Cisco™ Internetwork Troubleshooting (CIT) Output Review

Designed for Version 4.0 of the CIT exam

The output listed below is commonly referenced on the CIT version 4.0 exam, do your best to memorize the fields and what they mean, because it is highly probable you will be tested on them. This output is primary derived from CCO, but is provided here for your convienence.

DEBUG ISDN Q921

Sample Debug ISDN Q921 Output--Outgoing Call

```
router# debug isdn q921
Nov 15 9:53:24.475: ISDN BR0: TX -> INFOc sapi = 0 tei = 64 ns = 5 nr = 2 i =
0x08010705040288901801837006803631383835
Nov 15 9:53:24.503: ISDN BR0: RX <- RRr sapi = 0 tei = 64 nr = 6
Nov 15 9:53:24.527: ISDN BR0: RX <- INFOc sapi = 0 tei = 64 ns = 2 nr = 6 i =
0x08018702180189
Nov 15 9:53:24.535: ISDN BR0: TX -> RRr sapi = 0 tei = 64 nr = 3
Nov 15 9:53:24.643: ISDN BR0: RX <- INFOc sapi = 0 tei = 64 ns = 3 nr = 6 i = 0x08018707
Nov 15 9:53:24.655: ISDN BR0: TX -> RRr sapi = 0 tei = 64 nr = 4
%LINK-3-UPDOWN: Interface BRI0:1, changed state to up
Nov 15 9:53:24.683: ISDN BR0: TX -> INFOc sapi = 0 tei = 64 ns = 6 nr = 4 i = 0x0801070F
Nov 15 9:53:24.699: ISDN BR0: RX <- RRr sapi = 0 tei = 64 nr = 7
%LINEPROTO-5-UPDOWN: Line protocol on Interface BRI0:1, changed state to up
%ISDN-6-CONNECT: Interface BRI0:1 is now connected to 61885 goodie
Nov 15 9:53:34.415: ISDN BR0: RX <- RRp sapi = 0 tei = 64 nr = 7
Nov 15 9:53:34.419: ISDN BR0: TX -> RRf sapi = 0 tei = 64 nr = 4
```

In the following lines from “debug isdn q921” the seventh and eighth most significant hexadecimal numbers indicate the type of message. 0x05 indicates a Call Setup message, 0x02 indicates a Call Proceeding message, 0x07 indicates a Call Connect message, and 0x0F indicates a Connect Ack message.

A router can be the calling or called party of the ISDN Q.921 data link layer access procedures. If the router is the calling party, the command displays information about an outgoing call. If the router is the called party, the command displays information about an incoming call and the keepalives.

Sample Debug ISDN Q921 Output--Incoming Call

```
router# debug isdn q921
Nov 15 9:53:22.507: ISDN BR0: TX ->  RRp sapi = 0  tei = 64 nr = 0
Nov 15 9:53:22.523: ISDN BR0: RX <-  RRf sapi = 0  tei = 64  nr = 2
Nov 15 9:53:32.527: ISDN BR0: TX ->  RRp sapi = 0  tei = 64 nr = 0
Nov 15 9:53:32.543: ISDN BR0: RX <-  RRf sapi = 0  tei = 64  nr = 2
Nov 15 9:53:42.067: ISDN BR0: RX <-  RRp sapi = 0  tei = 64 nr = 2
Nov 15 9:53:42.071: ISDN BR0: TX ->  RRf sapi = 0  tei = 64  nr = 0
Nov 15 9:53:47.307: ISDN BR0: RX <-  UI sapi = 0  tei = 127
                              i = 0x08011F05040288901801897006C13631383836
    %LINK-3-UPDOWN: Interface BRI0:1, changed state to up
Nov 15 9:53:47.347: ISDN BR0: TX ->  INFOc sapi = 0  tei = 64  ns = 2  nr = 0
                              i = 0x08019F07180189
Nov 15 9:53:47.367: ISDN BR0: RX <-  RRr sapi = 0  tei = 64  nr = 3
Nov 15 9:53:47.383: ISDN BR0: RX <-  INFOc sapi = 0  tei = 64  ns = 0  nr = 3
                              i = 0x08011F0F180189
Nov 15 9:53:47.391: ISDN BR0: TX ->  RRr sapi = 0  tei = 64  nr = 1
%LINEPROTO-5-UPDOWN: Line protocol on Interface BRI0:1, changed state to up
```

Nov 15 9:53:47.391 - the date and time The time is maintained by an internal clock on the router.

TX – indicates the frame originated from the ISDN router

RX – indicates the frame originated elsewhere (outside)

IDREQ – type type of Identity Request message sent from the local router to the network (assignment source point [ASP]) during the automatic terminal endpoint identifier (TEI) assignment procedure. This message is sent in a UI command frame. The service access point identifier (SAPI) value for this message type is always 63 (indicating that it is a Layer 2 management procedure) but it is not displayed. The TEI value for this message type is 127 (indicating that it is a broadcast operation).

ri = 31815 – is the reference number used to differentiate between user devices requesting TEI assignment. This value is a randomly generated number between 0 and 65535. The same ri value sent in the IDREQ message should be returned in the corresponding IDASSN message. Note that a Reference number of 0 indicates that the message is sent from the network side management layer entity and a reference number has not been generated.

ai = 127 - Indicates the Action indicator used to request that the ASP assign any TEI value. It is always 127 for the broadcast TEI. Note that in some message types, such as IDREM, a specific TEI value is indicated.

IDREM - Indicates the Identity Remove message type sent from the ASP to the user side layer management entity during the TEI removal procedure. This message is sent in a UI command frame. The message includes a reference number that is always 0, because it is not responding to a request from the local router. The ASP sends the Identity Remove message twice to avoid message loss.

IDASSN - Indicates the Identity Assigned message type sent from the ISDN service provider on the network to the local router during the automatic TEI assignment procedure. This message is sent in a UI command frame. The SAPI value for this message type is always 63 (indicating that it is a Layer 2 management procedure). The TEI value for this message type is 127 (indicating it is a broadcast operation).

ai = 64 - Indicates the TEI value automatically assigned by the ASP. This TEI value is used by data link layer entities on the local router in subsequent communication with the network. The valid values are in the range 64 to 126.

SABME - Indicates the set asynchronous balanced mode extended command. This command places the recipient into modulo 128 multiple frame acknowledged operation. This command also indicates that all exception conditions have been cleared. The SABME command is sent once a second for N200 times (typically three times) until its acceptance is confirmed with a UA response. For a list and brief description of other commands and responses that can be exchanged between the data link layer entities on the local router and the network, see ITU-T Recommendation Q.921.

sapi = 0 - Identifies the service access point at which the data link layer entity provides services to Layer 3 or to the management layer. A SAPI with the value 0 indicates it is a call control procedure. Note that the Layer 2 management procedures such as TEI assignment, TEI removal, and TEI checking, which are tracked with the debug isdn q921 command, do not display the corresponding SAPI value; it is implicit. If the SAPI value were displayed it would be 63.

Tei = 90 - Indicates the TEI value automatically assigned by the ASP. This TEI value will be used by data link layer entities on the local router in subsequent communication with the network. The valid values are in the range 64 to 126.

IDCKRQ - Indicates the Identity Check Request message type sent from the ISDN service provider on the network to the local router during the TEI check procedure. This message is sent in a UI command frame. The ri field is always 0. The ai field for this message contains either a specific TEI value for the local router to check or 127, which indicates that the local router should check all TEI values.

IDCKRP - Indicates the Identity Check Response message type sent from the local router to the ISDN service provider on the network during the TEI check procedure. This message is sent in a UI command

frame in response to the IDCKRQ message. The ri field is a randomly generated number between 0 and 65535.
The ai field for this message contains the specific TEI value that has been checked.
UAf - verifies that the network side has accepted the SABME command previously sent by the local router. The final bit is set to 1.
INFOc - Indicates that this is an Information command. It is used to transfer sequentially numbered frames containing information fields that are provided by Layer 3. The information is transferred across a datalink connection.
INFORMATION pd = 8 callref = (null) Indicates the information fields provided by Layer 3. The information is sent one frame at a time. If multiple frames need to be sent, several Information commands are sent. The pd value is the protocol discriminator. The value 8 indicates it is call control information. The call reference number is always null for SPID information.
SPID information i = 0x343135393033383336363031 - Indicates the service profile identifier (SPID). The local router sends this information to the ISDN switch to indicate the services to which it subscribes. SPIDs are assigned by the service provider and are usually 10-digit telephone numbers followed by optional numbers. Currently, only the DMS-100 switch supports SPIDs, one for each B channel. If SPID information is sent to a switch type other than DMS-100, an error may be displayed in the debug information.
ns = 0 -the send sequence number of transmitted I frames.
nr = 0 - Indicates the expected send sequence number of the next received I frame. At time of transmission, this value should be equal to the value of ns. The value of nr is used to determine whether frames need to be retransmitted for recovery.
RRr - Indicates the Receive Ready response for unacknowledged information transfer. The RRr is a response to an INFOc.
RRp - Indicates the Receive Ready command with the poll bit set. The data link layer entity on the user side uses the poll bit in the frame to solicit a response from the peer on the network side.
RRf - Indicates the Receive Ready response with the final bit set. The data link layer entity on the network side uses the final bit in the frame to indicate a response to the poll.
sapi - Indicates the service access point identifier. The SAPI is the point at which data link services are provided to a network layer or management entity. Currently, this field can have the value 0 (for call control procedure) or 63 (for Layer 2 management procedures).
tei - Indicates the terminal endpoint identifier (TEI) that has been assigned automatically by the assignment source point (ASP) (also called the layer management entity on the network side). The valid range is 64 to 126. The value 127 indicates a broadcast.

DEBUG ISDN Q931

Using **debug isdn q931 t**he router tracks only activities that occur on the user side, not the network side, of the network connection. The display information **debug isdn q931** command output is limited to commands and responses exchanged during peer-to-peer communication carried over the D channel. This debug information does not include data transmitted over the B channels, which are also part of the router's ISDN interface. The peers (network layers) communicate with each other via an ISDN switch over the D channel.

Sample Debug ISDN Q931 Output--Call Setup Procedure for an Incoming Call

```
router# debug isdn q931
RX <- SETUP pd = 8 callref = 0x06
 Bearer Capability i = 0x8890
 Channel ID i = 0x89
 Calling Party Number i = 0x0083, '81012345678902'
TX -> CONNECT pd = 8 callref = 0x86
```

```
RX <- CONNECT_ACK pd = 8 callref = 0x06
```

Sample Debug ISDN Q931 Output--Call Teardown Procedure from the Network

```
router# debug isdn q931
TX -> DISCONNECT pd = 8 callref = 0x05
 Cause i = 0x879081
RX <- RELEASE pd = 8 callref = 0x85
 Looking Shift to Codeset 6
 Codeset 6 IE 0x1 1 0x82 '10'
TX <- RELEASE_COMP pd = 8 callref = 0x05
```

Sample Debug ISDN Q931 Output--Call Setup Procedure for an Outgoing Call

```
router# debug isdn q931
TX -> SETUP pd = 8 callref = 0x04
 Bearer Capability i = 0x8890
 Channel ID i = 0x83
 Called Party Number i = 0x80, '415555121202'
RX <- CALL_PROC pd = 8 callref = 0x84
 Channel ID i = 0x89
RX <- CONNECT pd = 8 callref = 0x84
TX -> CONNECT_ACK pd = 8 callref = 0x04....
Success rate is 0 percent (0/5)
```

TX - Indicates that this message is being transmitted from the local router (user side) to the network side of the ISDN interface.
RX - Indicates that this message is being received by the user side of the ISDN interface from the network side.
SETUP - Indicates that the SETUP message type has been sent to initiate call establishment between peer network layers. This message can be sent from either the local router or the network.
pd - Indicates the protocol discriminator. The protocol discriminator distinguishes messages for call control over the user-network ISDN interface from other ITU-T-defined messages, including other Q.931messages. The protocol discriminator is 8 for call control messages such as SETUP. For basic-1tr6, the protocol discriminator is 65.
callref - Indicates the call reference number in hexadecimal. The value of this field indicates the number of calls made from either the router (outgoing calls) or the network (incoming calls). Note that the originator of the SETUP message sets the high-order bit of the call reference number to 0. The destination of the connection sets the high-order bit to 1 in subsequent call control messages, such as the CONNECT message. For example, callref = 0x04 in the request becomes callref = 0x84 in the response.
Bearer Capability - Indicates the requested bearer service to be provided by the network. Refer to Table B-4 in the "ISDN Switch Types, Codes, and Values" appendix for detailed information about bearer capability values.
i= - Indicates the Information Element Identifier. The value depends on the field it is associated with. Refer to the ITU-T Q.931 specification for details about the possible values associated with each field for which this identifier is relevant.
Channel ID - Indicates the Channel Identifier. The value 83 indicates any channel, 89 indicates the B1 channel, and 8A indicates the B2 channel. For more information about the Channel Identifier, refer to ITU-T Recommendation Q.931.
Called Party Number - Identifies the called party. This field is only present in outgoing SETUP messages. Note that it can be replaced by the Keypad facility field. This field uses the IA5 character set.

Calling Party Number - Identifies the origin of the call. This field is present only in incoming SETUP messages. This field uses the IA5 character set.
CALL_PROC - Indicates the CALL PROCEEDING message; the requested call setup has begun and no more call setup information will be accepted.
CONNECT - Indicates that the called user has accepted the call.
CONNECT_ACK - Indicates that the calling user acknowledges the called user's acceptance of the call.
DISCONNECT - Indicates either that the user side has requested the network to clear an end-to-end connection or that the network has cleared the end-to-end connection.
Cause - Indicates the cause of the disconnect. Refer to Table B-2 and Table B-3 in the "ISDN Switch Types, Codes, and Values" appendix for detailed information about DISCONNECT cause codes and RELEASE cause codes.
Looking Shift to Codeset 6 - Indicates that the next information elements will be interpreted according to information element identifiers assigned in codeset 6. Codeset 6 means that the information elements are specific to the local network.
Codeset 6 IE 0x1 i = 0x82, '10' - Indicates charging information. This information is specific to the NTT switch type and may not be sent by other switch types.
RELEASE - Indicates that the sending equipment will release the channel and call reference. The recipient of this message should prepare to release the call reference and channel.
RELEASE_COMP - Indicates that the sending equipment has received a RELEASE message and has now released the call reference and channel.

Show Buffers

Syntax: show buffers [interface [type number]] [alloc [dump]]

```
Router# show buffers
Buffer elements:
          421 in free list (500 max allowed)
          409 hits, 0 misses, 0 created
      Public buffer pools:
     Small buffers, 104 bytes (total 50, permanent 50):
          50 in free list (20 min, 150 max allowed)
          277 hits, 0 misses, 0 trims, 0 created
     Middle buffers, 600 bytes (total 25, permanent 25):
          24 in free list (10 min, 75 max allowed)
          19 hits, 0 misses, 0 trims, 0 created
     Big buffers, 1524 bytes (total 50, permanent 50):
          50 in free list (5 min, 40 max allowed)
          4 hits, 0 misses, 0 trims, 0 created
     Large buffers, 5024 bytes (total 0, permanent 0):
          0 in free list (0 min, 10 max allowed)
          0 hits, 0 misses, 0 trims, 0 created
     Huge buffers, 18024 bytes (total 0, permanent 0):
          0 in free list (0 min, 4 max allowed)
          0 hits, 0 misses, 0 trims, 0 created
      Interface buffer pools:
     Fddi buffers, 5024 bytes (total 256, permanent 256):
          0 in free list (0 min, 256 max allowed)
          256 hits, 0 misses
          256 max cache size, 110 in cache
          14 buffer threshold, 0 threshold transitions
     Ethernet0 buffers, 1524 bytes (total 64, permanent 64):
          16 in free list (0 min, 64 max allowed)
          48 hits, 0 misses
          16 max cache size, 16 in cache
     Ethernet1 buffers, 1524 bytes (total 64, permanent 64):
          16 in free list (0 min, 64 max allowed)
          48 hits, 0 misses
          16 max cache size, 16 in cache
     Serial0 buffers, 1524 bytes (total 64, permanent 64):
          16 in free list (0 min, 64 max allowed)
          48 hits, 0 misses
          16 max cache size, 16 in cache
     Serial1 buffers, 1524 bytes (total 64, permanent 64):
          16 in free list (0 min, 64 max allowed)
          48 hits, 0 misses
          16 max cache size, 16 in cache
     0 failures (0 no memory)
```

Buffer elements - Buffer elements are small structures used as placeholders for buffers in internal operating system queues. Buffer elements are used when a buffer may need to be on more than one queue.
-- in free list (-- max allowed) - Maximum number of buffers that are available for allocation.
hits – number of successful attempts to allocate a buffer when needed.
misses – number of attempts that resulted in growing the buffer pool in order to allocate a buffer.
created – number of new buffers created to satisfy buffer allocation attempts when the available buffers in the pool have already been allocated.
Small buffers - Blocks of memory used to hold network packets. The sizes of these buffers can vary as follows: small, middle, big, large and huge.
bytes - Size of this type of buffer.
(total , permanent) - Total number of this type of buffer, and the number of these buffers that are permanent (cannot be deallocated).
trims - Number of buffers released to the system because they were not being used. This field is displayed only for dynamic buffer pools, not interface buffer pools, which are static.
created – Number of new buffers created in response to misses. This field is displayed only for dynamic buffer pools, not interface buffer pools, which are static.
failures - Total number of allocation requests that have failed because no buffer was available for allocation; the datagram was lost. Such failures normally occur at interrupt level.
(no memory) - Number of failures because no memory was available to create a new buffer.

Note: it is also a good idea to take a look at the following commands (planned for possible inclusion later).
Show buffers all

show memory [type] [free]

Syntax Description
type -(Optional) Memory type to display (processor, multibus, io, sram). If type is not specified, statistics for all memory types present in the communication server will be displayed.
free - (Optional) Displays free memory statistics

cs# show memory

```
               Head  FreeList    Total(b)     Used(b)     Free(b)  Largest(b)
Processor    2E0FF8    2AABFC    13758472      847216    12911256    12908036
          Processor memory
Address   Bytes Prev.   Next     Ref  PrevF   NextF   Alloc PC  What
2E0FF8     2128 0       2E1848     1                  84352     *Init*
2E1848     2052 2E0FF8  2E204C     1                  86184     *Init*
2E204C      564 2E1848  2E2280     1                  861B0     *Init*
2E2280     2052 2E204C  2E2A84     1                  1266      *Init*
2E2A84      308 2E2280  2E2BB8     1                  44974     *Init*
2E2BB8      220 2E2A84  2E2C94     1                  3F788     *Init*
2E2C94     2052 2E2BB8  2E3498     1                  3F7A8     *Init*
2E3498     4052 2E2C94  2E446C     1                  46770     *Init*
2E446C      516 2E3498  2E4670     1                  44E4C     *Packet Buffer*
2E4670      516 2E446C  2E4874     1                  44E4C     *Packet Buffer*
2E4874      516 2E4670  2E4A78     1                  44E4C     *Packet Buffer*
2E4A78      516 2E4874  2E4C7C     1                  44E4C     *Packet Buffer*
2E4C7C      516 2E4A78  2E4E80     1                  44E4C     *Packet Buffer*
2E4E80      516 2E4C7C  2E5084     1                  44E4C     *Packet Buffer*
2E5084      516 2E4E80  2E5288     1                  44E4C     *Packet Buffer*
```

```
2E5288      516 2E5084  2E548C     1                  44E4C     *Packet Buffer*
2E548C      516 2E5288  2E5690     1                  44E4C     *Packet Buffer*
2E5690      516 2E548C  2E5894     1                  44E4C     *Packet Buffer*
```

Address - Hexadecimal address of block
Bytes - Size of block in bytes
Prev. - Address of previous block (should match Address on previous line)
Next - Address of next block (should match address on next line)
Ref - Reference count for that memory block, indicating how many different processes are using that block of memory
PrevF - Address of previous free block (if free)
NextF - Address of next free block (if free)
Alloc - PC Address of the system call that allocated the block
What - Name of process that owns the block, or "(fragment)" if the block is a fragment, or "(coalesced)" if the block was coalesced from adjacent free blocks

See a show or debug command we forgot? Send email to cit@networkstudyguides.com