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Dialogic® NaturalAccess™ Signaling Software Configuration Manual

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Revision history

Revision	Release date	Notes
9000-6464-12	January, 1998	SS7 B.1.5
9000-6464-1.3	July, 1998	GJG
9000-6464-1.4	September, 1998	GJG
9000-6464-1.5	March, 1999	GJG
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9000-6464-1.7	December, 1999	GJG, SS7 2.11
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9000-6464-1.9	July, 2000	GJG, SS7 3.5
9000-6464-2.0	November, 2000	GJG, SS7 3.6
9000-6464-2.1	August, 2001	GJG, SS7 3.8 Beta
9000-6464-2.2	February, 2002	MVH, SS7 3.8
9000-6464-2.3	November, 2003	MCM, SS7 4.0 Beta
9000-6464-2.4	April, 2004	MCM, SS7 4.0
9000-6464-2.5	April, 2005	MVH, SS7 4.2
9000-6464-2.6	August, 2006	LBZ, SS7 4.3
9000-6464-2.7	July, 2008	SRG, SS7 5.0 Beta
9000-6464-2.8	September, 2008	SRG, SS7 5.0
64-0452-10	July, 2009	LBG, SS7 5.1
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Table Of Contents

1 Introduction

The *Dialogic® NaturalAccess™ Signaling Software Configuration Manual* explains how to configure NaturalAccess Signaling Software for either TDM or IP.

For a TDM configuration, this manual explains how to bring the links into service and discusses the following configurations:

- TDM channels
- MTP 2 and 3 layers
- Optional ISUP, SCCP, TCAP, and TUP layers

For an IP configuration, this manual explains how to configure IP and discusses the following configurations:

- M3UA
- SCTP
- Optional ISUP, SCCP, TCAP, and TUP layers

Note: The product to which this document pertains is part of the NMS Communications Platforms business that was sold by NMS Communications Corporation ("NMS") to Dialogic Corporation ("Dialogic") on December 8, 2008. Accordingly, certain terminology relating to the product has been changed. Below is a table indicating both terminology that was formerly associated with the product, as well as the new terminology by which the product is now known. This document is being published during a transition period; therefore, it may be that some of the former terminology will appear within the document, in which case the former terminology should be equated to the new terminology, and vice versa.

Former terminology	Current terminology
NMS SS7	Dialogic® NaturalAccess™ Signaling Software
Natural Access	Dialogic® NaturalAccess™ Software
NMS TUP	NaturalAccess TUP

2 Configuration overview

Configuring NaturalAccess™ Signaling Software

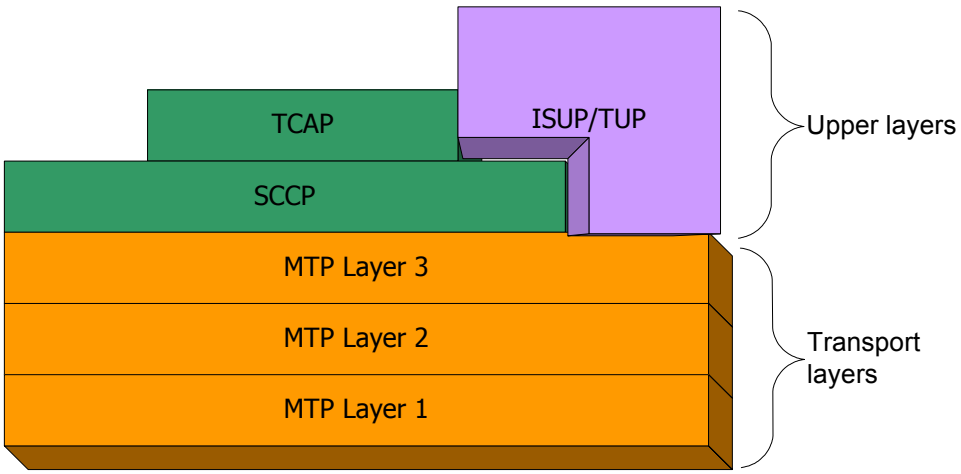
Dialogic® NaturalAccess™ Signaling Software can be configured for one of the following network types:

- TDM
- IP (SIGTRAN)

TDM configuration

In a TDM configuration, MTP layers 1, 2, and 3 are used as the transport layers for SCCP, TCAP, ISUP, and TUP.

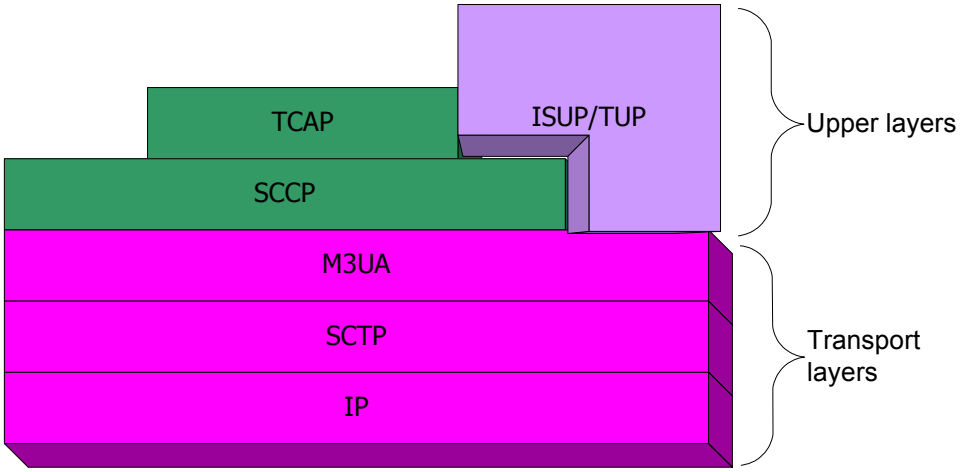
The following illustration shows an SS7 TDM configuration:



IP (SIGTRAN) configuration

In an IP configuration, the SIGTRAN layers (IP, SCTP, and M3UA) are used as the transport layers for SCCP, TCAP, ISUP, and TUP.

The following illustration shows an SS7 SIGTRAN configuration:



Sample SS7 TDM configurations

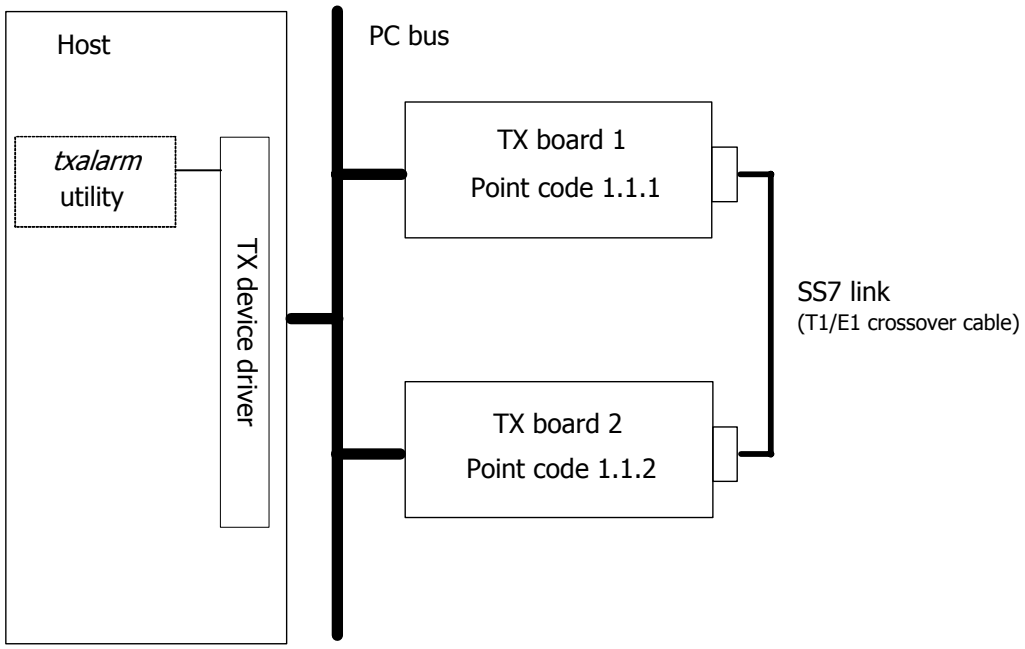
Depending on the physical hardware configuration of your TX boards, the SS7 link interface between the boards can be one of the following:

- A single timeslot on one of the T1/E1 trunks. TX boards include one or more on-board quad T1/E1 interfaces.
- All of the timeslots on a T1/E1 trunk. High speed links (HSL) meet the ANSI T1.111-1996 and Q.703/Annex A standards. Each HSL occupies a full (unchannelized) T1/E1 line and transfers data at the rate of 2.0 (1.544) Mbps.
- A single timeslot on the H.100/H.110 bus.

NaturalAccess™ Signaling Software provides the following sample configurations that you can modify for your specifications:

Configuration type	Location
ANSI standalone	*\Program Files\dialogic\tx\config\standalone\ansi* for a Windows system */opt/dialogic/tx/etc/standalone/ansi* for a UNIX system
ANSI redundant	*\Program Files\dialogic\tx\config\redundant\ansi* for a Windows system */opt/dialogic/tx/etc/redundant/ansi* for a UNIX system
ITU standalone	*\Program Files\dialogic\tx\config\standalone\itu* for a Windows system */opt/dialogic/tx/etc/standalone/itu* for a UNIX system
ITU redundant	*\Program Files\dialogic\tx\config\redundant\itu* for a Windows system */opt/dialogic/tx/etc/redundant/itu* for a UNIX system

The following illustration shows the ANSI standalone sample configuration:

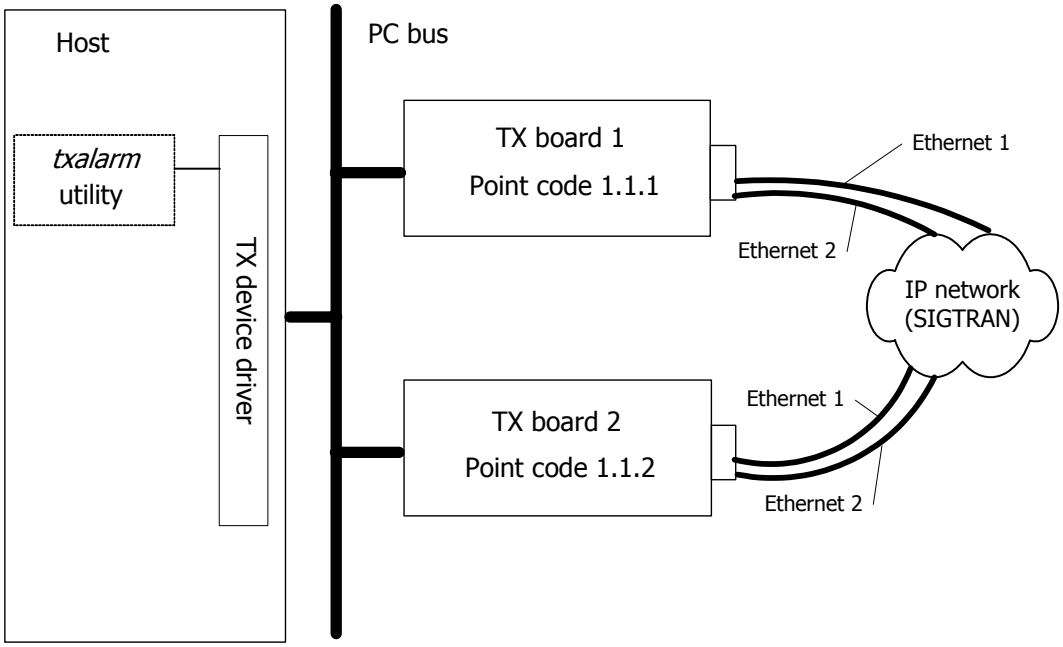


Sample SS7 IP configurations

NaturalAccess™ Signaling Software provides the following sample IP configurations that you can modify for your specifications:

Configuration type	Location
ANSI standalone	*\Program Files\dialogic\tx\config\standalone\ansi* for a Windows system */opt/dialogic/tx/etc/standalone/ansi* for a UNIX system
ANSI redundant	*\Program Files\dialogic\tx\config\redundant\ansi* for a Windows system */opt/dialogic/tx/etc/redundant/ansi* for a UNIX system
ITU standalone	*\Program Files\dialogic\tx\config\standalone\itu* for a Windows system */opt/dialogic/tx/etc/standalone/itu* for a UNIX system
ITU redundant	*\Program Files\dialogic\tx\config\redundant\itu* for a Windows system */opt/dialogic/tx/etc/redundant/itu* for a UNIX system

The following illustration shows a sample IP configuration:



Configuration summary

Before starting the NaturalAccess™ Signaling Software configuration, complete the following installations:

Step	Description	For details, refer to the...
1	Install the TX board.	Appropriate board installation manual.
2	Install the Natural Access development environment under Windows or UNIX.	*Installing Natural Access **x.x*** booklet and the *Natural Access Developer's Reference Manual*.
3	Install the NaturalAccess™ Signaling Software.	*Installing Dialogic® NaturalAccess™ Signaling Software* booklet.

After these installations are complete, configure NaturalAccess™ Signaling Software for either TDM or IP.

TDM configuration

Follow these steps to configure NaturalAccess™ Signaling Software over TDM and bring the links into service for TX boards:

Step	Description	For details, refer to...
1	To use T1/E1 trunks or H.100/H.110 bus channels as the physical SS7 links, configure the streams and timeslots to carry the SS7 links.	*TDM configuration overview* on page 17
2	Configure the MTP layers.	*MTP configuration overview* on page 75
3	Configure the optional layers.	*ISUP configuration overview* on page 109 *SCCP configuration overview* on page 121 *TCAP configuration overview* on page 143 *TUP configuration overview* on page 149
4	Start the *txalarm* utility on the host to monitor the status of the links.	*Starting txalarm* on page 157
5	Download the appropriate configurations to the TX boards.	*Downloading to the boards* on page 157
6	Check the *txalarm* messages to see that the links come into service on the boards.	*Monitoring link status* on page 167
7	Troubleshoot any problems indicated in the *txalarm* messages.	*Troubleshooting link problems* on page 168

IP configuration

Follow these steps to configure NaturalAccess™ Signaling Software over IP for TX boards:

Step	Description	For details, refer to...
1	Configure the IP interfaces.	*IP configuration overview* on page 45
2	Configure the M3UA layer.	*M3UA configuration reference* on page 63
3	Configure the SCTP layer.	*SCTP configuration reference* on page 71
4	Configure the optional layers.	*ISUP configuration overview* on page 109 *SCCP configuration overview* on page 121 *TCAP configuration overview* on page 143 *TUP configuration overview* on page 149
5	Download the appropriate configuration to the TX boards.	*Downloading to the boards* on page 157
6	Monitor the SIGTRAN associations.	*Monitoring association status* on page 170
7	Troubleshoot any problems indicated in the *txalarm* messages.	*Troubleshooting association problems* on page 171 *Dialogic® TX Series SS7 Boards TX Utilities Manual*

3 Configuring TDM

TDM configuration overview

Before T1/E1 trunks or H.100/H.110 bus channels (also known as TDM channels) can be used for physical SS7 links, you must download a TDM configuration to the TX board. To configure a TX board, create a TDM configuration file (*txcfg**n.***txt) that defines clocking control, configures all T1/E1 trunks, and defines all dedicated data channels. Each TX board in a system requires a separate TDM configuration file.

The *txconfig* configuration utility runs as part of the initial board configuration with *ss7load. txconfig* reads the configuration file and downloads the specified configuration to the TX board.

This topic presents:

- Sample TDM configuration files
- Common TDM configuration changes

Note: If you are configuring TX boards for redundancy, you must configure the IP interface to be used for redundancy traffic using the txconfig utility's ifcreate command. You must also specify the IP address of the TX board's redundant mate using the *txconfig* utility's mate command. For more information, refer to *ifcreate command* on page 50 and *mate command* on page 52.

Sample TDM configuration files

The Signaling Software provides the following sample TDM configuration files for ANSI standalone and redundant configurations and ITU standalone and redundant configurations that you can modify for your specifications. The sample TDM configuration files present the most common type of TX board use.

Files	Description
txcfg1.txt	Configures the first TX board in a chassis with four T1 trunks. This configuration file specifies that the clock signal recovered from the first trunk connection (trunk 1) is used as the clock source for the TX board. No H.100/H.110 clock signals are driven by this configuration.
txcfg2.txt	For two TX boards in a chassis. This configuration file configures the second board with the T1 trunks set as loop master. This board is configured as the master clock source (using the board's internal oscillator). No H.100/H.110 clock signals are driven by this configuration.

For the location of the sample configuration files, refer to *Sample SS7 TDM configurations* on page 13.

The following example shows a *txcfg.txt* for a TX board operating in T1 mode:

```
#         T1 Example
#         Timing Configurations:
#
# use clock recovered from trunk 1 as board's clock and drive H.100/H.110 A clocks
clock net=1 a

# use clock recovered from trunk 2 as network reference clock (drive NR1 signal)
netref 2 nr1

#
# Configure all 4 trunks as T1 mode (not loop master)
#-------------------------------------------------------------------------------
#     Trunk     Framing   Encoding   Buildout   Loop Master
t1cfg 1         esf       b8zs       0          false
t1cfg 2         esf       b8zs       0          false
t1cfg 3         esf       b8zs       0          false
t1cfg 4         esf       b8zs       0          false

# define ports that SS7 links will connect through
#-------------------------------------------------------------------------------
#    PortNum    L|H|E|T|J   Trunk   Channel     Speed
port 1          t1          1       0
port 2          t1          2       23
```

The following example shows a *txcfg.txt* for a TX board operating in E1 mode:

```
#         E1 Example
#         Timing Configurations:
#
# use clock recovered from trunk 1 as board's clock and drive H.100/H.110 A clocks
clock net=1 a

# use clock recovered from trunk 2 as network reference clock (drive NR1 signal)
netref 2 nr1

#
# Configure all 4 trunks as E1 mode (not loop master)
#-------------------------------------------------------------------------------
#     Trunk     Framing   Encoding   Loop Master
e1cfg 1         ccs       hdb3       false
e1cfg 2         ccs       hdb3       false
e1cfg 3         ccs       hdb3       false
e1cfg 4         ccs       hdb3       false

# define ports that SS7 links will connect through
#-------------------------------------------------------------------------------
#    PortNum    L|H|E|T|J   Trunk   Channel     Speed
port 1          e1          1       1
port 2          e1          2       31
```

Common TDM configuration changes

The following list provides some common TDM configuration changes required for different hardware configurations.

- The sample TDM configuration files assume T1 trunks for ANSI configurations and E1 trunks for ITU configurations. If you use a different trunk type than the examples use, change the T1/E1 parameter lines to reflect the proper parameters. For T1 port definitions, the channel number is a zero-based value identifying the timeslot to access. For T1, channels 0 through 23 are available, providing access to all 24 timeslots of a T1 trunk. For E1, channels 1 through 31 are available, providing access to the 31 E1 timeslots beyond timeslot zero. Timeslot zero is used solely for framing on E1 trunks and cannot be used to transport data such as SS7.
- To configure a high speed link (HSL), replace the channel number with an asterisk (*).
- The sample configuration files contain commented out sections that define other types of TDM connections, such as E1 for files that default to T1 or H.100/H.110. To change from T1 to E1 or from T1 to H.100 for example, comment out the original configuration lines and paste a copy of the desired example lines, removing the comment character to activate the pasted lines.
- Modify clocking control based on the specific environment. The sample configuration file for board 1 (*txcfg1.txt*) assumes the board receives the clock signal from the first T1 or E1 trunk, implying that the first trunk is connected to another trunk that is acting as the loop master. The sample configuration file for board 2 (*txcfg2.txt*) configures that board to act as the loop master for all its T1 or E1 trunks. If this is not the configuration you want to use, modify the clock statement, or the Loop Master field, or both.

For details on configuring TDM, refer to the following topics:

- *H.100 and H.110 bus clocking overview* on page 20
- *Configuring clocking* on page 28
- *Configuring T1/E1 trunks* on page 31
- *Configuring ports* on page 38

H.100 and H.110 bus clocking overview

If the boards in a system are connected to each other on the CT bus, you must set up a bus clock to synchronize communications between the boards connected to the bus. To provide redundant and fault-tolerant clocking on the bus, configure alternative (fallback) clock sources to provide the clock signal if the primary source fails.

This topic presents:

- Clock masters and clock slaves
- Timing references
- Fallback timing references
- Clock signal summary
- Board-level clock fallback
- NETREF (NETREF1) and NETREF2

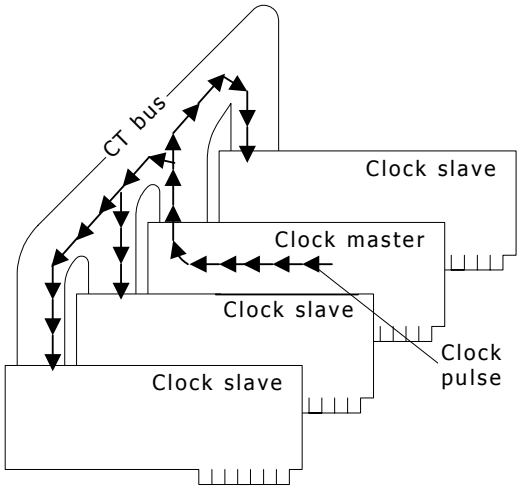
These topics present H.100/H.110 clocking as described in the *ECTF H.110 Hardware Compatibility Specification: CT Bus R1.0.*

Note: Board clocking procedures are not transparent to the application. In addition to configuring clocking, the application must monitor clocking and take appropriate action when required.

Clock masters and clock slaves

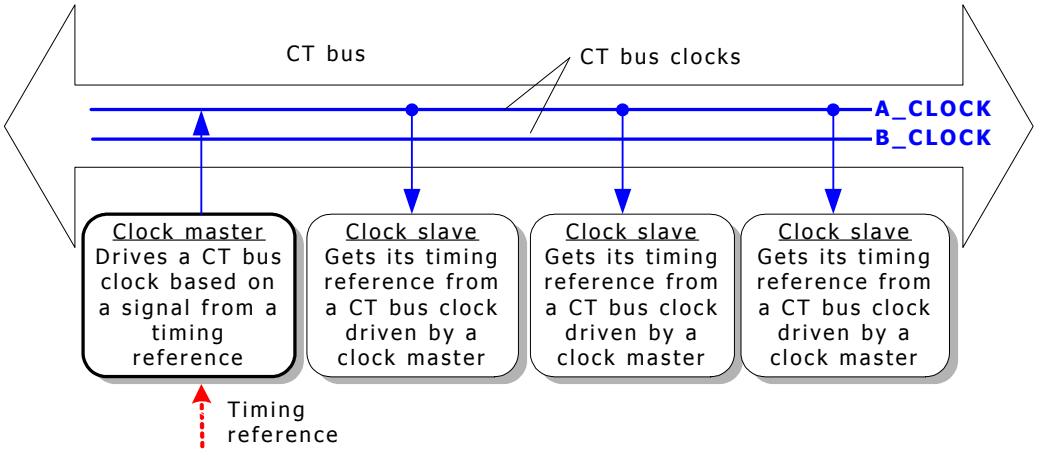
To synchronize data transfer from board to board across the H.100 bus or H.110 bus, boards on the bus must be phase-locked to a high-quality 8 MHz clock and 8 kHz frame pulse. These signals together compose a CT bus clock.

One board on the bus generates (drives) the clock. This board is called the clock master. All other boards use this clock as a timing reference by which they synchronize their own internal clocks. These boards are called clock slaves. The following illustration shows the clock master and clock slaves:



Two CT bus clocks can run simultaneously on the bus. They are called A_CLOCK and B_CLOCK. The clock master can drive either one. When you set up CT bus clocking, choose one of these clocks for your master and slaves. The other one is a redundant signal that can be used by a secondary clock master (described in *Secondary clock master fallback* on page 25).

In the following illustration, the system is set up to use A_CLOCK:

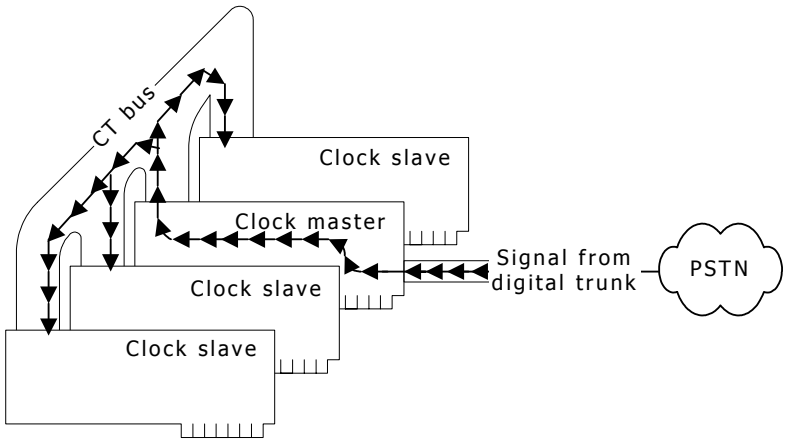


Timing references

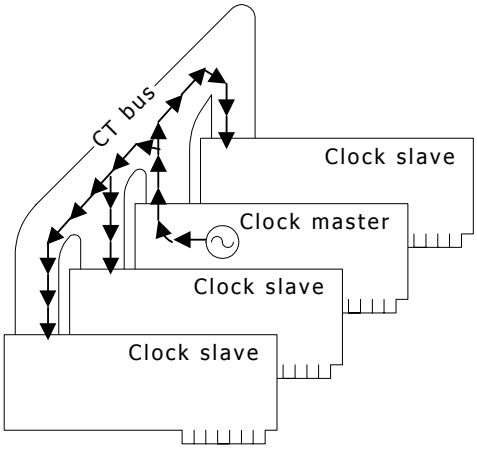
To drive its CT bus clock, a clock master takes a reference signal, extracts the frequency information, defines a phase reference at the extracted frequency, and broadcasts this information as A_CLOCK or B_CLOCK. This reference signal is called a timing reference. When you set up a clock master, you specify what source the board uses as its timing reference.

The timing reference signal originates in one of three places:

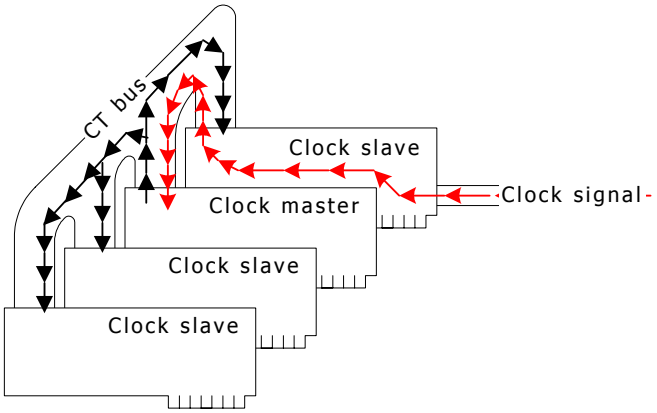
- It can originate within the public network and enter the system through a digital trunk. This is called a NETWORK timing reference as shown in the following illustration:



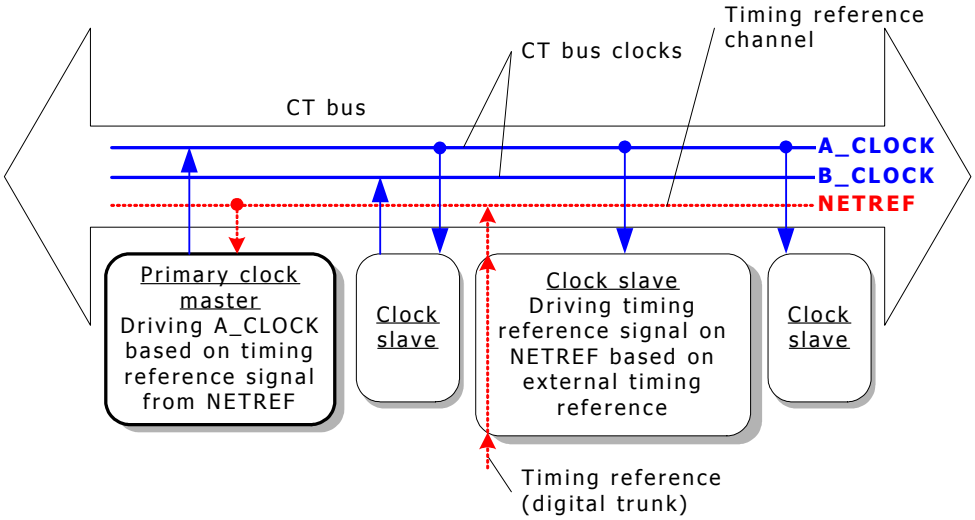
- In a system with no digital telephone network interfaces, an on-board oscillator can be used as the timing reference to drive the clock signals. This is called an OSC timing reference and is shown in the following illustration. Use OSC only if there is no external clock source available.



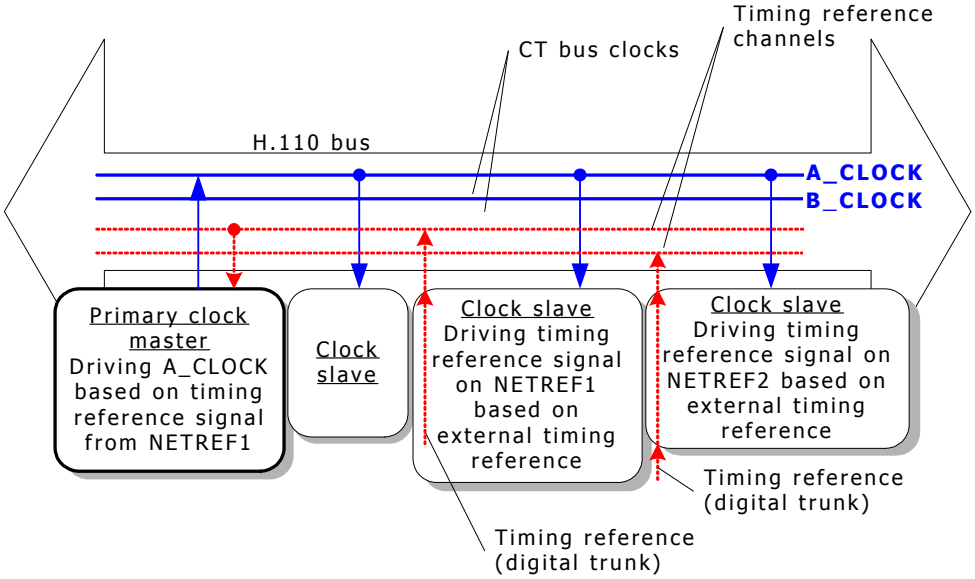
- The timing reference used by a clock master to drive the CT bus clock can also originate from an oscillator or trunk connected to another device in the system. In this case, the timing reference signal is carried over the CT bus to the clock master, which derives the clock signal and drives the clock for the slaves. The following illustration shows a timing reference from another device:



The channel over which the timing reference signal is carried to the clock master is called NETREF, as shown in the following illustration:



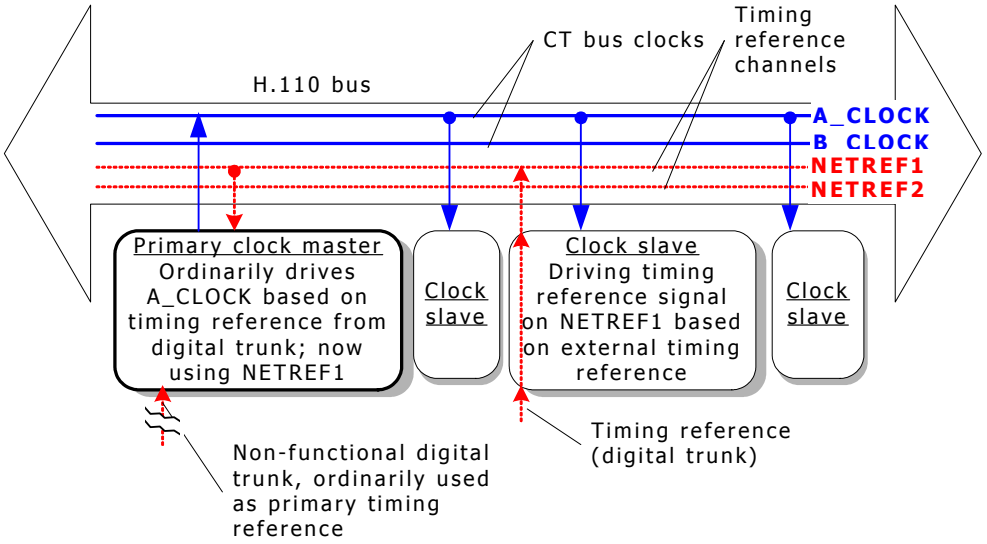
On the H.110 bus, a second timing reference signal can be carried on a fourth channel, called NETREF2 as shown in the following illustration. NETREF is referred to as NETREF1 in this case.



Fallback timing references

Boards can optionally be assigned a backup (fallback) timing reference that it can use if its primary timing reference fails. For a clock master, the source for the fallback timing reference must be a different source than the one currently used by the clock master for its primary timing reference.

For example, if a clock master's primary timing reference source is a NETWORK signal from one of its trunks, the fallback timing reference source can be a NETWORK signal from another one of its trunks, or a signal from NETREF1, NETREF2 (if H.110), or OSC. In the following illustration, the fallback timing reference source is NETREF1:



The ability of a board to automatically switch to its fallback timing reference if its primary timing reference fails is called clock fallback. This feature can be enabled or disabled.

Clock signal summary

The following table summarizes the reference clocks that a clock master can drive:

Clock	Details
A_CLOCK	The set of primary bit clocks (CT8A) and framing signals (CTFrameA). The CT8A signal is an 8 MHz clocking reference for transferring data over the CT bus. The CTFrameA provides a low going pulse signal every 1024 (8 MHz) clock cycles.
B_CLOCK	The set of secondary bit clocks (CT8B) and framing signals (CTFrameB). The CT8B signal is an 8 MHz clocking reference for transferring data over the CT bus. The CTFrameB provides a low going pulse signal every 1024 (8 MHz) clock cycles.

The following table summarizes the timing references that a clock master can use:

Timing reference	Details
NETWORK	The timing signal from a digital trunk attached to the clock master board. Within the digital trunk interface, an 8 kHz reference is derived from the frequency of the incoming signal. The clock master is frequency-locked to this 8 kHz reference so that the long-term timing of the system matches that of the public telephone network. **Note:** No timing signal is available from an analog trunk.
NETREF/NETREF1	The CTNETREF_1 signal. This signal can be 8 kHz, 1.544 MHz, or 8 MHz. Most boards use only 8 kHz signals.
NETREF2	(H.110 only) The CTNETREF_2 signal. This signal can be 8 kHz, 1.544 MHz, or 8 MHz. Most boards use only 8 kHz signals.
OSC	Clock signal derived from an oscillator on the clock master board. **Note:** Use this timing reference source only if no network timing references are available.

Board-level clock fallback

A TX board can be configured to perform in any one of the following fallback roles:

- Primary clock master
- Secondary clock master
- Clock slave

The clock fallback role a TX board takes is based on how the main clocking parameters are configured. If no fallback clock is configured, the TX board does not participate in any fallback behavior. For more information, refer to *Configuring clocking* on page 28.

Primary clock master fallback

Clock fallback for a primary clock master works as follows:

1. The primary clock master synchronizes with its primary network timing reference and drives the primary CT bus clock.
2. If the primary network reference fails, the clock master continues to drive the primary CT bus clock, but switches to the fallback network timing reference as its synchronization source.
3. If the secondary timing reference fails, the primary clock master stops driving the primary CT bus clock, and falls back to the secondary CT bus clock, which is now driven by the secondary clock master off its fallback timing reference.
4. If the secondary CT bus clock fails, the board falls back to its internal oscillator and continues to monitor the state of the secondary CT bus clock.
5. If the secondary CT bus clock is reestablished, the board synchronizes again with the secondary CT bus clock.

Secondary clock master fallback

You can set up a second device to be used as a backup or a secondary clock master if the primary clock master stops driving its CT bus clock (because both of its timing references failed, or it was hot-swapped out).

Clock fallback for a secondary clock master works as follows:

1. As long as the primary clock master is driving its CT bus clock, the secondary clock master acts as a slave to the primary clock master. However, the secondary master also drives the CT bus clock not driven by the primary master (for example, B_CLOCK if the primary master is driving A_CLOCK).
2. If the primary clock master stops driving its CT bus clock, all slaves (including the secondary clock master) lose their primary timing reference.
3. This failure triggers the secondary master to fall back to its fallback timing reference and continue to drive the secondary CT bus clock from the fallback reference.
4. This failure also triggers other slaves to fall back to the CT bus clock driven by the secondary clock master.
5. The secondary master and slaves do not switch back to the primary timing reference automatically if the primary reference is reestablished. Software intervention is required prior to any further clock changes.

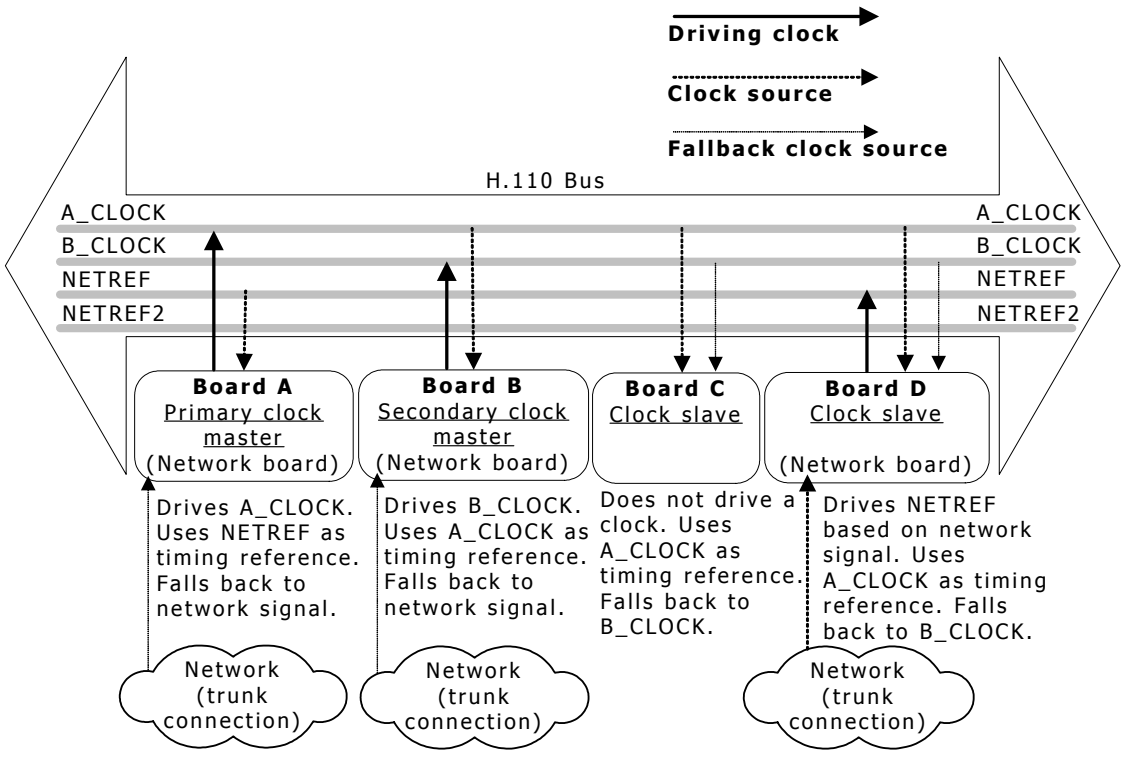
6. If the board formerly used as the primary clock master is still active but is not receiving a primary or fallback timing reference, the board becomes a slave to the clock driven by the secondary master.
7. If the secondary clock master's fallback clock reference fails, it switches to an internal oscillator and continues to drive the secondary CT bus clock.
8. Upon recovery of the fallback clock reference, the secondary clock master synchronizes again with the clock reference and continues to drive the secondary CT bus clock based on the fallback reference.

Clock slave fallback

Clock fallback for a clock slave works as follows:

1. As long as the primary clock master is driving its CT bus clock, the clock slave uses this clock.
2. Upon detecting failure of the primary CT bus clock, the clock slave switches to the secondary CT bus clock.
3. If the secondary CT bus clock fails, the board falls back to its internal oscillator and continues to monitor the state of the secondary CT bus clock.
4. If the secondary CT bus clock is reestablished, the board synchronizes again with the secondary CT bus clock.

The following illustration shows a sample clock fallback configuration:



NETREF (NETREF1) and NETREF2

If you specify that any board use NETREF (NETREF1) or NETREF2 as a timing reference, you must configure one or two other boards to drive the signals. Configure a different board for each signal. The source for each signal must be a digital trunk.

Note: NETREF2 is available only in H.110 configurations.

Using NETREF with a PCI or PCI Express TX board

PCI or PCI Express TX boards have a single trunk group consisting of trunks 1, 2, 3, and 4. If the primary or fallback clock reference is a digital trunk, and the board is configured to drive NETREF, the same digital trunk must be configured for both the clocking reference source and the NETREF source. If a different digital trunk is selected for NETREF, this configuration is silently overridden, and the board drives NETREF from the digital trunk selected as the main or fallback clock source.

Using NETREF with a CompactPCI TX board

CompactPCI TX boards have two separate trunk groups. Trunk group one consists of trunks 1, 2, 5, and 6. Trunk group two consists of trunks 3, 4, 7, and 8. If the primary or fallback clock reference is a digital trunk, and the board is configured to drive NETREF, the NETREF source can be either:

- The same digital trunk used for the primary or fallback clock reference
- Any of the digital trunks in the other trunk group

If a different digital trunk in the same trunk group is selected to drive NETREF, this configuration is silently overridden, and the board drives NETREF from the digital trunk selected as the main or fallback clock source.

Configuring clocking

The *txcfg.txt* clock command defines the clocking configuration of the TX board main clock source. This clock is used as the internal clock for TX boards. The clock signal can also be routed to other clocking signals. The clock source can be a clock signal of the H.100/H.110 bus, the TX board internal oscillator, or an oscillator or trunk connected to another device in the system (refer to *H.100 and H.110 bus clocking overview* on page 20).

If the clock command is not specified, the TX board remains in its default clocking mode (standalone mode). In this mode, the main clock source is the on-board oscillator. No clock signals are driven and clock fallback is disabled.

This topic presents:

- Clock command
- Configuring fallback
- Configuring NETREF

Clock command

The clocking configuration statement syntax is:

```
clock source [=network] outsigs [netref speed] [fallback source [=fallback network]]
```

where ***source*** specifies the source of the timing reference signal and is one of the following values:

Value	Description
a	H.100/H.110 bus A_CLOCK.
b	H.100/H.110 bus B_CLOCK.
nr1	H.100/H.110 bus NETREF or NETREF1.
nr2	H.100/H.110 bus NETREF2.
net	Clock derived from external network connection (T1/E1 trunk). When specifying net, use the =***network*** syntax to identify from which network trunk to extract the clock. For example, clock net=1 specifies using the clock derived from network trunk 1 as the board's clock source.
osc	On-board oscillator.

where ***outsigs*** specifies the clock signal to drive and is one of the following values:

Value	Description
a	Drive H.100/H.110 bus A_CLOCK.
b	Drive H.100/H.110 bus B_CLOCK.
-	Do not drive any H.100/H.110 bus A_CLOCK or B_CLOCK.

where ***netref speed*** optionally specifies the NETREF speed and is one of the following values:

Value	Description
8k	8 kHz NETREF clock signal.
15m	1.544 MHz NETREF clock signal.
20m	2.048 MHz NETREF clock signal.
-	Speed of NETREF clock signal not provided.

where ***fallback source*** optionally specifies the clock signal to fall back to and is one of the following values:

Value	Description
a	H.100/H.110 bus A_CLOCK.
b	H.100/H.110 bus B_CLOCK.
nr1	H.100/H.110 bus NETREF or NETREF1.
nr2	H.100/H.110 bus NETREF2.
net	Clock derived from external network connection (T1/E1 trunk). When specifying net, use the =***fallback network*** syntax to identify from which network trunk to extract the clock. For example, net=1 specifies fallback to clock derived from network trunk 1.
osc	On-board oscillator.

Note: If ***fallback source*** is not specified, clock fallback is disabled on the board.

Configuring fallback

Primary clock master

Follow these guidelines when configuring a TX board as the primary clock master:

- Its primary timing reference must be a NETWORK reference. This timing reference can be any one of its T1/E1 trunks or the NETREF signal from the CT bus.
- Its fallback timing reference must be a different NETWORK reference.
- It must be configured to drive one of the CT bus clocks (A_CLOCK or B_CLOCK).

For example:

```
clock net=1 a - net=2
```

This clocking configuration receives the timing reference from network 1 clock, drives A_CLOCK, and falls back to network 2 clock.

Secondary clock master

Follow these guidelines when configuring a TX board as the secondary clock master:

- It must receive its primary timing reference from the CT bus clock driven by the primary clock master (either A_CLOCK or B_CLOCK).
- It must drive the CT bus clock not driven by the primary master. For example, if the primary clock master is driving A_CLOCK, the secondary clock master must drive B_CLOCK. In this case, both clocks are synchronized.
- It must have a fallback timing reference. This timing reference must not be the primary clock master's primary or fallback timing reference.

For example:

```
clock a b - net=1
```

This clocking configuration receives the timing reference from A_CLOCK, drives B_CLOCK, and falls back to network 1 clock.

Clock slave

Follow these guidelines when configuring a TX board as the clock slave:

- The primary clock source is the primary CT bus clock driven by the primary clock master.
- The fallback clock source is the secondary CT bus clock driven by the secondary clock master.

For example:

```
clock a - - b
```

This clocking configuration receives the timing reference from A_CLOCK and falls back to B_CLOCK.

Configuring NETREF

Use the *txcfg.txt* netref command to route a clock signal recovered from a specified T1/E1 network connection to the indicated H.100/H.110 bus NETREF signals. If the netref command is not specified, the TX board does not drive any of the H.100/H.110 NETREF clock signals.

The NETREF clocking configuration statement syntax is:

```
netref network outsigs [netref speed]
```

where ***network*** is the network number (T1/E1 trunk number) from which to derive the clock signal, and ***outsigs*** specifies the clock signal to drive and is one of the following values:

Value	Description
nr1	Drive H.100/H.110 bus NETREF or NETREF1.
nr2	Drive H.100/H.110 bus NETREF2.
nr12	Drive H.100/H.110 bus NETREF1 AND NETREF2.
-	Do not drive any H.100/H.110 bus NETREF signal.

where ***netref speed*** optionally specifies the NETREF speed and is one of the following values:

Value	Description
8k	8 kHz NETREF clock signal.
15m	1.544 MHz NETREF clock signal.
20m	2.048 MHz NETREF clock signal.
-	Speed of NETREF clock signal not provided.

Configuring T1/E1 trunks

The *txcfg.txt* T1/E1 configuration command determines whether a TX board's trunk is configured as E1 (e1cfg), T1 (t1cfg), or J1 (j1cfg) mode. The configuration command consists of an identifier for the trunk being configured (1 through 4 for PCI and PCI Express TX boards, 1 through 8 for CompactPCI TX boards) and parameters specifying the circuit framing, line encoding, line buildout (T1/J1 only), and loop master configuration. This configuration statement defines the most common attributes of a trunk interface. Each T1/E1 command also supports an optional command that can be used to configure less common options for the given trunk type (E1 (e1opt), T1 (t1opt), J1 (j1opt)). Options must be specified before the trunk configuration command is specified.

This topic presents:

- E1 configuration
- T1 and J1 configuration

E1 configuration

Use the *txcfg.txt* e1cfg command to configure a trunk as an E1 interface. The information provided by the e1cfg command is combined with any information provided in previous e1opt commands to produce the full E1 trunk configuration information.

The E1 trunk configuration statement syntax is:

```
e1cfg trunk_num framing encoding master
```

where ***trunk_num*** is the trunk number to configure (1 through 4 for PCI and PCI Express TX boards, 1 through 8 for CompactPCI TX boards) and ***framing*** is one of the following values:

Value	Description
ccs	Clear channel signaling (double frame format).
cas	Channel associated signaling.
ccsrc	Clear channel signaling (CRC4 multiframe format).
casrc	Channel associated signaling (CRC4 multiframe format).

where ***encoding*** is one of the following values:

Value	Description
nozcs	AMI encoding with no zero code suppression.
hdb3	High density bipolar order 3.

where ***master*** is one of the following values:

Value	Description
true	Local side of connection acts as timing source for this circuit.
false	Remote side of connection acts as timing source.

E1 options

Use the e1opt command to control all E1 trunk configuration options that are not specified by the e1cfg command. The e1opt command does not send configuration requests to the TX board; the command modifies the optional configuration information attached to the E1 trunk configuration request issued by the e1cfg command. Because the E1 configuration options are not reset by an e1cfg command, all E1 options can be specified once and used for the configuration of each E1 trunk. A single e1opt command can be used to set up to 15 different options. Multiple e1opt commands can also be used.

The E1 trunk configuration options statement syntax is:

```
e1opt ! flag name value name=value
```

where:

Parameter	Description
!	Clear a flag. Use to disable an option that is enabled by default.
flag name	Flag to set, or clear if ! is specified. Refer to *E1 option flags* on page 33.
value name	Value to change. Refer to *E1 option values* on page 34.
value	New value for named parameter.

E1 option flags

The following table lists the E1 option flags. If the default of the specified option flag is SET, use ! ***flag name*** to clear the flag.

Flag name	Description
EXZE	Extended code violation or excessive zero detection.
ALM	Standard by which AIS is detected. SET = ITU-T G.775; CLEAR = ETS300233. Default is SET.
SA6Y	Detection of Sa6-bit pattern done synchronously to multiframe.
EXTIW	Extended CRC4 to non-CRC4 interworking (search after 400 ms). Default is SET.
AXRA	Remote alarm bit set automatically if receiver in asynchronous state. Default is SET.
CRCI	Automatic CRC (4) bit inversion.
XCRCI	Transmission of CRC (4|6) bit inversion.
DCOXC	Center function of transmission circuitry enabled.
ALMF	Automatic loss of multiframe alignment when excessive CRC errors. Default is SET.
AXS	Automatic transmission of submultiframe status. Default is SET.
EBP	In asynchronous state, E-bit is set (valid only if AXS is set). Default is SET.
DAIS	Automatic AIS insertion disabled.
DAXLT	Automatic high impedance transmission pins on short detect disabled.
DXJA	Internal transmit jitter attenuation disabled.
DCF	Center function of receive circuitry disabled.
AFR	Automatic search for double frame alignment disabled.
XSIS	First bit of the service word. Default is SET.
XSIF	Transmission of spare bit for international use (FAS word). Default is SET.
XS13	Transmission of spare bit (frame 13, CRC-multiframe). Default is SET.
XS15	Transmission of spare bit (frame 15, CRC-multiframe). Default is SET.
SWD	Loss of synchronization based on service word disabled.
ASY4	Four consecutive incorrect FAS words cause LOS (CLEAR = 3).
EQON	-43 dB receiver (long haul mode). CLEAR = -10 dB (short haul).
RLM	Receiver mode for receive line monitoring.
CLOS	Received data is cleared as soon as LOS detected.
SCF	Corner frequency of DCO-R reduced by factor of 10 to 0.2 Hz.

E1 option values

Option name	Default	Valid range	Description
XP0	E1_XPM_0 (0xFF)	0x00 through 0x1F	Transmission of pulse shape mask (for 1st level).
XP1	E1_XPM_1 (0xFF)	0x00 through 0x1F	Transmission of pulse shape mask (for 2nd level).
XP2	E1_XPM_2 (0xFF)	0x00 through 0x1F	Transmission of pulse shape mask (for 3rd level).
XP3	E1_XPM_3 (0xFF)	0x00 through 0x1F	Transmission of pulse shape mask (for 4th level).
RIL	0x02	0x00 through 0x07	Receive input threshold.
SLT	0x02	0x00 through 0x03	Voltage threshold when receive slicer generates mark.
PCD	0x0A	0x00 through 0xFF	LOS alarm generated if no transmission in 16x(pcd+1) consecutive pulses.
PCR	0x15	0x00 through 0xFF	LOS alarm cleared if pcr+1 pulses in detect interval.
XY	0x1F	0x00 through 0x1F	Spare bits for national use.

T1 and J1 configuration

Use the *txcfg.txt* t1cfg command to configure a trunk as a T1 interface. The information provided by the t1cfg command is combined with information provided in previous t1opt commands to produce the full T1 trunk configuration information. As a variant of the standard T1 trunk configuration, use the j1cfg command to configure the trunk in J1 mode. The syntax for both the t1cfg and the j1cfg commands is identical.

The T1 trunk configuration statement syntax is:

```
t1cfg trunk_num framing encoding build_out master
```

The J1 trunk configuration statement syntax is:

```
j1cfg trunk_num framing encoding build_out master
```

where ***trunk_num*** is the trunk number to configure (1 through 4 for PCI and PCI Express TX boards, 1 through 8 for CompactPCI TX boards) and ***framing*** is one of the following values:

Value	Description
d4	D4 (193S) framing: 12-frame multiframe format (F12, D3/4).
f4	4-frame multiframe format (F4).
esf	Extended superframe format: 24-frame multiframe format (ESF).
f72	72-frame multiframe format (F72, remote switch mode).

where ***encoding*** is one of the following values:

Value	Description
nozsc	AMI encoding with no zero code suppression.
b7zs	Bit 7 stuffing with zero code suppression.
b8zs	Bipolar eight zero substitution.

where ***build_out*** is one of the following values:

Value	Transmitter attenuation
0	0 dB
1	-7.5 dB
2	-15 dB
3	-22.5 dB

where ***master*** is one of the following values:

Value	Description
true	Local side of connection acts as timing source for this circuit.
false	Remote side of connection acts as timing source.

T1 and J1 options

Use the t1opt or j1opt command to control all T1 or J1 trunk configuration options that are not specified by the t1cfg or j1cfg command. The t1opt or j1opt command does not send configuration requests to the TX board; the command modifies the optional configuration information attached to the T1 or J1 trunk configuration request issued by the t1cfg or j1cfg command. Because the T1 and J1 configuration options are not reset by a t1cgf or a j1cfg command, all T1 or J1 options can be specified once and used for the configuration of each T1 or J1 trunk. A single t1opt or j1opt command can be used to set up to 15 different options. Multiple t1opt or j1opt commands can also be used.

The T1 trunk configuration options statement syntax is:

```
t1opt ! flag name value name=value
```

The J1 trunk configuration options statement syntax is:

```
j1opt ! flag name value name=value
```

where:

Parameter	Description
!	Clear a flag. Use to disable an option that is enabled by default.
flag name	Flag to set, or clear if ! is specified. Refer to *T1 and J1 option flags* on page 36.
value name	Value to change. Refer to *T1 and J1 option values* on page 37.
value	New value for named parameter.

T1 and J1 option flags

The following table lists the T1 and J1 option flags. If the default of the option flag is SET, use ! ***flag name*** to clear.

Flag name	Description
EXZE	Extended code violation or excessive zero detection.
SRAF	F12: FS-bit of frame 12; ESF: bit 2 = 0.
CRC	CRC6 check or generation (ESF format only) enabled. Default is SET.
AIS3	AIS detection only in asynchronous state.
SSC2	LFA declaration if more than 320 CRC6 errors per second.
RRAM	Detection of remote (yellow) alarm allowed during bit error rates.
LOS1	Additional condition for LOS alarm cleared: GR-499-CORE.
SJR	Alarm handling done according to ITU-T JG.704 and 706. Default is CLEAR (T1) and SET (J1).
AXRA	Remote alarm bit set automatically if receiver in asynchronous state. Default is SET.
CRCI	Automatic CRC(4) bit inversion.
XCRCI	Transmission of CRC(4|6) bit inversion.
DCOXC	Center function of transmit circuitry enabled.
DAIS	Automatic AIS insertion disabled.
DAXLT	Automatic high impedance transmission pins on short detect disabled.
DXJA	Internal transmit jitter attenuation disabled.
DCF	Center function of receive circuitry disabled.
EQON	-36 dB receiver (long haul mode). CLR = -10 dB (short haul).
RLM	Receiver mode for receive line monitoring.
CLOS	Received data is cleared as soon as LOS detected.
SCF	Corner frequency of DCO-R reduced by a factor of 10 to 0.6 Hz.
MCSP	Multiple candidates synchronization procedure.
SSP	Synchronization procedure.

T1 and J1 option values

Option name	Default	Valid range	Description
XP0	T1_XPM_0 (0xFF)	0x00 through 0x1F	Transmission of pulse shape mask (for 1st level). Refer to *Line buildout values* on page 37.
XP1	T1_XPM_1 (0xFF)	0x00 through 0x1F	Transmission of pulse shape mask (for 2nd level). Refer to Line buildout values.
XP2	T1_XPM_2 (0xFF)	0x00 through 0x1F	Transmission of pulse shape mask (for 3rd level). Refer to Line buildout values.
XP3	T1_XPM_3 (0xFF)	0x00 through 0x1F	Transmission of pulse shape mask (for 4th level). Refer to Line buildout values.
RIL	0x00	0x00 through 0x07	Receive input threshold.
SLT	0x02	0x00 through 0x03	Voltage threshold when receive slicer generates mark.
PCD	0x00	0x00 through 0xFF	LOS alarm generated if no transmission in 16x(pcd+1) consecutive pulses.
PCR	0x00	0x00 through 0xFF	LOS alarm cleared if pcr+1 pulses in detection interval.
XY	0x00	0x00 through 0x1F	Spare bits for national use.
SSC	0x00	0x00 through 0x03	Synchronization conditions.

Line buildout values

The default values for the transmit pulse shape mask trigger the TX board to define the pulse shape according to the value of the EQON option flag and the value of the line buildout. These default values are tuned for each specific TX board type (and potentially fine-tuned to each specific trunk).

Configuring ports

The *txcfg.txt* port command defines a full-duplex connection between the TX board communication controller and a remote SS7 connection over either the H.100/H.110 bus or over one of the boards T1/E1 trunks. Port numbers are specified in the MTP configuration file as T***n*** where ***n*** is the port number.

The port command abstracts the TX boards internal local stream mapping scheme. Define dedicated TDM connections with this command. The connect command is an alternative to the port command to define a pair of half-duplex connections. However, because the connect command does not abstract the TX boards local stream mapping, use the port command for all SS7 TDM connection definitions.

This topic presents:

- Local stream mapping scheme
- Port command
- Connect command
- Examples

Local stream mapping scheme

Each TX board provides a number of SS7 resources (communication controllers) used to terminate SS7 links. For the TX boards, these SS7 resources are addressed on local streams 72 and 73.

Use the *txcfg.txt* port command to define TDM connections to SS7 resources. A port command for a standard speed link creates two half-duplex TDM connections between the communication controller and either a T1/E1 channel or an H.100/H.110 channel. The timeslot used to connect to the communication controller is always ***port number*** - 1. The timeslot used when defining a T1 port is in the range of 0 through 23. The timeslot used when defining an E1 port is in the range of 1 through 31.

The following table presents the local stream mapping scheme:

Trunk connections (T1 or J1 trunks)	Trunk 1: Streams 0 and 1, Trunk 2: Streams 4 and 5, Trunk 3: Streams 8 and 9, Trunk 4: Streams 12 and 13, Trunk 5: Streams 16 and 17, Trunk 6: Streams 20 and 21, Trunk 7: Streams 24 and 25, Trunk 8: Streams 28 and 29,	timeslots 0 through 23 timeslots 0 through 23 timeslots 0 through 23 timeslots 0 through 23 timeslots 0 through 23 (CompactPCI TX boards only) timeslots 0 through 23 (CompactPCI TX boards only) timeslots 0 through 23 (CompactPCI TX boards only) timeslots 0 through 23 (CompactPCI TX boards only)
Trunk connections (E1 trunks)	Trunk 1: Streams 0 and 1, Trunk 2: Streams 4 and 5, Trunk 3: Streams 8 and 9, Trunk 4: Streams 12 and 13, Trunk 5: Streams 16 and 17, Trunk 6: Streams 20 and 21, Trunk 7: Streams 24 and 25, Trunk 8: Streams 28 and 29,	timeslots 1 through 31 timeslots 1 through 31 timeslots 1 through 31 timeslots 1 through 31 timeslots 1 through 31 (CompactPCI TX boards only) timeslots 1 through 31 (CompactPCI TX boards only) timeslots 1 through 31 (CompactPCI TX boards only) timeslots 1 through 31 (CompactPCI TX boards only)
SS7 communication controller	Streams 72 and 73, timeslots 0 through 31	

Port command

The port statement syntax is:

```
port portnum bus outstream slot speed
```

where ***portnum*** is the port number to define (1 through the maximum number links supported [***TX board type specific***] or * for HSL) and ***bus*** is one of the following values:

Value	Description
h100	Defines a connection across the H.100/H.110 bus.
local	Defines a connection across one of the TX boards local streams. This value is similar to the connect command since the TX boards local stream mapping scheme must be known to use this bus type.
e1	Defines a connection across a timeslot of an E1 trunk.
t1	Defines a connection across a timeslot of a T1 trunk.
j1	Defines a connection across a timeslot of a J1 trunk.

where ***outstream*** is interpreted based on the value of ***bus***:

If bus is...	Then outstream (and implied instream) is...
h100	Outbound H.100/H.110 stream number. The range is 0 through 31. If ***outstream*** is even, ***instream*** = ***outstream*** + 1. If ***outstream*** is odd, ***instream*** = ***outstream*** - 1.
local	Outbound local stream number. The range is based on the specific TX board type. Refer to *Local stream mapping scheme* on page 38. ***instream*** = ***outstream***.
e1/t1/j1	One-based trunk number. The range is 1 through 4 for PCI and PCI Express TX boards and 1 through 8 for CompactPCI TX boards. ***instream*** = ***outstream***.

where ***slot*** is interpreted based on the value of ***bus***:

If bus is...	Then slot is...
h100	Inbound and outbound H.100/H.110 timeslot number. The range is 0 through 127.
local	Inbound and outbound local timeslot number. The range is 0 through 31.
e1	Timeslot on the E1 trunk. The range is 1 through 31 or * for HSL. You cannot configure an SS7 port on E1 timeslot 0.
t1/j1	Zero-based timeslot number on the T1 (or J1) trunk. The range is 0 through 23 or * for HSL.

where ***speed*** is one of the following values (not used for HSL):

Value	Description
64	64 Kb connection (default speed of all port connections).
56	56 Kb connection.
48	48 Kb connection.

Connect command

Use the *txcfg.txt* connect command to define a half-duplex connection between any two TDM endpoints so that TDM timeslots not in use by SS7 links can be switched to other devices. To properly use the connect command, it is important to understand the TX board's local stream mapping scheme.

Note: For connections that terminate SS7 links, use the port command since it abstracts all knowledge of the TX board's internal switching model.

The connect statement syntax is:

```
connect inbus instream inslot outbus outstream outslot
```

where ***inbus*** specifies the input source and is one of the following values:

Value	Description
h100	Input source is the stream and timeslot from the H.100/H.110 bus.
local	Input source is the stream and timeslot from one of the TX boards local streams (either a T1/E1 interface or an SS7 communication controller).

where ***instream*** is the inbound stream number: 0 through 31 (Hbus); 0 through ***n*** (local).

where ***inslot*** is the inbound timeslot: 0 through 127 (Hbus); 0 through 31 (local).

where ***outbus*** is one of the following values:

Value	Description
h100	Output endpoint is the stream and timeslot to the H.100/H.110 bus.
local	Output endpoint is the stream and timeslot to one of the TX boards local streams (either a T1/E1 interface or an SS7communication controller).

where ***outstream*** is the outbound stream number: 0 through 31 (Hbus); 0 through ***n*** (local).

where ***outslot*** is the outbound timeslot: 0 through 127 (Hbus); 0 through 31 (local).

Examples

This section presents the following port configuration examples:

- T1 example
- H.100/H.110 example
- Example mapping of all non-signaling T1 channels (trunk 1) to H.100/H.110
- Example mapping of all non-signaling T1 channels (trunk 2) to trunk 3
- Example mapping of all non-signaling E1 channels (trunk 1) to H.100/H.110
- Example mapping of all non-signaling E1 channels (trunk 2) to trunk 3

T1 example

This command:

```
port 5 t1 2 7
```

creates the following TDM connections:

- Local stream 72 timeslot 4 transmitting to local stream 4 timeslot 7
- Local stream 4 timeslot 7 transmitting to local stream 72 timeslot 4

This command creates a full-duplex connection used by the MTP link defined as T5.

Local stream 72 connects to and from the SS7 communication controller with timeslot 4 (port number 5 - 1).

Local stream 4 connects to T1 trunk 2 with timeslot 7 mapping to T1 channel 7.

The same stream numbers are used for input and output connections when the stream is a local stream.

H.100/H.110 example

This command:

```
port 9 h100 2 7
```

creates the following TDM connections:

- Local stream 72 timeslot 8 transmitting to H.100 stream 2 timeslot 7
- H.100 stream 3 timeslot 7 transmitting to local stream 72 timeslot 8

This command creates a full-duplex connection used by the MTP link defined as T9.

Local stream 72 connects to and from the SS7 communication controller with timeslot 8 (port number 9 - 1).

H.100 stream 2 is specified as the output stream. This is an even stream number, so the corresponding input stream number is 2 + 1 = 3.

The same stream numbers are used for input and output connections for the local stream (connecting to the communication controller), while different streams are used to connect over the H.100 bus.

Example mapping of all non-signaling T1 channels (trunk 1) to H.100/H.110

This example shows the port and connect commands required to fully access the channels on T1 trunk 1.

The example creates a single SS7 port on T1 channel 0 (trunk 1) and maps all other channels of trunk 1 to the H.100/H.110 bus (transmitting to stream 30 and receiving from stream 31).

Command	Description
port 1 t1 1 0	Port 1 maps to T1 trunk 1 channel 0.
connect local 0 1 h100 30 1	Local stream 0 (trunk 1) channel 1 maps to H.100/H.110 stream 30 timeslot 1.
connect h100 31 1 local 0 1	H.100/H.110 stream 31 timeslot 1 maps to local stream 0 (trunk 1) channel 1.
connect local 0 2 h100 30 2	Local stream 0 (trunk 1) channel 2 maps to H.100/H.110 stream 30 timeslot 2.
connect h100 31 2 local 0 2	H.100/H.110 stream 31 timeslot 2 maps to local stream 0 (trunk 1) channel 2.
Pair of connect commands for channels 3 through 22	
connect local 0 23 h100 30 23	Local stream 0 (trunk 1) channel 23 maps to H.100/H.110 stream 30 timeslot 23.
connect h100 31 23 local 0 23	H.100/H.110 stream 31 timeslot 23 maps to local stream 0 (trunk 1) channel 23.

Example mapping of all non-signaling T1 channels (trunk 2) to trunk 3

This example shows the port and connect commands required to fully access the channels on T1 trunk 2.

The example creates a single SS7 port on T1 channel 23 (trunk 2) and maps all other channels of trunk 2 to trunk 3.

Command	Description
port 1 t1 2 23	Port 1 maps to T1 trunk 2 channel 23.
connect local 4 0 local 8 0	Local stream 4 (trunk 2) channel 0 maps to local stream 8 (trunk 3) channel 0.
connect local 8 0 local 4 0	Local stream 8 (trunk 3) channel 0 maps to local stream 4 (trunk 2) channel 0.
connect local 4 1 local 8 1	Local stream 4 (trunk 2) channel 1 maps to local stream 8 (trunk 3) channel 1.
connect local 8 1 local 4 1	Local stream 8 (trunk 3) channel 1 maps to local stream 4 (trunk 2) channel 1.
Pair of connect commands for channels 2 through 21	
connect local 4 22 local 8 22	Local stream 4 (trunk 2) channel 22 maps to local stream 8 (trunk 3) channel 22.
connect local 8 22 local 4 22	Local stream 8 (trunk 3) channel 22 maps to local stream 4 (trunk 2) channel 22.

Example mapping of all non-signaling E1 channels (trunk 1) to H.100/H.110

This example shows the port and connect commands required to fully access the channels on E1 trunk 1.

The example creates a single SS7 port on E1 channel 1 (trunk 1) and maps all other channels of trunk 1 to the H.100/H.110 bus (transmitting to stream 30 and receiving from stream 31).

Command	Description
port 1 e1 1 1	Port 1 maps to E1 trunk 1 channel 1.
connect local 0 2 h100 30 2	Local stream 0 (trunk 1) channel 2 maps to H.100/H.110 stream 30 timeslot 2.
connect h100 31 2 local 0 2	H.100/H.110 stream 31 timeslot 2 maps to local stream 0 (trunk 1) channel 2.
connect local 0 3 h100 30 3	Local stream 0 (trunk 1) channel 3 maps to H.100/H.110 stream 30 timeslot 3.
connect h100 31 3 local 0 3	H.100/H.110 stream 31 timeslot 3 maps to local stream 0 (trunk 1) channel 3.
Pair of connect commands for channels 4 through 30	
connect local 0 31 100 30 31	Local stream 0 (trunk 1) channel 31 maps to H.100/H.110 stream 30 timeslot 31.
connect h100 31 31 local 0 31	H.100/H.110 stream 31 timeslot 31 maps to local stream 0 (trunk 1) channel 31.

Example mapping of all non-signaling E1 channels (trunk 2) to trunk 3

This example shows the port and connect commands required to fully access the channels on E1 trunk 2.

The example creates a single SS7 port on E1 channel 31 (trunk 2) and maps all other channels of trunk 2 to trunk 3.

Command	Description
port 1 e1 2 31	Port 1 maps to E1 trunk 2 channel 31.
connect local 4 1 local 8 1	Local stream 4 (trunk 2) channel 1 maps to local stream 8 (trunk 3) channel 1.
connect local 8 1 local 4 1	Local stream 8 (trunk 3) channel 1 maps to local stream 4 (trunk 2) channel 1.
connect local 4 2 local 8 2	Local stream 4 (trunk 2) channel 2 maps to local stream 8 (trunk 3) channel 2.
connect local 8 2 local 4 2	Local stream 8 (trunk 3) channel 2 maps to local stream 4 (trunk 2) channel 2.
Pair of connect commands for channels 3 through 29	
connect local 4 30 local 8 30	Local stream 4 (trunk 2) channel 30 maps to local stream 8 (trunk 3) channel 30.
connect local 8 30 local 4 30	Local stream 8 (trunk 3) channel 30 maps to local stream 4 (trunk 2) channel 30.

4 Configuring IP

IP configuration overview

Before SS7 can be transported over IP, you must create and download an IP configuration file (*ipcfgn.txt*) to the TX board. This file contains parameters that configure one or more IP interfaces. Each TX board in a system requires a separate IP configuration file. Refer to *Configuring an IP interface* on page 49 for more information.

The configuration utility, *txconfig,* runs as part of the initial board configuration with *ss7load. txconfig* reads the configuration file and downloads the specified configuration to the TX board.

This topic presents:

- Sample IP configuration file
- Example configurations
- Common IP configuration changes

Sample IP configuration file

NaturalAccess™ Signaling Software provides a sample IP configuration file that you can modify for your specifications. The sample IP configuration file presents the most common type of TX board use:

File	Description
ipcfgn.txt	Configures the TX board with explicit addressing information for two Ethernets. This file contains commented-out examples for defining interfaces with DHCP or for defining a redundant TX board mate.

For the location of the sample configuration files, refer to *Sample SS7 IP configurations* on page 14.

Example configurations

The following example shows how to assign IP address 192.168.1.1 to Ethernet interface 1 and 10.2.1.1 to Ethernet interface 2 (used for redundancy):

```
#-------------------------------------------------------------------------
# Ethernet interface number 1 connects to the 192.168.*.* subnet:
ifcreate 1 192.168.1.1 255.255.0.0


#-------------------------------------------------------------------------
# Ethernet interface number 2 connects to the 10.1.*.* subnet:
ifcreate 2 10.1.1.1 255.255.0.0


#-------------------------------------------------------------------------
# Default gateway for each network
gateway 192.168.0.0 255.255.0.0 192.168.0.1
gateway 10.1.0.0 255.255.0.0 10.1.0.1


#-------------------------------------------------------------------------
# Redundancy Mate Board
mate 10.1.1.2
```

The following example shows how to configure an IP network using a DHCP server on both Ethernet 1 and Ethernet 2:

```
#-------------------------------------------------------------------------
# Ethernet interface number 1 is to obtain addressing info using DHCP:
ifcreate 1 dhcp
#-------------------------------------------------------------------------
# Ethernet interface number 2 is to obtain addressing info using DHCP:
ifcreate 2 dhcp
#^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
```

The following example shows how to configure Ethernet 1 for a SIGTRAN network with a DHCP server and Ethernet 2 for redundancy:

```
#-------------------------------------------------------------------------
# Ethernet interface number 1 is to obtain addressing info using DHCP:
ifcreate 1 dhcp
#-------------------------------------------------------------------------
# Ethernet interface number 2 has IP address 192.168.1.1:
#ifcreate 2 10.1.1.1 255.255.255.0
#-------------------------------------------------------------------------
# Redundancy Mate Board
#mate 10.1.1.2
#^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
```

The following example shows how to configure Ethernet 1 and Ethernet 2 to the SIGTRAN 10.* subnetwork with no DHCP server:

```
#-------------------------------------------------------------------------
# Ethernet interface number 1 connects to the 10.1.*.* subnet:
#ifcreate 1 10.1.1.1 255.255.0.0
#-------------------------------------------------------------------------
# Ethernet interface number 2 connects to the 10.2.*.* subnet:
#ifcreate 2 10.2.1.1 255.255.0.0
#-------------------------------------------------------------------------
# Default gateway for each network
#gateway 10.1.0.0 255.255.0.0 10.1.0.1
#gateway 10.2.0.0 255.255.0.0 10.2.0.1
#^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
```

Ethernet configuration changes

All TX board Ethernet interfaces will initialize to a state where auto-negotiation is performed to determine the maximum speed and duplex settings that the Ethernet interface will operate at. Each TX Ethernet interface will also perform pair swap detection to automatically activate whether a straight-through or crossover cable has been connected.

Certain network connections require the ability to specify a fixed speed and duplex mode (as well as manually identifying whether a straight-through or crossover cable has been connected). Use the ethcfg command to configure an Ethernet interface to operate at a fixed speed, duplex setting, and cabling mode.

For more information, refer to

Common IP configuration changes

The following IP configuration changes are commonly required for different hardware installations:

- Maximum transmission unit (MTU) modifications
- DHCP timing modifications (NDATTEMPTS, NDRETRAN)
- ARP adjustments (ARPRETRY, ARPMAX, ARPREACH, and ARPUNUSED)

All changes from default IP behavior are controlled through the ifopt command. Use the ifopt command before the ifcreate command to change optional controls.

Refer to the following topics for information on configuring IP:

- *Configuring an IP interface* on page 49
- *SIGTRAN configuration overview* on page 53

Configuring an Ethernet interface

To modify the default Ethernet interface configuration, use the ethcfg command of the TDM configuration utility, *txconfig*:

```
ethcfg command
```

The default Ethernet configuration is set to use auto-negotiation and to negotiate for the fastest speed possible, as well as to perform pair swap detection. Certain TX board Ethernet interfaces support a maximum speed of 100 Mb/s while other Ethernet interfaces support up to 1 Gigabit/s. Do not specify the ethcfg command for any interface where Gigabit speed is desired, allowing auto-negotiation to select the speed.

The ethcfg command deactivates auto-negotiation for the specified Ethernet interface and fixes the configuration using the following syntax:

```
ethcfg <Ethernet number> <speed> <duplex> [<mdix control>]
```

where:

Value	Description
Ethernet number	The 1-based Ethernet interface number uniquely identifying the specific TX board Ethernet interface being configured.
speed	The speed (in megabits per second) that the interface will operate at: 10 | 100 **Note:** Do not use the ethcfg command if Gigabit speed is desired.
duplex	Indication of whether the Ethernet will operate in half duplex or full duplex mode: HALF | FULL
mdix control	Optional indication of internal crossover (transmit and receive pair swapping). The MDIX feature can be used instead of using a crossover cable: NOMDIX – No swapping of transmit and receive pairs. MDIX – Transmit and receive pairs are swapped (internal crossover). Default: If ethcfg command is not specified, then the default behavior is for the Ethernet to perform pair swap detection. If the ethcfg command is specified, MDIX control defaults to NOMDIX.

Examples

Enter the following command to deactivate auto-negotiation for Ethernet 1, fixing the speed at 10 megabits per second (HALF DUPLEX) and use a configuration that does not swap transmit and receive pairs:

```
ethcfg 1 10 half
```

Enter the following command to deactivate auto-negotiation for Ethernet 2, fixing the speed at 100 megabits per second (FULL DUPLEX) and use a configuration that swaps transmit and receive pairs:

```
ethcfg 2 100 full mdix
```

Configuring an IP interface

The following table describes the IP configuration commands that must be set in the TDM configuration utility, *txconfig*:

Command	Description
ifopt	Sets an IP interface option.
ifcreate	Defines an IP interface.
gateway	Defines a gateway route.
mate	Assigns the IP address of the TX board's redundant mate board. Required in a redundant configuration for both SIGTRAN and TDM networks.
ethtrace	Controls Ethernet data tracing.

ifopt command

The ifopt command sets an IP interface option using the following syntax:

```
ifopt [!]<optName>[ = <optValue>]
```

where:

Value	Description
optName	***optName*** indicates that the option is enabled. ***!optName*** indicates that the option is disabled.
optValue	Value options are specified as: `optName = optValue`

The following table lists the valid option names:

Option name	Type	Description
PINGBLOCK	BIT	Indicates if automatic responses to PING messages are blocked.
MTU	VALUE	Maximum transmission unit (in bytes).
FRAGDROP	SECS	Partial fragment drop timeout.
HOPLIMIT	VALUE	Reserved for future use.
ICMPRATE	VALUE	Reserved for future use.
IPV6	BIT	Reserved for future use.
IPSEC	BIT	Reserved for future use.
NDATTEMPTS	VALUE	Specifies the neighbor discovery attempt (NDA) limit for the specified Ethernet interface.
NDRETRAN	SECS	Neighbor discovery retransmission timeout.
NDREACH	SECS	Reserved for future use.
ARPRETRY	MSECS	Amount of time to wait after issuing an ARP request before re-transmitting the same ARP request.
ARPMAX	VALUE	Maximum number of times to retry an ARP request before terminating retry attempts and considering the remote entity to be unreachable.
ARPREACH	MSECS	Maximum amount of time without receiving any message from the remote IP address before probing to verify connectivity.
ARPUNUSED	MSECS	Amount of time that an unused ARP entry remains in the ARP table. An ARP entry is used each time an outbound IP packet is sent to the remote entity for the given ARP entry.

Examples

Enter the following command to block responses to received PING requests:

```
ifopt pingblock
```

Enter the following command to drop all fragments if incomplete after 10 seconds:

```
ifopt fragdrop 10
```

ifcreate command

The ifcreate command defines an IP interface that uses either:

- DHCP to determine IP address and mask, or
- A fixed IP address and mask

An interface is created with default options unless options were specifically set using previous ifopt commands.

Using DHCP

The ifcreate command syntax using DHCP is:

```
ifcreate intfNum DHCP
```

where:

Value	Description
intfNum	1-based Ethernet interface number.
DHCP	Obtains the IP address, network mask, and default gateway.

The following example shows an interface that uses DHCP:

```
ifcreate 1 dhcp
```

Not using DHCP

The ifcreate command syntax when not using DHCP is:

```
ifcreate intfNum IPaddr mask
```

where:

Value	Description
intfNum	1-based Ethernet interface number.
IPaddr	IP address to assign to the interface.
mask	IP subnet mask.

The following example shows an interface with a specific address and mask:

```
ifcreate 2 10.3.9.15 255.255.255.0
```

gateway command

The gateway command defines a gateway route using the following syntax:

```
gateway IPaddress mask gatewayAddress
```

where:

Value	Description
IPaddress	IPv4 address in dot notation. For example, 1.2.3.4.
mask	Mask associated with IP address, in dot notation.
gatewayAddress	IPv4 address, in dot notation, of routing gateway.

Example

The following example sends all traffic not covered by a more specific route to the gateway at 10.1.0.1:

```
gateway 0.0.0.0 0.0.0.0 10.1.0.1
```

mate command

The mate command assigns the IP address of the TX board's redundant mate using the following syntax:

```
mate IP address | NONE
```

where:

Value	Description
IP address	IPv4 address in dot notation, for example 1.2.3.4.
NONE	No mate IP address (default).

Example

The following example indicates that the TX board's redundant mate is at address 10.1.1.2:

```
mate 10.1.1.2
```

Refer to the *Dialogic® TX Series SS7 Boards Health Management Developer's Reference Manual* for information about SS7 redundancy.

ethtrace command

The ethtrace command controls Ethernet data tracing using the following syntax:

```
ethtrace <iface|*> on [<hostchan>]|off
```

To activate tracing of all Ethernet traffic as part of the TX board boot process, add the following command to the TX configuration file:

```
ethtrace * ON
```

This causes the TX board to trace all packets (sent or received over any on-board Ethernet interface) to the default trace channel (47). The *ss7trace* utility uses Channel 47 to receive all types of SS7 tracing. Refer to the *Dialogic® TX Series SS7 Boards TX Utilities Manual* for information about *ss7trace*.

Examples

The following example shows how Ethernet tracing can be activated for specific interfaces:

```
ethtrace 1 on
ethtrace 2 on
```

Ethernet tracing can also be directed to channels other than the default channel. The following example causes Ethernet 1 to trace to host channel 101 while Ethernet 2 traces to host channel 102:

```
ethtrace 1 on 101
ethtrace 2 on 102
```

To deactivate tracing, run the *txconfig* utility without a configuration file (interactive mode) and enter the following command:

```
txconfig> ethtrace * off
```

5 Configuring SIGTRAN for IP

SIGTRAN configuration overview

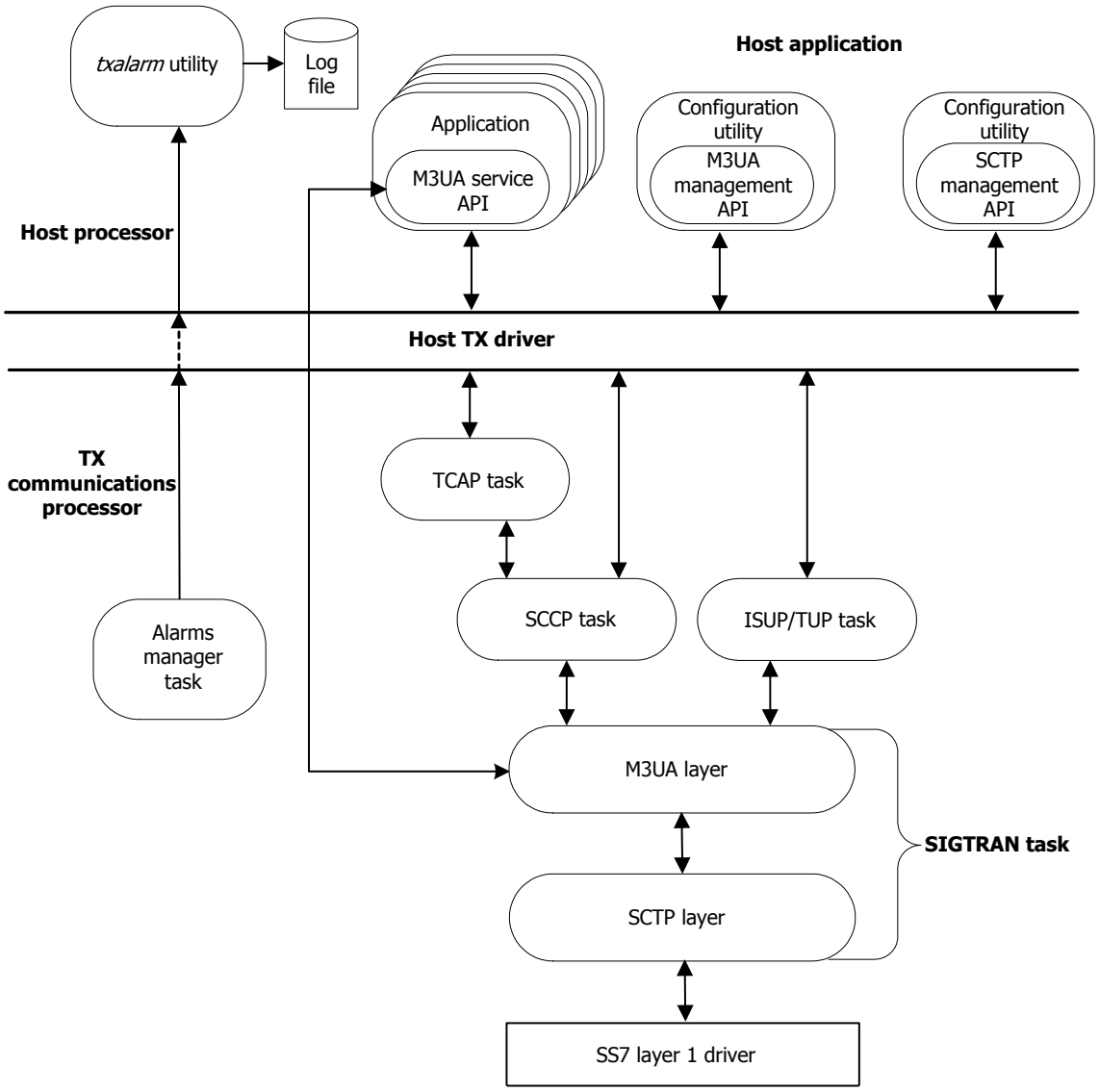
NaturalAccess™ Signaling Software uses the signaling transport (SIGTRAN) protocol to transport upper layer SS7 signaling packets over the IP network.

The Dialogic® NaturalAccess™ SIGTRAN stack consists of the following protocols:

Protocol	Description
M3UA (MTP3 User Adaptation Layer)	M3UA is an adaptation layer protocol that replaces the traditional SS7 MTP 3 layer in an IP network. It supports the transport of SS7 MTP 3 user signaling messages (such as ISUP and SCCP) over IP, using the services of SCTP. M3UA is used for communication between an application server process (ASP) and a signaling gateway process (SGP), or between two IP server processes (IPSPs). An ASP can serve as a media gateway controller (MGC) or IP-resident database. The M3UA implementation includes a data transfer or service API and a management API (MAPI). Host applications can use the service functions to transfer data, control flow, and obtain API statistics. They can use the management functions to configure and control M3UA entities, and to obtain status and statistical information from the M3UA layer. Refer to *Creating the M3UA configuration* on page 58 for more information.
SCTP (Stream Control Transmission Protocol)	SCTP is a reliable transport protocol that replaces the traditional SS7 MTP 2 layer in an IP network. It transports M3UA and higher layer SS7 signaling messages over IP networks. The SCTP implementation includes a management API (MAPI) that host applications can use to configure and control SCTP entities and to obtain SCTP status and statistical information from the SCTP layer. Refer to *Creating the SCTP configuration* on page 69 for more information.

SIGTRAN architecture

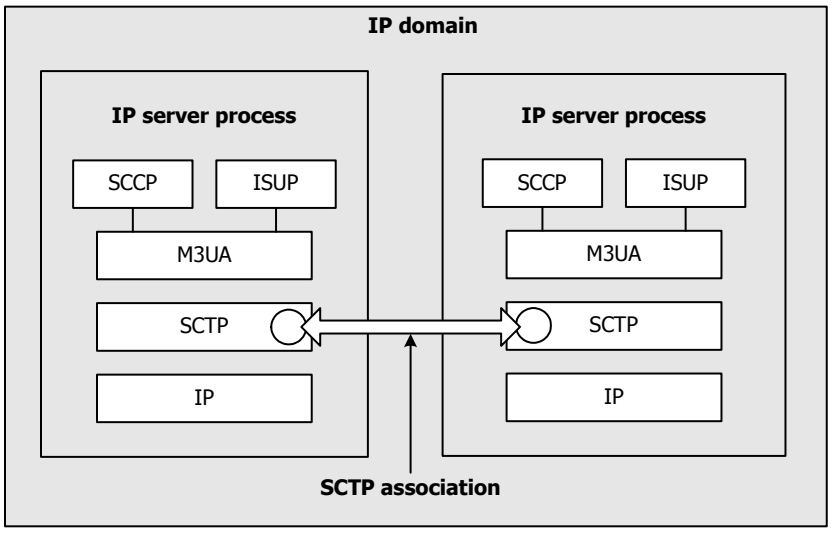
The following illustration shows the SIGTRAN high-level architecture:



Two endpoints in a SIGTRAN network can be logically connected as:

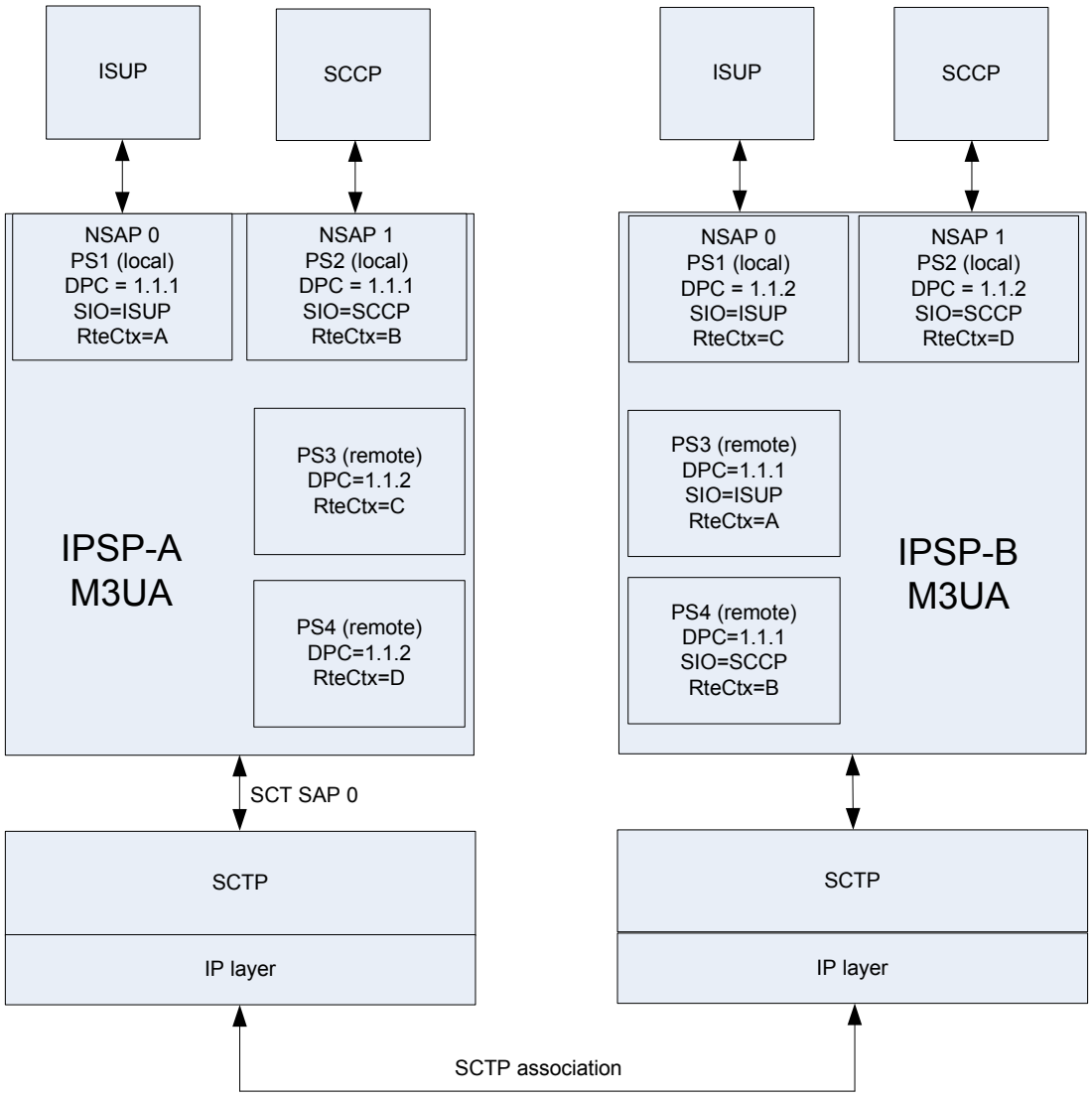
- Nodes in a client-server relationship, where one node is an application server process (ASP) and the other is a signaling gateway process (SGP).
- Peer IP-only nodes, where each node is an IP server process (IPSP).

M3UA represents the connection between two endpoints as an SCTP association. The following illustration shows an association example:

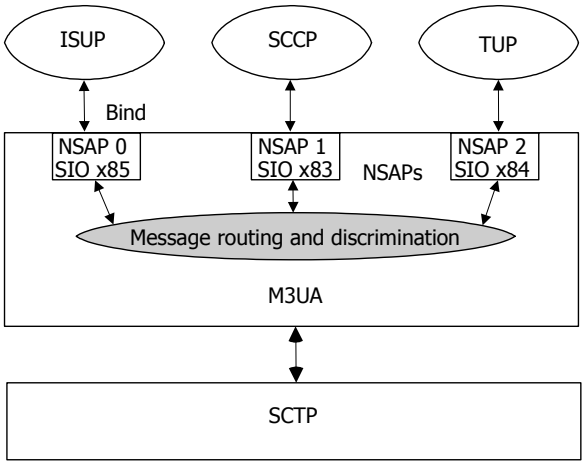


Refer to the *Dialogic® NaturalAccess™ SIGTRAN Stack Developer's Reference Manual* for more information.

The following illustration shows the relationship among NSAPs, peer servers, routes, and peer signaling processes:



The following illustration shows three NSAPs defined for M3UA:



If multiple protocol variants are configured on the same M3UA instance (same board), two NSAPs are required: one for each protocol variant. A single application can associate itself with both NSAPs for that service, or separate applications can be used for each protocol variant.

Creating the M3UA configuration

M3UA has three primary functions:

- Provides an interface between the higher SS7 layers (ISUP, SCCP, and TUP) and the lower SCTP layer.
- Routes messages to their IP destinations. M3UA uses a flexible configuration capable of supporting a wide variety of network routing and addressing requirements.
- Maintains the availability status of all destinations through all routes in the case of failure or congestion.

Refer to the *Dialogic® NaturalAccess™ SIGTRAN Stack Developer's Reference Manual* for more information.

SS7 provides the following sample files for M3UA configurations that you can modify for your specifications:

Files	Description
M3UAcp1.cfg	M3UA file for board 1.
M3UAcp2.cfg	M3UA file for board 2.

Refer to *Sample SS7 IP configurations* on page 14 for more information.

The M3UA configuration utility (*m3uacfg*) runs as part of the initial board download with *ss7load.* The utility reads the text configuration file and downloads the specified configuration to the M3UA and SCTP tasks on the TX board. You can also run the M3UA configuration utility after the initial configuration to dynamically update selected configuration parameters.

This topic presents:

- Sample M3UA configuration files
- M3UA configuration file structure

Sample M3UA configuration files

The following example is the M3UA configuration file for board 1 in an IPSP-IPSP configuration:

```
#
# M3UA Sample Configuration File
#
# All timer values are in milliseconds
#
#-------------------------------------------------
# General M3UA Parameters
#-------------------------------------------------
NODE_TYPE       ASP     # Only ASP currently supported
MAX_NSAP        2       # Max number of NSAP (M3UA
users/variants to support simultaneously)
MAX_NETWORK     2       # Max number of network contexts (one per network ID/variant)
MAX_ROUTE       16      # Max number of route entries including local routes
MAX_DPC         32      # Max # of DPCs supported includes configured & dynamically learn
ed
MAX_PS          8       # Max number of peer servers including local
MAX_LPS         4       # Max number of local peer server
MAX_PSP         16      # Max number of peer server processes
MAX_MSG         128     # Max number of M3UA messages in transit
MAX_RNDRBN_LS   4       # Max number of peer servers using round robin load sharing
MAX_SLS_LS      4       # Max number of peer servers using SLS based load sharing
MAX_SLS         128     # Max number of SLS values (total number used by all PS)
```

```
QUEUE_SIZE      256     # Outgoing congestion queue size per association
CONG_LEVEL1     64      # Congestion level 1
CONG_LEVEL2     128     # Congestion level 2
CONG_LEVEL3     196     # Congestion level 3

TMR_RESTART     10000   # Restart hold-off time (not used for IPSP)
TMR_AS_PEND     5000    # Time a PS can remain in AS_PENDING state
TMR_ASP_UP1     2000    # Initial time between ASPUP retries
TMR_ASP_UP2     2000    # Steady-state time between ASPUP retries
NMB_ASP_UP1     3       # Number of initial attempts at sending ASPUP
TMR_ASPDN       2000    # Time between ASPDN retries
TMR_ASPM        2000    # Time to wait after send ASPM message (ASPAC/ASPIA) before fail
TMR_DAUD        2000    # Time between DAUD messages
TMR_DRKM        2000    # Time between DRKM messages
NMB_DRKM        3       # Number of DRKM attempts before failing
TMR_SEQ_CNTRL   1000    # Delay when diverting traffic to maintain sequencing
END

#-----------------------------------------------
# Network Configuration Parameters
#-----------------------------------------------
NETWORK_ID        1     # Network ID
NETWORK_APPEAR    1234  # Optional network appearance code coordinated with SGP
SSF               NAT   # Subservice field (NAT / INTL)
DPC_LENGTH        24    # Point code Length (24 / 16 / 14)
SLS_LENGTH        5     # SLS Length (4 / 5 / 8)
SERVICE_USER_VAR  ANSI  # Service user variant, ANSI, ITU, CHINA, BICI, TTC, NTT
SERVICE_USER_VAR2 ANSI  # Service user variant for TCAP ANSI/ETSI/ITU
END

# -----------------------------------------------
# NSAP Configuration
#-----------------------------------------------
NSAP_ID           0       # Network sap ID
NWK_ID            1       # Network ID corresponding to above section
SERVICE_TYPE      ISUP    # Service type ISUP/TUP/SCCP/BICC
END

NSAP_ID           1       # Network sap ID
NWK_ID            1       # Network ID corresponding to above section
SERVICE_TYPE      SCCP    # Service type ISUP/TUP/SCCP/BICC
END

#-----------------------------------------------
# M3UA SCT SAP Configuration
#-----------------------------------------------
SCT_SAP_ID        0       # M3UA reference for SCTP SAP. Currently, This value must be 0
SRC_PORT          2905    # Source Port
SP_ID             0       # SCTP reference for SCTP SAP. Currently, This value must be 0
END

#-----------------------------------------------
# Peer Signaling Process (PSP) Configuration
#-----------------------------------------------
PSP_ID            1           # Unique PSP ID from 1 to Max Number of PSP -1
PSP_TYPE          IPSP        # Type of Peer (SGP/IPSP)
IPSP_MODE         DE          # Used if PSP_TYPE=IPSP (SE=single ended/DE=double ended)
DRKM_ALLOWED      FALSE       # Whether this PSP can accept DRKM messages
USE_NWK_APP       FALSE       # Use network appearance in M3UA msgs? TRUE if exchanging
                              # messages from different networks over same association.
ASP_ID_MAND       NONE        # Whether AspId is mandatory to by transmitted/received in
                              # ASPUP/ASPUP-ACK msgs (NONE / RX / TX / BOTH)
NWK_ID            1           # Default network context for incoming messages

# Association parameters
PRIME_DEST_ADDR   192.168.1.2 # Primary Peer Destination Address.
DEST_PORT         2905        # Remote SCTP Port
CLIENT_SIDE       TRUE        # Whether we initiate associations if IPSP
NMB_OUT_STREAMS   2           # Number of streams supported by this association
END
```

```
#-----------------------------------------------
# Peer Server (PS) Configuration
#-----------------------------------------------

# Local PS for ISUP
PS_ID             1           # Local PS ID, does not have to be zero
NWK_ID            1           # Selects a network context for this PS
MODE              ACTSTANDBY  # Active/standby
LOCAL             TRUE        # Is this a local AS? Yes
PSP               1
RTE_CTX           0xA         # Routing context
END

# Local PS for SCCP
PS_ID             2           # Local PS ID, does not have to be zero
NWK_ID            1           # Selects a network context for this PS
MODE              ACTSTANDBY  # Active/standby
LOCAL             TRUE        # Is this a local AS? Yes
PSP               1
RTE_CTX           0xB         # Routing context
END

# Remote PS for ISUP
PS_ID             3           # Remote PS ID
LOCAL             FALSE       # Is this a local AS? No
NWK_ID            1           # Selects a network context for this PS
MODE              ACTSTANDBY  # Peer server mode
LOAD_SHARE_TYPE   ROUND_ROBIN # Load Share type (ROUND_ROBIN / SLS )
PSP               1
RTE_CTX           0xC         # Routing context
END

# Remote PS for SCCP
PS_ID             4           # Remote PS ID
LOCAL             FALSE       # Is this a local AS? No
NWK_ID            1           # Selects a network context for this PS
MODE              ACTSTANDBY  # Peer server mode
LOAD_SHARE_TYPE   ROUND_ROBIN # Load Share type (ROUND_ROBIN / SLS )
PSP               1
RTE_CTX           0xD         # Routing context
END


#-----------------------------------------------
# Routing Entry Parameters
#-----------------------------------------------
#
DPC             1.1.1       # DPC to accept traffic for
SIO             ISUP        # SIO value ISUP/TUP/SCCP/BICC or numeric 0 - 0xF
SIO_MASK        0xF         # Use SIO for routing
RTE_TYPE        PS          # PS
NWK_ID          1           # Selects a network context for this PS
NSAP_ID         0
RTE_PS_ID       1
END

DPC             1.1.1       # DPC to accept traffic for
SIO             SCCP        # SIO value ISUP/TUP/SCCP/BICC or numeric 0 - 0xF
SIO_MASK        0xF         # Use SIO for routing
RTE_TYPE        PS          # PS
NWK_ID          1           # Selects a network context for this PS
NSAP_ID         1
RTE_PS_ID       2
END

DPC             1.1.2       # DPC supported by the peer server
RTE_TYPE        PS          # PS
NWK_ID          1           # Selects a network context for this PS
DPC_MASK        0xFFFFFF    # Match exactly
OPC             0           # Optional OPC - 0 if OPC route matching unused
OPC_MASK        0           # Optional OPC mask if OPC route matching used
```

```
SIO             ISUP        # SIO value ISUP/TUP/SCCP/BICC or numeric 0 - 0xF
SIO_MASK        0xF         # Option SIO mask if SIO route matching used
RTE_PS_ID       3           # Peer Server ID for this Route
END

DPC             1.1.2       # DPC supported by the peer server
RTE_TYPE        PS          # PS
NWK_ID          1           # Selects a network context for this PS
DPC_MASK        0xFFFFFF    # Match exactly
OPC             0           # Optional OPC - 0 if OPC route matching unused
OPC_MASK        0           # Optional OPC mask if OPC route matching used
SIO             SCCP        # SIO value ISUP/TUP/SCCP/BICC or numeric 0 - 0xF
SIO_MASK        0xF         # Option SIO mask if SIO route matching used
RTE_PS_ID       4           # Peer Server ID for this Route
END
```

Refer to *M3UA configuration considerations* on page 62 for more information.

M3UA configuration file structure

M3UA implements services through the configuration of the following entities:

Entity	Description
General M3UA	The general configuration parameters define and control the general operation of M3UA including maximum values of various layer resources, congestion levels, and protocol timers.
Network configuration	Defines the SS7 network context or appearance for potential use over multiple SS7 networks, including SSF, DPC length, and SLS length.
Network service access points (NSAPs)	Defines the upper layer SS7 applications that use M3UA. Each NSAP is associated with one application, as identified by the service indicator field of a message, and one protocol variant.
M3UA SCT SAP (service access points)	Defines the lower layer interface between M3UA and SCTP. Only one SCT SAP can be defined.
Peer signaling process (PSP)	An instance of a peer server that can either be local or remote. A peer signaling process can process signaling traffic for multiple peer servers. **Note:** A peer server process can be a signaling gateway process (SGP), an application server process (ASP), or an IP server process (IPSP).
Peer server (PS)	A logical entity that serves a specific routing key. For example, a peer server can be a virtual switch element that handles a signaling relation identified by DPC/OPC, or a virtual database element that handles all HLR transactions for a particular SIO/DPC/OPC combination. There is a one-to-one relationship between a peer server and a routing key. Because the application server effectively represents an MTP3 user, it has its own point code. **Note:** A peer server can be an application server (AS) or signaling gateway (SG).
Routing entry	Set of M3UA parameters that uniquely define the range of signaling traffic to be handled by a particular peer server.

Refer to *M3UA configuration reference* on page 63 for more information.

M3UA configuration considerations

Configure M3UA as either an application server process (ASP) or an IP server process (IPSP). In the actual configuration, there is little difference. The following table shows the required differences when configuring M3UA:

Parameter name	ASP	IPSP
MODE (for remote peer servers)	Must be set to LOADSHARE	Can be set to either LOADSHARE or ACTSTANDBY
PSP_TYPE	Set to SGP	Set to IPSP

If M3UA is configured as an IPSP, the IPSP_MODE parameter must be configured as either singled-ended (SE) or double-ended (DE):

Mode	Description
Single-ended	A single exchange of the ASPAC (ASP Active) and ASPAC ACK (ASP Active Acknowledgement) messages, that initiated from either side, is sufficient to allow traffic to flow in both directions.
Double-ended	Each side must send and receive the ASPAC and ASPAC ACK messages before allowing traffic flow.

IPSP_MODE is valid only when IPSP is configured as the remote peer signaling process type.

The CLIENT_SIDE parameter is required in an IPSP configuration. This parameter tells M3UA whether or not to initiate an association to the peer. Setting the CLIENT_SIDE parameter to TRUE indicates that M3UA always initiates an association. Setting this parameter to FALSE indicates that the other side is expected to initiate the association. If configured as an ASP, M3UA always initiates the association.

The RTE_CTX parameter, in the PS configuration section of the M3UA configuration file, must match the peer side's configuration. For example, the route context for a remote PS must match that side's route context for a local PS, and vice versa. The route context is passed in most M3UA messages and is used to match incoming messages with their associated NSAPs and upper layers. Refer to *SIGTRAN architecture* on page 54 for more information.

M3UA configuration reference

This topic presents the M3UA configuration file parameters. To satisfy entity dependency, configuration sections must be loaded to the M3UA task in the following order:

- General M3UA configuration
- Network configuration
- SCT SAP configuration
- NSAP configuration
- Peer signaling process configuration
- Peer server configuration
- Routing entry configuration

It is not required that these sections appear in this order in the text file, provided that the configuration program reads and downloads the sections in the correct order, as the provided *m3uacfg* sample file does.

General M3UA configuration

The following table lists the configurable parameters in the M3UA general configuration section. The default values for all timers at the M3UA level are shown in milliseconds. A configuration value of zero for a timer disables that timer.

Parameter	Default	Description
NODE_TYPE	ASP	Type of M3UA node. Only application server process (ASP) is currently supported. Use this parameter for both ASP and IPSP nodes.
MAX_NSAP	2	Maximum number of NSAPs supported simultaneously.
MAX_NETWORK	2	Maximum number of network contexts supported. There is one network context per variant and network indicator.
MAX_ROUTE	16	Maximum number of route entries supported, including local routes.
MAX_DPC	32	Maximum number of destination point codes (DPC) supported, including configured and dynamically learned DPCs.
MAX_PS	8	Maximum number of peer servers supported, including both local and remote peer servers.
MAX_LPS	4	Maximum number of local peer servers.
MAX_PSP	16	Maximum number of peer signaling processes supported.
MAX_MSG	128	Number of M3UA messages in transit supported.
MAX_RNDRBN_LS	4	Maximum number of peer servers that can use round-robin load sharing.
MAX_SLS_LS	4	Maximum number of peer servers that can use SLS-based (signaling link selector) load sharing.
MAX_SLS	128	Maximum number of SLS values that can be used by all peer servers.
QUEUE_SIZE	256	Outgoing congestion queue size per association. Messages above this limit are dropped.
CONG_LEVEL1	64	Congestion level 1 in the queue; not valid in international networks.
CONG_LEVEL2	128	Congestion level 2 in the queue; not valid in international networks.

Parameter	Default	Description
CONG_LEVEL3	196	Congestion level 3 in the queue; not valid in international networks.
TMR_RESTART	1000	Restart hold-off time. This parameter is only used in an SGP configuration.
TMR_AS_PEND	5000	Time for which a peer server can remain in an AS_PENDING state.
TMR_ASP_UP1	2000	Initial time between ASPUP (ASP Up) retries.
TMR_ASP_UP2	2000	Steady state time between ASPUP retries.
NMB_ASP_UP1	3	Number of initial attempts at sending ASPUP messages at interval TMR_ASP_UP1 before sending them at interval TMR_ASP_UP2.
TMR_ASPDN	2000	Time between ASPDN (ASP Down) retries.
TMR_ASPM	2000	Time to wait before failing, after sending ASPAC (ASP Active) or ASPIA (ASP Inactive) messages.
TMR_DAUD	2000	Time between DAUD (Destination State Audit) messages.
TMR_DRKM	2000	Time between DRKM (Dynamic Routing Key Registration Message).
NMB_DRKM	3	Number of DRKM attempts before failing.
TMR_SEQ_CNTRL	1000	Delay used when diverting traffic to maintain sequencing.
PC_FORMAT	DFLT	Point code format used for all point codes in the M3UA configuration files. DFLT = Point codes are interpreted and displayed as 24-bit 8.8.8 values. INTL = Point codes are interpreted and displayed as 14-bit 3.8.3 values. JNTT = Use for both Japan NTT and TTC networks. Point codes are interpreted and displayed as 16-bit mcode.scode.ucode values with the U-code in the most significant 7 bits, the S-code in the next 4 bits, and the M-code in the least significant 5 bits.
TRACE_DATA	FALSE	Turns data tracing on or off. Data tracing is sent to the *ss7trace* utility. Refer to the *TX Utilities Manual* for information about *ss7trace*. Data tracing can also be turned on or off through the *m3uamgr* utility. Refer to the *Dialogic® NaturalAccess™ SIGTRAN Stack Developer's Reference Manual* for information about *m3uamgr*.
DEBUG_LOG	FALSE	Turns debug logging on or off. Debug logging is sent to the *txalarm* utility. Refer to the *TX Utilities Manual* for information about *txalarm*. Debug logging can also be turned on or off through the *m3uamgr* utility. Refer to the *Dialogic® NaturalAccess™ SIGTRAN Stack Developer's Reference Manual* for information about *m3uamgr*.
END	N/A	Marks the end of this general configuration definition. This parameter is required.

Network configuration

The following table describes the M3UA network configuration parameters:

Parameter	Default	Description
NETWORK_ID	1	Network identifier. Valid range is 1 - 255.
NETWORK_APPEAR	1234	Network appearance code. Network appearance values are determined and configured by network operators on each side of an association.
SSF	NAT	Subservice field. Valid values are: INTL = International NAT = National
DPC_LENGTH	24	DPC or OPC length. Valid values are: 14 = Length for ITU networks 16 = Length for Japanese networks 24 = Length for ANSI networks and other national variants
SLS_LENGTH	5	SLS length, in bits. Valid values are: 4 = SLS length 4 bits 5 = SLS length 5 bits 8 = SLS length 8 bits
SERVICE_USER_VAR	ANS	Protocol variant of the M3UA service user, such as ISUP, SCCP, and TUP. Valid values are: ANSI = ANSI variant BICI = BICI ITU = CCITT variant China = China variant NTT = NTT Japan TTC = TTC Japan
SERVICE_USER_VAR2	ANS	Protocol variant for user of the M3UA service user, such as TCAP, which uses SCCP. Valid values are: ANSI = TCAP type ANSI ETSI = TCAP type ETSI ITU = TCAP type ITU
END	N/A	Marks the end of this network configuration definition. This parameter is required.

SCT SAP configuration

The following table describes the M3UA SCT SAP configuration parameters:

Parameter	Default	Description
SCT_SAP_ID	0	M3UA identifier for this SCT SAP. This value must be 0.
SRC_PORT	2095	Source port for the listening endpoint.
SP_ID	0	SCTP identifier for this SCT SAP. This value must be 0.
END	N/A	Marks the end of this M3UA SCT SAP definition. This parameter is required.

NSAP configuration

The following table describes the M3UA NSAP configuration parameters:

Parameter	Default	Description
NSAP_ID	0 for ISUP 1 for SCCP	Identifier for this NSAP.
NWK_ID	1	Logical network identifier for this NSAP.
SERVICE_TYPE	ISUP	Type of NSAP service user. Valid values are: ISUP = ISUP user SCCP = SCCP user TUP = TUP user BICC = BICC user
END	N/A	Marks the end of this NSAP definition. This parameter is required.

Peer signaling process configuration

The following table describes the M3UA peer signaling process configuration parameters:

Parameter	Default	Description
PSP_ID	1	Peer service process (PSP) identifier. Valid values range from 1 to the result of (Max Number of PSP -1).
PSP_TYPE	IPSP	Remote peer signaling process type. Valid values are: SGP = Signaling gateway process. IPSP = IP service process.
IPSP_MODE	DE	Valid when PSP_TYPE = IPSP. Indicates whether the IPSP mode is single-ended or double-ended. Valid values are: DE = Double-ended mode SE = Single-ended mode
DRKM_ALLOWED	FALSE	Indicates whether this peer signaling process can send and receive dynamic routing key management (DRKM) messages. Valid values are: TRUE = Peer signaling process can send and receive DRKM messages. FALSE = Peer signaling process cannot send or receive DRKM messages.
USE_NWK_APP	FALSE	Determines whether the optional network appearance parameter is included when communicating with the remote peer. Valid values are: TRUE = Include the network appearance parameter. FALSE = Do not include the network appearance parameter.

Parameter	Default	Description
ASP_ID_MAND	NONE	Indicates whether an ASP identifier is required in sent and/or received ASPUP and ASPUP ACK (ASP Up Acknowledgement) messages. Valid values are: RX = Identifier is required in received ASPUP and ASPUP ACK messages. TX = Identifier is required in transmitted ASPUP and ASPUP ACK messages. BOTH = Identifier is required in transmitted and received ASPUP and ASPUP ACK messages. NONE= ASP ID not required in transmitted or received ASPUP and ASPUP ACK messages.
NWK_ID	1	Default network context identifier for incoming messages, if the messages do not include one.
CFG_ALL_LPS	FALSE	Whether this PSP needs to be configured for all local peer servers: TRUE = Configure all local peer servers with this PSP. FALSE indicates = Do not configure all local peer servers with this PSP.
Association parameters		
PRIME_DEST_ADDR	192.168.1.2	Primary destination address of the remote peer used in outgoing association requests.
DEST_PORT	2905	Remote SCTP port.
CLIENT_SIDE	TRUE	TRUE = Associations are automatically initiated from this PSP, if PSP_TYPE = IPSP. FALSE = Associations are not initiated from this PSP, if PSP_TYPE = IPSP. The other side is expected to initiate any associations.
NMB_OUT_STREAMS	2	Number of streams supported by this association. Valid range is 1 - 255.
TOS	0	Type of Service octet sent in all outgoing packets for this association. This can be changed later using the M3UA management API. For more information, refer to *Dialogic® NaturalAccess™ SIGTRAN Stack Developer's Reference Manual*.
END	N/A	Marks the end of this PSP configuration definition. This parameter is required.

Peer server configuration

The following table describes the M3UA peer server configuration parameters:

Parameter	Default	Description
PS_ID	N/A	Peer server identifier.
NWK_ID	1	Peer server network identifier.
MODE	ACTSTANDBY	Peer server availability mode. Valid values are: ACTSTANDBY LOADSHARE BROADCAST (not supported)
LOAD_SHARE_TYPE	ROUND_ROBIN	If MODE = LOADSHARE, the LOAD_SHARE_TYPE parameter selects the type of load sharing to use. Valid values are: ROUND_ROBIN SLS
LOCAL	FALSE	Indicates whether the peer server is local or remote: TRUE = Local peer server FALSE = Remote peer server
PSP	1	Ordered list of PSP identifiers configured in the system that handle the routing key associated with this PS. Preference is given to earlier entries in the list when performing fail-over or fail-back procedures. Valid values are 1 to MAX_PSP.
RTE_CTX	0	Routing context. Allowed value is any unsigned 32-bit integer.
END	N/A	Marks the end of this peer server definition. This parameter is required.

Routing entry configuration

The following table describes the M3UA routing configuration entry parameters:

Parameter	Default	Description
DPC	N/A	Destination point code associated with this route.
DPC_MASK	0xFFFFFF	Wildcard mask for the DPC. In most cases, set to all 1 bits to use the entire DPC for routing.
OPC	0	Origination point code (OPC) associated with this route, if any.
OPC_MASK	0	Wildcard mask for the OPC. In most cases, set to all 1 bits (0xFFFFFF) to use the entire OPC for routing, if OPC routing is required. Otherwise, set to 0 to indicate that OPC routing is not used.
SIO	0	Service information octet (SIO) associated with this route, if any. Valid values are ISUP, SCCP, BICC, TUP, or a numeric value between 0 and 0xF. **Note:** If SIO is not specified, the default is 0, which indicates that SIO is not used for routing.
SIO_MASK	0	Wildcard mask for the service information octet (SIO). If SIO is set, set SIO_MASK to 0xF to use the specified SIO value for routing. Set SIO_MASK to 0 if SIO routing is not used.
RTE_TYPE	PS	Route type. Valid value is PS.
NWK_ID	1	Network identifier. Valid range is 1 - 255.
NSAP_ID	0	NSAP identifier configured in the system with which this route is associated. Used only for local (or up) routes. Do not specify for remote routes.

Parameter	Default	Description
RTE_PS_ID	0	Identifier of the peer server associated with this route.
END	N/A	Marks the end of this routing entry definition. This parameter is required.

Creating the SCTP configuration

NaturalAccess Signaling Software provides the following sample files for SCTP configurations that you can modify for your specifications:

Files	Description
SCTPcp1.cfg	SCTP file for board 1.
SCTPcp2.cfg	SCTP file for board 2.

Refer to *Sample SS7 IP configurations* on page 14 for more information.

The SCTP configuration utility runs as part of the initial board download with *ss7load.* The utility reads the text configuration file and downloads the specified configuration to the SCTP control layer (part of the SIGTRAN task) on the TX board. You can also run the SCTP configuration utility after the initial configuration to dynamically update selected configuration parameters.

This topic presents:

- Sample SCTP configuration file
- SCTP configuration file structure

Sample SCTP configuration file

The following example is the SCTP configuration file for board 1:

```
# SCTP Sample Configuration File
#
# All timer values are in milliseconds
#
#-------------------------------------------------
# General SCTP Parameters
#-------------------------------------------------
MAX_ASSOC          4       # Max SCTP associations
MAX_DEST_ADDRS     8       # Max active dest addresses in all assoc
MAX_TX_QUEUE       256     # Max datagrams that can be queued for Tx
MAX_RX_QUEUE       256     # Max datagrams that can be queued for Rx
MAX_INSTREAM       8       # Max incoming streams per assoc
MAX_OUTSTREAM      8       # Max outgoing streams per assoc
MTU_INITIAL        1400    # Initial max transmit size in bytes
MTU_MAX            1400    # Max value used in searching for optimal MTU
MTU_MIN            500     # Min value used in searching for optimal MTU
PERFORM_MTU        FALSE   # Whether or not to perform MTU discovery
HOSTNAME           myhost1 # Self-hostname
USE_HOSTNAME       FALSE   # Whether or not to send hostname in INIT/INIT-ACK
MAX_INIT_RETRY     0       # Max retries for INIT message. 0 = infinite.
MAX_ASSOC_RETRY    10      # Max datagram retries for existing association
MAX_DEST_RETRY     5       # Max datagram retries to a destination address.
ACCEPT_ALT         FALSE   # Whether or not to accept additional lifetime param
                           # from peer to extend cookie lifetime
TMR_MD5_KEY        60000   # Lifetime of an MD5 key.  New one generated every
                           # time it expires.
RTT_ALPHA          1       # Used for RTT calculations
RTT_BETA           1       # Used for RTT calculations
END

#-------------------------------------------------
# SCT Upper SAP parameters
#-------------------------------------------------
```

```
SCT_SAP_ID          0       # SAP ID used by upper layer (M3UA). Must be 0.
TMR_ACK_DELAY       200     # Max time before sending a SACK
NMB_ACK_DELAY       2       # Max number of received datagrams before sending a SACK
TMR_INIT_RTO        3000    # Initial value of the retransmission timeout
TMR_MIN_RTO         2000    # Minimum value of the retransmission timeout
TMR_MAX_RTO         10000   # Maximum value of the retransmission timeout

TMR_BUNDLE          200     # Bundle timer
TMR_COOKIE_LIFE     60000   # Base cookie life time
TMR_HB_INTERVAL     3000    # Default heartbeat interval timer
MAX_BURST           4       # Maximum burst value
MAX_HB_BURST        1       # Max heartbeats sent upon retransmission timeouts
ABORT_ON_STREAM     FALSE   # Abort assoc if Rx instream count less than Tx
                            # outstream count
ENABLE_HEARTBEAT    TRUE    # Enable / Disable heartbeat by default
FLOW_START_THR      192     # Number of messages in outgoing queues when
                            # flow control to layer 3 is invoked
FLOW_STOP_THR       64      # Number of messages in outgoing queues when
                            # flow control to layer 3 is stopped
TMR_SD_GUARD        15000   # Shutdown guard timer for graceful shutdowns.
END

#-----------------------------------------------
#SCT Lower SAP (TSAP) parameters
#-----------------------------------------------
TSAP_ID             0       # SCTP reference for this SAP. Must be 0.
SAP_ID              0       # Transport reference for this SAP. Must be 0.
MAX_BIND_RETRY      3       # Maximum number of Bind Req retries
TMR_CFM             200     # Timeout waiting for bind or status confirm from lower Layer
END
```

SCTP configuration file structure

The following table describes the sections of the SCTP configuration file:

Section	Description
General SCTP	General configuration parameters for SCTP.
SCT Upper SAP	SCT SAP configuration parameters.
SCT Lower SAP (TSAP)	TSAP configuration parameters.

Refer to *SCTP configuration reference* on page 71 for more information.

SCTP configuration reference

This topic presents the SCTP configuration file parameters:

- General SCTP
- SCT Upper SAP
- SCT Lower SAP (TSAP)

All timer values are in milliseconds.

General SCTP

The following table describes the SCTP general configuration parameters:

Parameter	Default	Description
MAX_ASSOC	4	Maximum number of SCTP associations the service user can open simultaneously. Valid range is 1 - 65535.
MAX_DEST_ADDRS	8	Maximum number of destination addresses that can be active simultaneously in SCTP. Valid range is 1 - 65535.
MAX_TX_QUEUE	256	Maximum number of datagrams that can be queued for sending to the peer. Valid range is 1 - the result of (2^32-1).
MAX_RX_QUEUE	256	Maximum number of datagrams received from the peer that can be queue before being sent up to the service user. Valid range is 1 - the result of (2^32-1).
MAX_INSTREAM	8	Maximum number of incoming streams per association. Valid range is 1 - 65545.
MAX_OUTSTREAM	8	Maximum number of outgoing streams per association. Valid range is 1 - 65545.
MTU_INITIAL	1400	Initial path max transmit unit (MTU) in bytes. Valid range is 1 - 1400.
MTU_MAX	1400	Maximum value in bytes to be used in searching for an optimal MTU size using the midpoint algorithm. This field is mandatory if the value of the PERFORM_MTU parameter is TRUE. Valid range is 1 - 1400.
MTU_MIN	500	Minimum value in bytes to be used in searching for an optimal MTU size using the midpoint algorithm. This field is mandatory if the value of the PERFORM_MTU parameter is TRUE. Valid range is 1 - 1400.
PERFORM_MTU	FALSE	Indicates whether or not to perform MTU discovery. Valid values are: TRUE = Perform MTU discovery. FALSE = Do not perform MTU discovery.
HOSTNAME	NULL	Self-hostname.
USE_HOSTNAME	FALSE	Whether or not to send hostname in INIT (Initiation) / INIT ACK (Initiation Acknowledgement).
MAX_INIT_RETRY	0	Maximum number of retries for INIT message to open an association. Valid range is 0 - 255. Set to 0 to retry indefinitely. When MAX_INIT_RETRY number of sends is reached, SCTP terminates the association and M3UA immediately attempts to establish another association The INIT for this new association will contain new TSN and InitTag parameters.
MAX_ASSOC_RETRY	10	Maximum retransmissions for an association. Valid range is 0 - 255.
MAX_DEST_RETRY	5	Maximum retransmissions for a destination address. Valid range is 0 - 255.

Parameter	Default	Description
ACCEPT_ALT	FALSE	TRUE = Accepts additional lifetime parameters from the peer to extend cookie lifetime. FALSE = Does not accept additional lifetime parameters from the peer to extend cookie lifetime.
TMR_MD5_KEY	60000	Lifetime of an MD5 key. A new private key is generated every time this timer expires. Valid range is 1 - 65535.
RTT_ALPHA	12	Used for round trip time (RTT) calculations. Valid range is 0 - 65535.
RTT_BETA	25	Used for RTT calculations. Valid range is 0 - 65535.
TRACE_DATA	FALSE	Turns data tracing on or off. Data tracing is sent to the *ss7trace* utility. Refer to the *Dialogic® TX Series SS7 Boards TX Utilities Manual* for information about *ss7trace*. Data tracing can also be turned on or off through the *sctpmgr* utility. Refer to the *Dialogic® NaturalAccess™ SIGTRAN Stack Developer's Reference Manual* for information about *sctpmgr*.
DEBUG_LOG	FALSE	Turns debug logging on or off. Debug logging is sent to the *txalarm* utility. Refer to the *Dialogic® TX Series SS7 Boards TX Utilities Manual* for information about *txalarm*. Debug logging can also be turned on or off through the *sctpmgr* utility. Refer to the *Dialogic® NaturalAccess™ SIGTRAN Stack Developer's Reference Manual* for information about *sctpmgr*.
END	N/A	Marks the end of this general SCTP definition. This parameter is required.

SCT Upper SAP

The following table describes the SCT upper SAP configuration parameters:

	Default	Description
SCT_SAP_ID		SAP ID used by the upper layer (M3UA). This identifier must be specified and must be 0.
TMR_ACK_DELAY	200	Maximum time to wait before the SCTP layer must send a SACK (Selective Acknowledgement) message. Valid range is 1 -165535.
NMB_ACK_DELAY		Maximum number of messages to receive before the SCTP layer must send a SACK message. Valid range is 1 - 165535.
TMR_INIT_RTO	3000	Initial value of the retransmission timeout (RTO). The SCTP layer retransmits data after waiting for feedback during this time period. Valid range is 1 - 65535.
TMR_MIN_RTO		Minimum value used for the RTO. If the computed value of RTO is less than TMR_MIN_RTO, the computed value is rounded up to this value. Valid range is 1 - 65535.
TMR_MAX_RTO	10000	Maximum value used for RTO. If the computed value of RTO is greater than TMR_MAX_RTO, the computed value is rounded down to this value. Valid range is 1 - 65535.
TMR_COOKIE_LIFE	60000	Base cookie lifetime for the cookie in the INIT ACK (Initiation Acknowledgement) message. Valid range is 1 - 65535.
TMR_HB_INTERVAL	3000	Default heartbeat interval timer. Valid range is 1 - 65535.
MAX_BURST	4	Maximum burst value. Valid range is 1 - 65535.
MAX_HB_BURST	1	Maximum number of heartbeats sent at each retransmission timeout (RTO). Valid range is 1 - 65535.
ABORT_ON_STREAM	FALSE	Action to take when the receiver's number of incoming streams is less than the sender's number of outgoing streams. Valid values are: TRUE = Accept incoming stream and continue association. FALSE = Abort the association.
ENABLE_HEARTBEAT	TRUE	Whether to enable or disable heartbeat by default. Valid values are: TRUE = Enable heartbeat (recommended for allowing earlier detection of loss of associations). FALSE = Disable heartbeat.
FLOW_START_THR		Number of messages waiting in queue, when flow control indication is sent to the service user (M3UA) to inform it that the queue is nearly full. Valid range is FLOW_STOP_THR to MAX_TX_QUEUE.
FLOW_STOP_THR	64	Number of messages waiting in queue, when flow control indication is sent to the service user (M3UA) to inform it that the queue is almost empty. Valid range is 0 to FLOW_START_THR.
TMR_SD_GUARD	15000	Shutdown guard timer for graceful shutdowns. Valid range is 1 - 65535.
END	N/A	Marks the end of this SCT upper SAP definition. This parameter is required.

SCT Lower SAP (TSAP)

The following table describes the SCT lower SAP (TSAP) parameters:

Parameter	Default	Description
TSAP_ID	0	Service user ID for the TSAP being configured. This must be 0.
SAP_ID	0	Service provider ID of the TSAP to which this TSAP binds. This must be 0.
MAX_BIND_RETRY	3	Maximum number of bind request retries allowed.
TMR_CFM	200	Time interval for which the SCTP layer waits for bind or status confirmations from the lower layer.
END	N/A	Marks the end of this SCT lower SAP (TSAP) definition. This parameter is required.

6 Configuring MTP

MTP configuration overview

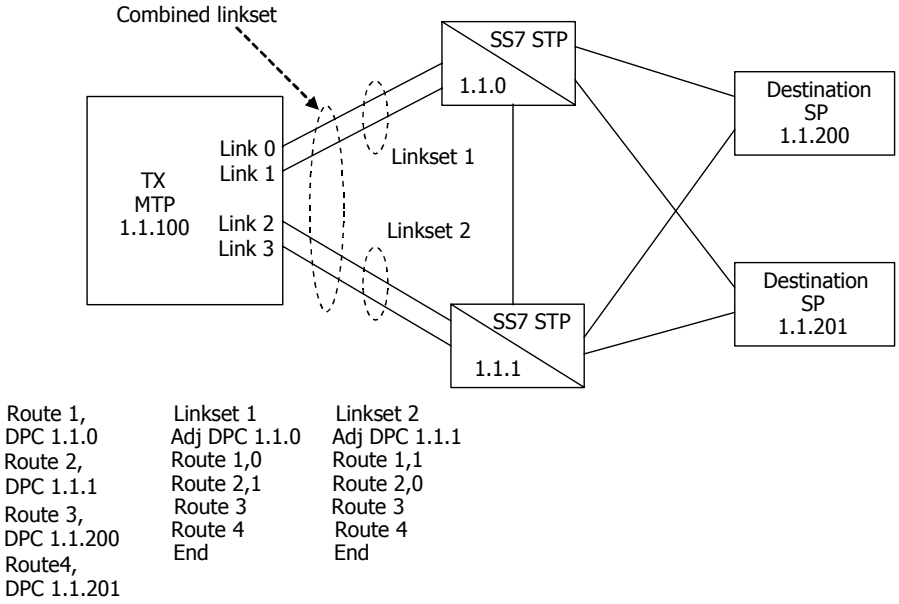
MTP 3 (Message Transfer Part 3) has two primary functions:

Function	Description
Message routing and distribution	Routes outgoing messages to specified destinations and distributes incoming messages to the appropriate user part or application. MTP uses a flexible configuration capable of supporting a wide variety of network routing and addressing requirements.
Signaling network management	Reconfigures the signaling network as needed to maintain signaling capability in the case of failures or congestion. This task includes redirecting traffic away from failed links and signaling points (SPs), restoring traffic to restored links or SPs, and exchanging route status with adjacent SPs. MTP 3 supports all required ANSI and ITU-T network management procedures without intervention from the user parts or applications.

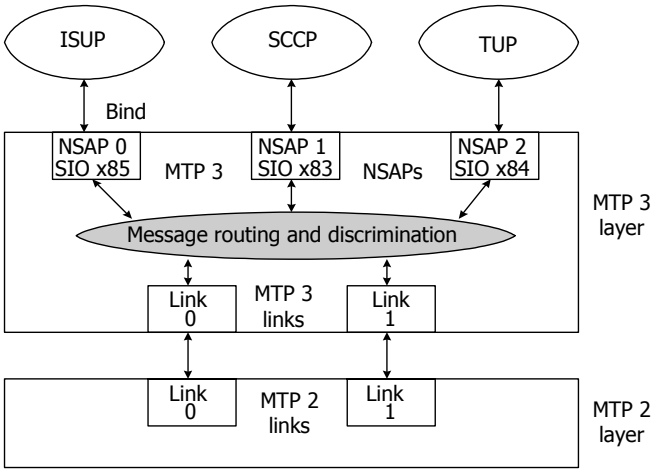
MTP implements services through the configuration of general parameters and the following entities:

Entity	Description
Links	Physical signaling links between the TX board and the adjacent signaling points. One link configuration must be performed for each physical signaling link.
Linksets	Groups of from one through 16 links that directly connect two signaling points. Although a linkset usually contains all parallel signaling links between two SPs, it is possible to define parallel linksets. Each defined signaling link is assigned membership in one linkset.
Routes	Destination signaling points (sub-networks or clusters when route masks are employed) accessible from the target node. Each route is assigned a direction, up or down. One up route is required for the actual point code assigned to the signaling point being configured and for each point code that is to be emulated. Up routes are used to identify incoming messages that are to be routed up to the applications or user parts. One down route is required for each remote signaling point, network, or cluster accessible from the SP being configured. Down routes are used to route outgoing messages to the appropriate signaling links. Each down route is assigned to all linksets that can be used to reach that destination. Each linkset within the route's associated combined linkset can be assigned an optional priority. MTP routing chooses the highest priority available linkset when routing an outgoing packet to a particular destination.
Network service access points (NSAPs)	SS7 user parts or applications that are MTP users. Each NSAP is associated with one user part or application as identified by the service indicator field of a message, and one protocol variant (ITU-T or ANSI).

The following illustration shows the relationship among links, linksets, and routes:



The following illustration shows the concept of network service access points (NSAPs):



If multiple protocol variants are configured on the same MTP 3 instance (same board), two NSAPs are required for each user part: one for ANSI and one for ITU-T. In this case, a single user part or application can associate itself with both NSAPs for that service, or separate user part or applications can be used for each protocol variant.

MTP configuration considerations

Configure MTP 3 as either a signal transfer point (STP) or as a signaling end point (SP). The primary difference between STP operation and SP operation is the handling of messages that MTP 3 receives from signaling links that are addressed to other destinations.

When configured as an STP, MTP 3 searches for an outbound route to the message destination and, if found, routes the message over an outbound link. When configured as an SP, MTP 3 discards such messages.

When configured as an STP, MTP 3 also performs the additional signaling route management procedures required of an STP. These procedures include notifying adjacent SPs when they must no longer route messages to a particular destination through that STP due to failures or congestion (transfer prohibited/restricted), and notifying them again when normal communication with the concerned destination is restored (transfer allowed).

Creating the MTP configuration

SS7 provides the following sample files for ANSI standalone and redundant configurations and ITU standalone and redundant configurations that you can modify for your specifications:

Files	Description
mtp3cp1.cfg (Windows) *MTP3cp1.cfg* (UNIX)	MTP 3 file for board 1.
mtp3cp2.cfg (Windows) *MTP3cp2.cfg* (UNIX)	MTP 3 file for board 2.

Refer to *Sample SS7 TDM configurations* on page 13 for more information.

The MTP configuration utilities, *mtp3cfg* and *mtp2cfg,* run as part of the initial board configuration with *ss7load.* The utilities read the text configuration file and download the specified configuration to the MTP task on the TX board. *mtp3cfg* configures the MTP layer 3. *mtp2cfg* is optional. Run it only to override the default MTP layer 2 parameters assigned to each link. You can also run *mtp3cfg* and *mtp2cfg* after initial configuration to dynamically update some configuration parameters.

This topic presents:

- Sample MTP 3 configuration file
- MTP 3 configuration file structure

Sample MTP 3 configuration file

The following example is the ANSI configuration file for board 1 in the two-board sample configuration:

```
#-------------------------------------------------
# Overall MTP3 Parameters
#-------------------------------------------------
NODE_TYPE           STP         # choose STP [routing] or SP [non-routing]
PC_FORMAT           DFLT        # Point code format:  DFLT (8.8.8) / INTL (3.8.3) /
#                                 JNTT (7.4.5)
POINT_CODE          1.1.1
RESTART_REQUIRED    TRUE
VALIDATE_SSF        FALSE
MAX_LINKS           4
MAX_USERS           2           # sccp & isup
MAX_ROUTES          64
MAX_ROUTE_ENTRIES   1024
MAX_LINK_SETS       2
MAX_ROUTE_MASKS     1
ROUTE_MASK          0xFFFFFFFF
END
#
#-------------------------------------------------
# Link Parameters
#-------------------------------------------------
LINK                0           #  Link number specified in MTPMGR commands
PORT                T1          #  T<n> for T1/E1, R for remote
LINK_SET            1
```

```
LINK_TYPE           ANSI        #  ANSI / ITU / JNTT / JTTC
ADJACENT_DPC        1.1.2       #  Board 2
LINK_SLC            0
LSSU_LEN            2
SSF                 NATIONAL    # NATIONAL / INTERNATIONAL
END
#
#-------------------------------------------------
# User Parameters (NSAP definition)
#-------------------------------------------------
NSAP                0           # isup must be NSAP 0 if its present
LINK_TYPE           ANSI        # ANSI / ITU / JNTT / JTTC
END
#
NSAP                1           # sccp can be 0 or 1, must be 1 if isup present
LINK_TYPE           ANSI        # ANSI / ITU / JNTT / JTTC
END
#
#-------------------------------------------------
# Routing Parameters
#-------------------------------------------------
#
# Route UP from network to applications on this node
#
ROUTE               0
DPC                 1.1.1       # this node
LINK_TYPE           ANSI        # ANSI / ITU / JNTT / JTTC
DIRECTION           UP          # default is DOWN
ADJACENT_ROUTE      FALSE
END
#
# Route to board 2
#
ROUTE               1
DPC                 1.1.2       # board 2's point code
LINK_TYPE           ANSI        # ANSI / ITU / JNTT / JTTC
END
#
#
#-------------------------------------------------
# Linkset Parameters
#-------------------------------------------------
LINK_SET_DESCRIPTOR       1
ADJACENT_DPC              1.1.2       # link set to board 2
MAX_ACTIVE_LINKS          4
ROUTE_NUMBER              1
END
#
```

MTP 3 configuration file structure

This topic discusses the following sections of the configuration file:

- General configuration section
- Links configuration section
- Network service access points (NSAPs) section
- Route definition section
- Linkset definition section

General configuration section

The general configuration parameters define and control the general operation of the signaling point (SP) implemented by the SS7 software. General configuration parameters include:

- Type of signaling point being constructed (SP or STP)
- Point code assigned to the signaling point
- MTP 3 timer resolution
- Values for various SP-level timers
- Maximum number of other configurable elements (NSAPs, links, linksets, routes) to control memory allocation

The general parameters are configured once at board download time, before any other entities are configured. The board must be downloaded again to change any of the general configuration parameters.

Links configuration section

The links configuration section defines the physical signaling links between the TX board and the adjacent signaling points. It contains a link configuration block for each SS7 link. The MTP 3 and MTP 2 configuration utilities scan the links section. The links section is the only section scanned by the MTP 2 configuration utility. Each link configuration block is composed of both layer 3 parameters and layer 2 parameters, in any order.

The layer 3 configurable attributes of a link include:

- Link number
- Port and port type (serial or TDM) assigned to a link
- Point code of the adjacent signaling point
- Protocol variant employed on the link
- Point code length
- Maximum packet length
- Various timer values
- Membership in a linkset

The layer 2 configurable attributes include:

- All layer 2 timers
- LSSU length to be used on the link
- Whether this is a high speed link (HSL)
- Whether extended sequence numbers are to be used for a HSL

Network service access points (NSAPs) section

Network service access points (NSAPs) define the SS7 user parts, or applications, that are MTP users. The configurable attributes of NSAPs include:

- Protocol variant and point code length supported by the user part or application associated with the NSAP
- Maximum number of user part or application messages to be queued (at each of the four possible message priority levels) when flow control between the MTP 3 and the application is in effect

Route definition section

Routes specify the destination signaling points (sub-networks or clusters when route masks are employed) that are accessible from the node being configured. Each route is assigned an up or down direction. Up routes are used to identify incoming messages that are to be routed up to the applications or user parts. One down route is required for each remote signaling point, network, or cluster accessible from the SP being configured. Down routes are used to route outgoing messages to the appropriate signaling links.

Other configurable attributes of routes include:

- Destination point code
- Protocol variant in use at the destination SP, cluster, or network
- Timers associated with MTP route management

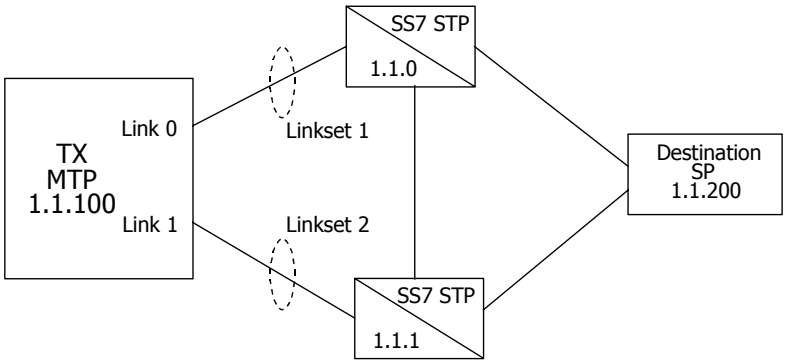
Linkset definition section

The linkset section defines each linkset between the TX board and the adjacent signaling points. Linksets are numbered from 1 to MAX_LINKSETS (MAX_LINKSETS is a general configuration section parameter). The configurable attributes of a linkset include:

- Point code of the adjacent signaling point
- List of routes that are accessible from that linkset
- Number of links to attempt to keep active

Configuring routes to non-adjacent nodes

You may need to configure non-adjacent signaling points. A non-adjacent signaling point is a signaling point that is not directly connected to the MTP 3 layer but is accessible through a signaling point that is directly connected. The following illustration shows this type of configuration:



Follow this procedure to configure a non-adjacent signaling point:

Step	Action
1	Configure all links, linksets, and routes to adjacent signaling points as described in the sample configuration files.
2	Add a route entry (direction down) for the non-adjacent SP, specifying its point code as the destination of the route.
3	Add the route number for the non-adjacent SP to the linkset entry for each linkset that can be used to reach the non-adjacent destination.

Since the non-adjacent SP in the illustration (point code 1.1.200) is accessible from both STPs, the route entry for 1.1.200 is added to the linkset definitions for both linksets 1 and 2. Since the STPs are cross connected, the route to each STP is also added to both linksets 1 and 2 since STP 1.1.1 can be reached directly through linkset 2 or indirectly through linkset 1 with STP 1.1.0.

The following example MTP configuration file configures non-adjacent signaling points:

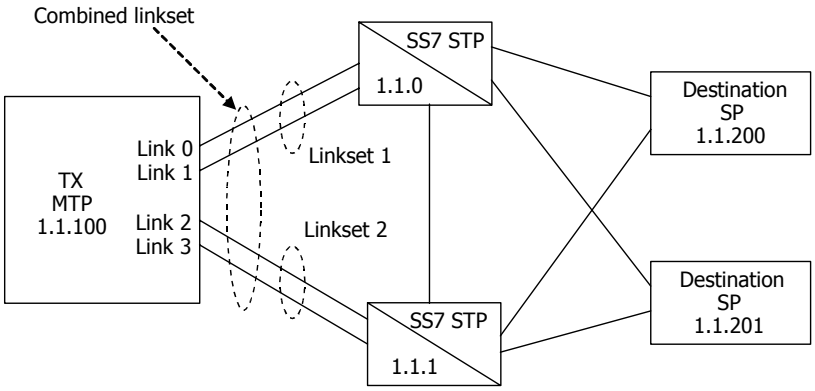
```
<General Parameters>
#
#Link Parameters
#
LINK                    T1       # Link 0 to STP 1.1.0
LINK_SET                1
ADJACENT_DPC            1.1.0
END
#
LINK                    T2       # Link 1 to STP 1.1.1
LINK_SET                2
ADJACENT_DPC            1.1.1
END
#
#Routing Parameters
#
# Route UP from network to applications on this node
#
ROUTE                   0
DPC                     1.1.100  # this node
DIRECTION               UP
END
#
```

```
ROUTE                       1
DPC                         1.1.0    # STP 1.1.0
END
#
ROUTE                       2
DPC                         1.1.1    # STP 1.1.1
END
#
ROUTE                       3
DPC                         1.1.200  # Route to non-adjacent 1.1.200
END
#
# Link set Parameters
#
LINK_SET_DESCRIPTOR         1
ADJACENT_DPC                1.1.0    # link set to STP 1.1.0
ROUTE_NUMBER                1
ROUTE_NUMBER                2
ROUTE_NUMBER                3
END
#
LINK_SET_DESCRIPTOR         2
ADJACENT_DPC                1.1.1    # link set to STP 1.1.1
ROUTE_NUMBER                1
ROUTE_NUMBER                2
ROUTE_NUMBER                3
END
```

Using priorities

Priority levels range from 0 (highest) to 15 (lowest). To use priorities, start with zero for the highest priority linkset for a given route and increment by one for lower priority linksets for that route. There can be no gaps in the priority assigned for a given route, although equal priorities are allowed.

Use linkset priorities to ensure that the shortest path is taken by a message, when available. In the following illustration, messages destined for STP 1.1.0 use linkset 1 (when available) and not linkset 2, which would require an extra hop through STP 1.1.1. Messages to STP 1.1.1 use linkset 2, if available:



To ensure that linkset 1 is always chosen for messages to STP 1.1.0, if available, a higher priority is assigned to route 1 in linkset 1. The same is done for STP 1.1.1, route 2, and linkset 2. Linkset priorities are defined in the configuration file by placing a comma and the priority after a route number in the linkset definition.

Note: Route 1 (STP 1.1.0) is assigned priority zero in linkset 1 and priority 1 in linkset 2, indicating linkset 1 is higher priority than linkset 2 for messages destined for STP 1.1.0. Route 2 (STP 1.1.1) is assigned the reverse priorities. Routes 3 and 4 have no priorities assigned to them, indicating both linksets are of equal priority for reaching SP 1.1.200 and SP 1.1.201. When a priority is not specified, the default of zero (highest) is assigned. Therefore specifying 3,0 and 4,0 in both linksets has the same result as not specifying a priority level at all. They are configured as equal priority because no matter which linkset is chosen, a message to either 1.1.200 or 1.1.201 requires two hops.

The following configuration sample shows how to specify linkset priorities for the illustrated example:

```
#
# Routing Parameters
#
ROUTE           0
DPC             1.1.100      # this node
DIRECTION       UP
END
#
ROUTE           1
DPC             1.1.0        # STP 1.1.0
END
#
ROUTE           2
DPC             1.1.1        # STP 1.1.1
END
#
ROUTE           3
DPC             1.1.200      # SP 1.1.200
```

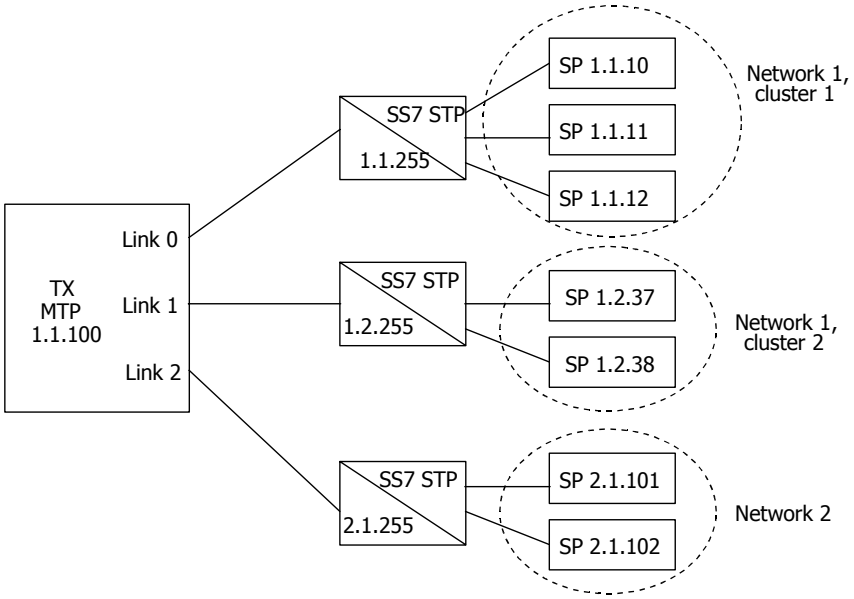
```
ADJACENT_ROUTE  FALSE        # Route to non-adjacent SP 1.1.200
END
#
ROUTE           4
DPC             1.1.201      # STP 1.1.201
ADJACENT_ROUTE  FALSE        # Route to non-adjacent SP 1.1.201
END
#
# Link Set Parameters
#
LINK_SET_DESCRIPTOR  1
ADJACENT_DPC         1.1.0
ROUTE_NUMBER         1,0
ROUTE_NUMBER         2,1
ROUTE_NUMBER         3
ROUTE_NUMBER         4
END

LINK_SET_DESCRIPTOR  2
ADJACENT_DPC         1.1.1
ROUTE_NUMBER         1,1
ROUTE_NUMBER         2,0
ROUTE_NUMBER         3
ROUTE_NUMBER         4
END
```

Using routing masks

Use routing masks to help decrease the size of the routing tables that must be configured. Routing masks are bit masks that specify a subset of a destination point code to be matched against the routing table when searching for a route for either an inbound or outbound message.

Use routing masks to implement network and cluster routing in ANSI networks. In the following example, rather than specifying explicit routes to each of the seven remote SPs, routing masks and routes are used. All point codes and routing masks, regardless of point code length, are stored internally as 32-bit unsigned integers. Routing masks are also useful when implementing server-type applications, such as service control points (SCPs), where it is impractical to preconfigure the point codes of all possible requester signaling points.

Routing masks are global to all links, linksets, and user parts, and apply to both incoming and outgoing messages.



The following table shows typical routing masks used in ANSI networks for routing based on network or cluster IDs. Routing masks are applied to a message in the order in which they appear in the MTP configuration file. The first matching mask or route is the one selected.

Routing mask	Comment
0xFFFFFFFF	Always specify exact match as first mask.
0xFFFFFF00	Match on network ID and cluster ID next.
0xFFFF0000	Match on just network ID last.

The following partial MTP configuration file configures routing masks:

```
MAX_ROUTE_MASKS          3
ROUTE_MASK               0xFFFFFFFF     # always specify exact match 1st
ROUTE_MASK               0xFFFFFF00     # cluster mask next
ROUTE_MASK               0xFFFF0000     # network mask next
<Link Parameters>
#Routing Parameters
ROUTE                    0
DPC                      1.1.100        # Route up to this node
DIRECTION                UP
END
#
ROUTE                    1
DPC                      1.1.255        # Explicit route to STP 1.1.255
END
#
ROUTE                    2
DPC                      1.2.255        # Explicit route to STP 1.2.255
END
#
ROUTE                    3
DPC                      2.1.255        # Explicit route to STP 2.1.255
END
#
ROUTE                    4
DPC                      1.1.0          # Partial route to cluster 1.1.x
ADJACENT_ROUTE           FALSE          # Route to non-adjacent cluster 1.1.x
END
#
ROUTE                    5
DPC                      1.2.0          # Partial route to cluster 1.2.x
ADJACENT_ROUTE           FALSE          # Route to non-adjacent cluster 1.2.x
END
#
ROUTE                    6
DPC                      2.0.0          # Partial route to network 2.x.y
ADJACENT_ROUTE           FALSE          # Route to non-adjacent cluster 2.x.y
END
# Link set Parameters
LINK_SET_DESCRIPTOR      1
ADJACENT_DPC             1.1.255        # link set to STP 1.1.255
ROUTE_NUMBER             1              # explicit route to 1.1.255
ROUTE_NUMBER             4              # cluster route to 1.1.x
END
#
LINK_SET_DESCRIPTOR      2
ADJACENT_DPC             1.2.255        # link set to STP 1.2.255
ROUTE_NUMBER             2              # explicit route to 1.2.255
ROUTE_NUMBER             5              # cluster route to 1.2.x
END
#
LINK_SET_DESCRIPTOR      3
ADJACENT_DPC             2.1.255        # link set to STP 2.1.255
ROUTE_NUMBER             3              # explicit route to 2.1.255
ROUTE_NUMBER             6              # network route to 2.x.y
END
#
```

Although the previous example is specific to ANSI networks, routing masks can be applied equally to other networks to reduce the size of routing tables.

When using routing masks and partial-match routes, follow these guidelines:

- Always configure an up route with the TX board point code first.
- Always configure an explicit route to each node directly connected to the TX board.
- Always configure an exact match routing mask (0xFFFFFFFF) before configuring any partial match routing masks.

Configuring multiple OPC emulation

You can configure MTP to act as multiple point codes to the network and receive and send inbound traffic destined to a number of point codes. This configuration can be used to:

- Bridge multiple networks, as in a gateway application
- Provide a service from a single application to multiple networks
- Test applications

This topic presents:

- Configuring multiple OPC emulation for a single network
- Emulating different point codes to directly connected signaling points
- Configuring multiple OPC emulation for multiple networks

Configuring multiple OPC emulation for a single network

To configure multiple OPC emulation for a single network in MTP, configure an up route for each of the point codes to be emulated. The following sample configuration file shows how to configure MTP to act as point codes 1.1.100, 1.2.200, and 1.3.300 to the network. The modifications are shown in **bold** type. Higher layer traffic for the extra point codes is passed to a registered (bound) upper layer rather than being discarded as undeliverable. In this configuration, MTP is 1.1.100 to both adjacent signaling points for MTP management messages. Links and linksets still have an OPC equal to the general OPC of 1.1.100.

```
<General Parameters>
NODE_TYPE    STP
POINT_CODE    1.1.100  # This node's point code
#
#Link Parameters
#
LINK                      T1       # Link 0 to STP 1.1.0
LINK_SET                  1
ADJACENT_DPC              1.1.0
END
#
LINK                      T2       # Link 1 to STP 1.1.1
LINK_SET                  2
ADJACENT_DPC              1.1.1
END
#
#Routing Parameters
#
# Route UP from network to applications on this node
#
ROUTE                     0
DPC                       1.1.100  # this node
DIRECTION                 UP
END
#
ROUTE                     1
DPC                       1.1.0    # STP 1.1.0
END
#
ROUTE                     2
DPC                       1.1.1    # STP 1.1.1
END
#
ROUTE                     3
DPC                       1.1.200  # Route to non-adjacent 1.1.200
END
#
ROUTE                     4
DPC                       1.2.200  # emulated point code
DIRECTION                 UP
END
#
ROUTE                     5
DPC                       1.3.300  # emulated point code
DIRECTION                 UP
END
#
#
# Link set Parameters
#
LINK_SET_DESCRIPTOR       1
ADJACENT_DPC              1.1.0    # link set to STP 1.1.0
ROUTE_NUMBER              1
ROUTE_NUMBER              2
ROUTE_NUMBER              3
END
#
LINK_SET_DESCRIPTOR       2
ADJACENT_DPC              1.1.1    # link set to STP 1.1.1
ROUTE_NUMBER              1
ROUTE_NUMBER              2
ROUTE_NUMBER              3
END
```

While the previous configuration allows upper layers to receive messages directed to 1.2.200 and 1.3.300, this is not sufficient for all upper layers to operate properly (for example, the ISUP layer). ISUP requires that a RESUME indication be returned for each OPC/DPC combination for which it has circuits defined, so it can activate those circuits and respond to incoming IAM messages. In the previous configuration, when linkset 1 or 2 become available, only one RESUME indication with OPC/DPC (1.1.100/1.1.200) is generated. This does not include the RESUME indications generated for the STPs. There is only one down route that is not to an STP, and that route uses the general OPC by default.

MTP generates a RESUME for each available down route using the OPC and DPC associated with that route. Therefore, if you are using ISUP with multiple OPCs or your own application requires RESUMES for all OPC/DPC combinations, you must add a down route for each combination.

The following example shows how to add down routes so that RESUMES are generated for each OPC/DPC combination. The modifications are shown in **bold** type.

```
<General Parameters>
NODE_TYPE    STP
POINT_CODE    1.1.100  # This node's point code
#
#Link Parameters
#
LINK                      T1       # Link 0 to STP 1.1.0
LINK_SET                  1
ADJACENT_DPC              1.1.0
END
#
LINK                      T2       # Link 1 to STP 1.1.1
LINK_SET                  2
ADJACENT_DPC              1.1.1
END
#
#Routing Parameters
#
# Route UP from network to applications on this node
#
ROUTE                     0
DPC                       1.1.100  # this node
DIRECTION                 UP
END
#
ROUTE                     1
DPC                       1.1.0    # STP 1.1.0
END
#
ROUTE                     2
DPC                       1.1.1    # STP 1.1.1
END
#
ROUTE                     3
DPC                       1.1.200  # Route to non-adjacent 1.1.200
END
#
ROUTE                     4
DPC                       1.2.200  # emulated point code
DIRECTION                 UP
END
#
ROUTE                     5
DPC                       1.3.300  # emulated point code
DIRECTION                 UP
END
#
ROUTE                     6
OPC                       1.2.200  # emulated point code
```

```
DPC                         1.1.200  # Route to non-adjacent 1.1.200

END
#
ROUTE                       7
OPC                         1.3.300  # emulated point code
DPC                         1.1.200  # Route to non-adjacent 1.1.200
END
#
#
# Link set Parameters
#
LINK_SET_DESCRIPTOR         1
ADJACENT_DPC                1.1.0    # link set to STP 1.1.0
ROUTE_NUMBER                1
ROUTE_NUMBER                2
ROUTE_NUMBER                3
ROUTE_NUMBER                6
ROUTE_NUMBER                7
END
#
LINK_SET_DESCRIPTOR         2
ADJACENT_DPC                1.1.1    # link set to STP 1.1.1
ROUTE_NUMBER                1
ROUTE_NUMBER                2
ROUTE_NUMBER                3
ROUTE_NUMBER                6
ROUTE_NUMBER                7
END
```

In the previous configuration RESUMES are generated for three OPC/DPC combinations (not including the RESUMES for the adjacent STPs). These combinations are:

OPC	DPC
1.1.100	1.1.200
1.2.200	1.1.200
1.3.300	1.1.200

Emulating different point codes to directly connected signaling points

If MTP needs to emulate different point codes to directly connected signaling points (as in a gateway application), the configuration must include the emulated OPCs in the link and linkset definitions, in addition to the additional up routes. The following example shows the modifications in **bold** type. In this configuration, MTP acts as 1.1.100 to the STP 1.1 network and 1.2.200 to the STP 2 network. Traffic is received for all three point codes from either network.

```
<General Parameters>
NODE_TYPE    STP
POINT_CODE    1.1.100  # This node's point code
#
#Link Parameters
#
LINK                        T1       # Link 0 to STP 1.1.0
LINK_SET                    1
ADJACENT_DPC                1.1.0

OPC     1.1.100
END
#
LINK                        T1       # Link 1 to STP 1.1.1
LINK_SET                    2
ADJACENT_DPC                1.1.1
```

```
OPC   1.2.200
END
#
#Routing Parameters
#
# Route UP from network to applications on this node
#
ROUTE                     0
DPC                       1.1.100  # this node
DIRECTION                 UP
END
#
ROUTE                     1
DPC                       1.1.0    # STP 1.1.0
END
#
ROUTE                     2
DPC                       1.1.1    # STP 1.1.1
END
#
ROUTE                     3
DPC                       1.1.200  # Route to non-adjacent 1.1.200
END
#
ROUTE                     4
DPC                       1.2.200  # emulated point code
DIRECTION                 UP
END
#
ROUTE                     5
DPC                       1.3.300  # emulated point code
DIRECTION                 UP
END
#
#
# Link set Parameters
#
LINK_SET_DESCRIPTOR       1
ADJACENT_DPC              1.1.0    # link set to STP 1.1.0

OPC    1.1.100
ROUTE_NUMBER              1
ROUTE_NUMBER              2
ROUTE_NUMBER              3
END
#
LINK_SET_DESCRIPTOR       2
ADJACENT_DPC              1.1.1    # link set to STP 1.1.

OPC    1.2.200
ROUTE_NUMBER              1
ROUTE_NUMBER              2
ROUTE_NUMBER              3
END
```

The OPC lines for link 1 and linkset 1 are not required since the OPC always defaults to the general configuration point code when not specified. However, the OPC makes it clearer that point code emulation is being used and that the linksets (and their respective links) are using different OPCs. If an OPC different from the general configuration point code is specified in a linkset or in one or more of its links but not both, the specified point code is propagated to the entities where OPC is unspecified. If two different OPCs are specified for a linkset and for one or more of its links, an alarm is generated and the second entity encountered is not configured.

To avoid confusion when emulating different point codes to directly connected signaling points, specify the OPCs in each link and linkset and make sure they match between the linkset and the links.

Configuring multiple OPC emulation for multiple networks

In the previous configurations, outbound traffic is routed by destination point code (DPC) and signaling link selector (SLS) only. For multiple network configurations, use OPC_ROUTING = TRUE to specify that outbound routing take into account the OPC.

The following configuration defines two routes to 1.1.200 with differing OPCs. Traffic to 1.1.200 with an OPC of 1.1.100 is routed over link/linkset 1, and traffic to 1.1.200 with an OPC of 1.2.200 is routed over link/linkset 2. The modifications are shown in **bold** type.

```
<General Parameters>
NODE_TYPE    STP

POINT_CODE    1.1.100  # This node's point code

OPC_ROUTING    TRUE
#
#Link Parameters
#
LINK                      T1       # Link 0 to STP 1.1.0
LINK_SET                  1
ADJACENT_DPC              1.1.0

OPC     1.1.100
END
#
LINK                      T2       # Link 1 to STP 1.1.1
LINK_SET                  2
ADJACENT_DPC              1.1.1

OPC                       1.2.200
END
#
#Routing Parameters
#
# Route UP from network to applications on this node
#
ROUTE                     0
DPC                       1.1.100  # this node
DIRECTION                 UP
END
#
ROUTE                     1
DPC                       1.1.0    # STP 1.1.0

OPC                       1.1.100
END
#
ROUTE                     2
DPC                       1.1.1    # STP 1.1.1

OPC                       1.2.200
END
#
ROUTE                     3
DPC                       1.1.200  # Route to non-adjacent 1.1.200

OPC                       1.1.100
END
#
ROUTE                     4
DPC                       1.1.200  # Route to non-adjacent 1.1.200

OPC                       1.2.200
END
#
ROUTE                     5
DPC                       1.2.200  # emulated point code
```

```
DIRECTION                 UP
END
#
ROUTE                     6
DPC                       1.3.300  # emulated point code
DIRECTION                 UP
END
#
#
# Link set Parameters
#
LINK_SET_DESCRIPTOR       1
ADJACENT_DPC              1.1.0    # link set to STP 1.1.0
OPC    1.1.100
ROUTE_NUMBER              1
ROUTE_NUMBER              2
ROUTE_NUMBER              3
END
#
LINK_SET_DESCRIPTOR       2
ADJACENT_DPC              1.1.1    # link set to STP 1.1.1
OPC    1.2.200
ROUTE_NUMBER              1
ROUTE_NUMBER              2
ROUTE_NUMBER              4
END
```

If OPC_ROUTING is FALSE, traffic to 1.1.200 is shared across linksets 1 and 2 because the OPC is not taken into account for outbound routing.

Configuring MTP for the Japan-NTT variant

Follow these guidelines when configuring the MTP layer for Japan-NTT network operation:

- Set the LINK_TYPE attribute for all links, NSAPs, and route entries to JNTT.
- The point code length for links and NSAPs defaults to 16 after the LINK_TYPE is set to JNTT. If desired for documentation purposes, the point code length can be explicitly set to 16 (the only supported value for JNTT link type) in the link and NSAP configurations.
- Specify the 16-bit point codes in either hexadecimal or ***x.y.z*** dotted notation. Specify hexadecimal point codes in the order in which they are transmitted on the link: the U-code in the most significant seven bits, the S-code in the next four bits, and the M-code in the least significant five bits. To specify J-NTT 16-bit point codes in ***x.y.z*** notation, set the PC_FORMAT parameter in the MTP 3 general configuration section to the value JNTT.

For example:

```
PC_FORMAT     JNTT
...
LINK          S1
LINK_TYPE     JNTT
ADJACENT_DPC  1.1.2
...
```

is equivalent to:

```
...
LINK          S1
LINK_TYPE     JNTT
ADJACENT_DPC  0x421
...
```

Sample MTP configuration file for the Japan-NTT protocol variant

The following sample MTP 3 configuration file configures two TDM ports with the JNTT protocol variant:

```
#-----------------------------------------------------
# Sample MTP3 configuration for J-NTT protocol variant
#-----------------------------------------------------
#Overall MTP3 Parameters
#-----------------------
#
NODE_TYPE           SP           # choose STP [routing] or SP [non-routing]
PC_FORMAT           JNTT
POINT_CODE          1.1.1
RESTART_REQUIRED    FALSE
MAX_LINKS           4
MAX_USERS           2            # isup + 1 extra
MAX_ROUTES          64
MAX_ROUTE_ENTRIES   1024
MAX_LINK_SETS       2
MAX_ROUTE_MASKS     1
ROUTE_MASK          0xFFFFFFFF
END
#
#Link Parameters
#---------------
#
# Link 0
#
LINK                T1           # TDM port 1
LINK_SET            1
LINK_TYPE           JNTT
ADJACENT_DPC        1.1.2
LINK_SLC            0
END
#
# Link 1
#
LINK                T2           # TDM port 2
LINK_SET            1
LINK_TYPE           JNTT
ADJACENT_DPC        1.1.2
LINK_SLC            1
END
#
#User Parameters (NSAP definition)
#---------------------------------
#
NSAP                0            # isup
LINK_TYPE           JNTT
END
#
NSAP                1            # spare
LINK_TYPE           JNTT
END
#
#
#Routing Parameters
#------------------
#
# Route UP from network to applications on this node
#
ROUTE               0
LINK_TYPE           JNTT
DPC                      1.1.1   # this node
DIRECTION           UP           # default is DOWN
ADJACENT_ROUTE      FALSE
END
#
# Route to Adjacent node
#
```

```
ROUTE               1
LINK_TYPE           JNTT
DPC                 1.1.2
END
#
#
# Linkset Parameters
#-------------------
LINK_SET_DESCRIPTOR 1
ADJACENT_DPC        1.1.2
MAX_ACTIVE_LINKS    4
ROUTE_NUMBER        1
END
#
```

Configuring MTP for the Japan-TTC variant

Follow these guidelines when configuring the MTP layer for Japan-TTC network operation:

- Set the LINK_TYPE attribute for all links, NSAPs, and route entries to JTTC.
- The point code length for links and NSAPs defaults to 16 when the LINK_TYPE is set to JTTC. If desired for documentation purposes, the point code length can be explicitly set to 16 (the only supported value for JTTC link type) in the link and NSAP configurations.
- Specify the 16-bit point codes in either hexadecimal or ***x.y.z*** dotted notation. Specify hexadecimal point codes in the order in which they are transmitted on the link: the U-code in the most significant seven bits, the S-code in the next four bits, and the M-code in the least significant five bits. To specify J-NTT or J-TTC 16-bit point codes in ***x.y.z*** notation, set the PC_FORMAT parameter in the MTP 3 general configuration section to the value JNTT.

  For example:

```
PC_FORMAT     JNTT
...
LINK          T1
LINK_TYPE     JTTC
ADJACENT_DPC  1.1.2
...
```

  is equivalent to:

```
...
LINK          T1
LINK_TYPE     JTTC
ADJACENT_DPC  0x421
...
```

- Set the following general parameters:
  - RESTART_REQUIRED to FALSE.
  - DISABLE_UPU to TRUE.
- Set the following parameters for each link definition:
  - LSSU_LEN to 1.
  - IDLE_FREQ to 24.
  - RT_FREQ to 24.

Sample MTP configuration file for the Japan-TTC protocol variant

The following sample MTP 3 configuration file configures two T1/E1 links with the JTTC protocol variant. The required settings are shown in **bold** type.

```
#-----------------------------------------------------
# Sample MTP3 configuration for J-TTC protocol variant
#-----------------------------------------------------
#Overall MTP3 Parameters
#-----------------------
#
NODE_TYPE           SP           # choose STP [routing] or SP [non-routing]
PC_FORMAT           JNTT         # Note this is not JTTC
POINT_CODE          1.1.1
RESTART_REQUIRED    FALSE
DISABLE_UPU         TRUE
MAX_LINKS           4
MAX_USERS           2            # isup + 1 extra
MAX_ROUTES          64
MAX_ROUTE_ENTRIES   1024
MAX_LINK_SETS       2
MAX_ROUTE_MASKS     1
ROUTE_MASK          0xFFFFFFFF
END
#
#Link Parameters
#---------------
#
# Link 0
#
LINK                T1           # TDM port 1
LINK_SET            1
LINK_TYPE           JTTC
ADJACENT_DPC        1.1.2
LINK_SLC            0
LSSU_LEN            1
RT_FREQ 24
IDLE_FREQ 24
END
#
# Link 1
#
LINK                T2           # TDM port 2
LINK_SET            1
LINK_TYPE           JTTC
ADJACENT_DPC        1.1.2
LINK_SLC            1
LSSU_LEN            1
RT_FREQ 24
IDLE_FREQ 24
END
#
#User Parameters (NSAP definition)
#---------------------------------
#
NSAP                0            # isup
LINK_TYPE           JTTC
END
#
NSAP                1            # spare
LINK_TYPE           JTTC
END
#
#
#Routing Parameters
#------------------
#
# Route UP from network to applications on this node
#
ROUTE               0
LINK_TYPE           JTTC
```

```
DPC                  1.1.1       # this node
DIRECTION            UP          # default is DOWN
ADJACENT_ROUTE       FALSE
END
#
# Route to Adjacent node
#
ROUTE                1
LINK_TYPE            JTTC
DPC                  1.1.2
END
#
#
# Linkset Parameters
#-------------------
LINK_SET_DESCRIPTOR 1
ADJACENT_DPC         1.1.2
MAX_ACTIVE_LINKS     4
ROUTE_NUMBER         1
END
#
```

Configuring high speed links (HSL)

High speed links (HSL) meet the ANSI T1.111-1996 and Q.703/Annex A standards. Each HSL occupies a full (unchannelized) T1/E1 line and transfers data at the rate of 2.0 (1.544) Mbps.

Parameters

Configuring high speed links in MTP uses two parameters, HS_LINK and HS_EXT_SEQ, which are contained in the Link section of the configuration file. The following table describes these parameters:

Parameter	Description
HS_LINK	Setting this parameter to TRUE, notifies MTP that high speed links are in effect and automatically sets HS_EXT_SEQ to TRUE. Set HS_EXT_SEQ to FALSE for high speed links with normal sequence numbers.
HS_EXT_SEQ	Setting this parameter to TRUE, notifies MTP that extended sequence numbers are in effect and changes the size of: • FSN, BSN, and LI fields in MTP 2 packets • The last FSN field of COO and COA messages at layer 3 Sequence numbers increase from 7 to 12 bits and the length indicator increases from 6 to 8 bits. Setting HS_EXT_SEQ to TRUE automatically sets HS_LINK to TRUE. Normal speed links with extended sequence numbers are not supported.

A combination of high speed and normal speed links is not supported.

High speed link configuration example

The following sample configuration file shows the configuration for high speed links:

```
#-----------------------------------------------
# Link Parameters
#-----------------------------------------------
LINK                0           #  Link number specified in MTPMGR commands
PORT                T1          #  T<n> for T1/E1, R for remote
HS_LINK             TRUE
HS_EXT_SEQ          TRUE
LINK_SET            1
LINK_TYPE           ANSI        #  ANSI / ITU / JNTT / JTTC
ADJACENT_DPC        1.1.2       #  Board 2
LINK_SLC            0
LSSU_LEN            2
SSF                 NATIONAL    # NATIONAL / INTERNATIONAL
END
```

MTP configuration reference

This topic presents the MTP configuration file parameters:

- General parameters
- Link parameters
- NSAP parameters
- Routing parameters
- Linkset parameters

General parameters

The following table lists the configurable parameters in the MTP 3 general configuration section. The default values for all timers at the MTP 3 level are shown below in tenths of a second. The default resolution when setting timers in the MTP3 configuration file is in seconds. Use the MTP3_TIMER_RES general parameter to specify if timer values being overridden in the MTP 3 configuration file are in seconds or tenths of a second. A configuration value of zero for a timer disables that timer.

Note: The PC_FORMAT parameter applies to all point codes in the MTP configuration file.

Parameter	Default	Valid values	Description
PC_FORMAT	DEFAULT	DFLT INTL JNTT	Point code format. DFLT = Point codes are interpreted and displayed as 24-bit 8.8.8 values. INTL = Point codes are interpreted and displayed as 14-bit 3.8.3 values. JNTT = Use for both Japan NTT and TTC networks. Point codes are interpreted and displayed as 16-bit ***mcode.scode.ucode*** values with the U-code in the most significant 7 bits, the S-code in the next 4 bits, and the M-code in the least significant 5 bits.
POINT_CODE	None	N/A	Point code of this node, specified in dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101). This parameter is required.

Parameter	Default	Valid values	Description
NODE_TYPE	STP	STP SP	Mode of operation. STP = transfer functionality SP = no transfer functionality
POINT_CODE2	None	N/A	Alternate point code for this node when supporting both ANSI and ITU-T networks from the same board. Specify the ITU-T point code in the POINT_CODE parameter and the ANSI point code here.
MTP3_TIMER_RES	SECONDS	SECONDS TENTHS	Whether timer values in the configuration file are specified in seconds or tenths of a second.
RESTART_REQUIRED	TRUE	TRUE/YES FALSE/NO	If TRUE, full restart procedure is required whenever node becomes accessible.
VALIDATE_SSF	TRUE	TRUE/YES FALSE/NO	If TRUE, MTP 3 validates incoming MTP 3 signaling network management (SNM) and test (SLTM/SLTA) messages. Messages with an SSF that does not match the value configured for the link on which the message was received are rejected. If FALSE, the SSF is not checked on incoming MTP 3 management or test messages (any SSF value is accepted). MTP 3 does not validate the SSF in any incoming or outgoing user part messages.
DISABLE_UPU	FALSE	TRUE/YES FALSE/NO	If TRUE, MTP never sends a User Part Unavailable message.
MAX_LINKS	4	1 through 128	Maximum number of physical links (actual maximum depends on TX board model and hardware configuration).
MAX_USERS	2	1 through 64	Maximum number of MTP 3 users (user parts).
MAX_ROUTES	32	1 through 32767	Maximum number of routes.
MAX_ROUTE_ENTRIES	1024	1 through 32767	Maximum number of route instances. Logical maximum is MAX_ROUTES * number of SLS values (16 - ITU, 32 - ANSI), but this number can be decreased.
MAX_LINK_SETS	1	1 through 16	Maximum number of supported linksets.
MAX_ROUTE_MASKS	0	0 through 8	Maximum number of routing masks. If zero, all destination point codes in outgoing messages must exactly match a point code in a route entry.
ROUTE_MASK	None	0x00 through 0xFFFFFFFF	Routing mask to be applied to destination point code before matching against routing table entries. Use to reduce the number of routes that must be configured or use if remote destination point codes are not known at configuration time (a database server). You can specify multiple ROUTE_MASKs. They are applied in the order in which they appear in the configuration file.
TIMER_T15	30	0 through 65535	Time to wait to start or repeat route set congestion test.
TIMER_T16	20	0 through 65535	Time to wait for route set congestion status update.

Parameter	Default	Valid values	Description
TIMER_T18_ITU	300	1 through 65535	ITU restart timer for an STP during which links are restarted and TFA, TFR, and TFP messages are received.
TIMER_T20_ITU	600	1 through 65535	ITU overall restart timer.
TIMER_T22_ANSI	300	1 through 65535	ANSI restart timer at restarting SP waiting for links to become available.
TIMER_T23_ANSI	300	1 through 65535	ANSI restart timer at restarting SP waiting for TRA messages.
TIMER_T26_ANSI	130	1 through 65535	ANSI restart timer at restarting SP waiting to repeat TRW message.
TIMER_T27_ANSI	30	1 through 65535	Minimum duration of unavailability for full restart.
TIMER_TRTEINST	18000	0 through 65535	Internal route instance timer (how long a route instance is valid). Not ANSI T30.
MTP3_TRACE_DATA	FALSE	TRUE FALSE	If TRUE, start tracing of all data between MTP 2 and MTP 3.
OPC_ROUTING	FALSE	TRUE FALSE	If TRUE, outbound routing takes into account OPC values, as well as DPC and SLS values. If FALSE, outbound routing takes into account only DPC and SLS values. Refer to *Configuring multiple OPC emulation* on page 87 for more information.
TRANSPARENT_MODE	FALSE	TRUE FALSE	If TRUE, all inbound traffic is passed up to the SIO matching bound application regardless of DPC or OPC values. All outbound traffic is shared across all links regardless of DPC or OPC values. If FALSE, normal routing is in effect.
END	N/A	N/A	Marks the end of the general parameters section. This parameter is required.

Link parameters

The following tables list the MTP 3 and MTP 2 configuration parameters applicable to each link:

MTP 3 link parameters

Note: The application cannot configure HSLs and LSLs at the same time.

Parameter	Default	Valid values	Description
PORT	None	T1 through 128 (TDM) R (remote)	T***n*** for T1, E1, H.100, and H.110 (actual maximum depends on TX board model and hardware configuration). R for remote links (links on the other board in a redundant system).
LINK	None	0 through 127	Zero-based link number. Use this number to refer to the link in MTPMGR commands.

Parameter	Default	Valid values	Description
LINK_TYPE	ANSI	ANSI ITU JNTT JTTC	MTP 3 protocol variant used on link.
ADJACENT_DPC	None	N/A	Point code of the node on the other end of the link. Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101).
OPC	None	N/A	Originating point code. Use for multiple OPC emulation and OPC routing. Refer to *Configuring multiple OPC emulation* on page 87 for more information.
LINK_SET	1	1 through 16	Linkset to which this link belongs.
SSF	NATIONAL (ANSI) INTERNATIONAL (ITU-T)	NATIONAL INTERNATIONAL	Value used in the subservice field (SSF) of the SIO.
SUB_SERVICE	2	0 through 3	Overrides SSF parameter. Use either SUB_SERVICE or the SSF parameter.
LINK_PRIORITY	0	0 through 3	Priority of this link within the link set.
MESSAGE_SIZE	272	64 through 1024	Maximum message length for this link.
DISABLED	FALSE	TRUE FALSE	If TRUE, link is initially disabled. No attempt is made to align with the remote side without manual intervention. If FALSE, link is initially enabled. It tries to align with the remote side immediately.
USE_PRIORITY	TRUE	TRUE FALSE	If TRUE, message priorities generated by user parts are inserted into the SIO octet (spare bits) of outgoing messages. If FALSE, the SIO spare bits are set to zero. Usually set to TRUE in ANSI networks and FALSE in ITU-T networks.
MGNT_MSG_PRIORITY	3	0 through 3	Priority to use for MTP3 management messages.
DPC_LENGTH	24 (ANSI) 14 (ITU) 16 (JNTT/JTTC)	14 16 24	Number of bits in a point code.
MAX_SLTM_RETRY	2	0 through 255	Maximum times to retry signaling link test messages (SLTM) before disabling the link. A value of zero results in infinite retries.

Parameter	Default	Valid values	Description
HS_LINK	FALSE	TRUE FALSE	Setting this parameter to TRUE, notifies MTP that high speed links are in effect and automatically sets HS_EXT_SEQ to TRUE. Set HS_EXT_SEQ to FALSE for high speed links with normal sequence numbers. **Note:** Layers 2 and 3 use this parameter.
HS_EXT_SEQ	FALSE	TRUE FALSE	Setting this parameter to TRUE, notifies MTP that extended sequence numbers are in effect and changes the size of: • FSN, BSN, and LI fields in MTP 2 packets • The last FSN field of COO and COA messages at layer 3 Sequence numbers increase from 7 to 12 bits and the length indicator increases from 6 to 8 bits. Setting HS_EXT_SEQ to TRUE automatically sets HS_LINK to TRUE. Normal speed links with extended sequence numbers are not supported. **Note:** Layers 2 and 3 use this parameter.
P0QUE_LENGTH	16	2 through 1024	Transmit queue length threshold at which the congestion priority is raised to level 0.
P1QUE_LENGTH	32	(p0Qlen + 2) through 1024	Transmit queue length threshold at which the congestion priority is raised to level 1.
P2QUE_LENGTH	64	(p1Qlen + 2) through 1024	Transmit queue length threshold at which the congestion priority is raised to level 2.
P3QUE_LENGTH	128	(p2Qlen + 2) through 1024	Transmit queue length threshold at which the congestion priority is raised to level 3.
DISCARD_PRIORITY	0	0 through 3	Congestion priority at which messages with priority below the current threshold are discarded rather than being queued and risking further congestion escalation.
LINK_SLC	0	0 through 15	Link selection code for signaling link testing.
LINK_TEST_PATTERN	TST	1 through 15 ASCII characters	Link test pattern for SLTM messages.
TIMER_T1	10	0 through 65535	Time delay to avoid an out-of-sequence condition on changeover.
TIMER_T2	10	0 through 65535	Time to wait for changeover acknowledgment.

Parameter	Default	Valid values	Description
TIMER_T3	10	0 through 65535	Time delay to avoid an out-of-sequence condition on changeback.
TIMER_T4	10	0 through 65535	Time to wait for first changeback acknowledgment (first attempt).
TIMER_T5	10	0 through 65535	Time to wait for first changeback acknowledgment (second attempt).
TIMER_T6	10	0 through 65535	Time delay to avoid an out-of-sequence condition on controlled rerouting.
TIMER_T7	20	0 through 65535	Time to wait for data link connection acknowledgment.
TIMER_T11	600	0 through 65535	Transfer restricted timer.
TIMER_T12	12	0 through 65535	Time to wait for uninhibit acknowledgment.
TIMER_T13	10	0 through 65535	Time to wait for forced uninhibit.
TIMER_T14	30	0 through 65535	Time to wait for inhibit acknowledgment.
TIMER_T17	10	0 through 65535	Time delay to avoid oscillation of initial alignment failure and link restart.
TIMER_T22	1100	0 through 65535	Time to wait to repeat local inhibit test (ANSI T20 value).
TIMER_T23	1100	0 through 65535	Time to wait to repeat remote inhibit test (ANSI T21 value).
TIMER_T24	40	0 through 65535	Reserved for future use (not ANSI T24).
TIMER_T31	50	0 through 65535	Internal BSN requested timer (not ANSI T31).
TIMER_T32	100	0 through 65535	Time to wait for response to SLTM timer (ANSI T1.111.7 timer T1, not ANSI T32).
TIMER_T33	200	0 through 65535	Signaling link connection timer (not ANSI T33).
TIMER_T34	600	0 through 65535	Periodic signaling link test timer (ANSI T1.111.7 timer T2, not ANSI T34).
TIMER_T40	30	1 through 65535	Time to wait for a bind confirmation from MTP 2 before sending another bind request.
TIMER_T41	30	1 through 65535	Time to wait for a disconnect confirmation from MTP 2 before sending another disconnect request.
TIMER_T42	30	1 through 65535	Time to wait for a flow control confirmation from MTP 2 before sending another flow control request.
TIMER_T43	30	1 through 65535	Time to wait for a status confirmation from MTP 2 before sending another status request.
TIMER_T44	30	1 through 65535	Time to wait for an unbind confirmation from MTP 2 before sending another unbind request.

Parameter	Default	Valid values	Description
LINK_TRACE_DATA	FALSE	TRUE FALSE	If TRUE, starts tracing of all data between MTP 2 and MTP 3 on this link.
END	N/A	N/A	Marks the end of this link definition. This parameter is required.

MTP 2 link parameters

All layer 2 timer values are specified in tenths of a second (60 = 6 seconds).

Parameter	Default	Valid values	Description
ERR_TYPE	NORMAL	NORMAL PCR	Error correction method. NORMAL = normal PCR = preventive cyclic retransmission
HS_LINK	False	TRUE FALSE	Setting this parameter to TRUE, notifies MTP that high speed links are in effect and automatically sets HS_EXT_SEQ to TRUE. Set HS_EXT_SEQ to FALSE for high speed links with normal sequence numbers. **Note:** Layers 2 and 3 use this parameter.
HS-EXT_SEQ	False	TRUE FALSE	Setting this parameter to TRUE, notifies MTP that extended sequence numbers are in effect and changes the size of: • FSN, BSN, and LI fields in MTP 2 packets • The last FSN field of COO and COA messages at layer 3 Sequence numbers increase from 7 to 12 bits and the length indicator increases from 6 to 8 bits. Setting HS_EXT_SEQ to TRUE automatically sets HS_LINK to TRUE. Normal speed links with extended sequence numbers are not supported. **Note:** Layers 2 and 3 use this parameter.
L2_T1	130 (ANSI) 400 (ITU-T)	1 through 65535	Timer aligned and ready.
L2_T2	115 (ANSI) 100 (ITU-T)	1 through 65535	Timer not aligned.
L2_T3	115 (ANSI) 15 (ITU-T)	1 through 65535	Timer aligned.
L2_T4_N	23 (ANSI) 82 (ITU-T)	1 through 65535	Normal proving period.
L2_T4_E	6 (ANSI) 5 (ITU-T)	1 through 65535	Emergency proving period.

Parameter	Default	Valid values	Description
L2_T5	1	1 through 65535	Timer sending busy indications (SIBs).
L2_T6	60	1 through 65535	Timer remote congestion.
L2_T7	20	1 through 65535	Timer excessive delay of acknowledgement.
L2_T10	30	1 through 65535	Amount of time MTP 2 can be isolated from a remote MTP 3 before sending processor outage (SIPO).
L2_T11	20	1 through 65535	Time to wait for a flow control acknowledgement from MTP 3 before sending another flow control indication.
L2_T12	20	1 through 65535	Time to wait for a status confirmation from MTP 3 before sending another status indication.
L2_T13	20	1 through 65535	Time to wait for a disconnect confirmation from MTP 3 before sending another disconnect indication.
LSSU_LEN	2	1 through 2	LSSU length.
MAX_FRAME	272	64 through 1024	Maximum frame length for MSU.
SUERM_THRESH	64	1 through 255	Signal unit error rate monitor threshold (bad frames).
SUERM_D_RATE	256	1 through 65535	Signal unit error rate monitor decrement rate (frames).
AERM_THRESH_E	1	1 through 255	Alignment error rate monitor threshold (emergency alignment).
AERM_THRESH_N	4	1 through 255	Alignment error rate monitor threshold (normal alignment).
MAX_RTB_MSGS	127	1 through 255	Maximum number of MSUs for retransmission (only when using PCR error correction).
MAX_RTB_OCTETS	34544	1 through 65535	Maximum number of MSU octets for retransmission (only when using PCR error correction).
MAX_PROV_ABORT	5	1 through 255	Maximum number of proving failures.
DATA_ENC	NRZ	NRZ NRZI	Data encoding.
SHARE_FLAGS	TRUE	TRUE FALSE	If TRUE, allow a single flag to be shared between frames.
USE_FLAGS	TRUE	TRUE FALSE	If TRUE, use flags between frames. If FALSE, idle between frames.
MIN_FLAGS	0	0 through 15	Minimum number of additional flags between frames (in addition to shared flag).
ISO_THRESH	1000	1 through 65535	Number of messages queued to MTP 3 while isolated that cause MTP 2 to begin processor outage (SIPOs).
L2_TXQ_THRESH1	50	1 through 65535	Transmission queue length at which the outbound flow control level is raised to one.

Parameter	Default	Valid values	Description
L2_TXQ_THRESH1_A	20	1 through 65535	Transmission queue length at which the outbound flow control level is lowered to zero.
L2_TXQ_THRESH2	200	1 through 65535	Transmission queue length at which the outbound flow control level is raised to two. The subsequent indication causes MTP 3 to cease all transmission to MTP 2 until the flow control level returns to one or zero.
L2_TXQ_THRESH2_A	100	1 through 65535	Transmission queue length at which the outbound flow control level is lowered to one.
L2_SAP_THRESH	500	1 through 65535	Number of messages queued to MTP 3 while inbound flow control is in effect that cause MTP 2 to send busy indications (SIBs).
L2_SAP_THRESH_A	100	1 through 65535	Number of messages queued to MTP 3 while inbound flow control is in effect that cause MTP 2 to stop sending busy indications (SIBs).
IDLE_FREQ	0	1 through 65535	Frequency at which FISUs are sent by the software (in ms). Zero indicates that hardware constantly retransmits duplicate FISUs as is the norm. Switches that process all FISUs in the software (including duplicate FISUs) can use non-zero frequencies.
RT_FREQ	0	1 through 65535	Frequency at which other retransmitted SUs (LSSUs) are sent by the software (in ms). Zero indicates that hardware constantly retransmits duplicate LSSUs as is the norm. Switches that process all FISUs in the software (including duplicate FISUs) can use non-zero frequencies.
END	N/A	N/A	Marks the end of this link definition. This parameter is required.

Network service access point (NSAP) parameters

The following table lists the parameters used for defining an NSAP:

Parameter	Default	Valid values	Description
NSAP	None	0 through MAX_USERS - 1	NSAP number. This parameter is required.
LINK_TYPE	ANSI	ANSI ITU JNTT JTTC	MTP 3 protocol variant used by this MTP 3 user part.
P0QUE_LENGTH	0	2 through 1024	Receive queue length threshold at which the congestion priority is raised to level 0.
P1QUE_LENGTH	512	(p0Qlen + 2) through 1024	Receive queue length threshold at which the congestion priority is raised to level 1.
P2QUE_LENGTH	768	(p1Qlen + 2) through 1024	Receive queue length threshold at which the congestion priority is raised to level 2.
P3QUE_LENGTH	896	(p2Qlen + 2) through 1024	Receive queue length threshold at which the congestion priority is raised to level 3.

Parameter	Default	Valid values	Description
DPC_LENGTH	24 (ANSI) 14 (ITU-T) 16 (JNTT/JTTC)	14 16 24	Number of bits in a point code.
END	N/A	N/A	Marks the end of this NSAP definition. This parameter is required.

Routing parameters

The following table lists the configurable parameters for an MTP 3 route entry:

Parameter	Default	Valid values	Description
ROUTE	None	0 through MAX_ROUTES	Route identifier number. This parameter is required.
DPC	None	N/A	Point code that is the target of the route entry. Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101).
OPC	None	N/A	Originating point code. Use for multiple OPC emulation and OPC routing. Refer to *Configuring multiple OPC emulation* on page 87 for more information.
SPTYPE	STP	SP STP	Destination signaling point type.
LINK_TYPE	ANSI	ANSI ITU JNTT JTTC	MTP 3 protocol variant associated with this route.
SSF	NATIONAL (ANSI) INTERNATIONAL (ITU-T)	NATIONAL INTERNATIONAL	Value for the sub-service field (SSF) to be used in route management messages for this route.
SUB_SERVICE	2	0 through 3	Overrides SSF parameter. Use either SUB_SERVICE or the SSF parameter.
DIRECTION	DOWN	UP DOWN	Route direction. Up routes result in messages being routed to user parts or applications on this node; Down routes are routes to remote signaling points.
ADJACENT_ROUTE	TRUE	TRUE|YES FALSE|NO	If TRUE, this is a route to an adjacent signaling point (a signaling point that is directly connected to this node).
ADJACENT_CLUSTER	FALSE	TRUE|YES FALSE|NO	If TRUE, this is a route to any cluster, enabling use of the cluster variant of route management messages (ANSI only).
TIMER_T8	10	0 through 65535	Transfer prohibited inhibition timer.
TIMER_T10	450	0 through 65535	Time to wait to start or repeat periodic route set test.
TIMER_T19_ITU	680	1 through 65535	ITU restart timer to avoid ping-pong of TFP, TFR, or TRA messages.
TIMER_T21_ITU	640	1 through 65535	Overall ITU restart timer at adjacent SP.

Parameter	Default	Valid values	Description
TIMER_T25_ANSI	320	1 through 65535	ANSI restart timer at adjacent SP waiting for a TRA message.
TIMER_T28_ANSI	300	1 through 65535	ANSI restart timer at adjacent SP waiting for a TRW message.
TIMER_T29_ANSI	630	1 through 65535	ANSI restart timer started when a TRA is sent in response to an unexpected TRA or TRW.
TIMER_T30_ANSI	320	1 through 65535	ANSI restart timer to limit sending of TFPs and TFRs in response to an unexpected TRA or TRW.
END	N/A	N/A	Marks the end of this route definition. This parameter is required.

Linkset parameters

The following table lists the parameters for defining a linkset:

Parameter	Default	Valid values	Description
LINK_SET_DESCRIPTOR	None	1 through MAX_LINKSETS	Linkset identifier number; referenced in LINK_SET parameter of each individual link.
ADJACENT_DPC	None	N/A	Point code of the adjacent SP that terminates this linkset. Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101).
OPC	None	N/A	Originating point code. Use for multiple OPC emulation and OPC routing. Refer to *Configuring multiple OPC emulation* on page 87 for more information.
MAX_ACTIVE_LINKS	16	1 through 32	Target number of links in this linkset to keep active at any given time.
ROUTE_NUMBER	None (priority for a route defaults to zero)	0 through MAX_ROUTES	Route number and optional priority associated with a destination that can be reached through this linkset. As many as 256 route numbers can be specified per linkset. The same route number can be assigned to multiple linksets. The optional priority associated with the route number is relative to other linksets that also contain this route number.
END	N/A	N/A	Marks the end of this linkset definition. This parameter is required.

7 Configuring ISUP

ISUP configuration overview

The ISUP (ISDN User Part) layer provides the interface for applications to establish, maintain, and clear circuit switched connections through the SS7 network in accordance with the following recommendations:

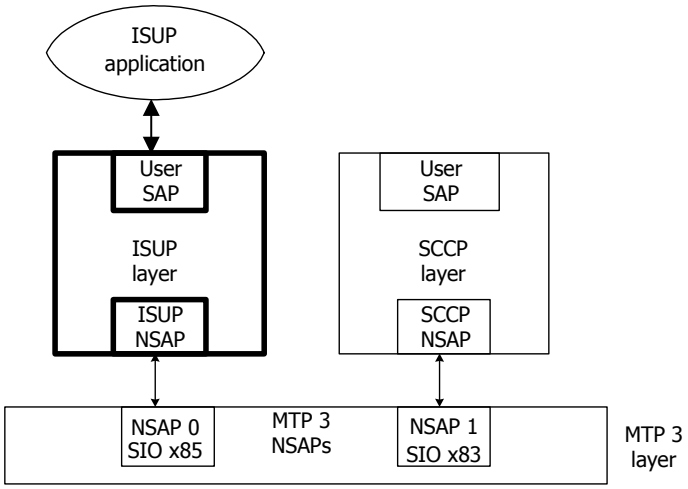
- CCITT Q.761 - Q.764 (Blue Book, White Book, and 1997)
- ANSI T1.113 (1988, 1992, and 1995)
- ETSI Version 2
- ETSI Version 3
- Q.767
- NTT Q.761 - 764
- ITU BICC (Q.1901 and Q.1902 series)
- ANSI BICC (T1.673-2002[R2007])

The ISUP layer is also responsible for circuit group management such as blocking, unblocking, and resetting circuits and circuit groups.

ISUP implements services through the configuration of general parameters and the following entities:

Entity	Description
Circuits	Physical bearer circuits controlled by the ISUP layer. Circuits are identified by both a circuit index and a circuit identification code (CIC). The circuit index is a number unique across all circuits configured on a particular TX board. This number has only local significance. It is used between the ISUP layer and the local call processing application to identify a particular circuit. The CIC (usually called the kick, or kick code) is used between signaling points (the ISUP layer and the far exchange that terminates the other end of the circuit) to uniquely identify a particular circuit. The CIC must be configured at both ends of the circuit to identify the exact same bearer facility (the same T1 span and timeslot). CICs need not be unique across circuits that terminate on different far exchanges. Circuits are specified in the ISUP configuration file in groups. A group is one or more circuits with contiguous circuit indexes and contiguous CICs that terminate on the same far exchange and have common characteristics. A single circuit group is frequently used to represent all the timeslots on a single T1 or E1 span. When defining a circuit group, only the circuit index and CIC of the first circuit in the group, along with the number of circuits in the group, are specified. The ISUP layer derives the circuit index and CIC for subsequent circuits since they are considered to be contiguous. The starting circuit index and starting CIC for a group need not be the same value.
User service access points (SAPs)	Define the interface between the ISUP layer and the user applications. **Note:** ISUP supports only a single user application; configure only one user SAP.
Network service access points (NSAPs)	Define the interface between the ISUP layer and the MTP layer. NSAPs identify the MTP network SAP to be used by the ISUP layer, allowing multiple user parts (for example, ISUP and SCCP) to share access to the MTP layer services.

The following illustration shows the concept of user SAPs and network SAPs:



Creating the ISUP configuration

SS7 provides sample files for ANSI standalone and redundant configurations and ITU standalone and redundant configurations that you can modify for your specifications. Refer to *Sample SS7 TDM configurations* on page 13 for more information.

The *isupcfg* configuration utility runs as part of the initial board configuration with *ss7load. isupcfg* reads the text configuration file and downloads the specified configuration to the ISUP task on the TX board. The utility can also be run after initial configuration to dynamically update some configuration parameters. For more information about running *isupcfg* after an initial download, refer to the *Dialogic® NaturalAccess™ ISUP Layer Developer's Reference Manual.*

Sample ISUP configuration file

The following example is the configuration file for board 1 in the two-board ANSI sample configuration:

```
# General configuration parameters
MAX_SAPS              2
MAX_NSAPS             2
MAX_CIRCUITS          96
MAX_GROUPS            5               !max number of circuit groups
MAX_CALLREFS          96              !max number of active circuits
MAX_ROUTES            10              !max number of routes
OPC                   1.1.1           !my point code
CLLINAME              myname123
END
# Service Access Point (SAP)
USER_SAP              0
SWITCH_TYPE           ANSI92          !switch type (ITU, ANSI88, ANSI92,
                                       ANSI95, ITUWHITE, ITUBLUE, Q767)
MAX_LENGTH            20              !max length of a phone number
END
# Network Service Access Point (NSAP)
NSAP                  0
SWITCH_TYPE           ANSI92          !switch type (ITU, ANSI88, ANSI92,
                                       ITUWHITE, ITUBLUE, Q767)
END
# Circuit Database
CIRCUIT               1               !circuit number
CIC                   1               !Circuit identification code
DPC                   1.1.2           !DPC of far exchange
SWITCH_TYPE           ANSI92          !switch type (ITU, ANSI88, ANSI92,
                                       ITUWHITE, ITUBLUE, Q767)
TRUNK                 708
CIRCUIT_TYPE          BOTHWAY         !INCOMING, OUTGOING, or BOTHWAY
CONTROL_TYPE          ODD_EVEN        !ALL, NONE, or ODD_EVEN
NUM_CIRCUITS          24              !number of circuits in this group
END
#
CIRCUIT               25              !circuit number
CIC                   25              !Circuit identification code
DPC                   1.1.2           !DPC of far exchange
SWITCH_TYPE           ANSI92          !switch type (ITU, ANSI88, ANSI92,
                                       ITUWHITE, ITUBLUE, Q767)
TRUNK                 847
CIRCUIT_TYPE          BOTHWAY         !INCOMING, OUTGOING, or BOTHWAY
CONTROL_TYPE           ODD_EVEN       !ALL, NONE, or ODD_EVEN
NUM_CIRCUITS           24             !number of circuits in this group
END
#
END
```

Configuring ISUP for the Japan-NTT variant

Follow these guidelines when configuring the ISUP layer for Japan-NTT network operation:

- Set the SWITCH_TYPE attribute for all USAP, NSAP, and CIRCUIT entries to JNTT.
- Specify 16-bit point codes in either hexadecimal or ***x.y.z*** dotted notation:
  - Specify hexadecimal point codes in the order in which they are transmitted on the link; that is, the U-code in the most significant seven bits, the S-code in the next four bits, and the M-code in the least significant five bits.
  - To specify J-NTT 16-bit point codes in ***x.y.z*** notation, add the following statement to the MTP 3 general configuration section:

```
PC_FORMAT       JNTT
```

This statement tells the ISUP configuration utility to treat all subsequent point codes as ***mcode.scode.ucode*** format and generate 16-bit internal point codes with the U-code in the most significant seven bits, the S-code in the next four bits, and the M-code in the least significant five bits.

Note: The Japanese TTC variant is supported with the JNTT setting and the Global Messaging Toolkit.

Configuring ISUP for the BICC variants

The following example shows an ISUP configuration for the ANSI BICC variant. The required settings are shown in bold type. For the ITU BICC variant, change the SWITCH_TYPE field in the SAP, NSAP, and Circuit group configuration sections to ITUBICC.

```
#  ISUP Configuration File (Configuring BICC variant)
#---------------------------
# General configuration parameters
MAX_SAPS       2
MAX_NSAPS      2
MAX_CIRCUITS   2048
MAX_GROUPS     5           !max number of circuit groups
MAX_CALLREFS   2048        !max number of active circuits
MAX_ROUTES     10          !max number of routes
OPC            0.1.1       !my point code
CLLINAME       mynameABC
END
#--------------------------------
# Service Access Point (SAP)
USER_SAP       0
SWITCH_TYPE    ANSIBICC
MAX_LENGTH     20       !max length of a phone number
END
#-------------------------------
# Network Service Access Point (NSAP)
NSAP           0
SWITCH_TYPE    ANSIBICC
END
#----------------------------------
# Circuit Database
CIRCUIT        1        !circuit number (For BICC, configure with same value as CIC)
CIC            1        !Circuit identification Code (ISUP)/Call Instance Code (BICC)
DPC            0.1.2    !point code of far exchange
SWITCH_TYPE    ANSIBICC
CIRCUIT_TYPE   BOTHWAY  !INCOMING, OUTGOING, or BOTHWAY
CONTROL_TYPE   ODD_EVEN !ALL, NONE, or ODD_EVEN
NUM_CIRCUITS   200      !number of circuits(ISUP)/CIC(BICC) in this group
END
#
CIRCUIT        201      !circuit number (For BICC, configure with same value as CIC)
CIC            201      !Circuit identification code (In BICC, called Call Instance Code)
DPC            0.1.2    !point code of far exchange
SWITCH_TYPE    ANSIBICC
CIRCUIT_TYPE   BOTHWAY  !INCOMING, OUTGOING, or BOTHWAY
CONTROL_TYPE   ODD_EVEN !ALL, NONE, or ODD_EVEN
NUM_CIRCUITS   200      !number of circuits(ISUP)/CIC(BICC) in this group
END
#
END
```

ISUP configuration reference

This topic presents the ISUP configuration file parameters:

- General parameters
- SAP parameters
- NSAP parameters
- Circuit group parameters

General parameters

The general parameters control the overall operation of the ISUP layer process.

Note: All ISUP timer values are in seconds.

Parameter	Default	Valid values	Description
MAX_SAPS	1	1	Maximum number of user applications.
MAX_NSAPS	1	1 through 255	Maximum number of interfaces with the MTP 3 network layer.
MAX_GROUPS	32	0 through 65535	Maximum number of circuit groups managed by the ISUP layer.
MAX_ROUTES	16	0 through 65535	Maximum number of routes.
MAX_CIRCUITS	96	0 through 65535	Maximum number of circuits to be managed by the ISUP layer.
MAX_CALLREFS	16	0 through 65535	Maximum number of call references (connections) that ISUP can keep track of simultaneously.
OPC	None	N/A	Point code of this node, specified as ***x.y.z*** (three bytes, decimal value, separated by periods), as a hexadecimal value preceded by 0x (0x123), or as a decimal value.
PC_FORMAT	DEFAULT	DFLT INTL JNTT	Point code format. DFLT = Point codes are interpreted and displayed as 24-bit 8.8.8 values. INTL = Point codes are interpreted and displayed as 14-bit 3.8.3 values. JNTT = Use for both Japan NTT and TTC networks. Point codes are interpreted and displayed as 16-bit ***mcode***.***scode***.***ucode*** values with the U-code in the most significant 7 bits, the S-code in the next 4 bits, and the M-code in the least significant 5 bits.
CLLINAME	None	N/A	Common language location identifier (CLLI) name assigned to this node (exactly 11 ASCII characters).
T18_TIMER	12	0 through 65535	Time to wait for a response to a group blocking message that was sent.

Parameter	Default	Valid values	Description
T19_TIMER	60	0 through 65535	Time to wait for a response to an initial group blocking message that was sent.
T20_TIMER	12	0 through 65535	Time to wait for a response to a group unblocking message that was sent.
T21_TIMER	60	0 through 65535	Time to wait for a response to an initial group unblocking message that was sent.
T22_TIMER	12	0 through 65535	Time to wait for a response to a circuit group reset message that was sent.
T23_TIMER	60	0 through 65535	Time to wait for a response to an initial circuit group reset message that was sent.
T28_TIMER	10	0 through 65535	Time to wait for a CQR after sending a CQM.
TGRES_TIMER	5	0 through 65535	Group reset timer.
TFGR_TIMER	5	0 through 65535	ANSI first group received timer.
TRACE_EVENT	FALSE	TRUE FALSE	If TRUE, enables event logging.
TRACE_DATA	FALSE	TRUE FALSE	If TRUE, enables data tracing.
TRACE_WARNING	FALSE	TRUE FALSE	If TRUE, enables logging of unexpected information element value warnings.
TRACE_ERROR	FALSE	TRUE FALSE	If TRUE, enables logging of message encoding errors.
IG_PASS_ALNG	FALSE	TRUE FALSE	If TRUE, messages are sent in pass-along format.
ITU_UCICS	FALSE	TRUE FALSE	If TRUE, enables an ITU configuration to send UCIC messages. If FALSE, UCICs are not sent.
EXT_ELMTS	FALSE	TRUE FALSE	If TRUE, enables the sending and receiving of extended elements.
RAW_MSGS	FALSE	TRUE FALSE	If TRUE, enables the sending and receiving of raw messages.
ONE_GRPMSG	FALSE	TRUE FALSE	If TRUE, the stack reacts to the first CGB and GRS group message (ANSI only).
QCONGONSET1	600	0 through 65535	Queue to the host application congestion level 1 onset.
QCONGABATE1	400	0 through 65535	Queue to the host application congestion level 1 abatement threshold.

Parameter	Default	Valid values	Description
QCONGONSET2	900	0 through 65535	Queue to the host application congestion level 2 onset.
QCONGABATE2	700	0 through 65535	Queue to the host application congestion level 2 abatement threshold.
QCONGONSET3	1200	0 through 65535	Queue to the host application congestion level 3 onset.
QCONGABATE3	1000	0 through 65535	Queue to the host application congestion level 3 abatement threshold.
MCONGONSET1	20	0 through 65535	TX percentage of memory remaining congestion level 1 onset.
MCONGABATE1	25	0 through 65535	TX percentage of memory remaining congestion level 1 abatement threshold.
MCONGONSET2	10	0 through 65535	TX percentage of memory remaining congestion level 2 onset.
MCONGABATE2	15	0 through 65535	TX percentage of memory remaining congestion level 2 abatement threshold.
MCONGONSET3	5	0 through 65535	TX percentage of memory remaining congestion level 3 onset.
MCONGABATE3	8	0 through 65535	TX percentage of memory remaining congestion level 3 abatement threshold.
RMTUSRUNAVL	FALSE	TRUE FALSE	If TRUE, configures the stack to start in remote user unavailable mode.
GRPRESETEVENT	FALSE	TRUE FALSE	If TRUE, configures the stack to send up one group reset event instead of many separate circuit reset events.
SLSFROMCICS	TRUE	TRUE FALSE	If TRUE, sets the ANSI SLS value to the bottom bits of the CIC.
DSBLRMTUSRUNAVL	FALSE	TRUE FALSE	If TRUE, disables appropriate user part test procedure (for SSURN among others).
RESTARTT7	FALSE	TRUE FALSE	If TRUE, restarts T7 when an inbound INR is received (for SSURN among others).
DISABLEACL	FALSE	TRUE FALSE	If TRUE, disables automatic congestion control (for SSURN among others).
END	N/A	N/A	Marks the end of the general section. This parameter is required.

SAP parameters

The service access point (SAP) parameters define the characteristics of the ISUP layer presented to the user applications.

Note: The ISUP layer software allows for configuration of only a single ISUP user SAP. Therefore, only one application can use the ISUP layer at a time. Timer default values in parentheses are ITU values.

Parameter	Default	Valid values	Description
USER_SAP	None	0 through MAX_SAPS	SAP number
SWITCH_TYPE	ANSI92	ITU ITUWHITE ITUBLUE ITU97 ETSIV2 ETSIV3 Q767 ANSI88 ANSI92 ANSI95 JNTT	Protocol variant employed for this application. Must match one of the switch types defined in the NSAP definition section. For Japan TTC, use JNTT and the Global Messaging Toolkit.
MASK	None	N/A	Routing mask for circuit selection by ISUP. Maximum of 20 ASCII characters where a 1 indicates the digit is significant for route matching and a 0 indicates the digit is ignored for route matching. For example, 1110000000 causes ISUP to treat the first three digits of a called address as significant when route matching.
MAX_USER2USER	20	0 through 0xff	Maximum length of user-to-user information in an IAM.
T1_TIMER	12 (15)	0 through 65535	Time to wait for a response to a release message sent.
T2_TIMER	0	0 through 65535	Time to wait for a resume message after a suspend message received.
T5_TIMER	60 (300)	0 through 65535	Time to wait for a response to initial release message sent.
T6_TIMER	30	0 through 65535	Time to wait for a resume message after a suspend (network) message received.
T7_TIMER	25	0 through 65535	Time to wait for a response (for example, ACM, ANS, or CON) to the latest address message sent.
T8_TIMER	12	0 through 65535	Time to wait for a continuity message after receiving IAM requiring continuity check.
T9_TIMER	180	0 through 65535	Time to wait for answer of outgoing call after ACM message received.
T16_TIMER	12	0 through 65535	Time to wait for a response to a reset message sent.
T17_TIMER	12 (300)	0 through 65535	Time to wait for a response to initial reset message sent.
T27_TIMER	240	0 through 65535	Time to wait for a continuity check request after ensuing continuity check failure indication is received. See the TCCR_TIMER field.

Parameter	Default	Valid values	Description
T31_TIMER	0 (disabled)	0 through 65535	Time to wait before reusing call reference after a connection is cleared.
T33_TIMER	15	0 through 65535	Time to wait for a response to information request message sent.
TEX_TIMER	0 (disabled)	0 through 65535	Time to wait before sending ANSI exit message.
TCRM_TIMER	4	0 through 65535	Time to wait for a response to a circuit reservation message sent.
TCRA_TIMER	10	0 through 65535	Time to wait for an IAM message after circuit reservation acknowledgment message sent.
TCCR_TIMER	20 (240)	0 through 65535	Time to wait for CCR after the first COT indicating failure. See the T27_TIMER field.
END	N/A	N/A	Marks the end of the SAP section. This parameter is required.

NSAP parameters

The NSAP parameters define the characteristics of the ISUP interface to the MTP 3 layer:

Parameter	Default	Valid values	Description
NSAP	None	1 through 32	Name of the NSAP section for the rest of the parameters.
SWITCH_TYPE	ANSI92	ITU ITUWHITE ITUBLUE ITU97 ETSIV2 ETSIV3 Q767 ANSI88 ANSI92 ANSI95 JNTT	Protocol variant employed for this MTP interface. Must match one of the switch types defined in the MTP 3 NSAP definition section. For Japan TTC, use JNTT and the Global Messaging Toolkit.
SSF	NATIONAL	NATIONAL INTERNATIONAL 0 through 3 RESERVED SPARE	Value used in the subservice field (SSF) of the service information octet in outgoing ISUP messages on this MTP interface.
MTP_SAP	0	0 through 255	MTP service access point to which to bind ISUP. Must match one of the NSAP numbers defined in the MTP configuration file; must be unique among all user parts that use MTP (SCCP, TUP).
END	N/A	N/A	Marks the end of the NSAP section. This parameter is required.

Circuit group parameters

The circuit group parameters specify the characteristics of each of the circuit groups to be managed by the ISUP layer. One entry is made for each circuit group.

Note: Timer default values in parentheses are ITU values.

Parameter	Default	Valid values	Description
CIRCUIT	None	1 through MAX_CIRCUITS	Number of the first circuit in this group. Circuits in this group are numbered from this value to (value + NUM_CIRCUITS - 1). This range must be unique for all circuits defined. This value is used by the application and the ISUP layer to identify circuits, but has no meaning to the far exchange.
CIC	1	0 through 4095	Circuit identification code (CIC) of the first circuit in this group. Circuits in this group are assigned CICs from this value to (value + NUM_CIRCUITS - 1). The number range must agree with the CICs assigned to this circuit group at the far exchange.
DPC	None	N/A	Destination point code to which this circuit group connects.
ALT_OPC	0	N/A	Originating Point code for this set of circuits. If not present, the OPC is set to OPC from the NSAP. This needs to be used carefully with the appropriate MTP configuration changes.
CIRCUIT_TYPE	INCOMING	INCOMING OUTGOING BOTHWAY	Direction of calls allowed on this circuit group.
CONTROL_TYPE	NONE	NONE ALL ODD_EVEN	Dual seizure control.
GROUP_CHARS	0	0 through 0xff	When non-zero, this value is placed in the group characteristics of the CVR message.
SWITCH_TYPE	ANSI92	ITU ITUWHITE ITUBLUE ITU97 ETSIV2 ETSIV3 Q767 ANSI88 ANSI92 ANSI95 JNTT	Protocol variant employed for this application. Must match one of the switch types defined in the NSAP definition section. For Japan TTC, use JNTT and the Global Messaging Toolkit.
SSF	0xff (NSAP)	NATIONAL INTERNATIONAL 0 through 3 RESERVED SPARE 0xff	NSAP value is the default; however, putting a value in this field overrides the default.
NUM_CIRCUITS	1	1 through 4095	Number of circuits in this circuit group.
T4_TIMER	0	0 through 65535	Time to wait for call modification complete message.

Parameter	Default	Valid values	Description
T12_TIMER	12 (15)	0 through 65535	Time to wait for response to blocking message.
T13_TIMER	60 (300)	0 through 65535	Time to wait for a response to the initial blocking message sent.
T14_TIMER	12 (15)	0 through 65535	Time to wait for a response to an unblocking message sent.
T15_TIMER	60 (300)	0 through 65535	Time to wait for a response to the initial unblocking message sent.
TVAL_TIMER	30	0 through 65535	ANSI circuit validation timer.
TPAUSE_TIMER	2	0 through 65535	Time to wait after MTP pause before resetting circuits.
END	N/A	N/A	Marks the end of this circuit group definition. This parameter is required.

8 Configuring SCCP

SCCP configuration overview

The SCCP (Signaling Connection Control Part) layer builds on the services of the MTP layer to provide SS7 applications with a higher level transport subsystem. SCCP adds the following services to those provided by the MTP layers:

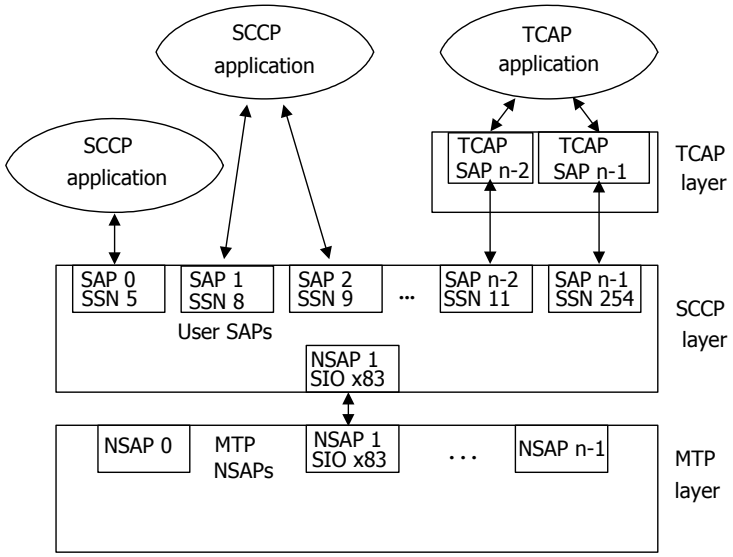
- The ability to address individual applications or databases, known as subsystems, at a signaling point through a SCCP-level address consisting of a point code and a subsystem number.
- An OSI-like connectionless transport service.
- An OSI-like connection-oriented transport service.
- An address translation mechanism called global title translation that can translate a string of digits (such as a telephone number or mobile identification number) into a point code or subsystem number, isolating applications from changes in the physical SS7 network structure.
- A subsystem management layer that tracks the status of targeted subsystems at particular signaling points, known as concerned signaling points, and can optionally associate a backup signaling point with a subsystem for high availability applications.

Applications access these services either directly from the SCCP layer or indirectly through the TCAP layer.

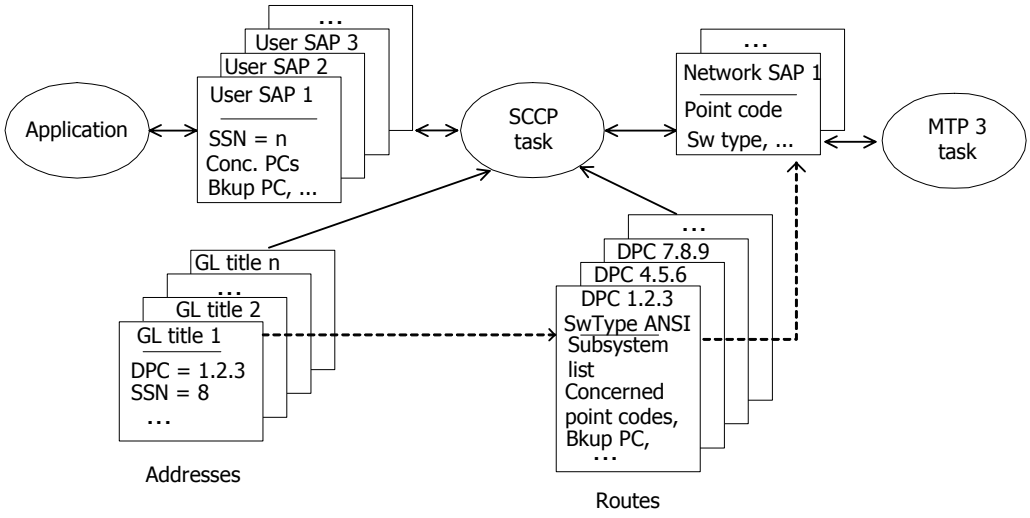
SCCP implements services through the configuration of general parameters and the following entities:

Entity	Description
User SAPs	Define the interface between the user applications and the SCCP layer. One user SAP is defined for each application using the SCCP layer services. A user SAP is associated with a single subsystem number and protocol variant (ANSI or ITU-T). The user SAP defines whether the application is replicated on another node for reliability purposes and lists any concerned point codes (nodes that must be notified of any change in the status of the application).
NSAPs	Define the interface between the SCCP layer and the MTP layer 3. One network SAP is defined for each MTP 3 layer interface that the SCCP layer uses. Typically the SCCP layer has only a single network SAP. If the same system supports multiple protocol variants (ANSI and ITU-T), the SCCP layer has a separate network SAP for each switch type.
Routes	Define one route for each destination signaling point that the SCCP layer may be used to access. The route defines the destination point code of that signaling point and each subsystem of interest at that signaling point, as well as any backup point codes that replicate those subsystems. If the SCCP default routing feature is employed, all routing is deferred to the MTP layers and no SCCP routes need to be defined. Refer to *Using default routing* on page 126.
Address translations	Define how the SCCP layer is to translate or route between global titles, point codes, and subsystem numbers. Refer to *Configuring global title translations* on page 129.

The following illustration shows the concept of user SAPs. When the application interfaces with the TCAP layer, the TCAP SAPs map one-for-one with an SCCP user SAP.



The following illustration shows the relationship between the SCCP configurable entities:



Creating the SCCP configuration

SS7 provides sample SCCP files for ANSI standalone and redundant configurations and ITU standalone and redundant configurations that you can modify for your specifications. To learn the location of the sample configuration files, refer to *Sample SS7 TDM configurations* on page 13.

The *sccpcfg* configuration utility runs as part of the initial board configuration with *ss7load*. *sccpcfg* reads the text configuration file and downloads the specified configuration to the SCCP task on the TX board. The utility can also be run after initial configuration to dynamically update some configuration parameters. For more information on running *sccpcfg* after initial download, refer to the *Dialogic® NaturalAccess™ SCCP Layer Developer's Reference Manual.*

Sample SCCP configuration file

The following example is the configuration file for board 1 in the two-board ANSI sample configuration:

Note: All SCCP timer values are in seconds; a timer value of zero disables that timer.

```
#
# Sample SCCP configuration file for the following configuration
#
#       General:
#       4 user APPs max
#       1 MTP3 network SAP
#       all others general defaults
#       User SAPs:
#       ANSI-92, 1.1.2 is concerned PC
#       Network Saps:
#       ANSI, point code = 1.1.1
#       Routes:
#       1 to 1.1.2, SSNs 3 & 4, 1.1.2 is concerned PC
#       Address translations:
#       8477069701 = far point code, SSN 3, 8477069700
#       847xxxxxxx = far point code, SSN 4
#
# General Configuration Section
MAX_USERS          4          # Max SCCP user applications
MAX_NSAPS          2          # Number of MTP3 interface (max 1
                              # per switch type)
MAX_SCLI           1          # Max simultaneous sequenced
                              # connectionless data xfers (Class 1 only)
MAX_ADDRS          2          # Max Address translation entries
MAX_ROUTES         10         # Max far point codes SCCP knows
DEF_ROUNTING       FALSE      # Set Default Routing (FALSE=OFF, TRUE=ON)
SAVE_CONNS         FALSE      # Drop connections on lost link
                              # (FALSE) or don't drop (TRUE).
ALARM_LEVEL        1          # Set alarm level reporting (0=off,
                              # 1=default, 2=debug, 3=detail)
TRACE_DATA         FALSE      # Set data tracing (FALSE=OFF, TRUE=ON)
MAX_ADJDPC         2          # Max far point codes directly adjacent to us
MAX_MSGDRN         5          # Max msgs to send in a batch when MTP comes
                              # up. (prevents flooding when link(s)come up)
MAX_XUDT           1          # Number of control blocks to allocate for
                              # reassembling segmented extended
                              # UnitDaTa (ITU-92 only)
MAX_XUDTXREF       2          # Max number of local references
                              # used to segment eXtended UnitDaTa
MAX_CONN           512        # Max number of simultaneous connections
CONN_THRESH        1          # Minimum number of SCCP buffers
                              # that must be available for new
                              # connection to be accepted
QUEUE_THRESH       8          # Max number of buffers that can
```

```
                            # be queued for connection waiting
                            # for conn window to open
SOG_THRESH        3         # Minimum number of SCCP buffers
                            # that must be available for SOR
                            # request from replicated (backup)
                            # subsystem to be accepted

# Note all timer values are in seconds (0 disables timer)
XREFFRZ_TIMER     2         # wait before reusing local reference
#ASMB_TIMER       0         # wait for all segments of
                            # segmented XUDT (ITU-92 only)
FREEZE_TIMER      2         # wait before reusing connection reference
CONN_TIMER        180       # wait for response to connection request
TXINACT_TIMER     600       # wait with no outgoing packets on
                            # a connection before issuing
                            # Inactivity test (IT) message
RXINACT_TIMER     900       # wait with no incoming packets on
                            # a connection before releasing
                            # connection (should be > TXINACT_TIMER)
REL_TIMER         10        # wait for response to release request
#REPREL_TIMER     0         # wait for response to 2nd release
                            # request (ITU only)
#INTERVAL_TIMER   0         # wait before reporting abnormal
                            # release (ITU only)
GUARD_TIMER       2         # wait after MTP3 traffic restart
                            # before application traffic
RESET_TIMER       30        # wait for response to Reset Request
#SCLI_TIMER       0         # max time sequenced
                            # connectionless transmission can
                            # take(class 1)
SST_TIMER         30        # time between subsystem status tests
SRT_TIMER         30        # time between subsystem routing tests

NSAP_TIMER        1         # time between bursts of messages
                            # to MTP3 when draining built-up
                            # queue (prevents congestion when
                            # link comes back up
IGNORE_TIMER      30        # delay after receiving SOG before
                            # actually going out of service
COORD_TIMER       30        # wait for grant to go out of
                            # service (SOG) after issuing SOR request
END
#
# User SAP configuration for 1st application
#
USER_SAP          0          # Sap number start at 0
SWITCH_TYPE       ANSI92     # one of ITU92, ITU88, ITU96, ANSI92, ANSI88, ANSI96
#BACKUP_PC        1.2.3      # this application not replicated for now

#Concerned point codes (Nodes to be notified of App's availability) up to 8
CONC_PC           1.1.2
ADDR_MASK         FFF0000000 # requires match on only 1st 3
                             # digits of global title
MAX_HOPS          10         # maximum network hops
END                          # User application 0
#
# User SAP configuration for 2nd application
#
USER_SAP          1          # Application 1
SWITCH_TYPE       ANSI92     # one of ITU92, ITU88, ITU96, ANSI92, ANSI88, ANSI96
#BACKUP_PC        1.2.3      # this application not replicated for now

#Concerned point codes (Nodes to be notified of App's availability) up to 8
CONC_PC           1.1.2
ADDR_MASK         FFF0000000 # requires match on only 1st 3
                             # digits of global title
MAX_HOPS          10         # maximum network hops
END                          # User application 1
#
# User SAP configuration for 3rd application
#
```

```
USER_SAP          2          # Application 2
SWITCH_TYPE       ANSI92     # one of ITU92, ITU88, ITU96, ANSI92, ANSI88, ANSI96
#BACKUP_PC        1.2.3      # this application not replicated for now

# Concerned point codes (Nodes to be notified of Apps availability) up to 8
CONC_PC           1.1.2
ADDR_MASK         FFF0000000 # requires match on only 1st 3
                             # digits of global title
MAX_HOPS          10         # maximum network hops
END                          # User application 1
#
# User SAP configuration for 4th application
#
USER_SAP          3          # Application 3
SWITCH_TYPE       ANSI92     # one of ITU92, ITU88, ITU96, ANSI92, ANSI88, ANSI96
#BACKUP_PC        1.2.3      # this application not replicated for now
# Concerned point codes (Nodes to be notified of App's availability) up to 8
CONC_PC           1.1.2
ADDR_MASK         FFF0000000 # requires match on only 1st 3
                             # digits of global title
MAX_HOPS          0          # maximum network hops
END                          # User application 1
#
# Network (MTP3) Saps - one per switch type
#
NSAP              1          # SCCP must be NSAP 1 if isup present too
SWITCH_TYPE       ANSI       # one of ITU, ANSI
DPC               1.1.1      # REQUIRED - this node's point code
DPC_LEN           4          # normally wouldn't specify this -
                             # let it default based on switch type
MSG_LEN           256        # MTU length on this network
TXQ_THRESH        20         # max packets queued to this MTP3
ADDR_MASK         FFFFFFFFFF # match 10 digits for global title
                             # translation of incoming packets
MAX_HOPS          10         # maximum network hops
END                          # of ANSI MTP3 NSAP
#
# Address Translations: 8477069701
#
ADDRESS           8477069701 # global title - incoming
REPLACE_GLT       TRUE       # remove translated global title
                             # from message
SWITCH_TYPE       ANSI       # one of ITU, ANSI
NI_IND            NATIONAL   # one of NATIONAL [NAT],INTERNATIONAL [INTL]
ROUTING_IND       C_SSN      # set outgoing routing flag(PC_SSN or GLT)
DPC               1.1.2      # translated destination point code
SSN               3          # translated subsystem number
GT_FORMAT         1          # outgoing global title includes
                             # translation type, numbering
                             # plan, and encoding scheme
TRANS_TYPE        2          # translation type
NUM_PLAN          1          # ISDN numbering plan
GL_TITLE          8477069700 # outgoing global title
END                          # of address translation for 8477069701
#
# Address Translations: 847xxxxxxx
#
ADDRESS           847        # global title - incoming
REPLACE_GLT       FALSE      # include translated global title
                             # in message
SWITCH_TYPE       ANSI       # one of ITU, ANSI
NI_IND            NATIONAL   # one of NATIONAL [NAT].INTERNATIONAL [INTL]
ROUTING_IND       GLT        # set outgoing routing flag(PC_SSN or GLT)
DPC               1.1.2      # translated destination point code
SSN               4          # translated subsystem number
END                          # of address translation for 847xxxxxxx

#
# Routes: 1 for each node known to the SCCP layer
#
ROUTE            1.1.2       # destination point code
```

```
SWITCH_TYPE      ANSI        # one of ITU, ANSI
ADJACENT         TRUE        # this dest directly adjacent
TRANSLATOR       FALSE       # not a translator node
#BACKUP_PC       x.y.z       # this node not currently replicated

       #define all subsystems of interest at 1.1.1 (up to 8)
SSN              3           # first subsystem at 1.1.2
SSN_SNR          TRUE        # normal routed
SSN_ACC          TRUE        # initially accessable
#SSN_BPC         x.y.z       # this subsystem not currently replicated
       # concerned point codes - other nodes to be notified when
       # status of this SSN at this node changes - must have a
       # route for any point code listed here
#CONC_PC         q.r.s       # 1st concerned point code
#CONC_PC         q.r.t       # 2nd concerned point code
END                          # of route 1.1.2, SSN 3

SSN              4           # another subsystem at 1.1.2
SSN_SNR          TRUE        # normal routed
SSN_ACC          TRUE        # initially accessable
#SSN_BPC         x.y.z       # this subsystem not currently replicated
       #concerned point codes - other nodes to be notified when
       # status of this SSN at this node changes - must have a
       # route for any point code listed here
#CONC_PC         q.r.s       # 1st concerned point code
#CONC_PC         q.r.t       # 2nd concerned point code
END                          # of route 1.1.2, SSN 4

END                          # of route 1.1.2
```

Using default routing

The SCCP default routing feature enables routing of SCCP packets generated by local applications, either directly with SCCP or through the TCAP layer, to signaling points whose point codes and subsystem numbers are not preconfigured.

This feature is primarily intended for applications that act as databases, or servers, in an SS7 network and cannot be preconfigured with the point codes of all clients that access the server. This feature is also suitable for other SCCP or TCAP-based applications such as replicated subsystems that do not require the signaling point and subsystem management features of the SCCP management functions.

When default routing is enabled, the SCCP layer attempts to deliver messages for which it has no explicit route entry by relying solely on the MTP layer routing. Default routing applies to all classes of SCCP messages (connectionless, connection-oriented, and management). Default routing effectively disables all SCCP management functionality for those remote signaling points or subsystems without explicit routes.

When default routing is enabled, you can preconfigure routes to certain known destinations, such as adjacent STPs or translators, or other remote subsystems that are replicated and require the SCCP management procedures for routing to backup signaling points in case of outages or congestion.

This topic presents:

- Enabling default routing
- Impact of default routing on SCCP message routing
- Impact of default routing on SCCP management
- SCCP limitations when default routing is enabled

Enabling default routing

Default routing is disabled by default. To enable default routing, add the following statement to the general configuration parameters section of the SCCP configuration file:

```
DEF_ROUTING   TRUE    # Default Routing (FALSE = OFF, TRUE = ON)
```

Impact of default routing on SCCP message routing

With default routing enabled, routing of outbound messages by the SCCP layer is performed as follows:

1. Global title translation, if necessary, is performed on the outbound message.
2. The SCCP layer checks for an explicit route to the destination point code. If an explicit route exists, the status of the destination signaling point and subsystem, if known, is checked. If the destination signaling point is active and the destination subsystem available (or unknown, such as routing by global title), the message is passed to the MTP 3 layer for delivery. If the signaling point is not accessible or the subsystem is unavailable, standard routing failure treatment is applied.
3. If no explicit route exists for the destination point code and default routing is disabled, standard routing failure treatment is applied.
4. If no explicit route exists for the destination point code and default routing is enabled, the message is passed to MTP 3 for delivery. If the MTP 3 layer is unable to deliver the message for any reason, the message is discarded and no notification is given to the application that originated the message.

Impact of default routing on SCCP management

The SCCP layer does not attempt to track the status of signaling points and subsystems that are not explicitly defined with route entries. Subsystem prohibited (SSP) and subsystem allowed (SSA) messages received for signaling points with no explicit route entry are ignored. Likewise, pause, resume, and remote user unavailable indications from the MTP 3 layer regarding signaling points with no explicit route entry are ignored. In effect, signaling points/subsystems with no explicit route entry are always considered available at the SCCP layer.

Subsystem testing (SST) is applied only to explicitly configured signaling points and subsystems. SST messages are never sent to destinations with no explicit route entry defined.

If an SST message is received from a signaling point that is not explicitly configured with a route entry, the appropriate response (SSA if the local subsystem is available, no response if the local subsystem is prohibited or unequipped) is returned, provided that the MTP 3 layer can route the response to that signaling point.

If the SCCP layer receives a message from an unknown (not explicitly configured) remote signaling point for a local subsystem that is either prohibited or unequipped, a subsystem prohibited (SSP) message is returned to the originating signaling point, provided that the MTP 3 layer can route to that signaling point. The appropriate message return (connectionless) or connection refusal (connection request) procedures are also performed.

SCCP limitations when default routing is enabled

The use of default routing effectively disables the SCCP layer management functions for those signaling points not explicitly configured with route entries. Following are some limitations of default routing:

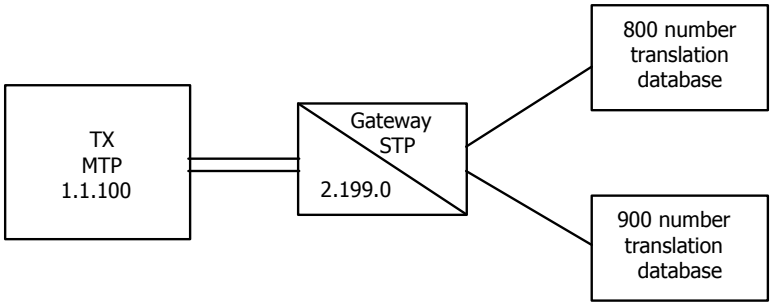
- If a local subsystem is to be replicated to take advantage of the SCCP layer's ability to route incoming messages to the backup signaling point when the local application is unavailable, an explicit route to the backup signaling point must be configured.
- If a remote subsystem is to be replicated to take advantage of the SCCP layer's ability to route outgoing messages to the backup signaling point when the primary signaling point or subsystem is unavailable, explicit routes to both the primary and backup signaling points must be configured.
- If a local application (SCCP or TCAP user) wants to receive status indications for a remote signaling point or subsystem when it becomes available, unavailable, or congested, an explicit route entry must be configured for each such remote signaling point. It must be listed as a concerned point code in the application's user SAP configuration.
- If a remote subsystem is to receive automatic SSP and SSA messages when a local application (SCCP or TCAP user) declares itself unavailable or available, an explicit route entry must be configured for each such remote signaling point. It must be listed as a concerned point code in the application's user SAP configuration.
- Subsystem prohibited (SSP) and subsystem allowed (SSA) messages received for signaling points with no explicit route entry are ignored. In effect, signaling points or subsystems with no explicit route entry are always considered available at the SCCP layer.

Configuring global title translations

The SCCP layer supports global title translation, enabling applications to address messages with a string of digits such as a telephone number or a mobile identification number. Applications can rely on the network configuration to route the message to the correct destination signaling point and subsystem. Global title translations can help isolate applications from changes in the network structure, such as when a particular network database is moved from one signaling point code to another. This feature is available for both applications directly accessing the SCCP layer and for applications indirectly using the SCCP layer through the TCAP layer.

The SCCP layer can translate a global title into its final destination address (point code and subsystem number) or into the address of a gateway signal transfer point (STP). A gateway STP is typically an STP containing a global title translation capability that acts as the entry point to a network for all requests originating from outside the network. In either case, the global title digits can be carried through in the translated address for subsequent translation by the gateway STP or analysis by the destination application.

In the following example network illustration, the SCCP application uses both the 800 number translation services and the 900 number translation services provided by the databases shown:



In this example, the node does not know the network addresses (point codes) of these databases; only the address of the gateway is configured in the SS7 configuration files.

When the application sends a request for either an 800 number or 900 number translation, it generates a SCCP request (or TCAP request) with the 10-digit 800 or 900 number to be translated as the global title digits and the routing indicator field set to route by global title. The application does not include a point code or subsystem number in the destination address.

The following SCCP sample configuration file illustrates the configuration of the address translation.

- The ADDRESS_MASK parameter for the user SAP that corresponds to this application is set to FFF0000000. This setting results in the SCCP layer choosing the first address translation entry with the first three digits matching the first three global title digits in the message address being translated.
- The configured address translation for both 800 and 900 numbers specifies the point code of the gateway STP. The gateway STP performs subsequent global title translation on the message destination address to insert the actual point code of the appropriate database. A subsystem number is also included here, although it could also be inserted by the gateway STP.
- The configured address translation for both 800 and 900 numbers specifies a routing indicator of route by global title to indicate to the gateway STP to perform global title translation. It also indicates that the original global digits are not to be replaced in the outgoing message so that the gateway STP can perform the subsequent translation.

```
# Sample configuration of Global Title Translation
< ... General Parameters >
# User SAP configuration for example application
USER_SAP          0           # Application 1
SWITCH_TYPE       ANSI92      # protocol variant
CONC_PC           2.199.0     # Gateway STP
ADDR_MASK         FFF0000000  # match 1st 3 global title digits
END                           # User application 0

# Address Translations: 800XXXXXXX numbers
ADDRESS           800         # global title - incoming
REPLACE_GLT       FALSE       # retain global title in message
SWITCH_TYPE       ANSI        # Address format - one of ITU, ANSI
NI_IND            NATIONAL    # national address format
DPC               2.199.0     # translated destination point code
SSN               254         # translated subsystem number
ROUTING_IND       GLT         # set outgoing routing flag to GLT
END                           # of address translation for 800xxxxxxx
# Address Translations: 900XXXXXXX numbers
ADDRESS           900         # global title - incoming
REPLACE_GLT       FALSE       # retain global title in message
SWITCH_TYPE       ANSI        # Address format - one of ITU, ANSI
NI_IND            NATIONAL    # national address format
DPC               2.199.0     # translated destination point code
SSN               254         # translated subsystem number
ROUTING_IND       GLT         # set outgoing routing flag to GLT
END                           # of address translation for 900xxxxxxx
< Route entry for gateway STP >
```

The address masks have the following properties:

- Incoming messages use the address masks defined in the network SAP section of the SCCP configuration file.
- Outgoing messages use the address masks defined in the user SAP section of the SCCP configuration file.
- Up to four address masks can be defined in each network SAP or user SAP section.
- Address masks are applied in the order they are defined in the configuration file. Therefore, list the most specific mask first and the most general mask last.

Multiple originating point codes (OPC)

The SCCP layer can be configured to support multiple OPCs to both single networks or multiple networks. The SCCP layer receives SCCP messages, both connectionless and connection-oriented, addressed to any of the configured OPC values. SCCP subsystem management messages for each OPC are also supported.

MTP multiple OPC configuration

The MTP layer must be configured correctly for multiple OPC emulation. For more information and examples for emulating multiple OPCs to a single network and to multiple networks, refer to *Configuring multiple OPC emulation* on page 87.

Configuring multiple OPC emulation for a single network

The SCCP layer can be configured to emulate two different OPCs to a single destination.

In this example, the SCCP layer emulates OPC 0.0.2 to the DPC 0.0.1, and emulates OPC 0.0.4 to the same DPC 0.0.1. An ALT_OPC section (ALT_OPC through the END statement) must be added to the USAP section for each emulated OPC:

```
USER_SAP                0               # Sap number start at 0
SWITCH_TYPE             ITU92           # one of ITU92, ITU88, ANSI92, ANSI88
ADDR_MASK               FFF0000000      # match on only 1st 3 digits of GT
MAX_HOPS                10              # maximum network hops
INACT_CONTROL           TRUE            # app inactivity timing
# ALT_OPC section must be placed at end of USER_SAP section
ALT_OPC                 0.0.2           # Alternate Originating Point Code
CONC_PC                 0.0.1           # Concerned point code
END
ALT_OPC                 0.0.4           # Alternate Originating Point Code
CONC_PC                 0.0.1           # Concerned point code
END
END                                     # User application 0
```

An ALT_OPC field must be added to the ROUTE section for each emulated OPC:

```
ROUTE                   0.0.1           # destination point code
SWITCH_TYPE             ITU             # one of ITU, ANSI
ADJACENT                TRUE            # this dest directly adjacent
TRANSLATOR              FALSE           # not a translator node
ALT_OPC                 0.0.2
ALT_OPC                 0.0.4
  #define all subsystems of interest at 0.1.2 (up to 8)
SSN                     3               # first subsystem
SSN_SNR                 TRUE            # normal routed
SSN_ACC                 TRUE            # initially accessable
END                                     # SSN 3

SSN                     254             # another subsystem
SSN_SNR                 TRUE            # normal routed
SSN_ACC                 TRUE            # initially accessable
END                                     # SSN 254

END                                     # of route 0.1.2
```

Configuring multiple OPC emulation to multiple networks

The SCCP layer can be configured to emulate a different OPC to each of two different networks.

In this example, the SCCP layer emulates OPC 0.0.2 to the DPC 0.0.1, and emulates OPC 0.0.4 to the DPC 0.0.3. An ALT_OPC section (ALT_OPC through the END statement) must be added to the USAP section for each emulated OPC:

```
USER_SAP                0               # Sap number start at 0
SWITCH_TYPE             ITU92           # one of ITU92, ITU88, ANSI92, ANSI88
#CONC_PC                 0.0.1           # Concerned point code
ADDR_MASK               FFF0000000      # match on only 1st 3 digits of GT
MAX_HOPS                10              # maximum network hops
INACT_CONTROL           TRUE            # app inactivity timing
# ALT_OPC section must be placed at end of USER_SAP section
ALT_OPC                 0.0.2           # Alternate Originating Point Code
CONC_PC                 0.0.1           # Concerned point code
END
ALT_OPC                 0.0.4           # Alternate Originating Point Code
CONC_PC                 0.0.3           # Concerned point code
END
END                                     # User application 0
```

An ALT_OPC field must be added to each ROUTE section for each emulated OPC:

```
ROUTE                   0.0.1           # destination point code
SWITCH_TYPE             ITU             # one of ITU, ANSI
ADJACENT                TRUE            # this dest directly adjacent
TRANSLATOR              FALSE           # not a translator node
ALT_OPC                 0.0.2
  #define all subsystems of interest at 0.1.1 (up to 8)
SSN                     3               # first subsystem
SSN_SNR                 TRUE            # normal routed
SSN_ACC                 TRUE            # initially accessable
END                                     # SSN 3

SSN                     254             # another subsystem
SSN_SNR                 TRUE            # normal routed
SSN_ACC                 TRUE            # initially accessable
END                                     # SSN 254

END                                     # of route 0.1.1
#
ROUTE                   0.0.3           # destination point code
SWITCH_TYPE             ITU             # one of ITU, ANSI
ADJACENT                TRUE            # this dest directly adjacent
TRANSLATOR              FALSE           # not a translator node
ALT_OPC                 0.0.4

  #define all subsystems of interest at 0.1.1 (up to 8)
SSN                     3               # first subsystem
SSN_SNR                 TRUE            # normal routed
SSN_ACC                 TRUE            # initially accessable
END                                     # SSN 3

SSN                     254             # another subsystem
SSN_SNR                 TRUE            # normal routed
SSN_ACC                 TRUE            # initially accessable
END                                     # SSN 254

END                                     # of route 0.1.1
```

SCCP configuration reference

This topic presents the SCCP configuration file parameters:

- General parameters
- User SAP parameters
- Network SAP parameters
- Address translation parameters
- Route parameters

General parameters

The general parameters define the operational characteristics of the SCCP layer, such as upper bounds for internal data structures (these determine the amount of memory used by the SCCP layer), queue thresholds, and various protocol timer values. It is the first section of the configuration file.

Parameter	Default	Valid values	Description
MAX_USERS	2	1 through 255	Maximum number of user SAPs.
MAX_NSAPS	1	1 through 255	Maximum number of network SAPs.
MAX_SCLI	20	0 through 65535	Maximum number of simultaneous sequenced connectionless data transfers.
MAX_ADDRS	7	0 through 65535	Maximum number of address translation entries.
MAX_ROUTES	4	0 through 65535	Maximum number of route entries.
MAX_ADJDPC	4	0 through 65535	Maximum number of point codes that can be specified as adjacent (that are notified directly by this node of status changes).
MAX_MSGDRN	5	0 through 65535	Maximum number messages queued to MTP3 to send in one time interval when exiting flow control.
MAX_XUDT	0	0 through 65535	Maximum number of control blocks to allocate for reassembling segmented extended unit data. Used only for ITU-92. Should be zero for ANSI operation.
MAX_XUDTXREF	0	0 through 65535	Maximum number of local references used to segment extended unit data. Used only for ITU-92. Should be zero for ANSI operation.
MAX_CONN	512	0 through 65535	Maximum number of simultaneous connections.
DEF_ROUTING	FALSE	TRUE FALSE	If TRUE, enables default routing.

Parameter	Default	Valid values	Description
PC_FORMAT	DEFAULT	DFLT INTL JNTT	Point code format. DFLT = Point codes are interpreted and displayed as 24-bit 8.8.8 values. INTL = Point codes are interpreted and displayed as 14-bit 3.8.3 values. JNTT = Point codes are interpreted and displayed as 16-bit ***mcode.scode.ucode*** values with the U-code in the most significant 7 bits, the S-code in the next 4 bits, and the M-code in the least significant 5 bits.
SAVE_CONNS	FALSE	TRUE FALSE	If TRUE, retains connections when destination inaccessible. If FALSE, drops connections when destination inaccessible.
ALARM_LEVEL	1	0 1 2 3	Alarm level reporting. 0 = Disable 1 = Default 2 = Debug 3 = Detail
TRACE_DATA	FALSE	TRUE FALSE	If TRUE, enables data tracing.
CONN_THRESH	3	0 through 9	Minimum percentage of board memory that must be available before accepting a new connection in either direction. Expressed in units of 10 percent (for example, 3 = 30 percent).
QUEUE_THRESH	3	0 through 32766	Maximum number of data messages that can be queued for a connection waiting for the connection window to open.
SOG_THRESH	1	0 through 9	Minimum percentage of board memory that must be available before granting a subsystem out-of-service (SOR) request from a backup signaling point. Expressed in units of 10 percent (for example, 3 = 30 percent).
SCLI_TIMER	2 seconds	0 through 65535	Maximum time that a sequenced connectionless transmission can take before control block is deallocated.
SST_TIMER	30 seconds	0 through 65000	Time to wait between subsystem status tests.
NSAP_TIMER	1 second	0 through 65535	Time to wait between draining blocks of queued messages to the MTP 3 layer after exiting flow control. Used to prevent flooding MTP 3 after network congestion abates. See MAX_MSGDRN.
SRT_TIMER	30 seconds	0 through 65535	Time to wait between subsystem routing tests (ANSI only).
IGNORE_TIMER	30 seconds	0 through 65535	Time period after local subsystem goes out of service to ignore subsystem test messages.
COORD_TIMER	30 seconds	0 through 65535	Time to wait for response to coordinated state change request.

Parameter	Default	Valid values	Description
XREFFRZ_TIMER	1 second	0 through 65535	Time to freeze an XUDT local reference before reusing it (ITU-92 only).
ASMB_TIMER	20 seconds	0 through 65535	Maximum time for reassembling all segments of an XUDT message (ITU-92 only).
FREEZE_TIMER	1 second	0 through 65535	Time to freeze a connection local reference before reusing it.
CONN_TIMER	180 seconds	0 through 65535	Time to wait for response to connection request.
TXINACT_TIMER	600 seconds	0 through 65535	Time to wait with no outgoing packets on a connection before sending an inactivity test message.
RXINACT_TIMER	900 seconds	0 through 65535	Time to wait with no incoming packets on a connection before clearing connection. Must be greater than TXINACT_TIMER.
REL_TIMER	4 seconds	0 through 65535	Time to wait for response to release request.
REPREL_TIMER	4 seconds	0 through 65535	Time to wait for response to second release request (ITU-T 92 only).
INTERVAL_TIMER	8 seconds	0 through 65535	Time to wait to report abnormal release timer.
GUARD_TIMER	1 second	0 through 65535	Time to wait after MTP 3 restart before allowing application traffic.
RESET_TIMER	6 seconds	0 through 65535	Time to wait for response to reset request.
AIC_TIMER	480 seconds	0 through 65535	Time with no application activity for an active connection before SCCP generates a connection inactivity indication event. Used only if the application inactivity control is enabled for that user SAP.
AIC_RESP_TIMER	10 seconds	0 through 65535	Time the application gets to respond to a connection inactivity indication event. Use only if the application inactivity control is enabled for that user SAP.
ACR_TIMER	10 seconds	0 through 65535	Time the application gets to respond to an incoming connection indication with either a connection response or release request before the SCCP layer refuses connection. If the value is zero, no timing for the application response is performed.
SCCP_ALARM_LEVEL	1	1 2 3	Desired level of alarms generated by SCCP layer. 1 = (Normal) Normal service impacting alarms. 2 = (Debug) All normal alarms plus all messages in or out. 3 = (Detail) All debug alarms plus detailed events.

Parameter	Default	Valid values	Description
MEM_THRESH_1	10	0 through 99	Percentage of board memory available at which memory congestion level 1 starts.
MEM_THRESH_2	8	0 through 99	Percentage of board memory available at which memory congestion level 2 starts.
MEM_THRESH_3	5	0 through 99	Percentage of board memory available at which memory congestion level 3 starts.
END	N/A	N/A	Denotes end of the section. This parameter is required.

User SAP parameters

One user service access point (SAP) is defined for each application using SCCP. A user SAP is associated with a single subsystem number and switch type (ANSI88, ANSI92, ANSI96, ITU88, ITU92, ITU96). The user SAP defines whether the application is replicated on another node for reliability purposes, and lists any concerned point codes (nodes that must be notified of any change in the availability of the application).

Parameter	Default	Valid values	Description
USER_SAP	None	0 through (MAX_USERS-1)	Marks the start of a user SAP definition.
SWITCH_TYPE	ANSI92	ITU88 ITU92 ITU96 ANSI88 ANSI92 ANSI96	Protocol variant employed on this user SAP.
BACKUP_PC	None	Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101)	Point code where this subsystem is backed up.
CONC_PC	None	Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101)	Concerned point code to be notified of changes in the availability of this application. As many as eight CONC_PC entries (on separate lines) are allowed per user SAP. **Note:** If OPC emulation is used, any concerned point codes must be listed in an ALT_OPC section.
ADDR_MASK	FFF...F	N/A	ASCII string describing which digits of the global title to match when performing global title translation. As many as four ADDR_MASK entries are allowed per user SAP. **Note:** Address masks are ASCII strings containing a 0 (zero) or F in each character position to determine whether the corresponding global title digit is used in the match. For example, the string 000FFFFFFF ignores the first three digits and compares only the last seven digits when searching the global title table for a match. Similarly, the string FFF compares only the first three digits to determine a match.

Parameter	Default	Valid values	Description
MAX_HOPS	10	1 through 15	Hop count value to be used on outgoing SCCP messages from this SAP.
INACT_CONTROL	False	True/1/Yes False/0/No	When True, enables SCCP inactivity timing on connections associated with this SAP, enabling SCCP to detect and clear connections of which the application has lost track. The application must handle the connection inactivity indication event and respond with a connection inactivity response if this feature is enabled.
CONG_THRESH_1	600	1 through 2000	Number of messages outstanding to a higher level task (such as TCAP) or a user application at which inbound congestion level 1 starts.
CONG_THRESH_2	900	1 through 2000	Number of messages outstanding to a higher level task (such as TCAP) or a user application at which inbound congestion level 2 starts.
CONG_THRESH_3	1200	1 through 2000	Number of messages outstanding to a higher level task (such as TCAP) or a user application at which inbound congestion level 3 starts.
ALT_OPC	None	Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101)	Denotes the start of an emulated OPC section. All emulated OPC values must be listed in their own ALT_OPC section. A maximum of eight ALT_OPC sections are allowed in a USER_SAP section.
CONC_PC	None	Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101)	Concerned point code to be notified of changes in the availability of this application. As many as eight CONC_PC entries (on separate lines) are allowed in each ALT_OPC section.
END	N/A	N/A	Denotes the end of the ALT_OPC section in the current USER_SAP section.
END	N/A	N/A	Denotes end of the section. This parameter is required.

Network SAP parameters

The network service access point (SAP) defines the point at which the SCCP layer accesses the network (MTP 3) layer. One network SAP is defined for each supported switch type (ANSI or ITU-T). The NSAP number assigned in this section (NSAP ***number*** statement) must match a valid NSAP number defined in the NSAP section (NSAP ***number*** statement) of the MTP 3 configuration file.

Note: If both the SCCP and ISUP layers are used on the same board, the SCCP layer cannot be assigned to MTP3 NSAP 0 (zero); ISUP always uses this NSAP.

Parameter	Default	Valid values	Description
NSAP	None	0 through (MAX_NSAPS - 1)	Marks start of a network SAP definition. Must match an NSAP number defined in the MTP 3 configuration.
SWITCH_TYPE	ANSI	ITU ANSI	Protocol variant employed on this NSAP.

Parameter	Default	Valid values	Description
SSF	NATL (ANSI) INTL (ITU)	INTERNATIONAL|INTL SPARE NATIONAL|NATL RESERVED|RES	Value to be used in the subservice field for this network.
DPC	None	Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101)	Point code of this node on this network interface. If OPC emulation is in use, the default OPC should be listed here. This parameter is required.
DPC_LEN	24 (ANSI | ITU) 14 (ITU)	14 24	Point code length employed on this network.
ALT_OPC	None	Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101)	List of additional emulated OPC values.
MSG_LEN	256	32 through 1500	Maximum length of a message passed to MTP 3 on this SAP.
TXQ_THRESH	20	0 through 32766	Maximum number of messages to queue to MTP 3 when flow control is on before discarding.
ADDR_MASK	FFF...F	N/A	ASCII string describing which digits of the global title to match when performing global title translation. Up to four ADDR_MASK entries are allowed per network SAP. **Note:** The network SAP address mask is used only when providing global translation for incoming messages (those received from the network). For messages originated by an application on this node, the user SAP address mask is used.
MAX_HOPS	10	1 through 15	Hop count value to be used when returning undeliverable incoming messages back to the source of the message.
SCCP_NI_IND	0 (ITU) 1 (ANSI)	0 1	National or international indicator in the called or calling party address parameter of the outgoing SCCP management messages.
END	N/A	N/A	Denotes the end of the section. This parameter is required.

Address translation parameters

Address entries define how the SCCP layer translates global titles. A global title can translate into one of the following:

- A point code and subsystem number (use GT_FORMAT 0).
- Another global title only (in this case the message to be routed must include a destination point code in addition to the incoming global title).
- Another global title and point code.
- Another global title and subsystem number (in this case the message to be routed must include a destination point code in addition to the incoming global title).
- Another global title and point code and subsystem number.

Multiple address translations can be configured, up to the MAX_ADDRS value specified in the general parameters section.

Parameter	Default	Valid values	Description
ADDRESS	None	N/A	Incoming global title string, ASCII digits (for example, 0 through 9).
REPLACE_GLT	FALSE	TRUE FALSE	If TRUE, replace the translated global title in the outgoing message. If FALSE, copy the incoming global title, translated point code, and subsystem to the outgoing message.
SWITCH_TYPE	ANSI	ITU ANSI	Format of this address.
NI_IND	NAT	NATIONAL|NAT INTERNATIONAL|INTL	National or international indicator.
ROUTING_IND	PC_SSN	PC_SSN GLT	Routing indicator for the translated address. PC_SSN = Route by PC and SSN GLT = Route by global title
SSN	None	0 through 255	Translated subsystem number (required for GT_FORMAT 0).
DPC	None	Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101)	Translated destination point code (required for GT_FORMAT 0).
GT_FORMAT	0	0 through 4	Structure of the outgoing global title. Use only when REPLACE_GLT parameter is TRUE. 0 = No global title translation. 1 = (ANSI) Outgoing global title includes translation type, numbering plan, and encoding scheme. (ITU) Outgoing global title includes nature of address indicator. 2 = (ANSI and ITU) Outgoing global title includes translation type only. 3 = (ITU only) Outgoing global title includes translation type, numbering plan, and encoding scheme. 4 = (ITU only) Outgoing global title includes translation type, numbering plan, encoding scheme, and nature of address indicator.
GL_TITLE	None	N/A	Outgoing global title string (ASCII digits; such as 0 through 9). Use only when REPLACE_GLT parameter is TRUE.
TRANS_TYPE	0	0 through 255	Outgoing global title translation type. Use only when REPLACE_GLT parameter is TRUE.
NAT_ADDR	3	0 through 4	Outgoing global title nature of address indicator (ITU only). Use only when REPLACE_GLT parameter is TRUE.
NUM_PLAN	1	0 through 15	Outgoing global title numbering plan (ISDN numbering plan). Use only when REPLACE_GLT parameter is TRUE.

Parameter	Default	Valid values	Description
END	N/A	N/A	Denotes the end of the section. This parameter is required.

Route parameters

A route configuration entry defines a point code (and its subsystems) known to this node. Define a route entry for each point code and switch type to which this node can send SCCP messages.

Note: A route definition contains one or more subsystem definitions, each of which spans multiple lines and is terminated with an END statement. Each route definition as a whole is also terminated with an END statement. Mismatched END statements are a common cause of configuration errors and can cause unpredictable results.

Parameter	Default	Valid values	Description
ROUTE	None	Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101).	Destination point code. This parameter is required.
SWITCH_TYPE	ANSI	ITU ANSI	Protocol variant for this point code.
TRANSLATOR	TRUE	TRUE FALSE	If TRUE, this signaling point is a translator node.
ADJACENT	TRUE	TRUE FALSE	If TRUE, this signaling point is adjacent for SCCP point code and subsystem management procedures.
BACKUP_PC	None	Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101).	Backup point code. If not present, signaling point is not replicated.
ALT_OPC	None	Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101)	List of any emulated OPC values for this route. This field is not required if OPC emulation is not in use.
SSN	None	0 through 255	Subsystem number. Also denotes the beginning of the subsystem definition subsection that is terminated by the END statement. As many as eight subsystem definition subsections can be included in each route definition.
SSN_SNR	TRUE	TRUE FALSE	Subsystem routing. TRUE = Normal routed FALSE = Backup routed
SSN_ACC	TRUE	TRUE FALSE	Subsystem accessibility. TRUE = Initially accessible FALSE = Not initially accessible
SSN_BPC	None	Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101).	Subsystem backup point code. If not present, the subsystem is not replicated.

Parameter	Default	Valid values	Description
SSN_UP_ON_RESUME	1	1 0	1 = Subsystem is immediately put back in service when a point code resume message is received from MTP. The subsystem test procedure is not started. 0 = Disables this functionality.
CONC_PC	None	Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101).	Concerned point code to be notified of changes in the availability of this subsystem. As many as eight CONC_PC entries (on separate lines) are allowed per subsystem per route.
END	N/A	N/A	Required parameter denoting the end of the current subsystem definition subsection. Repeated for each separate SSN section within this route entry.
END	N/A	N/A	Required parameter denoting the end of the current route definition section.

9 Configuring TCAP

TCAP configuration overview

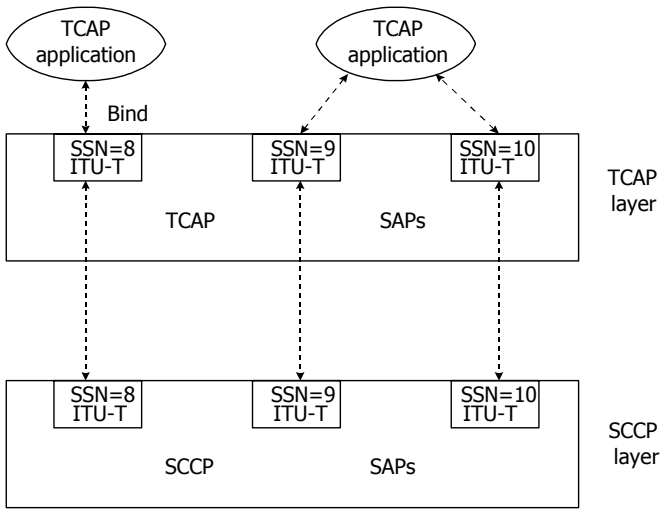
The TCAP (Transaction Capabilities Application Part) layer adds transaction services onto the connectionless data transfer service provided by SCCP. Transactions in the SS7 network are typically database queries and responses or requests to activate services in remote switching points.

TCAP can be configured for either ANSI (see ANSI T1.114) or ITU-T (see Q.771 - Q.775) operation, on a per-application basis. Use of ITU-T TCAP on top of an ANSI MTP/SCCP stack is fully supported. TCAP requires using SCCP and MTP.

TCAP implements services through the configuration of the following entities:

Entity	Description
configuration parameters	Define the resource allocation for the TCAP layer: maximum number of user SAPs, simultaneous dialogs, and outstanding invokes.
User service access points (SAPs)	Define the interface between a TCAP user application and the TCAP layer. One user SAP is defined for each application using the TCAP layer services. A user SAP is associated with a single subsystem number and protocol variant (ANSI-88, ANSI-92, ANSI-96, ITU-88, ITU-92, or ITU-97). Each TCAP user SAP maps directly to a SCCP user SAP in the SCCP configuration file, although not all SCCP SAPs must be assigned to TCAP applications. Some applications can access the SCCP layer directly. Refer to the *SCCP configuration overview* on page 121 for more information.

The following illustration shows the relationship between TCAP user SAPs and SCCP user SAPs:



Creating the TCAP configuration

SS7 provides sample TCAP files for ANSI standalone and redundant configurations and ITU standalone and redundant configurations that you can modify for your specifications. To learn the location of the sample configuration files, refer to the *Sample SS7 TDM configurations* on page 13.

The *tcapcfg* configuration utility runs as part of the initial board configuration with *ss7load. tcapcfg* reads the text configuration file and downloads the specified configuration to the TCAP task on the TX board. *tcapcfg* can also be run after initial configuration to dynamically update some configuration parameters. For more information on running *tcapcfg* after initial download, refer to the *Dialogic® NaturalAccess™ TCAP Layer Developer's Reference Manual.*

Sample TCAP configuration file

Note: Most configurable parameters default to reasonable values if not specified.

```
#
# Sample TCAP configuration file for the following configuration
#
#       General:
#           4 user APPs max
#           200 max simultaneous dialogs
#           200 max simultaneous invokes
#           all others general defaults
# General Configuration Section
TCAP_ALARM_LEVEL      1       # standard alarms
MAX_TCAP_USERS        4       # Max TCAP user applications
MAX_TCAP_DIALOGS      200     # Max TCAP simultaneous dialogs
MAX_TCAP_INVOKES      200     # Max TCAP simultaneous invokes
END
#
# User SAP configuration for 1st application
#
USER_SAP              0       # Sap number start at 0
SWITCH_TYPE           ANSI92  # one of ITU88, ITU92, ITU97, ANSI88, ANSI92, ANSI96
END                           # User application 0
#
# User SAP configuration for 2nd application
#
USER_SAP              1       # Sap number start at 0
SWITCH_TYPE           ANSI92  # one of ITU88, ITU92, ITU97, ANSI88, ANSI92, ANSI96
END                           # User application 0
#
# User SAP configuration for 3rd application
#
USER_SAP              2       # Sap number start at 0
SWITCH_TYPE           ANSI92  # one of ITU88, ITU92, ITU97, ANSI88, ANSI92, ANSI96
END                           # User application 0
#
# User SAP configuration for 4th application
#
USER_SAP              3       # Sap number start at 0
SWITCH_TYPE           ANSI92  # one of ITU88, ITU92, ITU97, ANSI88, ANSI92, ANSI96
END                           # User application 0
```

TCAP configuration reference

This topic presents the TCAP configuration file parameters:

- General parameters
- User SAP parameters

General parameters

The general parameters define the upper bounds for internal data structures, which determine the amount of memory used by the TCAP layer:

Parameter	Default	Valid values	Description
MAX_TCAP_USERS	4	1 through 512	Maximum number of user SAPs.
MAX_TCAP_DIALOGS	256	1 through 32767	Maximum number of TCAP transactions that can be pending at any one time.
MAX_TCAP_INVOKES	256	1 through 32767	Maximum number of TCAP invoke operations that can be pending at any one time.
MIN_TID_LEN	1	1 through 4	Forces use of transaction IDs of at least the specified number of bytes when using ITU-T TCAP. Primarily for interoperability with certain networks that require use of 4-byte transaction IDs.
PC_FORMAT	DEFAULT	DFLT INTL JNTT	Point code format. DFLT = Point codes are interpreted and displayed as 24-bit 8.8.8 values. INTL = Point codes are interpreted and displayed as 14-bit 3.8.3 values. JNTT = Point codes are interpreted and displayed as 16-bit values in ***mcode***.***scode***.***ucode*** format where ***ucode*** occupies the most significant 7 bits, ***scode*** occupies the next 4 bits, and ***mcode*** occupies the least significant 5 bits.
TCAP_ALARM_LEVEL	1	0 1 2 3	Level of alarms to be generated by the TCAP layer. 0 = None (not recommended) 1 = Service impacting events 2 = Individual transaction impacting events (encode/decode errors) 3 = Debugging level
TCAP_TRACE_DATA	0	0 1	Enables tracing of TCAP packets to the *ss7trace* utility. 0 = Tracing disabled 1 = Tracing enabled
TCMEM_THRESH_1	20	1 through 99	Percentage of memory available in default message buffer pool below which congestion level 1 is triggered.
TCMEM_THRESH_2	15	1 through 99	Percentage of memory available in default message buffer pool below which congestion level 2 is triggered. Must be less than TCMEM_THRESH_1.

Parameter	Default	Valid values	Description
TCMEM_THRESH_3	10	1 through 99	Percentage of memory available in default message buffer pool below which congestion level 1 is triggered. Must be less than TCMEM_THRESH_2.
END	N/A	N/A	Marks the end of this section. This parameter is required.

User SAP parameters

Define one user SAP for each application or subsystem using the TCAP layer services. A user SAP is associated with a single subsystem number and switch type (ANSI88, ANSI92, ANSI96, ITU88, ITU92, ITU97).

Parameter	Default	Valid values	Description
ALLOW_INVOKE_END	0	0 1	When set to 1, allows an invoke component in an ITU-T end message.
ALT_PARAM_LEN	0	0 1	When set to 0, uses the normal method of deriving a component parameter length from the component length field. When set to 1, uses an alternate method of obtaining the parameter length from the Set or Sequence tag and length. Used only for ANSI TCAP protocols.
DEFAULT_CHECKPOINT	CHKPT_NONE	CHKPT_NONE CHKPT_SEND CHKPT_ALL	CHKPT_NONE = No transactions are checkpointed. CHKPT_SEND = Only transactions initiated by the TX board are checkpointed. CHKPT_ALL = All transactions are checkpointed to the backup TCAP task.
INACTIVITY_TIMER	0	0 through 64535	Default inactivity timer. Number of seconds before an inactivity indication is sent for a transaction with no traffic. If set to zero, the inactivity timer is disabled.
SCCP_ADDR_OVERRIDE	0	0 1	SCCP called and calling addresses specified by a user application are ignored for the following messages: • ITU-T: continue, end, and user abort • ANSI: conversation, response, and user abort When set to 1, SCCP called and calling addresses specified by the user application are used for all affected messages.
SCCP_SAP	Same value as TCAP SAP ID	0 through 32766	SCCP SAP ID (from SCCP configuration file) to map this TCAP SAP to.
SWITCH_TYPE	ANSI92	ITU88 ITU92 ITU97 ANSI88 ANSI92 ANSI96	Protocol variant used on this SAP.
TCAP_T1	60	1 through 32767	Default invocation timer, in seconds (time to wait for response to invoke).

Parameter	Default	Valid values	Description
TCAP_T2	60	1 through 32767	Time to wait for reject of a non-invoke component, in seconds, before considering operation successful (where applicable).
TCAP_SEQ_TIMER	60	1 through 255	Duration to request SCCP to maintain SLS when sequential delivery required.
TCQ_THRESH_1	600	1 through 65535	Number of inbound messages queued to the application before entering level 1 congestion.
TCQ_THRESH_2	900	1 through 65535	Number of inbound messages queued to the application before entering level 2 congestion. Must be greater than TCQ_THRESH_1.
TCQ_THRESH_3	1200	1 through 65535	Number of inbound messages queued to the application before entering level 2 congestion. Must be greater than TCQ_THRESH_2.
USER_SAP	None	0 through MAX_USERS - 1	Marks start of a user SAP definition.
END	N/A	N/A	Marks the end of this section. This parameter is required.

10 Configuring TUP

TUP configuration overview

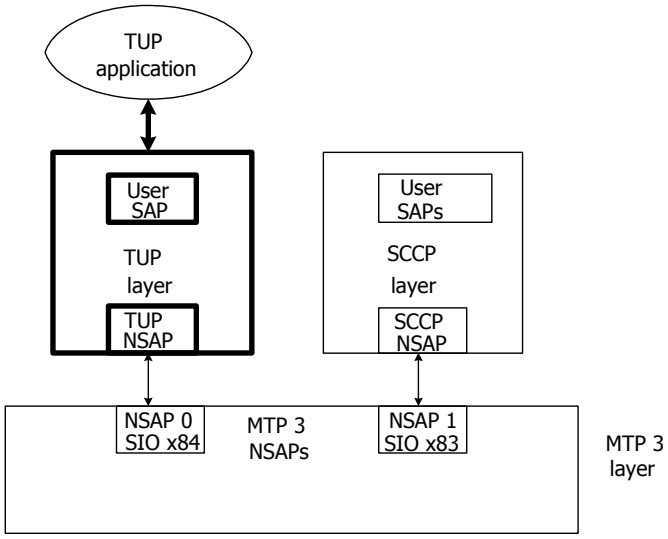
Like the ISUP layer, the TUP (Telephone User Part) layer provides an interface for applications to establish, maintain, and clear circuit switched connections with the SS7 network. The TUP layer is also responsible for circuit group management, such as blocking, unblocking, and resetting of circuits and circuit groups.

The TUP layer operates in accordance with the CCITT (ITU-T) recommendations Q.721 - Q.724 and China GF001 - 9001 *(Technical Specifications of SS7 for the National Telephone Network of China).* TUP is not used in ANSI networks, so there is no applicable ANSI standard for TUP.

TUP implements services through the configuration of general parameters and the following entities:

Entity	Description
Circuits and circuit groups	Physical bearer circuits controlled by the TUP layer. Like the ISUP layer, circuits are identified by both a circuit index and a circuit identification code (CIC). The circuit index is a number unique across all circuits configured on a particular TX board. This number has only local significance. It is used between the TUP layer and the local call processing application to identify a particular circuit. The CIC (the kick or kick code) is used between signaling points (the SS7 TUP layer and the far exchange that terminates the other end of the circuit) to uniquely identify a particular circuit. The CIC must be configured at both ends of the circuit to identify the exact same bearer facility, for example, the same T1 span and timeslot. CICs need not be unique across circuits that terminate on different far exchanges. Circuits are specified in the TUP configuration file in groups. A group is one or more circuits with contiguous circuit indexes and contiguous CICs that terminate on the same far exchange and have common characteristics. A single circuit group is frequently used to represent all the timeslots on a single T1 or E1 span, for example. When defining a circuit group, only the circuit index and CIC of the first circuit in the group, along with the number of circuits in the group, are specified. The TUP layer derives the circuit index and CIC for subsequent circuits since they are considered to be contiguous. The starting circuit index and starting CIC for a group need not be the same value.
User SAPs	Define the interface between the TUP layer and the user applications. TUP supports only a single user application. Configure only one user SAP.
NSAPs	Define the interface between the TUP layer and the MTP layer. NSAPs identify the MTP network SAP to be used by the TUP layer, allowing multiple user parts (TUP, ISUP, and SCCP) to share access to the MTP layer services.

The following illustration shows the concept of user SAPs and NSAPs:



Creating the TUP configuration

SS7 provides sample TUP files for both ITU-T and China configurations that you can modify for your specifications. To learn the location of the sample configuration files, refer to *Sample SS7 TDM configurations* on page 13.

The *tupcfg* configuration utility runs as part of the initial board configuration with *ss7load. tupcfg* reads the text configuration file and downloads the specified configuration to the TUP task on the TX board. *tupcfg* can also be run after initial configuration to dynamically update some configuration parameters. For more information on running *tupcfg* after initial download, refer to the *Dialogic® NaturalAccess™ TUP Layer Developer's Reference Manual.*

Sample TUP configuration file

The following example configures board 1 for ITU-T:

```
#  TUP Configuration File
# General configuration parameters
MAX_SAPS              1
MAX_NSAPS             2
MAX_CIRCUITS          2048
MAX_GROUPS            16      !max number of circuit groups
MAX_DPCS              16      !max number of dest. point codes
MAX_ROUTES            10      !max number of routes
ALARM_LEVEL           2       !alarm level
TRACE_EVENT           NO      !turning on=YES/off=NO event tracing
TRACE_DATA            NO      !turning on=YES/off=NO data tracing
TIMER_TRACE           NO      !turning on=YES/off=NO timer tracing
CHECKPOINT_TYPE       YES     !enable checkpointing from primary to backup
                              !this parameter is not required in
                              !standalone mode
MTPPAUSE_TIMER        2       !MTP3 Pause timer started when pause is
                              !received from MTP3. On expiration, all of
                              !the configured circuits are cleaned up.
                              !If it is set to zero, then this timer is
                              !disabled.
END
# Service Access Point (SAP)
```

```
USER_SAP              0
SWITCH_TYPE           ITU-T   !switch type (ITU-T, CHINA)
QCONGONSET1           64      !user queue congestion onset level 1
QCONGABATE1           32      !user queue congestion abatement level 1
QCONGONSET2           96      !user queue congestion onset level 2
QCONGONSET2           64      !user queue congestion abatement level 2
QCONGONSET3           128     !user queue congestion onset level 3
QCONGONSET3           96      !user queue congestion abatement level 3
END
# Network Service Access Point (NSAP)
NSAP                  0       !Network layer SAP Id
MTPSAP                0       !MTP layer SAP Id
SWITCH_TYPE           ITU-T   !switch type (ITU-T, CHINA)
OPC                   0x01    !my point code
SSF                   SSF_NAT !sub-service field value to use
END
#
# Circuit Database
CIRCUIT               1       !circuit number
CIC                   0       !circuit identification code
DPC                   0x02    !DPC of serving far exchange
NUM_CIRCUITS          200     !number of circuits in this group
GROUP_ID              1
SWITCH_TYPE           ITU-T   !switch type (ITU-T, CHINA)
END
#
# Circuit Group 2
CIRCUIT               201     !circuit number
CIC                   200     !circuit identification code
DPC                   0x02    !DPC of serving stp
NUM_CIRCUITS          200     !number of circuits in this group
GROUP_ID              2
SWITCH_TYPE           ITU-T   !switch type (ITU-T, CHINA)
END
#
# Circuit Group 3
CIRCUIT               513     !circuit number
CIC                   513     !circuit identification code
DPC                   2       !DPC of serving stp
NUM_CIRCUITS          255     !number of circuits in this group
GROUP_ID              3
END
#
END                           # End TUP configuration
```

TUP configuration reference

This topic presents the TUP configuration file parameters:

- General parameters
- User SAP parameters
- Network SAP parameters
- Circuit and circuit group parameters

General parameters

The general parameters control the overall operation of the TUP layer process.

Parameter	Default	Valid values	Description
MAX_SAPS	1	1	Maximum number of user applications.
MAX_NSAPS	1	1	Maximum number of interfaces with the MTP 3 network layer.
MAX_CIRCUITS	96	0 through 65535	Maximum number of circuits to be managed by the TUP layer.
MAX_GROUPS	32	0 through 65535	Maximum number of circuit groups managed by the TUP layer.
MAX_DPCS	16	1 through 256	Maximum number of destination point codes configured.
ALARM_LEVEL	1	1 through 4	Number of alarms. Set this number closer to 1 to limit the alarms received to the more critical alarms.
TRACE_EVENT	NO	YES NO	YES = Enable event tracing NO = Disable event tracing
TRACE_DATA	NO	YES NO	YES = Enable data tracing NO = Disable data tracing
TIMER_TRACE	NO	YES NO	YES = Enable timer tracing NO = Disable timer tracing
CHECKPOINT_TYPE	YES	YES NO	YES = Enable checkpointing from primary to backup in redundancy mode. NO = Disable checkpointing. Not required in standalone mode.
MTPPAUSE_TIMER	2	0 through 65535	Maximum duration of an MTP3 pause timer before clearing the circuits associated with a DPC. The MTP3 pause timer starts when a pause is received from MTP3. When the pause timer expires, all the configured circuits associated with the DPC for which the pause is received are cleaned up. Setting the timer value to 0 disables this functionality.

Parameter	Default	Valid values	Description
PC_FORMAT	DEFAULT	DFLT INTL JNTT	Point code format. DFLT = Point codes are interpreted and displayed as 24-bit 8.8.8 values. INTL = Point codes are interpreted and displayed as 14-bit 3.8.3 values. JNTT = Point codes are interpreted and displayed as 16-bit ***mcode***.***scode***.***ucode*** values with the U-code in the most significant 7 bits, the S-code in the next 4 bits, and the M-code in the least significant 5 bits.
T20 _TIMER	5	0 through 65535	Time to wait to send the second confirming group reset signal.
T21_TIMER	15	0 through 65535	Time to wait for a response to a circuit group reset signal. Use 4 through 15 seconds.
T22_ TIMER	60	0 through 65535	Time to wait to send another group reset signal.
T23_TIMER	5	0 through 65535	Time to wait to send the second confirming maintenance group block signal.
T24_TIMER	5	0 through 65535	Time to wait to send the second confirming maintenance group unblock signal.
T25_ TIMER	300	0 through 65535	Time to wait to alert the maintenance group unblock signal.
T26_TIMER	15	0 through 65535	Time to wait for a response to a maintenance group block signal. Use 4 through 15 seconds.
T27_TIMER	60	0 through 65535	Time to wait to send another maintenance group block signal.
T28_TIMER	15	0 through 65535	Time to wait for a response to a maintenance group unblock signal. Use 4 through 15 seconds.
T29_TIMER	60	0 through 65535	Time to wait to send another maintenance group unblock signal.
T30_TIMER	5	0 through 65535	Time to wait to send the second confirming hardware failure group block signal.
T31_TIMER	5	0 through 65535	Time to wait to send the second confirming hardware failure group unblock signal.
T32_TIMER	15	0 through 65535	Time to wait for a response to a hardware failure group block signal. Use 4 through 15 seconds.
T33_TIMER	60	0 through 65535	Time to wait to send another hardware failure group block signal.

Parameter	Default	Valid values	Description
T34_TIMER	15	0 through 65535	Time to wait for a response to a hardware failure group unblock signal. Use 4 through 15 seconds.
T35_TIMER	60	0 through 65535	Time to wait to send another hardware failure group unblock signal.
T36_TIMER	5	0 through 65535	Time to wait to send the second confirming software group block signal.
T37_TIMER	5	0 through 65535	Time to wait to send the second confirming software group unblock signal.
T38_TIMER	15	0 through 65535	Time to wait for a response to a software group block signal. Use 4 through 15 seconds.
T39_TIMER	60	0 through 65535	Time to wait to send another software group block signal.
T40_TIMER	15	0 through 65535	Time to wait for a response to a software group unblock signal. Use 4 through 15 seconds.
T41_TIMER	60	0 through 65535	Time to wait to send another software group unblock signal.
END	N/A	N/A	Marks the end of the general section. This parameter is required.

User SAP parameters

The SAP parameters define the characteristics of the TUP layer presented to the user applications. NaturalAccess TUP allows for configuration of only a single TUP user SAP. Only one application can use NaturalAccess TUP at a time.

Parameter	Default	Valid values	Description
USER_SAP	None	0 through MAX_SAPS	SAP number.
SWITCH_TYPE	ITU-T	ITU-T CHINA	Protocol variant employed for this application. Must match one of the switch types defined in the NSAP definition section.
QCONGONSET1	32	32	User queue congestion onset level 1.
QCONGABATE1	16	16	User queue congestion abatement level 1.
QCONGONSET2	64	64	User queue congestion onset level 2.
QCONGABATE2	48	48	User queue congestion abatement level 2.
QCONGONSET3	96	96	User queue congestion onset level 3.
QCONGABATE3	80	80	User queue congestion abatement level 3.
END	N/A	N/A	Marks the end of the SAP section. This parameter is required.

Network SAP parameters

The NSAP parameters define the characteristics of the TUP interface to the MTP 3 layer. NaturalAccess TUP allows for configuration of only a single NSAP. Only one switch type can be handled at a time.

Parameter	Default	Valid values	Description
NSAP	None	N/A	NSAP ID.
SWITCH_TYPE	ITU-T	ITU-T CHINA	Switch type (version of the SS7 protocol employed for this MTP 3 interface).
OPC	None	N/A	Point code of this node, specified as ***x.y.z*** (three bytes, decimal value, separated by periods) or as a hexadecimal number (for example, 0x***nnnnn***).
SSF	SSF_NAT	SSF_INTL SSF_SPARE SSF_NAT SSF_RES	Subservice field of the SIO in the outgoing TUP packets.
MTPSAP	0	0 through MAX_NSAPS	MTP SAP with which to bind.
END	N/A	N/A	Marks the end of the NSAP section. This parameter is required.

Circuit and circuit group parameters

The circuit set parameters specify the characteristics of each of the circuit sets to be managed by the TUP layer, including the circuit identification codes (CICs) and destination point code (DPC) at the other end of the circuits. One entry is made for each circuit set. Any set can be designated as a predefined group by adding a group number to this definition. A predefined group can more easily be reset, blocked, and unblocked with the TUP functions or by the network.

Parameter	Default	Valid values	Description
CIRCUIT	None	1 through 65535	Number of the first circuit in this set. Circuits in this set are numbered from this number to (this number + NUM_CIRCUITS - 1). This range must be unique for all circuits defined. This number is used by the application and the TUP layer to identify circuits, but has no meaning to the far exchange.
CIC	0	0 through 4095	Circuit identification code (CIC) of the first circuit in this set. Circuits in this set are assigned CICs from this number to (this number + NUM_CIRCUITS - 1). This number range must agree with the CICs assigned to this circuit set at the far exchange.
DPC	None	N/A	Destination point code to which this circuit set connects. Use dotted notation, such as 2.45.76, or a hexadecimal number, such as 0x101.
ALT_OPC	None	N/A	Originating point code for this set of circuits. If not present, the OPC is set to OPC from the NSAP. Use this carefully with the appropriate MTP configuration changes and specified as *x.y.z* (three bytes, decimal value, separated by periods) or as a hexadecimal number (for example, 0x***nnnnn***).
GROUP_ID	0	0 through 65535	Group ID number to assign to this group of circuits. 0 designates these circuits as not being a group.

Parameter	Default	Valid values	Description
NSAP_ID	0	0 through MAX_NSAPS	NSAP to use for these circuits. This value must match an NSAP ID in the NSAP definition area.
SWITCH_TYPE	ITU-T	ITU-T CHINA	Protocol variant employed for this MTP 3 interface.
NUM_CIRCUITS	1	1 through 255	Number of circuits in this circuit set.
T1_TIMER	15	0 through 65535	Time to wait for a continuity or continuity failure signal. Use 10 through 15 seconds.
T2_TIMER	30	0 through 65535	Time to wait for an address complete signal. Use 20 through 30 seconds.
T3_TIMER	15	0 through 65535	Time to wait for a clear forward signal after sending an unsuccessful signal. Use 4 through 15 seconds.
T4_TIMER	15	0 through 65535	Time to wait for a clear forward signal after sending a call failure signal. Use 4 through 15 seconds.
T5_TIMER	60	0 through 65535	Time to stop sending call failure signals.
T6_TIMER	15	0 through 65535	Time to wait for a release guard signal. Use 4 through 15 seconds.
T7_TIMER	60	0 through 65535	Time to stop sending clear forward signals.
T8_TIMER	2	0 through 65535	Time to wait for a backward check-tone. Do not exceed 2 seconds.
T9_TIMER	5	0 through 65535	Time to delay a start first-time continuity recheck. Use 1 through 10 seconds.
T10_TIMER	180	0 through 65535	Time to delay for multiple retests of continuity. Use 60 through 180 seconds.
T11_TIMER	60	0 through 65535	Time to wait to alert maintenance following initiation of a blocking signal.
T12_TIMER	15	0 through 65535	Time to wait for a response to a blocking signal. Use 4 through 15 seconds.
T13_TIMER	60	0 through 65535	Time to wait to alert maintenance that a response to the initial blocking signal was not received.
T14_TIMER	60	0 through 65535	Time to wait to repeat a blocking signal.
T15_TIMER	15	0 through 65535	Time to wait for a response to an unblocking signal. Use 4 through 15 seconds.
T16_TIMER	60	0 through 65535	Time to wait to alert maintenance that a response to the initial unblocking signal was not received.
T17_TIMER	60	0 through 65535	Time to wait to repeat an unblocking response.
T18_TIMER	15	0 through 65535	Time to wait for a response to a reset-circuit signal. Use 4 through 15 seconds.
T19_TIMER	60	0 through 65535	Time to wait to send another reset circuit signal.
END	N/A	N/A	Marks the end of this circuit group definition. This parameter is required.

11 Downloading the configurations

Starting txalarm

Use the *txalarm* utility as the primary tool to monitor what is happening in the system, including detecting:

- TDM links that have aligned or have failed to align
- SCTP associations that have connected or have failed to connect
- Problems downloading configurations to the board

txalarm captures messages from the boards, displays them on the screen, and optionally saves them to a file.

Run *txalarm* from a separate window according to the following syntax:

```
txalarm [-f filename]
```

where ***filename*** specifies the file to which alarms are copied.

Downloading to the boards

After modifying the configuration files and starting *txalarm*, download the configurations to the TX boards using *ss7load*. *ss7load* is located in the following directories:

Operating system	Directory
Windows	*\Program Files\dialogic\tx\bin\ss7load.bat*
UNIX	*/opt/dialogic/tx/bin/ss7load*

ss7load contains commands to download and configure all the SS7 layers, but only the MTP layer is activated by default. To enable the optional SS7 layers, edit *ss7load* to remove the comment symbols from the desired layers. To choose SIGTRAN instead of MTP as the transport layer, change TXTRANSPORT=mtp to TXTRANSPORT=sigtran. You can also modify the script to change the file names, the path names, or both as you modify the sample configuration files to meet your system needs.

Note: Superuser permissions are required to edit *ss7load* on UNIX systems.

Run *ss7load* according to the following syntax:

```
ss7load board number
```

where ***board number*** specifies the board to which you are downloading configurations.

The following examples show the output of *ss7load.* User input is shown in **bold** type.

Sample ss7load output in a TDM configuration

```
TX FLASH Interface Utility V4.0
(c)Copyright 1997-2009 Dialogic Corporation.  All Rights Reserved.
..
CP number 1 booted.
Loading: mtp
/opt/dialogic/tx/bin/mtp2cfg: sample MTP2 configuration application version 5.1 Jun  8
2009
/opt/dialogic/tx/bin/mtp3cfg: sample MTP3 configuration application version 9.1 Jun  8
2009
```

Sample ss7load output in an IP configuration

```
TX FLASH Interface Utility V4.0
(c)Copyright 1997-2009 Dialogic Corporation.  All Rights Reserved.
..
CP number 1 booted.
Loading: sigtran
/opt/dialogic/tx/bin/sctpcfg: sample SCTP configuration application version 1.1 Jun  8
2009
SCTP Gen Config: Success
SCTP SCT SAP Config: Success
SCTP TSAP Config: Success
/opt/dialogic/tx/bin/m3uacfg: sample M3UA configuration application version 1.1 Jun  8
2009
M3UA GenConfig: Success
M3UA Network Config: Success
M3UA Network Config: Success
M3UA SCT SAP Config: Success
M3UA NSAP Config: Success
M3UA NSAP Config: Success
M3UA PSP Config: Success
M3UA Peer Server Config: Success
M3UA Peer Server Config: Success
M3UA Peer Server Config: Success
M3UA Peer Server Config: Success
M3UA Route Config: Success
M3UA Route Config: Success
M3UA Route Config: Success
M3UA Route Config: Success
```

Sample txalarm messages

txalarm messages display when *ss7load* is executed for board 1. An equivalent set of messages displays for board 2 when it is downloaded.

Sample txalarm messages in a TDM configuration

```
<12/05/2003 15:51:58> mtp 1   1 Registering MTP Layer 2
<12/05/2003 15:51:58> mtp 1   1 Registering MTP Layer 3
<12/05/2003 15:51:58> mtp 1   1 Configuring MTP Layer 1
<12/05/2003 15:51:58> mtp 1   1 MTP1 Initializing.
<12/05/2003 15:51:58> mtp 1   1 MTP1 General Configuration
<12/05/2003 15:51:58> mtp 1   1 MTP1 Configuring link 0: TDM, External
<12/05/2003 15:51:58> mtp 1   1 MTP1 Configuring link 1: TDM, External
<12/05/2003 15:51:58> mtp 1   1 MTP1 Configuring link 2: TDM, External
<12/05/2003 15:51:58> mtp 1   1 MTP1 Configuring link 3: TDM, External
<12/05/2003 15:51:58> mtp 1   1 MTP1 Configuration Done
<12/05/2003 15:51:58> mtp 1   1 Configuring MTP Layer 2
<12/05/2003 15:51:58> mtp 1   1 MTP2: General Configuration
<12/05/2003 15:51:58> mtp 1   1 MTP2: Link 0 Configuration
<12/05/2003 15:51:58> mtp 1   1 MTP2: Link 1 Configuration
<12/05/2003 15:51:58> mtp 1   1 MTP2: Link 2 Configuration
<12/05/2003 15:51:58> mtp 1   1 MTP2: Link 3 Configuration
<12/05/2003 15:51:58> mtp 1   1 MTP3: Ready...
```

Sample txalarm messages in an IP configuration

```
<06/03/08 15:42:04> sigtran   1  16387 Initializing M3UA
<06/03/08 15:42:04> sigtran   1  16387 Registering SCTP
<06/03/08 15:42:04> sigtran   1  16387 Registering M3UA
<06/03/08 15:42:04> sigtran   1  16387 M3UA now Stand-alone
<06/03/08 15:42:04> sigtran   1  16387 SCTP now Stand-alone
```

ss7load tasks

ss7load performs the following tasks:

Task	Description
1	Executes a utility to determine the model number of the board so that it can download the correct TX-based software. The *txflash* utility is used to reset the boards. If the version of the kernel image on the TX board's flash memory does not match the version installed on the host system, *txflash* automatically updates the board's flash image before resetting the board.
2	Downloads the appropriate communications processor tasks using the *cplot* utility. Downloads the SS7 MTP layer task (*mtp.elf*) or the SIGTRAN layer task (*sigtran.elf*). This task must be downloaded before any of the other SS7 software layers. This is the only required SS7 module.
3	Downloads any optional SS7 layers that were manually enabled.
4	If the transport is MTP, executes the *mtp2cfg* (optional) and *mtp3cfg* (required) utilities to download the MTP configuration to the MTP task. The MTP layers must be configured before any of the other SS7 layers are configured. If the transport is SIGTRAN, executes the *sctpcfg* and *m3uacfg* (both required) utilities to download the SIGTRAN configuration to the SIGTRAN task. The SIGTRAN layers must be configured before any of the other SS7 layers are configured.
5	Executes any optional SS7 configuration utilities that are enabled to download the respective configurations to the appropriate SS7 layer task. The order of these tasks as originally listed in the *ss7load* file must be maintained.

Sample ss7load for Windows

```
@echo off
REM ************************************************************************
REM              TX Series COMMUNICATIONS PROCESSOR BOOT FILE
REM
REM  Execute this file to perform the following:
REM     - Reset the TX board
REM     - Synchronize the on-board flash image with the installed software
REM     - Download TDM configuration
REM     - Download all TX-based tasks
REM     - Configure SS7
REM ************************************************************************
if "%DIALOGIC_ROOT%"=="" set DIALOGIC_ROOT=\Program Files\Dialogic
if "%TX_ROOT%"=="" set TX_ROOT=%DIALOGIC_ROOT%\tx

REM ************************************************************************
REM  Choose MTP or SIGTRAN for the transport layers
REM
if "%TXTRANSPORT%"=="" set TXTRANSPORT=mtp
REM if "%TXTRANSPORT%"=="" set TXTRANSPORT=sigtran

REM ************************************************************************
REM  Choose redundant or standalone mode
REM
if "%TXMODE%"=="" set TXMODE=standalone
REM if "%TXMODE%"=="" set TXMODE=redundant

REM ************************************************************************
REM  Choose ansi or itu for configuration files
REM
if "%TXCONFIG%"=="" set TXCONFIG=%TX_ROOT%\config\%TXMODE%\ansi
REM if "%TXCONFIG%"=="" set TXCONFIG=%TX_ROOT%\config\%TXMODE%\itu

REM ************************************************************************
REM  Define all other script parameters
REM
if "%TXUTIL%"=="" set TXUTIL=%TX_ROOT%\bin
if "%TXCP%"=="" set TXCP=%TX_ROOT%\cp

REM ************************************************************************
REM  Process arguments - Get the board number
REM
set BRD=1
if not "%1"=="" set BRD=%1

REM ************************************************************************
REM  Clear driver statistics
REM
"%TXUTIL%\txstats" -b %BRD% -z -q

REM ************************************************************************
REM  Get the model number (TX board type)
REM
"%TXUTIL%\cpmodel" -b %BRD%
if %errorlevel% == 4000 goto set4000
if %errorlevel% == 5000 goto set5000
if %errorlevel% == 5020 goto set5000
if %errorlevel% == 5500 goto set5000
echo ERROR! TX board number %BRD% not available.
goto end

REM ************************************************************************
REM  Setup for TX 4000 Family
REM
:set4000
set TASKTYPE=elf
set TXKERNEL=cpk4000.fls
goto resetboard
```

```
REM ************************************************************************
REM  Setup for TX 5000 Family
REM
:set5000
set TASKTYPE=elf
set TXKERNEL=cpk5000.elf

REM ************************************************************************
REM  Perform board type-specific boot for TX 5000 Family
REM
:resetboard
REM  Reset TX board (and verify TX flash image in sync with installed software)
"%TXUTIL%\txflash" -s "%TXCP%\%TXKERNEL%" -b %BRD%
if %errorlevel% == 1 goto failedreset

REM load TDM or IP configuration
if "%TXTRANSPORT%"=="sigtran" goto loadipcfg
        "%TXUTIL%\txconfig" -b %BRD% -f "%TXCONFIG%\txcfg%BRD%.txt"
        goto loadcommon
:loadipcfg
        "%TXUTIL%\txconfig" -b %BRD% -f "%TXCONFIG%\ipcfg%BRD%.txt"

REM ************************************************************************
REM  Load all TX-based tasks that are common to all board types
REM
:loadcommon

REM To use txdbg,
REM you should uncomment the following line to load the debug task
REM "%TXUTIL%\cplot" -c %BRD% -f "%TXCP%\debug.%TASKTYPE%"    -n debug    -p 11 -a

REM Load TXMON
REM
REM ****** IMPORTANT NOTE: *******
REM For convenience we are loading TXMON only in redundant mode.  This is
REM convenient because MTP will detect the lack of TXMON and will auto-
REM matically enter standalone mode and attempt to bring up links, without
REM application intervention.  NOTE HOWEVER, TXMON can be used as a health
REM monitor for a single board application in standalone mode.  In this case
REM the MTP will remain in a Starting state until an application (eg. RMG),
REM using the HMI API, specifically sets the mode to Standalone. In other
REM words links will not automatically try to align if TXMON is loaded.
REM
if "%TXMODE%"=="standalone" goto notxmon
"%TXUTIL%\cplot" -c %BRD% -f "%TXCP%\txmon.%TASKTYPE%"    -n txmon    -p 19 -a
:notxmon

REM Load MTP or SIGTRAN task
REM
if "%TXTRANSPORT%"=="sigtran" goto loadsigtran
"%TXUTIL%\cplot" -c %BRD% -f "%TXCP%\mtp.%TASKTYPE%"      -n mtp      -p 20 -a -s 40960
goto endload
:loadsigtran
"%TXUTIL%\cplot" -c %BRD% -f "%TXCP%\sigtran.%TASKTYPE%"      -n sigtran      -p 20 -a -
s 40960
:endload

REM Enable the following to use JNTT
REM
REM "%TXUTIL%\cplot" -c %BRD% -f "%TXCP%\jntt.%TASKTYPE%" -n jntt -p 15 -a

REM Enable the following downloads for SS7 layers you do use
REM
REM "%TXUTIL%\cplot" -c %BRD% -f "%TXCP%\sccp.%TASKTYPE%"     -n sccp     -p 21  -a
REM "%TXUTIL%\cplot" -c %BRD% -f "%TXCP%\isup.%TASKTYPE%"     -n isup     -p 21  -a -
s 40960
REM "%TXUTIL%\cplot" -c %BRD% -f "%TXCP%\tup.%TASKTYPE%"      -n tup      -p 22  -a -
s 40960
REM "%TXUTIL%\cplot" -c %BRD% -f "%TXCP%\tcap.%TASKTYPE%"     -n tcap     -p 23  -a

REM ISUP only: Enable the download of the ISUP database required for your configuration.
```

```
REM
REM "%TXUTIL%\cplot" -c %BRD% -f "%TXCP%\itublue.%TASKTYPE%"  -n itublue  -p 15 -a
REM "%TXUTIL%\cplot" -c %BRD% -f "%TXCP%\ituwhite.%TASKTYPE%" -n ituwhite -p 15 -a
REM "%TXUTIL%\cplot" -c %BRD% -f "%TXCP%\q767.%TASKTYPE%"     -n q767     -p 15 -a
REM "%TXUTIL%\cplot" -c %BRD% -f "%TXCP%\ansi88.%TASKTYPE%"   -n ansi88   -p 15 -a
REM "%TXUTIL%\cplot" -c %BRD% -f "%TXCP%\ansi92.%TASKTYPE%"   -n ansi92   -p 15 -a
REM "%TXUTIL%\cplot" -c %BRD% -f "%TXCP%\ansi95.%TASKTYPE%"   -n ansi95   -p 15 -a
REM "%TXUTIL%\cplot" -c %BRD% -f "%TXCP%\itu97.%TASKTYPE%"    -n itu97    -p 15 -a
REM "%TXUTIL%\cplot" -c %BRD% -f "%TXCP%\etsiv2.%TASKTYPE%"   -n etsiv2   -p 15 -a
REM "%TXUTIL%\cplot" -c %BRD% -f "%TXCP%\etsiv3.%TASKTYPE%"   -n etsiv3   -p 15 -a
REM "%TXUTIL%\cplot" -c %BRD% -f "%TXCP%\ansibicc.%TASKTYPE%" -n ansibicc -p 15 -a
REM "%TXUTIL%\cplot" -c %BRD% -f "%TXCP%\itubicc.%TASKTYPE%"  -n itubicc  -p 15 -a

REM ************************************************************************
REM  Configure SS7 MTP2, MTP3, SCTP, M3UA, ISUP, TUP, TCAP & SCCP
REM  (enable these commands for any SS7 layers you do use)
REM
REM NOTE: MTP level 2 configurability is now available.
REM       However, level 2 configuration is not strictly necessary.
REM       The defaults will work for most installations.
REM
if "%TXTRANSPORT%"=="sigtran" goto cfgsigtran
"%TXUTIL%\mtp2cfg" -b %BRD% -f "%TXCONFIG%\MTP3cp%BRD%.cfg"
"%TXUTIL%\mtp3cfg" -b %BRD% -f "%TXCONFIG%\MTP3cp%BRD%.cfg"
goto endcfg
:cfgsigtran
"%TXUTIL%\sctpcfg" -b %BRD% -f "%TXCONFIG%\SCTPcp%BRD%.cfg"
"%TXUTIL%\m3uacfg" -b %BRD% -f "%TXCONFIG%\M3UAcp%BRD%.cfg"
:endcfg

if "%TXMODE%"=="standalone" goto stdalncfg
REM
REM  Load redundant configuration files - note that both boards in redundant
REM  pair use the same configuration file
REM
REM "%TXUTIL%\sccpcfg" -b %BRD% -f "%TXCONFIG%\SCCP.cfg"
REM "%TXUTIL%\isupcfg" -b %BRD% -f "%TXCONFIG%\ISUP.cfg"
REM "%TXUTIL%\tupcfg"  -b %BRD% -f "%TXCONFIG%\TUP.cfg"
REM "%TXUTIL%\tcapcfg" -b %BRD% -f "%TXCONFIG%\TCAP.cfg"
goto end
:stdalncfg
REM
REM  Load standalone configuration files - note that each board in a standalone
REM  configuration gets a configuration file unique to that board
REM
REM "%TXUTIL%\sccpcfg" -b %BRD% -f "%TXCONFIG%\SCCPcp%BRD%.cfg"
REM "%TXUTIL%\isupcfg" -b %BRD% -f "%TXCONFIG%\ISUPcp%BRD%.cfg"
REM "%TXUTIL%\tupcfg"  -b %BRD% -f "%TXCONFIG%\TUPcp%BRD%.cfg"
REM "%TXUTIL%\tcapcfg" -b %BRD% -f "%TXCONFIG%\TCAPcp%BRD%.cfg"
goto end

REM ************************************************************************
REM  Report reset error
REM
:failedreset
echo ERROR! Unable to reset TX board number %BRD%.
goto end

REM ************************************************************************
REM  Exit load script
:end
set TXMODE=
set TXUTIL=
set TXCP=
set TXCONFIG=
set BRD=
set TASKTYPE=
set TXKERNEL=
set TXTRANSPORT=
```

Sample ss7load for UNIX

```
#!/bin/bash
#*****************************************************************************
#             TX Series COMMUNICATIONS PROCESSOR BOOT FILE
#
#  Execute this file to perform the following:
#     - Reset the TX board
#     - Synchronize the on-board flash image with the installed software
#     - Download TDM configuration
#     - Download all TX-based tasks
#     - Configure SS7
#*****************************************************************************
if [ -z "$DIALOGIC_ROOT" ]
then
        DIALOGIC_ROOT=/opt/dialogic
fi

if [ -z "$TX_ROOT" ]
then
        TX_ROOT=$DIALOGIC_ROOT/tx
fi

#*****************************************************************************
#  Set transport (if not already determined)
#      Valid options are mtp and sigtran
if [ -z "$TXTRANSPORT" ]
then
        TXTRANSPORT=mtp
fi

#*****************************************************************************
#  Set mode (if not already determined)
#      Valid options are standalone and redundant
if [ -z "$TXMODE" ]
then
     TXMODE=standalone
fi

#*****************************************************************************
#  Set configuration (if not already determined)
#
if [ -z "$TXCONFIG" ]
then
     TXCONFIG=$TX_ROOT/etc/$TXMODE/ansi
fi

#*****************************************************************************
#  Define all other script parameters
#
if [ -z "$TXUTIL" ]
then
     TXUTIL=$TX_ROOT/bin
fi
if [ -z "$TXBASE" ]
then
     TXBASE=$TX_ROOT/cp
fi

#*****************************************************************************
#  Process arguments - Get the board number
#
case $# in
     0)
          BRD=1
          ;;
     1)
          BRD=$1
          ;;
     *)
```

```
            echo "Usage: ss7load <board#>"
            exit 1
esac

#*****************************************************************************
#  Clear driver statistics
#
$TXUTIL/txstats -b $BRD -z -q

#*****************************************************************************
#  Get the model number (TX board type)
#
BOARDTYPE=`$TXUTIL/cpmodel -b$BRD | tail -1 | cut -d' ' -f6`

case $BOARDTYPE in
        4000)
                FLASH="cpk4000.fls"
          ;;
        5000E)
                FLASH="cpk5000.elf"
          ;;
        5020E)
                FLASH="cpk5000.elf"
          ;;
        5500E)
                FLASH="cpk5000.elf"
          ;;
     *)
                echo "ERROR! Board number $BRD not available"
          exit 1
          ;;
esac

#*****************************************************************************
#  Reset TX board (and verify TX flash image in sync with installed software)
#
$TXUTIL/txflash -s $TXBASE/$FLASH -b$BRD

#*****************************************************************************
#  Perform TX board type-specific load
#
#       Perform board type-specific boot for TX 4000
     TASKTYPE=elf

#       load TDM or IP configuration
if [ $TXTRANSPORT = "mtp" ]
then
     $TXUTIL/txconfig -b $BRD -f $TXCONFIG/txcfg$BRD.txt
else
        $TXUTIL/txconfig -b $BRD -f $TXCONFIG/ipcfg$BRD.txt
fi

#*****************************************************************************
#  Load all TX-based tasks that are common to all board types
#

# To use txdbg,
# you should uncomment the following line to load the debug task
#$TXUTIL/cplot -c $BRD -f $TXBASE/debug.$TASKTYPE     -n debug    -p 11 -a

# Load TXMON
#
# ***** IMPORTANT NOTE *****
# For convenience we are loading TXMON only in redundant mode. This is
# convenient because MTP will detect the lack of TXMON and will automatically
# enter standalone mode and attempt to bring up the links, without
# application intervention. NOTE HOWEVER, TXMON can be used as a health
# monitor for a single board application in standalone mode. In this case
# the MTP will remain in a Starting state until an application (ie. RMG),
# using the HMI API, specifically sets the mode to Standalone. In other
# words links will not automatically try to align if TXMON is loaded.
```

```
#
if [ $TXMODE = "redundant" ]
then
     $TXUTIL/cplot -c $BRD -f $TXBASE/txmon.$TASKTYPE   -n txmon    -p 19 -a
fi

# Load MTP task
#
if [ $TXTRANSPORT = "mtp" ]
then
        $TXUTIL/cplot -c $BRD -f $TXBASE/mtp.$TASKTYPE        -n mtp      -p 20 -a -
s 40960
else
        $TXUTIL/cplot -c $BRD -f $TXBASE/sigtran.$TASKTYPE    -n sigtran  -p 20 -a -
s 40960
fi

# Enable the following to use JNTT
#
# $TXUTIL/cplot -c $BRD -f $TXBASE/jntt.$TASKTYPE -n jntt -p 15 -a

# Enable the following downloads for SS7 layers you do use
#
#$TXUTIL/cplot -c $BRD -f $TXBASE/sccp.$TASKTYPE      -n sccp     -p 21 -a
#$TXUTIL/cplot -c $BRD -f $TXBASE/isup.$TASKTYPE      -n isup     -p 21 -a -s 40960
#$TXUTIL/cplot -c $BRD -f $TXBASE/tup.$TASKTYPE       -n tup      -p 22 -a -s 40960
#$TXUTIL/cplot -c $BRD -f $TXBASE/tcap.$TASKTYPE      -n tcap     -p 23 -a

# ISUP only: Enable the download of the ISUP database
#            required for your configuration.
#
#$TXUTIL/cplot -c $BRD -f $TXBASE/itublue.$TASKTYPE   -n itublue  -p 15 -a
#$TXUTIL/cplot -c $BRD -f $TXBASE/ituwhite.$TASKTYPE  -n ituwhite -p 15 -a
#$TXUTIL/cplot -c $BRD -f $TXBASE/q767.$TASKTYPE      -n q767     -p 15 -a
#$TXUTIL/cplot -c $BRD -f $TXBASE/ansi88.$TASKTYPE    -n ansi88   -p 15 -a
#$TXUTIL/cplot -c $BRD -f $TXBASE/ansi92.$TASKTYPE    -n ansi92   -p 15 -a
#$TXUTIL/cplot -c $BRD -f $TXBASE/ansi95.$TASKTYPE    -n ansi95   -p 15 -a
#$TXUTIL/cplot -c $BRD -f $TXBASE/itu97.$TASKTYPE     -n itu97    -p 15 -a
#$TXUTIL/cplot -c $BRD -f $TXBASE/etsiv2.$TASKTYPE    -n etsiv2   -p 15 -a
#$TXUTIL/cplot -c $BRD -f $TXBASE/etsiv3.$TASKTYPE    -n etsiv3   -p 15 -a
#$TXUTIL/cplot -c $BRD -f $TXBASE/ansibicc.$TASKTYPE  -n ansibicc -p 15 -a
#$TXUTIL/cplot -c $BRD -f $TXBASE/itubicc.$TASKTYPE   -n itubicc  -p 15 -a

#*****************************************************************************
#  Configure SS7 MTP2, MTP3, SCTP, M3UA, ISUP, TUP, TCAP & SCCP
#  (enable these commands for any SS7 layers you do use)
#
#  NOTE: MTP level 2 configurability is now available.
#        However, level 2 configuration is not strictly necessary.
#        The defaults will work for most installations.
#
if [ $TXMODE = "redundant" ]
then
#
# Load redundant configuration files - note that both boards in redundant
# pair use the same configuration file
#
        if [ $TXTRANSPORT = "mtp" ]
        then
                $TXUTIL/mtp2cfg -b $BRD -f $TXCONFIG/MTP3cp${BRD}.cfg
                $TXUTIL/mtp3cfg -b $BRD -f $TXCONFIG/MTP3cp${BRD}.cfg
        else
                $TXUTIL/sctpcfg -b $BRD -f $TXCONFIG/SCTPcp${BRD}.cfg
                $TXUTIL/m3uacfg -b $BRD -f $TXCONFIG/M3UAcp${BRD}.cfg
        fi
#     $TXUTIL/sccpcfg -b $BRD -f $TXCONFIG/SCCP.cfg
#     $TXUTIL/tcapcfg -b $BRD -f $TXCONFIG/TCAP.cfg
#     $TXUTIL/isupcfg -b $BRD -f $TXCONFIG/ISUP.cfg
#     $TXUTIL/tupcfg  -b $BRD -f $TXCONFIG/TUP.cfg
else
#
```

```
# Load standalone configuration files - note that each board in a standalone
# configuration gets a configuration file unique to that board
#
        if [ $TXTRANSPORT = "mtp" ]
        then
                $TXUTIL/mtp2cfg -b $BRD -f $TXCONFIG/MTP3cp${BRD}.cfg
                $TXUTIL/mtp3cfg -b $BRD -f $TXCONFIG/MTP3cp${BRD}.cfg
        else
                $TXUTIL/sctpcfg -b $BRD -f $TXCONFIG/SCTPcp${BRD}.cfg
                $TXUTIL/m3uacfg -b $BRD -f $TXCONFIG/M3UAcp${BRD}.cfg
        fi
#     $TXUTIL/sccpcfg -b $BRD -f $TXCONFIG/SCCPcp${BRD}.cfg
#     $TXUTIL/tcapcfg -b $BRD -f $TXCONFIG/TCAPcp${BRD}.cfg
#     $TXUTIL/isupcfg -b $BRD -f $TXCONFIG/ISUPcp${BRD}.cfg
#     $TXUTIL/tupcfg  -b $BRD -f $TXCONFIG/TUPcp${BRD}.cfg
fi

#*****************************************************************************
#  Exit load script
exit 0
```

12 Troubleshooting TDM configurations

Identifying failures related to licensing (TDM)

To successfully execute the full stack of SS7 protocol layers, a TX board must be properly licensed. Certain extended link capabilities (such as the use of High Speed Links) also require specific board-based licensing. The following example shows a set of *txalarm* messages that indicate licensing-related startup failure conditions:

```
isup      2  16384 Cannot run task isup: board not licensed for full stack operation
sccp      2  16384 Cannot run task sccp: board not licensed for full stack operation
tup       2  16384 Cannot run task tup: board not licensed for full stack operation
tcap      2  16384 Cannot run task tcap: board not licensed for full stack operation
$swi      2  352   Cannot define port: board not licensed for High Speed Links
```

Monitoring link status

After the configuration files are downloaded to the boards, the links are aligned (brought up through layer 2). When MTP layer 2 achieves link alignment, MTP layer 3 brings the links into service through an exchange of signaling link test messages (SLTMs) with its peer MTP 3 on the other board. When this signaling link test successfully completes, each board generates a message indicating that the link is up (in service). The following example shows a typical *txalarm* message sequence for successful link startup:

```
<06/04/08 11:04:40> mtp 1  16387 Flushing Buffers (OutPktCnt=0) (Lnk 0)
<06/04/08 11:04:40> mtp 1  16387 Starting Alignment (Lnk 0)
<06/04/08 11:04:40> mtp 1  16387 Sent SIO (Lnk 0)
<06/04/08 11:04:39> mtp 2  16387 Flushing Buffers (OutPktCnt=0) (Lnk 0)
<06/04/08 11:04:39> mtp 2  16387 Starting Alignment (Lnk 0)
<06/04/08 11:04:39> mtp 2  16387 Sent SIO (Lnk 0)
<06/04/08 11:04:42> mtp 1  16387 Rcvd SIO (Lnk 0)
<06/04/08 11:04:42> mtp 1  16387 Sent SIE (Lnk 0)
<06/04/08 11:04:42> mtp 1  16387 Rcvd SIO (Lnk 0)
<06/04/08 11:04:41> mtp 2  16387 Rcvd SIE (Lnk 0)
<06/04/08 11:04:41> mtp 2  16387 Sent SIE (Lnk 0)
<06/04/08 11:04:42> mtp 1  16387 Rcvd SIE (Lnk 0)
<06/04/08 11:04:42> mtp 2  16387 Timer 4 Expired (LINK 0 ALIGNED at layer 2)
<06/04/08 11:04:42> mtp 1  16387 Discarding Signal Unit (Lnk 0), accept flag is off
<06/04/08 11:04:42> mtp 1  16387 Discarding Signal Unit (Lnk 0), accept flag is off
<06/04/08 11:04:43> mtp 1  16387 Timer 4 Expired (LINK 0 ALIGNED at layer 2)
<06/04/08 11:04:43> mtp 1  18229 MTP3 Resume for DPC 1.1.2 (0x10102), OPC 1.1.1 (0x10101)
<06/04/08 11:04:43> mtp 1  16387 Setting link 0 ACTIVE from SLTA
<06/04/08 11:04:43> mtp 1  18179 MTP3 Link 0 Up
<06/04/08 11:04:42> mtp 2  18229 MTP3 Resume for DPC 1.1.1 (0x10101), OPC 1.1.2 (0x10102)
<06/04/08 11:04:42> mtp 2  16387 Setting link 0 ACTIVE from SLTA
<06/04/08 11:04:42> mtp 2  18179 MTP3 Link 0 Up
```

Troubleshooting link problems

If a link does not come into service shortly after downloading the configuration files to the board, determine the cause of the problem from the *txalarm* messages. Physical connection problems are the primary cause of link initialization failures, and are usually indicated by a repeated sequence of alarms, as shown in the following example:

```
<06/04/08 11:04:26> mtp  1  16387 Layer1: SUERM Threshold Reached (Lnk 0)
<06/04/08 11:04:26> mtp  1  16387 LinkFailure : was in service (Lnk 0)
<06/04/08 11:04:26> mtp  1  16387 Sent SIOS (Lnk 0) (Fail in InService)
<06/04/08 11:04:26> mtp  1  18228 MTP3 Pause for DPC 1.1.2 (0x10102), OPC 1.1.1 (0x10101)
<06/04/08 11:04:27> mtp  1  16387 Flushing Buffers (OutPktCnt=0) (Lnk 0)
<06/04/08 11:04:27> mtp  1  18180 MTP3 Link 0 Down
<06/04/08 11:04:27> mtp  1  16387 Flushing Buffers (OutPktCnt=0) (Lnk 0)
<06/04/08 11:04:27> mtp  1  16387 Starting Alignment (Lnk 0)
<06/04/08 11:04:27> mtp  1  16387 Sent SIO (Lnk 0)
<06/04/08 11:04:39> mtp  1  16387 ALIGN TIMER 2 EXPIRED iacSt=8 (Lnk 0)
<06/04/08 11:04:39> mtp  1  16387 LinkFailure (Lnk 0): Alignment Not Possible
<06/04/08 11:04:39> mtp  1  16387 Sent SIOS (Lnk 0) (AlignNP in InitialAlign)
<06/04/08 11:04:40> mtp  1  18180 MTP3 Link 0 Down
```

Some of the causes of physical link connection problems are:

- Missing or loose cable connections between the T1/E1 ports.
- Missing bus cable when one board is deriving clocking from the H.100/H.110 bus.
- Incorrect clocking configuration between the two boards (for example, both boards driving H.100/H.110 bus clocks, neither driving H.100/H.110 bus clocks, clocking not synchronized to T1/E1 port).
- Mismatched channel timeslot assignments between the two boards.

The link can also align successfully at layer 2 but fail the signaling link test at layer 3, resulting in this type of alarm:

```
<06/04/08 11:05:04> mtp  1  16387 Rcvd SIOS (Lnk 0)
<06/04/08 11:05:04> mtp  1  16387 Rcvd SIO (Lnk 0)
<06/04/08 11:05:04> mtp  1  16387 Sent SIE (Lnk 0)
<06/04/08 11:05:04> mtp  1  16387 Rcvd SIO (Lnk 0)
<06/04/08 11:05:04> mtp  1  16387 Rcvd SIE (Lnk 0)
<06/04/08 11:05:05> mtp  1  16387 Timer 4 Expired (LINK 0 ALIGNED at layer 2)
<06/04/08 11:05:05> mtp  1  16387 MTP3: Link 0 SNT msg dropped, bad point code (1.1.3 (0x
10103))
<06/04/08 11:05:05> mtp  1  16387 MTP3: Link 0 SNT msg dropped, bad point code (1.1.3 (0x
10103))
<06/04/08 11:05:05> mtp  1  16387 MTP3: Link 0 SNT msg dropped, bad point code (1.1.3 (0x
10103))
<06/04/08 11:05:05> mtp  1  16387 Deactivating link 0 due to MaxSLTRetries!
```

This type of failure is almost always caused by one of the following configuration errors:

- Point codes assigned to each of the boards in the MTP 3 configuration file do not properly refer to each other.
- Link select code assigned to the link in the MTP 3 configuration file (LINK_SLC) of one board does not exactly match the link select code assigned to the same link in the MTP 3 configuration file of the second board.

13 Troubleshooting IP configurations

Identifying failures related to licensing (IP)

To successfully execute the full stack of SS7 protocol layers, a TX board must be properly licensed. Certain extended link capabilities (such as the use of High Speed Links) also require specific board-based licensing. The following example shows a set of *txalarm* messages that indicate licensing-related startup failure conditions:

```
sigtran   2  16384 Cannot run task sigtran: board not licensed for full stack operation
isup      2  16384 Cannot run task isup: board not licensed for full stack operation
sccp      2  16384 Cannot run task sccp: board not licensed for full stack operation
tup       2  16384 Cannot run task tup: board not licensed for full stack operation
tcap      2  16384 Cannot run task tcap: board not licensed for full stack operation
```

Monitoring association status

After the configuration files are downloaded to the boards, associations are created with the configured peer entities (either SGPs or IPSPs). The following *txalarm* output shows a successful association establishment and exchange of M3UA status messages from the client side's viewpoint in an IPSP-DE configuration:

```
<08/19/08 14:02:11> sigtran   1  16387 Initializing M3UA
<08/19/08 14:02:11> sigtran   1  16387 Registering SCTP
<08/19/08 14:02:11> sigtran   1  16387 Registering M3UA
<08/19/08 14:02:11> sigtran   1  16387 M3UA now Stand-alone
<08/19/08 14:02:11> sigtran   1  16387 SCTP now Stand-alone
<08/19/08 14:02:11> sigtran   1  16387 Local IP 192.168.1.1:  State now INACTIVE
<08/19/08 14:02:13> sigtran   1  16387 Local IP 192.168.1.1:  State now ACTIVE
<08/19/08 14:02:14> sigtran   1  16387 Creating association with 192.168.1.2
<08/19/08 14:02:14> sigtran   1  16387 Sending INIT to 192.168.1.2
<08/19/08 14:02:14> sigtran   1  16387 PAUSE for opc=1, dpc=2
<08/19/08 14:02:16> sigtran   1  16387 Resending INIT to 192.168.1.2
<08/19/08 14:02:18> sigtran   1  16387 Received INIT-ACK from 192.168.1.2
<08/19/08 14:02:18> sigtran   1  16387 Sending COOKIE to 192.168.1.2
<08/19/08 14:02:18> sigtran   1  16387 Received INIT-ACK from 192.168.1.2
<08/19/08 14:02:18> sigtran   1  16387 Received COOKIE-ACK from 192.168.1.2
<08/19/08 14:02:18> sigtran   1  16387 Association 1 established successfully
<08/19/08 14:02:18> sigtran   1  16387 Sending ASPUP on association 1
<08/19/08 14:02:18> sigtran   1  16387 Received ASPUP-ACK on association 1
<08/19/08 14:02:18> sigtran   1  16387 Sending ASPAC on association 1
<08/19/08 14:02:18> sigtran   1  16387    Rte Ctx : 0xa
<08/19/08 14:02:18> sigtran   1  16387    Rte Ctx : 0xb
<08/19/08 14:02:18> sigtran   1  16387 Received NOTIFY on association 1 (ASCHG, INACT)
<08/19/08 14:02:18> sigtran   1  16387    Rte Ctx : 0xa,
<08/19/08 14:02:18> sigtran   1  16387 Received NOTIFY on association 1 (ASCHG, INACT)
<08/19/08 14:02:18> sigtran   1  16387    Rte Ctx : 0xb,
<08/19/08 14:02:18> sigtran   1  16387 Received ASPAC-ACK on association 1
<08/19/08 14:02:18> sigtran   1  16387    Rte Ctx : 0xa
<08/19/08 14:02:18> sigtran   1  16387 Received NOTIFY on association 1 (ASCHG, ACT)
<08/19/08 14:02:18> sigtran   1  16387    Rte Ctx : 0xa,
<08/19/08 14:02:18> sigtran   1  16387 Received ASPAC-ACK on association 1
<08/19/08 14:02:18> sigtran   1  16387    Rte Ctx : 0xb
<08/19/08 14:02:18> sigtran   1  16387 Received NOTIFY on association 1 (ASCHG, ACT)
<08/19/08 14:02:18> sigtran   1  16387    Rte Ctx : 0xb,
<08/19/08 14:02:19> sigtran   1  16387 Received ASPAC on association 1
<08/19/08 14:02:19> sigtran   1  16387    Rte Ctx : 0xc
<08/19/08 14:02:19> sigtran   1  16387    Rte Ctx : 0xd
<08/19/08 14:02:19> sigtran   1  16387 RESUME for opc=1, dpc=2
<08/19/08 14:02:19> sigtran   1  16387 Sending ASPAC-ACK on association 1
<08/19/08 14:02:19> sigtran   1  16387    Rte Ctx : 0xc
<08/19/08 14:02:19> sigtran   1  16387 Sending NOTIFY on association 1 (ASCHG, ACT)
<08/19/08 14:02:19> sigtran   1  16387    Rte Ctx : 0xc,
<08/19/08 14:02:19> sigtran   1  16387 Sending ASPAC-ACK on association 1
<08/19/08 14:02:19> sigtran   1  16387    Rte Ctx : 0xd
<08/19/08 14:02:19> sigtran   1  16387 Sending NOTIFY on association 1 (ASCHG, ACT)
<08/19/08 14:02:19> sigtran   1  16387    Rte Ctx : 0xd,
```

Refer to the *Dialogic® TX Series SS7 Boards TX Utilities Manual* for more information about *txalarm*.

Use the *m3uamgr* utility to check the association status with the status psp command as shown in the following code example. The association state is ACTIVE.

```
m3uamgr[1]>status psp 1
=====================PSP 1 Association Status===================
AssocId = 0       State = ACTIVE  ASP State = INACTV  Inhibit = NO

=================Active PSs (0)================
        None

=================Registered PSs (0)==============
        None
====================Current PSP 1 Confuration=================
pspType       = IPSP    ipspMode      = DBL END dynRegAllow   = NO
loadShareMode = RNDRBN  nwkAppIncl    = NO      rxTxAspId     = NO
selfAspId     = 0       nwkId         = 1       PriDestAddr   = 10.51.1.184
DestPort      = 2905    locOutStrms   = 2
```

Refer to the *Dialogic 0174 NaturalAccess™ SIGTRAN Stack Developer's Reference Manual* for information about the *m3uamgr* utility.

Troubleshooting association problems

If both endpoints are active, are configured correctly, and have network connectivity, an association is created successfully. If an association was not established, troubleshoot the problem as described in the following table:

Task	Description
1	Examine the *txalarm* log for error messages that explain the cause, such as configuration or communication errors. Refer to *Starting txalarm* on page 157 for information.
2	Examine the configuration files to ensure that: • The M3UA primary destination address (PRIME_DEST_ADDR) matches the other side's actual IP address. • The routing contexts match the routing contexts on the other side. • One side has the CLIENT_SIDE parameter set to TRUE so that it initiates associations.
3	Use the *cpcon* ping command to determine that the other side is reachable over the IP network. Refer to the *TX Utilities Manual* for information.
4	Turn on data tracing in SCTP (and M3UA) to see the sent and received messages. In the *sctpmgr* or *m3uamgr* utilities, use the trace ena command.
5	Turn on debug logging in SCTP (and M3UA) to cause additional log information to be sent to *txalarm*. In the *sctpmgr* or *m3uamgr* utilities, use the debug ena command.

Refer to the *Dialogic® NaturalAccess™ SIGTRAN Stack Developer's Reference Manual* for information about the *sctpmgr* and *m3uamgr* utilities.

Loss of an existing association

If an association already exists when one or the other side reboots, it may take time to re-establish the association, depending on which side rebooted.

- If the side that initiates the association (client side) reboots, the association is re-established immediately upon successful reload.
- If the side that waits for the initiation of an association (server side) reboots, it may take time for the client side to realize that the server side has rebooted.

The only method that the system has to determine that the association is gone is when messages go unacknowledged. It takes MAX_DEST_RETRY (default 5) unacknowledged messages before SCTP declares the association terminated and

M3UA attempts to re-establish it. If there is no data traffic (only heartbeats are being sent), it takes at least TMR_HB_INTERVAL (default 3 seconds) times MAX_DEST_RETRY for the loss of association to be detected. These parameters can be reduced to speed up the detection of loss of an association. Refer to *SCTP configuration reference* on page 71 for information.

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