GENI

- Infrastructure for experimenting with the cloud
  - Compute resources that can be connected in Layer 2 topologies based on the specifications of user
  - Number of GENI racks distributed all over the US, including Alaska, Hawaii, and Puerto Rico
- Terms and definitions
  - Slice
    - Abstraction for a collection of resources capable of running experiments
      - Experiments use resources in a slice
      - Slices isolate experiments
      - Users responsible for their slices
  - Slice authority
    - Creates and registers slices upon request from user
    - Returns slice credentials to the user
  - Aggregate
    - Provides resources to GENI users
    - Owned and managed by an organization
    - GENI racks, Internet2, Emulab, PlanetLab
    - Implement the GENI AM API (aggregate manager API)
    - A slice many contain slivers from many aggregates
- Deeply programmable
  - Install software throughout network slice (into routers/switches) using OpenFlow
  - OpenFlow is part of both infrastructure and experiment
- Resource specifications (RSpecs)
  - Language to describe and request resources
  - *Machine language* to negotiate resources between experiment and aggregate
  - Experimenter tools eliminate the need for most users to write or read RSpec
  - RSpec to request a single node

```
<?xml version="1.0" encoding="UTF-8"?>
<rspec xmlns="http://www.protogeni.net/resources/rspec/2"
       xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
       xsi:schemaLocation="http://www.protogeni.net/resources/rspec/2
                           http://www.protogeni.net/resources/rspec/2/request.xsd"
       type="request" >
  <node client_id="my-node"
        exclusive="true">
    <sliver_type name="raw-pc" />
  </node>
</rspec>
```

A First Experiment Using GENI

1. Design the experiment

- Use resources at an aggregate
- Use any aggregate with *insta*GENI or *Exo*GENI in its name

2. Establish the environment
   (a) Create a GENI account
      - Go to `https://portal.geni.net`
      - Press the button labeled **Use GENI**
      - Your organization is **University of Missouri System**
      - Login using your SSO ID and password
      - You will be transferred to an **Activation Page**. Make sure both checkboxes are checked and then press **Activate**

   (b) Join a project
      - Join the project CMPSCI5750Fall2018

   (c) Generate and download SSH keypair
      - Access to computer resources in GENI is provided through ssh key pairs
        – Portal need a public key to upload to compute resources
      - Create an SSH key pair on the portal
        – Hover on your name in the upper right hand corner and select **SSH Keys** from the pulldown menu
        – Select **Generate and download an SSH keypair** button
        – Enter the same passphrase twice, when asked (you will need to remember the passphrase)
        – Press **Generate SSH private key**
      - Download private key to your computer and save it in a location that you should note down

3. Obtain resources
   (a) Create a slice
      - Go to the **Home** tab
      - Press the button labeled **+ New slice**
      - Ensure the correct project name is selected in the Project name field
      - Name the slice *CMPSCI2018-<your name>*

   (b) Renew your slice, if needed
      - Slices and resources within slices have distinct expiration time; renew the slice and resources separately

   (c) Reserve two virtual machines at one aggregate
      - Portal is aggregated with a tool – Jack – allowing you to draw topologies of GENI resources and then reserve them
      - Click on your named slice, then click on **Add Resources**
      - Click the black **VM** box and drag it onto canvas
        – This is a generic `default-vm` which the aggregate has a well known default for
        – For InstaGENI, the default is a Xen VM, for ExoGENI, it is an ExoSmall
      - Repeat the above step; you'll see two **vm** boxes on canvas
      - Click near one of the VM boxes on the canvas; click and drag towards the other VM; release when you reach the other VM
        – You should see a line and a box representing a link connecting the two boxes
      - Click the VM box labeled **node-0** to edit the name of the VM
        – In the field labeled **Name**, replace "node-0" with "Client"
      - Repeat for the other VM, replacing "node-1" with "Server"
      - Click on the canvas background to return to Jacks

- Assign IP addresses to the interfaces; Look at **Editor Ops** towards the bottom, click on **Auto IP** to have the tool auto-assign IP addresses
- Click the box labeled **Site 1**
  - In the left hand part, from the pulldown menu under **Site**, select the aggregate you want to request resources from
    - Select any aggregate with InstaGENI or ExoGENI in its name
    - If **Missouri InstaGENI** is available, select that
- Click on the button labeled **Reserve Resources**

(d) Check whether VMs are ready to be used

- After clicking the **Reserve Resources** button, a new page will open giving "Status"
- Once the "Status" states "Finished," resources have been reserved; the nodes still may need to come up which may take some time
- Return to the **Slice** page; wait until all of the nodes turn green

4. Configure and initialize; you are ready to run your first GENI experiment

(a) Login to nodes

- Note the login information for the two nodes (Client and Server) on the **Slice** page
- Either click on **Details** button or click on each node and find information on the left, in the format `username@hostname:port_number`
- Mac OS X/Linux
  - Start SSH by typing (using the information from above)
    ```
    ssh username@hostname -p port_number
    ```
  - If the key is not added to the authentication agent
    ```
    ssh -i private_key_location username@hostname -p port_number
    ```
  - Enter your passphrase you chose when generating your key pair when prompted
- Windows PuTTY
  - Run PuTTY
  - On the Basic options screen, in the Host Name field enter: `username@hostname`
  - In the Port field, enter `port_number`
  - Make sure the Connection type is: SSH
  - Under the settings categories on the left, navigate to `Connection->SSH->Auth`
  - Next to the "Private key file for authentication" field at the bottom, click `Browse` and select the private key file you saved to your computer, and click **Open**
  - Click **Open** to establish the SSH connection
  - If prompted about whether you trust the host (key not cached in registry), click **Yes**
  - When prompted for the passphrase, enter the passphrase you chose when generating your key pair