



WiMAX Update and OMF Integration Scenarios

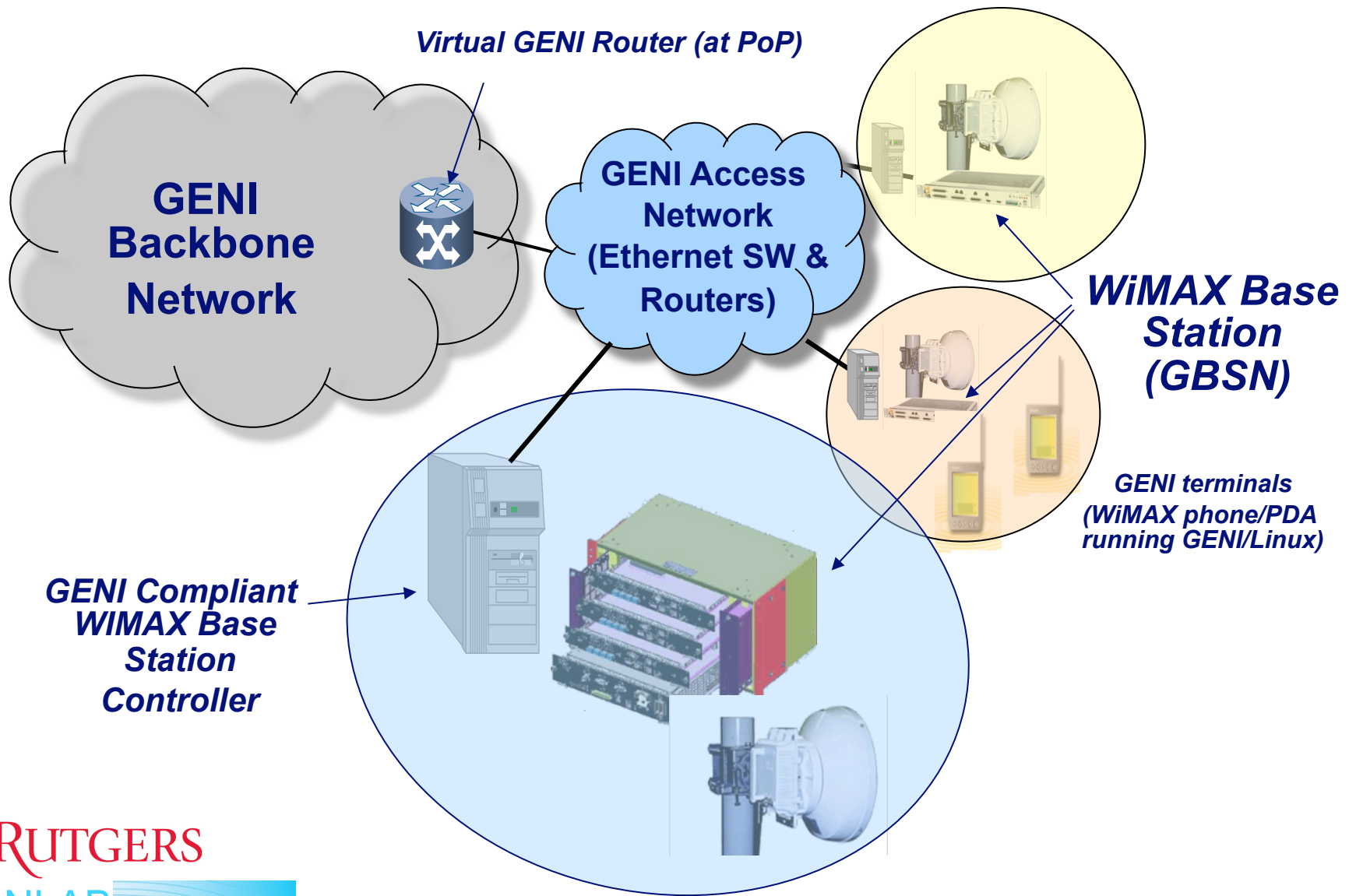
GENI Substrate Meeting GEC-5, July 2009

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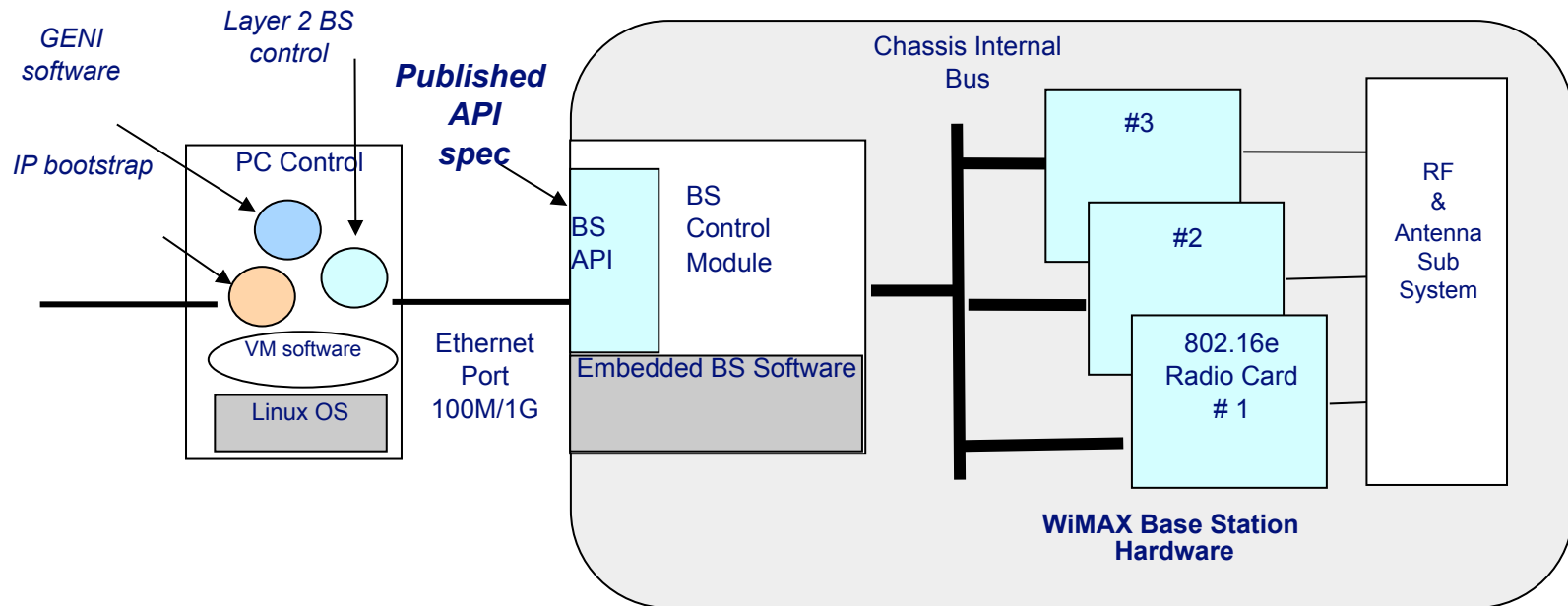
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GENI WiMAX: System Overview



GENI WiMAX: Project Scope & Goals



- Spiral 1 GENI proof-of-concept project with NEC Labs, Princeton
- Open API for control of 802.16e BTS parameters
- Support for L2/L3 programming and resource virtualization
- Integration with ORBIT Control & release to GENI experimenters

BS Technical Specs

PHY	Access mode	SOFDMA/TDD
	Frequency	2535 ~ 2605 MHz
	DL:UL ratio	35:12, 26:21, 29:18
	Channel BW	10 MHz , 8.75 MHz
	FFT size	1024, 512
	Frame duration	5ms
	TX output Power	35dBm (max)
	# of sectors	3
MAC	Head compression	PHS
	ARQ	HARQ/CC, ARQ
	MBS support	Single BS, multiple BS-MBS
	Resource management	Power control, mode control (idle, sleep etc.)
Networking	IP protocols	IPv4, IPv6
	Bridging/Routing	Transparent L2 switch, Bridging
	Packet handling	802.1Q VLAN, PHS**)

Base Station Features



rtPS	real-time polling service
ertPS	enhanced real-time polling service
nrtPS	non real-time polling service
UGS	unsolicited grant service
BE	best effort

Supported Service Classes

Base Station Deployment at WINLAB Tech Center Building

- Rt.1 campus deployment Q1/09
- Performance evaluation in progress

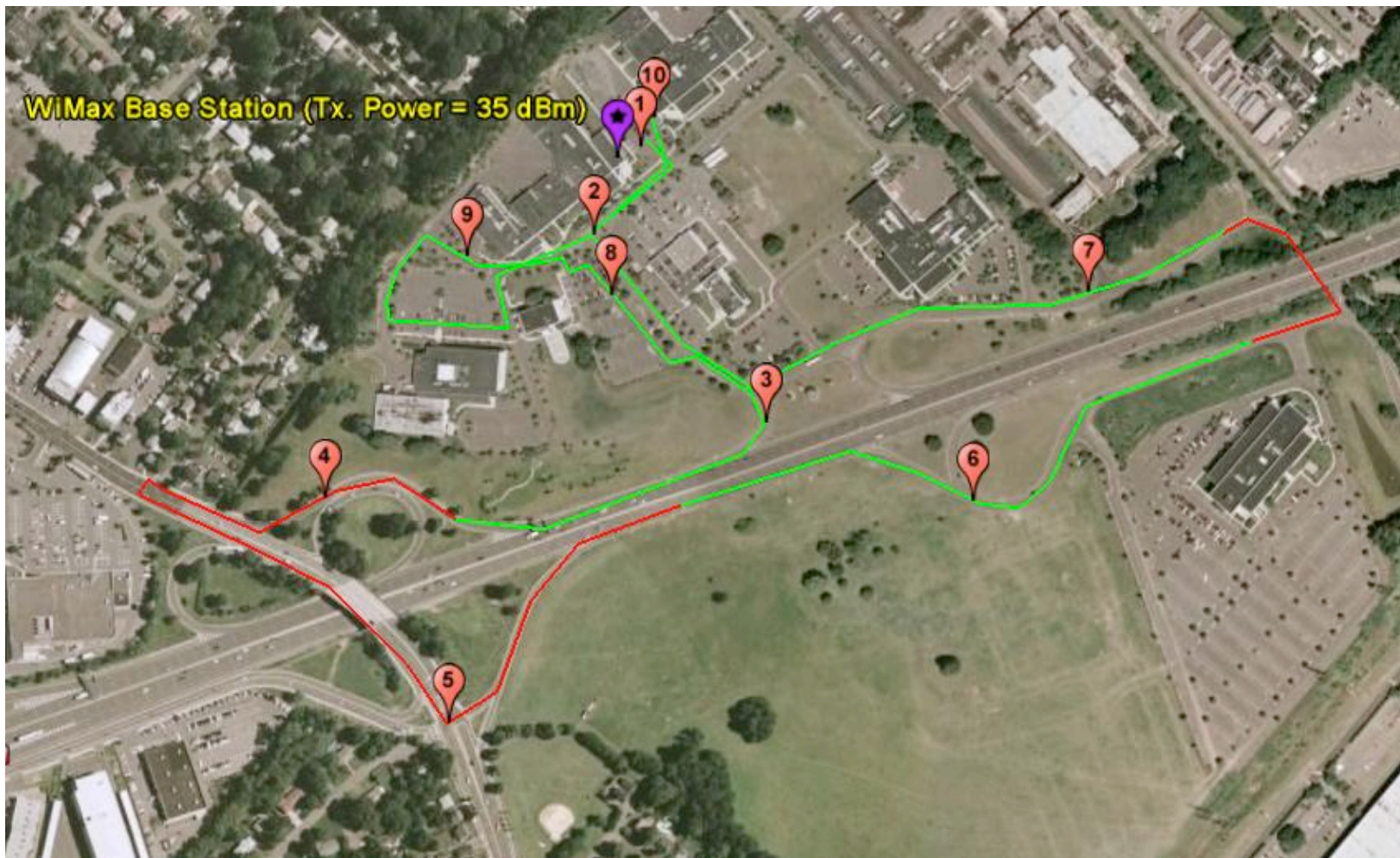
RF Module
(sector)

Base
Module

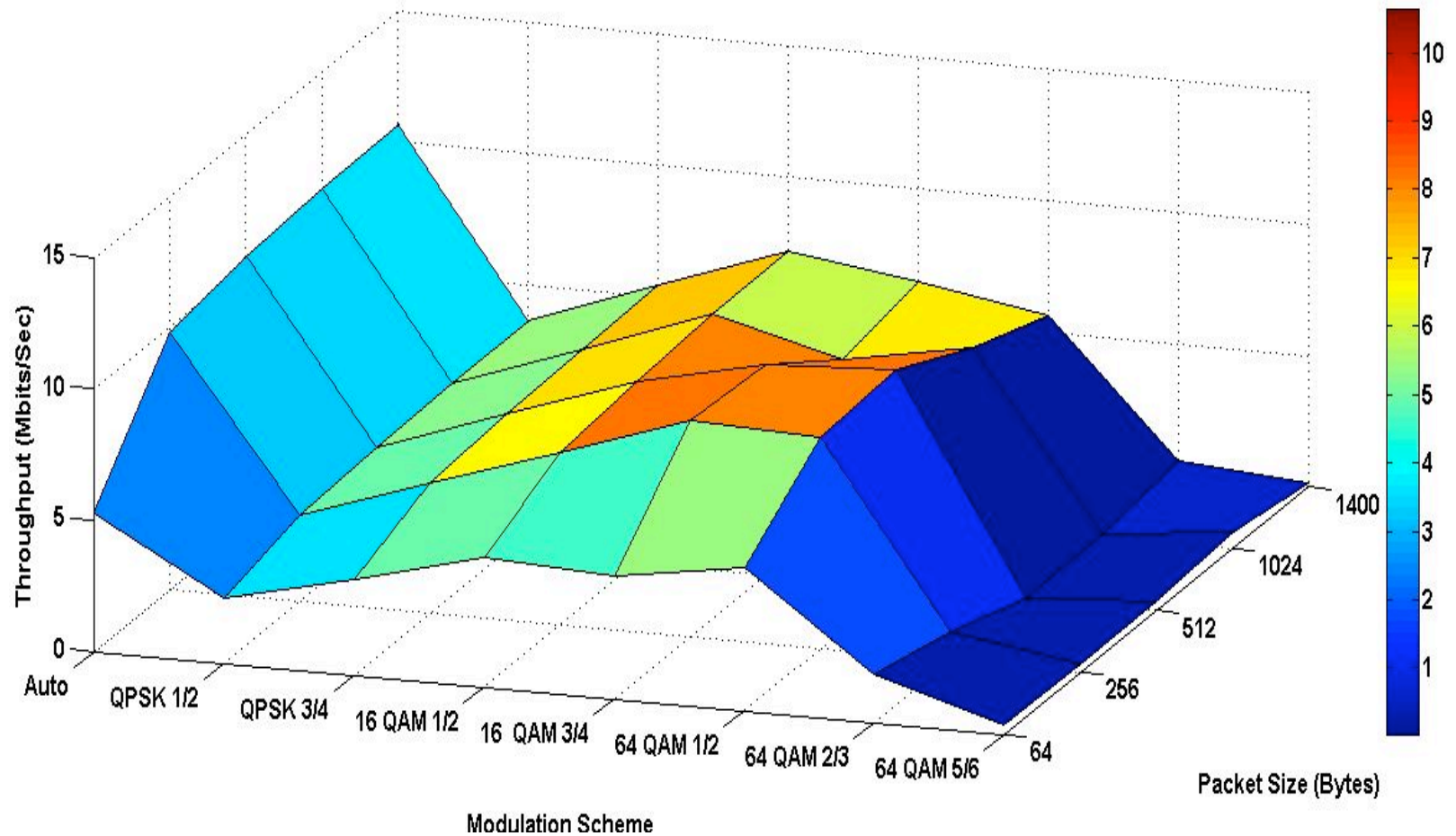


Omni-directional antenna
(elev. < 6ft above roof!)

Coverage: Drive-by Connectivity Trace

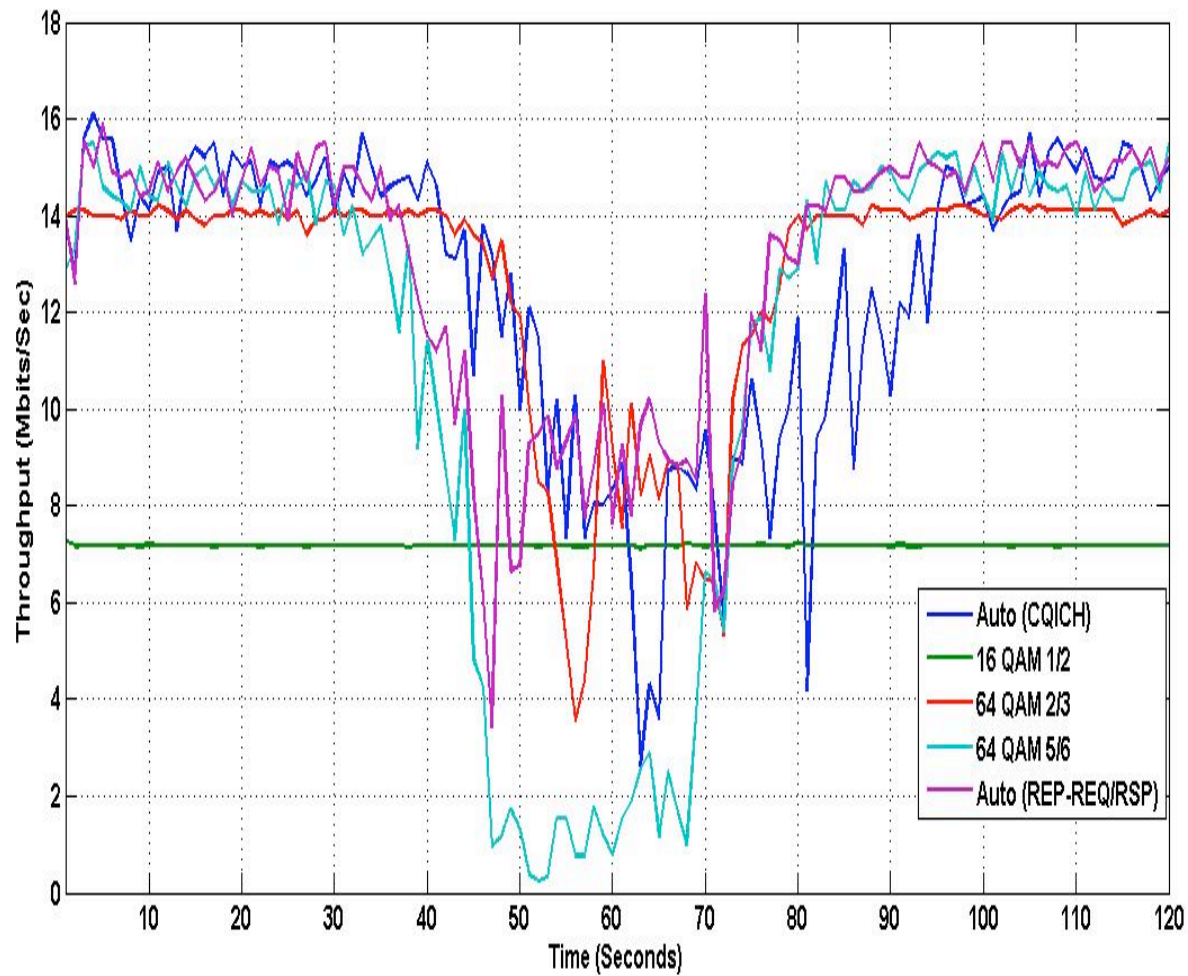


Performance: Stationary Throughput



Location 2 (Distance from BS = 0.14 Miles)-- > CINR = 24 RSSI = -72

Performance: Throughput Trace with Client Mobility



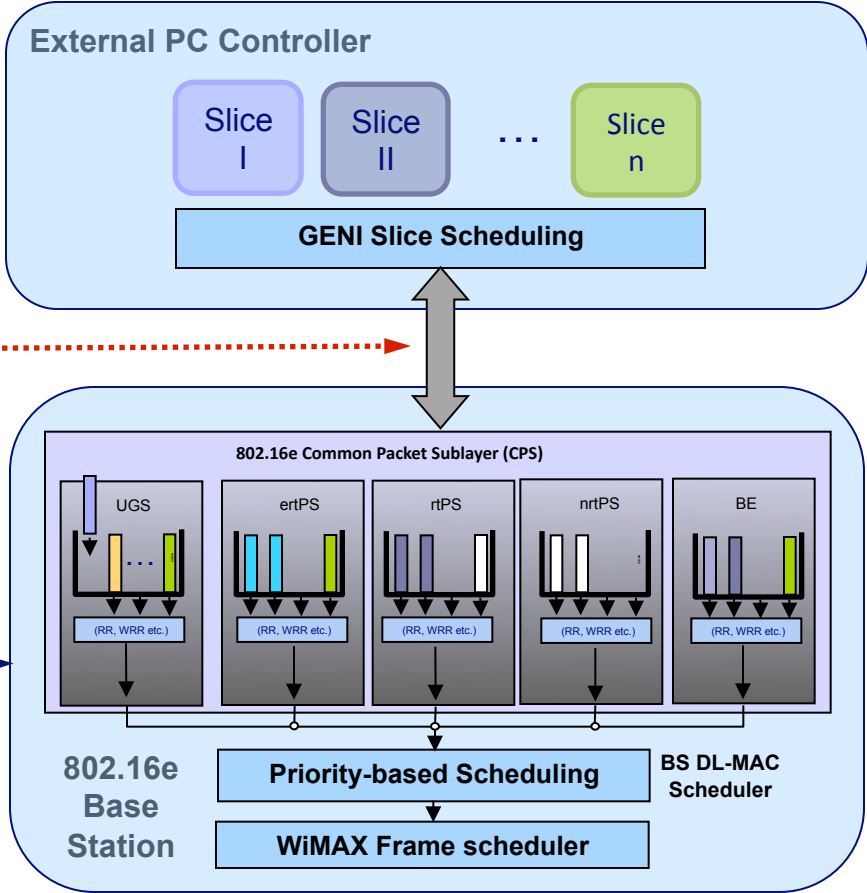
Open API & Interface to Base Station Queues

GENI Open API

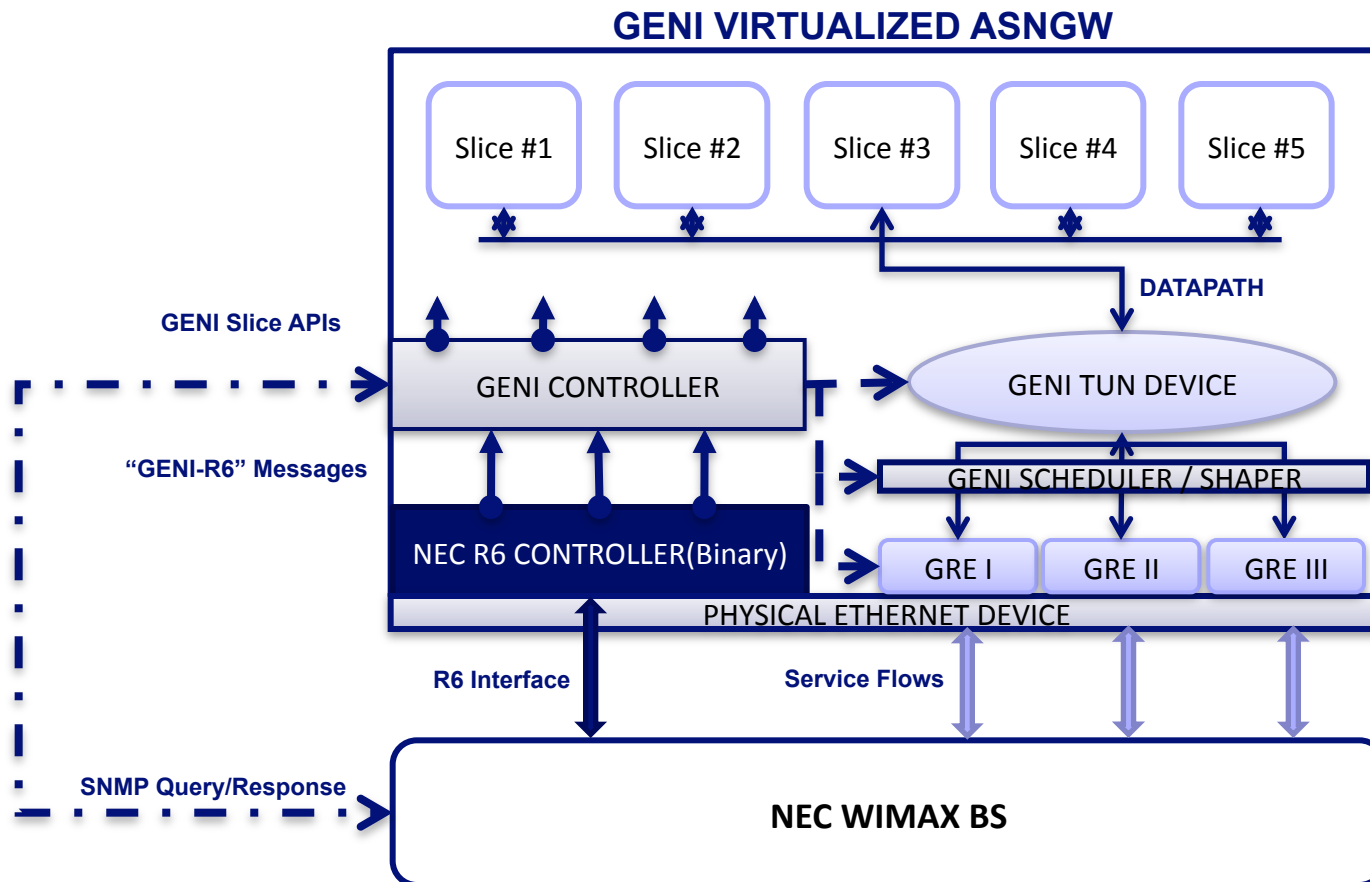
- Maximum Bit-Rate, Burst-Rate
- Minimum Tolerable Sending Bit-Rate
- Maximum Tolerable jitter
- Minimum Delay
- Scheduling Type (e.g., UGS, rtPs ,nrtPs)
- Frequency of Operation
- Rate / Power requirements

Base Station State

- Radio resources (UL and DL)
- Time slots (UL and DL)
- Downlink burst profile
- Uplink burst profile
- Frequency
- Power
- Rate



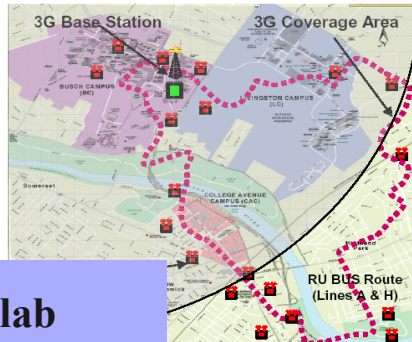
GENI WiMAX: BS Virtualization Architecture



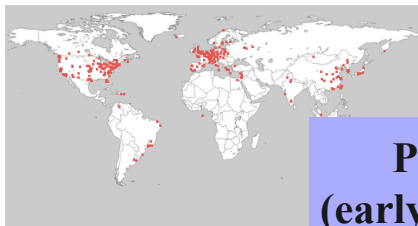
Where is OMF currently used ?



**Orbit, Winlab
Rutgers University, USA**



**Thomson Lab,
Paris, France
(under deployment)**



**PlanetLab,
(early deployment)**



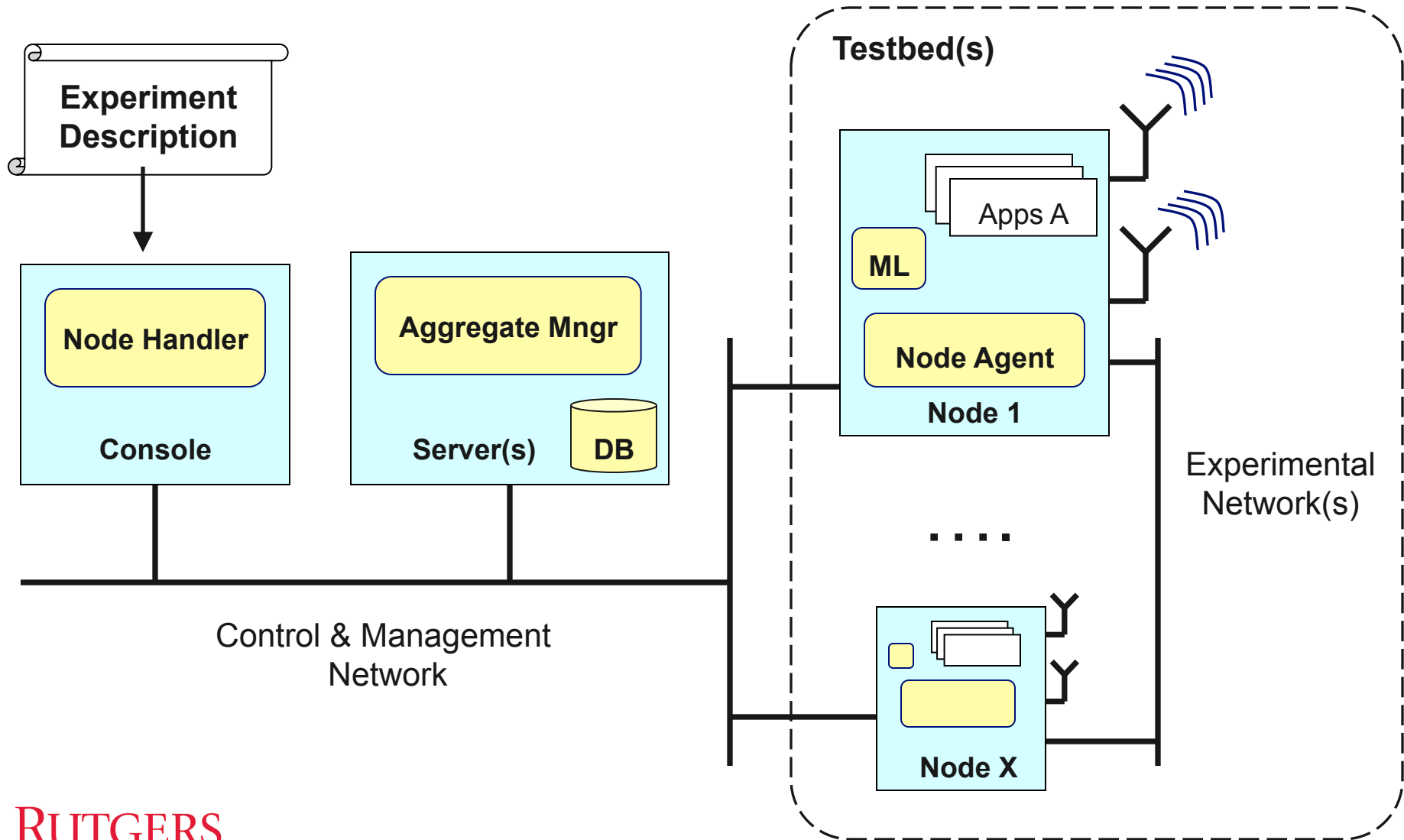
**Center for Research and Technology,
Greece, (under deployment)**



**NICTA
Sydney, Australia**

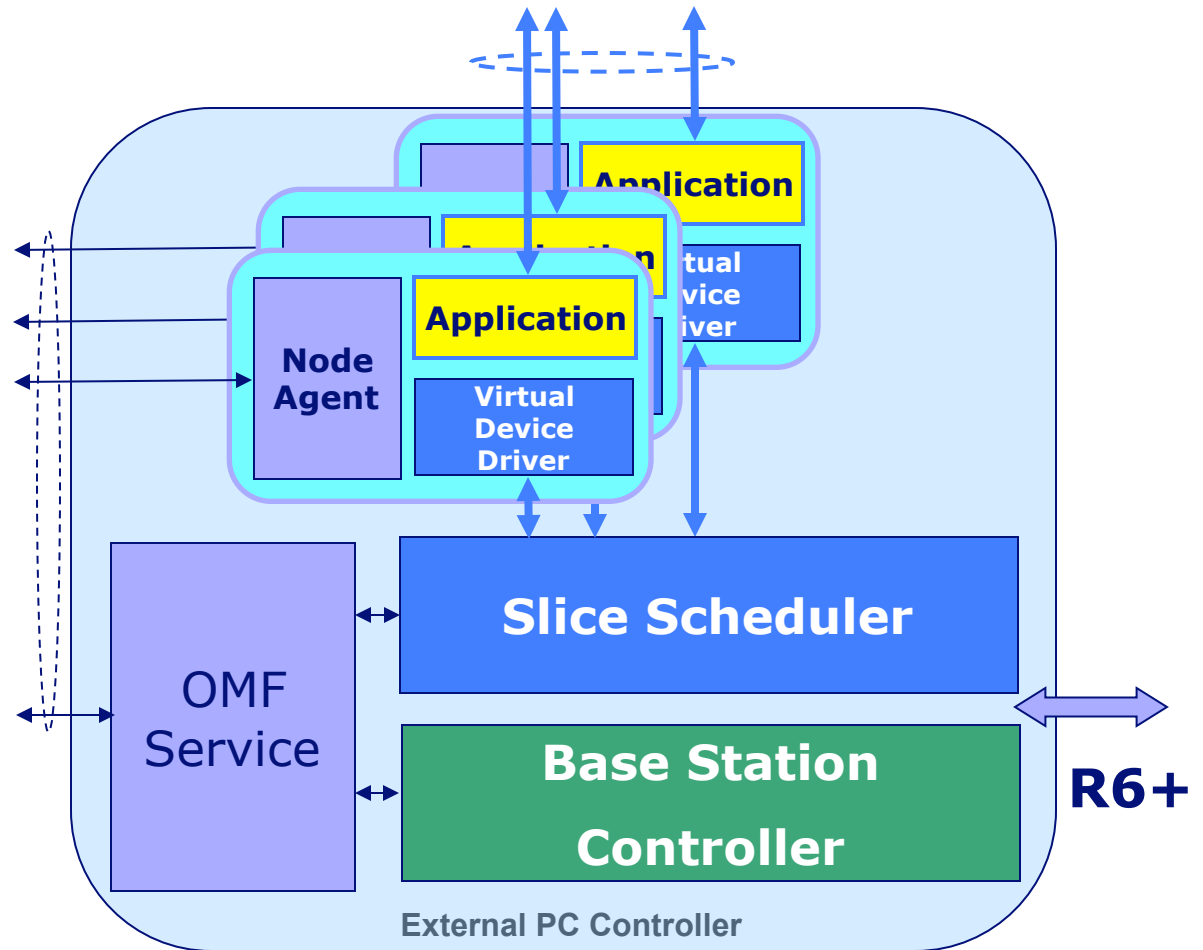


OMF - Operator View



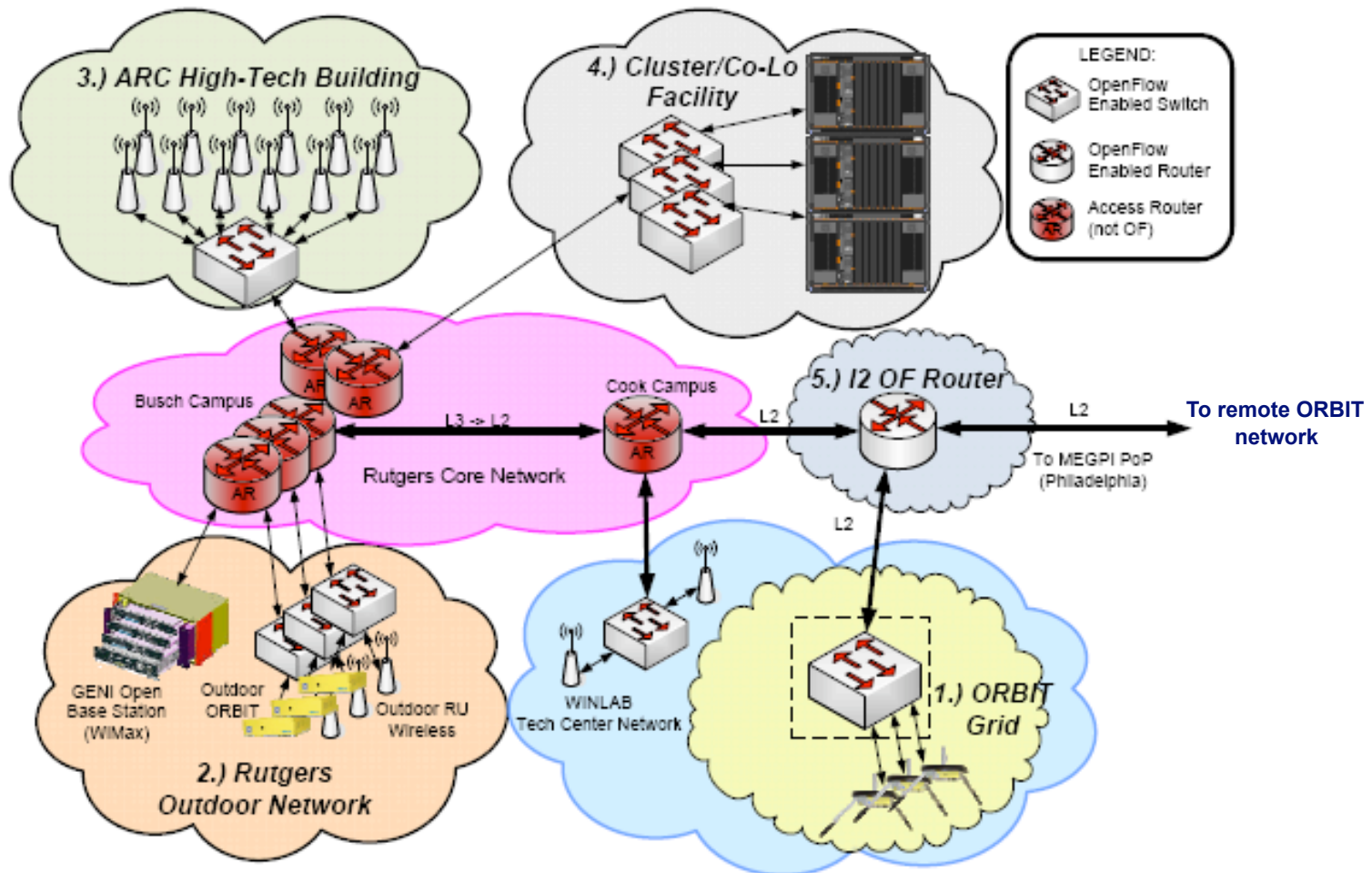
WiMAX Integration with OMF (software)

- OMF service for base station/slice scheduler control
- Node Agent for experiment orchestration support
- (WiMax) virtual device in each sliver



Capability Demonstrated at GEC-4

Layer-2 Horizontal Integration



Capability Demonstrated at GEC-5

Supporting Federation

