OnTimeMeasure Project Status

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Topics of Discussion

- Project Summary and Status
- Intended Uses
- MDA Integration
- MDOD Mapping Thoughts
- Authentication and Authorization
- Persistent Operational Services

Project Summary and Status

- Goal: Provide GENI community with capabilities for on-going and on-demand measurements
    - Useful for monitoring, forecasting, anomaly detection, and fault-location diagnosis in *GENI experiments* and *GENI operations*

- Users:
    - 41 registered users at Researcher Web-portal - http://ontime.oar.net
        - ~16 GENI experiments/projects
    - 3 detailed Experimenter I&M case studies: *OSU, Purdue, RIT*
    - Integrated with other GENI Projects: *ProtoGENI, PlanetLab, INSTOOLS, GUSH, CRON, DOR*

- Deliverables:
    - Software with documentation, GEC10 Tutorial, Wikis, Videos, GIMA Development participation

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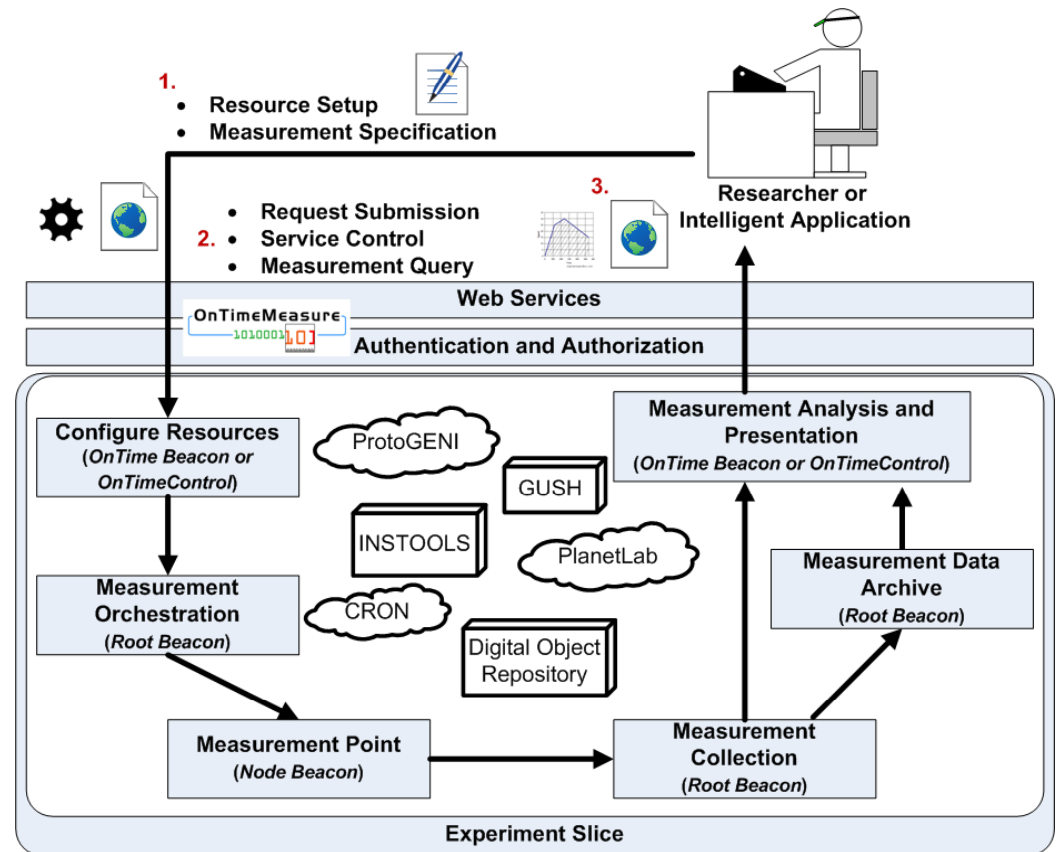
Experimenter Use Cases

- Experiment Environment Monitoring
    - Have I got the system and network resources I asked in my slice?
    - Is the experiment environment functioning as expected over my slice lifetime?
    - Can I trace my non-intuitive results in my experiment to a problem in the slice environment?

- Experiment I&M Management
    - I want to collect active and passive measurements at hop, link, path and slice levels for my experiments…
    - I need measurements feedback with anomaly detection and forecasts to control my experiment progress…
    - I would like to have a measurement framework in my experiment to be configured once and be re-usable for subsequent experiment runs…
    - I want an archive of the experiment measurements collected for offline analysis or to share with colleagues…

What OnTimeMeasure can provide Experimenters?

- Data Aggregation
  - Your distributed data sources can be controlled and accessed (start/stop/query) in a centralized manner via web-portal or command line
- Data Visualization
  - Measurement data graphs, dashboards
- Data Analysis
  - Time Series files with Anomalies/Time Series with Forecasts/others
  - Ability to use analysis of the measurements to reconfigure the measurement specifications without human intervention or use in research experiment schemes
- Data Archive
  - Slice owners can access and download data and metadata; transfer to GENI archive
- Integration with other GENI projects to extend OnTimeMeasure functionality:
  - OnTimeMeasure-ProtoGENI, OnTimeMeasure-PlanetLab - I&M service for GENI aggregate users
  - OnTimeMeasure-Gush - I&M service control through Experimenter workflow tool
  - OnTimeMeasure*-INSTOOLS** - Both active* and passive** measurements in experiment slice
  - OnTimeMeasure-CRON - I&M service for 10Gbps network path experiments
  - OnTimeMeasure-DOR – I&M Data Archive service

OnTimeMeasure Integration with Digital Object Repository

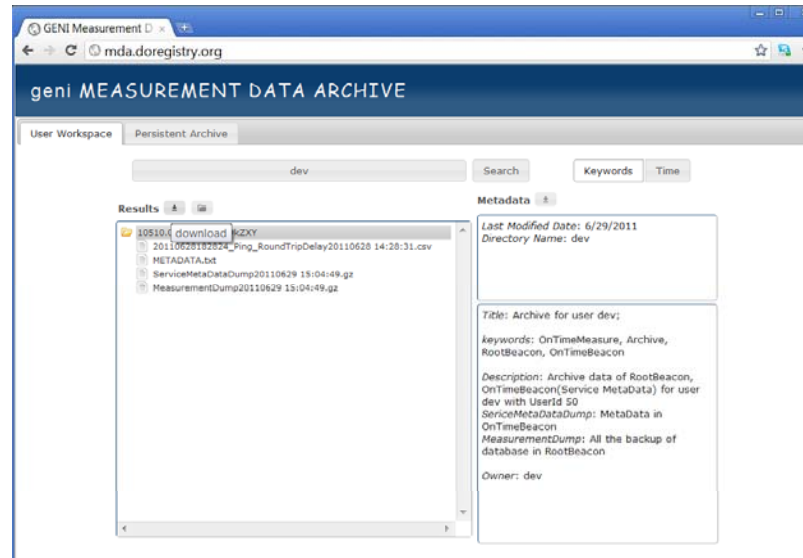Demo Video - http://ontime.oar.net/demo/archive_to_dor.htm
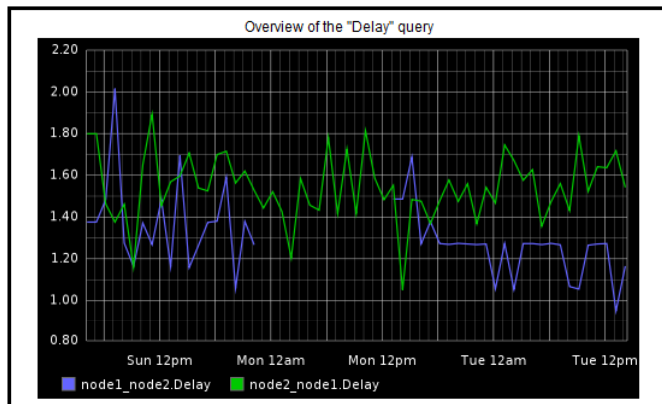
- Integration allows archiving experiment slice measurement datasets along with meta-data collected by OnTimeMeasure into the GENI Measurement Data Archive being developed in the CNRI's DOR project

- Use Cases
  1. Archive and Share Subsets of Experiment Results
  2. Archive and Share Entire Experiment Slice Measurement Results
  3. Backup and Restore Entire Experiment Slice Measurement Results

MDOD Mapping Thoughts

- Measurement Data Objects
  - Use Case: Archive and Share Subsets of Experiment Results
    - Measurement data: graphs, time series, time series with anomaly detection analysis, time series with forecasts, raw measurement tool outputs
  - Use Case: Archive and Share Entire Experiment Slice Measurement Results
    - Mysql dump of "Measurements" database; includes data and database scheme that can be recreated for offline analysis
  - Use Case: Backup and Restore Entire Experiment Slice Measurement Results
    - XML config files for OnTime Control and Gush, Graphite dashboard commands list, log files (based on debug level set)
- Identifiers, Descriptors, Holders (Metadata)
  - We collect: OnTime web-portal user name and ID#, slice registration information (RSpec parts that describe measurement topology, slice name), measurement requests and their configurations and output data types (e.g., Iperf tool command)
  - Names of objects have meta-data (e.g., location is in node name, result file has timestamp and context e.g., 20110603131747_Ping_RoundTripDelay.csv)
- We can couple XML records for all our measurement objects
  - "Required"/"Optional" implementation – evaluating feasibility to convert our metadata.txt in the DOR workspace

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Authentication and Authorization

- User accesses measurement sub-services only using OnTime Beacon web-portal or OnTime Control command-line tool
  - For performing control actions (e.g., start/stop/query), user uses the "portal password" registered in Researcher web-portal (http://ontime.oar.net)
  - User provides "slice password" that is used for configuring and accessing Root Beacon database that contains all measurements
    - Same password is used for Graphite Dashboard viewing
- User logins with ProtoGENI and/or PlanetLab credentials to access their slice measurement nodes and install OnTimeMeasure software
  - Once software is installed and invoked, OnTimeMeasure components communicate with each other and other GENI services using "slice password"
- Measurement archive transfer functions done by "Researcher web-portal's user account" in DOR
  - Since we have already authenticated the user, we trust the user, and the user trusts OnTimeMeasure to transfer data on his/her behalf

Persistent Operational Services

- OnTime Beacon Web-portal
  - Registers users, slices, maintains meta-data, and allows user control of measurement functions of Node/Root Beacons in ProtoGENI and PlanetLab

- OnTime Control Command-line Tool
  - Same capabilities as OnTime Beacon web-portal GUI provides

- Archive capability in GENI Measurement Archive (DOR)
  - Result file(s), entire archive can be transferred through OnTime Beacon web-portal

- Gush experiment workflow tool can control OnTimeMeasure
  - Example XML experiment files available for OnTime Control functions when customized with slice-specific info can get responses from Node and Root Beacons

- CRON testbed users are monitoring host and network health using OnTimeMeasure as a default measurement service

- Experiment "New Metric Integration" Service (Coming Soon!)
 - OSU, Purdue and RIT Experimenter case studies in progress

Thank you for your attention!

GENI Experiment Case Studies

- Case Study I: "Resource allocation in virtual desktop clouds" led by The Ohio State University
  - Path-based measurements of network health such as delay, available bandwidth, loss
  - Host-based measurements from `VMware tools` such as CPU, memory, number of VM connections
- Case Study II: "Emulating cloud dynamics for performance sensitive applications" led by Purdue University
  - Path-based measurements of network health such as delay
  - Host-based measurements from `tshark` such as packet sizes for HTTP sessions

Experiment Information needed for OnTimeMeasure Integration
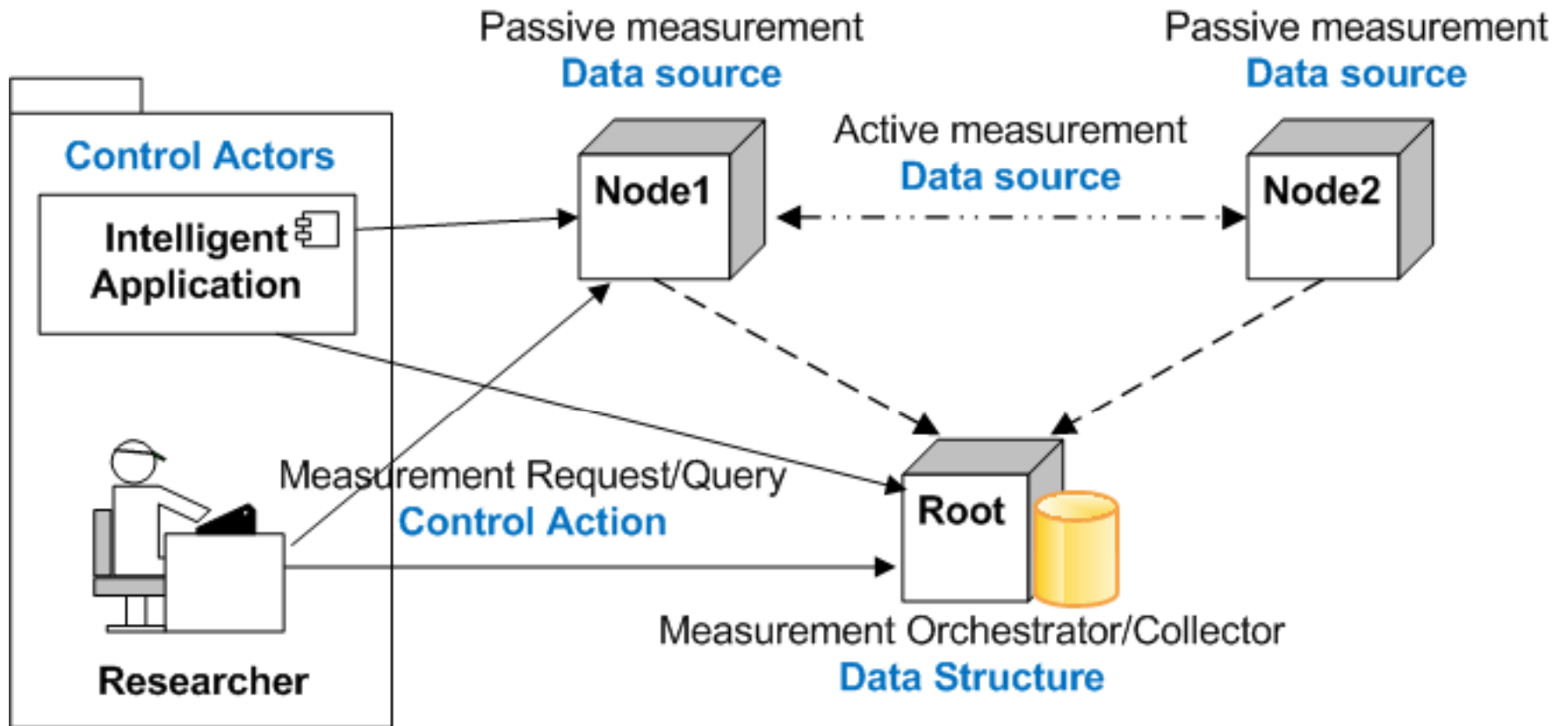
Abstraction from perspective of adding new metric (2)

- Experiment's measurement service basics
    - Control Actors
        - Project members or your research application that would access the data or share the data with other actors
    - Data Sources
        - Data generation tools deployed in slice nodes; the tool would communicate with other nodes to perform active measurements or inherently collects passive measurements in on-going and on-demand manners
    - Data Structures/Data Types
        - Measurement data would be stored in a data base with proper data structure and data types
    - Control Actions
        - Control start and stop of the data generation tool, control how to retrieve and utilize the data e.g., dashboard, plot, time series file with anomaly annotation

NOTE: To integrate new measurement metrics of Experiments in OnTimeMeasure, we need information about your Control Actors, Data Sources, Data Structures/Data Types, and Control Actions

Abstraction from perspective of adding new metric (3)

- A simple example scenario to better explain the basics: We have a virtual desktop cloud (VDC) experiment in GENI that adapts the bandwidth allocation dynamically based on feedback of network health from the client, and load on the server
- Data Source
  - VMware provides tools to access memory, CPU, network, etc. of each host
  - We developed a script to use the VMware tools to obtain experiment measurements
- Data Types
  - Host: string, Resource Pool:string, Time: timestamp, Metric:string, Value:float, Unit:string
- Control Actors
  - The VDC application script that requires end-to-end active measurements, passive measurements (i.e., packet capture) and VMware tools measurements
- Control Action
  - Measurements from VMware tools are queried every 10 seconds

Where do experimenter customizations go within OnTimeMeasure