

Lab Assignment 4 for ECE671

Posted: 04/01/2021

Due: 04/22/2021

Network Address Translation (NAT) on GENI

This assignment builds on assignment 3 and has the goal to introduce you to the GENI testbed. By now, you should be very familiar with the NAT part of the assignment. Please pay careful attention to the instructions.

Step 1:

Once you are in the GENI portal (<https://portal.geni.net/>), select “University of Massachusetts Amherst” as the organization. Then join in project “ECE671”.

Step 2:

Click on create the slice, give a name (Unique, only alphanumeric plus hyphen) and a short description (Not mandatory)

Create New Slice

A GENI slice is a container for reserving and managing a set of GENI resources.

Project name	VCNL ▾
Slice name	OpenFlowNAT -- Required
Slice description	<input type="text"/>

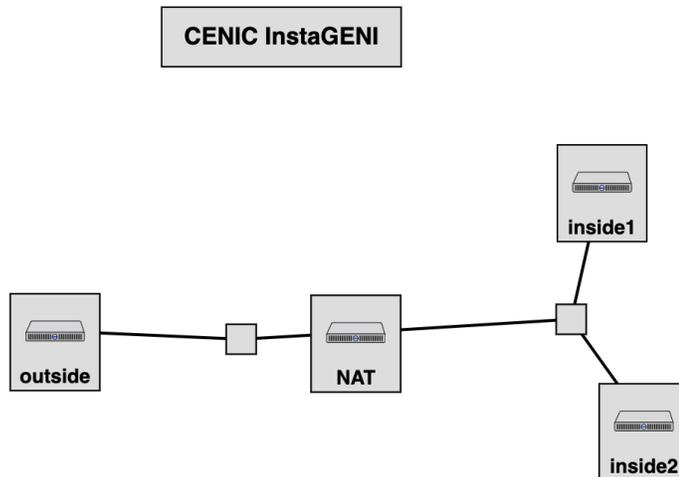
Note: Slice names must not contain whitespace. Use at most 19 alphanumeric characters or hyphen

Note: Slice names are public and must be unique across your project.

Step 3:

Once In the slice, click on ‘Add Resources’.

Step 3a: In the “Choose Rspec section click on the “File” radio button and upload the file posted on moodle from your computer. If successful, you’ll see an image similar to the one below:

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

About the RSpec

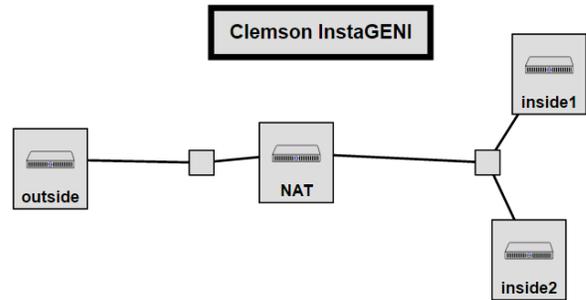
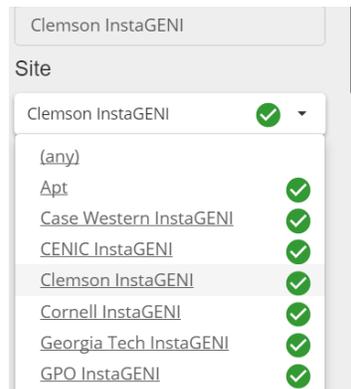
You can click on 'View RSpec' (Right corner) to see what constitutes an 'RSpec'. Key things to note in the RSpec:

1. <client id>: is the node that is being referred to currently. The above topology has 4 nodes, so there are 4 client_id's in this RSpec.
2. <disk image>: The image that is being run on each node. Here, we have 'outside', 'inside1' and 'inside2' has UBUNTU16-64 image and 'NAT' has an OVS image since the controller will be running on the NAT.
3. <execute command>: This command is quite useful. This allows you to execute bash scripts (similar to the ones that were implemented on the client and the server in the lab3 Mininet implementation). By providing these scripts, we are adding static routes automatically when the nodes are ready.
4. <interfaces>: Provides interfaces addressing between the nodes.
5. <link>: tells you how the nodes are interconnected.

Note: To edit this RSpec, copy the current RSpec, makes changes and paste it in the 'Text Box'

Step 4:

Once the RSpec has been selected. Click on Site and choose any one of the available once (indicated by a green tick).



Step 5:

Once you have chosen, click on reserve resources.

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)"

Reserve Resources Cancel

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

Step 6:

Next, you should click on the 'slice page' in the below window and wait till all the nodes turn green:

Total run time: **44 seconds**
 Status: **Finished**

Started at: **Mon, 08 Apr 2019 15:35:15 -0400**
 Finished at: **Mon, 08 Apr 2019 15:35:59 -0400**

Results | Detailed Progress | Request RSpec | Manifest RSpec | Send Problem Report | Advanced

Results

Resources requested from RSpec:

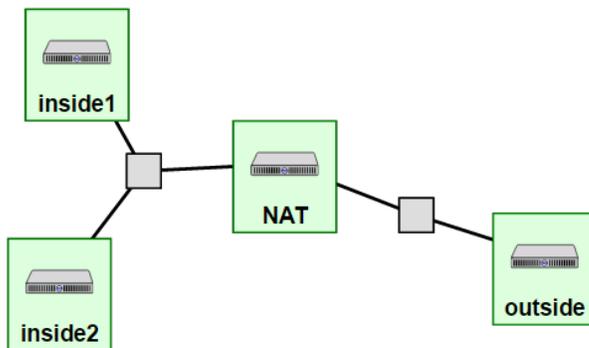
Note that the results are current as of the finish time. Your resource allocation may have changed after this time if resources expired or were deleted. Check the [slice page](#) for the most up-to-date results about your slice's current allocated resources.

Node #1 (at CENIC InstaGENI):

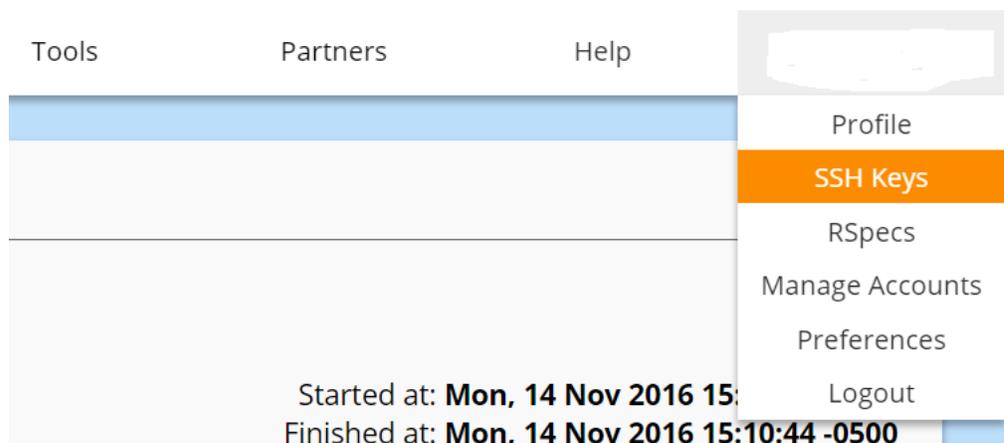
Status	Client ID	Component ID	Expiration	Type	Hostname
Unknown	outside	pc3		emulab-xen	outside.ECE671-1ab4-hd.ch-geni-net.instageni.cenic.net

(This step may take several minutes)

Step 7: Login to nodes (Once all the resources are green):



Once all the resources have turned green, click on details to see the SSH details to login to the node. To do this, you will need SSH keys, which can be found in the right corner:



The SSH command to login to each node is:

```
ssh -i ~/.ssh/id_geni_ssh_rsa <login_id>@<hostname/ip> -p <port_num>
```

Step 8: On the NAT node

From the RSpec, you should be able to see the following postboot scripts already installed. These scripts are added to the RSpec to help automate any steps, for example, the OVS configuration, that you would like to execute after the node has booted.

```
<execute command="sudo bash /tmp/of-setup/switch-setup-ryu" shell="bash"/>
<install install_path="/tmp" url="http://www.gpolab.bbn.com/exp/NAT/of-setup.tar.gz"/>
```

The command, as mentioned previously, runs a bash script. The script can be found in `'/tmp/of-setup'`

Be sure to check out the installations that occur with this step.

To obtain the login information for your nodes, click on Details in the Slice page. The controller will run on the same VM which means the switch connects to the controller on localhost.

Next on the NAT node execute the following commands:

1. `$wget https://bootstrap.pypa.io/ez_setup.py -O - | sudo python`
2. `$sudo pip install oslo.config tinyrpc`
3. `$sudo pip install eventlet --upgrade`
4. `$sudo pip install six --upgrade`
5. Setup the controller:
 - `$cd /tmp/ryu/`
 - `$wget http://emmy10.casa.umass.edu/nat_template.py`

Edit the `nat_template.py` code and run it on the NAT using the following command.

- `$. /bin/ryu-manager nat_template.py`

If you experienced problems with arrows/delete/enter keys in Vim, please change another CLI text editor, such as nano.

Step 9: On Outside and Inside1 node

On the Outside node:

```
outside:~$ nc -l 6666
```

On the Inside1 node:

```
inside1:~$ nc 128.128.128.2 6666
```

Step 10: Submission

Please submit a screenshot of your verification of the correct functionality of NAT and your controller file to Moodle!

Please include the name and path of your controller file in your submission.

Also, leave your GENI slice up and running. The grader will login to your GENI slice to verify the working of NAT.

Note: Each slice has an expiration date, please be sure to extend the date until 6/12 (using the RENEW icon on the slice page).