OpenAirInterface 5G Core Network: A Cloud-Native 3GPP-Compliant 5G CN

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OSM Hackfest, Sept 13-17, 2021
Outline

• Introduction of OpenAirInterface and 5G System
• Current Implementation Status of OAI 5G CN Components
• Roadmap
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What is OpenAirInterface?

- **OpenAirInterface (OAI)**: Open-source software-based implementation of 3GPP Technologies
  - E-UTRAN (eNB, gNB, UE, nr-UE)
  - EPC (MME, S/P-GW, HSS)
  - 5GC (AMF, SMF, NRF, UPF, etc.)

- **Objectives**
  - Building a community of individual developers, academics and major industrials embracing open-source for 5G
  - Provide a reference implementation for 4G/5G 3GPP systems
  - Allow easy adoption of the software in other projects or products

- **OpenAirInterface Software Alliance (OSA)**
  - Launched in 2014 as an endowment fund (French “Fonds de Dotation”) to facilitate OAI adoption
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
- License
  - 5G Core network license is OAI Public License v1.1
  - Contribution is opened to anyone who signs the license agreement
- Sponsors: Qualcomm, Facebook Connectivity, Interdigital
- Main contributors:
  - EURECOM, BUPT
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)

5G System Architecture (source: 3GPP TS 23.501)
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

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A solid and functional 5GC
- Basic procedures (with multiple UEs/multiple 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: SMF selection (for AMF), UPF selection (for SMF)
  - N2 handover, Paging, HTTP/2 (on-going), FQDN support
Two 5GC modes
- Minimal 5GC with AMF, SMF, NRF and UPF
- Basic 5GC with AMF, SMF, UDM, AUSF, UDR, NRF and UPF

Three UPF flavors:
- SPGW-U (from 4G) with additional features for 5G
- VPP-UPF (relying on VPP-Travelping, with DPDK support)
- Production grade UPF (Kaloom)
Validation, CI/CD

- With a professional tester (dsTest, Developing Solutions): Functional, stability, reliability and performance tests (number of supported UEs/sessions, throughput, packet loss):
  - Testing AMF, SMF and UPF with simulated gNB/UE
  - Bracket test for AMF, SMF (e.g., testing AMF with simulated SMF/UPF/gNB/UE)
- With OAI gNB/OAI UE (+ Quectel/SIMcom modules)
- With commercial gNBs (Amarisoft/Baicell) /COTS UEs
- With open-source RAN simulators (gNBSim, UERANSIM)
Deployments, CI/CD
- Traditional/classic deployment on Servers/Virtual machines
- Automated deployment of NFs in Docker containers using Docker Compose
- Could-native deployment using Helm Chart on OpenShift cluster
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Roadmap: OAI 5GC Components

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OAI CN 5G Project: Timeline

- Cloud native deployment
- Feature support N2 handover, paging, HTTP/2
- Integrating new network elements REL-16 UDM, AUSF, UDR
- Test with OAI gNB and UE
- Support for FQDN
- Compatibility test with opensource RAN simulators

MARCH
- Validate REL-16 AMF, SMF, UPF call flow
- NRF Integration
- Automated deployment support (Docker-compose)
- Interoperability test with commercial gNBs and COTS UE
- Multiple UPF support
- Test and benchmarking Traveling UPF

APRIL
- Event exposure for AMF/SMF/UDM (NWDAF and FlexCN)
- Timer handling (SMF/AMF)
- Test with production grade commercial UPF solutions
- NSSF with basic functionalities

MAY
- NEF, UDSF, NWDAF integration

JUNE
- Redundant transmission support for URLLC
- Uplink classifier (UL-CL)
- Mobility support

JULY

AUGUST

SEPTEMBER

OCTOBER

NOVEMBER

DECEMBER

JANUARY

FEBRUARY

MARCH 2022

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Useful links

• Project website:
  • 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
  • 5GC network functions: https://gitlab.eurecom.fr/oai/cn5g

• Videos:
  • OAI 5G Core testing with commercial gNB and COTS UE: https://www.youtube.com/watch?v=N5wuhh-1dxk&t=5s
  • OAI 5G Core Network Deployment: https://www.youtube.com/watch?v=ENQiwl2EY18

• Mailing lists: https://gitlab.eurecom.fr/oai/openairinterface5g/-/wikis/MailingList
  • openaircn-user/ openaircn-devel for the users/developers of OAI CN
Thank you for your attention!

Q&A!