

PrimoGENI Constellation (PGC) for Distributed At-Scale Hybrid Network Experimentation

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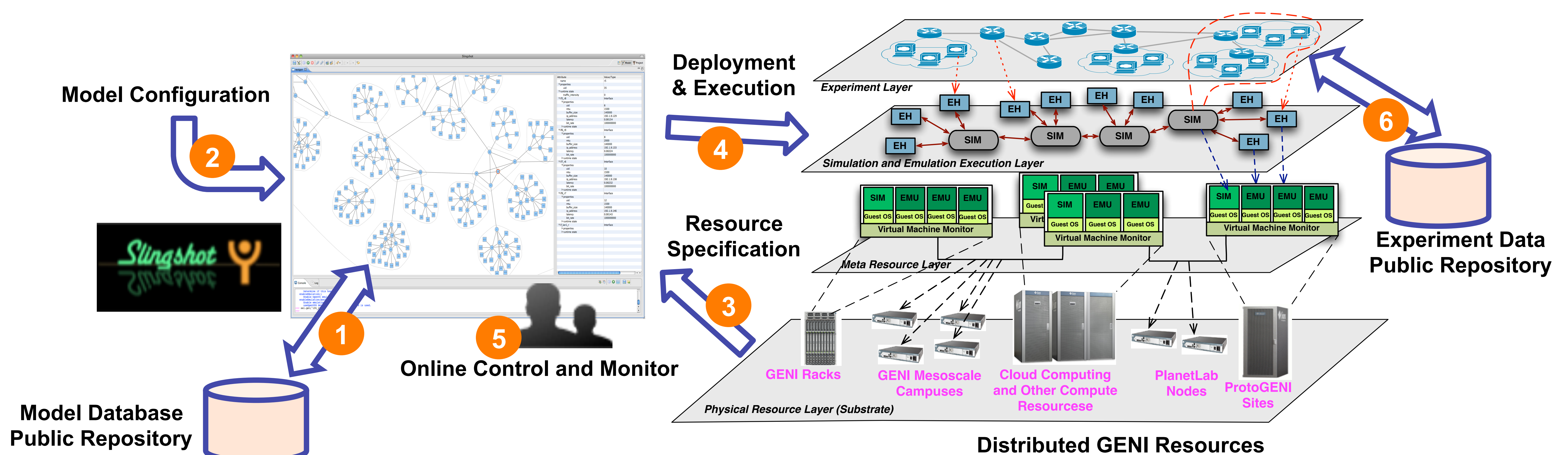
PrimoGENI Supports Hybrid Large-Scale Network Experimentation Using ProtoGENI Control Framework

- 1 PrimoGENI enables **hybrid** network experiments by extending real-time simulation to support network experiments involving physical, simulated and emulated network entities.
- 2 PrimoGENI experiments are instantiated on parallel platforms to enable simulation of **large-scale** network models interacting with a set of virtual machines as emulated nodes running unmodified applications.
- 3 PrimoGENI provides an integrated environment, called **slingshot**, to manage the “life cycle” of network experiments, including creating network models, instantiating experiments onto **ProtoGENI resources**, and controlling and visualizing network state during experiments.

PrimoGENI Constellation (PGC) Will Significantly Extend Existing PrimoGENI Efforts

- 1 PGC will extend beyond the current ProtoGENI control framework to run on **distributed and heterogeneous** GENI resources, including both ExoGENI and InstaGENI racks, and other resources.
- 2 PGC will enhance **slingshot** to facilitate **at-scale** experiments with a simple, streamlined user interface according to the GENI workflow and using existing GENI experimenter tools.
- 3 PGC will extend baseline **experiment support**, including the development of extensible and descriptive network constructs, and the incorporation of open model databases and public repositories to encourage model reuse and verification.
- 4 PGC will target specific **high-impact applications**, such as enabling interoperation with OpenFlow networks for hybrid testing of software-defined network (SDN) applications, and implementing in-network cache-and-forward and storage-aware network routing capabilities to allow large-scale MobilityFirst experiments.

PrimoGENI Constellation (PGC) Experiment Workflow/Life Cycle



- 1 PGC will provide standard mechanisms to incorporate models as first-order objects from databases, which would include well-designed, verified models of network topologies, traffic specifications, test scenarios, etc. Public repositories will be established to include published models from papers and case studies; there will be user contributions as part of a coordinated community-building effort.
- 2 Through the integrated development environment (slingshot), PGC will provide a set of semantically rich network commands, scripts, and experiment recipes for users to easily specify and configure the network models.
- 3 PGC will use existing GENI experimenter tools (such as OMNI, Flack and Flukes) to allocate the necessary GENI resources to support PGC experiments per user requirement; PGC will need to read the manifest of the allocated resources, which might be geographically distributed and heterogeneous.
- 4 PGC will assist the user to map the network models onto the allocated GENI resources, deploy the necessary software tools and launch the experiments. PGC will function as an extra virtualization layer on the GENI software stack that realizes hybrid experimentation interconnecting simulation networks with emulated applications running on virtual machines and physical networks.
- 5 PGC will provide a streamlined graphical user interface (slingshot) for network experiments, through which the users can monitor/inspect the state of the network in real time. The user may also modify certain network configurations/parameters in order to study the real-time responses of the network during experiment.
- 6 Experiment runtime results will be collected if required by user. The results can be shared and stored in public repositories. Together with the detailed network specification and configuration (in model databases), experimenter can repeat the experiments for verification and for future expansion.