FLEX - FIRE LTE TESTBEDS FOR OPEN EXPERIMENTATION

3RD INTERNATIONAL NORNET USERS WORKSHOP,
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FLEX OVERVIEW

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FLEX partnership

New partners have been added in FLEX partnership through the Open call activities.

FLEX partnership

FLEx
FIRE LTE TESTBEDS FOR OPEN EXPERIMENTATION

UNIVERSITY OF THESSALY

iMinds
CONNECT.INNOVATE.CREATE

EURECOM
Sophia Antipolis

SiRRAN
COMMUNICATIONS

ip access

COSMOTE

NICTA

INTRACOM TELECOM

i2cat

UPMC
SORBONNE UNIVERSITÉS

ubiwhere

Technische Universität Berlin

Fraunhofer FOKUS

UNIVERSIDAD DE MÁLAGA

European Commission

FLEX data

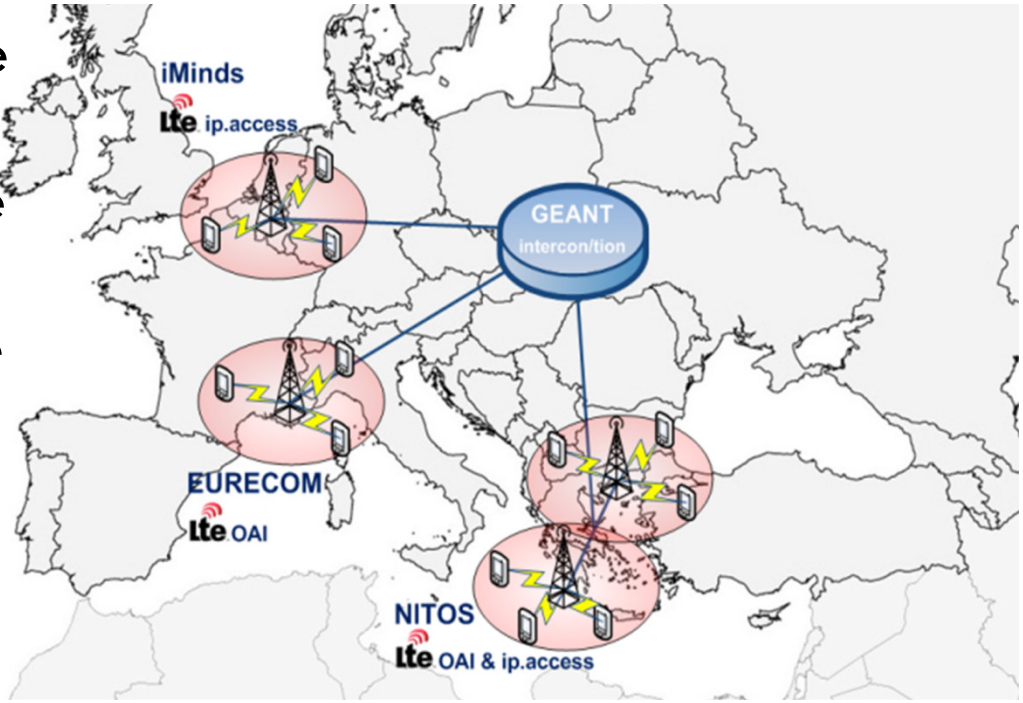
- Starting date: 1/1/2014
- Duration: 36 months

FLEX contribution

- Develop operational LTE testbeds using two approaches:
  - Setup 1: Based on commercial equipment
    - Provided by the industrial partners of the project (ip.access femtocells and SiRRAN EPC network)
  - Setup 2: Open Source components
    - Developed by Eurecom (OpenAirInterface – www.openairinterface.org)
- LTE software and hardware fully integrated into the control and management framework of the testbeds.
- Monitoring, RF emulation and mobility (controlled, uncontrolled and emulated) frameworks developed.

FLEX testbeds at a glance

- Open and highly configurable LTE platforms
- Interaction of the user with the real 4G world.
- Commercial and Open Source equipment



FLEX major achievements vs its objectives

Extend FIRE's resource pool with LTE resources

- The three testbed sites comprising FLEX are already extended to support experimentation with LTE components, which are based either on a commercial setup, assisted by FLEX's industrial partners, or on the open source setup of OpenAirInterface, provided by EURECOM.

FLEX major achievements vs its objectives

Expose the maximum possible flexibility in configuring the commercial components in the core and access part of the testbed

- SiRRAN extended their LTEnet EPC network in order to expose the configurable parameters through a JSON based API. This API is built exclusively for the needs of FLEX.
- ip.access has redesigned the access model on the ip.access femtocells.
- Regarding the OpenAirInterface solution, both the EPC and Access networks are tunable via a configuration file that is submitted to each running instance.

FLEX major achievements vs its objectives

Smoothly integrate this extension with existing FIRE facilities and technologies

- The extensions leverage existing solutions, like the OMF framework for experiment control and the SFA protocol for resource discovery and provisioning.
- FIRE facilities are extended, by means of defining the new LTE-specific Resource Specifications, developing the appropriate Experiment Controller and Resource Controller instances for each respective type of UE, and creating the appropriate services for controlling and managing the LTE Base Stations, EPC and datapath operations behind the LTE network.
- Moreover, the testbed sites are already connected to the GEANT network, while discussions for their end-to end interconnection through dedicated virtual circuits have started.

FLEX major achievements vs its objectives

Build mobility functionalities in the facilities

- The iMinds testbed has been extended in order to support controlled mobility experiments involving the LTE infrastructure.
- Smartphone applications related to uncontrolled mobility and monitoring of the LTE channel quality have been designed and started to be developed.
- EURECOM has started extending their OpenAirInterface platform for supporting X2 based handovers. Based on the existing resources, initial design on the handover toolkit has been made based on the Intra-MME handovers and Vertical Handovers based on SDN resources.

FLEX major achievements vs its objectives

Create the circumstances for innovation in the field of 4G cellular networks, which are expected to rule the cellular industry at least for the next decade and pave the way for developments, which will ultimately lead to 5G mobile networks

- OpenAirInterface platforms are already deployed at the three testbed sites. OpenAirInterface allows the experimenter to take full access on the LTE protocol stack, thus creating fertile ground for new protocols and schemes to evolve.
- The testbed sites also have OpenFlow capabilities, thus allowing the experimenters to dynamically configure smart back-hauling techniques or datapath schemes for the appropriate processing and forwarding of traffic stemming from the LTE network.

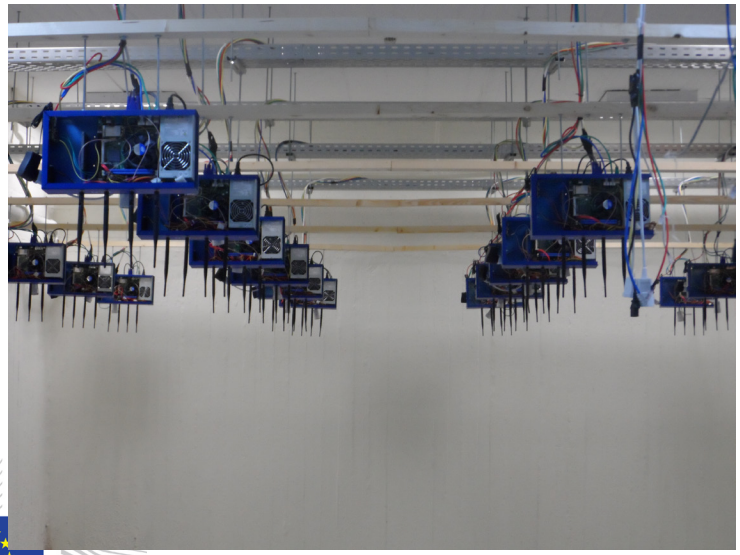
NITOS overview

- NITOS is a heterogeneous remotely accessible testbed offered by University of Thessaly (UTH), supporting experimentation with cutting-edge wireless networking technologies.
- NITOS is comprised of:
  - Over 100 Wireless nodes for experimentation with wired and wireless network technologies (WiFi, WiMAX, LTE, 3G, ZigBee). UTH is equipped with 1 WiMAX/LTE macro-scale Base Station, 2 commercial LTE femto cells, 4 open source LTE cells, one commercial and one Open Source EPC networks.
  - A Software Defined Radio testbed based on 10 USRP devices.
  - 30 High Definition Video Cameras for video related research.
  - Software Defined Networking resources (6 hardware switches) for experimentation with the emerging OpenFlow protocol.
  - One Cloud installation with 200-cores, part of the FI-WARE platform.
  - Multiple Wireless Sensor Network deployments, utilizing ZigBee and WiFi and LTE technologies for monitoring agricultural and smart-city installations.

http://nitlab.inf.uth.gr

NITOS testbed

- Two separate deployments
  - An indoor RF-isolated testbed
  - An outdoor prone to RF interference testbed
- Each testbed is offering 50 nodes (100 in total).



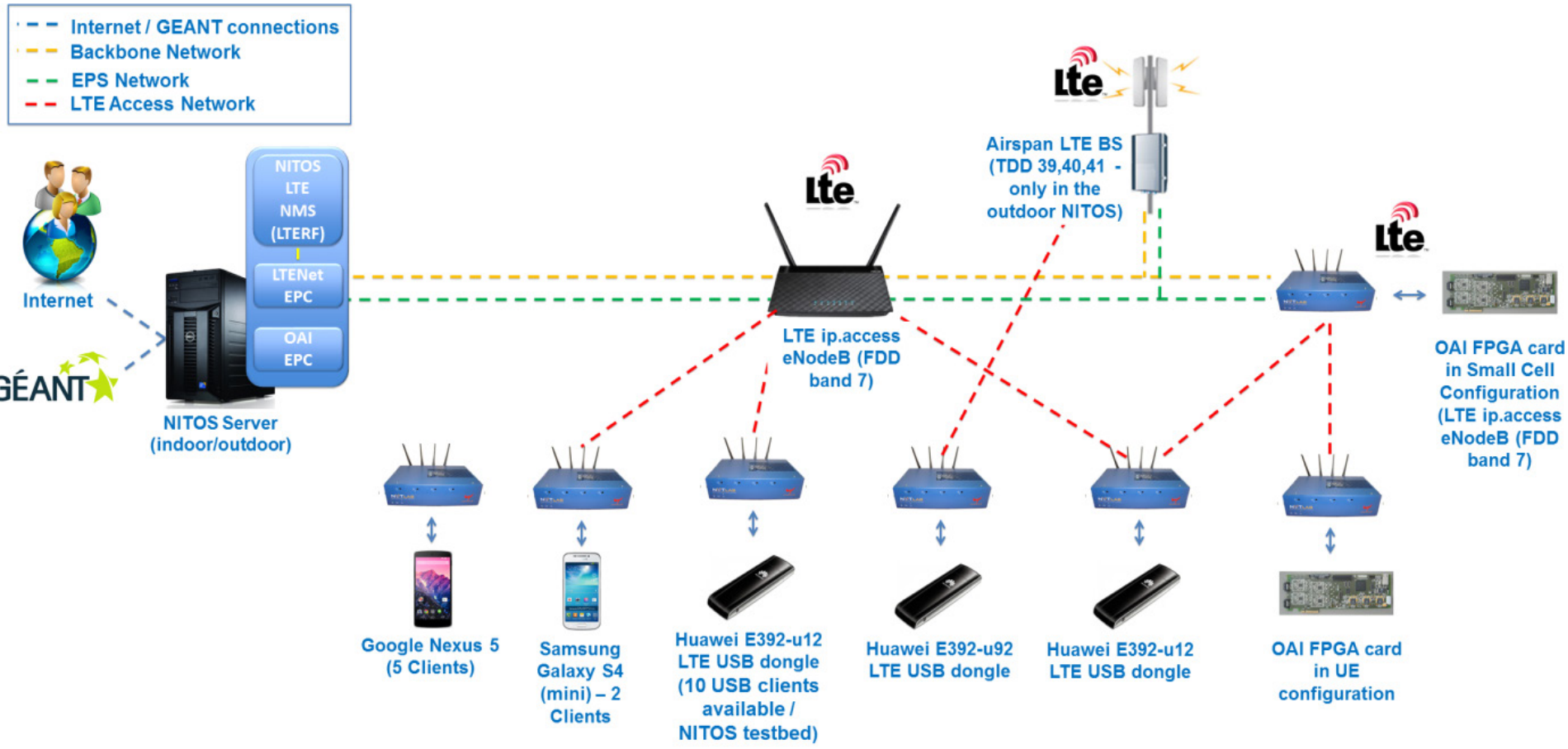
NITOS indoor (left) and outdoor (right) testbed deployments

Current LTE deployment

- One ip.access femtocell in the indoor testbed
- One ip.access femtocell in the outdoor testbed
- One SiRRAN EPC installation that controls both femtocells
- Equally distributed UEs at each site.
- The OAI platforms are mounted on ICARUS nodes at the two NITOS testbeds.

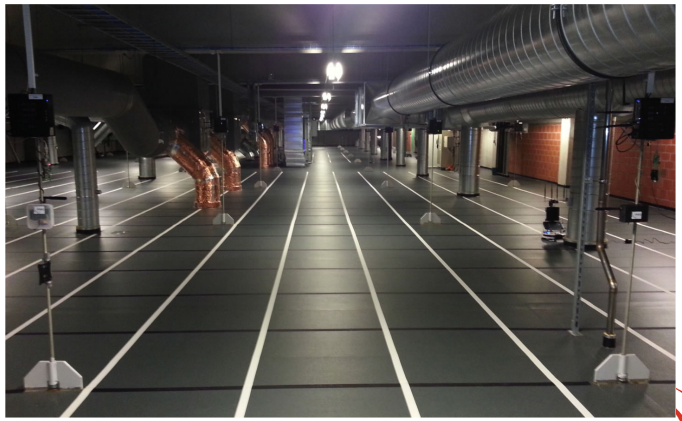
NITOS Testbed topology

- The following topology has been adopted for the needs of FLEX.



w-iLab.t testbed

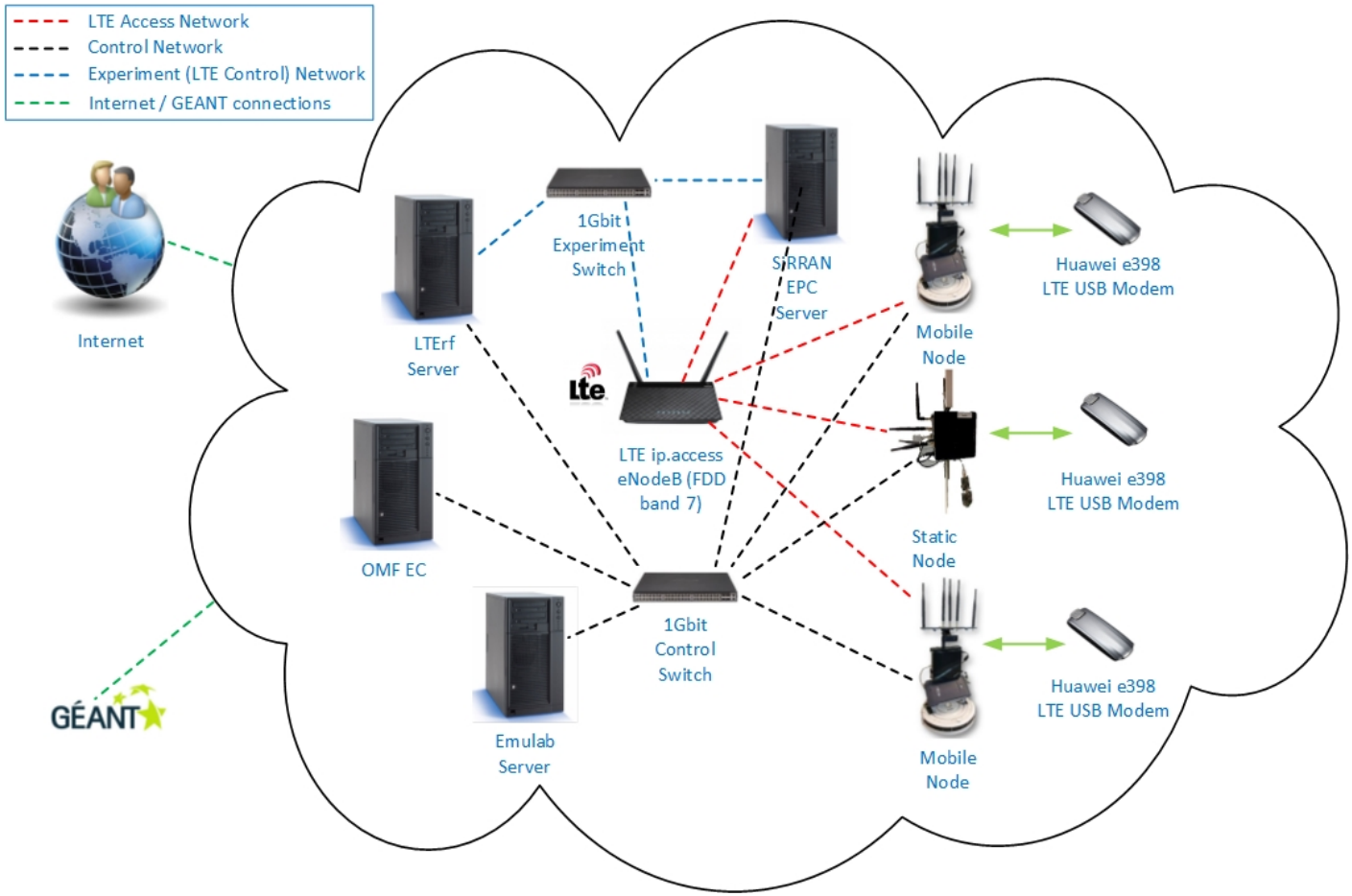
- w-iLab.t is an experimental, generic, heterogeneous wireless testbed deployed in the iMinds building and at a second, remote location.
- w-iLab.t provides a permanent testbed for development and testing of wireless applications via an intuitive web-based interface.
- w-iLab.t hosts different types of wireless nodes:
  - sensor nodes
  - Wi-Fi based nodes
  - sensing platforms
  - cognitive radio platforms (that are limited to operating in the ISM bands due to license restrictions.)



w-iLab.t LTE radio access network deployment

- As an indoor setup in the W-iLab.t testbed at Zwijnaarde
- 2 ip.access LTE 245F femtocells
  - Test frequencies in the licensed LTE band 7 are assigned by BIPT (Belgian Institute for Postal services and Telecommunications)
  - UL - 2520 to 2530 MHz
  - DL - 2640 to 2650 MHz

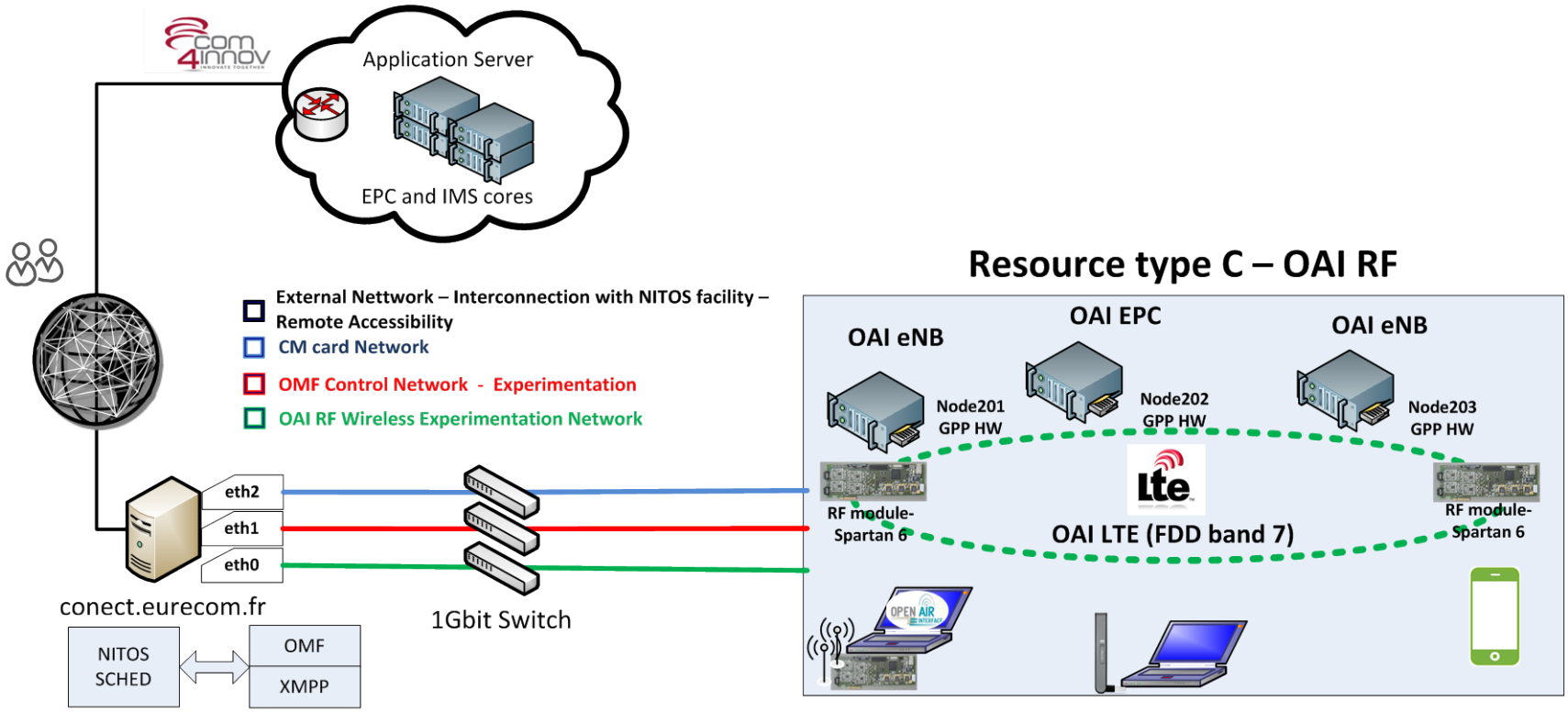
W-iLab.t LTE architecture deployment



OpenAirInterface (OAI) testbed at EURECOM

- Open-source (hardware and software) wireless technology platforms for deployment of reduced scale mock network
  - System approach with high level of realism
  - SDR architecture and full GPP C
- Current focus
  - 3GPP LTE, LTE-A and IEEE 802.11p
  - LTE mesh extension, 802.21
- Objectives : LTE in the box
  - Innovation in air-interface technologies and wireless networking through experimentation.
  - Proof-of-concepts through real-time prototypes and scalable emulation platforms.
  - Validation, experimentation, testing, performance evaluation, dissemination, teaching, and training.
- OAI can be configured as either an eNB or a UE.

EURECOM OAI testbed



FLEX open calls

- 1st open call experiments already running.
- 2nd open call is expected to be announced soon. Goals under FLEX discussion currently, probably ideas for both innovative experiments and functional extensions will be requested.

Questions?

European Commission