CSE 5344 - Fall 2023 - Project 1

Objectives for this lab:

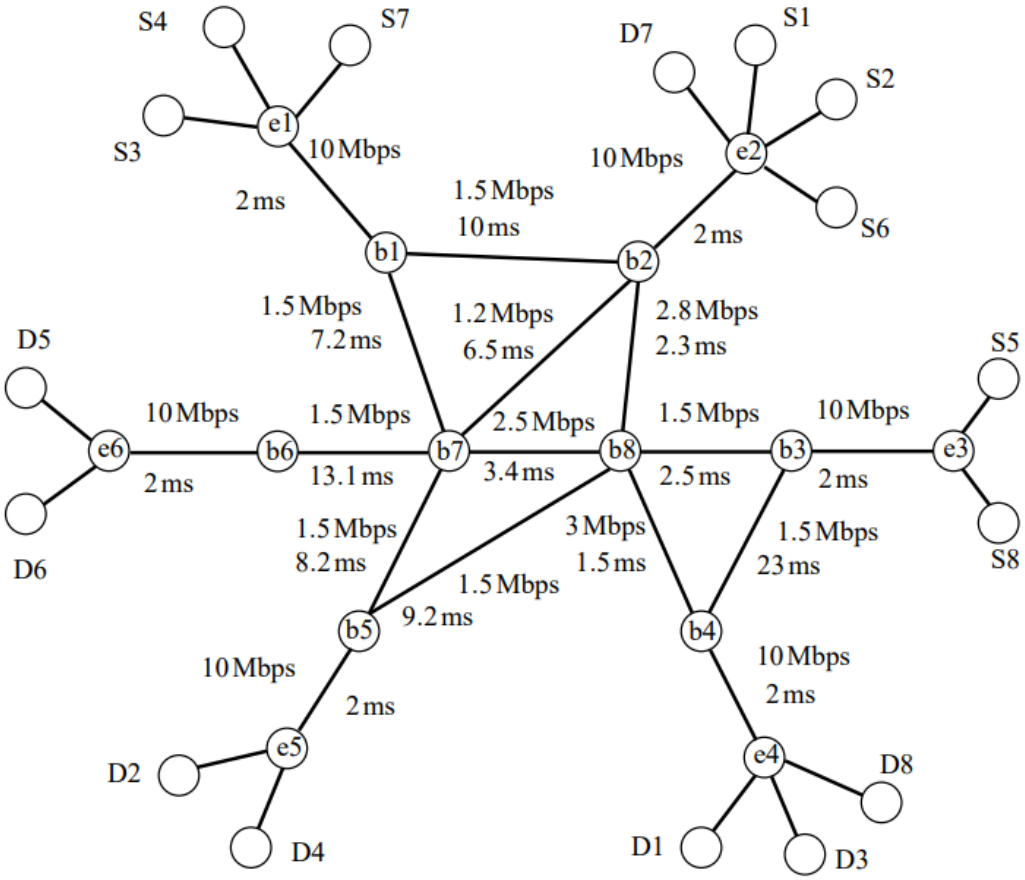
In this project you will use a simulator to construct a network, run TCP flows among a set of source-destination pairs and monitor the packets “walking” through the network.

You will use ns-3 simulator. This is a very useful simulation tool which supports all kinds of networks and network devices, such as routers, Ethernet, WIFI and SDN-enabled switches. Ns-3 supports both Python and C languages, but I suggest you use C since it is the most common language ns-3 researchers use.

This is an **individual project**. You can discuss with other students, but you need to write your simulation code independently. You can use any integrated development environment (IDE), such as Visual Studio/Eclipse, to write but must be executable by ns-3.

Due: Nov. 3rd, 2023, 11:59:59 p.m.

Code: The code needs to simulate the following network and the flows running through it:



- There are total of 8 pairs of senders (SX with source X)-receivers (DX with destination X) with a TCP session running between each pair that keep sending packets for 30 seconds.
- The nodes which are named bX and eX are routers.
- The propagation delays and link capacities are marked in the graph.

Outputs:

The simulation code needs to generate two outputs for observation.

- An animation records all TCP messages communications of all 8 sender-receiver pairs through the network.
- The overall throughput and goodput of each TCP flows in the 30 second simulation time.

NOTE: You may assign any IP address to a link, only making sure that each IP address assigned is unique. The port numbers for the sender and receiver in a sender-receiver pair must be the same, and there is no restriction on what the port number value you may assign to a pair.

Running the Script

The script file should have the following content

project1.cc

/* Copy Right */

/* CSE 5344 */

/* Your name */

#includes ….

int main{

/*main body*/

}

Put the project1.cc under the folder of ns-3.xx/scratch/

Runing it by ./waf --run project1 at ns-3.xx/ directory

Programming Hints & Grading Policy

You can go to the /example/tutorial/ to read first.cc second.cc third.cc. Copy them to ns-3.xx/scratch/

then go to main direction and run ./waf --run scratch/first

Here's a material to help you understand how the script file work.

https://www.nsnam.org/docs/tutorial/html/building-topologies.html

This are the steps (with the percentage of grade allocated) you need to take to complete the project:

- Create the hosts; 10%
- Connect the hosts by router; 10%
- Set up and assign the link status for each link; 10%
- Populate the routing table; 10%
- Deploy TCP connection on receiving and sending hosts pairs. 10%
- Generate the monitoring animation. 10%
- Generate the overall performance of each flow; 10%

The executable would take the rest 30% of the total grade.

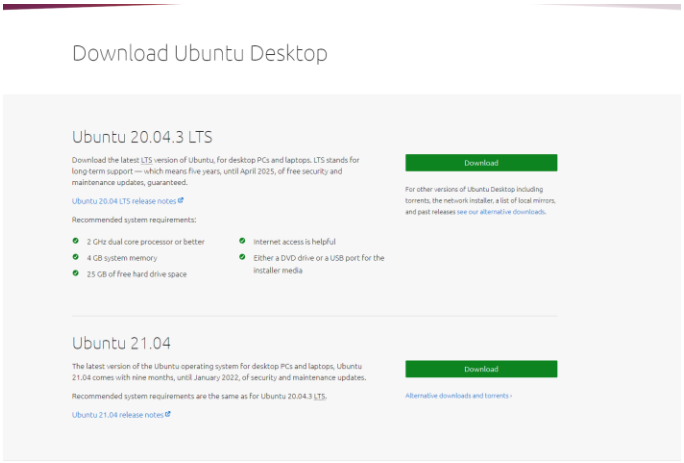
NS-3 Installation Guidelines

Platform: (prefer: Ubuntu. If you have Ubuntu already, jump to step 5)

Windows, Mac users:

Step 1: install VirtualBox. https://www.virtualbox.org/

Step 2: download Ubuntu. https://ubuntu.com/download/desktop

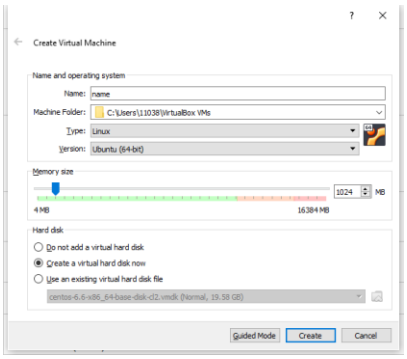


Step 3: Load Ubuntu into VirtualBox

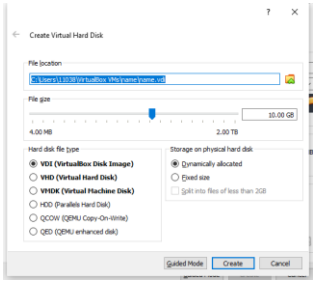
Click “new” button

Name your virtual machine, choose a folder your file would be stored.

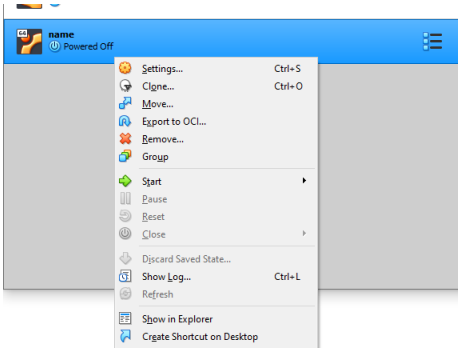
Select Linux and Ubuntu-64bit as Type and Version. Then click create



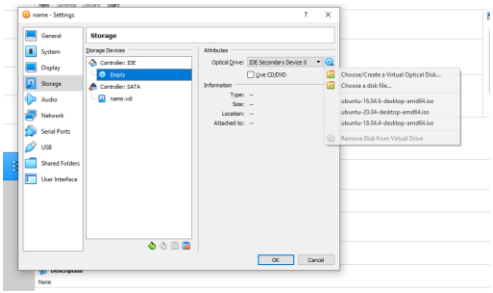
And click create again



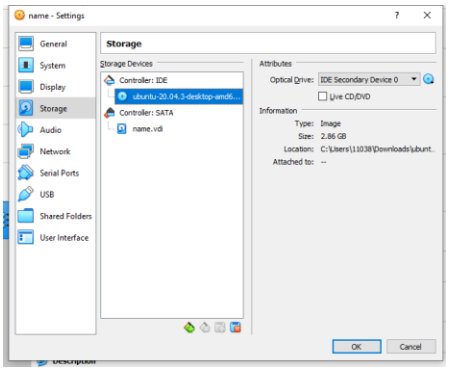
Right click your new virtual machine and choose setting



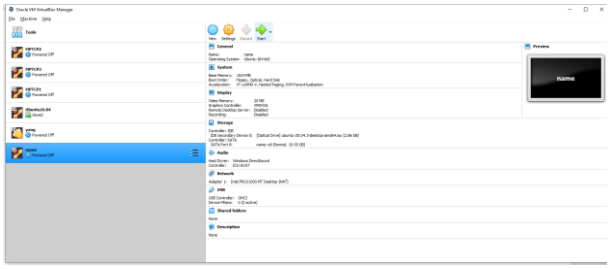
At Storage section choose the Empty under Controller:IDE. Then click the disk button right to the optical drive. Select Choose a disk file and find your ubuntu file just downloaded at step 2



Click OK



Start your virtual machine



Step 4: Install Ubuntu by install instruction

Step 5: install ns-3 https://www.nsnam.org/wiki/Installation

Step 6. Install netanim

This animation tool would be automatically installed with ns-3. If you find that this tool does not work, you can read https://www.nsnam.org/wiki/NetAnim_3.105

NS-3 Use Guidelines

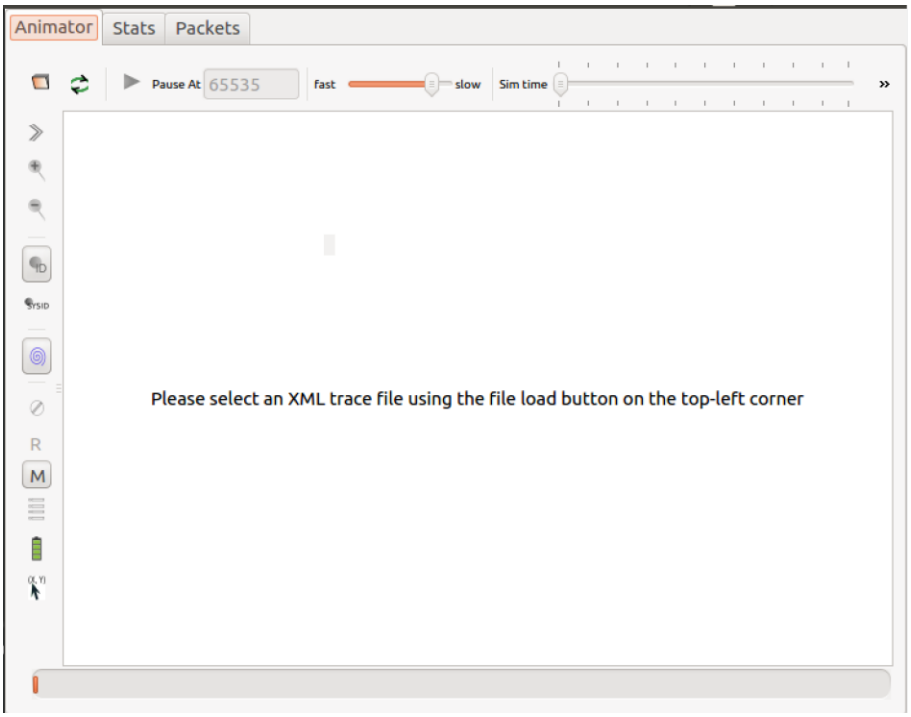
Before go to the next step, you should make sure that in the ./ns-allinone-3.xx/ns-3.xx/ directory, you can run ./waf --configure successfully.

You should put your code like xxxx.cc under .ns-3.xx/scratch directory and run ./waf --run scratch/xxxx at ./ns-3.xx/ directory

```
xxw@xxw-VirtualBox:~/ns-allinone-3.34/ns-3.34$ ./waf --run scratch/fifth
Waf: Entering directory `/home/xxw/ns-allinone-3.34/ns-3.34/build'
[1948/2004] Compiling scratch/fifth.cc
[1965/2004] Linking build/scratch/fifth
Waf: Leaving directory `/home/xxw/ns-allinone-3.34/ns-3.34/build'
Build commands will be stored in build/compile_commands.json
'build' finished successfully (12.754s)
```

NS-3 Use Guidelines

You can go to the ns-allinone-3.xx/netanim-3.xx directory and run the ./Netanim to open the netanim program. (If you cannot find the ./Netanim executable program go back to ns-allinone-3.xx directory and run ./build.py



When you successfully put the animation tracer in the script file, you can generate a xxx.xml file.

Use the open button(looks like a folder at the top left corner) and choose the xml file to see the packet transmission animation.