



CHAPTER 1

SS7 Basic Configurations

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Overview

Signaling System 7 (SS7) is an out of band signaling system used in the public switched telephone network (PSTN) to:

- Control call setup and tear down calls
- Transport circuit and non-circuit related information
- Support the Custom Local Calling Area Signaling Services (CLASS)

Signaling Transport (SIGTRAN) is a group of IETF standards that describe the SS7 signaling functionality of hardware nodes that interconnect IP based networks to SS7 networks.

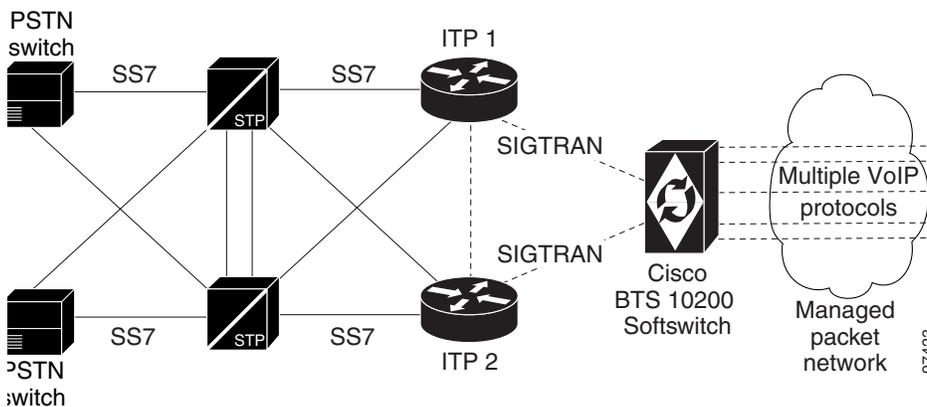
The Cisco BTS 10200 Softswitch communicates with SS7-based PSTN switches and service control points (SCPs) by using a SIGTRAN-based signaling gateway (SG), the Cisco IP Transfer Point (ITP). The SIGTRAN interface carries all SS7 messages encapsulated in IP packets.

For a description of SS7 architecture, see the following URL:

http://www.cisco.com/univercd/cc/td/doc/product/tel_pswt/vco_prod/ss7_fund/index.htm

The relationship of the Cisco BTS 10200 to the SS7 network is shown in [Figure 1-1](#).

Figure 1-1 Cisco BTS 10200 Softswitch Interface to SS7 Network



Cisco ITP Signaling Gateways

To interconnect with the Signaling System 7 (SS7) network, you must have Cisco IP Transfer Point (ITP). ITP transports SS7 traffic over traditional time-division multiplexing (TDM) networks or advanced SS7-over-IP (SS7oIP) networks. The following Cisco routers have ITP:

- 2600XM Series (2651XM)—Supports 2 or 4 SS7 links
- 7301—Supports up to 80 SS7 links
- 7500 Series Router (7507, 7513)—Supports from 32 to 256+ SS7 links
- 7600 Series Router—Supports up to 2772 SS7 links

When running ITP with BTS 10200, you may receive an "Unrecognized Parameter" error message. This appears because BTS 10200 supports an optical SCTP feature not supported by ITP. It does not affect calls or performance.

BTS 10200 and ITP both handle SS7 traffic using Sigtran protocols; they must be fully compatible with the Stream Control Transmission Protocol (SCTP) version.

ITP Redundancy

All customer deployments of the SIGTRAN solution require ITP redundancy, and the following sections provide a brief overview of the ITP redundancy choices.

**Note**

Throughout this document, the term Cisco BTS 10200 Softswitch (BTS) refers to a Cisco BTS Active/Standby mated pair.

Hardware Redundancy

If the Cisco ITP 7507 platform is chosen, redundancy can be accomplished in a single node by inserting redundant cards within the chassis. To failover with minimum call disruption, the 7507 should be configured to operate in ITP Non Stop Operation (NSO).

This document does not recognize the Cisco ITP 7507 platform as a fully redundant solution. However, it can be part of a fully redundant SG Mated Pair.

Platform Redundancy

ITP redundancy can also be accomplished by connecting two ITP nodes together. This can be done in one of two ways. The ITPs can be connected as SG Mated Pairs or as an ITP-Group.

**Note**

These two forms of redundancy cannot be combined.

The ITP NSO feature ensures that an ITP running on a Cisco 7500 router continues to operate in the with no outages in the event of a Route/Switch Processor (RSP) failure. The NSO feature supports two Signaling Gateway Platforms (SGPs) per Signaling Gateway (SG) in a Signaling Gateway Group (SG-grp) for mated Signal Transfer Points (STPs) and also supports the Sigtran M3UA and Single User Account (SUA) Application Server Process (ASP) load-share traffic modes.

This feature also enhances the IP layer implementation on the Versatile Interface Processor (VIP) cards for handling complex routing to remote destinations using either static routes or a routing protocol. With this additional capability, the ITP provides VIP redundancy in addition to platform and RSP redundancy.

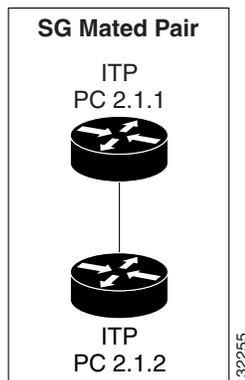
For additional information, refer to the [ITP NSO Configuration, page 1-9](#).

An SG Mated Pair is usually used to connect to the service provider's SS7 network via D-links. The ITP-Group is used when a customer wants a point code of the BTS to be shared with an SG point code. In this case, the connection to the service provider's SS7 network is via A, E, or F-links.

SG Mated Pair

[Figure 1-2](#) illustrates an SG Mated Pair connection. Each identical ITP has its own point code and acts as an STP that connects to STPs in the SS7 network via D-links. Note that any ITP platform can be used for this form of redundancy.

Figure 1-2 SG Mated Pair



In this configuration, an ITP is treated as a SG with a single SGP. Global title translation (GTT) can be supported by a capability point code, which is also known as an alias point code. A capability point code is shared by more than one system supporting the same GTT. Each signaling point with the same alias point code is capable of providing a predefined capability in the network.

From the BTS to the ITP, both load-sharing and redundancy standby mode are supported.

Benefits

This section lists the benefits of this feature:

- Fully hardware redundant and IP network redundant solution
- Each ITP acts as an STP and has full STP functionality
- GTT can be supported on the ITP through the use of a capability point code
- Geographical separation between ITPs is supported

Restrictions

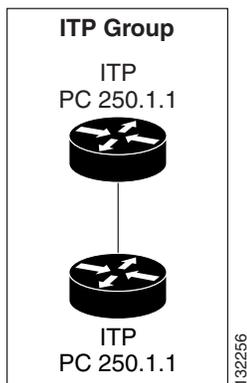
This section lists restrictions. These are conditions that might cause this feature to fail or work improperly.

- Each ITP requires a separate point code

ITP-Group

In an ITP-group configuration, illustrated in [Figure 1-3](#), each ITP acts as a physical signaling gateway process. Two of these physical signaling gateway processes can be connected together to form one logical signaling gateway. In this configuration, both ITPs share the same point code value, which is also shared by a Cisco BTS 10200 Softswitch. Note that this form of redundancy is not available for the 7507, since it has internal hardware redundancy. It is available for the 2651, the 7200VXR series, and the 7300 series ITPs.

Figure 1-3 ITP Group



Benefits

This section lists the benefits of ITP group:

- Two ITPs share the same point code, so fewer point codes are needed.
- Identical ITPs for an SG.
- A fully hardware redundant and IP network redundant solution.

Restrictions

This section lists restrictions. These are conditions that might cause this feature to fail or work improperly.

- GTT is not supported on the ITP.
- Only load sharing across the ITPs is supported. Prioritizing an ITP is not supported.
- The two ITPs must be collocated.
- There is no gain in SS7 link capacity when two ITPs are combined in this manner. The SS7 link capacity of an ITP group is only equal to the capacity of a single ITP.



Note The 72XX series ITP can be used for greater link density.

BTS and ITP Base Configurations

There are four basic BTS/ITP base configurations that form the basis of all customer offered profiles and are described in the following sections.

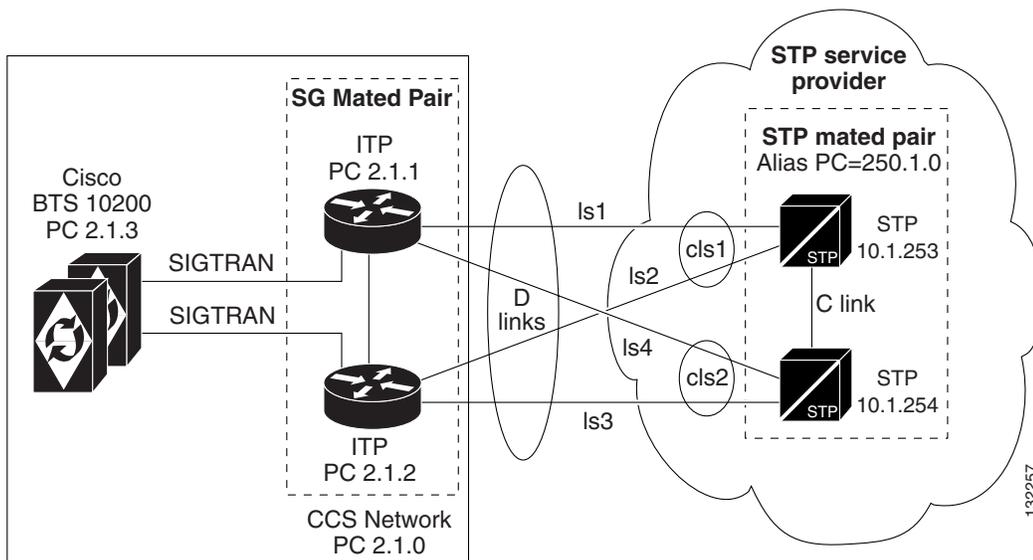
- [Mated STP-Pair Configuration, page 1-5](#)
- [Shared Point Code Configuration With A Links, page 1-6](#)
- [Shared Point Code Configuration Connecting With E-Links, page 1-8](#)
- [Shared Point Code Configuration Connecting With F-Links, page 1-8](#)

Mated STP-Pair Configuration

A “D” (diagonal) link connects a secondary (local or regional) STP pair to a primary (inter network gateway) STP pair in a quad-link configuration. Their function is to carry signaling messages beyond their initial point of entry to the signaling network towards their destination.

In a Mated STP-Pair configuration, each ITP acts as an STP and has its own unique point code. The ITPs connect to the SS7 network using D-links, as illustrated in [Figure 1-4](#). An SG mated pair is utilized for the Mated STP-Pair configuration.

Figure 1-4 Mated STP-Pair Configuration



In an SG mated pair, redundancy is supported between the ITPs. The ITPs can still operate and provide some services if a BTS were to become unavailable. In this case, an ITP would send a MTP3 Transfer Prohibit message (TFP) for the BTS point code and still act as a transfer point to other point codes in the SS7 network. Also, it can transfer messages to other BTS nodes in the case where there are multiple BTS nodes served by a single ITP pair.

The Mated STP-Pair configuration provides the following benefits:

- Multiple Origination Point Code (OPCs) are supported on the BTS with just two ITPs.
- Geographical separation is allowed between the ITPs.
- The ITP supports GTT by using capability point codes for redundancy.
- High volume SS7 traffic can be supported by load sharing the traffic between the SG mated pair.
- Unlike the Shared Point Code solution, there is no need to purchase additional connections to the SS7 network when more OPCs are added to the BTS.
- The SS7 network is able to distinguish between the status of the BTS and that of the ITP.
- All ITP platforms can be used as part of the Mated STP-Pair solution.

The Mated STP-Pair configuration has the following restrictions:

- Each ITP needs its own point code. This allows for greater scalability when multiple OPCs are needed on the Cisco BTS 10200 Softswitch.
- Service providers charge more for Mated STP-Pair connections when D-links are used, than when A-link connections are used, which is commonly part of the Shared Point Code solution.

Shared Point Code Configuration With A Links

“A” (access) links connect a signaling endpoint (an SCP or signal switching point [SSP]) to an STP. Only messages originating from or destined to the signaling endpoint are transmitted on an A-link.

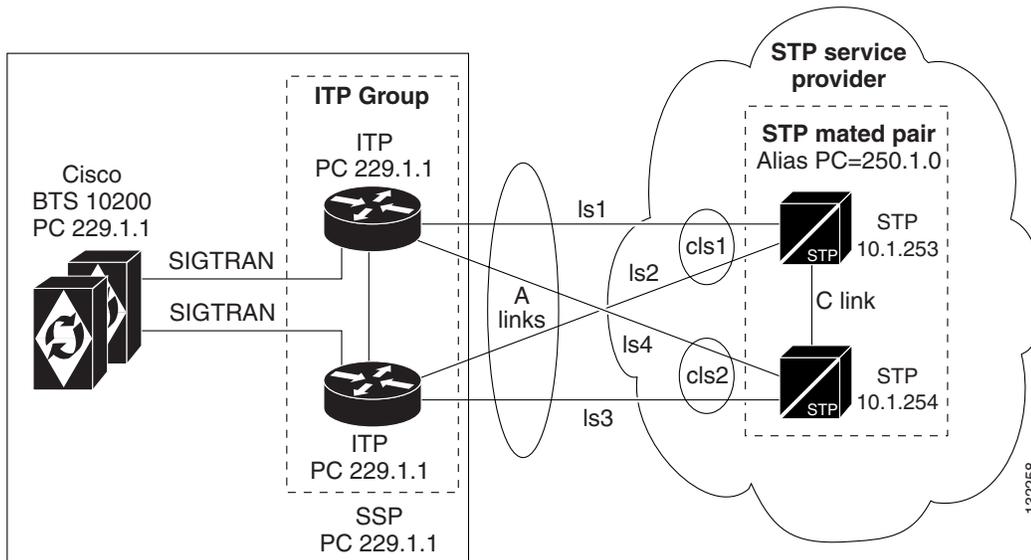
In this configuration, both ITPs and the Cisco BTS 10200 are viewed as a single point code from the service provider's SS7 network. This is possible since the same point code value is shared by both of the ITPs and is provisioned as an OPC value on the BTS. The ITP Group, consisting of two ITPs, acts as the SS7 proxy for the Cisco BTS 10200. The ITPs connect to the SS7 network using A-links, E-links, or F-links, as illustrated in [Figure 1-5](#).



Note

In the event that a Cisco BTS 10200 system becomes unavailable, the ITP will send a user part unavailable (UPU) to the SS7 network but cannot provide any other services.

Figure 1-5 Shared Point Code Configuration using an ITP Group (Distributed MTP)



In an ITP group (the Distributed MTP feature) configuration, each ITP acts as a physical signaling gateway process. Two of these physical signaling gateway processes can be connected together to form one logical SG. In this configuration, both ITPs share the same point code value. Note that this form of redundancy is not available for the Cisco 7507 ITP, since it has internal hardware redundancy. It is available for the Cisco 2651 and Cisco 7300 series ITPs.

The Shared Point Code configuration provides the following benefits:

- There is less charge from the service provider for A-link connections, which are typically used for the Shared Point Code solution, than D-link connections, which are typically used for the Mated STP-Pair solution.
- The BTS and ITPs share the same point code value, thereby requiring fewer point codes in the network.
- There is full hardware redundancy support between ITPs.
- High volume SS7 traffic can be supported by a single point code.

This configuration has the following restrictions:

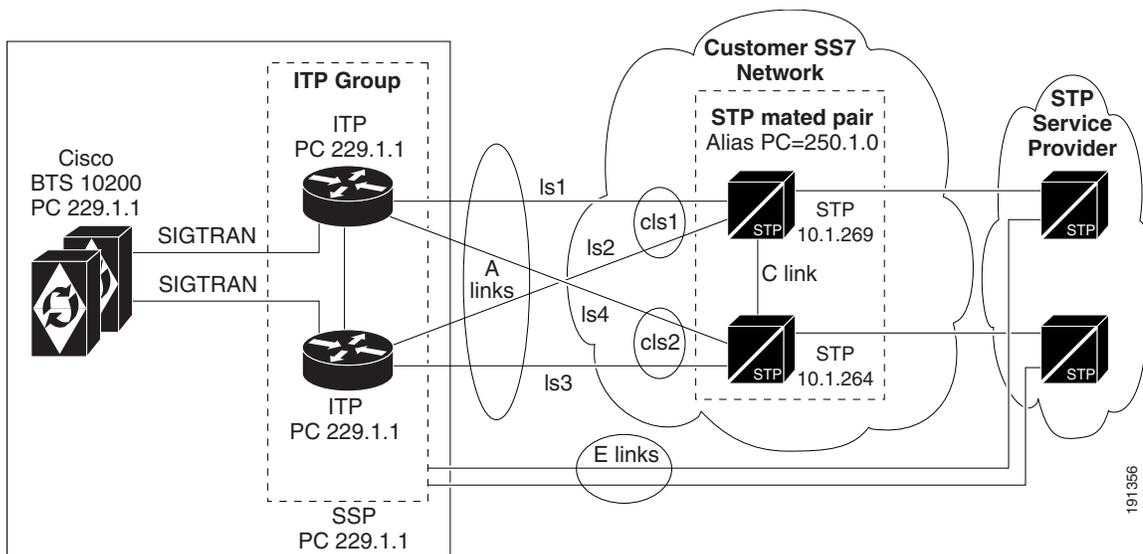
- GTT is not supported on the ITP and must be performed on the service provider's STP.
- Geographical separation of ITPs is not supported. ITPs must be collocated.
- Currently, a pair of ITPs is required for each OPC on the Cisco BTS 10200. In the Mated STP-Pair solution, only two ITPs are required, regardless of the number of OPCs on the Cisco BTS 10200.
- Approximately half of the SS7 traffic of each ITP goes across the inter-ITP connection. Therefore, the traffic between the ITPs is comparatively heavier than that of the Mated STP-Pair configuration. This extra processing requirement reduces the amount of processing power that is available for sending and receiving traffic on links that connect to the SS7 service provider, effectively reducing the amount of allowable links on each ITP platform in an ITP group by half. As a result, the two ITPs in an ITP group can only have a total number of SS7 links equal to that of one ITP that is not configured in an ITP group.

- If one ITP in the ITP group loses all IP communication, both ITPs will become isolated from each other. The ITP that has lost all IP communication will also not be able to communicate with the BTS. Its default behavior is to send a UPU to the network, which will stop all traffic towards the BTS, even though the other ITP is still functional.
- The Cisco 7507 is not available for ITP group mode. Only the Cisco 2651, Cisco 7206, and Cisco 7301 are supported.

Shared Point Code Configuration Connecting With E-Links

An “E” (extended) link configuration is a variation of the Shared Point Code configuration, but it serves as a backup in case all A-link connections become unavailable. It has the basic provisioning setup, benefits, and limitations as the Shared Point Code with A-links configuration. Figure 1-6 shows how the BTS and ITP can use E links to communicate with the service provider.

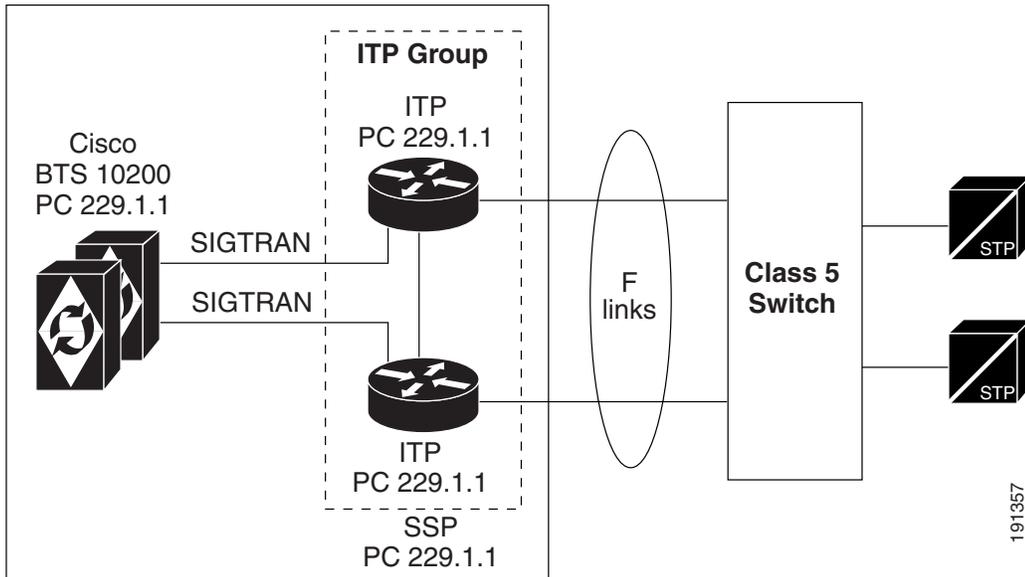
Figure 1-6 Shared Point Configuration with E Links



Shared Point Code Configuration Connecting With F-Links

An “F” (fully associated) link configuration is a variation of the Shared Point Code solution that uses A-links, except that, instead of connecting to an STP via A-links, it connects to another signaling end point (SEP), an SSP or SCP, in the SS7 network via fully associated F-links. In this configuration, the BTS and ITP usually function as a private bank exchange (PBX). An F-link configuration has the basic setup and list of benefits and restrictions as the Shared Point Code with A-links configuration. Figure 1-7 shows a typical F-link configuration.

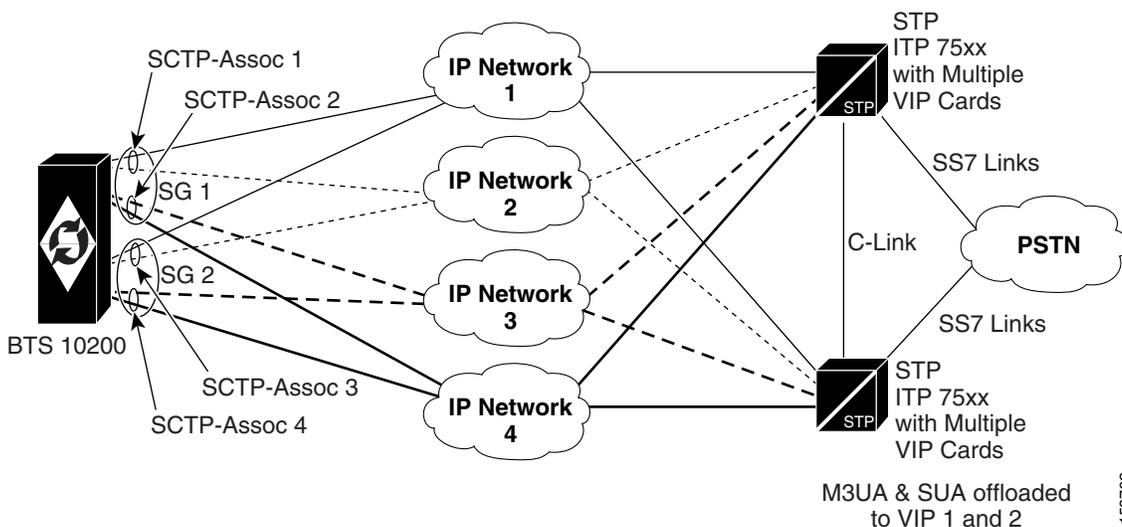
Figure 1-7 Shared Point Configuration with F-Links



ITP NSO Configuration

Figure 1-8 illustrates a Cisco BTS 10200 setup with the NSO feature. The Cisco 7500 series ITP supports multiple VIPs, with each VIP acting as a SGP in the SIGTRAN data model, each able to terminate an SCTP association from a single Cisco BTS 10200 Softswitch platform Call Agent (CA), Advanced Intelligent Network (AIN) Feature Server (FSAIN), and POTS, Tandem, and Centrex Feature Server (FSPTC).

Figure 1-8 Multiple SCTP Associations from Single Cisco BTS 10200 Softswitch Platform



The Cisco BTS 10200 supports three profiles for connecting to an SS7 service provider network: D link, A link, and F link.

NSO Configuration with D Links

The Cisco BTS 10200 Softswitch term for this profile is Mated STP. For the Cisco BTS 10200 Softswitch to support the Cisco 7500 series ITP NSO with VIP offload, the SG Group must be provisioned with the `sg-grp-mode` of Mated STP and the SGs in that group must have the `internal-redundancy-mode` set to `SSO-NSO`.

The D-link profile with NSO mode has the following characteristics:

- Redundancy is supported between the ITPs. NSO mode with VIP off-loading provides another layer of redundancy with dual VIP cards with LAN Port Adapters (PAs) on each Cisco 7500 series ITP.
- Two SCTP associations can terminate on two different VIP cards within a single ITP for a total of four associations in a Mated STP SG Group.
- Allows two SGPs per SG and a total of four SGPs per SG-Group.
- SCTP multi-home capability can be configured utilizing two LAN PAs on each VIP card.
- SIGTRAN traffic is load-balanced over the multiple associations.

The D-link profile with NSO mode has the following limitations:

- NSO mode operation is only supported on Cisco 7500 series ITP.
- NSO mode operation cannot be used with the ITP Group feature (Distributed MTP3).

NSO Configuration with A and F Links

The Cisco BTS 10200 term for these profiles is ITP group, which is the Distributed MTP configuration on an ITP. For the Cisco BTS 10200 Softswitch to support Distributed MTP on ITPs, the SG Group must be provisioned with parameter `sg-grp-mode=itp-group` with only one SG in that group whose parameter `internal-redundancy-mode=none`. The A-link and F-link profiles are identical because the Cisco BTS 10200 and the SG share the same point code.