Constellation

Jason Liu @ FIU

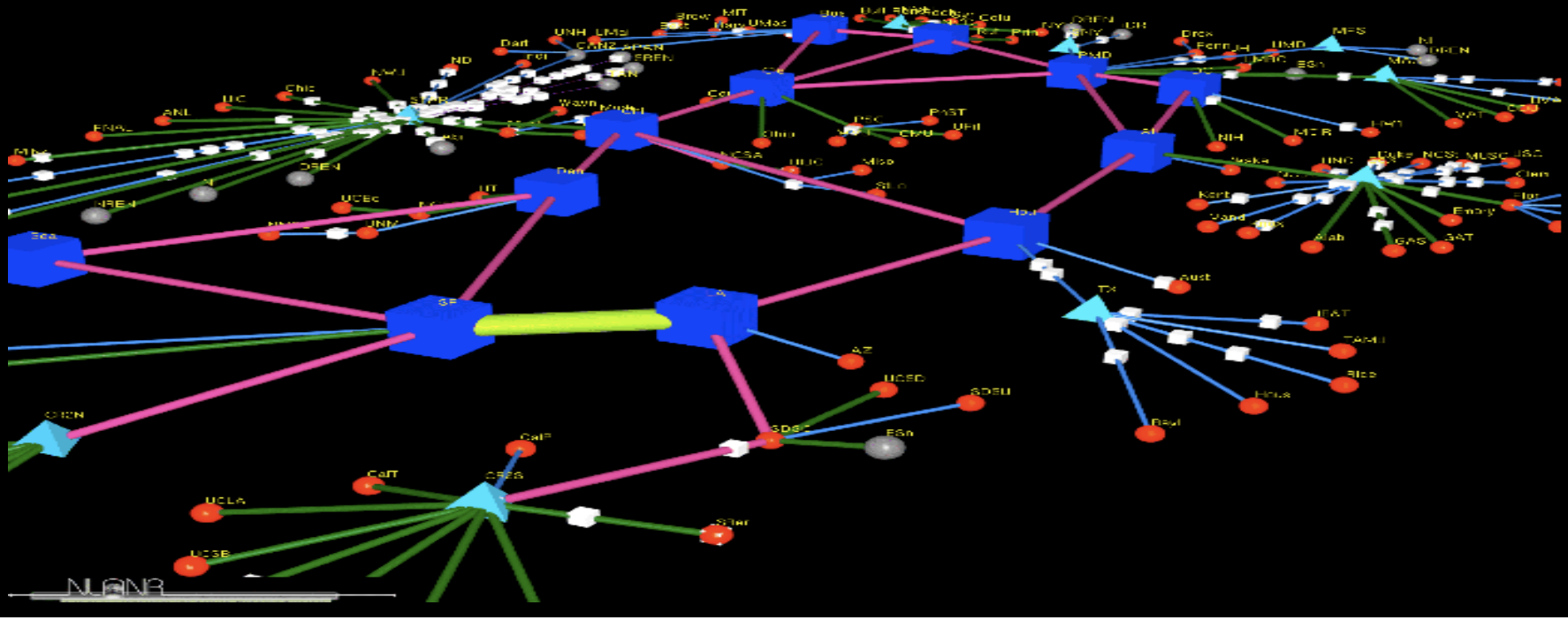
FIU FLORIDA INTERNATIONAL UNIVERSITY

geni Exploring Networks of the Future

NSF

Enable hybrid network experiments on GENI

- Including simulated, emulated, and physical components



Enable hybrid network experiments on GENI

- Including simulated, emulated, and physical components

network experiment at scale
modeling abstraction
fast prototyping
flexible

Enable hybrid network experiments on GENI

- Including simulated, emulated, and physical components

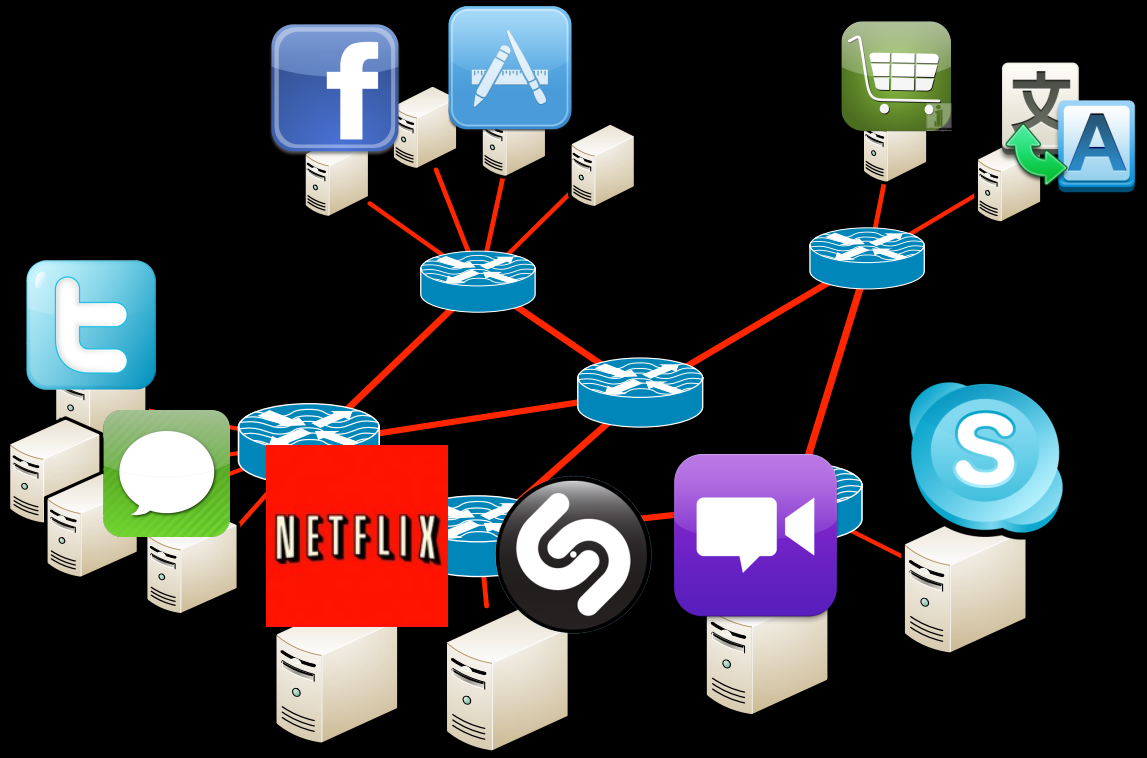
real protocols and applications
real execution environment
resource multiplexing
easily deployable

Enable hybrid network experiments on GENI

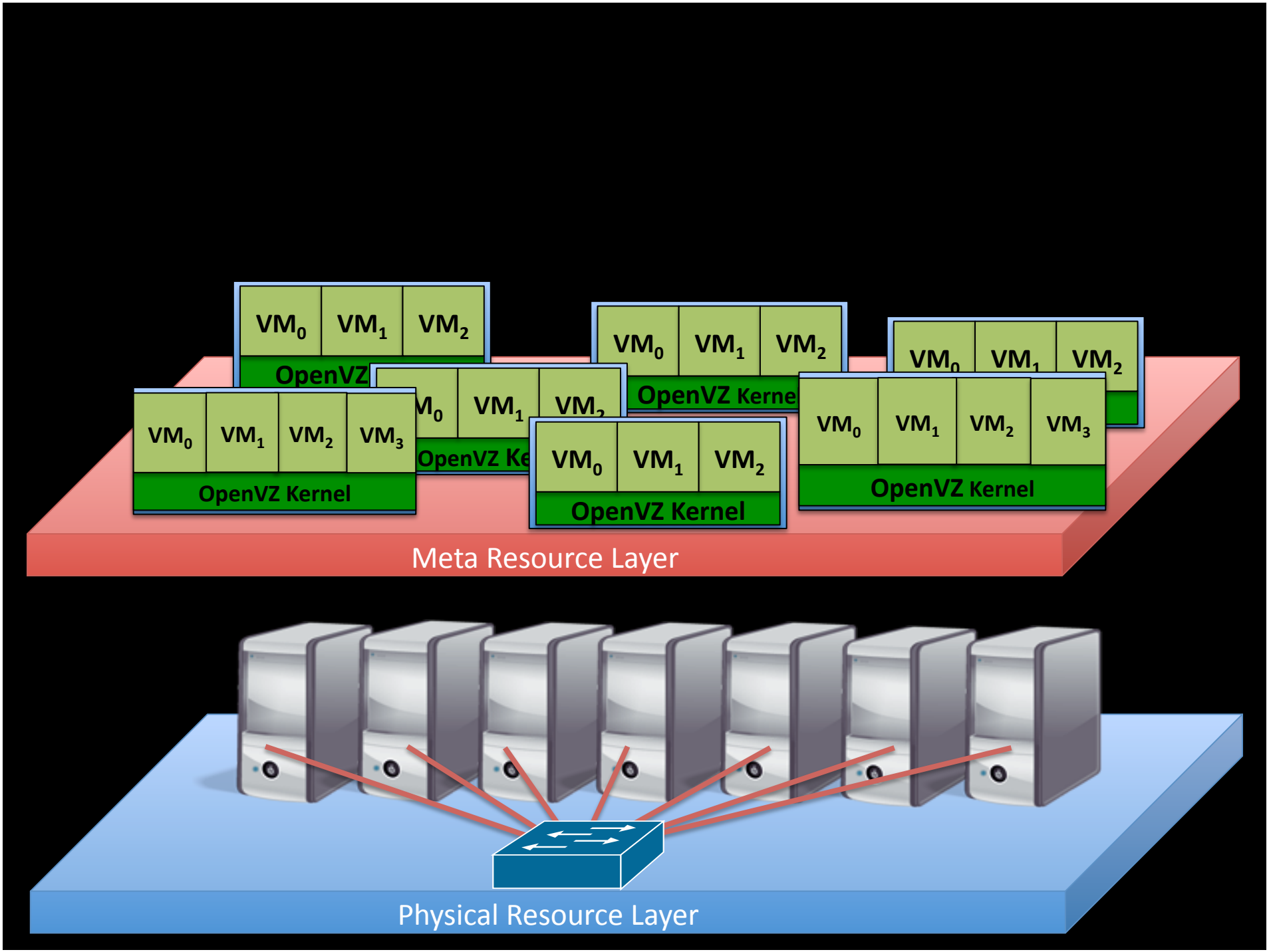
- Including simulated, emulated, and physical components

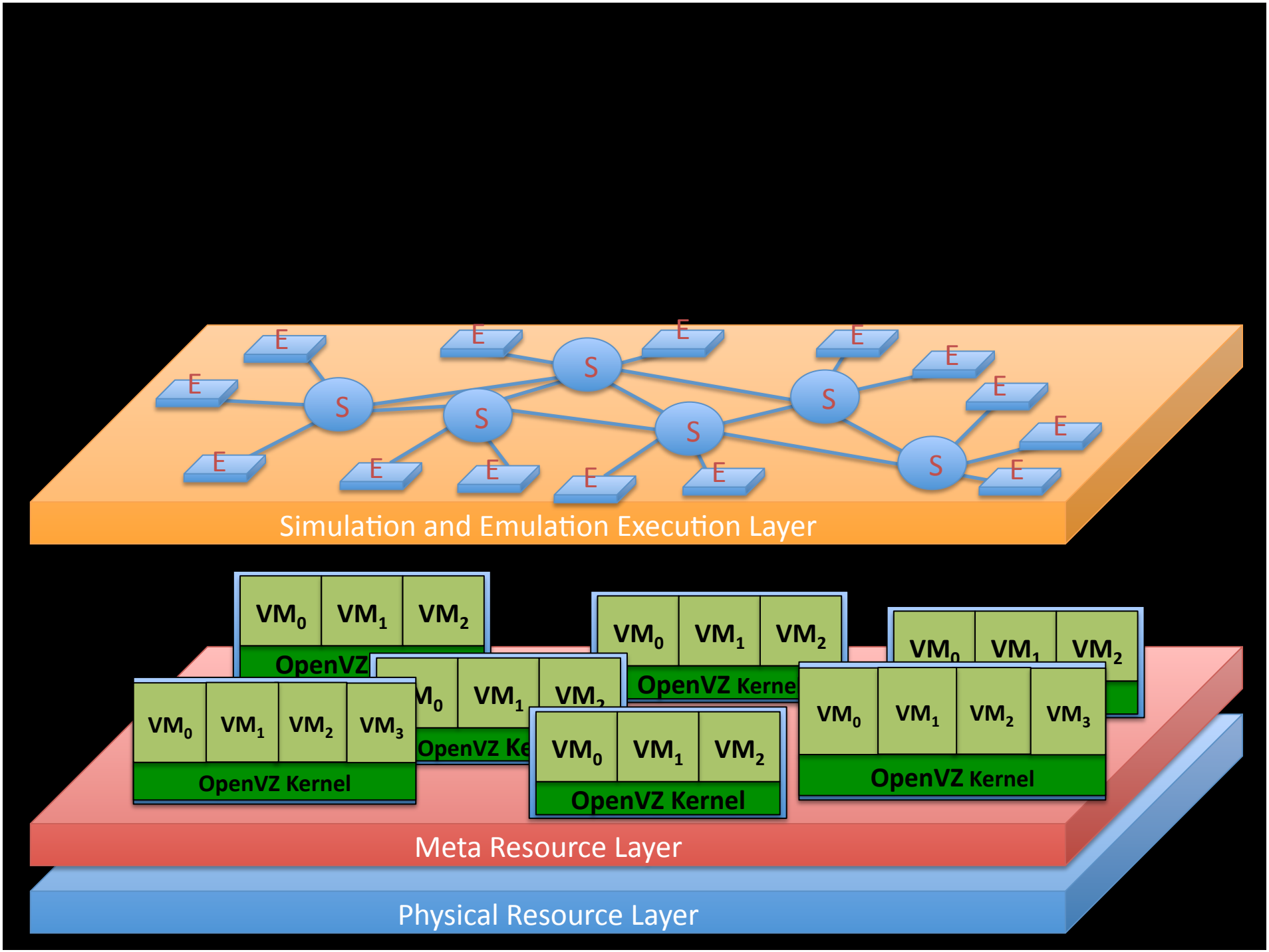
interact with real network
real traffic conditions
real devices

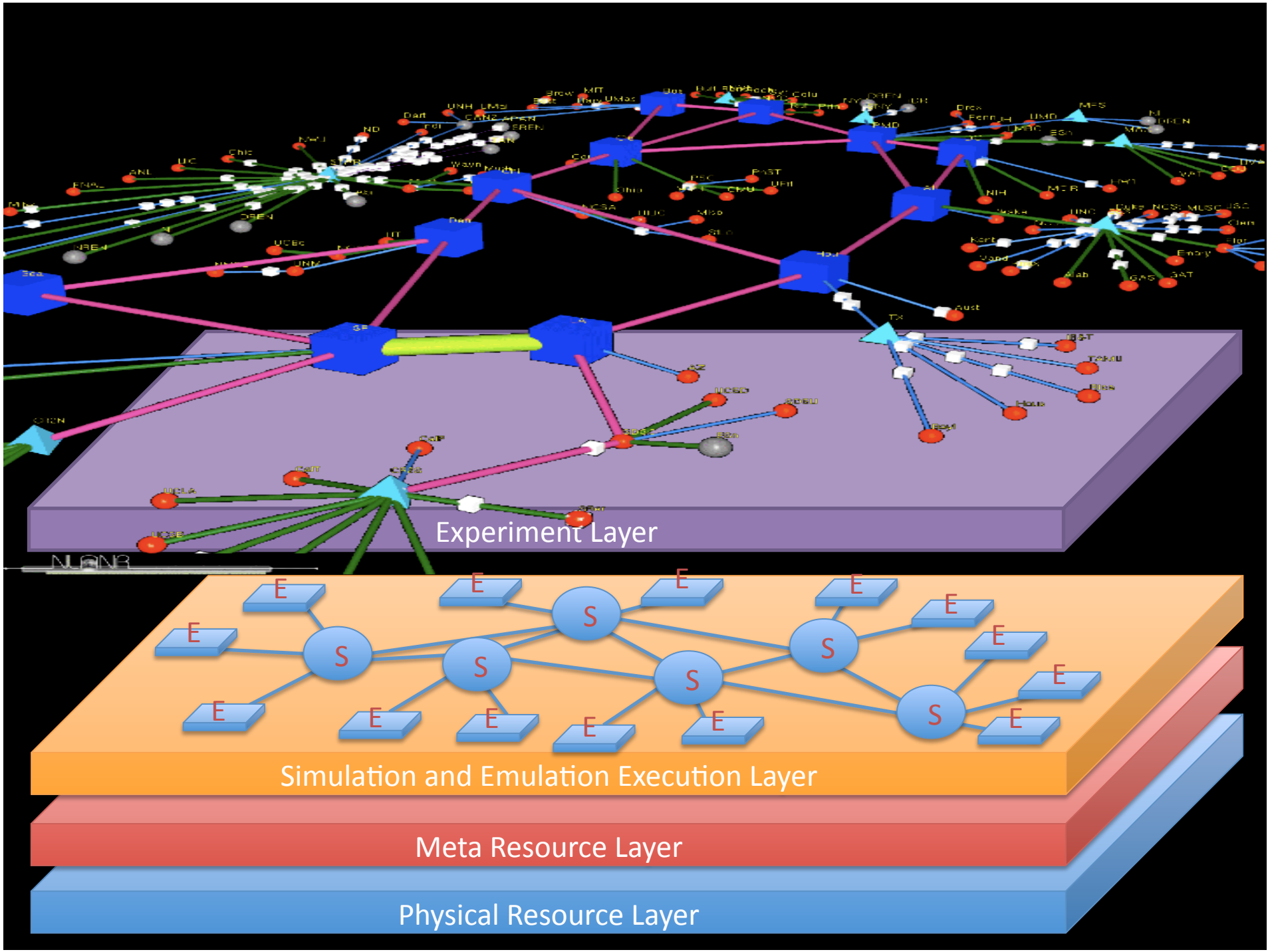
Net App Testbed

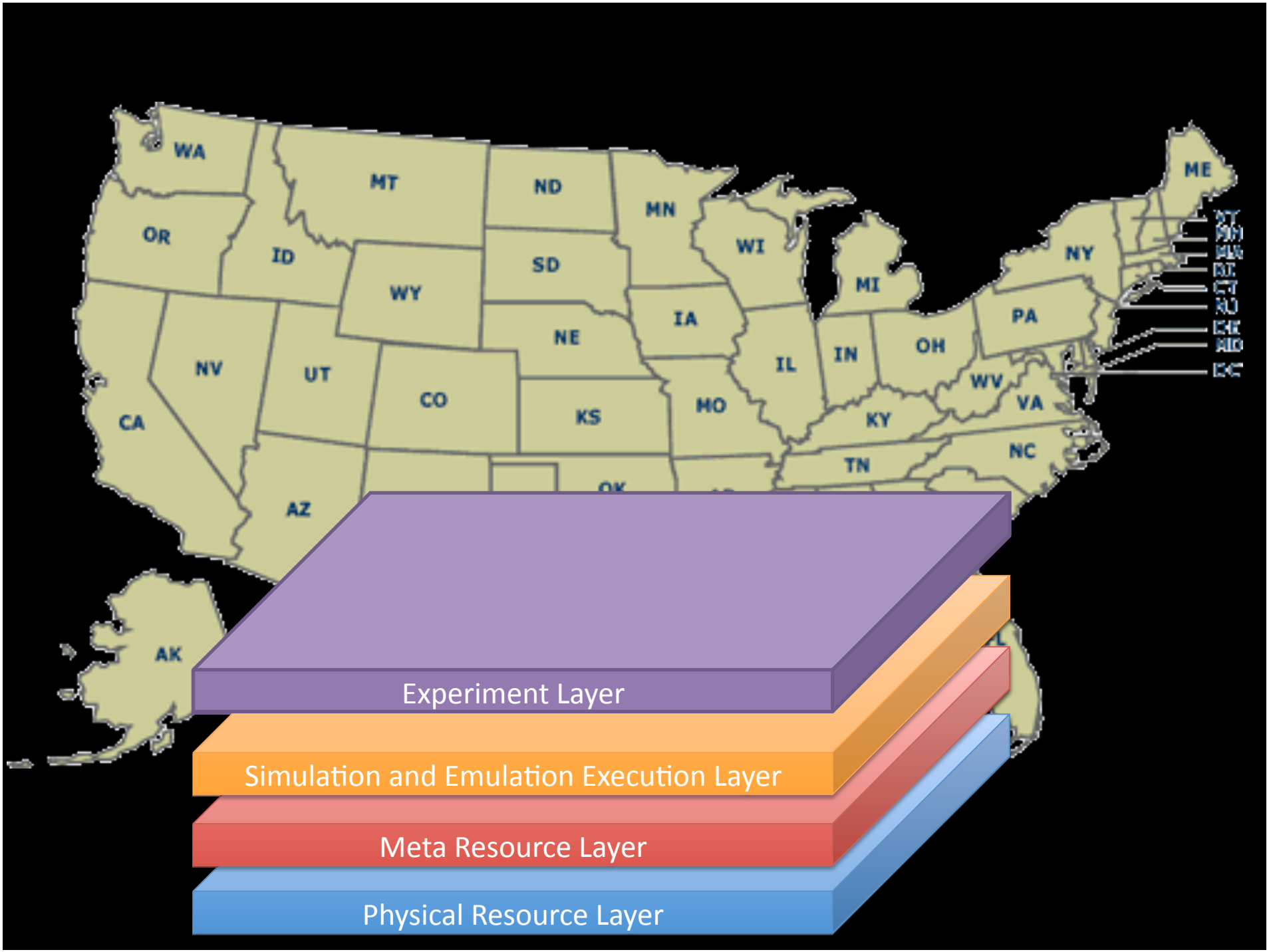


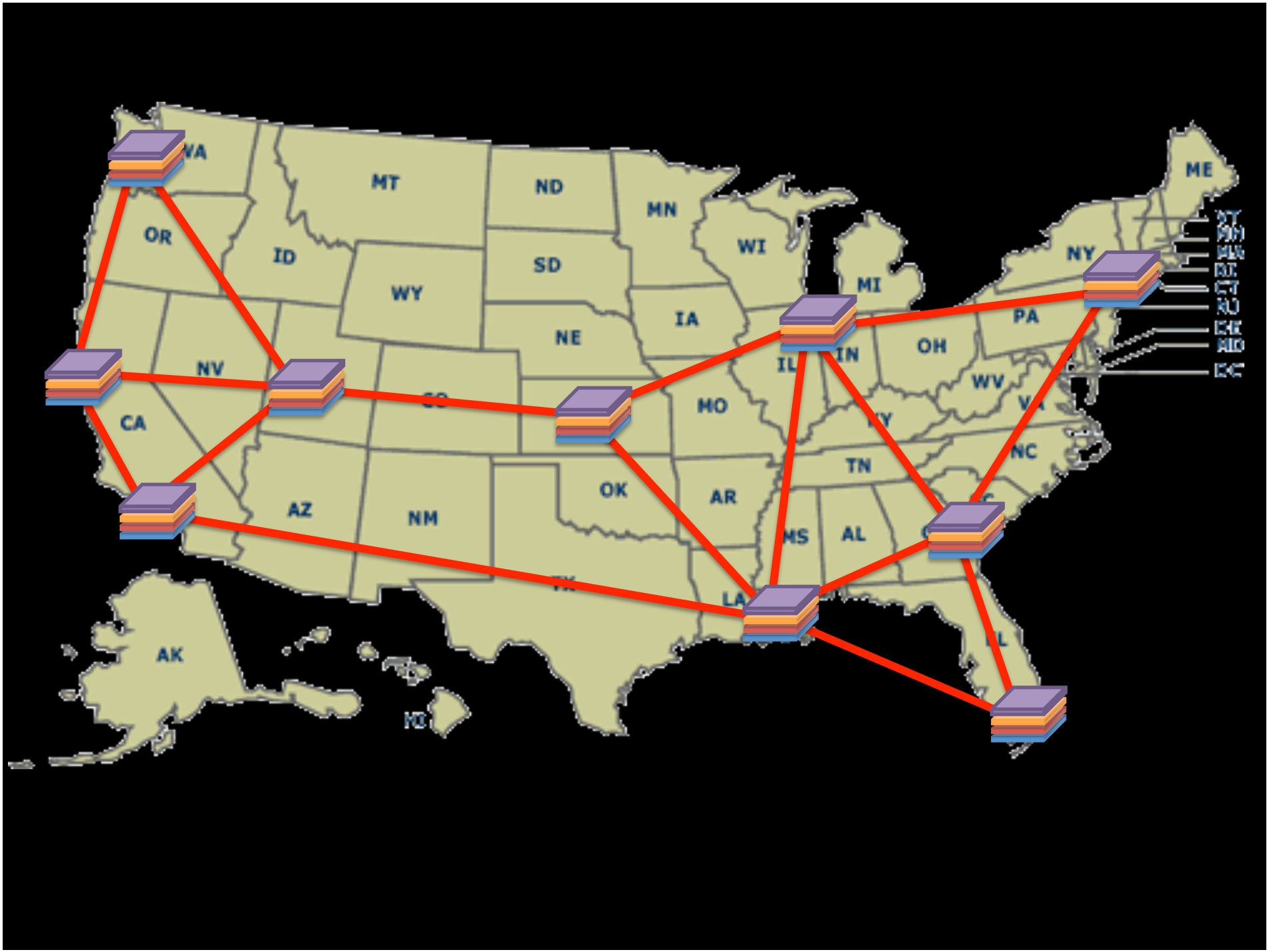
Run *real apps* under simulated network conditions

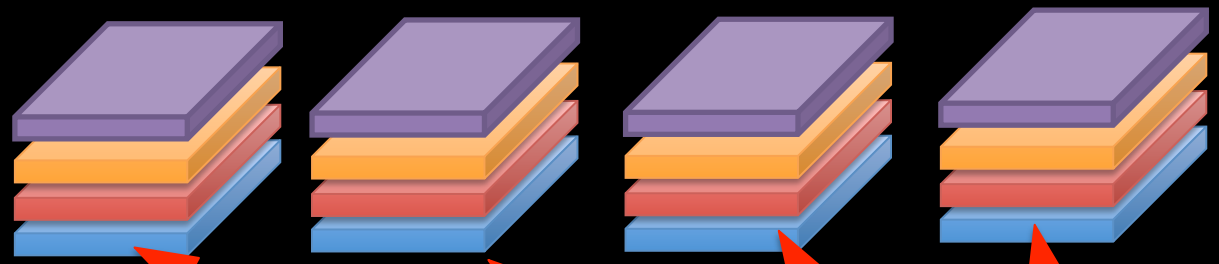

VM0 VM1 VM2
OpenVZ
VM0 VM1 VM2
OpenVZ Kerne
VM0 VM1 VM2
VM0 VM1 VM2 VM3
OpenVZ Kernel
VM0 VM1 VM2
OpenVZ Kernel
VM0 VM1 VM2 VM3
OpenVZ Kernel
Meta Resource Layer
Physical Resource Layer


E
S
Simulation and Emulation Execution Layer
VM0
VM1
VM2
VM3
OpenVZ Kernel
Meta Resource Layer
Physical Resource Layer


Experiment Layer
E
S
Simulation and Emulation Execution Layer
Meta Resource Layer
Physical Resource Layer


WA
MT
ND
MN
OR
ID
SD
WI
MI
NY
ME
WY
PA
NE
IA
IL
IN
OH
NV
UT
CO
KS
MO
WV
VA
CA
KY
TN
NC
AZ
AK
Experiment Layer
Simulation and Emulation Execution Layer
Meta Resource Layer
Physical Resource Layer

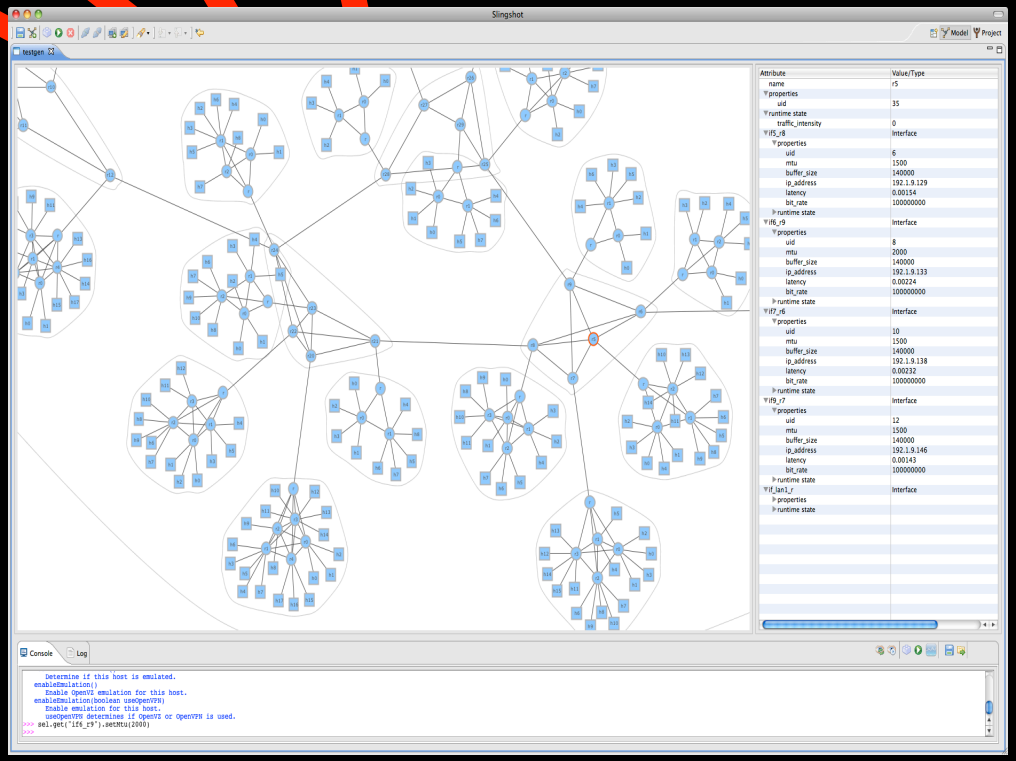

MT
ND
MN
OR
ID
SD
WI
MI
WY
NY
ME
IA
NE
PA
NV
IL
IN
OH
WV
CA
MO
TN
NC
OK
AR
AZ
NM
MS
AL
LA
AK
HI



Slingshot

Manage the *life cycle* of network experiments

- model configuration
- resource specification
- deployment & execution
- online control & monitoring



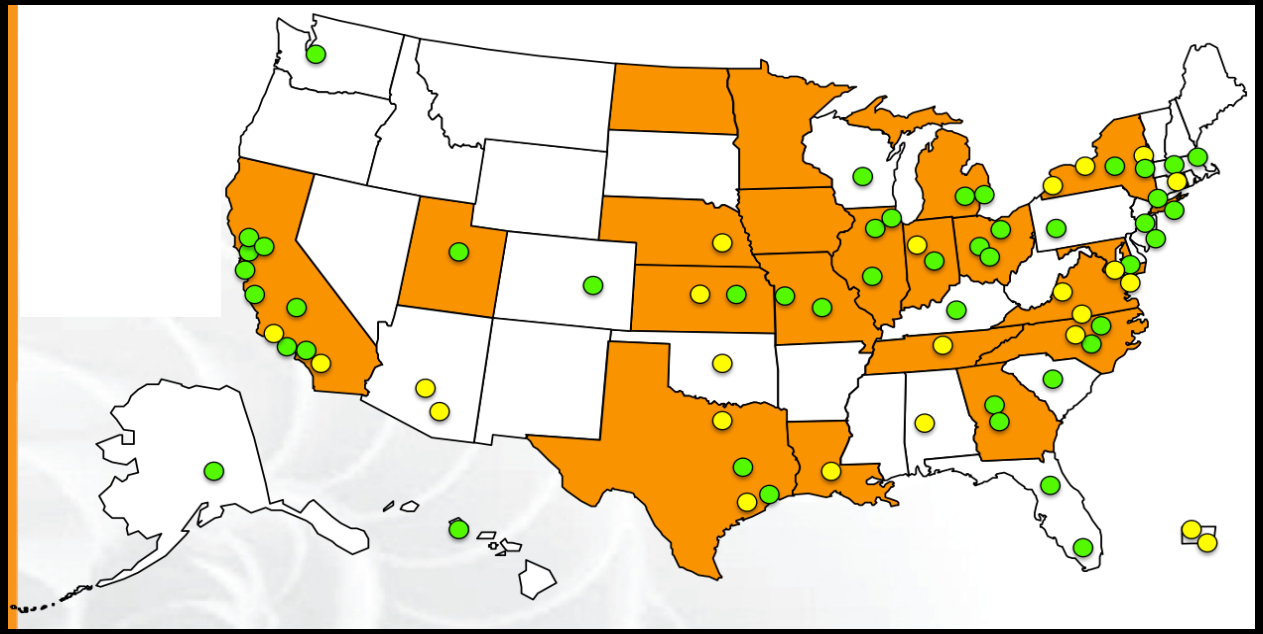
PrimoGENI in a Nutshell

- **Hybrid** experimentation (simulated, emulated, physical network entities)
- **At-scale** experimentation (large-scale simulation, virtualization)
- IDE (slingshot) to manage experiment life cycle
- PrimoGENI runs on ProtoGENI resources

Constellation

Area 1: Support for Distributed and Heterogeneous GENI Resources

- Local machine
- Compute cluster
- ProtoGENI slices
- ExoGENI racks
- InstaGENI racks
- OpenFlow switches



Source: GPO

Area 2: Streamlined ***slingshot*** for At-Scale Experimentation

- Incorporate GENI workflow and existing experimenter tools (e.g., Flack, OMNI, …)
  - PGC can be viewed as an additional layer of virtualization
  - Can be embedded in the existing tool chain
- Descriptive and extensive network constructs
  - "Generate TCP flows at given arrival rate from A to B"
  - "Disable this link at time T"
- Incorporate open model databases and public repositories for reuse and verification

Area 3: Support for High-Impact Applications

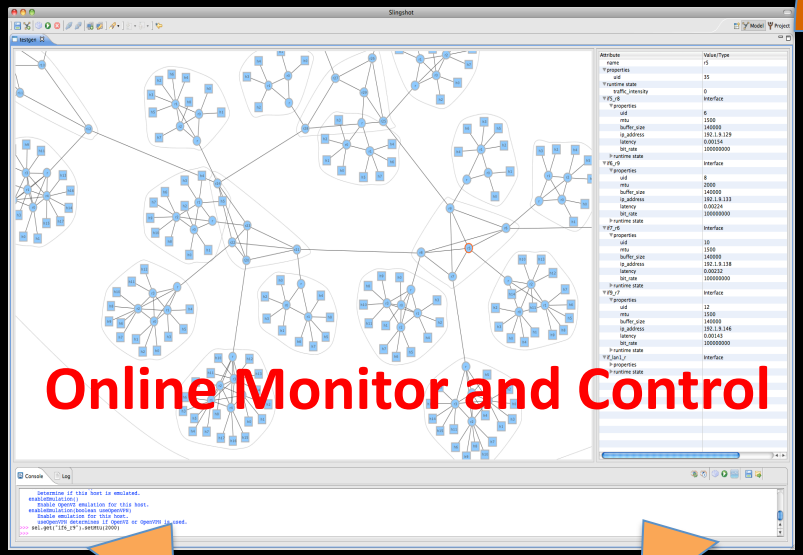
- Interoperate with OpenFlow networks
  - Hybrid testing of SDN applications
  - Large-scale!!
- Target clean-slate FIA design
  - e.g., MobilityFirst in-network cache-and-forward, storage-aware routing
  - Interoperability!!

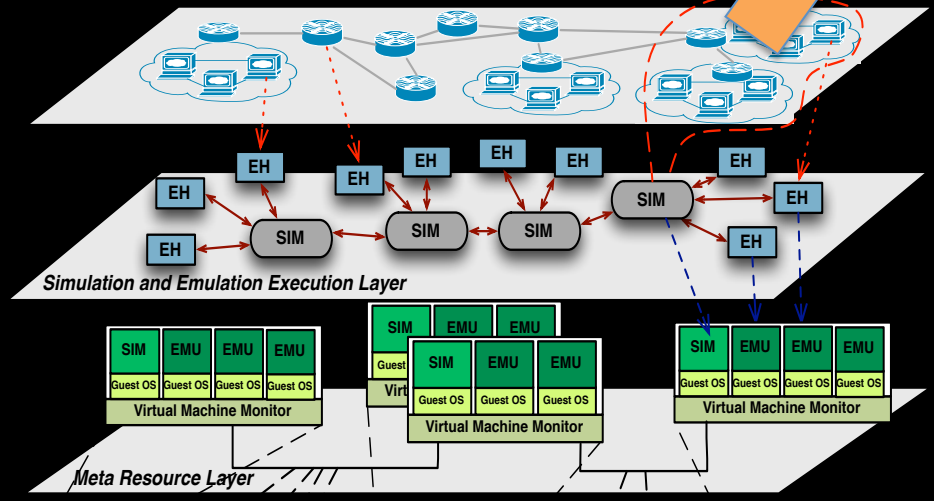
PGC Life Cycle

Experiment Data
Public Repository

Deploy and Execute

Slingshot





Model Database
Public Repository

Model Configuration

Resource
Specification

Constellation

It’s coming. Stay tuned!