

Are you ready for the tutorial?

1. Grab a worksheet and instructions
2. Did you do the pre-work?
 - A. Do you have an account?
 - B. Have you installed the tools?
 - * ssh
 - * omni
3. Connect to the network
Connect to *BU Guest*

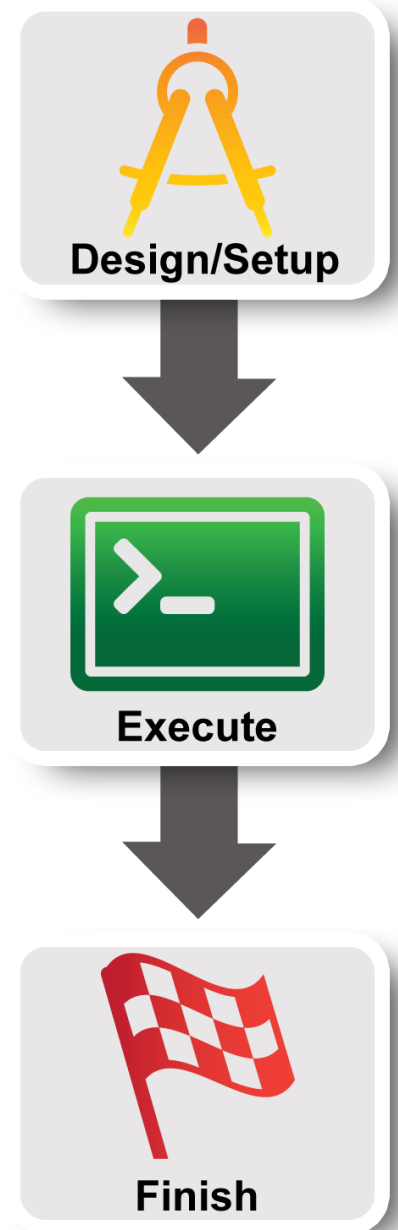
GENI Portal is at:

<http://portal.geni.net>

Lab Zero: A First Experiment using GENI

Violet R. Syrotiuk
Arizona State University

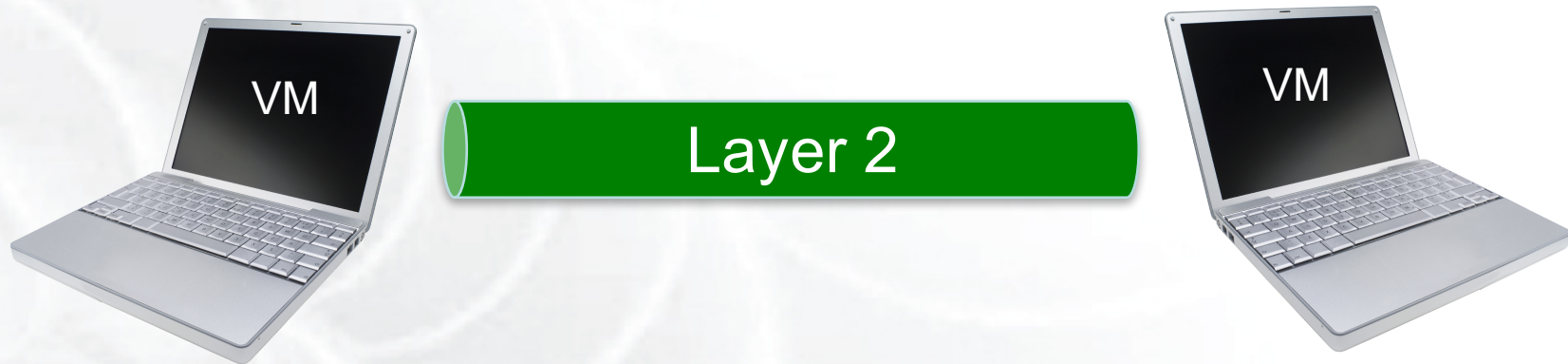
Presentation by Sarah Edwards, GENI Project Office



Hands On Exercise

Do a Simple Experiment in GENI

Reserve two VMs connected at Layer 2



Use the GENI Portal and Jacks



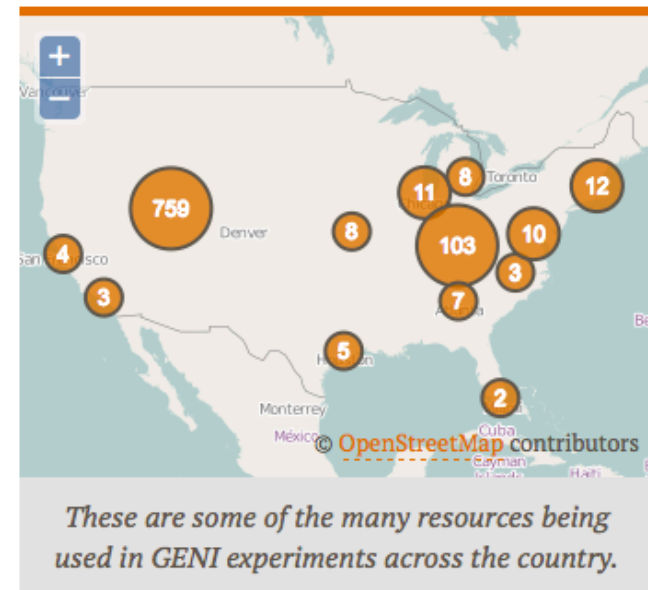
WELCOME TO GENI

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.

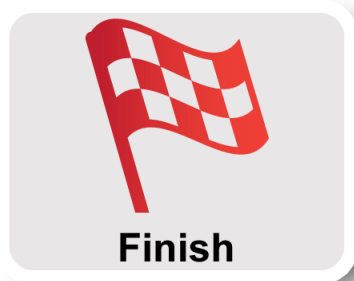
Use GENI

Find out more about using GENI

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



Experiment Workflow



- Part I: Design/Setup
- Part II: Execute
- Part III: Finish

The GENI Portal is...

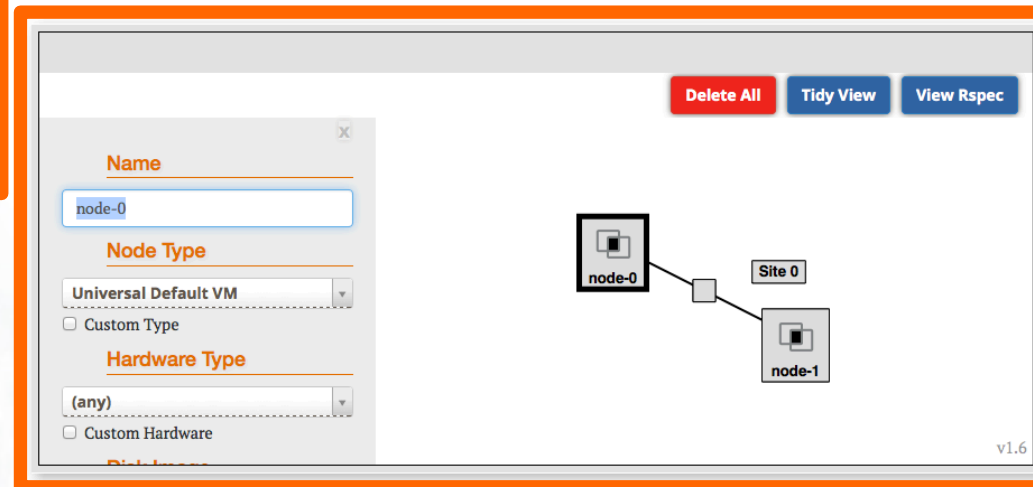
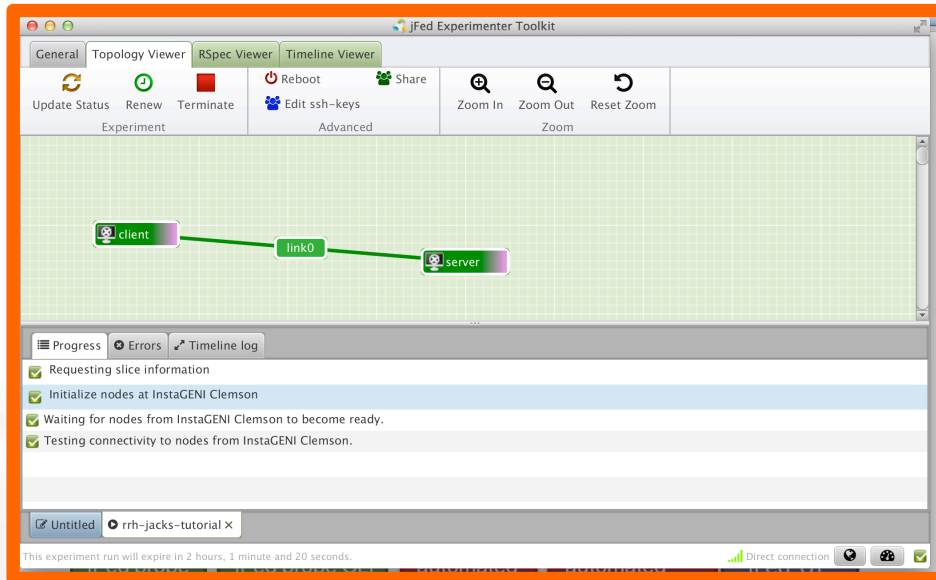
Use GENI

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

Includes simple tools to reserve **resources**.

More to come in the future.

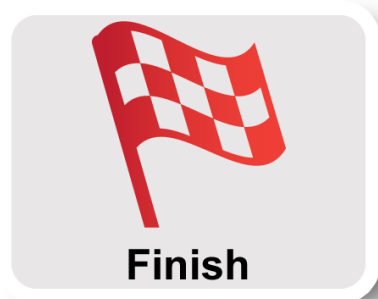
Jacks and jFed are ...



Graphical user interfaces (GUIs) for:

- **designing topologies** in GENI
- **reserving resources** in GENI

Experiment Workflow



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

Establish Management Environment

Use GENI

1 Pre-work: Design your experiment

2.1 Pre-work: Create a GENI account

2.2 Pre-work: Project lead (e.g., tutorial leader) adds you to project

Project Name: GRWBU2016

2.3 Generate and Download ssh keypair

Map

Projects

Slices

Tools

Log Messages

 [Home](#)

Current GENI Clearinghouse Resources



My Projects

Notice

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](#).

Warning

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.

My Slices

You do not have access to any slices.

Tools

GENI Desktop

GENI Messages

2013-08-08 18:13:36 UTC ch-ah.gpolab.bbn.com.km authorizing client ch-ah.gpolab.bbn.com.portal

2013-08-08 18:13:35 UTC Activated GENI account for sedwards@geni.net

2

Login

Join
Project

Logged in as Sarah Edwards | [Logout](#)

[Home](#) | [Projects](#) | [Slices](#) | [Profile](#) | [Help](#)

Home

Current GENI Clearinghouse Resources



OpenStreetMap contributors

My Projects

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No projects.
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Tools

[GENI Desktop](#)

GENI Messages

2013-08-08 18:13:36 UTC | ch-ah.gpolab.bbn.com.km authorizing client ch-ah.gpolab.bbn.com.portal

2013-08-08 18:13:35 UTC | Activated GENI account for sedwards@geni.net

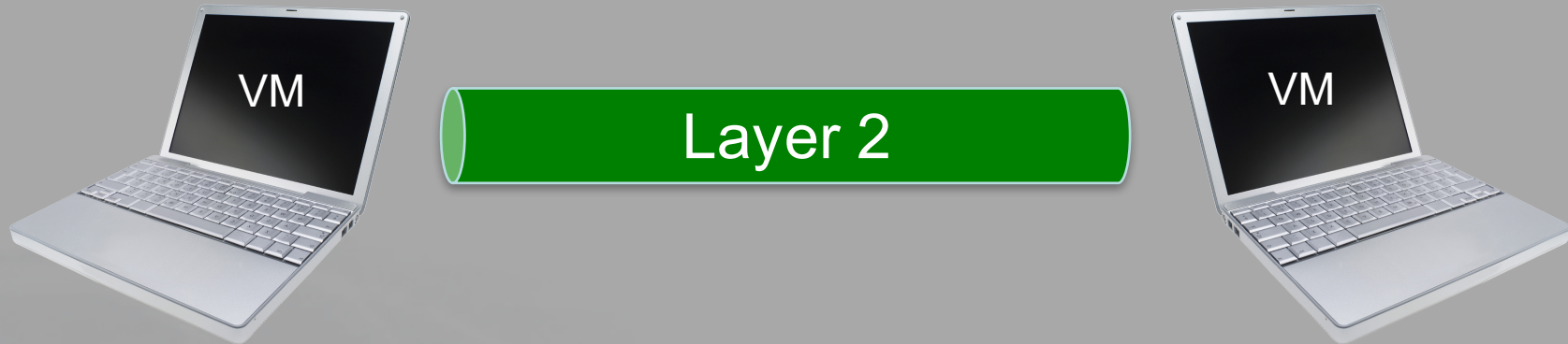
Generate
SSH Keys
&
SSL Certs

2

On your local machine...

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

slice



3.1 Create a slice

3.2 (Optional) Renew your slice

3.3 Reserve two VMs at one aggregate

3.4 Check whether VMs are ready to be used

3.1

Create Slice

 Home → Project *tutorial*

GENI PROJECT: *TUTORIAL*

Project Actions

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

Project Identifiers (public)


Name	tutorial
Purpose	GEC16 tutorial prep3
Expiration	None
Creation	2013-02-08 19:18:26 UTC

Contact Information

Project Lead	Niky Riga e-mail
--------------	----------------------------------

Project slices:

You have access to **2** slices.

Slice Name	Project	Slice Expiration	Slice Owner	Actions		
monitor	tutorial	2014-01-13 00:00:00 UTC	Sarah Edwards	Add Resources	Resource Status	Details
				Delete Resources	 Launch Flack	GENI Desktop
geni01	tutorial	2013-08-16 00:00:00 UTC	Sarah Edwards	Add Resources	Resource Status	Details
				Delete Resources	 Launch Flack	GENI Desktop

[Expired Slices](#)

Extend slice expiration

 [Home](#) → [Project tutorial](#) → [Slice geni01](#)

GENI Slice: *geni01*

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

Slice Actions

[Add Resources](#)[Manage Resources](#)[Manage Slice Members](#)[Slice Identifiers](#)[Recent Actions](#)

Renew Slice

Project does not have an expiration date
Slice expires on **2014-06-12 19:23:05 Z**

Renew ☒ slice only
☐ slice & known resources

until

[Renew](#)

Slice Tools

[Flack](#)[GENI Desktop](#)[LabWiki](#)[Omni](#)

Manage Resources

[Select All](#)[Deselect All](#)[Ready?](#)[Resource Details](#)[Resource Status](#)[Delete Resources](#)

Select Only:

Select Date...

[Renew Resources](#)

+ ☐ ExoGENI (0)

+ ☐ FOAM (0)

+ ☐ InstaGENI (0)

+ ☐ Other (0)

You do not have any aggregates selected.
Please select aggregates on the left.

3.3

Launch tool

 [Home](#) → [Project tutorial](#) → [Slice start](#)

GENI Slice: *start*

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

Slice Actions

[Add Resources](#)[Manage Resources](#)[Manage Slice Members](#)[Slice Identifiers](#)[Recent Actions](#)

Renew Slice

Project does not have an expiration date
Slice expires on **2014-10-25 23:35:16 Z**

Renew

☐ slice only

☒ slice & known resources

until

2014-10-25

[Renew](#)

Slice Tools

[Flack](#)[GENI Desktop](#)[LabWiki](#)[Omni](#)[jFed](#)[Slice Jacks \(beta\)](#)

Manage Resources

[Select All](#)[Deselect All](#)[Ready?](#)[Resource Details](#)[Resource Status](#)[Delete Resources](#)

Select Only:

This Slice

Select Date...

[Renew Resources](#)

+ ☐ ExoGENI (0)

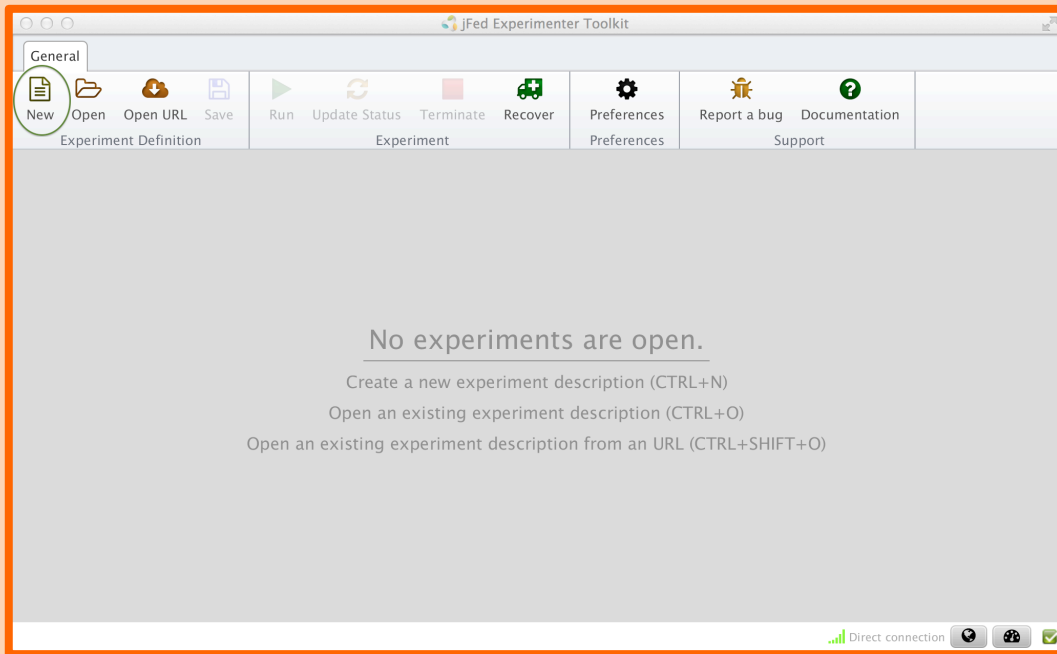
+ ☐ FOAM (0)

+ ☐ InstaGENI (0)

+ ☐ Other (0)

You do not have any aggregates selected.
Please select aggregates on the left.

3.3



Launch
Tool

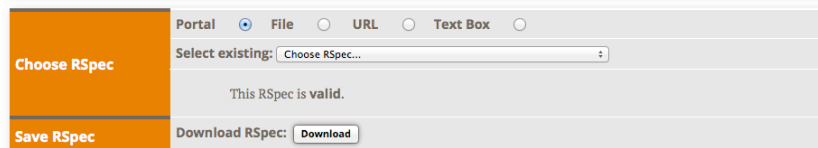
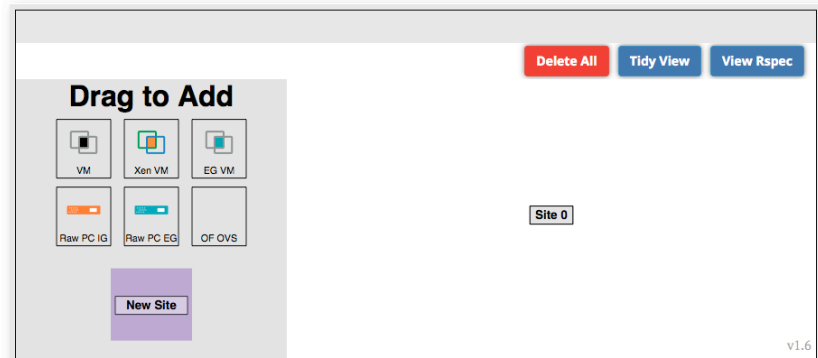
Home → Project tutorial → Slice start → Add Resources to start using Jacks

Add Resources to GENI Slice start

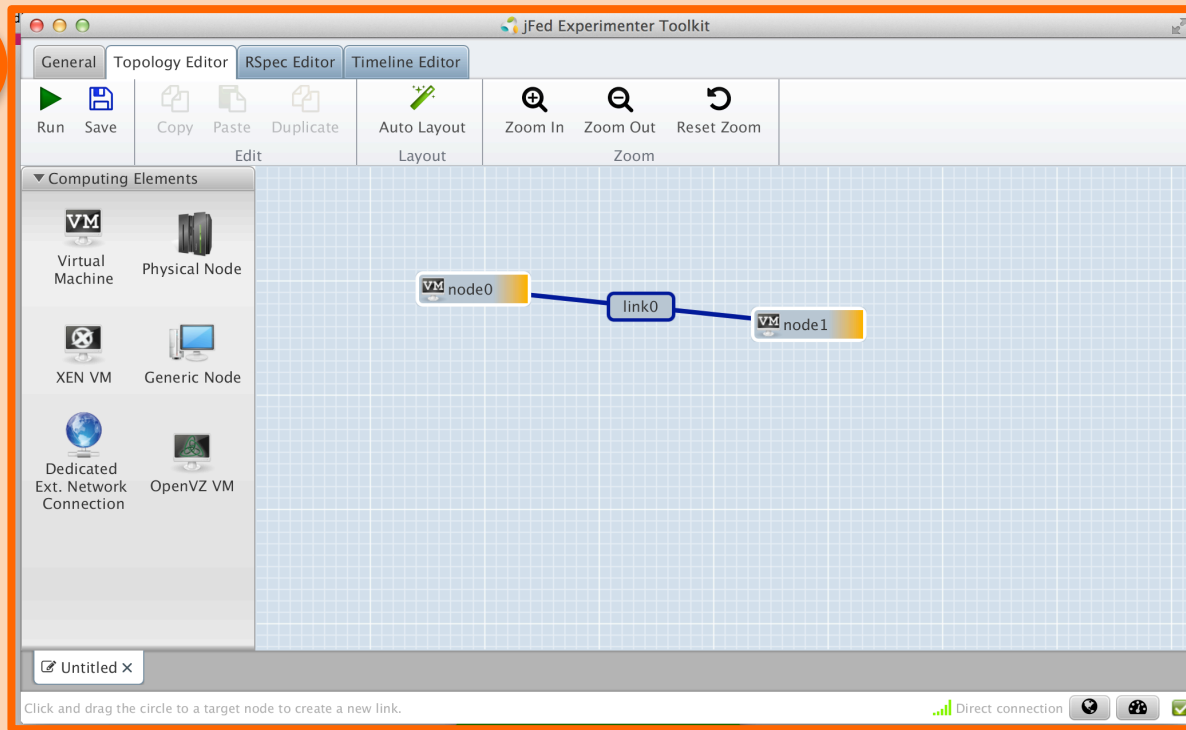
Add Resources | Manage RSpecs

Add Resources

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



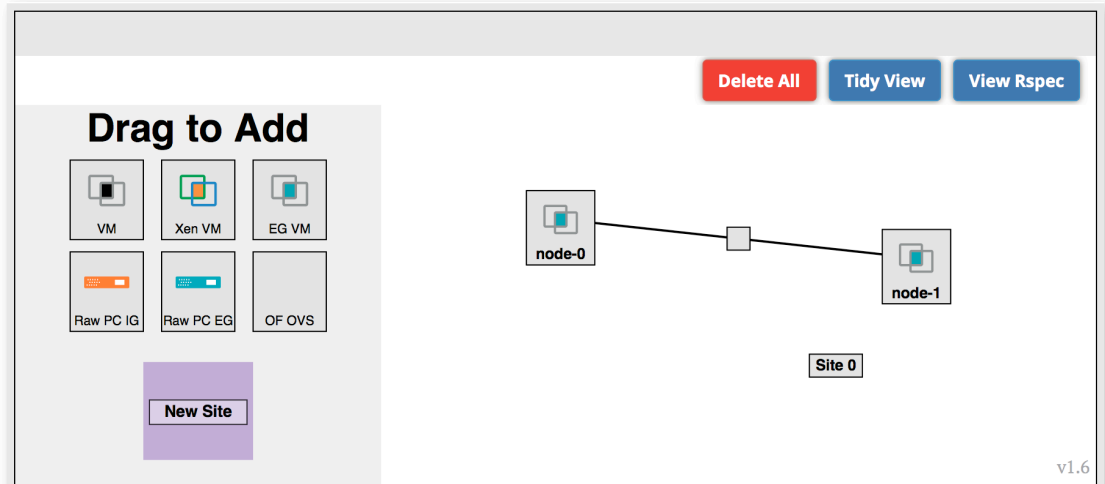
3.3



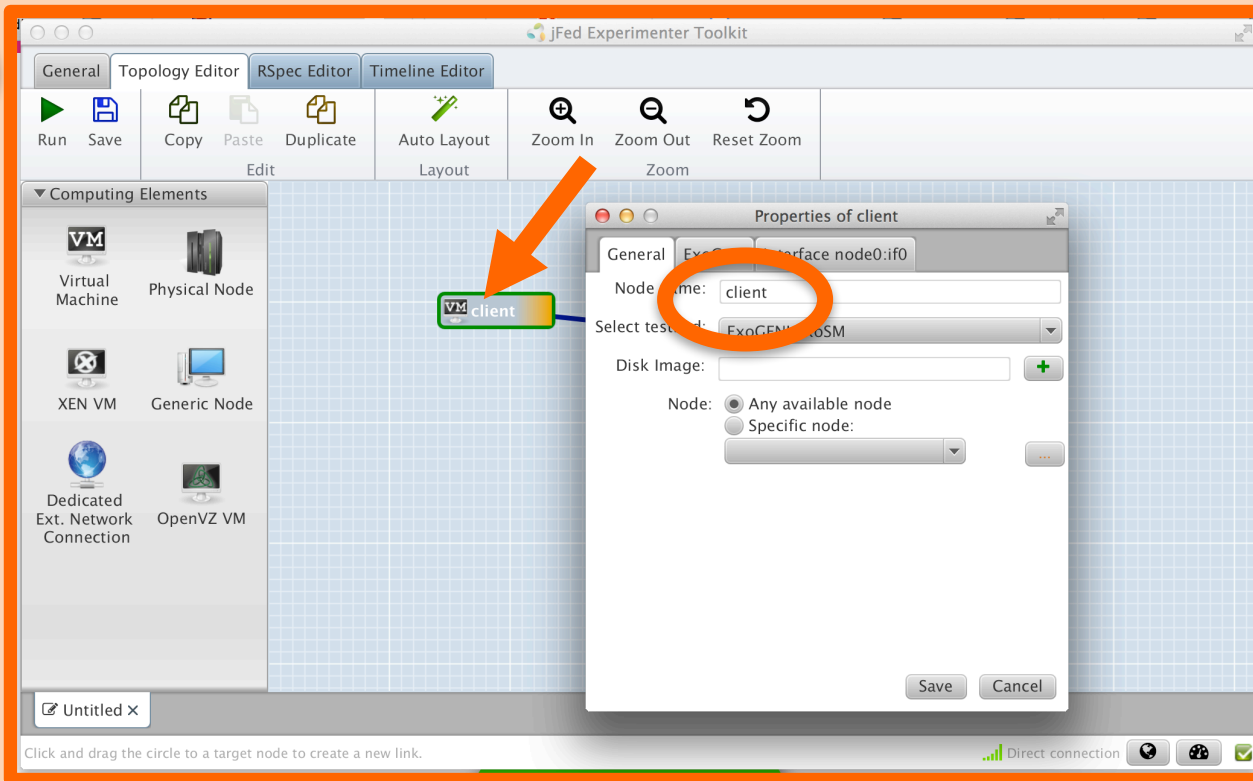
**Draw two VMs
connected by a link**

Add Resources

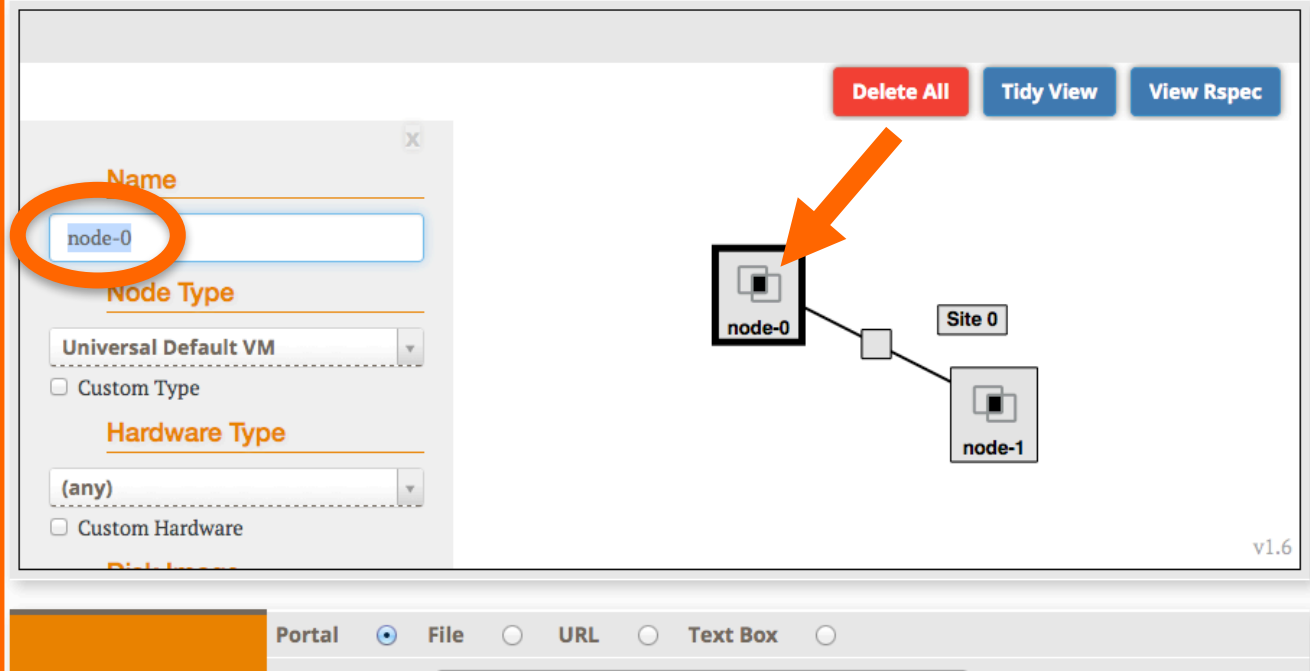
To add resources you need to choose a Resource Specification file (RSpec).



3.3



Change names
of VMs



3.3

Properties of link0

General Impairment Link Type

Link name: link0

Configuration t... ☐ Automatic ☒ IPv4 ☐ IPv6

Interface ID	IP Address	Netmask
node0:if0	10.1.1.1	255.255.255.0
node1:if0	10.1.1.2	255.255.255.0

IP addresses:

Save Cancel

Set IP and mask
of interfaces

Add Resources

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

Delete All Tidy View View Rspec

Interfaces

- Interface to node node-0

Name: interface-0

IP: 10.1.1.1

Netmask: 255.255.255.0

node node-1

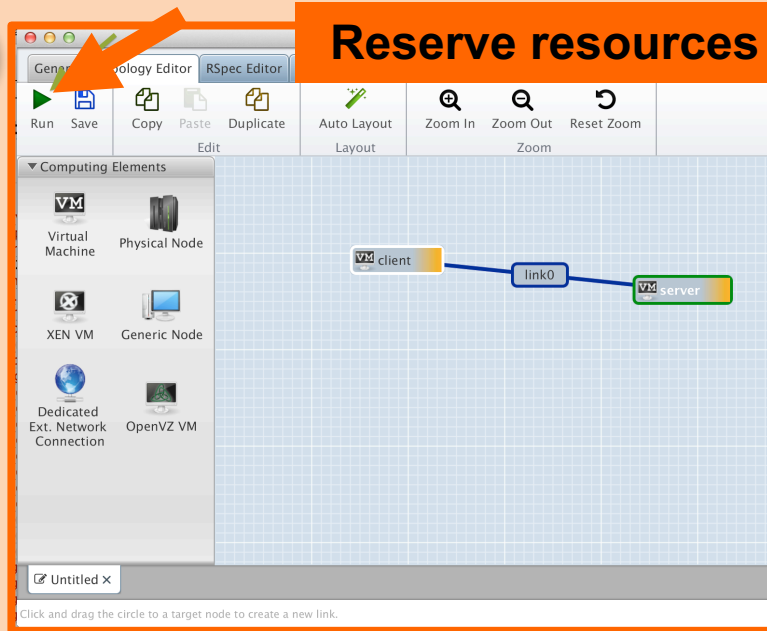
client node-1

Site 0

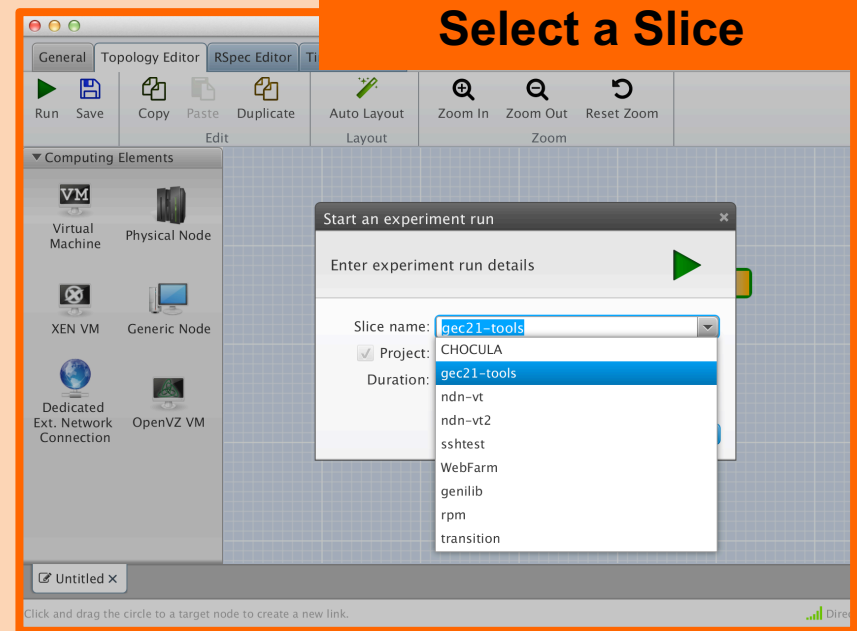
v1.6

3.3

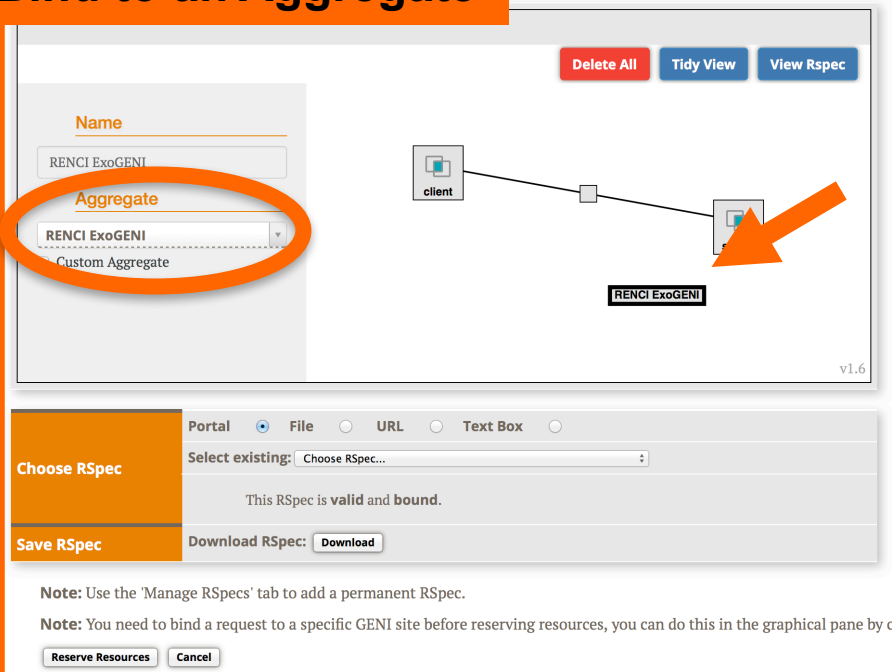
Reserve resources



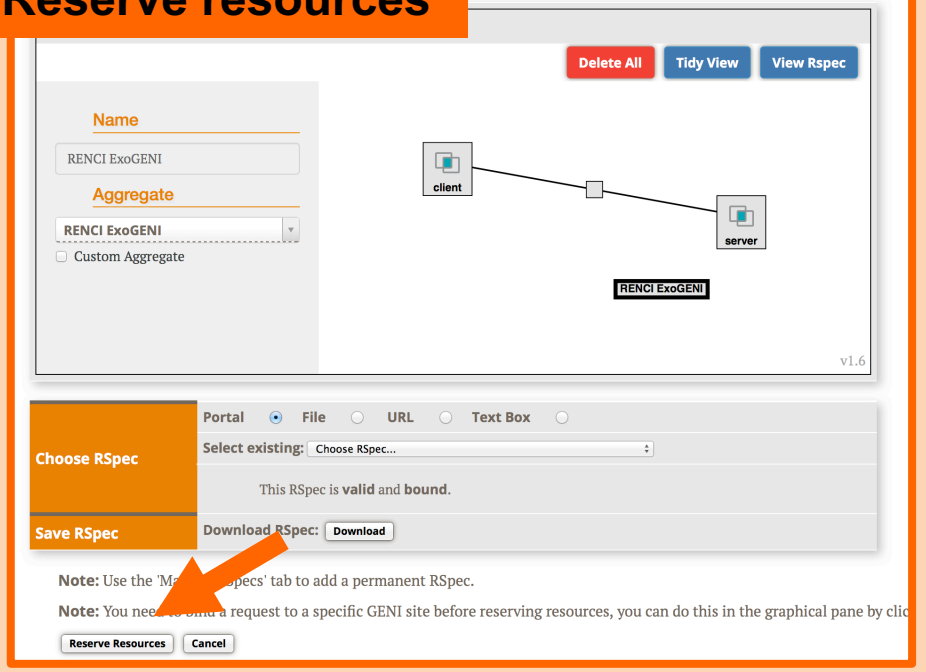
Select a Slice



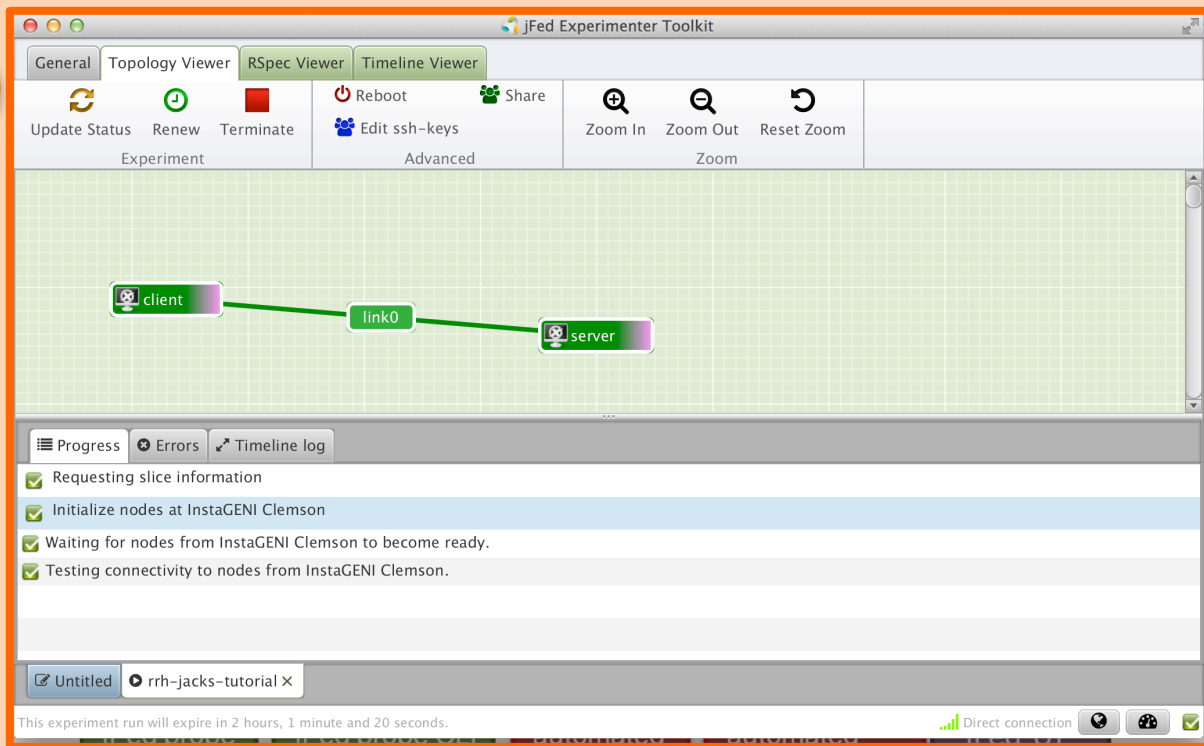
Bind to an Aggregate



Reserve resources



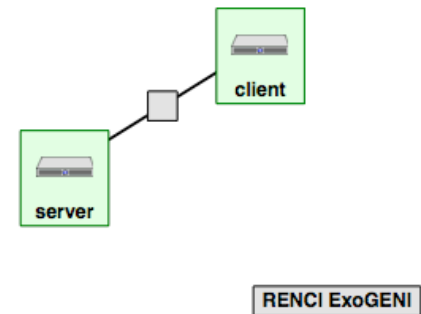
3.4



**Resources are
READY!!!**

Manage Resources

Resources on RENCi ExoGENI are ready.

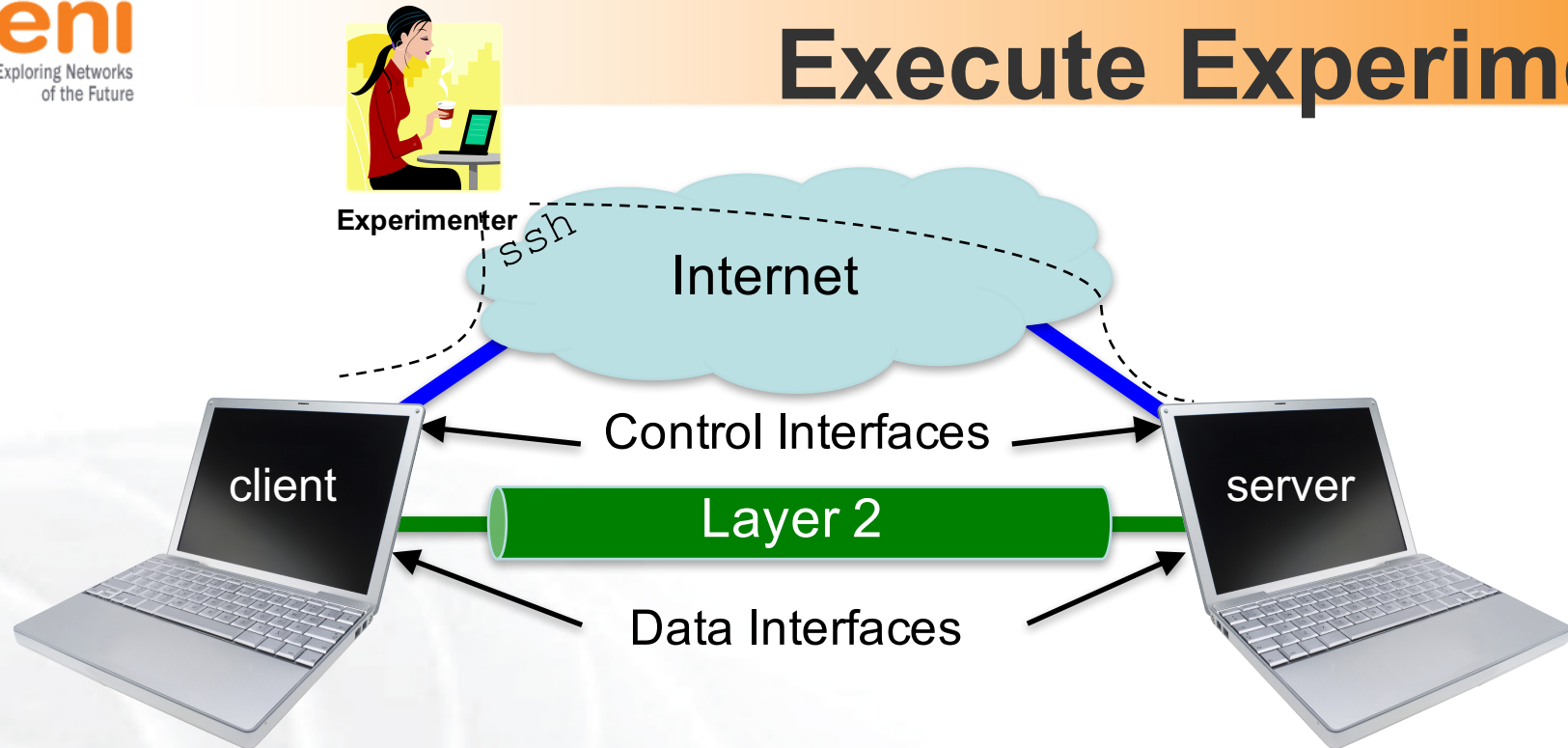


Renew Renew Date Delete SSH Restart Details Status Add Resources

Experiment Workflow

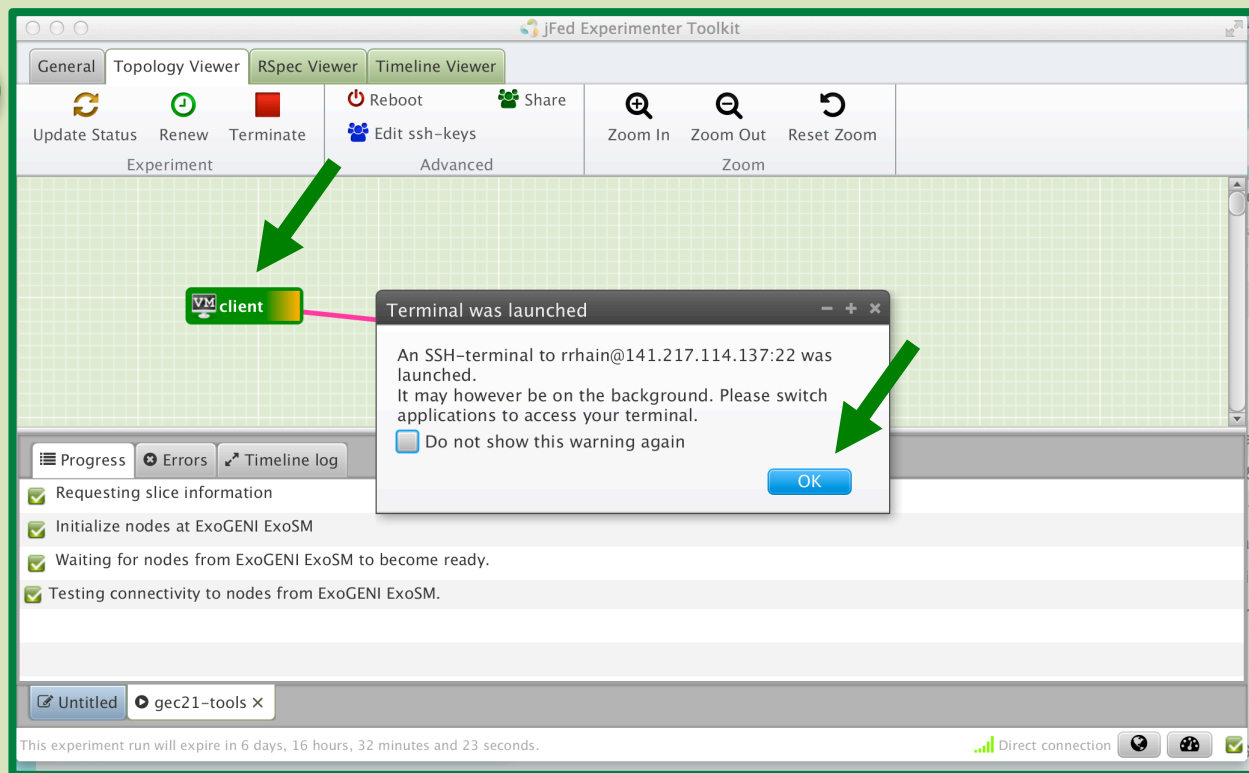


- Part I: Design/Setup
- **Part II: Execute**
- Part III: Finish



- 4.1 Login to the client and server nodes
- 5.1 Test connectivity
- 5.2 Explore the data and control planes
- 6.1 Logout of nodes

4.1

**Login**

Aggregate RENCI ExoGENI's Resources:

Node #1:

Client ID	Component ID	Exclusive	Type	Hostname
client	rcivmsite:orca-vm-cloud	not exclusive	xo.small	(not specified)
Login				ssh ahelsing@152.54.14.49
				ssh agosain@152.54.14.49
				ssh nriga@152.54.14.49
				ssh vthomas@152.54.14.49
				ssh tupty@152.54.14.49
				ssh asydney01@152.54.14.49
				ssh sedwards@152.54.14.49
				ssh tmitchel@152.54.14.49
				ssh lnevers@152.54.14.49
				ssh rrhain@152.54.14.49
				ssh root@152.54.14.49

5.1

```
$ sudo ifconfig
```

```
$ ping 192.168.1.11 -c 5 # server data i/f
```

```
$ ping 172.17.1.9 -c 5 # server ctrl i/f
```



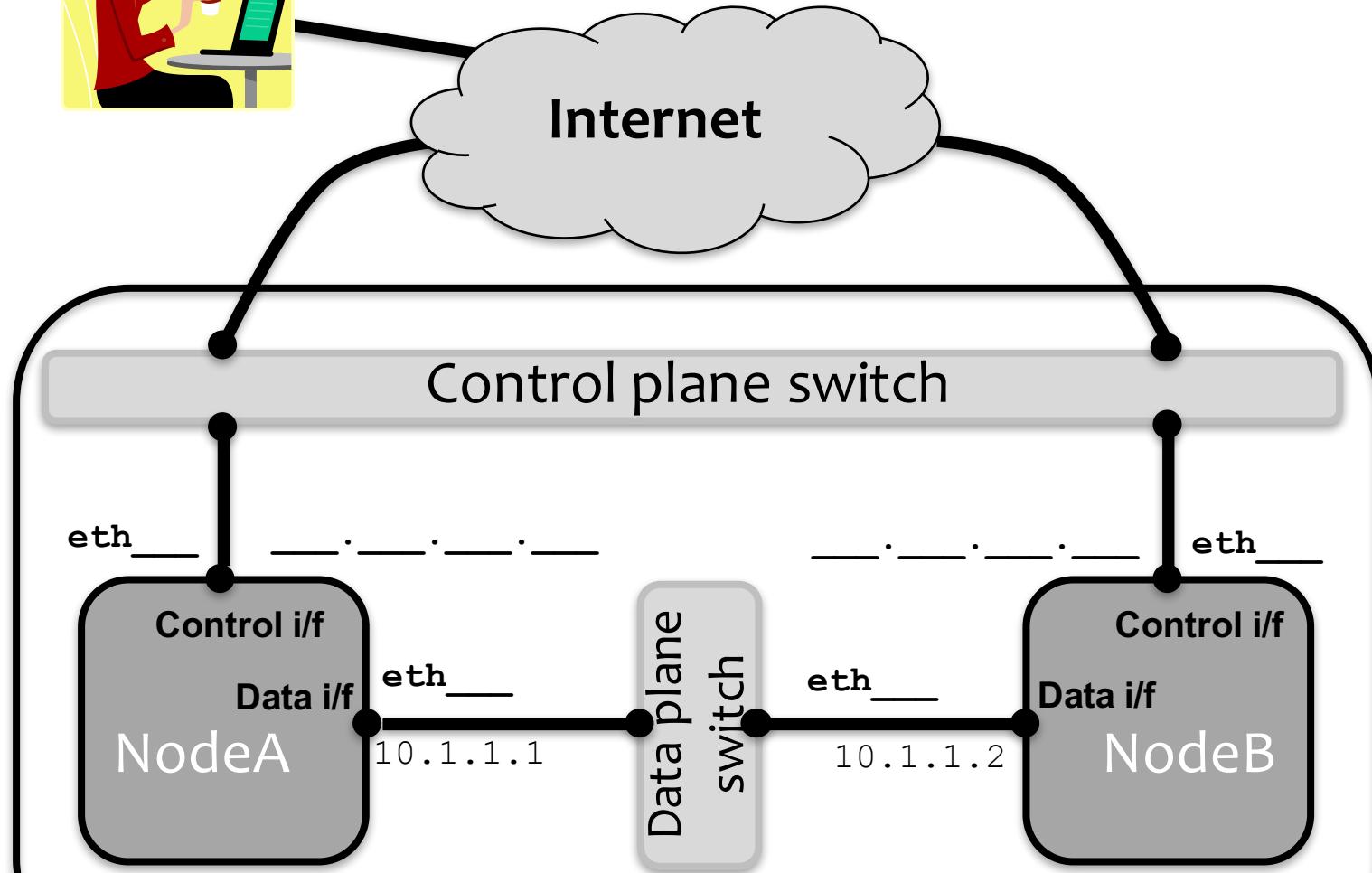
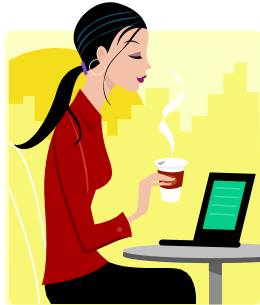
5.1

```
$ sudo ifconfig
```



Worksheet

Slice Name: lab0<your initials>



5.1

```
$ sudo apt-get install iperf  
$ hash
```

```
# server data i/f  
$ iperf -c 10.10.1.2  
...
```

```
# server ctrl i/f  
$ iperf -c 172.17.2.4  
...
```



```
$ sudo apt-get install iperf  
$ hash
```

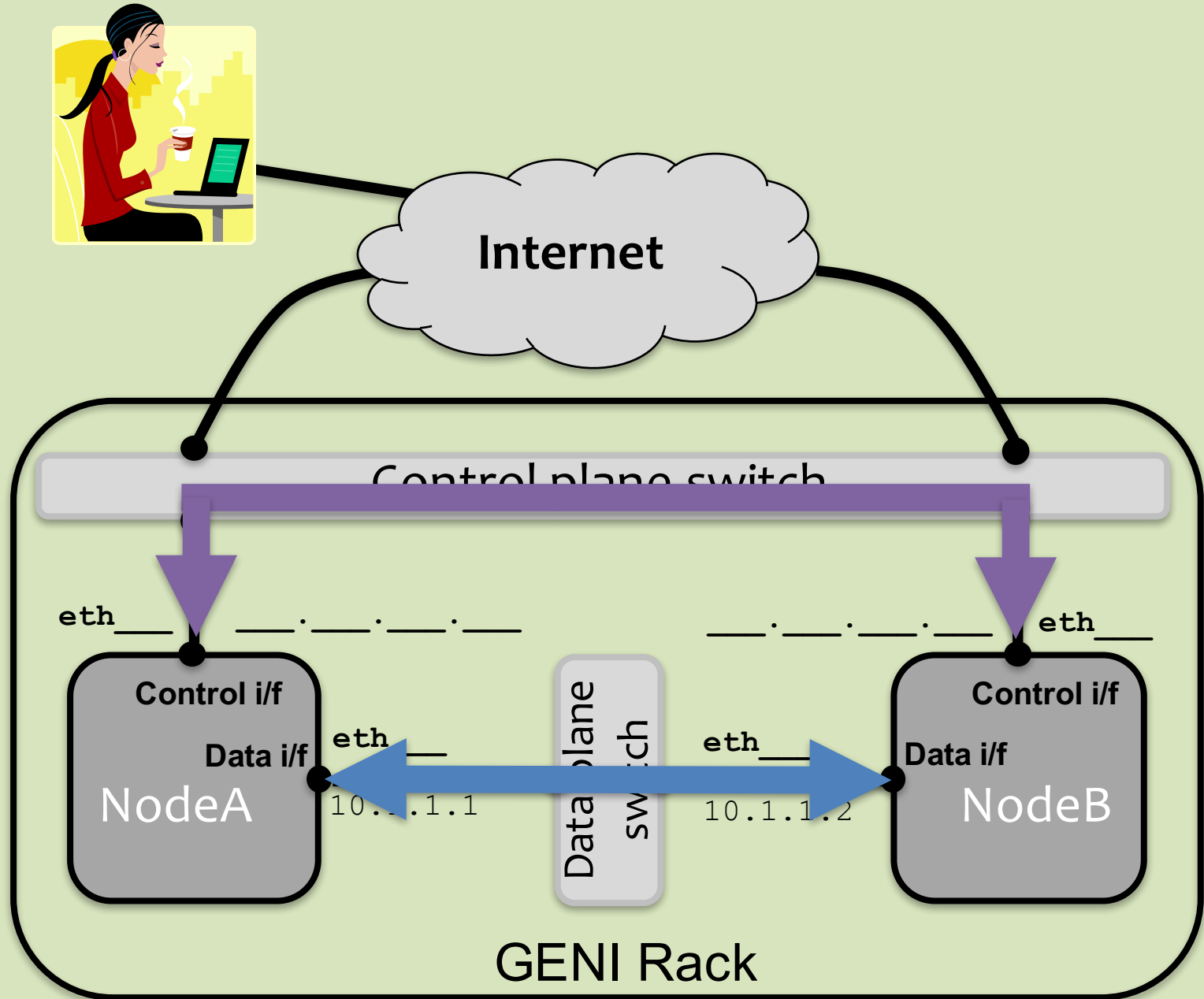
```
# start an iperf server  
$ iperf -s
```

```
# Stop the iperf server  
<ctrl-c>
```



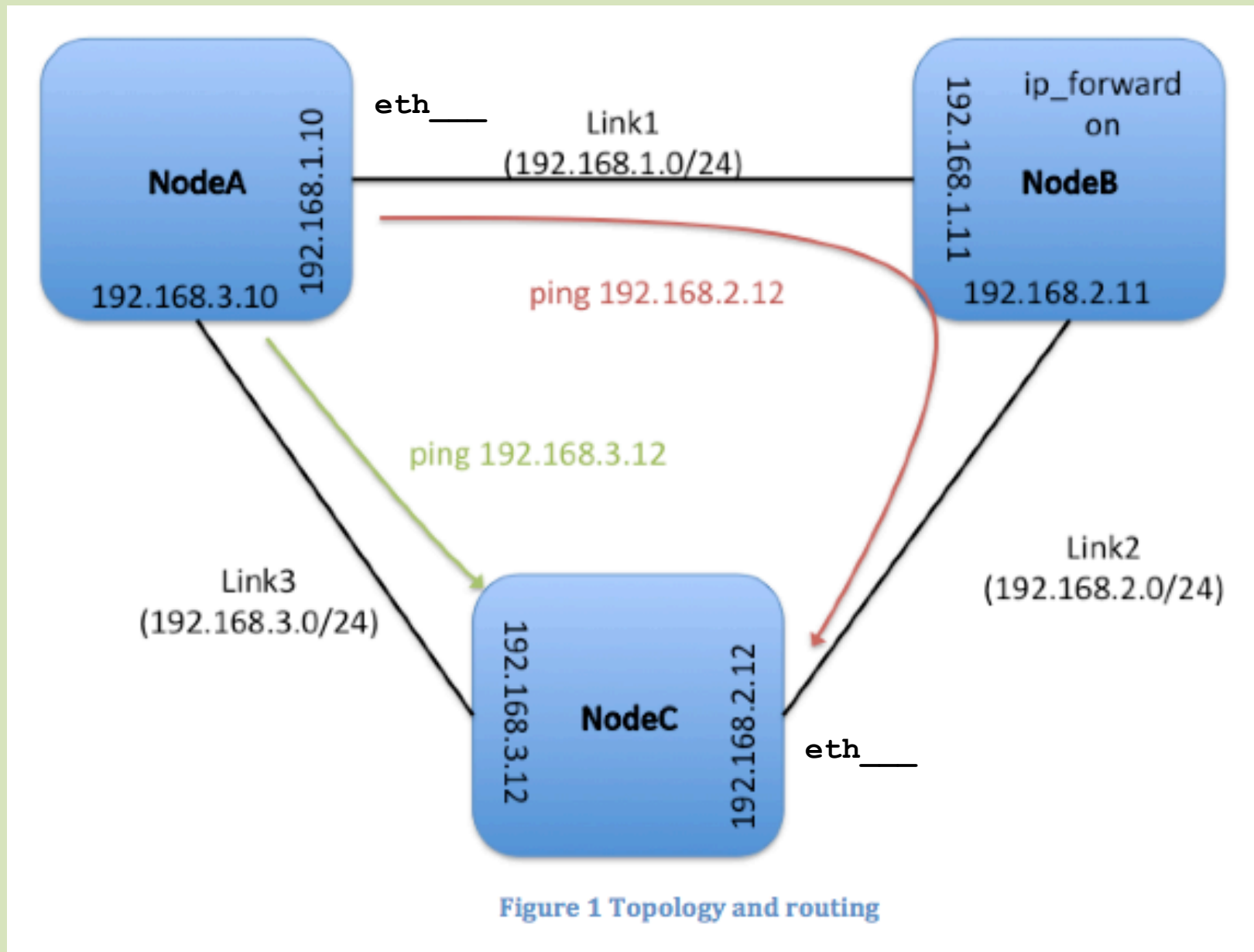
What is the bandwidth of the **data** link? Why?

5.1 What is the bandwidth of the **control** link? Why?



Demo here

5.2 Configure routing



5.2 *Configure a static route*

```
route add -net 192.168.1.0 netmask 255.255.255.0  
                                gw 192.168.1.1 dev eth0
```

In above command:

add	-Indicates that the route is added to routing table.
-net	-Indicates that destination is a network.
192.168.0.1	-Indicates IP address of destination network.
netmask	-Indicates the subnetmask of destination network.

Configure IP routing

```
sudo sh -c 'echo 1 > /proc/sys/net/ipv4/ip_forward'
```

From: <https://www.hscripts.com/tutorials/linux-commands/route.html>

5.3

```
# ping server data i/f
$ ping 192.168.1.11
...
```



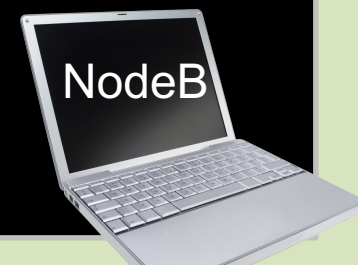
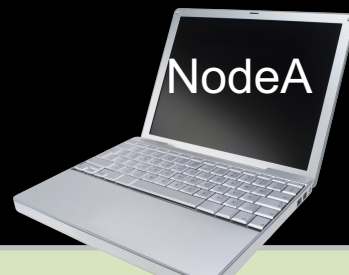
```
# For ExoGENI only do:
$ sudo service neuca stop
# bring down data i/f
$ sudo ifconfig eth12541 down
```

5.3

```
# ping server ctrl i/f
$ ping 172.17.2.4
...
```

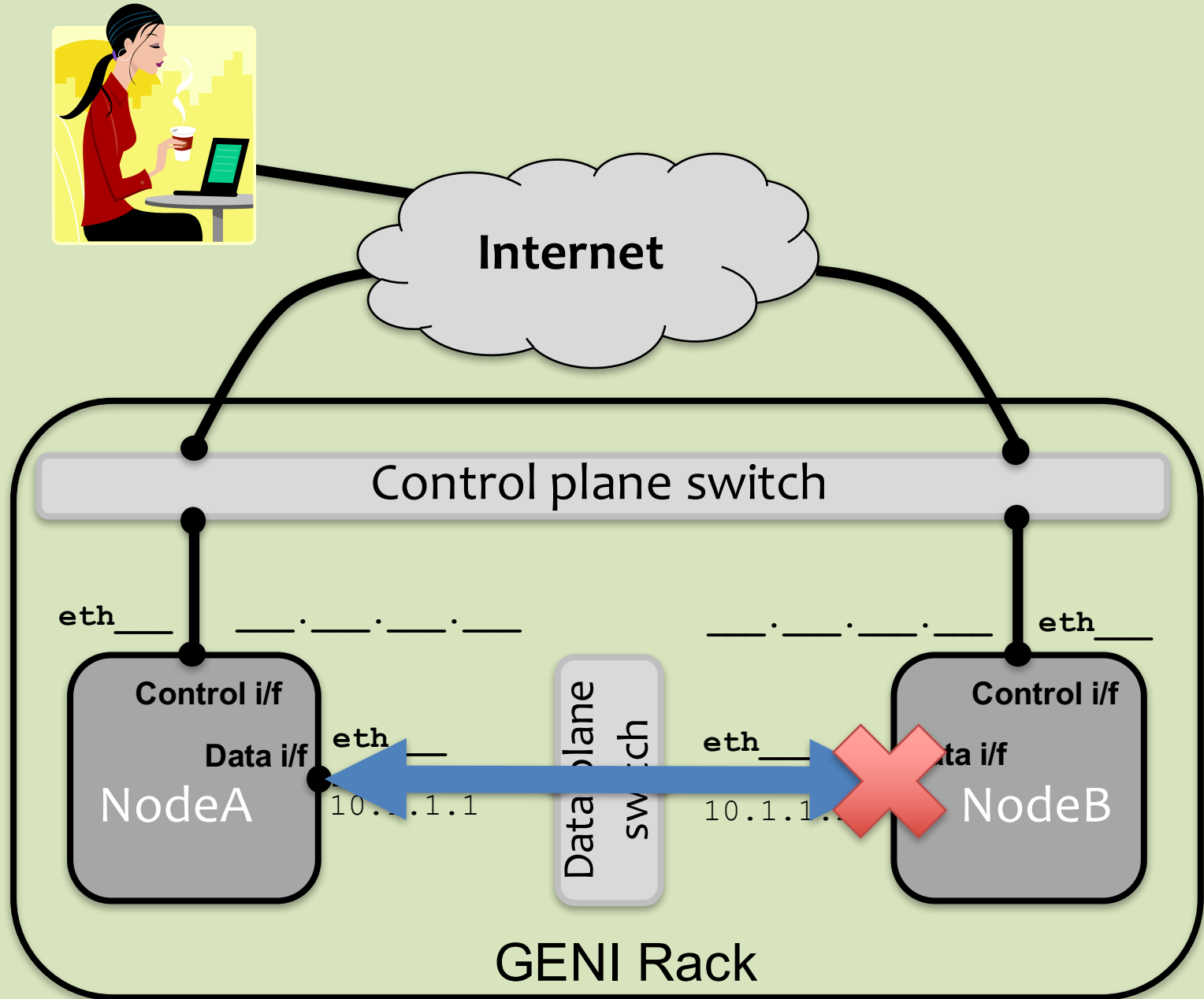
```
# bring down ctrl i/f
$ sudo ifconfig eth999 down
```

```
$ exit
```

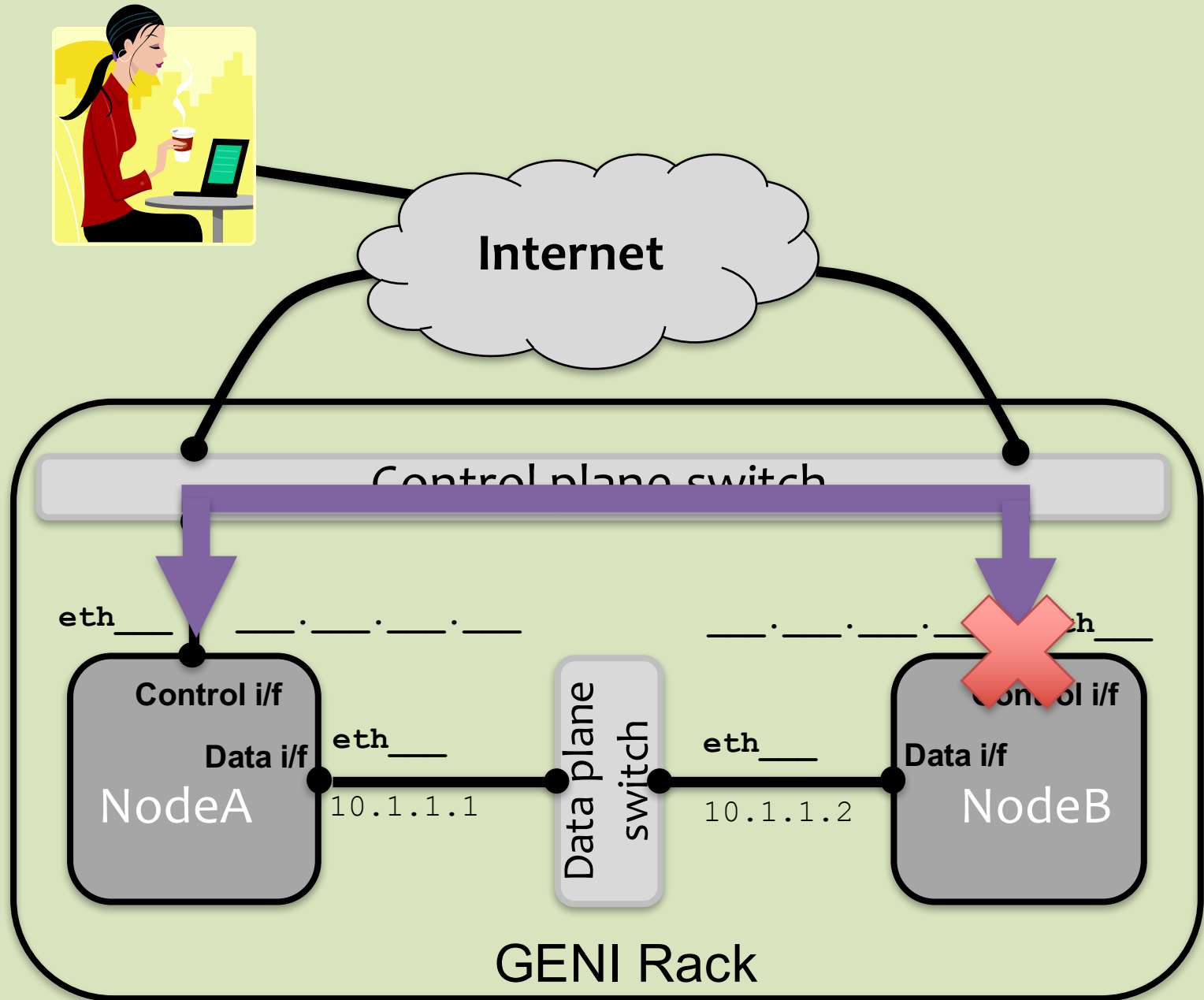


Demo here

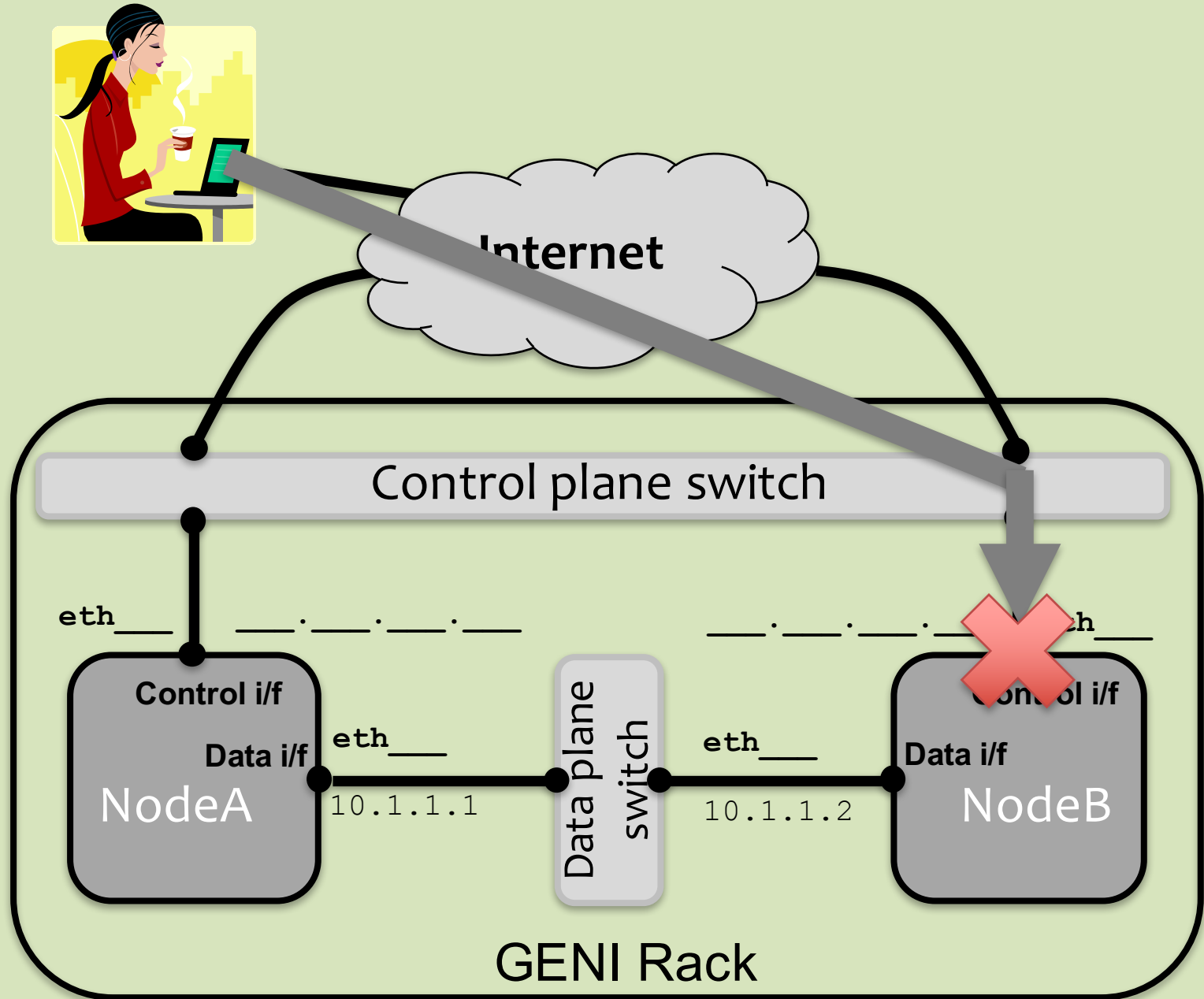
5.3 When you bring down the **data** interface, the destination should become unreachable. Why?



5.3 After you bring down the **control** interface, the destination becomes unreachable. Why?



5.3 After you bring down the **control** interface, your ssh session should immediately hang. Why?



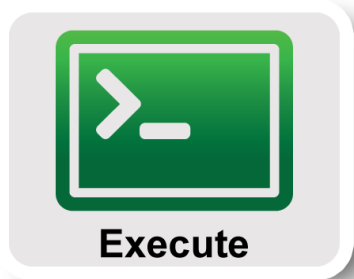


You are trying to log in to a compute node on GENI using SSH and can't.

Which are possible explanations?

- a) You entered the wrong password
- b) You didn't offer the private key that matches the public key
- c) The public key wasn't loaded onto the node
- d) Permissions on the private key are too permissive
- e) (b), (c), and (d)

Experiment Workflow

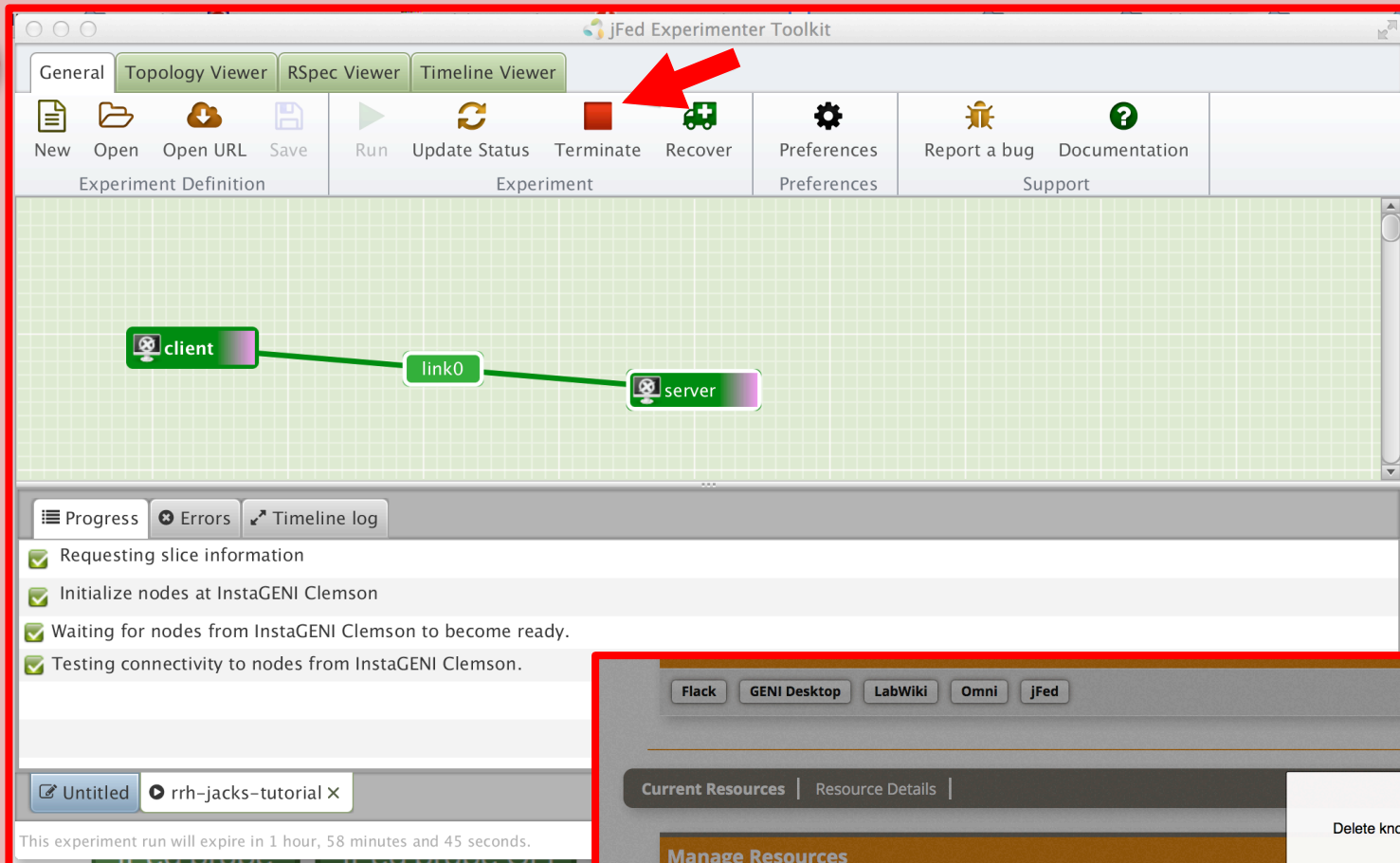


- Part I: Design/Setup
- Part II: Execute
- Part III: Finish

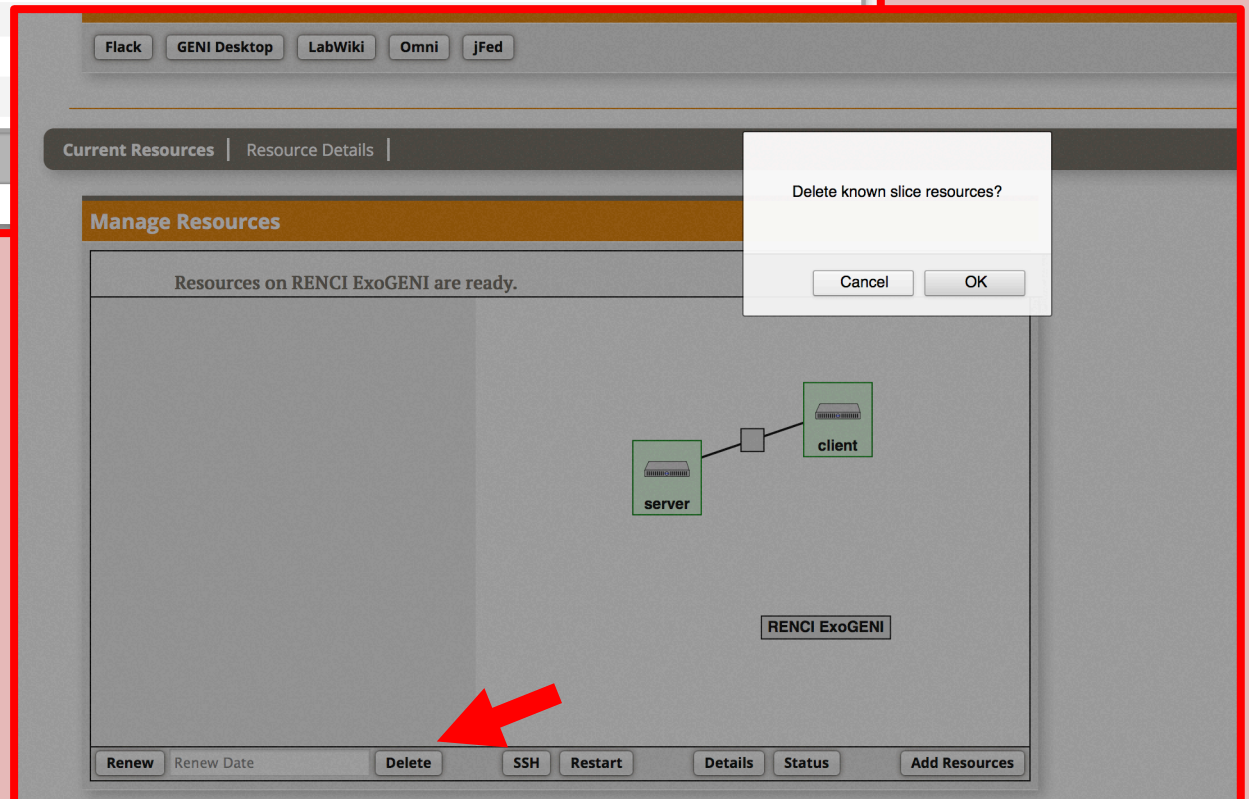
Don't Delete YET!!!

We will clean up later

7



Delete Resources



Part III: Finish Experiment

project resource
aggregate experimenter



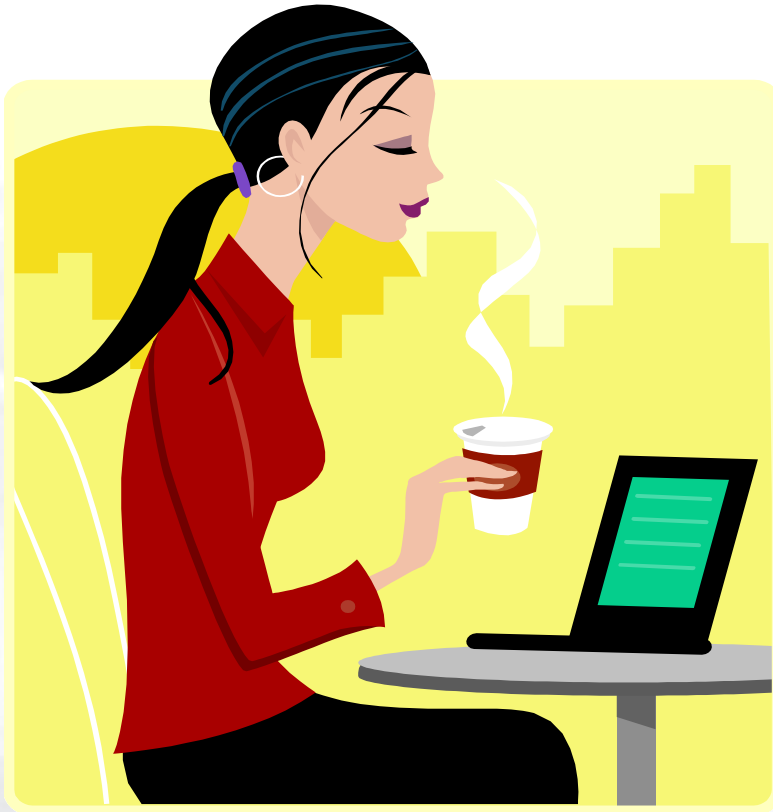
When your experiment is done, you should always release your resources.

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

Congratulations!

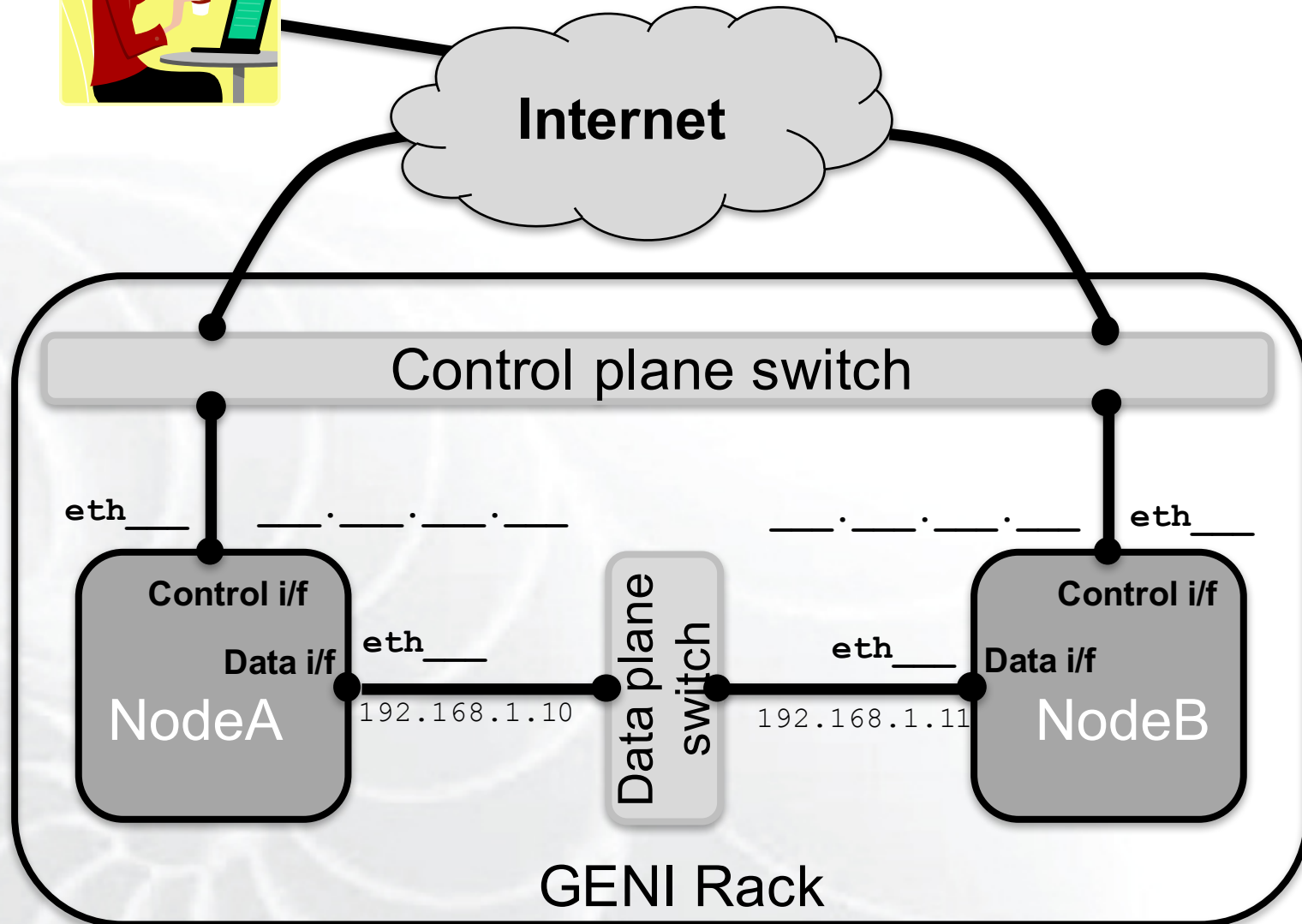
You have...

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



Welcome to GENI!





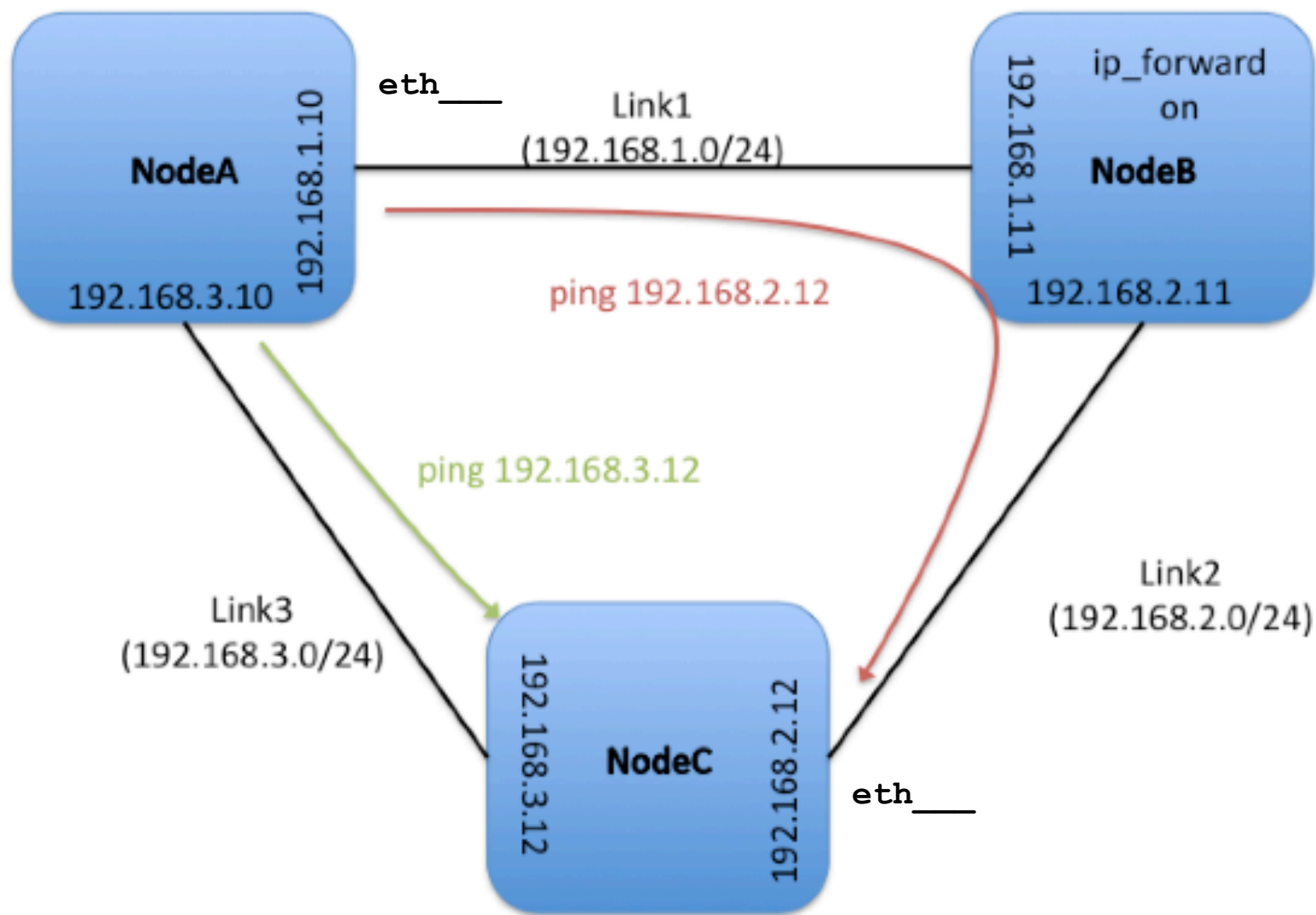
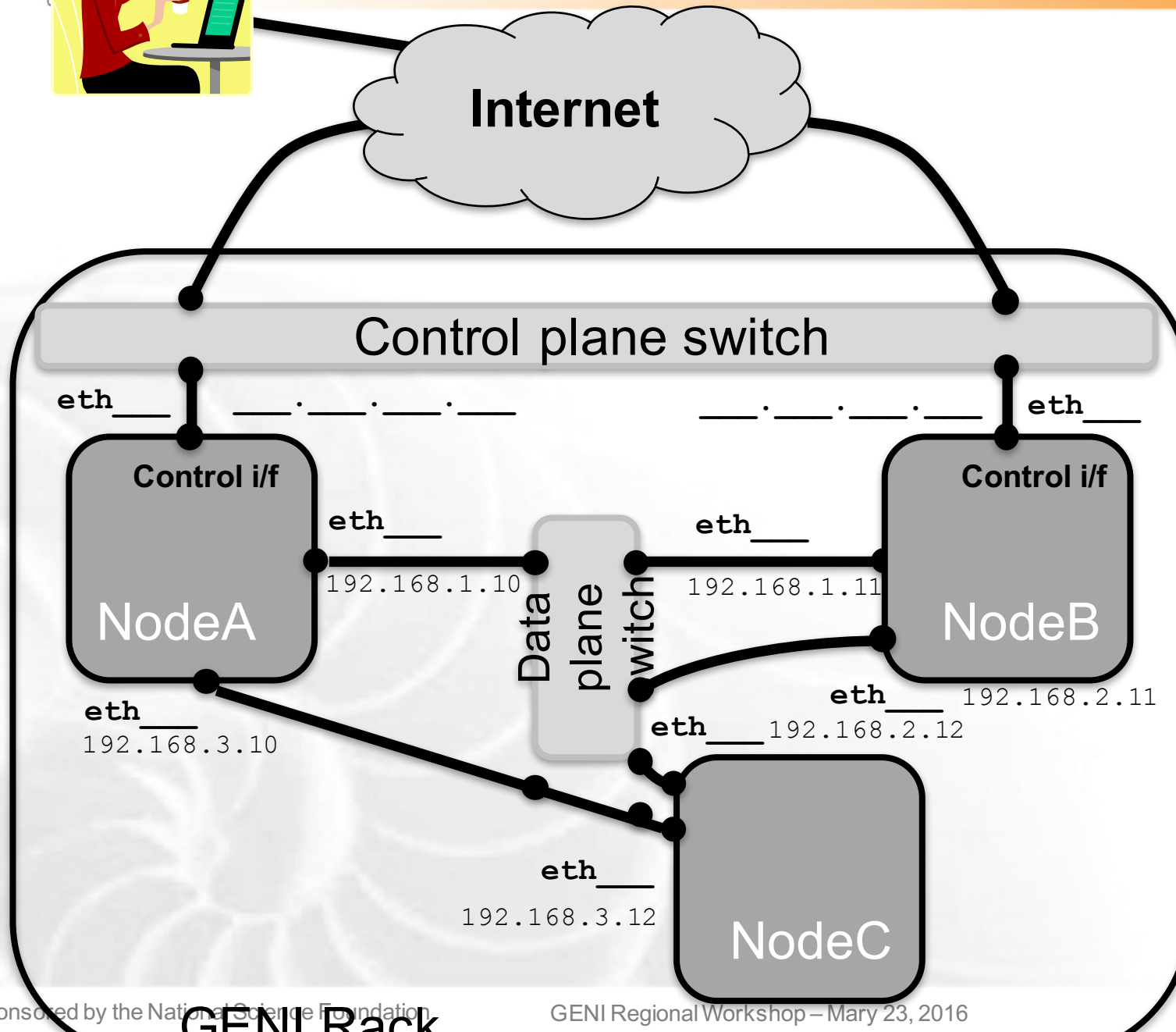
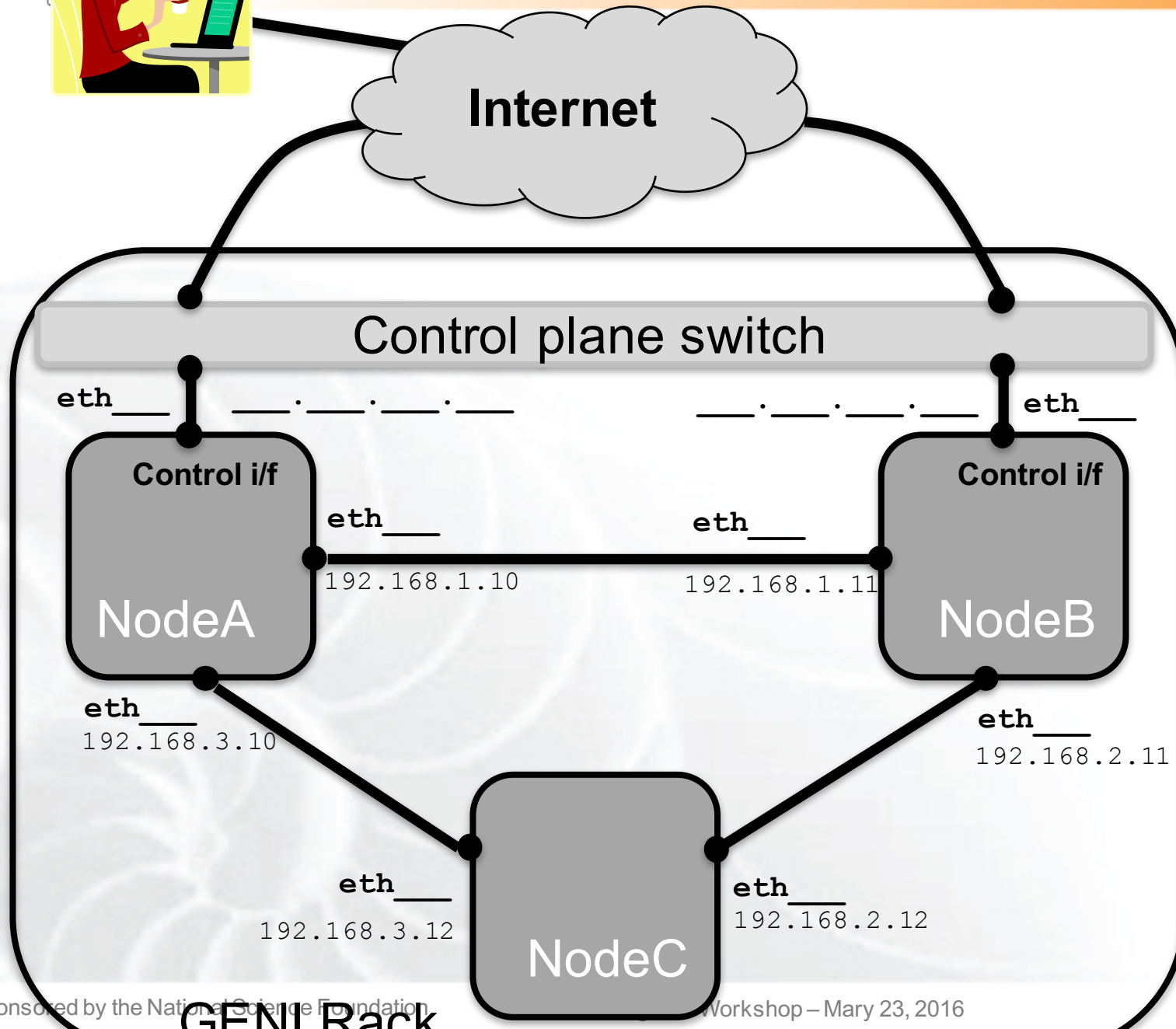
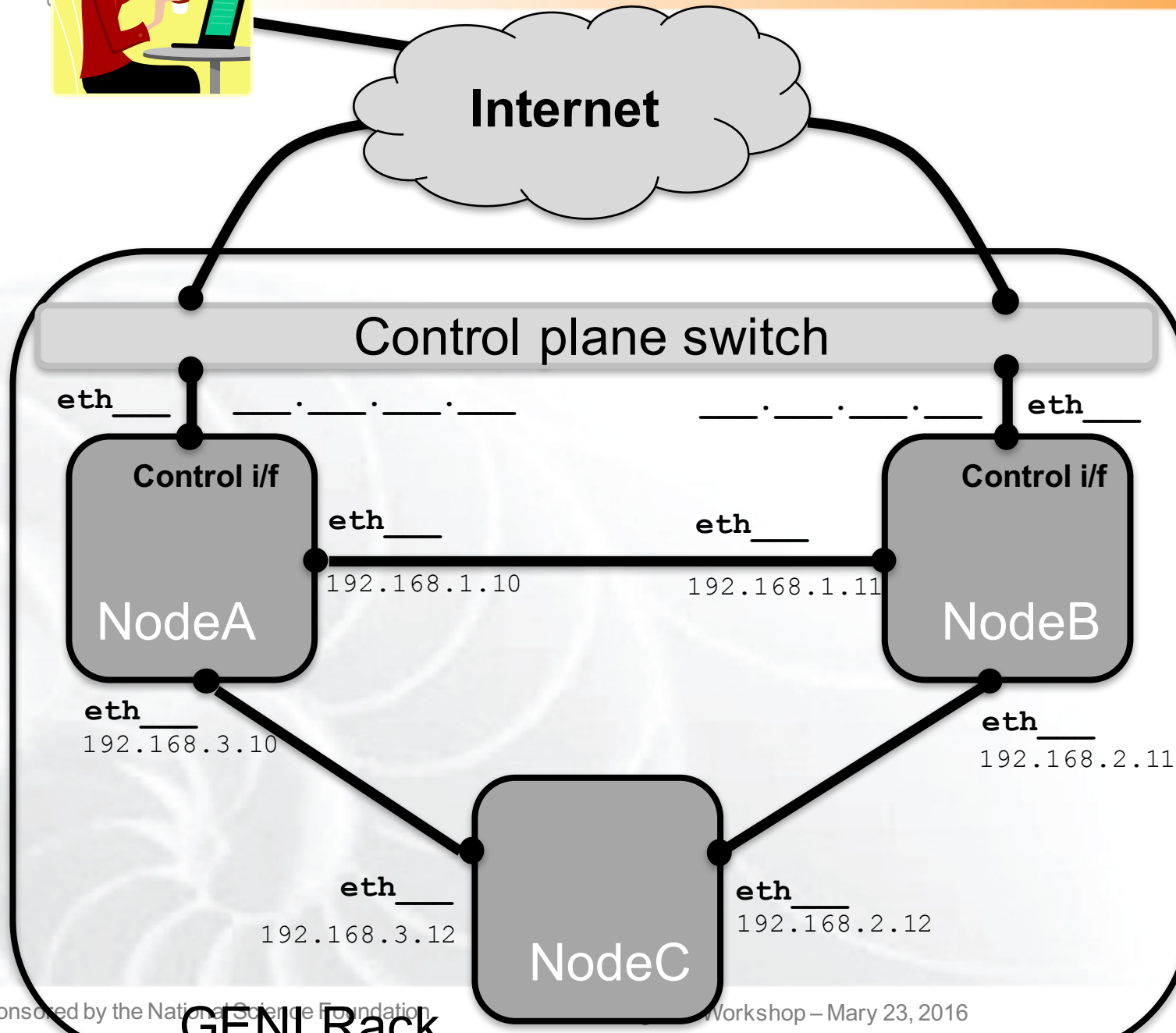


Figure 1 Topology and routing







Data
plane
switch

