CCIE Routing & Switching
Advanced Troubleshooting Bootcamp

WAN Troubleshooting

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WAN Overview

- WAN in CCIE R&S Lab mainly focuses on…
  - HDLC
  - PPP
  - Frame Relay

HDLC Troubleshooting

- Minimal issues outside of Layer 1
  - If link is down/down, layer 1 problem
- For back-to-back Serial links, DCE end must perform link clocking
  - If link is up/down, clocking problem possible
- Actual clock rate dependent on physical link
  - E.g. slow speed serial vs. HSSI
- **`show controllers Serial`** to verify DCE/DTE end and clocking parameters

PPP Troubleshooting

- Like HDLC, over back-to-back Serial, DCE end must perform clocking
- PPP links go through two discrete negotiation phases
  - Link Control Protocol (LCP)
  - Network Control Protocols (NCP)

PPP LCP

- Used to negotiate PPP specific options such as magic number & authentication
- If successful…
  - **`show interface`** shows "LCP Open"
  - Link should be up/up
- Assuming link clocking and both peers running PPP, LCP negotiation typically only fails due to authentication failure
- **`debug ppp negotiation`** for detailed troubleshooting
  - Understanding debug ppp negotiation output

PPP NCP

- Once low-level link parameters agreed on, NCP is used to negotiate…
  - CDPCP
  - IPCP
  - IPv6IP
  - Etc.
- Successfully negotiated NCP will show protocol as "Open" in **`show interface`**
  - Failed negotiation shows "Listen"
- **`debug ppp negotiation`** for details

Frame Relay Troubleshooting

- Frame Relay operation can be divided into three discrete steps
  - LMI keepalive establishment
  - PVC establishment
  - Layer 3 to layer 2 mapping establishment

Frame Relay LMI

- LMI is used to advertise VC information from DCE to DTE
- LMI type must match, but is auto negotiated unless manually set
- Link status of up/down can indicate LMI problem
- **`debug frame-relay lmi`**
  - Should show two-way communication
- **`show frame-relay pvc`**
  - "Static" PVCs mean that LMI was disabled with the **no `keepalive`** command

Frame Relay PVCs

- Once LMI is established link should be up/up
- **`show frame-relay pvc`** verifies LMI learned VC information
- VC states are
  - ACTIVE – normal operation
  - INACTIVE – up locally but not end-to-end
  - DELETED – configured locally but the switch does not agree
    - Commonly incorrectly configured **`frame-relay map`** or **`frame-relay interface-dlci`** statement
  - STATIC – LMI keepalive has been disabled

Frame Relay Mapping

- Once VC is ACTIVE mapping can occur
- Multipoint interfaces require mapping for protocol resolution
  - Frame Relay Inverse-ARP
  - Static mappings
- Point-to-point subinterfaces do not
  - **`frame-relay interface-dlci`** to assign VC
- **`show frame-relay map`**
- **`debug frame-relay packet`**
  - "Encaps failed--no map entry link" indicates mapping problem

Frame Relay Psuedo-broadcast

- Statically mapped VCs on multipoint interfaces do not support broadcast/multicast transmission by default
  - **`broadcast`** keyword on mapping statement
- InARP does automatically include broadcast

Frame Relay Further Reading

- Troubleshooting Frame Relay Connections
- Comprehensive Guide to Configuring and Troubleshooting Frame Relay

Q&A