



NSF SSO ISSU Support for VPLS

Virtual Private LAN Services (VPLS), with nonstop forwarding (NSF), stateful switchover (SSO), and in service software upgrade (ISSU) support, improves the availability of service provider networks that use VPLS for multipoint Layer 2 virtual private network (VPN) services. Cisco NSF with SSO is effective at increasing availability of network services. Cisco NSF with SSO provides continuous packet forwarding, even during a network processor hardware or software failure. In a redundant system, the secondary processor recovers control plane service in the event of a critical failure in the primary processor, while SSO synchronizes the network state information between the primary and the secondary processor.

In conjunction with VPLS NSF/SSO, VPLS High Availability (HA) features include the ISSU capability. Working together, ISSU and NSF/SSO enable upgrades or downgrades of a Cisco IOS image without control and data plane outages.

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Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for NSF SSO ISSU Support for VPLS

This section lists the following prerequisites that are required to use the NSF/SSO/ISSU Support for VPLS feature.

You must configure the following features on your network:

- VPLS (see the “Virtual Private LAN Services on the Optical Services Modules” chapter in the [Cisco 7600 Series Router Cisco IOS Software Configuration Guide](#) , Release 12.2SR)
- VPLS Autodiscovery (see VPLS Autodiscovery: BGP Based and BGP Support for the L2VPN Address Family)
- NSF/SSO: Any Transport over MPLS (see NSF/SSO—Any Transport over MPLS and AToM Graceful Restart)
- NSF/SSO router support on the 7600 router (see the “Configuring NSF with SSO Supervisor Engine Redundancy” chapter in the [Cisco 7600 Series Cisco IOS Software Configuration Guide](#) , Release 12.2SR)
- ISSU router support on the 7600 router (see the “ISSU and eFSU on Cisco 7600 Series Routers” chapter in the [Cisco 7600 Series Cisco IOS Software Configuration Guide](#) , Release 12.2SR)

Restrictions for NSF SSO ISSU Support for VPLS

The NSF/SSO/ISSU Support for VPLS feature has the following restrictions:

- NSF/SSO/ISSU support for VPLS does not include support for PWs to auto discovered neighbors via Border Gateway Protocol (BGP). Statically configured neighbors are supported.
- For supported hardware, see the Cisco Release 12.2SR Release Notes.
- NSF/SSO/ISSU support for VPLS does not include support for line cards that do not support Minimal Disruptive Restart (MDR) or pre downloading of firmware or driver code.

Information About NSF SSO ISSU Support for VPLS

How NSF SSO Works with VPLS

VPLS with NSF/SSO support improves the availability of service provider networks that use VPLS for multipoint Layer 2 VPN services. HA minimizes service disruptions that can occur if a system failure occurs. To address failures, VPLS HA includes SSO and NSF mechanisms using a standby Route Processor (RP) to provide control-plane redundancy. VPLS NSF is achieved by SSO and NSF mechanisms.

While the standby RP transitions to the active RP, packet forwarding either continues forwarding on line card(s) or packet forwarding is switched over (switchover) to other hardware devices associated with the newly active RP.

How ISSU Works with VPLS

In conjunction with VPLS NSF/SSO, VPLS HA includes ISSU, a comprehensive in-service upgrade solution for the IP/MPLS edge. ISSU minimizes network downtime due to software upgrades and maintenance activities. ISSU allows upgrades or downgrades to Cisco IOS software images with no effect on the control plane and minimal effect on system packet forwarding. With ISSU, all message data structures used for checkpointing, and exchanges between the active RP and standby RP are versioned.

To perform an in-service upgrade, the standby RP in a dual RP-based platform (such as the Cisco 7600 router) is first loaded with the desired Cisco IOS software release. The standby RP then comes up as a hot-standby RP with an upgraded version of the software, and a switchover is performed to transfer control to the standby RP and run the upgraded image.

During the ISSU procedure, supported SSO protocols and features maintain their session states with no disruption of the Layer 2 protocol sessions. Cisco NSF technology is used to continue packet forwarding during the software upgrade procedure while the routing information is re-created on the newly active RP. The result is a seamless software upgrade for an IP/MPLS provider edge router with no disruptions to Layer 2 protocol sessions and minimal effect on packet forwarding.

Benefits

Primary benefits for ISSU are:

- Rapid, nondisruptive feature deployment—By preserving user sessions and minimizing packet loss during software upgrades, ISSU helps enable rapid, nondisruptive deployments for new features and services at the IP/MPLS provider edge.
- Comprehensive solution for planned downtime—ISSU addresses the entire spectrum of software upgrade needs, from applying caveat fixes to deploying new features and services, and delivers a comprehensive solution for addressing planned network downtime.
- Increased operational efficiencies—ISSU minimizes and streamlines planned downtime and helps enable operational process changes for software deployment, significantly decreasing planned downtime effort and expenses and increasing operational efficiency.

How to Configure NSF SSO ISSU Support for VPLS

Configuring VPLS

VPLS must be configured on the router. See the “Virtual Private LAN Services on the Optical Services Modules” chapter in the [Cisco 7600 Series Router Cisco IOS Software Configuration Guide](#), Release 12.2SR for information on configuring VPLS.

Configuring NSF SSO Any Transport over MPLS

You must configure the NSF/SSO: Any Transport over MPLS feature on the router. See the NSF/SSO—Any Transport over MPLS and AToM Graceful Restart feature module for information on configuring the NSF/SSO: Any Transport over MPLS feature.

Configuring NSF SSO Router support

You must configure NSF/SSO router support on the Cisco 7600 router. See the “Configuring NSF with SSO Supervisor Engine Redundancy” chapter in the [Cisco 7600 Series Cisco IOS Software Configuration Guide](#), Release 12.2SR for information on configuring the NSF with SSO Supervisor Engine Redundancy feature.

Configuring ISSU Router Support

You must configure ISSU router support on the Cisco 7600 router.

- See the “ISSU and eFSU on Cisco 7600 Series Routers” chapter in the [Cisco 7600 Series Cisco IOS Software Configuration Guide](#), Release 12.2SR for information on configuring ISSU and Enhanced Fast Software Upgrade (eFSU) on Cisco 7600 series routers.

Verifying and Troubleshooting NSF SSO ISSU Support for VPLS

To verify the NSF/SSO/ISSU Support for VPLS configuration, use the following show and debug commands:

- 1 **show checkpoint clients**
- 2 **show vfi [name *vfi-name*] checkpoint [summary]**
- 3 **debug cwan atom**
- 4 **debug cwan ltl**
- 5 **debug issu client negotiation**
- 6 **debug issu client registration**
- 7 **debug issu client transform**
- 8 **debug vfi checkpoint**

SUMMARY STEPS

1. **show checkpoint clients**
2. **show vfi [name *vfi-name*] checkpoint [summary]**
3. **debug cwan atom**
4. **debug cwan ltl**
5. **debug issu client negotiation**
6. **debug issu client registration**
7. **debug issu client transform [clientID *client-id*]**
8. **debug vfi checkpoint**

DETAILED STEPS

Step 1 show checkpoint clients

Use this command to display information about checkpoint clients:

Example:

```
Router# show checkpoint clients
Check Point List of Clients
CHKPT on ACTIVE server.
-----
Client Name          Client  Entity  Bundle
                   ID      ID      Mode
-----
CHKPT Test client    1      --      On
Total API Messages Sent:      0
Total IPC Sent:                0
Total Message Len:            0
Total Bytes Allocated:        0
Buffers Held:                  0
IPC Frag Count:                0
IPC HW mark:                   0
IPC Sends w/Flow Off:         0
Send Errs:                     0
Send Peer Errs:                0
Rcv Xform Errs:                0
Xmit Xform Errs:               0
Incompatible Messages:        0
-----
Client Name          Client  Entity  Bundle
                   ID      ID      Mode
-----
Network RF Client    3      --      Off
Total API Messages Sent:      10
Total IPC Sent:                10
Total Message Len:            2144
Total Bytes Allocated:        2904
Buffers Held:                  0
IPC Frag Count:                0
IPC HW mark:                   0
IPC Sends w/Flow Off:         0
Send Errs:                     0
Send Peer Errs:                0
Rcv Xform Errs:                0
Xmit Xform Errs:               0
Incompatible Messages:        0
-----
Client Name          Client  Entity  Bundle
                   ID      ID      Mode
--More--
.
.
.
```

Step 2 show vfi [name vfi-name] checkpoint [summary]

Use this command to display checkpoint information related to a specific virtual forwarding instance (VFI) named H-VPLS-A-VFI:

Example:

```
Router# show vfi name H-VPLS-A-VFI checkpoint
VFI Active RP
Checkpointing: Allowed
ISSU Client id: 2092, Session id: 65543, Compatible with peer
```

```

Bulk-sync          VFI      VFI AC      VFI PW
Checkpoint failures: 0        3          21
Recovered at switchover: 0        0          0
Recovery failures: 0        0          0
Legend: C=Checkpointed
VFI name: H-VPLS-A-VFI, state: up, type: multipoint
VPN ID: 12, Internal ID 1 C
Local attachment circuits:
Vlan200 16387 / 8195 C
Neighbors connected via pseudowires:
Peer ID      VC ID      SSM IDs
10.0.0.12   12        4096 / 12292      C
10.0.0.15   12        8193 / 16389      C
10.0.0.14   12        12290 / 20486     C

```

Step 3 **debug cwan atom**

Use this command to enable debugging of Any Transport over MPLS (AToM) platform events.

The following example shows debug message output that appears when debugging is enabled and a PW port is configured and then unconfigured:

Example:

```

Router# debug cwan atom
ConstWan Generic AToM debugging is on
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router#(config)# 12 vfi VPLS-2000 manual
Router#(config-vfi)# vpn id 2000

Router#(config-vfi)# neighbor 10.1.1.1 encapsulation mpls
Router#(config-vfi)#
01:16:36: cwan_rp_vfi_atom_provision_vlan PROV[VFI-ATOM]: plat_index(0xC7D00084) vlanid(2000)
pseudo_port(0x84) vfi_plat_index(0xC7D00084) seginfo(0x53D38220) segtype(25) seghandle(0x53AEE074)
split-horizon(On) cwan_atom_intfs(3) vfi_vcs(3) spoke_vcs(0)
Router#(config-vfi)# end
Router# debug cwan atom
ConstWan Generic AToM debugging is on
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# 12 vfi VPLS-2000
Router(config-vfi)# no neighbor 10.1.1.1 encapsulation mpls
Router(config-vfi)#
01:27:18: cwan_rp_vfi_atom_unprovision_vlan: UNPROV[VFI-ATOM]: circ_index(0xC7D00084) is_vfi(1)
vlan(2000) vfi_vcs(3) spoke_vcs(0) split horizon(On)
01:27:18: cwan_atom_vlan_remove_rp: Vlan2000 ip_iw(0) ip_enabled(0)
Router#(config-vfi)# end

```

Step 4 **debug cwan ltl**

Use this command to enable debugging of Local Target Manager (LTL) debugging events and errors.

The following example shows debug message outputs that appear when debugging is enabled and a PW port is configured and then unconfigured:

Example:

```

Router# debug cwan ltl
ConstWan LTL manager debugging is on
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router#(config)# 12 vfi VPLS-2000 manual
Router#(config-vfi)# vpn id 2000
Router#(config-vfi)# neighbor 10.1.1.1 encapsulation mpls
Router#(config-vfi)#

```

```

01:17:35: CWAN LTL MGR: Port 133 is free to use for VPLS with vlan 2000 - tx_tvc(0x9F404)
Router#(config-vfi)# end
Router# debug cwan ltl
ConstWan LTL manager debugging is on
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# 12 vfi VPLS-2000 manual

Router(config-vfi)# no neighbor 10.1.1.1 encapsulation mpls
Router(config-vfi)#
01:29:05: CWAN LTL MGR: DELETE VPLS PW vlan(2000) pseudo_slotunit(133)
Router(config-vfi)# end

```

Step 5**debug issu client negotiation**

Use this command to enable debugging of ISSU client negotiation events and errors:

Example:

```

Router# debug issu client negotiation
*Jun 5 22:41:47.332: VFI ISSU: Negotiation rc ISSU_RC_NEGO_DONE, compatible
*Jun 5 22:41:47.332: ATOM HA: CID 84 Seq 230 Event RF_PROG_STANDBY_CONFIG Op 0 State ACTIVE Peer
STANDBY COLD-CONFIG
*Jun 5 22:41:47.432: ATOM ISSU: Propose L2HW cap 0xFFFF rc 0
*Jun 5 22:41:47.532: ATOM ISSU: Active negotiator, accept compatible L2HW cap 0xFFFF
*Jun 5 22:41:48.232: ATOM ISSU: Negotiation rc ISSU_RC_NEGO_DONE, compatible
*Jun 5 22:41:50.836: cwan_atom_issu_start_nego_session: Start session negotiation
*Jun 5 22:41:50.836: cwan_atom_issu_start_nego_session: Started nego successfully,
rc=ISSU_RC_NEGO_NOT_DONE
*Jun 5 22:41:50.836: cwan_atom_issu_receive_nego_msg: Start, cwan_atom_issu_nego_done=0
*Jun 5 22:41:50.840: cwan_atom_issu_receive_nego_msg: issu_receive_nego_msg rc=ISSU_RC_NEGO_NOT_DONE
*Jun 5 22:41:50.940: cwan_atom_issu_receive_nego_msg: Start, cwan_atom_issu_nego_done=0
*Jun 5 22:41:50.940: cwan_atom_issu_receive_nego_msg: issu_receive_nego_msg rc=ISSU_RC_NEGO_NOT_DONE
*Jun 5 22:41:51.040: cwan_atom_issu_receive_nego_msg: Start, cwan_atom_issu_nego_done=0
*Jun 5 22:41:51.040: cwan_atom_issu_receive_nego_msg: issu_receive_nego_msg rc=ISSU_RC_NEGO_NOT_DONE
*Jun 5 22:41:51.140: cwan_atom_issu_receive_nego_msg: Start, cwan_atom_issu_nego_done=0
*Jun 5 22:41:51.140: cwan_atom_issu_receive_nego_msg: issu_receive_nego_msg rc=ISSU_RC_NEGO_NOT_DONE
*Jun 5 22:41:51.240: cwan_atom_issu_receive_nego_msg: Start, cwan_atom_issu_nego_done=0
*Jun 5 22:41:51.240: cwan_atom_issu_receive_nego_msg: issu_receive_nego_msg rc=ISSU_RC_NEGO_NOT_DONE
*Jun 5 22:41:51.340: cwan_atom_issu_receive_nego_msg: Start, cwan_atom_issu_nego_done=0
*Jun 5 22:50:40.156: VFI ISSU: Negotiation rc ISSU_RC_NEGO_DONE, compatible
*Jun 5 22:50:40.156: ATOM HA: CID 84 Seq 230 Event RF_PROG_STANDBY_CONFIG Op 0 State ACTIVE Peer
STANDBY COLD-CONFIG
*Jun 5 22:50:40.256: ATOM ISSU: Passive negotiator, accept compatible L2HW cap 0xFFFF
*Jun 5 22:50:40.964: ATOM ISSU: Negotiation rc ISSU_RC_NEGO_DONE, compatible
*Jun 5 22:50:43.516: cwan_atom_issu_start_nego_session: Start session negotiation
*Jun 5 22:50:43.516: cwan_atom_issu_start_nego_session: Started nego successfully,
rc=ISSU_RC_NEGO_NOT_DONE
*Jun 5 22:50:43.520: cwan_atom_issu_receive_nego_msg: Start, cwan_atom_issu_nego_done=0
*Jun 5 22:50:43.520: cwan_atom_issu_receive_nego_msg: issu_receive_nego_msg rc=ISSU_RC_NEGO_NOT_DONE
*Jun 5 22:50:43.620: cwan_atom_issu_receive_nego_msg: Start, cwan_atom_issu_nego_done=0
*Jun 5 22:50:43.620: cwan_atom_issu_receive_nego_msg: issu_receive_nego_msg rc=ISSU_RC_NEGO_NOT_DONE
*Jun 5 22:50:43.720: cwan_atom_issu_receive_nego_msg: Start, cwan_atom_issu_nego_done=0
*Jun 5 22:50:43.720: cwan_atom_issu_receive_nego_msg: issu_receive_nego_msg rc=ISSU_RC_NEGO_NOT_DONE
*Jun 5 22:50:43.820: cwan_atom_issu_receive_nego_msg: Start, cwan_atom_issu_nego_done=0
*Jun 5 22:50:43.820: cwan_atom_issu_receive_nego_msg: issu_receive_nego_msg rc=ISSU_RC_NEGO_NOT_DONE
*Jun 5 22:50:43.920: cwan_atom_issu_receive_nego_msg: Start, cwan_atom_issu_nego_done=0
*Jun 5 22:50:43.920: cwan_atom_issu_receive_nego_msg: issu_receive_nego_msg rc=ISSU_RC_NEGO_NOT_DONE
*Jun 5 22:50:44.020: cwan_atom_issu_receive_nego_msg: Start, cwan_atom_issu_nego_done=0

```

Step 6**debug issu client registration**

Use this command to enable debugging of ISSU client registration events and errors.

After the peer router reloads, the following debug messages appear:

Example:

```

Router# debug issu client registration
Router#
00:42:21: VFI ISSU: Unregistered ISSU session 0, ISSU_RC_OK
00:42:21: %LINK-3-UPDOWN: Interface GigabitEthernet6/2, changed state to down
00:42:21: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet6/2, changed state to down
00:42:21: %LINK-3-UPDOWN: Interface Vlan2000, changed state to down
00:42:21: %LINK-3-UPDOWN: Interface Vlan2001, changed state to down
00:42:21: %LINK-3-UPDOWN: Interface Vlan2002, changed state to down
Router#
00:42:21: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan2000, changed state to down
00:42:21: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan2001, changed state to down
00:42:21: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan2002, changed state to down
Router#
00:49:01: %LINK-3-UPDOWN: Interface GigabitEthernet6/2, changed state to down
00:49:02: %LINK-3-UPDOWN: Interface GigabitEthernet6/2, changed state to up
PE-3#
00:49:05: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet6/2, changed state to up
Router#
00:49:35: %LINK-3-UPDOWN: Interface Vlan2000, changed state to up
00:49:35: %LINK-3-UPDOWN: Interface Vlan2001, changed state to up
00:49:35: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan2000, changed state to up
00:49:35: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan2001, changed state to up
00:49:35: %LINK-3-UPDOWN: Interface Vlan2002, changed state to up
Router#
00:49:35: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan2002, changed state to up
Router#
00:49:48: VFI ISSU: Registered session 131171, ISSU_RC_OK
Router#
00:50:08: %HA_CONFIG_SYNC-6-BULK_CFGSYNC_SUCCEED: Bulk Sync succeeded
Router#

```

Step 7 `debug issu client transform [clientID client-id]`

Use this command to enable debugging of ISSU client transform events and errors.

The following command example enables debug output for a specific ISSU client (clientID 2092). After the peer router reloads, the following debug messages appear:

Example:

```

Router# debug issu client transform clientID 2092
Router#
05:35:15: %LINK-3-UPDOWN: Interface GigabitEthernet6/2, changed state to down
05:35:15: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet6/2, changed state to down
05:35:15: %LINK-3-UPDOWN: Interface Vlan2000, changed state to down
05:35:15: %LINK-3-UPDOWN: Interface Vlan2001, changed state to down
05:35:15: %LINK-3-UPDOWN: Interface Vlan2002, changed state to down
Router#
05:35:15: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan2000, changed state to down
05:35:15: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan2001, changed state to down
05:35:15: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan2002, changed state to down
Router#
05:41:55: %LINK-3-UPDOWN: Interface GigabitEthernet6/2, changed state to down
05:41:56: %LINK-3-UPDOWN: Interface GigabitEthernet6/2, changed state to up
.
.
05:43:02: VFI ISSU: Xmit transform message 5, rc ISSU_RC_OK
05:43:02: ISSU Buffer dump @ 0x0817EC7C
05:43:02:    00 00 00 00
05:43:02: VFI ISSU: Xmit transform message 1, rc ISSU_RC_OK
05:43:02: %HA_CONFIG_SYNC-6-BULK_CFGSYNC_SUCCEED succeeded
Router#

```

Step 8 `debug vfi checkpoint`

Use this command to enable debugging VFI checkpointing events and errors:

Example:

```

Router# debug vfi checkpoint
Router# $may24_v1 6 slavedisk0:s72033-adventerprisek9_wan-mz.cflow_may24_v1
Router#
*Jun 5 22:37:17.268: ATom HA: CF status 3 not processed
*Jun 5 22:37:17.268: VFI HA: CF status 3 not processed
*Jun 5 22:37:17.296: AC HA RF: CId:83, Seq:228, Sta:RF_STATUS_PEER_COMM, Opr:0, St:ACTIVE, PSt:STANDBY
HOT
*Jun 5 22:37:17.296: VFI HA: CID 145, Seq 229, Status RF_STATUS_PEER_COMM, Op 0, State ACTIVE, Peer
STANDBY HOT
*Jun 5 22:37:17.296: ATom HA: CID 84, Seq 230, Status RF_STATUS_PEER_COMM, Op 0, State ACTIVE, Peer
STANDBY HOT
*Jun 5 22:37:17.444: ATom HA: CF status 3 not processed
*Jun 5 22:37:17.444: VFI HA: CF status 3 not processed
*Jun 5 22:37:17.268: %OIR-SP-3-PWRCYCLE: Card in module 6, is being power-cycled (RF request)
*Jun 5 22:37:17.792: AC HA RF: CId:83, Seq:228, Sta:RF_STATUS_PEER_PRESENCE, Opr:0, St:ACTIVE,
PSt:DISABLED
*Jun 5 22:37:17.792: VFI HA: CID 145, Seq 229, Status RF_STATUS_PEER_PRESENCE, Op 0, State ACTIVE,
Peer DISABLED
*Jun 5 22:40:40.244: SP-STDBY: SP: Currently running ROMMON from S (Gold) region
*Jun 5 22:40:45.028: %DIAG-SP-STDBY-6-RUN_MINIMUM: Module 6: Running Minimal Diagnostics...
*Jun 5 22:40:56.492: %DIAG-SP-STDBY-6-DIAG_OK: Module 6: Passed Online Diagnostics
*Jun 5 22:41:53.436: %SYS-SP-STDBY-5-RESTART: System restarted --
*Jun 5 22:42:12.760: VFI HA: CID 145 Seq 229 Event RF_PROG_STANDBY_BULK Op 0 State ACTIVE Peer
STANDBY COLD-BULK
*Jun 5 22:42:12.764: VFI HA: Ignore RF progression event, VFI Mgr process is not running, skipped
bulk sync
.
.
*Jun 5 22:42:16.948: %ISSU_PROCESS-SP-7-DEBUG: Peer state is [ STANDBY HOT ]; Please issue the
runversion command
*Jun 5 22:42:15.928: %PFREDUN-SP-STDBY-6-STANDBY: Ready for SSO mode
*Jun 5 22:42:16.956: %RF-SP-5-RF_TERMINAL_STATE: Terminal state reached for (SSO)
*Jun 5 22:42:16.112: %SYS-SP-STDBY-3-LOGGER_FLUSHED: System was paused for 00:00:00 to ensure console
debugging output.
Router#

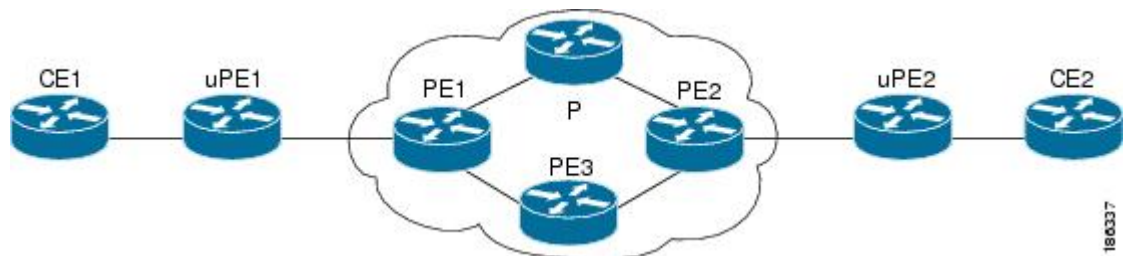
```

Configuration Examples for NSF SSO ISSU Support for VPLS

NSF SSO ISSU VPLS Example

The figure below shows a basic configuration of NSF/SSO/ISSU VPLS.

Figure 1: Basic NSF/SSO/ISSU VPLS Configuration



CE1

```

CE1_7206#
!
hostname CE1_7206
!
ip cef
!
interface Loopback0
  description - FULL MESH VPN
  ip address 10.0.0.0 10.255.255.255
!
interface FastEthernet0/0
  ip address 10.0.57.100 255.255.255.0
  no ip mroute-cache
  duplex half
  no cdp enable
!
interface FastEthernet1/0
  description - H-VPLS VPN to uPE1
  no ip address
  no ip mroute-cache
  duplex auto
  speed auto
!
interface FastEthernet1/0.1
  description - H-VPLS VPN to uPE1
  encapsulation dot1Q 121
  ip address 10.1.1.120 255.255.255.0
!
interface FastEthernet4/1
  description - FULL MESH VPN to PE1
  no ip address
  duplex auto
  speed auto
!
interface FastEthernet4/1.1
  description - FULL MESH VPN to PE1
  encapsulation dot1Q 120
  ip address 10.1.1.120 255.255.255.0
!
interface FastEthernet6/1
  description - VPWS VPN to PE1

```

```

no ip address
duplex auto
speed auto
!
interface FastEthernet6/1.1
description - VPWS VPN to PE1
encapsulation dot1q 122
ip address 10.1.1.120 255.255.255.0
!
router ospf 10
log-adjacency-changes
network 10.1.1.0 0.0.0.255 area 0
network 10.120.120.120 0.0.0.0 area 0
network 10.1.1.0 0.0.0.255 area 0
!
ip default-gateway 10.0.57.1
!
end

```

uPE1

```

uPE1_7609#
!
upgrade fpd auto
version 12.2
service timestamps debug datetime msec
service timestamps log datetime msec
service internal
!
hostname uPE1_7609
!
boot-start-marker
boot system flash disk0:s72033-adventerprisek9_wan_dbg-mz.xx
boot-end-marker
!
no aaa new-model
!
no ip domain lookup
ip host lab24 172.16.0.0
ip host dirt 172.16.0.19
!
vtp mode transparent
!
multilink bundle-name authenticated
mpls ldp graceful-restart
mpls ldp discovery targeted-hello accept
mpls label protocol ldp
!
!
spanning-tree mode pvst
spanning-tree extend system-id
!
redundancy
mode sso
main-cpu
auto-sync running-config
!
vlan internal allocation policy ascending
vlan dot1q tag native
vlan access-log ratelimit 2000
!
vlan 100
!
interface Loopback0
description - H-VPLS
ip address 10.0.0.0 255.255.255.255
!
interface GigabitEthernet1/1
description - H-VPLS to CE1
switchport
switchport trunk allowed vlan 10-1000

```

```

    switchport mode trunk
    !
interface GigabitEthernet5/2
  ip address 10.0.0.0 255.255.255.0
  media-type rj45
  no cdp enable
  !
interface GigabitEthernet9/0/0
  description - H-VPLS to PE1
  ip address 10.0.0.1 255.255.255.0
  negotiation auto
  mpls label protocol ldp
  mpls ip
  !
interface Vlan1
  no ip address
  shutdown
  !
router ospf 10
  log-adjacency-changes
  passive-interface Loopback0
  network 10.0.5.0 0.0.0.255 area 0
  network 10.0.0.8 0.0.0.0 area 0
  !
ip route 172.16.17.19 255.255.255.255 10.0.57.1
ip route 172.16.0.0 255.255.255.255 10.0.57.1
  !
mpls ldp router-id Loopback0 force
  !
control-plane
  !
end

```

PE1

```

PE1_7613#
!
upgrade fpd auto
service internal
!
hostname PE1_7613
!
boot-start-marker
boot system flash disk0:s72033-adventerprisek9_wan_dbg-mz.xxx
boot-end-marker
!
no aaa new-model
ip subnet-zero
!
!
no ip domain lookup
ip host dirt 172.16.0.0
ip host lab24 172.16.0.01
!
ipv6 mfib hardware-switching replication-mode ingress
!
mls ip multicast flow-stat-timer 9
no mls flow ip
no mls flow ipv6
no mls acl tcam share-global
mls cef error action freeze
multilink bundle-name authenticated
mpls ldp discovery targeted-hello accept
mpls label protocol ldp
!
!
spanning-tree mode pvst
no spanning-tree optimize bpdu transmission
spanning-tree extend system-id
!
redundancy

```

```
mode sso
main-cpu
  auto-sync running-config
!
vlan internal allocation policy ascending
vlan dot1q tag native
vlan access-log ratelimit 2000
l2 vfi vpls_auto autodiscovery
  vpn id 1
!
l2 vfi vpls_man manual
  vpn id 10
  neighbor 10.0.0.12 encapsulation mpls
  neighbor 10.0.0.11 encapsulation mpls
!
interface Loopback0
  description - FULL MESH
  ip address 10.0.0.9 255.255.255.255
!
interface Loopback1
  description - VPWS
  ip address 172.16.0.0 255.255.255.255
!
interface Loopback2
  description - H-VPLS
  ip address 10.0.0.0 255.255.255.255
!
interface GigabitEthernet7/2
  ip address 10.0.0.01 255.255.255.0
  media-type rj45
  no cdp enable
!
interface GigabitEthernet10/1
  description - FULL MESH to CE1
  switchport
  switchport trunk encapsulation dot1q
  switchport trunk allowed vlan 10-1000
  switchport mode trunk
!
interface GigabitEthernet10/2
  description - VPWS to CE1
  switchport
  switchport trunk encapsulation dot1q
  switchport trunk allowed vlan 10-1000
  switchport mode trunk
!
interface GigabitEthernet12/0/0
  description - H-VPLS to uPE1
  ip address 10.0.0.3 255.255.255.0
  negotiation auto
  mpls label protocol ldp
  mpls ip
!
interface GigabitEthernet12/0/1
  description - H-VPLS to nPE2
  ip address 10.0.0.1 255.255.255.0
  negotiation auto
  mpls label protocol ldp
  mpls ip
!
interface GigabitEthernet12/1/0
  description - VPWS to P
  ip address 10.0.0.3 255.255.255.0
  negotiation auto
  mpls label protocol ldp
  mpls ip
!
interface GigabitEthernet12/1/1
  description - FULL MESH to P
  ip address 10.0.2.0 255.255.255.0
  negotiation auto
  mpls label protocol ldp
  mpls ip
```

```

!
interface GigabitEthernet12/2/0
description - FULL MESH to PE3
ip address 10.1.0.3 255.255.255.0
negotiation auto
mpls label protocol ldp
mpls ip
!
interface Vlan1
no ip address
shutdown
!
interface Vlan10
no ip address
xconnect vfi vpls_auto
!
router ospf 10
! for FULL MESH
log-adjacency-changes
passive-interface Loopback0
network 10.1.1.0 0.0.0.255 area 0
network 10.2.2.0 0.0.0.255 area 0
network 10.5.5.0 0.0.0.255 area 0
network 10.9.9.9 0.0.0.0 area 0
network 10.0.0.02 0.0.0.255 area 0
network 10.0.0.04 0.0.0.0 area 0
network 10.0.0.5 0.0.0.0 area 0
!
router ospf 20
! for VPWS
log-adjacency-changes
passive-interface Loopback1
network 10.0.20.0 0.0.0.255 area 0
network 10.0.0.9 0.0.0.0 area 0
!
router bgp 1
bgp log-neighbor-changes
neighbor 10.0.11.0 remote-as 1
neighbor 10.0.10.0 update-source Loopback0
neighbor 10.0.12.0 remote-as 1
neighbor 10.0.0.12 update-source Loopback0
neighbor 10.0.0.32 remote-as 1
neighbor 10.0.0.31 update-source Loopback2
!
address-family ipv4
no synchronization
neighbor 10.0.11.0 activate
neighbor 10.12.0.0 activate
neighbor 10.0.32.0 activate
no auto-summary
exit-address-family
!
address-family l2vpn vpls
neighbor 10.0.0.11 activate
neighbor 10.0.11.0 send-community both
neighbor 10.12.0.0 activate
neighbor 10.0.0.12 send-community both
neighbor 10.0.0.32 activate
neighbor 10.0.32.0 send-community both
exit-address-family
!
ip default-gateway 10.0.57.1
ip route 172.16.0.0 255.255.255.255 10.0.57.1
ip route 172.16.0.2 255.255.255.255 10.0.57.1
!
mpls ldp router-id Loopback0 force
!
end

```

P

```
P_7206_g1#
!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname P_7206_g1
!
ip cef
ip host lab24 172.16.0.254
ip host dirt 172.16.0.129
!
mpls label protocol ldp
mpls ldp graceful-restart
mpls ldp discovery targeted-hello accept
!
interface Loopback0
  description - FULL MESH
  ip address 10.0.0.10 255.255.255.255
!
interface Loopback1
  description - VPWS
  ip address 10.0.0.1 255.255.255.255
!
!
interface GigabitEthernet1/0
  description - VPWS to PE1
  ip address 10.0.20.6 255.255.255.0
  negotiation auto
  mpls label protocol ldp
  mpls ip
!
interface GigabitEthernet2/0
  description - FULL MESH to PE1
  ip address 10.0.2.6 255.255.255.0
  negotiation auto
  mpls label protocol ldp
  mpls ip
!
interface GigabitEthernet3/0
  description - VPWS to PE2
  ip address 10.0.0.6 255.255.255.0
  negotiation auto
  mpls label protocol ldp
  mpls ip
!
interface GigabitEthernet4/0
  description - FULL MESH to PE2
  ip address 10.0.3.6 255.255.255.0
  negotiation auto
  mpls label protocol ldp
  mpls ip
!
router ospf 10
  ! for FULL MESH
  log-adjacency-changes
  passive-interface Loopback0
  network 10.0.2.6 0.0.0.0 area 0
  network 10.0.2.0 0.0.0.255 area 0
  network 10.0.3.6 0.0.0.0 area 0
  network 10.0.3.0 0.0.0.255 area 0
  network 10.0.0.0 0.0.0.255 area 0
!
router ospf 20
  ! for VPWS
  log-adjacency-changes
  passive-interface Loopback1
  network 10.0.20.0 0.0.0.255 area 0
  network 10.21.0.0 0.0.0.255 area 0
```

```

    network 10.0.10.0 0.0.0.0 area 0
    !
router bgp 1
  no synchronization
  bgp log-neighbor-changes
  neighbor 10.0.9.9 remote-as 1
  neighbor 10.9.0.9 update-source Loopback0
  neighbor 10.11.0.11 remote-as 1
  neighbor 10.0.11.0 update-source Loopback0
  no auto-summary
  !
ip default-gateway 10.0.0.0
  !
mpls ldp router-id Loopback0 force
  !

```

PE2

```

PE2_7606#
!
upgrade fpd auto
!
service internal
service counters max age 10
!
hostname PE2_7606
!
boot-start-marker
boot system flash disk0:s72033-adventerprisek9_wan_dbg-mz.xx
boot-end-marker
!
no aaa new-model
!
ipv6 mfib hardware-switching replication-mode ingress
!
mls ip multicast flow-stat-timer 9
!
multilink bundle-name authenticated
mpls ldp graceful-restart
mpls ldp discovery targeted-hello accept
mpls label protocol ldp
!
spanning-tree mode pvst
no spanning-tree optimize bpdu transmission
spanning-tree extend system-id
!
!
redundancy
  mode sso
  main-cpu
  auto-sync running-config
!
vlan internal allocation policy ascending
vlan dot1q tag native
vlan access-log ratelimit 2000
!
l2 vfi vpls_auto autodiscovery
  vpn id 1
!
l2 vfi vpls_manual manual
  vpn id 10
  neighbor 10.0.0.9 encapsulation mpls
  neighbor 10.0.0.11 encapsulation mpls
!
interface Loopback0
  description - FULL MESH
  ip address 10.0.0.12 255.255.255.255
!
interface Loopback1
  description - VPWS
  ip address 10.0.0.112 255.255.255.255

```



```

!
interface Loopback2
description - H-VPLS
ip address 10.0.32.0 255.255.255.255
!
interface GigabitEthernet2/1
description - FULL MESH to CE2
switchport
switchport trunk allowed vlan 10-1000
switchport mode trunk
!
interface GigabitEthernet4/0/0
description - FULL MESH to PE3
ip address 10.0.4.0 255.255.255.0
negotiation auto
mpls label protocol ldp
mpls ip
!
interface GigabitEthernet4/1/0
description - VPWS to P
ip address 10.0.21.0 255.255.255.0
negotiation auto
mpls label protocol ldp
mpls ip
!
interface GigabitEthernet4/1/1
description - FULL MESH to P
ip address 10.0.3.4 255.255.255.0
negotiation auto
mpls label protocol ldp
mpls ip
!
interface GigabitEthernet4/3/0
description - VPWS to CE2
no ip address
shutdown
negotiation auto
!
interface GigabitEthernet4/3/1
description - H-VPLS to nPE1
ip address 10.0.0.3 255.255.255.0
negotiation auto
mpls label protocol ldp
mpls ip
!
interface GigabitEthernet5/2
ip address 10.0.5.0 255.255.255.0
media-type rj45
no cdp enable
!
interface Vlan1
no ip address
shutdown
!
interface Vlan10
no ip address
shutdown
xconnect vfi vpls_auto
!
router ospf 10
log-adjacency-changes
passive-interface Loopback0
network 10.0.3.4 0.0.0.0 area 0
network 10.0.4.0 0.0.0.255 area 0
network 10.0.6.4 0.0.0.0 area 0
network 10.0.0.5 0.0.0.255 area 0
network 10.0.0.12 0.0.0.0 area 0
network 10.0.32.0 0.0.0.0 area 0
network 10.0.1.0 0.0.0.0 area 0
!
router bgp 1
no bgp default ipv4-unicast
bgp log-neighbor-changes

```

```

bgp update-delay 1
neighbor 10.0.0.9 remote-as 1
neighbor 10.0.9.0 update-source Loopback0
neighbor 10.0.11.0 remote-as 1
neighbor 10.0.0.11 update-source Loopback0
neighbor 10.0.29.0 remote-as 1
neighbor 10.0.0.29 update-source Loopback2
!
address-family ipv4
no synchronization
no auto-summary
exit-address-family
!
address-family l2vpn vpls
neighbor 10.0.0.9 activate
neighbor 10.0.9.0 send-community both
neighbor 10.0.11.0 activate
neighbor 10.0.0.11 send-community both
neighbor 10.0.0.2 activate
neighbor 10.0.0.3 send-community both
exit-address-family
!
ip default-gateway 10.0.0.1
ip route 172.16.0.0 255.255.255.255 10.0.57.1
ip route 172.16.0.254 255.255.255.255 10.0.57.1
!
mpls ldp router-id Loopback0 force
!
end

```

uPE2

```

uPE2_7606#
!
upgrade fpd auto
version 12.2
service timestamps debug uptime
service timestamps log uptime
service internal
!
hostname uPE2_7606
!
boot-start-marker
boot system flash disk0:s72033-adventerprisek9_wan_dbg-mz.xx
boot-end-marker
!
ipv6 mfib hardware-switching replication-mode ingress
!
multilink bundle-name authenticated
mpls ldp graceful-restart
mpls ldp discovery targeted-hello accept
mpls label protocol ldp
!
spanning-tree mode pvst
no spanning-tree optimize bpdu transmission
spanning-tree extend system-id
!
power redundancy-mode combined
!
redundancy
mode sso
main-cpu
auto-sync running-config
!
vlan internal allocation policy ascending
vlan dot1q tag native
vlan access-log ratelimit 2000
!
interface Loopback0
description - H-VPLS
ip address 10.0.0.13 255.255.255.255

```

```

!
interface FastEthernet3/1
description - H-VPLS to CE2
switchport
switchport trunk encapsulation dot1q
switchport trunk allowed vlan 10-1000
switchport mode trunk
!
interface GigabitEthernet4/0/0
description - H-VPLS to uPE2
ip address 10.0.0.2 255.255.255.0
negotiation auto
mpls label protocol ldp
mpls ip
!
interface GigabitEthernet5/2
ip address 10.0.0.11 255.255.255.0
media-type rj45
no cdp enable
!
interface Vlan1
no ip address
shutdown
!
router ospf 10
log-adjacency-changes
passive-interface Loopback0
network 10.0.6.0 0.0.0.255 area 0
network 10.0.0.13 0.0.0.0 area 0
!
ip default-gateway 10.0.0.1
ip route 172.16.1.129 255.255.255.255 10.0.57.1
ip route 172.16.192.254 255.255.255.255 10.0.57.1
!
mpls ldp router-id Loopback0 force
!
control-plane
!
end

```

CE2

```

CE2_7206#
!
hostname CE2_7206
!
ip cef
!
interface Loopback0
ip address 10.0.0.123 255.255.255.255
!
interface FastEthernet1/0
description - H-VPLS VPN to uPE2
no ip address
no ip mroute-cache
duplex auto
speed auto
!
interface FastEthernet1/0.1
description - H-VPLS VPN to uPE2
encapsulation dot1Q 10
ip address 10.0.0.121 255.255.255.0
!
interface Ethernet2/0
ip address 10.0.0.97 255.255.255.0
no ip mroute-cache
duplex half
no cdp enable
!
interface FastEthernet4/0
description - FULL MESH VPN to PE2

```

```

no ip address
no ip mroute-cache
duplex auto
speed auto
!
interface FastEthernet4/0.1
description - FULL MESH VPN to PE2
encapsulation dot1Q 10
ip address 10.0.0.121 255.255.255.0
!
interface GigabitEthernet5/0
description - VPWS VPN to PE2
no ip address
no ip mroute-cache
no negotiation auto
!
interface GigabitEthernet5/0.1
description - VPWS VPN to PE2
encapsulation dot1Q 10
ip address 10.0.0.121 255.255.255.0
!
router ospf 10
log-adjacency-changes
network 10.0.1.0 0.0.0.255 area 0
network 10.0.0.1 0.0.0.255 area 0
network 10.0.0.123 0.0.0.0 area 0
!
ip default-gateway 10.0.0.4
!
end

```

PE3

```

PE3_7606#
!
upgrade fpd auto
version 12.2
service timestamps debug uptime
service timestamps log uptime
service internal
!
hostname PE3_7606
!
boot-start-marker
boot system flash disk0:s72033-adventerprisek9_wan_dbg-mz.xx
boot-end-marker
!
ipv6 mfib hardware-switching replication-mode ingress
!
multilink bundle-name authenticated
mpls ldp graceful-restart
mpls ldp discovery targeted-hello accept
mpls label protocol ldp
!
spanning-tree mode pvst
no spanning-tree optimize bpdu transmission
spanning-tree extend system-id
!
redundancy
mode sso
main-cpu
auto-sync running-config
!
vlan internal allocation policy ascending
vlan dot1q tag native
vlan access-log ratelimit 2000
l2 vfi vpls_auto autodiscovery
vpn id 1
!
l2 vfi vpls_manual manual
vpn id 10

```

```

neighbor 10.0.9.9 encapsulation mpls
neighbor 10.0.0.12 encapsulation mpls
!
interface Loopback0
description - FULL MESH
ip address 10.0.0.11 255.255.255.255
!
interface Loopback1
description - H-VPLS
ip address 10.0.0.31 255.255.255.255
!
interface GigabitEthernet3/2/1
description - FULL MESH to PE1
ip address 10.0.0.5 255.255.255.0
negotiation auto
mpls label protocol ldp
mpls ip
!
interface GigabitEthernet5/2
ip address 10.0.0.115 255.255.255.0
media-type rj45
no cdp enable
!
interface GigabitEthernet6/2
description - FULL MESH to CE3
switchport
switchport trunk encapsulation dot1q
switchport trunk allowed vlan 10-1000
switchport mode trunk
no cdp enable
!
interface Vlan1
no ip address
shutdown
!
router ospf 10
log-adjacency-changes
passive-interface Loopback0
network 10.0.4.0 0.0.0.255 area 0
network 10.0.0.11 0.0.0.0 area 0
network 10.0.31.0 0.0.0.0 area 0
!
router bgp 1
no bgp default ipv4-unicast
bgp log-neighbor-changes
bgp update-delay 1
neighbor 10.0.0.9 remote-as 1
neighbor 10.0.9.0 update-source Loopback0
neighbor 10.0.12.0 remote-as 1
neighbor 10.0.0.12 update-source Loopback0
!
address-family ipv4
no synchronization
no auto-summary
exit-address-family
!
address-family l2vpn vpls
neighbor 10.0.9.0 activate
neighbor 10.0.0.9 send-community both
neighbor 10.0.0.12 activate
neighbor 10.0.12.0 send-community both
exit-address-family
!
ip default-gateway 10.0.57.1
ip route 172.16.0.129 255.255.255.255 10.0.57.1
ip route 172.16.0.254 255.255.255.255 10.0.57.1
!
mpls ldp router-id Loopback0 force
!
end

```

Additional References

The following sections provide references related to the NSF/SSO/ISSU Support for VPLS feature.

Related Documents

Related Topic	Document Title
Stateful switchover	Stateful Switchover
MPLS Label Distribution Protocol	MPLS Label Distribution Protocol (LDP)
Cisco nonstop forwarding	Cisco Nonstop Forwarding
Any Transport over MPLS	Any Transport over MPLS
NSF/SSO: Any Transport over MPLS	NSF/SSO—Any Transport over MPLS and AToM Graceful Restart
L2VPN Interworking configuration	L2VPN Interworking
VPLS	See the “Virtual Private LAN Services on the Optical Services Modules” chapter in the Cisco 7600 Series Router Cisco IOS Software Configuration Guide , Release 12.2SR)
VPLS Autodiscovery	See VPLS Autodiscovery: BGP Based and BGP Support for the L2VPN Address Family
NSF/SSO router support on the 7600 router	See the “Configuring NSF with SSO Supervisor Engine Redundancy” chapter in the Cisco 7600 Series Cisco IOS Software Configuration Guide , Release 12.2SR
ISSU router support on the 7600 router	See the “ISSU and eFSU on Cisco 7600 Series Routers” chapter in the Cisco 7600 Series Cisco IOS Software Configuration Guide , Release 12.2SR

Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	—

MIBs

MIB	MIBs Link
MPLS Label Distribution Protocol MIB Version 8 Upgrade	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
RFC 3036	<i>LDP Specification</i>
RFC 3478	<i>Graceful Restart Mechanism for Label Distribution</i>

Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	http://www.cisco.com/techsupport

Feature Information for NSF SSO ISSU Support for VPLS

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 1: Feature Information for NSF/SSO/ISSU Support for VPLS

Feature Name	Releases	Feature Information
NSF/SSO/ISSU Support for VPLS	12.2(33)SRC	<p>Virtual Private LAN Services (VPLS), with NSF/SSO/ISSU support, improves the availability of service provider networks that use VPLS for multipoint Layer 2 VPN services. Cisco nonstop forwarding (NSF) with stateful switchover (SSO) is effective at increasing availability of network services.</p> <p>In 12.2(33)SRC, this feature was introduced on the Cisco 7600 router.</p>