



CHAPTER 3

Cisco SCE8000 GBE Topology and Topology-Related Parameters

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Introduction

This chapter describes the possible deployment topologies of the Cisco SCE8000 GBE and explains how to configure the relevant parameters correctly for each topology.

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- [Topology Considerations, page 3-2](#)
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Cisco SCE8000 GBE Platform

The Cisco SCE8000 GBE is a solution for multi Gigabit Ethernet links with load sharing and asymmetrical routing and support for switchover between two SCE platforms.

The Cisco SCE8000 GBE is built to support wire speed processing of full-duplex Gigabit Ethernet streams. The Cisco SCE8000 GBE can, therefore, be deployed in a multi-link environment, in several different topologies.

- **Single Cisco SCE8000 GBE topology**—Provides the ability to process both directions of a bi-directional flow, processing both the upstream and downstream paths of a flow, even if they traverse different links.
- **Dual Cisco SCE8000 GBE topology (cascade)**—Cascaded Cisco SCE8000 GBE s provide high-availability and fail-over solution and maintain the line and service in case of Cisco SCE8000 GBE failure.

Topology Considerations

There are several issues that must be considered to arrive at the optimum configuration of the topology-related parameters:

Functionality

Is the system used to monitor traffic flow with report functionality only, or is it used for traffic flow control with enforcement, as well as report functionality?

- **Monitoring and control**—The Cisco SCE8000 GBE monitors and controls traffic flow. Decisions are enforced by the Cisco SCE8000 GBE depending on the results of the monitoring functions of the Cisco SCE8000 GBE and the configuration of the Service Control Application for Broadband or Mobile solution.

To perform control functions, the Cisco SCE8000 GBE must be physically installed as an inline installation.

- **Monitoring only**—The Cisco SCE8000 GBE monitors traffic flow, but cannot control it.

Either an inline installation or an optical splitter or Switched Port Analyzer (SPAN) installation may be used for monitoring only.

Size

A Cisco SCE8000 GBE deployment can range from a single platform to multiple platforms.

A complete discussion on sizing the system is beyond the scope of this document. Information about the number of Cisco SCE8000 GBE platforms required is related to the design considerations *per link* (topology and redundancy factors) rather than to overall sizing of the system.

Redundancy

Must the system be designed to guarantee uninterrupted Cisco SCE8000 GBE functionality? If so, there must be a backup Cisco SCE8000 GBE platform to assume operation in case of failure of the primary device.

A backup SCE platform is connected in a cascade configuration with the primary SCE platform so that, although all processing is performed only in the active Cisco SCE8000 GBE, the standby Cisco SCE8000 GBE is constantly updated with all the necessary information so that it can instantly take over processing the traffic on the data links should the active Cisco SCE8000 GBE fail.

Link continuity

How should the Cisco SCE8000 GBE respond to platform failure about link continuity? Should traffic flow continue even though the unit is not operating, or be halted until the platform is repaired or replaced?

If link continuity is a high priority, an external optical bypass module can be installed on the link. (See the “[Link Continuity](#)” section on page 3-7 and the “[Cisco SCE8000 GBE Optical Bypass](#)” section on page 2-10.)



Note

In cascade configuration, installation of an external optical bypass module is highly recommended.

These issues determine two important aspects of system deployment and configuration:

- Physical topology of the system—Actual physical placement and connection of the Cisco SCE8000 GBE platform or platforms in the system.
- Topology-related configuration parameters—Correct values for each parameter must be ascertained before configuring the system to make sure that the system functions in the desired manner.

Physical Topologies

Following are descriptions of several physical topologies that the Cisco SCE8000 GBE supports.

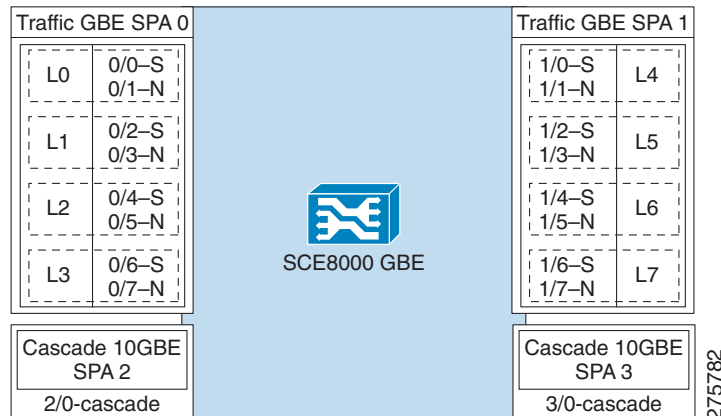
- [Cisco SCE8000 GBE Interface Numbering, page 3-4](#)
- [Single Cisco SCE8000 GBE Topologies, page 3-4](#)
- [Dual Cisco SCE8000 GBE Topology \(Cascade\), page 3-6](#)

Cisco SCE8000 GBE Interface Numbering

Figure 3-1 shows the numbering of the Cisco SCE8000 GBE interfaces as indicated in the topology diagrams in this chapter. The interface numbering is explained as follows:

- First digit is the slot number (always 3).
- Second digit is the number of the sub-slot or SPA module (0 to 3).
- Third digit is the number of the interface on the designated SPA module (0 to 7).

Figure 3-1 Cisco SCE8000 GBE Interface Numbering



Single Cisco SCE8000 GBE Topologies

A single Cisco SCE8000 GBE supports several different topologies, depending on the number of SPAs and the connection mode.

- [Inline vs. Receive-only Installation, page 3-5](#)

Table 3-1 lists the number of traffic links per number of SPAs.

Table 3-1 Number of SPAs

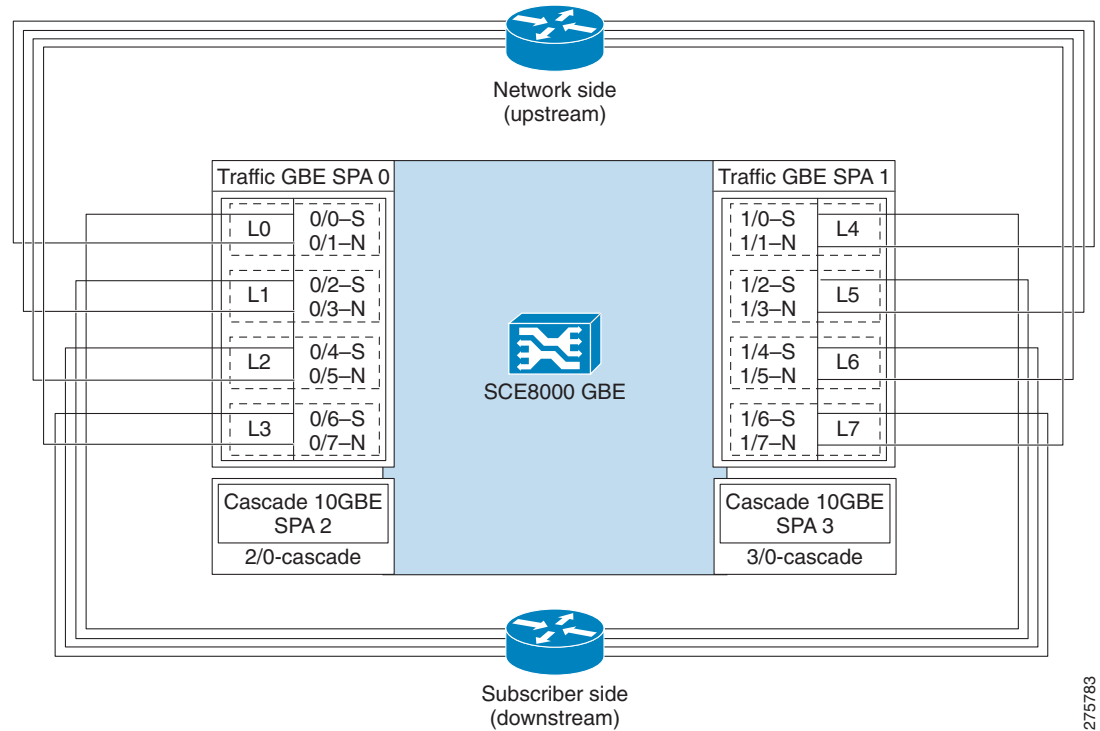
Number of SPAs	Number of Links	Place SPAs in subslots
1	4	0
2	8	0 and 1

Inline vs. Receive-only Installation

Inline Topology

Typically, the Cisco SCE8000 GBE is connected in a full duplex link between two devices (Router, BRAS, and so on). When the Cisco SCE8000 GBE is installed as an inline installation, it physically resides on the data link between the subscribers and the network. [Figure 3-2](#) displays the inline topology.

Figure 3-2 *Inline Topology*

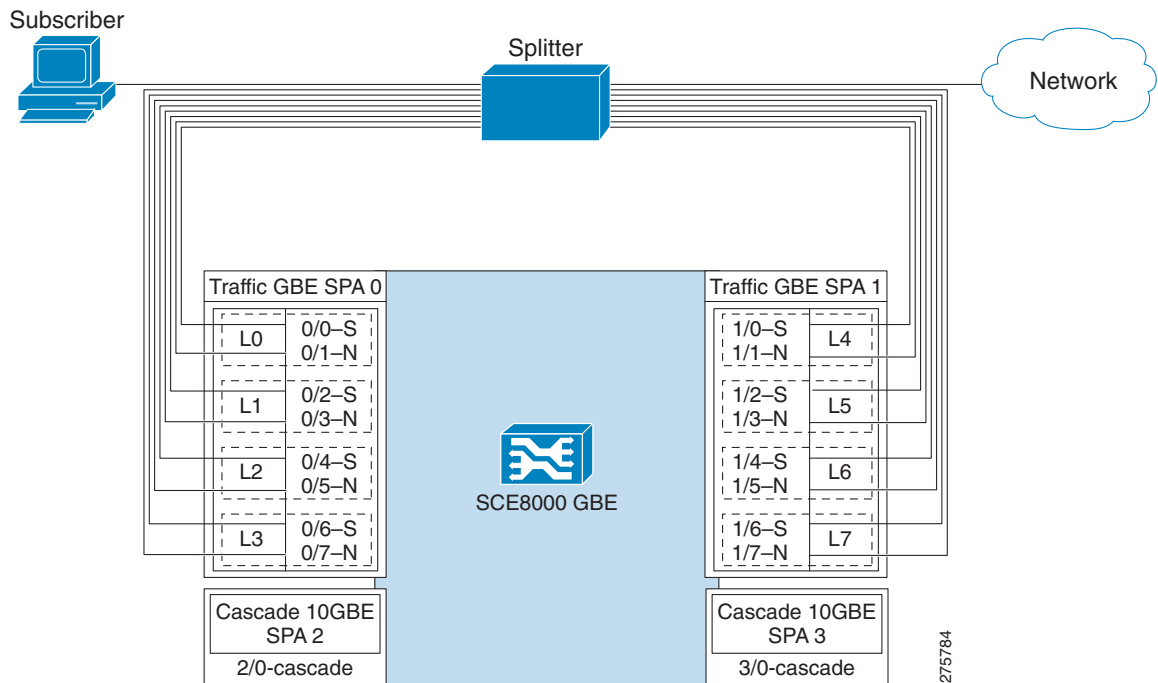


When configuring the Cisco SCE8000 GBE, an inline installation is referred to as *inline* connection mode.

Receive-only Topology

In this topology, an optical splitter resides physically on the link between the subscribers and the network. The traffic passes through the optical splitter, which splits traffic to the Cisco SCE8000 GBE. The Cisco SCE8000 GBE, therefore, only receives traffic and does not send. Figure 3-3 displays the receive-only topology.

Figure 3-3 Receive-only Topology



When configuring the Cisco SCE8000 GBE, an optical splitter topology is referred to as *receive-only* connection mode.

Note that in an optical splitter topology, the Cisco SCE8000 GBE only enables traffic monitoring functionality.



Note

When implementing receive-only topologies with a switch, the switch must support SPAN functionality that includes separation between ingress and egress traffic and multiple SPAN-ports destinations.

Dual Cisco SCE8000 GBE Topology (Cascade)

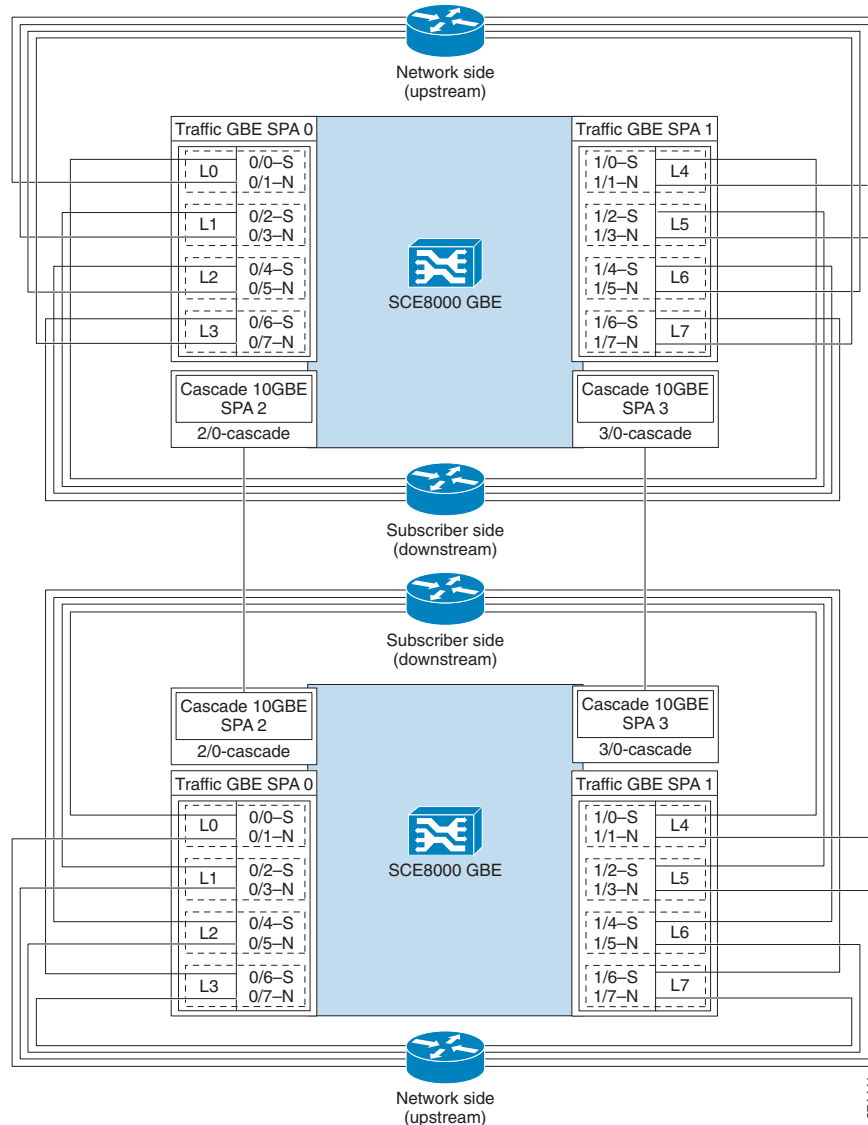
In this topology, two cascaded Cisco SCE8000 GBEs are used. This allows a switchover solution, where in case of a failure of one Cisco SCE8000 GBE the functionality that the Cisco SCE8000 GBE provides is preserved by the redundant platform.

This topology allows both control and monitoring functionality where redundancy is required and *inline* connection is used. The two Cisco SCE8000 GBEs are cascaded, so the active Cisco SCE8000 GBE processes the traffic of the two links, while the standby Cisco SCE8000 GBE only bypasses the traffic

of its links to the active Cisco SCE8000 GBE for processing, and then bypasses the processed traffic back to the link. The two Cisco SCE8000 GBEs also exchange keep-alive messages and subscriber state information.

In case the active Cisco SCE8000 GBE fails, the two Cisco SCE8000 GBEs switch their roles, and this way switchover is provided. Figure 3-4 displays the two cascaded Cisco SCE8000 GBE platforms topology.

Figure 3-4 Two Cascaded Cisco SCE8000 GBE Platforms



This switchover solution preserves the Cisco SCE8000 GBE functionality and the network link:

- Two Cisco SCE8000 GBEs are simultaneously aware of the subscriber contexts, and subscriber states are constantly exchanged between them, such that if the active Cisco SCE8000 GBE fails, the standby can take over with minimum state loss.

- When one Cisco SCE8000 GBE fails (depending on the type of failure) its link traffic is still bypassed to the functioning Cisco SCE8000 GBE and processed there, so the traffic processing continues for both the links.
- Bypass of the traffic through the failed Cisco SCE8000 GBE is configurable, and the user may choose to always cutoff the line that goes through the failed Cisco SCE8000 GBE. In this case network redundancy protocols like Hot Standby Router Protocol (HSRP) are responsible for identifying the line cutoff and switching all the traffic to go through the functioning Cisco SCE8000 GBE.
- In addition, optional external optical bypass devices provide link continuity during any failure of the Cisco SCE8000 GBE. This ensures 100% link continuity at the expense of service inaccuracy as a result of the traffic of the failing box not being processed.

Link Continuity

The internal bypass mechanism of the Cisco SCE8000 GBE allows traffic to continue to flow, if desired, even if the device itself is not fully functioning. In addition, the Cisco SCE8000 GBE is designed with the ability to control up to four external optical bypass devices (each optical bypass supports two links). This is needed because the internal bypass mechanism cannot maintain traffic flow in all cases.

- [Internal Bypass Mechanism, page 3-9](#)
- [External Optical Bypass, page 3-10](#)

Note that when the Cisco SCE8000 GBE is connected to the network through an optical splitter, a failure of the Cisco SCE8000 GBE does not affect the traffic flow, as the traffic continues to flow through the optical splitter.

Internal Bypass Mechanism

The Cisco SCE8000 GBE includes a SPA Interface Processor (SIP) module with a bypass mechanism that is enabled upon Cisco SCE8000 GBE failure.

The SIP module supports the following three modes:

- **Bypass**—The bypass mechanism preserves the network link, but traffic is not processed for monitoring or for control.
- **Forwarding**—This is the normal operational mode, in which the Cisco SCE8000 GBE processes the traffic for monitoring and control purposes.
- **Cutoff**—There is no forwarding of traffic, and the physical link is forced down (cutoff functionality at Layer 1).

The SIP module cannot preserve the link in the following circumstances:

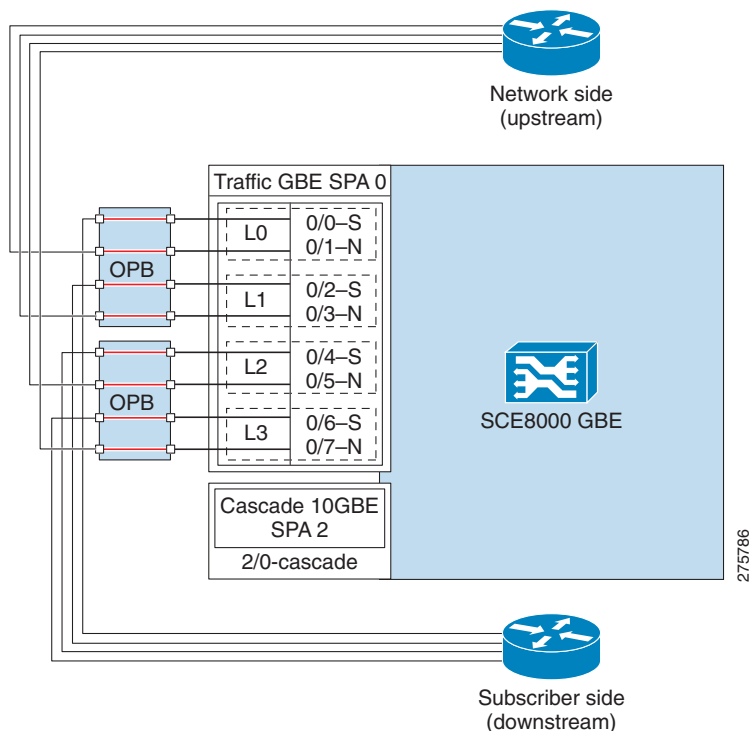
- During platform reboot (SW reload), there is an 11-second period during which the link is forced down (cutoff functionality). If any routing or spanning tree protocols are used in the network, this delay may be extended.
- During a power failure (The Cisco SCE8000 GBE has two power supplies. A power failure occurs only when both of them fail).
- Under certain types of failure within the SIP module, the SPA cards, or the 10 Gbps Small-form Factor Pluggable (XFP) optic modules.

External Optical Bypass

When a separate bypass mechanism is required, an external optical bypass device can be used to provide dependable link continuity. The external optical bypass device can be installed either inside the Cisco SCE8000 GBE chassis or be rack-mounted externally. The external optical bypass device can also be controlled manually by specific CLI commands.

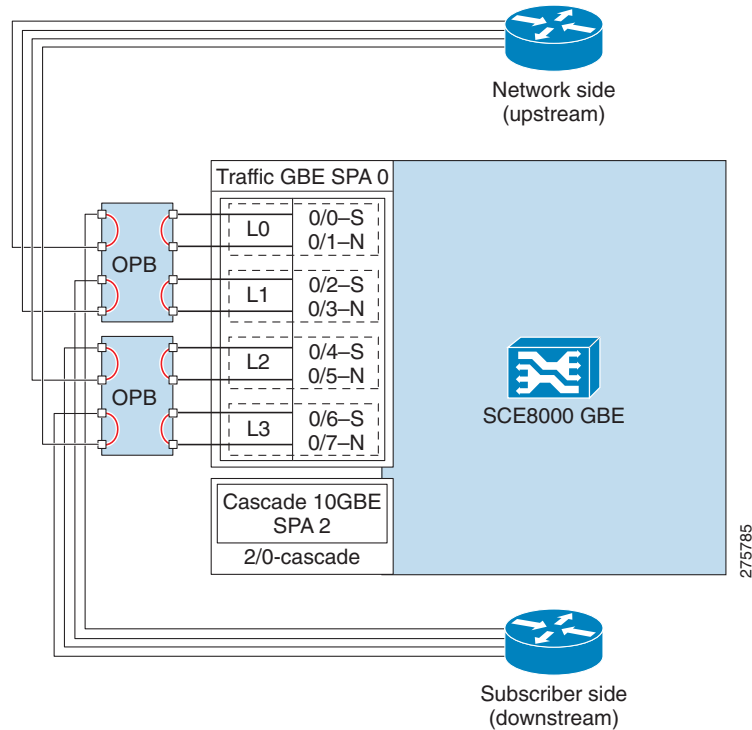
Under normal operating conditions, traffic flows through the link as usual, with the exception that the optical bypass module sits on the link. [Figure 3-5](#) displays the optical bypass under the normal operating condition.

Figure 3-5 Optical Bypass Under Normal Operating Condition



If the Cisco SCE8000 GBE platform fails, traffic flows through the optical bypass module, bypassing the Cisco SCE8000 GBE, so that traffic on the link is maintained. [Figure 3-6](#) displays the optical bypass under failure conditions.

Figure 3-6 Optical Bypass Under Failure Conditions



Note

In cascade configuration, installation of the optical bypass module is highly recommended.

This optical bypass module can be added to link without altering the basic characteristics of the topology. The installation procedure and the actual connections are somewhat different when the optical bypass module is used. (See the “[Optical Bypass Module Connectivity](#)” section on page 6-5.)

For more information about the external bypass module, see the “[Cisco SCE8000 GBE Optical Bypass](#)” section on page 2-10.

Topology-Related Parameters

See the following sections to determine the correct values for all topology-related parameters before beginning to run the initial setup of the Cisco SCE8000 GBE.

- [Connection Mode Parameter, page 3-13](#)
- [sce-id Parameter, page 3-13](#)
- [Priority, page 3-13](#)
- [On-Failure Mode Parameter, page 3-14](#)

There are four topology-related parameters:

- **Connection mode**—Can be any one of the following, depending on the physical installation of the Cisco SCE8000 GBE (See the “[Connection Mode Parameter](#)” section on page 3-11):
 - Inline—single Cisco SCE8000 GBE inline
 - Receive-only—single Cisco SCE8000 GBE receive-only
 - Inline-cascade—two inline Cisco SCE8000 GBE platforms cascaded
 - Receive-only-cascade—two receive-only Cisco SCE8000 GBE platforms cascaded
- **sce-id**—In cascaded configurations, this parameter identifies the SCE platform. (See the [sce-id Parameter, page 3-13](#).)

It is applicable only in a cascade topology.



Note

The sce-id parameter, which identifies the SCE platform, replaces the physically-connected-link parameter, which identified the link. This change was required because the Cisco SCE8000 GBE platform supports multiple links. However, for backwards compatibility, the physically-connected-link parameter will still be recognized and the number of the link assigned to that parameter (0 or 1) is defined as the sce-id.

- **Priority**—This parameter defines which is the primary Cisco SCE8000 GBE. (See the “[Priority](#)” section on page 3-11.)

It is applicable only in a cascade topology

- **On-failure**—This parameter determines whether the system cuts the traffic or bypasses it when the Cisco SCE8000 GBE either has failed or is booting. Traffic bypass can be achieved either through the external optical bypass device or through the internal bypass mechanism of the SPA interface processor. It is not applicable to receive-only topologies. (See the “[On-Failure Mode Parameter](#)” section on page 3-12.)

These parameters are configured using the **connection-mode** command.

Connection Mode Parameter

The connection mode parameter refers directly to the physical topology in which the Cisco SCE8000 GBE is installed. The connection mode depends on two factors:

- **Inline/Receive-only:**
 - **Inline**—The Cisco SCE8000 GBE resides on the data link between the subscriber side and the network side, thus both receiving and sending packets.
 - **Receive-only**—The Cisco SCE8000 GBE does not reside physically on the data link. Data is forwarded to the Cisco SCE8000 GBE via an external optical splitter. The Cisco SCE8000 GBE itself receives only and does not send.
- **Cascade**—Indicates a two Cisco SCE8000 GBE topology where the two Cisco SCE8000 GBE platforms are connected via the cascade ports (10GBE interfaces).

The connection mode parameter is determined by the physical deployment of the Cisco SCE8000 GBE, as follows:

- Single Cisco SCE8000 GBE inline installation = **Inline** connection mode.
- Single Cisco SCE8000 GBE optical splitter installation = **Receive-only** connection mode.
- Two-platform cascaded Cisco SCE8000 GBE inline installation = **Inline-cascade** connection mode.
- Two-platform cascaded Cisco SCE8000 GBE optical splitter installation = **Receive-only-cascade** connection mode.

sce-id Parameter

For each of the SCE platforms in a cascaded pair, this parameter identifies the platform (0 or 1). This in turn identifies the links, with links 0 to 7 on one SCE platform and links 8 to 15 on the other.

This parameter is then added to the slot/subslot/port designation in interface configuration commands as well as related show command output as follows:

```
sce-id/slot/subslot/port
```

where *sce-id* can have a value of **0** or **1**.

Priority

In a cascade topology, the user must define the priority of each Cisco SCE8000 GBE.

- **Primary**—The Primary Cisco SCE8000 GBE is active by default
- **Secondary**—The Secondary Cisco SCE8000 GBE is the default standby.

These defaults apply only when both devices are started together. However, if the primary Cisco SCE8000 GBE fails and then recovers, it will not revert to active status, but remains in standby status, while the secondary device remains active.

On-Failure Mode Parameter

The *on-failure* mode parameter configures the action taken by a failed SCE platform when a failure is detected.

As described in the “[Internal Bypass Mechanism](#)” section on page 3-7, the SPA Interface Processor card supports three different modes. The **Bypass**, **External Bypass**, and **Cutoff** modes are possible when the Cisco SCE8000 GBE is not operational because of platform failure or boot. The **Forwarding** mode enables control of traffic flow and is not compatible with the non-operational status.

The following *on-failure* modes are possible:

- **Bypass**—The SPA interface card forwards traffic between the two ports of each link with no intervention of the control application running in the Cisco SCE8000 GBE platform. This is also known as *electrical bypass*.

In a cascade setup, this allows the traffic of the link connected to the failed box to be passed to the active box for processing.
- **Cutoff**—There is no forwarding of traffic. The link is forced down, resulting in traffic cutoff at Layer 1.
- **External-bypass**—The external optical bypass device is used to bypass traffic, maintaining link continuity at all times.

In a single Cisco SCE8000 GBE topology, the value of this parameter is determined by whether or not the link can be completely cut when the Cisco SCE8000 GBE fails, or whether traffic flow should continue across the link in spite of platform failure. In the latter case, the **external-bypass** mode is the recommended setting, and is therefore the default value for the *on-failure* mode parameter.

In a cascaded Cisco SCE8000 GBE topology, the default on-failure mode is Bypass, because it preserves full traffic processing functionality on both links in most single box failures (as long as the SPA interface card is functioning properly).

- **Cutoff** mode is suggested for the following:
 - Non-redundant inline topology if value-added services (such as security) are crucial and are more important than maintaining connectivity.
- **Bypass** mode is suggested for the following:
 - When connectivity is of high importance. Note, however, that the link may be forced down for up to ten seconds during reboot and is not preserved on power failure.
- **External-bypass** mode is suggested for the following:
 - Non-redundant inline topology if connectivity is crucial and must also be preserved on power failure.
 - Redundant inline setups, if connectivity is crucial. Note that when this mode is used, the serviced traffic may experience some service inaccuracy because of the traffic of the failing box not being processed.

Asymmetric Routing Topology

In some Service Control deployments, asymmetrical routing occurs between potential service control insertion points. Asymmetrical routing can cause a situation in which the two directions of a bi-directional flow pass through different SCE platforms, resulting in each SCE platform seeing only one direction of the flow (either the inbound traffic or the outbound traffic).

This problem is typically solved by connecting the two SCE platforms in cascade mode, thereby making sure that both directions of a flow run through the same SCE platform. However, this is sometimes not feasible, because of the fact that the SCE platforms sharing the split flow are geographically remote (especially common upon peering insertion). In this type of scenario, the asymmetric routing solution enables the SCE platform to handle such traffic, allowing SCA BB to classify traffic based on a single direction and to apply basic reporting and global control features to uni-directional traffic.

Asymmetric Routing and Other Service Control Capabilities

Asymmetric routing can be combined with most other Service Control capabilities, however there are some exceptions.

Service Control capabilities that cannot be used in an asymmetric routing topology include the following:

- Subscriber redirect
- Subscriber notification
- Any kind of subscriber integration. (Use subscriber-less mode or anonymous subscriber mode instead)

