# Configuring Cisco StackWise Virtual


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# Prerequisites for Cisco StackWise Virtual

- All the switches in a Cisco StackWise Virtual solution must be of the same switch model.
- The supervisor modules in a Cisco StackWise Virtual solution must be of the same model.
- The supervisor module in each switch should be inserted in symmetrical slots. For example, in a Cisco Catalyst 9407R Switch, if you have installed the supervisor module in slot 3, ensure that the second switch also has the supervisor module installed in slot 3.

  For chassis slot restrictions, refer to the Cisco Catalyst 9400 Series Supervisor Module Installation Note.
- All the switches in a Cisco StackWise Virtual solution must be running the same license level.
- All the switches in a Cisco StackWise Virtual solution must be running the same software version.
- All the switches in a Cisco StackWise Virtual solution must be running the same SDM template.
- All the ports used for configuring a StackWise Virtual Link (SVL) must share the same speed. For example, you cannot configure a 10G or a 40G port to form an SVL, simultaneously.
- When configuring SVLs and dual-active detection (DAD) links on line cards, we recommend that you perform the following:
  - Enable autoLC shutdown on line cards. Auto line card shutdown feature allows you to configure line card power priority to enable the hardware to automatically shutdown least priority line cards in power constraint mode.

- Configure higher priority for line cards that have SVLs and DAD links configured. This ensures that in situations with insufficient power, the linecards with SVLs and DAD links will be reloaded last.

You can configure autoLC shutdown and line card power priority by using the **power supply autoLC** [ **priority** *physical-slot-number* ] [**shutdown**] command in global configuration mode.

On a switch stack, use the **power supply switch** *switch-number* **autoLC** [ **priority** *physical-slot-number* ] [**shutdown**] command.

- When downgrading an IOS image on a device, if certain LCs are not supported in the lower version of the IOS image, do one of the following:
  - Physically remove the line cards that will not be supported by the lower IOS version.
  - After the downgrade, change the offline provisioning to a supported LC, and remove the offline provisioning for the LC slot.

# Restrictions for Cisco StackWise Virtual

- Cisco StackWise Virtual configuration commands will be recognized only on a switch running Network Advantage license. The configuration commands will not be recognized on a Network Essentials license.
- Cisco StackWise Virtual can be configured only on one supervisor module per chassis. You must not install two supervisor modules in each chassis used in the Cisco StackWise Virtual solution.
- When deploying Cisco StackWise Virtual, ensure that VLAN ID 4094 is not used anywhere on the network. All inter-chassis system control communication between stack members is carried over the reserved VLAN ID 4094 from the global range.
- Only Cisco Transceiver Modules are supported.
- 100G transceiver modules are not supported on SVL interfaces.
- The interface VLAN MAC address that is assigned by default, can be overridden using the **mac-address** command. If this command is configured on a single SVI or router port that requires Layer 3 injected packets, all other SVIs or routed ports on the device also must be configured with the same first four most significant bytes (4MSB) of the MAC address. For example, if you set the MAC address of any SVI to xxxx.yyyy.zzzz, set the MAC address of all other SVIs to start with xxxx.yyyy. If Layer 3 injected packets are not used, this restriction does not apply.

**Note** This applies to all Layer 3 ports, SVIs, and routed ports. This does not apply to GigabitEthernet0/0 port.

- Broadcast, Unknown Unicast and Multicast (BUM) Traffic Optimization is not applicable to VLANs with standalone or physical ports.
- On Cisco Catalyst C9400X-SUP-2 and C9400X-SUP-2XL Supervisor Modules and C9400-LC-12QC and C9400-LC-24XY line cards, the multi-rate SFPs are supported. Multi-rate SFPs are not preferred for SVL or DAD links because auto-negotiation may lead to speed mismatches on some ports. If they are used, set both sides to the same speed; highest speed is recommended (example, 25G for SFP-10/25G

and 100G for QSFP-40/100G). Also, both sides of the link should be multi-rate SFPs and all the other SVL or DAD link ports should use multi-rate SFPs. Use the **show interfaces transceiver** command to view the physical properties of SFPs used in the device.

- When you disable SVL/DAD on a 100G port that is using a multi-rate SFP, you must manually configure the port to speed 100000 for the next reload.
- We recommend not to use **shutdown** or **no shutdown** commands or perform OIR operations such as removal and insertion of the line cards that have SVLs and DAD links configured.

# Information About Cisco StackWise Virtual

## Cisco StackWise Virtual on Cisco Catalyst 9400 Series Switches

This section describes the Cisco StackWise Virtual features specific to Cisco Catalyst 9400 Series Switches.

- Cisco StackWise Virtual is supported on Cisco Catalyst 9400 Series supervisor 1 module (C9400-SUP-1) and Cisco Catalyst 9400 Series supervisor 1XL module (C9400-SUP-1XL/C9400-SUP-1XL-Y). The feature requires a special, additional, C9400-SUP-UPG-LIC= license with Cisco Catalyst 9400 Series supervisor 1 module (C9400-SUP-1). Cisco StackWise Virtual is also supported on Cisco Catalyst 9400X series supervisor 2 module (C9400X-SUP-2) and Cisco Catalyst 9400 Series supervisor 2XL module (C9400X-SUP-2XL).
- Cisco StackWise Virtual is supported on Cisco Catalyst 9404R, Cisco Catalyst 9407R, and Catalyst 9410R switches.
- You can configure SVLs and DAD links on Cisco Catalyst 9400 Series supervisor modules and select Ethernet switching modules (line cards). SVL connections are established through 10G, 40G, 25G, or 100G uplink ports on the supervisor modules and 10G, 25G, 40G, and 100G downlink ports on the line cards. Starting with Cisco IOS XE Cupertino 17.9.1, SVL Links are supported on C9400X-SUP-2 and C9400X-SUP-2XLsupervisor modules.

  Starting with Cisco IOS XE Cupertino 17.12.1, support for SVL Links are supported on C9400-LC-12QC and C9400-LC-24XY line cards. When SVL connection is established through on ports 9 through 12 on C9400-LC-12QC, they are automatically enabled with 100G port speed even if they have not been configured to support 100G and one of the ports from 5 to 8, belonging to the same port group, is disabled.

  For information about supported supervisor modules, line cards, and SFP transceivers, see the following tables.

  The following table provides a matrix of StackWise Virtual communication mechanism on each module:

***Table 1: StackWise Virtual Feature Matrix for Supervisor Modules***

| Product ID | StackWise Virtual Link | Dual-Active Detection Link |
|---|---|---|
| **Supervisor Modules** | | |
| C9400-SUP-1 | Supported | Supported |
| C9400-SUP-1XL | Supported | Supported |
| C9400-SUP-1XL-Y | Supported | Supported |

| Product ID | StackWise Virtual Link | Dual-Active Detection Link |
|---|---|---|
| C9400X-SUP-2 | Supported | Supported |
| C9400X-SUP-2XL | Supported | Supported |

The following table provides a matrix of StackWise Virtual communication mechanism on each line card:

*Table 2: StackWise Virtual Feature Matrix for Line Cards*

| Product ID | StackWise Virtual Link | Dual-Active Detection Link |
|---|---|---|
| **Gigabit Ethernet Switching Modules** | | |
| C9400-LC-48P | Not Supported | Supported |
| C9400-LC-48T | Not Supported | Supported |
| C9400-LC-48U | Not Supported | Supported |
| **Fiber Optic Ethernet Switching Modules** | | |
| C9400-LC-24XS | Supported | Supported |
| C9400-LC-48XS | Supported | Supported |
| C9400-LC-24S | Not Supported | Supported |
| C9400-LC-48S | Not Supported | Supported |
| C9400-LC-12QC | Supported | Supported |
| C9400-LC-24XY | Supported | Supported |
| **Multigigabit Ethernet Switching Modules** | | |
| C9400-LC-48UX | Supported<br>Multigigabit (mGig) ports 25 to 48) | Supported |
| C9400-LC-48HX | Supported | Supported |
| C9400-LC-48HN | Not Supported | Supported |
| C9400-LC-48TX | Supported | Supported |

The following table provides a matrix of StackWise Virtual communication mechanism on SFP transceivers:

*Table 3: StackWise Virtual Feature Matrix for SFP Transceivers*

| Speed/Model | StackWise Virtual Link | Dual-Active Detection Link |
|---|---|---|
| **40G** | | |

| Speed/Model | StackWise Virtual Link | Dual-Active Detection Link |
|---|---|---|
| QSFP-H40G-AOC | Supported | Supported |
| QSFP-40G-SR4/CSR4/LR4 | Not Supported | Not Supported |
| QSFP-40/100-SRBD | Not Supported | Not Supported |
| **25G** | | |
| SFP-H25G-CU1M/4M | Supported | Supported |
| SFP28-25G-AOC1M to 10M | Supported | Supported |
| SFP-25G-SR-S/10/25G-LR-S | Not Supported | Not Supported |
| **10G** | | |
| SFP-10G-SR/SR-S/LR/LR-S | Supported | Supported |
| SFP-H10GB-CU1M to 5M | Supported | Supported |
| SFP-10G-AOC1M to 5M | Supported | Supported |
| QSFP-4X10G-AOC2M to 10M | Supported | Supported |
| SFP-10G-ER/ZR/BX/DWDM/CWDM | Not Supported | Not Supported |
| **1G** | | |
| GLC-TE/SFP-GE-T | Not Supported | Supported |
| GLC-SX-MMD/GLC-LH-SMD | Not Supported | Not Supported |

- On C9400-SUP-1XL-Y, 25G links can be established only through uplink ports 1 and 5. If you enable SVLs or DAD links on the 25G ports, the corresponding 10G and 40G ports on the modules are disabled. For example, if TwentyFiveGigE1/2/0/1 is configured as the SVL port, the ports - TenGigabitEthernet1/2/0/1 to TenGigabitEthernet1/2/0/4 and FortyGigabitEthernet1/2/0/9 are disabled. Similarly for a 40G port, if port FortyGigabitEthernet1/2/0/9 is configured as the SVL port, ports TenGigabitEthernet1/2/0/1 to TenGigabitEthernet1/2/0/4 and TwentyFiveGigE1/2/0/1 are disabled.

  For more information about configuring uplink ports on supervisor modules, see "Uplink Ports" section in "Configuring Interface Characteristics" chapter of the *Interface and Hardware Components Configuration Guide for Catalyst 9400 Switches*.

- You can configure up to 8 SVLs in a Cisco StackWise Virtual solution using Cisco Catalyst 9400 Series Switches.

- After configuring StackWise Virtual in a standalone chassis and rebooting the switches to form a stack, the interface naming convention changes from the default 3-tuple (slot/bay/port) to 4-tuple (chassis/slot/bay/port) which includes the chassis identifier as part of the interface name. For example, Gi2/0/1 will change to Gi1/2/0/1 where the first number denotes the chassis number.

  The following points explain changes to SNMP with the introduction of 4-tuple interface naming convention:

- The physical index for chassis 1 and 2 is 2 and 500 respectively.
- The physical index for the slots in chassis 1 is in the range of 1000-10000 and slots in chassis 2 is in the range of 11000-20000.
- All MIB Object Identifiers (OID) that require a slot number for query will use a physical slot index in the flat number space {1, 2, 3...20}, where slots 1-10 indicate chassis 1 and slots 11-20 indicate chassis 2.
- Use **show snmp slot-mapping** command to display the chassis/slot mapping.

### Supervisor Modules/Line Cards - Supported Combinations

An SVL can be formed between the supported combinations listed below.

- Same type of line cards/supervisor modules and interface speed on both sides of the SVL link peer with minimum 10G port speed.
- Same type of line cards/supervisor modules and interface speed on both sides of the DAD link peer with minimum 1G port speed.

For information about supported supervisor modules and line cards, see Cisco StackWise Virtual on Cisco Catalyst 9400 Series Switches, on page 3.

# Overview of Cisco StackWise Virtual

Cisco StackWise Virtual is a network system virtualization technology that pairs two directly connected switches into one virtual switch. The switches in a Cisco StackWise Virtual solution increase operational efficiency by using single control and management plane, scale system bandwidth with distributed forwarding plane, and help in building resilient networks using the recommended network design. Cisco StackWise Virtual allows two directly connected physical switches to operate as a single logical virtual switch using an Ethernet connection.

# Cisco StackWise Virtual Topology

A typical network design consists of core, distribution, and access layers. The default mode of a switch is standalone. When two redundant switches are deployed in the distribution layer, the following network challenges arise:

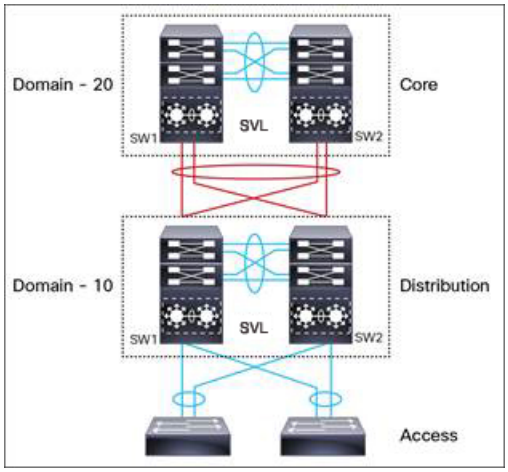
- If VLAN IDs are reused between access layers then, it will introduce a spanning tree loop that will impact the overall performance of the network.
- Spanning tree protocols and configuration are required to protect Layer 2 network against spanning tree protocol loop, and root and bridge protocol data unit management.
- Additional protocols such as first hop redundancy protocol are required to virtualize the IP gateway function. This should align with STP root priorities for each VLAN.
- The Protocol independent multicast designated router (PIM DR) configuration should be fine-tuned to selectively build a multicast forwarding topology on a VLAN.

- The standalone distribution layer system provides protocol-driven remote failure and detection, which results in slower convergence time. Fine-tune First Hop Redundancy Protocol (FHRP) and PIM timers for rapid fault detection and recovery process.

We recommend Cisco StackWise Virtual model for aggregation layers and collapsed aggregation and core layers. The stack can be formed over a 10G, 25G, 40G, and 100G link to ensure that the distribution or the aggregation switches can be deployed over a large distance.

Note that STP keeps one of the ports connected to the distribution switches blocked on the access switches. As a result of this, an active link failure causes STP convergence and the network suffers from traffic loss, flooding, and a possible transient loop in the network. On the other hand, if the switches are logically merged into one switch, all the access switches might form an EtherChannel bundle with distribution switches, and a link failure within an EtherChannel would not have any impact as long as at least one member within the EtherChannel is active.

***Figure 1: Typical Network Design using Cisco StackWise Virtual***




Etherchannel in StackWise Virtual is capable of implementing Multi-chassis EtherChannel (MEC) across the stack members. When access layer and aggregation layer are collapsed into a single StackWise Virtual system, MEC across the different access layer domain members and across distribution and access layer switches will not be supported. MEC is designed to forward the traffic over the local link irrespective of the hash result.

Since the control plane, management plane, and data plane are integrated, the system behaves as a single switch.

The virtualization of multiple physical switches into a single logical switch is from a control and management plane perspective only. Because of the control plane being common, it may look like a single logical entity to peer switches. The data plane of the switches is distributed. Each switch is capable of forwarding over its local interfaces without involving other members. However, when a packet coming into a switch has to be forwarded over a different member's port, the forwarding context of the packet is carried over to the destination switch after ingress processing is performed in the ingress switch. Egress processing is done only in the egress switch. This provides a uniform data plane behavior to the entire switch irrespective whether of the destination port is in a local switch or in a remote switch. However, the common control plane ensures that all the switches have equivalent data plane entry for each forwarding entity.

An election mechanism elects one of the switches to be Cisco StackWise Virtual active and the other switch to be Cisco StackWise Virtual standby in terms of Control Plane functions. The active switch is responsible for all the management, bridging and routing protocols, and software data path. The standby switch is in hot standby state ready to take over the role of active, if the active switch fails over.

The following are the components of the Cisco StackWise Virtual solution:

- Stack members
- SVL: 10G, 25G, 40G, and 100G Ethernet connections. SVL is established using the 10G, 25G, 40G, and 100G interfaces depending on the switch models. However, a combination of two different speeds is not supported.

SVL is the link that connects the switches over Ethernet. Typically, Cisco StackWise Virtual consists of multiple 10G, 25G, 40G, and 100G physical links. It carries all the control and data traffic between the switching units. You can configure SVL on a supported port. When a switch is powered up and the hardware is initialized, it looks for a configured SVL before the initialization of the control plane.

The Link Management Protocol (LMP) is activated on each link of the SVL as soon as the links are established. LMP ensure the integrity of the links and monitors and maintains the health of the links. The redundancy role of each switch is resolved by the StackWise Discovery Protocol (SDP). It ensures that the hardware and software versions are compatible to form the SVL and determines which switch becomes active or standby from a control plane perspective.

Cisco StackWise Virtual Header (SVH) is 64-byte frame header that is prepended over all control, data, and management plane traffic that traverse over each SVL between the two stack members of the Cisco StackWise Virtual domain. The SVH-encapsulated traffic operates at OSI Layer 2 and can be recognized and processed only by Cisco StackWise Virtual-enabled switches. SVL interfaces are non-bridgeable and non-routeable, and allows non-routeable traffic over L2 or L3 network.

# Cisco StackWise Virtual Redundancy

Cisco StackWise Virtual operates stateful switchover (SSO) between the active and standby switches. The following are the ways in which Cisco StackWise Virtual's redundancy model differs from that of the standalone mode:

- The Cisco StackWise Virtual active and standby switches are hosted in separate switches and use a StackWise Virtual link to exchange information.
- The active switch controls both the switches of Cisco StackWise Virtual. The active switch runs the Layer 2 and Layer 3 control protocols and manages the switching modules of both the switches.
- The Cisco StackWise Virtual active and standby switches perform data traffic forwarding.

**Note** If the Cisco StackWise Virtual active switch fails, the standby switch initiates a switchover and assumes the Cisco StackWise Virtual active switch role.

## SSO Redundancy

A StackWise Virtual system operates with SSO redundancy if it meets the following requirements:

- Both the switches must be running the same software version, unless they are in the process of software upgrade.
- SVL-related configuration in the two switches must match.
- License type must be same on both the switch models.

- Both the switch models must be in the same StackWise Virtual domain.

With SSO redundancy, the StackWise Virtual standby switch is always ready to assume control if a fault occurs on the StackWise Virtual active switch. Configuration, forwarding, and state information are synchronized from the StackWise Virtual active switch to the redundant switch at startup, and whenever changes to the StackWise Virtual active switch configuration occur. If a switchover occurs, traffic disruption is minimized.

If StackWise Virtual does not meet the requirements for SSO redundancy, it will be incapable of establishing a relationship with the peer switch. StackWise Virtual runs stateful switchover (SSO) between the StackWise Virtual active and standby switches. The StackWise Virtual determines the role of each switch during initialization.

The CPU in the StackWise Virtual standby switch runs in hot standby state. StackWise Virtual uses SVL to synchronize configuration data from the StackWise Virtual active switch to the StackWise Virtual standby switch. Also, protocols and features that support high availability synchronize their events and state information to the StackWise Virtual standby switch.

## Nonstop Forwarding

While implementing Nonstop Forwarding (NSF) technology in systems using SSO redundancy mode, network disruptions are minimized for campus users and applications. High availability is provided even when the control-plane processing stack-member switch is reset. During a failure of the underlying Layer 3, NSF-capable protocols perform graceful network topology resynchronization. The preset forwarding information on the redundant stack-member switch remains intact; this switch continues to forward the data in the network. This service availability significantly lowers the mean time to repair (MTTR) and increases the mean time between failure (MTBF) to achieve a high level of network availability.

# Multichassis EtherChannels

Multichassis EtherChannel (MEC) is an EtherChannel bundled with physical ports having common characteristics such as speed and duplex, that are distributed across each Cisco StackWise Virtual system. A Cisco StackWise Virtual MEC can connect to any network element that supports EtherChannel (such as a host, server, router, or switch). Cisco StackWise Virtual support up to 252 MECs deployed in Layer 2 or Layer 3 modes. EtherChannel 127 and 128 is reserved for SVL connections. Hence, the maximum available MEC count is 250.

On Cisco Catalyst 9400X Series Supervisor 2 Module (C9400X-SUP-2) and Cisco Catalyst 9400X Series Supervisor 2XL Module (C9400X-SUP-2XL), Cisco StackWise Virtual support up to 432 MECs deployed in Layer 2 or Layer 3 modes. EtherChannels 127 and 128 are reserved for SVL connection. The EtherChannel ports can be configured as follows:

- 1-128 with 8 ports per port-channel
- 129-192 with 4 ports per port-channel
- 193-432 with 2 ports per port-channel

In a Cisco StackWise Virtual system, an MEC is an EtherChannel with additional capability. A multichassis EtherChannel link reduces the amount of traffic that requires transmission across the SVL by populating the index port only with the ports local to the physical switch. This allows the switch to give precedence to the local ports of the multichassis EtherChannel link over those on the remote switch.

Each MEC can optionally be configured to support either Cisco PAgP, IEEE LACP, or Static ON mode. We recommend that you implement EtherChannel using Cisco PAgP or LACP with a compatible neighbor. If a remotely connected neighbor such as Cisco Wireless LAN Controller (WLC) does not support this link-bundling protocol, then a Static ON mode can be deployed. These protocols run only on the Cisco StackWise Virtual active switch.

**Note** On an SVL system, a maximum of 8 ports is supported in an LACP EtherChannel configuration.

An MEC can support up to eight physical links that can be distributed in any proportion between the Cisco StackWise Virtual active switch and the Cisco StackWise Virtual standby switch. We recommend that you distribute the MEC ports across both switches evenly.

## MEC Minimum Latency Load Balancing

The StackWise Virtual environment is designed such that data forwarding always remains within the switch. The Virtual Stack always tries to forward traffic on the locally available links. This is true for both Layer 2 and Layer3 links. The primary motivation for local forwarding is to avoid unnecessarily sending data traffic over the SVL and thus reduce the latency (extra hop over the SVL) and congestion.The bidirectional traffic is load-shared between the two StackWise Virtual members. However, for each StackWise Virtual member, ingress and egress traffic forwarding is based on locally-attached links that are part of MEC. This local forwarding is a key concept in understanding convergence and fault conditions in a StackWise Virtual enabled campus network.

The active and standby switches support local forwarding that will individually perform the desired lookups and forward the traffic on local links to uplink neighbors. If the destination is a remote switch in the StackWise Virtual domain, ingress processing is performed on the ingress switch and then traffic is forwarded over the SVL to the egress switch where only egress processing is performed.

## MEC Failure Scenarios

The following sections describe issues that may arise and the resulting impact:

### Single MEC Link Failure

If a link within a MEC fails (and other links in the MEC are still operational), the MEC redistributes the load among the operational links, as in a regular port.

### All MEC Links to the Cisco StackWise Virtual Active Switch Fail

If all the links to the Cisco StackWise Virtual active switch fail, a MEC becomes a regular EtherChannel with operational links to the Cisco StackWise Virtual standby switch.

Data traffic that terminates on the Cisco StackWise Virtual active switch reaches the MEC by crossing the SVL to the Cisco StackWise Virtual standby switch. Control protocols continue to run in the Cisco StackWise Virtual active switch. Protocol messages reach the MEC by crossing the SVL.

### All MEC Links Fail

If all the links in an MEC fail, the logical interface for the EtherChannel is set to Unavailable. Layer 2 control protocols perform the same corrective action as for a link-down event on a regular EtherChannel.

On adjacent switches, routing protocols and the Spanning Tree Protocol (STP) perform the same corrective action as for a regular EtherChannel.

#### Cisco StackWise Virtual Standby Switch Failure

If the Cisco StackWise Virtual standby switch fails, a MEC becomes a regular EtherChannel with operational links on the Cisco StackWise Virtual active switch. Connected peer switches detect the link failures, and adjust their load-balancing algorithms to use only the links to the StackWise Virtual active switch.

#### Cisco StackWise Virtual Active Switch Failure

Cisco StackWise Virtual active switch failure results in a stateful switchover (SSO). After the switchover, a MEC is operational on the new Cisco StackWise Virtual active switch. Connected peer switches detect the link failures (to the failed switch), and adjust their load-balancing algorithms to use only the links to the new Cisco StackWise Virtual active switch.

# Cisco StackWise Virtual Packet Handling

In Cisco StackWise Virtual, the Cisco StackWise Virtual active switch runs the Layer 2 and Layer 3 protocols and features and manages the ports on both the switches. Cisco StackWise Virtual uses SVL to communicate system and protocol information between the peer switches and to carry data traffic between the two switches.

The following sections describe packet handling in Cisco StackWise Virtual.

## Traffic on StackWise Virtual Link

SVL carries data traffic and in-band control traffic between two switches. All the frames that are forwarded over the SVL are encapsulated with a special StackWise Virtual Header (SVH). The SVH adds an overhead of 64 bytes for control and data traffic, which provides information for Cisco StackWise Virtual to forward the packet on the peer switch.

An SVL transports control messages between two switches. Messages include protocol messages that are processed by the Cisco StackWise Virtual active switch, but received or transmitted by interfaces on the Cisco StackWise Virtual standby switch. Control traffic also includes module programming between the Cisco StackWise Virtual active switch and the switching modules on the Cisco StackWise Virtual standby switch.

Cisco StackWise Virtual transmits data traffic over an SVL under the following circumstances:

- Layer 2 traffic flooded over a VLAN (even for dual-homed links).
- Packets processed by software on the Cisco StackWise Virtual active switch where the ingress interface is on the Cisco StackWise Virtual standby switch.
- The packet destination is on the peer switch, as described in the following examples:
  - Traffic within a VLAN where the known destination interface is on the peer switch.
  - Traffic that is replicated for a multicast group and the multicast receivers are on the peer switch.
  - The known unicast destination MAC address is on the peer switch.
  - The packet is a MAC notification frame destined for a port on the peer switch.

An SVL also transports system data, such as NetFlow export data and SNMP data, from the Cisco StackWise Virtual standby switch to the Cisco StackWise Virtual active switch.

Traffic on the SVL is load balanced with the same global hashing algorithms available for EtherChannels (the default algorithm is source-destination IP).

## Layer 2 Protocols

The Cisco StackWise Virtual active switch runs the Layer 2 protocols (such as STP and VTP) for the switching modules on both the switches. Protocol messages that are received on the standby switch ports must traverse SVLs to reach the active switch where they are processed. Similarly, protocol messages that are transmitted from the standby switch ports originate on the active switch, and traverse the SVLs to reach the standby ports.

All the Layer 2 protocols in Cisco StackWise Virtual work similarly in standalone mode. The following sections describe the difference in behavior for some protocols in Cisco StackWise Virtual.

### Spanning Tree Protocol

The Cisco StackWise Virtual active switch runs the STP. The Cisco StackWise Virtual standby switch redirects the STP BPDUs across an SVL to the StackWise Virtual active switch.

The STP bridge ID is commonly derived from the switch MAC address. To ensure that the bridge ID does not change after a switchover, Cisco StackWise Virtual continues to use the original switch MAC address for the STP Bridge ID.

### EtherChannel Control Protocols

Link Aggregation Control Protocol (LACP) and Port Aggregation Protocol (PAgP) packets contain a device identifier. Cisco StackWise Virtual defines a common device identifier for both the switches. Use either PAgP or LACP on Multi EtherChannels instead of mode ON, even if all the three modes are supported.

**Note** A new PAgP enhancement has been defined for assisting with dual-active scenario detection.

### Switched Port Analyzer

Switched Port Analyzer (SPAN) on SVL and fast hello DAD link ports is not supported. These ports can be neither a SPAN source, nor a SPAN destination. Cisco StackWise Virtual supports all the SPAN features for non-SVL interfaces. The number of SPAN sessions that are available on Cisco StackWise Virtual matches that on a single switch running in standalone mode.

### Private VLANs

Private VLANs on StackWise Virtual work the same way as in standalone mode. The only exception is that the native VLAN on isolated trunk ports must be configured explicitly.

Apart from STP, EtherChannel Control Protocols, SPAN, and private VLANs, the Dynamic Trunking Protocol (DTP), Cisco Discovery Protocol (CDP), VLAN Trunk Protocol (VTP), and Unidirectional Link Detection Protocol (UDLD) are the additional Layer 2 control-plane protocols that run over the SVL connections.

### Broadcast, Unknown Unicast and Multicast

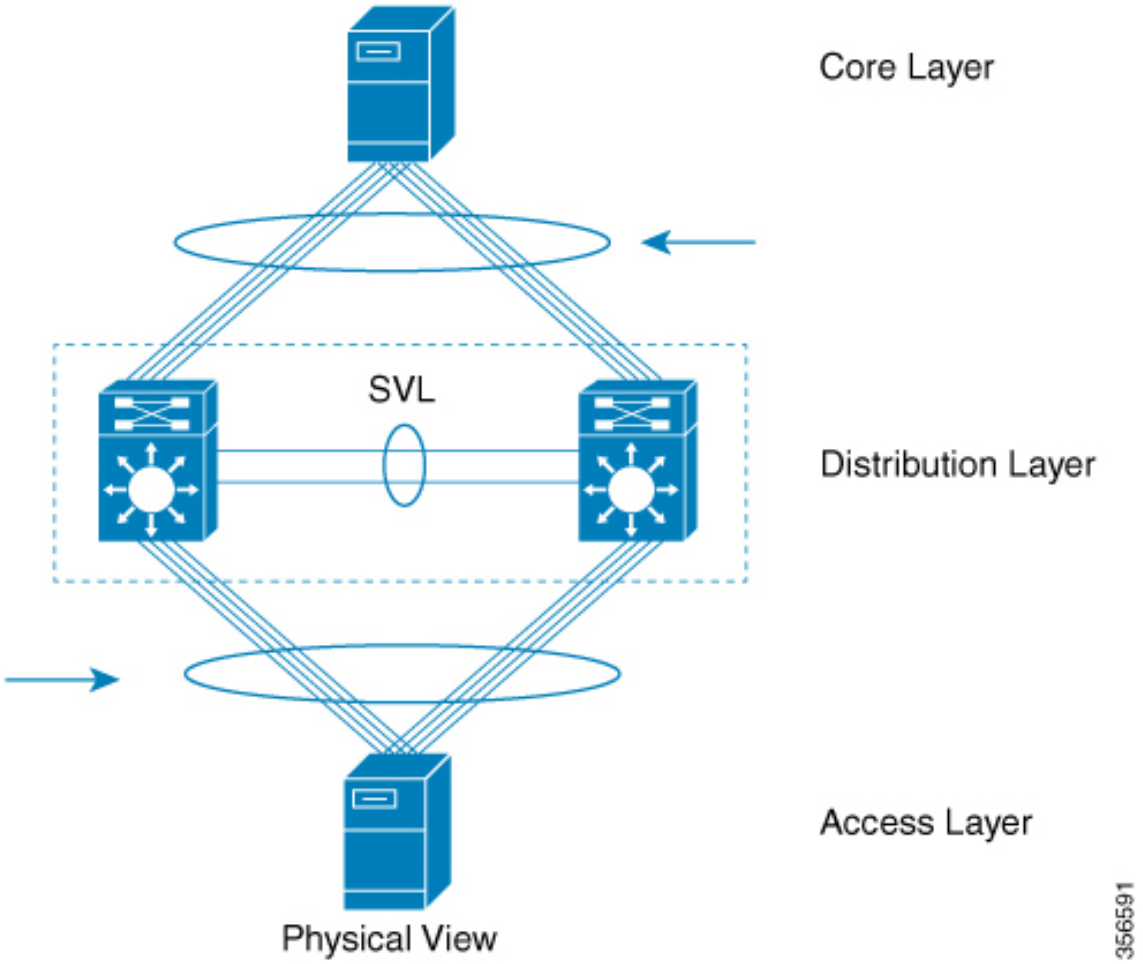
Cisco StackWise Virtual supports local switching for Broadcast, Unknown unicast and Multicast (BUM) traffic. In uncommon deployment scenarios, BUM traffic traverses through the StackWise Virtual Links. This section explains how BUM traffic is handled in a Cisco StackWise Virtual setup and in local switching.

When a VLAN is created, StackWise Virtual ports are added to the VLAN flood list. The ingress BUM traffic on active or standby switch traverses through the StackWise Virtual link to the other switch instead of a port in the VLAN. This traffic floods the StackWise Virtual links which impacts the system and network performance.

To address this, StackWise Virtual BUM optimization feature is introduced.

A general deployment guideline for Cisco StackWise Virtual is to distribute MEC ports evenly at the uplink and downlink as shown in the figure. In this topology, BUM traffic prefers the local link on MEC to send the traffic out instead of the StackWise Virtual link. In a scenario where there is a standalone port on a switch or members of EtherChannel on active or standby switch are down, BUM traffic traverses the StackWise Virtual link. When StackWise Virtual BUM optimization is enabled on VLAN, StackWise Virtual port is not added to the VLAN flood list. This design ensures BUM traffic does not traverse StackWise Virtual link only when MEC port channels are part of the VLAN. No optimization is done for VLANs with standalone or physical ports.

***Figure 2: Recommended Topology for Cisco StackWise Virtual***



# Layer 3 Protocols

The Cisco StackWise Virtual active switch runs the Layer 3 protocols and features for the StackWise Virtual. All the Layer 3 protocol packets are sent to and processed by the Cisco StackWise Virtual active switch. Both the member switches perform hardware forwarding for ingress traffic on their interfaces. When software forwarding is required, packets are sent to the Cisco StackWise Virtual active switch for processing.

The same router MAC address assigned by the Cisco StackWise Virtual active switch is used for all the Layer 3 interfaces on both the Cisco StackWise Virtual member switches. After a switchover, the original router MAC address is still used. The router MAC address is chosen based on chassis-mac and is preserved after switchover by default.

The following sections describe the Layer 3 protocols for Cisco StackWise Virtual.

### IPv4 Unicast

The CPU on the Cisco StackWise Virtual active switch runs the IPv4 routing protocols and performs any required software forwarding. All the routing protocol packets received on the Cisco StackWise Virtual standby switch are redirected to the Cisco StackWise Virtual active switch across the SVL. The Cisco StackWise Virtual active switch generates all the routing protocol packets to be sent out over ports on either of the Cisco StackWise Virtual member switches.

Hardware forwarding is distributed across both members on Cisco StackWise Virtual. The CPU on the Cisco StackWise Virtual active switch sends Forwarding Information Base (FIB) updates to the Cisco StackWise Virtual standby switch, which in turn installs all the routes and adjacencies into hardware.

Packets intended for a local adjacency (reachable by local ports) are forwarded locally on the ingress switch. Packets intended for a remote adjacency (reachable by remote ports) must traverse the SVL.

The CPU on the Cisco StackWise Virtual active switch performs all software forwarding and feature processing (such as fragmentation and Time to Live exceed functions). If a switchover occurs, software forwarding is disrupted until the new Cisco StackWise Virtual active switch obtains the latest Cisco Express Forwarding and other forwarding information.

In virtual switch mode, the requirements to support non-stop forwarding (NSF) match those in the standalone redundant mode of operation.

From a routing peer perspective, Multi-Chassis EtherChannels (MEC) remain operational during a switchover, that is, only the links to the failed switch are down, but the routing adjacencies remain valid.

Cisco StackWise Virtual achieves Layer 3 load balancing over all the paths in the Forwarding Information Base entries, be it local or remote.

### IPv6

Cisco StackWise Virtual supports IPv6 unicast and multicast because it is present in the standalone system.

### IPv4 Multicast

The IPv4 multicast protocols run on the Cisco StackWise Virtual active switch. Internet Group Management Protocol (IGMP) and Protocol Independent Multicast (PIM) protocol packets received on the Cisco StackWise Virtual standby switch are transmitted across an SVL to the StackWise Virtual active switch. The latter generates IGMP and PIM protocol packets to be sent over ports on either of the Cisco StackWise Virtual members.

The Cisco StackWise Virtual active switch synchronizes the Multicast Forwarding Information Base (MFIB) state to the Cisco StackWise Virtual standby switch. On both the member switches, all the multicast routes

are loaded in the hardware, with replica expansion table (RET) entries programmed for only local, outgoing interfaces. Both the member switches are capable of performing hardware forwarding.

**Note** To avoid multicast route changes as a result of a switchover, we recommend that all the links carrying multicast traffic be configured as MEC rather than Equal Cost Multipath (ECMP).

For packets traversing an SVL, all Layer 3 multicast replications occur on the egress switch. If there are multiple receivers on the egress switch, only one packet is replicated and forwarded over the SVL, and then replicated to all the local egress ports.

#### Software Features

Software features run only on the Cisco StackWise Virtual active switch. Incoming packets to the Cisco StackWise Virtual standby switch that require software processing are sent across an SVL to the Cisco StackWise Virtual active switch.

# Dual-Active Detection

If the standby switch detects a complete loss of the SVL, it assumes the active switch has failed and will take over as the active switch. However, if the original Cisco StackWise Virtual active switch is still operational, both the switches will now be Cisco StackWise Virtual active switches. This situation is called a dual-active scenario. This scenario can have adverse effects on network stability because both the switches use the same IP addresses, SSH keys, and STP bridge IDs. Cisco StackWise Virtual detects a dual-active scenario and takes recovery action. DAD link is the dedicated link used to mitigate this.

If the last available SVL fails, the Cisco StackWise Virtual standby switch cannot determine the state of the Cisco StackWise Virtual active switch. To ensure network uptime without delay, the Cisco StackWise Virtual standby switch then assumes the Cisco StackWise Virtual active role. The original Cisco StackWise Virtual active switch enters recovery mode and brings down all its interfaces, except the SVL and the management interfaces.

## Dual-Active-Detection Link with Fast Hello

To use the dual-active fast hello packet detection method, you must provision a direct ethernet connection between the two Cisco StackWise Virtual switches. You can dedicate up to four links for this purpose.

The two switches periodically exchange special dual-active hello messages containing information about the switch state. If all SVLs fail and a dual-active scenario occurs, each switch recognizes that there is a dual-active scenario from the peer's messages.

This initiates recovery actions as described in the Recovery Actions, on page 16 section. If a switch does not receive an expected dual-active fast hello message from the peer before the timer expires, the switch assumes that the link is no longer capable of dual-active detection.

**Note** Do not use the same port for StackWise Virtual Link and dual-active detection link.

## Dual-Active Detection with enhanced PAgP

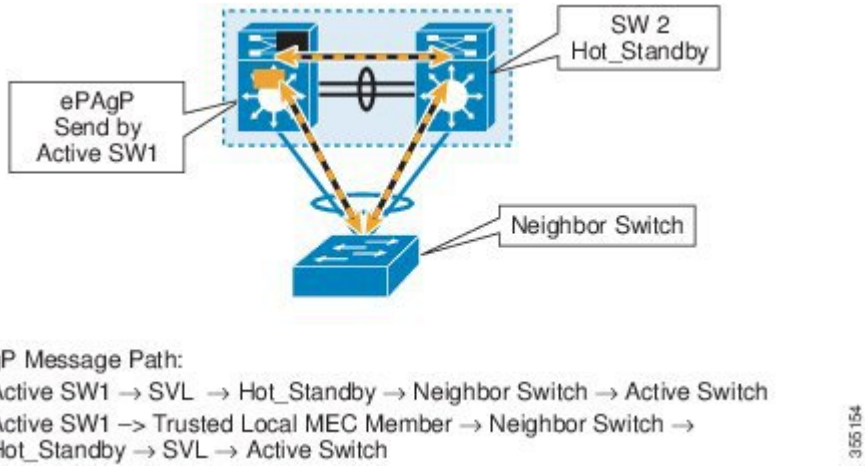
Port aggregation protocol (PAgP) is a Cisco proprietary protocol used for managing EtherChannels. If a StackWise Virtual MEC terminates on a Cisco switch, you can run PAgP protocol on the MEC. If PAgP is running on the MECs between the StackWise Virtual switch and an upstream or downstream switch, the StackWise Virtual can use PAgP to detect a dual-active scenario. The MEC must have at least one port on each switch of the StackWise Virtual setup.

Enhanced PAgP is an extension of the PAgP protocol. In virtual switch mode, ePAgP messages include a new type length value (TLV) which contains the ID of the StackWise Virtual active switch. Only switches in virtual switch mode send the new TLV.

When the StackWise Virtual standby switch detects SVL failure, it initiates SSO and becomes StackWise Virtual active. Subsequent ePAgP messages sent to the connected switch from the newly StackWise Virtual active switch contain the new StackWise Virtual active ID. The connected switch sends ePAgP messages with the new StackWise Virtual active ID to both StackWise Virtual switches.

If the formerly StackWise Virtual active switch is still operational, it detects the dual-active scenario because the StackWise Virtual active ID in the ePAgP messages changes.

***Figure 3: Dual-active-detection with ePAgP***




**Note** To avoid PAgP flaps and to ensure that dual-active detection functions as expected, the stack MAC persistent wait timer must be configured as indefinite using the command **stack-mac persistent timer 0 .**

## Recovery Actions

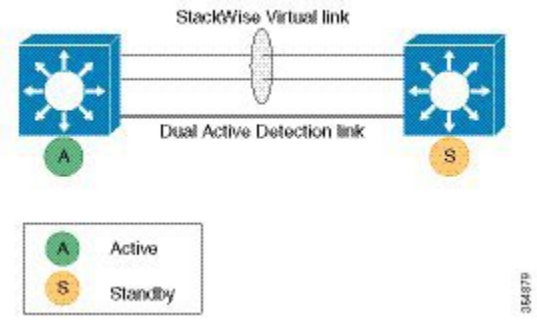
A Cisco StackWise Virtual active switch that detects a dual-active condition shuts down all of its non-SVL or non-DAD interfaces to remove itself from the network. The switch then waits in recovery mode until the SVLs recover. You should physically repair the SVL failure and the switch automatically reloads and restores itself as the standby switch. To enable the switch to remain in recovery mode after restoring the SVL links, see Disabling Recovery Reload, on page 25 section.

# Implementing Cisco StackWise Virtual

The two-node solution of Cisco StackWise Virtual is normally deployed at the aggregation layer. Two switches are connected over an SVL.

Cisco StackWise Virtual combines the two switches into a single logical switch with a large number of ports, offering a single point of management. One of the member switches is the active and works as the control and management plane, while the other one is the standby. The virtualization of multiple physical switches into a single logical switch is only from a control and management perspective. Because of the control plane being common, it may look like a single logical entity to peer switches. The data plane of the switches are converged, that is, the forwarding context of a switch might be passed to the other member switch for further processing when traffic is forwarded across the switches. However, the common control plane ensures that all the switches have equivalent data plane entry for each forwarding entity.

***Figure 4: Two-Node Solution***




An election mechanism that determines which switch is Cisco StackWise Virtual active and which one is a control plane standby, is available. The active switch is responsible for management, bridging and routing protocols, and software data path. These are centralized on the active switch supervisor of the Cisco StackWise Virtual active switch.

# Power Budgeting for Supervisor Modules

The power budget, or required budgeted power, is the power the system requires and reserves for supervisor modules, switching modules (line cards), and the fan tray to operate in the chassis.

By default, the system reserves power for a redundant setup, to ensure high availability. This means that the system reserves the power required by both the supervisor modules in the chassis, as part of the required budgeted power (system power). You can also configure the system to reserve power for a single supervisor.

When power budget mode is enabled for a single supervisor in StackWise Virtual mode, power is still reserved for the other supervisor even if the supervisor with power budget mode enabled is restarted or goes down.

# Cisco StackWise Virtual Offline Provisioning

The offline provisioning feature allows you to pre-provision an empty slot in any of the stackwise virtual switch (active or standby slots) before a shared port adaptor (SPA)/line card (LC) is physically inserted into the slot. You can configure the slot to a supported LC type which will create interfaces based on the provisioned LC type. This type of configuration is an offline pre-provisioned configuration that is created explicitly for an empty slot on the switch. For the existing physical SPAs in the slots, the system automatically or implicitly

configures provisioning during the boot-up based on the inserted LC type where no manual intervention is required for module provisioning. The provisioned configuration is created for a slot when a new line card is inserted into it if there is no provisioned configuration exists.

When you configure the interfaces associated with a provisioned slot, the switch accepts the configuration, and the information appears in the running configuration. However, as the slot is empty, any configuration on the interface is not operational and the interface associated with the provisioned slot does not appear in the display of the specific feature.

Cisco Catalyst 9400 Series Switches supports offline provisioning from Cisco IOS XE Bengaluru 17.6.1 onwards.

# How to Configure Cisco StackWise Virtual

## Configuring Cisco StackWise Virtual Settings

To enable StackWise Virtual, perform the following procedure :

### Procedure

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br>Enter your password, if prompted. |
| **Step 2** | **switch** *switch-number* **renumber** *new switch -number*<br>**Example:**<br>`Device# switch 1 renumber 2` | (Optional) Reassigns the switch number.<br>The default switch number will be 1. The valid values for the new switch number are 1 and 2. |
| **Step 3** | **switch** *switch-number* **priority** *priority-number*<br>**Example:**<br>`Device# switch 1 priority 5` | (Optional) Assigns the priority number.<br>The default priority number is 1. The highest priority number is 15. |
| **Step 4** | **configure terminal**<br>**Example:**<br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 5** | **stackwise-virtual**<br>**Example:**<br>`Device(config)# stackwise-virtual` | Enables Cisco StackWise Virtual and enters stackwise-virtual submode. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 6** | **domain** *id*<br>**Example:**<br>`Device(config-stackwise-virtual)# domain 2` | (Optional) Specifies the Cisco StackWise Virtual domain ID.<br>The domain ID range is from 1 to 255. The default value is one. |
| **Step 7** | **end**<br>**Example:**<br>`Device(config-stackwise-virtual)# end` | Returns to privileged EXEC mode. |
| **Step 8** | **show stackwise-virtual**<br>**Example:**<br>`Device# show stackwise-virtual` | |
| **Step 9** | **write memory**<br>**Example:**<br>`Device# write memory` | Saves the running-configuration which resides in the system RAM and updates the ROMmon variables. If you do not save the changes, the changes will no longer be part of the startup configuration when the switch reloads. Note that the configurations for **stackwise-virtual** and **domain** are saved to the running-configuration and the startup-configuration after the reload. |
| **Step 10** | **reload**<br>**Example:**<br>`Device# reload` | Restarts the switch and forms the stack. |

# Configuring Cisco StackWise Virtual Link

**Note** SVL is supported on all 10G, 25G, 40G and 100G interfaces of the supported switch models. However, a combination of different interface speeds is not supported.

To configure a switch port as an SVL port, perform the following procedure:

### Procedure

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br>Enter your password, if prompted. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 2** | **configure terminal**<br>**Example:**<br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **interface** { **TenGigabitEthernet** \| **FortyGigabitEthernet** \| **TwentyFiveGigE** } *<interface>*<br>**Example:**<br>`Device(config)# interface TenGigabitEthernet1/2/0/4` | Enters Ethernet interface configuration mode. |
| **Step 4** | **stackwise-virtual link** *link value*<br>**Example:**<br>`Device(config-if)# stackwise-virtual link 1` | Associates the interface with configured SVL. |
| **Step 5** | **end**<br>**Example:**<br>`Device(config-if)# end` | Returns to privileged EXEC mode. |
| **Step 6** | **write memory**<br>**Example:**<br>`Device# write memory` | Saves the running-configuration which resides in the system RAM and updates the ROMMON variables. If you do not save the changes, the changes will no longer be part of the startup configuration when the switch reloads. Note that the configuration for **stackwise-virtual link** *link value* is saved only in the running-configuration and not the startup-configuration. |
| **Step 7** | **reload**<br>**Example:**<br>`Device# reload` | Restarts the switch. |

# Configuring BUM Traffic Optimization

To configure BUM traffic optimization globally, perform the following procedure:

### Procedure

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br>Enter your password, if prompted. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 2** | **configure terminal**<br>**Example:**<br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **svl l2bum optimization**<br>**Example:**<br>`Device(config)# svl l2bum optimization` | Enables the BUM traffic optimization within StackWise Virtual setup globally. This feature is enabled by default.<br>Use the **no** form of this command to disable this feature. |
| **Step 4** | **end**<br>**Example:**<br>`Device(config-if)# end` | Returns to privileged EXEC mode. |
| **Step 5** | **show platform pm l2bum-status vlan** *vlan-id*<br>**Example:**<br>`Device# show platform pm l2bum-status vlan 1` | Displays the number of forwarding ports in VLAN. number of physical ports count in forwarding state |
| **Step 6** | **show platform software fed switch ac fss bum-opt summary**<br>**Example:**<br>`Device# show platform software fed switch ac fss bum-opt summary` | Displays the final state of optimization. |

# Configuring StackWise Virtual Fast Hello Dual-Active-Detection Link

To configure StackWise Virtual Fast Hello DAD link, perform the following procedure. This procedure is optional.

**Note** Configuring either the Fast Hello or EPAGP dual-active detection methods is recommended to prevent a dual-active situation if all SVL links go down.

## Procedure

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br>• Enter your password, if prompted. |
| **Step 2** | **configure terminal**<br>**Example:** | Enters global configuration mode. |

| | Command or Action | Purpose |
|---|---|---|
| | `Device# configure terminal` | |
| **Step 3** | **interface** { **TenGigabitEthernet** \| **FortyGigabitEthernet** \| **TwentyFiveGigE** } <*interface*><br>**Example:**<br>`Device(config)# interface TenGigabitEthernet1/2/0/5` | Enters ethernet interface configuration mode. |
| **Step 4** | **stackwise-virtual dual-active-detection**<br>**Example:**<br>`Device(config-if)# stackwise-virtual dual-active-detection` | Associates the interface with StackWise Virtual dual-active-detection.<br>**Note**<br>This command will not be visible on the device after the configuration, but will continue to function. |
| **Step 5** | **end**<br>**Example:**<br>`Device(config-if)# end` | Returns to privileged EXEC mode. |
| **Step 6** | **write memory**<br>**Example:**<br>`Device# write memory` | Saves the running-configuration which resides in the system RAM and updates the ROMMON variables. If you do not save the changes, the changes will no longer be part of the startup configuration when the switch reloads. Note that the configuration for **stackwise-virtual dual-active-detection** is saved only in the running-configuration and not the startup-configuration. |
| **Step 7** | **reload**<br>**Example:**<br>`Device# reload` | Restarts the switch and configuration takes effect. |

# Configuring Cisco StackWise Virtual Offline Provisioning

To enable offline provisioning, perform the following procedure:

### Procedure

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br>Enter your password, if prompted. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 2** | **configure terminal**<br>**Example:**<br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **switch** { **switch-number** } **provision** {**Chassis type**}<br>**Example:**<br>`Device(config)# switch 1 provision c9410r` | Select the module that you want to pre-provision. |
| **Step 4** | **provision slot** { **slot-number** \| **module-number**} **provision** {**Linecard type**}<br>**Example:**<br>`Device(config-module-provision)# provision slot 5 C9400-LC-24XS` | Selects the slot to pre-provision. |
| **Step 5** | **end**<br>**Example:**<br>`Device(config-module-provision)# end` | Returns to privileged EXEC mode. |
| **Step 6** | **show running-config startup-config**<br>**Example:**<br>`Device# show running-config` | Shows the current running configuration at the device. |

# Enabling ePAgP Dual-Active-Detection

To enable ePAgP dual-active-detection on a switch port, perform the following procedure. This procedure is optional.

### Procedure

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br>**Example:**<br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **interface** { **TenGigabitEthernet** \| **FortyGigabitEthernet** \| **TwentyFiveGigE** } *interface* | Enters ethernet interface configuration mode. |

| | Command or Action | Purpose |
|---|---|---|
| | **Example:**<br>`Device(config)# interface TenGigabitEthernet1/2/0/3` | |
| **Step 4** | **channel-group** *group_ID* **mode desirable**<br>**Example:**<br>`Device(config-if)# channel-group 1 mode desirable` | Enables PAgP MEC with channel-group id in the range of 1 to 128 for 10 GigabitEthernet interfaces. |
| **Step 5** | **exit**<br>**Example:**<br>`Device(config-if)# exit` | Exits interface configuration. |
| **Step 6** | **interface port-channel** *channel-group-id*<br>**Example:**<br>`Device(config)# interface port-channel 1` | Selects a port channel interface to configure. |
| **Step 7** | **shutdown**<br>**Example:**<br>`Device(config-if)# shutdown` | Shuts down an interface. |
| **Step 8** | **exit**<br>**Example:**<br>`Device(config-if)# exit` | Exits interface configuration. |
| **Step 9** | **stackwise-virtual**<br>**Example:**<br>`Device(config)# stackwise-virtual` | Enters the StackWise Virtual configuration mode. |
| **Step 10** | **dual-active detection pagp**<br>**Example:**<br>`Device(config-stackwise-virtual)# dual-active detection pagp` | Enables pagp dual-active detection. This is enabled by default. |
| **Step 11** | **dual-active detection pagp trust channel-group** *channel-group id*<br>**Example:**<br>`Device(config-stackwise-virtual)# dual-active detection pagp trust channel-group 1` | Enables dual-active detection trust mode on channel-group with the configured ID. |
| **Step 12** | **exit**<br>**Example:**<br>`Device(config-stackwise-virtual)# exit` | Exits the StackWise-Virtual configuration mode. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 13** | **interface port-channel** *portchannel*<br>**Example:**<br>`Device(config)# interface port-channel 1` | Configured port-channel on the switch. |
| **Step 14** | **no shutdown**<br>**Example:**<br>`Device(config-if)# no shutdown` | Enables the configured port-channel on the switch. |
| **Step 15** | **end**<br>**Example:**<br>`Device(config-if)# end` | Exits interface configuration. |
| **Step 16** | **write memory**<br>**Example:**<br>`Device# write memory` | Saves the running-configuration which resides in the system RAM and updates the ROMMON variables. If you do not save the changes, the changes will no longer be part of the startup configuration when the switch reloads. Note that the configuration for **dual-active detection pagp trust channel-group** *channel-group id* is saved to the running-configuration and the startup-configuration after the reload. |

# Disabling Recovery Reload

After recovering from StackWise Virtual link failure, the switch in recovery mode performs a recovery action by automatically reloading the switch. This is the default behaviour in the event of a link failure. In order to retain a switch in recovery mode and prevent the switch from reloading automatically, you must perform the following steps.

### Procedure

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br>Enter your password, if prompted. |
| **Step 2** | **configure terminal**<br>**Example:**<br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **stackwise-virtual**<br>**Example:** | Enables Cisco StackWise Virtual and enters stackwise-virtual mode. |

| | Command or Action | Purpose |
|---|---|---|
| | `Device(config)# stackwise-virtual` | |
| **Step 4** | **dual-active recovery-reload-disable**<br>**Example:**<br>`Device(config-stackwise-virtual)# dual-active recovery-reload-disable` | Disables automatic recovery reload of the switch.<br>Note that the configuration for **dual-active recovery-reload-disable** is saved only in the running-configuration and not the startup-configuration. |
| **Step 5** | **end**<br>**Example:**<br>`Device(config-stackwise-virtual)# end` | Returns to privileged EXEC mode. |

# Disabling Cisco StackWise Virtual

To disable Cisco StackWise Virtual on a switch, perform the following procedure:

### Procedure

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br>Enter your password, if prompted. |
| **Step 2** | **configure terminal**<br>**Example:**<br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **interface** { **TenGigabitEthernet** \| **FortyGigabitEthernet** \| **TwentyFiveGigE** } <*interface*><br>**Example:**<br>`Device(config)# interface TenGigabitEthernet 1/2/0/3` | Enters the interface configuration mode. |
| **Step 4** | **no stackwise-virtual dual-active-detection**<br>**Example:**<br>`Device(config-if)# no stackwise-virtual dual-active-detection` | Dissociates the interface from StackWise Virtual DAD. |
| **Step 5** | Repeat step #unique_77 unique_77_Connect_42_step_int_9400<br>**Example:**<br>`Device(config)# interface TenGigabitEthernet 1/2/0/2` | Enters the interface configuration mode. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 6** | **no stackwise-virtual link** *link*<br>**Example:**<br>`Device(config-if)# no stackwise-virtual link 1` | Dissociates the interface from SVL. |
| **Step 7** | **exit**<br>**Example:**<br>`Device(config-if)# exit` | Exits interface configuration. |
| **Step 8** | **no stackwise-virtual**<br>**Example:**<br>`Device(config)# no stackwise-virtual` | Disables StackWise Virtual configuration. |
| **Step 9** | **exit**<br>**Example:**<br>`Device(config)# exit` | Exits the global configuration mode. |
| **Step 10** | **write memory**<br>**Example:**<br>`Device# write memory` | Saves the running configuration. |
| **Step 11** | **reload**<br>**Example:**<br>`Device# reload` | Restarts the switch and the configuration takes effect. |

# Configuration Examples for StackWise Virtual

This section provides the following configuration examples:

- Example: Configuring StackWise Virtual Link, on page 27
- Example: Displaying StackWise Virtual Link Information, on page 28

## Example: Configuring StackWise Virtual Link

The following is a sample configuration for configuring SVL on a switch.

On Switch 1:

```
Device>enable
Device#configure terminal
Device(config)#interface TenGigabitEthernet1/0/1
Device(config-if)#stackwise-virtual link 1

WARNING: All the extraneous configurations will be removed for TenGigabitEthernet1/0/1 on
reboot
```

```
INFO: Upon reboot, the config will be part of running config but not part of start up config.
Device(config-if)#end
Device#write memory
Device#reload
```

On Switch 2:

```
Device>enable
Device#configure terminal
Device(config)#interface TenGigabitEthernet1/0/1
Device(config-if)#stackwise-virtual link 1

WARNING: All the extraneous configurations will be removed for TenGigabitEthernet1/0/1 on
reboot
INFO: Upon reboot, the config will be part of running config but not part of start up config.
Device(config-if)#end
Device#write memory
Device#reload
```

# Example: Configuring StackWise Virtual Fast Hello Dual-Active-Detection Link

The following example shows how to configure a StackWise Virtual Fast Hello dual-active detection link on a Switch 1 and Switch 2. You cannot configure StackWise Virtual Fast Hello dual-active-detection links on ports that are already configured as StackWise Virtual link ports:

```
On Switch 1:
Device>enable
Device#configure terminal
Device(config)#interface TenGigabitEthernet3/0/1
Device(config-if)#stackwise-virtual dual-active-detection
WARNING: All the extraneous configurations will be removed for TenGigabitEthernet3/0/1 on
reboot
INFO: Upon reboot, the config will be part of running config but not part of start up config.
Device(config-if)#exit
On Switch 2:
Device(config)#interface TenGigabitEthernet3/0/1
Device(config-if)#stackwise-virtual dual-active-detection
WARNING: All the extraneous configurations will be removed for TenGigabitEthernet3/0/1 on
reboot.
INFO: Upon reboot, the config will be part of running config but not part of start up config.
Device(config-if)#end
On both the switches:
Device#write memory
Device#reload
```

# Example: Displaying StackWise Virtual Link Information

### Sample output of show stackwise-virtual link command

```
Device# show stackwise-virtual link

Stackwise Virtual Configuration:
--------------------------------------------
Stackwise Virtual : Enabled
Domain Number :            1

Switch  Stackwise Virtual Link   Ports
```

```
------  ----------------------   ------
1       1                        TenGigabitEthernet1/1/0/1
2       1                        TenGigabitEthernet2/1/0/1
```

By default in standalone mode, the switches are identified as Switch 1 unless explicitly changed to some other switch number. During the conversion to StackWise Virtual, the switch numbers are changed automatically to reflect two switches in a StackWise Virtual domain.

# Example: Displaying StackWise Virtual Dual-Active-Detection Link Information

### Sample output of show stackwise-virtual dual-active-detection command

StackWise Virtual DAD links configuration:

```
Device# show stackwise-virtual dual-active-detection

Recovery Reload for switch 1: Enabled
Recovery Reload for switch 2: Enabled

Dual-Active-Detection Configuration:
------------------------------------
Switch   Dad port                          Status
------   ------------                      ---------
1        TenGigabitEthernet1/3/0/1         up
2        TenGigabitEthernet2/3/0/1         up
```

StackWise Virtual DAD links configuration after configuring the **dual-active recovery-reload-disable** command:

```
Device# show stackwise-virtual dual-active-detection

Recovery Reload for switch 1: Enabled
Recovery Reload for switch 2: Enabled
Dual-Active-Detection Configuration:
------------------------------------
Switch      Dad port                     Status
------      ------------                 ---------
1           TenGigabitEthernet1/3/0/1    up
2           TenGigabitEthernet2/3/0/1    up
```

### Sample output of show stackwise-virtual dual-active-detection epagp command

StackWise Virtual DAD ePAgP information:

```
Device# show stackwise-virtual dual-active-detection pagp

Pagp dual-active detection enabled: Yes
In dual-active recovery mode: No
Recovery Reload for switch 1: Enabled
Recovery Reload for switch 2: Enabled

Channel group 11
                Dual-Active          Partner             Partner         Partner
Port            Detect Capable       Name                Port            Version
Fo1/1/0/17      Yes                  SwitchA             Hu2/0/1         1.1
Fo2/2/0/21      Yes                  SwitchA             Hu1/0/4         1.1
```

**Partner Name** and **Partner Port** fields in the output represent the name and the ports of the peer switch to which the PagP port-channel is connected through MEC.

# Verifying Cisco StackWise Virtual Configuration

To verify your StackWise Virtual configuration, use the following **show** commands:

***Table 4: show Commands to Verify Cisco StackWise Virtual Configuration***

| | |
|---|---|
| **show stackwise-virtual switch** *number <1-2>* | Displays information of a particular switch in the stack. |
| **show stackwise-virtual link** | Displays StackWise Virtual link information. |
| **show stackwise-virtual bandwidth** | Displays the bandwidth available for the Cisco StackWise Virtual. |
| **show stackwise-virtual neighbors** | Displays the Cisco StackWise Virtual neighbors. |
| **show stackwise-virtual dual-active-detection** | Displays StackWise Virtual dual-active-detection information. |
| **show stackwise-virtual dual-active-detection pagp** | Displays ePAgP dual-active-detection information. |
| **Switch ½ renumber ½** | (Optional)Assigns a new switch number. The default number is 1. |

# Additional References for StackWise Virtual

***Table 5: Related Documents***

| Related Topic | Document Title |
|---|---|
| For complete syntax and usage information for the commands used in this chapter. | High Availability Command Reference for Catalyst 9400 Switches |

# Feature History for Cisco StackWise Virtual

This table provides release and related information for features explained in this module.

These features are available on all releases subsequent to the one they were introduced in, unless noted otherwise.

| Release | Feature | Feature Information |
|---|---|---|
| Cisco IOS XE Fuji 16.9.1 | Cisco StackWise Virtual | Cisco StackWise Virtual is a network system virtualization technology that pairs two switches into one virtual switch to simplify operational efficiency with a single control and management plane.<br>Support for this feature was introduced on the following chassis models and supervisor modules:<br>• Chassis Models: Catalyst 9404R Switch and Catalyst 9407R Switch.<br>• Supervisor Modules:<br>  • Cisco Catalyst 9400 Series Supervisor 1 Module (C9400-SUP-1). The feature requires a special, additional, C9400-SUP-UPG-LIC= license with this supervisor module.<br>  • Cisco Catalyst 9400 Series Supervisor 1XL Module(C9400-SUP-1XL). |
| Cisco IOS XE Gibraltar 16.11.1 | Recovery Reload | Support for disabling DAD recovery reload was introduced. Enter the **dual-active recovery-reload-disable** command in stackwise virtual mode (config-stackwise-virtual). |
| | Cisco StackWise Virtual: Catalyst 9410R Switch | Support for this feature was introduced on the Catalyst 9410R Switch. |
| Cisco IOS XE Amsterdam 17.2.1 | BUM Traffic Optimization on switches with Cisco StackWise Virtual | Support for the *BUM Traffic Optimization* feature was introduced on switches with Cisco StackWise Virtual configured. |
| Cisco IOS XE Cupertino 17.9.x | Cisco StackWise Virtual | Support for this feature was introduced on the C9400X-SUP-2, C9400X-SUP2-XL, and C9400-LC-48HX modules of Cisco Catalyst 9400 Series switches. |
| Cisco IOS XE Dublin 17.12.1 | Cisco StackWise Virtual | Support for this feature was introduced on the C9400-LC-12QC and C9400-LC-24XY modules of Cisco Catalyst 9400 Series switches. |
| Cisco IOS XE 17.13.x | Cisco StackWise Virtual | Support for this feature was introduced on the C9400-LC-48TX modules of Cisco Catalyst 9400 Series switches. |

Use the Cisco Feature Navigator to find information about platform and software image support. To access Cisco Feature Navigator, go to Cisco Feature Navigator.