



Are you ready for the tutorial?

1. Sign In
2. Grab a Worksheet
3. Did you do the pre-work?
 - A. Are you able to login to the GENI Portal?
 - Using your home institution username and password, or
 - Using a GPO issued username and password, or
 - A temporary account
 - B. Have the VM including both:
 - Installing VirtualBox
 - Importing NSDI Tutorial VM image
 - C. Sign and return the *GENI Project Software Disclaimer*

GENI Portal is at:

<http://panther.gpolab.bbn.com>



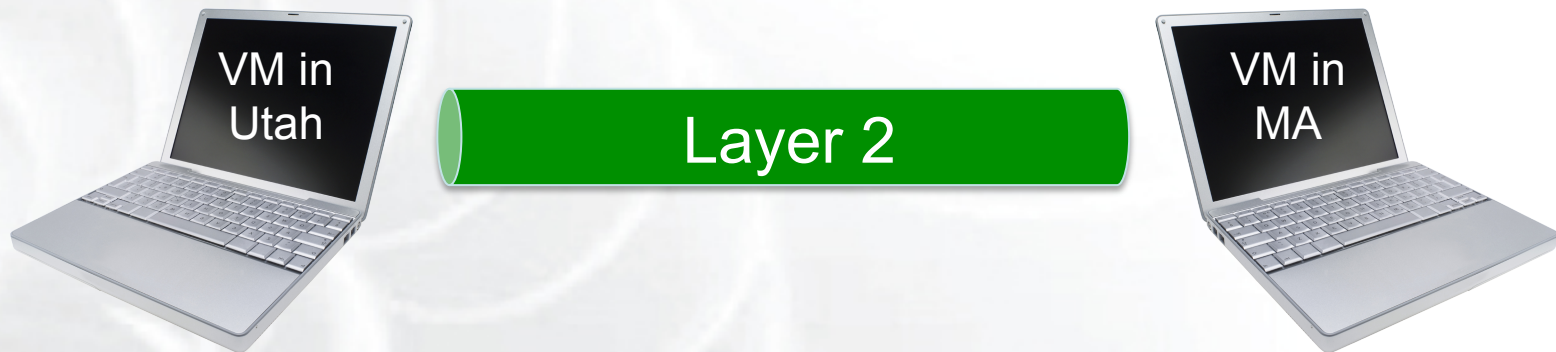
Tutorial: Getting Started with GENI Using the GENI Portal

Niky Riga, Vic Thomas
GENI Project Office
April 2 2013



Do a Simple Layer 2 Experiment in GENI

Reserve two VMs across the US from each other connected by a Layer 2 circuit



slice

project

experimenter

resource

aggregate

Use the GENI Portal



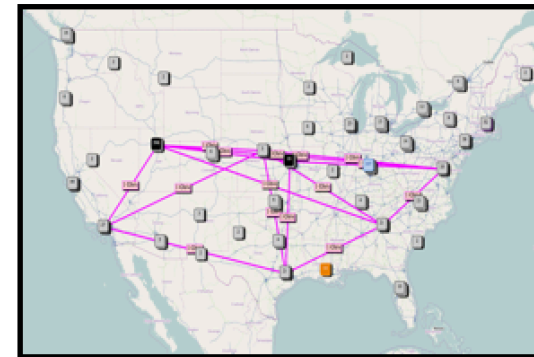
Welcome to GENI

GENI is a new, nationwide suite of infrastructure supporting "at scale" research in networking, distributed systems, security, and novel applications. It is supported by the National Science Foundation, and available without charge for research and classroom use.

Use GENI

Find out more about using GENI

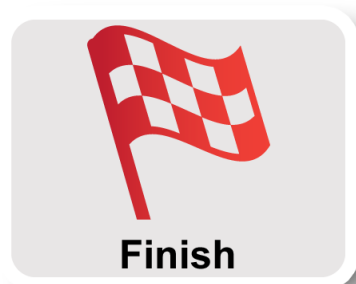
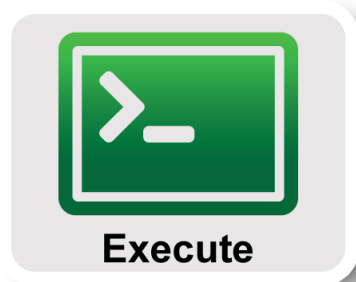
- Information for GENI experimenters
- Published research that used GENI resources
- Get help using GENI



These are some of the many resources being used in GENI experiments across the country.

GENI is sponsored by the  National Science Foundation

Experiment Workflow



- Part I: Design/Setup
 - Step 1: Establish Management Environment
 - Step 2: Obtain Resources
- Part II: Execute
 - Execute Experiment
- Part III: Finish
 - Teardown Experiment

The GENI Portal is...

Use GENI

A web-based tool for experimenters to manage **experimenters, projects, and slices.**

Includes simple tools to reserve **resources.**

More to come in the future.

An **experimenter** is a researcher who uses GENI resources

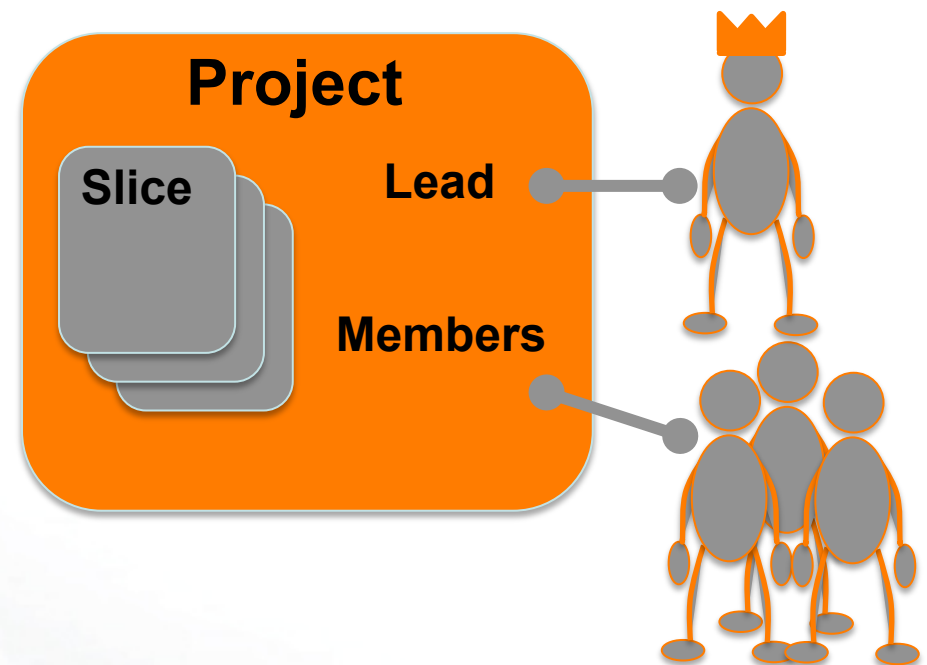
Different types of experimenters have different roles and permissions:

- Advisor vs Grad Student
- Teacher vs TA vs Student



Experimenter

Projects organize
research in GENI



Projects contain both **people** and their **experiments**

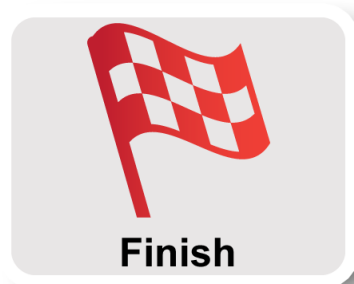
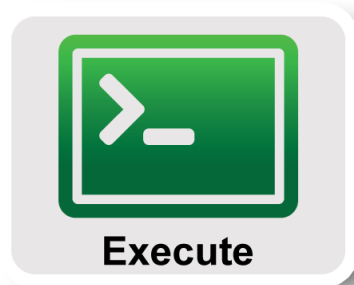
A project is led by a single responsible individual:
the **project lead**

Creating Projects

- Only project **leads** can create projects.
- Project **names** are *public*, *unique* and *permanent*
- A project may contain many experimenters; an experimenter may be a member of many projects
- Projects have an optional **expiration** (e.g. for classes, tutorials)

For today's tutorial we will all join a project which expires on Friday

Experiment Workflow



- **Part I: Design/Setup**
 - Step 1: Establish Management Environment
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Part I: Step 1: Establish Management Environment

Use GENI

1. Pre-work: Login to the Portal
2. Generate and Download SSH Keypair
3. Join a Project

Project Name: NSDI13

Tutorial instructions:

<http://groups.geni.net/geni/wiki/GENIExperimenter/Tutorials/NSDI13/PortalSimpleLayer2Example>

Creating a GENI account

- GENI Portal is at:

<https://panther.gpolab.bbn.com>

- Anyone with an account at a supported identity provider (usually your school or employer) can log in, but they will have no privileges
- If you don't have such an account, we will make you an account at the GPO Identity Provider
- You must be a member of a project to do anything interesting

Leverage InCommon for
single sign-on authentication

InCommon®

Experimenters from 288
educational and research
institutions have
InCommon accounts

For many experimenters:

- no new passwords
- familiar login screens





Projects

My Projects

Congratulations! Your GENI Portal account is now active.

You can now participate in GENI research, by joining a 'Project'. Note that your account is not a 'Project Lead' account, meaning you must join a project created by someone else, before you can create slices or use GENI resources.

A project is a group of people and their research, led by a single responsible individual - the project lead. See the [Glossary](#).

You are not a member of any projects. Please join an existing Project, ask someone to create a Project for you, or ask to be a Project Lead.

- Join a Project
- Ask Someone to Create a Project
- Ask to be a Project Lead

No projects.
No outstanding project join requests by you.

Slices

My Slices

You do not have access to any slices.

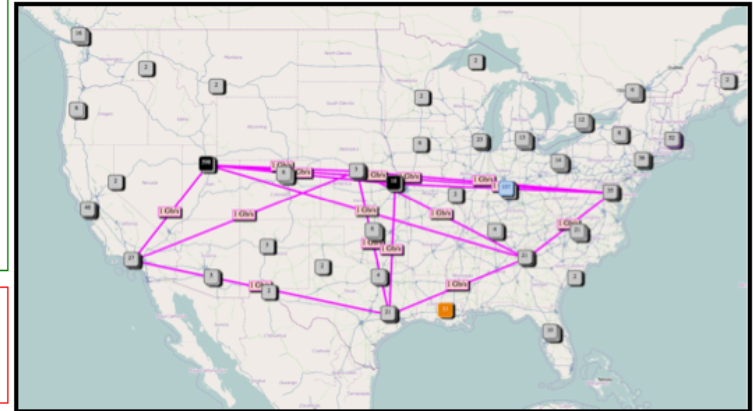
Log Messages

GENI Messages

2013-03-11 21:09:58 UTC	sergyar.mbrinn Registering SSH key "Generated SSH keypair"
2013-03-11 21:03:28 UTC	Canceled join request: Marshall Brinn in project P1
2013-02-26 16:02:23 UTC	Marshall Brinn requested to join project P1
2013-02-26 16:02:07 UTC	sergyar.km authorizing client sergyar.portal
2013-02-26 16:02:05 UTC	Activated GENI account for mbrinn@geni.net

Invite Someone to GENI

GENI Resources



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[Join a Project](#)

[Ask Someone to Create a Project](#)

[Ask to be a Project Lead](#)

No projects.

No outstanding project join requests by you.

My Slices

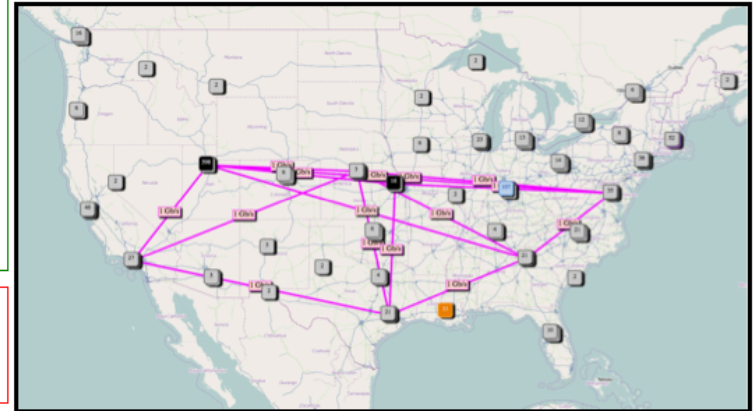
You do not have access to any slices.

GENI Messages

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2013-02-26 16:02:05 UTC	Activated GENI account for mbrinn@geni.net

[Invite Someone to GENI](#)

GENI Resources



In your local VM ...

```
> mv ~/Downloads/id_geni_ssh_rsa ~/.ssh/.  
> chmod 600 ~/.ssh/id_geni_ssh_rsa  
> ssh-add ~/.ssh/id_geni_ssh_rsa
```

My Projects

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[Join a Project](#)

[Ask Someone to Create a Project](#)

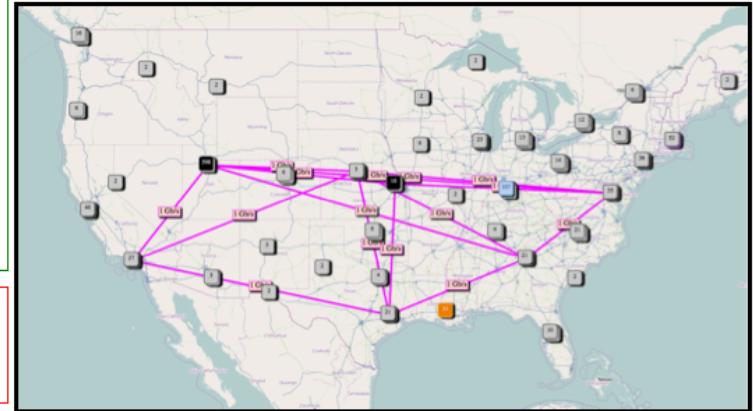
[Ask to be a Project Lead](#)

No projects.

No outstanding project join requests by you.

**Join a Project
NSDI13**

GENI Resources



My Slices

You do not have access to any slices.

GENI Messages

2013-03-11 21:09:58 UTC	sergyar.mbrinn Registering SSH key "Generated SSH keypair"
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[Invite Someone to GENI](#)

A **resource** is a piece of infrastructure

A resource can be real or virtual.

Resource specifications are used to describe and request resources.

Examples:

- Compute: computer vs virtual machine (VM)
- Wireline Network: VLAN or OpenFlow
- Wireless: WiMAX



An **aggregate** manages a set of reservable **resources**

Aggregates include:

GENI racks

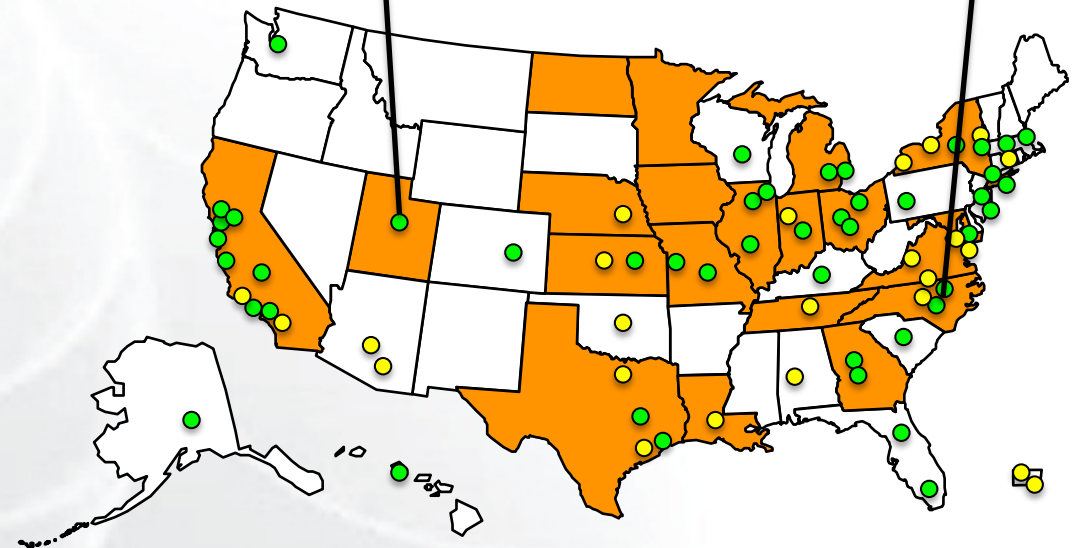
OpenFlow

WiMAX

InstaGENI Rack



ExoGENI Rack



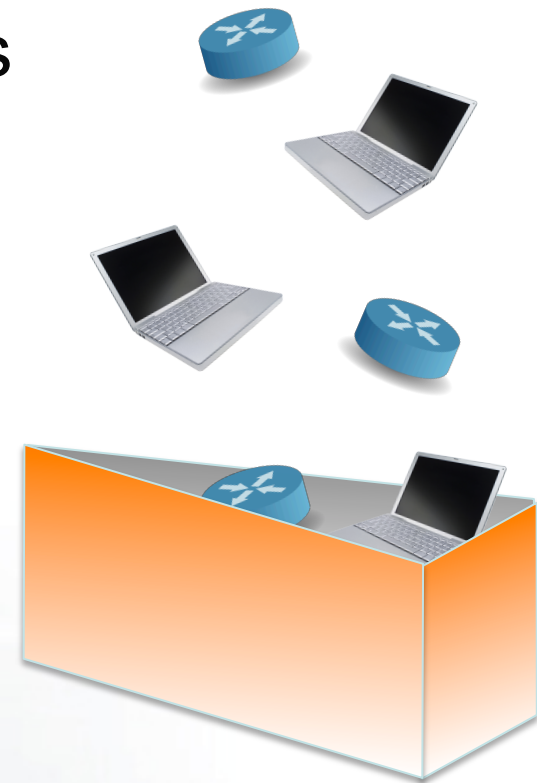
A **slice** is a *container* of resources used in an *experiment*.

A slice can contain resources from one or more aggregates

A slice is in a single project

A slice has an **expiration**

Slice names are **public, reusable** and **unique**



Putting it all together

project

Lead:



Experimenter

Member:



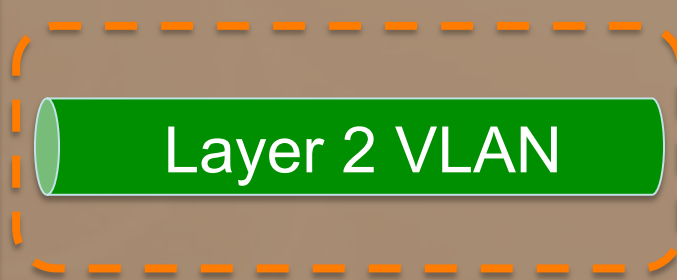
Experimenter

slice

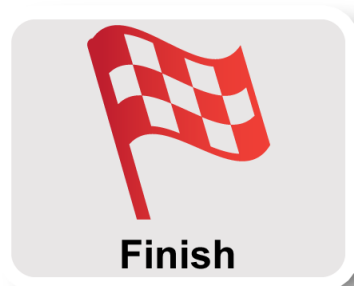
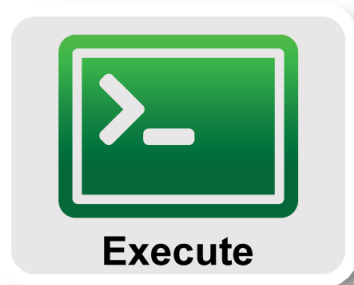
aggregate



aggregate



Experiment Workflow



- **Part I: Design/Setup**
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slice



Layer 2 VLAN



1. Create a slice
2. Reserve VM at Two Aggregates
 - Utah InstaGENI
 - GPO InstaGENI
3. Check Whether VMs are Ready to be Used

Wait for
blinking
ball

GENI Project: tutorial

Project Actions

[Create Slice](#) [Edit](#)

Create Slice

Project Identifiers (public)

Name	tutorial
Purpose	GEC16 tutorial prep
Expiration	<i>None</i>
Creation	2013-02-08 19:18:26 UTC

Contact Information

Project e-mail	project-tutorial@example.com
Project Lead	Sarah Edwards e-mail

Project slices:

You do not have access to any slices in this project.

Project members

Project Member	Roles
Sarah Edwards	Lead

Invite new project members

GENI Slice: portal01

Extend slice expiration
Extend resource expiration

Slice Actions		Renew	
Add Resources	Resource Status	Details	Add Note
	Delete Resources	2013-03-05 21:58:41 UTC	Renew Slice
		2013-03-05 21:58:41 UTC	Renew Resource Reservations
Tools		Ops Mgmt	
Launch Flack	Use omni	Disable Slice	Shutdown Slice

Add Resources

Confused? Look at the [Portal Help](#) or [GENI Glossary](#).

Slice Status

Status	Aggregate	Renew	Actions
READY	GPO InstaGENI	2013-03-05 21:58:41 UTC	Renew
no resources	Kentucky ProtoGENI	2013-03-05 21:58:41 UTC	Renew
no resources	ExoGENI ExoSM	2013-03-05 21:58:41 UTC	Renew
READY	Utah InstaGENI	2013-03-05 21:58:41 UTC	Renew
no resources	Utah ProtoGENI	2013-03-05 21:58:41 UTC	Renew
no resources	GPO ExoGENI	2013-03-05 21:58:41 UTC	Renew
no resources			

Add resources to GENI Slice: portal01

Choose Resources: or [upload your own Resource Specification \(RSpec\)](#).

Choose Aggregate:

**Add
Resources at
*Utah InstaGENI***

Wait for
blinking ball


Add resources to GENI Slice: portal01

Choose Resources: or [upload your own Resource Specification \(RSpec\)](#).

Choose Aggregate:

**Add
Resources at
*GPO InstaGENI***

GENI Slice: portal01

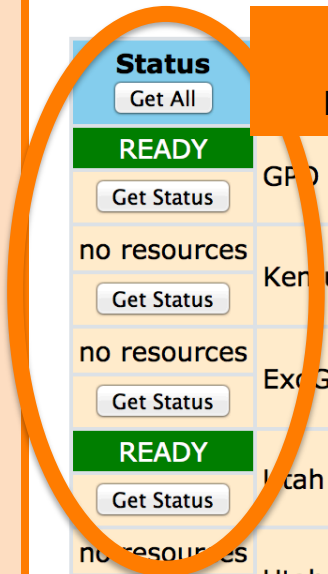
Slice Actions		Renew	
<input type="button" value="Add Resources"/>	<input type="button" value="Resource Status"/>	<input type="button" value="Details"/>	<input type="button" value="Add Note"/>
<input type="button" value="Delete Resources"/>		2013-03-05 21:58:41 UTC	<input type="button" value="Renew Slice"/>
		2013-03-05 21:58:41 UTC	<input type="button" value="Renew Resource Reservations"/>
Tools		Ops Mgmt	
	<input type="button" value="Launch Flack"/>	<input type="button" value="Use omni"/>	
		<input type="button" value="Disable Slice"/>	<input type="button" value="Shutdown Slice"/>

Confused? Look at the [Portal Help](#) or [GENI Glossary](#).

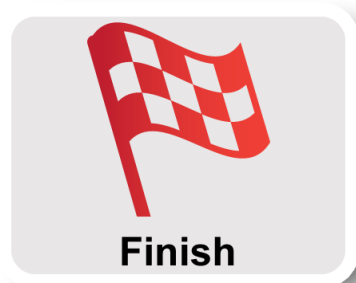
Slice Status

Status		Renew	Actions
<input type="button" value="Get All"/>			
READY	GPO InstaGENI	2013-03-05 21:58:41 UTC <input type="button" value="Renew"/>	<input type="button" value="Resource Status"/> <input type="button" value="Details"/> <input type="button" value="Delete Resources"/>
no resources	Kentucky ProtoGENI	2013-03-05 21:58:41 UTC <input type="button" value="Renew"/>	<input type="button" value="Resource Status"/> <input type="button" value="Details"/> <input type="button" value="Delete Resources"/>
no resources	ExoGENI ExoSM	2013-03-05 21:58:41 UTC <input type="button" value="Renew"/>	<input type="button" value="Resource Status"/> <input type="button" value="Details"/> <input type="button" value="Delete Resources"/>
READY	Utah InstaGENI	2013-03-05 21:58:41 UTC <input type="button" value="Renew"/>	<input type="button" value="Resource Status"/> <input type="button" value="Details"/> <input type="button" value="Delete Resources"/>
no resources	Utah ProtoGENI	2013-03-05 21:58:41 UTC <input type="button" value="Renew"/>	<input type="button" value="Resource Status"/> <input type="button" value="Details"/> <input type="button" value="Delete Resources"/>
no resources	GPO ExoGENI	2013-03-05 21:58:41 UTC <input type="button" value="Renew"/>	<input type="button" value="Resource Status"/> <input type="button" value="Details"/> <input type="button" value="Delete Resources"/>
no resources	RENCI ExoGENI	2013-03-05 21:58:41 UTC <input type="button" value="Renew"/>	<input type="button" value="Resource Status"/> <input type="button" value="Details"/> <input type="button" value="Delete Resources"/>

Nodes ready?



Experiment Workflow

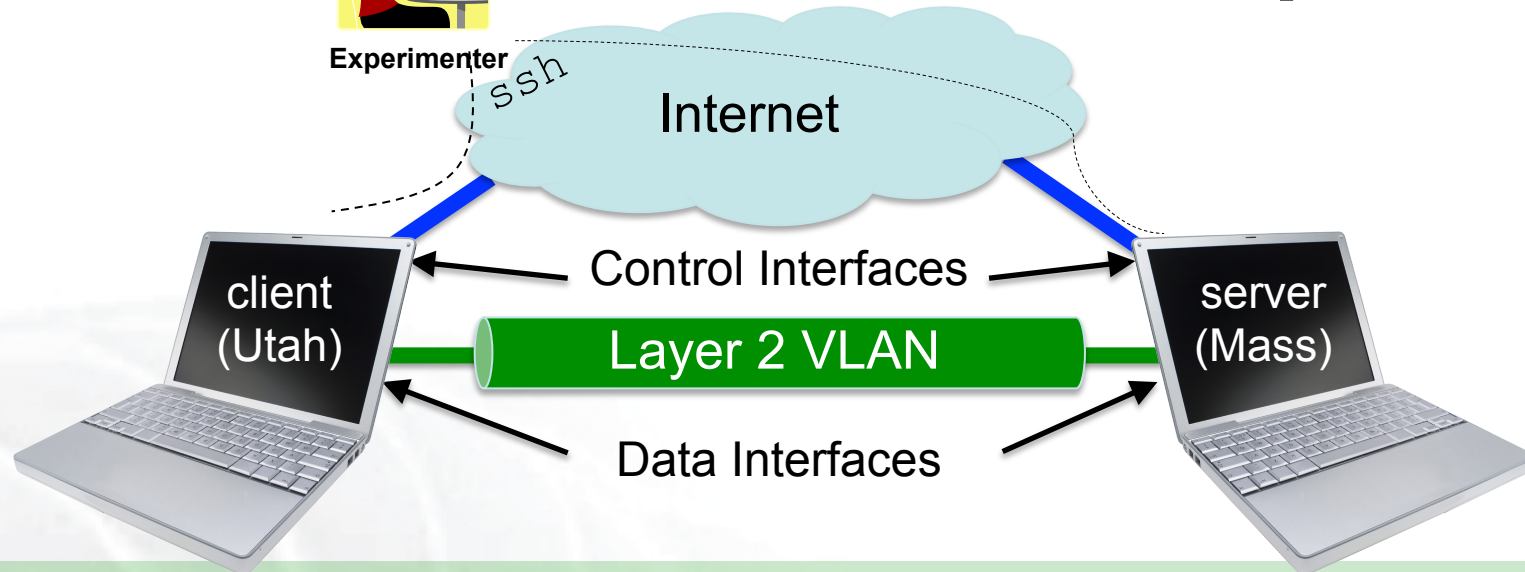


- Part I: Design/Setup
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- **Part II: Execute**
 - **Execute Experiment**
- Part III: Finish
 - Teardown Experiment




Experimenter

Part II: Execute Experiment



1. Login to nodes (two nodes: client & server)
2. Run your experiment
 1. Send IP Traffic
 2. Disable IP
 3. Send Layer 2 (non-IP) Traffic
3. Logout of nodes

GENI Slice: portal01

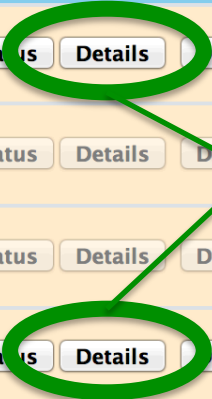
Slice Actions		Renew	
Add Resources	Resource Status	2013-03-05 21:58:41 UTC	Renew Slice
Details	Add Note	2013-03-05 21:58:41 UTC	Renew Resource Reservations
Delete Resources			
Tools		Ops Mgmt	
	Launch Flack	Disable Slice	Shutdown Slice
	Use omni		

Confused? Look at the [Portal Help](#) or [GENI Glossary](#).

Slice Status

Status	Aggregate	Renew	Actions
Get All			
READY	GPO InstaGENI	2013-03-05 21:58:41 UTC Renew	Resource Status Details Delete Resources
Get Status			
no resources	Kentucky ProtoGENI	2013-03-05 21:58:41 UTC Renew	Resource Status Details Delete Resources
Get Status			
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Get Status			
READY	Utah InstaGENI	2013-03-05 21:58:41 UTC Renew	Resource Status Details Delete Resources
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Get Status			
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Get Status			
no resources	RENCI ExoGENI	2013-03-05 21:58:41 UTC Renew	Resource Status Details Delete Resources

Login



```
# login to "client" VM
```

```
> ssh username@hostname1 -p port1
```

```
$ /sbin/ifconfig
```



```
# login to "server" VM
```

```
> ssh username@hostname2 -p port2
```

```
$ /sbin/ifconfig
```



Resources on slice: portal01

Aggregate **Utah InstaGENI's** Resources:

There are 1 node and 1 link at this aggregate.

Node #1

Client ID	Component ID	Exclusive	Type	Hostname
client	pc3	not exclusive	emulab-openvz	client.portal01.pantherlab.utah.geniracks.net
Login	ssh sedwards@pc3.utah.geniracks.net -p 31546			
Interfaces	MAC	Layer 3		
client:if0	pc3:eth1	0237463003a4	ipv4: 10.10.10.1	

Link #1

Client ID	Endpoint #0
L2-ping-tutorial-0	client:if0

Resources on slice: portal01

Aggregate **GPO InstaGENI's** Resources:

There are 1 node and 1 link at this aggregate.

Node #1

Client ID	Component ID	Exclusive	Type	Hostname
server	pc2	not exclusive	emulab-openvz	server.portal01.pantherlab.geni.gpolab.bbn.com
Login	ssh sedwards@pc2.instageni.gpolab.bbn.com -p 30778			
Interfaces	MAC	Layer 3		
server:if0	pc2:eth1	029ee9eb3614	ipv4: 10.10.1.1	

Link #1

Client ID	Endpoint #0
L2-ping-tutorial-0	server:if0

```
$ /sbin/ifconfig
```



```
$ /sbin/ifconfig
```



Worksheet

Project Name: NSDI

Slice Name: NSDIportal**01**

Client

Control Interface

Name eth ____
IP Address ____ . ____ . ____ . ____

Data Interface

Name mv ____ . ____
Initial IP Addr 10 . ____ . ____ . ____
Des IP Addr 10 . 12 . **1** . 1 /24

Server

Control Interface

Name eth ____
IP Address ____ . ____ . ____ . ____

Data Interface

Name mv ____ . ____
Initial IP Addr 10 . ____ . ____ . ____
Des IP Addr 10 . 12 . **1** . 2 /24
MAC Address __ : __ : __ : __ : __ : __

EtherType: 112**01**

```
# configure your IP
$ sudo /sbin/ifconfig
mv10.1 10.12.1.1/24

# should SUCCEED
$ ping 10.12.1.2 -c 5

# disable IP on your nodes
$ sudo /sbin/ifconfig
mv10.1 0.0.0.0

# should FAIL
$ ping 10.12.1.2 -c 5

# start L2 client
$ sudo /usr/local/bin/
pingPlus 01:02:03:04:05:06
mv10.1 11201

$ exit
```



```
# configure your IP
$ sudo /sbin/ifconfig
mv2.3 10.12.1.2/24

# disable IP on your nodes
$ sudo /sbin/ifconfig
mv2.3 0.0.0.0

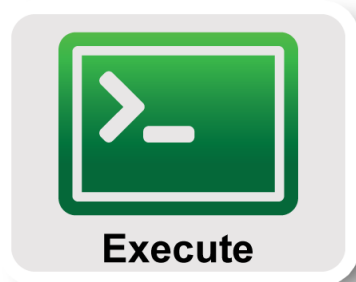
# start L2 server
$ sudo /usr/local/bin/
pingPlusListener 11201

$ exit
```



**Be
careful!**

Experiment Workflow



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project resource
aggregate experimenter



When your experiment is done, you should always release your resources.

- Normally this is when you would archive your data
- Delete your resources at **each** aggregate

GENI Slice: portal01

Slice Actions		Renew	
Add Resources	Resource Status	Details	Add Note
		Delete Resources	
Tools		Ops Mgmt	
	Use omni	Disable Slice	Shutdown Slice

Confused? Look at the [Portal Help](#) or [GENI Glossary](#).

Slice Status

Delete Resources at both *GPO InstaGENI* and *Utah InstaGENI*

Status	Aggregate	Renew	Actions
Get All			
READY	GPO InstaGENI	2013-03-05 21:58:41 UTC Renew	Resource Status Details Delete Resources
Get Status			
no resources	Kentucky ProtoGENI	2013-03-05 21:58:41 UTC Renew	Resource Status Details Delete Resources
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Get Status			
no resources	RENCI ExoGENI	2013-03-05 21:58:41 UTC Renew	Resource Status Details Delete Resources

You have...

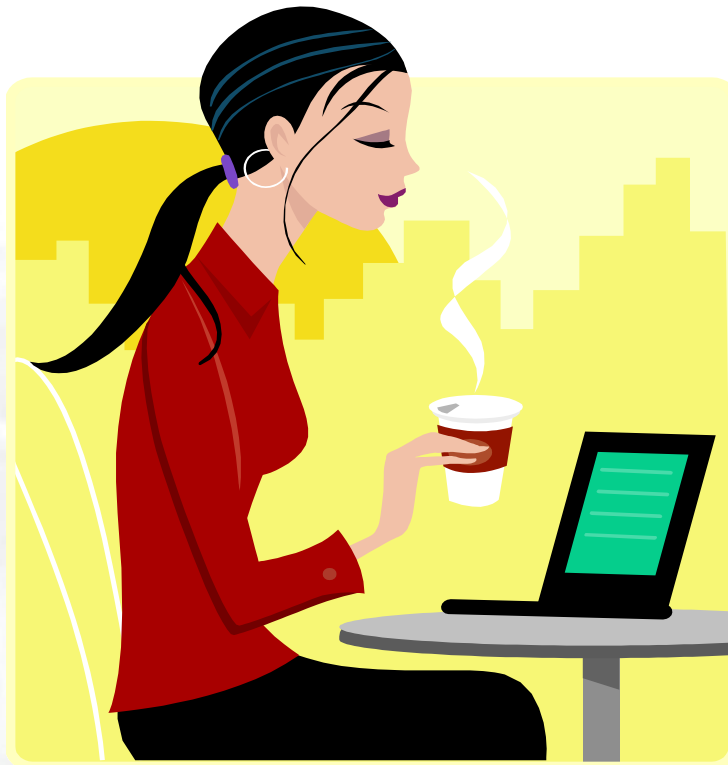
- Run your first GENI Experiment!
- Exercised your knowledge of GENI terminology
- Used the GENI Portal

- (If needed) Request a permanent account
- Are you a Professor or PI?
 - Ask to be a Project Lead so you can create projects
 - Invite students to join your project
- Are you a Student?
 - Ask your professor to create a project
 - Request to join that project

Keep experimenting!

Learn about other tools

- Tools that are integrated with the Portal
 - Flack GUI is linked on each slice page
 - Omni command line tool (config linked on bottom of portal page)
- Get help after NSDI
 - help@geni.net (Niky and Vic)



Welcome to GENI!

Don't forget to fill out the tutorial survey!