CSCE3313 Project

Project Goal and Description

The goal of this project is to understand and analyze the following, first, the File Transfer Protocol (FTP) and Trivial File Transfer Protocol (TFTP) networking protocols using different means. TFTP is an Internet software utility for transferring files that is simpler to use than the FTP, but less capable. Second, a network layer routing protocol OSPF. The Open Shortest Path First (OSPF) is a routing protocol for Internet Protocol (IP) networks. It uses a link state routing (LSR) algorithm and falls into the group of interior gateway protocols (IGPs). Last, the IPv6 addressing.

This project is divided into three parts in order to ensure full understanding of the different protocols. In addition, you will be able to learn and demonstrate different networking and programming skills.

First Part:

FTP/TFTP Protocol

- **In this part, you need to demonstrate the main difference between the FTP and TFTP protocols in terms of: definition, the ports used in each, and how these two different protocols work and highlight the similarities and major differences between them in detail in your report.**

- **Focus on the TFTP protocol. Using GNS3,**

    - Create a simple project in GNS3 to demonstrate TFTP (similar to the diagram below) and capture all the packets in Wireshark. Then proceed to analyze the headers of the TFTP packets you captured in Wireshark.

- **Focus on the TFTP protocol (using Command Prompt)**
    - Start a Wireshark capture on your local internet connection.
    - Start an FTP session using your command prompt (Any system).
    - Define all the commands used in FTP sessions.
    - You can use any ftp server to try and upload/download files such as ftp://speedtest.tele2.net or ftp.globalscape.com or any other.
    - Filter and identify the packets you find in Wireshark and analyze their headers.

- **On both FTP and TFTP (Socket Programming using C++)**

    This part will introduce you to the socket programming APIs and operating system concepts which are essential to deploy networked applications. You are required to build an FTP-like server socket. This could be realized through implementing two programs. First, a server socket that listens for any incoming connections. The server provides read and write operations that you will tailor to meet your application needs. Second, a client that connects to the server. Both the client and server must be written in C/C++ and operate under windows or Linux.


Second Part

OSPF Protocol

In this part, you need to be fully aware of what is the OSPF protocol, under which routing protocol the OSPF classified. Also, you need to understand the following and write the answers in detail in your report:
- What's the difference between Neighbor and Adjacency Routers?
- What is LSA and LSDB?
- What is DR and BDR? How to elect either one of them and how their assignment works
- How does router ID work in OSPF?
- Define the concept of Areas and their different types and properties.
- What's the metric used in OSPF and how to calculate the cost? Give an example.
- What are the steps to build a routing table in OSPF protocol?
- What are the OSPF packet types that can be captured using Wireshark?

1. Convert the network to use multi-area OSPF. R1 and R2 should be backbone routers, R4 and R5 normal routers in Area 1, and R3 and R6 ABRs as shown in the diagram

2. Verify the router's interfaces are in the correct areas. **Save a screenshot under Q2.**

3. What do you expect the OSPF Router ID to be on R1? Verify this. **Save a screenshot under Q3.**

4. Verify the routers have formed adjacencies with each other. **Save a screenshot under Q4.**

5. Verify all 10.x.x.x networks and loopbacks are in the router's routing tables. **Save a screenshot under Q5.**

6. How many paths are there which R1 could use to reach the 5.5.5.5/32 network? Which route is in the routing table?
   Save a screenshot under Q6.

7. Capture the OSPF packets and include them in your Zip. File. Identify the common OSPF header file and any extra added header.

8. For Area 0 and Area 1, get DR and BDR and justify your answer. **Save a screenshot under Q8.**

9. For Area 0, suppose that we replace all the links with 100 Mbps links. In addition, for Area 1, we replace all links with 10 Mbps links except for the link between R6 and R3 whose BW is changed to 155000 Kbps. Determine the cost of the route between R4 and network 10.1.1.0/24. Justify your answer.
   Save a screenshot under Q9.
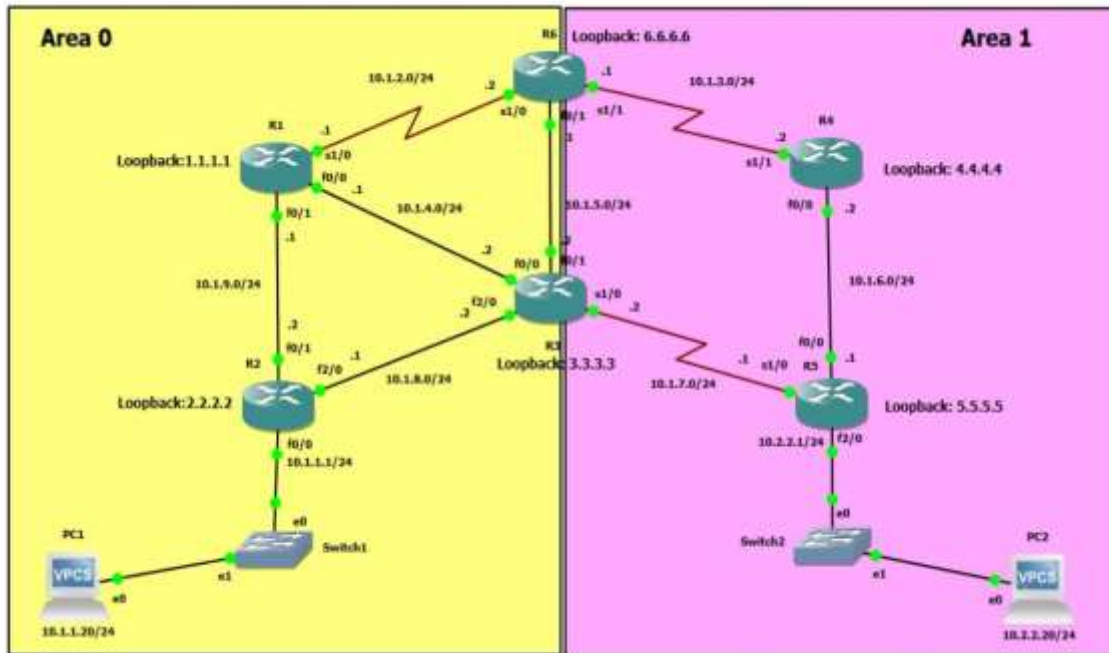
Third Part

IPv6

In this part, you will understand what is IPv6 and the motivation behind why IPv6 is needed. You will also be aware of the following. Write your answers in detail in your report.

1. Demonstrate the differences between IPv4 and IPv6.

2. Explain the IPv6 address format.

3. Explain the following Address types:

    a. Global Unicast Address

    b. Unique Local Address

    c. Link Local Address

4. What is SLAAC?

Bonus Part

IPV6 addressing and Routing:

A company network topology consists of three routers; each router is connected to one PC. Each user needs to be able to connect to all other PCs.

   a) Using the IPV6 addressing table, configure the network shown in figure 1, using Packet Tracer simulation tool. Screenshot all configuration under Part III (a), comment if needed.
   b) Verify in each router the connected interfaces and directly connected LANs, screenshot under part III (b).
   c) Apply on each router EIGRP protocol to allow any two devices from different LANs to ping each other, screenshot all your configuration under part III (c) and add the necessary commands to your report.
   d) Using EIGRP verification command, verify EIGRP neighbors, interfaces and topology screenshot under part III (d).
   e) Using Wireshark, capture the ping between two chosen devices. Save the Wireshark file under part III (e).
       • Save all your previous configuration files, configuration screenshots and Wireshark files.
   f) Apply on each router OSPF routing protocol to allow any two devices from different LANs to ping each other.
       • Save all your previous configuration, configuration screenshots and verification
       • State the main difference between the two routing methods in terms of operation, installation and metric calculation (metric calculations in OSPF and EIGRP). Comment under Part III (f)
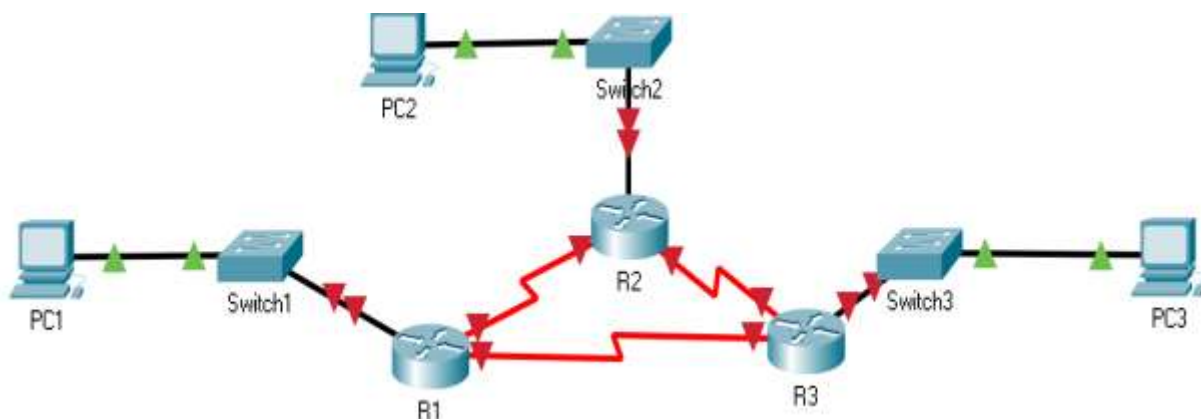
Note: Router version 2901

Figure 1 Part III Network Topology

Device	Interface	IPv6 Address/Prefix	Default Gateway
R1	G0/0	2001: DB8:CAFE:1::1/64	N/A
		fe80::1	
	S0/0/0	2001:DB8:CAFE:A001::1/64	N/A
		fe80::1	
	S0/0/1	2001:DB8:CAFE:A003::1/64	N/A
		fe80::1	
R2	G0/0	2001:DB8:CAFE:2::1/64	N/A
		fe80::2	
	S0/0/0	2001:DB8:CAFE:A001::2/64	N/A
		fe80::2	
	S0/0/1	2001:DB8:CAFE:A002::1/64	N/A
		fe80::2	
R3	G0/0	2001:DB8:CAFE:3::1/64	N/A
		fe80::3	
	S0/0/0	2001:DB8:CAFE:A003::2/64	N/A
		fe80::3	
	S0/0/1	2001:DB8:CAFE:A002::2/64	N/A
		fe80::3	
PC1	NIC	2001:DB8:CAFE:1::3/64	Fe80::1
PC2	NIC	2001:DB8:CAFE:2::3/64	Fe80::2
PC3	NIC	2001:DB8:CAFE:3::3/64	Fe80::3

The following are the learning outcomes for this project:

1. Understand the basic fundamentals of the TFTP and FTP protocols.

2. Extensive use of the GNS3 and Wireshark.

3. Understand socket programming and its role in computer networks.

4. Understand sockets and ports.

5. Program Sockets in C/C++.

6. Create comprehensive network applications using sockets.

7. Understand the OSFP Routing Protocol using GNS3

8. Understand the IPv6 addressing

Project Logistics:

1. Each team consists of two students only.

2. Avoid short answers, you have to answer each question in every detail related to it.

3. **Deliverables:**

   a. Technical report summarizing the results and major findings.

   b. GNS3 config files and Wireshark pcap files

   c. Project C/C++ files (Server.c and Client.c.)

   d. Demo with 10 minutes Q&A session