

Towards 5GS

The Kubernetesization of Free5GC and 5GS E2E orchestration using ONAP

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Orange Innovation



Agenda

- Rationale
- 5G-related software
- Towards 5GS platform
- Demo
- Limitations & next steps

Rationale

Several open source projects are dealing with the implementation of 5G core network



× None of them is providing tools to perform on Kubernetes platform



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



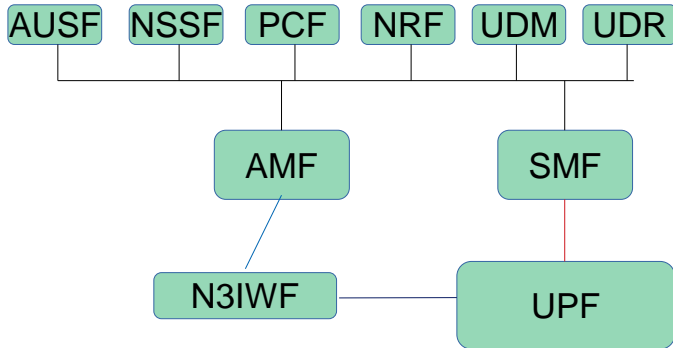
kubernetes



5G-related software

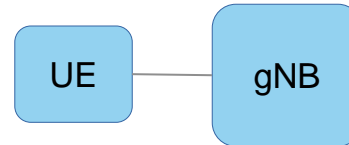


- Open source 5G core network based on 3GPP R15
- The ultimate goal of this project is to implement the 5G core network (5GC) defined in 3GPP Release 15 (R15) and beyond
- Supported versions are v3.0.4 and v3.0.5



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



5G-related software



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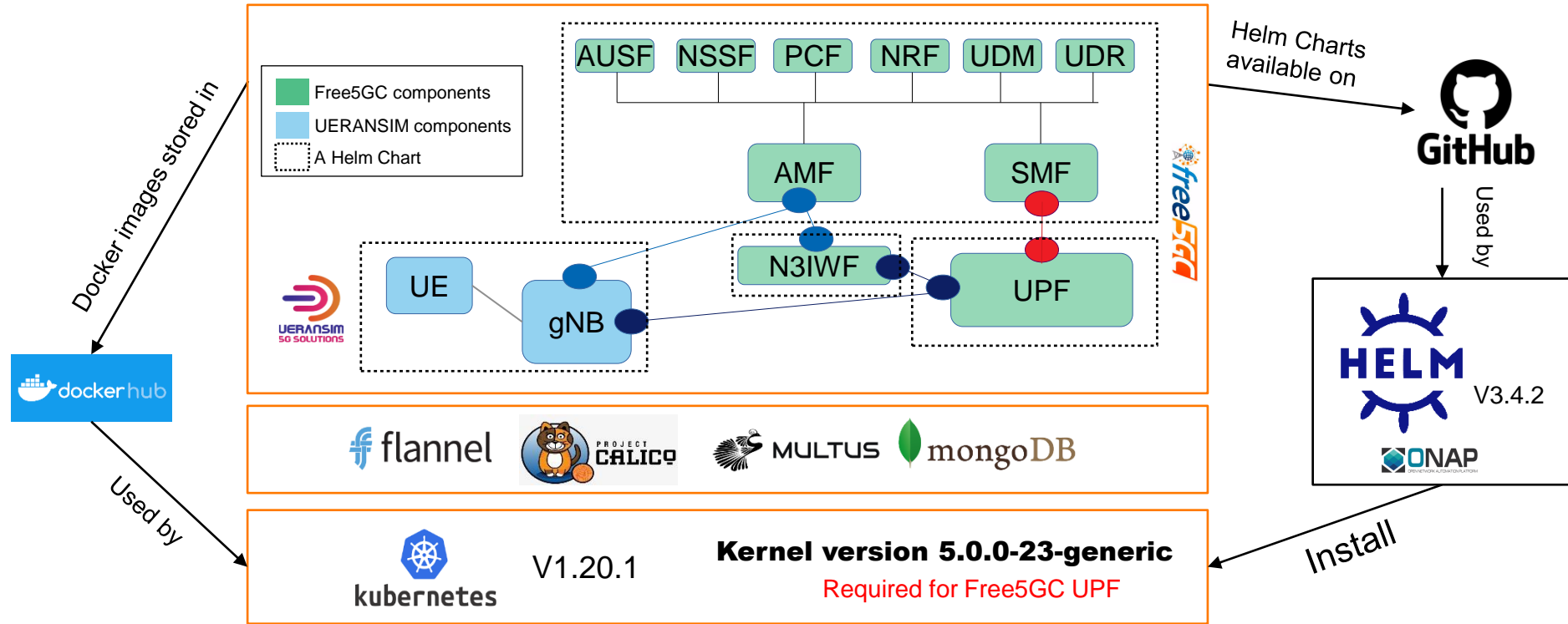
Link

s:

Free5GC: <https://github.com/free5gc/free5gc>

UERANSIM: <https://github.com/aligungr/UERANSIM>

Towards5GS platform



Link

s:

Github Repo: <https://github.com/Orange-OpenSource/towards5gs-helm>

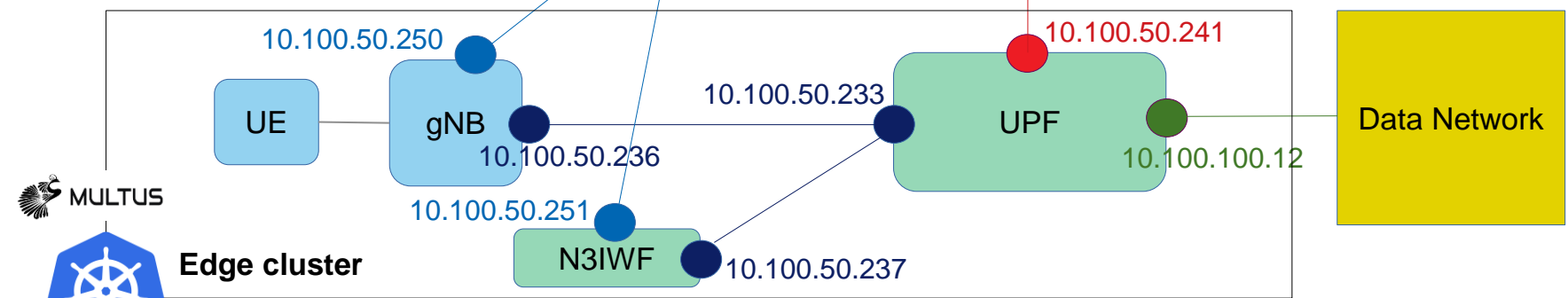
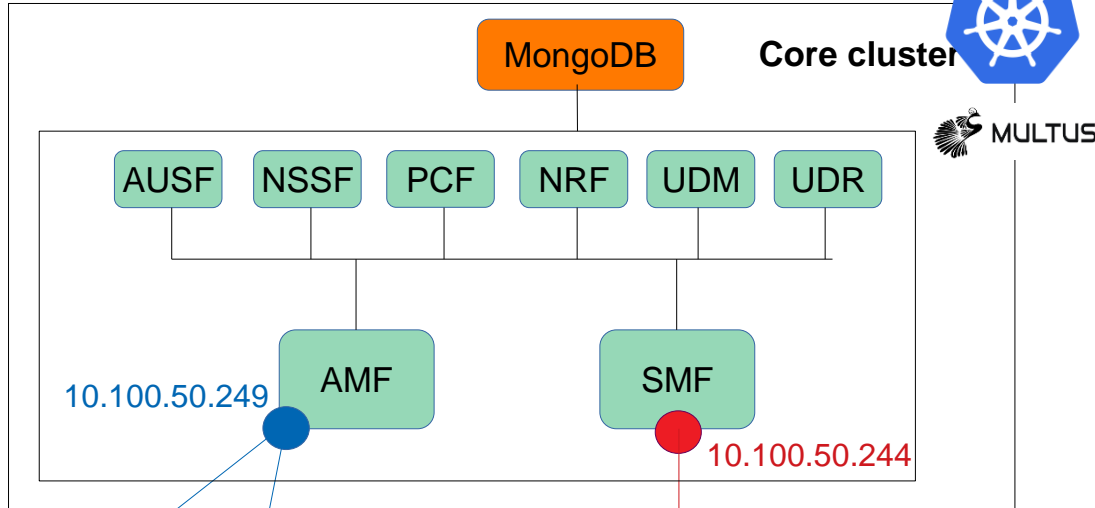
Dockerhub Organization: <https://hub.docker.com/u/towards5gs>

Bitnami's MongoDB Helm Chart:

<https://github.com/bitnami/charts/tree/master/bitnami/mongodb>

Two-cluster deployment

N2 subnet: 10.100.50.248/29
N3 subnet: 10.100.50.232/29
N4 subnet: 10.100.50.240/29
N6 subnet: 10.100.100.0/24



Kernel version 5.0.0-23-generic

- Free5GC components
- UERANSIM components
- Database

Demo: Free5GC deployment and E2E test with UERANSIM

```
Free5GC@edge1:~$ cd /opt/free5gc/
Free5GC@edge1:~/opt/free5gc$ ./install.sh -c edge --k8s-namespace=free5gc --k8s-namespace-core=free5gc-core --k8s-namespace-n3iwf=free5gc-n3iwf --k8s-namespace-ue=free5gc-ue
INFO: [2023-02-02 22:14:18] Installing Free5GC components on edge cluster...
INFO: [2023-02-02 22:14:18] Installing Free5GC components on core cluster...
INFO: [2023-02-02 22:14:18] Installing Free5GC components on n3iwf cluster...
INFO: [2023-02-02 22:14:18] Installing Free5GC components on ue cluster...
INFO: [2023-02-02 22:14:18] Free5GC installation completed successfully.
```

1

Deploy the Free5GC user-plane on the 'edge' cluster

```
Free5GC@core1:~$ cd /opt/free5gc/
Free5GC@core1:~/opt/free5gc$ ./install.sh -c core --k8s-namespace=free5gc --k8s-namespace-edge=free5gc-edge --k8s-namespace-n3iwf=free5gc-n3iwf --k8s-namespace-ue=free5gc-ue
INFO: [2023-02-02 22:14:18] Installing Free5GC components on core cluster...
INFO: [2023-02-02 22:14:18] Installing Free5GC components on edge cluster...
INFO: [2023-02-02 22:14:18] Installing Free5GC components on n3iwf cluster...
INFO: [2023-02-02 22:14:18] Installing Free5GC components on ue cluster...
INFO: [2023-02-02 22:14:18] Free5GC installation completed successfully.
```

2

Deploy the Free5GC control-plane on the 'core' cluster

```
Free5GC@edge1:~$ cd /opt/free5gc/
Free5GC@edge1:~/opt/free5gc$ ./install.sh -c edge --k8s-namespace=free5gc --k8s-namespace-core=free5gc-core --k8s-namespace-n3iwf=free5gc-n3iwf --k8s-namespace-ue=free5gc-ue
INFO: [2023-02-02 22:14:18] Installing Free5GC components on edge cluster...
INFO: [2023-02-02 22:14:18] Installing Free5GC components on core cluster...
INFO: [2023-02-02 22:14:18] Installing Free5GC components on n3iwf cluster...
INFO: [2023-02-02 22:14:18] Installing Free5GC components on ue cluster...
INFO: [2023-02-02 22:14:18] Free5GC installation completed successfully.
```

3

Deploy the Free5GC N3iwf on the 'edge' cluster



4

Subscribe an end user using Free5GC WEBUI

```
Free5GC@edge1:~$ cd /opt/free5gc/
Free5GC@edge1:~/opt/free5gc$ ./install.sh -c edge --k8s-namespace=free5gc --k8s-namespace-core=free5gc-core --k8s-namespace-n3iwf=free5gc-n3iwf --k8s-namespace-ue=free5gc-ue
INFO: [2023-02-02 22:14:18] Installing Free5GC components on edge cluster...
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INFO: [2023-02-02 22:14:18] Installing Free5GC components on n3iwf cluster...
INFO: [2023-02-02 22:14:18] Installing Free5GC components on ue cluster...
INFO: [2023-02-02 22:14:18] Free5GC installation completed successfully.
```

5

Deploy the UERANSIM on the 'edge' cluster

```
Free5GC@edge1:~$ cd /opt/free5gc/
Free5GC@edge1:~/opt/free5gc$ ./install.sh -c edge --k8s-namespace=free5gc --k8s-namespace-core=free5gc-core --k8s-namespace-n3iwf=free5gc-n3iwf --k8s-namespace-ue=free5gc-ue
INFO: [2023-02-02 22:14:18] Installing Free5GC components on edge cluster...
INFO: [2023-02-02 22:14:18] Installing Free5GC components on core cluster...
INFO: [2023-02-02 22:14:18] Installing Free5GC components on n3iwf cluster...
INFO: [2023-02-02 22:14:18] Installing Free5GC components on ue cluster...
INFO: [2023-02-02 22:14:18] Free5GC installation completed successfully.
```

6

Test the UE's connectivity

Limitations & next steps

- Limitations:
 - Currently Free5GC core network is containerized, but the it is not yet cloud-native
 - Data acceleration is not supported (e.g. SR-IOV) for the UPF yet
- Next Steps
 - Support of CNF health check functionality
 - Support day 0/1/2 operations using ONAP

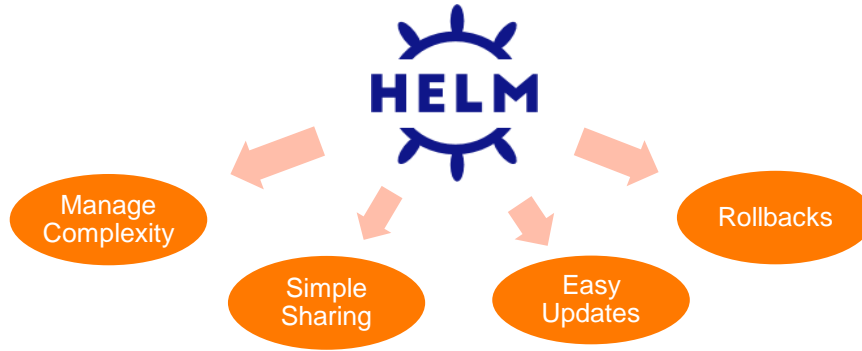
Thank you !

24/06/2020

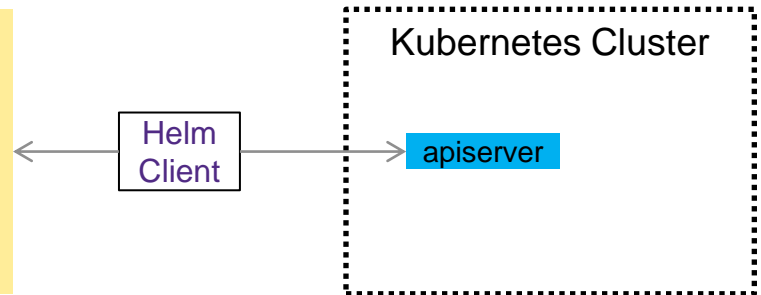


Helm

Helm is a Kubernetes package manager which enables managing Kubernetes Applications.
The packaging format used by Helm is called **charts**

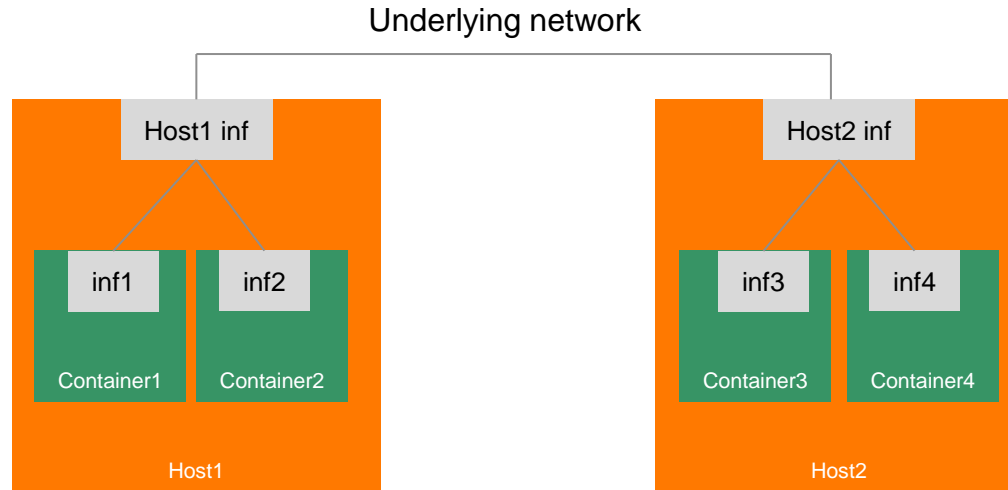


```
{Chart folder}/  
Chart.yaml      # A YAML file containing information about the chart  
values.yaml     # The default configuration values for this chart  
charts/        # Charts upon which this chart depends.  
templates/     # When combined with values, will generate valid  
               # Kubernetes manifest files.
```



MacVLAN plugin

MacVLAN allows us to create **virtual interfaces** sharing the same underlying network with their **master** interfaces



MacVLAN for Docker containers:

<https://docs.docker.com/network/macvlan/>

MacVLAN CNI: <https://www.cni.dev/plugins/main/macvlan/>