Cisco Systems

IP COMMUNICATIONS

Troubleshooting Cisco IP Telephony

Reveals the methodology you need to resolve complex problems in an IP telephony network

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Table 6-27 *Q.850 Cause Codes for Q.931 Signaling (Continued)*

Hexadecimal Code with High-Order Bit Set	Hexadecimal Code Without High-Order Bit Set	Decimal Code	Description
0xE5	**0x65**	**101**	The message is incompatible with the call state. This code is usually indicative of an ISDN protocol mismatch. Each ISDN protocol variant has a slightly different state machine based on the state machines defined in the Q.931 specification. If the two sides of an ISDN connection are not configured for the same protocol, one side might violate the other's call state machine. If an ISDN message is sent that is not expected in the current call state, this cause is generated.
0xE6	**0x66**	**102**	Recovery on timer expiry. This occurs when ISDN messages don't arrive in specified time according to the Q.931 specification. The E6 is sometimes followed by the timer that has expired (for example, 03 01 00—the 310 timer). The section "Understanding ISDN Timers" defines the various ISDN timers.
0xE7	**0x67**	**103**	Parameter nonexistent or not implemented—passed on (National use).
0xEE	**0x6E**	**110**	Message with unrecognized parameter discarded.
0xEF	**0x6F**	**111**	Protocol error, unspecified.
0xFF	**0x7F**	**127**	Interworking, unspecified.

Numbering Type and Plan Mismatches

The calling and called party number information elements contain fields called numbering plan and numbering type. In the majority of cases, these fields are ignored by most ISDN switches. However there are times when ISDN switches base their call routing decision partially on the numbering plan or type and some PBXs use the calling party numbering plan information for number presentation purposes.

The easiest way to look at the numbering plan and type information is to open the CCM trace file with the Enhanced Q.931 Translator. You will see the calling and called party

number information, including the ISDN numbering plan and type information. For example, the following line shows a numbering plan and type of Unknown:

```
Called Party Number i = '2001' - Plan: Unknown, Type: Unknown
```

If you see CallManager sending the proper digits to the PSTN, but the call is not being routed properly, check to make sure that the numbering plan and type are set in accordance with the way the device connected to the gateway is configured.

By default, for calls to route patterns containing the @ NANP wildcard, the called party numbering type is classified as National (International if 011 is dialed), and the called numbering plan is ISDN. For calls to route patterns not containing the @ NANP wildcard, the called party numbering plan and type are classified as Unknown. The calling party numbering plan and type can be classified differently, depending on the digits to be sent.

Note that this automatic selection occurs only if the outbound PRI gateway has the numbering plan and type configured to "Cisco CallManager." Any other settings override the automatic assignment from the NANP.

If you suspect a problem with the numbering plan or type, try changing the calling and called party numbering plan to National and the numbering type to ISDN. If the country you are in has a different numbering type, experiment with the different values to see if they help.

Whatever the case, make sure that the called and calling party are being classified correctly so that the CO can process that call. If you are unsure what the plan and type should be set to, contact your service provider and ask what they expect to see.

Troubleshooting Calling Name Display Problems

A common problem encountered when interfacing between an IP Telephony network and a traditional PBX environment is the ability to pass calling name information. CallManager uses the display information element to pass and receive calling name information on all PRI variants with the exception of Q.Sig. The display information element is defined as part of the Q.931 specification and is the standard way to pass calling name information.

Many legacy PBXs do not support calling name display via the display information element and require Q.Sig for calling name display to work. Q.Sig uses the Facility information element to pass calling name information. CallManager supports calling name display via the facility IE only on Q.Sig trunks as of CallManager version 3.3.

Some service providers provide calling name display service from the PSTN on ISDN PRIs configured for the NI3 switch type. NI3 also uses a facility information element to send calling name information. As of CallManager 3.3, CallManager supports only the NI2 switch type. Therefore, CallManager cannot accept calling party name information from a service provider that sends the name in a facility information element, but it supports any device sending the name in a display information element.

The only requirement in CallManager for calling name display to work is that the **Display IE Delivery** checkbox be enabled on the gateway (either H.323 or MGCP) on which you want name delivery. Q.931 traces (either CCM traces or **debug isdn q931** on a Cisco IOS gateway) show you the calling name information being sent or received. If you see the name being presented to the far end and it is not showing up, you need to work with the administrators of that equipment to determine why they are not accepting the name information.

As a general rule, Lucent/Avaya PBX equipment can send and receive calling name information using most switch types as long as it is configured to send the display information in codeset 0 (this is a trunk group configuration parameter on the PBX).

Nortel PBXs, on the other hand, generally provide calling name information via the display information element only when using the DMS100 switch type. Most Nortel PBXs, however, do not support network-side DMS100, so you need to use a gateway on the CallManager side that supports network-side DMS100 to get this to work or configure the Nortel PBX for network-side SL100 switch type and use user-side DMS100 on the CallManager side.

Understanding ISDN Timers

The ISDN Q.931 specification lists a variety of timers that dictate how long an ISDN device should wait for a certain event to occur before taking corrective action. The Q.921 specification also lists a variety of timers related to D-channel establishment procedures, however adjusting these timers is seldom required.

Understanding how these timers work and when they are used is important, especially if you are troubleshooting calls that are being disconnected with a cause code of 0xE6, "Recovery on timer expiry." This cause code indicates the call was disconnected because a timer expired and there was no further corrective action that could be taken other than disconnecting the call.

The cause code in the cause information element is sometimes followed by the name of the timer that has expired (for example, 03 01 00—the 310 timer).

For example, if CallManager sends a call out to the PSTN by sending a SETUP message and receives a CALL PROCEEDING from the PSTN as expected, the T310 timer starts. This timer specifies that CallManager must receive either ALERTING, CONNECT, or DISCONNECT from the PSTN before the timer expires. By default, this timer is 10 seconds. After 10 seconds, CallManager sends a DISCONNECT with a cause of "Recovery on Timer Expiry."

Tables 6-28 and 6-29 list the timers defined in the Q.931 specification for both the network side and the user side of a call.

Table 6-28 *ISDN Q.931 Timers on the Network Side*

Timer Name	Call State	Cause for Start	Normal Stop	Action Upon First Expiry	Action Upon Second Expiry
T301	Call received	ALERTING received.	CONNECT received.	Clear the call.	—
T302	Overlap sending	SETUP ACK sent. Receipt of INFO restarts T302.	Sending Complete indication, ALERTING, or CONNECT received.	Clear call if call information is incomplete; otherwise, send CALL PROCEEDING.	—
T303	Call present	SETUP sent.	ALERTING, CONNECT, CALL PROCEEDING, RELEASE COMPLETE, or SETUP ACK received.	Retransmit SETUP; Restart T303. If RELEASE COMPLETE has been received, clear the call.	Clear network connection. Enter call abort state.
T304	Overlap receiving	SETUP ACK received. Sending of INFO restarts T304.	Send INFO; Receive CALL PROCEEDING, ALERTING, or CONNECT.	Clear the call.	—
T305	Disconnect indication	DISCONNECT without progress indicator of 8 sent.	RELEASE or DISCONNECT received.	Network sends RELEASE.	—
T306	Disconnect indication	DISCONNECT with progress indicator of 8 sent.	RELEASE or DISCONNECT received.	Stop the tone/ announcement. Send RELEASE.	—

Table 6-28 *ISDN Q.931 Timers on the Network Side (Continued)*

Timer Name	Call State	Cause for Start	Normal Stop	Action Upon First Expiry	Action Upon Second Expiry
T307	—	SUSPEND ACK sent.	RESUME ACK sent.	Clear the network connection. Release call identity.	—
T308	Release request	RELEASE sent.	RELEASE COMPLETE or RELEASE received.	Retransmit RELEASE and restart T308.	Place B-channel in maintenance condition. Release call reference.
T309	Any stable state	Data link disconnection. Calls in stable states are not lost.	Data link reconnected.	Clear network connection. Release B-channel and call reference.	—
T310	Incoming call proceeding	CALL PROCEEDING received.	ALERTING, CONNECT, or DISCONNECT received.	Clear the call.	—
T312	Call present, call abort	SETUP sent.	Timeout.	In call abort state, the call reference is released. Otherwise, no action is taken.	—
T314	Receiving segmented message	Message segment received.	Last message segment received.	Discard message.	—
T316	Restart request	RESTART sent.	RESTART ACK received.	RESTART may be retransmitted several times.	RESTART may be retransmitted several times.
T317	Restart	RESTART received.	Internal clearing of call references.	Maintenance notification.	—

continues

Table 6-28 *ISDN Q.931 Timers on the Network Side (Continued)*

Timer Name	Call State	Cause for Start	Normal Stop	Action Upon First Expiry	Action Upon Second Expiry
T321	Any call state	D-channel failure.	Response to Layer 3 message received.	Send DL-ESTABLISH request on both D-channels.	—
T322	Any call state	STATUS ENQUIRY sent.	STATUS, DISCONNECT, RELEASE, or RELEASE COMPLETE received.	STATUS ENQUIRY may be retransmitted several times.	STATUS ENQUIRY may be retransmitted several times.

Table 6-29 *ISDN Q.931 Timers on the User Side*

Timer Name	Call State	Cause for Start	Normal Stop	Action Upon First Expiry	Action Upon Second Expiry
T301	Call delivered	ALERTING received.	CONNECT received.	Clear the call.	—
T302	Overlap receiving	SETUP ACK sent. Receipt of INFO restarts T302.	Sending Complete indication; or internal alerting; or internal connection; or a determination that sufficient information has been received.	Clear the call if call information incomplete; otherwise, send CALL PROCEEDING.	—
T303	Call initiated	SETUP sent.	ALERTING, CONNECT, CALL PROCEEDING, RELEASE COMPLETE, or SETUP ACK received.	Retransmit SETUP; Restart T303. If RELEASE COMPLETE has been received, clear the call.	Clear internal connection. Send RELEASE COMPLETE; Enter null state.