ISDN Decodes : Layer 2 Interpretation

ISDN D channel decodes provide pertinent information on call related messaging (Layer 3) as well as the management and maintenance of the D channel itself (Layer 2). Layer 3 messages help the user to troubleshoot problems such as: who is disconnecting a call, why a call is rejected or to see if calling party data is being provided. Layer 2 messages are used to troubleshoot malfunctions of the D channel itself such as: why the D channel will not establish, if a D channel link is being terminated or the possible cause for why a link is being terminated. This techtip addresses the messaging that takes place at Layer 2 and how they are involved in establishing, maintaining and terminating D channel communications.

The protocol used at Layer 2 in ISDN is LAPD (Link Access Procedure D-Channel).
There are 3 basic types of frames transmitted in LAPD: Information frames, Supervisory frame and Unnumbered frames. Information frames contain Layer 3 call information and are not addressed in this document. Unnumbered frames encompass those frames necessary to establish or terminate the D channel communications. The following are Unnumbered frame types. Any of these messages can be sent from the network or the customer.

SABME – Set Asynchronous Balanced Mode with Extended Sequence Numbering

UA – Unnumbered Acknowledgement

DISC – Disconnect (NOTE: Layer 3 also has a disconnect message, all references to disconnect in this document refer to Layer 2 and the D channel itself terminating)

DM – Disconnect Mode

FRMR – Frame Reject

UI – Unnumbered Information

A SABME is the message that is sent to first establish D channel communications.
The proper response, from the other end of the link, is a UA message. This is the initial handshake that is necessary to consider the D channel as operational.
The DISC message is the frame that is sent to terminate D channel communications. The proper response is also a UA. The DM can be seen as a negative response to the SABME request and would indicate that the node is not in a state that is ready for D channel communication. The DM may also be seen as a response to the DISC command and would be indicating that it is already in a disconnected state.
FRMR is sent when an unrecoverable link-level problem has occurred. This would occur on conditions that cannot be corrected by having a frame retransmitted (such as an invalid field content) and would be an indication of possible high level protocol issues between the two nodes.
UI frames are sent for link management activities that require some information exchange between the two nodes, such a TEI Request message which is sent by each BRI TE device during its initialization process.

Supervisory frames are used to maintain link communications once the link has been established. There are 3 supervisory frame types. Any of these messages can be sent from the network or the customer.

RR – Receiver Ready

RNR – Receiver Not Ready

REJ – Reject

RR messages are the most commonly seen frames in D channel decodes. They are routinely exchanged between nodes as a keep-alive signal and are also used to acknowledge the reception of frames. The D channel is only allowed to be inactive (no frames sent) for a brief period of time. When there are no call related messages to send, the nodes will transmit RR frames to ensure that the D channel link remains in service. Failure to send frames within the allotted time period would be one reason for seeing a node terminate and re-establish the D channel. Timers that control activity such as this are programmable within the switches and are therefore a possible source of incompatibility between nodes. A receive sequence number field within the RR frame is used to inform the far-end node of the number of frames that have been successfully received by this node. A RR frame is indicating that the transmitting device is present, in service, capable of receiving traffic but does not currently have any call related messages to transmit.

A RNR message is sent when a node is experiencing difficulties (such as buffer depletion) and is informing the far-end node that it cannot accept any additional information frames (call related messages) at this time. RNR frames should rarely be seen and should be investigated by switch personnel as to their cause.

REJ frames are used to force retransmission of bad frames. Supervisory frames as well as information frames always contain sequence numbers. Some frame types have both send and receive sequence numbers and some only require receive sequence numbers. These numbers are used to keep track of the frames that have been transmitted or received by a node and are used during transmission of supervisory and information frames to ensure that all frames are properly communicated to the far end. Frequent REJ frames are a sign of miscommunications on the D channels,

most likely due to frames experiencing errors during transmission.

As always, when looking at D channel decodes, the TE>NT or NT>TE designation of the message will identify the source of the message (syntax may change depending in the testset used but all decodes will have some type of designation to indicate where the message originated from). This is important to know when attempting to interpret faults. Consult the manual on the particular testset being used to see if there are any configuration requirements to ensure that the labeling of the messages is correct.

TE>NT indicates the message was sent by the customer whereas NT>TE indicates the message was sent by the network. Complaints where it is pertinent to look at layer 2 messages include: failure to get the D channel to go in service, unexplained loss of D channel communications or excessive delays or timeouts when trying to process calls.

Now that you understand the messages and when it is normal to see them you can use the ISDN D channel decode features of your ISDN testset to effectively isolate and troubleshoot layer 2 link communications problems.