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**

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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 wwo 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 a engineering support team for
    - CI/CD
    - Community management/building
    - Industry relations

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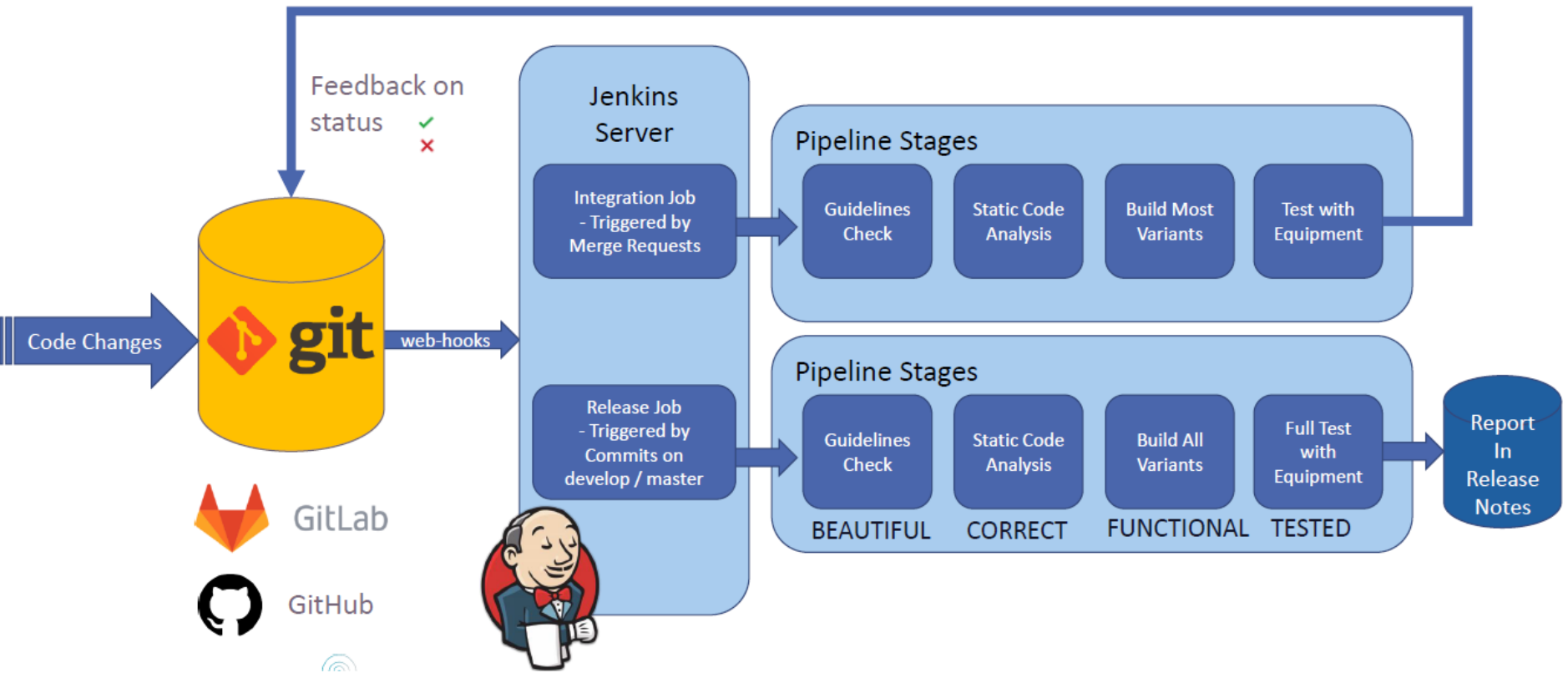
Technologies and Hardware for OAI Software

- **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**

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OAI Alliance Services

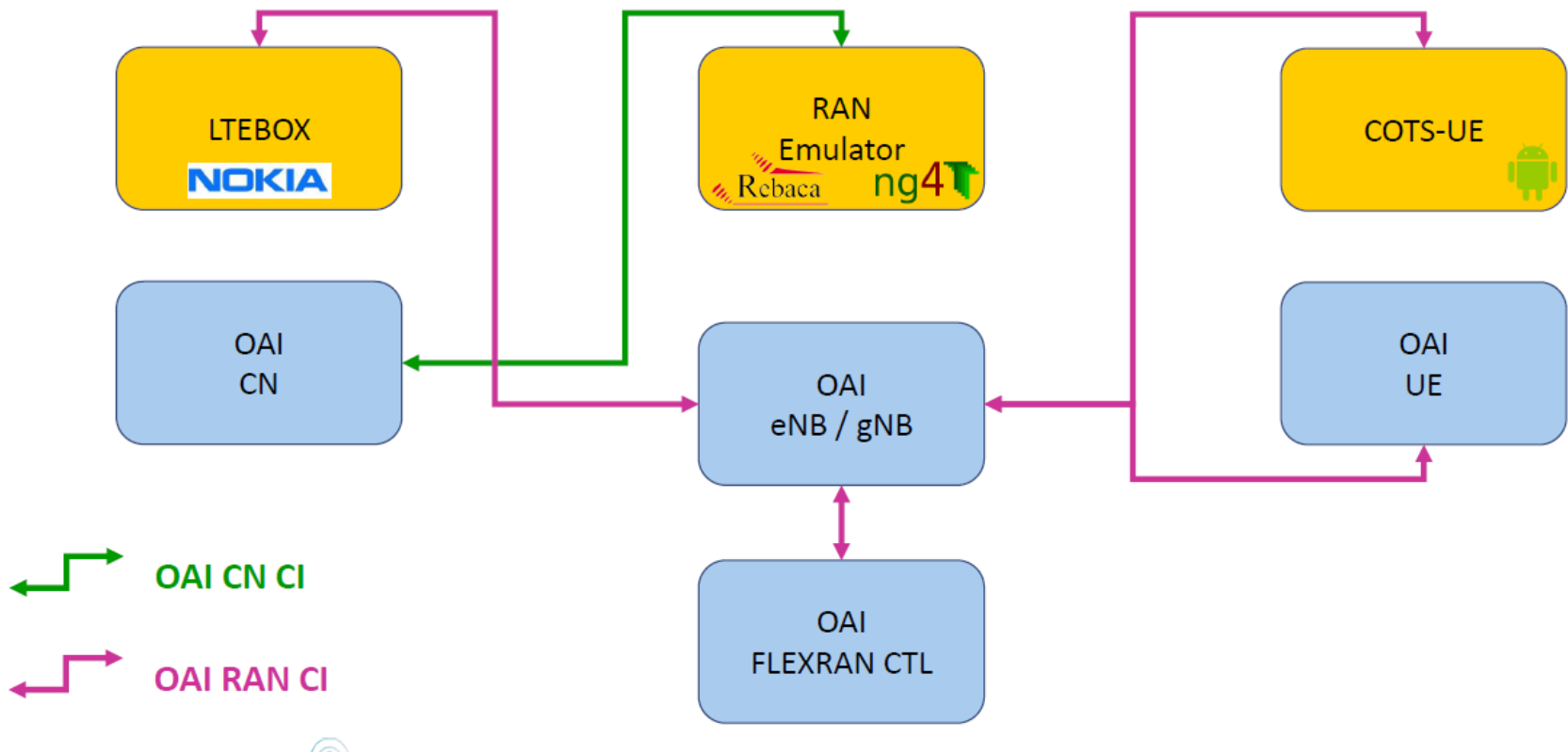- **Coordination of community development**
  - Management of gitlab/github repositories
    - RAN (gitlab EURECOM) and Core Network software packages (public github)
  - Jenkins-based CI and CD
    - Main site (EURECOM)
      - ☞ CI for both RAN and Core
        - ♦ Testing with commercial terminals (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

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Gitlab/Github and Jenkins

Testing Framework

OAI Code vs 3rd party

LTEBOX
NOKIA

RAN Emulator
Rebaca ng4T

COTS-UE

OAI CN

OAI eNB / gNB

OAI UE

OAI FLEXRAN CTL

OAI CN CI

OAI RAN CI

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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
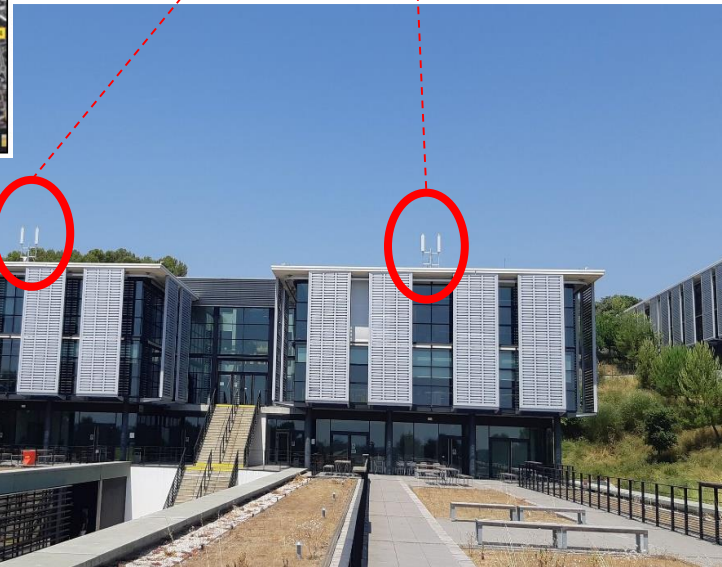 - Kaloom in Montreal

- **Please visit:**
  https://wiki.opnfv.org/display/OSDD/VCO+Demo+3.0+Home

Deployment Architecture @ EURECOM
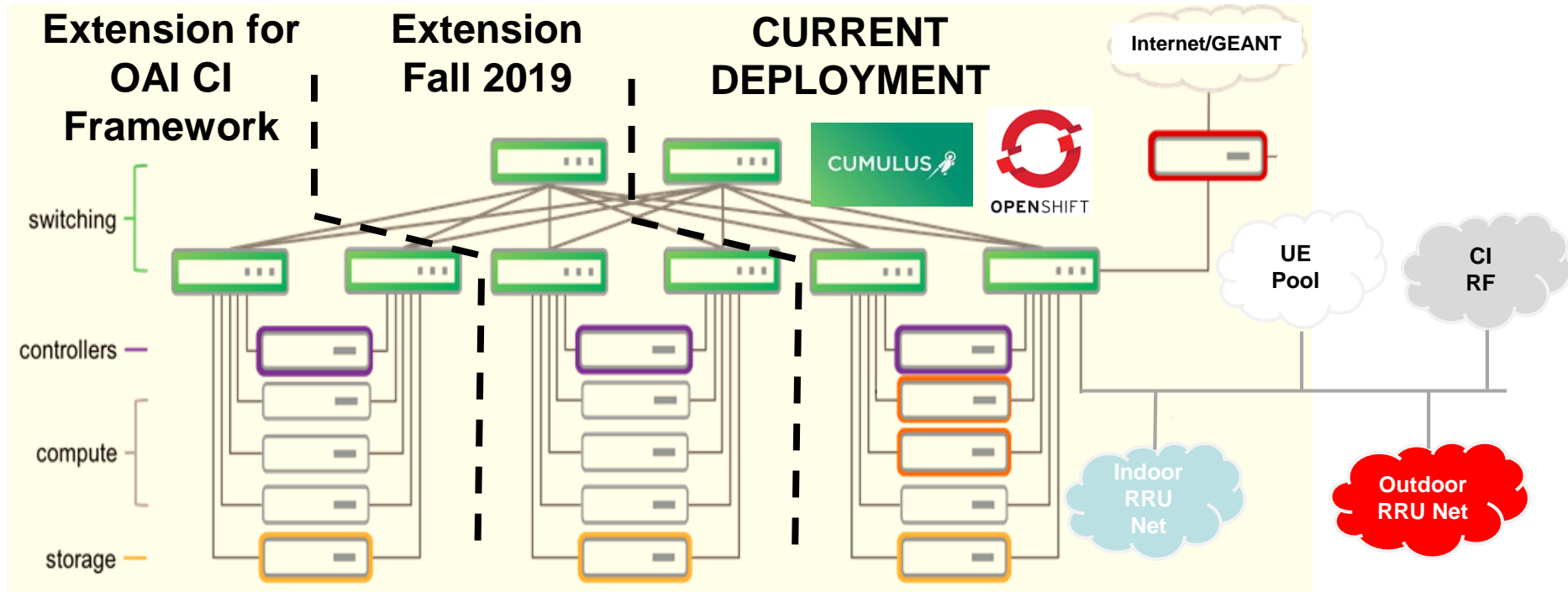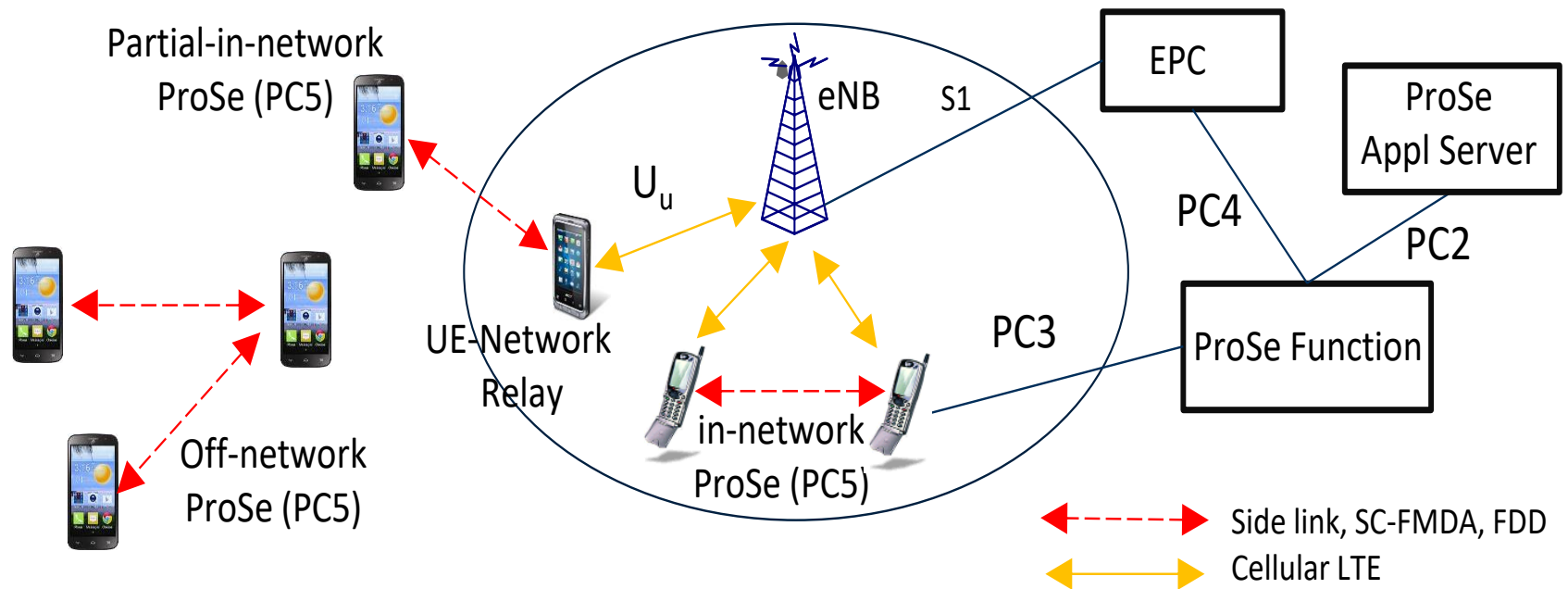
Deployment @ EURECOM

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

Partial-in-network ProSe (PC5)

eNB   S1

U_u

UE-Network Relay

Off-network ProSe (PC5)

in-network ProSe (PC5)

PC3

PC4

PC2

EPC

ProSe Appl Server

ProSe Function

Side link, SC-FMDA, FDD

Cellular LTE

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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**
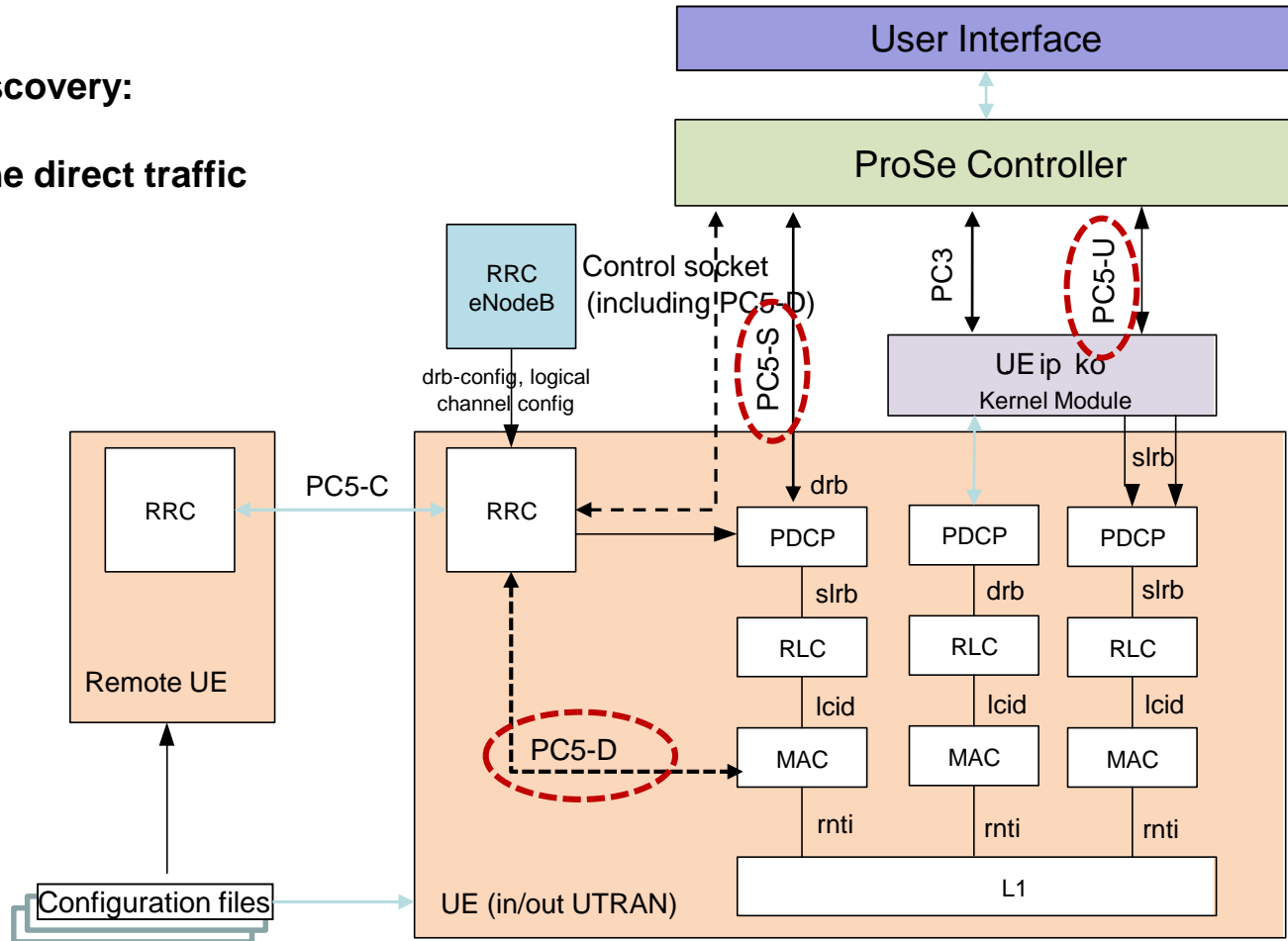
Testing D2D scenarios in OAI UE RF testbed examples

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

- **Multicast and Unicast scenarios in Mode2 (off-net)**
  - <u>**UE node:**</u> 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

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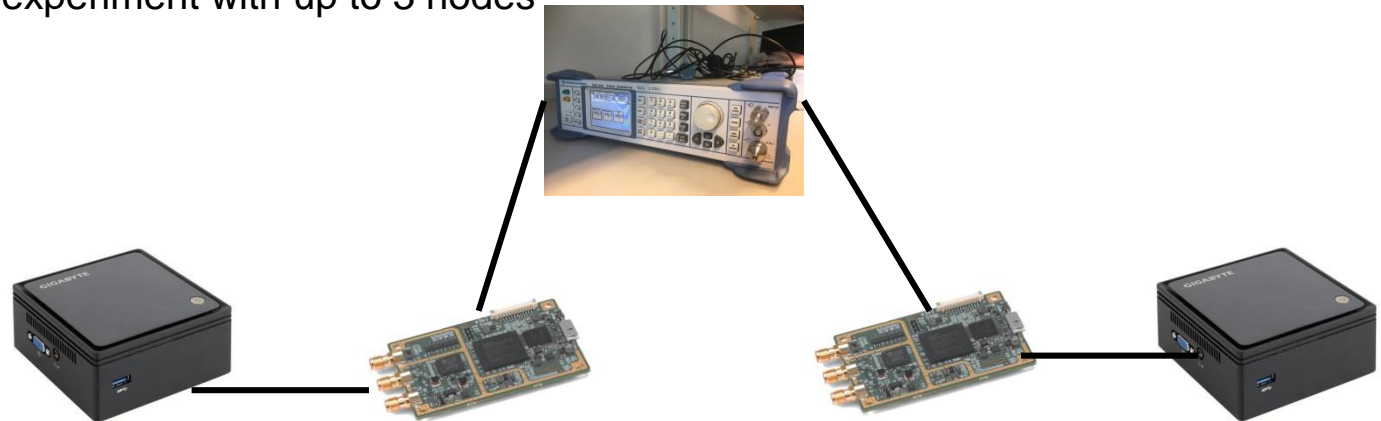
Relay support

- Extensions at the interfacing level between OAI to connect multiple USRP B2x0 devices
  - Simple prototype for cellular (FDD) and sidelink access on common PC
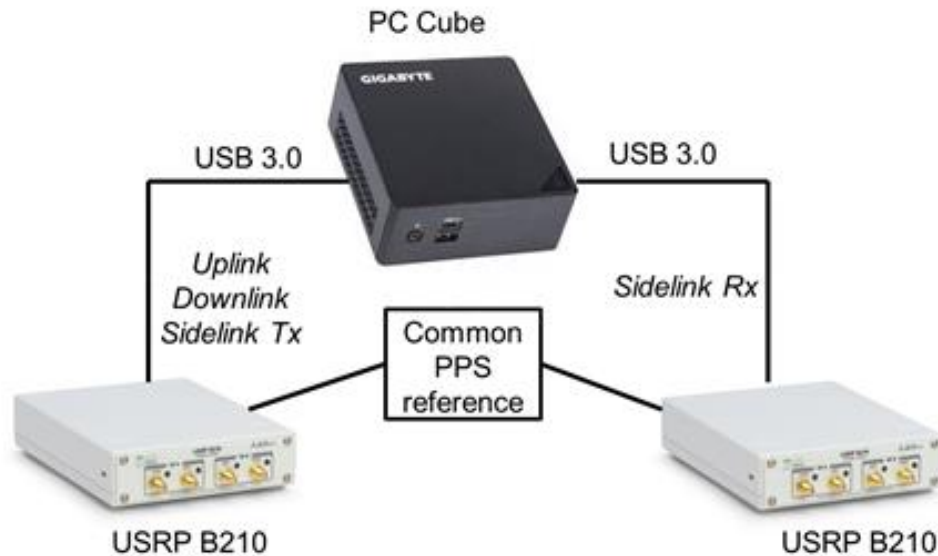
Future : OAI + Rel 17 Sidelink for Public-Safety

- **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**

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