Outline

• Introduction of 5G System and OAI 5G CN project
• Current Implementation Status of OAI 5GC Components
• Roadmap
• OAI CN-related Activities
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5G System Architecture

- Access and Mobility Management Function (AMF)
- Session Management Function (SMF)
- User plane function (UPF)
- Policy Control Function (PCF)
- Authentication Server Function (AUSF)
- Unified Data Management (UDM)

- Network Exposure function (NEF)
- NF Repository function (NRF)
- Network Slice Selection Function (NSSF)
- Unified Data Repository (UDR)
- Unstructured Data Storage Function (UDSF)
- Application Function (AF)
Core Network: From 4G to 5G Networks

CUPS: Control and User Plane Separation
SGW: Serving Gateway
PCRF: Policy and Charging Rules Function

MME: Mobility Management Entity
HSS: Home Subscriber Server
PGW: Packet Data Network (PDN) Gateway

OAI Workshop San Diego, Nov 2022
OAI 5G CN Project Group

- Website: https://openairinterface.org/oai-5g-core-network-project/
- Develop a fully 3GPP compatible 5G CN stack (SA) as open source software for the OAI community
- Sponsors: Qualcomm, Meta (Facebook) Connectivity, InterDigital
- Main contributors:
  - EURECOM/OSA, BUPT, KCL
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OAI 5G CN – Current Status (1): Release 1.5.0
OAI 5G CN – Current Status (2)

- **Solid and functional 5GC**
  - Basic procedures (with multiple UEs/PDU sessions): connection and registration procedures (UE registration/de-registration, service request), session management procedures (PDU session establishment, modification, release)
  - Additional features:
    - NF registration, NF discovery (e.g., to discover and select SMF, UPF)
    - Support N2 handover, Paging, HTTP/2, and FQDN
    - Event exposure services for SMF (7 events), AMF (6 events), UDM/UDR (on-going)
    - Basic support for Private 5G network (Static UE IP address allocation, non-NATed IP traffic between UE and DN)
    - Support Network slicing with NSSF and multiple AMFs
    - Support multiple UPFs in the same data path/Support UL Classifier

NF: Network Function, FQDN: Fully Qualified Domain Name
Different flavors

- Three 5GC modes
  - Minimalist 5GC with AMF, SMF, UPF (and NRF)
  - Basic 5GC with AMF, SMF, NRF, UPF, UDM, AUSF and UDR
  - Full 5GC with AMF, SMF, NRF, UPF, UDM, AUSF, UDR, PCF, NRF, UMF, SCF and NEF
- Three UPF flavors:
  - SPGW-U (from 4G) with additional features for 5G
  - VPP-UPF (relying on VPP-Travelping, with DPDK support)
  - P4-UPF (SD-Fabric, on-going)

Deployment options

- Traditional/classic deployment on Servers/Virtual machines
- Automated deployment of NFs in Docker containers using Docker-Compose
- Cloud-native deployment using Helm Chart (on OpenShift cluster)
OAI 5G CN – Current Status (4)

- **Validation, CI/CD with**
  - Professional tester (dsTest/ng4T): Functional, stability, reliability (and performance) tests

- **OAI gNB/OAI UE, COTS UEs (Rel 15 and Rel 16 UEs e.g., Quectel/SIMcom modules, Huawei P40/P40 Pro, Pixel 5, One Plus 8), Amarisoft UE**

- Open-source RAN simulators (gNBSim, UERANSIM, My5g-RANTester)

- Commercial gNBs (Amarisoft/Baicell)/COTS UEs

- **Stabilize 5GCN and add user-friendly functionalities**
  - Reduce image size, reduce CPU utilization footprint
  - Code cleanup for NGAP/NAS libraries
  - Provide customize APIs for User provisioning
  - Provide customize APIs for configuring AMF/SMF on the fly (e.g., get/update configuration information)
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OAI 5G CN – Roadmap

**Q2-Q3 2022:**
- Release PCF (with basic functionalities)
- Multiple UPFs in the same data path: Support of UL-Classifier
- Customize APIs for User provisioning
- Customize APIs for configuring NFs (e.g., AMF/SMF)
- Support Ubuntu 20.04/22.04

**Q4 2022 - :**
- Support of location service procedures (on-going)
- Support of Traffic Steering/Redirection
- Integration and testing with P4-UPF (SD-Fabric/ONF)
- Add Unit Test for NFs
- Support of Mobility
- IPv6 support (GTP-U for N4)
- Support of 5G LAN-type Services
- Redundant Transmission support (for URLLC)
- New entities: UDSF (for stateless NFs), NWDAF, NEF, SCP, LMF

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OAI CN-Related Activities

- Magma testing: OAI takes the charge of:
  - Magma Continuous Integration (CI) pipelines/workflows and release cycle: Maintaining and extending CI/CD framework
  - 4G/5G NSA testing
    - Fixing issues with current testing scenarios (LTE Integration tests)
    - Adding new testing scenarios for Federated Integration tests (with 3GPP components e.g., HSS, PCRF and OCS)
  - 5G SA testing
    - Implementing a new open-source 5G SA CN tester
- Orchestrating OAI CN with Magma Orchestrator: Bringing a 3GPP-compliant core to Magma ecosystem (Demo from Rohan KHARADE)
- OAI CN with Aether (ONF)
Useful links

- Project website:
  - [https://openairinterface.org/oai-5g-core-network-project/](https://openairinterface.org/oai-5g-core-network-project/)

- Git repositories
  - Federation of the OpenAir CN 5G repositories: [https://gitlab.eurecom.fr/oai/cn5g/oai-cn5g-fed](https://gitlab.eurecom.fr/oai/cn5g/oai-cn5g-fed)
  - 5GC network functions: [https://gitlab.eurecom.fr/oai/cn5g](https://gitlab.eurecom.fr/oai/cn5g)

- Videos:
  - OAI 5G Core testing with commercial gNB and COTS UE: [https://www.youtube.com/watch?v=N5wuuhh-1dxk&t=5s](https://www.youtube.com/watch?v=N5wuuhh-1dxk&t=5s)
  - OAI 5G Core Network Deployment: [https://www.youtube.com/watch?v=ENQiwl2EYI8](https://www.youtube.com/watch?v=ENQiwl2EYI8)
Thank you for your attention!

Q&A!