EURECOM 5G Experimental Site

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Unleashing the potential of open-source in the 5G arena
Summary

- Overview OpenAirInterface
- Applications in Public-Safety Networks
Commoditization of 3GPP Radio Systems and Open-Source: OAI Software Alliance

- Today it is feasible to put a fully-compliant 4G/5G eNodeB/gNodeB and EPC/5GC in a commodity computer or server farm
  - Emergence of “radio”-hackers in addition to commercial vendors
  - types of software (Amarisoft, closed, commercial), OAI (open-source, 3GPP-friendly), srsLTE (open-source, 3GPP-unfriendly)

- OAI maintains two software suites
  - openairinterface5g: x86/ARM implementation of 3GPP 4G/5G RAN procedures for generic computers
    - eNB/gNB, UE, RRU
  - openairCN: x86 implementation of 4G EPC and 5G Core
  - Licensing: FRAND-based for RAN/5G Core, Apache V2.0 for 4G Core

- Objectives
  - Federate contributions to OAI codebases
  - Manage orientation of community development to suit requirements of strategic partners
  - Provide software testing and Continuous Integration Framework
  - Foster collaboration between academics, SMEs and major industry

- Support/Testing
  - Donations are to maintain an engineering support team for
    - CI/CD
    - Community management/building
    - Industry relations
Technologies and Hardware for OAI Software

- **3GPP technologies**
  - 3GPP 5G NR (including RU,DU and CU node functions)
  - 3GPP 4G LTE (including RU,DU-LTE and CU-LTE node functions)
  - 3GPP 4G LTE-M
  - 3GPP 4G NB-IoT
  - 3GPP 4G LTE-Sidelink (ProSe / V2X)
  - 3GPP Rel 15 EPC (MME,HSS,S+PGw)
  - 3GPP Rel 15 5GC (end 2019)

- **commercially-available RF and computing equipment**
  - NI USRP B2x0, N3x0 + “Home-integrated” RF

- **some commercial eCPRI RRU support**
OAI Alliance Services

- **Coordination of community development**
  - Management of gitlab/github repositories
    - RAN (gitlab EURECOM) and Core Network software packages (public github)
  - Jenkins-based CI and CD
    - Main site (EURECOM)
      - CI for both RAN and Core
        - Testing with commercial terminals (UEs)
        - Interop. Testing with commercial networking solutions (Nokia Core, NG4T testers)
        - Triggered on merge requests to develop/master branches
  - Additional Sites
    - CI - Nokia Bell Labs (Paris-Saclay, RAN)
    - CI - Fujitsu (Tokyo, RAN)
    - CI – B-COM (Rennes, 4G/5G Core Network)
    - CD – R2Lab (INRIA Sophia Antipolis), running
    - CD – U. Utah/CloudLab (PAWR POWDER Project), testing now
    - CD – 5G-EVE (Orange/B-COM), coming 2020

- Organization of workshops
- Coordination of Technical and Strategic governance
Gitlab/Github and Jenkins

Code Changes

Feedback on status

Jenkins Server

Integration Job - Triggered by Merge Requests

Release Job - Triggered by Commits on develop/master

Pipeline Stages

Guidelines Check
Static Code Analysis
Build Most Variants
Test with Equipment

Guidelines Check
Static Code Analysis
Build All Variants
Full Test with Equipment

BEAUTIFUL
CORRECT
FUNCTIONAL
TESTED

Report
Release Notes

GitLab

GitHub
Testing Framework

OAI Code vs 3rd party

- LTEBOX
- OAI CN
- OAI CN CI
- OAI RAN CI
- RAN Emulator
- OAI eNB / gNB
- OAI FLEXRAN CTL
- OAI UE
- COTS-UE

2019 Workshop on 5G Technologies for First Responder and Tactical Networks
OPNFV VCO 3.0 use-case

- Managed by Linux Foundation and RedHat
- Objective: Full 5G, Cloud Native, and Edge
- 2 test sites
  - EURECOM in Sophia Antipolis using OAI Core and RAN
  - Kaloom in Montreal
- Please visit:
  https://wiki.opnfv.org/display/OSDD/VCO+Demo+3.0+Home
Deployment Architecture @ EURECOM
Deployment @ EURECOM

4G/5G Radio Site
Applications in Public-Safety Networks

- **ProSe Scenarios (4G LTE)**
  - Provide Interfaces for ProSe applications in OAI UE
  - Integration of Rel 14 Sidelink procedures (L1/L2)
  - Extensions in RAN and Core to support UE-Network relaying scenarios
OAI Architecture for ProSe Interfaces

PC5-D: Dedicated to direct discovery:

PC5-U: Dedicated to user plane direct traffic between two UEs.

PC5-S: Dedicated to control plane signaling
Testing D2D scenarios in OAI UE RF testbed examples

- **700 MHz / 10 MHz carrier (band 14)**
  - USRP radios (B2x0 series)
  - GPS synch

- **Multicast and Unicast scenarios in Mode2 (off-net)**
  - **UE node:** NUC PC (8 CPU-core, 8GB RAM) connected with USRP B200-mini
  - Operating at 763 MHz; 10 MHz Bandwidth
  - USRPs currently connected with external signal generator or octoclock with external frequency reference to get synchronized
    - Alternative: Use GPS-disciplined oscillator modules placed on top of USRP B210 USRPs
  - Current experiment with up to 3 nodes
Relay support

- Extensions at the interfacing level between OAI to connect multiple USRP B2x0 devices
  - Simple prototype for cellular (FDD) and sidelink access on common PC
3GPP is currently standardizing the 5G Sidelink for NR in the Rel-16 framework for V2X (primarily non-public safety scenarios)

Release 17 planning is now and includes
- [Sidelink_enh] (moderator: LG, Oppo)
  - Includes V2X, Commercial, and Critical Comms, FR2 aspects
  - Relay aspects, architecture aspects, related Uu aspects
  - Focus on common functions across the key use cases
  - Achieve maximum commonality between commercial, V2X, and Critical Communication usage of sidelink while addressing their specific requirements
  - Consider spinning off non-sidelink V2X aspects into a separate thread

OAI can be an excellent prototyping technology for Rel16/17 Sidelink based on current LTE framework and OAI 5G development