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Atlantic Research Center for Information and Communication Technologies

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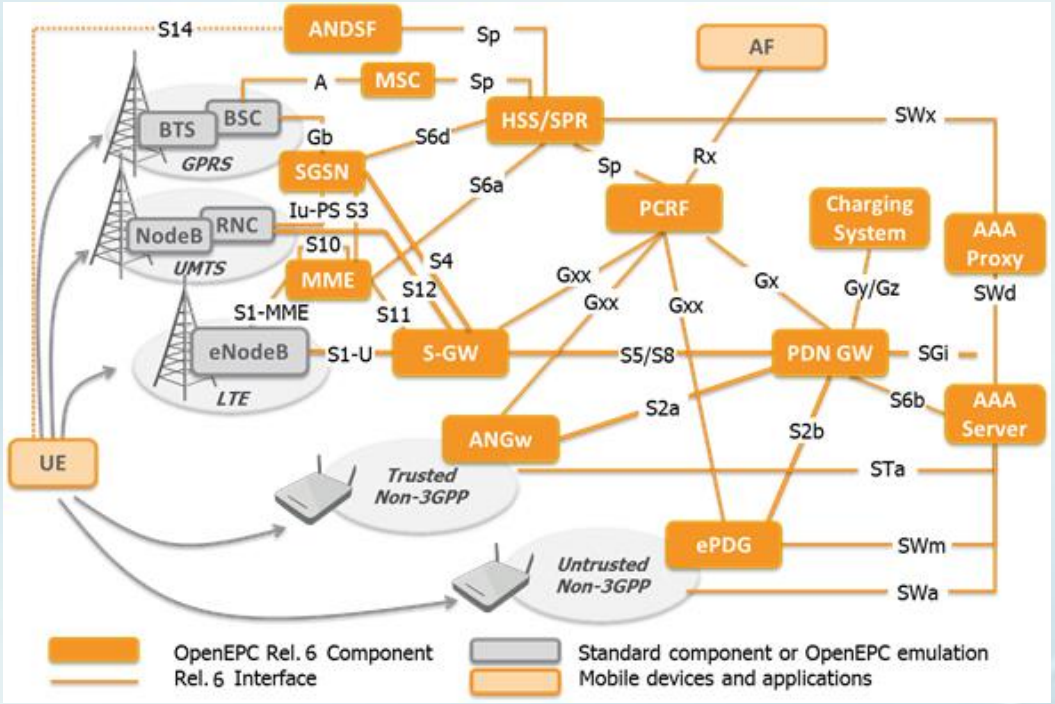
SDN-NFV: 5G Equipment for experimentation

Software Resources:

- ➔ SDN Networking OS (PicOS).
- ➔ OpenEPC Release 6, Full Suite.

PICOS

Routing: OSPF, BGP, PIM, NAT, VXLAN	OpenFlow: OVSDB, OF1.3, OF1.4, MPLS, CrossFlow Mode, VXLAN
Linux Switching OS: Network Linux, L2, MLAG, SNMP, Security, ZTP, Static Route	



Hardware:

- In house computing resources
- OpenSDN switches
- NetFPGAs (router desisgn)
- Hybrid SDN: Brocade commercial SDN switch
- IP Multimedia: Iskratel IMS operator core
- Commercial LTE Femtocell Stack(R&D License)

7x Dell 12cores/32GB

4 x netFPGA 10G

Xilinx Virtex-5 FPGA.
4 SFP+ interface 10Gbps.
X8 PCI Express Gen 2.
20 GTX Serial Transceivers.

PICA8 p-3297 48x1GbE

PICA8 p-3922 48x10GbE SFP+

Brocade ICX 6610 48x1/10 GbE RJ45

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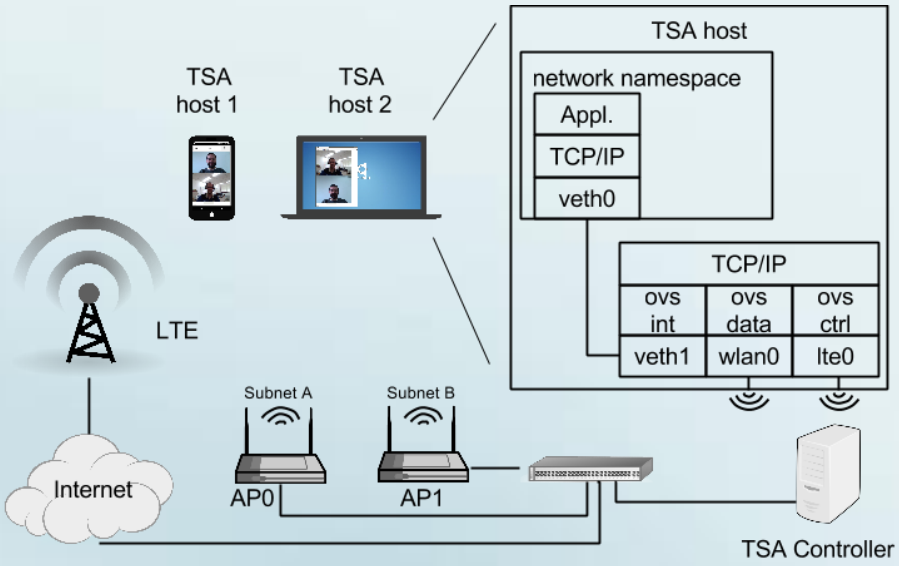
TSA: SDN controlled terminal prototype



[1] "TSA: Terminal-Supported 5G Network Optimization", *C. Giraldo-Rodríguez et al., IEEE CWN 2015*

[2] "TSA, an SDN Architecture including End Terminals", *C. Giraldo-Rodríguez et al., IEEE CCNC 2016*

TSA main concepts:

- Overlay Network at end-terminals using network namespaces (*netns*) and virtual switches.
- Applications are unaware of underlying access networks and technologies.
- Controller configure terminal's internal SDN switches to handle application traffic through the available access networks/technologies (OpenFlow rules).
- Terminal Access networks can be dynamically selected (by controller or by the terminal) without applications being aware (session continuity).

Prototype implementation

- Bluetooth/WiFi/LTE capable terminals.
- WebRTC Application running on terminals *netns*.

Use case example

Transparent reconfiguration of WiFi access network.

- Controller can steer traffic to BT/LTE during WIFI reconfiguration to avoid connectivity holes.
- WebRTC application unaware of underlay actions (session continuity).

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Full operator virtualization

OpenEPC services as Network Virtualized Functions

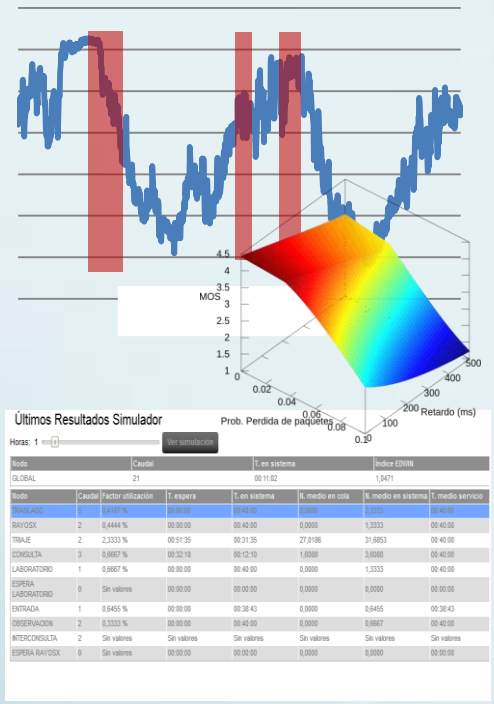
OpenEPC over OpenStack/Docker

- OpenStack Glance Images to deploy OpenEPC services over OpenStack.
- Dockerization of individual OpenEPC services to deploy as docker containers.

Automation (Puppet/Chef/Salt)

- One-click deployment of OpenEPC individual services in virtualized environments.
- Improved scalability with on-demand dynamic deployment of VMs/containers according to client load.
- High Availability (HA) in OpenEPC services with failover VMs/containers.

Cognitive Networking and Traffic Engineering



Capabilities

- Pattern detection
- Traffic monitoring
- Traffic prediction
- Learning strategies
- Quality of Experience
- Discrete event simulation
- Protocol engineering

Experience

- Operator Network optimization and traffic characterization
- Root Cause Analysis

Assets

- Proprietary discrete event simulator
- Quality of Experience models
- Traffic analysis plugins for Nagios

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