Message
amf/0*        active    idle   10.1.254.168
db/0*         active    idle   10.1.254.178
gnb/0*        blocked   idle   10.1.254.148  need amf and spgwwu relations
nr-ue/0*      blocked   idle   10.1.254.141  need gnb relation
nrf/0*        active    idle   10.1.254.133
smf/0*        blocked   idle   10.1.254.190  need nrf and amf relations
spgwwu-tiny/0* blocked   idle   10.1.254.143  need nrf and smf relations
```

# Task2 Cont.

- juju status

```
ubuntu@hackfest-team-4:~/OSM-MR11_Hackfest_Lion/OSM$ juju status
Model                                Controller  Cloud/Region  Version  SLA          Timestamp
oai-kdu-e85d558c-6685-4d2d-bbb6-6ff3492aa045  osm-vca    61ab0671-4086-43bb-91a2-ba2aba72e9e6/default  2.9.9    unsupported  06:54:13Z

App            Version  Status  Scale  Charm          Store  Channel  Rev  OS          Address        Message
amf            active   1       1       oai-amf        local          0    kubernetes  10.152.183.228
db            active   1       1       oai-db         local          0    kubernetes  10.152.183.67
gnb           active   1       1       oai-gnb        local          0    kubernetes  10.152.183.203
nr-ue         active   1       1       oai-nr-ue      local          0    kubernetes  10.152.183.92
nrf           active   1       1       oai-nrf        local          0    kubernetes  10.152.183.42
smf           active   1       1       oai-smf        local          0    kubernetes  10.152.183.137
spgwu-tiny    active   1       1       oai-spgwu-tiny local          0    kubernetes  10.152.183.195

Unit            Workload  Agent  Address        Ports  Message
amf/0*         active   idle   10.1.254.132
db/0*         active   idle   10.1.254.151
gnb/0*         active   idle   10.1.254.154
nr-ue/0*       active   idle   10.1.254.165
nrf/0*         active   idle   10.1.254.187
smf/0*         active   idle   10.1.254.146
spgwu-tiny/0*  active   idle   10.1.254.133
```

- Implement deployment descriptors for OAI network functions [**day 0 - VNFDs and NSDs**]
- Steps:
  1. Create VNFD
  2. Create NSD
  3. Post-deployment: test the connectivity – from UE to ping the Internet (please ss Task1 logs)



# Task3 Cont. 1- Create VNFD

- Create VNFD

```
OSM-MR11_Hackfest_Lion > OSM > vnfd > oai-5gc-src > ! combined_vnfd.yaml
```

```
1  vnfd:
2    product-name: oai_combined_cnf
3    version: "1.0"
4    provider: osm-mr11-lion-team
5    description: |
6      K8s containers for deployment of the OAI 5GC
7
8    id: oai_5gc_cnf
9
10   mgmt-cp: mgmtnet-ext
11
12   ext-cpd:
13     - id: mgmtnet-ext
14       k8s-cluster-net: mgmtnet
15
16   kdu:
17     - name: oai-kdu
18       juju-bundle: bundle.yaml
19
20   k8s-cluster:
21     nets:
22       - id: mgmtnet
23
24   df:
25     - id: oai-5gc-df
```

```
OSM-MR11_Hackfest_Lion > OSM > vnfd > oai-5gc-src > juju-bundles > ! bundle.yaml
```

```
1
2  bundle: kubernetes
3  applications:
4
5    nrf:
6      charm: ./oai-nrf-operator/nrf.charm
7      scale: 1
8      trust: true
9      options:
10        start-tcpdump: true
11      resources:
12        oai-nrf-image: rdefosseoai/oai-nrf:v1.1.0
13        tcpdump-image: corfr/tcpdump:latest
14
```

```
relations:
- - db:db
  | - amf:db
- - nrf:nrf
  | - amf:nrf
- - nrf:nrf
  | - smf:nrf
- - smf:amf
  | - amf:amf
- - nrf:nrf
  | - spgww-tiny:nrf
- - spgww-tiny:smf
  | - smf:smf
- - gnb:amf
  | - amf:amf
- - nr-ue:gnb
  | - gnb:gnb
- - spgww-tiny:spgww
  | - gnb:spgww
```

# Task3 Cont. 2- Create NSD

- Create NSD

OSM-MR11\_Hackfest\_Lion > OSM > nsd > ! oai\_5gc\_nsd.yaml

```
1  nsd:
2    nsd:
3      - description: NS for OSM hackfest team 4 lion
4        df:
5          - id: default-df
6            vnf-profile:
7              - id: '1'
8                virtual-link-connectivity:
9                  - constituent-cpd-id:
10                     - constituent-base-element-id: '1'
11                       constituent-cpd-id: mgmtnet-ext
12                         virtual-link-profile-id: mgmtnet
13                         vnfd-id: oai_5gc_cnf
14
15      id: oai_5gc_nsd
16      name: oai_5gc_nsd
17      version: '1.0'
18      virtual-link-desc:
19        - id: mgmtnet
20          mgmt-network: true
21          vim-network-name: mgmtnet
22      vnfd-id:
23        - oai_5gc_cnf
24
25
```

# Task3 Cont. post-deployment loga

```
NAMESPACE          NAME                                READY   STATUS    RESTARTS   AGE
kube-system         hostpath-provisioner-5c65fdb4f-5c5s6 1/1     Running   0           6d2h
metallb-system      controller-559b68bfd8-6sxx4          1/1     Running   0           6d2h
metallb-system      speaker-8hjb8                         1/1     Running   0           6d2h
kube-system         calico-node-r9pk6                    1/1     Running   0           6d2h
kube-system         tiller-deploy-85d66d7479-x47tb       1/1     Running   0           6d2h
kube-system         coredns-7f9c69c78c-jjmv2            1/1     Running   0           6d2h
kube-system         calico-kube-controllers-f7868dd95-ccm8n 1/1     Running   0           6d2h
oai                 mysql-86577dbd58-xw5qz               1/1     Running   0           17h
oai                 oai-nrf-5bcd85fd69-hhx9g             2/2     Running   0           17h
oai                 oai-amf-6bb75c8967-jjrfg            2/2     Running   0           16h
oai                 oai-smf-7dd779f9f9-qbgrq            2/2     Running   0           16h
oai                 oai-spgwu-tiny-978c4cc85-p65m8       2/2     Running   0           16h
oai                 oai-gnb-6b76f464-rzz97              2/2     Running   0           16h
oai                 oai-nr-ue-54f4c8d4bd-sfk28          2/2     Running   0           16h
oai-kdu-81b3e8e3-69a6-4fdc-8b0c-7a9e9a3bc7f2 modeloperator-5d6cf664d9-dwvbx       1/1     Running   0           3h2m
oai-kdu-81b3e8e3-69a6-4fdc-8b0c-7a9e9a3bc7f2 nr-ue-0                             3/3     Running   0           3h2m
oai-kdu-81b3e8e3-69a6-4fdc-8b0c-7a9e9a3bc7f2 db-0                                2/2     Running   0           3h2m
oai-kdu-81b3e8e3-69a6-4fdc-8b0c-7a9e9a3bc7f2 gnb-0                               3/3     Running   0           3h2m
oai-kdu-81b3e8e3-69a6-4fdc-8b0c-7a9e9a3bc7f2 nrf-0                               3/3     Running   0           3h1m
oai-kdu-81b3e8e3-69a6-4fdc-8b0c-7a9e9a3bc7f2 amf-0                               3/3     Running   0           3h1m
oai-kdu-81b3e8e3-69a6-4fdc-8b0c-7a9e9a3bc7f2 smf-0                               3/3     Running   0           3h1m
oai-kdu-81b3e8e3-69a6-4fdc-8b0c-7a9e9a3bc7f2 spgwu-tiny-0                        3/3     Running   0           3h1m
ubuntu@hackfest-microk8s-4:~$ kubectl logs smf-0 smf -n oai-kdu-81b3e8e3-69a6-4fdc-8b0c-7a9e9a3bc7f2 | grep 'Received N4 ASSOCIATION SETUP RESPONSE f
rom an UPF'
2021-09-16T15:02:33.837Z [oai_smf] [2021-09-16T17:02:33.837381] [smf] [smf_n4 ] [info ] Received N4 ASSOCIATION SETUP RESPONSE from an UPF
ubuntu@hackfest-microk8s-4:~$ kubectl logs spgwu-tiny-0 spgwu -n oai-kdu-81b3e8e3-69a6-4fdc-8b0c-7a9e9a3bc7f2 | grep 'Received SX HEARTBEAT REQUEST'
| wc -l
error: container spgwu is not valid for pod spgwu-tiny-0
0
ubuntu@hackfest-microk8s-4:~$ kubectl logs spgwu-tiny-0 spgwu-tiny -n oai-kdu-81b3e8e3-69a6-4fdc-8b0c-7a9e9a3bc7f2 | grep 'Received SX HEARTBEAT REQU
EST' | wc -l
1084
ubuntu@hackfest-microk8s-4:~$
```

- Automate a configuration parameter change [day 2 - in the charm]
  - which parameters to change/automate
    - Start/Stop gnb
    - Start/stop AMF

```
- name: start-gnb
  parameter:
    - name: application-name
      default-value: gnb
    - name: container
      data-type: STRING
      default-value: "gnb"
    - name: service
      data-type: STRING
      default-value: "oai_gnb"
- name: stop-gnb
  parameter:
    - name: application-name
      default-value: gnb
    - name: container
      data-type: STRING
      default-value: "gnb"
    - name: service
      data-type: STRING
      default-value: "oai_gnb"
```

# Task4 Cont.

- actions.yaml and charm.py

```
stop-gnb:
  description: "stop gnb"
  params:
    container:
      description: "container that will be stopped"
      type: string
      default: "gnb"
    service:
      description: "service that will be stopped"
      type: string
      default: "oai_gnb"
```

```
## action handler function
def _stop_gnb_action(self, event):
    filename = "gnb-stop"
    try:
        self._stop_service("gnb", "gnb_oai")
        subprocess.run(["touch", filename])
        event.set_results({
            "output": f"File {filename} created successfully"
        })
    except Exception as e:
        event.fail(f"Touch action failed with the following exception: {e}")
```



# Task4 Cont.

- `osm ns-create --name ...`

```
ubuntu@hackfest-team-4:~/OSM-MR11_Hackfest_Lion/OSM/vnfd$ osm ns-create --ns_name oai_5gc_ns --nsd_name oai_5gc_nsd --vim_account hackfest --config '{vld: [ {name: mgmtnet, vim-network-name: osm-ext} ] }'  
096de5ab-6062-455d-b4fe-662ce7f850fd  
ubuntu@hackfest-team-4:~/OSM-MR11_Hackfest_Lion/OSM/vnfd$ osm ns-action oai_5gc_ns --vnf_name 1 --kdu_name oai-kdu --action_name update-amf  
a1a20afc-5dac-40f5-9333-b9417bf3e10d
```

```
ubuntu@hackfest-team-4:~/OSM-MR11_Hackfest_Lion/OSM/vnfd$ osm ns-op-list oai_5gc_ns
```

id	operation	action_name	status	date	detail
68197bb1-1984-4e90-b162-e25684ff2774	instantiate	N/A	COMPLETED	2021-09-16T21:47:41	-
879f3f77-4cae-4042-a039-17a40a10746d	action	update-amf	COMPLETED	2021-09-16T21:49:13	-
db9e4ecf-d0f9-46a2-894b-96d851547111	action	update-amf	PROCESSING	2021-09-16T21:52:17	-

- Automate a scale-up operation by deploying additional gNB RF SIM  
**might need to write charm for gNB and descriptors**

```
df:
- id: oai-5gnb-df
  kdu-resource-profile:
    - id: oai-kdu-scale
      kdu-name: oai-kdu
      resource-name: gnb
      min-number-of-instances: 1
      max-number-of-instances: 5
  scaling-aspect:
    - id: scale-oai-kdu
      name: scale-oai-kdu
      max-scale-level: 10
      aspect-delta-details:
        deltas:
          - id: kdu-delta
            kdu-resource-delta:
              - id: oai-kdu-scale
                number-of-instances: 1
  lcm-operations-configuration:
```

# Task5 Cont.

- Juju scale-application gnb 3

```
buntu@hackfest-team-4:~/OSM-MR11_Hackfest_Lion/OSM/sondre_charmed_draft$ juju status
Model oai-kdu-aad12a18-bdfa-4188-88d8-999f03ae9725 Controller osm-vca Cloud/Region 61ab0671-4086-43bb-91a2-ba2aba72e9e6/default Version 2.9.9 SLA unsupported Timestamp 19:27:50Z

App      Version  Status  Scale  Charm      Store  Channel  Rev  OS      Address      Message
amf       1        active   1      oai-amf     local  -         0    kubernet 10.152.183.64
db        1        active   1      oai-db      local  -         0    kubernet 10.152.183.216
gnb       1        active   1      oai-gnb     local  -         0    kubernet 10.152.183.36
nr-ue     1        active   1      oai-nr-ue   local  -         0    kubernet 10.152.183.242
nrf       1        active   1      oai-nrf     local  -         0    kubernet 10.152.183.41
smf       1        active   1      oai-smf     local  -         0    kubernet 10.152.183.224
spgwtiny 1        active   1      oai-spgwtiny local  -         0    kubernet 10.152.183.214

Unit      Workload Agent Address      Ports  Message
amf/0*    active  idle  10.1.254.168
db/0*     active  idle  10.1.254.154
gnb/0*    active  idle  10.1.254.178
nr-ue/0*  active  idle  10.1.254.146
nrf/0*    active  idle  10.1.254.137
smf/0*    active  idle  10.1.254.163
spgwtiny/0* active  idle  10.1.254.190

buntu@hackfest-team-4:~/OSM-MR11_Hackfest_Lion/OSM/sondre_charmed_draft$ juju scale-application gnb 3
gnb scaled to 3 units
buntu@hackfest-team-4:~/OSM-MR11_Hackfest_Lion/OSM/sondre_charmed_draft$ juju status
Model oai-kdu-aad12a18-bdfa-4188-88d8-999f03ae9725 Controller osm-vca Cloud/Region 61ab0671-4086-43bb-91a2-ba2aba72e9e6/default Version 2.9.9 SLA unsupported Timestamp 19:28:41Z

App      Version  Status  Scale  Charm      Store  Channel  Rev  OS      Address      Message
amf       1        active   1      oai-amf     local  -         0    kubernet 10.152.183.64
db        1        active   1      oai-db      local  -         0    kubernet 10.152.183.216
gnb       1        active   1/3    oai-gnb     local  -         0    kubernet 10.152.183.36
nr-ue     1        active   1      oai-nr-ue   local  -         0    kubernet 10.152.183.242
nrf       1        active   1      oai-nrf     local  -         0    kubernet 10.152.183.41
smf       1        active   1      oai-smf     local  -         0    kubernet 10.152.183.224
spgwtiny 1        active   1      oai-spgwtiny local  -         0    kubernet 10.152.183.214

Unit      Workload Agent Address      Ports  Message
amf/0*    active  idle  10.1.254.168
db/0*     active  idle  10.1.254.154
gnb/0*    active  idle  10.1.254.178
nr-ue/0*  active  idle  10.1.254.146
nrf/0*    active  idle  10.1.254.137
smf/0*    active  idle  10.1.254.163
spgwtiny/0* active  idle  10.1.254.190
```



# Task5 Cont.

- Juju scale-application gnb 3

```
ubuntu@hackfest-team-4:~/OSM-MR11_Hackfest_Lion/OSM/sondre_charmed_draft$ juju status
```

Model	Controller	Cloud/Region	Version	SLA	Timestamp
oai-kdu-aad12a18-bdfa-4188-88d8-999f03ae9725	osm-vca	61ab0671-4086-43bb-91a2-ba2aba72e9e6/default	2.9.9	unsupported	19:28:58Z

App	Version	Status	Scale	Charm	Store	Channel	Rev	OS	Address	Message
amf		active	1	oai-amf	local		0	kubernetes	10.152.183.64	
db		active	1	oai-db	local		0	kubernetes	10.152.183.216	
gnb		active	3	oai-gnb	local		0	kubernetes	10.152.183.244	
nr-ue		active	1	oai-nr-ue	local		0	kubernetes	10.152.183.242	
nrf		active	1	oai-nrf	local		0	kubernetes	10.152.183.41	
smf		active	1	oai-smf	local		0	kubernetes	10.152.183.224	
spgww-tiny		active	1	oai-spgww-tiny	local		0	kubernetes	10.152.183.214	

Unit	Workload	Agent	Address	Ports	Message
amf/0*	active	executing	10.1.254.168		
db/0*	active	idle	10.1.254.154		
gnb/0*	active	idle	10.1.254.178		
gnb/1	maintenance	executing	10.1.254.173		patching StatefulSet for additional k8s permissions. Attempt 1/5
gnb/2	maintenance	executing	10.1.254.141		patching StatefulSet for additional k8s permissions. Attempt 1/5
nr-ue/0*	active	executing	10.1.254.146		
nrf/0*	active	idle	10.1.254.137		
smf/0*	active	idle	10.1.254.163		
spgww-tiny/0*	active	executing	10.1.254.190		

- Team4 tried for task 6 but not completed.
- Our approach was to write actions for:
  - Stop AMF
  - Modify container image and start AMF.
  - We plan to work on this task after OSM hackfest.
  - Any insight or documentation from OSM team will be helpful for us.



Open Source  
MANO

Thank You