Al-Najah National University
Network Design Lab

PPP

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1 Abstract

In this lab, we will configure PPP encapsulation on dedicated serial links between the branch routers . Also we will configure PPP Challenge Handshake Authentication Protocol (CHAP) on the PPP serial links. And we will also examine the effects of the encapsulation and authentication changes on the status of the serial link.

2 Introduction

A point-to-point connection is one of the most common types of WAN connection. PPP connections are used to connect LANs to service provider WANs, and to connect LAN segments within an organization network. A LAN-to-WAN point-to-point connection is also referred to as a serial connection or leased-line connection because the lines are leased from a carrier (usually a telephone company) and are dedicated for use by the company leasing the lines. Simply, when you establish a connection to your ISP (Internet Service Provider) through a modem. The connection between the ISP and you make up two points on the network. Therefore, the protocol that is used for establishing this connectivity between the two of you is the Point-to-Point Protocol or the PPP. Note: The default serial encapsulation method when you connect two Cisco routers is HDLC. This means Cisco HDLC can only work with other Cisco devices. However, when you need to connect to a non-Cisco router, you should use PPP encapsulation. The basic purpose of PPP at this point is to transport layer-3 packets across a Data Link layer point-to-point link. This is one of many advantages to using PPP, it is not proprietary. PPP can be used over twisted pair, fiber-optic lines, and satellite transmission. PPP provides transport over ATM, Frame Relay, ISDN and optical links. For security, PPP allows you to authenticate or secure connections using either Password Authentication Protocol **(PAP)** or the more effective Challenge Handshake Authentication Protocol **(CHAP).** PPP contains four main components: EIA/TIA-232-C, V.24, V.35, and ISDN A Physical layer international standard for serial communication. Data Encapsulations: this is a method used to encapsulate multi-protocol datagrams. Different network-layer protocols are simultaneously transported and encapsulated over the same link, the flexibility of the PPP design enables it to be compatible with most supporting network devices. HDLC: A method for encapsulating datagrams over serial links. Link Control Protocol: The LCP is used to establish, configure, and test the data link connection. It's flexible in handling different sizes of packets, detect a looped-back link, configuration errors, and terminate the link. Network Control Protocol: NCP is used for establishing and configuring different Network layer protocols. PPP enables the simultaneous use of multiple Network layer protocols.
Summary of Establishing a Point-to-Point WAN Connection with PPP
PPP is a common Layer 2 protocol for the WAN. Two components of PPP exist: LCP negotiates the connection and NCP encapsulates traffic. You can configure PPP to use PAP or CHAP. PAP sends everything in plain text. CHAP uses an MD5 hash. Common PPP verification commands include show interface to verify PPP encapsulation and debug ppp negotiation to verify the LCP handshake.

3 Scenario

Your Company has an HQ in Ramallah city and two branches one in Jenin and the other is in Nablus. Leased lines have been chosen to connect the branches to the HQ. Each branch consists of one LAN. The HQ router has an internet connection. The IP addressing scheme to be used is as follows:1. Classful class C networks for the Branch LANS.2. Class A subnets of block size 4 on the WAN connections.3. The internet connection on HQ has the IP address 209.165.200.225/27. Use the first Ethernet interface of each router for the LANs. The internet connection is simulated by Lo0 on Ramallah router. The first serial interface of Jenin router is to be connected to the first serial interface of Ramallah router. The second serial interface of Ramallah router in connected to the second serial interface of Nablus router.

4 Procedure

1. At first, we Design the logical topology as per the requirements, as show in figure 1.

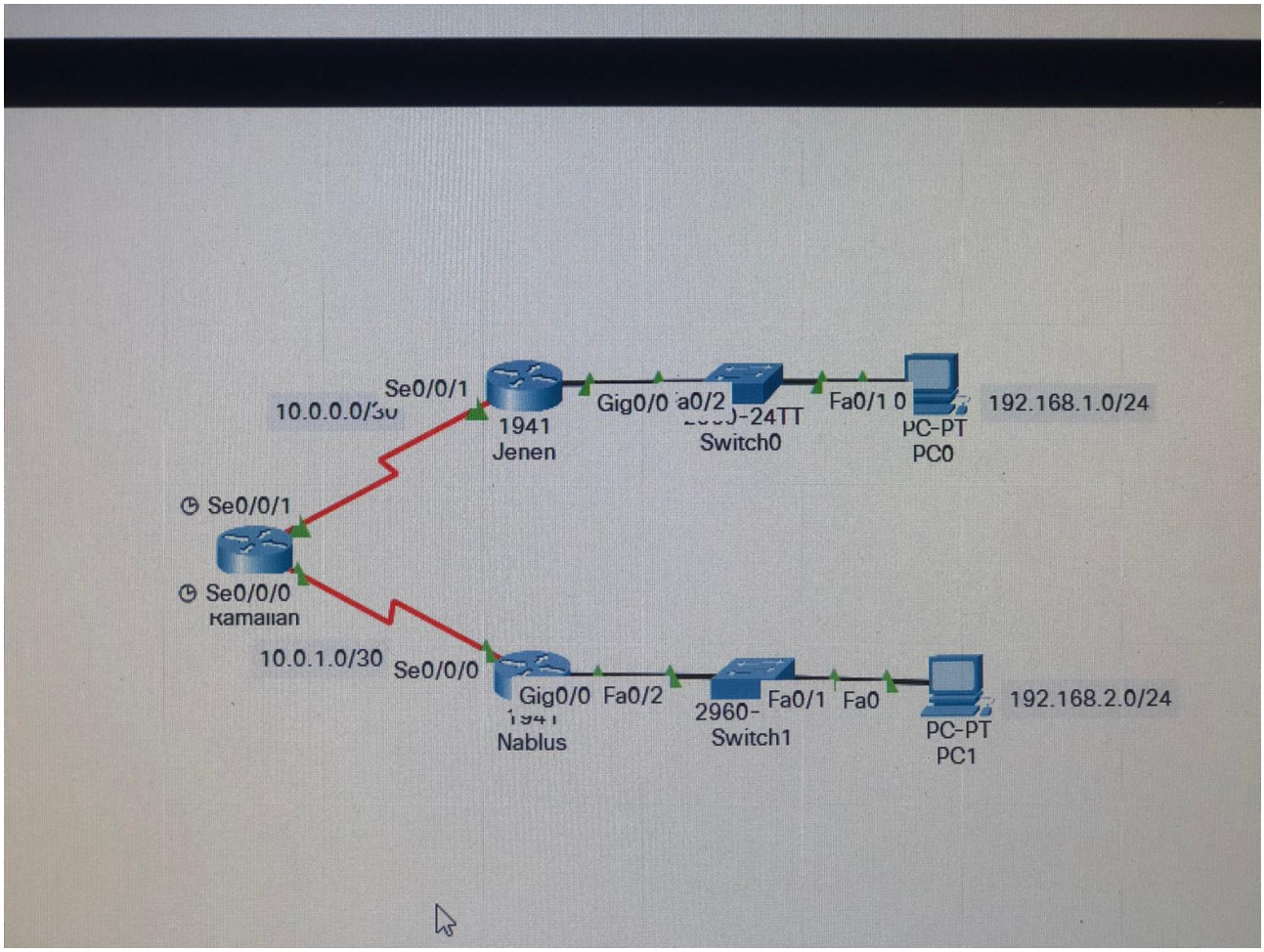

Figure 1: Logical Topology

2. Then we set up the network topology and configure basic router settings, such as the interface IP addresses, routing, device access, and passwords.
3. On the Ramallah router we create **Loopback0** to simulate access to the Internet and assign an IP address **209.165.200.225/27**.
4. We Configured routing ,by enable **single-area OSPF** on the routers and use a process ID of **1**.We added all the networks, except 209.165.200.224/27 into the OSPF process.
5. Also, We Configured a default route to the simulated Internet on the Ramallah router using Lo0 as the exit interface and redistribute this route into the OSPF process.
6. Then we assign IP addresses and default gateways to the PCs according to the Addressing Table.
7. We Verify end-to-end connectivity, fisrt from PC-O ping to PC-1 , and the internet and it is succsefull as figure2 show .Then from PC-1 to PC-0 and to internet as figure3 show .

4.1 Configure PPP Encapsulation

1. On the routers,we issued **show interfaces serial interface-id** to display the current serial encapsulation.
   And we show that the default serial encapsulation for a Cisco route is **HDLC**
2. Then we changed the serial encapsulation to PPP .

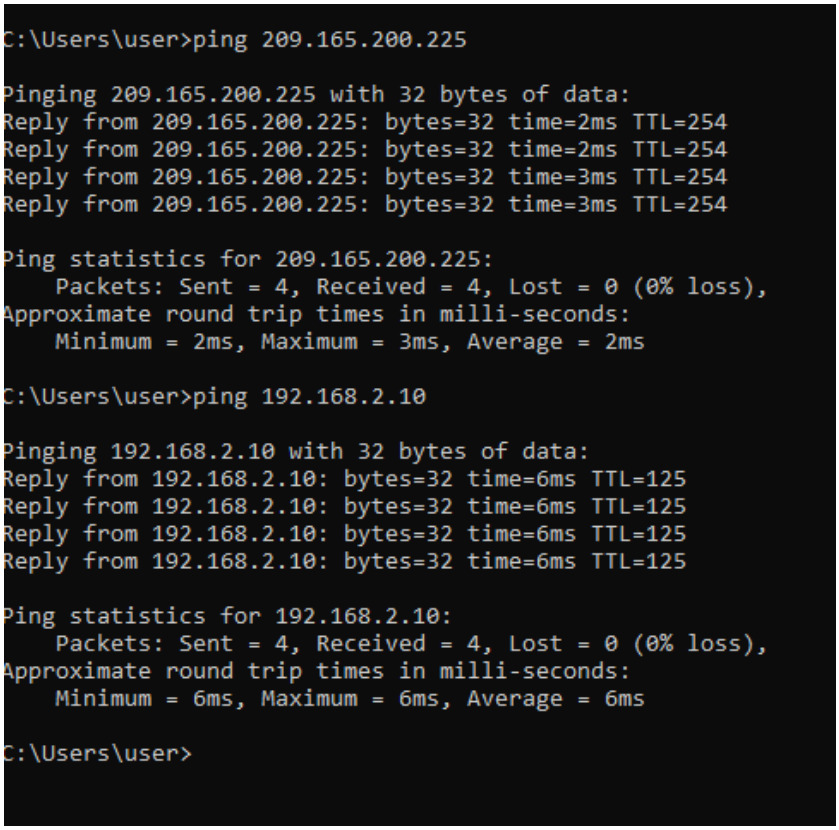

Figure 2: Verify connectivity from pc-0

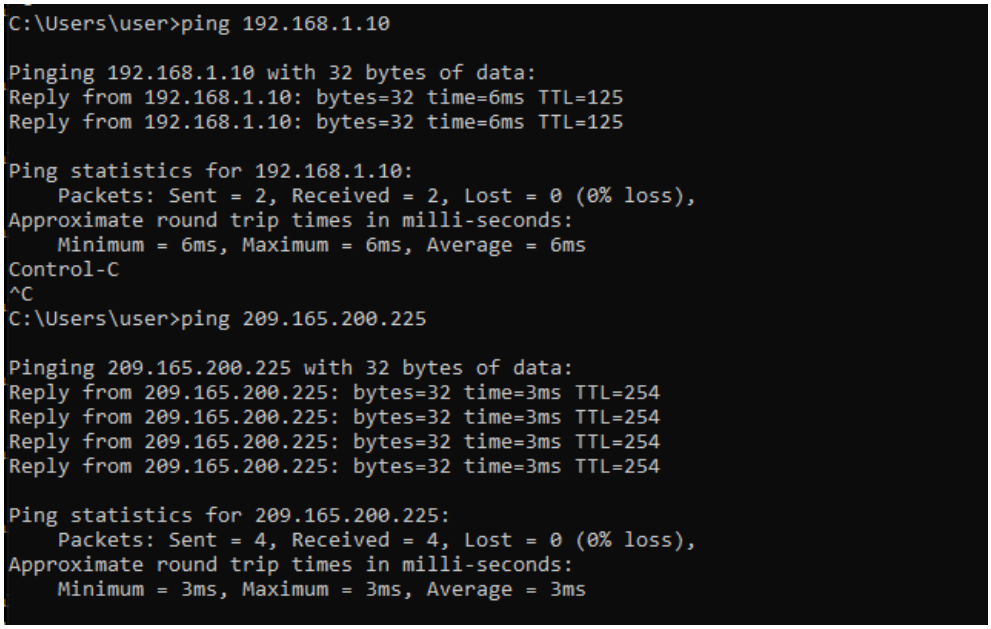

Figure 3: Verify connectivity from pc-1

- We Issued the encapsulation ppp command on the S0/0/0 interface for the Jenin router to change the encapsulation from HDLC to PPP, using the command **encapsulation ppp** on the serial 0/0/0 .

- We issued the command **show interface s0/0/0** to display the line status and line protocol for interface S0/0/0 on the Jenin router.
  The current interface status for S0/0/0 is down as figure 4 shows;because the Ramallah router is in different encapsulation .

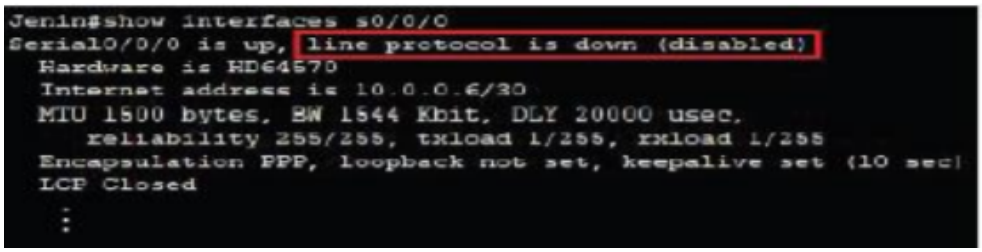

Figure 4: Status down of interface

- Then we change the encapsulation ppp command on interface S0/0/0 for the Ramallah router to correct the serialencapsulation mismatch.
- We verified that interface S0/0/0 on both Jenin and Ramallah routers was up/up and configured with PPP encapsulation.
- **Question:** What is the status of the PPP Link Control Protocol (LCP)? The status of PPP Link Control Protocol (LCP) was "Up".
- **Question:** Which Network Control Protocol (NCP) protocols have been negotiated? Internet Protocol Control Protocol (IPCP) and Cisco Discovery Protocol Control Protocol (CDPCP)

3. Intentionally break the serial connection.
   - We issued the debug ppp commands to observe the effects of changing the PPP configuration on the Jenin router and the Ramallah router.
   - We broke the serial connection by returning the serial encapsulation to HDLC for interface S0/0/0 on the Jenin router using command **"encapsulation hdlc"**.
   - We observed the debug PPP messages on the Jenin router. The serial connection has **terminated**, and the line protocol was down, as figure 5 shows.

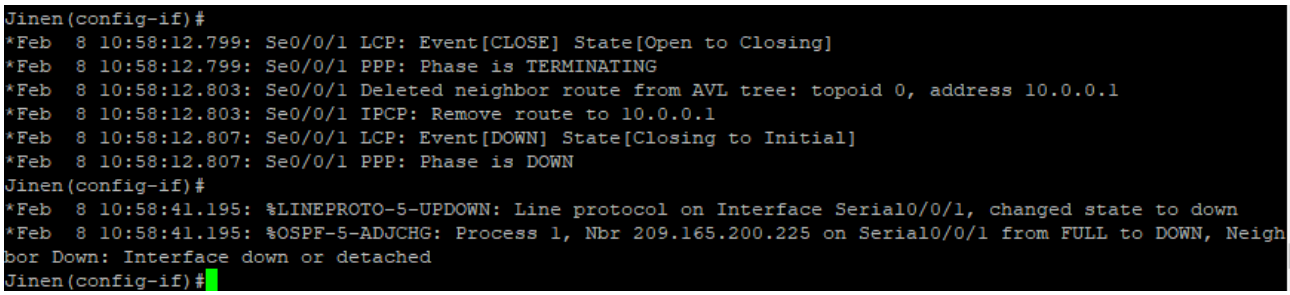

Figure 5: Status down of interface

- **Question:**What happens when one end of the serial link is encapsulated with PPP and the other end of the link is encapsulated with HDLC? The connection goes down because both interfaces could not communicate with each other to open a connection.
- Then we issued the encapsulation ppp command on the S0/0/0 interface for the Jenin router to correct mismatched encapsulation.
- **Question:** From the debug message, what phases does PPP go through when the other end of the serial link on the Ramallah router is configured with PPP encapsulation?The first phase was established, and the second was forwarding.
- **Question:** What happens when PPP encapsulation is configured on each end of the serial link? he interfaces started communication to establish and opened a new connection
- We issued the undebug all (or u all) command on the Jenin and Ramallah routers to turn off all debugging on both routers.

- We issued the show ip interface brief command on the Jenin and Ramallah routers after the network converges.The state of both interfaces was “Up”.
- Then we verified that the interface S0/0/0 on both Jenin and Ramallah routers were configured for PPP encapsulation
- After that, We changed the serial encapsulation for the link between the Ramallah and Nablus routers to PPP encapsulation.

4.2 Configure PPP CHAP Authentication.

1. We Configure PPP CHAP authentication for the link between the Ramallah router and the Nablus router as figure 6 shows.

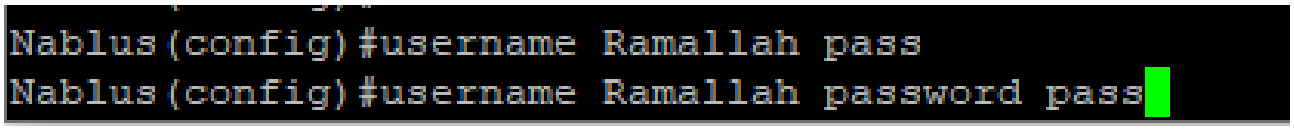

Figure 6: configured a username for CHAP authentication for Router Nablus

2. Also,We issued the command ppp authentication chap on Nablus router for the interface S0/0/1 to enable CHAP authentication.And We examined the debug PPP messages on the Nablus router during the negotiation with the Ramallah router.
3. **Question:** From the PPP debug messages, what phases did the Nablus router go through before the link is up with the Ramallah router? The phases that the Nablus router went through before the link was up with the Ramallah router were establishing phase and authenticating phase.
4. We issued the debug ppp authentication command to observed the CHAP authentication messages on the Ramallah router show that line protocol on Interface Serial0/0/0, changed state to up, as figure 7 shows.

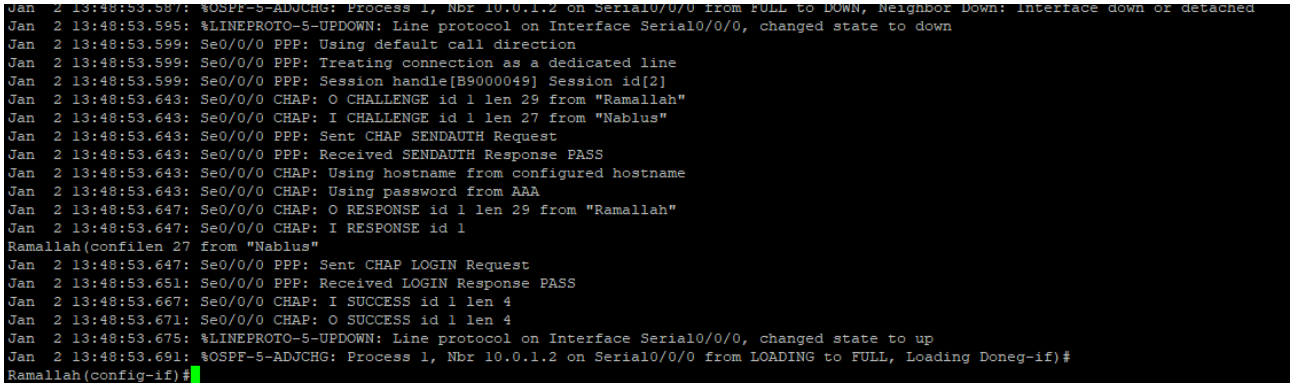

Figure 7: Status of CHAP Authentication

5. Then we configure CHAP authentication on S0/0/1 on the Ramallah router.
6. On the Ramallah router we configured a username for use with Jenin. Assign pass as the password.
7. Then on the Ramallah and Jenin routers we configured CHAP authentication on interface S0/0/0.The interfaces went to down phase due to only one router could complete the authentication using the username and password, and the other router has no username and password to use.
8. We verified end-to-end connectivity, and it was successfully reachable.

5 Conclusion

We have investigated PPP encapsulation configuration on dedicated serial links between sub routers and Ramallah road and configured PPP handshake authentication challenge CHAP on PPP serial links. Also, we examined the effects of encapsulation and authentication changes on the state of the serial link.