Third OAI General Workshop
Status and Objectives for 2017-2018
27th April 2017, BUPT, Beijing, China
Overview

- OAI Software Alliance background and news
  - About the alliance and OAI
  - members
  - Main projects
- openairCN status and objectives (Lionel Gauthier – EURECOM)
- openair5G RAN (eNB/RRU) status and objectives
- openair5G UE and road to 5G NR (Zhenhong Li TCL)
OAI Software Alliance

- Founded as a non-profit organization in France in November 2014 – *Fond de dotation* –
  - Aims to promote and extend the initial OAI software packages donated by EURECOM through community development
  - Accept monetary donations and development effort from industrial patrons to guarantee code quality, availability and applicability of OAI
  - Foster industry-academia-non-profit research collaboration on emerging 5G technologies
  - Appropriate licensing and intellectual property policy for synergy with standards setting organizations (3GPP) → allow collaboration with companies earning revenues on essential patents.
OAI Elements

openair5g

openairCN

OAI Public License (FRAND)

Apache V2.0 License
Members

- **Strategic members (40k€ donation / year)**
  - 2015: Ercom (new)
  - 2016: TCL (new), Orange (new), Ercom (terminated 12/16)
  - 2017: TCL (renewed), Orange, Nokia Bell Labs(new), Technicolor (new)

- **Associate (for-profit) members (10k€ donation / year)**
  - 2017: Cisco (new)

- **Associate (non-profit) members**
  - Too many to list … (>30)
    - P.R.C. (BUPT, CASIA, UESTC, Xidian)
    - Taiwan (III, NCTU)
**Boards**

### Strategic
- One voting representative from each strategic partner
  - Pierre BONNARD (TCL)
  - Christian GALLARD (Orange)
  - Laurent ROULLET (Nokia)
  - Henk HEIJNEN (Technicolor)
- Representatives of EURECOM (5 voting)
  - Christian BONNET (President)
  - Raymond KNOPP (General Secretary)
  - Catherine BETRANCOURT (Treasurer)
  - David GESBERT
  - Ulrich FINGER
  - Florian KALTENBERGER (Technical Liaison)

### Technical Committee
- Currently represented by project leaders who report to the strategic board
- Aim for regional representatives (China, USA) in 2017 to coordinate community activities locally

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**OAI - Open-Source Solutions for 5G**
Current Budget and Staff

- OAI Alliance funds: 212,368 € (today)
- First permanent employee (Operation’s Manager) to assume position in May
  - Community/ecosystem management
  - Relationships with current industrial members
  - Liaison with standards setting organizations (3GPP, ITU, NGMN), Fora (Small-cell) and other open-source/architecture communities (TIP, OpNFV, openCORD, etc.)

- Technical position (testing and code maintenance) envisaged with expected new donations in 2017
Important News since last workshop

- **OAI Public License / Contributor’s License Agreement**
  - Approval by strategic board on version 1.0, significant modifications by Nokia and Orange
    - Wording on relationship with essential patents
    - Wording on patent disclosure by contributors
    - Broad agreement by several major 3GPP industry, even non OAI members
  - To be applied to the codebase imminently

- **TCL 5G Lab**
  - Investment by TCL in Sophia Antipolis (currently at EURECOM premises) to develop OAI UE towards 5G for rapid-prototyping

- **Joint BUPT-EURECOM Open5G Lab**
  - Agreement for tight collaboration around open-source solutions for 5G, in particular around OAI. Exchange of staff, aid for Chinese OAI community.

- **NCTU OAI workshop (Nov. 2016)**
  - One day workshop at NCTU

- **Presentations/Demos**
  - OPNFV Summit (Berlin, June 2016), separate demos by EURECOM and Swisscom
  - OPNFV White Paper (EURECOM, BUPT, China Mobile, IITH, Orange, OPNFV)
  - MWC 2017, several demos (Intel, Canonical, Fraunhofer, B-COM)
Active Projects

- **Project 1a: RAN (Lead EURECOM)**
  - **RAN architecture evolution** (Main participants: EURECOM, Nokia, Cisco)
  - **RAN testing** (Main participants: EURECOM, Nokia, III, NCTU, Fujitsu, B-COM, INRIA, IITH)
  - **RAN Features** (Main participants: EURECOM, B-COM, NCTU, Fujitsu, Cisco)

- **Project 1b: UE (Lead TCL)**
  - **Rel 10 UE basic functionality** (Main participants: TCL, EURECOM)
  - **UE Testing** (Main participants: TCL, EURECOM, Nokia, Fujitsu)
  - **UE Features** (Main participants: TCL, EURECOM, Fujitsu)

- **Project 5: NB-IoT + eMTC (Lead EURECOM)**
  - **NB-IoT eNB/UE L1** (B-COM, EURECOM)
  - **NB-IoT eNB L2** (III/NTUST, UBologna, EURECOM)
  - **eMTC eNB** (Orange, EURECOM) – planned for 2nd half 2017

- **Weekly WEBEX meetings for status and coordination**
Testing and Continuous Integration

- **Main testing site at EURECOM/TCL 5G Lab**
  - eNB : EURECOM
  - UE : TCL5G / EURECOM

- **openairCN testing**
  - EURECOM
  - Facebook
  - Lots of community support

- **Continuous Integration**
  - Weekly merge request management into develop branch from feature / bugfix branches handled by EURECOM + TCL5G

- **Test site replication / Isolated environments**
  - III (Aeroflex 500 testing, outdoor deployment)
  - Nokia Bell Labs Paris (eNB stress testing, integration with Nokia Core, fronthaul interface testing)
  - INRIA Sophia Antipolis (Fall 2017, anechoic chamber)
  - Fujitsu Labs Tokyo (under discussion)
  - BUPT (Fall 2017)
  - Facebook (discussion for openairCN test framework)
OPENAIRCN STATUS
openairCN status

- **Done since last year**
  - HSS
    - Nothing significant
  - MME
    - Fairly high contribution from Radisys through sets of patches, we are currently in the process of integrating them (branch broadband into branch integ_broadband).
    - Rework of MME UE context to allow multiple PDN and multiple bearers
    - NAS
      - Merge of UE contexts: Now, NAS UE context is accessible through general purpose MME UE context.
      - Cleaning of NAS EMM procedures and some CN procedures.
    - Write of a inner MME tester tool called MME scenario player (XML). The automation of tests have to be done and the write of more test cases needed.
  - SPGW
    - Use now the GTP Linux Kernel module from Osmocom through their gtpnl library => far more greater stability and performance.
    - As a kind of POC, we patched the GTP Kernel module and libgtpnl for dedicated bearer support, performances have not been evaluated yet.
openairCN Objectives

- **Basic features of an EPC**
  - Finish implementation and stabilize basic procedures (Connection, mobility, session management)
  - Support of Release 14 for NB-IoT
  - Support X2 Handover

- **5G Core**
  - Evolution towards new network entities (AMF, UPF, UDM, AUSF)
  - Shall we consider this?
openair5G RAN

- **Main achievements since last workshop**
  - Automated testing procedures with COTS UE
    * Stability of eNB vastly improved through testing
  - improvements in threading
  - ‘T’ tracer
  - Initial CUDA port
  - Initial ARM port
  - Architecture for 5G lower-layer functional splits
  - TM7
  - SRS
  - PUCCH3

- **Buggy/Missing/Incomplete Essential Features**
  - RLC AM mode : buggy
  - Multi-UE scheduling : buggy
  - TM3-TM6 : incomplete
  - PUCCH2 : incomplete
  - Paging : missing
  - RRCConnectionReestablishment : explicit reject
  - Measurement gap handling : missing
  - DRX handling : missing
  - Carrier Aggregation : incomplete
  - X2 handover : incomplete
openair5G RAN: Objectives

- **Architecture revision**
  - **Modularization**: collaborations on/off mailing list with Nokia, Cisco, individuals in the community
  - Well underway

- **Architectural enhancements for**
  - **Higher-layer Functional split** (3GPP CU-DU)
    - Follow current 3GPP standardization for NR + 4G retrofit
  - **MAC-PHY split** (NFAPI)
    - Work underway with Cisco UK
    - Both LTE and NB-IoT
  - **Management interfaces** and configuration
  - **Precoding** and centralized management of large numbers of RRU (more in CRAN session)
Current vRAN Roadmap in OAI

OAI Functional Splits

OSS/BSS/MEC

LTE/NR/NB PDCP

LTE RRC

NR RRC

NB-IoT RRC

Radio-Cloud Center (RCC)

LTE MAC-RLC

LTE-L1

LTE MODEM

Radio-Access Unit (RAU)

NR MAC-RLC

NR-L1

NR MODEM

Remote Radio-Unit (RRU)

NB-IoT MAC-RLC

NB-IoT L1/MODEM

NFAPI

NFAPI

Modularization of OAI
openair5G RAN : Objectives

- **Features**
  - TM3-4 (June 2017)
  - PUCCH2 (June 2017)
  - Paging (June 2017)
  - NB-IoT L1/L2 (July 2017), more during NB-IoT session
  - Integration of Cisco open-NFAPI (July 2017)
  - 256 QAM (Sep. 2017)
  - eMTC (Sep. 2017)
  - 2 DL Carrier Aggregation (Sep. 2017)
  - Implementation of a subset of early NR specifications in support of TCL 5G UE (eMBB, 80 MHz BW, Dec. 2017)