Example: Configuring Link Aggregation Groups Using Uplink Virtual Chassis Ports

You can form link aggregation groups (LAGs) between Virtual Chassis member switches in different wiring closets using uplink Virtual Chassis ports (VCPs) and, on EX4200-24F switches, network VCPs. LAGs balance traffic across the member links, increase the uplink bandwidth, and provide increased availability. To form LAGs using uplink or network VCPs, you configure the uplink module interfaces or network interfaces on the member switches as VCPs and connect the VCPs using fiber-optic cables. For the LAGs to form, the uplink or network VCPs on each member switch that will form a LAG must operate at the same link speed and you must interconnect at least two uplink or network VCPs on each of those members. You can connect uplink or network VCPs operating at different link speeds, but they will not form a LAG.

NOTE: The LAGs formed by VCPs are different from LAGs formed by Virtual Chassis network interfaces. For more information on LAGs formed by network interfaces, see Understanding Virtual Chassis Configurations and Link Aggregation.

This example shows how to configure uplink module interfaces and network interfaces as VCPs on multiple member switches of a Virtual Chassis configuration and then connect them to form LAGs:

Requirements

This example uses the following hardware and software components:

- JUNOS Release 9.6 or later for EX Series switches
- Five EX4200 switches, one of which is an EX4200-24F model
- Two SFP uplink modules
- Two XFP uplink modules

Before you configure the uplink module interfaces and network interfaces on Virtual Chassis member switches as VCPs and interconnect the members to form a LAG, be sure you have:

1. Installed the SFP uplink modules in the SWA-0 and SWA-2 switches and installed the XFP uplink modules in the SWA-1 and SWA-3 switches. See Installing an Uplink Module in an EX3200 or EX4200 Switch.
2. Powered on SWA-0, connected it to the network, and run the EZSetup program. See Connecting and Configuring an EX Series Switch (CLI Procedure) or Connecting and Configuring an EX Series Switch (J-Web Procedure) for details.
3. Configured SWA-0 with the virtual management Ethernet (VME) interface for remote, out-of-band management of the Virtual Chassis configuration, if desired. See Configuring the Virtual Management Ethernet Interface for Global Management of a Virtual Chassis (CLI Procedure).
4. Ensured that SWA-1 is not powered on and then interconnected SWA-0 and SWA-1 using the dedicated VCPs on the rear panel.

NOTE: The interfaces for the dedicated VCPs are operational by default. They do not need to be configured.

5. Ensured that SWA-2, SWA-3, and SWA-4 are not powered on. They are not connected in any way, so when initially powered up they will be standalone switches.

Overview and Topology

In this example, five EX4200 switches will be interconnected to form LAGs for ease of monitoring and manageability. Two of these switches (SWA-0 and SWA-1) are located in wiring closet A and the three others (SWA-2, SWA-3, and SWA-4) are located in wiring closet B. SWA-0 will form one LAG with SWA-2 and another LAG with SWA-4, and SWA-1 will form a LAG with SWA-3.

We will use fiber-optic cables connected to the uplink and network VCPs to interconnect the member switches in wiring closet A to the member switches in wiring closet B.

We will specify the highest mastership priority value (255) for SWA-0 to make it the master before we power on SWA-1. Because SWA-0 and SWA-1 are interconnected with the dedicated VCPs, the master detects that SWA-1 is a member of its Virtual Chassis configuration and assigns it a member ID.

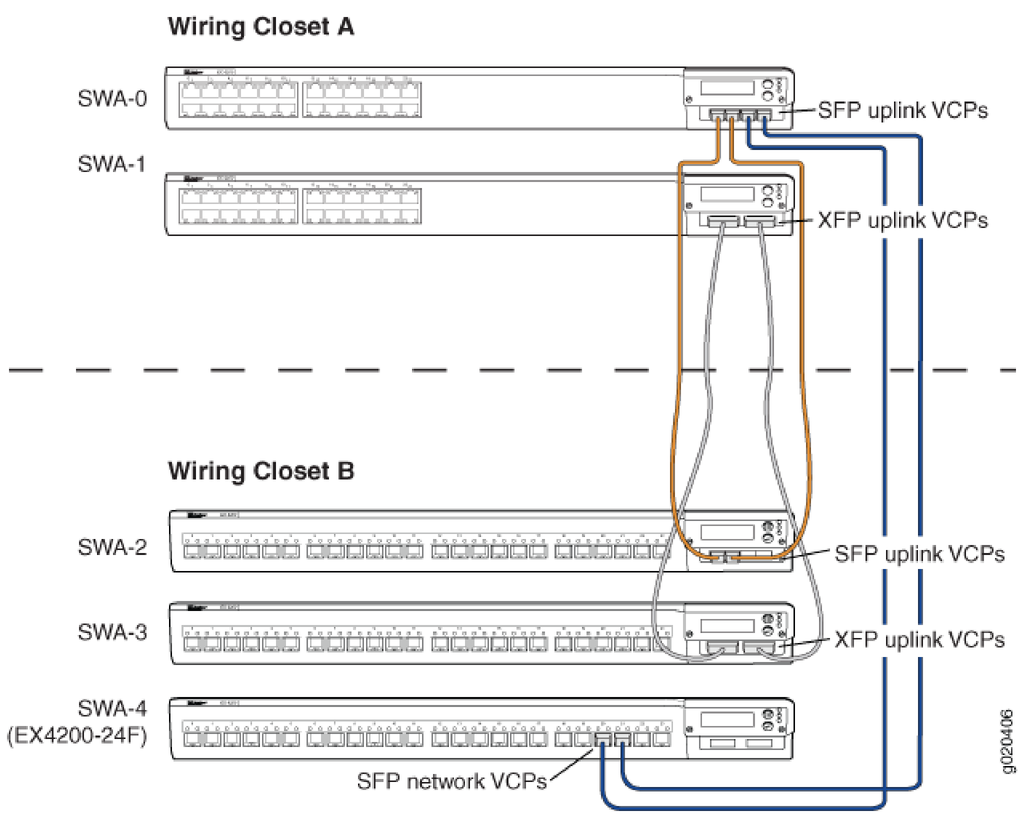
We will use SWA-2 as the backup of the Virtual Chassis configuration. We will configure the same mastership priority value for SWA-2 (255) that we configured for the master. Because we power on SWA-0 before we power on SWA-2, SWA-0 retains mastership of the Virtual Chassis configuration.

NOTE: We recommend setting identical mastership priority values for the master and backup members for high availability and smooth transition of mastership in case the original master becomes unavailable.

We will configure the uplink module interfaces on three of the switches as uplink VCPs. On the EX4200-24F switch we will configure two of the network interfaces as VCPs. We will interconnect two of the SFP uplink VCPs on SWA-0 with two of the SFP uplink VCPs on SWA-2. Similarly, we will interconnect the two XFP uplink VCPs on SWA-1 with the two XFP uplink VCPs on SWA-3. Finally, we will connect the two remaining SFP uplink VCPs on SWA-0 with two network VCPs on SWA-4. As a result, three LAGs will be automatically formed.

Figure 1 shows the interconnections used to form LAGs using uplink VCPs and the network VCPs after the procedure below has been completed.

Figure 1: Virtual Chassis Interconnected Across Wiring Closets to Form LAGs



Configuration

To configure the Virtual Chassis uplink module interfaces and network interfaces as uplink VCPs and interconnect them between two wiring closets to form LAGs, perform these tasks:

Step-by-Step Procedure

To configure a Virtual Chassis across multiple wiring closets and interconnect them to form LAGs:

1. Configure the mastership priority of SWA-0 (member 0) to be the highest possible value (255), thereby ensuring that it functions as the master of the expanded Virtual Chassis configuration:

```
[edit virtual-chassis]
user@SWA-0# set member 0 mastership-priority 255
```

2. Power on SWA-1.

3. Prepare the members in wiring closet A for interconnecting with the member switches in wiring closet B by setting all of the SFP uplink module interfaces on SWA-0 and two of the uplink module interfaces on SWA-1 as uplink VCPs:

```
user@SWA-0> request virtual-chassis vc-port  set pic-slot 1 port 0
user@SWA-0> request virtual-chassis vc-port set pic-slot 1 port 1
user@SWA-0> request virtual-chassis vc-port set pic-slot 1 port 2
user@SWA-0> request virtual-chassis vc-port set pic-slot 1 port 3
user@SWA-0> request virtual-chassis vc-port set pic-slot 1 port 0 member
1
user@SWA-0> request virtual-chassis vc-port set pic-slot 1 port 1 member
1
```

NOTE: This example omits the specification of the member *member-id* option in configuring the uplink VCPs for SWA-0 (and, later, for SWA-2). The command applies by default to the switch where it is executed.

4. Power on SWA-2.

5. If SWA-2 was previously configured, revert to the factory default configuration.

6. Prepare SWA-2 in wiring closet B by configuring its mastership priority to be the highest possible value (255). Its member ID is currently 0, because it is not yet interconnected with the other members of the Virtual Chassis configuration. It is operating as a standalone switch. Its member ID will change when it is interconnected.

```
[edit virtual-chassis]
user@SWA-2# set member 0 mastership-priority 255
```

NOTE: SWA-2 is configured with the same mastership priority value that we configured for SWA-0. However, the longer uptime of SWA-0 ensures that, once the interconnection is made, SWA-0 functions as the master and SWA-2 functions as the backup.

7. Specify two of the SFP uplink module interfaces in SWA-2 as uplink VCPs. The member IDs are 0, because they are not yet interconnected with the other members of the Virtual Chassis configuration:

NOTE: The setting of the uplink VCPs remain intact when SWA-2 reboots and joins the Virtual Chassis configuration as member 2.

```
user@SWA-2> request virtual-chassis vc-port set pic-slot 1 port 0
user@SWA-2> request virtual-chassis vc-port set pic-slot 1 port 1
```

8. Power down SWA-2.
9. Physically interconnect SWA-0 and SWA-2 across wiring closets using two of the uplink VCPs on each switch.
10. Power on SWA-2. SWA-2 joins the Virtual Chassis configuration and a LAG is automatically formed between SWA-0 and SWA-2. In addition, although SWA-0 and SWA-2 have the same mastership priority value (255), SWA-0 was powered on first and thus has longer uptime. This results in SWA-0 retaining mastership while SWA-2 reboots and joins the now expanded Virtual Chassis configuration as the backup, with member ID 2.
11. Power on SWA-3.
12. If SWA-3 was previously configured, revert to the factory default configuration.
13. Specify both XFP uplink module interfaces in SWA-3 as uplink VCPs:

```
user@SWA-3> request virtual-chassis vc-port set pic-slot 1 port 0
user@SWA-3> request virtual-chassis vc-port set pic-slot 1 port 1
```

14. Power down SWA-3.
15. Physically interconnect SWA-3 with SWA-2 using their dedicated VCPs.
16. Physically interconnect SWA-1 and SWA-3 across wiring closets using their uplink VCPs.
17. Power on SWA-3. It joins the Virtual Chassis configuration as member 3.

NOTE: Member ID 3 is assigned to SWA-3 because SWA-3 was powered on after members 0, 1, and 2.

A LAG is automatically formed between SWA-1 and SWA-3. In addition, both SWA-1 and SWA-3 have the default mastership priority value (128) and function in a linecard role.

18. Power on SWA-4.
19. If SWA-4 was previously configured, revert to the factory default configuration.
20. Configure two of the network interfaces on SWA-4 as uplink VCPs:

```
user@SWA-4> request virtual-chassis vc-port set pic-slot 0 port 20
user@SWA-4> request virtual-chassis vc-port set pic-slot 0 port 21
```

21. Power down SWA-4.
22. Physically interconnect SWA-4 and SWA-0 across wiring closets using the network VCPs on SWA-4 and the two remaining SFP uplink VCPs on SWA-0.
23. Power on SWA-4. A LAG is automatically formed between SWA-4 and SWA-0. In addition, SWA-4 joins the Virtual Chassis configuration in the linecard role.

Results Display the results of the configuration on SWA-0:

```
user@SWA-0> show configuration virtual-chassis
  member 0 {
    mastership-priority 255;
  }
  member 1 {
    mastership-priority 128;
  }
  member 2 {
    mastership-priority 255;
  }
  member 3 {
    mastership-priority 128;
  }
  member 4 {
    mastership-priority 128;
  }
}
```

Verification

To confirm that the configuration is working properly, perform these tasks:

- Verifying the Member IDs and Roles of the Member Switches on page 6
- Verifying That the VCPs Are Operational on page 7

Verifying the Member IDs and Roles of the Member Switches

Purpose Verify that all the interconnected member switches are included within the Virtual Chassis configuration and that their roles are assigned appropriately.

Action Display the members of the Virtual Chassis configuration:

```
user@SWA-0> show virtual-chassis status

Virtual Chassis ID: 0000.e255.00e0

                                       Mastership            Neighbor List
Member ID  Status   Serial No   Model     Priority  Role       ID Interface

0 (FPC 0)  Prsnt    abc123      ex4200-48p    255   Master*    1 vcp-0
                                                               1 vcp-1
                                                               2 vcp-255/1/0
                                                               2 vcp-255/1/1
                                                               4 vcp-255/0/20
                                                               4 vcp-255/0/21

1 (FPC 1)  Prsnt    def456      ex4200-24t    128   Linecard   0 vcp-0
                                                               0 vcp-1
                                                               3 vcp-255/1/0
                                                               3 vcp-255/1/1

2 (FPC 2)  Prsnt    ghi789      ex4200-48p    255   Backup     3 vcp-0
                                                               3 vcp-1
                                                               0 vcp-255/1/0
                                                               0 vcp-255/1/1

3 (FPC 3)  Prsnt    jkl012      ex4200-24t    128   Linecard   2 vcp-0
                                                               2 vcp-1
                                                               1 vcp-255/1/0
                                                               1 vcp-255/1/1

4 (FPC 4)  Prsnt    mno345      ex4200-24f    128   Linecard   0 vcp-255/1/2
                                                               0 vcp-255/1/3
```

Meaning The show virtual-chassis status command lists the member switches interconnected in a Virtual Chassis configuration with the member IDs that have been assigned by the master, the mastership priority values, and the roles. It also displays the neighbor members with which each member is interconnected by the dedicated VCPs, by uplink VCPs, and by network VCPs.

Verifying That the VCPs Are Operational

Purpose Verify that the dedicated VCPs interconnecting member switches in wiring closets A and B and the uplink and network VCPs interconnecting the member switches between wiring closets are operational.

Action Display the Virtual Chassis interfaces:

```
user@SWA-0> show virtual-chassis vc-port all-members


fpc0:
--------------------------------------------------------------------------
Interface   Type              Trunk  Status       Speed        Neighbor
or                             ID                 (mbps)       ID  Interface
PIC / Port
vcp-0       Dedicated           1    Up           32000        1   vcp-0
vcp-1       Dedicated           2    Up           32000        1   vcp-1
1/0         Configured          3    Up           1000         2   vcp-255/1/0
```

```
1/1         Configured          3    Up           1000          2   vcp-255/1/1
1/2         Configured          4    Up           1000          4   vcp-255/0/20
1/3         Configured          4    Up           1000          4   vcp-255/0/21

fpc1:
--------------------------------------------------------------------------
Interface   Type              Trunk  Status       Speed         Neighbor
or                             ID                 (mbps)        ID  Interface
PIC / Port
vcp-0       Dedicated           1    Up           32000         0   vcp-0
vcp-1       Dedicated           2    Up           32000         0   vcp-1
1/0         Configured          3    Up           10000         3   vcp-255/1/0
1/1         Configured          3    Up           10000         3   vcp-255/1/1

fpc2:
--------------------------------------------------------------------------
Interface   Type              Trunk  Status       Speed         Neighbor
or                             ID                 (mbps)        ID  Interface
PIC / Port
vcp-0       Dedicated           1    Up           32000         3   vcp-0
vcp-1       Dedicated           2    Up           32000         3   vcp-1
1/0         Configured          3    Up           1000          0   vcp-255/1/0
1/1         Configured          3    Up           1000          0   vcp-255/1/1
1/2                            –1    Down         1000
1/3                            –1    Down         1000

fpc3:
--------------------------------------------------------------------------
Interface   Type              Trunk  Status       Speed         Neighbor
or                             ID                 (mbps)        ID  Interface
PIC / Port
vcp-0       Dedicated           1    Up           32000         2   vcp-0
vcp-1       Dedicated           2    Up           32000         2   vcp-1
1/0         Configured          3    Up           10000         1   vcp-255/1/0
1/1         Configured          3    Up           10000         1   vcp-255/1/1

fpc4:
--------------------------------------------------------------------------
Interface   Type              Trunk  Status       Speed         Neighbor
or                             ID                 (mbps)        ID  Interface
PIC / Port
vcp-0       Dedicated           1    Down         32000
vcp-1       Dedicated           2    Down         32000
0/20        Configured          3    Up           1000          0   vcp-255/1/2
0/21        Configured          3    Up           1000          0   vcp-255/1/3
```

Meaning The dedicated VCPs are displayed as vcp-0 and vcp-1. The uplink module interfaces that have been set as uplink VCPs are displayed as 1/0, 1/1, 1/2, and 1/3. The network interfaces that have been set as VCPs are displayed as 0/20 and 0/21. The neighbor interface names of uplink and network VCPs are of the form vcp-255/*pic*/*port*—for example, vcp-255/1/0. In that name, vcp-255 indicates that the interface is a VCP, 1 is the uplink PIC number, and 0 is the port number. The fpc number is the same as the member ID. The trunk ID is a positive number ID assigned to the LAG formed by the Virtual Chassis. If no LAG is formed, the value is –1.

NOTE: Each switch assigns the trunk IDs to its local interfaces. As a result, the pair of interfaces that form one end of a LAG on one switch will have the same trunk ID, and the pair of interfaces that form the other end of the LAG will have the same trunk ID, but the trunk IDs on either end of the LAG might be different. For example, in Figure 1, the uplink VCPs 1/2 and 1/3 on SWA-0 form a LAG with the network VCPs 0/20 and 0/21 on SWA-4. Uplink VCPs 1/2 and 1/3 on SWA-0 both have trunk ID 4, while network VCPs 0/20 and 0/21 on SWA-4 both have trunk ID 3. The trunk IDs are different between the switches because SWA-0 assigns the trunk IDs for its local uplink VCPs and SWA-4 assigns the trunk IDs for its local VCPs.

Troubleshooting

To troubleshoot a Virtual Chassis configuration that is interconnected across wiring closets, perform this task:

Troubleshooting Nonoperational VCPs

Problem An uplink VCP shows a status of down.

Solution

- Check the cable to make sure that it is properly and securely connected to the interfaces.
- If the VCP is an uplink module interface, make sure that it has been explicitly set as an uplink VCP.
- If the VCP is an uplink module interface, make sure that you have specified the options (*pic-slot*, *port*, and *member*) correctly.

Related Topics

- Example: Configuring a Virtual Chassis with a Master and Backup in a Single Wiring Closet
- Example: Expanding a Virtual Chassis Configuration in a Single Wiring Closet
- Example: Setting Up a Multimember Virtual Chassis Access Switch with a Default Configuration
- Setting an Uplink Module Port as a Virtual Chassis Port (CLI Procedure)
- Reverting to the Default Factory Configuration for the EX Series Switch

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