

# Lab 1: CloudLab and Experiment Setup

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# Objective of Lab1

The objective of this lab is for students to utilize and understand how to use the CloudLab. In this lab, students can create a simple network topology in the CloudLab. Students will log in the CloudLab website, create a profile for an experiment, and create a topology that includes four instances of XEN Virtual Machines (VM). Students will then instantiate the topology by selecting an available cluster that they will use for their experiments. After the topology is instantiated, students then check whether the topology is successfully created and connected or not by sending the **Ping** command from one node to every other node.

## <General Information>

Students can refer to the link (<http://docs.cloudlab.us/cloudlab-tutorial.html>) for more information about creating profiles on CloudLab. Students should have an account with either CloudLab, GENI, or any other federated services like EmuLab to access the CloudLab. If the student wants to sign up for the CloudLab account, they need to select one of the existing projects to join. Students will wait for the approval of the project leader who first creates the existing project that they select.

CloudLab Login page: <https://www.cloudlab.us/login.php>

## Lab Submission

Complete the following steps (Step 1, 2, and 3) in the next section and attach a screenshot to show the created network topology in the CloudLab. List the steps to create an experiment profile and explain how to test the network connectivity.

### Step 1: Create a profile

This step aims to create a profile with four Xen VMs for a simple network topology. Students need to specify each node ( i.e. each VM ) by selecting a specific OS (i.e. **UBUNTU 16**), a hardware type, and a node type. All the nodes are also connected each other by selecting a link type (i.e. **Ethernet**). They can make an arbitrary name for this topology with a description. Once they click on the **Accept** button and then they can finally instantiate this profile to create their final network topology.

- 1) Start to click on the **Create Experiment Profile** on the **Experiments** menu at the left corner of the window as shown in Figure 1. Click the **“Create”** button to start.

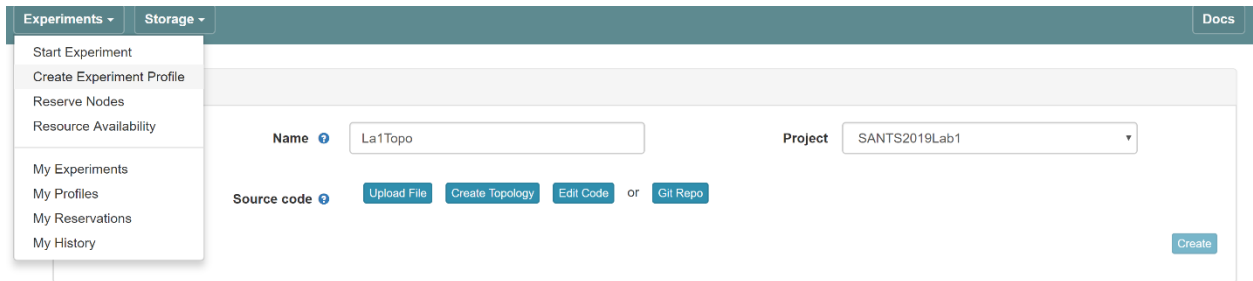


Figure 1. A screenshot to create a profile for an experiment

- 2) To create a network topology, students first drag and drop to add nodes (i.e. **Xen VM**) to the right editing screen, as shown in Figure 2.

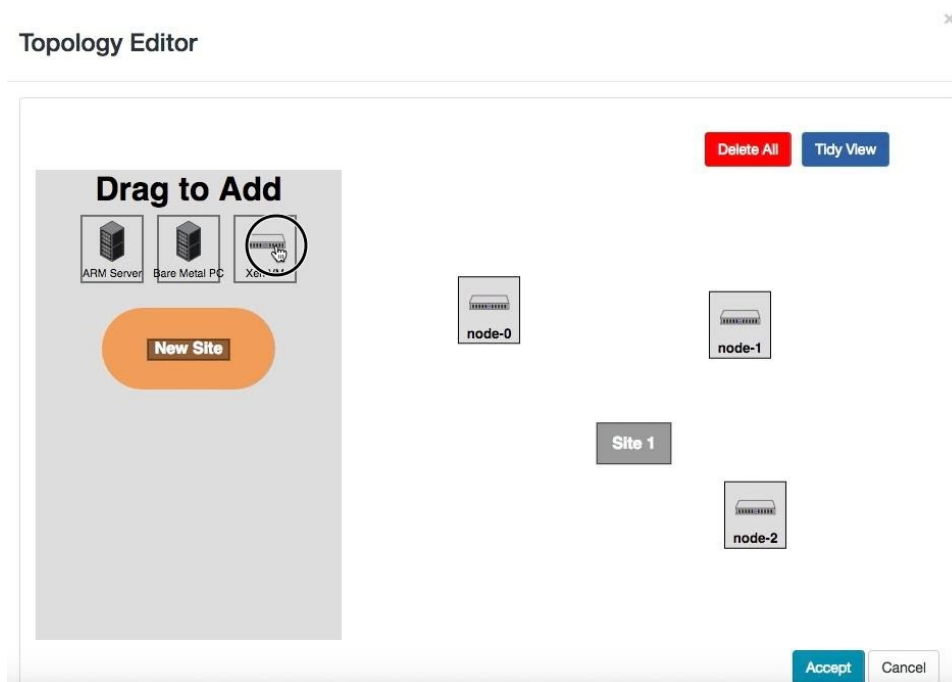


Figure 2. Create a network topology

- 3) To add a link between two nodes for network connections, move your mouse to approach a node. As shown in Figure 3, when a short black line appears, students will then drag the line from one node to the target node to make a connection between two nodes.

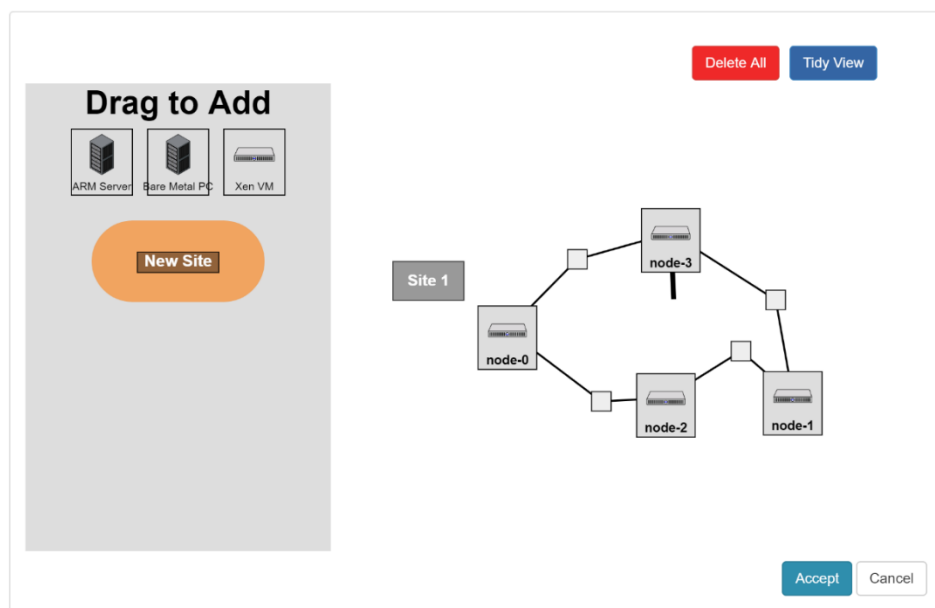


Figure 3. Link the nodes for network connections

- 4) Students must provide the detailed specification for each node as shown in Figure 4. They can write any name for their created topology. They need to select ***“emulab-xen”*** for the ***Node Type***, ***“any”*** for the ***Hardware Type***. They need to choose ***“UBUNTU16-64-STD”*** for the ***Disk Image***. Please check the ***“Require Routable IP”*** option so that the nodes can connect to an SDN Controller later by using a public IP address.

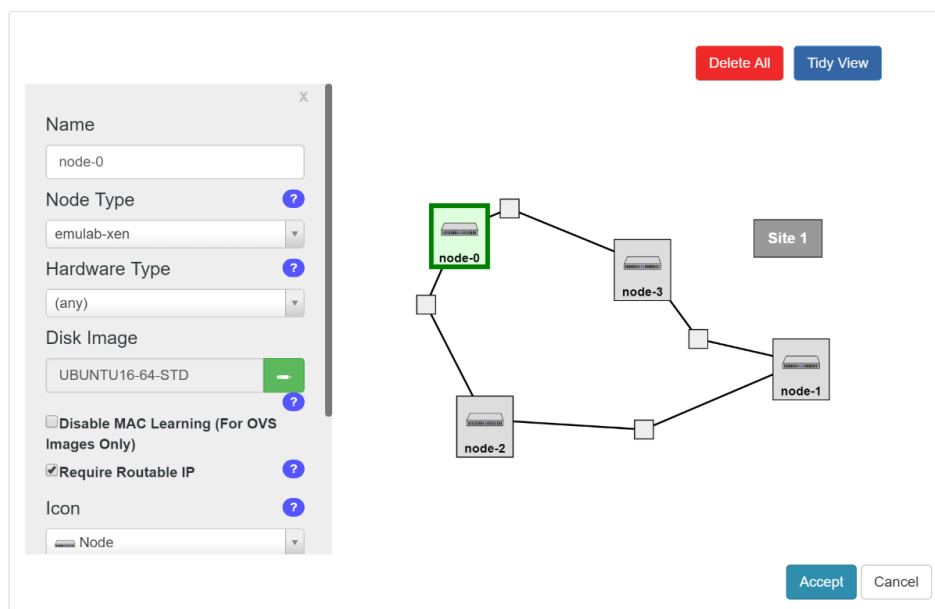


Figure 4. Describe and specify the hardware type, the node type, and the disk image for each node

- 5) Figure 5 shows how to describe each link between two nodes. Students need to select “**Ethernet**” for the **Link type** for this lab. Then, students click on the **Accept** button on the bottom of the window.

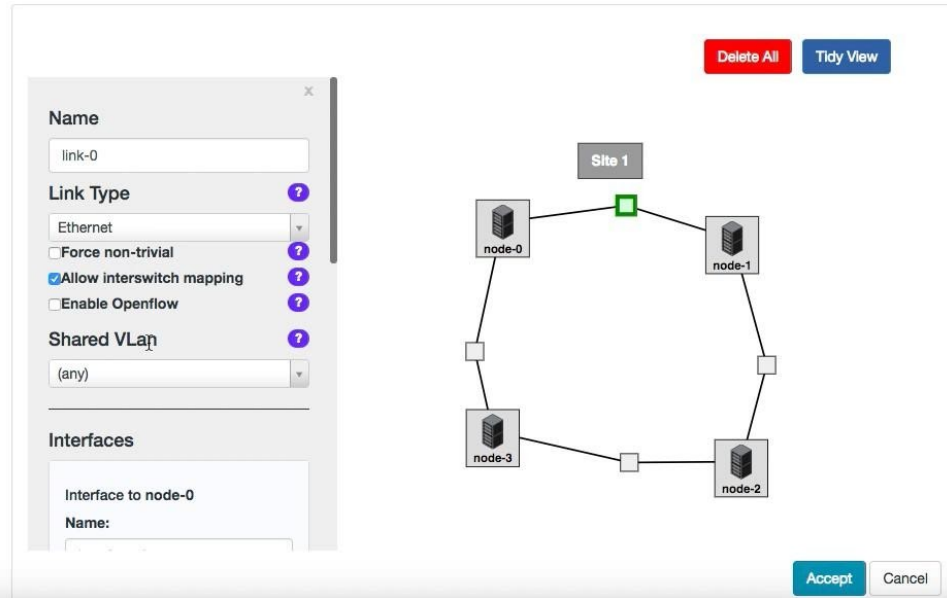


Figure 5. Specify each link between two nodes

- Students now save a profile for their experiments and instantiate the topology with their configuration by clicking on the 'Instantiate' button.

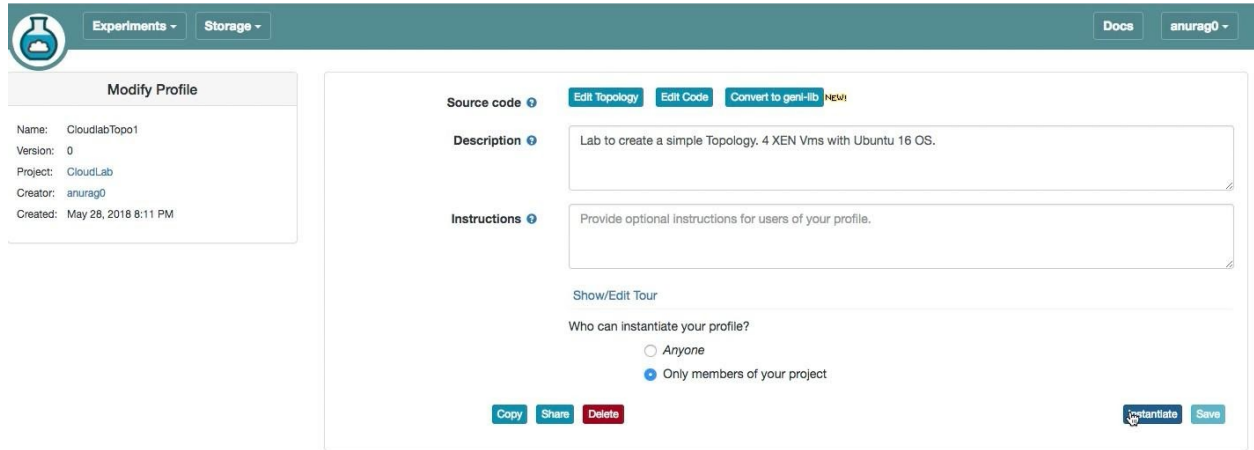


Figure 6. Instantiate the experiment with your configuration

[Tip 1] Create a topology by using the existing profile

Students have an option to create a topology by using the existing profile which is configured with an XML file. In addition, students can export their new profile with a new XML file for future use. Here are the steps to follow.

- If the students have not yet created the Experiment Profile, click on 'Create Experiment Profile' in Figure 7 and then click the "Edit Code" button in Figure 8.

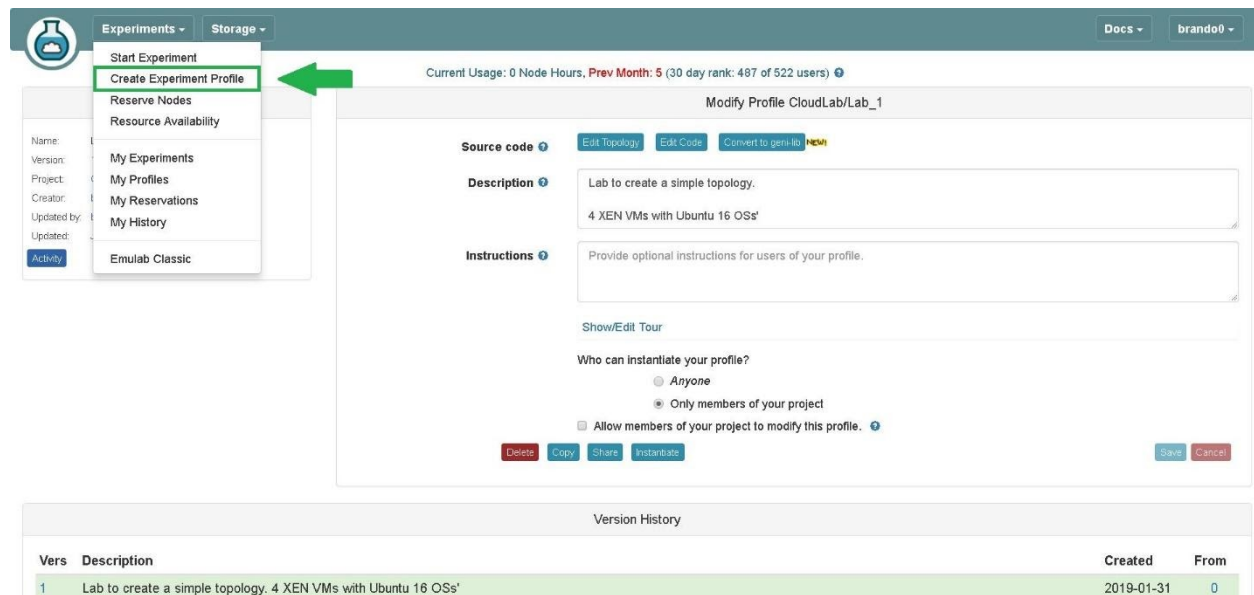


Figure 7. Create a profile

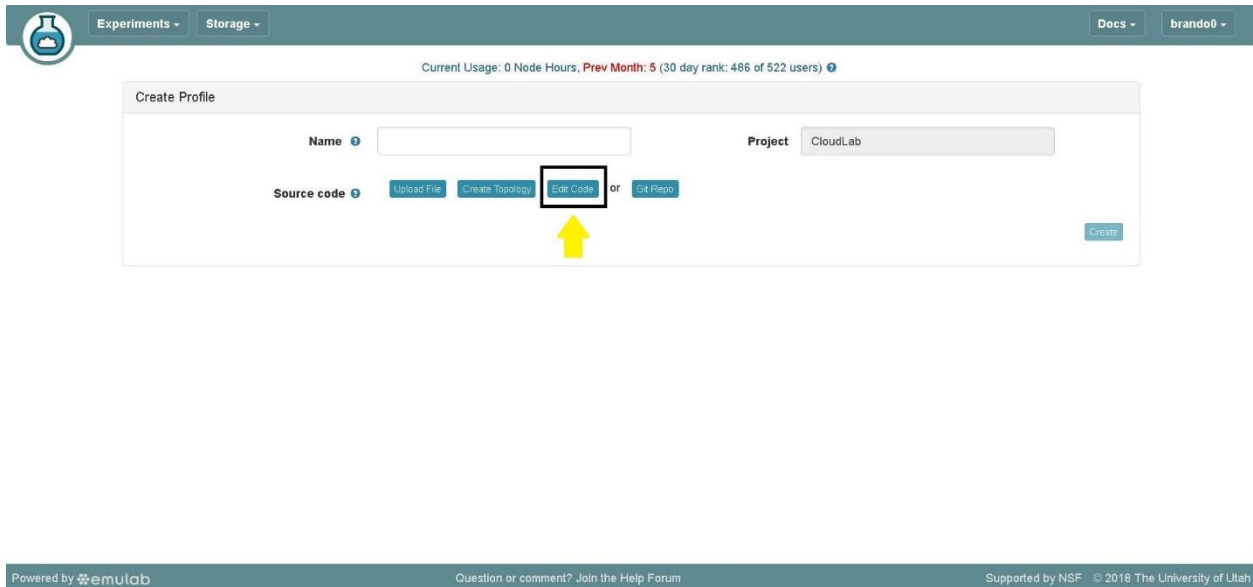


Figure 8. Edit the profile

- 2) As in Figure 9, click on the **'Upload'** button and search for the specified XML file for creating the topology. Click on the **'Accept'** button once the configuration file has been located and then instantiate the profile for a topology.

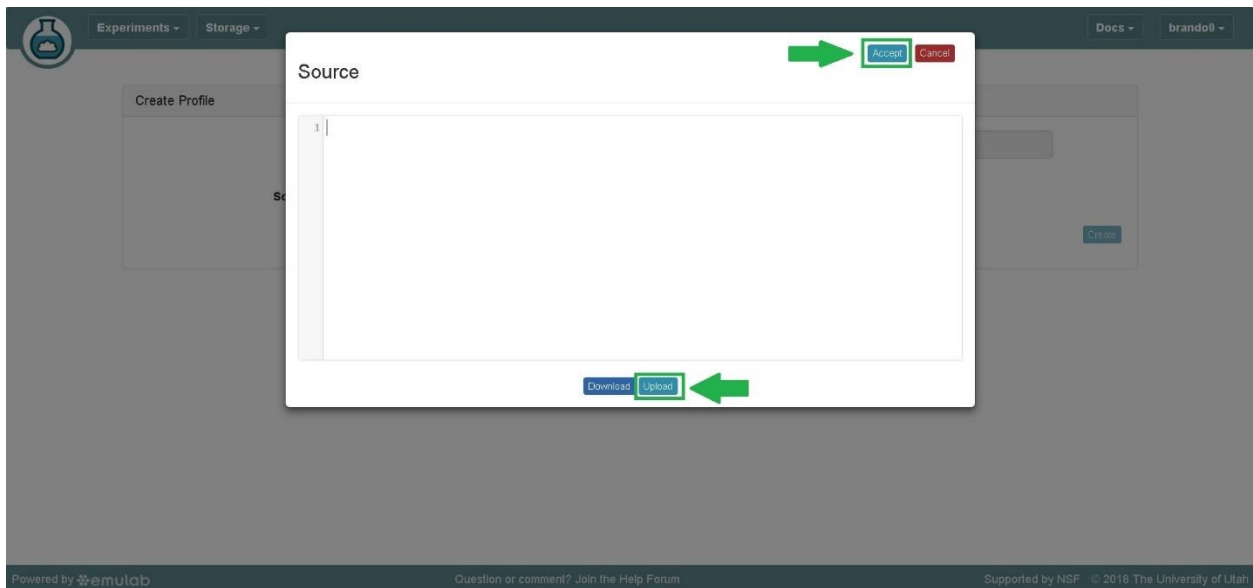


Figure 9. Search for an existing XML profile

## Step 2: Start Experiment

To start an experiment, students first select an available cluster as shown in Figure 10. Students can check the availability by hovering on the green colored dot next to each location



name in Figure 10. After selecting an available cluster from the pop-up menu, click on the 'Next' button.

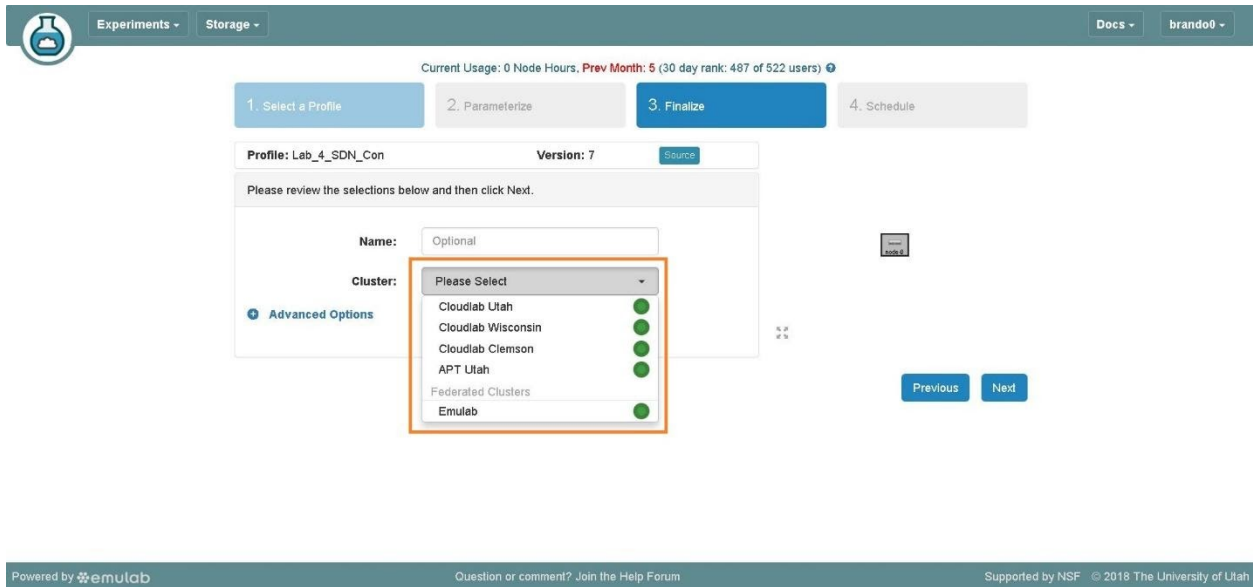


Figure 10. Select an available cluster at a specific site for use

Students can specify other information and then click on the 'Finish' button. It will take some time to instantiate the topology with the profile.

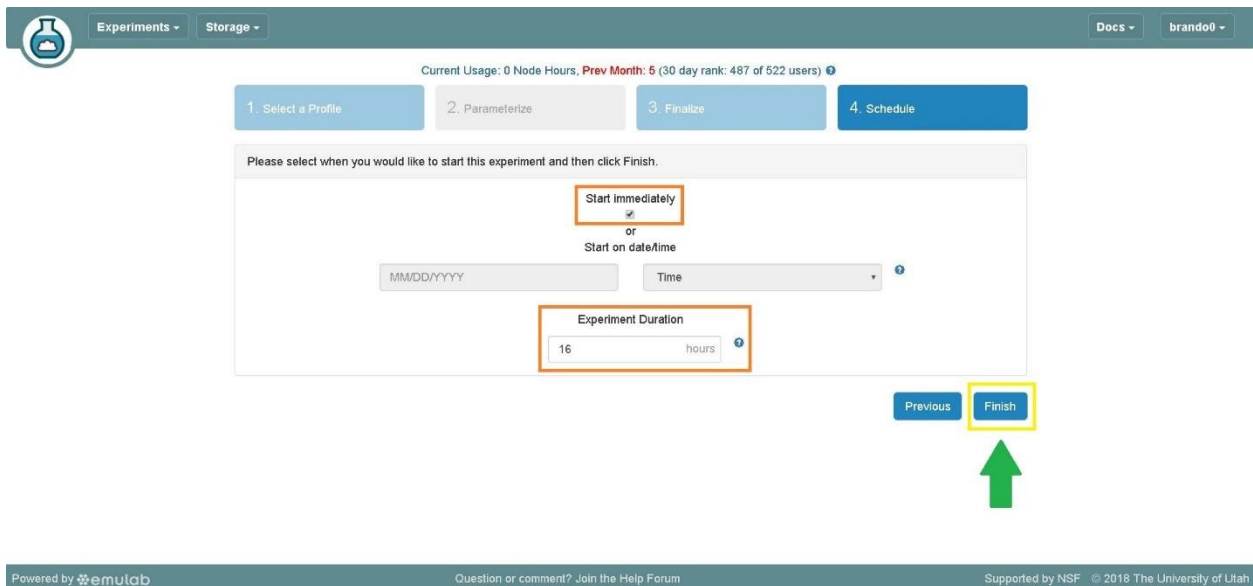


Figure 11. Finish and instantiate the topology

## [Tip 2] Troubleshooting

If students encounter an error when starting an experiment, there have been some errors in the steps of the profile creation. In this case, they need to terminate the current

experiment regardless of whether the experiment has completely booted up or not. This will release any resources that the experiment is occupying (or attempting to occupy). Then, students need to check and modify their profile again from the beginning step.

## Step 3: Conducting the lab

1) Test the network connections through the **Ping** command

Figure 12 demonstrates an example of the current topology that students created in Step 1. Students can open the terminals for each node by clicking each node and selecting shell as shown in Figure 13. Each window tab shows a running shell and students can install any software and use any Linux command to utilize this VM. To get the IP address information for each node, students can use the “**ifconfig**” command in the shell. As shown in Figure 14, from a node (i.e. node-0), students can ping all other nodes to test the network connections for all the nodes. Figure 4 shows the result of the successful **Ping** command like “ping 10.10. 4.1” on the node-0.

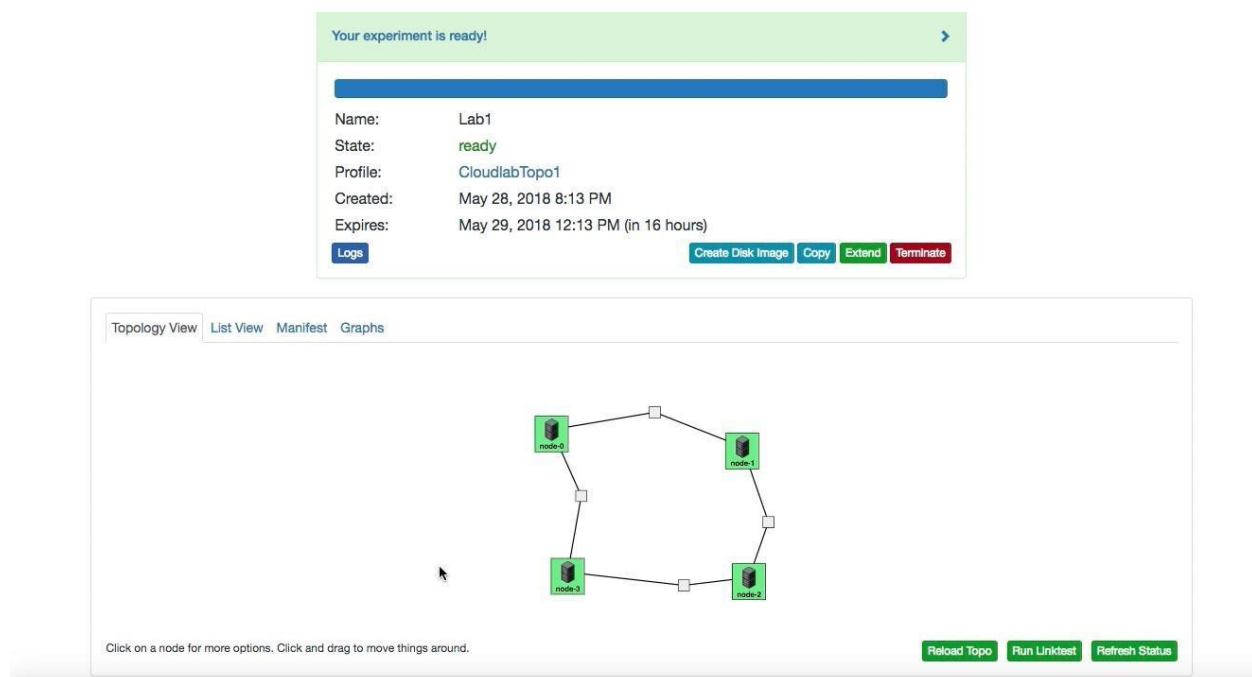


Figure 12. An example of topology view

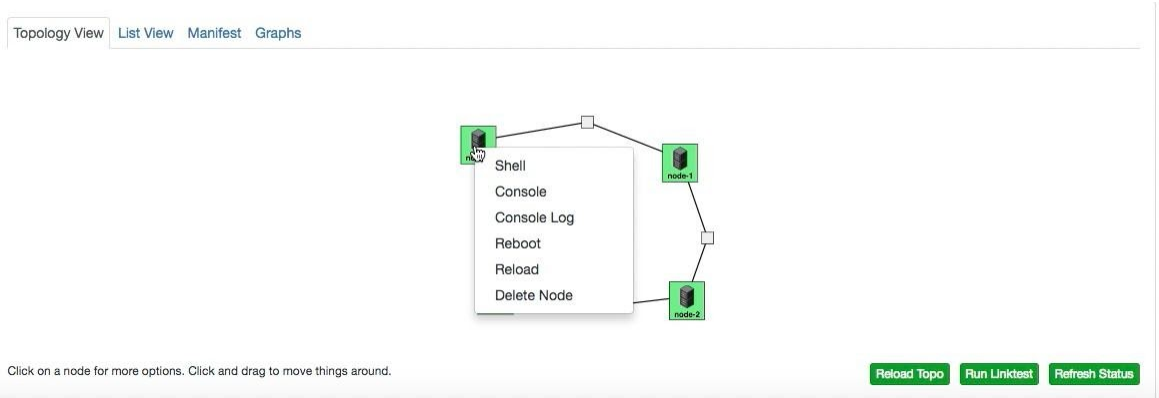


Figure 13. Open a shell for each node

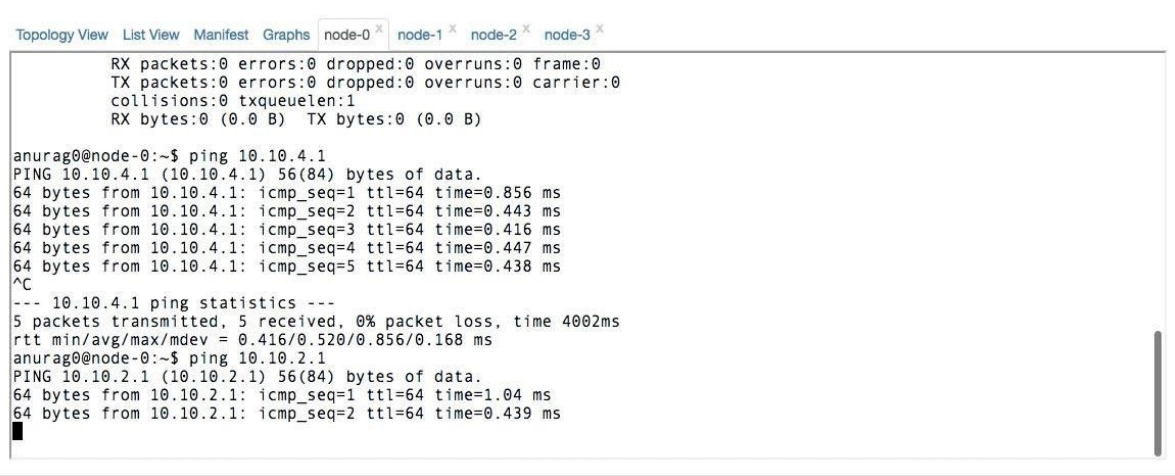


Figure 14. Check the network connections by using the **Ping** command

- 2) When students finish with all the tasks of the experiments, click on the **Terminate** button to free the system resources from their experiments.

Your experiment is ready! >

Name: Lab1  
State: ready  
Profile: CloudlabTopo1  
Created: May 28, 2018 8:13 PM  
Expires: May 29, 2018 12:13 PM (in 16 hours)

Logs Create Disk Image Copy Extend Terminate

Topology View List View Manifest Graphs

Click on a node for more options. Click and drag to move things around.

Reload Topo Run Linktest Refresh Status

Figure 15. Terminate the experiment