

GENI New Topics: Applying GENI Instrumentation and Measurement Tools, Services and Schemas

**GENI Engineering Conference 11
Denver, CO**

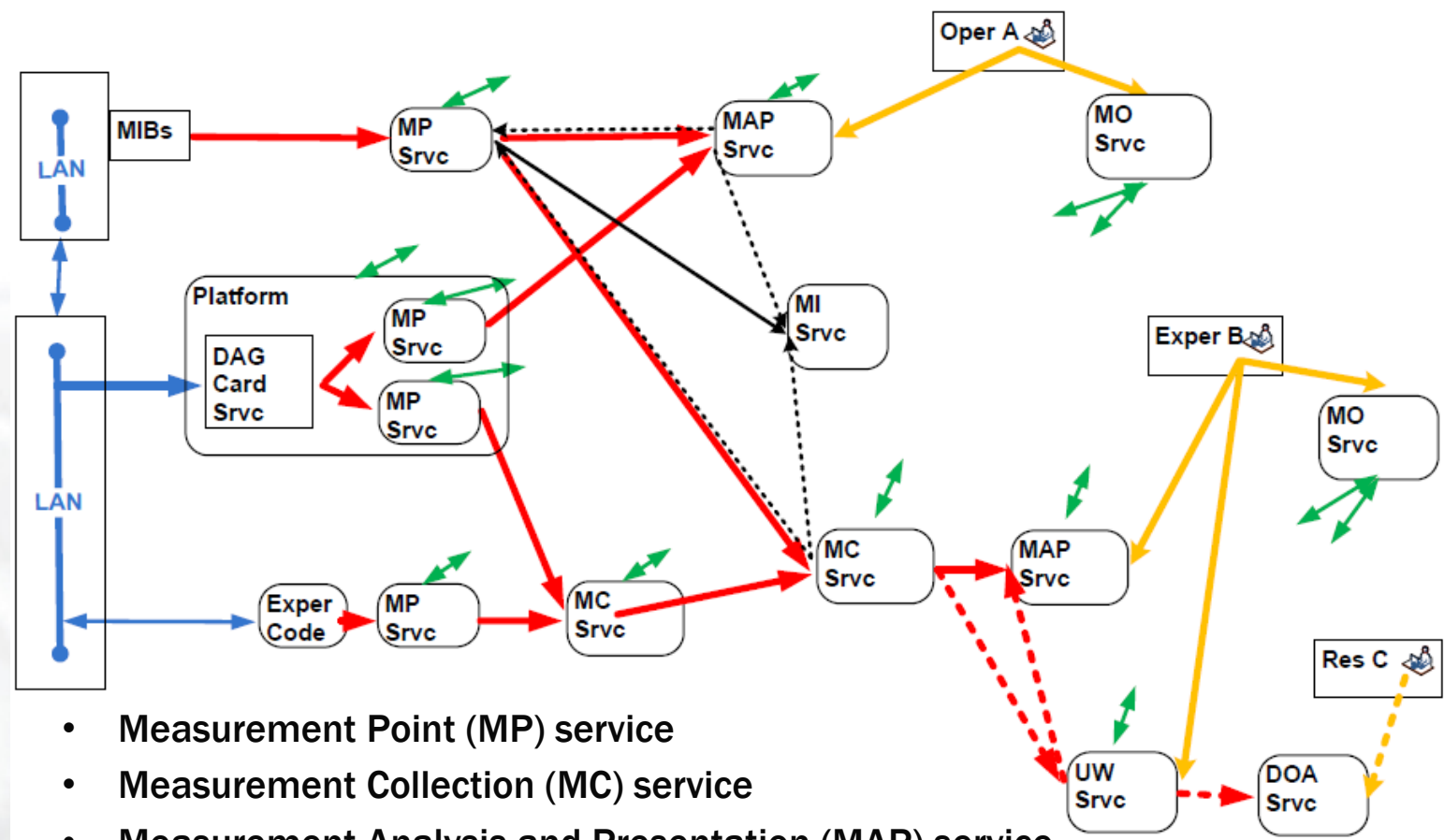


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- **Provide broad data gathering, analysis and archival capability that is sufficient for:**
 - Experiments
 - Maintaining the infrastructure
 - GENI operations
 - Sharing data with researchers outside of GENI
- **Support the experimenter:**
 - Remove the burden on the experimenter to become a system and network measurement infrastructure expert, so that they can better focus on the science in the experiments
- **Scale to support:**
 - Small-scale experiments
 - Long-running future-internet experiments
 - Operator monitoring their aggregate (or service)
 - GMOC monitoring all of GENI, 24x7
- **Interoperable protocols, schemas and APIs:**
 - Allows efficient development of services by reusing interface software modules
 - Allows different users to utilize same services

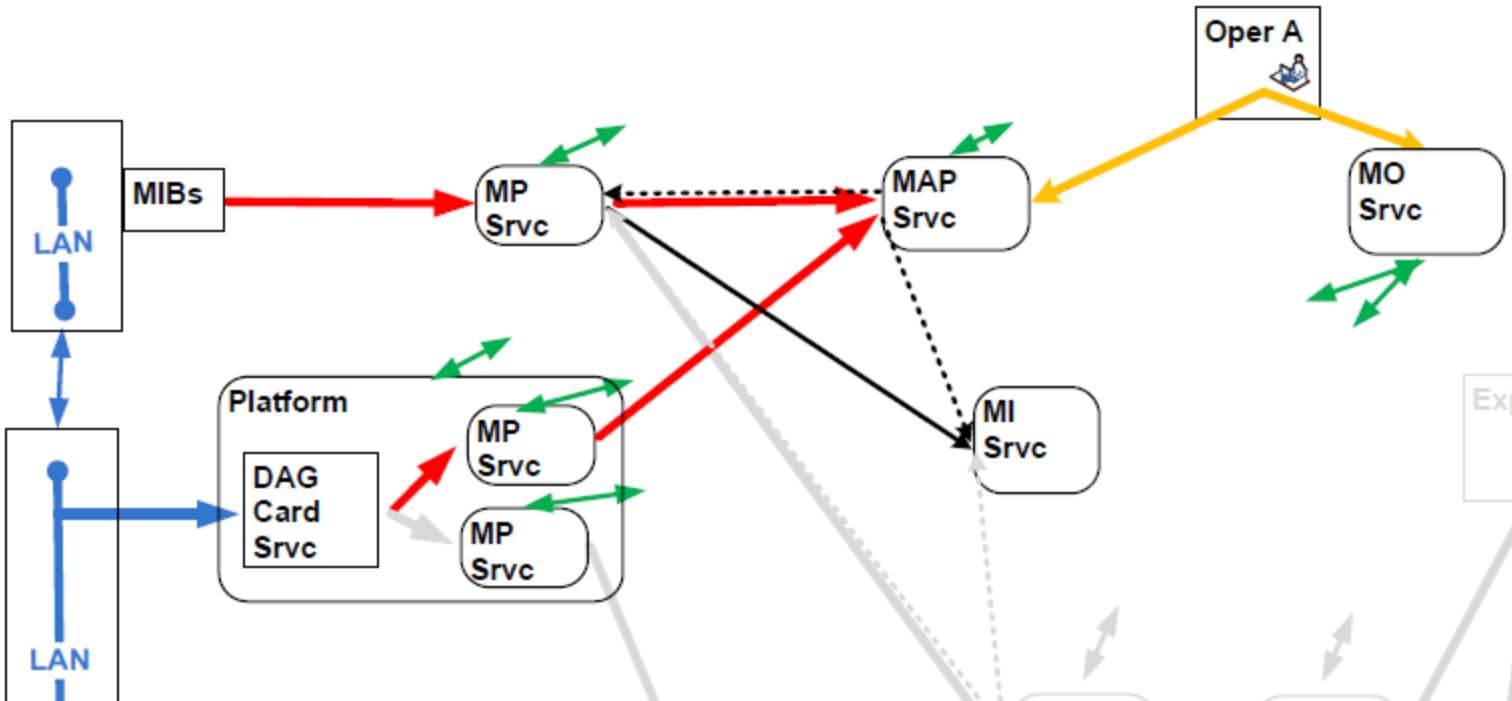
- **Architecture work completed:**
 - **Functional Services**
 - **Measurement Data Flows/Transfers**
 - **Measurement Traffic Flows**
 - **Principal Use Cases**
- **Architecture work in progress:**
 - **Defining Measurement Data Object Descriptor (“metadata”) schema**
 - **Authorizing Access to Measurement Data Objects**
- **I&M tools include:**
 - **Instrumentation Tools (Univ. of Kentucky)**
 - **OML (NICTA)**
 - **perfSONAR/LAMP (Univ. of Delaware, I2)**
 - **On-Time-Measure (Ohio State)**
- **I&M service deployments:**
 - **Prototype User Workspace (UW) and Digital Object Archive (DOA) services (CNRI)**
 - **Portal service and archive service for Ins Tools (Univ. Kentucky)**

GENI I&M Architecture: Functional Services



- Measurement Point (MP) service
- Measurement Collection (MC) service
- Measurement Analysis and Presentation (MAP) service
- Measurement Orchestration (MO) service
- Measurement Information (MI) service
- User Workspace (UW) service
- Digital Object Archive (MDA) service

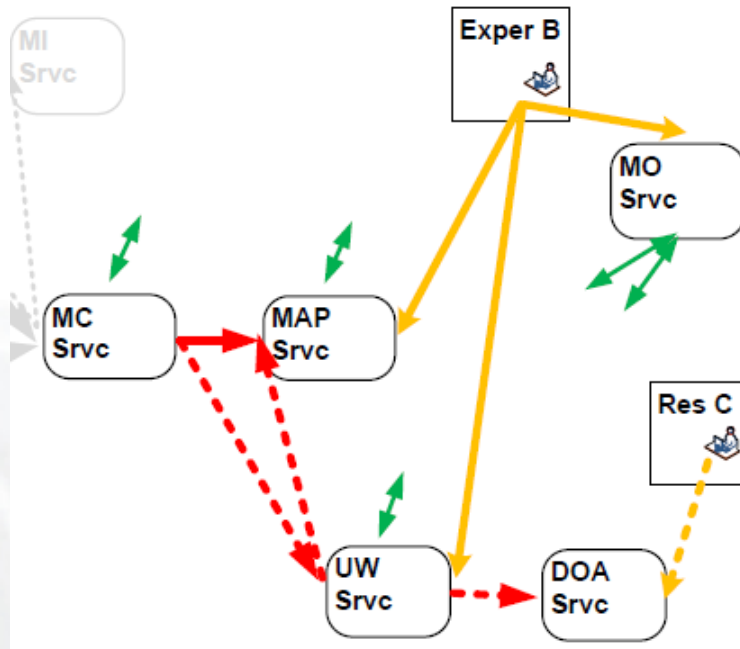
GENI I&M Use Case 2: Operator (or Service Provider) Gathering MD from GENI infrastructure



- An Operator (or Service Provider) can gather MD from GENI infrastructure into their slice
 - For their own use
 - To share with other operators, e.g., share with GMOC
 - To share with experimenters
- Possible uses:
 - A) Aggregate operator sets up measurement slice, and shares data with GMOC
 - B) GMOC sets up measurement slice for troubleshooting, and shares data with Experimenters

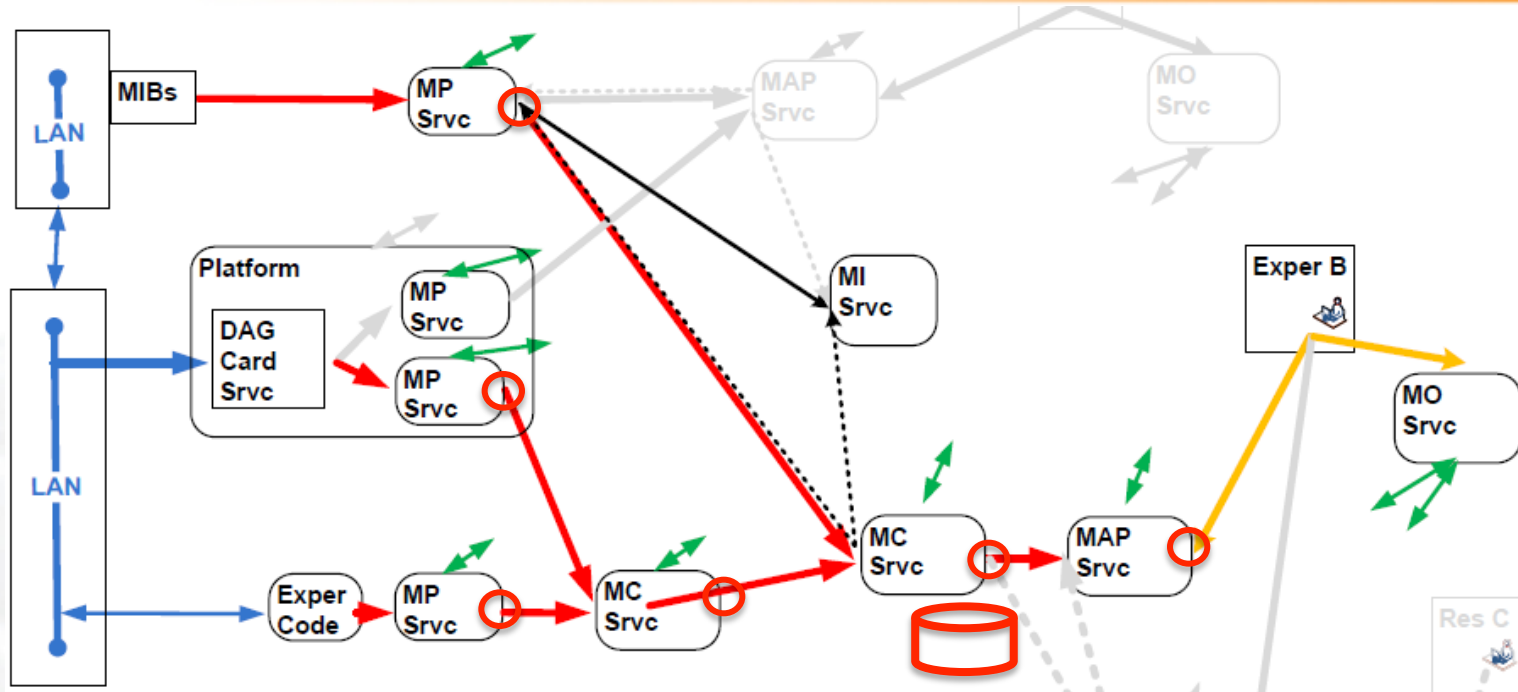
Applying GENI I&M Tools, Services and Schemas



- **1) Use available I&M tools and services to instrument GENI infrastructure**
 - For monitoring and troubleshooting by operators (or service providers)
 - Use available tools with standardized interfaces
 - Control sharing of data through authorization mechanisms
 - Prototyping now at BBN: Use perfSONAR/LAMP on Emulab servers to instrument an OpenFlow slice
 - Next steps?



- An Experimenter (or Operator) can move Measurement Data (MD) Objects:
 - From I&M service to a User Workspace (UW) service, to facilitate managing objects
 - With an associated MD Object Descriptor (MDOD) (“metadata”)
 - From UW service to a Digital Object Archive (DOA) service, to provide a long-term archive , and allow sharing as authorized

- **2) Use the User Workspace and Digital Object Archive services for all objects associated with an experiment, not just measurement data**
 - **Then the services provide a full Experiment Repository (not just a Measurement Data Repository)**
 - **Would need to extend Measurement Data Object Descriptor (MDOD) (“metadata”) to cover all types of objects**
 - **Next steps?**



- GENI MD Objects  include:
 - Packet flows and streams
 - Directories and files
- Each MD Object has an associated MD Object Descriptor (MDOD) 
 - Commonly called “metadata”
 - MDOD schema includes “transaction logs”, to track authorized movement of objects from one holder to another

Applying GENI I&M Tools, Services and Schemas

- **3) Adapt MDOD schema, including “transaction logs”, to track assignment of resource objects in an Aggregate Manager to an Experimenter**
 - **Currently defining MDOD schema to include “transaction logs”, useful for tracking authorized movement of MD objects, from one holder (owner) to another, at a certain date/time**
 - **Can use same schema to track assignment of resource objects (e.g., servers) by an Aggregate Manager to an Experimenter**
 - **“Transaction logs will be necessary for “accounting” and “forensics” of resource object assignments in an Aggregate Manager (equivalent to “call detail records” in telephony)**
 - **Next steps?**

Applying GENI I&M Tools, Services and Schemas

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 - Prototyping now at BBN: Use perfSONAR/LAMP on Emulab servers to instrument an OpenFlow slice
 - Next steps?
- **2) Use the User Workspace and Digital Object Archive services for all objects associated with an experiment, not just measurement data**
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- **3) Adapt MDOD schema, including “transaction logs”, to track assignment of resource objects in an Aggregate Manager to an Experimenter**
 - “Transaction logs will be necessary for “accounting” and “forensics” of resource object assignments in an Aggregate Manager (equivalent to “call detail records” in telephony)
 - Next steps?