

Iowa State University  
Department of Electrical and Computer Engineering  
Cpr E 489: Computer Networking and Data Communications  
Lab Experiment #4  
Introduction to GENI  
(Total Points: 100)

## Objective

To get familiar with GENI portal and perform and set up your profile for to run the experiment.

## Pre-Lab

Before the lab starts you need to create an account and login to the portal as follows:

- Go to <https://portal.geni.net/>, press the **Use GENI** button, and select your institution from the Drop-Down menu. (***Tip: start typing the name of Iowa State University and then select from the list.***)
- You will be transferred to the Login Page of iastate.edu. Fill in your **username** and **password**.

## Lab Expectations

Work through the lab and let the TA know if you have any questions. After the lab, write up a lab report. Be sure to:

- summarize what you learned in a few paragraphs. **(20 points)**
- include your answers to all exercises with screenshots. **(80 points)**

Your lab report is due at the beginning of the next lab.

## Problem Description

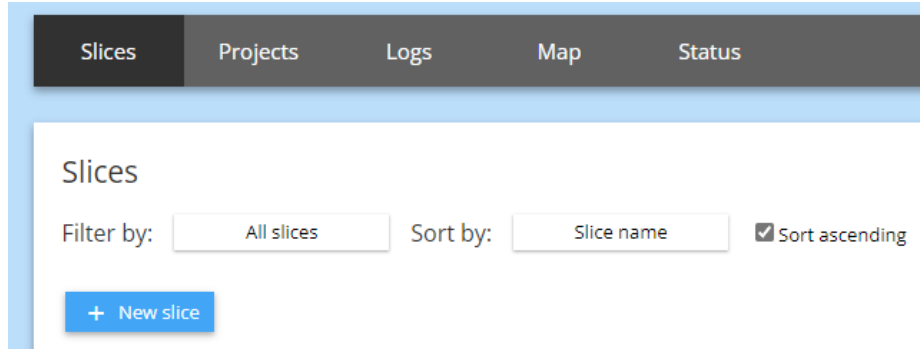
In this lab experiment, you are required to do the following:

- Accept an invitation (check your email)** to Join a project through GENI portal and create a slice.
- Generate and use a private SSH key.
- Implement a simple experiment of one server and one client that are connected with a layer 2 link.

## Procedure

- Join a project and create a slice:
  - After you log in through the GENI Portal website, click on **Projects**, and make sure you have joined the project **CPRE\_489\_S23**.  
***Note: Be sure that the Project lead is Daji Qiao***
  - After joining a project, you will be able to create a **Slice** (You can see the slice as your own experiment).

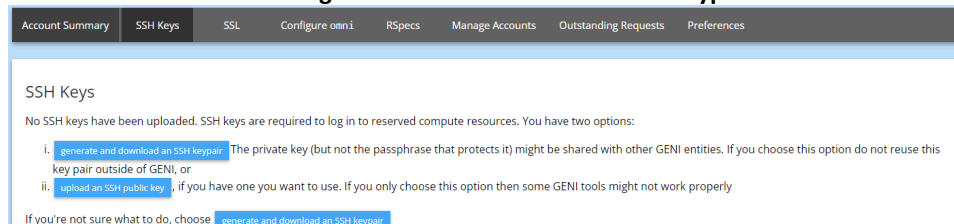
- c. On GENI Portal click on **slices** on top left corner for the website (or click on **Home > Slices**). Then click on **New Slice**.



- d. In the new window, name the slice **<YourLastName>-lab\_GENI**, then click on **Create Slice**

## 2) Generate and use a private SSH key.

- a. On the top right corner click on your **name** and choose **SSH Keys**.
- b. On the new window click on **generate and download an SSH keypair**.



- c. On the next window choose a passphrase for your SSH keypair (make sure that you remember the passphrase) and click on **Generate SSH private key**.

- d. Download your **Private SSH Key** onto your machine. Store the private SSH key somewhere you can easily access (Desktop, for example), as you'll need to provide SSH a path to access your private key.

Account Summary SSH Keys SSL Configure omni1 RSpecs Manage Accounts Outstanding Requests Preferences

### SSH Keys

Name	Description	Public Key	Private Key	PuTTY	Edit	Delete
id_geni_ssh_rsa	Generated SSH keypair	Download Public Key	Download Private Key	Download PuTTY Key	Edit	Delete

On Linux and Mac systems and for most Windows SSH clients (not PuTTY), do:

- Download your private key.
- On Windows, just point your SSH client (not PuTTY) to the downloaded private key.
- On Linux and Mac, open a terminal.
  - Store your key under ~/.ssh/:
    - If the directory does not exist, create it:

```
mkdir ~/.ssh
```
  - Move the key to ~/.ssh/:

```
mv ~/Downloads/id_geni_ssh_rsa ~/.ssh/
```
  - Change the file permissions:

```
chmod 0600 ~/.ssh/id_geni_ssh_rsa
```
- Your SSH command will be something like:

```
ssh -i ~/.ssh/id_geni_ssh_rsa [username]@hostname -p [port]
```

For PuTTY users:

- Download PuTTY key.
- In PuTTY, create a new session that uses the 'username', 'hostname' and 'port' for the resources you have reserved.
- Under the authentication menu, point the key field to the downloaded PuTTY key file.

[Upload another SSH public key](#)

### 3) Experiment Implementation:

- a. On the slice page, click on your **slice** and then click on the **Add Resources** button placed at the top part of the screen.

Slice: [redacted] Slice expires in 6 days ✓  
Project: CPRE\_489\_S23 Project has no expiration ✓ [Add Resources](#)

In the **Choose RSpec** section, choose the **Hello GENI** entry from **Select existing** entry. The selected RSpec file is stored in the Portal database.

Home -> Project CPRE\_489\_S23 -> Slice Team0 -> Add Resources to Team0 using Jacks

### Add Resources to GENI Slice [redacted]

[Add Resources](#) [Manage RSpecs](#)

Add Resources

To add resources you need to draw or choose a Resource Specification (RSpec).

**Drag to Add**

VM

Xen VM

EO VM

Raw PC IO

Raw PC EO

OF OVS

New Site

Site 1

[Delete All](#) [Tidy View](#) [View RSpec](#)

**Choose RSpec**

Portal File URL Text Box

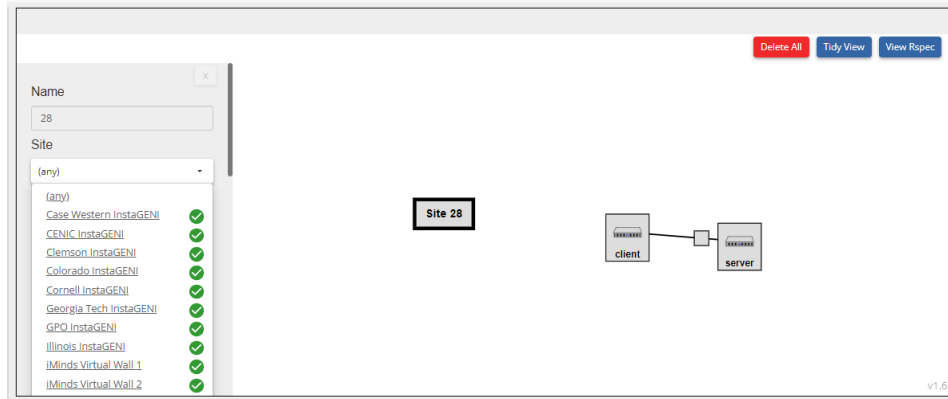
Select existing:  [Select](#)

This RSpec is valid.

Download RSpec: [Download](#)

Editor Ops: [Expand](#) [Duplicate Nodes only](#) [Auto IP](#) [Add Global Nodes](#)

- b. You will need to choose an aggregate where you want this topology to be instantiated. Click on the **Site 28 box** and a panel on the left side of the canvas will appear. **Choose any aggregate with InstaGENI or ExoGENI in its name.**



- c. Click on the **Reserve Resources** button on the bottom left part of the screen.

[View current aggregate status](#)

**Note:** Use the 'Manage RSpecs' tab to add a permanent RSpec.

**Note:** You need to bind a request to a specific GENI site before reserving resources, you can do this in the graphical pane by clicking on the "Site X" icon.

**Note:** You can only add resources at aggregates where you do not yet have a reservation.

**Note:** If you would like a Layer 2 link between sites, set the Link Type to "Stitched Ethernet". However, if you would like a Layer 2 link connecting only ExoGENI sites, instead set the Link Type to "(any)" and pick any two ExoGENI aggregates except "ExoGENI ExoSM".

[Reserve Resources](#) [Cancel](#)

**Note:** To reserve FOAM or other non-compute resources, use the [Non-Jacks Add Resources](#) page.

- d. Wait while your resources are being reserved. **This may take several minutes so be patient.** The resources will be setup once the status (underneath the total run time) indicates **Finished**.

## Add Resources to GENI Slice

Total run time: **48 seconds**

Status: **Finished**

- e. To get the information you need, you can load your slice in the portal, and from the **Home tab** locate your slice and click on it to load it.
- f. Under the topology canvas, click the **Details button**. This page should have all the information you need. Find the status of each node and link on this screen. Note that each item should indicate **READY** after enough time has passed to indicate when you may SSH into the nodes. The login information for each node can be found on this screen as well.

#### 4) Logging in to your nodes:

- Open the terminal program you have used for the previous labs. It is not necessary to login to co2061-head for this lab as the login addresses are public addresses.
- Run `ssh` and enter your passphrase when prompted.

```
ssh -i <private key location> <username>@<hostname> -p <port>
```

**E.g.,** `ssh -i Desktop/id_geni_ssh_rsa user@pcvm2-29.geni.it.cornell.edu -p 22`

**Note:** If you are prompted for a password (instead of the passphrase you set for GENI) then something went wrong. Make sure that all the information is correct.

- To get the information you need, you can load your slice in the portal, and from the **Home tab** locate your slice and click on it to load it.
- Under the topology canvas, click the **Details button**. This page should have all the information you need.

## 5) Exercise: View Results:

For this experiment, GENI used the install script facility to automatically install the necessary software and kick-off the experiment. In this very simple setup, we have installed and launched a web server as well as an iperf server on the server host. On the client, we have started some processes to test both services. To view the results of this experiment:

- a. Log in to the server node following the steps in step 4. Get the control interface IP address by typing **ifconfig**. This IP address should be accessible from the internet. In a web browser, type the IP address found from ifconfig. **(20 points)**
- b. Click the **Web Server Statistics** link to look at statistics. Refresh the page a couple of times to see how the statistics change as the client requests documents. **Make sure you include a screenshot in your report. (20 points)**
- c. Click the **Logs** from the iperf Server link to see the statistics from the iperf transfers. **Take a screenshot of what you observe. (10 points)**
- d. Then log in to the client node and run this command:

```
iperf -c server -P 2
```

- e. This task shouldn't take more than 30 seconds. Change the number after -P and watch how the performance is affected while you change the number of parallel TCP connections. **Make sure you include a screenshot in your report. (10 points)**
- f. For each of the three interfaces for the server in part a:
  - I: Identify if this interface can access the client and
  - II: Identify if this interface can access the world wide web
  - III: In each case, justify your answer with a screenshot or an explanation. **(20 points)**Ping may be used to assess connectivity with the client, but world wide web access can be determined by logging in to a computer in Coover 2061 and calling traceroute.  
(Hint: at least one server interface does not have access the client)

## 6) Cleanup experiment:

After you are done with the experiment, you should always release your resources so that other experimenters can use the resources. To cleanup your slice, press the **Delete** button at the bottom of the Manage Resources panel on the Slice page.

Wait a few moments for all the resources to be released and you will have an empty canvas again. Notice that your slice is still there. There is no way to delete a slice. It will be removed automatically after its expiration date but remember that a slice is just an empty container, which does not take up any resources.