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OSM-MR #11 Hackfest
OAI 5G Core Onboarding Challenge

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- Task 1 - Test OAI deployment according to the tutorial.
- Task 2 - Implement charms for OAI network functions.
- Task 3 - Implement deployment descriptors for OAI network functions.
- Task 4 - Automate a configuration parameter change.
- Task 5 - Automate a scale-up operation by deploying additional gNB RF SIM.
- Task 6 - Automate an upgrade of AMF.

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-  ~~Task 6 - Automate an upgrade of AMF.~~

Task 1

- We were able to install helm charts, and script the deployment of the OAI 5G Core functions through Step 4.0, as seen here.

```
clbds — ubuntu@hackfest-team-9: ~/oai-cn5g-fed/charts — ssh ubuntu@172.21.18.19 — 129x17
ubuntu@hackfest-team-9:~/oai-cn5g-fed/charts$ helm list
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        default         1             2021-09-17 12:34:35.267216872 +0000 UTCdeployed oai-amf-1.1.0      1.1.0
mysql      default         1             2021-09-17 12:33:58.679764237 +0000 UTCdeployed mysql-1.6.9         5.7.30
nrf        default         1             2021-09-17 12:34:15.746434807 +0000 UTCdeployed oai-nrf-1.1.0      1.1.0
smf        default         1             2021-09-17 12:34:59.800876213 +0000 UTCdeployed oai-smf-1.1.0      1.1.0
upf        default         1             2021-09-17 12:35:05.252301909 +0000 UTCdeployed oai-spgwu-tiny-1.1.2 1.1.2
ubuntu@hackfest-team-9:~/oai-cn5g-fed/charts$ kubectl get pods
NAME                                READY   STATUS    RESTARTS   AGE
mysql-7fd5db64cd-hwzld              1/1     Running   0           107s
oai-nrf-5fb797f749-t6qdm            2/2     Running   0           86s
oai-amf-7595bb48b9-sbx78            2/2     Running   0           52s
oai-smf-66df95578c-rtt5m            2/2     Running   0           47s
oai-spgwu-tiny-cbff445db-sl6kv      2/2     Running   0           28s
ubuntu@hackfest-team-9:~/oai-cn5g-fed/charts$
```

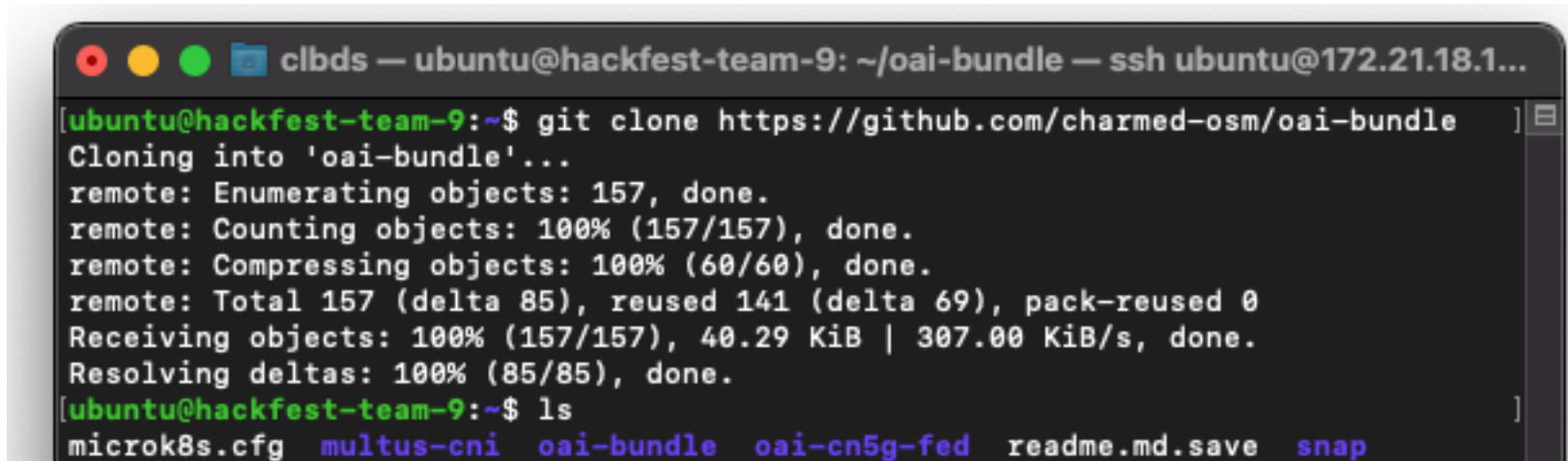
Task 1 (continued)

- We were also able to confirm the SMF and SPGWU connectivity, as part of Step 4.1.

```
clbds — ubuntu@hackfest-team-9: ~/oai-cn5g-fed/charts — ssh ubuntu@172.21.18.19 — 129x7
[ubuntu@hackfest-team-9:~/oai-cn5g-fed/charts$ kubectl logs oai-smf-66df95578c-rtt5m smf | grep 'Received N4 ASSOCIATION SETUP RES]
PONSE from an UPF'
[2021-09-17T14:35:27.813463] [smf] [smf_n4 ] [info ] Received N4 ASSOCIATION SETUP RESPONSE from an UPF
[ubuntu@hackfest-team-9:~/oai-cn5g-fed/charts$ kubectl logs oai-spgwu-tiny-cbff445db-sl6kv spgwu | grep 'Received SX HEARTBEAT REQ]
UEST' | wc -l
19
ubuntu@hackfest-team-9:~/oai-cn5g-fed/charts$
```

Task 2

- We were able to clone the repository.



```
clbds — ubuntu@hackfest-team-9: ~/oai-bundle — ssh ubuntu@172.21.18.1...  
[ubuntu@hackfest-team-9:~$ git clone https://github.com/charmed-osm/oai-bundle ]  
Cloning into 'oai-bundle'...  
remote: Enumerating objects: 157, done.  
remote: Counting objects: 100% (157/157), done.  
remote: Compressing objects: 100% (60/60), done.  
remote: Total 157 (delta 85), reused 141 (delta 69), pack-reused 0  
Receiving objects: 100% (157/157), 40.29 KiB | 307.00 KiB/s, done.  
Resolving deltas: 100% (85/85), done.  
[ubuntu@hackfest-team-9:~$ ls ]  
microk8s.cfg  multus-cni  oai-bundle  oai-cn5g-fed  readme.md.save  snap
```

Task 2 (continued)

- We were then able to build from the git files.

```
ubuntu@hackfest-team-9:~/oai-bundle$ ./build.sh
Packing charm 'oai-amf_ubuntu-20.04-amd64.charm'...
Packing charm 'oai-gnb_ubuntu-20.04-amd64.charm'...
Packing charm 'oai-nr-ue_ubuntu-20.04-amd64.charm'...
Packing charm 'oai-nrf_ubuntu-20.04-amd64.charm'...
Packing charm 'oai-smf_ubuntu-20.04-amd64.charm'...
Packing charm 'oai-spgwu-tiny_ubuntu-20.04-amd64.charm'...
Packing charm 'oai-db_ubuntu-20.04-amd64.charm'...
Created 'oai-gnb_ubuntu-20.04-amd64.charm'.
Created 'oai-smf_ubuntu-20.04-amd64.charm'.
Created 'oai-db_ubuntu-20.04-amd64.charm'.
Created 'oai-nrf_ubuntu-20.04-amd64.charm'.
Created 'oai-spgwu-tiny_ubuntu-20.04-amd64.charm'.
Created 'oai-amf_ubuntu-20.04-amd64.charm'.
Created 'oai-nr-ue_ubuntu-20.04-amd64.charm'.
```


Task 2 (continued)

- We were then able to deploy the packaged charms.

```
ubuntu@hackfest-team-9:~/oai-bundle$ ./deploy.sh
Executing changes:
- upload charm /home/ubuntu/oai-bundle/oai-amf-operator/amf.charm for series focal with architecture=amd64
- deploy application amf with 1 unit on focal
  added resource oai-amf-image
  added resource tcpdump-image
- upload charm /home/ubuntu/oai-bundle/oai-db-operator/db.charm for series focal with architecture=amd64
- deploy application db with 1 unit on focal
  added resource oai-db-image
- upload charm /home/ubuntu/oai-bundle/oai-gnb-operator/gnb.charm for series focal with architecture=amd64
- deploy application gnb with 1 unit on focal
  added resource oai-gnb-image
  added resource tcpdump-image
- upload charm /home/ubuntu/oai-bundle/oai-nr-ue-operator/nr-ue.charm for series focal with architecture=amd64
- deploy application nr-ue with 1 unit on focal
  added resource oai-nr-ue-image
  added resource tcpdump-image
- upload charm /home/ubuntu/oai-bundle/oai-nrf-operator/nrf.charm for series focal with architecture=amd64
- deploy application nrf with 1 unit on focal
  added resource oai-nrf-image
  added resource tcpdump-image
- upload charm /home/ubuntu/oai-bundle/oai-smf-operator/smf.charm for series focal with architecture=amd64
- deploy application smf with 1 unit on focal
  added resource oai-smf-image
  added resource tcpdump-image
- upload charm /home/ubuntu/oai-bundle/oai-spgwu-tiny-operator/spgwu-tiny.charm for series focal with architecture=amd64- deploy application spgwu-tiny with 1 unit on focal
  added resource oai-spgwu-tiny-image
  added resource tcpdump-image
- add relation db:db - amf:db
- add relation nrf:nrf - amf:nrf
- add relation nrf:nrf - smf:nrf
- add relation smf:amf - amf:amf
- add relation nrf:nrf - spgwu-tiny:nrf
- add relation spgwu-tiny:smf - smf:smf
- add relation gnb:amf - amf:amf
- add relation nr-ue:gnb - gnb:gnb
- add relation spgwu-tiny:spgwu - gnb:spgwu
Deploy of bundle completed.
ubuntu@hackfest-team-9:~/oai-bundle$
```


Task 2 (continued)

- We were then able to witness the successful deployment.

```
clbds — ubuntu@hackfest-team-9: ~/oai-bundle — ssh ubuntu@172.21.18.19 — 109x24
Every 2.0s: juju status --color                                     hackfest-team-9: Fri Sep 17 04:07:05 2021

Model      Controller  Cloud/Region  Version  SLA          Timestamp
oai-02     osm-vca     microk8s/localhost  2.9.9    unsupported  04:07:06Z

App        Version  Status  Scale  Charm          Store  Channel  Rev  OS          Address        Message
amf         1.0.0    active   1      oai-amf        local          0      kubernet   10.152.183.199
db          1.0.0    active   1      oai-db         local          0      kubernet   10.152.183.82
gnb         1.0.0    active   1      oai-gnb        local          0      kubernet   10.152.183.128
nr-ue       1.0.0    active   1      oai-nr-ue      local          0      kubernet   10.152.183.110
nrf         1.0.0    active   1      oai-nrf        local          0      kubernet   10.152.183.156
smf         1.0.0    active   1      oai-smf        local          0      kubernet   10.152.183.163
spgwwu-tiny 1.0.0    active   1      oai-spgwwu-tiny local          0      kubernet   10.152.183.177

Unit        Workload  Agent  Address  Ports  Message
amf/0*      active    idle   10.1.31.200
db/0*       active    idle   10.1.31.199
gnb/0*      active    idle   10.1.31.214
nr-ue/0*    active    idle   10.1.31.204
nrf/0*      active    idle   10.1.31.196
smf/0*      active    idle   10.1.31.222
spgwwu-tiny/0* active    idle   10.1.31.245
```

Task 3

- We were able to build and upload an NS, VNF.

```
clbds — ubuntu@hackfest-team-9: ~ — ssh ubuntu@172.21.18.19 — 88x36
[ubuntu@hackfest-team-9:~$ osm nfpkg-create ubuntu_cloudinit_vnf
Validating package ubuntu_cloudinit_vnf
Base directory: ubuntu_cloudinit_vnf
1 Descriptors found to validate
Validation OK
List of charms in the descriptor: []
Adding File: ubuntu_cloudinit_vnf
Package created: ./ubuntu_cloudinit_vnf.tar.gz
Uploading package ./ubuntu_cloudinit_vnf.tar.gz
da9efc25-d647-48cd-9425-b0c741ee8373
[ubuntu@hackfest-team-9:~$ osm nspkg-create ubuntu_cloudinit_ns
Validating package ubuntu_cloudinit_ns
Base directory: ubuntu_cloudinit_ns
1 Descriptors found to validate
Validation OK
List of charms in the descriptor: []
Adding File: ubuntu_cloudinit_ns
Package created: ./ubuntu_cloudinit_ns.tar.gz
0a9d3cef-d4b5-4363-ad5e-1148c46c43f3
```

Task 3 (continued)

- We were able to validate the packages, but not instantiate.

```
[ubuntu@hackfest-team-9:~$ osm package-validate ubuntu_cloudinit_ns
Base directory: ubuntu_cloudinit_ns
1 Descriptors found to validate
+-----+-----+-----+-----+
| TYPE          | PATH                                     | VALID | ERROR |
+-----+-----+-----+-----+
| etsi_nfv_nsd  | ubuntu_cloudinit_ns/ubuntu_cloudinit_nsd.yaml | OK    | -     |
+-----+-----+-----+-----+

[ubuntu@hackfest-team-9:~$ osm package-validate ubuntu_cloudinit_vnf
Base directory: ubuntu_cloudinit_vnf
1 Descriptors found to validate
+-----+-----+-----+-----+
| TYPE          | PATH                                     | VALID | ERROR |
+-----+-----+-----+-----+
| etsi_nfv_vnfd | ubuntu_cloudinit_vnf/ubuntu_cloudinit_vnfd.yaml | OK    | -     |
+-----+-----+-----+-----+

ubuntu@hackfest-team-9:~$
```

Task 4 & Task 6

- We had some last-minute, fatal, performance issues on two tasks.

```
clbds — ubuntu@hackfest-team-9: ~/oai-bundle — ssh ubuntu@172.21.18.1...
[ubuntu@hackfest-team-9:~/oai-bundle$ juju status
^C
[ubuntu@hackfest-team-9:~/oai-bundle$ who
ubuntu pts/0      2021-09-17 10:32 (172.21.18.1)
ubuntu pts/2      2021-09-17 10:53 (172.21.18.1)
[ubuntu@hackfest-team-9:~/oai-bundle$ w
11:30:40 up 6 days, 22:13,  2 users,  load average: 730.08, 681.33, 422.86
USER      TTY      FROM            LOGIN@   IDLE   JCPU   PCPU WHAT
ubuntu    pts/0    172.21.18.1     10:32   40.00s 17.64s  1.89s w
ubuntu    pts/2    172.21.18.1     10:53   37:17  0.03s  0.03s -bash
[ubuntu@hackfest-team-9:~/oai-bundle$ wall

^C
[ubuntu@hackfest-team-9:~/oai-bundle$ ^C
[ubuntu@hackfest-team-9:~/oai-bundle$ man wall
[ubuntu@hackfest-team-9:~/oai-bundle$ wall "who else is on this server?"

Broadcast message from ubuntu@hackfest-team-9 (pts/0) (Fri Sep 17 11:34:39 2021)

who else is on this server?

[ubuntu@hackfest-team-9:~/oai-bundle$ sudo reboot
ubuntu@hackfest-team-9:~/oai-bundle$
```

Task 5

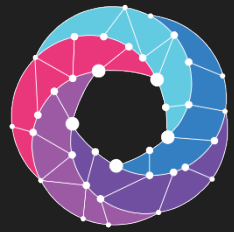
- We were able to define scaling on gNB, but not trigger scaling.

```
ubuntu@hackfest-team-9:~$ juju status
Model      Controller  Cloud/Region  Version  SLA          Timestamp
oai-02     osm-vca     microk8s/localhost  2.9.9    unsupported   12:00:30Z

App          Version  Status  Scale  Charm          Store  Channel  Rev  OS          Address        Message
amf          active   1       oai-amf      local         1      1      kubernet  10.152.183.12
db           active   1       oai-db       local         1      1      kubernet  10.152.183.25
gnb          active   2       oai-gnb      local         1      1      kubernet  10.152.183.160
nr-ue        active   1       oai-nr-ue    local         1      1      kubernet  10.152.183.203
nrf          active   1       oai-nrf      local         1      1      kubernet  10.152.183.94
smf          active   1       oai-smf      local         1      1      kubernet  10.152.183.234
spgwwu-tiny  active   1       oai-spgwwu-tiny  local         1      1      kubernet  10.152.183.138

Unit          Workload  Agent  Address        Ports  Message
amf/0*        active   idle   10.1.31.252
db/0*         active   idle   10.1.31.239
gnb/0*        active   idle   10.1.31.233
gnb/1         active   idle   10.1.31.207
nr-ue/0*      active   idle   10.1.31.195
nrf/0*        active   idle   10.1.31.205
smf/0*        active   idle   10.1.31.247
spgwwu-tiny/0* active   idle   10.1.31.212

ubuntu@hackfest-team-9:~$
```



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Lessons Learned

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OAI 5G Core Onboarding Challenge

- Communication – We had some trouble early on with the asynchronous communication and the diverse time zones of our participants.
- Documentation – We lost out on recording a lot of our documentation for the tasks we completed, thus missing out on screenshots that we would have otherwise had for our presentation.
- Known Bugs – Multiple teams ran into known bugs that hampered our progress.
- Unknown Bugs – Multiple teams ran into unknown bugs and code issues that caused a us to re-pull a few git repos during our progress.
- Server Performance – We lost our ability to take additional screenshots due to some performance issues with our server instances on the last day.



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Thank you to all the mentors!
Thank you to the teams and team members!