PGW 2200 Softswitch TCAP Release 9.3 and Later

Document ID: 61183

Contents

Introduction

Transaction Capabilities Applications Part (TCAP) provides support for interactive applications in a distributed environment. TCAP defines an end−to−end protocol between its users. This may be located in an SS7 network or another network that supports TCAP (IP).

Prerequisites

Requirements

Readers of this document should have knowledge of:

- Cisco Media Gateway Controller Release 9

Components Used

The information in this document is based on the Cisco PGW 2200 Softswitch.

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

Conventions

For more information on document conventions, refer to the Cisco Technical Tips Conventions.

Background Information

The TCAP protocol consists of two sub−layers:

- Component sub−layer
- Transaction sub−layer

The component sub−layer interfaces with the conversion engine. The conversion engine is the equivalent of a service user or subsystem number (SSN). The component sub−layer supports these services:

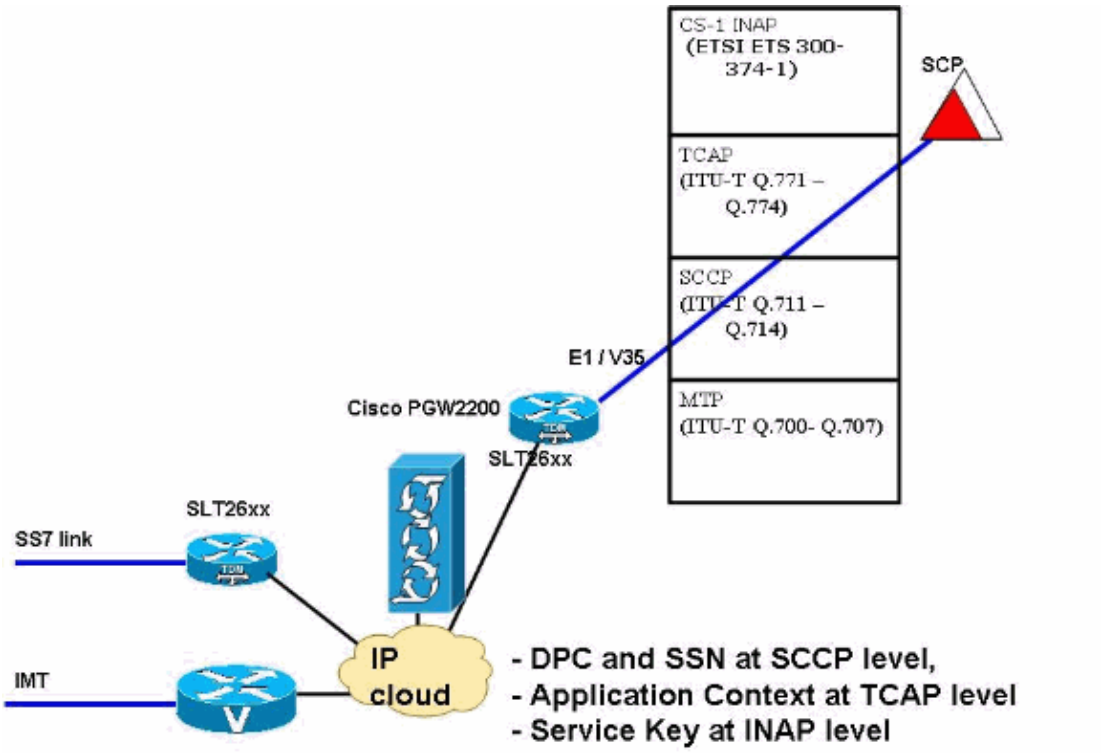
- Association of operations and replies.
- Abnormal situation handling.

The transaction sub−layer interfaces with Signalling Connection Control Part (SCCP). TCAP only supports a connectionless network service. The transaction sub−layer communicates with SCCP through the connectionless interface.

TCAP software uses the services of SCCP software to route the messages to the TCAP user in the destination node. The interface between the TCAP and the SCCP software is tightly coupled. Each TCAP request from the engine contains a global title and destination subsystem number. TCAP provides the subsystem number to SCCP for the Signal Transfer Points (STP) code look−up. If the SS7 addresses and routes are configured correctly and fully operational, troubleshoot the SCCP and TCAP information passed and received between the Cisco PGW 2200 and a remote SCCP or TCAP peer.

The Cisco PGW 2200 uses the SCCP to encapsulate TCAP queries for transport out Message Transfer Part (MTP). This SCCP communication between peers is sent without a connection over MTP. The Cisco PGW 2200 uses the SCCP Unidata (UDT) to send data to the remote SCCP node for connectionless communication. The PGW 2200 receives a valid response when the SCCP UDT message is delivered successfully. This is typically in the form of a UDT message. The exchange of these UDT messages facilitates the connectionless communication between the PGW 2200 and the remote SCCP peer (such as Service Control Point [SCP] for TCAP data base lookups). The PGW 2200 defines an optional field in the UDT that states the SCCP peer should "return on error" the contents of any message it sends to the remote node if the UDT message is undeliverable. The Unidata service (UDTS) message is used to facilitate this error response. The UDTS message indicates to the PGW 2200 that a UDT message received at the remote node (such as STP or SCP) cannot be delivered to the destination.

Cisco PGW 2200 Concept Setup



TCAP Resolution

The SCCP messaging (UDT/UDTS) discussed in the Background Information section is critical when you troubleshoot TCAP services and functionality. Resolve any problems at the SCCP layer before you troubleshoot TCAP data sent or received. The format of the UDT and the UDTS message is shown in Appendix C.

Use these Cisco PGW 2200 tools to debug calls that require the TCAP (TCAP / SCCP) services:

- Sniffer the Ethernet line with tools such as Ethereal, UNIX snoop, and Snooper.
- Platform.log TCAP trace on the PGW 2200.
- MDL Trace Tool for call processing at the protocol level.

Sniffer the Ethernet Line

The Cisco PGW 2200 uses Reliable UDP (RUDP) to send MTP3 and upper layer SS7 messages between the local MTP1 and MTP2 devices (such as a Signaling Link Terminal [SLT]). This communication is typically done over port 7000 on the Cisco PGW 2200 local Ethernet interface. This is configurable. Refer to the configuration guide for details on configuring the PGW "stPort" ports in XECfgParm.dat.

You can use any Ethernet sniffer to view the packets sent between the Cisco PGW 2200 and its local MTP2 control device. However, not all of them support the MTP and SCCP protocol used to display a decoded message. If an Ethernet sniffer is not available to the customer, use the UNIX **snoop** command to troubleshoot. The output of the **snoop** command is not user friendly, but is helpful in a worst case scenario.

An Ethernet sniffer that supports the SS7 protocol stack is preferred. It allows you to decode packets seen on the Cisco PGW 2200 Ethernet interface. An open source sniffer such as Ethereal can also be used and is available online.

If no commercial sniffer utility is available, issue the **snoop** command on the target Cisco PGW 2200 to see the hex data output of the messages sent to and from the Cisco PGW 2200. With root permission on the Cisco

PGW 2200, issue this command to see the hex data sent out of the configured 'stPort.' For additional information on the **snoop** command, refer to the 'snoop man pages' or the SUN Administrative guides.

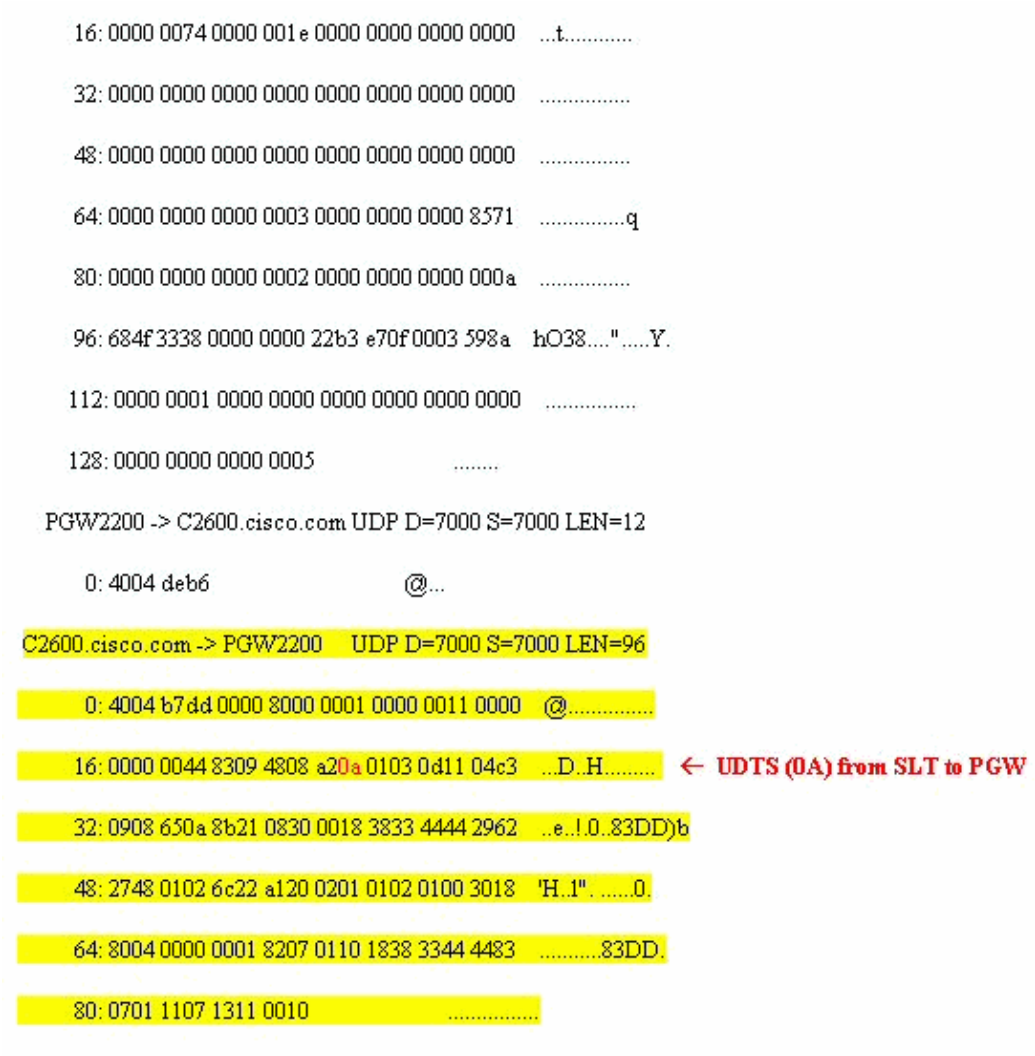
```
#snoop -d <ethernet device name> -x 42 port <stPort>
```

Issue this command to snoop the packets sent out the Ethernet device, hmeX, on port 7000.

```
#snoop -d hmeX -x 42 port 7000
```

This is example output of captured SS7 packets with the **snoop** command.

```
#snoop -d hme0 -x 42 port 7000

  PGW2200 -> C2600.cisco.com UDP D=7000 S=7000 LEN=96

      0: 4004 dcb5 0000 8000 0001 0000 0010 0000   @...............

     16: 0000 0044 8321 4802 3209 8003 0d11 0a8b   ...D.!H.2.....  <- UDT (09) to SLT from PGW

     32: 2108 3000 1838 3344 4404 c309 0865 2962   !.0..83DD....e)b

     48: 2748 0102 6c22 a120 0201 0102 0100 3018   'H..l". ......0.

     64: 8004 0000 0001 8207 0110 1838 3344 4483   ..........83DD.

     80: 0701 1107 1311 0010                       ........

  PGW2200 -> C2600.cisco.com UDP D=7000 S=7000 LEN=32

      0: 4004 ddb5 0000 8000 0001 0000 0044 0000   @...........D..

     16: 0000 0004 0000 0001                       ........

C2600.cisco.com -> PGW2200    UDP D=7000 S=7000 LEN=144

      0: 4004 b6dd 0000 8000 0001 0001 0045 0000   @...........E..

     16: 0000 0074 0000 001e 0000 0000 0000 0000   ...t............

     32: 0000 0000 0000 0000 0000 0000 0000 0000   ................

     48: 0000 0000 0000 0000 0000 0000 0000 0000   ................

      0: 4004 b6dd 0000 8000 0001 0001 0045 0000   @...........E..

     16: 0000 0074 0000 001e 0000 0000 0000 0000   ...t............
```



Cisco's Snooper can also be used (if available) to show the hex dump of the SCCP message. The SCCP message header is decoded but the display of the output is dependant on the version of Snooper chosen. The important point is that the message type is visible and gives an indication as to where to start to troubleshoot the call flow. The hex dump shows that message type `09` is a UDT message and message type `0a` is the UDTS service message that indicates an error. The direction of the message flow is also useful since the SS7 PCs are shown. If the rest of the hex dump is shown (depends on the snooper version) it can be used to further decode the SCCP and TCAP portions of message. This is based on the industry standards for SCCP and TCAP.

This is the Snooper output of the UDT SCCP message with TCAP data (to PSTN).

```
15:23:03.847052 1-001-1[02057]   1-004-1[02081]   ITU SCCP. -> UDT (09) CGPA=0103TCAPMsgType=   Pr:0 Ni:NTL
                                 09 80 03 07 0b 04 c3 21 08 0c 04 c3 09 08 67 52   .......!......gR
                                 62 50 48 01 1f 6b 22 28 20 06 07 00 11 86 05 01   bPH..k"( .......
                                 01 01 a0 15 60 13 80 02 07 80 a1 0d 06 0b 2a 81   ....`.........*.
                                 76 82 15 01 01 01 01 00 01 6c 27 a1 25 02 01 01   v........l'.%...
                                 02 01 00 30 1d 80 04 00 01 5f 91 82 08 83 10 65   ...0....._.....e
                                 27 32 54 76 0f 83 07 03 11 03 23 22 11 11 9a 02   '2Tv......#"....
                                 20 00                                             .
```

If there is an undeliverable SCCP UDT message sent from the Cisco PGW 2200 and / or an SCCP (on the remote node) has problems with the message, the Cisco PGW 2200 receives a UDTS response message. This message indicates a 'return cause' which is very useful in troubleshooting. The UDTS is message type 10 (or 0a hex).

This is an example of a UDTS SCCP message with TCAP data (from PSTN).

Note: This message is an example only and may not reflect an actual query response combination / sequence. The format and amount of information displayed varies depending on the Snooper version.

```
15:23:04.952706 1-004-1[02081]   1-001-1[02057]   ITU SCCP. -> UDTS (0a) CGPA=0012TCAPMsgType=0a
                                 Pr:0 Ni:NTL
                                 0a 01 03 0d 11 04 c3 09 08 65 0a 8b 21 08 30 00   .........g..!..v
                                 18 38 33 44 44 29 62 27 48 01 03 6c 22 a1 20 02   .etH.P...I..k*((.
                                 01 01 02 01 00 30 18 80 04 00 00 00 01 82 07 01   .........a......
                                 10 18 38 33 44 55 83 07 01 11 07 13 11 00 10      *.v.............
```

This Snooper output displays the IAM, UDT, UDTS, and REL sequence.

Note: This message is an example only and may not reflect an actual query response combination / sequence. The format and amount of information displayed varies depending on the Snooper version.

```
10:49:37.940189 1-022-1[02225]   1-001-1[02057]   ITU ISUP. -> IAM (01) CIC=00010 CDPN=8183334444 CGPN=7031110001
                                 SLS=00 Pr:0 Ni:NTL
10:49:37.962583 1-001-1[02057]   1-004-1[02081]   ITU SCCP. -> UDT (09) CGPA=0101TCAPMsgType=
                                 Pr:0 Ni:NTL
10:49:38.034121 1-004-1[02081]   1-001-1[02057]   ITU SCCP. -> UDTS (0a) CGPA=0068TCAPMsgType=
                                 Pr:0 Ni:NTL
10:49:38.052539 1-001-1[02057]   1-022-1[02225]   ITU ISUP. -> REL (0c) CIC=00010 Cause 31 = Normal, Unspecified
                                 SLS=00 Pr:0 Ni:NTL
```

This is an SS7 sniffer trace that includes SS7 SCCP and TCAP information.

```
------------------------------------------------------------------------
SCP(IN)- 19/03/04 18:01:54:223     SCCP     SCP(IN)  UDT     SCP(IN)  BGN INVK IDP
------------------------------------------------------------------------------
 Octet001  ITU-T SS7              Time=19/03/02 18:01:54:223
-------------------------------------------------------------------------------
 11010011  BIB/BSN                 1/83
 10010110  FIB/FSN                 1/22
 ..111111  SU type/length         MSU63
 00......  Spare                  0
-------------------------------------------------------------------------------
 Octet004  Service information octet
-------------------------------------------------------------------------------
 ....0011  Service indicator      SCCP Signalling Connection Control Part
 ..00....  Message priority       0
 10......  Network indicator      N  National network
-------------------------------------------------------------------------------
 Octet005  Routing label
-------------------------------------------------------------------------------
 ........  DPC                    10337 SCP(IN)
 ........  OPC                    10321
 0001....  SLS                    1
-------------------------------------------------------------------------------
 Octet009  Message type
-------------------------------------------------------------------------------
 00001001  Message type           UDT   Unitdata
-------------------------------------------------------------------------------
 Octet010  SCCP Protocol Class parameter
-------------------------------------------------------------------------------
 ....0001  Protocol class         Class 1
 0000....  Message handling       No special options
 00000011  Ptr -> Called number   3
 00000111  Ptr -> Calling #       7
 00001011  Pointer -> Data        11
-------------------------------------------------------------------------------
 Octet014  SCCP Called Party Address parameter
-------------------------------------------------------------------------------
 00000100  Parameter length       4
 .......1  Sgnl pt code bit       SPC present
 ......1.  Subsystem # bit        SSN present
 ..0000..  Global title ind       No global title included
 .1......  Routing bit            DPC and SSN based routing
 0.......  Reserved natl use      0
 ........  Point code             10337 SCP(IN)
 00......  Spare                  0
 11111100  Subsystem number       INAP     IN-CS1+
-------------------------------------------------------------------------------
 Octet019  SCCP Calling Party Address parameter
-------------------------------------------------------------------------------
 00000100  Parameter length       4
 .......1  Sgnl pt code bit       SPC present
 ......1.  Subsystem # bit        SSN present
 ..0000..  Global title ind       No global title included
 .1......  Routing bit            DPC and SSN based routing
 0.......  Reserved natl use      0
 ........  Point code             10321
 00......  Spare                  0
 11111100  Subsystem number       INAP      IN-CS1+
-------------------------------------------------------------------------------
 Octet024  SCCP Data parameter
-------------------------------------------------------------------------------
 01100001  Parameter length       97
 01100010  Tag                    BGN Begin, constructor, application-wide
 01011111  Length                 95
-------------------------------------------------------------------------------
```

```
Octet027  Originating Transaction ID
--------------------------------------------------------------------------------
...01000  Tag                    Originating Transaction ID
010.....  Class and form         Application-wide, primitive
00000011  Length                 3
........  Originating ID        F30051
--------------------------------------------------------------------------------
Octet032  TCAP Dialogue Portion
--------------------------------------------------------------------------------
...01011  Tag                    TCAP Dialogue Portion
011.....  Class and form         Application-wide, constructor
00100011  Length                 35
--------------------------------------------------------------------------------
Octet034  TCAP External
--------------------------------------------------------------------------------
...01000  Tag                    TCAP External
001.....  Class and form         Universal, constructor
00100001  Length                 33
--------------------------------------------------------------------------------
Octet036  Object identifier
--------------------------------------------------------------------------------
...00110  Tag                    Object identifier
000.....  Class and form         Universal, primitive
00000111  Length                 7
00000000  Organization           itu-t recommendation
00010001  q                     Q
........  773 (X'305)           773
00000001  as(1)                 1
00000001  Protocol data unit     dialogue PDU(1)
00000001  version(1)             1
10100000  Single-ASN.1-typeTag   Parameter
00010110  Length                 22
--------------------------------------------------------------------------------
Octet047  Dialogue request
--------------------------------------------------------------------------------
...00000  Tag                    Dialogue request
011.....  Class and form         Application-wide, constructor
00010100  Length                 20
--------------------------------------------------------------------------------
Octet049  Protocol-version
--------------------------------------------------------------------------------
...00000  Tag                    Protocol-version
100.....  Class and form         Context-specific, primitive
00000010  Length                 2
00000111  Unused Bit             07
.0000000  Unused Bit             00
1.......  Protocol Version       Version 1
--------------------------------------------------------------------------------
Octet053  Application-context-name
--------------------------------------------------------------------------------
...00001  Tag                    Application-context-name
101.....  Class and form         Context-specific, constructor
00001110  Length                 14
--------------------------------------------------------------------------------
Octet055  Object Identifier
--------------------------------------------------------------------------------
...00110  Tag                    Object identifier
000.....  Class and form         Universal, primitive
00001100  Length                 12
00101010  Protocol               ccitt identified-organization
10000110  SubProtocol            etsi
00111010  Domain                 inDomain
00000000  Network                in-Network
10001001  AC Name                ac (application context)
01100001  Service                cs1-ssp-to-scp(0)
00110011  Version                Reserved
```

```
........  Contents               01 00 01 00 01
-------------------------------------------------------------------------------
Octet069  TCAP Component Portion
-------------------------------------------------------------------------------
...01100  Tag                    TCAP Component Portion
011.....  Class and form         Application-wide, constructor
10000000  Length                 128
-------------------------------------------------------------------------------
Octet071  Invoke component
-------------------------------------------------------------------------------
...00001  Tag                    Invoke component
101.....  Class and form         Context-specific, constructor
00101111  Length                 47
-------------------------------------------------------------------------------
Octet073  Invoke ID
-------------------------------------------------------------------------------
...00010  Tag                    Invoke ID
000.....  Class and form         Universal, primitive
00000001  Length                 1
00000001  Invoke ID              01
-------------------------------------------------------------------------------
Octet076  Operation Code
-------------------------------------------------------------------------------
...00010  Tag                    Local
000.....  Class and form         Universal, primitive
00000001  Length                 1
........  Operation Code         IDP  InitialDP
-------------------------------------------------------------------------------
Octet079  Parameter Sequence
-------------------------------------------------------------------------------
...10000  Tag                    Parameter Sequence
001.....  Class and form         Universal, constructor
00100111  Length                 39
-------------------------------------------------------------------------------
Octet081  ServiceKey
-------------------------------------------------------------------------------
...00000  Tag                    ServiceKey
100.....  Class and form         Context-specific, primitive
00000001  Length                 1
........  Service key            94
-------------------------------------------------------------------------------
Octet084  CalledPartyNumber
-------------------------------------------------------------------------------
...00010  Tag                    CalledPartyNumber
100.....  Class and form         Context-specific, primitive
00000111  Length                 7
.0000011  Nature of address      National (significant) number( national use )
1.......  Odd/even               Odd number of address signals
....0000  Spare                  00
.001....  Numbering plan         ISDN (Telephony) numbering plan (Rec. E.164)
1.......  Internal network #     Routing to internal network number not allowed
........  Address signals       999956738
0000....  Filler                 0
-------------------------------------------------------------------------------
Octet093  CallingPartyNumber
-------------------------------------------------------------------------------
...00011  Tag                    CallingPartyNumber
100.....  Class and form         Context-specific, primitive
00000111  Length                 7
.0000011  Nature of address      National (significant) number( national use )
1.......  Odd/even               Odd number of address signals
......01  Screening Indicator    User provided, verified and passed
....00..  Presentation?          Presentation allowed
.001....  Numbering plan         ISDN (Telephony) numbering plan (Rec. E.164)
0.......  Number Incomplete?     Complete
........  Address signals       2199997137
```

```
0000....  Filler                0
-------------------------------------------------------------------------------
Octet102  CallingPartysCategory
-------------------------------------------------------------------------------
...00101  Tag                   CallingPartysCategory
100.....  Class and form        Context-specific, primitive
00000001  Length                1
00001010  CallngPartyCategory   Ordinary calling subscriber
-------------------------------------------------------------------------------
Octet105  ForwardCallIndicators
-------------------------------------------------------------------------------
...11010  Tag                   ForwardCallIndicators
100.....  Class and form        Context-specific, primitive
00000010  Length                2
.......0  Nat'l/International   Call to be treated as a national call
.....00.  End-to-end method     No end-to-end method available
....1...  Interworking          Interworking encountered
...0....  End-to-end info       No end-to-end information available
..1.....  ISUP indicator        ISDN user part used all the way
01......  ISUP preference       ISDN user part not required all the way
.......1  Orig ISDN access      Originating access ISDN
.....00.  SCCP method           No indication
....0...  Spare                 0
0000....  ReservedForNat'lUse   0
-------------------------------------------------------------------------------
Octet109  BearerCapability
-------------------------------------------------------------------------------
...11011  Tag                   BearerCapability
101.....  Class and form        Context-specific, constructor
00000101  Length                5
-------------------------------------------------------------------------------
Octet111  Bearer Cap
-------------------------------------------------------------------------------
...00000  Tag                   Bearer Cap
100.....  Class and form        Context-specific, primitive
-------------------------------------------------------------------------------
Octet112  User service information parameter
-------------------------------------------------------------------------------
00000011  Parameter length      3
-------------------------------------------------------------------------------
Octet113  User service info octet 3
-------------------------------------------------------------------------------
...00000  Transfer capability   Speech
.00.....  Coding standard       CCITT standardized coding
1.......  Extension bit         1
-------------------------------------------------------------------------------
Octet114  User service info octet 4
-------------------------------------------------------------------------------
...10000  Transfer rate         64 kbit/s
.00.....  Transfer mode         circuit mode
1.......  Extension bit         1
-------------------------------------------------------------------------------
Octet115  User service info octet 5
-------------------------------------------------------------------------------
...00011  Layer 1 protocol      Recommendation G.711 A-law
.01.....  Layer 1 Identifier    User information layer 1 protocol
1.......  Extension bit         1
-------------------------------------------------------------------------------
Octet116  CalledPartyNumber
-------------------------------------------------------------------------------
...00010  Tag                   CalledPartyNumber
110.....  Class and form        Private use, primitive
00000010  Length                2
.0000000  Nature of address     Spare
0.......  Odd/even              Even Number of Address signals
....1010  Spare                 0A
```

```
 .000....  Numbering plan         Spare (no interpretation)
 0.......  Internal network #     Routing to internal network number allowed
-------------------------------------------------------------------------------
 Octet120  End-of-contents
-------------------------------------------------------------------------------
 00000000  Tag                    00
 00000000  Length                 00
-------------------------------------------------------------------------------
 Checksum  CRC16.............  0001011001110111 hex=1677
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------


SCP(IN)- 19/03/04  18:01:54:269   SCCP   SCP(IN)   UDT    SCP(IN) CON INVK CUE

-------------------------------------------------------------------------------
 Octet001  ITU-T SS7              Time=19/03/02 18:01:54:269
-------------------------------------------------------------------------------
 10000001  BIB/BSN                 1/1
 10110010  FIB/FSN                 1/50
 ..111111  SU type/length         MSU63
 00......  Spare                  0
-------------------------------------------------------------------------------
 Octet004  Service information octet
-------------------------------------------------------------------------------
 ....0011  Service indicator      SCCP Signalling Connection Control Part
 ..00....  Message priority       0
 10......  Network indicator      N  National network
-------------------------------------------------------------------------------
 Octet005  Routing label
-------------------------------------------------------------------------------
 ........  DPC                    10321
 ........  OPC                    10337 SCP(IN)
 1010....  SLS                    10
-------------------------------------------------------------------------------
 Octet009  Message type
-------------------------------------------------------------------------------
 00001001  Message type           UDT   Unitdata
-------------------------------------------------------------------------------
 Octet010  SCCP Protocol Class parameter
-------------------------------------------------------------------------------
 ....0001  Protocol class         Class 1
 0000....  Message handling       No special options
 00000011  Ptr -> Called number   3
 00000111  Ptr -> Calling #       7
 00001011  Pointer -> Data        11
-------------------------------------------------------------------------------
 Octet014  SCCP Called Party Address parameter
-------------------------------------------------------------------------------
 00000100  Parameter length       4
 .......1  Sgnl pt code bit       SPC present
 ......1.  Subsystem # bit        SSN present
 ..0000..  Global title ind       No global title included
 .1......  Routing bit            DPC and SSN based routing
 0.......  Reserved natl use      0
 ........  Point code             10321 Matinha
 00......  Spare                  0
 11111100  Subsystem number       INAP     IN-CS1+
-------------------------------------------------------------------------------
 Octet019  SCCP Calling Party Address parameter
-------------------------------------------------------------------------------
 00000100  Parameter length       4
 .......1  Sgnl pt code bit       SPC present
 ......1.  Subsystem # bit        SSN present
 ..0000..  Global title ind       No global title included
```

```
.1......  Routing bit            DPC and SSN based routing
0.......  Reserved natl use      0
........  Point code             10337 SCP(IN)
00......  Spare                  0
11111100  Subsystem number       INAP     IN-CS1+
-------------------------------------------------------------------------------
Octet024  SCCP Data parameter
-------------------------------------------------------------------------------
01001001  Parameter length       73
01100101  Tag                    CON Continue, constructor, application-wide
01000111  Length                 71
-------------------------------------------------------------------------------
Octet027  Originating Transaction ID
-------------------------------------------------------------------------------
...01000  Tag                    Originating Transaction ID
010.....  Class and form         Application-wide, primitive
00000011  Length                 3
........  Originating ID        7A01B4
-------------------------------------------------------------------------------
Octet032  Destination Transaction ID
-------------------------------------------------------------------------------
...01001  Tag                    Destination Transaction ID
010.....  Class and form         Application-wide, primitive
00000011  Length                 3
........  Destination ID        F30051
-------------------------------------------------------------------------------
Octet037  TCAP Dialogue Portion
-------------------------------------------------------------------------------
...01011  Tag                    TCAP Dialogue Portion
011.....  Class and form         Application-wide, constructor
00101111  Length                 47
-------------------------------------------------------------------------------
Octet039  TCAP External
-------------------------------------------------------------------------------
...01000  Tag                    TCAP External
001.....  Class and form         Universal, constructor
00101101  Length                 45
-------------------------------------------------------------------------------
Octet041  Object identifier
-------------------------------------------------------------------------------
...00110  Tag                    Object identifier
000.....  Class and form         Universal, primitive
00000111  Length                 7
00000000  Organization           itu-t recommendation
00010001  q                      Q
........  773 (X'305)            773
00000001  as(1)                  1
00000001  Protocol data unit     dialogue PDU(1)
00000001  version(1)             1
10100000  Single-ASN.1-typeTag   Parameter
00100010  Length                 34
-------------------------------------------------------------------------------
Octet052  Dialogue response
-------------------------------------------------------------------------------
...00001  Tag                    Dialogue response
011.....  Class and form         Application-wide, constructor
00100000  Length                 32
-------------------------------------------------------------------------------
Octet054  Protocol-version
-------------------------------------------------------------------------------
...00000  Tag                    Protocol-version
100.....  Class and form         Context-specific, primitive
00000010  Length                 2
00000111  Unused Bit             07
.0000000  Unused Bit             00
1.......  Protocol Version       Version 1
```

```
-------------------------------------------------------------------------------
 Octet058  Application-context-name
-------------------------------------------------------------------------------
 ...00001  Tag                    Application-context-name
 101.....  Class and form         Context-specific, constructor
 00001110  Length                 14
-------------------------------------------------------------------------------
 Octet060  Object Identifier
-------------------------------------------------------------------------------
 ...00110  Tag                    Object identifier
 000.....  Class and form         Universal, primitive
 00001100  Length                 12
 00101010  Protocol               ccitt identified-organization
 10000110  SubProtocol            etsi
 00111010  Domain                 inDomain
 00000000  Network                in-Network
 10001001  AC Name                ac (application context)
 01100001  Service                cs1-ssp-to-scp(0)
 00110011  Version                Reserved
 ........  Contents               01 00 01 00 01
-------------------------------------------------------------------------------
 Octet074  Result
-------------------------------------------------------------------------------
 ...00010  Tag                    Result
 101.....  Class and form         Context-specific, constructor
 00000011  Length                 3
-------------------------------------------------------------------------------
 Octet076  Integer
-------------------------------------------------------------------------------
 ...00010  Tag                    Integer
 000.....  Class and form         Universal, primitive
 00000001  Length                 1
 ........  Value                  accepted
-------------------------------------------------------------------------------
 Octet079  Result-source-diagnostic
-------------------------------------------------------------------------------
 ...00011  Tag                    Result-source-diagnostic
 101.....  Class and form         Context-specific, constructor
 00000101  Length                 5
-------------------------------------------------------------------------------
 Octet081  Dialogue service user
-------------------------------------------------------------------------------
 ...00001  Tag                    Dialogue service user
 101.....  Class and form         Context-specific, constructor
 00000011  Length                 3
-------------------------------------------------------------------------------
 Octet083  Integer
-------------------------------------------------------------------------------
 ...00010  Tag                    Integer
 000.....  Class and form         Universal, primitive
 00000001  Length                 1
 ........  Value                  Null
-------------------------------------------------------------------------------
 Octet086  TCAP Component Portion
-------------------------------------------------------------------------------
 ...01100  Tag                    TCAP Component Portion
 011.....  Class and form         Application-wide, constructor
 10000000  Length                 128
-------------------------------------------------------------------------------
 Octet088  Invoke component
-------------------------------------------------------------------------------
 ...00001  Tag                    Invoke component
 101.....  Class and form         Context-specific, constructor
 00000110  Length                 6
-------------------------------------------------------------------------------
 Octet090  Invoke ID
```

```
-------------------------------------------------------------------------------
 ...00010  Tag                    Invoke ID
 000.....  Class and form         Universal, primitive
 00000001  Length                 1
 00000001  Invoke ID              01
-------------------------------------------------------------------------------
 Octet093  Operation Code
-------------------------------------------------------------------------------
 ...00010  Tag                    Local
 000.....  Class and form         Universal, primitive
 00000001  Length                 1
 ........  Operation Code         CUE  Continue
-------------------------------------------------------------------------------
 Octet096  End-of-contents
-------------------------------------------------------------------------------
 00000000  Tag                    00
 00000000  Length                 00
-------------------------------------------------------------------------------
 Checksum  CRC16.............  0011010011100010 hex=34E2
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
```

Troubleshoot Tip: UDTS Return Cause

For a UDTS message, the 'return cause' is the first byte after the message type `0a`. This value helps determine why the STP / SCP sends a UDTS error response. If this information is not visible in the sniffer, proceed to the Platform.log TCAP Trace section in order to enable TCAP traces in the Cisco PGW 2200 log.

Platform.log TCAP Trace

MML allows a user to start a TCAP trace that dumps `<Trace>` messages for the TCAP channel controller into /opt/CiscoMGC/var/log/platform.log. A TCAP trace allows the user to see the TCAP / SCCP messages sent to the SS7 channel controller to route out to the SS7 switch over MTP3. See Appendix E for the message flow of a TCAP query through the PGW 2200 software.

TCAP tracing is started via mml with the **sta−tcap−trc** command. In order to capture the relevant information, enable debug logging for the TCAP and SS7 channel controller.

This is an example of how to enable a TCAP trace:

```
mml> set-log:TCAP-01:debug,confirm

   MGC-01 - Media Gateway Controller 2004-03-26 11:17:31.503 EST

M  COMPLD

   "TCAP-01"

   ;

mml> set-log:ss7-i-1:debug,confirm

   MGC-01 - Media Gateway Controller 2004-03-26 11:17:40.715 EST

M  COMPLD

   "ss7-i-1"

   ;

mml> sta-tcap-trc
```

```
   MGC-01 - Media Gateway Controller 2004-03-26 11:05:27.040 EST

M  RTRV

   SROF

   "TCAP-01"

   /* Component already started */

   ;
```

Note: Debug logging can have an effect on system performance and should not be used in a production environment under high call volume. Please plan your maintenance window accordingly.

TCAP Messages Sent by the Cisco PGW 2200

Once an `IN_TRIGGER` is sent to the engine, the engine beings to send the message out of the PGW 2200. Information passed down from the protocol level is relayed to the TCAP channel controller. The TCAP portion is sent down to the SCCP channel controller. Also, a log is created in platform.log to indicate a TCAP message was 'transmitted'. From the previous UDT message (shown in the sniffer portion of this document) you can see how the PGW 2200 logs information related to this same message in the platform.log. This platform log matches the data content shown in the Sample SCCP Message Breakdown: Unitdata / Unitdata Service table in Appendix C. From this table, the first value is the data length value (52 hex = 82 decimal). The actual TCAP data portion follows the message length. In the event that sniffer or snooper is not available, this platform.log can be used to view / debug TCAP and SCCP transactions.

Troubleshoot Tip: If the TCAP message is not sent down to SCCP, there is a problem at the MDL or Engine level. Troubleshoot the MDL trace and look at the `Ltrigger` and `LTriggerRelease` signal.

This output shows the PGW 2200 log sending TCAP down stack to SCCP/MTP.

```
Thu Dec  4 15:23:03:837 2003 EST | TCAP (PID 9513) <Trace>
PROT_TRACE_TCAP_PDU_TX: Hex dump of TCAP message transmitted, SSN=103,
LEN=82,
 62 50 48  1 1f 6b 22 28 20 6  7  0 11 86  5  1   1  1 a0 15 60 13 80  2  7 80 a1  d  6  b 2a 81 76 82 15
 1  1  1  1  0  1 6c 27 a1 25  2  1  1  2  1  0 30 1d 80  4  0  1 5f 91 82  8 83 10 65  27 32 54 76  f 83  7  3
 11  3 23 22 11 11 9a  2  20  0
```

After TCAP sends the message to SCCP, the SS7 channel controller plays `RECEIVED MSG FROM SCCP` and logs the hex representation of the message to indicate receipt of the message. This hex dump includes the SCCP and TCAP portions as shown in this output.

```
Thu Dec  4 15:23:03:846 2003 EST | ss7-i-1 (PID 9518) <Debug>
RECEIVED MSG FROM SCCP  ← INDICATES MESSAGE WAS FROM SCCP (TCAP)

Thu Dec  4 15:23:03:846 2003 EST | ss7-i-1 (PID 9518) <Debug>
 <<<< To: 821 from 809 (bytes 98) prior 0 sio 83 sls 8:  ← DPC 1-004-1, OPC 1-001-1

Thu Dec  4 15:23:03:846 2003 EST | ss7-i-1 (PID 9518) <Trace>
PROT_TRACE_MTP3_PDU: Hex dump of MTP3 and UP messages 1e0002 1  09 80 03 07 0b 04 c3 21 08 0c 04 c3 09 08
67
52 62 50 48 01 1f 6b 22 28 20 06 07 00 11 86 05 01 01 01 a0 15 60 13 80 02 07 80 a1 0d 06 0b 2a 81 76 82 15 01 01 01 01 00
01 6c 27 a1 25 02 01 01 02 01 00 30 1d 80 04 0  0 01 5f 91 82 08 83 10 65 27 32 54 76 0f 83 07 03 11 03 23 22 11 11 9a 02 20
00
```

Troubleshoot Tips:

- Use the SCCP message format shown in Appendix C to decode the message type, SCCP header information (shown in the output in yellow) and the beginning of the TCAP data (shown in the output in blue). The `1e0002` in the output represents the destination point code from dpc.dat and the SCCP message dump begins immediately after type "1" (beginning with SCCP message type).
- The PGW 2200 logs counter and Alarms for SCCP, TCAP and SS7 events. If measurements are enabled, check the counters for the TCAP message. Also check the SCCP, UDT, and UDTS received and transmitted. Refer to these documents for MGC operational procedures.

    - ♦ Managing System Measurements
    - ♦ Cisco MGC Measurements
    - ♦ Retrieving TCAP Transactions
- If the SS7 channel controller does not receive the message sent out of the PGW 2200, verify that TCAP transmitted a message down to SCCP. If the TCAP layer transmits the message down, it can be because the SCCP does not have enough information to build the proper SCCP message. This may also be an indication that the SS7 subsystem is not provisioned properly or is not available. Check this list to verify:

    - ♦ SS7 Point code configuration and status
    - ♦ SS7 Subsystem configuration
    - ♦ SS7 Subsystem routing configuration
    - ♦ Local and Remote SSN status
    - ♦ IN Service configuration (trigger.dat)

System Verification

```
mml>rtrv-spc:all

   MGC-01 - Media Gateway Controller 2004-03-26 13:22:05.492 EST

M  RTRV

   "ss7svc1:DPC=001.022.001,DNW=2:OPC=001.001.001:IS"

   "ss7svc2:DPC=001.022.002,DNW=2:OPC=001.001.001:IS"

   "itussn1:DPC=001.004.001,DNW=2:OPC=001.001.001:IS"

   "itussn2:DPC=001.003.001,DNW=2:OPC=001.001.001:IS"

   "itussn3:DPC=001.004.001,DNW=2:OPC=001.001.001:IS"

   ;

mml> prov-rtrv:ss7subsys:NAME="itussn1"

   MGC-01 - Media Gateway Controller 2004-03-26 11:48:26.321 EST

M  RTRV

   "session=fix551tgp:ss7subsys"

   /*

NAME = itussn1

DESC = pc_ssn rte-ssn 48

SVC = scp1

PRI = 1
```

```
MATEDAPC =
LOCALSSN = 101
PROTO = SS7-ITU
STPSCPIND = 1
TRANSPROTO = SCCP
OPC = opc1
SUAKEY =
REMOTESSN = 48
   */
   ;
mml> rtrv-lssn:all
   MGC-01 - Media Gateway Controller 2004-03-26 11:49:01.985 EST
M  RTRV
   "TCAP-01:SSN=12,PST=IS"
   "TCAP-01:SSN=101,PST=IS"
   "TCAP-01:SSN=102,PST=IS"
   ;
mml> rtrv-rssn:all
   MGC-01 - Media Gateway Controller 2004-03-26 11:49:04.695 EST
M  RTRV
   "scp1:PC=001.004.001,SSN=12,PST=IS"
   "scp1:PC=001.004.001,SSN=48,PST=IS"
   ;
mml> prov-rtrv:inservice:name="finap-initdp"
   MGC-01 - Media Gateway Controller 2004-03-29 14:45:25.738 EST
M  RTRV
   "session=fix551tgp:inservice"
   /* NAME = finap-initdp
SKORTCV = 90001
GTORSSN = ROUTEBYSSN
GTFORMAT = NOGT
MSNAME = finap-initdp
   */
```

```
;

mml> prov-rtrv:SS7ROUTE:NAME="route4"

   MGC-01 - Media Gateway Controller 2004-03-30 11:53:08.493 EST

M  RTRV

   "session=fix551tgp:SS7ROUTE"

   /*

NAME = route4

DESC = rte to 1.4.1 scp1

OPC = opc1

DPC = scp1

LNKSET = ls3

PRI = 1

   */

   ;
```

- If all of this information appears to be correct (as shown in the output displayed above) verify the tagged values sent down from the TCAP protocol level such as the SSN, SCCPCalledParty address and / or SCCPCallingParty address.

TCAP Messages that enter the Cisco PGW 2200

The reverse logic can be used to trace an SS7 message that comes into the Cisco PGW 2200 that is destined to the TCAP / SCCP user layer of the SS7 stack. The PGW 2200 logs show the SS7 message that comes into the SS7 channel controller (from the SS7 line) and is sent to TCAP for processing. The message is broken down at each layer of the SS7 stack. Also, note the OPC/DPC, Service Indicator (SIO) and signaling link selection (SLS). The OPC and DPC is represented in ITU format (in this example only).

Troubleshoot Tip: Verify the message type received from the SS7 line. If a UDTS message is receive check the 'return cause'.

This output shows the PGW 2200 log when it receives SCCP messages from the SS7 line:

```
Thu Dec  4 15:23:04:953 2003 EST | ss7-i-1 (PID 9518) <Debug>
CP Received PDU from ssetId 3, chan 0

Thu Dec  4 15:23:04:953 2003 EST | ss7-i-1 (PID 9518) <Trace>
PROT_TRACE_MTP3_PDU: Hex dump of MTP3 and UP
messages 1d0005 0 CP DATA IND len: 139 data: 83 09 48 08 02 09 ←msgtype 09= UDT

Thu Dec  4 15:23:04:953 2003 EST | ss7-i-1 (PID 9518) <Debug>
 >>>> from: 821 to opc 809 (bytes 134) sio 83 sls 0:    ← OPC 1-004-1, DPC 1-001-1

Thu Dec  4 15:23:04:953 2003 EST | ss7-i-1 (PID 9518) <Trace>
PROT_TRACE_MTP3_PDU: Hex dump of MTP3 and UP messages
1e0002 0 09 ffffff80 03 07 0b 04 ffffffc3 09 08 67 04 ffffffc3 21 08 0c 7...<continues>

Thu Dec  4 15:23:04:953 2003 EST | ss7-i-1 (PID 9518) <Debug>
RECEIVED SCCP STACK MSG
<lines omitted>
Thu Dec  4 15:23:04:954 2003 EST | TCAP (PID 9513) <Trace>
PROT_TRACE_TCAP_PDU_RX: Hex dump of TCAP message received, SSN=103, LEN=118,
 65 74 48  4 50  0  0  0 49  1 1f 6b 2a 28 28  6  7  0 11 86  5  1  1  1 a0 1d 61 1b a1  d  6  b
2a 81 76 82 15  1  1  1  1  0  1 a2  3  2  1  0  a3  5 a1  3  2  1  1 6c 3d a1 17  2  1  4  2  1 17 30  f a0  d
30  b 80  1  a 81  1  0 a2  3 80  1  1 a1 22  2  1  5  2  1 23 30 1a 80 10 30  e  a0  c a0  a a1  5 a0  3 81
 1  6 82  1  a 81  1  1 a2  3 80  1  1
```

Troubleshoot Tip: Use the SCCP message format shown in Appendix C to decode the message type, SCCP header information (shown in the output in yellow) and the start of the TCAP data. The 1e0002 in the output above represents the calling address (OPC) for the message received at the PGW as represented in dpc.dat. The SCCP message dump begins immediately after the "0" (beginning with SCCP message type).

This output is from the PGW 2200 log when it receives UDTS TCAP over SCCP/MTP:

```
Thu Mar 25 18:35:35:385 2004 EST | ss7-i-1 (PID 27288) <Debug>

CP Received PDU from ssetId 3, chan 0

Thu Mar 25 18:35:35:385 2004 EST | ss7-i-1 (PID 27288) <Trace>

PROT_TRACE_MTP3_PDU: Hex dump of MTP3 and UP messages 1d0005 0
CP DATA IND len: 68 data: 83 09 48 08 a2 0a



Thu Mar 25 18:35:35:385 2004 EST | ss7-i-1 (PID 27288) <Debug>

 >>>> from: 821 to opc 809 (bytes 63) sio 83 sls a:



Thu Mar 25 18:35:35:385 2004 EST | ss7-i-1 (PID 27288) <Trace>

PROT_TRACE_MTP3_PDU: Hex dump of MTP3 and UP messages 1e0002 0 0a 01 03 0d
11 04 ffffffc3 09 08 65 0a ffffff8b 21 08 30 00 18 38 33 44 44 29  62
27 48 01 02 6c 22 fffffa1 20 02 01 01 02 01 00 30 18 ffffff80 04 00 00
00 01 ffffff82 07 01 10 18 38 33 44 44 ffffff83 07 01 11 07 13 11 00 10



Thu Mar 25 18:35:35:385 2004 EST | TCAP (PID 27283) <Debug>

Got 91 bytes from fifo /tmp/sccp_input (fd=16)
```

```
Thu Mar 25 18:35:35:385 2004 EST | ss7-i-1 (PID 27288) <Debug>

RECEIVED SCCP STACK MSG

!--- Indicates message is from MTP(SS7 stack).


!--- Lines omitted.


Thu Mar 25 18:35:35:385 2004 EST | TCAP (PID 27283) <Debug>

00 01 00 01 1E 00 15 00 00 00 1A 00 00 02 00 00 00 00 00 00 08 21 00 00
08 09 FFF0A 0A 01 03 0D 11 04 FFF09 08 65 0A FFF21 08 30 00 18 38 33 44
44 29 62 27 48 01 02 6C 22 FFF20 02 01 01 02 01 00 30 18 FFF04 00 00  00
01 FFF07 01 10 18 38 33 44 44 FFF07 01 11 07 13 11 00 10


Thu Mar 25 18:35:35:386 2004 EST | TCAP (PID 27283) <Debug>

ioTcSuIntfc::handleNotInd: Cause =1


Thu Mar 25 18:35:35:386 2004 EST | TCAP (PID 27283) <Debug>

Calling StUiStuDatReq(), spId = 1


Thu Mar 25 18:35:35:386 2004 EST | TCAP (PID 27283) <Debug>

Deleted spDlgEntry 2-69


Thu Mar 25 18:35:35:386 2004 EST | TCAP (PID 27283) <Debug>

Sending msgType 15 to Engine

!--- TCAP sends response to Engine which is translated into L.
```

This output is from the PGW 2200 log when it receives an invalid TCAP message over SCCP / MTP:

```
Tue Mar 23 16:24:51:565 2004 EST | ss7-i-1 (PID 22997) <Trace>
PROT_TRACE_MTP3_PDU: Hex dump of MTP3 and UP messages
1d0005 0 CP DATA IND len: 12 data: 83 09 48 08 02 0a ←msgtype 10= UDTS

Tue Mar 23 16:24:51:565 2004 EST | ss7-i-1 (PID 22997) <Debug>
>>>> from: 821 to opc 809 (bytes 7) sio 83 sls 0:

Tue Mar 23 16:24:51:565 2004 EST | ss7-i-1 (PID 22997) <Trace>
PROT_TRACE_MTP3_PDU: Hex dump of MTP3 and UP messages
1e0002 0 0a 03 00 00 00 00 00  ←Msg Type 10 (UDTS), Return cause = 03 =
<lines omitted>
Tue Mar 23 16:24:51:565 2004 EST | ss7-i-1 (PID 22997) <Debug>
RECEIVED SCCP STACK MSG
<lines omitted>
Tue Mar 23 16:24:51:566 2004 EST | TCAP (PID 22992) <Debug>
00 01 00 01 1E 00 15 00 00 00 1A 00 00 02 00 00 00 00 00 00 08 21 00 00 08
09 FFF00 0A 03 00 00 00 00 00 ← OA= dec (10) = UDTS message is
incorrect format missing parameters

Tue Mar 23 16:24:51:566 2004 EST | TCAP (PID 22992) <Error>
TIOS_ERR_SCCP_SYNTAX_ERR: Syntax error in SCCP switch 1 suId = 0
```

MDL Trace Tool

The Cisco PGW 2200 uses triggers to initiate a TCAP transaction. TCAP protocol transactions use the `IN_TRIGGER` method to send and receive messages to and from the TCAP control layer. When call analysis hits result type `22`, the `IN_TRIGGER` TCAP protocol is initialized. TCAP information / messages are exchanged between the TCAP protocol layer (for example, triggers written in MDL language) and the Cisco PGW 2200 engine process using a tag, length, and value or TLV syntax. The engine then forwards the information to the TCAP channel controller for further processing.

Use the Cisco PGW 2200 MDL trace to see the data that is sent to and from the TCAP protocol layer to the TCAP controller (via the engine). The TCAP channel controller does the necessary processing on MDL messages received and forwards them to the appropriate IOCC (either TALI−IOCC, IP−IOCC or SS7−IOCC). The engine also converts TCAP message information received from the TCAP channel controller (via SCCP / MTP3) into a TLV format that can be passed to the TCAP protocol layer, also known as `IN_TRIGGER`. To trace a TCAP call at the protocol level, complete these steps:

1. Start an MDL trace.

   ```
   mml> sta-sc-trc:ss7svc1:log="udts",confirm
   ```

2. Make a call that triggers a TCAP service (hits analysis result type `IN_TRIGGER`).
3. Stop the MDL trace.

   ```
   mml> stp-sc-trc:all

      MGC-01 - Media Gateway Controller 2004-03-24 17:41:04.702 EST

   M  COMPLD

      "ALL:Trace stopped for the following files:


      ../var/trace/udts_ss7svc2_20040324174103.btr
   ```

4. Run **get_trc** to view the captured MDL trace.

   ```
   get_trc.sh udts_ss7svc2_20040324174103.btr
   ```

5. Run option **S** to see a 'sim print' of the call that shows the message flow between internal PGW 2200 processes.
6. Run option **D** to see the actual trace of the call through the PGW 2200 code.

Note: The content shown by options **D** and **S** in **get_trc.sh** may not be obvious to understand as the data is shown with internal data types and variable names. However a description of what to look for to debug TCAP transactions is shown in the **MDL Trace Analysis for TCAP** section.

MDL Trace Analysis for TCAP

Use 'sim print' (option S of **get_trc.sh**) to view the overall call flow at the Cisco PGW 2200 protocol level. The sim print resembles the one shown in Appendix D. If it does not, try to make a note of where the derived call flow diverges and begin to troubleshoot with that event. For TCAP troubleshooting, focus your attention on one of these events.

- `LTrigger`
- `LTriggerInformation`
- `LTriggerNext`
- `LtriggerRelease`

These are the internal events that drive the `IN_TRIGGER` state machine.

Use the Cisco PGW 2200 MDL trace to see the actual code flow for each of these events. LTrigger results in an OUTPUT IN_TRIGGER, and the other three are sent received by IN_TRIGGER by an INPUT IN_TRIGGER message from the engine.

Outgoing TCAP Messages

To identify messages that come in and out of MDL for TCAP, search for `IN_TRIGGER` in the MDL trace. The Sample IN_TRIGGER Syntax from MDL Trace graphic shows a message sent out and one received into MDL to and from the engine. The `OUTPUT` indicates that `IN_TRIGGER` has sent a request for the Engine to forward a TCAP message.

Troubleshoot Tips

- Use the MDL trace to verify that the `TRIGGER` message was sent to the engine if `IN_TRIGGER` or `OUTPUT` was not sent.
- Check the dialplan for the `IN_TRIGGER` result configuration.
- Check the inservice and / or trigger.dat configuration.
- Verify that the message was sent out of the SS7 channel controller. If the message never made it out of the SS7 channel controller, it is a result of the SCCP channel controller not having enough information to route the call or build a valid message.
- Check the SCCP configuration and SS7_SUBSYSTEM configuration.
- Check the SSN status.
- Check the PC status.

If the output of the `IN_TRIGGER` is successful, the Cisco PGW 2200 MDL trace displays the response to that message as an `INPUT` into the `IN_TRIGGER`.

Sample `IN_TRIGGER` Syntax from MDL Trace

```
OUTPUT "IN_TRIGGER": 00 00 00 0e 00 00 00 69 00 01 0b 00 01 00 01 01 00 02 00 01 01 00 03 00 07 01 00 00 00 00 00 00 00 0c 00 01 03 00 0f
00 01 01 00 13 00 0d 02 00 2a 81 76 82 15 01 01 01 01 00 01 00 05 00 01 01 00 06 00 03 01 02 00 00 07 00 01 01 00 09 00 1d 80 04 00 01 5f 91
82 08 83 10 65 27 32 54 76 0f 83 07 03 11 03 23 22 11 11 9a 02 20 00 00 0a 00 00

INPUT "IN_TRIGGER": 00 00 00 02 00 00 00 69 00 02 0d 00 12 00 04 00 00 08 21 00 11 00 04 00 00 00 02 00 10 00 12 00 00 00 08 21 0c 01 67
02 04 50 00 00 00 00 00 00 08 09 00 13 00 0d 03 00 2a 81 76 82 15 01 01 01 01 00 01 00 05 00 01 01 00 06 00 03 01 00 17 00 07 00 01 04 00 09 00
0f a0 0d 30 0b 80 01 0a 81 01 00 a2 03 80 01 01 00 05 00 01 01 00 06 00 03 01 00 23 00 07 00 01 05 00 09 00 1a 80 10 30 0e a0 0c a0 0a a1 05 a0
03 81 01 06 82 01 0a 81 01 01 a2 03 80 01 01 00 0a 00 00
```

The `INPUT` message is the response from the engine in reference to the request (or `OUTPUT` message) sent from the TCAP protocol. The engine can respond on its own behalf or on behalf of the TCAP layer.

The `IN_TRIGGER` message indicates that MDL sends TCAP / SCCP information down to the engine and channel controllers to be used to construct a UDT message that is sent out on the LINE to the SCP. Information sent down to the engine is derived from the trigger.dat file and it shows directly above the output of this message. To see the content of this message as MDL built it, scroll up from the text `IN_TRIGGER`. The start of the message building procedure is indicated by `SendMessage()&,` as shown here.

```
            FUNCTION SendMessage() BEGIN

              <messageData>.tagCount := bit(card(<messageData>.DATA), 8) -> '00001011'B

              <messageData>.processId := bit(self(), 32) -> '00000000000000000000000001101001'B

              <messageData>.callRef := bit(CC.db.essentialData.releaseData.DATA.globalCallRefElem.DATA, 32)
-> '00000000000000000

000000000000101'B

              VAR inTable := GetTT(<trigger>, 2) -> 24   ←TRIGGER TABLE in trigger.dat (FINAP Initial DP)

              VAR msTable := GetIN(inTable, 1) -> 24   ←IN Service Index (see figure 9 )

              SELECT GetMS(msTable, 3) -> 1                ←Msg type 1 = ITU BEGIN

                OUTPUT Begin TO LINE AS <messageData> -> ELEMENT

                SET TcapTimer := <defaultTimer> -> 5000

...<omitted lines>

     NEXTSTATE <state> -> STATE_WaitResponse

   END INPUT

 END STATE

ok
```

```
writing message Begin                ←TCAP MESSAGE TYPE
  writing element _Begin
    writing field callRef            ← Identifies Call reference for MDL/engine Xaction
      '0000 0000 0000 0000 0000 0000 0000 0010'B
    ok
    writing field processed          ← Identifies process ID for MDL/engine Xaction
      '0000 0000 0000 0000 0000 0000 0110 1001'B
    ok
    writing field msgType            ← Identifies Msg Type for MDL/engine Xaction
      '0000 0000 0000 0001'B         ← Msg type 1 = ITU BEGIN
    ok
    writing field tagCount           ← Identifies number of tags included in this msg
      '0000 1011'B 11 0x0b
    ok

    writing field DATA                        ← beginning of tags
      writing element TcapTypeElem            ←Tag element #1
        writing field DATA                    ←Tag element #1 data portion begins
          writing field octet1                ←Tag element #1 field begins
            writing field tcapType            ←Tag element #1 field, variable name
              '0000 0001'B 1 0x01             ←Tag #1 VALUE; tcapType = 01
            ok
          ok
        ok
        writing field ieId                    ←Tag element #1 TAG ID
          '0000 0000 0000 0001'B
        ok
        writing field ieLength                ←Tag element #1 TAG LENGTH
          '0000 0000 0000 0001'B
        ok
      ok
      writing element TcapSystemDestElem      ←Tag element #2
...
```

Troubleshoot Tips

- If a TCAP query is sent out of the Cisco PGW 2200 with incorrect data, the MDL trace can be used to see exactly where the Cisco PGW 2200 derived its information. Most of the information comes from the trigger.dat file. To see where the Cisco PGW 2200 derived its information for the outgoing message, search up (from `IN_TRIGGER`) for the TCAP element in question. For example, if the TCAP type is incorrectly encoded, search for the string `tcapType` in the MDL trace (around the `writing field tcapType`).
- To see where the Cisco PGW 2200 reads trigger.dat to encode TCAP content, search for the strings shown in this table. These strings represent the procedure calls used to retrieve the trigger.dat information. These procedure calls should occur between the `INPUT LTrigger` event and the `OUTPUT IN_TRIGGER` message in question.

Name	Description	MDL Search String
TT	Trigger Table Record	GetTT
MA	Message Action Record	GetMA
MS	Message Sending Record	GetMS
OS	Operation Sending	GetOS
PS	Parameter Sending Record	GetPS
RR	Received Response Record	GetRR
MR	Message Receiving Record	GetMR
OR	Operation Receiving	GetOR
PR	Parameter Receiving Record	GetPR
RA	Response Action Record	GetRA
AD	Action Data	GetAD

Incoming TCAP Messages

The `INPUT` message is the response from the engine in reference to the request. The engine can respond on its own behalf or on behalf of the TCAP layer. The incoming message is identified by the `INPUT IN_TRIGGER` message string in the Cisco PGW 2200 MDL trace as shown in this example output. This example also shows the message that is decoded. This is helpful if you need to identify any problems that may exist with the TCAP response.

To decode the Engine message received by Cisco PGW 2200 MDL, use the same TLV format described earlier in this document. These message are decoded immediately after the text, `INPUT IN_TRIGGER`.

```
INPUT  "IN_TRIGGER": 00 00 00 02 00 00 00 69 00 02 0d 00 12 00 04
00 00 08 21 00 11 00 04 00 00 00 02 00 10 00 12 00 00 00 08 21 0c 01 67 02
04 50 00 00 00 00 00

 08 09 00 13 00 0d 03 00 2a 81 76 82 15 01 01 01 01 00 01 00 05 00 01 01
00 06 00 03 01 00 17 00 07 00 01 04 00 09 00 0f a0 0d 30 0b 80 01 0a 81
01 00 a2 03 80 0

1 01 00 05 00 01 01 00 06 00 03 01 00 23 00 07 00 01 05 00 09 00 1a 80
10 30 0e a0 0c a0 0a a1 05 a0 03 81 01 06 82 01 0a 81 01 01 a2 03 80 01
01 00 0a 00 00
```

```
reading element header: TcapMessageStyle
   reading field callRef
!--- Identifies call reference for MDL / engine Xaction.

      '0000 0000 0000 0000 0000 0000 0000 0010'B
   ok
   reading field processed
!--- Identifies process ID for MDL/engine Xaction.

      '0000 0000 0000 0000 0000 0000 0110 1001'B
   ok
   reading field msgType
!--- Identifies message type for MDL/engine Xaction.

      '0000 0000 0000 0010'B
!--- Message type 2 = ITU CONTINUE.

   ok
   reading field tagCount
!--- Identifies the number of tags included in this message.

      '0000 1101'B 13 0x0d
   ok
ok
reading element _Continue
!--- TCAP message type.

   reading field RAW
      1136 bits read
   ok
   reading field DATA
      reading element header: TcapElementStyle
!--- Tag element #1.

         reading field ieId
!--- Tag element #1 TAG ID.
```

```
            '0000 0000 0001 0010'B
         ok
         reading field ieLength
!--- Tag element #1 Tag Length.

            '0000 0000 0000 0100'B
!--- 4 bytes.

         ok
      ok
      reading element TcapDatabaseIdElem
         reading field RAW
            32 bits read
         ok
         reading field DATA
!--- Tag element #1 data portion begins.

            '0000 0000'B 0 0x00
!--- Byte 1.

            '0000 0000'B 0 0x00
!--- Byte 1.

            '0000 1000'B 8 0x08
!--- Byte 1.

            '0010 0001'B 33 0x21 "!"
!--- Byte 1.

            ''B
         ok
      ok
      reading element header: TcapElementStyle
!--- Tag element #2.

         reading field ieId
```

This is sample output of an incoming response to a UDTS message:

```
INPUT  "IN_TRIGGER": 00 00 00 02 00 00 00 69 00 0f 02 00 0b
00 01 01 00 0a 00 00


reading element header: TcapMessageStyle
   reading field callRef
      '0000 0000 0000 0000 0000 0000 0000 0010'B
   ok
   reading field processId
      '0000 0000 0000 0000 0000 0000 0110 1001'B
   ok
   reading field msgType
!--- Message type - Information message.

      '0000 0000 0000 1111'B
   ok
   reading field tagCount
      '0000 0010'B 2 0x02
   ok
ok
reading element _Information
   reading field RAW
      72 bits read
   ok
   reading field DATA
      reading element header: TcapElementStyle
         reading field ieId
            '0000 0000 0000 1011'B
         ok
         reading field ieLength
            '0000 0000 0000 0001'B
         ok
      ok
      reading element TcapErrorElem
!--- TCAP error element.
```

```
            reading field RAW

               8 bits read

            ok

            reading field DATA

               reading field octet1

                  reading field error

                     '0000 0001'B 1 0x01

!--- TCAP error element = 01  > TCAP_ERROR_SSN_OOS.


                  ok

               ok

            ok

         ok

      ok

ok

Continuing State Machine: IN_TRIGGER (105)

   STATE *

      INPUT Information AS <messageData>

         CC.db.nonEssentialData.TCAPTransactionUnixEndTimeElem.DATA
:= MGetTime(CC.db.nonEssentialData.TCAPTransactionMsecEndTimeElem.DATA)
-> 1080257735
```

Another valuable piece of information you can obtain from the Cisco PGW 2200 MDL trace (for TCAP calls) is the `LTriggerRelease` cause value. The `INErrorElem` encoded in the `LTriggerRelease` also provides insight into why a call or TCAP transaction does not work as expected. See this Cisco PGW 2200 MDL graphic that shows a `LTriggerRelease` that is sent out in response to the initial `LTrigger` event received by `IN_TRIGGER`. See Appendix E for details about `IN_TRIGGER` events and `INErrorElem` values.

```
  OD
  END FUNCTION
  VAR iNErrorElem := NULL
  iNErrorElem.DATA.error := 42          ➔ TRIG_ERROR_UNKNOWN
  INSERT iNErrorElem INTO <signalData>
  IF (<signalData>::INActionElem = NULL) -> FALSE
  FI
  OUTPUT LTriggerRelease TO <callingProcess> -> 3 AS <signalData> -> ELEMLIST
  NEXTSTATE <state> -> STATE_WaitResponse
 END INPUT
END STATE
```

Appendix A: MDL Tags

The Cisco PGW 2200 MDL tags are exchanged between the Cisco PGW 2200 MDL and the engine. This Appendix describes the order, content, and format of all tags used in TCAP transactions. The information used to populate these tag values is obtained from call context and values populated in the trigger.dat file. The trigger file is also used to indicate what should be sent to / from the engine for TCAP message building and what should be received from the engine for TCAP message processing when a response is received.

These tags are used for TCAP call processing:

- **TAG ID 1 TCAP Type**

  Description: Indication of the type of TCAP MDL

  Data Length: fixed(1)

  Data Format:

```
1 = ETSI 300 374-1
2 = Bell Core   GR-1298-CORE
                TR-NWT-001284
                TR-NWT-001285
3 = Bell Core   Pre AIN
                GR-1428-CORE
```

- **TAG ID 2 System Destination**

  Description: Internal Destination of event

  Data Length: fixed(1)

Data Format: Octet

Contents: 0 = Internal SCP, 1 = Trillium TCAP

- **TAG ID 3 SCCP Called Address**

Description: SCCP data required by trillium

Data Length: Variable

Data Format:

```
Octet 1 Routing Indicators

       Bit A 0 − Route by GT, 1 − Route by SSN
       Bit B DPC is present (Octets 2 to 4 have valid data)
       Bit C SSN is present  (Octet 5 has valid data)

Octet 2 DPC Network
Octet 3 DPC Cluster
Octet 4 DPC Member
Octet 5 Called SSN
Octet 6 GTFormat
       0 − No global Title Included
       1 − Global Title includes nature of address indicator only (ITU)
         − Global title includes translation type,
           numbering plan and encoding scheme.(ANSI)
       2 − Global Title Includes translation type only.(ITU/ANSI)
       3 − Global title includes translation type,
           numbering plan and encoding scheme.
          (ITU).  − not used in ANSI.
       4 − Global Title includes translation type, numbering plan,
          encoding scheme and  nature of address digits.
          (ITU). − Not used in ANSI.

 Octet 7 Translation Type Value
 Octet 8 Numbering Plan
       0 − Unknown
       1 − ISDN Telephony
       2 − Telephony
       3 − Data
       4 − Telex
       5 − Maritime Mobile
       6 − Land Mobile
       7 − ISDN Mobile

Octet 9 Nature Of Number
       1 − Subscriber Number
       2 − National Number
       3 − International Number

Octet 10    Number Of Digits in octets 11 to 43

Octet 11 to 43
      Digits in IA5 format
```

- **TAG ID 4 SCCP Calling Address**

Description: SCCP data required by trillium

Data Length: Variable

Data Format:

```
Octet 1 Routing Indicators

            Bit A 0 – Route by GT, 1 – Route by SSN
            Bit B DPC is present (Octets 2 to 4 have valid data)
            Bit C SSN is present  (Octet 5 has valid data)

Octet 2 DPC Network

Octet 3 DPC Cluster

Octet 4 DPC Member

Octet 5 Calling SSN
```

- **TAG ID 5 TCAP Component Type**

  Description: Type of TCAP component

  Data Length: fixed(1)

  Data Format:

```
Octet
    0 = Unknown
    1 = Invoke
    2 = Return Result Last
    3 = Return Error
    4 = Reject
    5 = Return Result Not Last
    6 = Invoke Last
    7 = Invoke Not Last
```

- **TAG ID 6 TCAP Operation Code**

  Description: TCAP message operation code

  Data Length: Variable (Always 4 for ANSI)

  Data Format:

```
Octet 1 Flag
      0 = None
      1 = Local
      2 = Global
      3 = National
      4 = Private

 Octet 2 Operation Class

 Octet 3 Op Code Highest byte (ITU)    Family (ANSI)

 Octet 4 Op Code Next byte (ITU)  Specifier (ANSI)

 Octet n Op Code Least byte (ITU)
```

- **TAG ID 7 TCAP Invoke ID**

  Description: ID of the component

  Data Length: fixed(1)

  Data Format: Octet

- **TAG ID 8 TCAP Correlation ID**

Description: ID of the component that this component correlates to

Data Length: fixed(1)

Data Format: Octet

- **TAG ID 9 TCAP Dialogue Component ANSI**

Description: Body of a TCAP message from first parameter onwards

Data Length: Variable

Data Format: Octet

- **TAG ID 10 TCAP Dialogue End Marker**

Description: Body of a TCAP message from first parameter onwards (SEQUENCE)

Data Length: fixed(0)

Data Format: None

- **TAG ID 11 Error**

Description: Error data

Data Length: fixed(1)

Data Format: Octet

Contents:

```
1 = TCAP_ERROR_SSN_OOS
2 = TCAP_ERROR_PC_UNAVAILABLE
3 = TCAP_ERROR_SERVICE_NOT_RESPONDING
4 = TCAP_TRIGGER_TIMEOUT
```

- **TAG ID 12 STP−SCP group index**

Description: STP−SCP group index, data passed from analysis.

Data Length: fixed(1)

Data Format: Octet

Contents: STP−SCP group index value.

- **TAG ID 13 TCAP Transport Protocol**

Description: Type of transport protocol

Data Length: fixed(1)

Data Format: Octet

Contents:

```
1 = TCAP_TRANSPORT_SCCP
2 = TCAP_TRANSPORT_TCP_IP
```

- **TAG ID 14 TCAP External Error / Problem**

Description: Error or Problem value received or sent in Error & Result components

Data Length: Variable

Data Format: Octet

- **TAG ID 15 TCAP Body Type**

Description: Type of body of component

Data Length: fixed(1)

Data Format: Octet

Contents:

```
1 = TCAP_BODY_SEQUENCE

2 = TCAP_BODY_SET
```

- **TAG ID 16 TCAP Dialog info**

Description: Trillium TCAP includes this TAG in all the messages sent to MDL. MDL should store this information and send it to the Trillium TCAP in all subsequent messages for the dialog or unidirectional messages related to the call.

Data Length: Variable

Data Format: Octet

- **TAG ID 17 TCAP Transaction Id**

Description: Trillium TCAP includes this TAG in all the messages sent to MDL. MDL should store this information for sending to CDB.

Data Length: Variable

Data Format: Octet

- **TAG ID 18 TCAP Database Id**

Description: Trillium TCAP will include this TAG in all the messages sent to MDL. MDL should store this information for sending to CDB.

Data Length: Variable

Data Format: Octet

Appendix B: Log off SS7 Point Codes

```
ETSI PC 1-1-1 (padded to 16 bits) =
00001000 00001001 = 08 09 = 809 (shown in log)

ETSI PC 1-4-1 (padded to 16 bits) = 00001000 00100001 =
08 21 = 821 (shown in log)

ETSI PC 3-3-3 (padded to 16 bits)   00011000 00011011 =
18 1B = 181b (another ex.)
```

	Cluster	Network	Member	Point Code
ESTI (14 bits)	3 bits	8 bits	3 bits	14 bits
ANSI (24 bits)	8 bits	8 bits	8 bits	24 bits
PC 1−1−1 (no padding, 14 bit only)	001	000 00001	001	001000 = 8 00000001 = 01
PC 1−4−1 (no padding, 14 bit only)	001	00000100	001	001000 = 8 00100001 = 01
PC 3−3−3	011	00000011	011	011000 = 18 00011011 = 1B

Appendix C: SCCP Message Types

Message Type	Message Type Code
CR Connection request	0000 0001
CC Connection confirm	0000 0010
CREF Connection refused	0000 0011
RLSD Released	0000 0100
RLC Release complete	0000 0101
DT1 Data form 1	0000 0110
DT2 Data form 2	0000 0111
AK Data acknowledgement	0000 1000
UDT Unitdata	0000 1001
UDTS Unitdata service	0000 1010
ED Expedited data	0000 1011
EA Expedited data acknowledgement	0000 1100
RSR Reset request	0000 1101
RSC Reset confirmation	0000 1110
ERR Protocol data unit error	0000 1111
IT Inactivity test	0001 0000
XUDT Extended unitdata	0001 0001
XUDTS Extended unitdata service	0001 0010
LUDT Long unitdata	0001 0011
LUDTS Long unitdata service	0001 0100

Unitdata (UDT)

The UDT message contains:

- Three pointers
- The parameters indicated in this table.

Parameter	Q.713 reference	Type (F V O)	Length (octets)
Message type	2.1	F	1
Protocol class	3.6	F	1
Called party address	3.4	V	3 minimum
Calling party address	3.5	V	3 minimum
Data	3.16	V	2−X (Note 1)

Note: Due to the ongoing studies on the SCCP called and calling party address, the maximum length of this parameter needs further study. It is also noted that the transfer of up to 255 octets of user data is allowed when the SCCP called and calling party address do not include global title.

Unitdata service (UDTS)

The UDTS message contains:

- Three pointers.
- The parameters indicated in this table.

Parameter	Q.713 reference	Type (F V O)	Length (octets)
Message type	2.1	F	1
Return cause	3.12	F	1
Called party address	3.4	V	3 minimum
Calling party address	3.5	V	3 minimum
Data	3.16	V	2−X (Note)

Note: Due to the ongoing studies on the SCCP called and calling party address, the maximum length of this parameter needs further study. It is also noted that the transfer of up to 255 octets of user data is allowed when the SCCP called and calling party address do not include global title.

This table shows a sample SCCP message breakdown for the Unitdata / Unitdata service:

Parameter	Type (F V O)	Length (octets)	Correlation outgoing message	Correlation incoming message

Message type	F	1	09	0a
Protocol class	F	1	80	01
Called party address pointer	F	1	03	03
Calling party address pointer	F	1	07	0d
Data Pointer	F	1	0b	11
Called party address	V	3 minimum	04 c3 21 08	04 c3 & 30
Calling party address	V	3 minimum	0c 04 c3 09 08	00 18 38 33 44
Data (TCAP DATA)	V	04 c3 09 08 67 18 38 33 44 44 Data (TCAP DATA) V	67 52 62 & 20 00	44 29 62 & 00 10

Note: These messages are examples only and may not reflect an actual query response combination / sequence.

UDTS Return Causes

In the Unitdata service, Extended Unitdata service, or Long Unitdata service message, the "return cause" parameter field is a one octet field that contains the reason for a message return. Bits 1 through 8 are coded as shown here:

```
Value Bits
0   0 0 0 0 0 0 0 0  no translation for an address of such nature
1   0 0 0 0 0 0 0 1  no translation for this specific address
2   0 0 0 0 0 0 1 0  subsystem congestion
3   0 0 0 0 0 0 1 1  subsystem failure
4   0 0 0 0 0 1 0 0  unequipped user
5   0 0 0 0 0 1 0 1  MTP failure
6   0 0 0 0 0 1 1 0  network congestion
7   0 0 0 0 0 1 1 1  unqualified
8   0 0 0 0 1 0 0 0  error in message transport (Note)
9   0 0 0 0 1 0 0 1  error in local processing (Note)
10  0 0 0 0 1 0 1 0  destination cannot perform reassembly (Note)
11  0 0 0 0 1 0 1 1  SCCP failure
12  0 0 0 0 1 1 0 0  hop counter violation
13  0 0 0 0 1 1 0 1  segmentation not supported
14  0 0 0 0 1 1 1 0  segmentation failure
15  0 0 0 0 1 1 1 1

to

228  1 1 1 0 0 1 0 0  Reserved for International Use
229  1 1 1 0 0 1 0 1
```

```
to

254  1 1 1 1 1 1 1 0  Reserved for National Networks
255  1 1 1 1 1 1 1 1  Reserved
```

Appendix D: MDL Interface for TCAP Message

All messages adhere to a common TLV format:

- **Call Instance and ProcessId** − 8 bytes long and should be received by the Engine and returned in the response message from the Engine unaltered.
- **Message ID** − Identifies the message that is sent or received by TCAP protocol layer (values shown in this table).
- **Tagged Id** − Number of tags and tag data (tag ID, data length and data) dictate what is sent out in the TCAP message to the remote destination. All field sizes are fixed except for the data field of a tag item whose length is variable and is defined (in octets) by the data length.

Octet 1−8	Octet 9−10	Octet 11	Octet 12−13	Octet 14−15	Octet 16 (15+n)	Octet (17+n) −(16+n)	Octet (18+n)− (17+n)	...
Call Instance and Process ID	Message ID	Number of tags	Tag ID X	Data length (n)	Data	Tag ID y	Data length (m)	&.

Each of the fields Total Length, Call Instance and Process Id, Message Id, Tag Id and Data Length is transmitted by the most significant byte first.

1	ITU Begin
2	ITU Continue
3	ITU End
4	ITU Abort
6	ANSI QueryWithPermission
8	ANSI Response
9	ANSI ConversationWithPermission
99	ANSI ConversationWithOutPermission
17	ANSI Abort
12	ANSI Protocol Abort
11	ANSI User Abort
5	Unidirectional
15	Information
16	Release

Appendix E: Internal MDL Interface

Internally, communication with TCAP State Machine Objects (SMOs) is through signals with data. Any MDL data type can be sent with the signal. The names and meanings of the signals and data are listed here.

- **LTrigger**

  Description: This is the first signal that LCM sends to TCAP to start the dialogue. In Elan, `INTriggerElem` also contains the `stpScpGroupIndex`. `MSG_ACTION_COPY_STP_SCP_INDEX_FROM_SIGNAL_DATA` must be set in the MA table for this to be used.

  Components: INTriggerElem, BNumberElem, BNumberDataElem
- **LTriggerInformation**

  Description: This signal is sent from TCAP to LCM in response to `LTrigger`, when the dialogue continues.

  Components: INTriggerElem, BNumberElem, BNumberDataElem
- **LTriggerNext**

  Description: This signal is sent from LCM to TCAP as a subsequent trigger request in an existing dialogue.

  Components: INTriggerElem, BNumberElem, BNumberDataElem
- **LTriggerRelease**

  Description: This signal is the last to be sent from either LCM or TCAP and can be sent from TCAP in response to `LTrigger` after a response has been received from the SCP.

  Components: INErrorElem, BNumberElem, BNumberDataElem

  `INErrorElem` has these values :

```
1      TRIG_ERROR_NONE,

2      TRIG_EXIT_UNABLE_TO_COMPLETE_MA_IS_LNP_M_BIT_CLEAR,

3      TRIG_ERROR_NULL_TRIGGER,

4      TRIG_ERROR_TRIGGER_TABLE_NOT_FOUND,

5      TRIG_ERROR_UNKNOWN_MESSAGE_ACTION,

6      TRIG_ERROR_UNKNOWN_RESPONSE_ACTION,

7      TRIG_ERROR_UNKNOWN_PARAMETER_ACTION,

8      TRIG_ERROR_MESSAGE_ACTION_FAILED,

9      TRIG_ERROR_UNABLE_TO_LOAD_DIALOGUE_COMPONENT,

10     TRIG_ERROR_UNABLE_TO_LOAD_TAG,

11     TRIG_ERROR_READING_TT,

12     TRIG_ERROR_READING_MA,
```

```
13      TRIG_ERROR_READING_PS,
14      TRIG_ERROR_READING_RR,
15      TRIG_ERROR_READING_PR,
16      TRIG_ERROR_READING_RA,
17      TRIG_ERROR_ACTION_NOT_COMPATIBLE_IN_PR,
18      TRIG_ERROR_NO_ACTION_DATA_FOR_ACTION_RE_TRIGGER,
19      TRIG_ERROR_NO_ACTION_DATA_FOR_ACTION_SEND_ACTION_TO_LCM,
20      TRIG_ERROR_UNKNOWN_MESSAGE_IN_MS,
21      TRIG_ERROR_UNKNOWN_PR_ACTION,
22      TRIG_ERROR_UNABLE_TO_COMPLETE_MA_COPY_SCCP_GT_FROM_BNUMBER,
23      TRIG_ERROR_UNABLE_TO_COMPLETE_MA_COPY_STP_SCP_INDEX_FROM_SIGNAL_DATA,
24      TRIG_ERROR_UNKNOWN_DIALOGUE_COMPONENT,
25      TRIG_ERROR_SIGNAL_IN_WRONG_STATE,
26      TRIG_ERROR_SCCP_TIMEOUT,
27      TRIG_ERROR_IN_RESPONSE_OPERATION_CODE_MISSING,
28      TRIG_ERROR_IN_RESPONSE_INVOKE_ID_IN_USE,
29      TRIG_ERROR_IN_RESPONSE_INVOKE_ID_NOT_FOUND,
30      TRIG_ERROR_IN_RESPONSE_CORROLATION_ID_NOT_FOUND,
31      TRIG_ERROR_IN_RESPONSE_UNEXPECTED_CORROLATION_ID,
32      TRIG_ERROR_IN_RESPONSE_NO_COMPONENT_CONTENTS,
33      TRIG_ERROR_IN_RESPONSE_INVALLID_COMPONENT_CONTENTS,
34      TRIG_ERROR_IN_RESPONSE_UNEXPECTED_INVOKE_ID,
35      TRIG_ERROR_IN_RESPONSE_EXTERNAL_ERROR_NOT_FOUND,
36      TRIG_ERROR_ABORT,
37      TRIG_ERROR_USER_ABORT,
38      TRIG_ERROR_PROTOCOL_ABORT,
39      TRIG_ERROR_UNKNOWN
```

Related Information

- **Cisco PGW 2200 Softswitch Tech Notes**
- **Voice Technology Support**
- **Voice and Unified Communications Product Support**
- **Troubleshooting Cisco IP Telephony**
- **Technical Support & Documentation − Cisco Systems**

Updated: Jul 23, 2008 Document ID: 61183