Hybrid Modeling and Simulation Platform for Rapid Prototyping and Testing of Ad-hoc Wireless Networks

Presented to:

Telcordia Contact:

Dennis Mok, Ph.D.
Principal Systems Engineer
Telcordia Technologies Inc.
dmok@telcordia.com
(703) 875-2286

Michael Maszczak
Senior Systems Engineer
Telcordia Technologies Inc.
mmaszcza@telcordia.com

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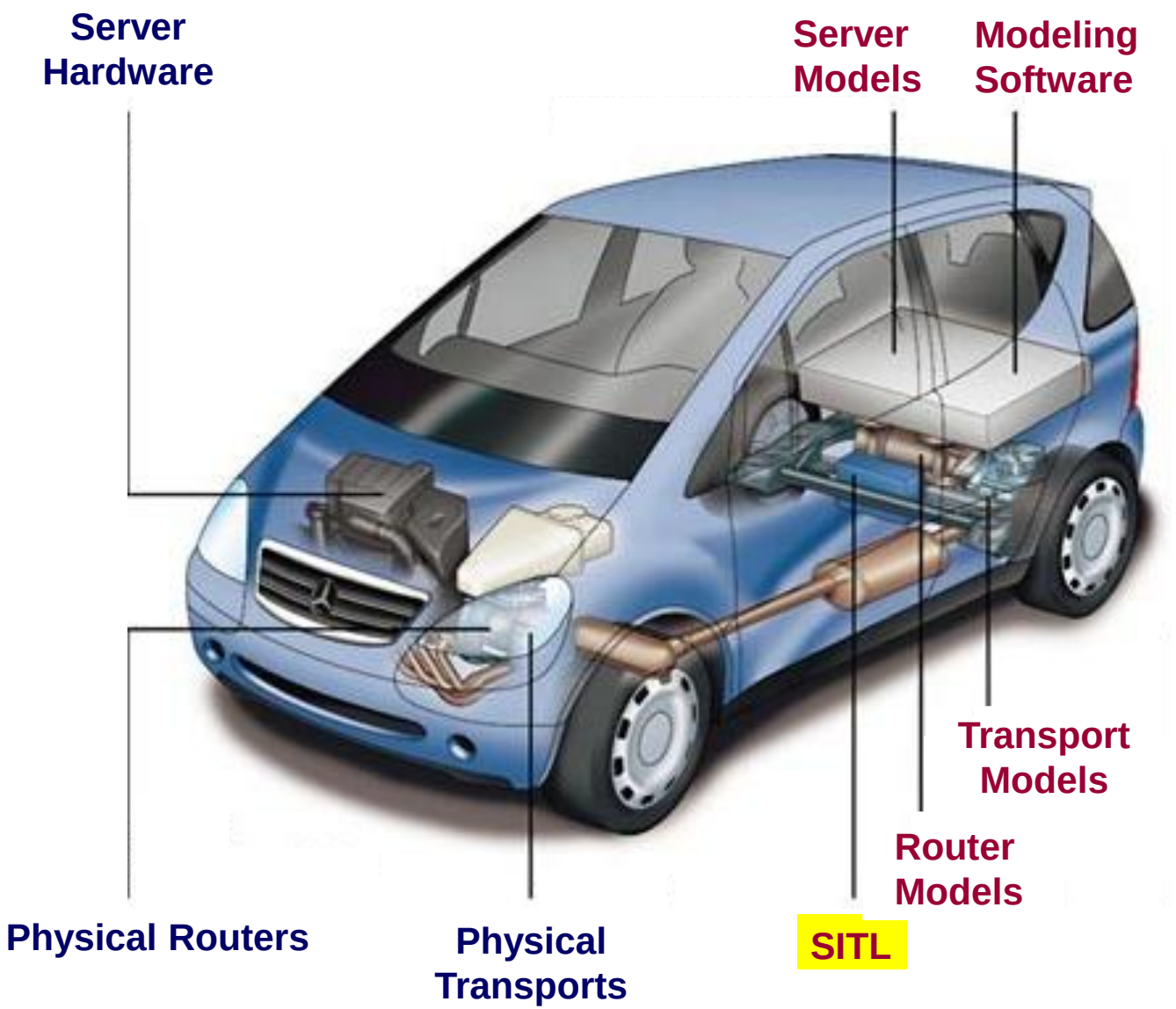
The Hybrid Concept



Desired Prototyping/Testing Characteristics

Realism

- Physical - High
- Modeling - Low
- Hybrid - Medium

Performance

- Physical - High
- Modeling - Low
- Hybrid - Medium

Scalability

- Physical - Low
- Modeling - High
- Hybrid - Medium

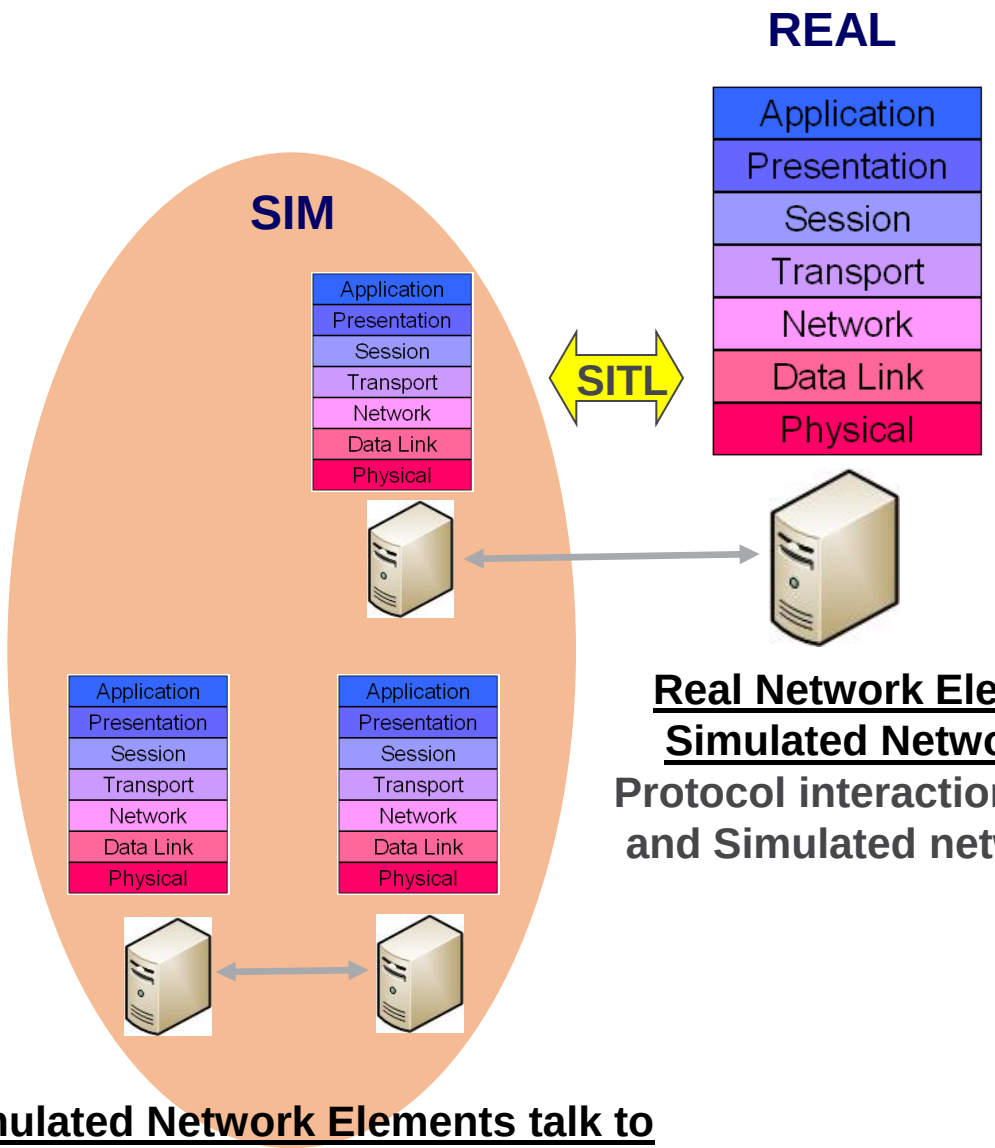
Cost

- Physical - High
- Modeling - Low
- Hybrid - Medium

SITL (System-In-The-Loop)

- SITL is an add-on module for OPNET's modeling and simulation products
- SITL provides a simple "plug and play" interface that connects live applications or network devices, such as servers and routers, to OPNET© simulations
- Real ⟺ Sim Scenario: provides a communication path between a simulated network element and a real network element
- Real ⟺ Sim ⟺ Real Scenario: provides transparent transport of traffic between real network elements

REAL to SIM Scenario



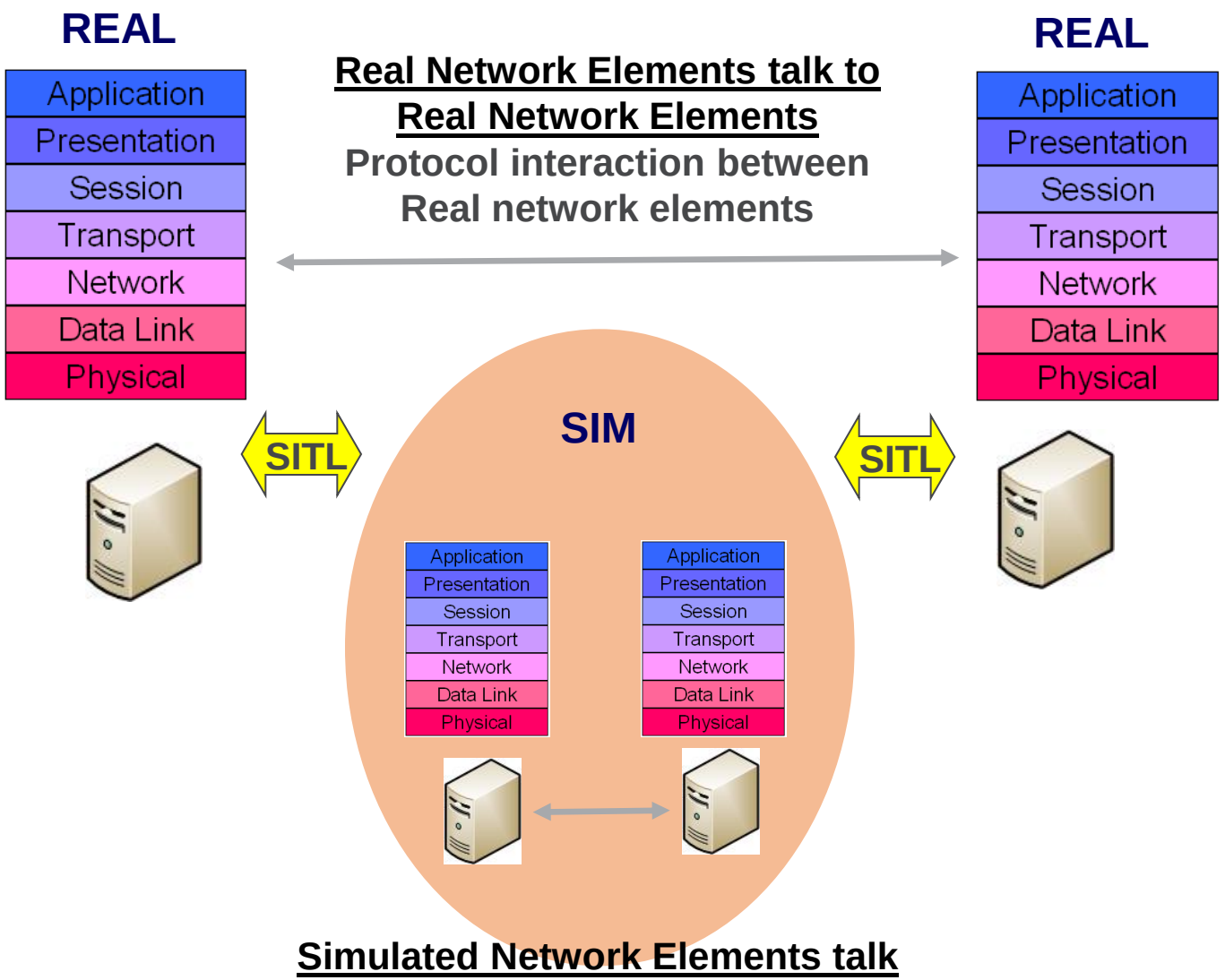
Real Network Elements talk to Simulated Network Elements

Protocol interaction between Real and Simulated network elements

Simulated Network Elements talk to Simulated Network Elements

Protocol interaction between Simulated network elements

REAL to SIM to REAL Scenario



Hybrid Modeling and Simulation Platform

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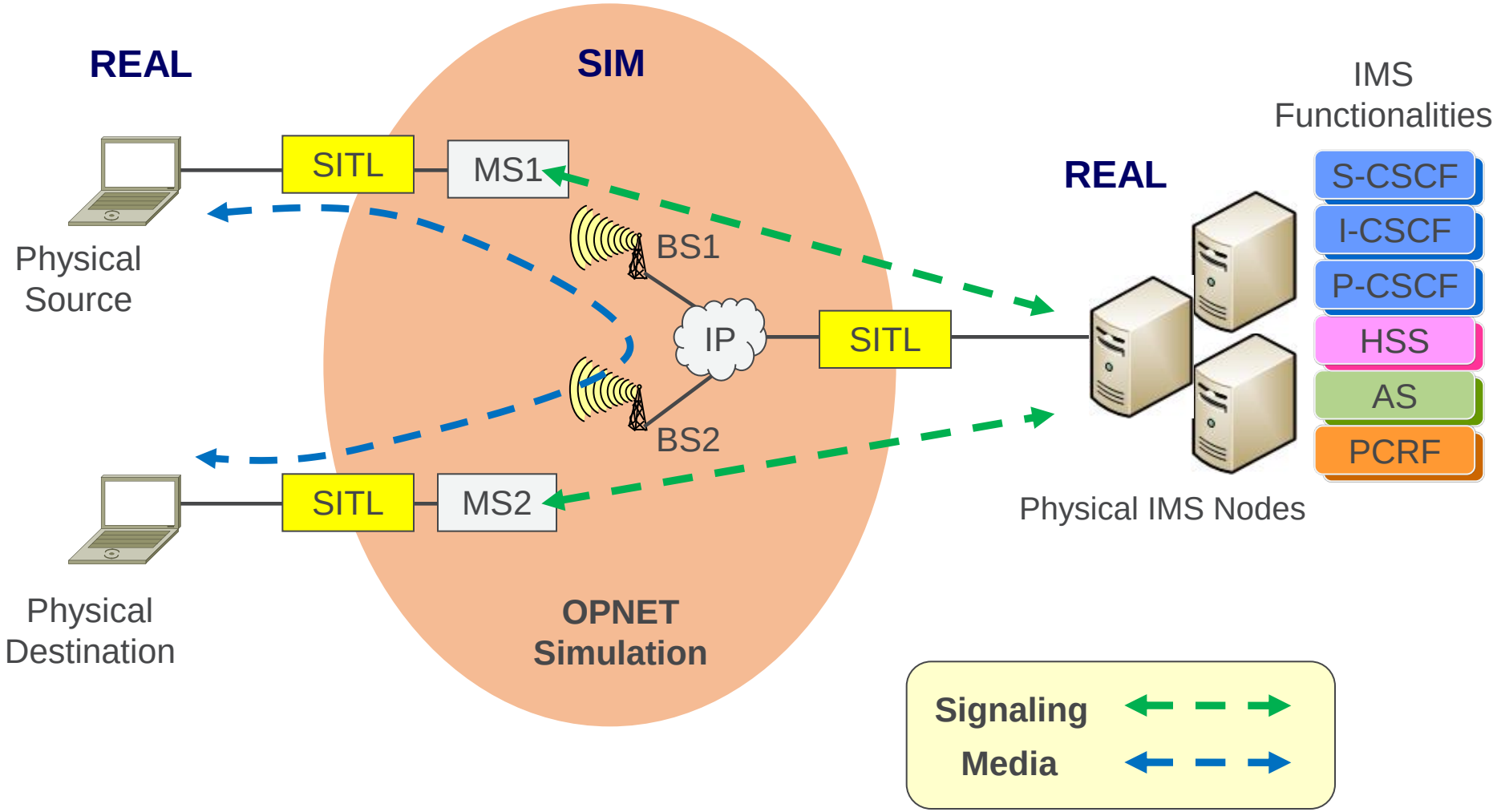

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End-to-End Prototyping Framework

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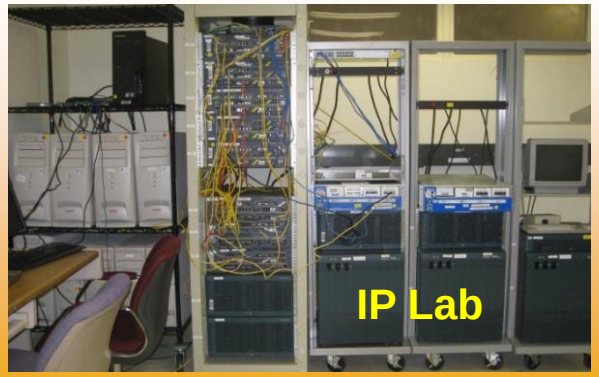

IMS Stack

- S-CSCF
- I-CSCF
- P-CSCF
- HSS
- AS
- PCRF

OPNET Access Network Models

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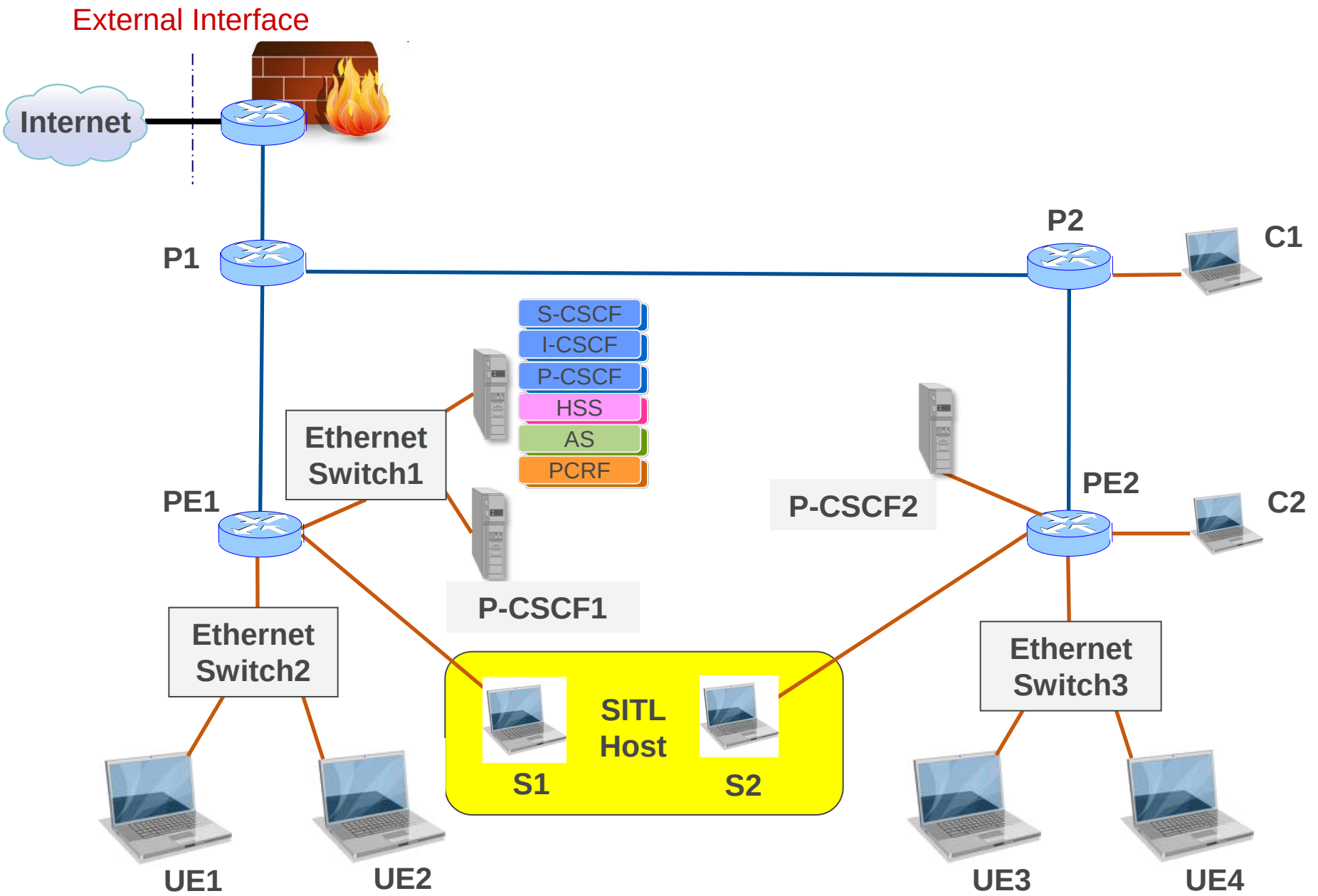
Example Testbed Hardware Configuration



End-to-End Network Prototyping

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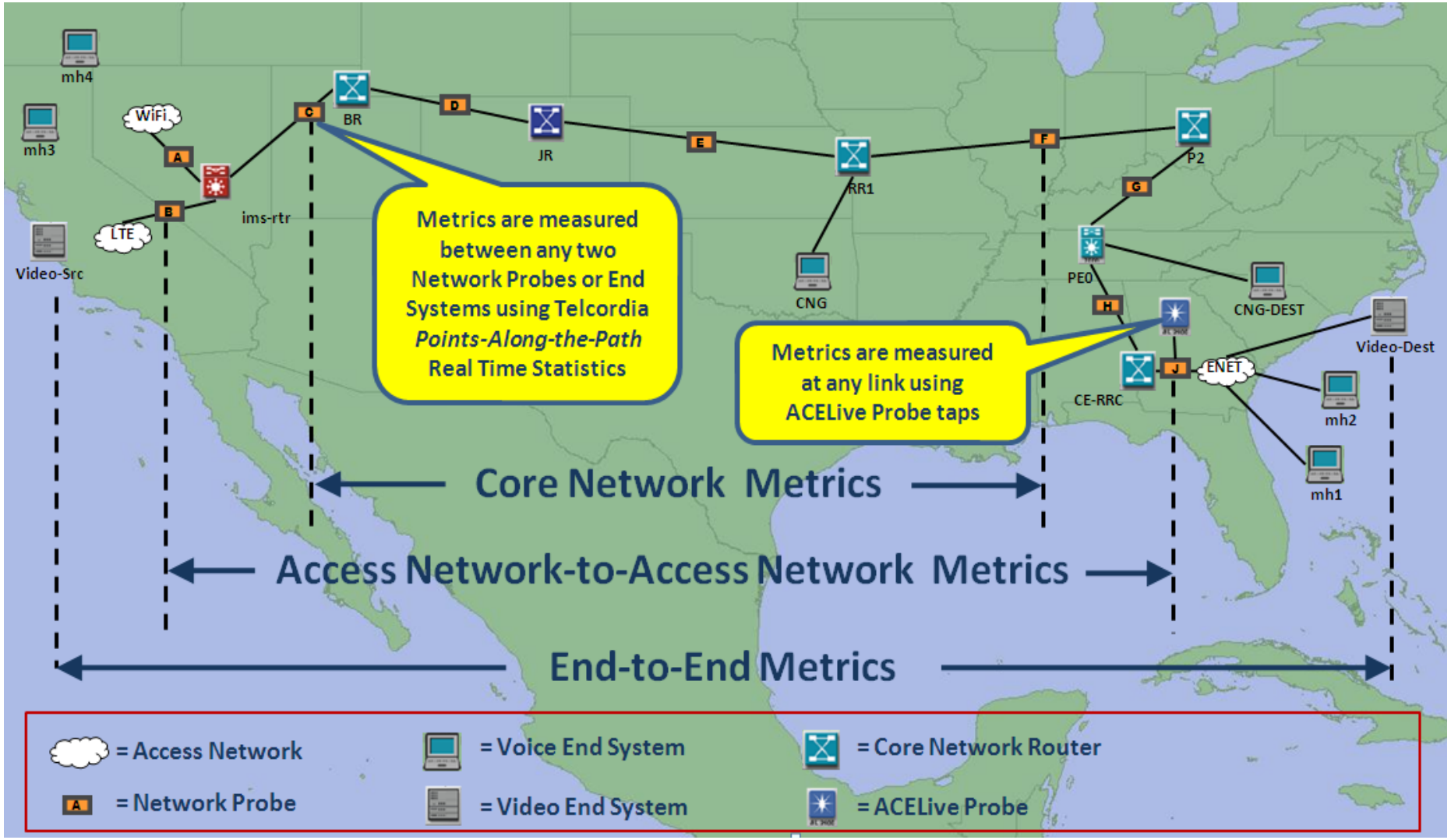

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End-to-End Performance Features

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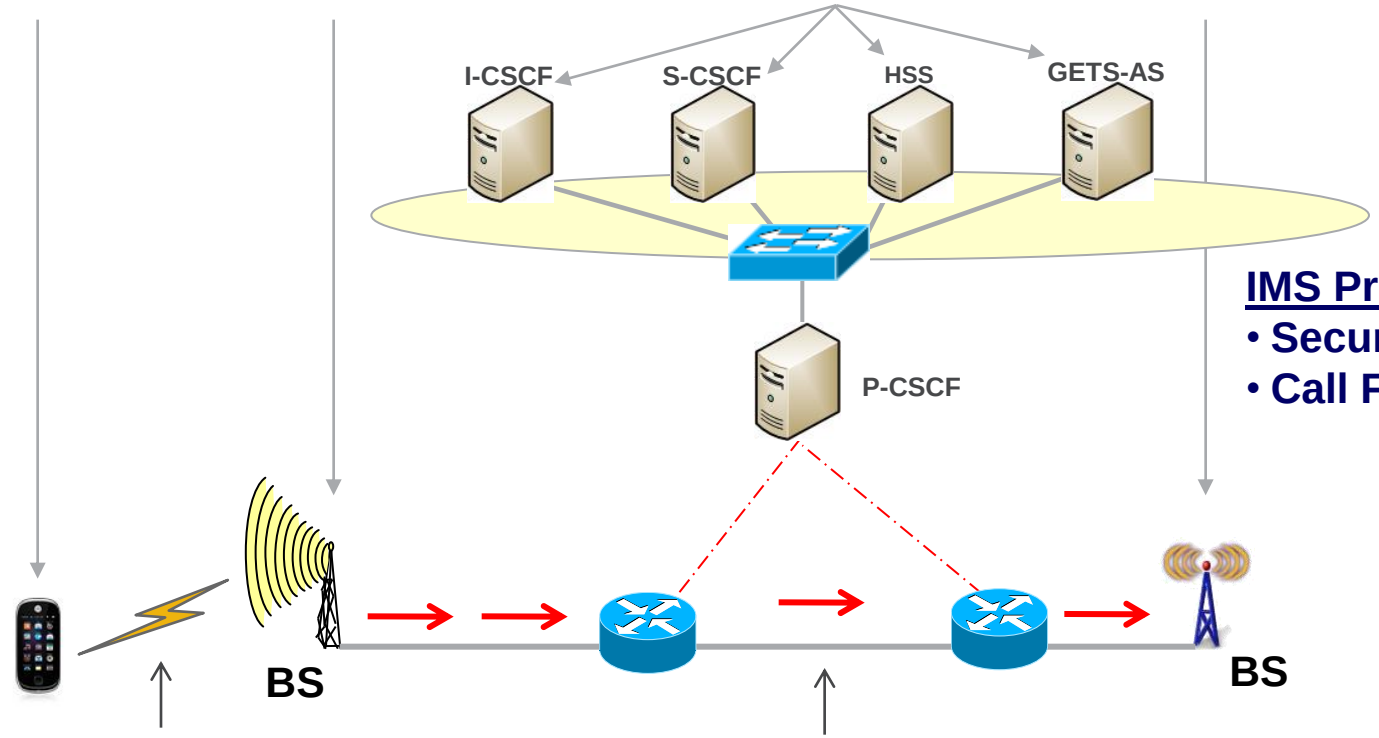
- Access Control Algorithm
- Transport Queueing
- Server Processing
- Management Queueing



IMS Prototyping
- Security
- Call Flows

Access Modeling
- EvDO
- WiMAX
- LTE
- Ad-hoc Mobile

IP v4/v6 Prototyping
- Multi-Domain Transport
- Quality of Service (DiffServ)

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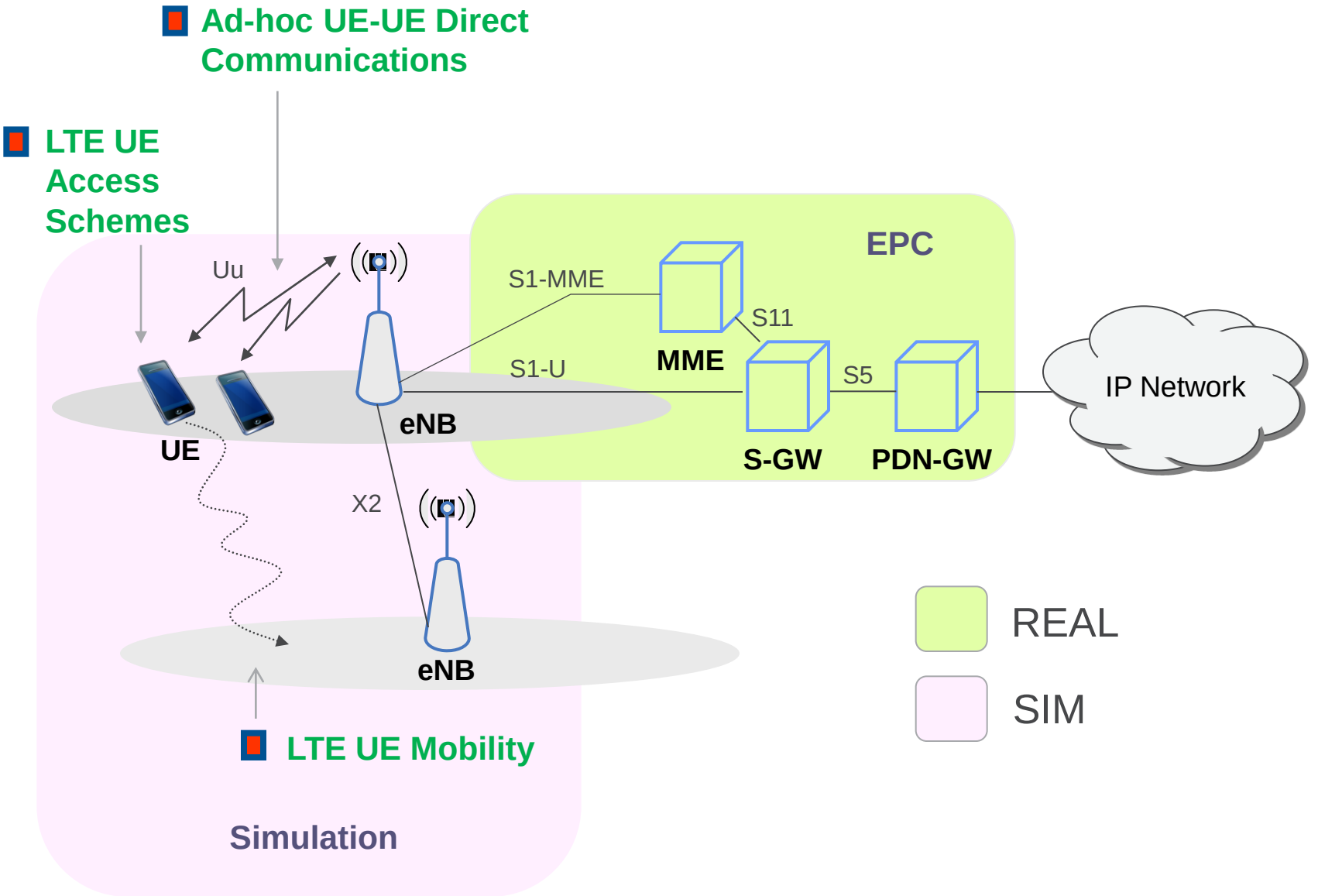
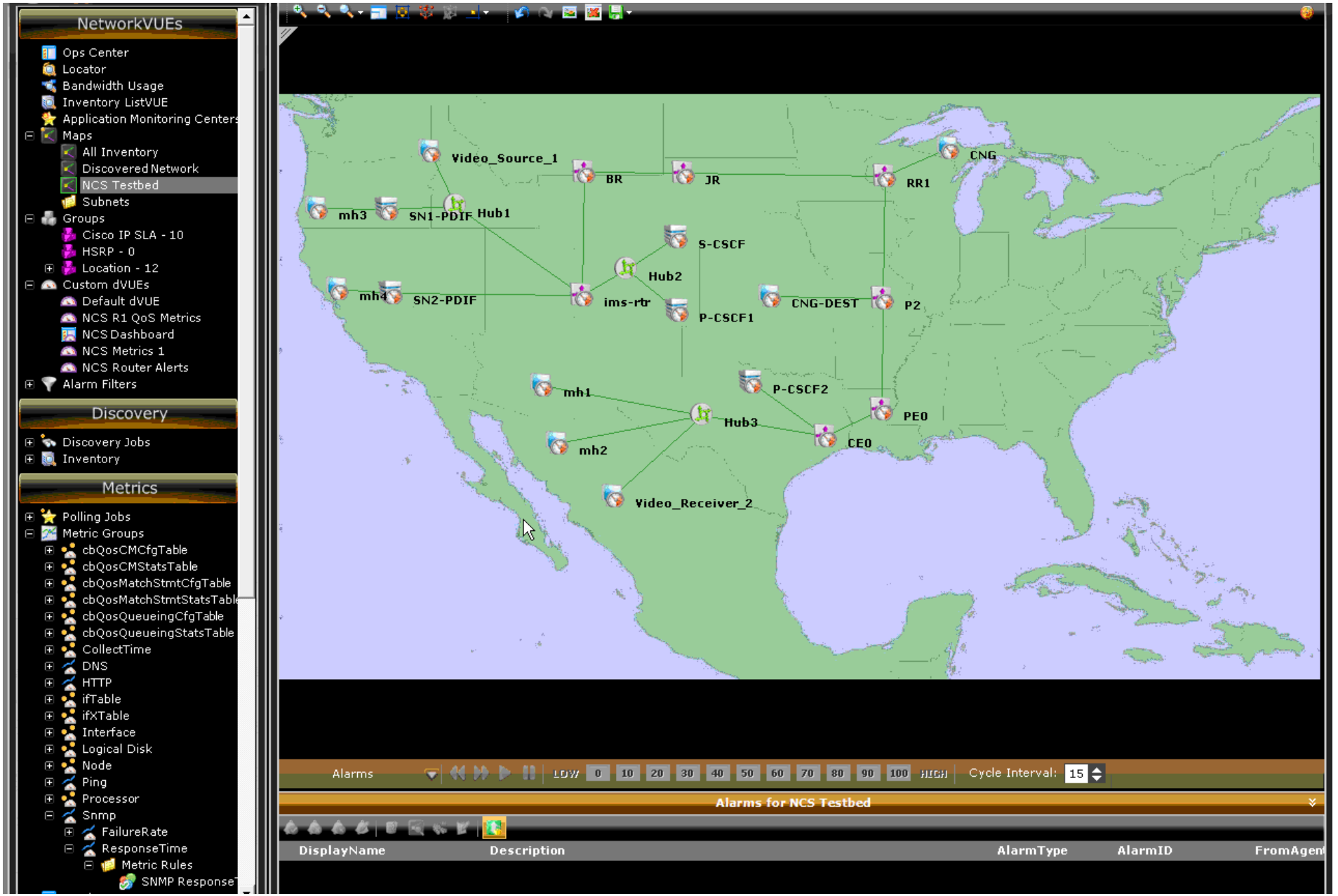
LTE Access Performance Features



Visualization of Prototyped Network



Network Performance Dashboard

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End-to-End Performance Measurement

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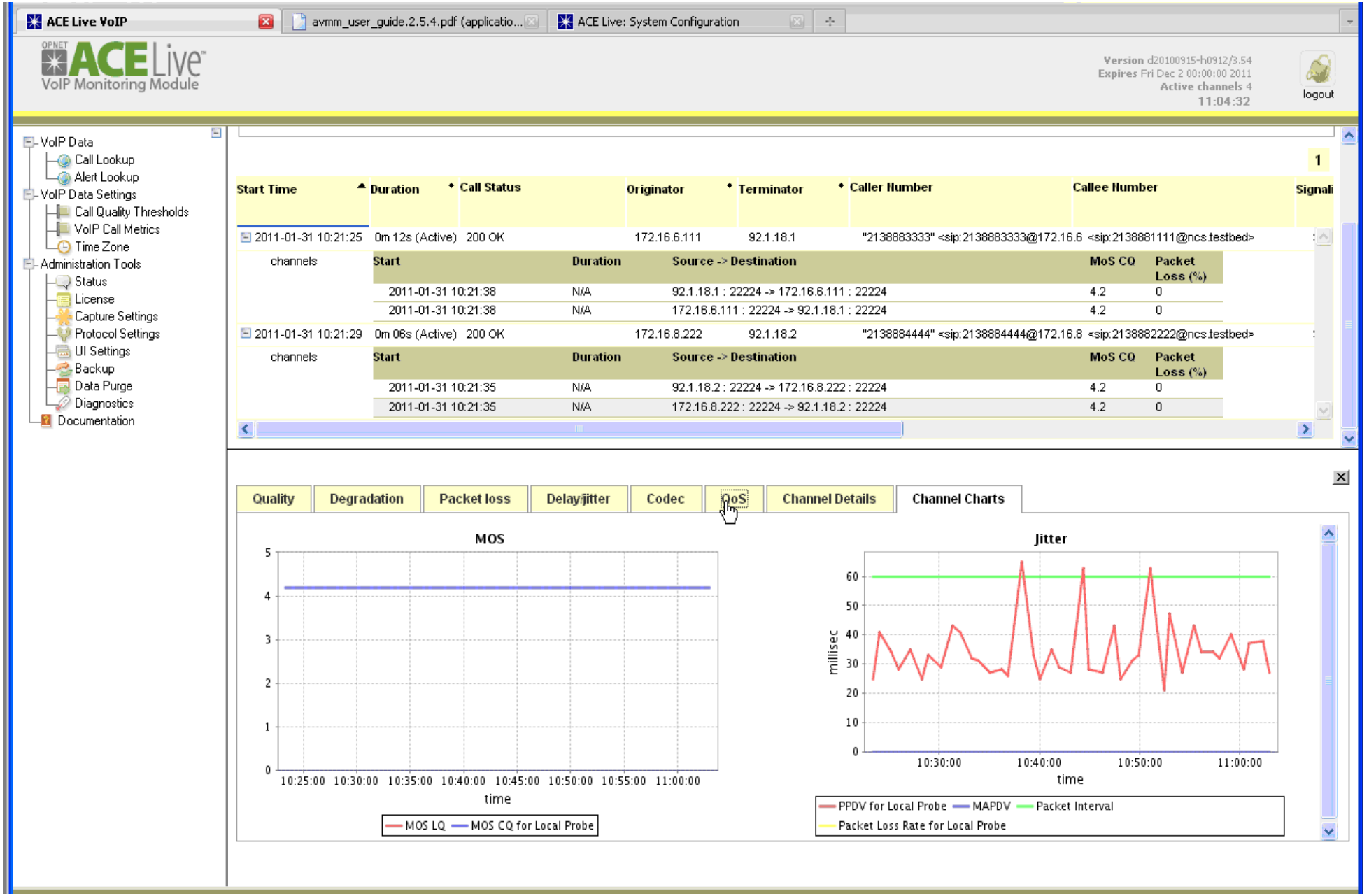

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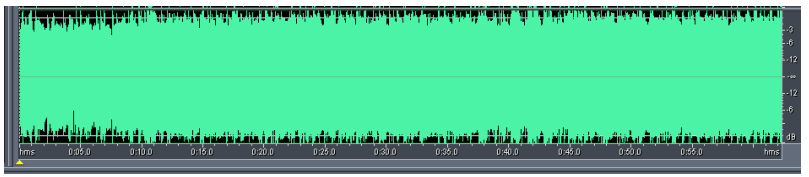
Experience the Performance

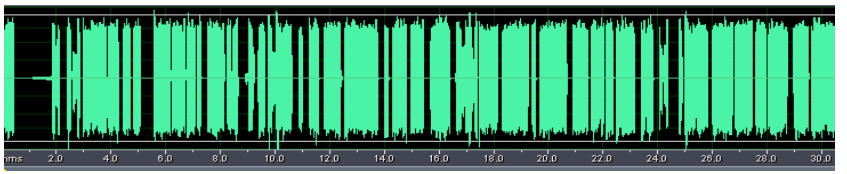
- **Transmitted Video under Normal Load**

- **Transmitted Video under Congestion**

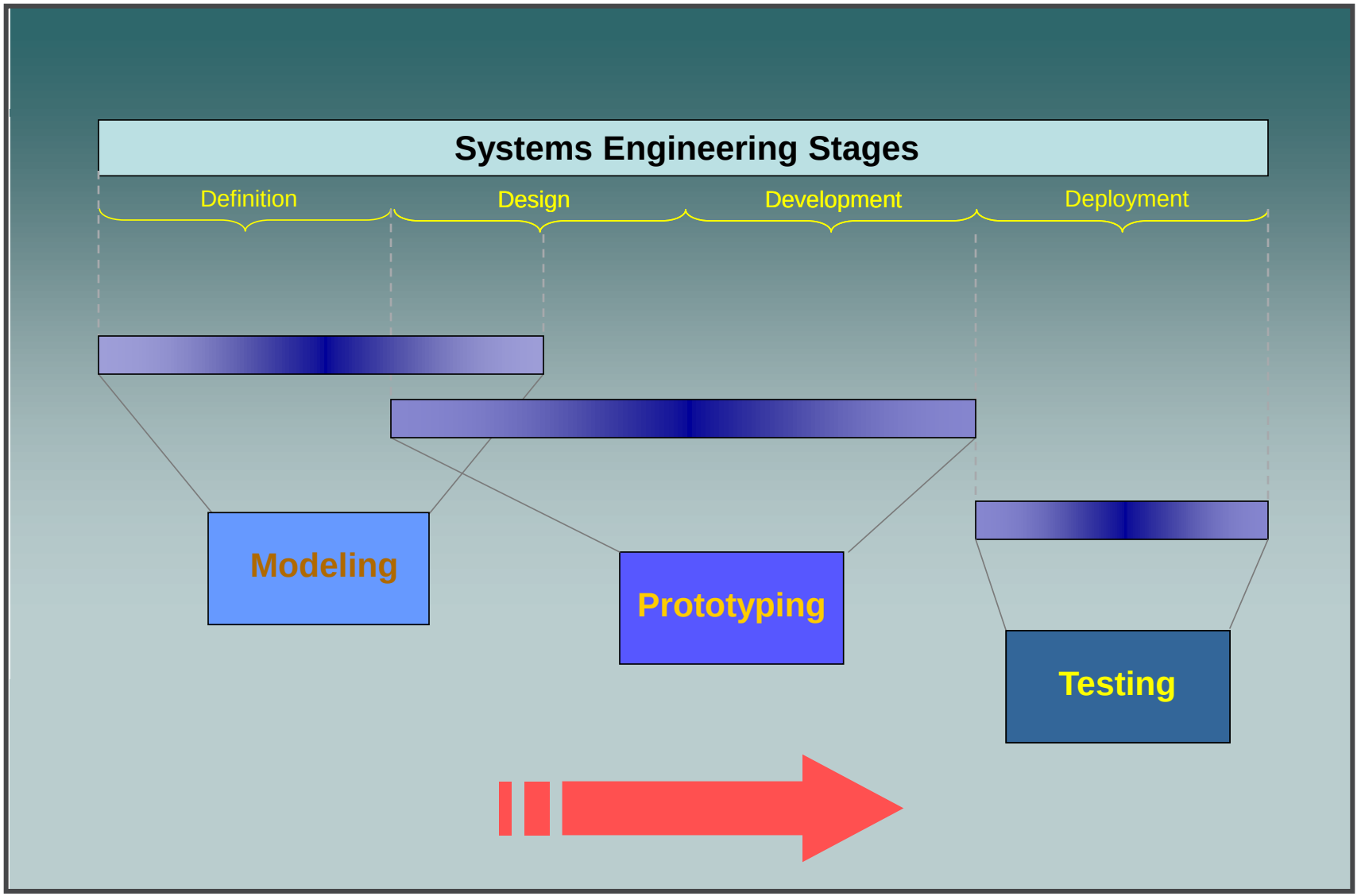
- **Transmitted Audio under Normal Load**



- **Transmitted Audio under Congestion**



Continuously Evolving Hybrid Platform



Q & A