



Introduction to OpenAirInterface Network functions and Operators

Day 1 - October 9



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Agenda

- Introduction to OpenAirInterface (OAI)
- OAI 5G RAN and Core Network Functions
- R2 OAI Operators
- Beyond R2 for OAI and RAN support

Introduction to OpenAirInterface (OAI)

- OpenAirInterface Software Alliance (OSA)
 - Established in 2014
 - LFM member since 2018
 - French non-profit organization, funded by corporate sponsors

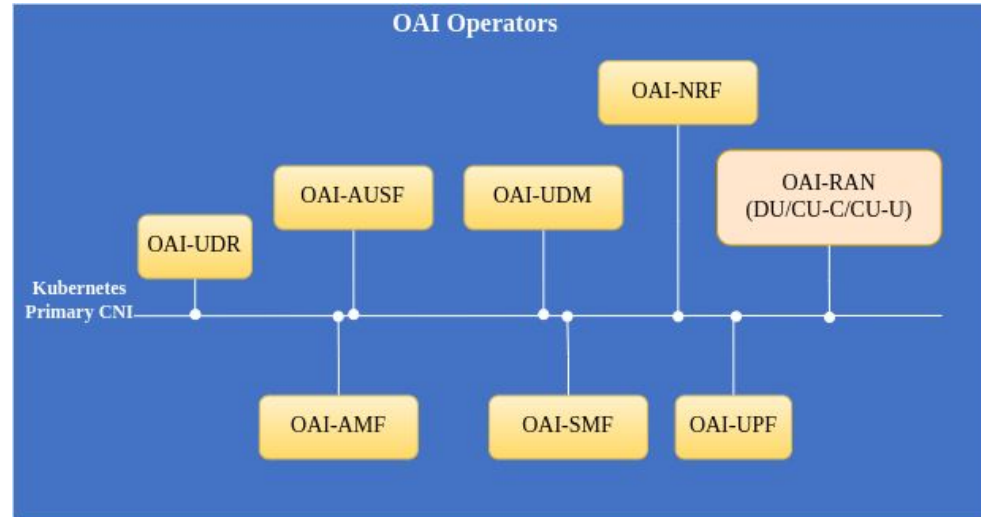
- OpenAirInterface (OAI)
 - Open Source Community
 - Licensed under OAI Public License V1.1
 - Build wireless cellular Radio Access Network (RAN) and Core Network (CN) functions
 - 5G 3GPP release 16 compatible
 - Reference implementation for O-RAN



OAI 5G RAN and Core Network Functions

- Offers open source software implementation of 4G/5G RAN, CN and UE
 - 5G Core: AMF, SMF, UPF, NRF, PCF, NSSF, UDR, UDM, AUSF
 - 5G RAN: DU, CU-CP, CU-UP, Monolithic gNB, Near Real-Time RIC (FlexRIC)
- Supports
 - Operating System: RHEL, CoreOS, Ubuntu
 - CPU Architecture: x86, AArch64
 - Container platform: Vanilla Kubernetes and Openshift
- Containerized network functions images hosted on docker hub

R2 OAI Operators

- OAI-RAN operators code bootstrapped by using the helm to operator code generator.
 - Enhancements to enable Nephio approach to perform IP allocations, interfaces handling and dependency handling.
 - Currently one controller to deploy and undeploy OAI CU-CP, CU-UP, DU
 - Hosted in Nephio repository under apache 2 license
- Core network function operators are written in python using kopf framework
 - Hosted in OAI github repository under 3 Clause BSD license



-  Written in go resides in Nephio repository
-  Written in python resides in OAI repository

Beyond R2

These two points depends on Nephio (how it provides the infra)

- Including Radio Units (RUs) as infrastructure resources (Either split 8 RUs or 7.2 RUs) [Optional]
- Exposing DPDK NICs, DPUs, Hardware Accelerators for DU

These are OAI points

- Improve the RAN intent to have more 3GPP/O-RAN Oriented parameters
- Testing DU with hardware RUs
- Configuration management using Netconf for RAN NF
- Developing operators for PCF and NWDAF



RAN use case: O-RAN and OpenAirInterface

Day 2 - October 10



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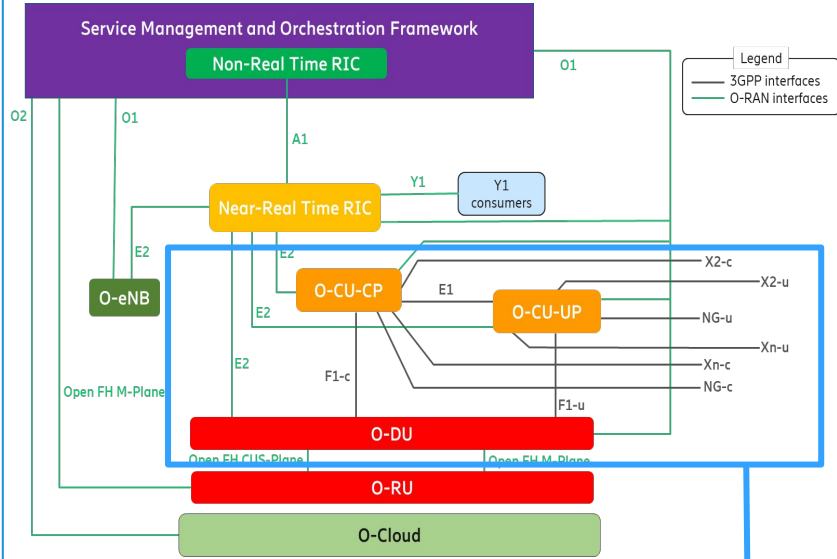
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Agenda

- R2 Architecture Mapping
- R2 Deployment Blueprint
- OAI Operators (RAN + Core)
- Proposed RAN Custom Resources (CRs)

R2 Architecture Mapping

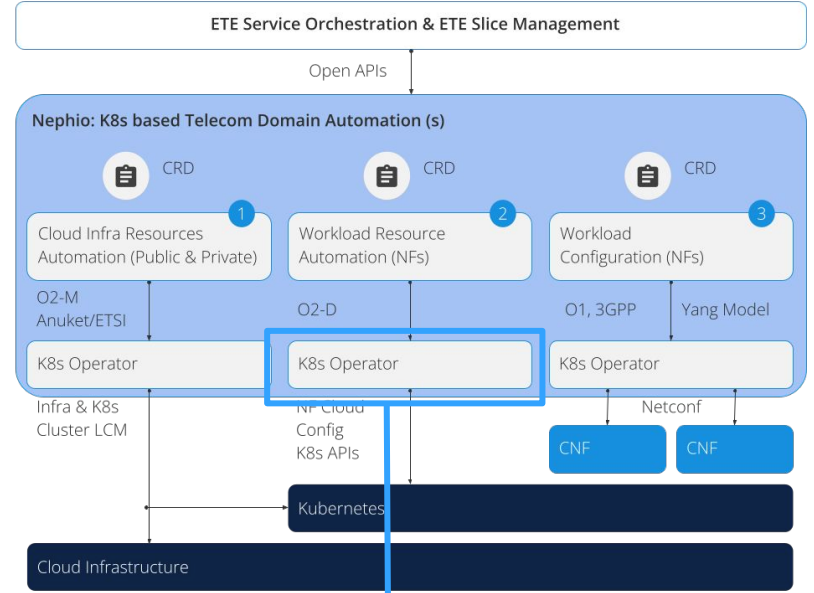


Source: O-RAN Alliance (O-RAN.WG1.OAD-R003-v10.00)

CNFs Provided by OAI



R2 Scope

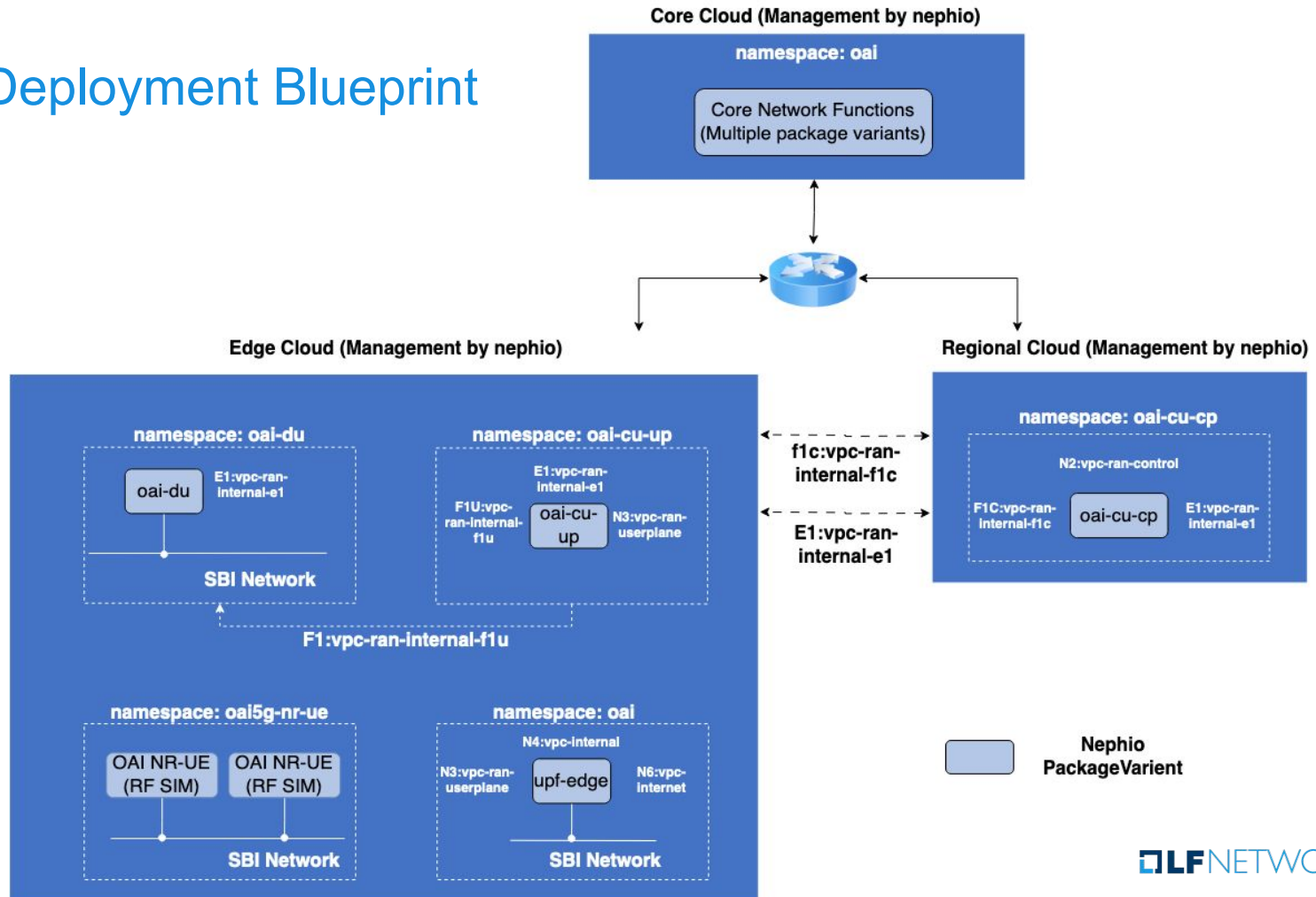


Source: Nephio Website

Simplified Operators for deploying OAI NFs (not O-RAN O2)



R2 Deployment Blueprint



R2 Deployment Blueprint

Intent: defined the dependencies between CU-CP, CU-UP, and AMF for connectivity (similar as SMF one)

Realization: Nephio KRM functions

- Interfaces
- NAD
- NF-Deploy

All the KRM functions used are generic and not RAN-specific, making them re-usable across use cases.

Example dependency.yaml for cu-cp

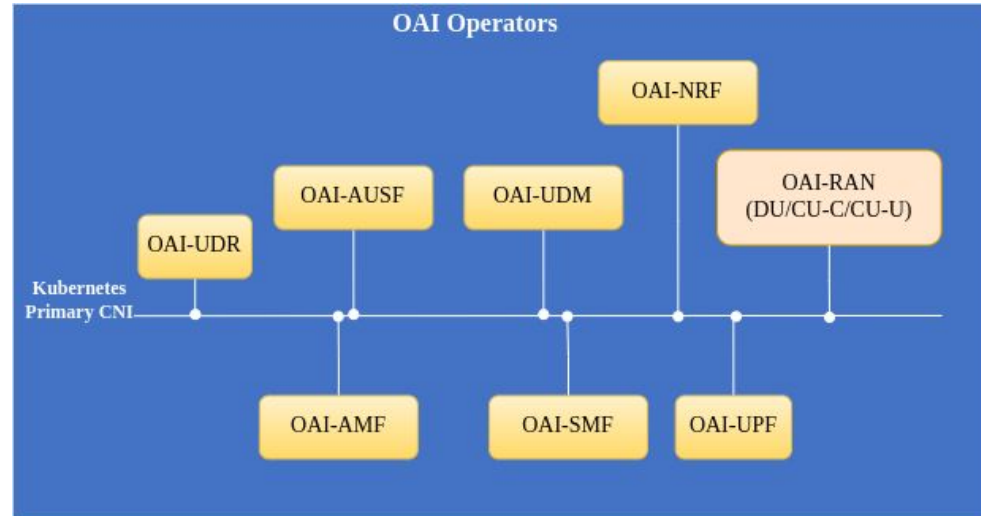
```
apiVersion: req.nephio.org/v1alpha1
kind: Dependency
metadata:
  name: CU-CP
  annotations:
    config.kubernetes.io/local-config: "true"
    specializer.nephio.org/owner:
workload.nephio.org/v1alpha1.RANDeployment.cu-up-example
  specializer.nephio.org/namespace: example
spec:
  packageName: oai-amf
  injectors:
  - apiVersion: workload.nephio.org/v1alpha1
    kind: AMFDeployment
```



Example KRM functions

```
pipeline:
  mutators:
  - image: gcr.io/kpt-fn/apply-replacements:v0.1.1
    configPath: apply-replacements-owner.yaml
  - image: gcr.io/kpt-fn/apply-replacements:v0.1.1
    configPath: apply-replacements-namespace.yaml
  - image: gcr.io/kpt-fn/set-namespace:v0.4.1
    configPath: cm-namespace.yaml
  - image: docker.io/nephio/nf-deploy-fn:v1.0.1
  - image: docker.io/nephio/interface-fn:v1.0.1
  - image: docker.io/nephio/nad-fn:v1.0.1
  - image: docker.io/nephio/interface-fn:v1.0.1
  - image: docker.io/nephio/nf-deploy-fn:v1.0.1
```

OAI Operators

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Proposed RAN Custom Resources

This is up for discussion and not definitive

```
apiVersion: workload.nephio.org/v1alpha1
kind: RANDeployment
metadata:
  name: oai-ran-cu-up
  namespace: oai-ran
spec:
  ranNfType: CU-UP
```

```
apiVersion: workload.nephio.org/v1alpha1
kind: RANDeployment
metadata:
  name: oai-ran-du
  namespace: oai-ran
spec:
  ranNfType: DU
```

```
apiVersion: workload.nephio.org/v1alpha1
kind: RANDeployment
metadata:
  name: oai-ran-cu-cp
  namespace: oai-ran
spec:
  ranNfType: CU-CP
  params3gpp:
    physicalCellId: 0
    cellIdentity: '12345678L'
    plmn:
      mcc: '001'
      mnc: '01'
      mncLength: 2
    tac: '1'
    nssaiList:
      - sst: '1'
        sd: '0xffffffff'
  nflatency: 1
  capacity:
    maxDownlinkThroughput: 100M
    maxUplinkThroughput: 1M
```