

GENI

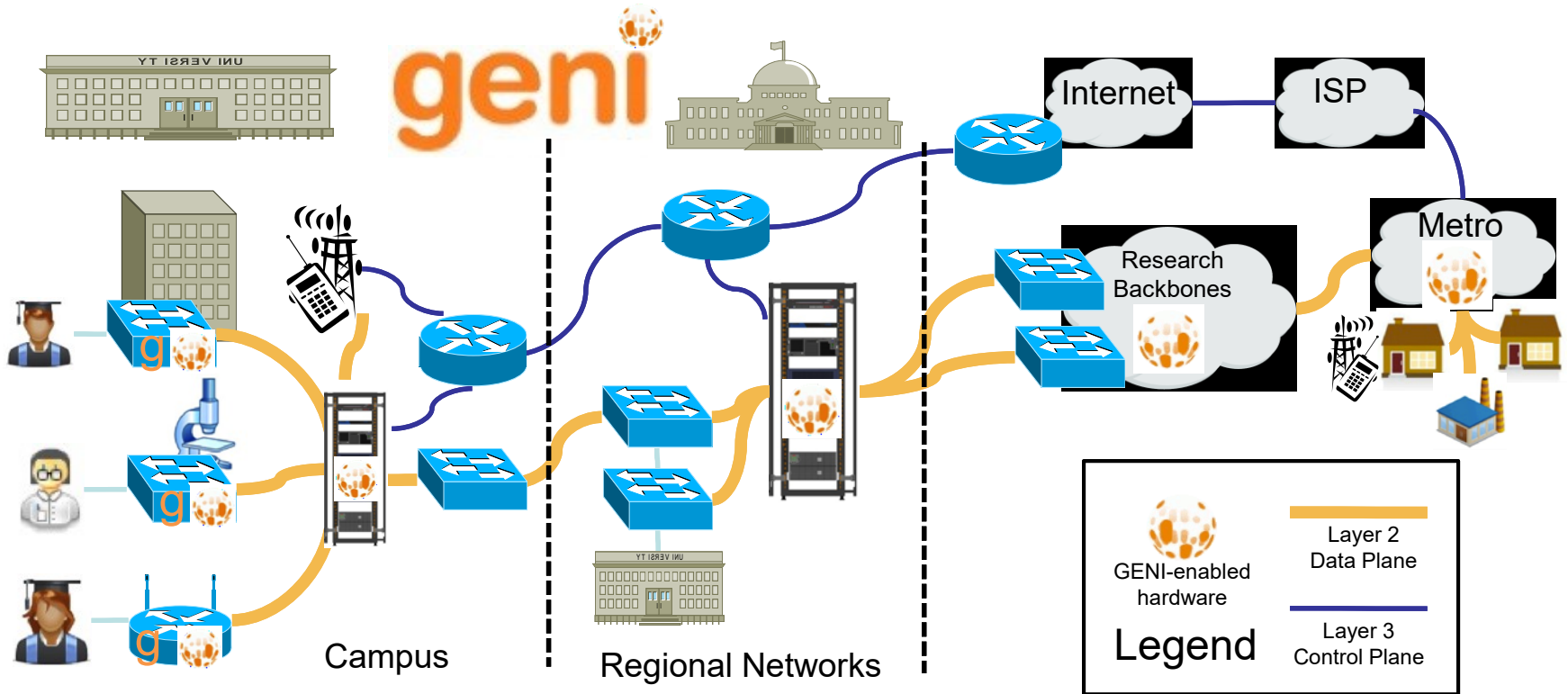
An open ecosystem for wireless
communications research

www.geni.net

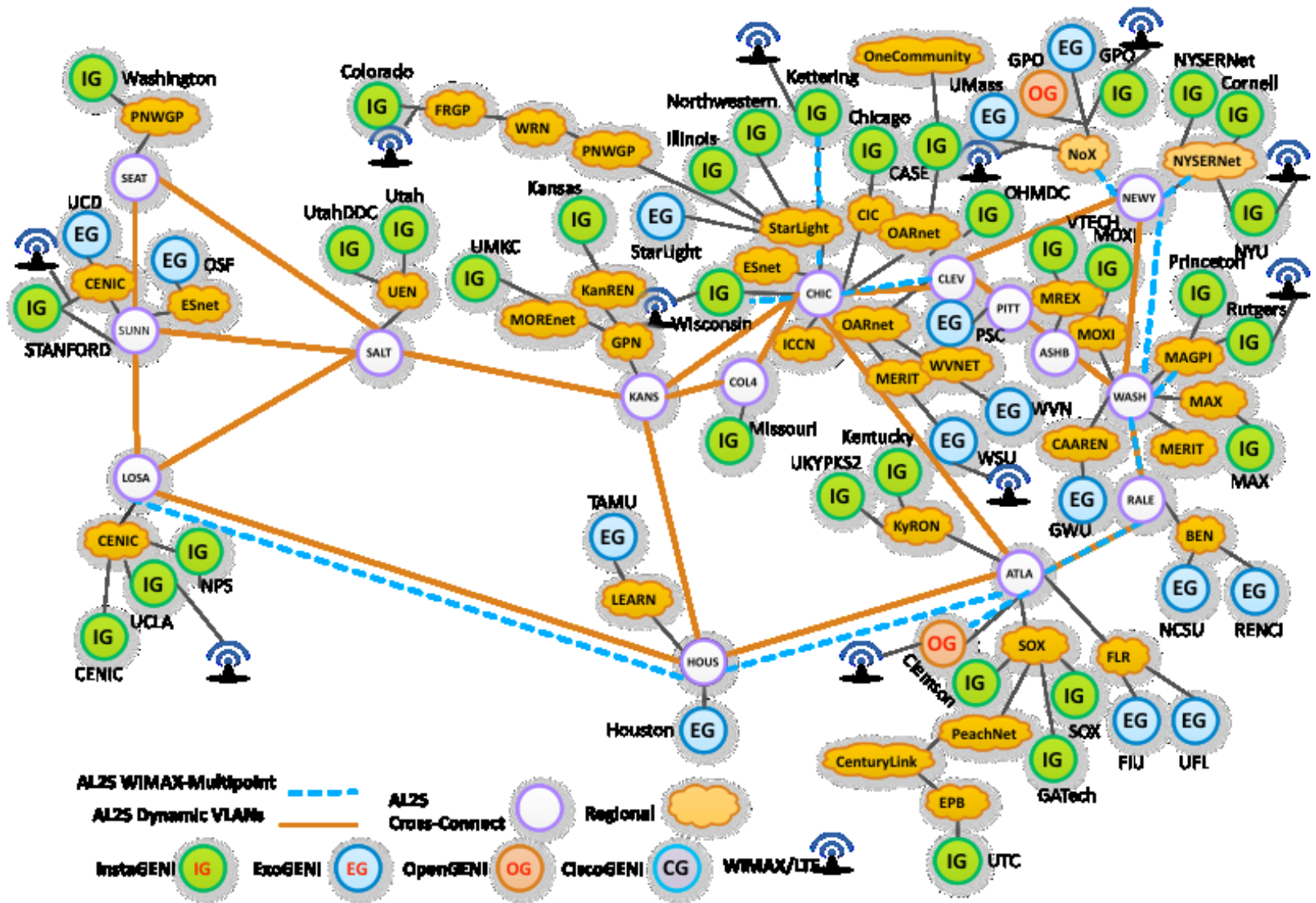
Abhimanyu Gosain
11/18/2016

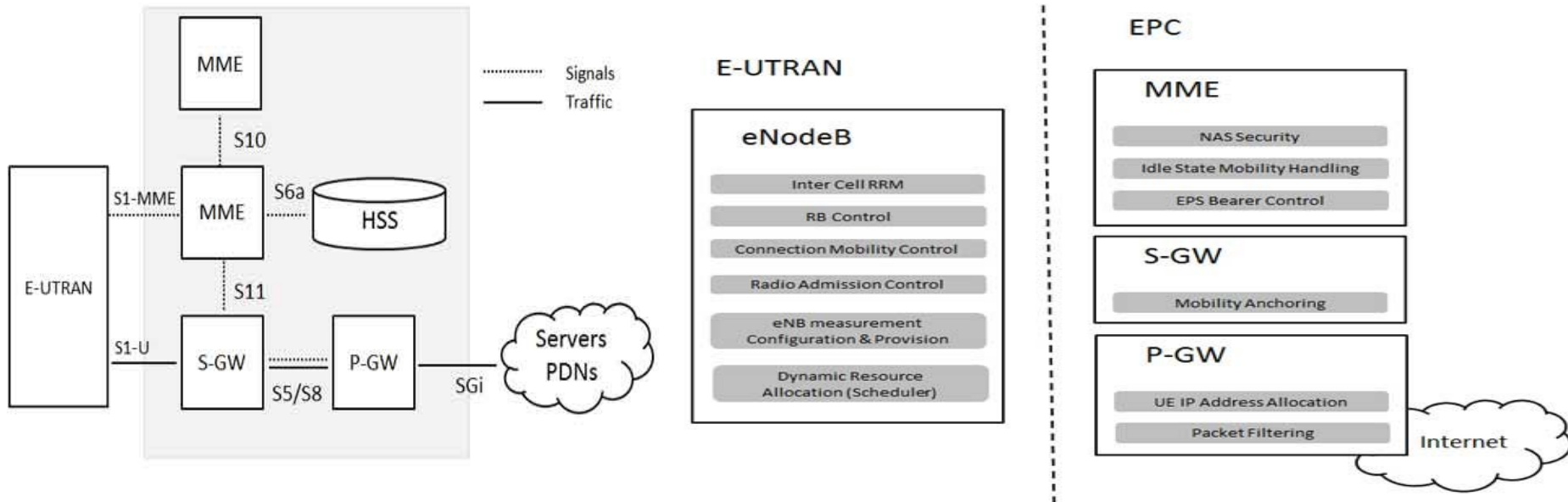
This document does not contain technology or technical data controlled under either the U.S. International Traffic in Arms Regulations or the U.S. Export Administration Regulations.

- GENI Architecture
- Intro to LTE
- Research Motivation
- Campus Deployment Kit



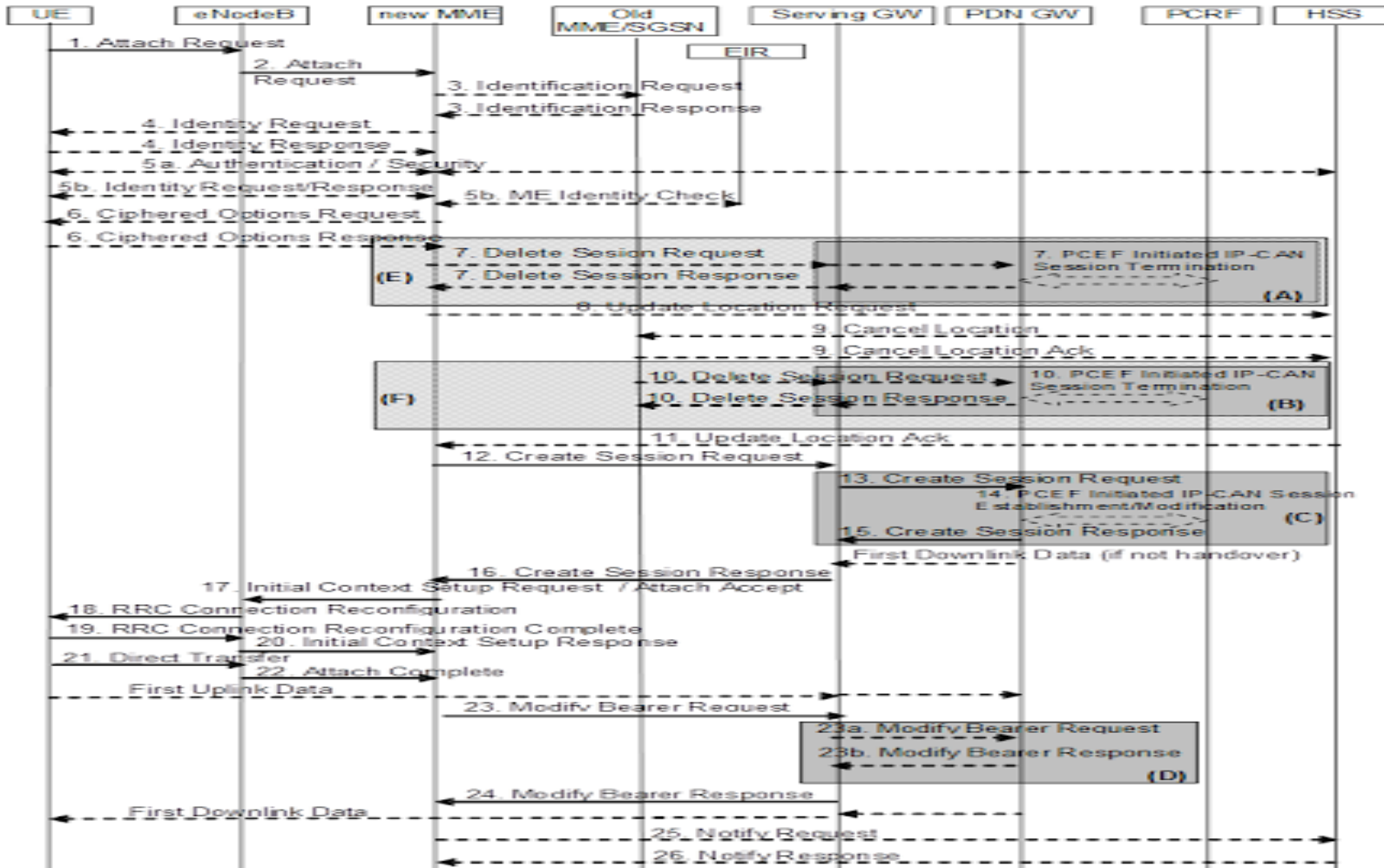
- Flexible network / cloud research infrastructure
- Also suitable for physics, genomics, other domain science
- Distributed cloud (racks) for content caching, acceleration, etc.



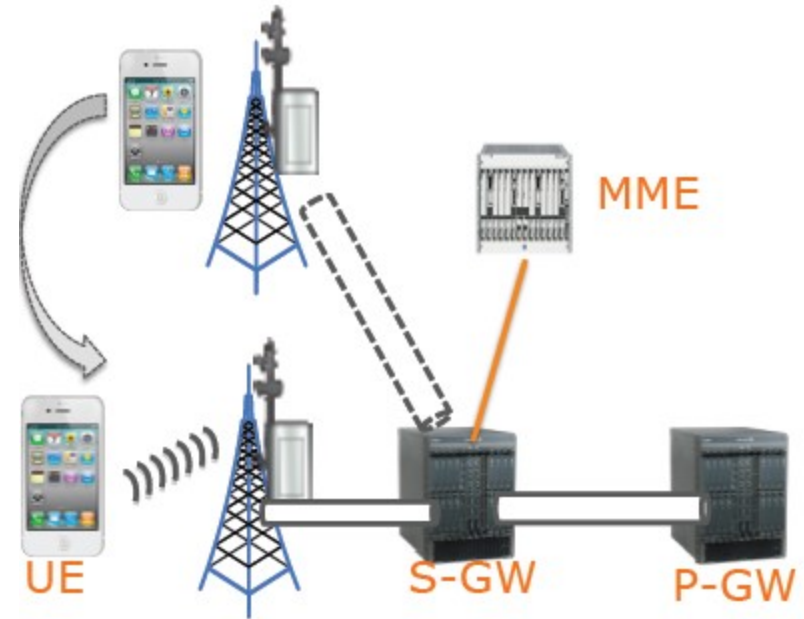


Components of a LTE Network:

- ✓ eNodeB: Evolved Node B
- ✓ EPC: Evolve Packet Core
- ✓ MME: Mobility Management Entity
- ✓ S-GW: Service Gateway
- ✓ P-GW: Packet Gateway
- ✓ HSS: Home Subscriber Server



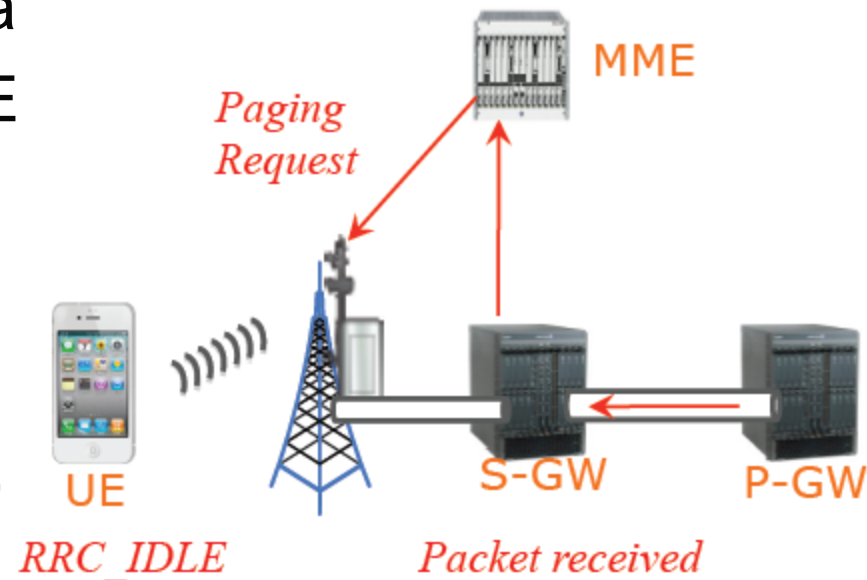
- Handoff without change of SP GW – (S1 handoff)
- Results in up to **33 control messages** in total across SGW, MME and eNBs.
- Handoff with change of S-GW or MME has more overhead



Source: "Rethinking Cellular architecture and Protocols for IoT Communication", KK Ramakrishan, Koushik Kar, Zubair Shafiq

Paging

- If S-GW receives a packet to a UE in IDLE state, inform MME
- MME pages UE through base station
- Results in **15 to 19 control messages** between S-P GW, MME and eNB



Source: "Rethinking Cellular architecture and Protocols for IoT Communication", KK Ramakrishan, Koushik Kar, Zubair Shafiq

- Deploy GENI Network slicing concepts in EPC by setting up OpenVswitch to map different client GTP (uplink/downlink) tunnel pair to VLAN(s).
- Experimentation with next generation cellular and core network systems (5G, Mobile SDN, Cloud-RAN, Virtualized EPC)
- Provide a campus kit for ~\$20K for turnkey access to LTE technology.

4G Base Station Hardware

AirHarmony

Located closer to the end user, providing much higher aggregate data rates

TDD LTE

Max Transmit Power: 30 dBm per Tx (2 X 5W)

2 x 2 MIMO:

Operational Frequency Bands:

7 and 41 (2.6 GHz), 12, 13, 14 and 17 (700 MHz), 20 (800 MHz), 40 (2.3-2.4 GHz), 42 and 43 (3.4-3.8 GHz)





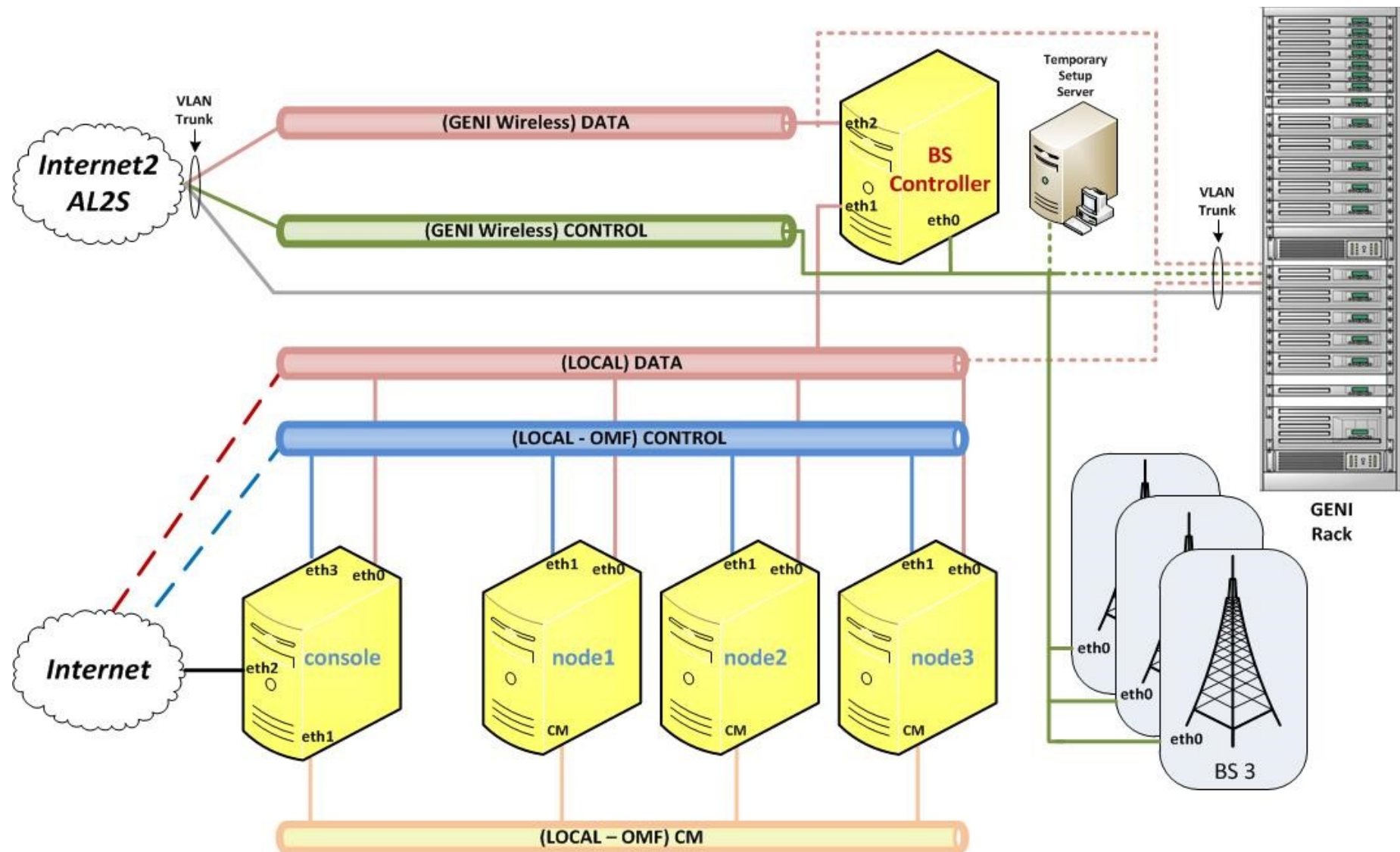
LG Nexus 5, Samsung Galaxy S4
Android 5, AT commands
Test SIM

USB Dongles



**Netgear 341U, Sierra Wireless,
Greenpacket LTE CPE**
Linux Driver
Test SIM

- ✓ Help determine Location for LTE BS deployment.
- ✓ Negotiate Installation Quote from Facilities Engineering Dept.
- ✓ Provide Ethernet/Fiber network drops for BS.
- ✓ Provide Power outlets for BS.
- ✓ Configure VLAN(s) on campus network for backhaul network to Control Server.
- ✓ Configure Netspan Server (if not already in place)
- ✓ Configure EPC VNF VM(s) on GENI Rack
- ✓ Configure VLAN on GENI Rack to connect BS to GENI L2 AL2S Network.
- ✓ Provide a public IP subnet from Control Server to allow Internet access from User Devices.



QUESTIONS

