



Eldorado OpenLAB - 5G Private Networks



Summer 2022 OpenAirInterface Workshop Paris

INTRODUCTION

Presenter:

My name is Jose A. Mechaileh and I manage the Open Networks Lab at the Brazilian Eldorado Institute. The “Instituto Eldorado” is a non-profit civil research and development organization with over 20 years of experience in the areas of Software, Hardware, Energy, Microelectronics, Education, IT/Telecom, Agribusiness, Oil & Gas, Health, Automotive, among others. Present in 4 sites and with more than 1,600 employees, it is one of the largest R&D institutes in Latin America.

Abstract:

Considering the disruptive technologies of OpenRAN, SDR, Virtualization & Cloudification, Edge Computing, we built a laboratory for open networks, implementing 4G/LTE and 5G/NR networks in sub-6 frequencies, using COTS HW, open source SW and SDR radio technology.

Evolving this lab, we are in the process of partial cloudification, also introducing use cases for IIoT solutions.

HIGHLIGHTS

- This project aimed to implement a 4G LTE and 5G NR mobile networks, using open architecture, COTS (commercial-off-the-shelf) hardware and opensource software, mainly from OAI (Open Air Interface).
- The Eldorado OpenLAB is a flexible, remotely accessible, end-to-end software defined platform, supporting wireless & mobile research and developments. It creates the necessary ecosystem to further developments, such as Edge Computing, C-V2X, IIoT, AI/ML.
- This lab follows, as much as possible, the architecture of the O-RAN Alliance and uses SDR (SW Defined Radio) technology. The OpenRAN and SDR approach creates a new paradigm, making the development & deployment of mobile solutions more flexible and at a lower cost.



PROJECT PHASES

Phase 1: the first phase of this project aimed to implement 4G and 5G networks through the use of x64 desktop/server, USRP software-defined radio units and open source software.

Phase 2: the second phase virtualized some network elements through the use of containers and kubernetes. Kubernetes is an open-source container orchestration platform for managing, automating and scaling containerized applications.

Phase 3: the third phase aims to evolve the implementation towards the partial cloudification of the network elements, migrating from the bare metal to a commercial cloud service. Also, IIoT devices will be developed and tested, creating real use cases for Industry 4.0 deployments.

HARDWARE DESIGN

- All radios at OpenLAB are SDR, meaning users have control over all related parameters. We are using a combination of USRPs from Ettus, Dell servers and desktops, antennas, attenuators, cables, etc.
- OpenLAB operates with a frequency range from 800 MHz up to 6 GHz, emulating a mobile NW deployment in both dense and rural areas.

The 4G LTE Network is implemented using:

- USRP x300 + daughterboard
- 2 antennas vert900 dualband, 824-960 Mhz and 1710-1990 Mhz
- 10 Gbps Ethernet connections
- accessories: cables, programmable attenuators, etc

The 5G LTE Network is implemented using:

- USRP N300
- 2 antennas vert2450, dualband, 2.4-2.5 and 4.9-5.9 Ghz
- 10 Gbps Ethernet connections
- accessories: cables, programmable attenuators, etc

USRP ETTUS N300

The RF front end features the AD9371 RFIC transceiver from Analog Devices to provide 2X2 MIMO capability, up to 100 MHz of instantaneous bandwidth and an extended frequency range from 10 MHz to 6 GHz.



FEATURES:

- 2 RX, 2 TX
- Filter banks
- 10 MHz to 6 GHz
- Up to 100 MHz bandwidth per channel
- Baseband Processing
- Xilinx Zynq 7035
- Dual-core ARM Cortex-A9 800 MHz with 1 GB DDR3 RAM

USRP ETTUS X300

The Ettus Research USRP X300 is a high-performance, scalable software defined radio (SDR) platforms covering DC – 6 GHz with up to 120 MHz of baseband bandwidth, multiple high-speed interface options (PCIe, Dual 1/10 GigE)



FEATURES:

- Two wideband RF daughterboard slots
- Up 120MHz bandwidth per channel
- Selection covers DC to 6 GHz
- Large, customizable Kintex-7 FPGA
- Multiple high-speed interfaces
- Dual SFP(+) ports for 1/10 Gigabit Ethernet



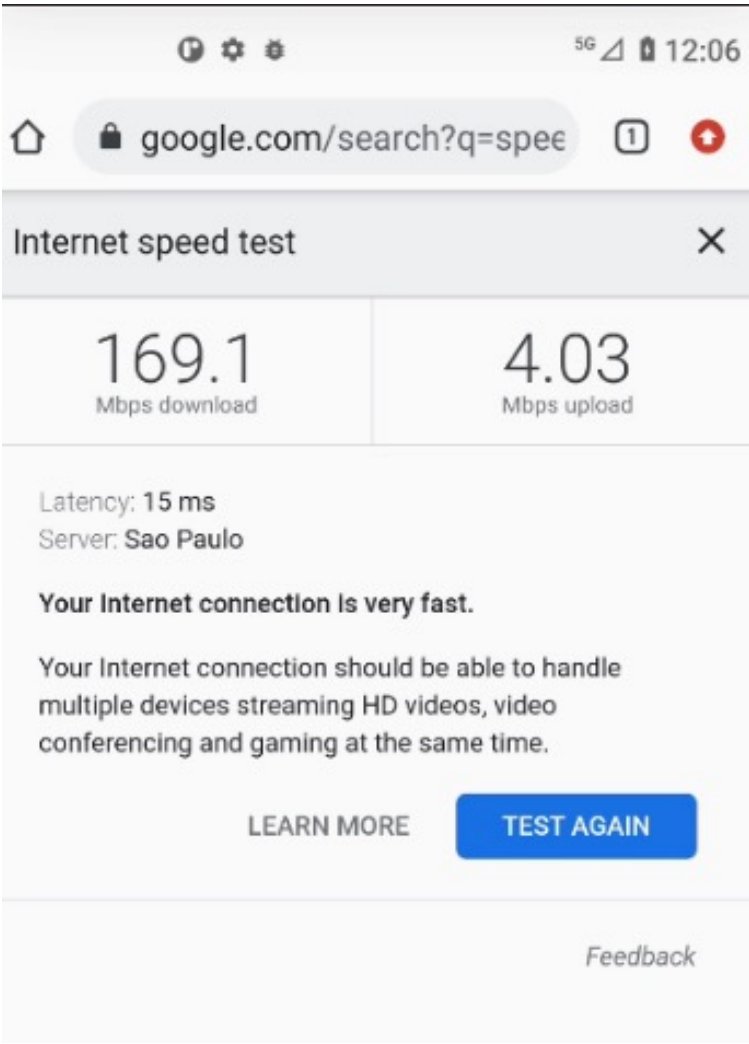
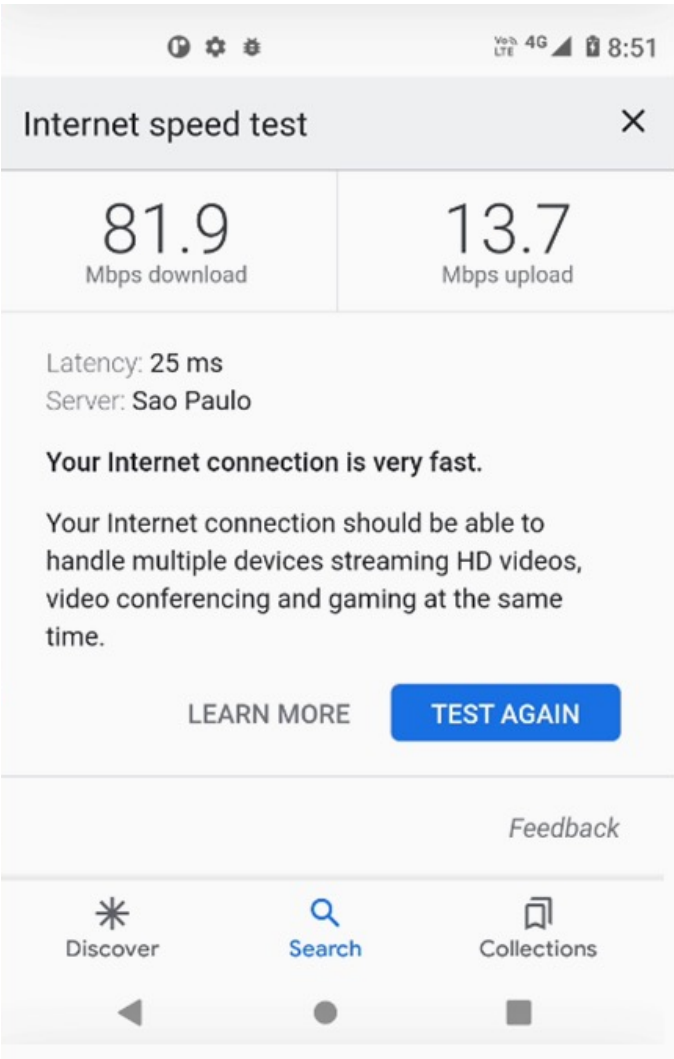
DEPLOYMENT STATUS

This is an ongoing project. Currently we are deploying IIoT devices and preparing for the cloudification.



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THANK YOU!