OnTimeMeasure
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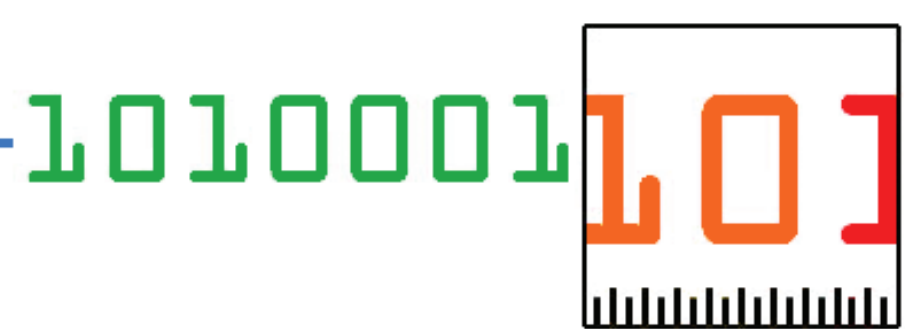
Centralized and Distributed Measurement Orchestration Software

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Project Overview

Goal:

- Provide GENI community with a shared measurement service for provisioning on-going and on-demand measurement requests
  - To be deployed on testbeds aimed at "clean-slate" re-design of the Internet to overcome limitations of current Internet
  - E.g., ProtoGENI testbed for Internet-scale research experiments, GENI Meta Operations (GMOC) that monitors GENI facility status

Expected Outcomes:

- OnTimeMeasure-GENI Software to perform centralized and distributed measurement orchestration and provisioning of active measurements
- Measurement service that uses OnTimeMeasure-GENI software in GENI experiments to enable:
  - Network paths monitoring
  - Network weather forecasting
  - Network performance anomaly detection
  - Network-bottleneck fault-location diagnosis
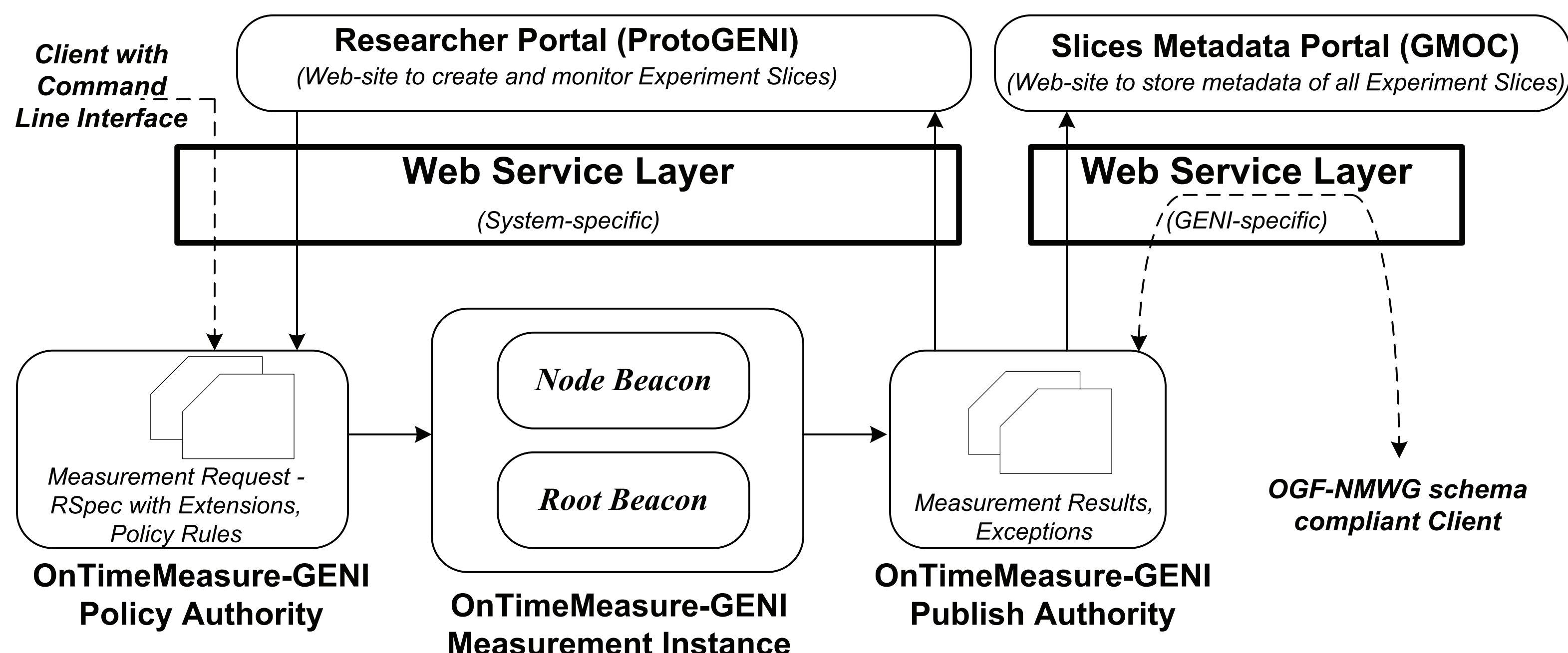
Software Modules

- Customizable software [*] developed at OSC/OARnet
- Two main modules installed within a GENI experiment slice as part of an active measurement service

- **Node Beacon**
  - Installs tools that measure network health metrics such as: route changes, delay, jitter, loss, bandwidth
    - TCP/UDP Iperf, Traceroute, Ping, Pathload, OWAMP, etc.
  - Runs measurements based on a schedule and outputs in "raw" and "processed" formats
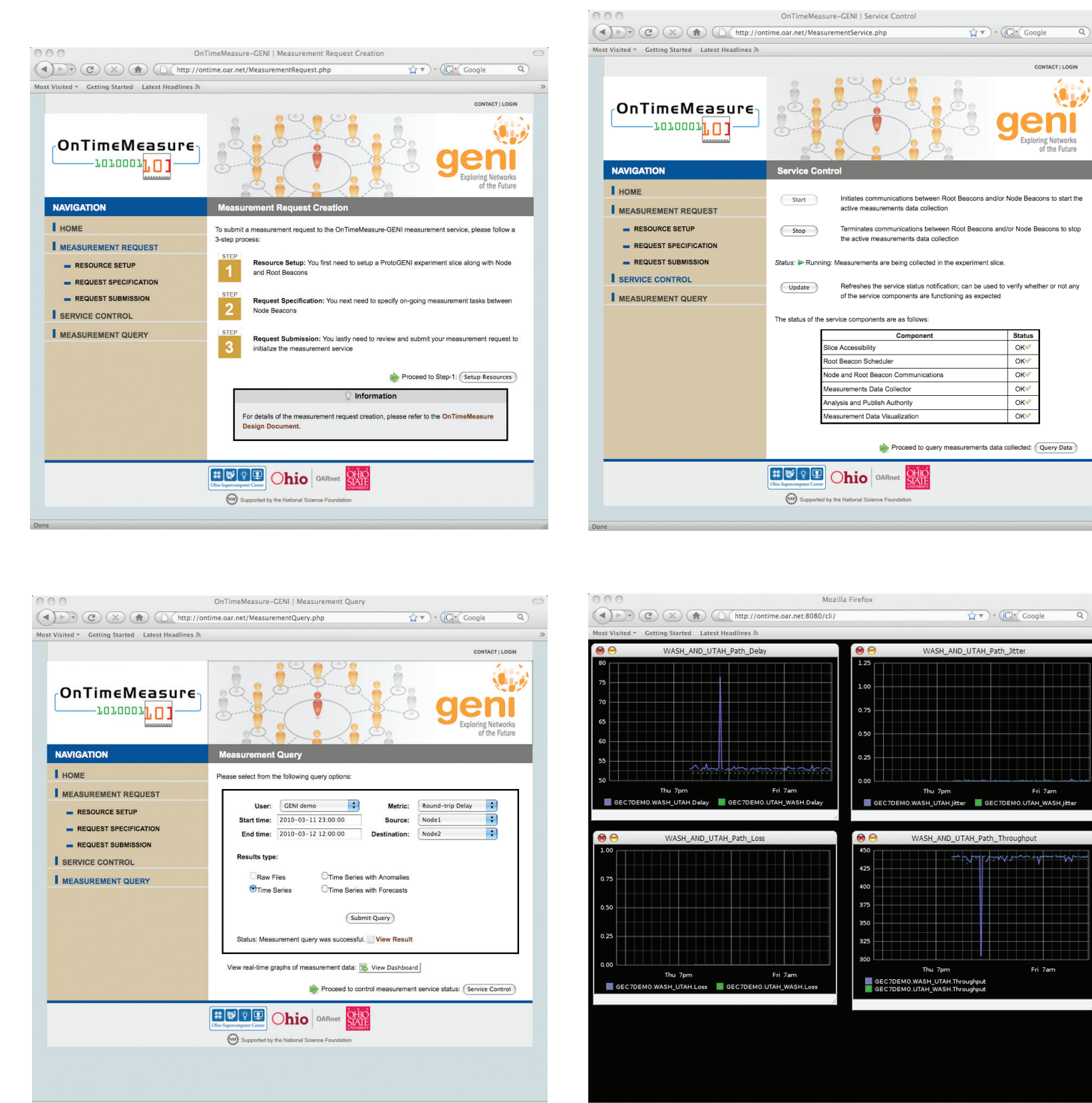
- **Root Beacon**
  - Installs Apache, MySQL and other packages
  - Creates database tables and configuration files
  - Generates measurement schedules for node beacons
  - Collects data and provides dashboard visualization, statistical analysis (i.e., anomaly detection and weather forecasting) with alarm generation

[*] P. Calyam, C.-G.Lee, E. Ekici, M. Haffner, N. Howes, "Orchestrating Network-wide Active Measurements for Supporting Distributed Computing Applications", *IEEE Transactions on Computers Journal (TC)*, 2006

Service Capabilities

- Active measurement request handling
  - **Sampling requirements** (e.g., periodic, stratified random, random, adaptive)
  - **Active measurement tools to be used** (e.g., Ping, Traceroute, Iperf)
  - **Measurement topology** (e.g., full-mesh, tree, hybrid)

- Enforce policies for measurements scheduling
  - **Semantic priorities** (e.g., superGENI-er vs. GENI-er)
  - **Measurement level restrictions** (e.g., allowable measurement bandwidth and measurement flow duration for different nodes/paths/user-roles)

- Provide raw and processed measurement
  - **Measurements provisioning interfaces** (e.g., raw output of a tool to human/component-service, processed output of multiple tools to a viz application)
  - **Measurement use context** (e.g., curiosity about network path(s) performance in a new slice, network-awareness in an experiment to develop a novel network control scheme, troubleshoot a network bottleneck affecting an advanced application)

OnTimeMeasure-GENI Integration in ProtoGENI

Client with Command Line Interface

Researcher Portal (ProtoGENI)
(Web-site to create and monitor Experiment Slices)

Slices Metadata Portal (GMOC)
(Web-site to store metadata of all Experiment Slices)

Web Service Layer
(System-specific)

Web Service Layer
(GENI-specific)

Node Beacon

Root Beacon

Measurement Request - RSpec with Extensions, Policy Rules

Measurement Results, Exceptions

OGF-NMWG schema compliant Client

OnTimeMeasure-GENI Policy Authority

OnTimeMeasure-GENI Measurement Instance

OnTimeMeasure-GENI Publish Authority

Assumptions

- All user requests for measurements are routed through the ProtoGENI control framework for slice requests
  - User requests measurement instances in an out-of-band fashion through ProtoGENI API

- Each experiment slice needing measurement gets its own OnTimeMeasure-GENI instance
  - Rspec extensions could allow reservation of measurement resources
  - Node/Root Beacons get installed as slivers

- User sees centralized and distributed measurement data and related analysis display through separate OnTimeMeasure web-portal

- User can also request measurement data using an OGF-NMWG schema compliant client with corresponding slice experimenter's credentials

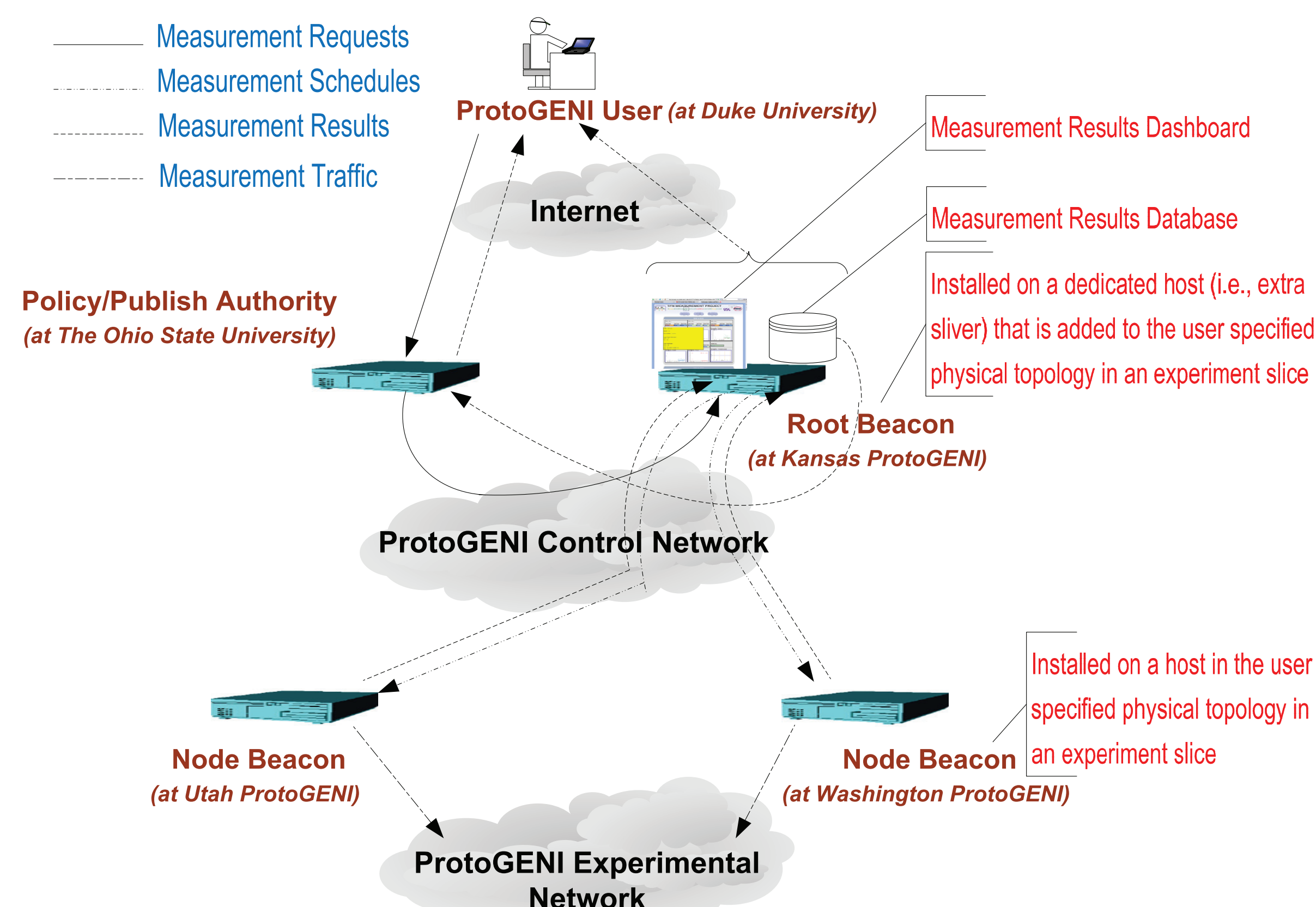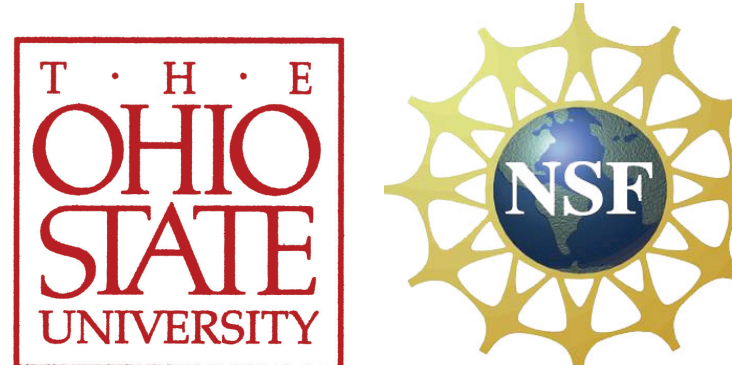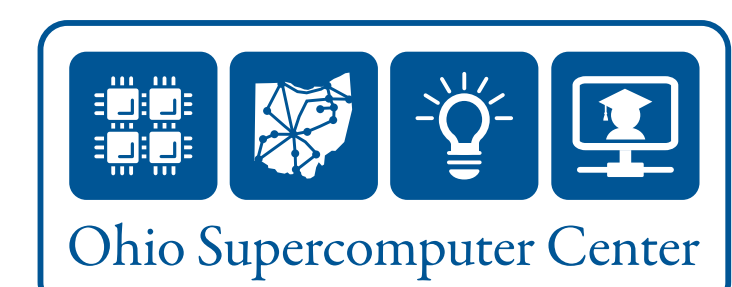- Every OnTimeMeasure-GENI instance metadata gets stored at GMOC

Screen Shots

GEC7 Demo Testbed

— Measurement Requests
-- Measurement Schedules
··· Measurement Results
-·- Measurement Traffic

ProtoGENI User *(at Duke University)*

Internet

Measurement Results Dashboard

Measurement Results Database

Policy/Publish Authority *(at The Ohio State University)*

Installed on a dedicated host (i.e., extra sliver) that is added to the user specified physical topology in an experiment slice

Root Beacon *(at Kansas ProtoGENI)*

ProtoGENI Control Network

Installed on a host in the user specified physical topology in an experiment slice

Node Beacon *(at Utah ProtoGENI)*

Node Beacon *(at Washington ProtoGENI)*

ProtoGENI Experimental Network

Ohio | OARnet

Ohio Supercomputer Center

THE OHIO STATE UNIVERSITY

NSF