



# PrimoGENI Tutorial

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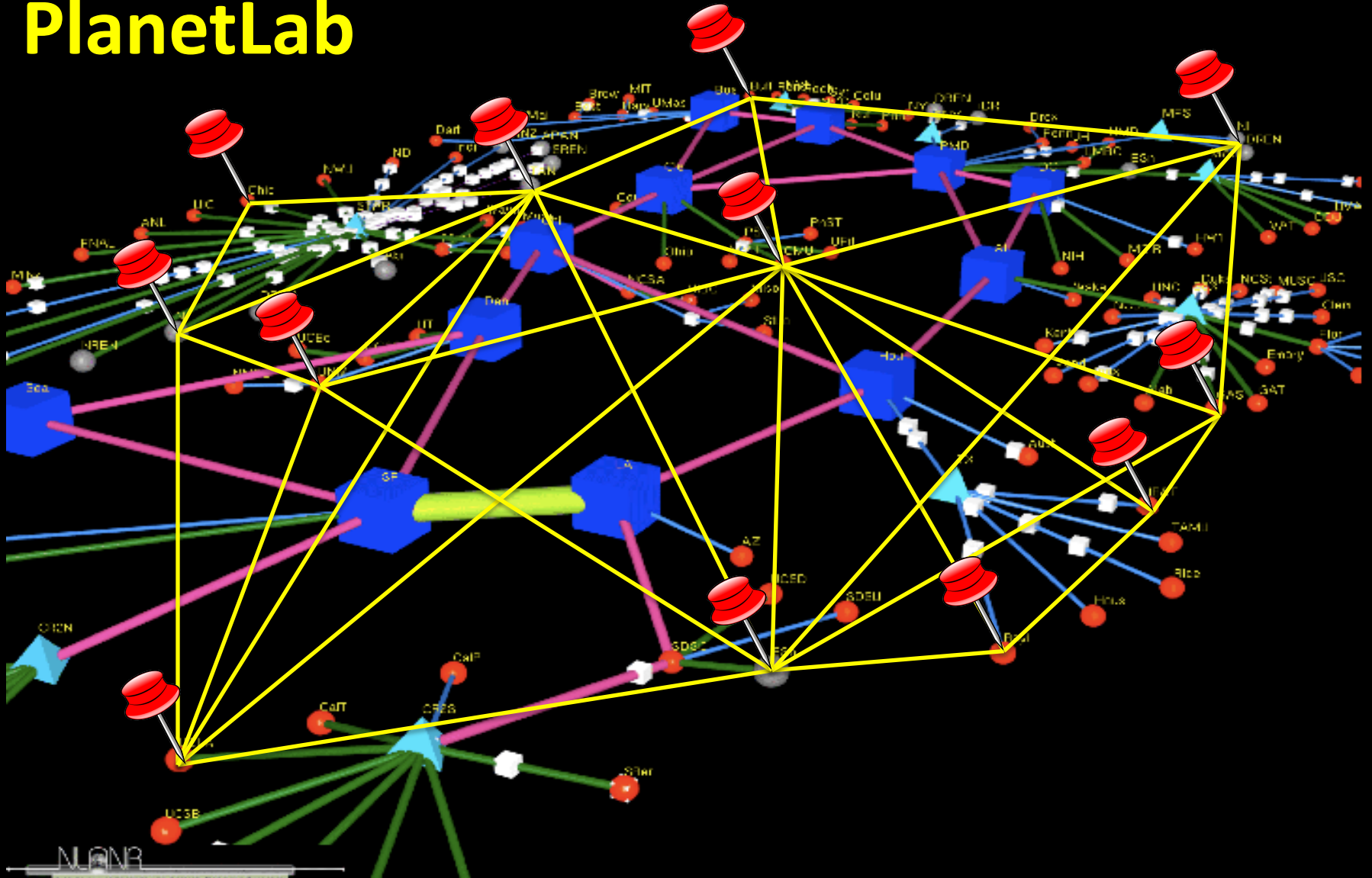
Other project participants: Julio Ibarra and Heidi Alvarez



# Outline

- Introduction
- Setup (in parallel)
- Demo and hands-on

# PlanetLab

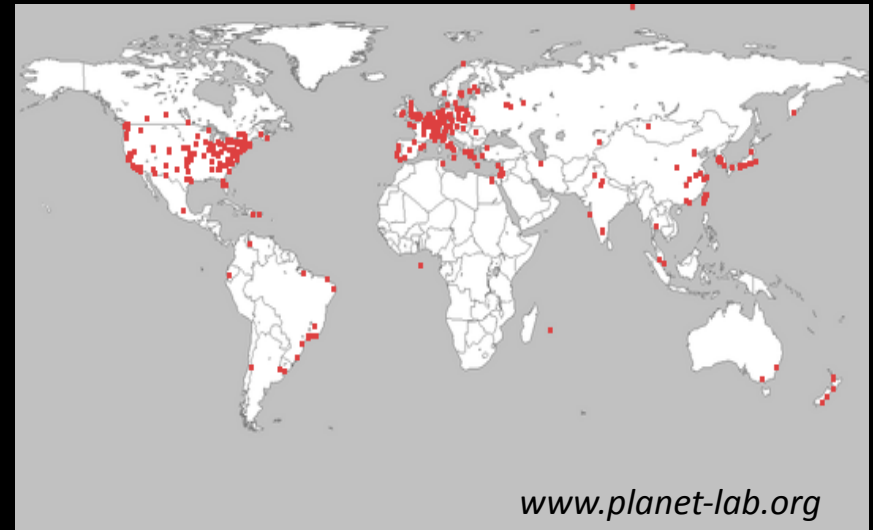


# PlanetLab

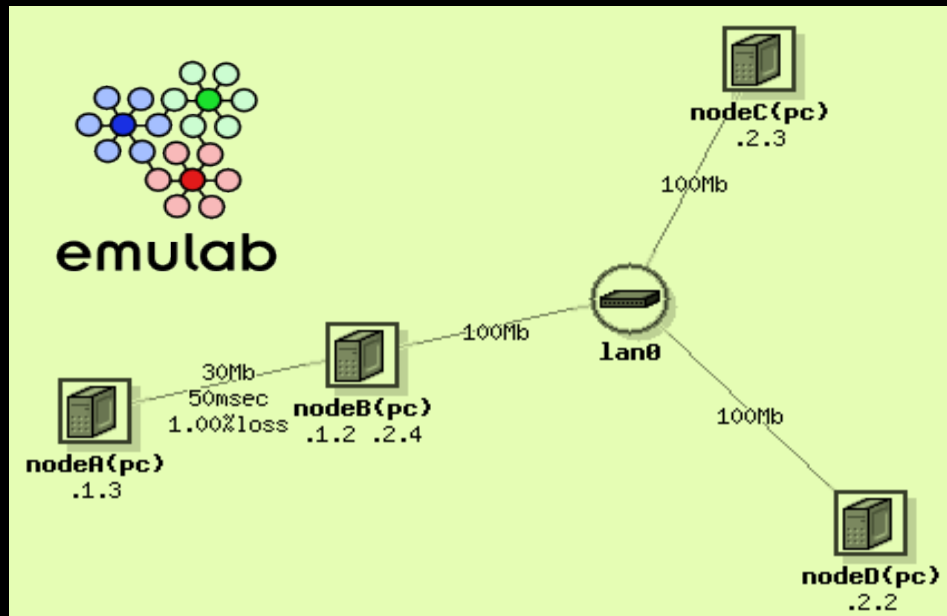
- In vitro experimentation
- Life traffic and conditions
- Sharing via virtualization

# PlanetLab

- Limited size?
  - *1090 nodes at 516 sites (3/12/11)*
- Heavy use?
  - *Limited availability?*
  - *Accuracy?*
- One instance of Internet
  - *Limited control*
  - *Sampling bias?*



# Emulation

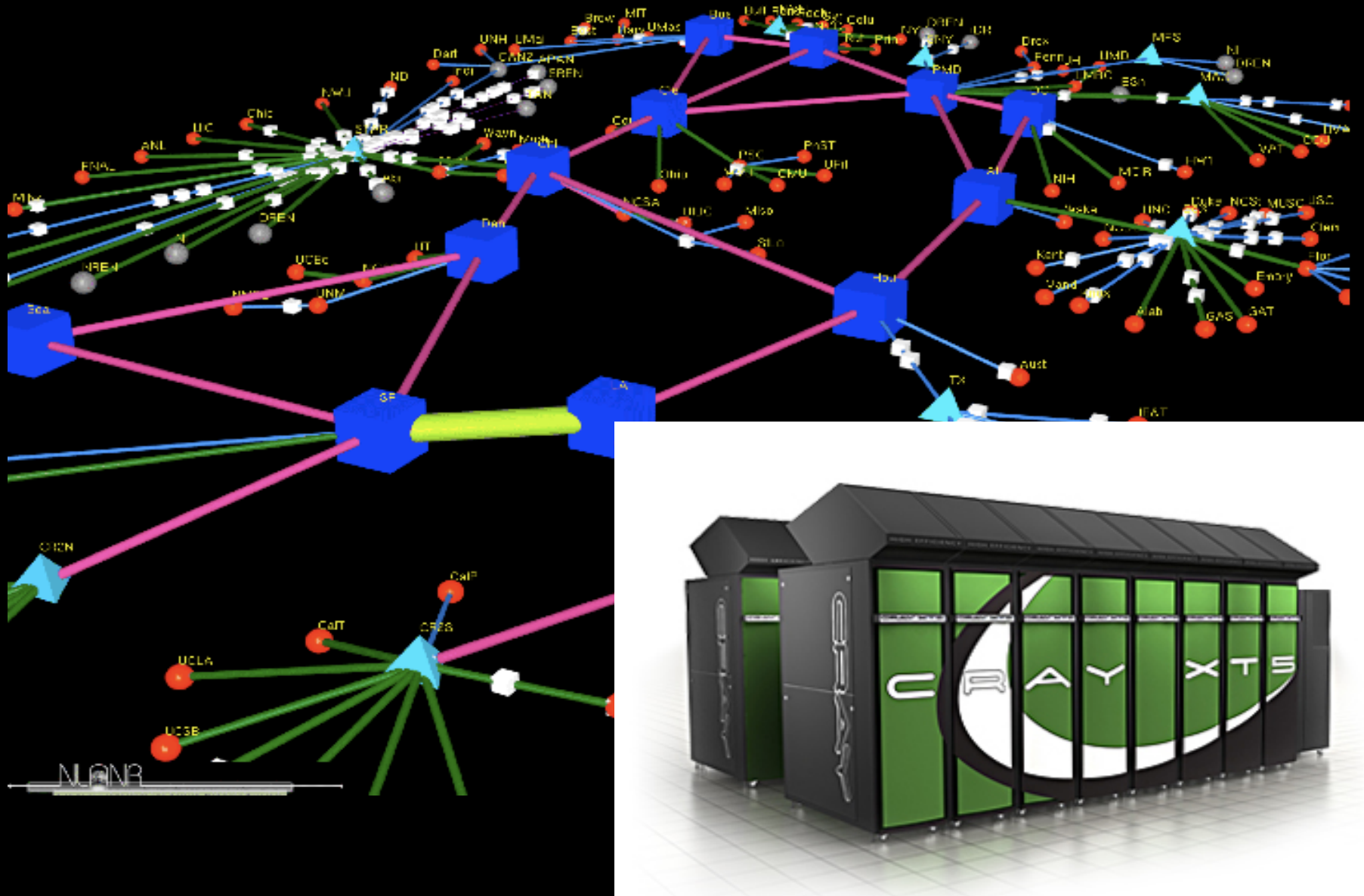


- Sharing via OS Swapping
- Traffic shaping
- *Limited size?*
- *Heavy use: Limited availability?*
- *Limited emulation scenarios?*

Current Experiments	
68	Active
39	Idle
7055	Swapped
<b>31</b>	<b>Free PCs</b>

Vers: 4.234 Build: 03/04/2011 Sat Mar 12 9:40am MST  
6457394a2b78f01fd2a966a7

# Simulation





## Enable hybrid network experiments on GENI

- Including **simulated**, **emulated**, and physical components

- **Simulation:**

- Network experiment at scale
- Modeling abstraction
- Flexibility

- **Emulation**

- Real execution environment
- Resource multiplexing

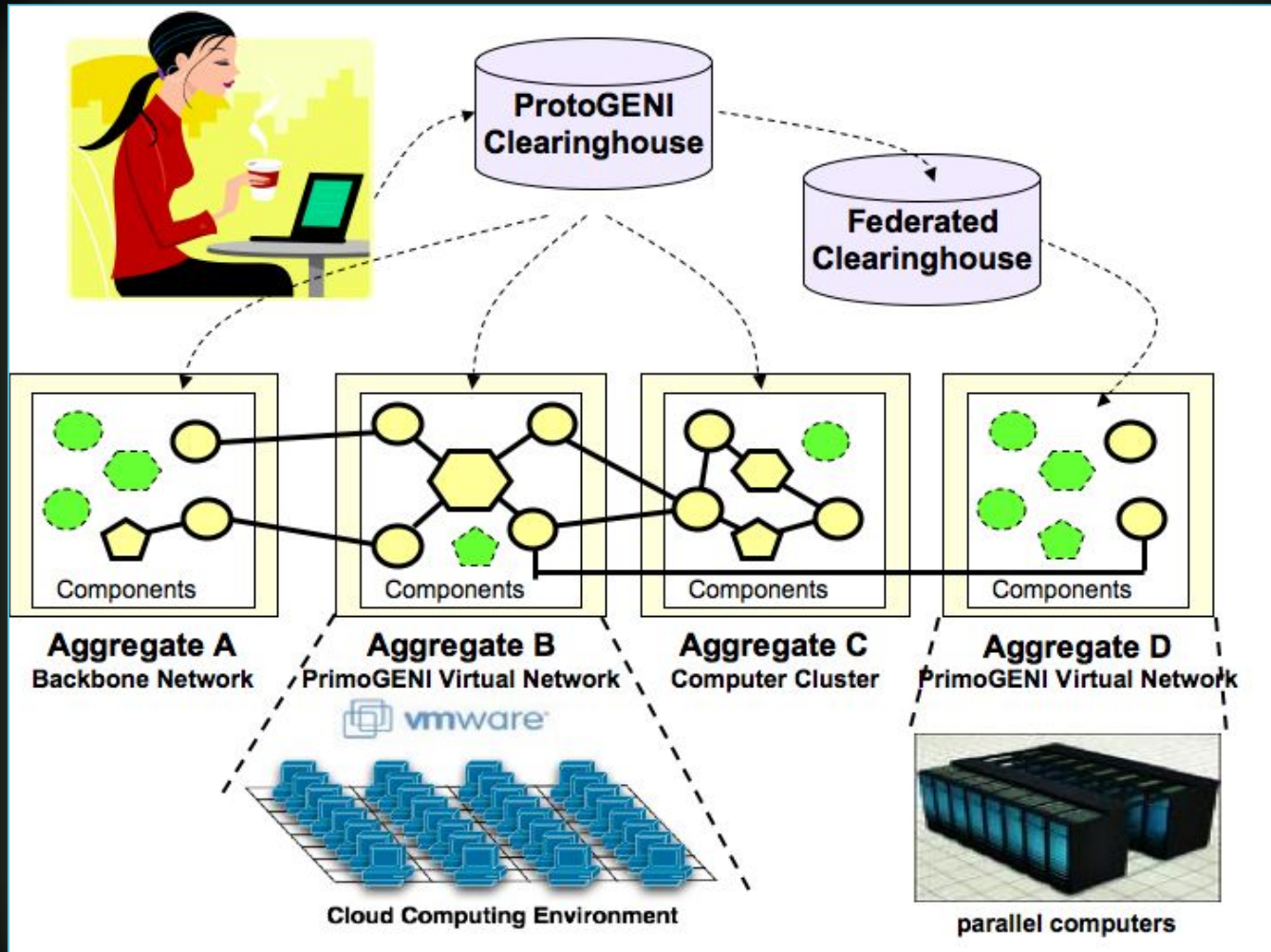
- **Physical testbeds**

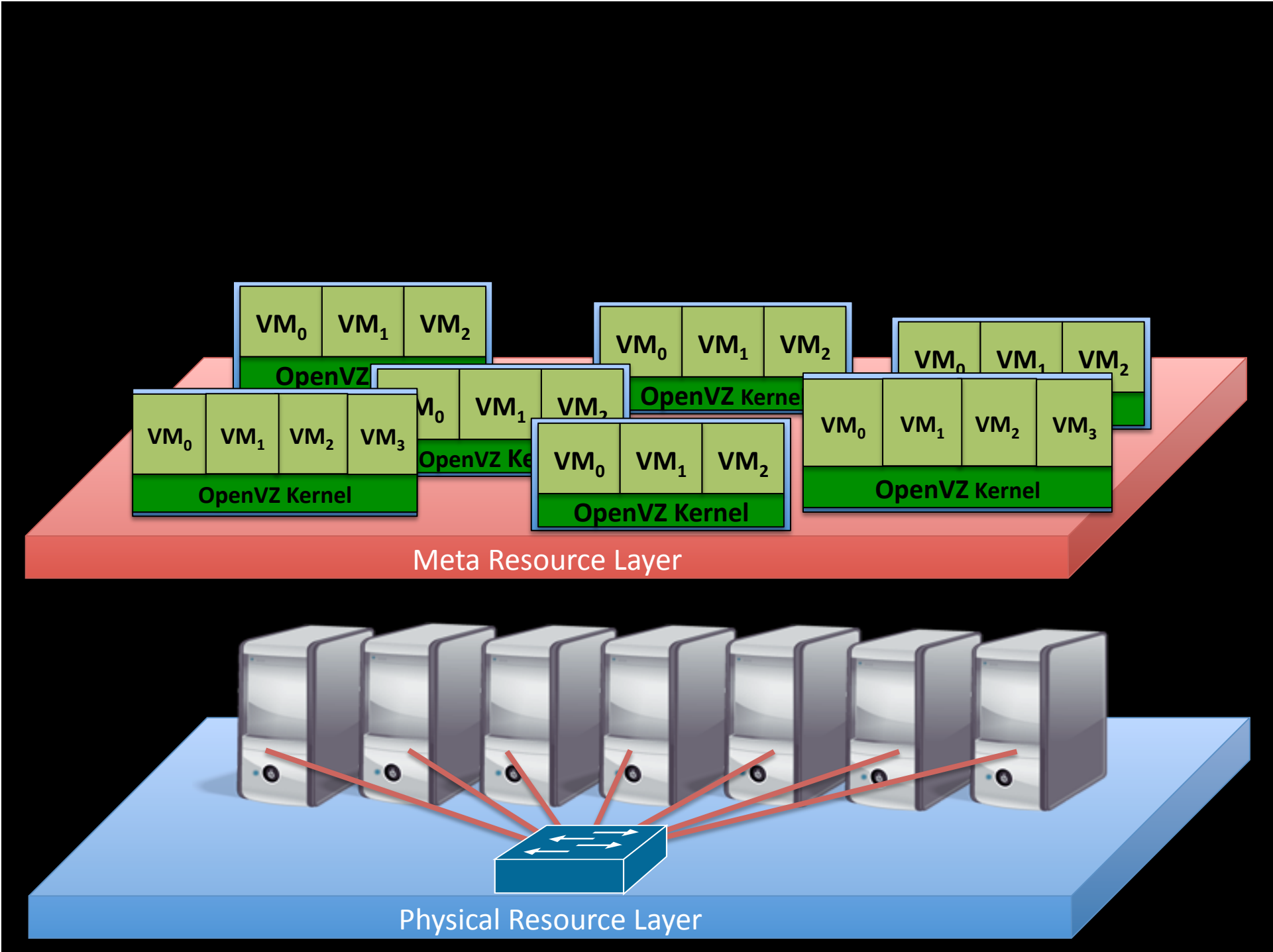
- Real traffic interaction

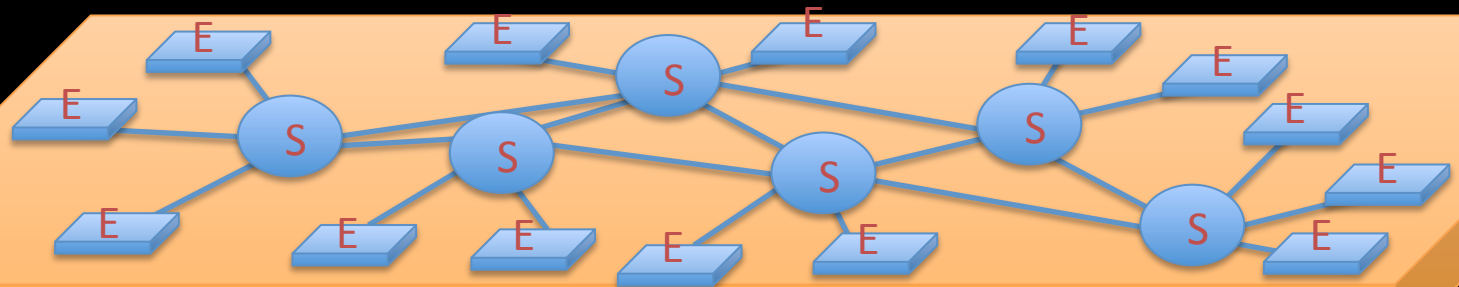




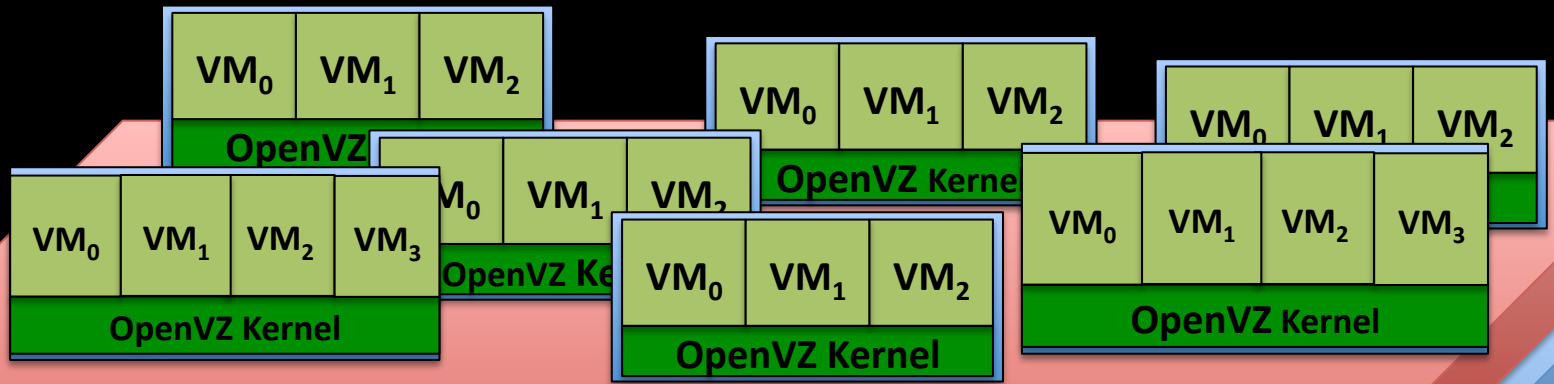
# PrimoGENI is a GENI Aggregate



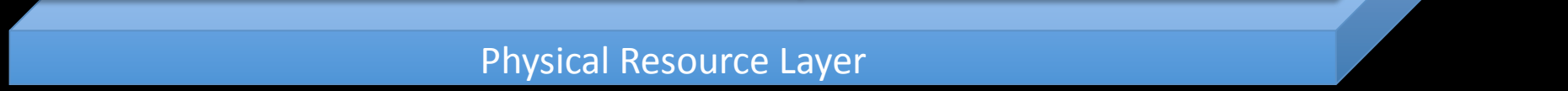




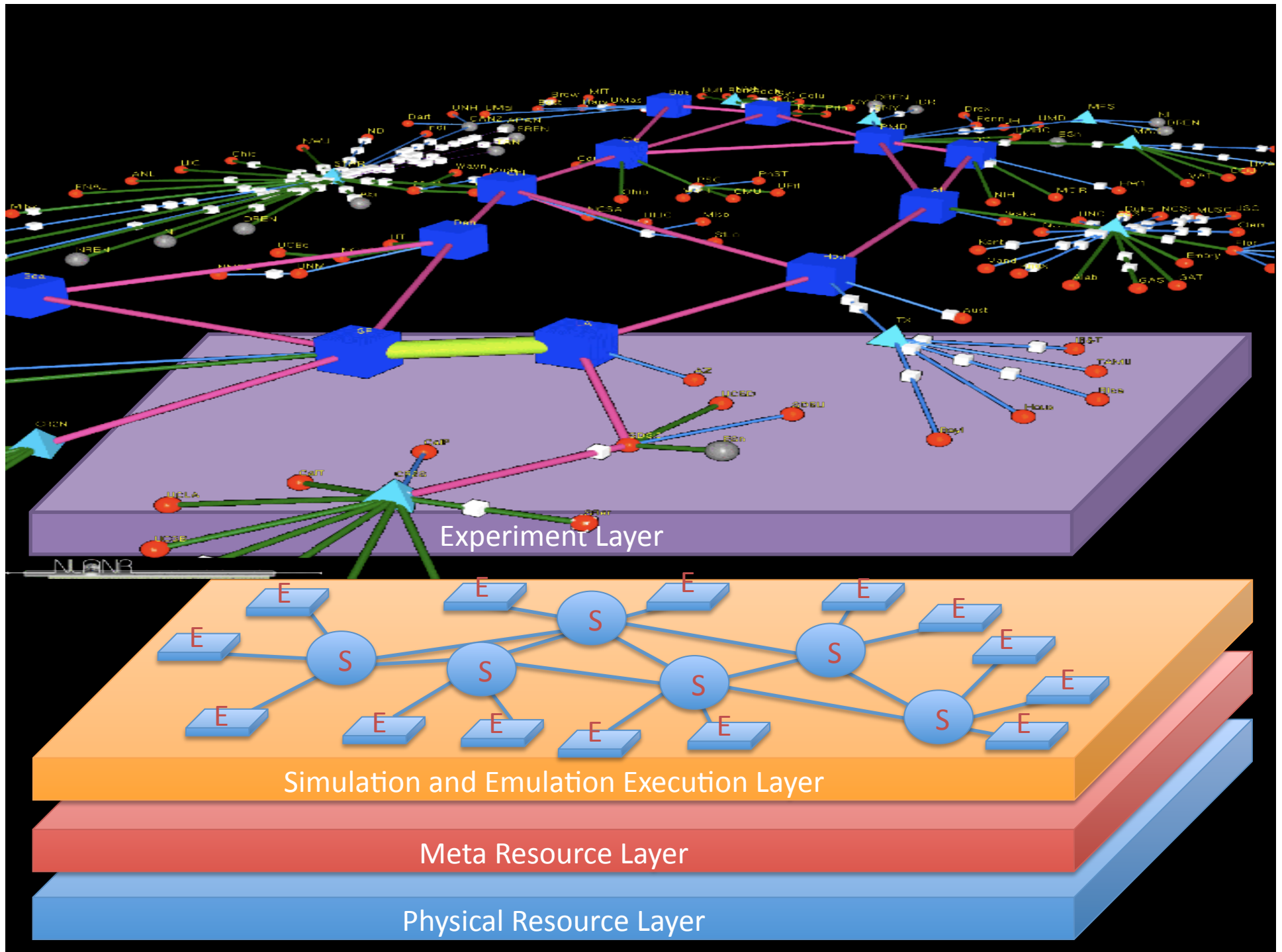
Simulation and Emulation Execution Layer



Meta Resource Layer



Physical Resource Layer



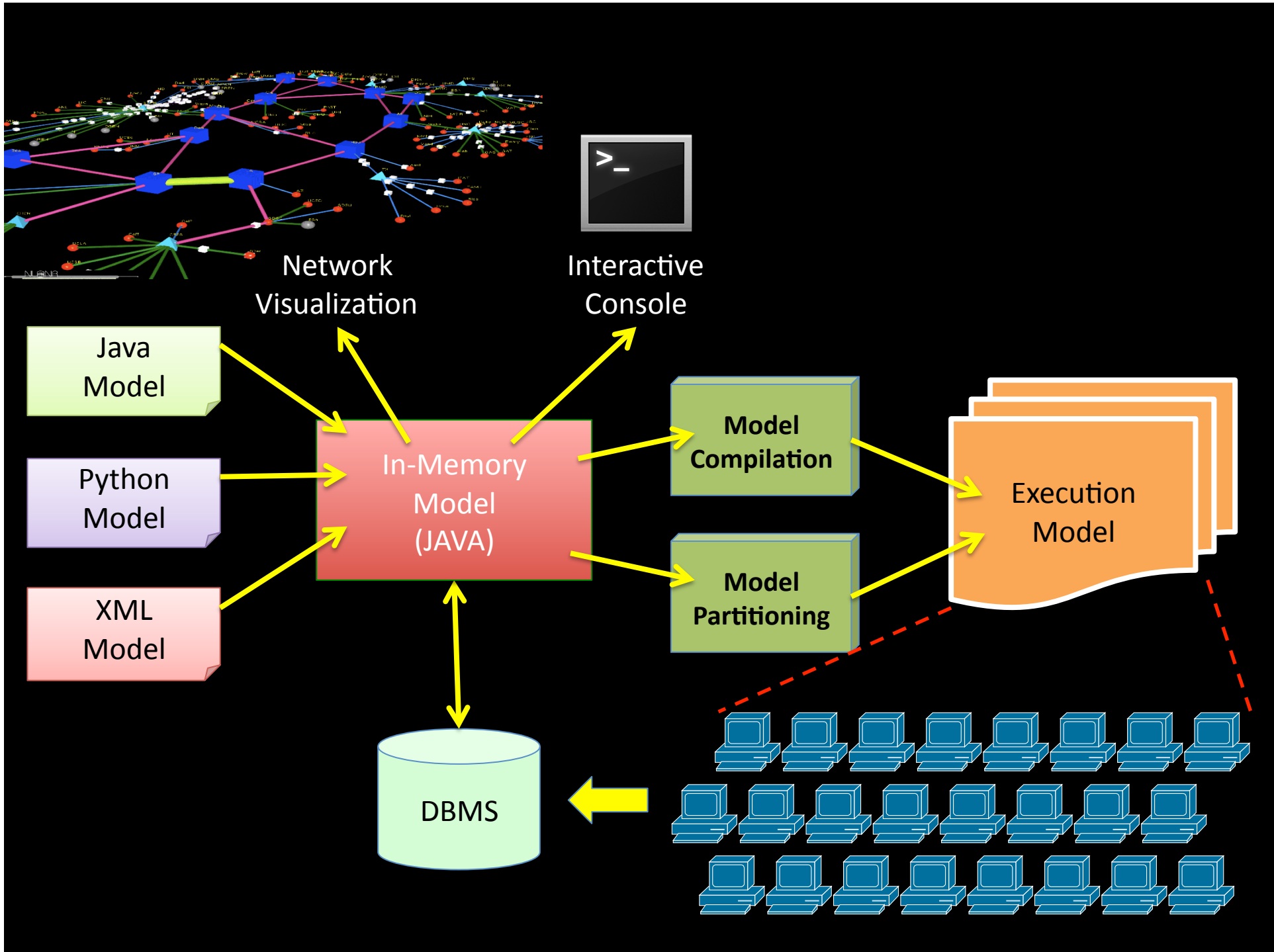
*Slingshot*

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*fool?nill?*



Manage the entire *“life cycle”* of a large-scale network experiment, including *model configuration*, resource specification, experiment deployment, *execution*, online monitoring and steering, inspection, *visualization*, data collection and analysis.



## Step 1: Setup



- Install slingshot on client machine
- Obtain user account on emulab (with primogeni)
- Upload SSH public key (for remote access)
- Generate and download SSL certificate

# Step 2: Create Model



The screenshot displays the Slingshot software interface. The main window shows a complex network topology with multiple interconnected nodes and links. A console window at the bottom left contains the following text:

```
Determine if this host is emulated.
enableEmulation()
enableOpenvzEmulationForThisHost()
enableEmulation(boolean useOpenvz)
enableEmulationForThisHost()
useOpenvz determines if openvz or Openvni is used.
>>> sel.get('lfe_r9').setmtu(1000)
```

On the right side, a properties panel lists various attributes and their values for selected components:

Attribute	Value/Type
name	r5
properties	
uid	35
runtime state	
traffic_intensity	0
r5_r6	Interface
properties	
uid	6
mtu	1500
buffer_size	140000
ip_address	192.1.9.129
latency	0.00154
bit_rate	100000000
runtime state	
r5_r8	Interface
properties	
uid	8
mtu	2000
buffer_size	140000
ip_address	192.1.9.133
latency	0.00224
bit_rate	100000000
runtime state	
r5_r6	Interface
properties	
uid	10
mtu	1500
buffer_size	140000
ip_address	192.1.9.138
latency	0.00232
bit_rate	100000000
runtime state	
r5_r7	Interface
properties	
uid	12
mtu	1500
buffer_size	140000
ip_address	192.1.9.146
latency	0.00143
bit_rate	100000000
runtime state	
Jan1_...	Interface
properties	
runtime state	

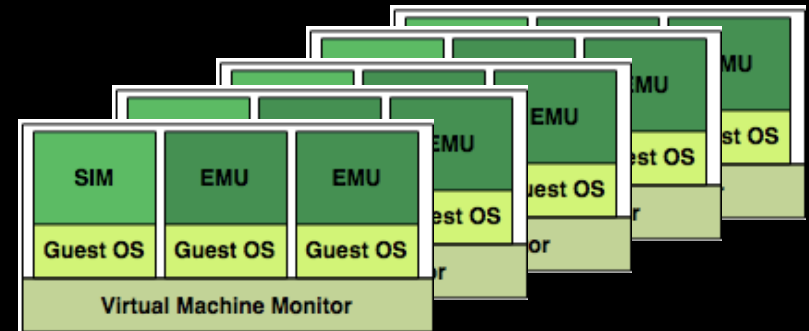
- One can:
  - Import Java, Python, XML models
  - Use network model generators
  - Use existing models from database
  - Interactively modify models using slingshot GUI/console
  - Set up simulation and emulation traffic



# Step 3: Run Experiment



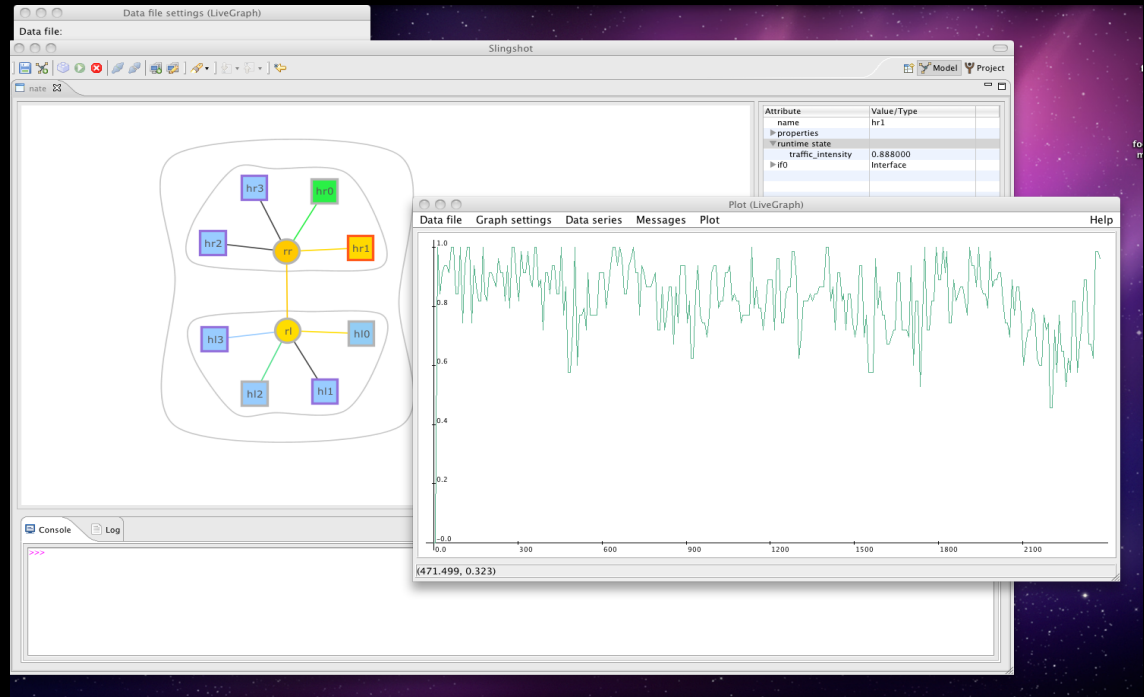
Master  
Meta-controller



Slave Meta-controller

- Set up primogeni environment in slingshot
  - Enter SSL certificate and pass phrase; select resources
- Compile model
  - Automatic address assignment
  - Compute static routing
- Run Experiment
  - Partition model in slingshot
  - Update software on VMs (tuf, yum, ...)
  - Start VMs, launch simulator, run emulation commands

# Step 4: Online Monitor



- Inspect network runtime state updates
  - NIC queue size, packet/bytes in and out
- Network heat map: traffic intensity
- Live graph: time series data
- Log onto virtual hosts

# Demo and hands-on session

