



National Institute Of Technology Srinagar

Network Simulator - Physical and Data link layer

Submitted by:

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1. Objectives Completed

1. Implemented Physical Layer Functionalities.

- Creating End Devices, Hubs.
- Creating Connections Between Them To Form A Topology
- Sending And Receiving Data.
- Visualising Topology Of Network

2. Implemented Data Link Layer Functionalities.

- Creating Layer 2 Devices: Bridge and Switch
- Performing Address Learning In Case Of Switch
- Implementing At Least One Access Control Protocol - Token Passing Access Control
- Implementing At Least Two Flow Control Protocols For Noisy Channels - Stop And Wait, Selective Repeat.
- Finding Number Of Broadcast And Collision Domains In The Network.

3. Implement Network layer functionalities.

- Creating and configuring a router
- Assigning well formatted classless IPV4 address to the devices
- Using ARP to find the MAC address of a host within a network
- Implementing RIP protocol for dynamic routing

4. Implement Transport and Application layer functionalities.

- Assigning port no.'s to various processes, both well known and ephemeral port no.'s and enable process-process communication
- TODO: Implement at least two application layer services

2. Languages And Libraries

- Language : Python 3
- Libraries : Matplotlib, Time, Random, Networkx, Netaddr, Threading

3. Documentation

All the Classes And Functions used have been written with proper documentation in the code files. Here is the brief overview of the functionalities.

- *Class: Devices* - It represents End Devices. They have various attributes like IP Address, MAC Address, Device Id etc.
- *Class: Hubs* - It represents the Hubs in the Network. It has a function to broadcast message.
- *Class : Bridges* - It represents the Bridges in the Network. They have functionality to learn MAC Address mapping to its 2 ports dynamically.
- *Class: Switch* - It represents the Switches in the Network. They can map MAC Address of devices to the multiple ports they are connected to.
- *Class: Router* - It represents Router in the Network. They have various attributes like IP Address, MAC Address, Device Id etc. They have several interface to which other devices can be connected. They have functions to configure IP address and MAC Address to each interface. The Routing tables can be constructed using RIP or OSPF Protocol. All of these are based on longest subnet mask matching.
- *Class: Process* - It represents all the various processes like HTTP, SSH which can be used by the user to communicate with other hosts.
- *Class: HTTP* - The Hypertext Transfer Protocol (HTTP) is the foundation of the World Wide Web, and is used to load web pages using hypertext links. HTTP is an application layer protocol designed to transfer information between networked devices and runs on top of other layers of the network protocol stack. A typical flow over HTTP involves a client machine making a request to a server, which then sends a response message.
- *Class: SSH* - The SSH protocol (also referred to as Secure Shell) is a method for secure remote login from one computer to another. It provides several alternative options for strong authentication, and it protects the communications security and integrity with strong encryption. It is a secure alternative to the non-protected login protocols (such as telnet, rlogin) and insecure file transfer methods (such as FTP).
- *Function: Send Message Request/ARP Request* - Each Class Has A Corresponding Method To Respond To Request Type It Receives
- *Other Functions Used* : MAC Generator, Visualize Network, Frame Message, Make Connections etc.

4. Prerequisite

Basic knowledge of Python language and Logic of Physical and Data Link Layer.

References

- Course https://piazza.com/nit_srinagar/spring2021/it604it605p/resources
Lecture 2 - Lab for information on various devices and their functioning.
- <https://matplotlib.org/3.3.3/tutorials/index.html>
Matplotlib docs for plotting the topology.
- <https://netaddr.readthedocs.io/>
Netaddr docs for IP addressing and other related functions.
- <https://www.practicalnetworking.net/series/packet-traveling/packet-traveling/> for information regarding how packets travel through the network.