Running a class in GENI

Design/Setup

Execute

Finish

GENI Project Office

GENI Accounts and Projects

Exercises on GENI

Tips

Wrap Up

Access to GENI

Leverage InCommon for
single sign-on authentication

InCommon.

Experimenters from 304
educational and research
institutions have
InCommon accounts

For many experimenters:
- no new passwords
- familiar login screens

GENI Project Office runs a federated IdP to
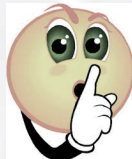**provide accounts** for non-federated organizations.

Asymmetric cryptography, a.k.a. public-key cryptography is based on using **different keys** for encryption and decryption
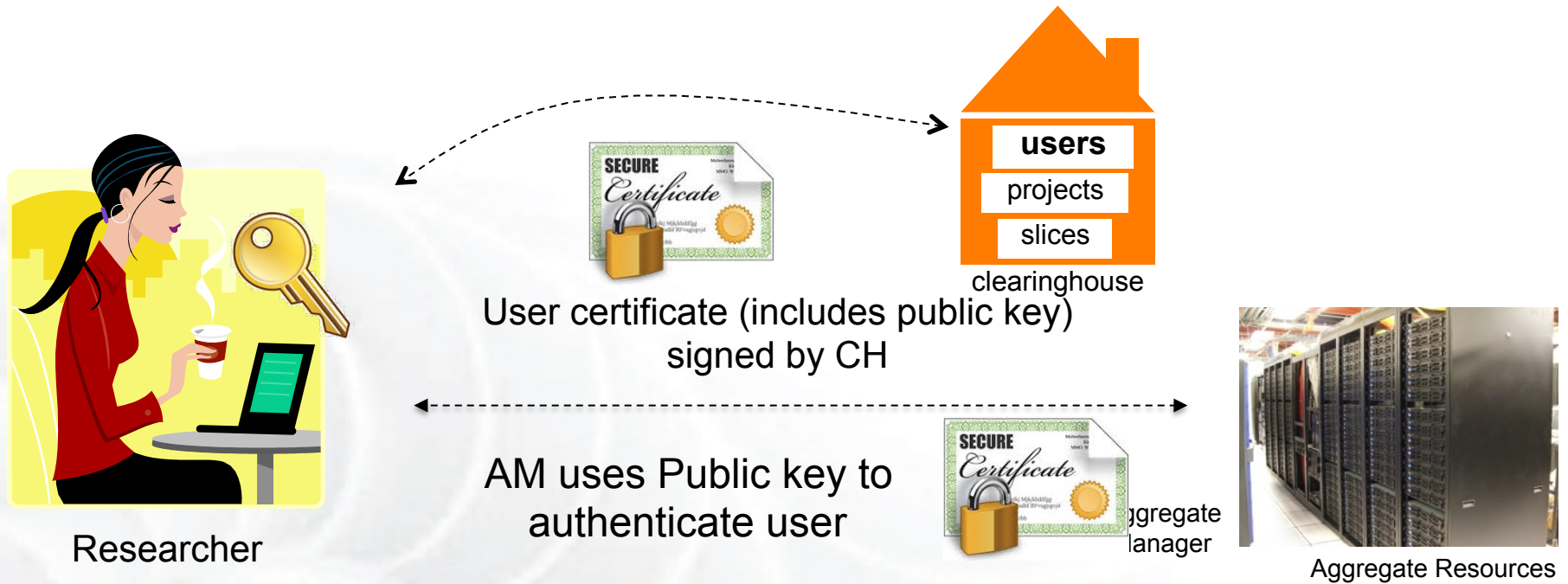
Private key

Public key

Only the private key can decrypt challenges created with the public key. Private key is usually protected with a passphrase.
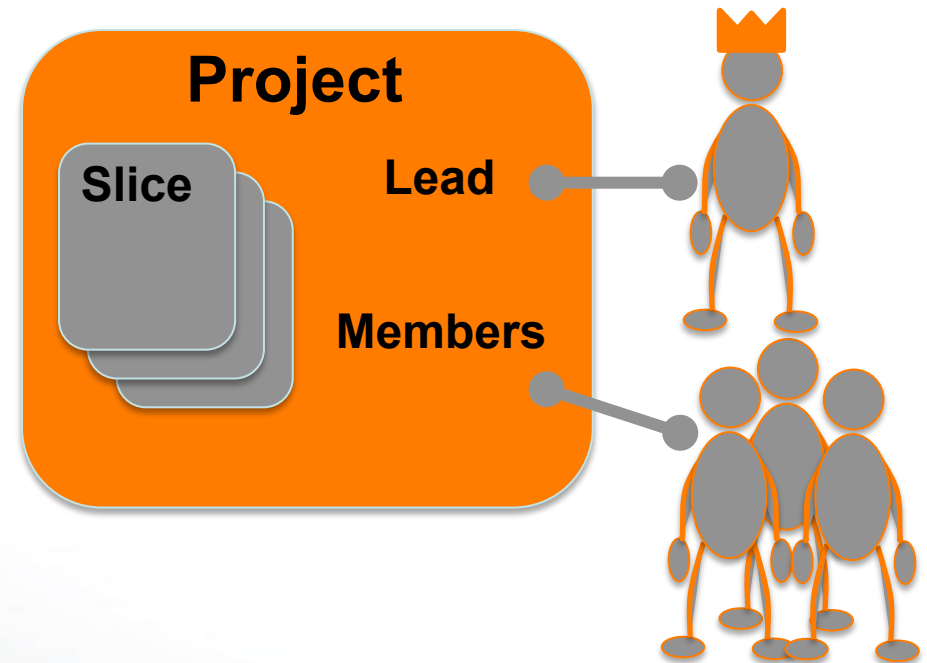
http://en.wikipedia.org/wiki/Public-key_cryptography

users

projects

slices

clearinghouse

User certificate (includes public key)
signed by CH

AM uses Public key to
authenticate user

Researcher

Aggregate
Manager

Aggregate Resources

Projects organize research in GENI
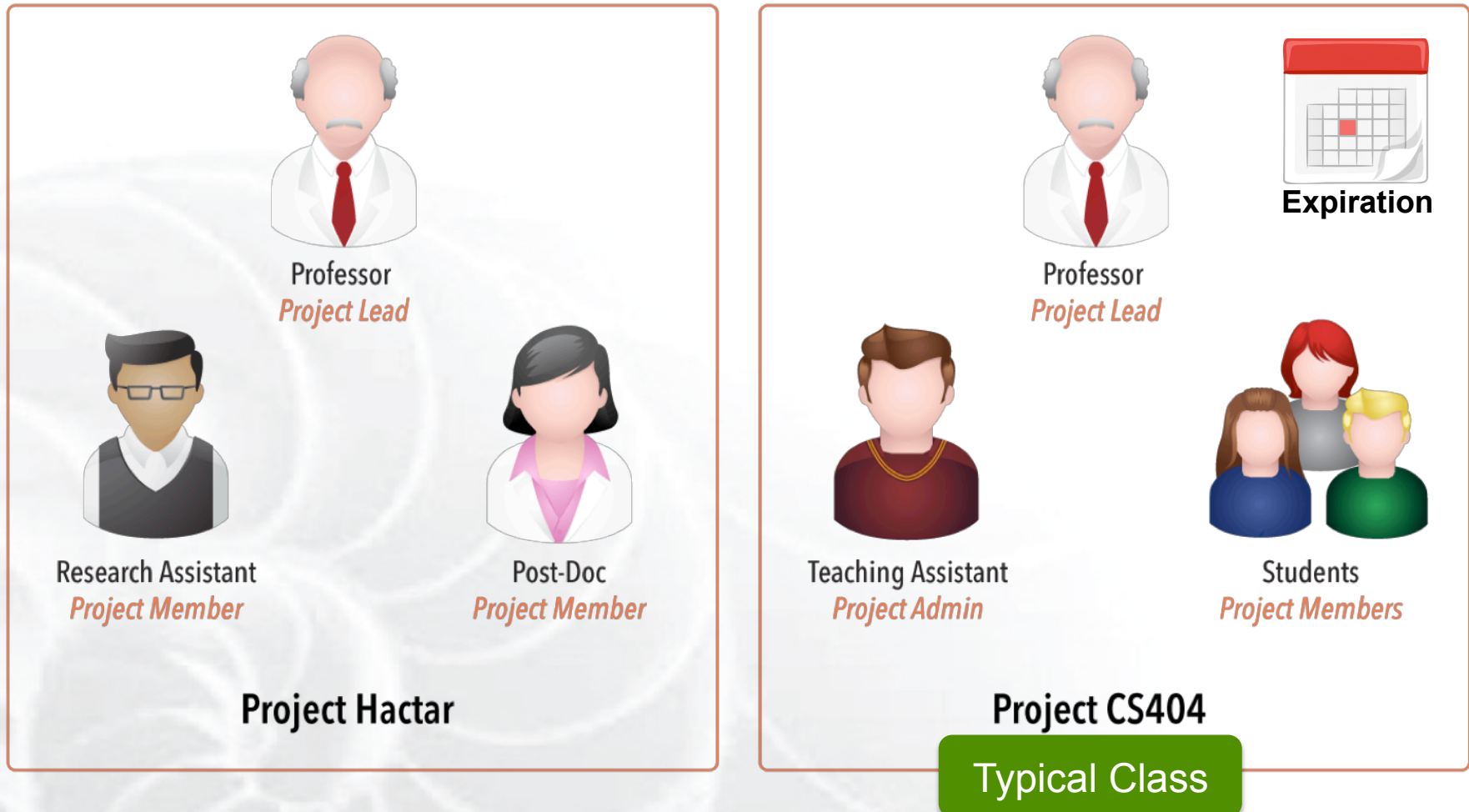
Project

Slice

Lead

Members

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

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

Project Membership example

Projects have 1 **Lead** and any number of **Admins**, **Members**, and **Auditors**

Professor
Project Lead

Research Assistant
Project Member

Post-Doc
Project Member

Project Hactar

Expiration

Professor
Project Lead

Teaching Assistant
Project Admin

Students
Project Members

Project CS404

Typical Class

http://groups.geni.net/geni/wiki/GENIConcepts#Project

1. Member-initiated

Each experimenter asks to join a project, approval needed

- Typical for Research projects

Project	Purpose	Project Lead	Join
ADAMANT	Use GENI to demonstrate use in data-driven computational workflows	Ilya Baldin	Join
ASU-GREE-Summer-Camp-2013		Violet Syrotiuk	Join

2. Admin-initiated

Project Lead/Admin bulk-adds experimenters

- Typical for Classrooms or Tutorials

Upload Project Members

Action Legend
Add as ... Candidates who already use the portal will be added to your project with the specified role immediately.
Invite as ... Others will receive an invitation email with instructions on joining your project.

Candidate Name	Candidate Email	Action
Niky Riga	nriga@bbn.com	Already Member
Sarah Edwards	sedwards@bbn.com	Add as Member
Vic Thomas	vthomas@geni.net	Invite as Member

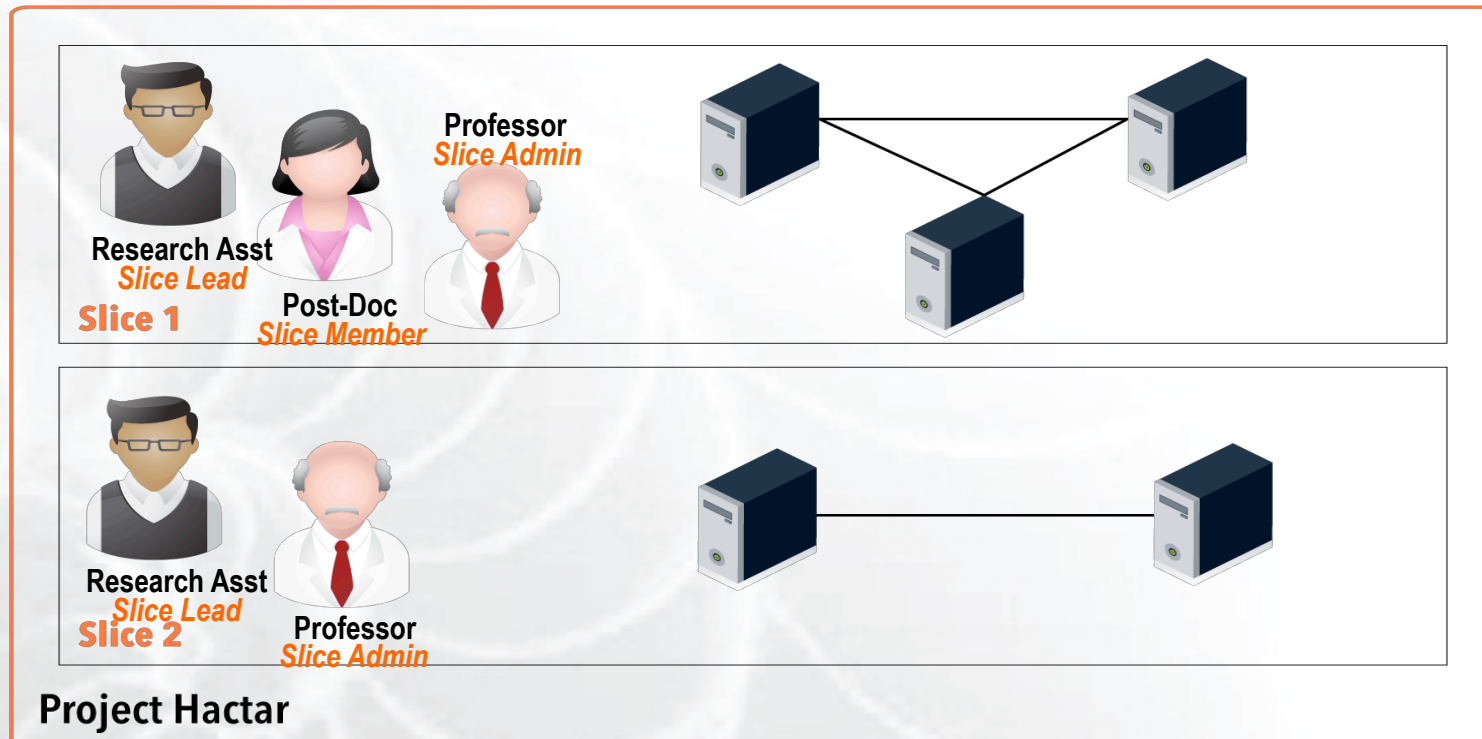▶ Live Demo

Slice Membership example

Slices have:

- 1 **Lead** (person who **created** the slice)
- any number of **Admins**, **Members**, and **Auditors**
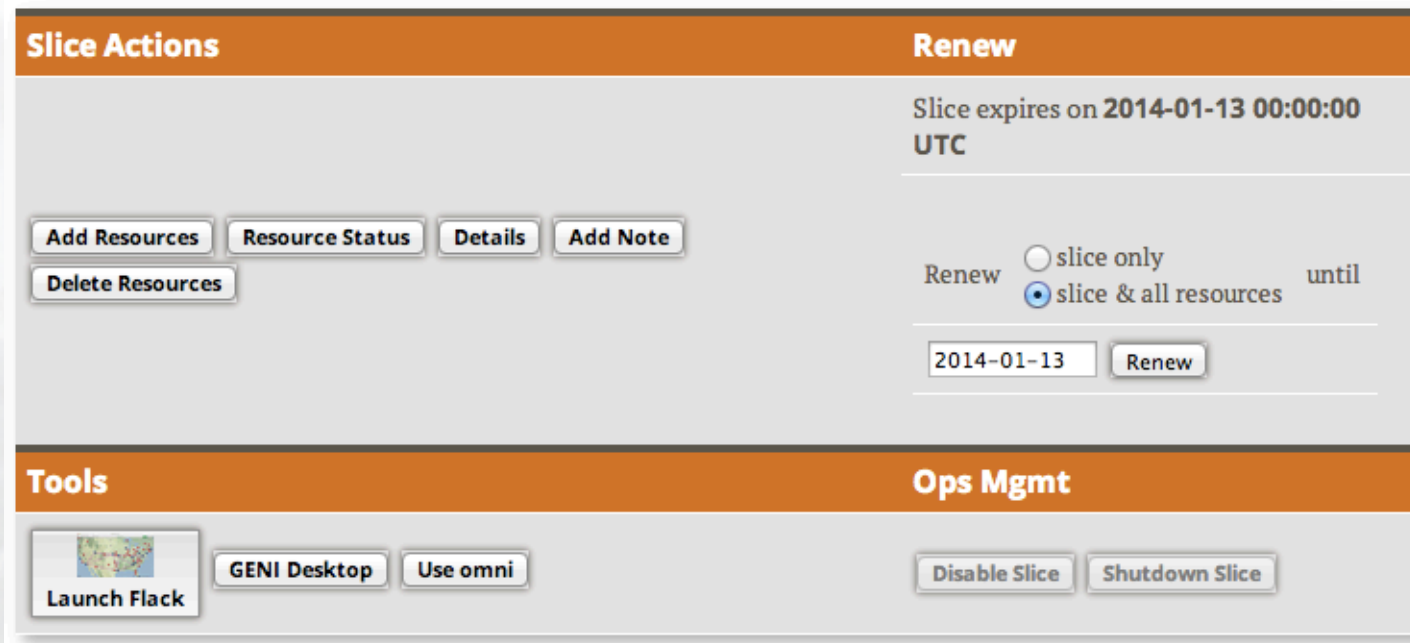- **Project Lead/Admins** added as slice Admins

Research Asst
Slice Lead
Slice 1

Post-Doc
Slice Member

Professor
Slice Admin

Research Asst
Slice Lead
Slice 2

Professor
Slice Admin

Project Hactar

http://groups.geni.net/geni/wiki/GENIConcepts#Slice

Project and Slice Roles

		Create project	Modify project & manage membership	Create slice	View project
Project	Lead	✔	✔	✔	✔
	Admin		✔	✔	✔
	Member			✔	✔
	Auditor				✔

		Manage slice membership	Act on slice	View slice	Account/ keys loaded on slice
Slice	Lead	✔	✔	✔	✔
	Admin	✔	✔	✔	✔
	Member		✔	✔	✔
	Auditor			✔	✔

http://groups.geni.net/geni/wiki/ProjectSlicesRoles

Being a member of a slice means you can act on a slice:

- Add resources
- Check status
- Delete resources
- Renew resources

With any tool!

Slice Access: Logging in to resources

> ⚠️ **Slice membership does not guarantee ability to login to resources!**
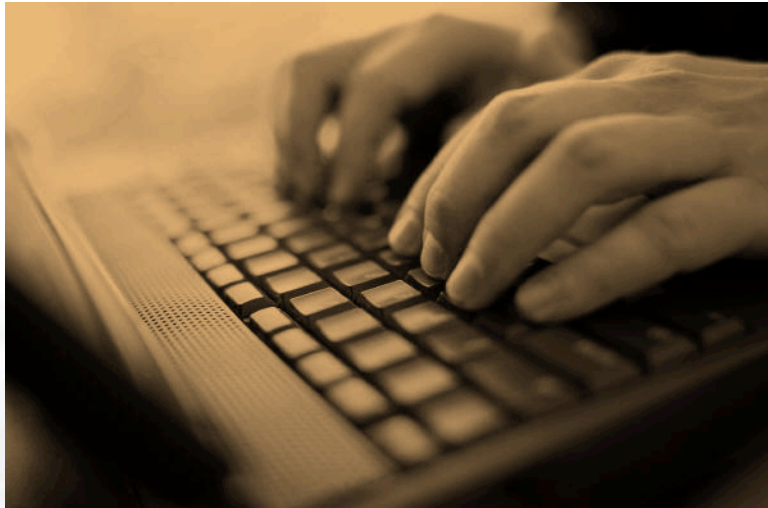
To ensure access in student's resources:

Option 1: Make resource reservation from Portal/Omni

- fix the membership of the slice before reserving resources

Option 2: Ensure common public key is loaded

- distribute common public key to students
- ask students to upload it in their profile
- use corresponding private key to login

Ability to login can help in debugging!

- Test Slice access

- Test access to compute resources using both methods

GENI Accounts and Projects

Exercises on GENI

Tips

Wrap Up

- **List of sample assignments and tutorials:**
  - Use as they are
  - Modify to meet your needs

- **Annotated:**
  - Type
  - Purpose
  - Resources needed
  - Difficulty/Duration

Design/Setup

Execute

Finish

- **Each sample exercise has:**
  – Handouts / Instructions for students
  – Further information about the instructors
  – For solutions email help@geni.net

- **Instruction format:**
  – 3 Steps based on standard experiment lifecycle

Popular Samples

Tutorials:

- **Lab Zero**
  Basic GENI understanding, ensures students setup their environment

- **Intro To OpenFlow**
  Basic OpenFlow introductory tutorial, students learn how to setup OVS and write simple controllers

Assignments:

- **IPv4 Routing**
  Students understand IPv4 forwarding and how to configure static routes

- **TCP Network Awareness**
  Students explore different TCP flavors and TCP parameters

Migrate an Assignment to GENI

Design/Setup

Execute

Finish

1. **Figure out GENI Resources/Tools**
   – **Wireless/Wired**
   – **Flack, Omni, Portal, I&M?**

2. **Test your exercise**

3. **Adjust writeup for GENI**
   – **Remember to include Clean Up!**

Test the Assignment in GENI

- **Run through the exercise**

- **Automate:**
  - Install scripts (HowTo/WriteInstallScripts)
  - Custom Image

Create RSpec that instantiate the topology
  – install scripts, images are included

Resource Reservation

1. **Students make the reservation:**
   - RSpec (URL, File, Upload it in Portal)
     - Or the topology if they are just drawing it in Flack (e.g. Lab 0)
   - AMs, Tool

2. ***Admin (Prof., TA) makes all the reservations:**
   - Create a Slice per student/group
   - Make the student(s) member of the slice
   - Ensure they have keys (email us if needed)
   - Reserve resources **from the Portal or omni**
   - Omni scripts automate this process

   * **Lab Exercises:** Resource reservation might take time
   Assignments: Resource reservation is complicated/unique or out of scope

GENI Accounts and Projects

Exercises on GENI

Tips

Wrap Up

Tip #1: Start Early

2 weeks before (or sooner)

1 week before

First Exercise in GENI

Class Prep:
- GENI Access
- Project for the Class
- Test Exercises
- Notify GMOC
- Figure Student setup
- Email help@geni.net

Email Prework:
- GENI account
- Computer setup*
- Other?

- Bulk-add students to project

* Include steps for testing the setup

Tip #2: Load Balance the students

- Split students/groups between equivalent resources (e.g. racks) to avoid resource contention

- If using scarce resources consider a rolling deadline

GMOC: GENI Meta-operation Center

- Keeps track of outages
- Notification system for resource reservation

GMOC Google Calendar keeps track of reservations/outages

http://groups.geni.net/geni/wiki/HowTo/PreReserveGENIResources

Tip #4: Setup for the Students

- **Use their personal laptop**
  - **LabZero** is a good way to get setup
  - There are Mac/Windows Binaries for Omni

- **Use Lab computers**
  - Go through the exercises in lab computers
  - stress-test the resources or split students

- **Use a VM with all the software loaded**
  - http://groups.geni.net/geni/wiki/HowTo/CreateTutorialVM

Make sure they test it early in the class!

Login to all GENI compute resources using

ssh keys **– no password**

If you are ever **prompted** for a **password** during login to **GENI nodes** something is **wrong**

Using key-pair to SSH:

Public key: is public to everyone, loaded to nodes

Private key: kept private in your computer, provided to SSH to verify it matches the loaded public key

- Students might not be familiar with CLI

- Students might not be familiar with public key cryptography
  - Hard to distinguish between private and public
  - Hard to distinguish between password and passphrase

Consider a brief SSH tutorial/intro

http://groups.geni.net/geni/wiki/HowTo/LoginToNodes

SSH with keys from **Windows** is **non-trivial**

– No built-in ssh client

Possible Solutions

– BitVise

– FireSSH – javascript plugin for Firefox

– SecureCRT (not free)

– cygwin

– *Linux VM – make use of a slim OS*

– PuTTy (private key format different)

Need to address this early!

http://groups.geni.net/geni/wiki/HowTo/LoginToNodes

Tip #6: Effective debugging

- Ask students to be specific about what is not working
  - Step-by-step run through usually helps

- Ask for what they see:
  - screenshots
  - omni output errors

- Gather as much information as you can
  - get slice name
  - tool they used
  - rspec

- Remember you have access to their slices, check for yourself!

- Register for resource mailing lists
  - Better that you contact resource owners and not the students

Problem: Can't login to a node

Possible causes:

– **Slice/sliver expired**

– Wrong username

– Public key isn't loaded, Private key is wrong or non-existing

– Private key has wrong permissions (it should have 0600)

– Technical issue with node

Debug strategy:

1. Check the status of the sliver

2. Try logging in to the node yourself
   - Look for loaded keys
     ```
     sudo cat <student_user_path>/.ssh/authorized_keys
     ```

3. Ask them to use '-v' option
     ```
     ssh -v foo@bar.example.net
     ```

Hands On
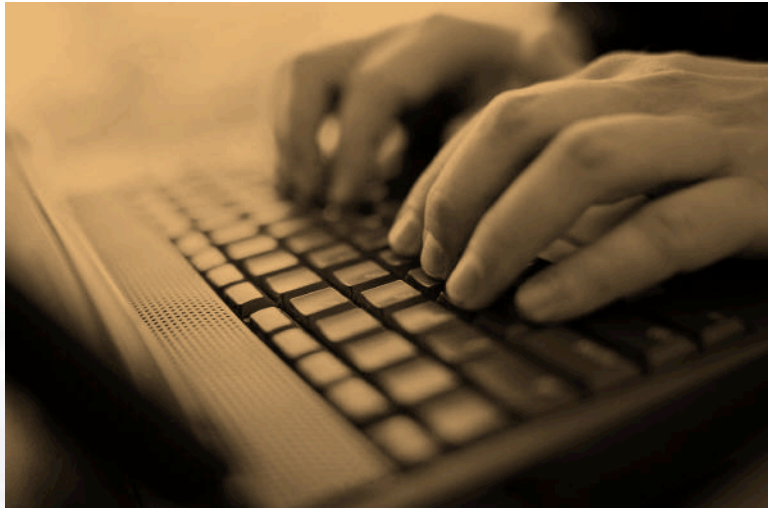
- Renew slices/slivers

- Use of different tools
  - Flack, Portal, (Omni)

GENI Accounts and Projects

Exercises on GENI

Tips

Wrap up

Have a question?
Answer is

help@geni.net

which is an email list which only goes to members of the GPO including…

Sarah Edwards
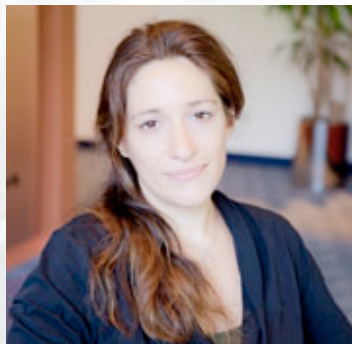
Niky Riga

Vic Thomas

(However, the archive of the list is public)

- Sign Up for :

  geni-users@googlegroups.com

- Use #geni IRC chatroom

- Go over HowTo pages

http://groups.geni.net/geni/wiki/GENIExperimenter/GetHelp

Finding other resources

- ## GENI wiki
  - Pages for **Instructors** and **Experimenters**

    http://groups.geni.net/geni/wiki

"How To" pages

Ask

- Listed under the "Experimenters" section
- Each "How To" is a short descriptions of how to do various tasks
- New entries being added all the time

Tutorials
PlanetLab
Index

Using GENI

- How to Pick a Slice Name
- How to Login to Nodes
- How to Write Install Scripts
- How to pre-reserve GENI resources (aka How to Notify GMOC)

Omni

- ⤷ How to Specify Aggregates In Omni
- ⤷ How to Specify RSpecs In Omni
- How to Add Users to an `omni_config`

OpenFlow

- How to Install OVS in ProtoGENI
- How to Run OpenFlow tutorial
- How to write OpenFlow v3 rspecs
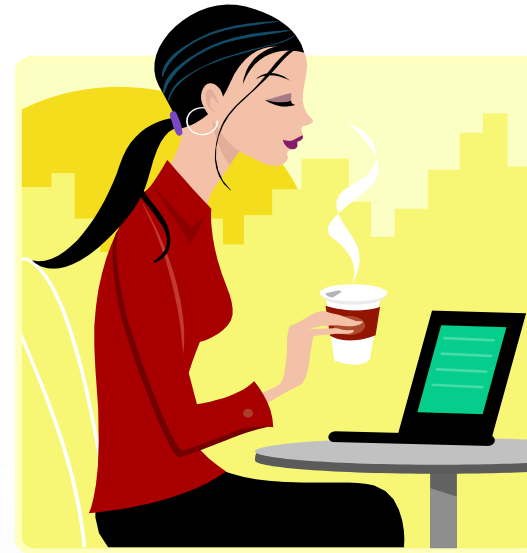- How to run the OpenFlow Nox controller in Fedora8 (OS in many MyPlc hosts)

RSpecs

- How to Convert ProtoGENI v2 to GENI v3 RSpecs

- **21st meeting, open to all:**
  October 20-23, 2014**, Indiana University, Bloomington**
  - Planning & discussion for experimenters, software, infrastructure
  - Tutorials and workshops
  - **Travel grants** to US academics for participant diversity
- **GENI Summer Camp**

Thank you for attending!

Please fill out the survey
http://tinyurl.com/Train-TA-Fall2014