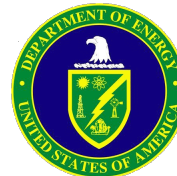


Cyber-Security Challenges for Smart Power Grids

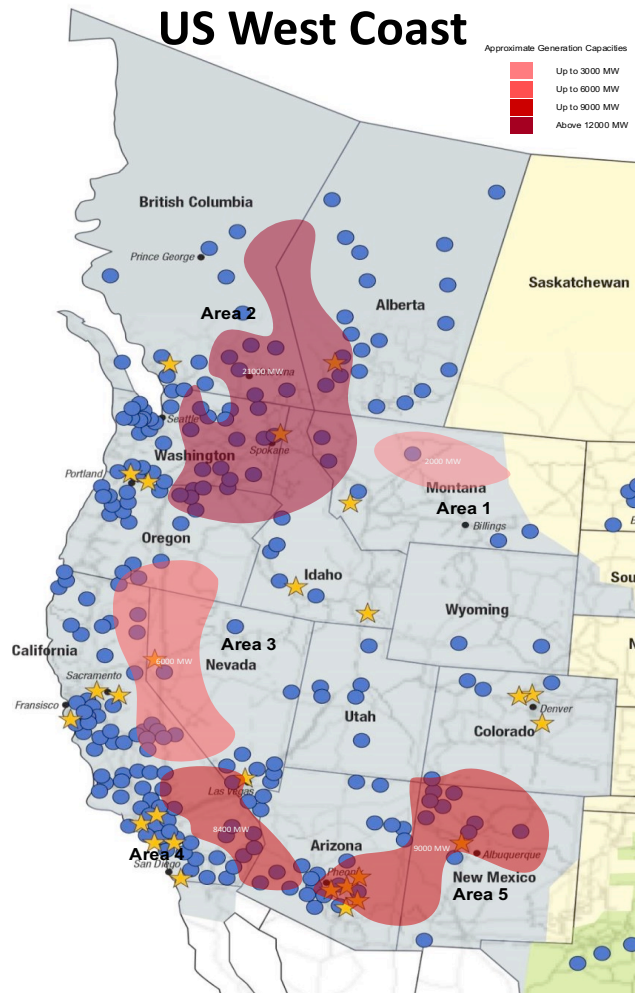
Aranya Chakraborty
North Carolina State University

Internet2 Global Summit

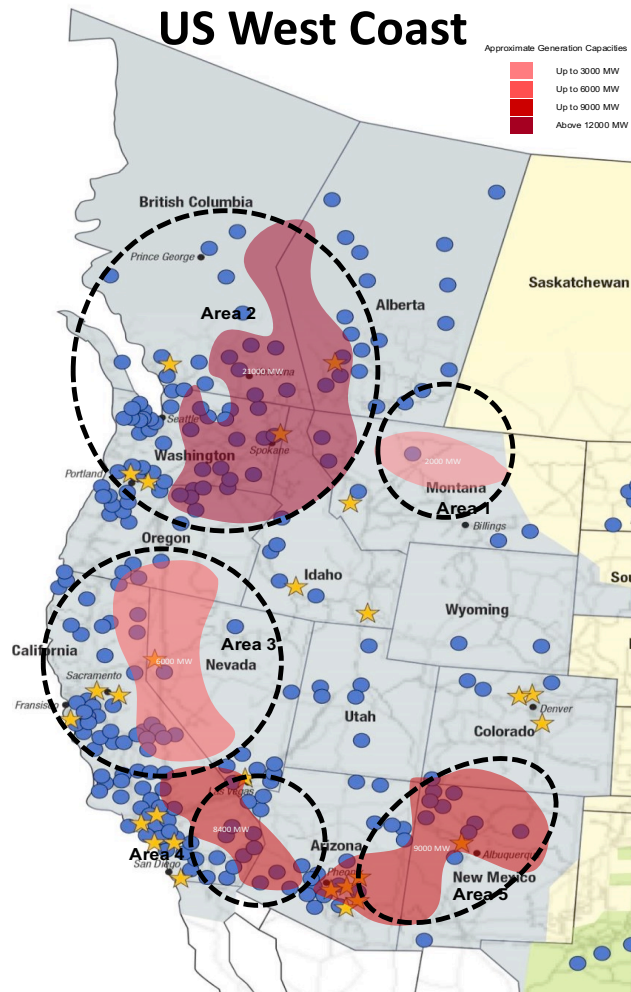
April 26, 2017, Washington DC



Why is Communication So Important for Controlling Power Systems?

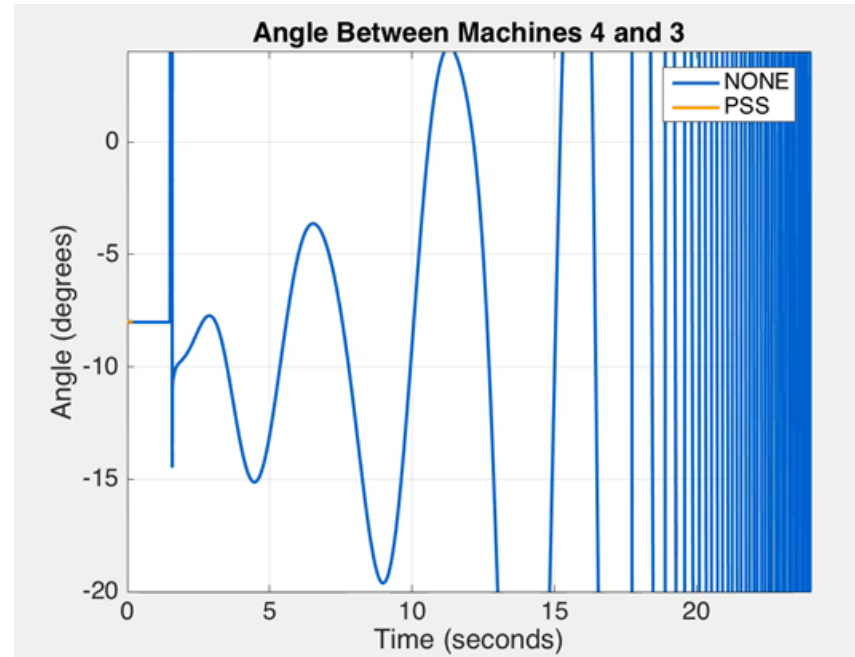
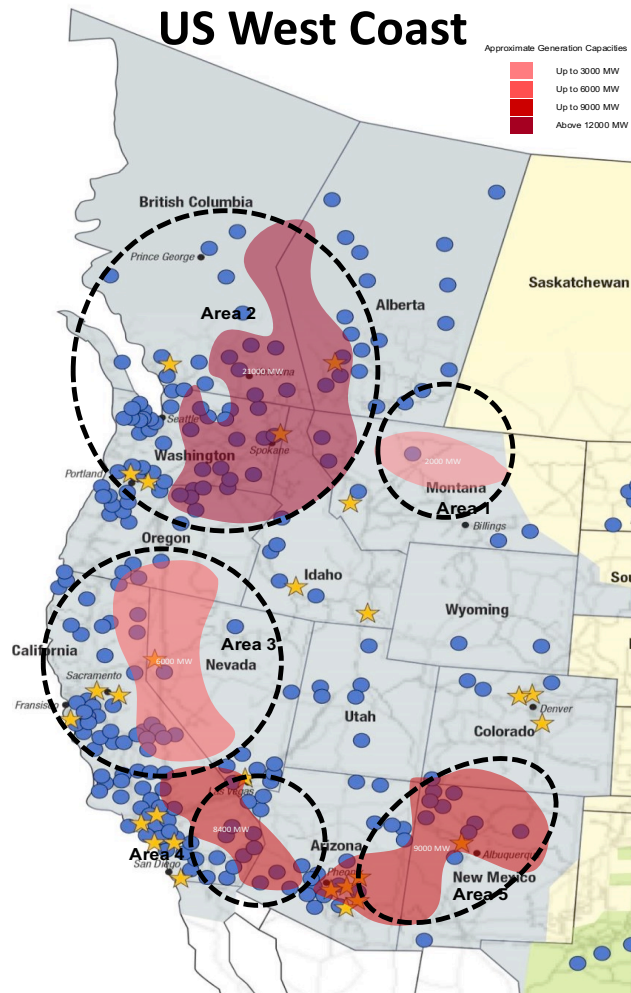


Why is Communication So Important for Controlling Power Systems?

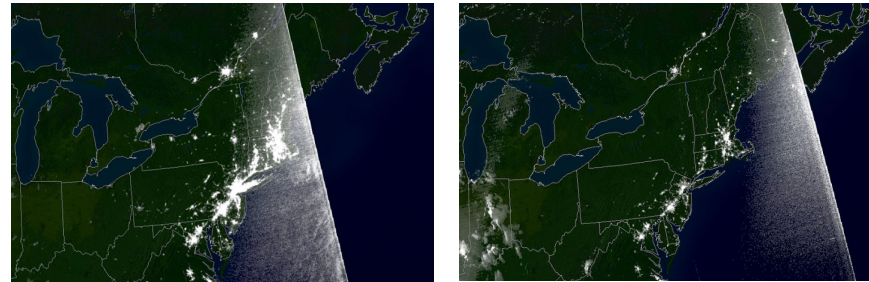
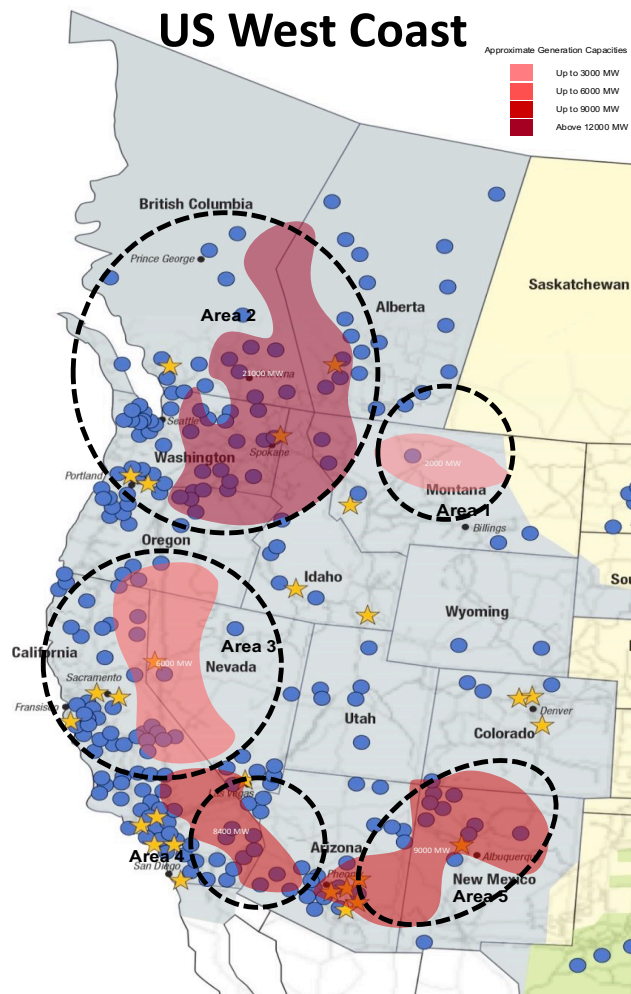


Companies take control actions inside their regions agnostic of the health of other parts of the grid

Why is Communication So Important for Controlling Power Systems?

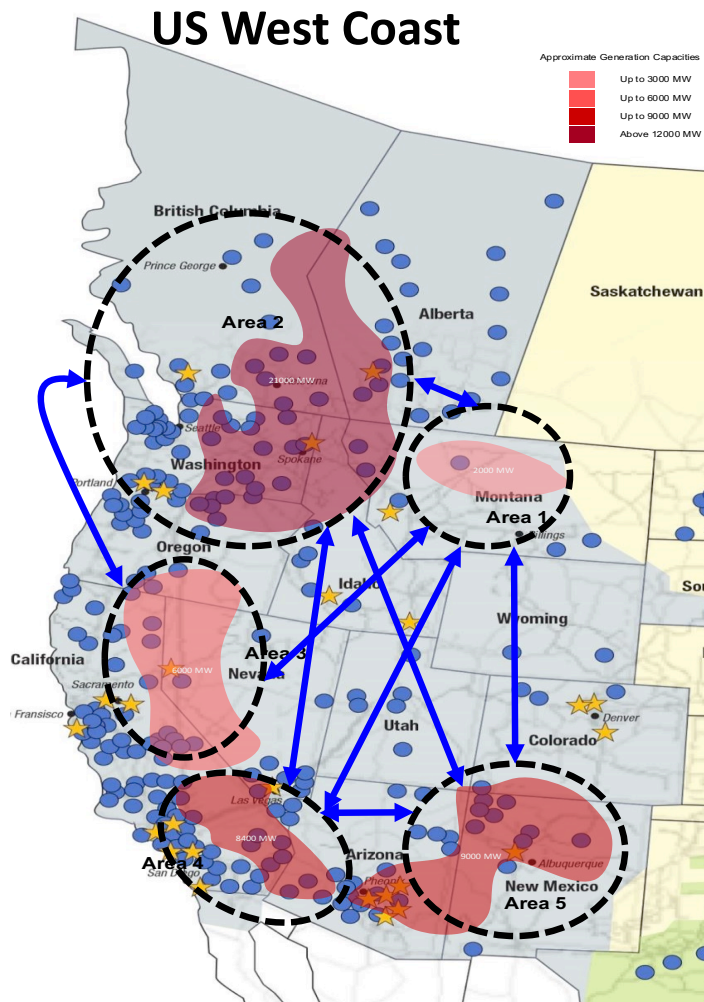


Why is Communication So Important for Controlling Power Systems?

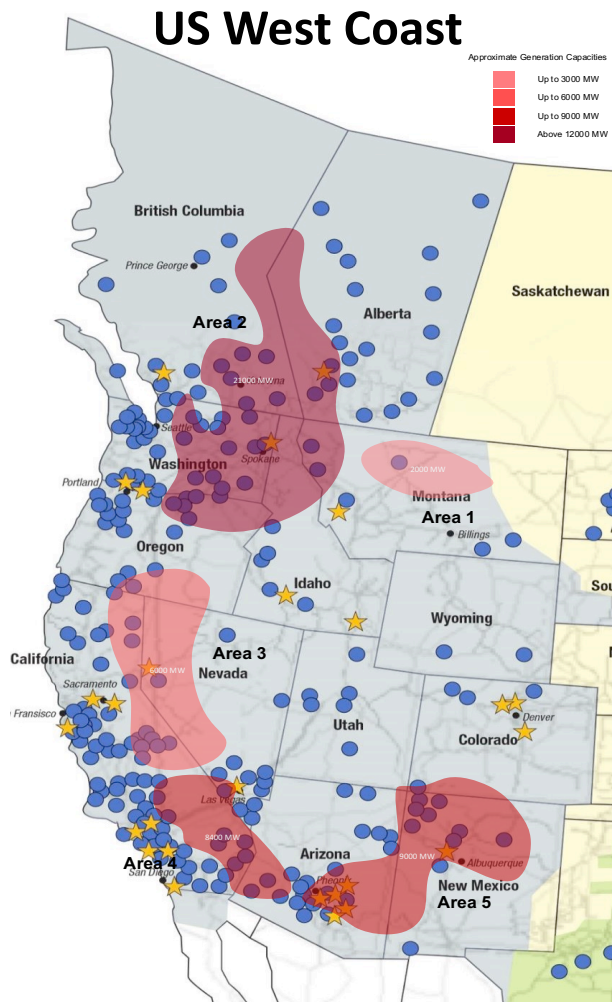


2003 Northeast blackout

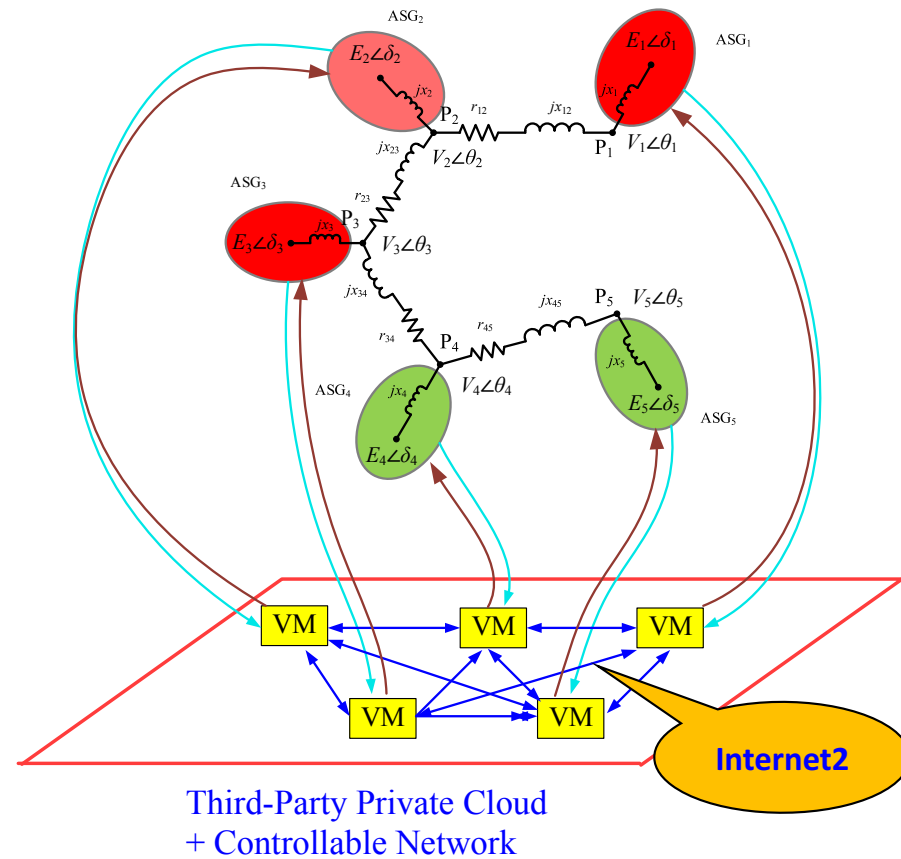
Why is Communication So Important for Controlling Power Systems?



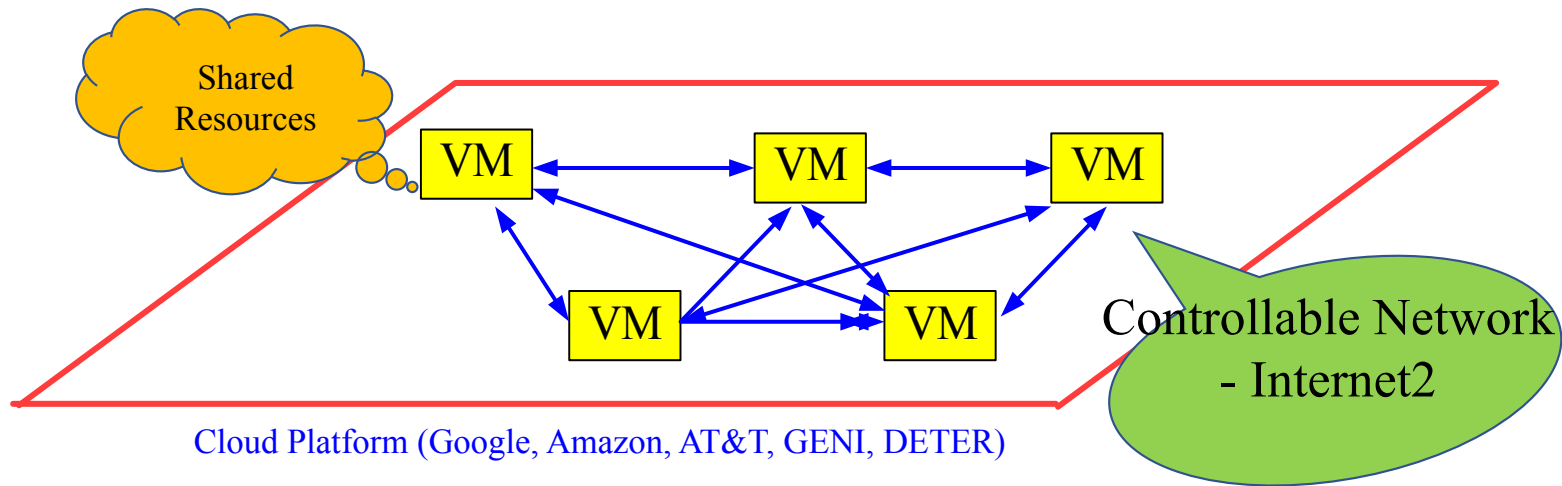
Balancing Regions are Sensitive to Data Privacy!



Close the loop from cloud to grid



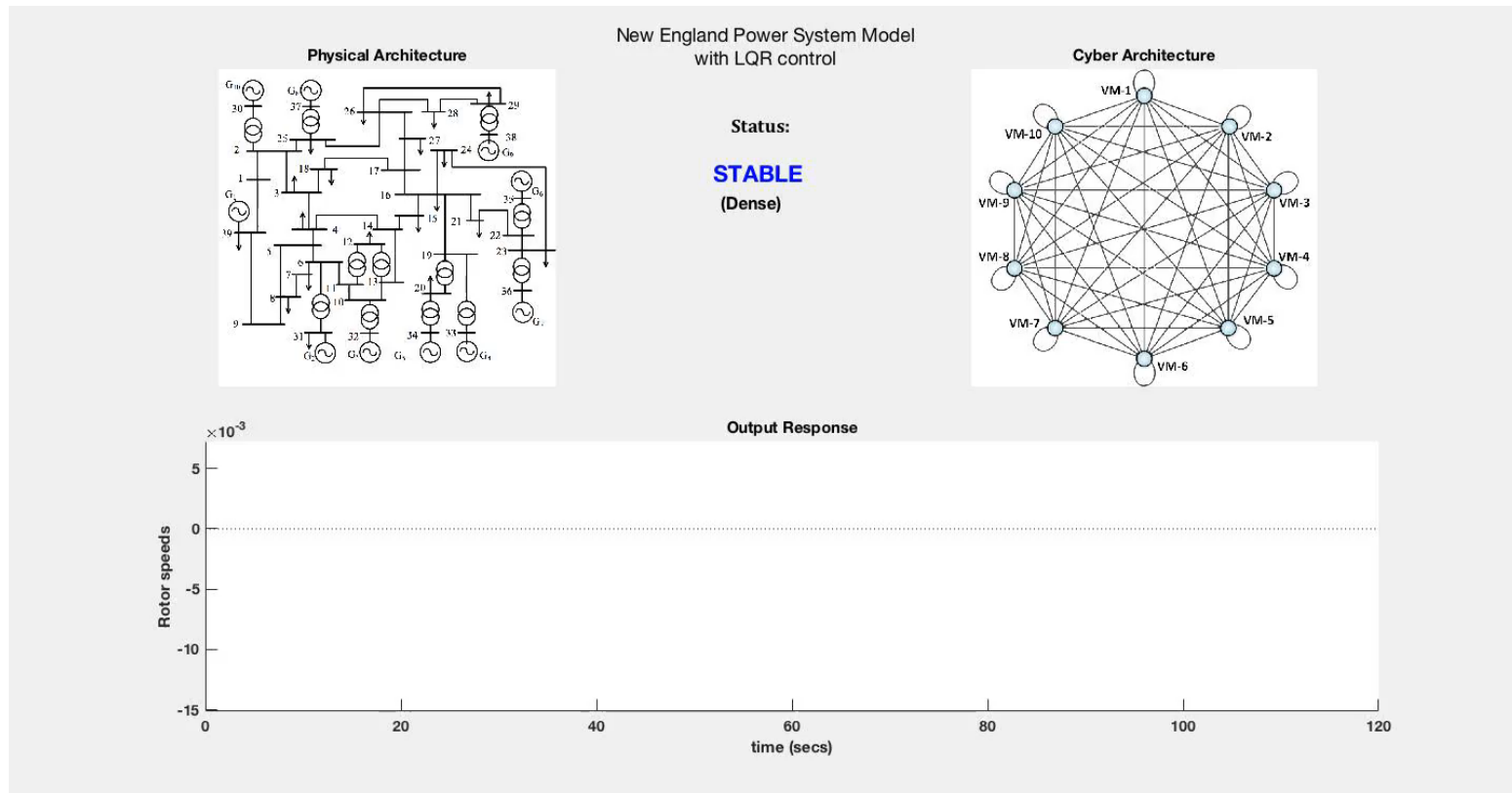
Interesting Things Going on in the Communication Plane



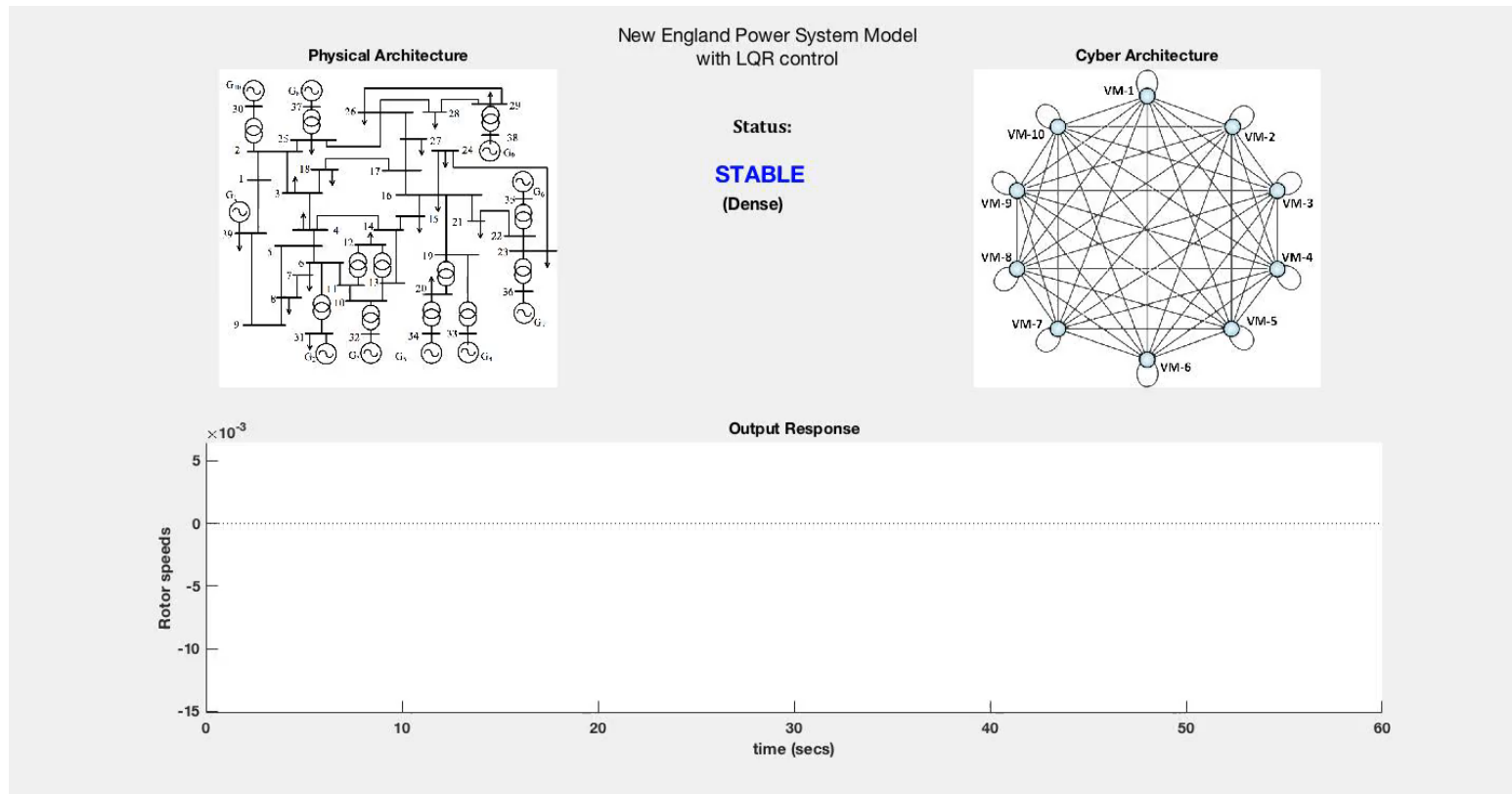
Different types of attacks:

1. Denial-of-Service
2. Data manipulation
3. GPS spoofing
4. Replay attacks

Denial-of-Service Attack

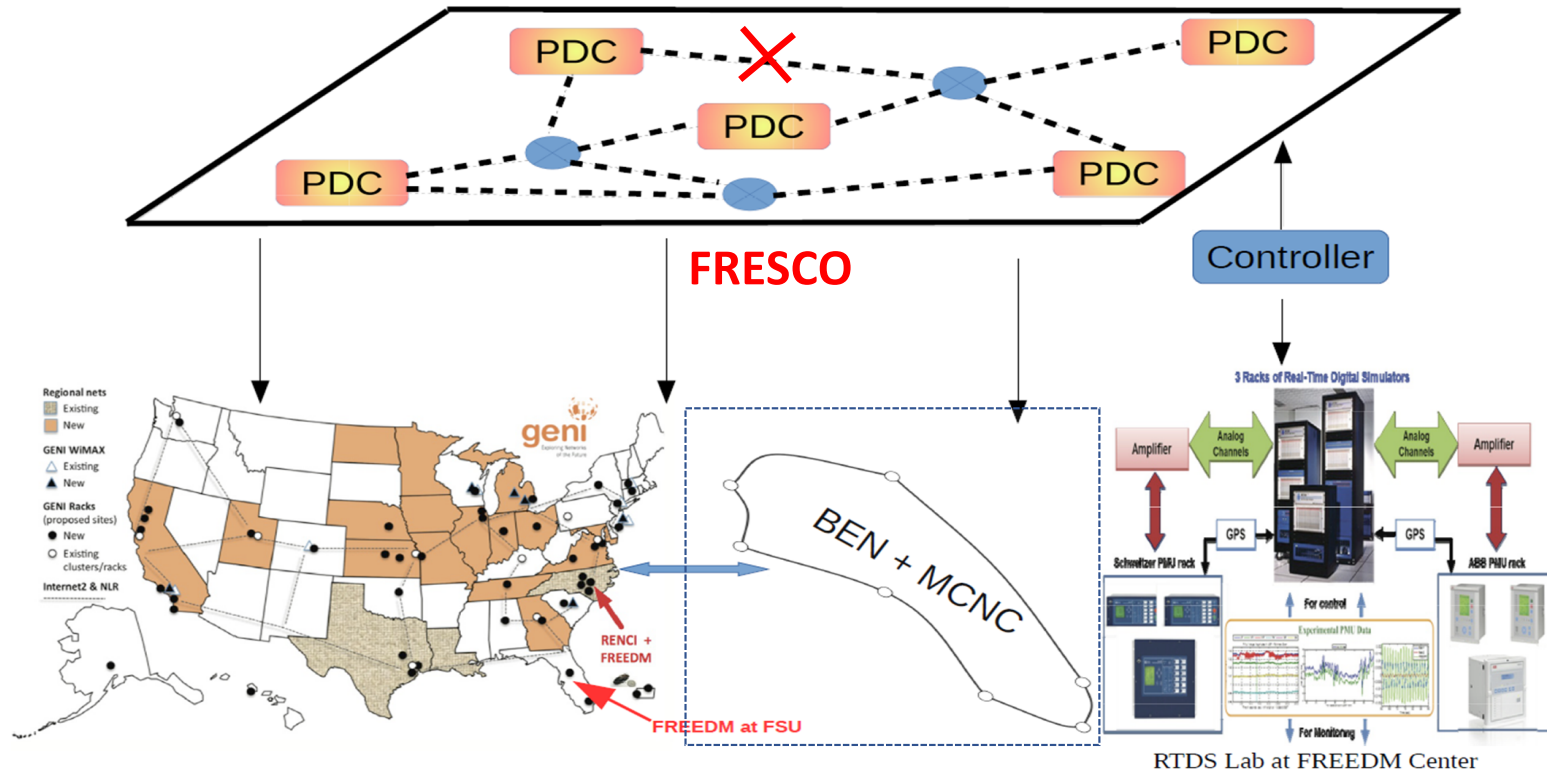


Denial-of-Service Attack



ExoGENI-DETER-WAMS Testbed at NC State

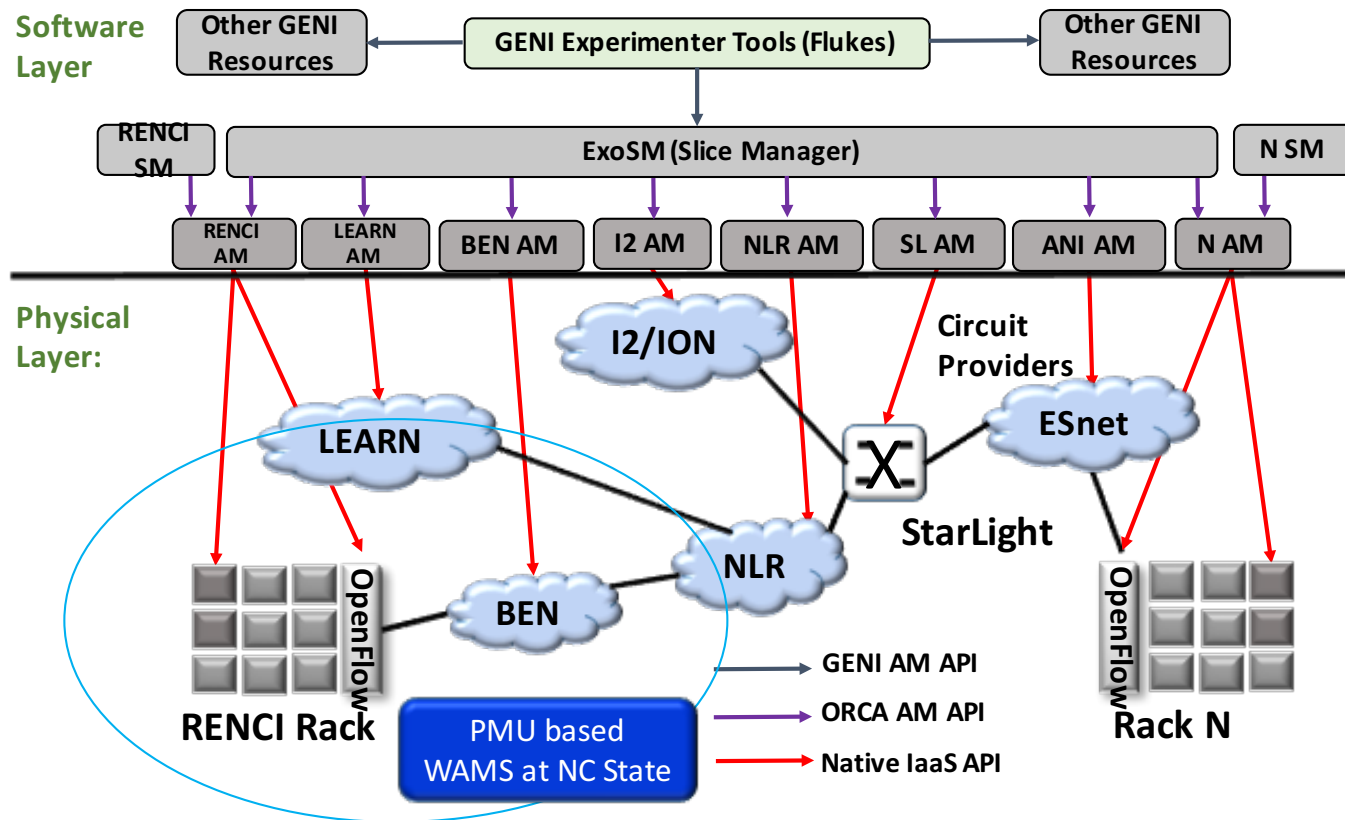
DoS Attack in DETER Testbed



Middleware provided by Green Energy Corporation and RTI

Networked Cloud Computing Testbed - ExoGENI

ExoGENI provides in virtual IaaS services for innovative research on distributed applications for Wide-Area Monitoring and Control (14 rack sites at universities & labs over the US)

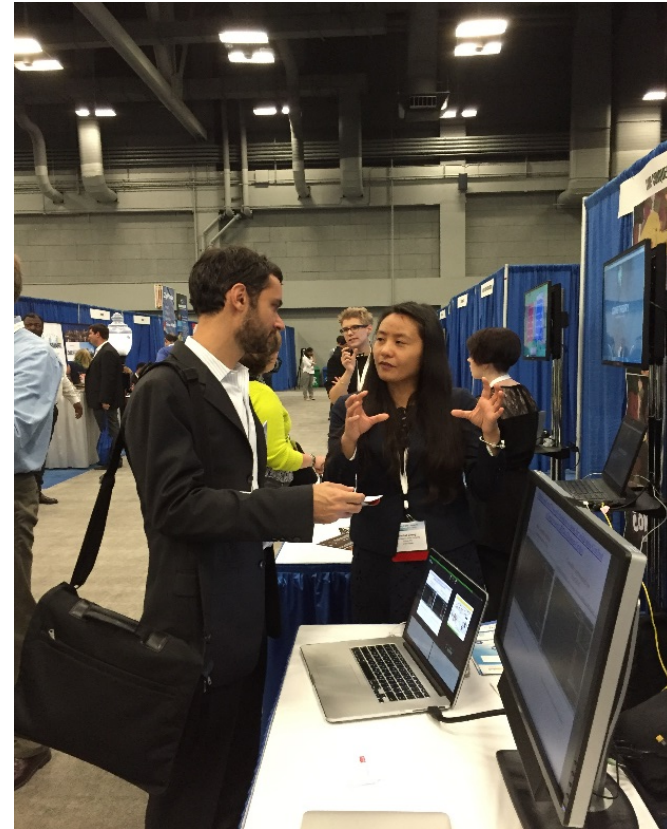


Project Impacts:



DETER Demo at NIST & Smart-America 2014

Best Energy App Award at US Ignite 2015



US Ignite & NIST
Smart Cities Application
Summit, Austin, TX, 2016

Thank You

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