

PPP

Module 3, Review



3.1.1 Introduction to serial communication

- RS-232 is the cabling used to connect a router to a modem.
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3.1.2 Time-division multiplexing

- ❑ Time-Division Multiplexing (TDM) is the transmission of several sources of information using one common channel, or signal, and then the reconstruction of the original streams at the remote end.
 - ❑ TDM is a physical layer concept, it has no regard for the nature of the information that is being multiplexed onto the output channel.
 - ❑ TDM is independent of the Layer 2 protocol that has been used by the input channels.
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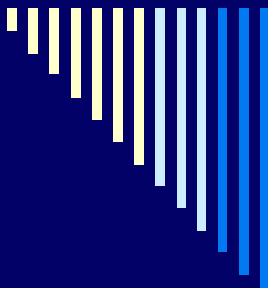
3.1.5 HDLC encapsulation

- The Cisco HDLC frame uses a proprietary ‘type’ field that acts as a protocol field.
 - HDLC defines a Layer 2 framing structure that allows for flow control and error control using acknowledgments and a windowing scheme.
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3.1.5 HDLC encapsulation

- Uses sequencing and acknowledgements
 - HDLC defines the following three types of frame, each with a different control field format:
 - **Information frames (I-frames)**
 - **Supervisory frames (S-frames)**
 - **Unnumbered frames (U-frames)**
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3.1.7 Troubleshooting a serial interface

- ❑ The **show controllers** command is another important diagnostic tool when troubleshooting serial lines.
 - ❑ The **show controllers** output indicates the state of the interface channels and whether a cable is attached to the interface.
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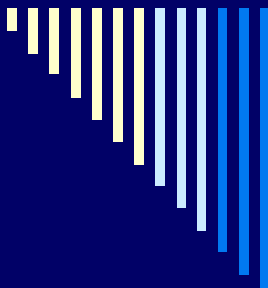
3.1.7 Troubleshooting a serial interface

Troubleshooting a Serial Interface

FIGURES

- 1
- 2
- 3
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Status Line	Condition Possible	Problem Solution
		line or other carrier service for line troubleshooting assistance.
Serial x is up, line protocol is down (disabled)	<p>A high error rate has occurred due to a WAN service provider problem.</p> <p>A CSU or DSU hardware problem has occurred.</p> <p>Router hardware (interface) is bad.</p>	<ol style="list-style-type: none"> 1. Troubleshoot the line with a serial analyzer and breakout box. Look for toggling CTS and DSR signals. 2. Loop CSU/DSU (DTE loop). If the problem continues, it is likely that there is a hardware problem. If the problem does not continue, it is likely that there is a WAN service provider problem. 3. Swap out bad hardware as required (CSU, DSU, switch, local or remote router).
Serial x is administratively down, line protocol is down	<p>The router configuration includes the shutdown interface configuration command.</p> <p>A duplicate IP address</p>	<ol style="list-style-type: none"> 1. Check the router configuration for the shutdown command. 2. Use the no shutdown interface configuration command to remove the shutdown command. 3. Verify that there are no identical IP addresses



3.1.7 Troubleshooting a serial interface

- If the electrical interface output is shown as UNKNOWN, instead of V.35, EIA/TIA-449, or some other electrical interface type, an improperly connected cable is the likely problem. A problem with the internal wiring of the card is also possible. If the electrical interface is unknown, the corresponding display for the **show interfaces serial <X>** command will show that the interface and line protocol are down.
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3.2.1 PPP layered architecture

- PPP provides a method for encapsulating multi-protocol datagrams over a point-to-point link, and uses the data link layer for testing the connection. Therefore PPP is made up of two sub-protocols:
 - **Link Control Protocol** – Used for establishing the point-to-point link.
 - **Network Control Protocol** – Used for configuring the various network layer protocols.
- PPP can be configured on the following types of physical interfaces:
 - Asynchronous serial
 - Synchronous serial
 - High-Speed Serial Interface (HSSI)
 - Integrated Services Digital Network (ISDN)



3.2.1 PPP layered architecture

- ❑ **Multilink** – Cisco IOS Release 11.1 and later supports multilink PPP.
 - ❑ This alternative provides load balancing over the router interfaces that PPP uses.
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3.2.1 PPP layered architecture

PPP Protocol Field Numbers

FIGURES

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Value (in hex)	Protocol Name
8021	Internet Protocol Control Protocol
8023	OSI Network Layer Control Protocol
8029	Appletalk Control Protocol
802b	Novell IPX Control Protocol
c021	Link Control Protocol
c023	Password Authentication Protocol
c223	Challenge Handshake Authentication Protocol



3.2.2 Establishing a PPP session

- The LCP protocol in the PPP architecture provides:
 - Testing the quality of a link
 - Limiting bandwidth consumption
 - Providing load balancing
 - Preventing frame looping
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3.2.2 Establishing a PPP session

- Tasks which must be accomplished before a link between two routers using PPP can become active:
 - Send keepalives between the two links
 - Send LCP and NCP frames to negotiate configuration parameters.
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3.2.3 PPP authentication protocols

- The authentication options require that the calling side of the link enter authentication information. This helps to ensure that the user has the permission of the network administrator to make the call.
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3.2.4 Password Authentication Protocol (PAP)

- PAP is not a strong authentication protocol. Passwords are sent across the link in clear text and there is no protection from playback or repeated trial-and-error attacks.
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3.2.5 Challenge Handshake Authentication Protocol (CHAP)

- CHAP
 - Exchanges a random challenge number during the session to verify identity.
 - Prevents transmission of login information in plain text
 - Disconnects the PPP session if authentication fails.
 - The remote node responds with a unique value calculated using a one-way hash function, which is typically Message Digest 5 (MD5).
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3.3.2 Configuring PPP

- Enter the following to monitor the data dropped on the link, and avoid frame looping:
 - Router(config)#**interface serial 0/0**
Router(config-if)#**encapsulation ppp**
Router(config-if)#**ppp quality percentage**
 - *The following commands perform load balancing across multiple links:*
 - *Router(config)#interface serial 0/0*
Router(config-if)#encapsulation ppp
Router(config-if)#ppp multilink
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3.3.3 Configuring PPP authentication

Configuring PPP Authentication

FIGURES

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Step	Description
Step 1	<p>On each router, define the username and password to expect from the remote router:</p> <pre>Router(config)#username <i>name</i> password <i>secret</i></pre> <p>The arguments are described as follows:</p> <ul style="list-style-type: none">• <i>name</i>-This is the host name of the remote router. Note: That it is case sensitive.• <i>secret</i>-On Cisco routers, the secret password must be the same for both routers.



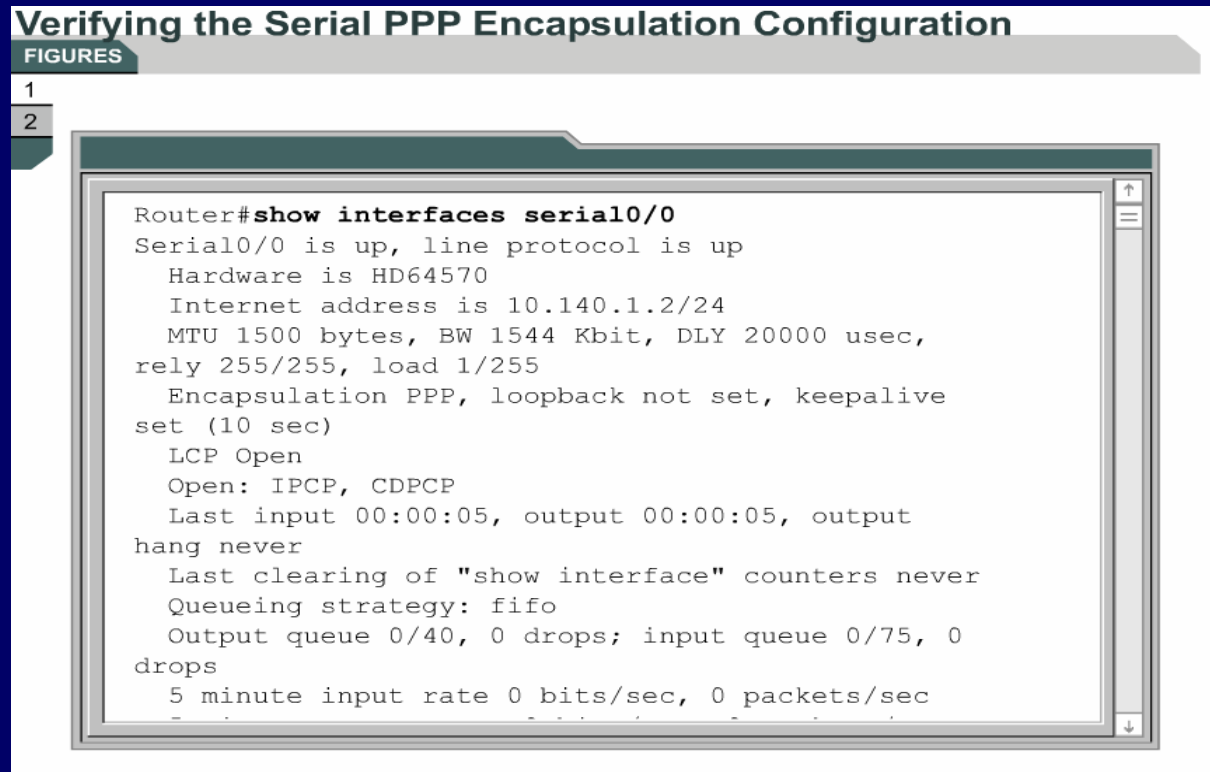
3.3.3 Configuring PPP authentication

```
1d00h: Se0/0 LCP: I CONFREQ [REQsent] id 32 len 10
1d00h: Se0/0 LCP:      MagicNumber 0x0D3792AE (0x05060D3792AE)
1d00h: Se0/0 LCP: O CONFACK [REQsent] id 32 len 10
1d00h: Se0/0 LCP:      MagicNumber 0x0D3792AE (0x05060D3792AE)
1d00h: Se0/0 LCP: I CONFACK [ACKsent] id 1 len 10
1d00h: Se0/0 LCP:      MagicNumber 0x0DF026AF (0x05060DF026AF)
1d00h: Se0/0 LCP: State is Open
```

- Command used to display the output:
 - **debug ppp negotiation**
- Items negotiated during the PPP session shown:
 - Challenge Handshake Authentication Protocol
 - Error detection

3.3.4 Verifying the serial PPP encapsulation configuration

- How many NCP's have been established?



```
Verifying the Serial PPP Encapsulation Configuration
FIGURES
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Router#show interfaces serial10/0
Serial0/0 is up, line protocol is up
  Hardware is HD64570
  Internet address is 10.140.1.2/24
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
  rely 255/255, load 1/255
  Encapsulation PPP, loopback not set, keepalive
  set (10 sec)
  LCP Open
  Open: IPCP, CDPCP
  Last input 00:00:05, output 00:00:05, output
  hang never
  Last clearing of "show interface" counters never
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0
  drops
  5 minute input rate 0 bits/sec, 0 packets/sec
```



3.3.5 Troubleshooting the serial encapsulation configuration

```
4d20h: %LINK-3-UPDOWN: Interface Serial0/0, changed state to up
4d20h: Se0/0 PPP: Treating connection as a dedicated line
4d20h: Se0/0 PPP: Phase is AUTHENTICATING, by both
4d20h: Se0/0 CHAP: O CHALLENGE id 2 len 28 from "left"
4d20h: Se0/0 CHAP: I CHALLENGE id 3 len 28 from "right"
4d20h: Se0/0 CHAP: O RESPONSE id 3 len 28 from "left"
4d20h: Se0/0 CHAP: I RESPONSE id 2 len 28 from "right"
4d20h: Se0/0 CHAP: O SUCCESS id 2 len 4
4d20h: Se0/0 CHAP: I SUCCESS id 3 len 4
4d20h: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0,
changed state to up
```

- ❑ The LCPs were already negotiated
- ❑ The router can begin NCP negotiations
- ❑ The **debug ppp authentication** command was executed