StackWise Virtual Configuration Guide

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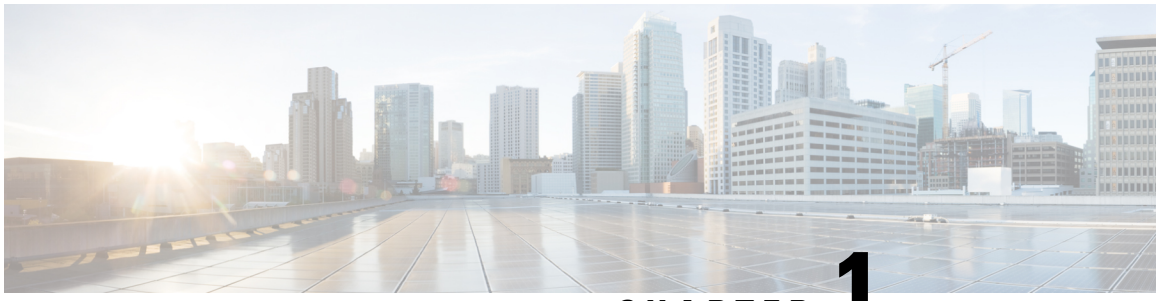

CHAPTER 1

Configure Cisco StackWise Virtual

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Prerequisites for Cisco StackWise Virtual

- Both switches in the Cisco StackWise Virtual pair must be directly connected to each other.
- Both switches in the Cisco StackWise Virtual pair must be of the same switch model.
- Both supervisors in the Cisco StackWise Virtual pair must be of the same supervisor model.
- Both switches in the Cisco StackWise Virtual pair must be running the same license level.
- Both switches in the Cisco StackWise Virtual pair must be running the same software version.
- Both switches in the Cisco StackWise Virtual pair must be running the same SDM template.
- All the ports used for configuring a StackWise Virtual Link (SVL) must share the same speed. Forexample, you cannot configure a 10G or a 40G port to form an SVL, simultaneously. Furthermore, allports used for configuring SVL must be either from the same line card or across line cards within thesame chassis.

Restrictions for Cisco StackWise Virtual

General restrictions

- If a dual-rate optic is used as SVL and/or DAD link, it automatically links up to the highest speed supported by the dual-rate optic (example, 10/25G dual optic will link up at 25G, and 40/100G dual optic will link up at 100G), and lower speeds cannot be configured on the SVL and/or DAD links.
- Only Cisco Transceiver Modules are supported as stackwise-virtual links and Dual Active Detection links.

- 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.
- Cisco StackWise Virtual is not supported on No Payload Encryption (NPE) images.
- 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.
- Secure Stackwise Virtual is not supported.

Restrictions for Cisco C9610 Series Smart Switches

- Quad Supervisor module configuration with StackWise Virtual topology is not supported on Cisco C9610 Series Smart Switches Supervisor 3 Module (C9610R SUP-3 and SUP-3-XL).
- Only Line cards C9610-LC-32CD, C9610-LC-40YL4CD, C9600-LC-48TX, C9600-LC-40YL4CD, C9600X-LC-32CD, C9600X-LC-56YL4C are supported on Cisco C9610 Series Smart Switches.
- Cisco StackWise Virtual can be configured only on the same supervisor module slot on both the chassis as asymmetric supervisor module slots between the chassis is not supported. For example, if you have inserted the supervisor module in slot 5 in chassis 1, then chassis 2 should also have the supervisor module in slot 5.
- We highly recommend using identical line cards for configuring SVL and DAD links on both switches and chassis in the SVL system.
- Cisco StackWise Virtual configuration commands will be recognised only on a switch running Advantage license.
- DAD links configured between C9600-LC-40YL4CD and C9610-LC-40YL4CD is supported only on 1G interfaces.
- Cisco C9610 Series Smart Switches Supervisor 3 Module (C9610R SUP-3 and SUP-3-XL) operating in SVL models is FIPS 140-2 compliant. FIPS keys must be configured on both the switch members individually to enable SVL with FIPS mode.
- In a Cisco StackWise Virtual solution, QSA along with 10G interfaces can be used as data ports or SVL or DAD links.
- In a Cisco StackWise Virtual solution, QSA along with 1G interfaces can be used as data ports or DAD links. SVL links are not supported on 1G interfaces.

Restrictions for Cisco C9550 Series Smart Switches

- Cisco StackWise Virtual configuration commands will be recognised only on a switch running Advantage license.
- Cisco StackWiseVirtual links are not supported on 1G.
- Cisco C9550 Series Smart Switches operating in SVL models is FIPS 140-2 compliant. FIPS keys must be configured on both the switch members individually to enable SVL with FIPS mode.

Information About Cisco StackWise Virtual

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:

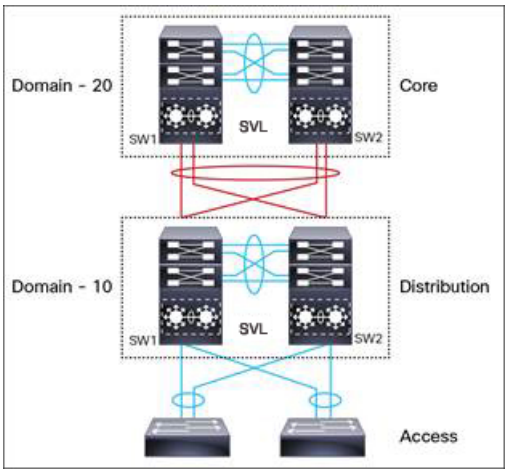
- If VLAN IDs are reused between access layers then, it will introduce a spanning tree loop that will impact the overall performance of the network.
- Spanning tree protocols and configuration are required to protect Layer 2 network against spanning tree protocol loop, and root and bridge protocol data 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.

Note Ensure that the cables or transceivers or both on all the SVL and DAD links are not disturbed when SVL is brought up.

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:

- SVL active and SVL standby
- SVL: 10G, 25G, 40G, 50G, 100G, or 400G Ethernet connections. SVL is established using the 10G,25G, 40G, 50G, 100G, or 400G interfaces depending on the switch models. However, a combination oftwo different speeds is not supported.

SVL is the link that connects the switches over Ethernet. Typically, Cisco StackWise Virtual consists of multiple 400G, 100G, 50G, 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 Aggregation Control Protocol (LACP) is activated on each member of the SVL port-channel bundle as soon as the links are established. LACP 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 termediate System to Intermediate System (ISIS). It ensures that the hardware and software versions are compatible to form the SVL active and standby and determines which switch becomes active or standby from a control plane perspective.

Cisco StackWise Virtual Header (SVH) is prepended over all control, data, and management plane traffic that traverse over each SVL between the active and standby 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 supports upto 128 MECs deployed in Layer2 or Layer 3 modes with Sup3 and Sup3-XL modules.

On Cisco C9550 Series Smart Switches (C9550-96L4D), Cisco StackWise Virtual supports upto 96 MECs deployed in Layer2 or Layer3 modes.

EtherChannel 241 is reserved for internal SVL link port-channel bundling.

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 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 and Port).

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

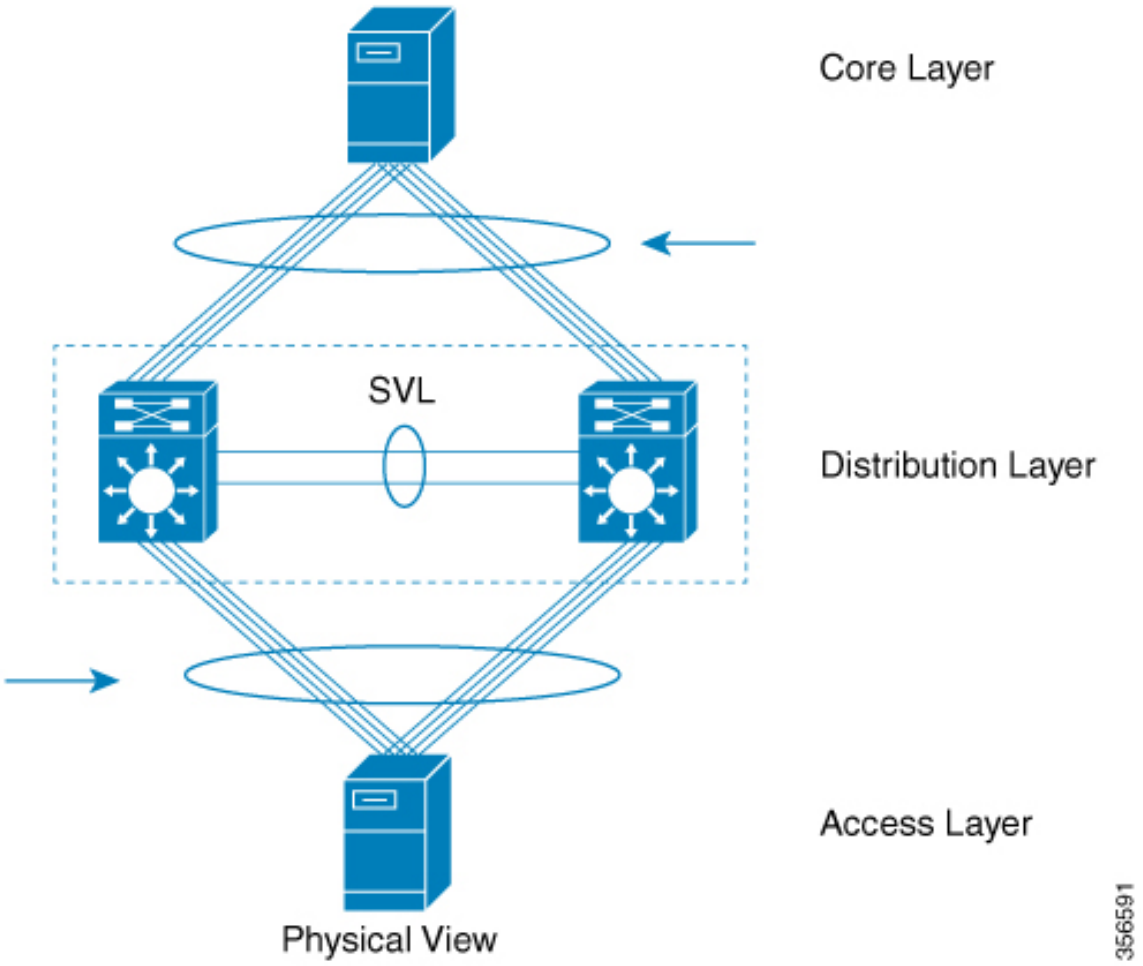
Cisco StackWise Virtual supports local switching for Broadcast, Unknown unicast and Multicast (BUM) traffic. In uncommon deployment scenarios, BUM traffic traverses through the StackWise Virtual Links. This section explains how BUM traffic is handled in a Cisco StackWise Virtual setup and in local switching.

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.

Note On the Cisco C9610 Series Smart Switches Supervisor 3 Module (C9610R-SUP-3 and SUP-3-XL) and Cisco C9550 Series Smart Switches:

- Dynamic addition and removal of SVL and DAD links are supported. If the switch is already operating in SVL mode, a device restart is not required for the SVL and DAD link addition or removal configuration to take effect.
- If a user tries to remove the last active SVL link, the user is notified of a stack split through a syslog message.

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.

This initiates recovery actions as described in the Recovery Actions, on page 13 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

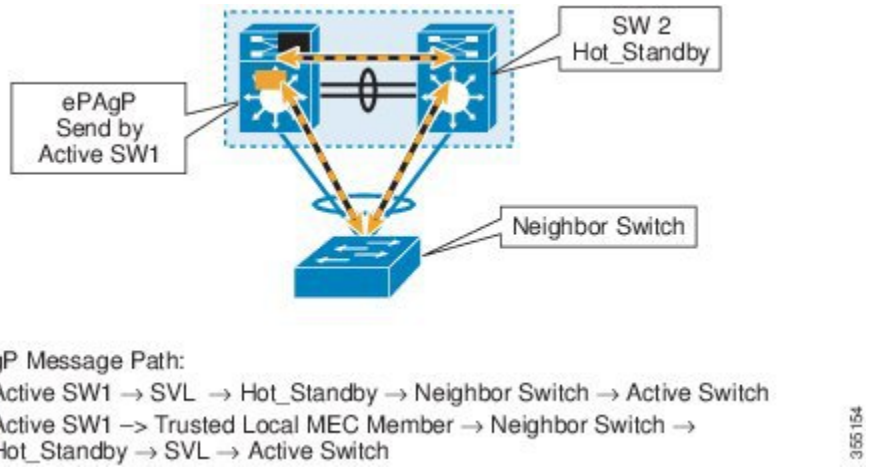
StackWise Virtual can use PAgP to detect a dual-active scenario. The MEC must have at least one port on each switch of the StackWise Virtual setup.

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 Disable Recovery Reload, on page 28 section.

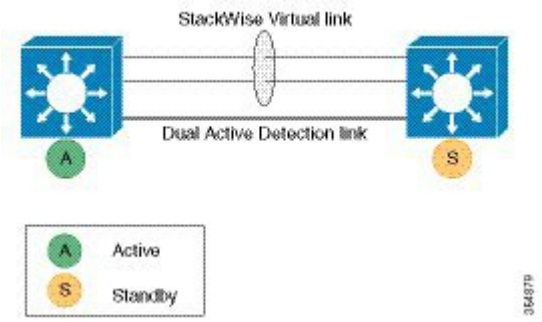
Note When a switch operating in StackWise Virtual mode enters recovery mode, its hostname will revert to the default format "Switch#". To detect and confirm that a switch is in recovery mode, users should run the command **show stackwise-virtual dual-active-detection** and check the output for the line stating "In dual-active recovery mode: Yes", which indicates that the switch is currently in recovery mode.

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.

How to Configure Cisco StackWise Virtual

Configure Cisco StackWise Virtual Settings

To enable StackWise Virtual, perform the following procedure on both the switches:

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	**switch** *switch-number* **renumber** *new switch -number*	(Optional) Reassigns the switch number.

	Command or Action	Purpose
	Example: `Device# switch 1 renumber 2`	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* **Example:** `Device# switch 1 priority 5`	(Optional) Assigns the priority number. The default priority number is 1. The highest priority number is 15.
Step 4	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 5	**stackwise-virtual** **Example:** `Device(config)# stackwise-virtual`	Enables Cisco StackWise Virtual and enters stackwise-virtual submode.
Step 6	**domain** *id* **Example:** `Device(config-stackwise-virtual)# domain 2`	(Optional) Specifies the Cisco StackWise Virtual domain ID. The domain ID range is from 1 to 255. The default value is one.
Step 7	**end** **Example:** `Device(config-stackwise-virtual)# end`	Returns to privileged EXEC mode.
Step 8	**show stackwise-virtual** **Example:** `Device# show stackwise-virtual`	
Step 9	**write memory** **Example:** `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. **Note** On the Cisco C9610 Series Smart Switches Supervisor modules (C9610R-SUP-3 and SUP-3-XL), the system database is updated instead of ROMMON variables.
Step 10	**reload** **Example:**	Restarts the switch and forms the stack.

	Command or Action	Purpose
	`Device# reload`	

Configure Cisco StackWise Virtual Link

Note

- Depending on the switch model, SVL is supported on all 400G, 100G, 50G, 40G, 25G and 10G interfaces of the Cisco C9610 Series Smart Switches and Cisco C9550 Series Smart Switches. However, a combination of different interface speeds is not supported.
- Dynamic addition and removal of SVL links with the same speed as that of the active SVL link are supported on the Cisco C9610 Series Smart Switches Supervisor 3 Module (C9610R-SUP-3) and Cisco C9550 Series Smart Switches, and therefore, a reload is not required for adding or removing the SVL links when the device is already operating in SVL mode.
- If a user tries to remove the last active SVL link, they will be notified of a stack split through a syslog message.

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

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** {**HundredGigabitEthernet** | **FortyGigabitEthernet** | **TenGigabitEthernet** | **FiftyGigabitEthernet**} <*interface*> **Example:** `Device(config)# interface FortyGigabitEthernet1/0/5`	Enters ethernet interface configuration mode.
Step 4	**stackwise-virtual link** *link value* **Example:** `Device(config-if)# stackwise-virtual link 1`	Associates the interface with configured SVL.

	Command or Action	Purpose
Step 5	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.
Step 6	**write memory** **Example:** `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. **Note** On the Cisco C9610 Series Smart Switches Supervisor 3 Module (C9610R-SUP-3 and SUP-3-XL) and Cisco C9550 Series Smart Switches, the system database is updated instead of ROMMON variables.

Step 7	**reload**
	Example:
	`Device# reload`
		Restarts the switch.
		Note: When converting a Cisco C9610 Series Smart switch or a Cisco C9550 Series Smart switch from standalone mode to SVL mode for the first time, one of the switches boots up or resets, for resolving the switch number conflict and sets the SWITCH_NUMBER environment variable to 2. The following message appears on the console prompt indicating this:
		`Waiting for remote chassis to join`
		`##########################################################`
		`Chassis number is 2`
		`All chassis in the stack have been discovered. Accelerating discovery`
		`Chassis is reloading, reason: Configured Switch num conflicts with peer, Changing local switch number to 2 and reloading to take effect`
		On the Cisco C9610 Series Smart Switches Supervisor 3 Module (C9610R-SUP-3 and SUP-3-XL) and Cisco C9550 Series Smart Switches, the following message is displayed on the console prompt:
		`%CLUSTERMGR-1-RELOAD: B0/0: clustermgr: Reloading due to reason Chassis is reloading; switch num conflicts with peer, changing local switch number to 2 and reloading`

	Command or Action	Purpose
		to take effect %PMAN-5-EXITACTION: B0/0: pvp: Process manager is exiting: process exit with reload fru code %PMAN-5-EXITACTION: R0/0: pvp: Process manager is exiting: reload fru action requested

The following is sample output from the C9610R-SUP-3 and SUP-3-XL bootup in SVL mode:

```
Switch# show module

Chassis Type: C9610R

Switch Number 1

Mod Ports Card Type                                     Model          Serial No.
---+-----+-----------------------------------------+--------------+--------------
1   44   40x1/10/25/50GE + 2x200GE + 2x400GE         C9600-LC-40YL4CD FDO253602CE
2   44   40x1/10/25/50GE + 2x200GE + 2x400GE         C9600-LC-40YL4CD FDO251809YJ
3   32   30x40/100GE + 2x40/100/400GE                C9600X-LC-32CD   FDO253205BS
4   60   56x1/10/25/50GE + 4x40/100GE                C9600X-LC-56YL4C FDO27080QKZ
5   0    Supervisor 3 Module                         C9610-SUP-3      FDO28160V76
6   0    Supervisor 3 Module
7   48   48-Port 10GE and MGIG COPPER                C9600-LC-48TX    CAT2308L2G9
8   44   40x1/10/25/50GE + 2x200GE + 2x400GE         C9610-LC-40YL4CD FDO283807D8
9   32   30x40/100GE + 2x40/100/400GE                C9600X-LC-32CD   FDO254907VU
10  32   30x40/100GE + 2x40/100/400GE                C9600X-LC-32CD   FDO26030AA5

Mod MAC addresses                     Hw   Fw           Sw                  Status
---+---------------------------------+----+------------+-------------------+--------
1   A478.06EC.7000 to A478.06EC.707F 1.0  17.18.1r      BLD_V1718_THROTTLE_ ok
2   BCD2.9513.D400 to BCD2.9513.D47F 0.2  17.18.1r      BLD_V1718_THROTTLE_ ok
3   A478.0633.F800 to A478.0633.F81F 0.2  17.18.1r      BLD_V1718_THROTTLE_ ok
4   C02C.178D.4480 to C02C.178D.44FF 0.2  17.18.1r      BLD_V1718_THROTTLE_ ok
5   24D5.E4D1.E480 to 24D5.E4D1.E4FF 0.9  17.18.1r      BLD_V1718_THROTTLE_ ok
6   N/A                               N/A  N/A           N/A                 other
7   6C8B.D3F4.7E00 to 6C8B.D3F4.7E7F 0.4  17.18.1r      BLD_V1718_THROTTLE_ ok
8   286B.5C1A.8400 to 286B.5C1A.847F 0.3  17.18.1r      BLD_V1718_THROTTLE_ ok
9   E069.BA16.1180 to E069.BA16.119F 0.2  17.18.1r      BLD_V1718_THROTTLE_ ok
10  E069.BADA.4000 to E069.BADA.401F 0.2  17.18.1r      BLD_V1718_THROTTLE_ ok

Mod Redundancy Role     Operating Redundancy Mode Configured Redundancy Mode
---+-------------------+-------------------------+---------------------------
5   Standby             sso                       sso
6   Standby             sso                       sso

Switch Number 2

Mod Ports Card Type                                     Model          Serial No.
---+-----+-----------------------------------------+--------------+--------------
1   32   30x40/100GE + 2x40/100/400GE                C9600X-LC-32CD   FDO254907W3
2   44   40x1/10/25/50GE + 2x200GE + 2x400GE         C9600-LC-40YL4CD FDO2512144G
3   44   40x1/10/25/50GE + 2x200GE + 2x400GE         C9610-LC-40YL4CD FDO283807CX
4   32   30x40/100GE + 2x40/100/400GE                C9600X-LC-32CD   FDO254907VX
5   0    Supervisor 3 Module                         C9610-SUP-3      FDO28160V74
7   32   30x40/100GE + 2x40/100/400GE                C9600X-LC-32CD   FDO261800XK
8   32   30x40/100GE + 2x40/100/400GE                C9600X-LC-32CD   FDO254909K3
9   60   56x1/10/25/50GE + 4x40/100GE                C9600X-LC-56YL4C FDO27130Q65
10  32   30x40/100GE + 2x40/100/400GE                C9610-LC-32CD    FDO28390S8J

Mod MAC addresses                     Hw   Fw           Sw                  Status
```

```
---+--------------------------------+----+------------+-----------------+--------
1   E069.BA16.1400 to E069.BA16.141F 0.2  17.18.1r      BLD_V1718_THROTTLE_ ok
2   6C03.090E.DF00 to 6C03.090E.DF7F 0.2  17.18.1r      BLD_V1718_THROTTLE_ ok
3   286B.5C1A.6400 to 286B.5C1A.647F 0.3  17.18.1r      BLD_V1718_THROTTLE_ ok
4   E069.BA16.2780 to E069.BA16.279F 0.2  17.18.1r      BLD_V1718_THROTTLE_ ok
5   8C44.A586.6280 to 8C44.A586.62FF 0.9  17.18.1r      BLD_V1718_THROTTLE_ ok
7   806A.000F.D300 to 806A.000F.D31F 0.2  17.18.1r      BLD_V1718_THROTTLE_ ok
8   E069.BA16.1E00 to E069.BA16.1E1F 0.2  17.18.1r      BLD_V1718_THROTTLE_ ok
9   6C29.D2B7.EF00 to 6C29.D2B7.EF7F 0.2  17.18.1r      BLD_V1718_THROTTLE_ ok
10  286B.5C1A.D880 to 286B.5C1A.D89F 0.3  17.18.1r      BLD_V1718_THROTTLE_ ok

Mod Redundancy Role     Operating Redundancy Mode Configured Redundancy Mode
---+------------------+-------------------------+---------------------------
5   Active              sso                       sso

Chassis 1 MAC address range: 64 addresses from b08d.57ac.bf00 to b08d.57ac.bf3f

Chassis 2 MAC address range: 64 addresses from b08d.57ac.be00 to b08d.57ac.be3f

Switch#
rommon 1 > boot
boot: attempting to boot from [bootflash:packages.conf]
boot: reading file packages.conf
#
################################################################################################


Image validated


*Dec 19 05:24:01.719: %IOSXEBOOT-4-SMART_LOG: (local/local):
Fri Dec 19 05:24:01 Universal 2025 INFO: Starting SMART daemon

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ROMMON variable 'MCP_STARTUP_DEBUG': debugging enabled
ROMMON variable 'MCP_STARTUP_DEBUG_CMD0': debug cwan oir
FIPS: Crimson DB Key Check : Key Not Found, FIPS Mode Not Enabled
cisco C9610R (X86) processor (revision V00) with 239563K bytes of memory.
CMD: debug cwan oir
Processor board ID FOX2814P8MX
0 Virtual Ethernet interface
154 Forty/Hundred Gigabit Ethernet interfaces
136 One/Ten/TwentyFive/Fifty Gigabit Ethernet interfaces
4 Forty/Hundred/TwoHundred Gigabit Ethernet interfaces
14 Forty/Hundred/FourHundred Gigabit Ethernet interfaces
8192K bytes of non-volatile configuration memory.
33554432K bytes of physical memory.
24190976K bytes of Bootflash at bootflash:.
3276800K bytes of Crash Files at crashinfo:.
468850503K bytes of SATA hard disk at disk0:.

Base Ethernet MAC Address          : b0:8d:57:ac:be:00
Motherboard Assembly Number        : 53A3
Motherboard Serial Number          : FOX2814P8MX
Model Revision Number              : V02
Motherboard Revision Number        : 2
Model Number                       : C9610R
System Serial Number               : FOX2814P8MX

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Press RETURN to get started!


*Dec 19 05:25:07.905: %CRYPTO-5-SELF_TEST_START: Crypto algorithms release (Rel5b), Entropy
 release (3.4.1)
       begin Crypto Module self-tests
*Dec 19 05:25:07.905: %CRYPTO-5-SELF_TEST_START: Crypto algorithms release (Rel5b), Entropy
 release (3.4.1)
       begin Crypto Module Integrity Test
*Dec 19 05:25:07.942: %CRYPTO-5-SELF_TEST_END: Crypto Integrity self-test completed
```

```
successfully
       All tests passed.
*Dec 19 05:25:08.234: %CRYPTO-5-SELF_TEST_END: Crypto Algorithm self-test completed
successfully
       All tests passed.
*Dec 19 05:25:09.025: %IOSD_INFRA-6-IFS_DEVICE_OIR: Device disk0 added
*Dec 19 05:25:10.958: %CRYPTO-4-AUDITWARN: Encryption audit check could not be performed
*Dec 19 05:25:10.958: %CRYPTO_ENGINE-4-CSDL_COMPLIANCE_DISABLED: Cisco PSB security compliance

has been disabled by configuration
*Dec 19 05:25:12.131: %LINK-3-UPDOWN: Interface LIIN49/2, changed state to up
*Dec 19 05:25:12.796: %LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback999999,
changed state to up
*Dec 19 05:25:13.009: %CLNS-6-DFT_OPT: Protocol timers for fast convergence are Enabled.
*Dec 19 05:25:13.248: %LINEPROTO-5-UPDOWN: Line protocol on Interface LIIN49/2,
changed state to up
*Dec 19 05:25:14.136: %LINK-3-UPDOWN: Interface uds_punject49/3, changed state to up
*Dec 19 05:25:14.143: %SYS-7-NVRAM_INIT_WAIT_TIME: Waited 0 seconds for NVRAM to be available
*Dec 19 05:25:15.141: %LINEPROTO-5-UPDOWN: Line protocol on Interface uds_punject49/3,
changed state to up
*Dec 19 05:27:08.540: %SPA_OIR-6-ONLINECARD: SPA (C9600X-LC-56YL4C) online in subslot 9/0
*Dec 19 05:27:16.341: %LINK-3-UPDOWN: Interface FiftyGigE9/0/48, changed state to up
*Dec 19 05:27:18.333: %LINK-3-UPDOWN: Interface Port-channel241, changed state to up
*Dec 19 05:27:19.332: %LINEPROTO-5-UPDOWN: Line protocol on Interface FiftyGigE9/0/48,
changed state to up
*Dec 19 05:27:19.344: %LINEPROTO-5-UPDOWN: Line protocol on Interface Port-channel241,
changed state to up
*Dec 19 05:27:20.374: %CLNS-5-ADJCHANGE: ISIS: Adjacency to 0871.7219.1000 (Port-channel241)
 Up,
 new adjacency
*Dec 19 05:27:21.344: %CLNS-5-ADJCHANGE: ISIS: Adjacency to sw.B08D57ACBF00 (Port-channel241)

Up, new adjacency
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ROMMON variable 'MCP_STARTUP_DEBUG': debugging enabled
ROMMON variable 'MCP_STARTUP_DEBUG_CMD0': debug cwan oir
Unable to obtain tty for signal, defaulting to console
CMD: debug cwan oir
debug cwan oir
      ^
% Invalid input detected at '^' marker.

FIPS: Crimson DB Key Check : Key Not Found, FIPS Mode Not Enabled

*Dec 19 05:27:39.780: ISIS-GRACEFUL-RELOAD: Init State GR_NOT_SUPPORTED
*Dec 19 05:27:40.081: Default mpls label mode set to "per-vrf"
cisco C9610R (X86) processor (revision V00) with 5763019K/6147K bytes of memory.
CMD: debug cwan oir
Processor board ID FOX2814P8MX
0 Virtual Ethernet interface
154 Forty/Hundred Gigabit Ethernet interfaces
136 One/Ten/TwentyFive/Fifty Gigabit Ethernet interfaces
4 Forty/Hundred/TwoHundred Gigabit Ethernet interfaces
14 Forty/Hundred/FourHundred Gigabit Ethernet interfaces
32768K bytes of non-volatile configuration memory.
33554432K bytes of physical memory.
24190976K bytes of Bootflash at bootflash:.
3276800K bytes of Crash Files at crashinfo:.
468850503K bytes of SATA hard disk at disk0:.

Base Ethernet MAC Address          : b0:8d:57:ac:be:00
Motherboard Assembly Number        : 53A3
Motherboard Serial Number          : FOX2814P8MX
Model Revision Number              : V02
Motherboard Revision Number        : 2
Model Number                       : C9610R
System Serial Number               : FOX2814P8MX

ConstWan OIR debug debugging is on
*Dec 19 05:27:47.030: Master key is already set, not generating new key
Warning: When Cisco determines that a fault or defect can be traced to
the use of third-party transceivers installed by a customer or reseller,
then, at Cisco's discretion, Cisco may withhold support under warranty or
a Cisco support program. In the course of providing support for a Cisco
networking product Cisco may require that the end user install Cisco
transceivers if Cisco determines that removing third-party parts will
assist Cisco in diagnosing the cause of a support issue.
```

```
*Dec 19 05:27:47.088: %CNS IQ:0.1 ID:0 Changed:[Switch]
*Dec 19 05:27:47.088: %CNS IQ:0.2 ID:1 Changed:[Switch]
*Dec 19 05:27:47.088: %CNS IQ:0.3 ID:2 Changed:[Switch]
*Dec 19 05:27:47.091:  Power redundancy mode changed to: Combined

*Dec 19 05:27:47.092:  Power redundancy mode changed to: Combined

login on-success log 14400
                     ^
% Invalid input detected at '^' marker.

*Dec 19 05:27:56.548: yang-infra: self-signed cert inserted(TP-self-signed-1944634332)
*Dec 19 05:27:56.563: AAA CC: AAA CC Default Policy Validation: AAA Default policy is
 not available, creating one
% Password has less than number of numeric characters configured
% Warning: Password/key validation failed against default policy
 INSECURE DYNAMIC WARNING - Module: AAA, Command: username admin privilege 15 password 6
*,
 Reason: Configuration employs a weak password or key, Remediation:
 Configure a strong password or key meeting security complexity requirements,
 Submode: configure, Parent CLI: configure
 INSECURE DYNAMIC WARNING - Module: IP, Command: ip forward-protocol udp tftp,
 Reason: Legacy protocol poses data confidentiality and integrity risks due to
 lack of encryption and authentication, Remediation: This is a legacy feature,
 please consider disabling it, Submode: configure, Parent CLI: Not Applicable
 INSECURE DYNAMIC WARNING - Module: TELNET, Command: ip telnet comport enable,
 Reason: IP traffic is not encrypted, Remediation: Migrate to secure SSH-based remote access,

 Submode: configure, Parent CLI: Not Applicable
 SECURITY WARNING - Module: TFTP, Command: ip tftp source-interface GigabitEthernet0/0 ,
 Reason: Legacy protocol poses data confidentiality and integrity risks due to lack of
encryption
 and authentication, Description: TFTP service enabled - unencrypted file transfer protocol

 vulnerable to eavesdropping and tampering, Remediation: Transition to secure file transfer

 methods using SCP, SFTP, HTTPS protocols
 INSECURE DYNAMIC WARNING - Module: RCMD, Command: ip rcmd domain-lookup,
 Reason: No encryption is configured, Remediation: This is a legacy feature,
 please consider disabling it,
 Submode: configure, Parent CLI: Not Applicable
 SECURITY WARNING - Module: LINE, Command: transport input all ,
 Reason: Legacy protocol poses data confidentiality and integrity risks due to
 lack of encryption and authentication, Description: Line transport
 configured with unencrypted protocols - allows plaintext transmission of sensitive
 data, Remediation: Migrate to secure SSH-based remote access


Press RETURN to get started!
```

The following is a sample output from Cisco C9550 Series Smart Switches bootup in SVL mode:

```
Switch# show module

Chassis Type: C9550-48L4CD

Switch Number 1

Mod Ports Card Type                                  Model          Serial No.
---+-----+--------------------------------------+--------------+--------------
1   54   Cisco 9550-48L4CD Switch                  C9550-48L4CD     FDO301707X5

Mod MAC addresses                     Hw   Fw           Sw                  Status
---+--------------------------------+----+------------+-------------------+--------
```

```
1   B02B.64CC.8400 to B02B.64CC.8435 0.6  26.1.1.9      26.02.01ea1        ok

Mod Redundancy Role     Operating Redundancy Mode Configured Redundancy Mode
---+-------------------+-------------------------+---------------------------
1   Active              sso                       sso

Switch Number 2

Mod Ports Card Type                                  Model          Serial No.
---+-----+--------------------------------------+--------------+--------------
1   54   Cisco 9550-48L4CD Switch                  C9550-48L4CD     FDO30170772

Mod MAC addresses                    Hw   Fw           Sw                  Status
---+--------------------------------+----+------------+-------------------+--------
1   F4B8.211B.E400 to F4B8.211B.E435 0.6  26.1.1.9      26.02.01ea1        ok

Mod Redundancy Role     Operating Redundancy Mode Configured Redundancy Mode
---+-------------------+-------------------------+---------------------------
1   Standby             sso                       sso

Switch#
```

Enabling 400G SVL on the C9600X-LC-32CD and C9610-LC-32CD Line Card

SVL and DAD link configurations on the QSFP-DD interfaces (400G Ethernet ports 27 and 31) of the C9600X-LC-32CD and C9610-LC-32CD line card are not supported when the ports are operating in non-SVL mode. To enable the SVL links on ports 27 and 31, you must first enable StackWise Virtual on both the switches without configuring any links as SVL or DAD.

After both the switches are up in StackWise Virtual mode after reload, execute the **hw-module switch** {**1 | 2**} *slot number* **port-group** *range* **mode 400G** command to enable the 400G interface. After the **hw-module** configuration is complete, you can configure the linked 400G interfaces (FourHundredGigabitEthernet 27 and FourHundredGigabitEthernet 31) as SVL links and run the **write memory** command to save the configuration.

The switches then auto-detect the SVL links, and one of the switches restarts because of stack merge. In the next restart cycle, the same switch restarts again to set switch number 2. In subsequent restart cycles, the device joins the SVL stack as standby, and the entire SVL system reaches SSO state. You can use the **show stackwise-virtual link** and **show switch** commands to verify whether the switch is operating in SVL mode in SSO state.

Configure BUM Traffic Optimization

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

Procedure

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

	Command or Action	Purpose
Step 3	**svl l2bum optimization** **Example:** `Device(config)# svl l2bum optimization`	Enables the BUM traffic optimization within StackWise Virtual setup globally. This feature is enabled by default. Use the **no** form of this command to disable this feature.
Step 4	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.
Step 5	**show platform pm l2bum-status vlan** *vlan-id* **Example:** `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** **Example:** `Device# show platform software fed switch ac fss bum-opt summary`	Displays the final state of optimization.

Configure 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 Dynamic addition and removal of DAD links are supported on Cisco C9610 Series Smart Switches Supervisor 3 Module (C9610R-SUP-3 and SUP-3-XL), and on Cisco C9550 Series Smart Switches and therefore, a reload is not required for adding or removing the DAD links when the device is already operating in SVL mode.

Procedure

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

	Command or Action	Purpose
Step 3	**interface** {**HundredGigabitEthernet** | **FortyGigabitEthernet** | **TenGigabitEthernet** | **FiftyGigabitEthernet**} *<interface>* **Example:** `Device(config)# interface FortyGigabitEthernet1/0/20`	Enters ethernet interface configuration mode.
Step 4	**stackwise-virtual dual-active-detection** **Example:** `Device(config-if)# stackwise-virtual dual-active-detection`	Associates the interface with StackWise Virtual dual-active-detection. **Note** This command will not be visible on the device after the configuration, but will continue to function.
Step 5	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.
Step 6	**write memory** **Example:** `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. **Note** On the Cisco C9610 Series Smart Switches Supervisor 3 Module (C9610R-SUP-3 and SUP-3-XL), the system database is updated instead of ROMMON variables.
Step 7	**reload** **Example:** `Device# reload`	Restarts the switch and configuration takes effect.

Enable 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** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**channel-group** *group_ID* **mode desirable** **Example:** `Device(config-if)# channel-group 1 mode desirable`	Enables PAgP MEC with channel-group id in the range of 1 to for 10 GigabitEthernet interfaces.
Step 4	**exit** **Example:** `Device(config-if)# exit`	Exits interface configuration.
Step 5	**interface port-channel** *channel-group-id* **Example:** `Device(config)# interface port-channel 1`	Selects a port channel interface to configure.
Step 6	**shutdown** **Example:** `Device(config-if)# shutdown`	Shuts down an interface.
Step 7	**exit** **Example:** `Device(config-if)# exit`	Exits interface configuration.
Step 8	**stackwise-virtual** **Example:** `Device(config)# stackwise-virtual`	Enters the StackWise Virtual configuration mode.
Step 9	**dual-active detection pagp** **Example:** `Device(config-stackwise-virtual)# dual-active detection pagp`	Enables pagp dual-active detection. This is enabled by default.
Step 10	**dual-active detection pagp trust channel-group** *channel-group id* **Example:**	Enables dual-active detection trust mode on channel-group with the configured ID.

	Command or Action	Purpose
	`Device(config-stackwise-virtual)# dual-active detection pagp trust channel-group 1`	
Step 11	**exit** **Example:** `Device(config-stackwise-virtual)# exit`	Exits the StackWise-Virtual configuration mode.
Step 12	**interface port-channel** *portchannel* **Example:** `Device(config)# interface port-channel 1`	Configured port-channel on the switch.
Step 13	**no shutdown** **Example:** `Device(config-if)# no shutdown`	Enables the configured port-channel on the switch.
Step 14	**end** **Example:** `Device(config-if)# end`	Exits interface configuration.
Step 15	**write memory** **Example:** `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.

Disable 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** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password, if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**stackwise-virtual** **Example:** `Device(config)# stackwise-virtual`	Enables Cisco StackWise Virtual and enters stackwise-virtual mode.
Step 4	**dual-active recovery-reload-disable** **Example:** `Device(config-stackwise-virtual)# dual-active recovery-reload-disable`	Disables automatic recovery reload of the switch. 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** **Example:** `Device(config-stackwise-virtual)# end`	Returns to privileged EXEC mode.

Disable Cisco StackWise Virtual

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

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**no stackwise-virtual dual-active-detection** **Example:** `Device(config-if)# no stackwise-virtual dual-active-detection`	Dissociates the interface from StackWise Virtual DAD.
Step 4	Repeat step **Example:** `Device(config)#`	Enters the interface configuration mode.

	Command or Action	Purpose
Step 5	**no stackwise-virtual link** *link* **Example:** `Device(config-if)# no stackwise-virtual link 1`	Dissociates the interface from SVL.
Step 6	**exit** **Example:** `Device(config-if)# exit`	Exits interface configuration.
Step 7	**no stackwise-virtual** **Example:** `Device(config)# no stackwise-virtual`	Disables StackWise Virtual configuration.
Step 8	**exit** **Example:** `Device(config)# exit`	Exits the global configuration mode.
Step 9	**write memory** **Example:** `Device# write memory`	Saves the running configuration.
Step 10	**reload** **Example:** `Device# reload`	Restarts the switch and the configuration takes effect.

Configuration Examples for StackWise Virtual

This section provides the following configuration examples:

- Example: Configure StackWise Virtual Link, on page 30
- Example: Display StackWise Virtual Link Information, on page 33

Example: Configure 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 HundredGigabitEthernet5/0/1
Device(config-if)# stackwise-virtual link 1
WARNING: All the extraneous configurations will be removed for HundredGigabitEthernet5/0/1
 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 HundredGigabitEthernet5/0/1
Device(config-if)# stackwise-virtual link 1
WARNING: All the extraneous configurations will be removed for HundredGigabitEthernet5/0/1
 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
```

The following example show how to configure SVL on the Cisco C9610 Series Smart Switches Supervisor 3 Module (C9610R-SUP-3 and SUP-3-XL):

```
Device> enable
Device# configure terminal
Device(config)# interface FiftyGigabitEthernet1/0/5
Device(config-if)# stackwise-virtual link 1
WARNING: AUTO-LC-SHUTDOWN is disabled for chassis 1. Suggested to be enabled and configured
 with highest priority for line cards with stackwise virtual links
WARNING: All the extraneous configurations will be removed for FiftyGigE1/0/5
*Sep 29 09:33:25.572: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
console as console
```

Example: Display StackWise Virtual Link Information with FIPS enabled

The following is a sample output of **show fips authorization-key** command from the Cisco C9550 Series Smart Switches:

```
Device(config)#fips authorization-key ?
  WORD  128-bits (16 octet) key to be used

Device(config)#fips authorization-key
FIPS: Stored key (16) : ABCDABCDABCDABCDABCDABCDABCDABCD

Device#show
%SYS-5-CONFIG_I: Configured from console by priv! on console

Device#show fips ?
  authorization-key  Show the installed authorization key
  status             Show fips status

Device#show fips status
Switch is in Fips Configured state and not SESA Ready
Device#show fips authorization-key
FIPS: No key installed.

Device# show fips status
Switch is in Fips Running state and SESA Ready
Device# sh fips au
Device# sh fips authorization-key
FIPS: Stored key (16): ABCDABCDABCDABCDABCDABCDABCDABCD
Device# end
```

Example: Configure 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 HundredGigabitEthernet5/0/1
Device(config-if)#stackwise-virtual dual-active-detection
Please reload the switch for Stackwise Virtual configuration to take effect
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 HundredGigabitEthernet5/0/1
Device(config-if)#stackwise-virtual dual-active-detection
Please reload the switch for Stackwise Virtual configuration to take effect
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
```

The following is a sample configuration for configuring a StackWise Virtual Fast Hello dual-active-detection link on the Cisco C9610 Series Smart Switches Supervisor 3 Module (C9610R-SUP-3 and SUP-3-XL).

```
Device> enable
Device# configure terminal
Device(config)# interface FiftyGigabitEthernet2/5/0/41
Device(config-if)# stackwise-virtual dual-active-detection
WARNING: All the extraneous configurations will be removed for FiftyGigE2/5/0/41.
*Sep 29 09:38:01.035: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
console as console
*Sep 29 09:38:01.063: %LINEPROTO-5-UPDOWN: Line protocol on Interface FiftyGigE2/5/0/41,
changed state to down
Device(config-if)#
*Sep 29 09:38:02.067: %LINEPROTO-5-UPDOWN: Line protocol on Interface FiftyGigE1/6/0/41,
changed state to down
Device(config-if)#
Device(config-if)#
*Sep 29 09:38:03.067: %LINK-3-UPDOWN: Interface FiftyGigE1/6/0/41, changed state to down
*Sep 29 09:38:03.080: %LINK-3-UPDOWN: Interface FiftyGigE2/5/0/41, changed state to downint
 fif
*Sep 29 09:38:07.544: %CLUSTERMGR-6-DUAL_ACTIVE_CFG_MSG: Chassis 2 B0/0: clustermgr: Dual
Active Detection link is available now1/6/0
*Sep 29 09:38:09.525: %LINK-3-UPDOWN: Interface FiftyGigE1/6/0/41, changed state to up
*Sep 29 09:38:09.544: %LINK-3-UPDOWN: Interface FiftyGigE2/5/0/41, changed state to up
*Sep 29 09:38:10.525: %LINEPROTO-5-UPDOWN: Line protocol on Interface FiftyGigE1/6/0/41,
changed state to up/41
Device(config-if)#
Device(config-if)#
Device(config-if)#
*Sep 29 09:38:10.544: %LINEPROTO-5-UPDOWN: Line protocol on Interface FiftyGigE2/5/0/41,
changed state to upstackwise-virtual dual-active-detection
Device(config-if)#stackwise-virtual dual-active-detection
WARNING: All the extraneous configurations will be removed for FiftyGigE1/6/0/41.
*Sep 29 09:38:14.108: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
console as console
*Sep 29 09:38:14.141: %LINEPROTO-5-UPDOWN: Line protocol on Interface FiftyGigE1/6/0/41,
changed state to down
Device(config-if)#
*Sep 29 09:38:14.144: %CLUSTERMGR-6-DUAL_ACTIVE_CFG_MSG: Chassis 2 B0/0: clustermgr: Dual
```

```
Active Detection links are not available anymore
Device#
*Sep 29 09:38:16.213: %LINK-3-UPDOWN: Interface FiftyGigE1/6/0/41, changed state to down
*Sep 29 09:38:16.216: %LINK-3-UPDOWN: Interface FiftyGigE2/5/0/41, changed state to down
*Sep 29 09:38:17.206: %SYS-5-CONFIG_I: Configured from console by console
*Sep 29 09:38:17.217: %LINEPROTO-5-UPDOWN: Line protocol on Interface FiftyGigE2/5/0/41,
changed state to down
*Sep 29 09:38:17.254: %CLUSTERMGR-6-DUAL_ACTIVE_CFG_MSG: Chassis 2 B0/0: clustermgr: Dual
Active Detection link is available now
*Sep 29 09:38:17.255: %CLUSTERMGR-6-DUAL_ACTIVE_CFG_MSG: Chassis 1 B0/0: clustermgr: Dual
Active Detection link is available now
Device#
*Sep 29 09:38:19.252: %LINK-3-UPDOWN: Interface FiftyGigE2/5/0/41, changed state to up
*Sep 29 09:38:19.256: %LINK-3-UPDOWN: Interface FiftyGigE1/6/0/41, changed state to up
*Sep 29 09:38:20.252: %LINEPROTO-5-UPDOWN: Line protocol on Interface FiftyGigE2/5/0/41,
changed state to up
Device#
Device#
*Sep 29 09:38:20.256: %LINEPROTO-5-UPDOWN: Line protocol on Interface FiftyGigE1/6/0/41,
changed state to up
Device#
```

Example: Display StackWise Virtual Link Information

Sample output of show stackwise-virtual link command

In this example, the output is displayed from a switch where SVL is configured.

```
Device# show stackwise-virtual link

Stackwise Virtual Link(SVL) Information:
----------------------------------------
Flags:
------
Link Status
-----------
U-Up D-Down
Protocol Status
---------------
S-Suspended P-Pending E-Error T-Timeout R-Ready
-----------------------------------------------
Switch       SVL      Ports                          Link-Status        Protocol-Status
------       ---      -----                          -----------        ---------------
1            1        HundredGigabitEthernet1/5/0/1          U                  R

2            1        HundredGigabitEthernet2/5/0/1          U                  R
```

The following is a sample output from the Cisco C9610 Series Smart Switches Supervisor 3 Module (C9610R-SUP-3 and SUP-3-XL):

```
Device# show stackwise-virtual link

Stackwise Virtual Link(SVL) Information:
----------------------------------------
Flags:
------
Link Status
-----------
U-Up D-Down
Protocol Status
---------------
```

```
s-Suspended P-Bundled E-Error D-Down R-RLayer3 I-Indiv
-----------------------------------------------------
Switch  SVL     Ports              Link-Status     Protocol-Status
------  ---     -----              -----------     ---------------
1       1       HundredGigE1/0/7   U               P
2       1       HundredGigE2/0/7   U               P
```

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: Display 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        HundredGigabitEthernet1/5/0/1         up
2        HundredGigabitEthernet2/5/0/1         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: Disabled
Recovery Reload for switch 2: Disabled
Dual-Active-Detection Configuration:
-------------------------------------
Switch Dad port Status
------ ------------ ---------
1 HundredGigabitEthernet1/5/0/1 up
2 HundredGigabitEthernet2/5/0/1 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
Fo2/1/0/21        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.

Verify the Cisco StackWise Virtual Configuration

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

Table 1: 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.

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 notedotherwise.

Release	Feature Name and Description	Supported Platforms
Cisco IOS XE 26.2.1ea	Cisco StackWise Virtual: Cisco StackWise Virtual feature support has been introduced.	Cisco C9550 Series Smart Switches
Cisco IOS XE 17.18.2	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	Cisco C9610 Series Smart Switches