

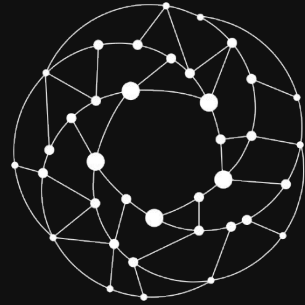
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HACKFEST 11 -- OAI 5GC Onboarding

TEAM HAWK

Agenda

- Team Introduction and Task Distribution
- Demo -- Task 1
 - Procedures and Issues faced
- Demo -- Task 2
 - Procedures and Issues faced
- Demo -- Task 3
 - Procedures and Issues faced
- Demo -- Task 4 and 5
 - Procedures and Issues faced
- Conclusion



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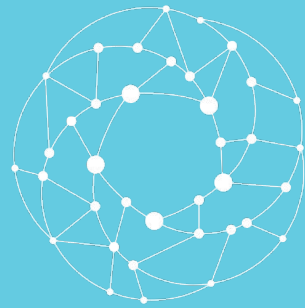
Team Intro & Task Distribution

TEAM HAWK

Team Intro & Task Distribution

TEAM MEMBERS	TASK ORGANIZATION
Akshay Jain	Task 1, Task 5, Presentation
Alejandro Llorens-Carrodegua	Task 3, Task 5, Presentation
Andrés Meseguer Valenzuela	Task 2, Presentation
Cristina Cervelló-Pastor	Task 3, Task 5, Presentation
Irian Leyva-Pupo	Task 3, Task 5, Presentation
Kashif Mehmood	Task 1, Task 4, Presentation

- **Kindly note that this is just a broad description. Everyone was somehow involved in all the tasks as we helped each other out. Hence, In a way everyone worked equally.**



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Task - 1: OAI 5GC deployment using Helm Charts

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Demo - Task 1

Helm and Kubernetes Deployment

```
ubuntu@hackfest-microk8s-3:~$ helm list --namespace=oai
WARNING: Kubernetes configuration file is group-readable. This is insecure. Location: /home/ubuntu/.kube/config
WARNING: Kubernetes configuration file is world-readable. This is insecure. Location: /home/ubuntu/.kube/config
NAME      NAMESPACE    REVISION    UPDATED                               STATUS      CHART              APP VERSION
amf       oai           1           2021-09-15 13:09:06.905108978 +0000 UTC deployed    oai-amf-1.1.0      1.1.0
gnb       oai           1           2021-09-15 13:13:35.645824943 +0000 UTC deployed    oai-gnb-0.1.1      v1
mysql     oai           1           2021-09-15 08:21:48.493250725 +0000 UTC deployed    mysql-1.6.9         5.7.30
nr-ue     oai           1           2021-09-15 13:14:37.603161968 +0000 UTC deployed    oai-nr-ue-0.1.1    v1
nrf       oai           1           2021-09-15 13:07:07.570519836 +0000 UTC deployed    oai-nrf-1.1.0      1.1.0
smf       oai           1           2021-09-15 13:09:51.241910295 +0000 UTC deployed    oai-smf-1.1.0      1.1.0
spgwu     oai           1           2021-09-15 13:11:25.046298447 +0000 UTC deployed    oai-spgwu-tiny-1.1.2 1.1.2
ubuntu@hackfest-microk8s-3:~$
```

```
ubuntu@hackfest-microk8s-3:~$ kubectl get pods -n oai
NAME                                READY   STATUS    RESTARTS   AGE
oai-nrf-5bcd85fd69-pdlh7            2/2     Running   0           28h
oai-spgwu-tiny-5b5f5f49fd-5m627     2/2     Running   0           28h
oai-amf-84cd7f6b4c-d26zj            2/2     Running   0           28h
mysql-86577dbd58-zmv4r              1/1     Running   0           32h
oai-nr-ue-65957c8bb8-hj247          2/2     Running   5           28h
oai-gnb-ffd5d6cd7-ws5fv             2/2     Running   3           28h
oai-smf-7dd779f9f9-nqlx6            2/2     Running   1           28h
ubuntu@hackfest-microk8s-3:~$
```

Demo - Task 1 (*Verification and Testing*)

5GC Network Connectivity

```
ubuntu@hackfest-microk8s-3:~/logs$ kubectl logs oai-smf-7dd779f9f9-nqlx6 smf | grep 'Received N4 ASSOCIATION SETUP RESPONSE from an UPF'
[2021-09-16T18:06:02.065593] [smf] [smf_n4 ] [info ] Received N4 ASSOCIATION SETUP RESPONSE from an UPF
ubuntu@hackfest-microk8s-3:~/logs$ kubectl logs oai-spgwu-tiny-5b5f5f49fd-5m627 spgwu | grep 'Received SX HEARTBEAT REQUEST' | wc -l
2806
ubuntu@hackfest-microk8s-3:~/logs$ kubectl logs -c amf oai-amf-84cd7f6b4c-d26zj | grep Connected | grep gnb-rfsim | wc -l
796
```

UE Connectivity

```
root@oai-nr-ue-65957c8bb8-hj247:/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
```

IP routes under nr-ue pod

Ping test

```
ubuntu@hackfest-microk8s-3:~/tmp/oai-cn5g-fed/charts$ kubectl exec -it oai-nr-ue-585769b6dc-sqp47 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-585769b6dc-sqp47:/opt/oai-nr-ue# ping 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=57.7 ms
64 bytes from ams17s10-in-f14.1e100.net (142.250.179.142): icmp_seq=2 ttl=107 time=88.7 ms
64 bytes from ams17s10-in-f14.1e100.net (142.250.179.142): icmp_seq=3 ttl=107 time=62.7 ms
^C
--- google.com ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2001ms
rtt min/avg/max/mdev = 57.764/69.772/88.790/13.604 ms
root@oai-nr-ue-585769b6dc-sqp47:/opt/oai-nr-ue# ping -I oaitun_ue1 osm.etsi.org
PING osm.etsi.org (195.238.226.13) from 12.1.1.129 oaitun ue1: 56(84) bytes of data:
64 bytes from osm.etsi.org (195.238.226.13): icmp_seq=1 ttl=58 time=34.6 ms
64 bytes from osm.etsi.org (195.238.226.13): icmp_seq=2 ttl=58 time=52.3 ms
64 bytes from osm.etsi.org (195.238.226.13): icmp_seq=3 ttl=58 time=52.3 ms
64 bytes from osm.etsi.org (195.238.226.13): icmp_seq=4 ttl=58 time=43.9 ms
64 bytes from osm.etsi.org (195.238.226.13): icmp_seq=5 ttl=58 time=34.4 ms
64 bytes from osm.etsi.org (195.238.226.13): icmp_seq=6 ttl=58 time=53.8 ms
64 bytes from osm.etsi.org (195.238.226.13): icmp_seq=7 ttl=58 time=55.6 ms
64 bytes from osm.etsi.org (195.238.226.13): icmp_seq=8 ttl=58 time=42.8 ms
^C
--- osm.etsi.org ping statistics ---
8 packets transmitted, 8 received, 0% packet loss, time 7280ms
rtt min/avg/max/mdev = 34.471/46.273/55.668/8.004 ms
```

Demo - Task 1 (*Issues*)

Static IP Configuration for gNB, and NR-UE

- Subnet from the calico network (10.1.115.x)
- Configuration in gNB, NR-UE values.yaml, deployment.yaml.
- Issue related to mismatch and conflict of IPs due to allocation to other CN elements
- Thanks to Sagar and many hours resolved.

```
config:
  timeZone: "Europe/Paris"
  rfSimulator: "server"
  useSATddMono: "yes"
  gnbName: "gnb-rfsim"
  mcc: "208" # check the information with AMF, SMF, UPF/SPGWU
  mnc: "95" # check the information with AMF, SMF, UPF/SPGWU
  mncLength: "2" # check the information with AMF, SMF, UPF/SPGWU
  tac: "1" # check the information with AMF
  nssaiSst: "1" #currently only 4 standard values are allowed 1,2,3,4
  nssaiSd0: "1" #values in hexa-decimal format
  nssaiSd1: "112233"
  amfIpAddress: "10.1.115.101" # amf ip-address currently we can not provide the amf service name to be used by gNB
  gnbNgaIfName: "eth0" #ngap interface
  gnbNgaIpAddress: "10.1.115.100"
  gnbNguIfName: "eth0" #gtu interface for upf/spgwu
  gnbNguIpAddress: "10.1.115.100"
  useAdditionalOptions: "--sa -E --rfsim"
```

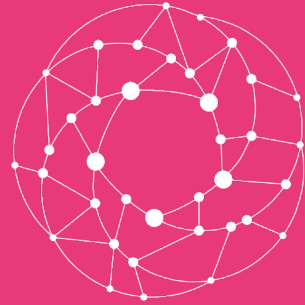
gNB

RAN & E2E Connectivity

- The same issue with the conflict of IPs and also misconfigured IP in the NR-UE
- NR-UE not able to connect and oaitun_ue1 interface down
- Thanks to Sagar and many hours resolved.

```
config:
  timeZone: "Europe/Paris"
  rfSimulator: "10.1.115.100" # ip-address of gnb rf-sim (Updated by Akshay)
  fullImsi: "208950000000031" # make sure all the below entries are present in the subscriber database
  fullKey: "0C0A34601D4F07677303652C0462535B"
  opc: "63bfa50ee6523365ff14c1f45f88737d"
  dnn: "oai"
  nssaiSst: "1" # configure according to gnb and amf, smf and upf
  nssaiSd: "1"
  useAdditionalOptions: "-E --sa --rfsim -r 106 --numerology 1 -C 3619200000 --nokrnmod"
```

NR-UE



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Task 2: OAI 5GC deployment using JuJu-Charms TEAM HAWK

Demo - Task 2 (Procedures)

Installation of Juju

```
$ sudo snap install charmcraft
```

```
$ sudo snap install lxd  
$ sudo adduser $USER lxd  
$ newgrp lxd  
$ lxd init --auto
```

```
$ sudo snap install juju --classic
```

Demo - Task 2 (Procedures)

Get the charms and deploy

```
git clone https://github.com/charmed-osm/oai-bundle.git
```

```
cd oai-bundle
```

```
juju add-model oai-10
```

```
./build.sh
```

```
juju deploy ./bundle.yaml --trust
```

```
ubuntu@hackfest-microk8s-3:~/tmp/oai-bundle$ ls
README.md      oai-gnb-operator
build.sh       oai-nr-ue-operator
bundle.yaml    oai-nrf-operator
deploy.sh      oai-smf-operator
oai-amf-operator  oai-spgwu-tiny-operator
oai-db-operator
```

Demo - Task 2 (*Verification and Testing*)

Check status

```
ubuntu@hackfest-microk8s-3:~/tmp/oai-bundle$ juju status
Model          Controller  Cloud/Region  Version  SLA          Timestamp
oai-final-day  micro      microk8s/localhost  2.9.14   unsupported   08:21:47Z

App            Version  Status  Scale  Charm          Store  Channel  Rev  OS          Address        Message
amf            active   1       1       oai-amf        local  -         0    kubernetes  10.152.183.96
db            active   1       1       oai-db         local  -         0    kubernetes  10.152.183.191
gnb           active   1       1       oai-gnb        local  -         0    kubernetes  10.152.183.183
nr-ue         active   1       1       oai-nr-ue      local  -         0    kubernetes  10.152.183.120
nrf           active   1       1       oai-nrf        local  -         0    kubernetes  10.152.183.95
smf           active   1       1       oai-smf        local  -         0    kubernetes  10.152.183.220
spgww-tiny    active   1       1       oai-spgww-tiny local  -         0    kubernetes  10.152.183.196

Unit           Workload  Agent  Address        Ports  Message
amf/0*         active    idle   10.1.115.81
db/0*          active    idle   10.1.115.114
gnb/0*         active    idle   10.1.115.117
nr-ue/0*       active    idle   10.1.115.109
nrf/0*         active    idle   10.1.115.95
smf/0*         active    idle   10.1.115.89
spgww-tiny/0*  active    idle   10.1.115.76
```

Demo - Task 2 (Issues)

- *There were no charms for gnb and nr-ue*
- *IP with ue: Detected a bug, and reported to @David. Also gave some ideas to solve it*

```
ubuntu@hackfest-microk8s-3:~/tmp/oai-bundle$ microk8s.kubectl -n oai-09 logs amf-0 -c amf | less
2021-09-15T14:10:37.259Z [oai_amf] [2021-09-15T16:10:37.259104] [AMF] [amf_n1 ] [error] An error occurred while connecting to db: Unknown MySQL server host '10.1.115.89:3306' (0)
2021-09-15T14:10:37.259Z [oai_amf] [2021-09-15T16:10:37.259142] [AMF] [amf_n1 ] [error] Cannot connect to MySQL
2021-09-15T14:10:37.260Z [oai_amf] 0x0000000000000000
2021-09-15T14:10:37.260Z [oai_amf] [2021-09-15T16:10:37.260706] [AMF] [nas_mm ] [warn ] IE ie_eap_message is not available
2021-09-15T14:10:37.290Z [oai_amf] [2021-09-15T16:10:37.289780] [AMF] [amf_n2 ] [info ] Encoding DOWNLINK NAS TRANSPORT message, sending
2021-09-15T14:10:37.445Z [oai_amf] InitiatingMessage ::= {
2021-09-15T14:10:37.446Z [oai_amf]   procedureCode: 4
2021-09-15T14:10:37.446Z [oai_amf]   criticality: 1 (ignore)
2021-09-15T14:10:37.446Z [oai_amf]   value: DownlinkNASTransport ::= {
2021-09-15T14:10:37.446Z [oai_amf]     protocolIEs: ProtocolIE-Container ::= {
2021-09-15T14:10:37.446Z [oai_amf]       DownlinkNASTransport-IEs ::= {
2021-09-15T14:10:37.446Z [oai_amf]         id: 10
2021-09-15T14:10:37.446Z [oai_amf]         criticality: 0 (reject)
2021-09-15T14:10:37.446Z [oai_amf]         value: 1
2021-09-15T14:10:37.446Z [oai_amf]       }
2021-09-15T14:10:37.446Z [oai_amf]     DownlinkNASTransport-IEs ::= {
2021-09-15T14:10:37.446Z [oai_amf]       id: 85
2021-09-15T14:10:37.446Z [oai_amf]       criticality: 0 (reject)
2021-09-15T14:10:37.446Z [oai_amf]       value: 1037432706
2021-09-15T14:10:37.446Z [oai_amf]     }
2021-09-15T14:10:37.446Z [oai_amf]     DownlinkNASTransport-IEs ::= {
2021-09-15T14:10:37.446Z [oai_amf]       id: 38
2021-09-15T14:10:37.446Z [oai_amf]       criticality: 0 (reject)
2021-09-15T14:10:37.446Z [oai_amf]       value:
2021-09-15T14:10:37.446Z [oai_amf]         7E 00 56 02 02 00 00 21 00 00 00 00 00 00 00 00
2021-09-15T14:10:37.446Z [oai_amf]         00 00 00 00 00 00 00 00 20 10 00 00 00 00 00 00
2021-09-15T14:10:37.446Z [oai_amf]         00 00 00 00 00 00 00 00 00 00
2021-09-15T14:10:37.446Z [oai_amf]     }
2021-09-15T14:10:37.446Z [oai_amf]   }
2021-09-15T14:10:37.446Z [oai_amf] }
2021-09-15T14:10:37.447Z [oai_amf] }
2021-09-15T14:10:37.448Z [oai_amf] er.encoded(552)
2021-09-15T14:10:37.524Z [oai_amf] [2021-09-15T16:10:37.524488] [AMF] [sctp ] [info ] ****[Assoc_id 67, Socket 19] Received a msg (length 67) from port 38412, on stream 1, PPID 60 ****
2021-09-15T14:10:37.525Z [oai_amf] InitiatingMessage ::= {
2021-09-15T14:10:37.525Z [oai_amf]   procedureCode: 46
2021-09-15T14:10:37.525Z [oai_amf]   criticality: 1 (ignore)
```



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Task-3: OAI 5GC deployment and scaling using OSM

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Demo - Task 3 (Procedures)

nsd:

```
nsd:
- df:
  - id: default-df
  vnf-profile:
  - id: oai_k8s_charm-vnf
  virtual-link-connectivity:
  - constituent-cpd-id:
    - constituent-base-element-id: oai_k8s_charm-vnf
    constituent-cpd-id: mgmt-ext
    virtual-link-profile-id: osm-ext
  vnfd-id: oai_k8s_charm-vnf
id: oai_k8s_charm-ns
name: oai_k8s_charm-ns
version: '1.0'
virtual-link-desc:
- id: osm-ext
  mgmt-network: true
vnfd-id:
- oai_k8s_charm-vnf
```

vnfd:

```
df:
- id: default-df
.
. } Scaling aspects
.
ext-cpd:
- id: mgmt-ext
  k8s-cluster-net: osm-ext
id: oai_k8s_charm-vnf
k8s-cluster:
  nets:
  - id: osm-ext
kdu:
- name: oai-kdu
  juju-bundle: bundle.yaml
mgmt-cp: mgmt-ext
product-name: oai_k8s_charm-vnf
```

Demo - Task 3 (Procedures)

```
ubuntu@hackfest-team-3:~$ osm ns-list
```

ns instance name	id	date	ns state	current operation	error details
test	7d98dacd-cb37-4060-b8a4-85f605a6f788	2021-09-16T15:58:41	READY	IDLE (None)	N/A

```
ubuntu@hackfest-microk8s-3:~$ kubectl get pods -n oai-kdu-7d98dacd-cb37-4060-b8a4-85f605a6f788
```

NAME	READY	STATUS	RESTARTS	AGE
modeloperator-68b766ffc-5m5bs	1/1	Running	0	92m
db-0	2/2	Running	0	92m
nrf-0	3/3	Running	0	91m
nr-ue-0	3/3	Running	0	91m
amf-0	3/3	Running	0	91m
gnb-0	3/3	Running	0	91m
spgwu-tiny-0	3/3	Running	0	91m
smf-0	3/3	Running	0	91m

Demo - Task 3 (Procedures)

kdu-resource-profile:

- id: oai5g

- kdu-name: oai-kdu

- resource-name: gnb

- min-number-of-instances: 1

- max-number-of-instances: 3

scaling-aspect:

- id: scale-kdu

- name: scale-kdu

- max-scale-level: 10

- aspect-delta-details:

- deltas:

- id: kdu-delta

- kdu-resource-delta:

- id: oai5g

- number-of-instances: 1

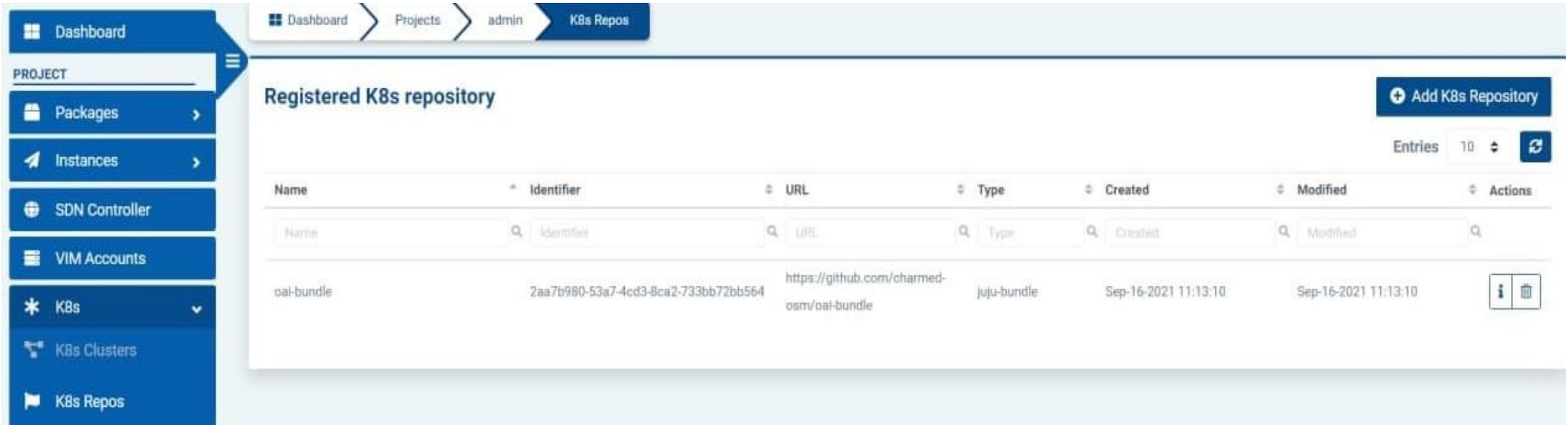
```
osm vnf-scale [ns_name] [vnf_name] --scaling-group scale-kdu --scale-out/in
```



```
ubuntu@hackfest-microk8s-3:~$ kubectl get pods -n oai-kdu-7d98dacd-cb37-4060-b8a4-85f605a6f788
NAME                                READY   STATUS    RESTARTS   AGE
modeloperator-68b766fffc-5m5bs      1/1     Running   0           8m8s
db-0                                 2/2     Running   0           7m51s
nrf-0                                3/3     Running   0           7m19s
nr-ue-0                              3/3     Running   0           7m9s
amf-0                                3/3     Running   0           6m59s
gnb-0                                3/3     Running   0           6m49s
spgww-tiny-0                         3/3     Running   0           6m49s
smf-0                                3/3     Running   0           6m49s
gnb-1                                3/3     Running   0           76s
ubuntu@hackfest-microk8s-3:~$ kubectl get pods -n oai-kdu-7d98dacd-cb37-4060-b8a4-85f605a6f788
NAME                                READY   STATUS    RESTARTS   AGE
modeloperator-68b766fffc-5m5bs      1/1     Running   0           20m
db-0                                 2/2     Running   0           19m
nrf-0                                3/3     Running   0           19m
nr-ue-0                              3/3     Running   0           19m
amf-0                                3/3     Running   0           18m
gnb-0                                3/3     Running   0           18m
spgww-tiny-0                         3/3     Running   0           18m
smf-0                                3/3     Running   0           18m
```

Demo - Task 3 (Issues)

Error: Stage 2/5: deployment of KDUs, VMs and execution environments. 1/2. Errors: Deploying KDU oai-kdu: [Errno 2] No such file or directory: ". VIM: (progress 0/1)

Cause: We were trying to use a k8s repo from OSM.



Name	Identifier	URL	Type	Created	Modified	Actions
oai-bundle	2aa7b980-53a7-4cd3-8ca2-733bb72bb564	https://github.com/charmed-osm/oai-bundle	juju-bundle	Sep-16-2021 11:13:10	Sep-16-2021 11:13:10	 

Solution: Include the Juju Bundles inside the VNF package.



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TASK 4-5: Automatic Parameter change and scaling

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Task 4 and 5: Actions taken

- We explored several options to perform automatic scaling and parameter changes.
- One of the aspects we explored was the part of “scaling policy” in the vnfd, similar to vdu

```
scaling-group-descriptor:  
- name: "cpu_autoscaling_descriptor"  
  min-instance-count: 0  
  max-instance-count: 10  
  scaling-policy:  
  - name: "cpu_scaling_policy"  
    scaling-type: "automatic"  
    cooldown-time: 120  
    scaling-criteria:  
    - name: "cpu_autoscaling_criteria"  
      scale-in-threshold: 20  
      scale-in-relational-operation: "LT"  
      scale-out-threshold: 80  
      scale-out-relational-operation: "GT"  
      vnf-monitoring-param-ref: "vnf01_cpu_util"  
  
vdu:  
- count: 1  
  vdu-id-ref: vdu01
```

Upon further exploration we did not see that the OSM vnfd model supports similar scaling properties for the kdus.

Is that supposed to be available in a future release?

- Another aspect was to look charms.py and create new actions in the actions.yaml file. The relationship on how the actions.yaml helps in auto-scaling and param change is quite unclear.

Task 4 and 5: Actions taken

- We used David's scripts to do the oai-gnb scaling

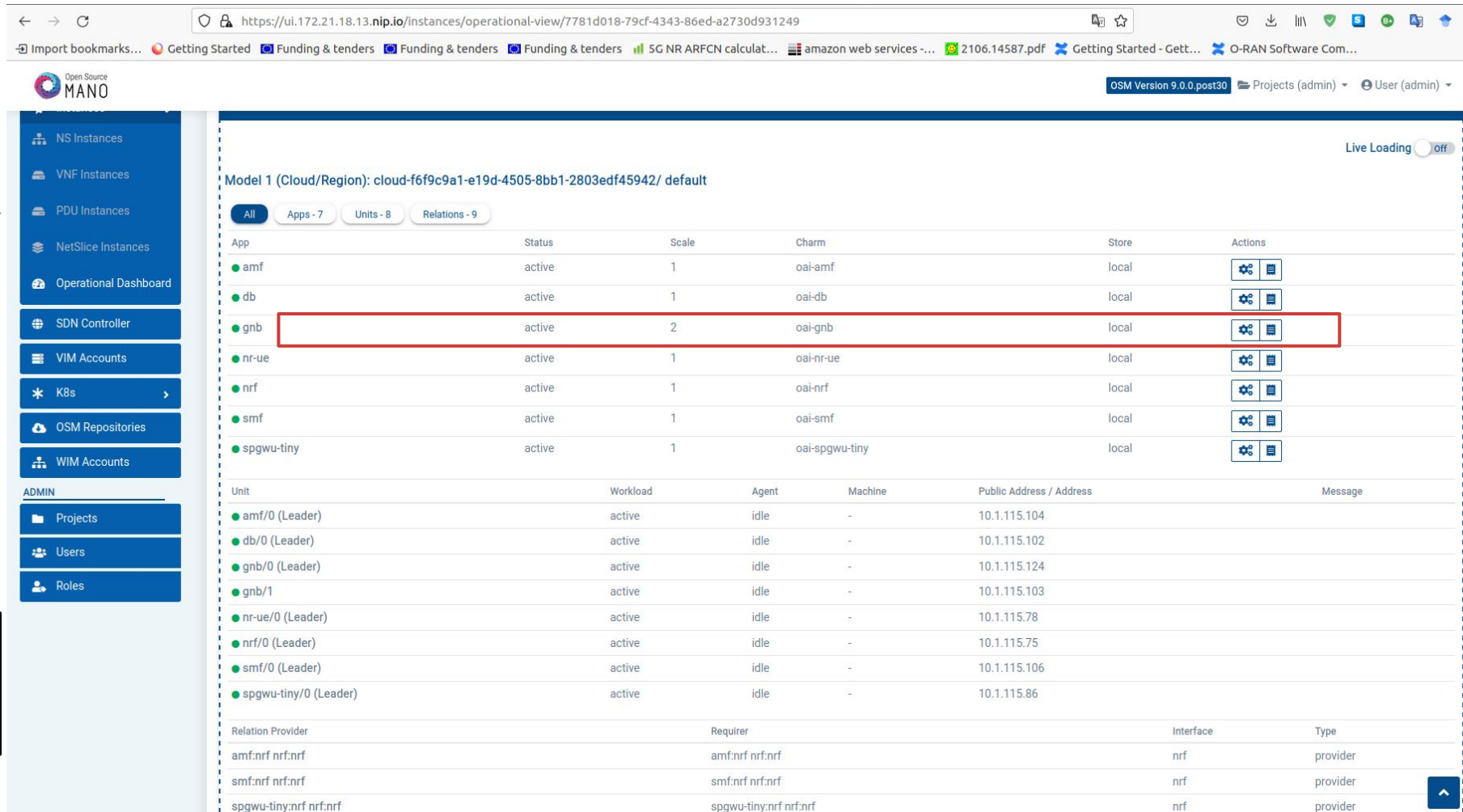
```
ubuntu@hackfest-microk8s-3:~$ kubectl get pods -n oai-kdu-scaling-7781d018-79cf-4343-86ed-a2730d931249
NAME                                READY   STATUS    RESTARTS   AGE
modeloperator-5957b4ccc6-pllhx      1/1     Running   0           18m
db-0                                 2/2     Running   0           18m
amf-0                                3/3     Running   0           17m
smf-0                                3/3     Running   0           17m
gnb-1                                3/3     Running   0           17m
nrt-0                                3/3     Running   0           17m
nr-ue-0                              3/3     Running   0           17m
spqwu-tiny-0                         3/3     Running   0           17m
gnb-0                                3/3     Running   0           16m
ubuntu@hackfest-microk8s-3:~$
```

There are two gNBs after
executing a scale-out action

Two gNBs connections in the
AMF logs















```
2021-09-17T09:29:43.126Z [oai_amf] [2021-09-17T11:29:42.940945] [AMF] [amf_app] [info] |-----gNBs' information-----|
2021-09-17T09:29:43.126Z [oai_amf] [2021-09-17T11:29:42.946468] [AMF] [amf_app] [info] |
2021-09-17T09:29:43.126Z [oai_amf] [2021-09-17T11:29:42.946471] [AMF] [amf_app] [info] |   Index   |   Status   |   Global ID   |   gNB Name   |   PLMN   |
2021-09-17T09:29:43.126Z [oai_amf] [2021-09-17T11:29:42.946484] [AMF] [amf_app] [info] |   1   | Connected |   0xe000   | gnb-rfsim-gnb-0 | 208, 95 |
2021-09-17T09:29:43.126Z [oai_amf] [2021-09-17T11:29:42.946490] [AMF] [amf_app] [info] |   2   | Connected |   0xe010   | gnb-rfsim-gnb-1 | 208, 95 |
2021-09-17T09:29:43.126Z [oai_amf] [2021-09-17T11:29:42.946492] [AMF] [amf_app] [info] |-----|
```


Task 4 and 5: Actions taken



Model 1 (Cloud/Region): cloud-f6f9c9a1-e19d-4505-8bb1-2803edf45942/ default

Live Loading ☐ off

App	Status	Scale	Charm	Store	Actions
amf	active	1	oai-amf	local	 
db	active	1	oai-db	local	 
gnb	active	2	oai-gnb	local	 
nr-ue	active	1	oai-nr-ue	local	 
nrf	active	1	oai-nrf	local	 
smf	active	1	oai-smf	local	 
spgwtu-tiny	active	1	oai-spgwtu-tiny	local	 

Unit	Workload	Agent	Machine	Public Address / Address	Message
amf/0 (Leader)	active	idle	-	10.1.115.104	
db/0 (Leader)	active	idle	-	10.1.115.102	
gnb/0 (Leader)	active	idle	-	10.1.115.124	
gnb/1	active	idle	-	10.1.115.103	
nr-ue/0 (Leader)	active	idle	-	10.1.115.78	
nrf/0 (Leader)	active	idle	-	10.1.115.75	
smf/0 (Leader)	active	idle	-	10.1.115.106	
spgwtu-tiny/0 (Leader)	active	idle	-	10.1.115.86	

Relation Provider	Requirer	Interface	Type
amf:nrf nrf:nrf	amf:nrf nrf:nrf	nrf	provider
smf:nrf nrf:nrf	smf:nrf nrf:nrf	nrf	provider
spgwtu-tiny:nrf nrf:nrf	spgwtu-tiny:nrf nrf:nrf	nrf	provider

We can see that two gNBs have been scaled -- OSM view



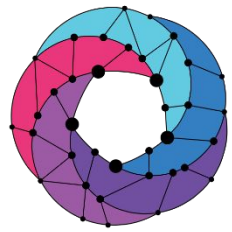
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CONCLUSION

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CONCLUSIONS

- Achievements: We finished Tasks 1,2,3, and 5.
- We learnt quite a bit collectively about deploying a 5GC and testing it, using k8s, juju-charms, and OSM
- We also learnt to identify the issues and solve them collectively. We would like to mention @Sagar @Maciej @DavidGarcia @Endika specially for helping us throughout this process
- We identified certain issues as well as suggestions during this entire process:
 - **Probably an initial survey on the level of the participants can help in better planning of the resources that need to be made available for the hackfest**
 - **The nr-ue has some connectivity issues when deployed through juju-charms and through OSM, we already raised this issue with David and would love to help in anyway possible**
 - **We believe that kdu scaling at present is a bit cumbersome. Scaling policy needs to be extended to the kdus similar to vdus, and hence, monitoring params also need to be defined for kdus**
- The most amazing part was: we collaborated and learnt how to function as a team in such a short space of time!



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THANK YOU

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