Experiment Lifecycle Tools

GENI Engineering Conference 15
Houston, TX

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www.geni.net

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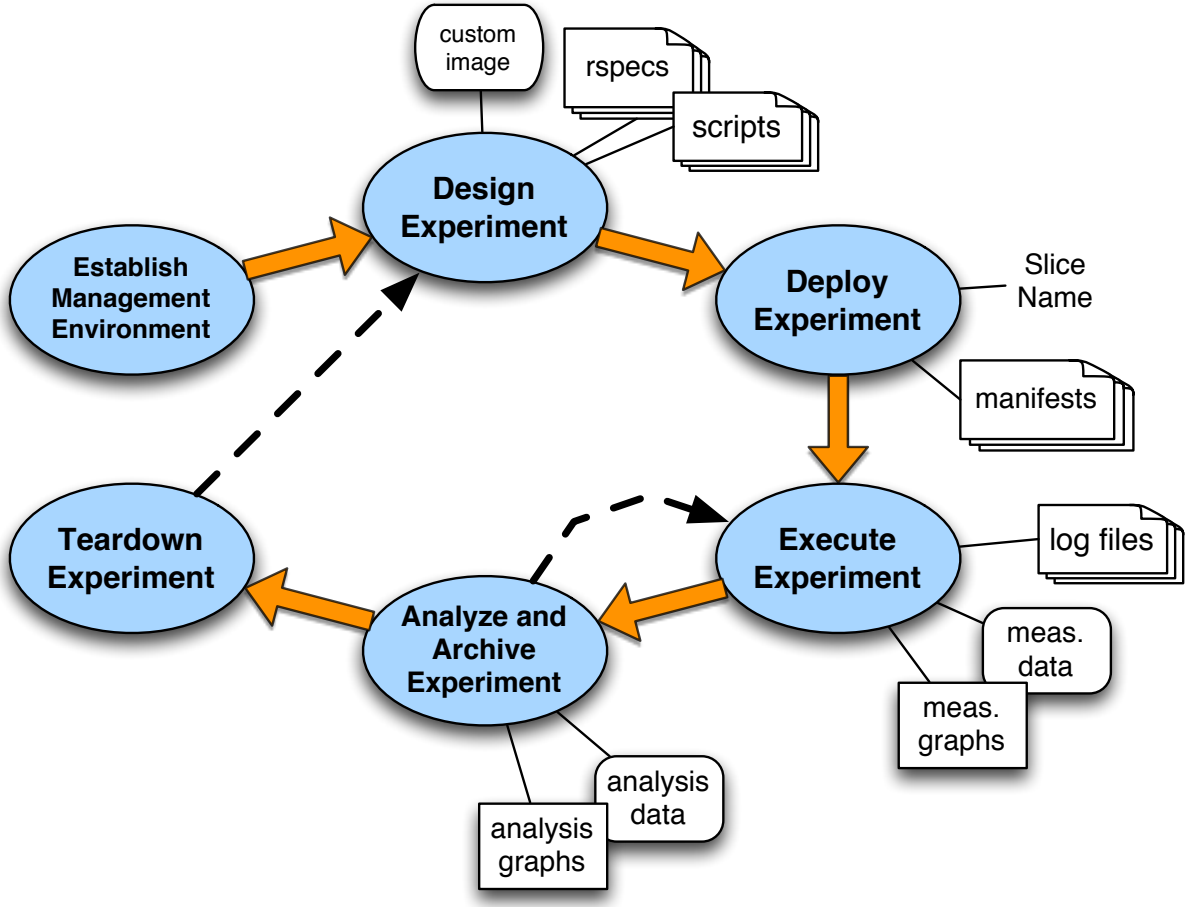
Introduction

- Objectives
  - Describe a general lifecycle process that can be followed when conducting GENI experiments
  - Provide guidance to experimenters on what tools are available, how and when they are best used.
  - Gather feedback on the experiment workflow and tools for future improvements
- Please contribute your thoughts and ideas!
  - The process I will describe is a strawman
  - You are the GENI experimenters and developers
  - What is your workflow?
  - What can we do to make this workflow easier?

Agenda

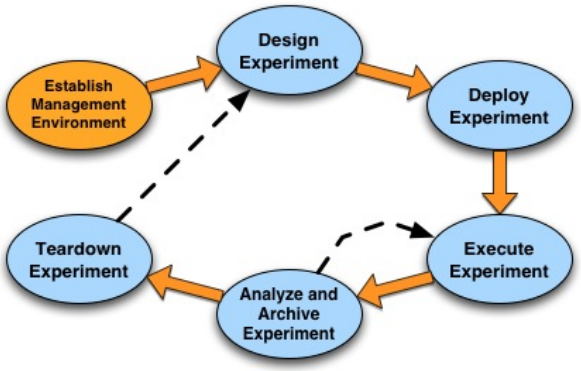
- Experiment Workflow Process
  - Broken down into 6 major steps
  - Describe each step
  - Discuss available tools
  - Discuss artifacts produced and consumed
- Upcoming tools
- Two GENI experimenters share their experience
  - Fraida Fund (Polytechnic Institute of NYU)
  - Roberto Francescangeli (Columbia University)
- Feedback
  - What tools or steps are missing?
  - What are the rough spots in the flow?

Experiment Lifecycle



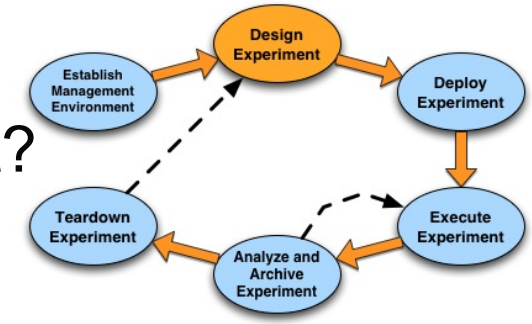
Establish Management Environment

- Download and configure GENI credentials
  - GENI certificate
    - Download from GENI Slice Authority
    - Load into browser cache for Flack
      - Log in to Slice Authority website
  - SSH key pair
    - Download from GENI Slice Authority
    - Generate from GENI certificate
    - Add to ssh-agent
  - Archive service account
    - iRODS/CNRI-DOR
    - Obtain from service provider

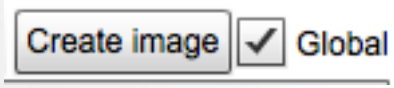


Design Experiment

- A lot of questions to consider
  - What is the hypothesis of the experiment?
  - What is the experiment plan?
  - What resources are needed and available?
  - Are required services available? (iRODS, UNIS, etc.)
  - What is the required topology?
  - What applications are needed?
  - How will the experiment be orchestrated?
  - What measurements are needed?
  - Who needs access to the experiment?
  - Who needs access to the results?



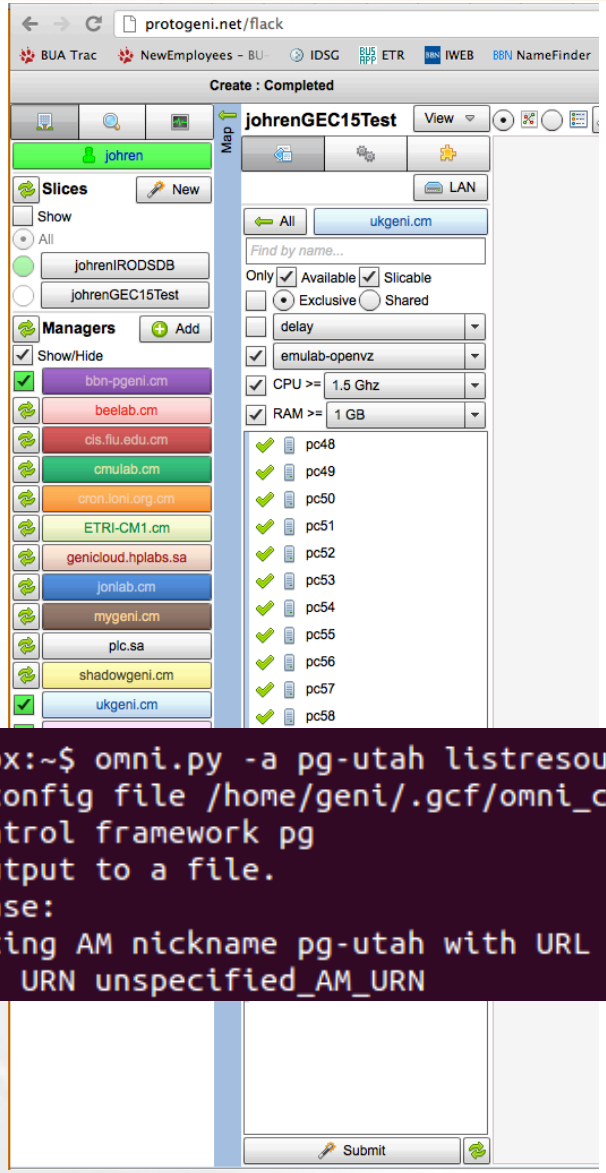
Design Experiment

- What images are needed?
  - Generic images
    - Use install scripts to install and configure additional software
    - Easy to get started
  - Custom images
    - Configure and capture a custom image with necessary software for the experiment
    - ProtoGENI/InstaGENI
      - createimage.py
        - » https://users.emulab.net/trac/protogeni/wiki/ImageHowTo
      - Create Image button in Flack 

    - ExoGENI process (VMs only):
      - https://geni-orca.renci.org/trac/wiki/virtual-machines

Design Experiment

- Tools
  - Flack
    - Determine what resources are available
    - Design the topology
  - OMNI
    - Determine what resources are available

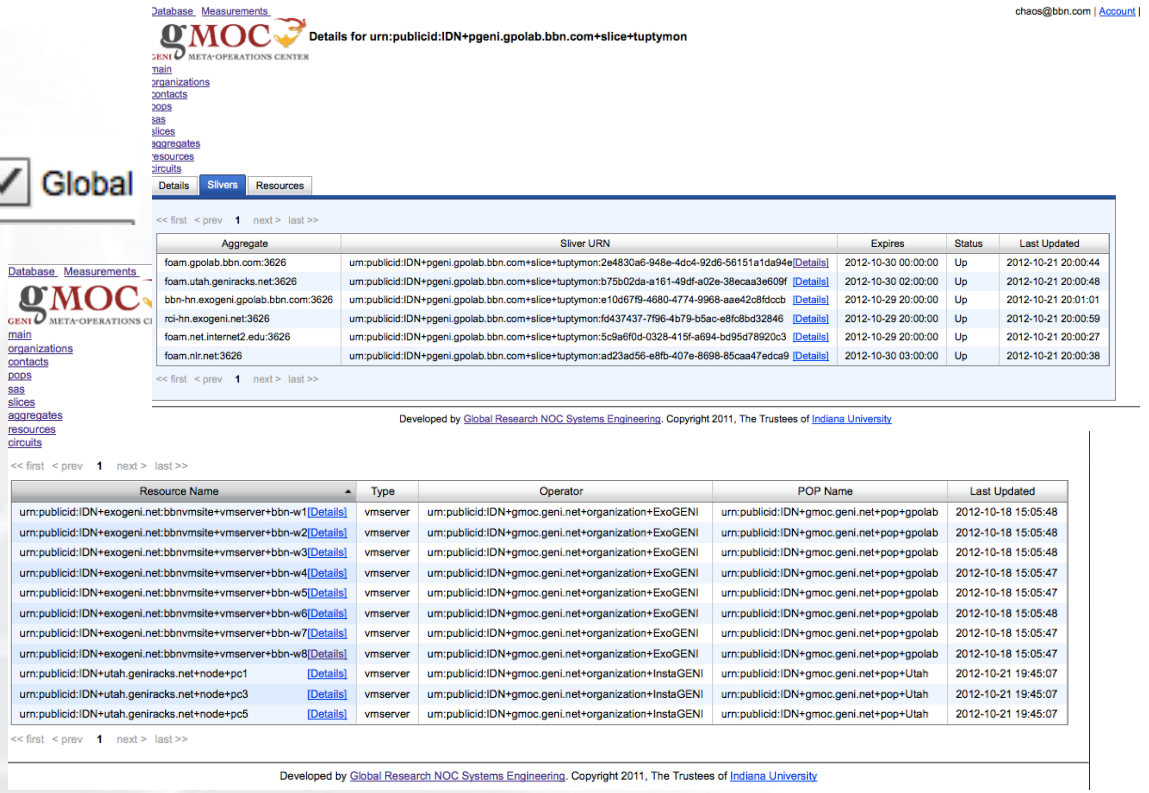



```
geni@geni-VirtualBox:~$ omni.py -a pg-utah listresources -o
INFO:omni:Loading config file /home/geni/.gcf/omni_config
INFO:omni:Using control framework pg
INFO:omni:Saving output to a file.
Enter PEM pass phrase:
INFO:omni:Substituting AM nickname pg-utah with URL https://
geni/xmlrpc/am/2.0, URN unspecified_AM_URN
```

Design Experiment

- Tools
  - OMF/Gush
    - Orchestration scripts
  - Images
    - Createimage.py
    - Flack 

  - Monitoring
    - GMOC

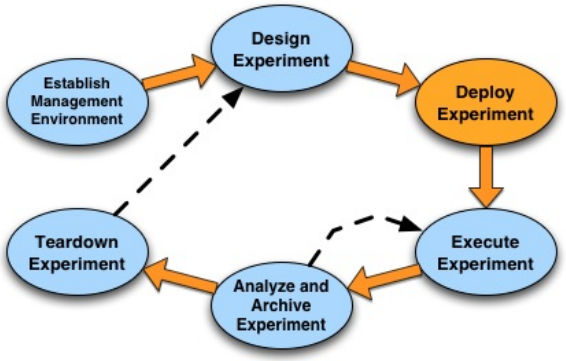


Design Experiment

- Artifacts
  - Advertisement rspecs (transient)
  - Request rspecs
  - Software package lists
  - Experiment orchestration scripts
  - Custom images
  - Install scripts

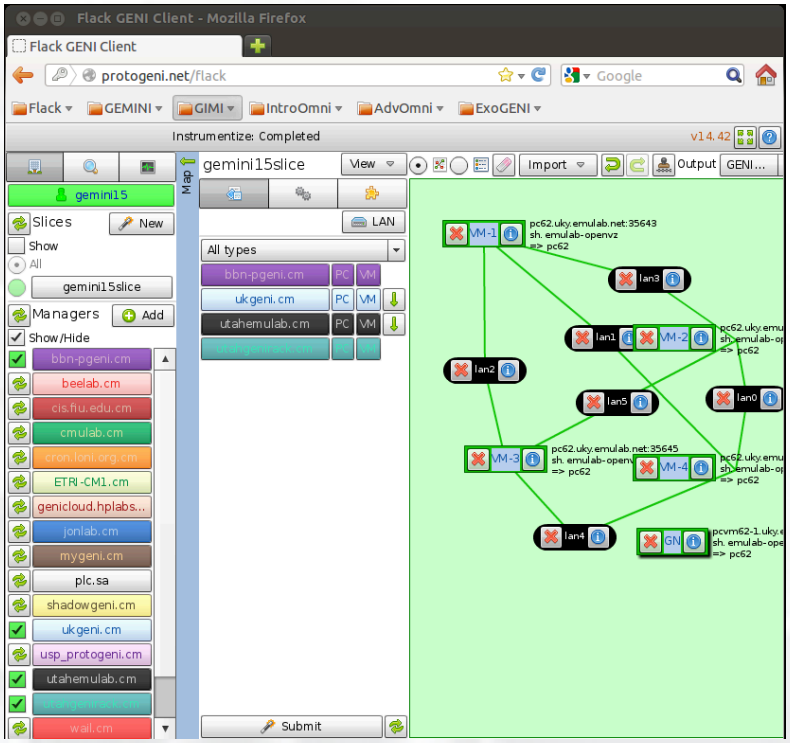
Deploy Experiment

- Create slice(s)
- Create slivers
- Install and configure software
  - Experiment applications and services
  - Instrumentation and Measurement tools
- Verify Deployment
  - Node access (can I ping/login to the nodes?)
  - Connectivity (is the network topology set up correctly?)
  - Software configuration (are services running?)



Deploy Experiment

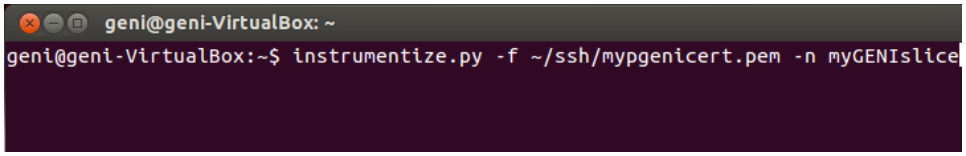
- Resource Configuration Tools
  - Flack
  - Omni

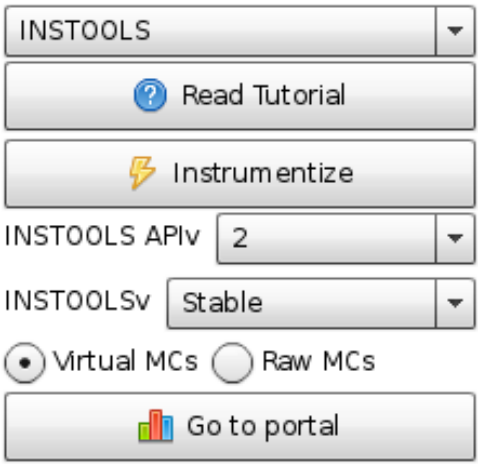



```
geniuser@UserWorkspace: ~
geniuser@UserWorkspace:~$ omni.py -a insta-utah createsliver jo
hGEC15Test insta.rspec
INFO:omni:Loading config file /home/geniuser/.gcf/omni_config
INFO:omni:Using control framework pg
INFO:omni:Slice urn:publicid:IDN+pgeni.gpolab.bbn.com+slice+joh
GEC15Test expires on 2012-10-20 19:33:21 UTC
INFO:omni:Substituting AM nickname insta-utah with URL https://
boss.utah.geniracks.net/protogeni/xmlrpc/am/2.0, URN unspecifie
d_AM_URN
INFO:omni:Substituting AM nickname insta-utah with URL https://
boss.utah.geniracks.net/protogeni/xmlrpc/am/2.0, URN unspecifie
d_AM_URN
INFO:omni:Creating sliver(s) from rspec file insta.rspec for sl
ice urn:publicid:IDN+pgeni.gpolab.bbn.com+slice+johGEC15Test
INFO:omni:Got return from CreateSliver for slice johGEC15Test a
t https://boss.utah.geniracks.net/protogeni/xmlrpc/am/2.0:
INFO:omni:<?xml version="1.0" ?>
INFO:omni:  <!-- Reserved resources for:
        Slice: johGEC15Test
        at AM:
```

Deploy Experiment

- I&M Tools
  - GEMINI
    - Instrumentize.py
  - GIMI
    - OMF scripts
  - INSTOOLS
    - Instrumentize button in Flack





Deploy Experiment

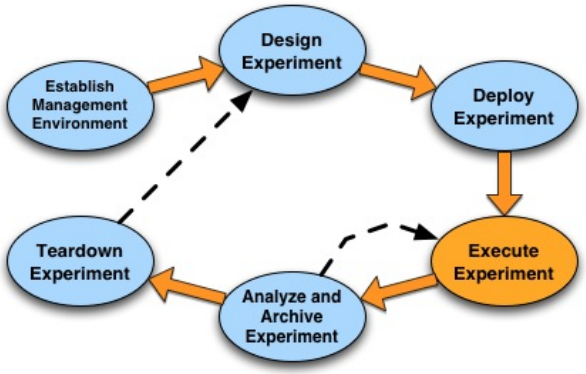
- Artifacts
  - Slice Name
  - Manifest rspec

```
<?xml version="1.0" ?>
  <!-- Reserved resources for:
        Slice: gemini17slice
        at AM:
        URN: unspecified_AM_URN
        URL: https://www.uky.emulab.net/protogeni/xmlrpc/am/2.0
 -->
  <rspec expires="2012-10-24T00:00:00Z" generated="2012-10-10T16:34:53Z" generated_b
y="Flack" type="manifest" xmlns="http://www.geni.net/resources/rspec/3" xmlns:client
="http://www.protogeni.net/resources/rspec/ext/client/1" xmlns:flack="http://www.pro
togeni.net/resources/rspec/ext/flack/1" xmlns:gemini="http://geni.net/resources/rspe
c/ext/gemini/1" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLoca
tion="http://www.geni.net/resources/rspec/3 http://www.geni.net/resources/rspec/3/ma
nifest.xsd ">
    <node client_id="VM-1" component_id="urn:publicid:IDN+uky.emulab.net+node+pc73"
component_manager_id="urn:publicid:IDN+uky.emulab.net+authority+cm" exclusive="false
" sliver_id="urn:publicid:IDN+uky.emulab.net+sliver+57851" xmlns:flack="http://www.p
rotogeni.net/resources/rspec/ext/flack/1" xmlns:gemini="http://geni.net/resources/rs
pec/ext/gemini/1" xmlns:rs="http://www.protogeni.net/resources/rspec/ext/emulab/1">

        <rs:vnode name="pcvm73-7"/>
        <sliver_type name="emulab-openvz"/>
        <interface client_id="VM-1:if0" component_id="urn:publicid:IDN+uky.emulab.ne
t+interface+pc73:lo0" mac_address="00000a800202" sliver_id="urn:publicid:IDN+uky.emu
lab.net+sliver+57861">
            <ip address="10.128.2.2" netmask="" type="ipv4"/>
            <flack:interface_info addressUnset="false"/>
        </interface>
```

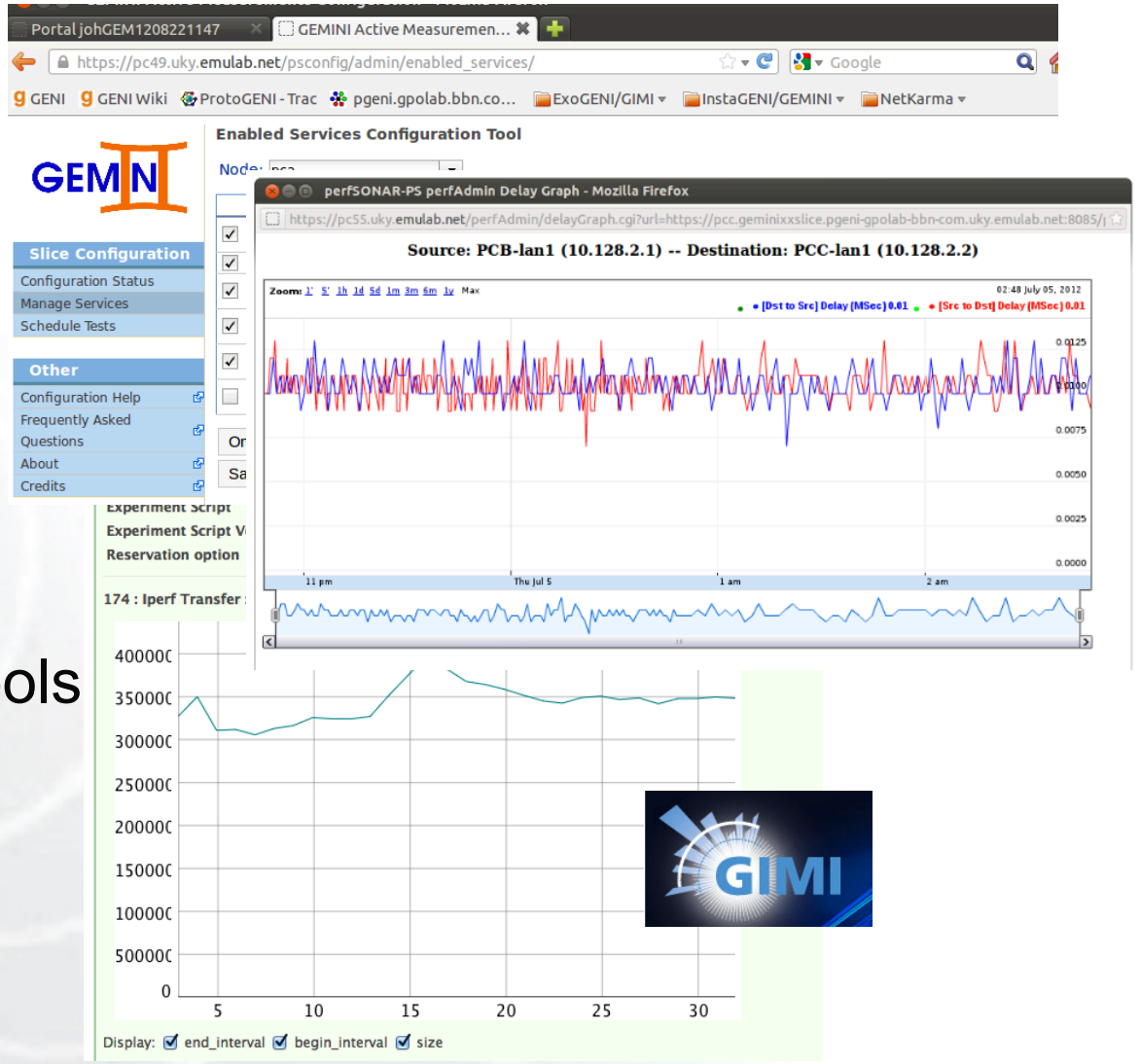
Execute Experiment

- Configure and enable I&M services
- Configure and execute the experiment
- Observe real-time experiment measurements and output
- Push results to off-slice storage



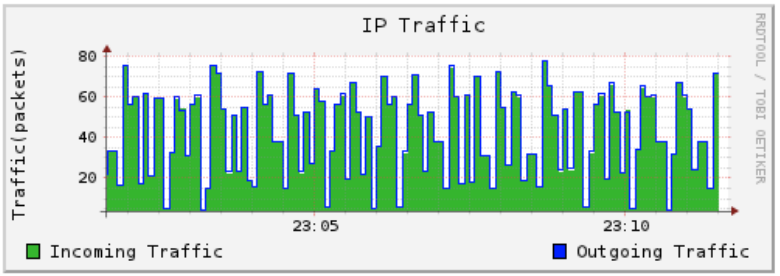
Execute Experiment

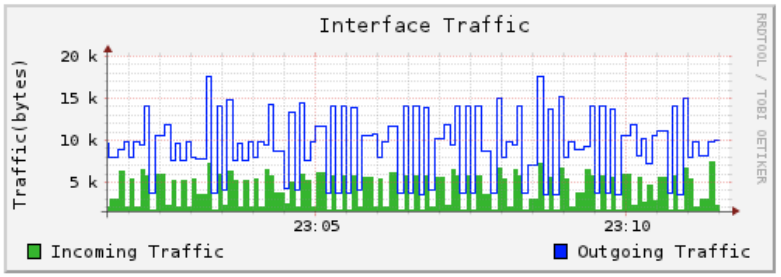
- Tools
  - I&M tools
    - GIMI
    - GEMINI
    - INSTOOLS
  - Monitoring
    - GMOC
  - Orchestration tools
    - OMF
    - Gush

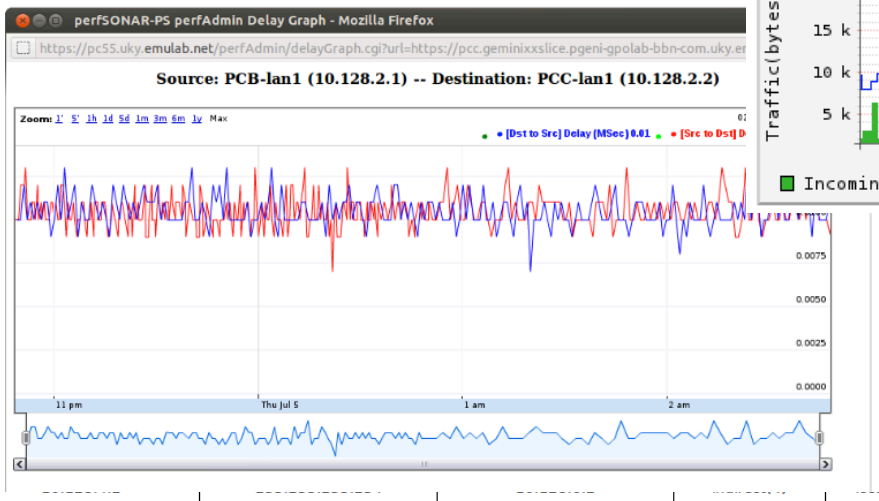


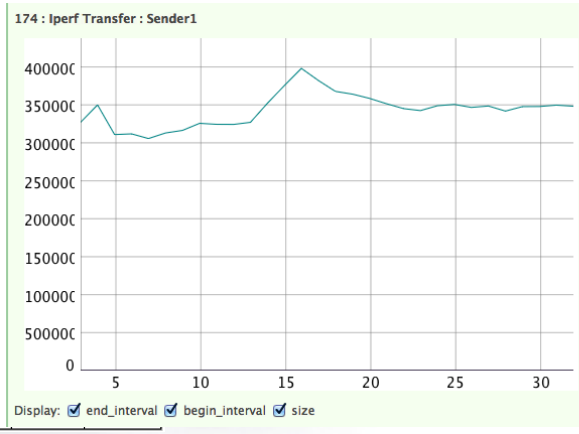
Execute Experiment

- Artifacts
  - Measurement data
  - Measurement graphs
  - Log files





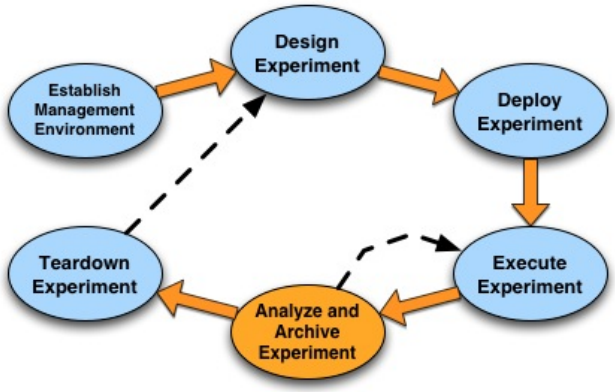




10.128.5.0	255.255.255.0	0.0.0.0	direct(3)	local(2)
10.128.6.0	255.255.255.0	0.0.0.0	direct(3)	local(2)
128.163.143.128	255.255.255.128	0.0.0.0	direct(3)	local(2)
172.16.0.0	255.240.0.0	0.0.0.0	direct(3)	local(2)

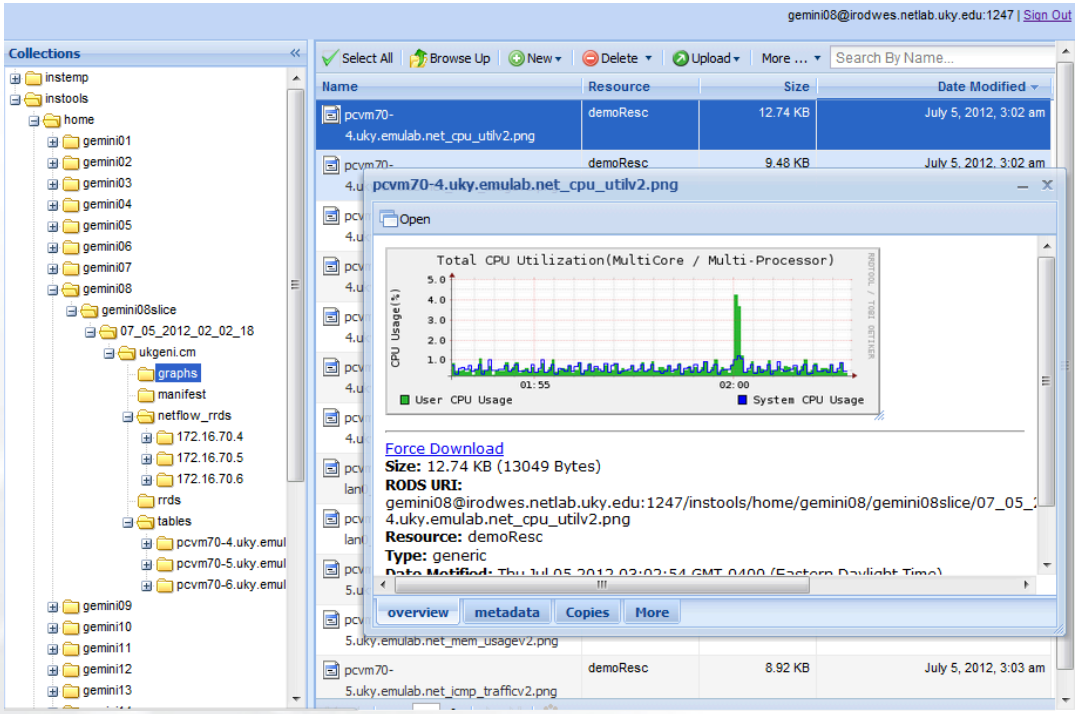
Analyze and Archive Experiment

- Observe post-experiment measurements
- Observe experiment results
- Analyze results
- Push analysis results to off-slice storage
- Push full experiment and metadata to long-term archive



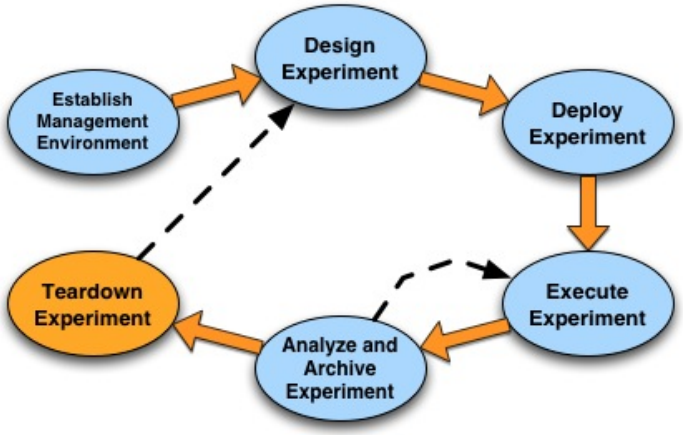
Analyze and Archive Experiment

- Tools
  - I&M Tools
    - GIMI
    - GEMINI,
    - INSTOOLS
  - Analysis Software
    - Third-party tools:
      - R, gnuplot, etc.
  - Archival Services
    - iRODS
    - CNRI-DOR



Teardown Experiment

- Delete slivers
  - Releases resources
- Tools
  - Flack
  - OMNI



Tool Breakdown

	Tools	Notes
Design/Deploy	Flack	not supported with ExoGENI
	OMNI	
Execute/ Orchestrate	OMF, Gush	
Monitoring	GMOC	
I&M	GEMINI, INSTOOLS,	Currently ProtoGENI/InstaGENI only
	GIMI	Currently ExoGENI only
Archival	iRODS, CNRI-DOR	
Image Creation	Createimage.py	ProtoGENI/InstaGENI

Upcoming GENI Tool Tutorials

Tool	Session Time
Intro to OMNI	Today, 3pm
GEMINI (part 2)	Today, 3pm
Advanced OMNI	Wednesday, 1pm
ExoGENI	Wednesday, 1pm
GIMI	Thursday, 8:30am
WiMAX (OMF)	Thursday, 8:30am

Coming Soon

- GENI Portal
  - An entry to GENI for experimenters
  - A user interface to the GENI Clearinghouse services

geni portal

Logged in as Aaron Helsinger

Home | Projects | Slices | Profile | Help | Debug

My Projects

Join a Project

Ask Someone to Create a Project

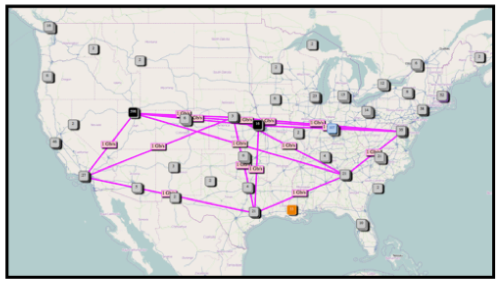
No outstanding project join requests.

Project Name	Project Lead	Purpose	Slice Count	Create Slice
CS101	Marshall Brinn	teach CS	1	Create Slice

My Slices

Slice Name	Project	Slice Expiration	Slice Owner	Add Slivers	Sliver Status	Manifest	Delete Slivers	Flack
TuesdaySession	CS101	2012-06-26 21:27:44	Aaron Helsinger	Add Slivers	Sliver Status	Manifest	Delete Slivers	Launch Flack

GENI Resources



GENI Messages

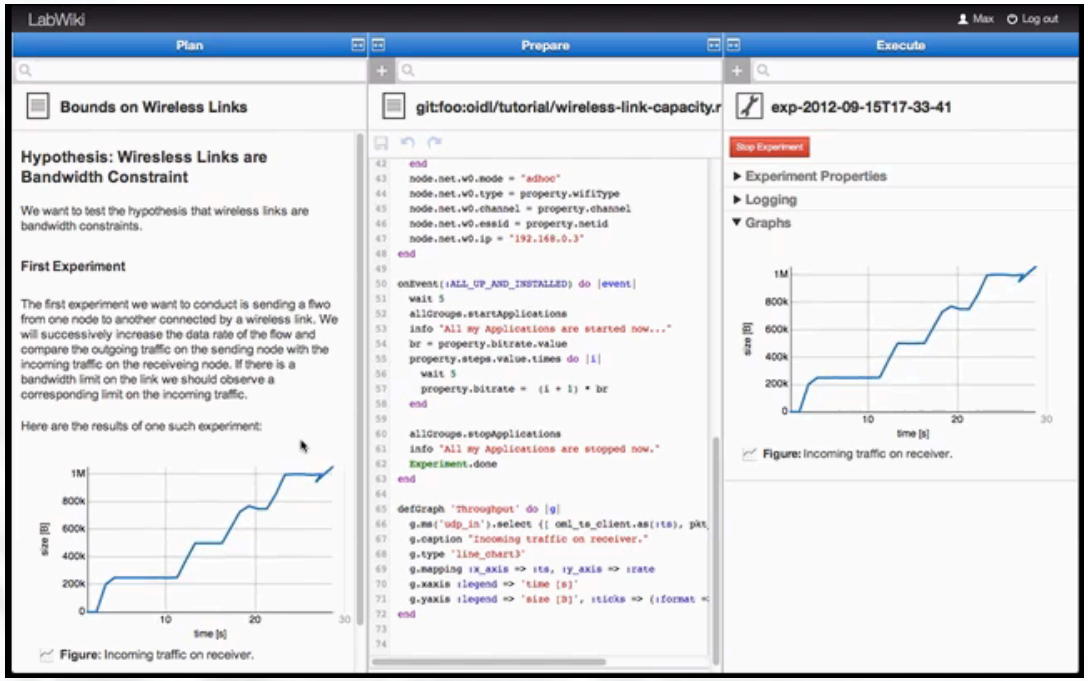
2012-06-26 13:24:20:	Added Aaron Helsinger to project CS101 as Member
2012-06-26 13:22:54:	Aaron Helsinger requested to join project CS101
2012-06-26 13:46:40:	Deleted resources from slice TuesdaySession
2012-06-26 13:31:37:	Added resources to slice TuesdaySession
2012-06-26 13:27:44:	Created slice TuesdaySession

Invite Someone to GENI

  - See **GENI Portal and Clearinghouse** session at 1pm tomorrow for more details

Work In Progress

- LabWiki
  - A web-based tool to support the experimenter throughout the entire investigative lifecycle.
  - Designed as a framework with plugins



  - See http://labwiki.mytestbed.net for introductory video
  - See **GIMI Tutorial** at 8:30am Thursday for more details

Real Experiences of GENI Experimenters

- Fraida Fund
  - Polytechnic Institute of New York University
  - GENI WiMAX Project
- Roberto Francescangeli
  - Columbia University
  - NetServ Project

Feedback

- Does this workflow fit your process or model of planning and executing experiments?
- What steps or tools are missing?
- What is out of order?
- What are the rough spots in the flow?
  - Places where tools can help smooth out the process

Birds of a Feather

- Experiment Management BoF Dinner
  - Wednesday 6pm
  - Ninfa's (http://www.ninfas.com)
  - RSVP to Sarah Edwards (sedwards@bbn.com)
  - Meet at 6pm in lobby of hotel