

Are you ready?

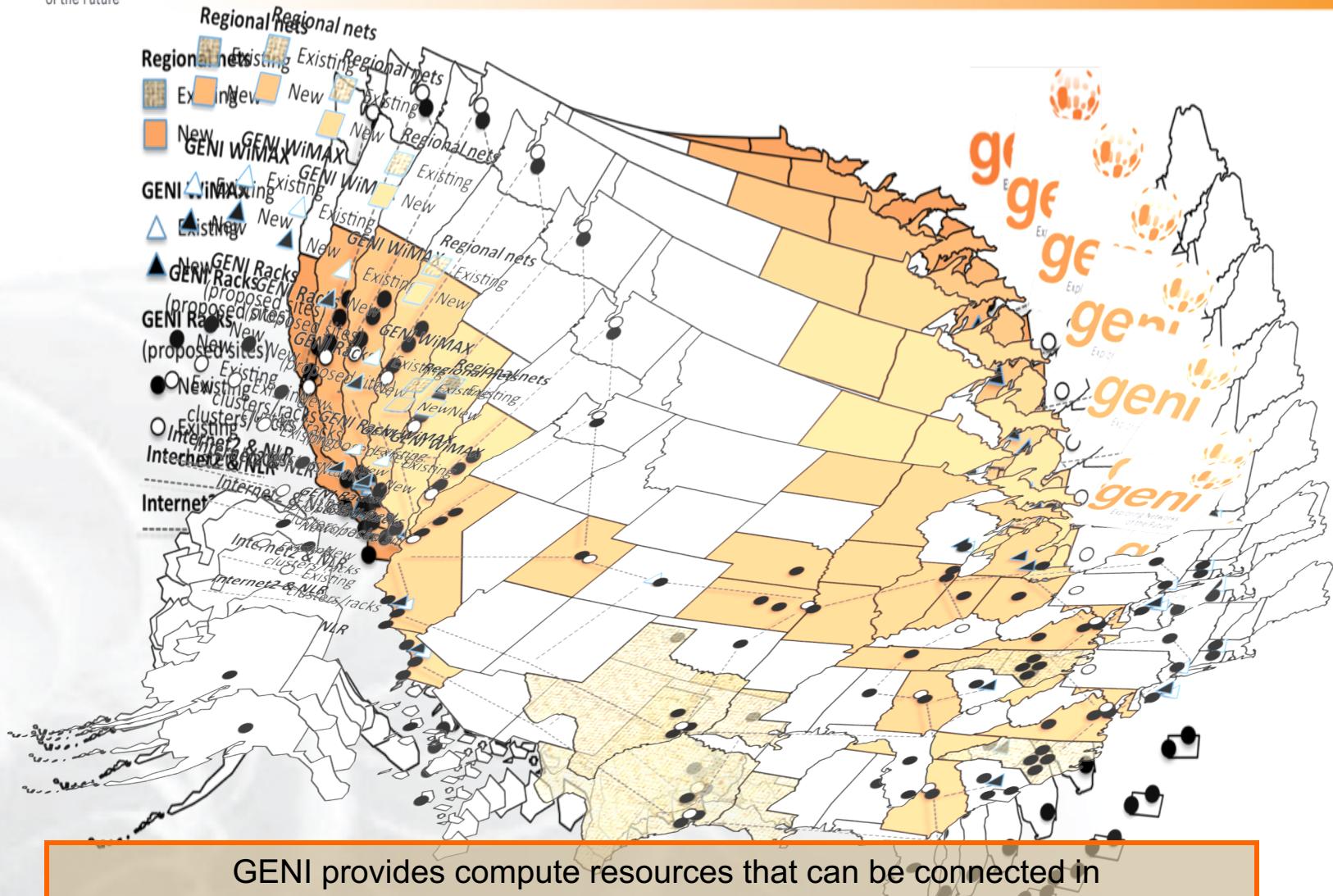
Go to the GENI Portal at:

<http://portal.geni.net>

Your 1st GENI Experiment



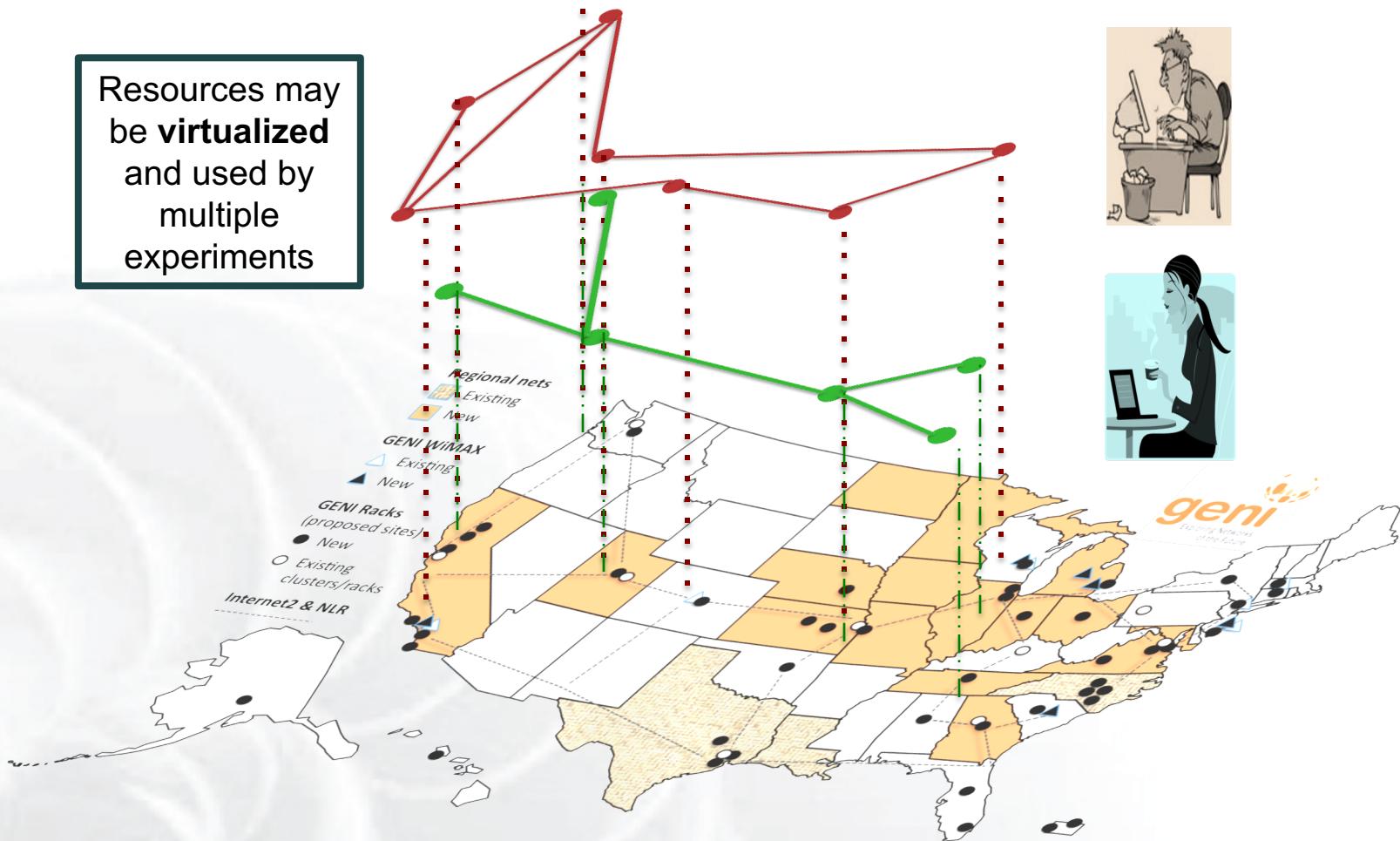
Infrastructure for Experimentation



GENI provides compute resources that can be connected in experimenter specified Layer 2 topologies.

Experiments run Concurrently

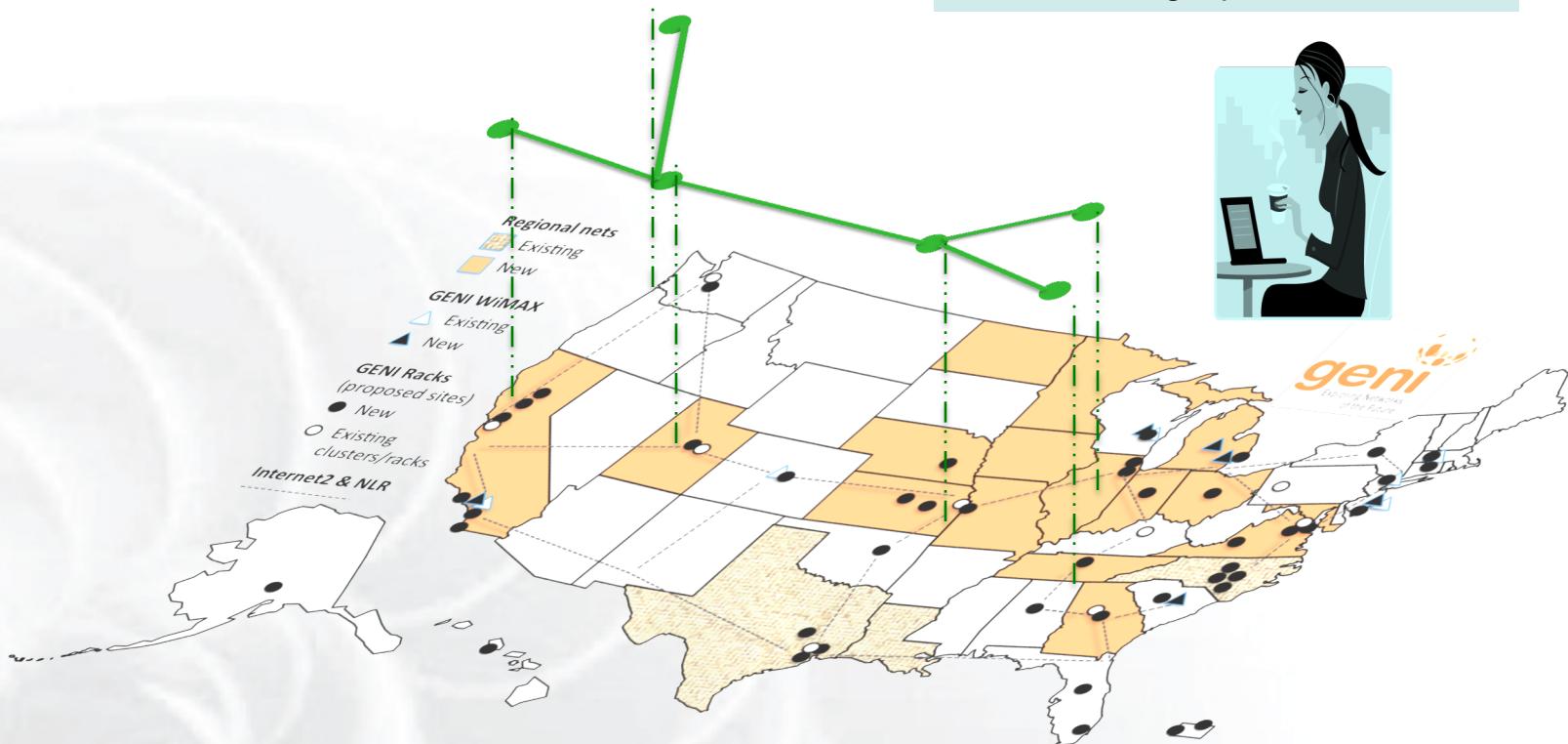
Resources may be **virtualized** and used by multiple experiments



Experiments live in **isolated “slices”**

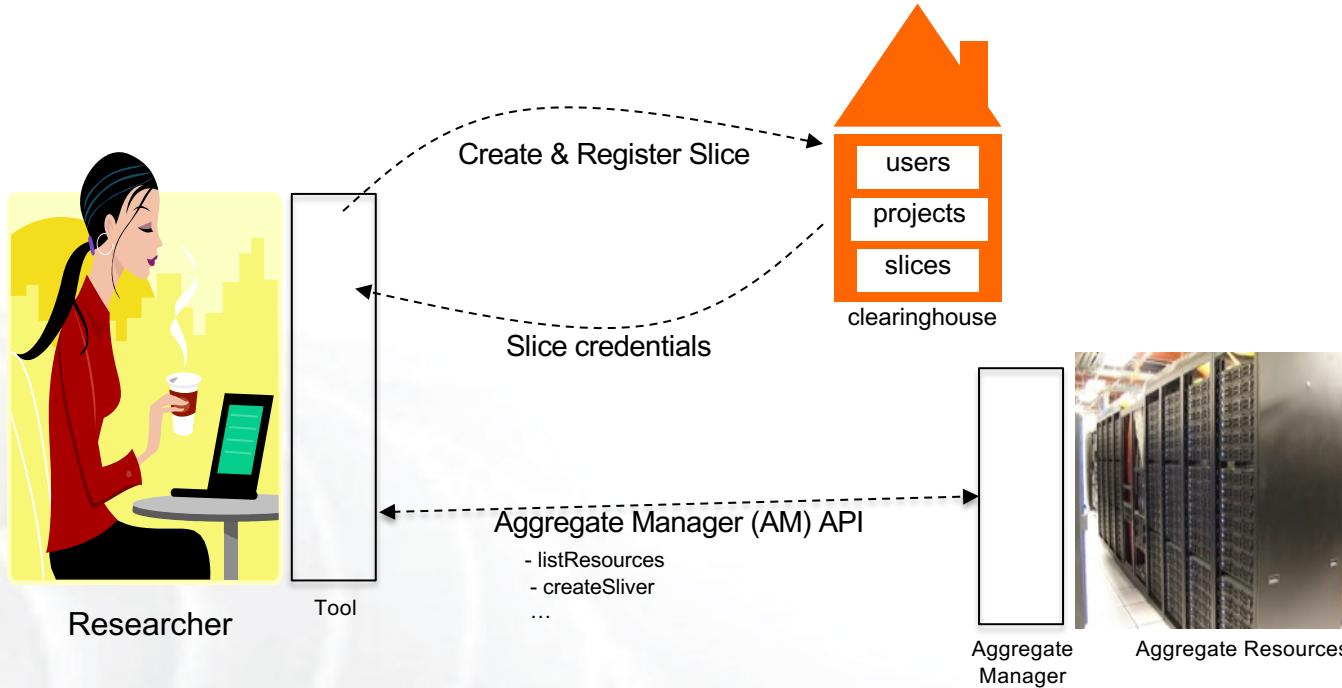
GENI is “Deeply Programmable”

I install software I want throughout my network slice (into routers, switches, ...) or control switches using OpenFlow



Everything is programmable: Experimenters create and program custom topologies, protocols and flows

Clearinghouse and Aggregates



- **Clearinghouse:** Manages users, projects and slices
 - Standard credentials shared via custom API or new Common CH API
 - GENI supported accounts: GENI Portal/CH, PlanetLab CH, ProtoGENI CH
- **Aggregate:** Provides resources to GENI experimenters
 - Typically owned and managed by an organization
 - Speaks the GENI AM API
 - Examples: PlanetLab, Emulab, GENI Racks on various campuses

Resource Specifications (Rspecs)

- **RSpecs:** Lingua franca for describing and requesting resources
 - “Machine language” for negotiating resources between experiment and aggregate
 - Experimenter tools eliminate the need for most experimenters to write or read RSpec

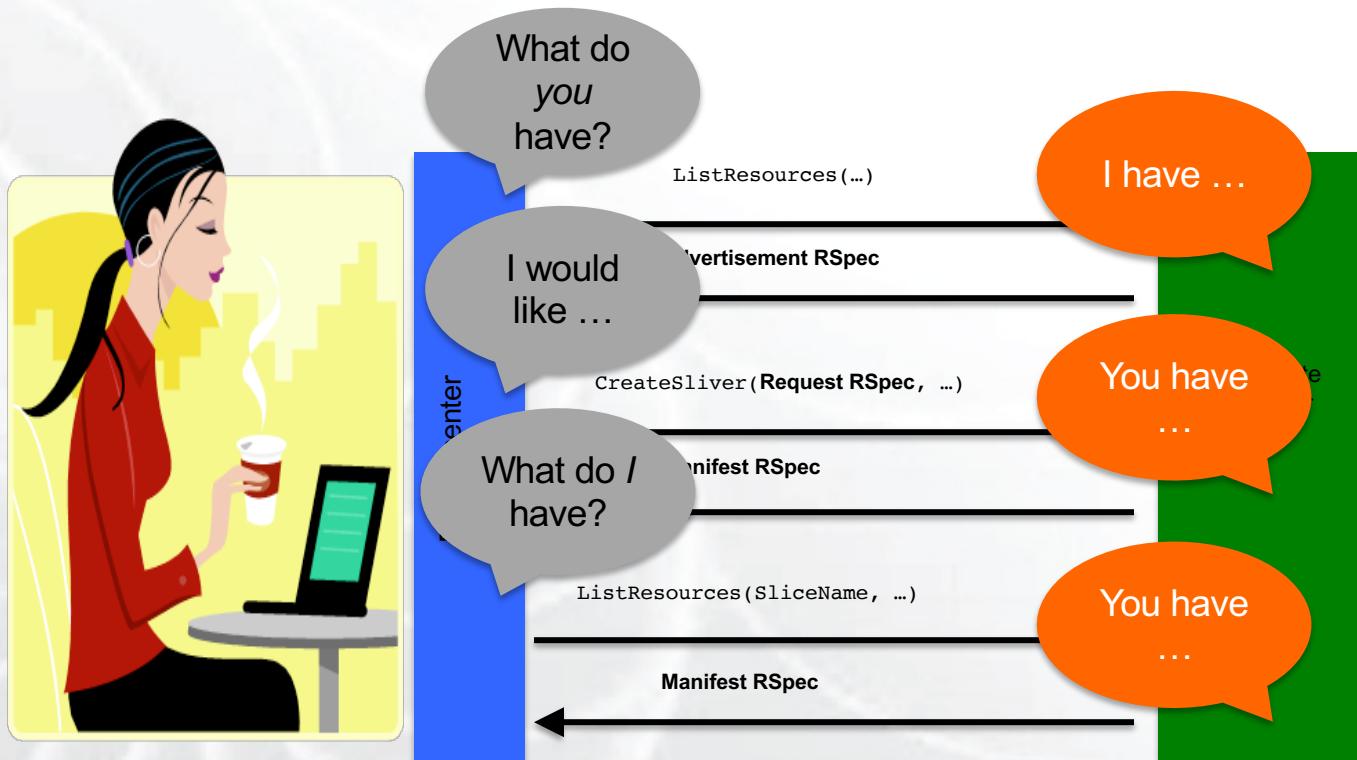
```
<?xml version="1.0" encoding="UTF-8"?>
<rspec xmlns="http://www.protogeni.net/resources/rspec/2"
       xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
       xsi:schemaLocation="http://www.protogeni.net/resources/rspec/2
                           http://www.protogeni.net/resources/rspec/2/request.xsd"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

RSpec for requesting a single node

Reserving Resources using RSpecs and the AM API

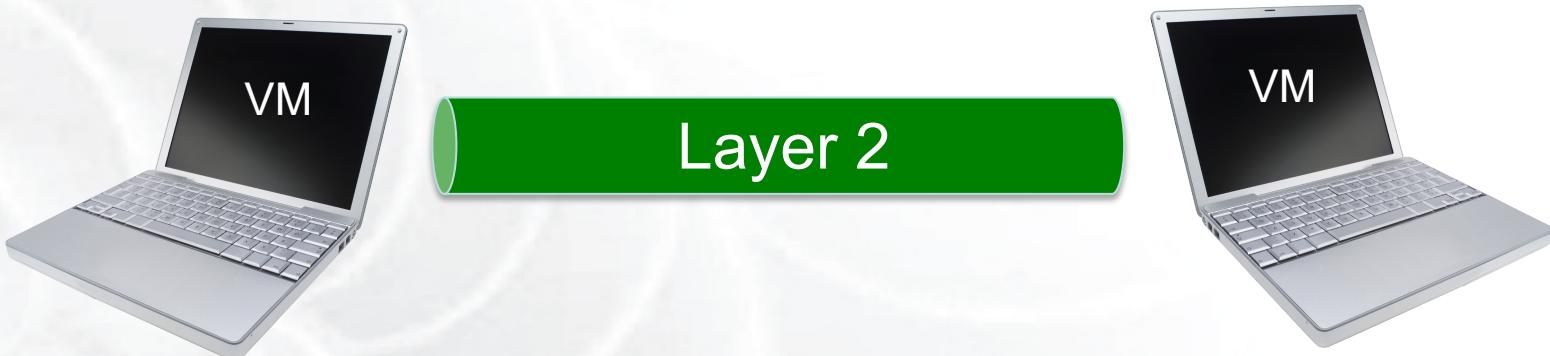
Experimenter **tools** and **aggregates talk** to each other **using** resource specifications (**RSpecs**) and the GENI Aggregate Manager API (**GENI AM API**)

- **Advertisement RSpec:** What does an aggregate have?
- **Request RSpec:** What does the experimenter want?
- **Manifest RSpec:** What does the experimenter have?



Experiment #1 in GENI

Reserve two VMs connected at Layer 2



Use the GENI Portal and Jacks



The screenshot shows the "WELCOME TO GENI" page. On the left, the geni logo is displayed with the tagline "Exploring Networks of the Future". In the center, the text "WELCOME TO GENI" is prominently shown. Below it, a paragraph describes GENI as a nationwide suite of infrastructure supporting research in networking, distributed systems, security, and novel applications, supported by the National Science Foundation. A large orange button labeled "Use GENI" is centered below the paragraph. To the right, there is a map of North America and parts of Central America and Mexico, showing various locations with orange circles containing numbers indicating the count of resources or experiments. A legend at the bottom right of the map area states "© OpenStreetMap contributors". Below the map, a caption reads: "These are some of the many resources being used in GENI experiments across the country."

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.

<http://portal.geni.net>

The GENI Portal is...

Use GENI

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

Includes simple tools to reserve **resources**.

Among other things!

Use GENI

- Establish the environment
 - Pre-work: Create a GENI account
 - Pre-work: Ask to join a project
- Generate and download ssh keypair
 - Click on SSH Keys drop-down menu under “Your Name”

- Login to the GENI Portal
 - Log in using your BU's username/password
- Join the GENI project for the course
 - Click Home → Projects → Join a Project
 - The project is CS-655-Fall2020

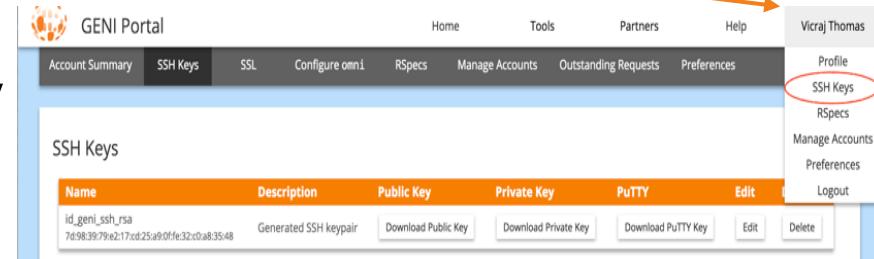


The screenshot shows the GENI Portal login interface. At the top is the geni portal logo. Below it is a red-bordered input field labeled "Enter your organization's name" with a placeholder "Enter your organization's name". To the right of the input field are two buttons: "Continue" and "Help". Below the input field is a link "Allow me to pick from a list".



The screenshot shows a dark grey sidebar with the text "Looking for the GENI Project Office login?". Below it is a horizontal line. Further down, there is text "Can't find your school or organization above?", followed by links "Request an account" and "Contact GENI Help". Another horizontal line follows. At the bottom, it says "GENI is sponsored by the National Science Foundation" with the NSF logo, and "NSF Award CNS-0714770".

- Create your ssh keys
 - Look for SSH Keys under your name



GENI Portal

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

Vicraj Thomas

Profile SSH Keys RSpecs Manage Accounts Preferences Logout

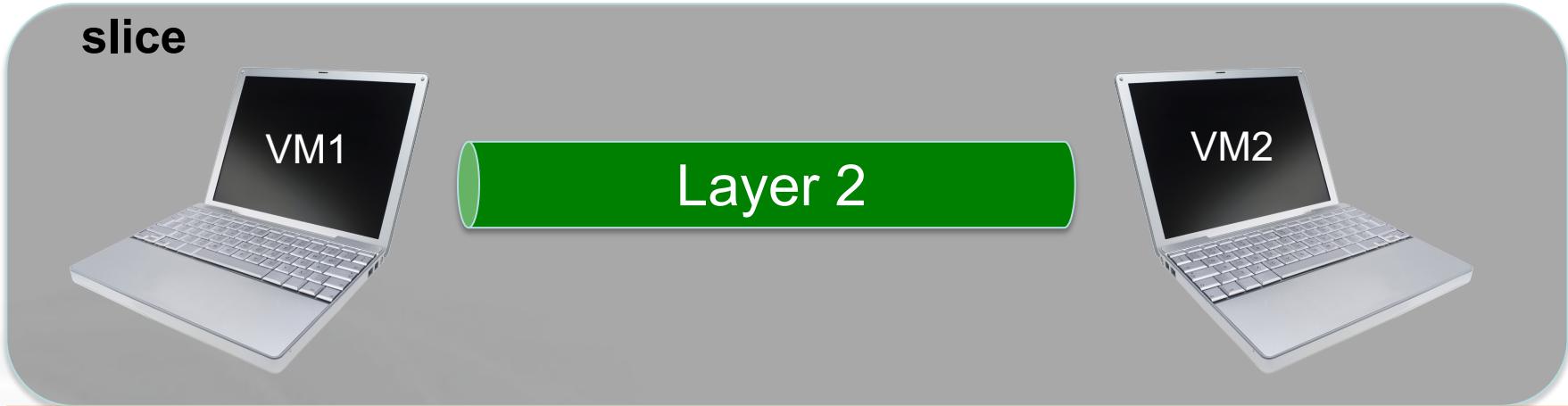
Name	Description	Public Key	Private Key	PuTTY	Edit	Delete
id_geni_ssh_rsa 7d983979e217cd25a90fe32c0a83548	Generated SSH keypair	Download Public Key	Download Private Key	Download PuTTY Key	Edit	Delete

- Download your ssh private key
 - Mac/Linux:
 - Move key to .ssh folder

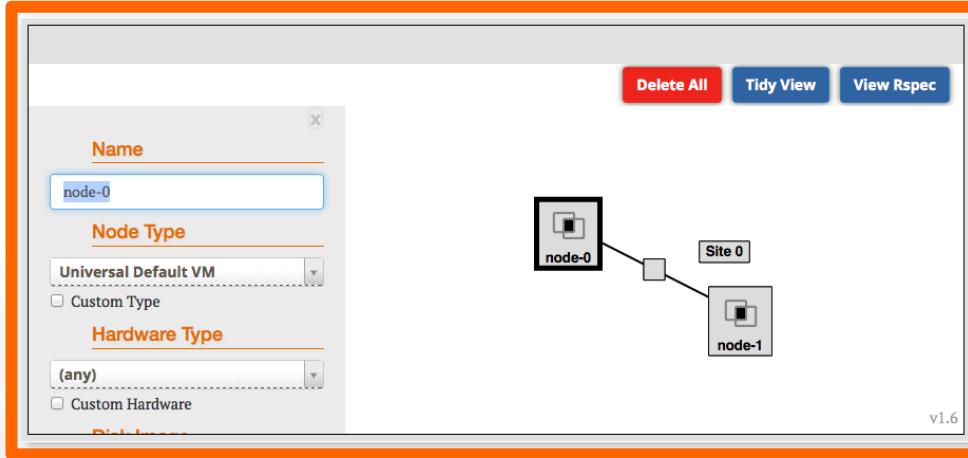

```
mv ~/Downloads/id_geni_ssh_rsa ~/.ssh/.
```
 - Change permission so only you can read it and add to keychain


```
chmod 600 ~/.ssh/id_geni_ssh_rsa
```

```
ssh-add ~/.ssh/id_geni_ssh_rsa
```
 - Windows:
 - PuTTY download: <http://www.putty.org>
 - Download your PuTTY key

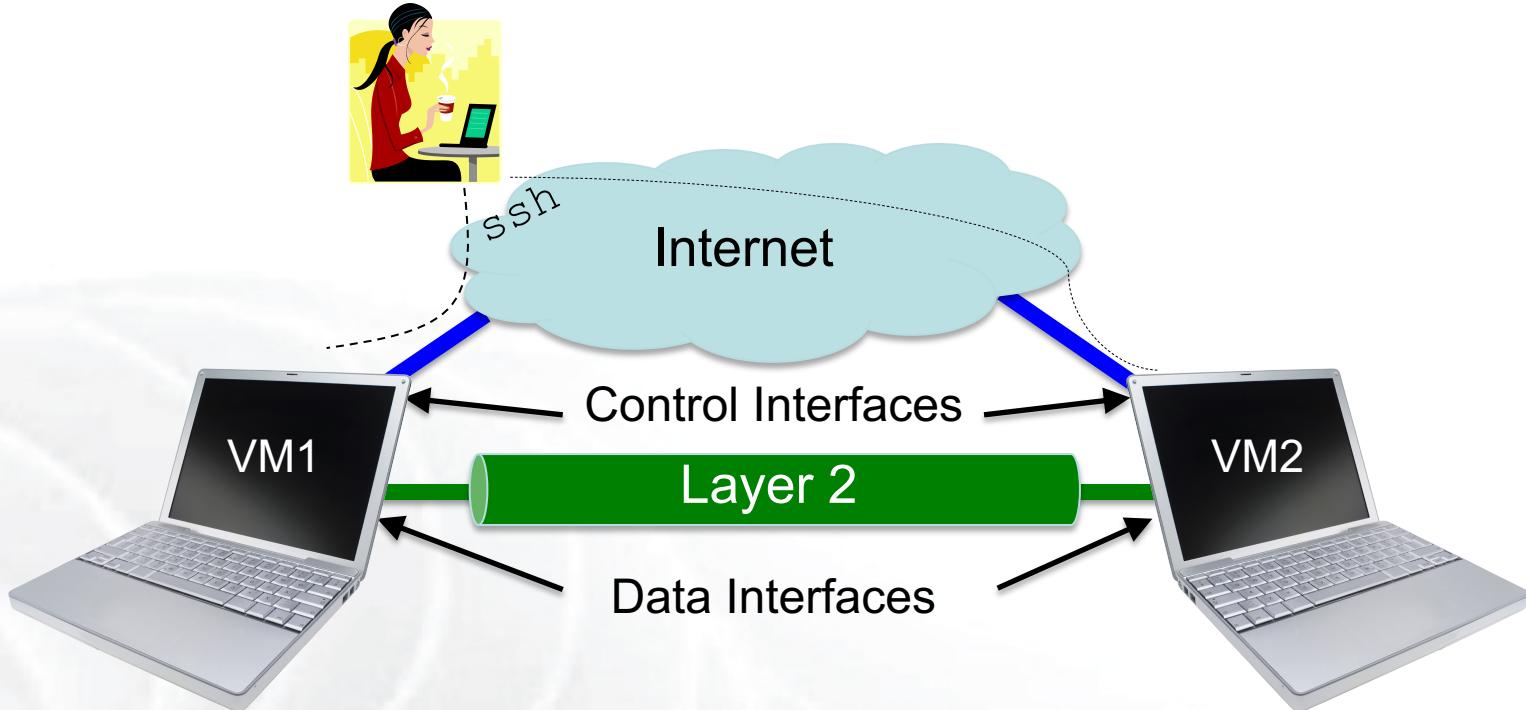


- Create a slice
 - call it “exp1-xy” where “xy” are your initials
- Reserve two VMs at one aggregate using Jacks
 - choose a lightly-loaded instaGENI rack: check status at <https://genimon.uky.edu/status>
- Check whether VMs are ready to be used



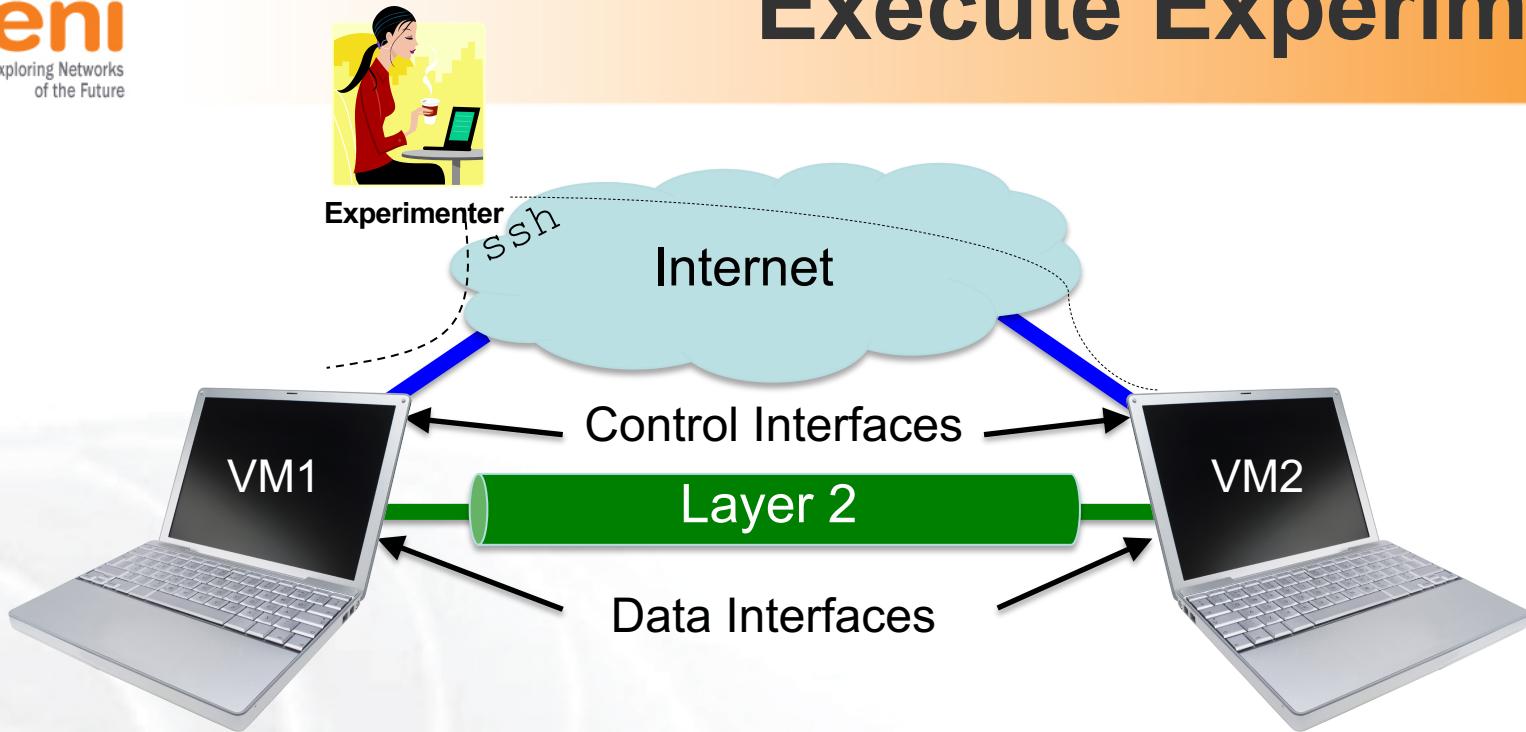
- A graphical user interface (GUI) for:
 - **Designing topologies** in GENI
 - **Reserving resources** in GENI
- In your slice, launch Jacks
 - Use drag and drop to create the two-node topology
 - Select an aggregate to instantiate the resources
 - Click on the blue reserve button

Execute Experiment



- Configure and initialize
 - Wait for the VMs to boot
 - ssh into the VM1 and VM2 nodes

Execute Experiment



- Execute experiment
 - Test connectivity: ping interfaces
 - Logout of your nodes
- Teardown experiment
 - Delete your resources

Teardown Experiment

project
resource
aggregate
experimenter



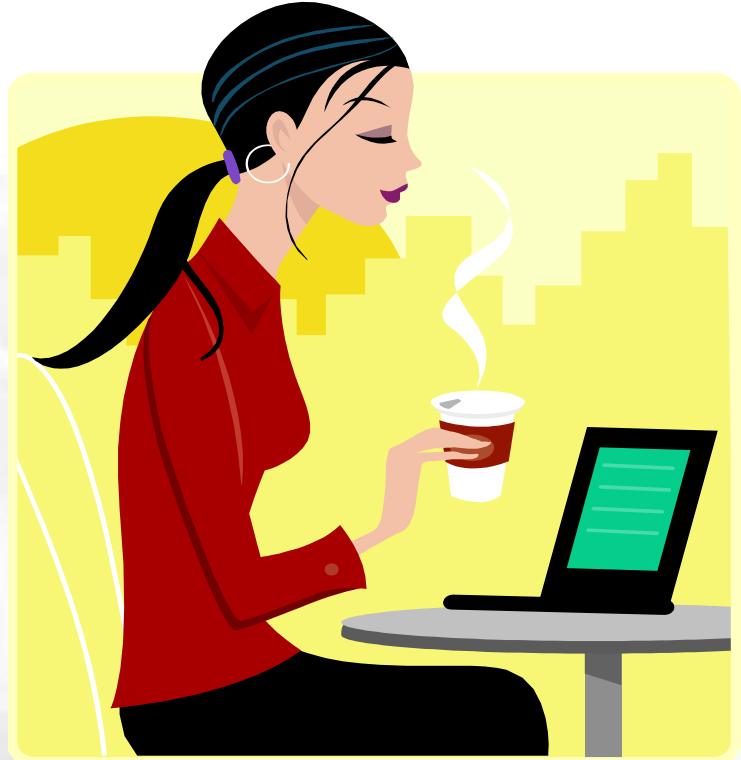
When your experiment is done, you should always release your resources

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

Congratulations!

You have...

- Run your first GENI experiment!
- Exercised your knowledge of GENI terminology
- Used the GENI Portal and Jacks



Welcome to GENI!

- Instructions of this lab are at <http://tinyurl.com/geni-labzero>
- *Show your work by filling out the lab worksheet posted on Piazza*
- *In addition to the worksheet, also answer the lab questions under Part II (Execute):*
 - 5.2 d) What is the bandwidth (throughput) of this link? Why?
 - 5.2 e) What is the bandwidth (throughput) of this link? Why?
- Submit a PDF file on Gradescope