



Stateful Switchover (SSO)

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Note

- For complete syntax and usage information for the commands used in this chapter, see these publications:
- Cisco IOS Release 15.1SY supports only Ethernet interfaces. Cisco IOS Release 15.1SY does not support any WAN features or commands.
- SSO and NSF do not support IPv6 multicast traffic.



Tip

For additional information about Cisco Catalyst 6500 Series Switches (including configuration examples and troubleshooting information), see the documents listed on this page:

http://www.cisco.com/en/US/products/hw/switches/ps708/tsd_products_support_series_home.html

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Prerequisites for SSO

None.

Restrictions for SSO

- [General Restrictions, page 7-2](#)
- [Configuration Mode Restrictions, page 7-2](#)
- [Switchover Process Restrictions, page 7-2](#)

General Restrictions

- Two RPs must be installed in the chassis, each running the same version of the Cisco IOS software.
- Both RPs must run the same Cisco IOS image. If the RPs are operating different Cisco IOS images, the system reverts to RPR mode even if SSO is configured.
- Configuration changes made through SNMP may not be automatically configured on the standby RP after a switchover occurs.
- Load sharing between dual processors is not supported.
- The Hot Standby Routing Protocol (HSRP) is not supported with Cisco Nonstop Forwarding with Stateful Switchover. Do not use HSRP with Cisco Nonstop Forwarding with Stateful Switchover.
- Enhanced Object Tracking (EOT) is not stateful switchover-aware and cannot be used with HSRP, Virtual Router Redundancy Protocol (VRRP), or Gateway Load Balancing Protocol (GLBP) in SSO mode.
- Multicast is not SSO-aware and restarts after switchover; therefore, multicast tables and data structures are cleared upon switchover.

Configuration Mode Restrictions

- The configuration registers on both RPs must be set the same for the networking device to behave the same when either RP is rebooted.
- During the startup (bulk) synchronization, configuration changes are not allowed. Before making any configuration changes, wait for a message similar to the following:

```
%HA-5-MODE:Operating mode is sso, configured mode is sso.
```

Switchover Process Restrictions

- If any changes to the fabric configuration happen simultaneously with an RP switchover, the chassis is reset and all line cards are reset.
- If the switch is configured for SSO mode, and the active RP fails before the standby is ready to switch over, the switch will recover through a full system reset.
- During SSO synchronization between the active and standby RPs, the configured mode will be RPR. After the synchronization is complete, the operating mode will be SSO. If a switchover occurs before the synchronization is complete, the switchover will be in RPR mode.
- If a switchover occurs before the bulk synchronization step is complete, the new active RP may be in inconsistent states. The switch will be reloaded in this case.
- Switchovers in SSO mode will not cause the reset of any line cards.

- Interfaces on the RP itself are not stateful and will experience a reset across switchovers. In particular, the GE interfaces on the RPs are reset across switchovers and do not support SSO.
- Any line cards that are not online at the time of a switchover (line cards not in Cisco IOS running state) are reset and reloaded on a switchover.

Information About SSO

- [SSO Overview, page 7-3](#)
- [SSO Operation, page 7-5](#)
- [Route Processor Synchronization, page 7-6](#)
- [SSO Operation, page 7-8](#)
- [SSO-Aware Features, page 7-10](#)

SSO Overview

The switch supports fault resistance by allowing a redundant supervisor engine to take over if the primary supervisor engine fails. Cisco SSO (frequently used with NSF) minimizes the time a network is unavailable to its users following a switchover while continuing to forward IP packets. The switch supports route processor redundancy (RPR). For more information, see [Chapter 9, “Route Processor Redundancy \(RPR\).”](#)

SSO is particularly useful at the network edge. Traditionally, core routers protect against network faults using router redundancy and mesh connections that allow traffic to bypass failed network elements. SSO provides protection for network edge devices with dual Route Processors (RPs) that represent a single point of failure in the network design, and where an outage might result in loss of service for customers.

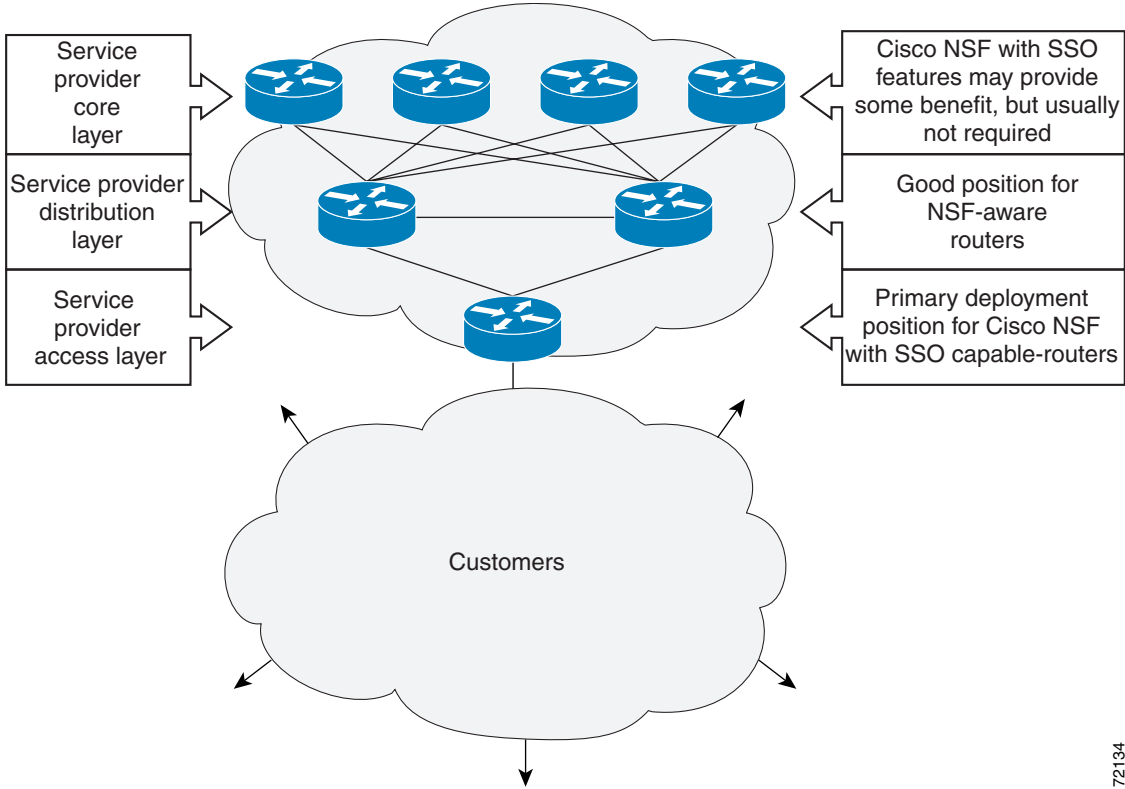
SSO has many benefits. Because the SSO feature maintains stateful feature information, user session information is maintained during a switchover, and line cards continue to forward network traffic with no loss of sessions, providing improved network availability. SSO provides a faster switchover than RPR by fully initializing and fully configuring the standby RP, and by synchronizing state information, which can reduce the time required for routing protocols to converge. Network stability may be improved with the reduction in the number of route flaps had been created when routers in the network failed and lost their routing tables.

SSO is required by the Cisco Nonstop Forwarding (NSF) feature (see [Chapter 8, “Nonstop Forwarding \(NSF\)”](#)).

Figure 7-1 illustrates how SSO is typically deployed in service provider networks. In this example, Cisco NSF with SSO is primarily at the access layer (edge) of the service provider network. A fault at this point could result in loss of service for enterprise customers requiring access to the service provider network.

For Cisco NSF protocols that require neighboring devices to participate in Cisco NSF, Cisco NSF-aware software images must be installed on those neighboring distribution layer devices. Additional network availability benefits might be achieved by applying Cisco NSF and SSO features at the core layer of your network; however, consult your network design engineers to evaluate your specific site requirements.

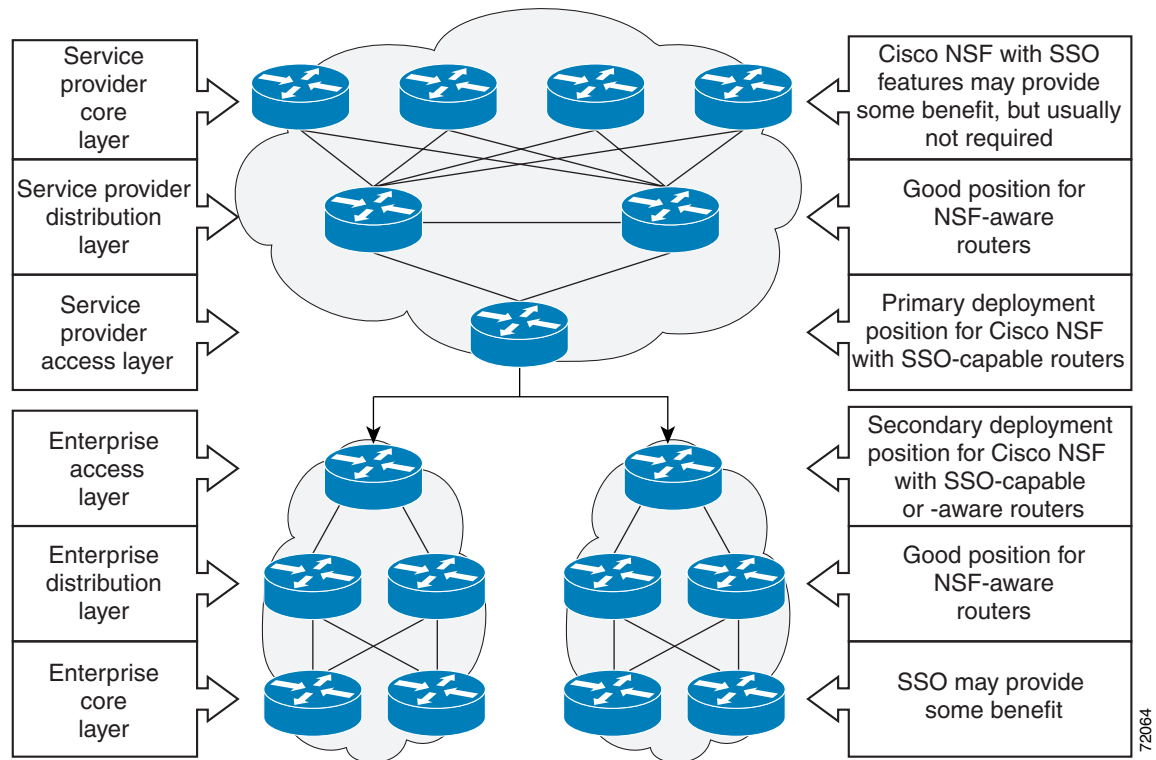
Figure 7-1 Cisco NSF with SSO Network Deployment: Service Provider Networks



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Additional levels of availability may be gained by deploying Cisco NSF with SSO at other points in the network where a single point of failure exists. [Figure 7-2](#) illustrates an optional deployment strategy that applies Cisco NSF with SSO at the enterprise network access layer. In this example, each access point in the enterprise network represents another single point of failure in the network design. In the event of a switchover or a planned software upgrade, enterprise customer sessions would continue uninterrupted through the network.

Figure 7-2 Cisco NSF with SSO Network Deployment: Enterprise Networks



SSO Operation

SSO establishes one of the RPs as the active processor while the other RP is designated as the standby processor. SSO fully initializes the standby RP, and then synchronizes critical state information between the active and standby RP.

During an SSO switchover, the line cards are not reset, which provides faster switchover between the processors. The following events cause a switchover:

- A hardware failure on the active supervisor engine
- Clock synchronization failure between supervisor engines
- A manual switchover or shutdown

An SSO switchover does not interrupt Layer 2 traffic. An SSO switchover preserves FIB and adjacency entries and can forward Layer 3 traffic after a switchover. SSO switchover duration is between 0 and 3 seconds.

Route Processor Synchronization

- [Synchronization Overview, page 7-6](#)
- [Bulk Synchronization During Initialization, page 7-6](#)
- [Synchronization of Startup Configuration, page 7-6](#)
- [Incremental Synchronization, page 7-7](#)

Synchronization Overview

In networking devices running SSO, both RPs must be running the same configuration so that the standby RP is always ready to assume control if the active RP fails. SSO synchronizes the configuration information from the active RP to the standby RP at startup and whenever changes to the active RP configuration occur. This synchronization occurs in two separate phases:

- While the standby RP is booting, the configuration information is synchronized in bulk from the active RP to the standby RP.
- When configuration or state changes occur, an incremental synchronization is conducted from the active RP to the standby RP.

Bulk Synchronization During Initialization

When a system with SSO is initialized, the active RP performs a chassis discovery (discovery of the number and type of line cards and fabric cards, if available, in the system) and parses the startup configuration file.

The active RP then synchronizes this data to the standby RP and instructs the standby RP to complete its initialization. This method ensures that both RPs contain the same configuration information.

Even though the standby RP is fully initialized, it interacts only with the active RP to receive incremental changes to the configuration files as they occur. Executing CLI commands on the standby RP is not supported.

Synchronization of Startup Configuration

During system startup, the startup configuration file is copied from the active RP to the standby RP. Any existing startup configuration file on the standby RP is overwritten.

The startup configuration is a text file stored in the NVRAM of the RP. It is synchronized whenever you perform the following operations:

- CLI command **copy system:running-config nvram:startup-config** is used.
- CLI command **copy running-config startup-config** is used.
- CLI command **write memory** is used.
- CLI command **copy filename nvram:startup-config** is used.
- SNMP SET of MIB variable ccCopyEntry in CISCO_CONFIG_COPY MIB is used.
- System configuration is saved using the **reload** command.
- System configuration is saved following entry of a forced switchover CLI command.

Incremental Synchronization

- [Incremental Synchronization Overview, page 7-7](#)
- [CLI Commands, page 7-7](#)
- [SNMP SET Commands, page 7-7](#)
- [Routing and Forwarding Information, page 7-7](#)
- [Chassis State, page 7-7](#)
- [Line Card State, page 7-7](#)
- [Counters and Statistics, page 7-8](#)

Incremental Synchronization Overview

After both RPs are fully initialized, any further changes to the running configuration or active RP states are synchronized to the standby RP as they occur. Active RP states are updated as a result of processing feature information, external events (such as the interface becoming up or down), or user configuration commands (using CLI commands or Simple Network Management Protocol [SNMP]) or other internal events.

CLI Commands

CLI changes to the running configuration are synchronized from the active RP to the standby RP. In effect, the CLI command is run on both the active and the standby RP.

SNMP SET Commands

Configuration changes caused by an SNMP set operation are synchronized on a case-by-case basis. Currently only two SNMP configuration set operations are supported:

- **shut** and **no-shut** (of an interface)
- **link up/down trap enable/disable**

Routing and Forwarding Information

Routing and forwarding information is synchronized to the standby RP:

- State changes for SSO-aware features (for example, SNMP) are synchronized to the standby RP.
- Cisco Express Forwarding updates to the Forwarding Information Base (FIB) are synchronized to the standby RP.

Chassis State

Changes to the chassis state due to line card insertion or removal are synchronized to the standby RP.

Line Card State

Changes to the line card states are synchronized to the standby RP. Line card state information is initially obtained during bulk synchronization of the standby RP. Following bulk synchronization, line card events, such as whether the interface is up or down, received at the active processor are synchronized to the standby RP.

Counters and Statistics

The various counters and statistics maintained in the active RP are not synchronized because they may change often and because the degree of synchronization they require is substantial. The volume of information associated with statistics makes synchronizing them impractical.



Note

Not synchronizing counters and statistics between RPs may create problems for external network management systems that monitor this information.

SSO Operation

- [SSO Conditions, page 7-8](#)
- [Switchover Time, page 7-8](#)
- [Online Removal of the Active RP, page 7-9](#)
- [Fast Software Upgrade, page 7-9](#)
- [Core Dump Operation, page 7-9](#)

SSO Conditions

An automatic or manual switchover may occur under the following conditions:

- A fault condition that causes the active RP to crash or reboot—automatic switchover
- The active RP is declared dead (not responding)—automatic switchover
- The CLI is invoked—manual switchover

The user can force the switchover from the active RP to the standby RP by using a CLI command. This manual procedure allows for a “graceful” or controlled shutdown of the active RP and switchover to the standby RP. This graceful shutdown allows critical cleanup to occur.



Note

This procedure should not be confused with the graceful shutdown procedure for routing protocols in core routers—they are separate mechanisms.



Caution

The SSO feature introduces a number of new command and command changes, including commands to manually cause a switchover. The **reload** command does not cause a switchover. The **reload** command causes a full reload of the box, removing all table entries, resetting all line cards, and interrupting nonstop forwarding.

Switchover Time

The time required by the device to switch over from the active RP to the standby RP is between zero and three seconds.

Although the newly active processor takes over almost immediately following a switchover, the time required for the device to begin operating again in full redundancy (SSO) mode can be several minutes, depending on the platform. The length of time can be due to a number of factors including the time needed for the previously active processor to obtain crash information, load code and microcode, and synchronize configurations between processors.

On DFC-equipped switching modules, forwarding information is distributed, and packets forwarded from the same line card should have little to no forwarding delay; however, forwarding packets between line cards requires interaction with the RP, meaning that packet forwarding might have to wait for the switchover time.

Online Removal of the Active RP

Online removal of the active RP automatically forces a stateful switchover to the standby RP.

Fast Software Upgrade

You can use Fast Software Upgrade (FSU) to reduce planned downtime. With FSU, you can configure the system to switch over to a standby RP that is preloaded with an upgraded Cisco IOS software image. FSU reduces outage time during a software upgrade by transferring functions to the standby RP that has the upgraded Cisco IOS software preinstalled. You can also use FSU to downgrade a system to an older version of Cisco OS or have a backup system loaded for downgrading to a previous image immediately after an upgrade.

SSO must be configured on the networking device before performing FSU.

**Note**

During the upgrade process, different images will be loaded on the RPs for a short period of time. During this time, the device will operate in RPR mode.

Core Dump Operation

In networking devices that support SSO, the newly active primary processor runs the core dump operation after the switchover has taken place. Not having to wait for dump operations effectively decreases the switchover time between processors.

Following the switchover, the newly active RP will wait for a period of time for the core dump to complete before attempting to reload the formerly active RP. The time period is configurable. For example, on some platforms an hour or more may be required for the formerly active RP to perform a coredump, and it might not be site policy to wait that much time before resetting and reloading the formerly active RP. In the event that the core dump does not complete within the time period provided, the standby is reset and reloaded regardless of whether it is still performing a core dump.

The core dump process adds the slot number to the core dump file to identify which processor generated the file content.

**Note**

Core dumps are generally useful only to your technical support representative. The core dump file, which is a very large binary file, must be transferred using the TFTP, FTP, or remote copy protocol (rcp) server and subsequently interpreted by a Cisco Technical Assistance Center (TAC) representative that has access to source code and detailed memory maps.

SSO-Aware Features

A feature is SSO-aware if it maintains, either partially or completely, undisturbed operation through an RP switchover. State information for SSO-aware features is synchronized from active to standby to achieve stateful switchover for those features.

The dynamically created state of SSO-unaware features is lost on switchover and must be reinitialized and restarted on switchover.

The output of the **show redundancy clients** command displays the SSO-aware features (see the “[Verifying SSO Features](#)” section on page 7-13).

Default Settings for SSO

None.

How to Configure SSO



Note

See [Chapter 6, “Fast Software Upgrade,”](#) for information about how to copy images onto the switch. During the upgrade process, different images will be loaded on the RPs for a very short period of time. If a switchover occurs during this time, the device will recover in RPR mode.

Either the SSO or RPR redundancy mode is always configured. The SSO redundancy mode is configured by default. To revert to the default SSO redundancy mode from the RPR redundancy mode, perform this task:

	Command	Purpose
Step 1	Router> enable	Enables privileged EXEC mode (enter your password if prompted).
Step 2	Router# configure terminal	Enters global configuration mode.
Step 3	Router(config)# redundancy	Enters redundancy configuration mode.
Step 4	Router(config)# mode sso	Sets the redundancy configuration mode to SSO on both the active and standby RP. Note After configuring SSO mode, the standby RP will automatically reset.
Step 5	Router(config-red)# end	Exits redundancy configuration mode and returns the switch to privileged EXEC mode.
Step 6	Router# copy running-config startup-config	Saves the configuration changes to the startup configuration file.

This example shows how to configure the SSO redundancy mode:

```
Router> enable
Router# configure terminal
Router(config)# redundancy
Router(config)# mode sso
```

```
Router(config-red)# end
Router# copy running-config startup-config
Router#
```

Troubleshooting SSO

- [Possible SSO Problem Situations, page 7-11](#)
- [SSO Troubleshooting, page 7-12](#)

Possible SSO Problem Situations

- The standby RP was reset, but there are no messages describing what happened—To display a log of SSO events and clues as to why a switchover or other event occurred, enter the **show redundancy history** command on the newly active RP:

```
Router# show redundancy history
```

- The **show redundancy states** command shows an operating mode that is different than what is configured on the networking device—On certain platforms the output of the **show redundancy states** command displays the actual operating redundancy mode running on the device, and not the configured mode as set by the platform. The operating mode of the system can change depending on system events. For example, SSO requires that both RPs on the networking device be running the same software image; if the images are different, the device will not operate in SSO mode, regardless of its configuration.

For example, during the upgrade process different images will be loaded on the RPs for a short period of time. If a switchover occurs during this time, the device will recover in RPR mode.

- Reloading the device disrupts SSO operation—The SSO feature introduces a number of commands, including commands to manually cause a switchover. The reload command is not an SSO command. This command causes a full reload of the box, removing all table entries, resetting all line cards, and thereby interrupting network traffic forwarding. To avoid reloading the box unintentionally, use the **redundancy force-switchover** command.
- During a software upgrade, the networking device appears to be in a mode other than SSO—During the software upgrade process, the show redundancy command indicates that the device is running in a mode other than SSO.

This is normal behavior. Until the FSU procedure is complete, each RP will be running a different software version. While the RPs are running different software versions, the mode will change to either RPR. The device will change to SSO mode once the upgrade has completed.

- The previously active processor is being reset and reloaded before the core dump completes—Use the **crashdump-timeout** command to set the maximum time that the newly active processor waits before resetting and reloading the previously active processor.
- Issuing a “send break” does not cause a system switchover—This is normal operation. Using “send break” to break or pause the system is not recommended and may cause unpredictable results. To initiate a manual switchover, use the **redundancy force-switchover** command.

In Cisco IOS software, you can enter ROM monitor mode by restarting the switch and then pressing the Break key or issuing a “send break” command from a telnet session during the first 60 seconds of startup. The send break function can be useful for experienced users or for users under the direction of a Cisco Technical Assistance Center (TAC) representative to recover from certain system problems or to evaluate the cause of system problems.

SSO Troubleshooting

The following commands may be used as needed to troubleshoot the SSO feature. These commands do not have to be entered in any particular order.

Command	Purpose
Router(config-red)# crashdump-timeout [<i>mm</i> <i>hh:mm</i>]	Sets the longest time that the newly active RP will wait before reloading the formerly active RP.
Router# debug redundancy { all ui clk hub }	Debugs redundancy on the networking device.
Router# show diag [<i>slot-number</i> chassis subslot slot/subslot] [details summary]	Displays hardware information.
Router# show redundancy [clients counters debug-log handover history switchover history states inter-device]	Displays the redundancy configuration mode of the RP. Also displays information about the number of switchovers, system uptime, processor uptime, and redundancy state, and reasons for any switchovers.
Router# show version	Displays image information for each RP.

Verifying the SSO Configuration

- [Verifying that SSO Is Configured](#)
- [Verifying that SSO Is Operating on the Device](#)
- [Verifying SSO Features](#)

Verifying that SSO Is Configured

In the following example, the **show redundancy** command is used to verify that SSO is configured on the device.

```
Router> enable
Router# show redundancy
Redundant System Information :
-----
    Available system uptime = 3 days, 4 hours, 35 minutes
Switchovers system experienced = 0
    Standby failures = 1
    Last switchover reason = none

    Hardware Mode = Duplex
Configured Redundancy Mode = sso
Operating Redundancy Mode = sso
Maintenance Mode = Disabled
Communications = Up

Current Processor Information :
-----
    Active Location = slot 5
    Current Software state = ACTIVE
Uptime in current state = 3 days, 4 hours, 35 minutes
    Image Version = Cisco IOS Software, s2t54 Software ...

Synced to ...
Copyright (c) 1986-2011 by Cisco Systems, Inc.
```

```

Compiled ...
                                BOOT = disk0:0726_c4,12
                                CONFIG_FILE =
                                BOOTLDR =
                                Configuration register = 0x2102

Peer Processor Information :
-----
                                Standby Location = slot 6
                                Current Software state = STANDBY HOT
                                Uptime in current state = 3 hours, 55 minutes
                                Image Version = Cisco IOS Software, s2t54 Software ...

Synced to ...
Copyright (c) 1986-2011 by Cisco Systems, Inc.
Compiled ...
                                BOOT = disk0:0726_c4,12
                                CONFIG_FILE =
                                BOOTLDR =
                                Configuration register = 0x2102

Router#

```

Verifying that SSO Is Operating on the Device

In the following example, the **show redundancy** command with the **states** keyword is used to verify that SSO is configured on the device.

```

Router# show redundancy states
my state = 13 -ACTIVE
  peer state = 8 -STANDBY HOT
    Mode = Duplex
    Unit = Primary
    Unit ID = 5

Redundancy Mode (Operational) = sso
Redundancy Mode (Configured) = sso
Redundancy State = sso
  Maintenance Mode = Disabled
  Manual Swact = enabled
  Communications = Up

  client count = 135
  client_notification_TMR = 30000 milliseconds
  keep_alive TMR = 9000 milliseconds
  keep_alive count = 1
  keep_alive threshold = 18
  RF debug mask = 0x0

Router#

```

Verifying SSO Features

Enter the **show redundancy clients** command to display the list of features that have registered as SSO features.

```

Router# show redundancy clients
clientID = 0          clientSeq = 0          RF_INTERNAL_MSG
clientID = 1319      clientSeq = 1          Cat6k Platform First
clientID = 29        clientSeq = 60         Redundancy Mode RF
clientID = 139       clientSeq = 61         IfIndex

```

clientID = 3300	clientSeq = 62	Persistent Variable
clientID = 25	clientSeq = 68	CHKPT RF
clientID = 1515	clientSeq = 69	HAL RF
clientID = 3100	clientSeq = 73	MCM
clientID = 77	clientSeq = 80	Event Manager
clientID = 1328	clientSeq = 81	Cat6k Asic API RF Cl
clientID = 1334	clientSeq = 82	Cat6k AUTOSHUT RF Cl
clientID = 1333	clientSeq = 83	Cat6k OVERSUB RF Cli
clientID = 1302	clientSeq = 84	Cat6k Fabric Manager
clientID = 1331	clientSeq = 86	Cat6k Inline Power
clientID = 1303	clientSeq = 88	Cat6k OIR
clientID = 518	clientSeq = 89	PM Port Data
clientID = 1306	clientSeq = 93	Cat6k QoS Manager
clientID = 1501	clientSeq = 98	Cat6k CWAN HA
clientID = 1503	clientSeq = 99	CWAN VLAN RF Client
clientID = 1310	clientSeq = 100	Cat6k Feature Manage
clientID = 1700	clientSeq = 101	Cat6k L3 Lif
clientID = 78	clientSeq = 102	TSPTUN HA
clientID = 305	clientSeq = 103	Multicast ISSU Conso
clientID = 304	clientSeq = 104	IP multicast RF Clie
clientID = 22	clientSeq = 105	Network RF Client
clientID = 88	clientSeq = 106	HSRP
clientID = 114	clientSeq = 107	GLBP
clientID = 225	clientSeq = 108	VRRP
clientID = 1505	clientSeq = 111	Cat6k SPA TSM
clientID = 1509	clientSeq = 114	Cat6k Online Diag HA
clientID = 1337	clientSeq = 116	Cat6k MPLS RF Client
clientID = 75	clientSeq = 120	Tableid HA
clientID = 1338	clientSeq = 124	Cat6k CTS Manager
clientID = 512	clientSeq = 126	LAN-Switch BD Manage
clientID = 501	clientSeq = 127	LAN-Switch VTP VLAN
clientID = 513	clientSeq = 128	LAN-Switch IDBHAL
clientID = 71	clientSeq = 129	XDR RRP RF Client
clientID = 24	clientSeq = 130	CEF RRP RF Client
clientID = 146	clientSeq = 132	BFD RF Client
clientID = 301	clientSeq = 135	MRIB RP RF Client
clientID = 306	clientSeq = 139	MFIB RRP RF Client
clientID = 1504	clientSeq = 146	Cat6k CWAN Interface
clientID = 1507	clientSeq = 147	CWAN LTL Mgr HA RF C
clientID = 520	clientSeq = 151	RFS RF
clientID = 210	clientSeq = 152	Auth Mgr
clientID = 5	clientSeq = 153	Config Sync RF clien
clientID = 138	clientSeq = 155	MDR SM
clientID = 1308	clientSeq = 156	Cat6k Local Target L
clientID = 1351	clientSeq = 157	RF VS Client
clientID = 1358	clientSeq = 158	Cat6k VSlot
clientID = 502	clientSeq = 162	LAN-Switch Port Mana
clientID = 514	clientSeq = 163	SWITCH_VLAN_HA
clientID = 1313	clientSeq = 165	Cat6k Platform
clientID = 1318	clientSeq = 166	Cat6k Power
clientID = 23	clientSeq = 171	Frame Relay
clientID = 49	clientSeq = 172	HDLIC
clientID = 72	clientSeq = 173	LSD HA Proc
clientID = 113	clientSeq = 174	MFI STATIC HA Proc
clientID = 1335	clientSeq = 180	C6K EFP RF client
clientID = 200	clientSeq = 181	ETHERNET OAM RF
clientID = 207	clientSeq = 183	ECFM RF
clientID = 202	clientSeq = 184	ETHERNET LMI RF
clientID = 208	clientSeq = 186	LLDP
clientID = 20	clientSeq = 193	IPROUTING NSF RF cli
clientID = 21	clientSeq = 197	PPP RF
clientID = 1352	clientSeq = 201	C6K_provision_rf_cli
clientID = 1307	clientSeq = 202	Cat6k IDPROM
clientID = 74	clientSeq = 206	MPLS VPN HA Client

clientID = 34	clientSeq = 208	SNMP RF Client
clientID = 1502	clientSeq = 209	CWAN APS HA RF Clie
clientID = 52	clientSeq = 210	ATM
clientID = 35	clientSeq = 219	History RF Client
clientID = 90	clientSeq = 231	RSVP HA Services
clientID = 250	clientSeq = 243	EEM Server RF CLIENT
clientID = 252	clientSeq = 245	EEM POLICY-DIR RF CL
clientID = 54	clientSeq = 247	SNMP HA RF Client
clientID = 73	clientSeq = 248	LDP HA
clientID = 76	clientSeq = 249	IPRM
clientID = 57	clientSeq = 250	ARP
clientID = 50	clientSeq = 257	FH_RF_Event_Detector
clientID = 1508	clientSeq = 263	CWAN LTL SP RF Clie
clientID = 1304	clientSeq = 267	Cat6k Ehc
clientID = 1305	clientSeq = 271	Cat6k PAGP/LACP
clientID = 503	clientSeq = 272	Spanning-Tree Protoc
clientID = 1309	clientSeq = 273	CMRP RF Client
clientID = 1311	clientSeq = 275	Cat6k L3 Manager
clientID = 1317	clientSeq = 276	Cat6k CAPI
clientID = 1506	clientSeq = 277	CWAN SRP RF Client
clientID = 83	clientSeq = 284	AC RF Client
clientID = 145	clientSeq = 285	VFI Mgr
clientID = 84	clientSeq = 286	AToM manager
clientID = 85	clientSeq = 287	SSM
clientID = 87	clientSeq = 291	SLB RF Client
clientID = 504	clientSeq = 294	Switch SPAN client
clientID = 507	clientSeq = 295	Switch Backup Interf
clientID = 105	clientSeq = 298	DHCP Snooping
clientID = 1510	clientSeq = 304	Call-Home RF
clientID = 203	clientSeq = 307	MVRP RF
clientID = 151	clientSeq = 310	IP Tunnel RF
clientID = 94	clientSeq = 311	Config Verify RF cli
clientID = 516	clientSeq = 314	EnergyWise rf client
clientID = 508	clientSeq = 316	Port Security Client
clientID = 509	clientSeq = 317	LAN-Switch IP Host T
clientID = 515	clientSeq = 318	SISF table
clientID = 135	clientSeq = 322	IKE RF Client
clientID = 136	clientSeq = 323	IPSEC RF Client
clientID = 130	clientSeq = 324	CRYPTO RSA
clientID = 400	clientSeq = 326	IP Admission RF Clie
clientID = 3099	clientSeq = 335	ISSU process
clientID = 4005	clientSeq = 338	ISSU Test Client
clientID = 93	clientSeq = 342	Network RF 2 Client
clientID = 1320	clientSeq = 343	Cat6k PF_ML_RP
clientID = 510	clientSeq = 345	LAN-Switch PAGP/LACP
clientID = 511	clientSeq = 346	LAN-Switch Private V
clientID = 1321	clientSeq = 347	PM SP client
clientID = 1322	clientSeq = 348	VLAN Mapping
clientID = 1315	clientSeq = 350	Cat6k Clear Counter
clientID = 141	clientSeq = 352	DATA DESCRIPTOR RF C
clientID = 1000	clientSeq = 361	CTS HA
clientID = 1001	clientSeq = 362	Keystore
clientID = 3150	clientSeq = 363	SIA SD RF CLIENT
clientID = 3151	clientSeq = 364	SIA SB RF CLIENT
clientID = 3152	clientSeq = 365	SIA SCL RF CLIENT
clientID = 3153	clientSeq = 366	SIA SVE RF CLIENT
clientID = 3154	clientSeq = 367	SIA TCP RF CLIENT
clientID = 1332	clientSeq = 373	PCLC
clientID = 1367	clientSeq = 375	Cat6k ITASCA_RP
clientID = 4032	clientSeq = 379	ACL handle RF Client
clientID = 4020	clientSeq = 381	IOS Config ARCHIVE
clientID = 4021	clientSeq = 382	IOS Config ROLLBACK
clientID = 1339	clientSeq = 404	Cat6k blue beacon RF
clientID = 1362	clientSeq = 405	VS HA

```
clientID = 517      clientSeq = 406      LAN-Switch IDBHAL2
clientID = 1336     clientSeq = 415      Cat6k NTI SUP SI swi
clientID = 65000    clientSeq = 416      RF_LAST_CLIENT
```

Configuration Examples for SSO

This example configures the SSO redundancy mode :

```
Router# configure terminal
Router(config)# redundancy
Router(config-red)# mode sso
Router(config-red)# exit
Router# copy running-config startup-config
```

**Tip**

For additional information about Cisco Catalyst 6500 Series Switches (including configuration examples and troubleshooting information), see the documents listed on this page:

http://www.cisco.com/en/US/products/hw/switches/ps708/tsd_products_support_series_home.html

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