Cpr E 489: Computer Networking and Data Communications
Lab Experiment #4 – Introduction to CloudLab
(Total Points: 100)

Objective

To get familiar with CloudLab by creating an experiment and testing a node's connectivity.

Pre-Lab

Before the lab starts you need to create an account and login to the portal as follows:

1. Go to the invite at the following link: https://www.cloudlab.us/signup.php?pid=ISUCPRE489
2. Fill in the form to create a login profile and request to join the project (don't worry about creating SSH keys yet)

Lab Expectations

Work through the lab and let the TA know if you have any questions. After the lab, write up a lab report. Be sure to:

- Attend the lab. **(5 points)**
- Summarize what you learned in a few paragraphs. **(25 points)**
- Include your answers to all exercises with screenshots when asked. **(70 points)**

Problem Description

In this lab experiment, you are required to do the following:

a) Generate and use a private SSH key.
b) Connect to your nodes.
c) Interact with your nodes in short experiments.

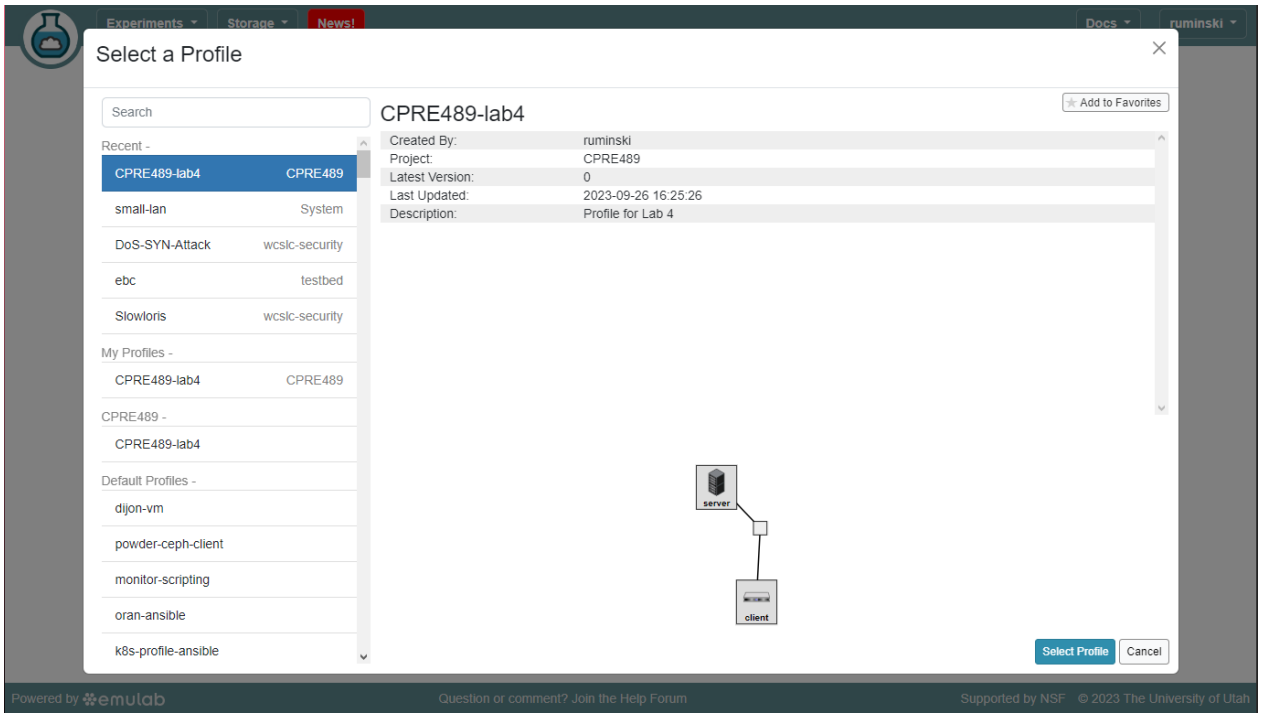
Procedure

Creating SSH Keys

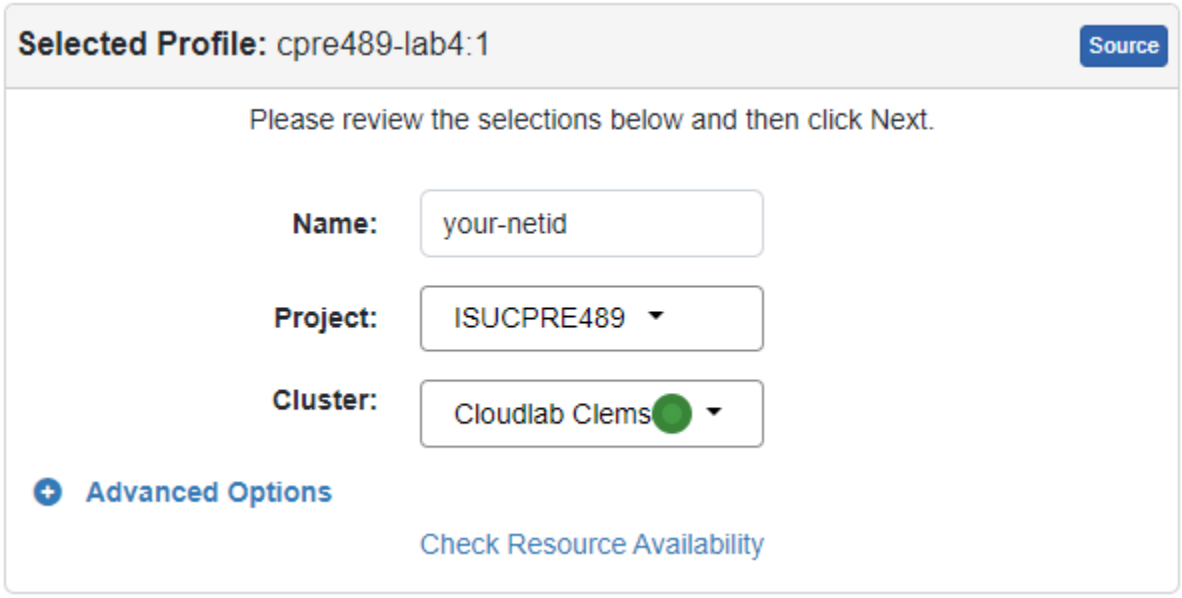
1) Login to CloudLab at: https://www.cloudlab.us/login.php
2) Click on your username in the top right. Select **Manage SSH Keys**
3) Open a terminal window and run `ssh-keygen -t rsa`
4) Name the key pair **"id_cloudlab_rsa"**. Create a passphrase and remember it. If you forget you will have to repeat this process again later
5) Find **id_cloudlab_rsa.pub**
6) Return to CloudLab and select **Load from file**. Choose **id_cloudlab_rsa.pub** and then **Add key**

Exercise 1: Create an Experiment

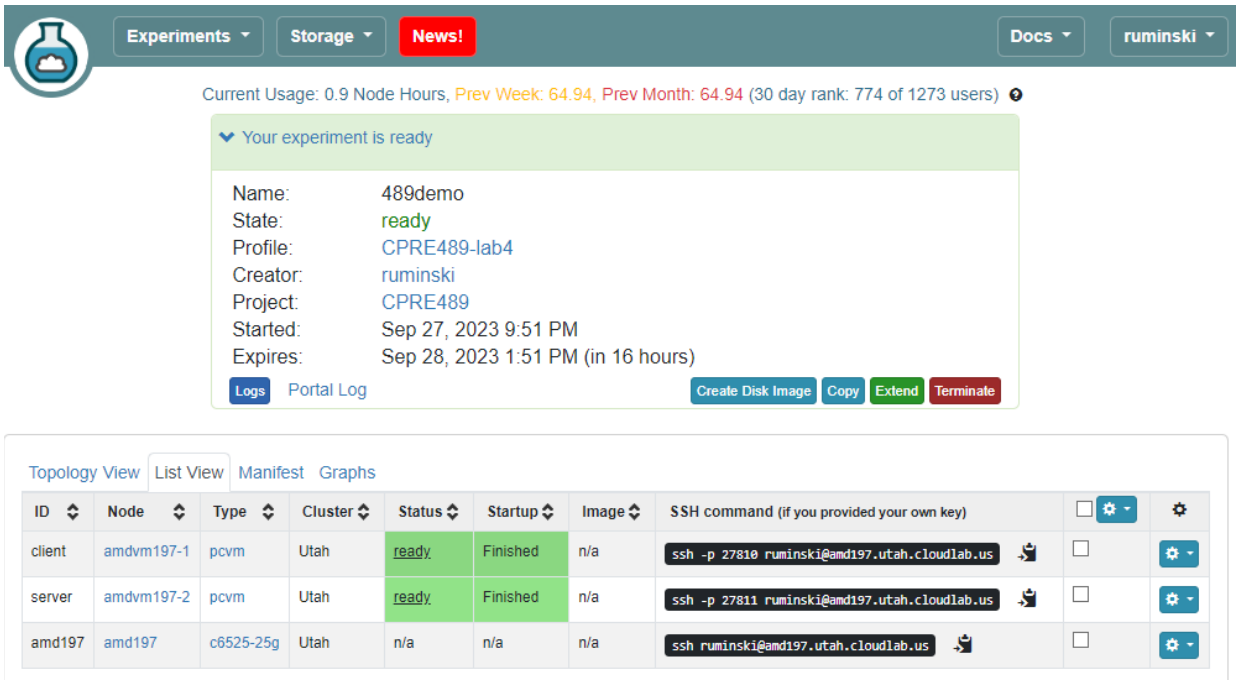
7) If you haven't already, login to CloudLab at: https://www.cloudlab.us/login.php
8) Select **Experiments** and **Start Experiment**
9) Select **Change profile**, search for **cpre489-lab4** and click on it. You should see the screen similar to what's shown in the figure below:



10) Click **Select Profile** and then **Next**
11) Use your net-id for the name of the experiment and select a cluster with a green dot next to it. Make sure the Project field is set to **ISUCPRE489**. Then select **Next**



12) Select **Finish**
13) Wait for your resources to be ready. This may take several minutes.
14) Select **List View** and take a screenshot of your experiment's resources when they are ready. **(10 points)** Refer to the screenshot below as a guide.



Exercise 2: Logging into your nodes

1) Open a terminal program. It is not necessary to be in lab for this because the address you are connecting to is public.
2) Refer to the list view of your experiment. You will see a **SSH command** header in the table. Take note of the port number and hostname of each node. You can use the following prompt to connect to it.
   ssh -i <private-key-location> <username>@<hostname> -p <port>
3) Login to both server and client and take a screenshot of each terminal after you have done so. **(10 points)**

Exercise 3: Interact with Your Nodes

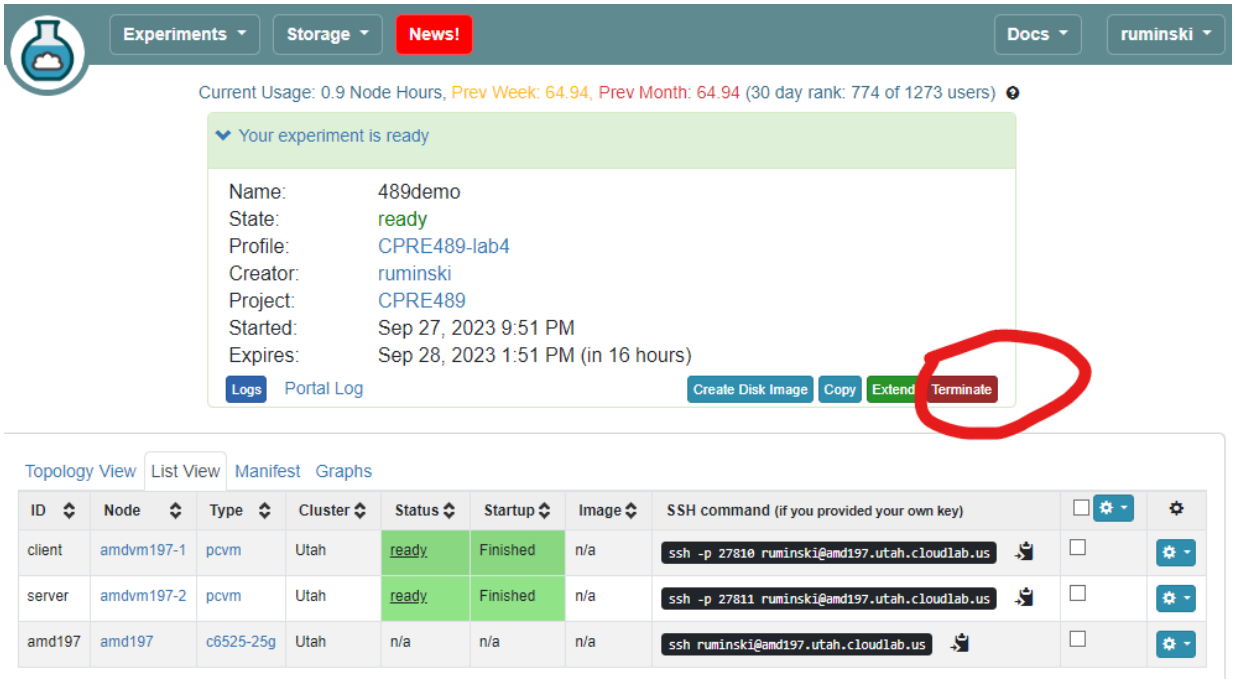
For this exercise, CloudLab has been configured with a script to automatically install iperf on each node. You will now use iperf and other commands to interact with your nodes.

1) On each node, execute **ifconfig** and take note of the IP addresses there. Take a screenshot of your output for each node. **(10 points)**
2) On your *server* node, run iperf -s
3) On your *client* node, run iperf -c server -P 2
4) The task should not take more than 30 seconds to complete. Change the number after -P and watch how the performance is affected while you change the number of parallel TCP connections. How was performance affected as the number of parallel connections increased? **Answer the question and include screenshots of testing different "-P" values in your report. (10 points)**
5) For **each** of the **three** interfaces for the **server** machine:
   i. Identify if this interface can be accessed by the client
   ii. Identify if this interface can be accessed by a machine over the Internet

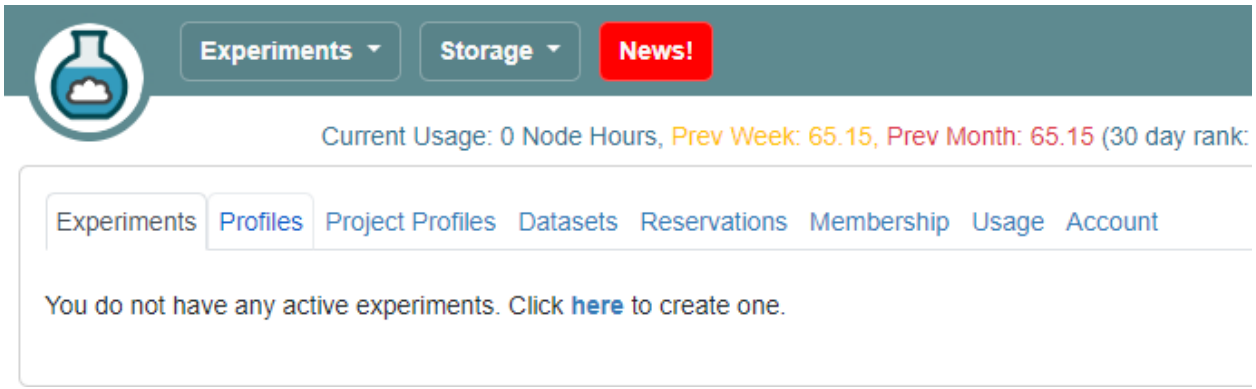
   In each case, justify your answer with a screenshot and/or an explanation. (20 points)
   HINT: Ping, traceroute, and tcpdump are tools that can help determine if packets are reaching a destination.

Exercise 4: Clean Up Your Work

1) CloudLab is a shared resource used for academic research and education. Therefore, it is important that we clean up our reserved resources when we are done with them.
2) When you are done with your resources, return to your experiment in the CloudLab interface. Select **Terminate** to release your resources back to CloudLab. (see below)



3) Wait a few moments for your resources to be released. Then, go to Experiments (top left) -> My Experiments and take a screenshot of your empty experiment list after completing the lab. **(10 points)** See below for an example.



Tips

- After 16 hours, your resources will automatically be terminated. If you wish to extend their reservation you must **Extend** the resources. This button is located next to **Terminate**.
- It is recommended to complete this lab on your own lab account so that your SSH keys will be on your student X drive. Using **489labuser** will leave your keys on the lab computer unless extra steps are taken.
- If reserving your resources fails, select a different cluster and try again.