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Sophia Antipolis

OPEN AIR INTERFACE
SOFTWARE ALLIANCE

Bell Labs
Alcatel·Lucent

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ALCATEL onetouch

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# OSA Objectives 2016

UNIVERSIDAD DE MÁLAGA

RUB

UNIVERSITY OF THESSALY

instituto de telecomunicações

THE UNIVERSITY of EDINBURGH

UNIVERSITÄT BERN

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

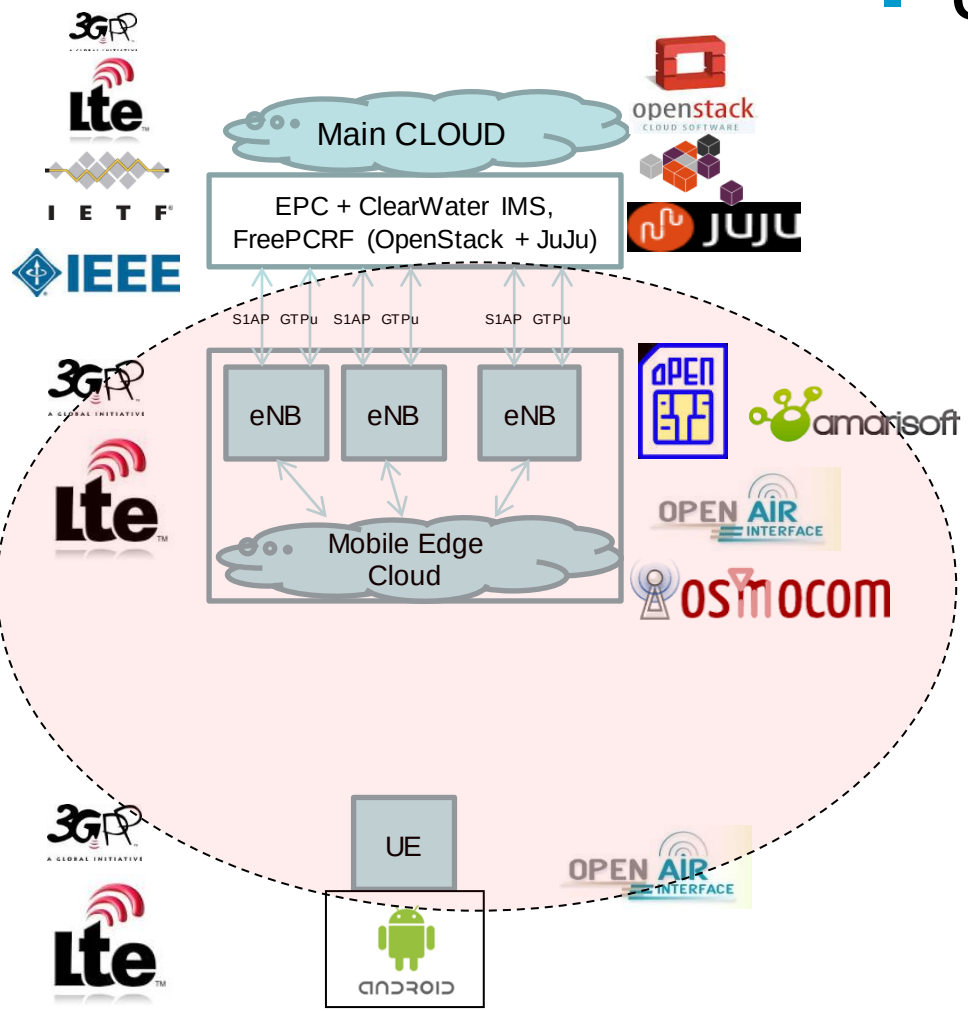
# Agenda OAI Objectives

- **Open-Source for 5G**
- **Strategic Areas**
  - 2 technical examples
- **Roadmap for 2016**

# Commoditization of 3GPP Radio Systems and Open-Source

- **Today it is feasible to put a fully-compliant 4G eNodeB and EPC in a commodity x86 or ARM-based computer (or data center for a pool of eNodeBs)**
  - Emergence of “radio”-hackers in addition to commercial vendors
  - OAI Alliance
    - launched in 2014
    - 3GPP strategic members in 2015
- **Coupling this with an open-source community makes for a very disruptive technology for the onset of 5G**
  - What we’re building
    - Community of hackers, academics and major industrials embracing open-source for 5G
  - What we hope to become
    - A strong voice and maybe a game-changer in the 3GPP world
      - ☞ Real impact from “the little guys” on 3GPP systems

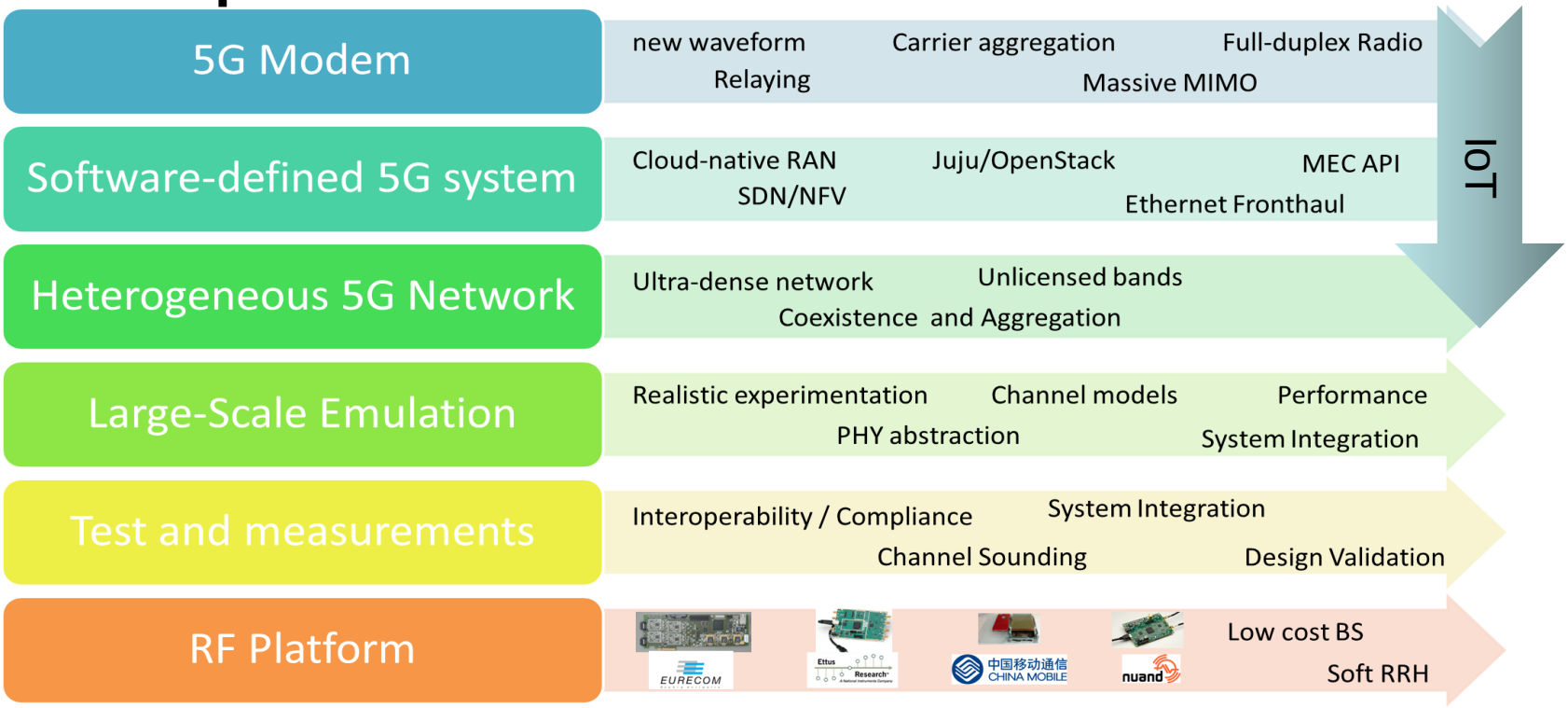
# Bringing open-source into the access-networks




- **Challenges for 4.5G/5G**
  - FRAND License for open-source
    - Allow 3GPP members to contribute to open-source and still perceive royalties
    - Compatible with
      - ☞ academic/research/prototyping use
      - ☞ commercial use in devices, data centers and testing equipment
  - Community coexistence/synergy with standardization process
    - Use of open-source in prototyping phase of 5G
    - Open-source community following 3GPP process
    - Community representation in 3GPP via OSA?

# Strategic Areas

- **Main areas of work around which we organize development**



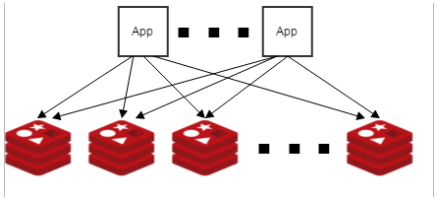
# Liaisons with other bodies

- **Currently**
  - Regular interactions with
    - ETSI
    - NGMN
  - 3GPP
    - Discussions planned in coming weeks with TSG RAN,SA,CN
  - ITU
    - Discussions with ITU-T FG-IMT-2020, ITU-T focus group looking into the wireline requirements for 5G
  - 5GPPP
    - Several users of OAI in 5GPPP projects (e.g. EURECOM, Nokia, Telecom Italia)
  - OpNFV
    - Discussions planned in coming weeks

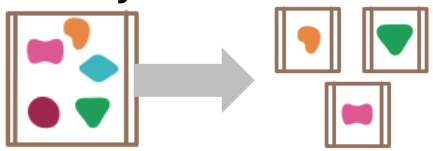
# Two examples of 5G experimentation using OAI

- **Softwarization of Networks**
- **IoT Waveforms**

# OSA Roadmaps toward Software-define 5G Network



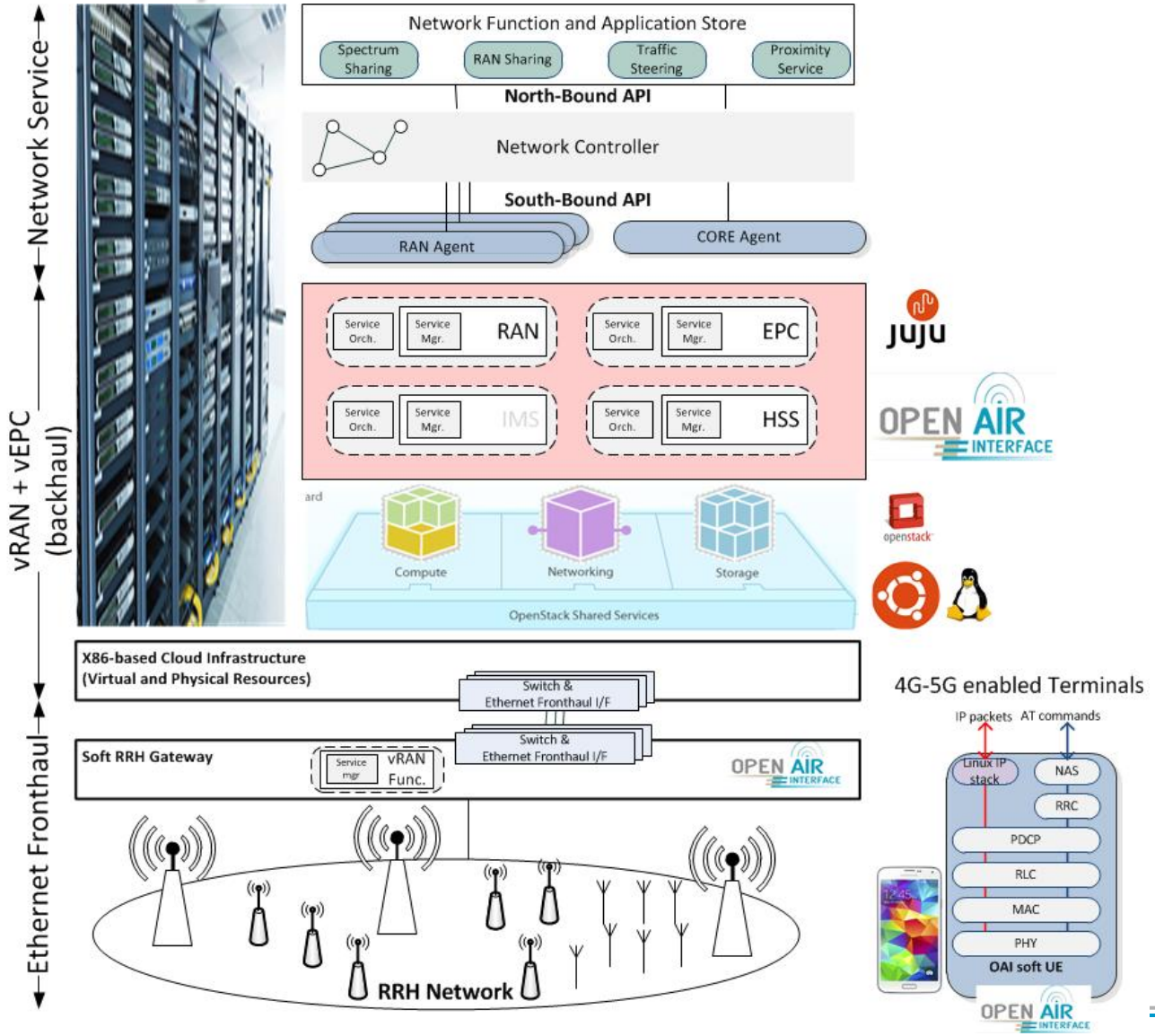

- **Cloud-native 5G networks**
  - Phase 1: Stateless through distributed shared memory, multitenancy
  - Phase 2: Mircoservice Architecture and NFV
  - Supported projects: FP7 MCN, FUI ELASTIC



- **Network Orchestration**
  - Approach 1) Openstack and heatstack orchestrator
  - Approach 2) Juju modeling for service-oriented deployment (https://jujucharms.com/q/oai)
  - Supported project: FP7 MCN, FP7 FLEX, Canonical partnership program

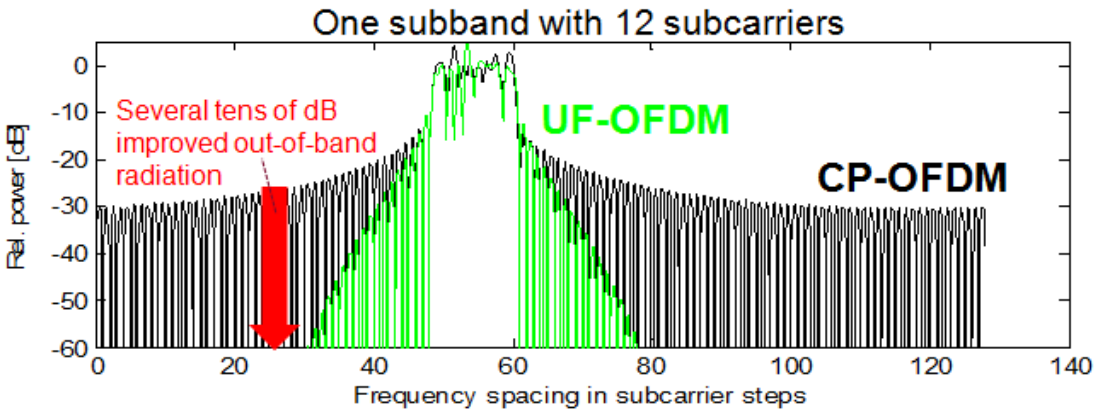
- **Network Programmability → network slicing**
  - Agent-controller protocol and southband API in support of SDN+MEC
    - agents: in charge of network function monitoring and programmability
    - Network controller: network abstraction (network state graphs), network application
      - ☞ realtime, standalone mode or as a plugin
  - Supported projects: H2020 Coherent, H2020 Q4Health, ETSI MEC PoC

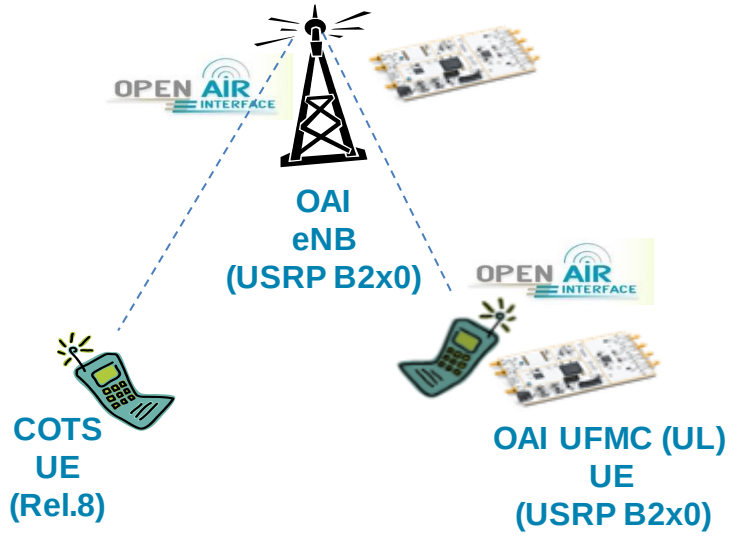
# Softwarization of Networks (see it with Canonical at MWC 2016)



# New waveforms and protocols for IoT

- **OAI is including new ideas for 5G waveforms in support of IoT (e.g. UF-OFDM from Bell Labs underway, NB-LTE under discussion in community)**
- **Coupled with low-latency contention-based access**



# Next Steps for OAI and the OSA (general)

- **Ensure a path 4G → 5G through open-source policy**
  **Reference implementation of Rel 13/14 → 5G**
  - Work with new carrier candidates now (e.g. UFMC), short packet low-latency carriers, contention-based access
  - VRAN, NFV, MEC architectures
  - Rapidly-deployable EPC/eNB (with LTE or other backhaul)
- **Serious contributors from outside Eurecom**
  - Combination of hackers, academics, SMEs and major industry
- **« ready to use » for anybody on commodity hardware (PCs + National Instruments)**
  - and industrial platforms !
  - EURECOM ExpressMIMO2, NI/Ettus USRP, Nuand BladeRF, soon SoDeRa
- **Multi-architecture**
  - x86, ARM, soon NXP (Freescale)

# Next Steps for OAI and the OSA (specific)

- **Robustification of current 4G implementation**
  - Maximum DL and UL Throughput (TM1-4)
  - Mobility and handover support
  - Carrier Aggregation
- **UE**
  - Making it work with a real eNodeB/EPC
  - UF-OFDM
- **EPC**
  - Separation of elements (MME,S/PGw) for cloud deployment
- **New elements**
  - eRRH (ethernet based remote radio heads with synchronization methods)
  - Cloudification of access and core networks (data center deployments)
- **GitLab integration of testing procedures on several remote testing sites**
  - EURECOM, USA and China