

PrimoGENI Constellation for Hybrid At-Scale Network Experimentation



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What's PrimoGENI Constellation?

PrimoGENI Constellation allows hybrid at-scale network experiments on GENI resources:

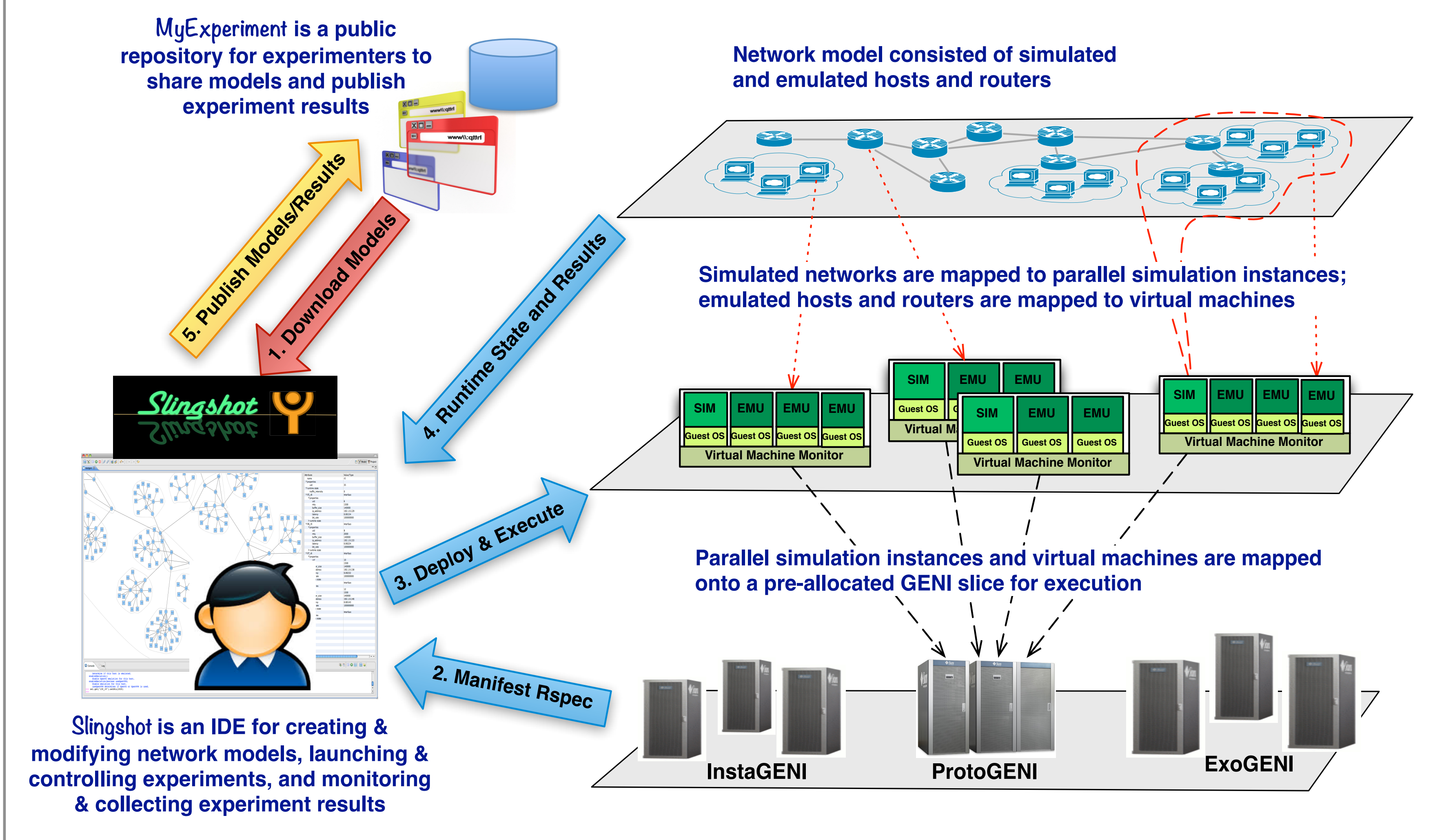
- A network experiment may consist of simulated network with selected emulated hosts implemented as virtual machines
- Each emulated host runs as a virtual machine with real applications and network protocols
- Communications between emulated hosts are modified with packet delays and losses calculated by simulation as if through the virtual network
- PrimoGENI supports parallel simulation to enable large-scale network experiments in real time
- PrimoGENI runs on desktops, on ProtoGENI clusters, and on ExoGENI or InstaGENI racks



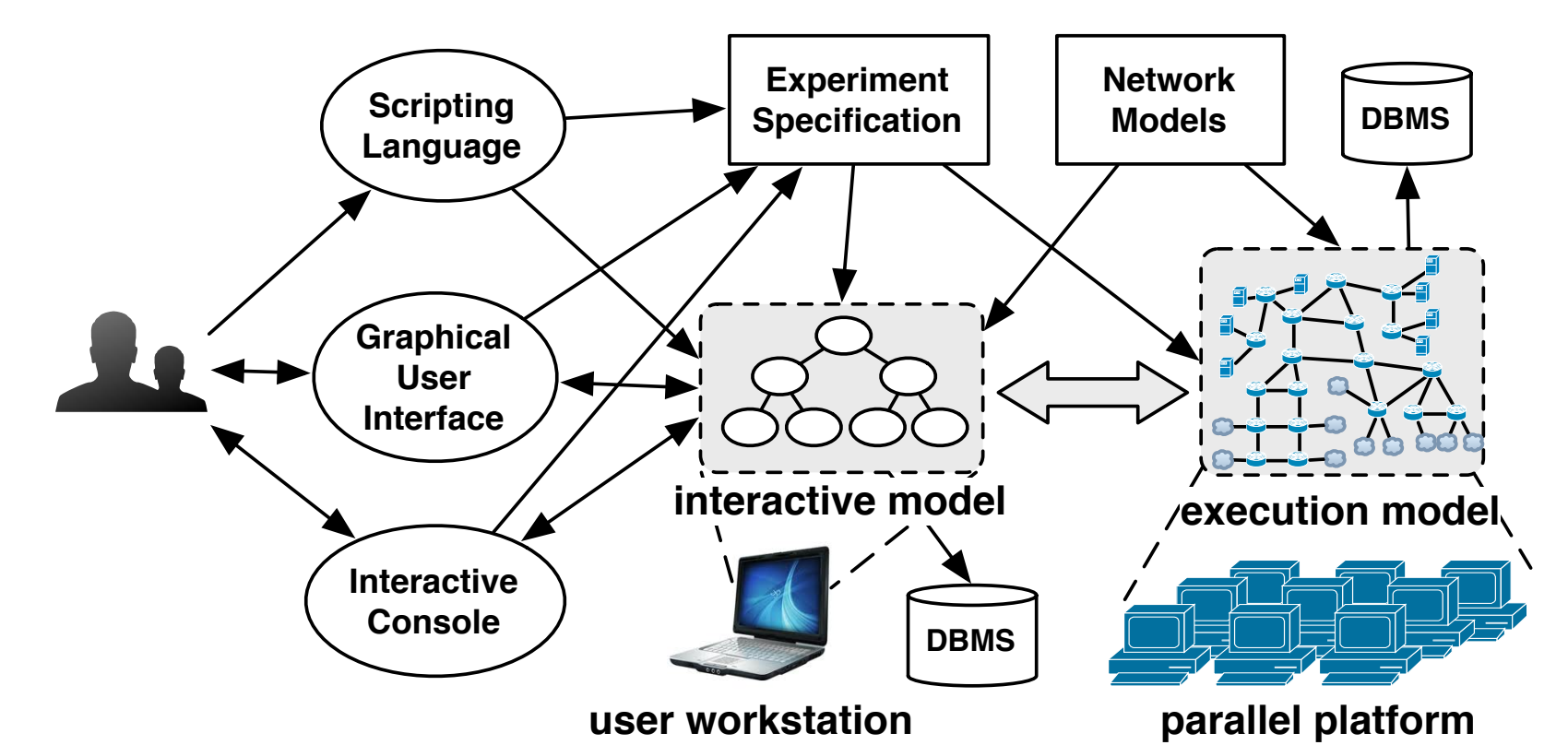
PrimoGENI Constellation provides experimenter tools for managing experiments:

- **Slingshot** provides a graphical user interface for building models, launching experiments, and monitoring results in real time
- **MyExperiment** is a public model repository for creating and sharing network models and experiment results

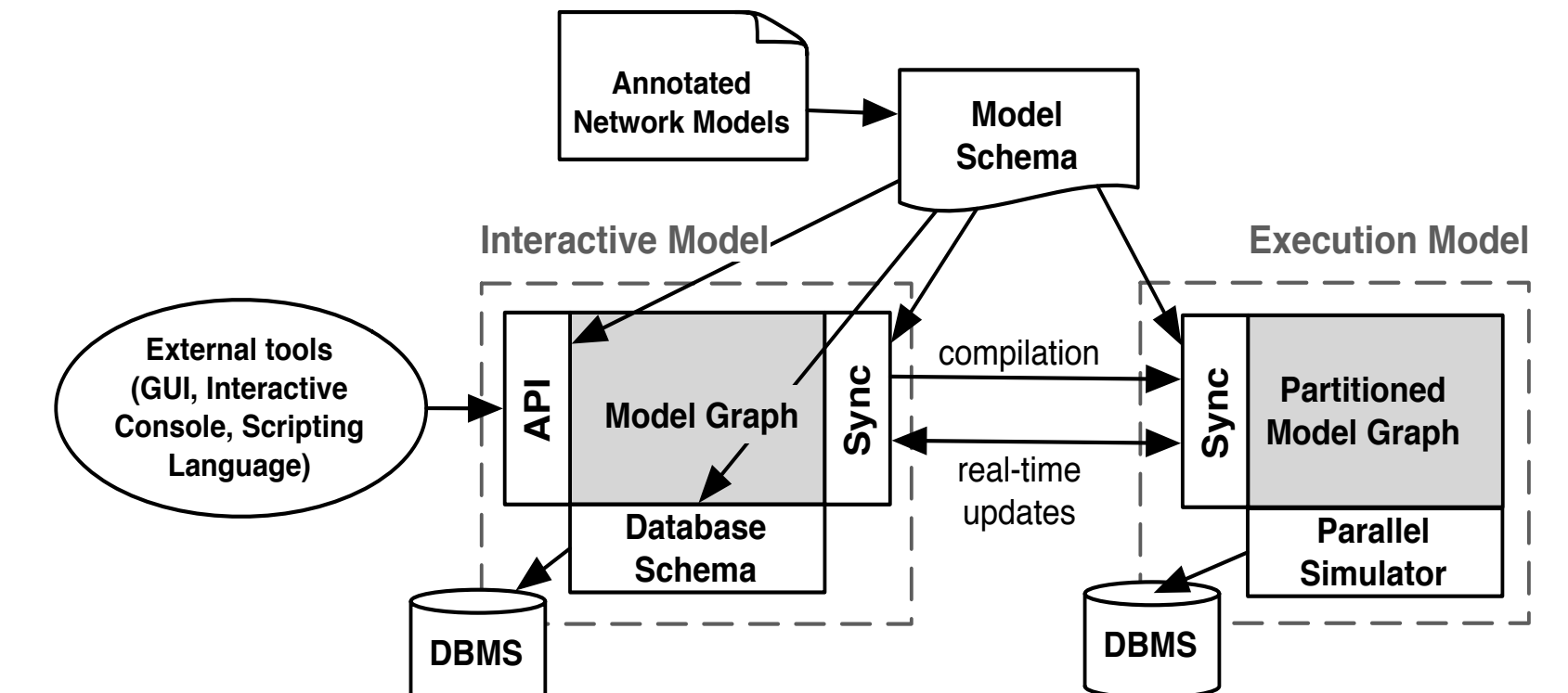
PrimoGENI Experiment Workflow



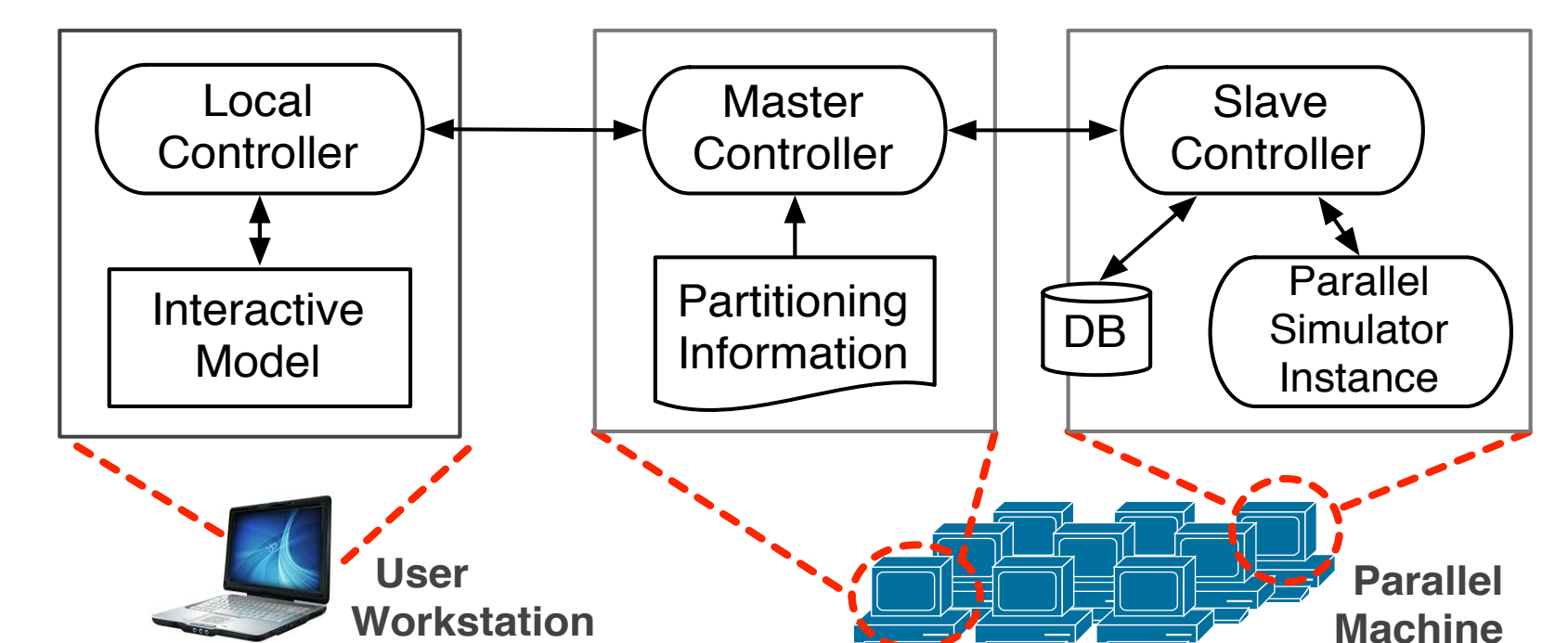
A schematic view of model splitting



Supporting model consistency



Online monitoring & control framework



On implementation: To facilitate interactive at-scale experiments, PrimoGENI adopts a “model splitting” approach—by dividing the system into an **interactive model**, which provides an iconic, succinct representation of the target network to support user interaction, and an **execution model**, which provides the full-scale network experimentation using parallel processing on GENI slices.

Current State and Future Work

Current State:

- Support simulation-only experiment on local machine
- Support hybrid experiments on ProtoGENI clusters (running openvz on raw pc)
- Support hybrid experiments on InstaGENI racks (running openvz on xen)
- Support hybrid experiments on ExoGENI racks (running openvz on kvm)
- Preliminary support for cross-platform experiments
- Implementation of MyExperiment prototype (with preliminary model generation)
- Extensive validation on hybrid TCP experiments

Planned Future Work:

- Full-fledged MyExperiment support (with automatic model generation, federated sign-on, and full capabilities of sharing, publishing and extending experiments) → **GEC22 (March 2015)**
- Support for Linux native lightweight virtualization to increase the scale of hybrid network experiments → **GEC23 (June 2015)**
- Support for hybrid experiments on local machines using Linux lightweight virtual machines → **GEC23 (June 2015)**
- Support for hybrid experiments for OpenFlow-based SDN applications → **GEC24 (October 2015)**