OPEN NETWORKING & EDGE SUMMIT

Kubernetes on EDGE DAY

ONAP for xNF Based 5G Service Orchestration

Łukasz Rajewski, Michał Chabiera, Abderaouf Khichane, Ilhem Fajjari (Orange)

Seshu Kumar Mudiganti (Huawei)

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Kubernetes on EDGE DAY

ONAP
OPEN NETWORK AUTOMATION PLATFORM

Net. Slicing
Rel. 6

Closed Loop
Rel. 1

ETSI
Rel. 3

Design
Rel. 1

ONAP
OPEN NETWORK AUTOMATION PLATFORM

Runtime
Rel. 1

PNF
Rel. 3

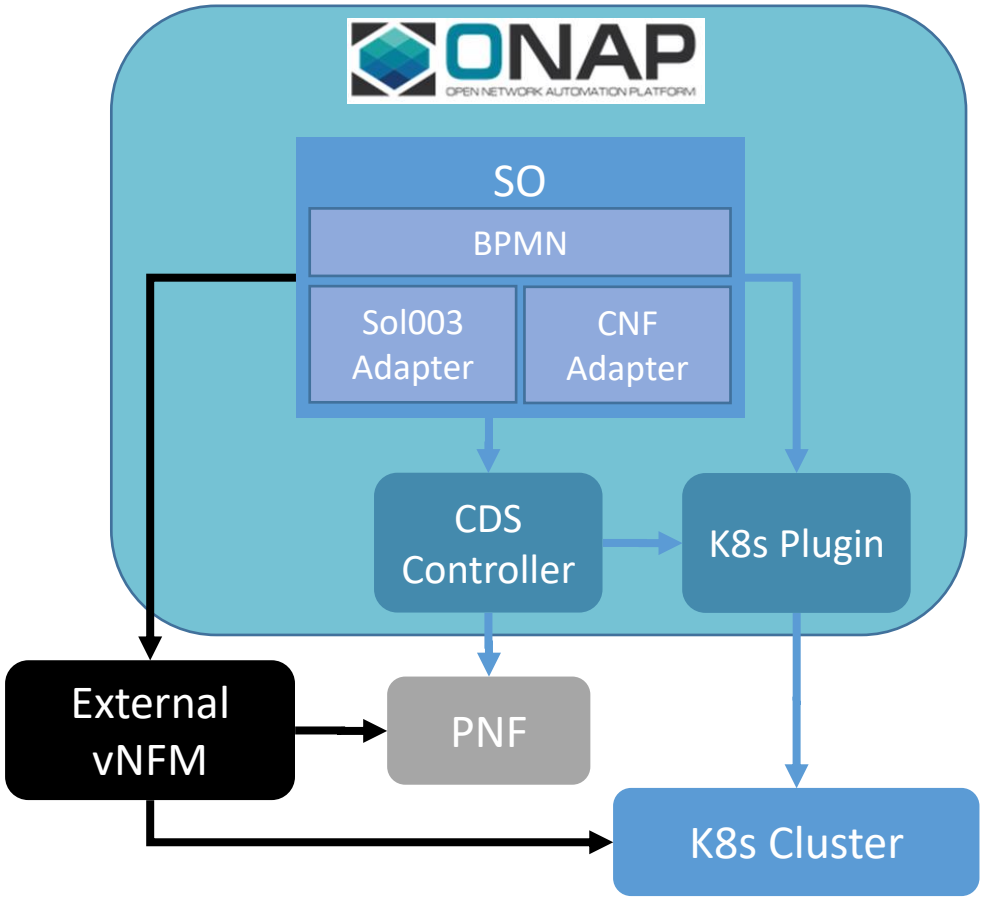
VNF
Rel. 1

CNF
Rel. 4

Amsterdam 11.2017
Beijing 6.2018
Casablanca 12.2018
Dublin 7.2019
El Alto 10.2019
Frankfurt 6.2020
Guilin 12.2020
Honolulu 5.2021

ONAP Orchestration Scenarios: Native vs ETSI

- SO takes decision of the resource orchestration based on the input model
- Currently we manage the flows of the ETSI and the Native Helm as separate entities and call the flow on need basis.
- The idea is to merge them in future, based on the ETSI spec for the CNFs
- The current Demo is using the native orchestration flow for the VNF, PNF and CNF



Towards5GS

Simplified Free5GC Deployment

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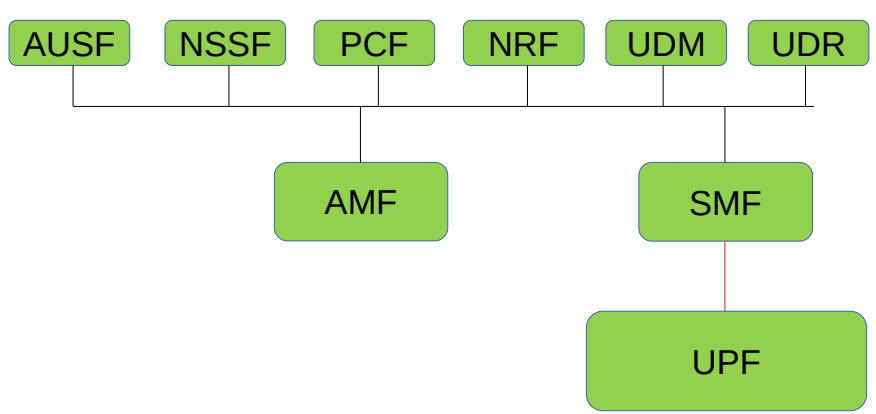
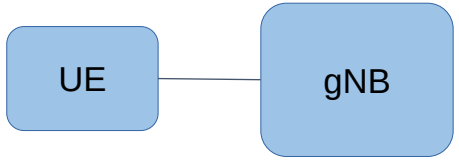
Towards5GS rationale & related software

Towards5GS provides Helm charts for deploying and testing a containerized 5G service on top of Kubernetes

- Open source 5G core network based on 3GPP R15
- The ultimate goal of th implement the 5G core network (5GC) defined in 3GPP Release 15 (R15) and beyond
- Supported versions are v3.0.4 and v3.0.5



- Open sou ser Equipment (UE) and gNodeB (gNB) imp ion
- The project can be used for testing 5G Core Network and studying E2E 5G System
- The latest supported version is v3.1.3



Towards5GS rationale & related software

free5GC

- Open source 5G core network based on 3GPP R15
- The ultimate goal of this project is to implement the 5G core network (5GC) defined in 3GPP Release 15 (R15) and beyond
- Supported versions are v3.0.4 and v3.0.5

THE APACHE SOFTWARE FOUNDATION 20TH ANNIVERSARY

UERANSIM 5G SOLUTIONS

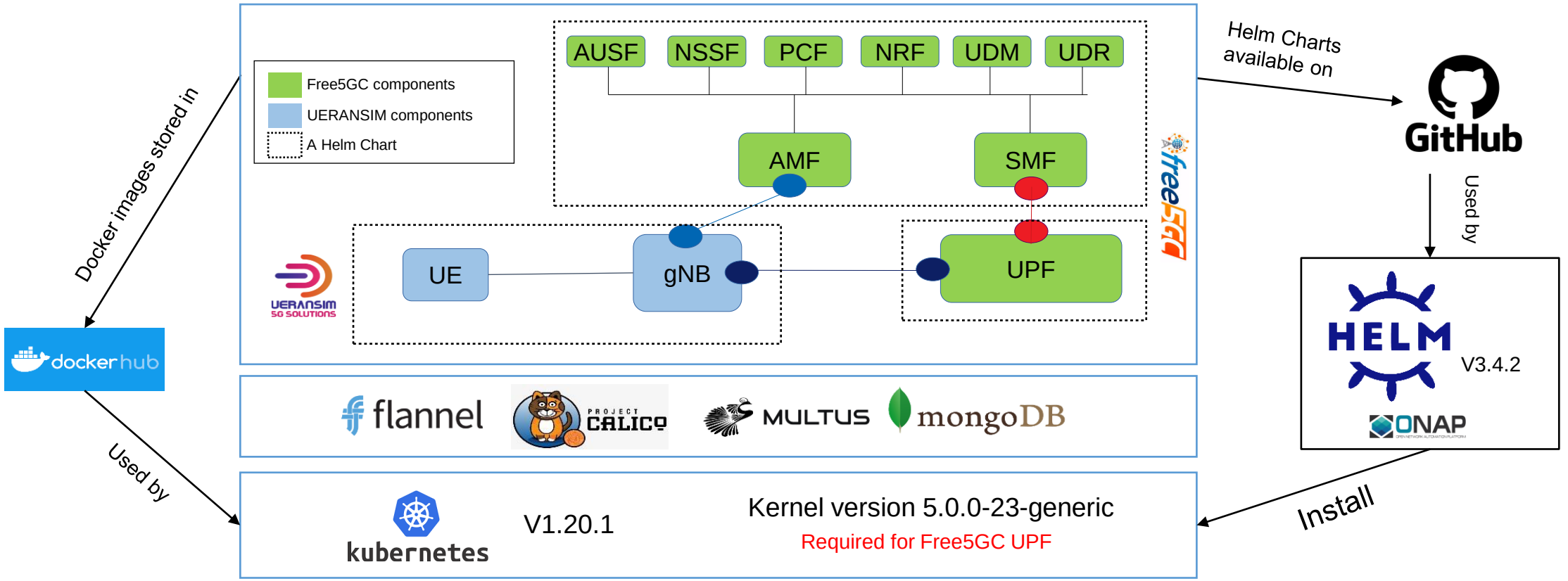
- Open source 5G User Equipment (UE) and gNodeB (gNB) implementation
- The project can be used for testing 5G Core Network and studying E2E 5G System
- The latest supported version is v3.1.3

GPL Free Software

Links:

Free5GC: https://github.com/free5gc/free5gc
UERANSIM: https://github.com/aligungr/UERANSIM

Towards5GS platform



Links:

Github Repo: https://github.com/Orange-OpenSource/towards5gs-helm
Dockerhub Organization: https://hub.docker.com/u/towards5gs
Bitnami's MongoDB Helm Chart: https://github.com/bitnami/charts/tree/master/bitnami/mongodb

ONAP for xNF Based 5G Service Orchestration

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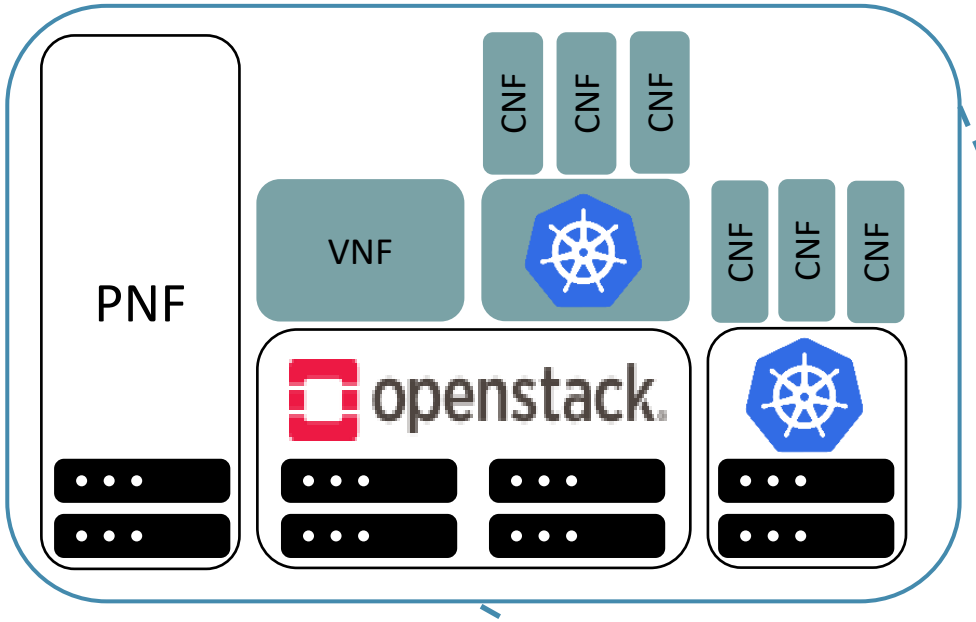
ONAP for xNF Based 5G Service Orchestration



xNF Orchestration

ONAP
OPEN NETWORK AUTOMATION PLATFORM

ADMIN

UE

5G RAN PNF/CNF

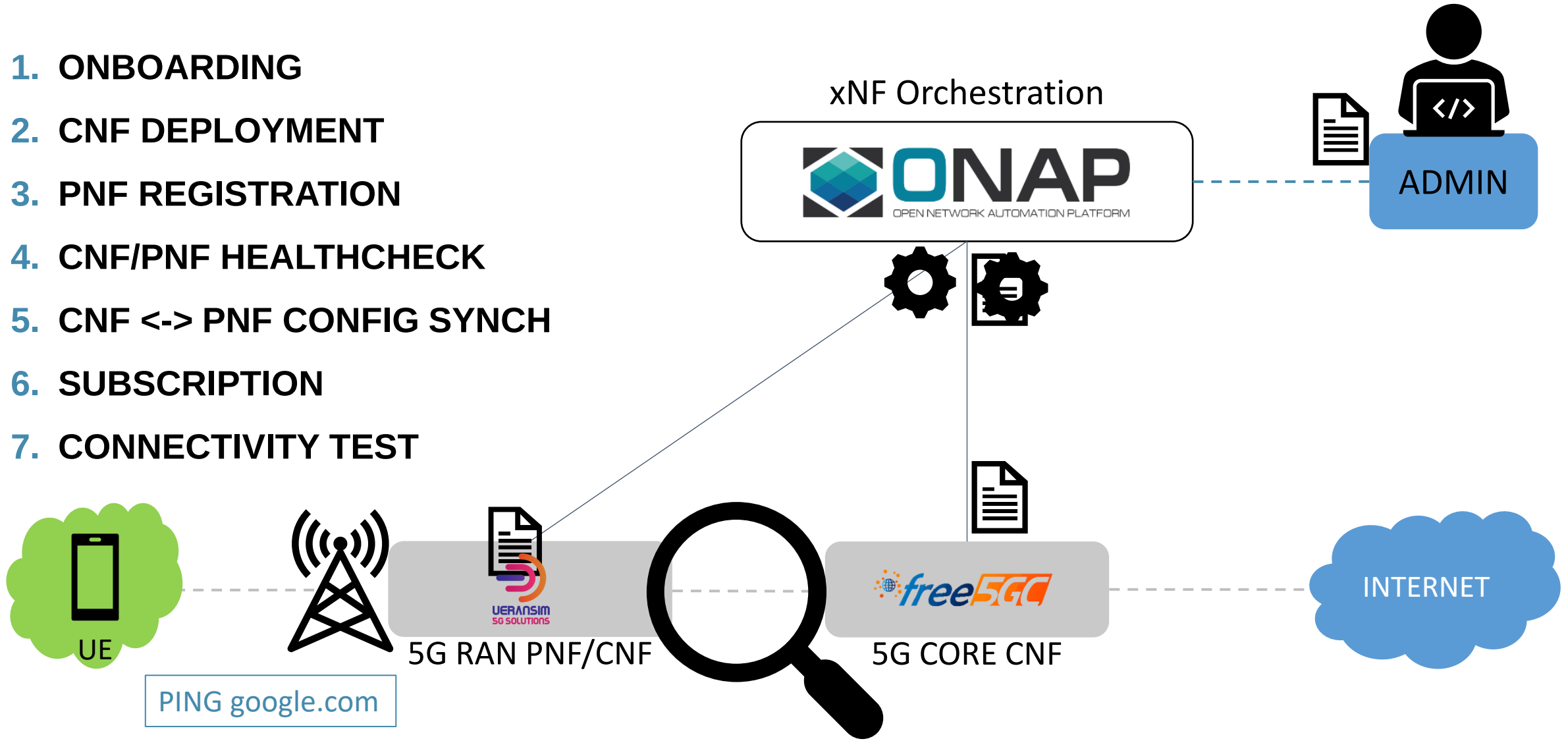
5G CORE CNF

INTERNET

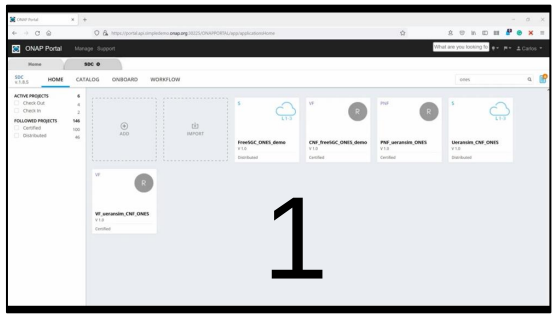
PING google.com

ONAP for xNF Based 5G Service Orchestration

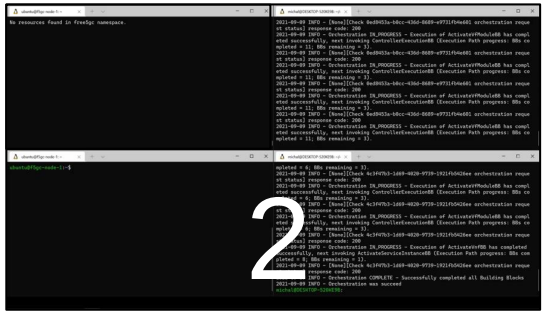
1. ONBOARDING
2. CNF DEPLOYMENT
3. PNF REGISTRATION
4. CNF/PNF HEALTHCHECK
5. CNF <-> PNF CONFIG SYNCH
6. SUBSCRIPTION
7. CONNECTIVITY TEST



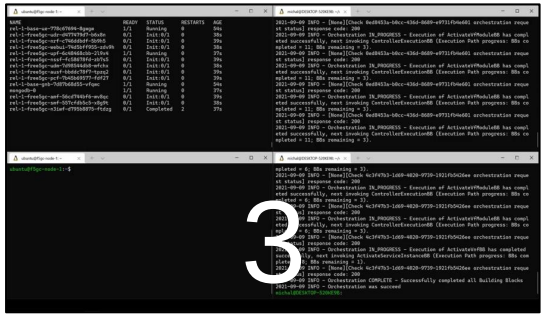
ONAP for xNF Based 5G Service Orchestration



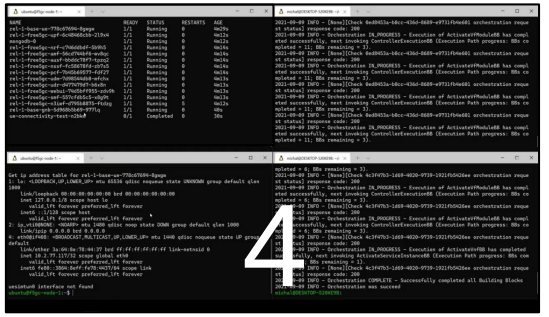
ONBOARD 5G SERVICE



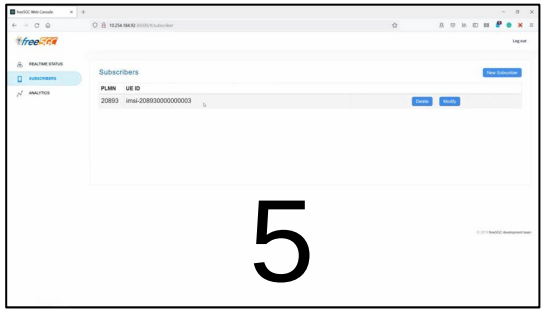
DEPLOY 5G CORE CNF



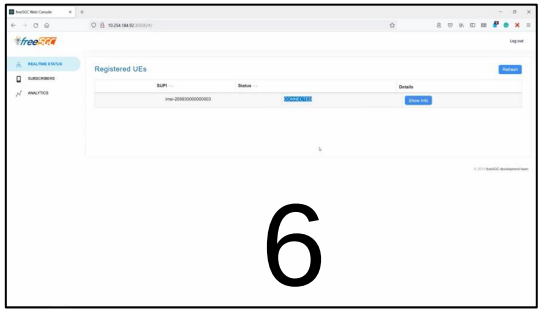
REGISTER 5G RAN PNF



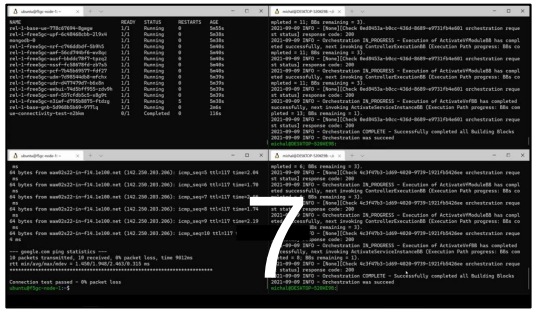
START CONNECTIVITY TEST



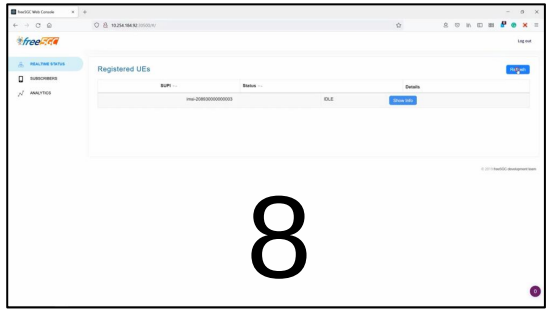
SUBSCRIBE UE



CONFIGURE 5G RAN PNF



CONNECTIVITY TEST VERIFY



DISCONNECTION RAN

Demo

Orchestration of Free5GC using ONAP

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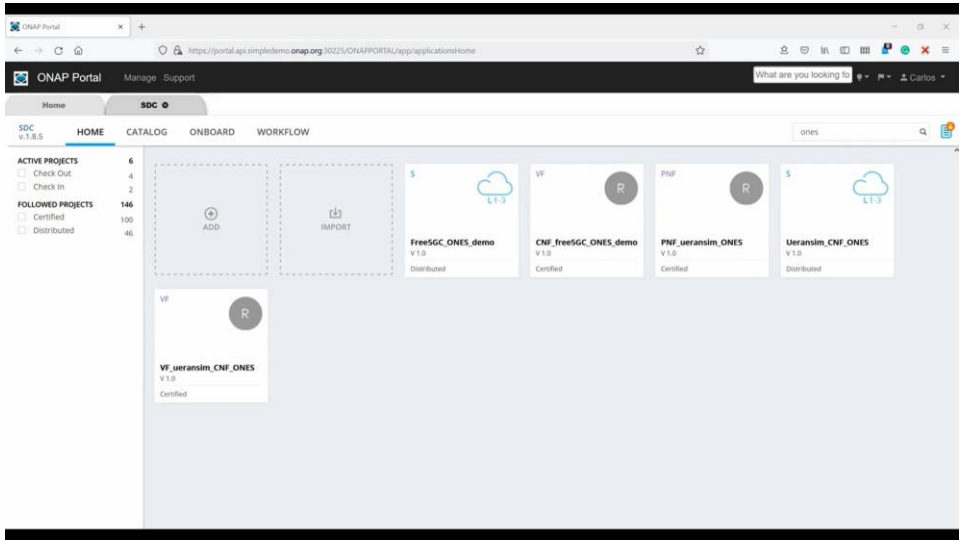
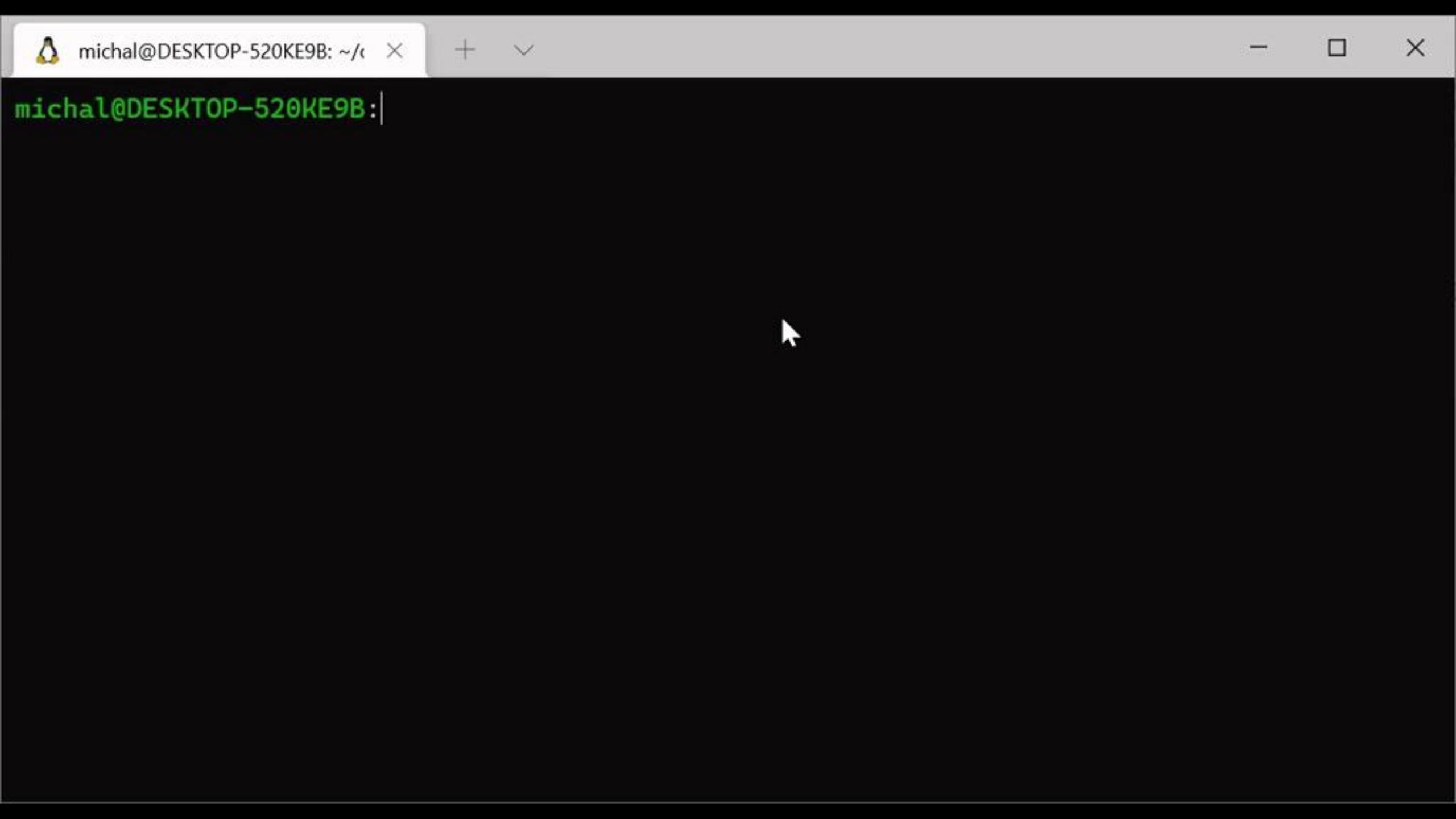
#1



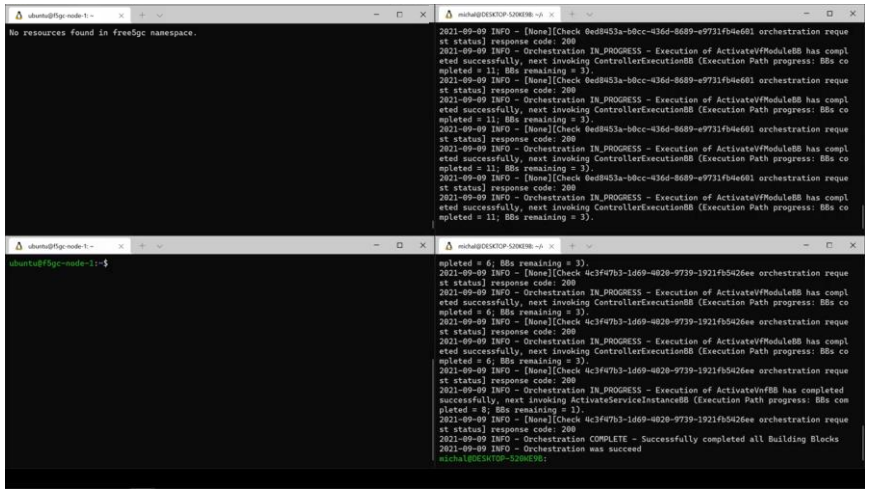
ONBOARD 5G SERVICE


michal@DESKTOP-520KE9B: ~/
michal@DESKTOP-520KE9B:

OPEN NETWORKING & EDGE SUMMIT

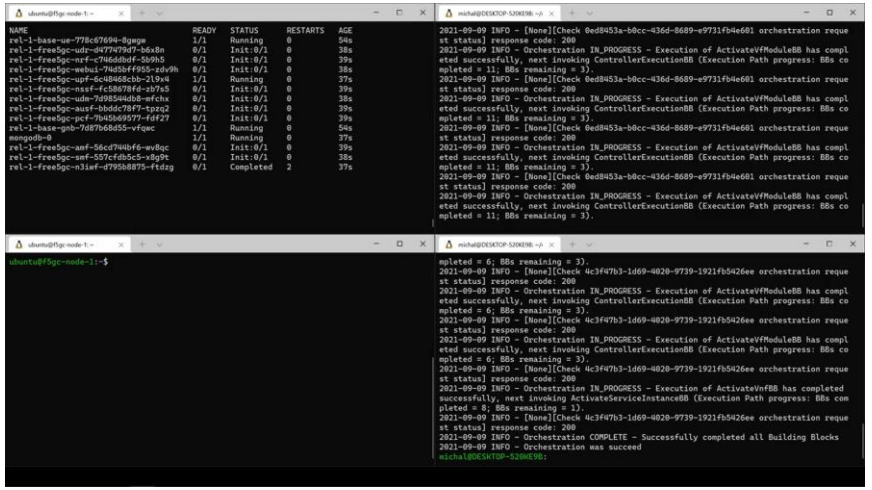
Kubernetes on EDGE DAY

#2

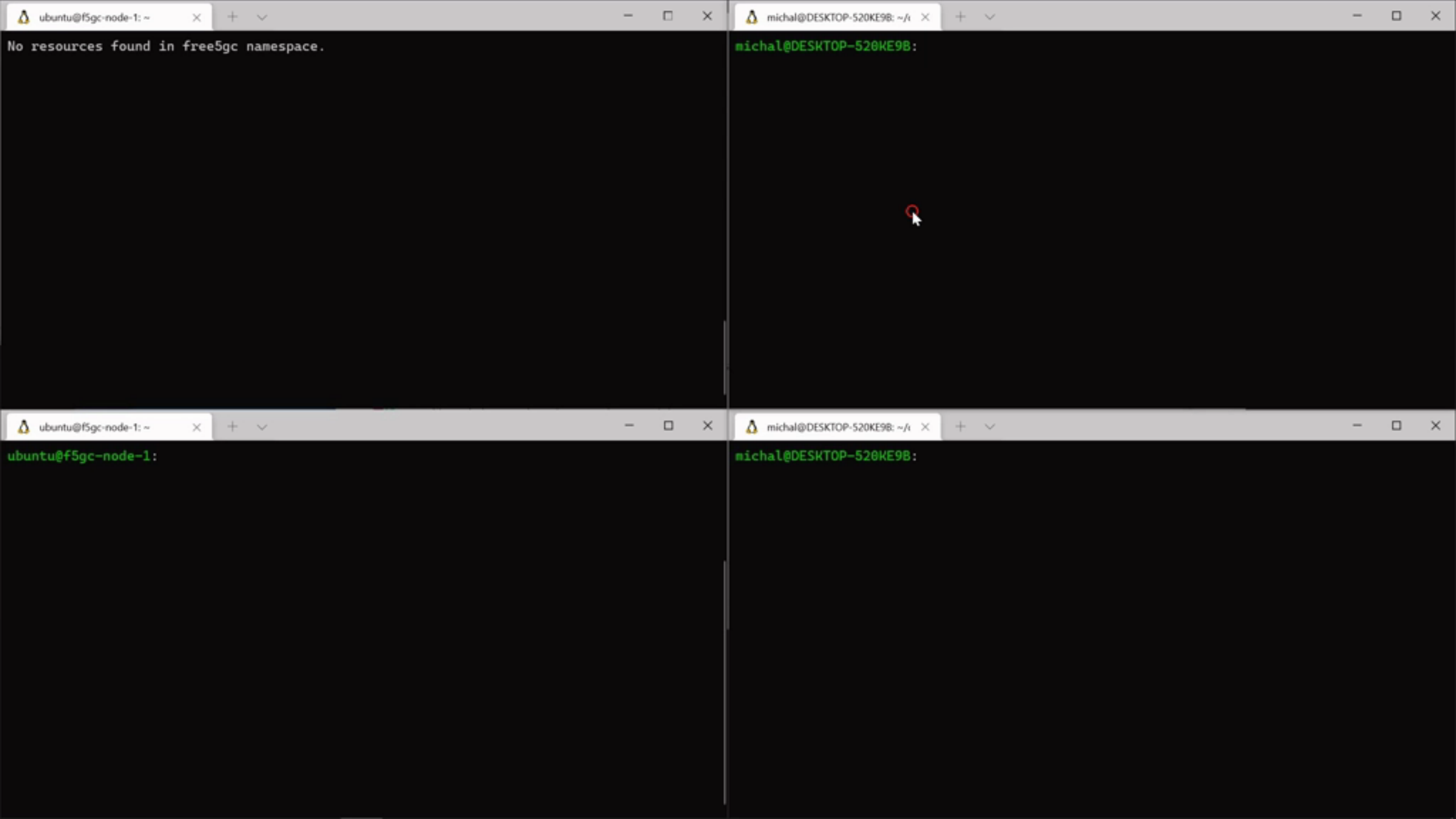


DEPLOY 5G CORE CNF

#3



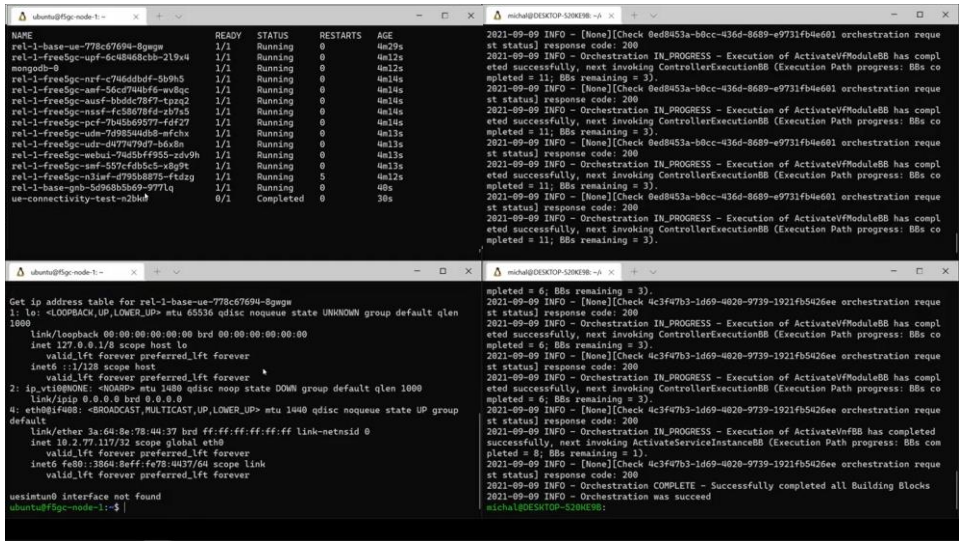
REGISTER 5G RAN PNF


ubuntu@f5gc-node-1: ~
No resources found in free5gc namespace.
michal@DESKTOP-520KE9B: ~/
michal@DESKTOP-520KE9B:
ubuntu@f5gc-node-1: ~
ubuntu@f5gc-node-1:
michal@DESKTOP-520KE9B: ~/
michal@DESKTOP-520KE9B:

OPEN NETWORKING & EDGE SUMMIT

Kubernetes on EDGE DAY

#4



CONNECTIVITY TEST FAIL

ubuntu@f5gc-node-1: ~

```
NAME                                  READY   STATUS    RESTARTS   AGE
rel-1-base-ue-746fd86c64-bp2mf        1/1     Running   0          3m38s
rel-1-free5gc-upf-547bbd5658-s76ch    1/1     Running   0          3m19s
rel-1-base-gnb-6c77ddb9f9-lb8wq       1/1     Running   0          3m38s
mongodb-0                             1/1     Running   0          3m19s
rel-1-free5gc-nrf-9fc84ff49-pdbds     1/1     Running   0          3m21s
rel-1-free5gc-amf-6994f765d4-fr5lh    1/1     Running   0          3m21s
rel-1-free5gc-ausf-6b6cfbb98f-zphl5   1/1     Running   0          3m21s
rel-1-free5gc-nssf-5cc6f6585d-ccggq   1/1     Running   0          3m21s
rel-1-free5gc-pcf-5d8dddc977-dn8bb    1/1     Running   0          3m20s
rel-1-free5gc-smf-768d684887-vczsn    1/1     Running   0          3m20s
rel-1-free5gc-udm-59988764b8-v27tz    1/1     Running   0          3m20s
rel-1-free5gc-udr-7998f4cc87-dhmd5    1/1     Running   0          3m20s
rel-1-free5gc-webui-67494bddff-lvb5s  1/1     Running   0          3m19s
rel-1-free5gc-n3iwf-594f77456c-f7m8f  1/1     Running   5          3m19s
```

michal@DESKTOP-520KE9B: ~/

```
mpleted = 11; BBs remaining = 3).
2021-09-12 INFO - [None][Check 6194ef03-ce37-40ad-9ad5-01ff1d9bfe24 orchestration reque
st status] response code: 200
2021-09-12 INFO - Orchestration IN_PROGRESS - Execution of ActivateVfModuleBB has compl
eted successfully, next invoking ControllerExecutionBB (Execution Path progress: BBs co
mpleted = 11; BBs remaining = 3).
2021-09-12 INFO - [None][Check 6194ef03-ce37-40ad-9ad5-01ff1d9bfe24 orchestration reque
st status] response code: 200
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2021-09-12 INFO - [None][Check 6194ef03-ce37-40ad-9ad5-01ff1d9bfe24 orchestration reque
st status] response code: 200
2021-09-12 INFO - Orchestration IN_PROGRESS - Execution of ActivateVfModuleBB has compl
eted successfully, next invoking ControllerExecutionBB (Execution Path progress: BBs co
mpleted = 11; BBs remaining = 3).
```

ubuntu@f5gc-node-1: ~

```
ubuntu@f5gc-node-1:
```

michal@DESKTOP-520KE9B: ~/

```
2021-09-12 INFO - Orchestration IN_PROGRESS - Execution of ActivateVfModuleBB has compl
eted successfully, next invoking ControllerExecutionBB (Execution Path progress: BBs co
mpleted = 6; BBs remaining = 3).
2021-09-12 INFO - [None][Check 25142b64-09a5-45fb-b4a9-7b99c1d31c73 orchestration reque
st status] response code: 200
2021-09-12 INFO - Orchestration IN_PROGRESS - Execution of ActivateVfModuleBB has compl
eted successfully, next invoking ControllerExecutionBB (Execution Path progress: BBs co
mpleted = 6; BBs remaining = 3).
2021-09-12 INFO - [None][Check 25142b64-09a5-45fb-b4a9-7b99c1d31c73 orchestration reque
st status] response code: 200
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st status] response code: 200
2021-09-12 INFO - Orchestration IN_PROGRESS - Successfully completed all Building Block
s
2021-09-12 INFO - [None][Check 25142b64-09a5-45fb-b4a9-7b99c1d31c73 orchestration reque
st status] response code: 200
2021-09-12 INFO - Orchestration COMPLETE - Successfully completed all Building Blocks
2021-09-12 INFO - Orchestration was succeed
michal@DESKTOP-520KE9B:
```

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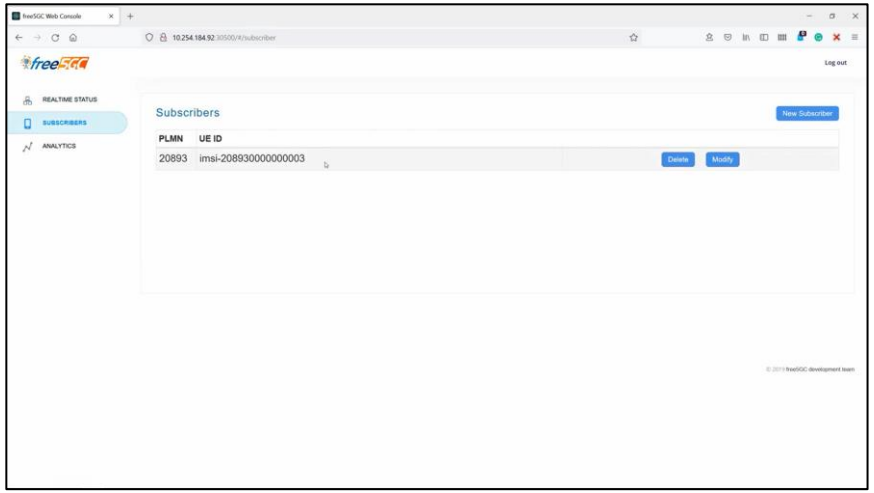
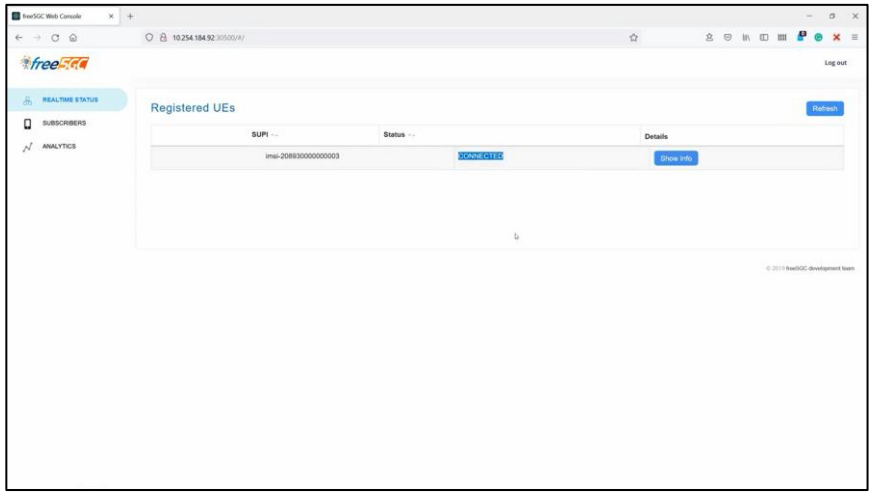
#5



SUBSCRIBE UE

#6



CONFIGURE 5G RAN PNF

ubuntu@f5gc-node-1: ~

```
NAME                                  READY   STATUS              RESTARTS   AGE
rel-1-base-ue-746fd86c64-bp2mf        1/1     Running             0          3m43s
rel-1-free5gc-upf-547bbd5658-s76ch    1/1     Running             0          3m24s
rel-1-base-gnb-6c77ddb9f9-lb8wq       1/1     Running             0          3m43s
mongodb-0                             1/1     Running             0          3m24s
rel-1-free5gc-nrf-9fc84ff49-pdbds     1/1     Running             0          3m26s
rel-1-free5gc-amf-6994f765d4-fr5lh    1/1     Running             0          3m26s
rel-1-free5gc-ausf-6b6cfbb98f-zphl5   1/1     Running             0          3m26s
rel-1-free5gc-nssf-5cc6f6585d-ccggq   1/1     Running             0          3m26s
rel-1-free5gc-pcf-5d8dddc977-dn8bb    1/1     Running             0          3m25s
rel-1-free5gc-smf-768d684887-vczsn    1/1     Running             0          3m25s
rel-1-free5gc-udm-59988764b8-v27tz    1/1     Running             0          3m25s
rel-1-free5gc-udr-7998f4cc87-dhmd5    1/1     Running             0          3m25s
rel-1-free5gc-webui-67494bddff-lvb5s  1/1     Running             0          3m24s
rel-1-free5gc-n3iwf-594f77456c-f7m8f  1/1     Running             5          3m24s
ue-connectivity-test-8wzqf            0/1     ContainerCreating   0          0s
```

michal@DESKTOP-520KE9B: ~/

```
mpleted = 11; BBs remaining = 3).
2021-09-12 INFO - [None][Check 6194ef03-ce37-40ad-9ad5-01ff1d9bfe24 orchestration reque
st status] response code: 200
2021-09-12 INFO - Orchestration IN_PROGRESS - Execution of ActivateVfModuleBB has compl
eted successfully, next invoking ControllerExecutionBB (Execution Path progress: BBs co
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2021-09-12 INFO - [None][Check 6194ef03-ce37-40ad-9ad5-01ff1d9bfe24 orchestration reque
st status] response code: 200
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2021-09-12 INFO - Orchestration IN_PROGRESS - Execution of ActivateVfModuleBB has compl
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2021-09-12 INFO - [None][Check 6194ef03-ce37-40ad-9ad5-01ff1d9bfe24 orchestration reque
st status] response code: 200
2021-09-12 INFO - Orchestration IN_PROGRESS - Execution of ActivateVfModuleBB has compl
eted successfully, next invoking ControllerExecutionBB (Execution Path progress: BBs co
mpleted = 11; BBs remaining = 3).
```

ubuntu@f5gc-node-1: ~

```
ubuntu@f5gc-node-1:curl -X POST -k https://10.254.184.164:30283/api/multicloud-k8s/v1/v
1/instance/objective_keller/healthcheck
{"healthcheck-id":"infallible_zhukovsky","status":"Running"}
ubuntu@f5gc-node-1:
```

michal@DESKTOP-520KE9B: ~/

```
2021-09-12 INFO - Orchestration IN_PROGRESS - Execution of ActivateVfModuleBB has compl
eted successfully, next invoking ControllerExecutionBB (Execution Path progress: BBs co
mpleted = 6; BBs remaining = 3).
2021-09-12 INFO - [None][Check 25142b64-09a5-45fb-b4a9-7b99c1d31c73 orchestration reque
st status] response code: 200
2021-09-12 INFO - Orchestration IN_PROGRESS - Execution of ActivateVfModuleBB has compl
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2021-09-12 INFO - Orchestration IN_PROGRESS - Execution of ActivateVfModuleBB has compl
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2021-09-12 INFO - [None][Check 25142b64-09a5-45fb-b4a9-7b99c1d31c73 orchestration reque
st status] response code: 200
2021-09-12 INFO - Orchestration IN_PROGRESS - Successfully completed all Building Block
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2021-09-12 INFO - [None][Check 25142b64-09a5-45fb-b4a9-7b99c1d31c73 orchestration reque
st status] response code: 200
2021-09-12 INFO - Orchestration COMPLETE - Successfully completed all Building Blocks
2021-09-12 INFO - Orchestration was succeed
michal@DESKTOP-520KE9B:
```

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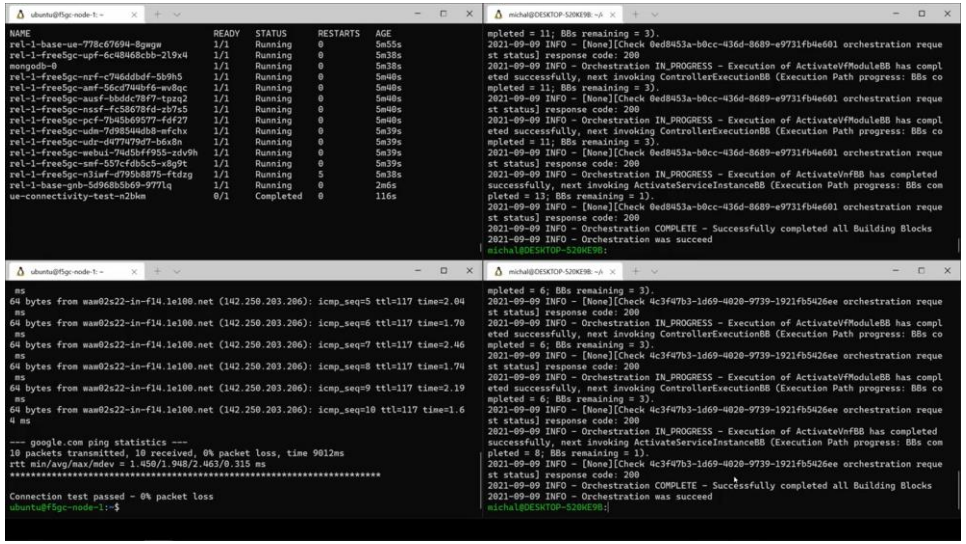
Kubernetes on EDGE DAY

#7



CONNECTIVITY TEST SUCCESS

ubuntu@f5gc-node-1: ~

```
NAME                                  READY   STATUS    RESTARTS   AGE
rel-1-base-ue-746fd86c64-bp2mf        1/1     Running   0          4m30s
rel-1-free5gc-upf-547bbd5658-s76ch    1/1     Running   0          4m11s
mongodb-0                             1/1     Running   0          4m11s
rel-1-free5gc-nrf-9fc84ff49-pdbds     1/1     Running   0          4m13s
rel-1-free5gc-amf-6994f765d4-fr5lh    1/1     Running   0          4m13s
rel-1-free5gc-ausf-6b6cfbb98f-zphl5   1/1     Running   0          4m13s
rel-1-free5gc-nssf-5cc6f6585d-ccggq   1/1     Running   0          4m13s
rel-1-free5gc-pcf-5d8dddc977-dn8bb    1/1     Running   0          4m12s
rel-1-free5gc-smf-768d684887-vczsn    1/1     Running   0          4m12s
rel-1-free5gc-udm-59988764b8-v27tz    1/1     Running   0          4m12s
rel-1-free5gc-udr-7998f4cc87-dhmd5    1/1     Running   0          4m12s
rel-1-free5gc-webui-67494bddff-lvb5s  1/1     Running   0          4m11s
rel-1-free5gc-n3iwf-594f77456c-f7m8f  1/1     Running   5          4m11s
ue-connectivity-test-8wzqf            0/1     Error     0          47s
ue-connectivity-test-z4r45            0/1     Error     0          45s
ue-connectivity-test-4zhxc            0/1     Error     0          35s
rel-1-base-gnb-67d48cb6c7-857pl       1/1     Running   0          39s
```

michal@DESKTOP-520KE9B: ~/

```
eted successfully, next invoking ControllerExecutionBB (Execution Path progress: BBs co
mpleted = 11; BBs remaining = 3).
2021-09-12 INFO - [None][Check 6194ef03-ce37-40ad-9ad5-01ff1d9bfe24 orchestration reque
st status] response code: 200
2021-09-12 INFO - Orchestration IN_PROGRESS - Execution of ActivateVfModuleBB has compl
eted successfully, next invoking ControllerExecutionBB (Execution Path progress: BBs co
mpleted = 11; BBs remaining = 3).
2021-09-12 INFO - [None][Check 6194ef03-ce37-40ad-9ad5-01ff1d9bfe24 orchestration reque
st status] response code: 200
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mpleted = 11; BBs remaining = 3).
2021-09-12 INFO - [None][Check 6194ef03-ce37-40ad-9ad5-01ff1d9bfe24 orchestration reque
st status] response code: 200
2021-09-12 INFO - Orchestration IN_PROGRESS - Execution of ControllerExecutionBB has co
mpleted successfully, next invoking ActivateVnfBB (Execution Path progress: BBs complet
ed = 12; BBs remaining = 2).
2021-09-12 INFO - [None][Check 6194ef03-ce37-40ad-9ad5-01ff1d9bfe24 orchestration reque
st status] response code: 200
2021-09-12 INFO - Orchestration COMPLETE - Successfully completed all Building Blocks
2021-09-12 INFO - Orchestration was succeed
michal@DESKTOP-520KE9B:
```

ubuntu@f5gc-node-1: ~

```
ubuntu@f5gc-node-1:
```

michal@DESKTOP-520KE9B: ~/

```
2021-09-12 INFO - Orchestration IN_PROGRESS - Execution of ActivateVfModuleBB has compl
eted successfully, next invoking ControllerExecutionBB (Execution Path progress: BBs co
mpleted = 6; BBs remaining = 3).
2021-09-12 INFO - [None][Check 25142b64-09a5-45fb-b4a9-7b99c1d31c73 orchestration reque
st status] response code: 200
2021-09-12 INFO - Orchestration IN_PROGRESS - Execution of ActivateVfModuleBB has compl
eted successfully, next invoking ControllerExecutionBB (Execution Path progress: BBs co
mpleted = 6; BBs remaining = 3).
2021-09-12 INFO - [None][Check 25142b64-09a5-45fb-b4a9-7b99c1d31c73 orchestration reque
st status] response code: 200
2021-09-12 INFO - Orchestration IN_PROGRESS - Execution of ActivateVfModuleBB has compl
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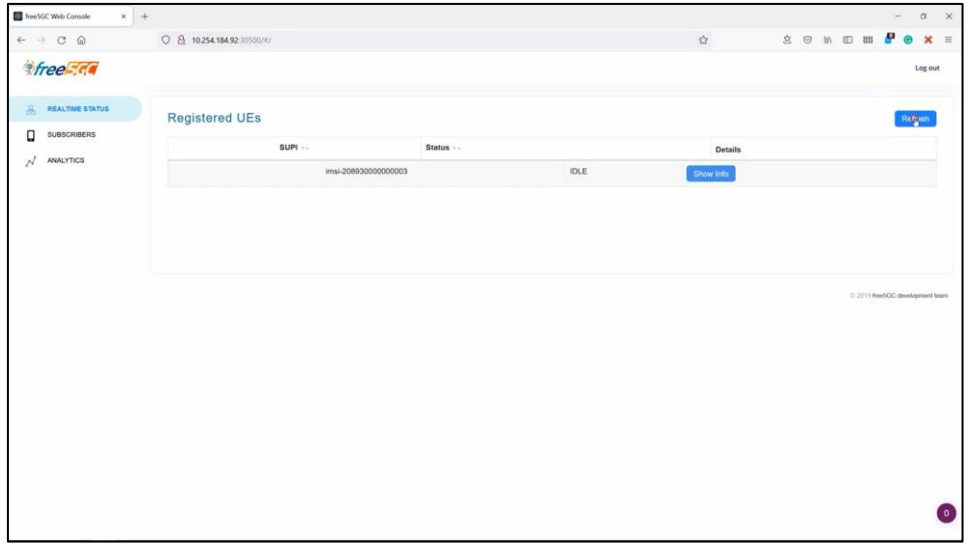
2021-09-12 INFO - [None][Check 25142b64-09a5-45fb-b4a9-7b99c1d31c73 orchestration reque
st status] response code: 200
2021-09-12 INFO - Orchestration IN_PROGRESS - Successfully completed all Building Block
s
2021-09-12 INFO - [None][Check 25142b64-09a5-45fb-b4a9-7b99c1d31c73 orchestration reque
st status] response code: 200
2021-09-12 INFO - Orchestration COMPLETE - Successfully completed all Building Blocks
2021-09-12 INFO - Orchestration was succeed
michal@DESKTOP-520KE9B:
```

OPEN NETWORKING & EDGE SUMMIT

Kubernetes on EDGE DAY

#8



DISCONNECT RAN

ubuntu@f5gc-node-1: ~

```
NAME                                  READY   STATUS        RESTARTS   AGE
rel-1-base-ue-746fd86c64-bp2mf        1/1     Running       0          4m24s
rel-1-free5gc-upf-547bbd5658-s76ch    1/1     Running       0          4m5s
mongodb-0                             1/1     Running       0          4m5s
rel-1-free5gc-nrf-9fc84ff49-pdbds     1/1     Running       0          4m7s
rel-1-free5gc-amf-6994f765d4-fr5lh    1/1     Running       0          4m7s
rel-1-free5gc-ausf-6b6cfbb98f-zphl5   1/1     Running       0          4m7s
rel-1-free5gc-nssf-5cc6f6585d-ccggq   1/1     Running       0          4m7s
rel-1-free5gc-pcf-5d8dddc977-dn8bb    1/1     Running       0          4m6s
rel-1-free5gc-smf-768d684887-vczsn    1/1     Running       0          4m6s
rel-1-free5gc-udm-59988764b8-v27tz    1/1     Running       0          4m6s
rel-1-free5gc-udr-7998f4cc87-dhmd5    1/1     Running       0          4m6s
rel-1-free5gc-webui-67494bddff-lvb5s  1/1     Running       0          4m5s
rel-1-free5gc-n3iwf-594f77456c-f7m8f  1/1     Running       5          4m5s
ue-connectivity-test-8wzqf            0/1     Error         0          41s
ue-connectivity-test-z4r45            0/1     Error         0          39s
ue-connectivity-test-4zhxc            0/1     Error         0          29s
rel-1-base-gnb-67d48cb6c7-857pl       1/1     Running       0          33s
rel-1-base-gnb-6c77ddb9f9-lb8wq       0/1     Terminating   0          4m24s
```

michal@DESKTOP-520KE9B: ~/

```
eted successfully, next invoking ControllerExecutionBB (Execution Path progress: BBs co
mpleted = 11; BBs remaining = 3).
2021-09-12 INFO - [None][Check 6194ef03-ce37-40ad-9ad5-01ff1d9bfe24 orchestration reque
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2021-09-12 INFO - Orchestration IN_PROGRESS - Execution of ControllerExecutionBB has co
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2021-09-12 INFO - Orchestration COMPLETE - Successfully completed all Building Blocks
2021-09-12 INFO - Orchestration was succeed
michal@DESKTOP-520KE9B:
```

ubuntu@f5gc-node-1: ~

```
ubuntu@f5gc-node-1:
```

michal@DESKTOP-520KE9B: ~/

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2021-09-12 INFO - Orchestration IN_PROGRESS - Successfully completed all Building Block
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2021-09-12 INFO - [None][Check 25142b64-09a5-45fb-b4a9-7b99c1d31c73 orchestration reque
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2021-09-12 INFO - Orchestration COMPLETE - Successfully completed all Building Blocks
2021-09-12 INFO - Orchestration was succeed
michal@DESKTOP-520KE9B:
```

धन्यवाद

Merci

Thank you

Dziękujemy

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