Introduction to Network Simulator 2 (NS2)

Name and ID (*print*) _____

Objectives

The purpose of today's lab is to familiarize yourself with the network simulation tool: "Network Simulator (Version 2)", widely known as NS2 that is an open-source event-driven simulator designed specifically for research in computer communication networks. NS2 contains modules for numerous network components such as routing, transport layer protocol, application, mobility, etc. To investigate network performance, researchers can simply use an easy-to-use scripting language to configure a network and observe results generated by NS2. So, NS2 has become the most widely used open-source network simulator, and one of the most widely used network simulators. Therefore, we will use NS2 to evaluate network performance such as end-to-end delay, packet loss, and throughput.

Activities

Before you get started, you need to know how to install NS2. So, please follow the instruction on how to download and install NS2 on Ubuntu.

****** **How to Install NS2 on Ubuntu at VirtualBox** ******

1) Download and Install **VirtualBox** on your OS system
   https://www.virtualbox.org/wiki/Downloads

   For Windows: You can use the latest version available or 7.0.12 is the most recent and preferred version.
   For Mac: For some of the Mac systems, the latest version is not supported. You can choose the best version for your OS, by checking out the system configurations and the versions supported. Suggested Version: 6.1.48 or 6.0.24

2) Download Ubuntu ISO file (Ubuntu 22.04 latest version) (18.04 – that is the best version for ns2)
   https://ubuntu.com/download/desktops

3) Install **Ubuntu** on VirtualBox
   Tutorial: https://brb.nci.nih.gov/seqtools/installUbuntu.html
   (i). Select New and then give the Name and add ubuntu as ISO Image
   (ii). Leave other options to default and then click Next. A New VM will be created.
   (iii). Power On the VM and Install Ubuntu
   - Do not select "Download updates while installing", better to do after installation done.
   - After install Ubuntu, Restart VM and do the following steps:
      a) Get update software list:
         sudo apt-get update
      b) Update software:
         sudo apt-get upgrade

4) Install **NS2** on Ubuntu at VirtualBox
   Follow the ns2 installation below.

Installation: NS2
   • Go to NS2 web page:

- - o https://www.isi.edu/nsnam/ns/ns-build.html
    - o Click "all at once" on the NS2 web page: https://www.isi.edu/nsnam/ns/ns-build.html#allinone
    - o Then download by clicking on **current release 2.35**

- Download:
  - o ns-allinone-2.35.tar.gz

- Make a directory named as "ns2" in your home directory.
  - o mkdir ns2

```
ahyoung@ahyoung-VirtualBox:~$ pwd
/home/ahyoung
ahyoung@ahyoung-VirtualBox:~$ ls
Desktop    Downloads   ns2      Public   Templates
Documents  Music       Pictures temp     Videos
```

- Change directory to ns2 folder.
  - o cd ns2

- Move the downloaded ns-allinone-2.35.tar.gz from Downloads folder to ns2 folder
  - o mv ~/Downloads/ns-allinone-2.35.tar.gz ~/ns2/

- Unzip the file in the directory "ns2"
  - o tar –xzf ns-allinone-2.35.tar.gz

**** Configuration and Errors for gcc compiler*****

- ns2 uses gcc-4.8 as c compiler and g++-4.8 as C++ Compiler, thus ns2, nam and xgraph all these softwares were comfortable with 4.8 version.

- So, add xenial to /etc/apt/sources.list temporarily to install g++-4.8:
  - o `sudo gedit /etc/apt/sources.list`

    `deb http://dk.archive.ubuntu.com/ubuntu/ xenial main`
    `deb http://dk.archive.ubuntu.com/ubuntu/ xenial universe`

  - o and do `sudo apt update && sudo apt install g++-4.8`
  - o `sudo apt update`
  - o `sudo apt install build-essential autoconf automake libxmu-dev`

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- Next, we need to change these settings in the Makefile.in
  - o We have to modify at three locations;
    1. ~/ns-allinone-2.23/ns-2.35/Makefile.in
       ~/ns-allinone-2.23/nam-1.15/Makefile.in
       ~/ns-allinone-2.23/xgraph-12.2/Makefile.in

    2. Change as per the following in the above three files
       `@CC@ --> gcc-4.8`
       `@CPP@ or @CXX@ --> g++-4.8`

- Go to the directory "linkstate" in /ns2/ns-allinone-2.35/ns-2.35/linkstate

- In the "ls.h" file, there is an error at the line 137th: add "`this->`"erase

```cpp
// this next typedef of iterator seems extraneous but is required by gcc-2.96
typedef typename map<Key, T, less<Key> >::iterator iterator;
typedef pair<iterator, bool> pair_iterator_bool;
iterator insert(const Key & key, const T & item) {
        typename baseMap::value_type v(key, item);
        pair_iterator_bool ib = baseMap::insert(v);
        return ib.second ? ib.first : baseMap::end();
}

void eraseAll() { this->erase(baseMap::begin(), baseMap::end()); }
T* findPtr(Key key) {
        iterator it = baseMap::find(key);
        return (it == baseMap::end()) ? (T *)NULL : &((*it).second);
}
```

- Use the installation package:
  - sudo apt-get install libx11-dev xorg-dev libxmu-dev libperl4-corelibs-perl
  - cd ns-allinone-2.35
  - ./install
    - follow the instruction that shows important path setups into .bash profile.

    - Go to home directory, just type "cd" and enter
    - "ls -a"

    - open the ".bashrc" file.

- Add paths into the bashrc file. For example:

- Save the bashrc file.
- Do "source ~/.bashrc"
- Type "ns" on a terminal, if you see "%" symbol then the installation is correct.

NS2 tutorial:
- Marc Greis' Tutorial for the UCB/LBNL/VINT Network Simulator "ns":
 - https://www.isi.edu/nsnam/ns/tutorial/

Exercise (100 points)

Try to write a script the given network simulation example and save the script with "lab1.tcl" run it as "ns lab1.tcl".

In some of the machines, if the installed ubuntu version and the nam version are not compatible, you will get below error while executing the lab1.tcl.

Error : could not execute "nam" : no such file or directory

Then download the following file "nam_1.14_amd64.deb" and run the command
sudo dpkg --install nam_1.14_amd64.deb
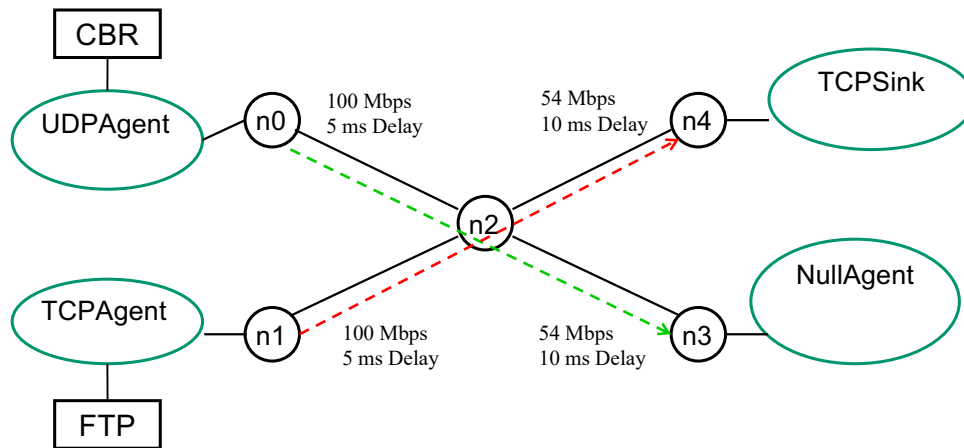
You may look at the tutorial website: http://nile.wpi.edu/NS/simple_ns.html

Next lab class, we will learn how to analyze **.tr** file that is the output about your script file (lab1.tcl), then we will see results of network performance.