

# **|JUNIPER SWITCHING| |LAB EXERCISE 3|**

VLANs, Spanning Tree and  
Inter VLAN Routing

**JUNIPER**  
NETWORKS<sup>®</sup>

# Juniper Networks

## Enterprise Switching Summer School

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9.b

**Lab 3: VLANs, Spanning Tree and  
Inter VLAN Routing**

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*OJXE Summer School Detailed Lab Guide*

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## General Lab Instructions

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Your lab pod consists of two Juniper Networks EX-4200 switches. Switches are connected together over 3 GE interfaces: ge-0/0/10, Ge-0/0/11 and ge-0/0/12 according to the lab diagram. You do not need to configure additional physical interfaces in the lab exercises. Switches are also interconnected over the OoB Management Network via switches' me0 interfaces.

You gain access to the switches via three different ways:

- Console port, CLI
- Management interface, me0, CLI
- Management interface, me0, J-Web

Access to each of these user interfaces is explained in lab access instructions sent to you via e-mail. Make sure you do not change the IP address of the me0.0 logical interface. This would cut your telnet/HTTP session after committing the changes. If that should happen log in via the Console port and issue **rollback 1** command followed by **commit** command. Also be careful not to change the hostname of the switch. That will make it hard for you to follow the lab instructions in this Lab guide where we normally refer the pod switches as **POD\_NAME-S1** and **POD\_NAME-S2**. Pods are labeled **A**, **B**, **C** and **D** thus the individual switches are labeled **A-S1 & A-S2**, **B-S1 & B-S2**, **C-S1 & C-S2** and **D-S1 & D-S2**.

When given instructions to configure a switch, the instructions normally refer to both of your pod's switches. In special cases you only need to configure one of the two switches. In these sections the specific switch will be indicated in the lab exercise by name **S1** or **S2**.

Note that your lab login (password *lab123*) grants you all permissions needed to complete this lab; but some restrictions have been made to prevent loss of connectivity to the devices. Please be careful, and have fun!

The time needed to complete each of the 4 lab exercise sets may vary very much between each individual student. Some of you might finish the tasks in less than the scheduled two hours. Some of you might not have time to complete them. If you get stuck in an exercise or do not fully understand the meaning of a task use the Detailed Lab Guide where all commands and outputs as well the answers for all questions are presented for you.

# Lab 3

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## VLANs, Spanning Tree and Inter VLAN Routing(Detailed)

### Overview

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This lab demonstrates the configuration and monitoring of Ethernet switching and Virtual LANs on the EX-series switches. You will be using both CLI configuration and monitoring commands normally associated with Ethernet switching and VLANs.

Second section of this lab will cover the various types of Spanning Tree protocol operations in the EX-Series switches like MSTP and VSTP.

This lab is available in two formats: a high-level format that is designed to make you think through each step and a detailed format that offers step-by-step instructions complete with sample output from most commands.

By completing this lab, you will perform the following tasks:

- Configure interfaces for Layer 2 switching operations.
- Monitoring Layer 2 switching operations.
- Configure and monitor VLANs.
- Configure and monitor MSTP.
- Configure and monitor VSTP

## Part 1: Initial Preparations (Detailed)

---

### Step 1.1

Before starting this Lab you need to ensure the switches are in ready-to-go state for Lab 3. Load both switches with the Lab3-start file from /JSS directory using following command:

```
{master:0}[edit]
lab@D-S1# load merge /JSS/Lab3-start
```

```
{master:0}[edit]
lab@D-S1# commit
```

#### S2

Restore the interface `ge-0/0/10` to normal operation.

```
[edit interfaces]
lab@A-S2# delete ge-0/0/10 disable
```

```
[edit interfaces]
lab@A-S2# commit
commit complete
```

```
[edit interfaces]
lab@A-S2#
```

### Step 1.2

Question: What is the state of S1 interface `ge-0/0/10`? Is it the same as `ge-0/0/10` in S2?

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Answer: Yes. Both `ge-0/0/10` interfaces in S1 and S2 are back in normal operation showing both physical and logical administrative and link status up.

## Part 2: Creating the VLANs (Detailed)

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### Step 2.1

Create the VLANs `v1`, `v2`, `v3` and `v4` with VLAN IDs `1`, `2`, `3` and `4` respectively. Assign the correct IP addresses for your device on the VLAN interfaces.

```
lab@A-S1# show vlans | display set
set vlans v1 vlan-id 1
set vlans v1 l3-interface vlan.1
set vlans v2 vlan-id 2
set vlans v2 l3-interface vlan.2
set vlans v3 vlan-id 3
```

```
set vlans v3 l3-interface vlan.3
set vlans v4 vlan-id 4
set vlans v4 l3-interface vlan.4
```

```
lab@A-S1# show interfaces vlan | display set
set interfaces vlan unit 1 family inet address 10.1.1.1/24
set interfaces vlan unit 2 family inet address 10.1.2.1/24
set interfaces vlan unit 3 family inet address 10.1.3.1/24
set interfaces vlan unit 4 family inet address 10.1.4.1/24
```

## Step 2.2

Check the status of the VLANs. Enter the **show vlans details** command to confirm that the VLANs are created.

Question: What is the state of the VLANs?

---

---

Answer: They should be enabled and the assigned IP address should also show in the output.

Question: Are there any interfaces associated to the VLANs? If not, why?

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---

Answer: No, it is normal that at this time the VLANs have no ports associated with them.

```
lab@A-S1# run show vlans detail
VLAN: default, 802.1Q Tag: Untagged, Admin State: Enabled
Number of interfaces: 5 (Active = 5)
  Untagged interfaces: ge-0/0/0.0*, ge-0/0/1.0*, ge-0/0/10.0*, ge-0/0/11.0*,
  ge-0/0/12.0*

VLAN: v1, 802.1Q Tag: 1, Admin State: Enabled
  Primary IP: 10.1.1.1/24
Number of interfaces: 0 (Active = 0)

VLAN: v2, 802.1Q Tag: 2, Admin State: Enabled
  Primary IP: 10.1.2.1/24
Number of interfaces: 0 (Active = 0)

VLAN: v3, 802.1Q Tag: 3, Admin State: Enabled
  Primary IP: 10.1.3.1/24
Number of interfaces: 0 (Active = 0)

VLAN: v4, 802.1Q Tag: 4, Admin State: Enabled
  Primary IP: 10.1.4.1/24
Number of interfaces: 0 (Active = 0)
```

## Step 2.3

Change the aggregated Ethernet interface `ae0` from layer 3 operation to layer 2 operation. You need to delete family `inet` and configure family `ethernet-switching` on the aggregated interface's `unit 0`. Configure also LACP active mode on this bundled interface.

```
[edit]
lab@A-S1# delete interfaces ae0 unit 0 family inet

[edit]
lab@A-S1# set interfaces ae0 unit 0 family ethernet-switching

[edit]
lab@A-S1# set interfaces ae0 aggregated-ether-options lacp active
```

## Step 2.4

Assign VLANs `v1`, `v2`, `v3` and `v4` to interfaces `ae0` and `ge-0/0/10`. Remember that the port-mode for interfaces carrying tagged Ethernet frames for multiple VLANs must be `trunk`.

```
lab@A-S1# show | display set
set interfaces ge-0/0/10 unit 0 family ethernet-switching port-mode trunk
set interfaces ge-0/0/10 unit 0 family ethernet-switching vlan members v1
set interfaces ge-0/0/10 unit 0 family ethernet-switching vlan members v2
set interfaces ge-0/0/10 unit 0 family ethernet-switching vlan members v3
set interfaces ge-0/0/10 unit 0 family ethernet-switching vlan members v4
set interfaces ae0 unit 0 family ethernet-switching port-mode trunk
set interfaces ae0 unit 0 family ethernet-switching vlan members v1
set interfaces ae0 unit 0 family ethernet-switching vlan members v2
set interfaces ae0 unit 0 family ethernet-switching vlan members v3
set interfaces ae0 unit 0 family ethernet-switching vlan members v4
```

## Step 2.5

After committing your changes check the status of the aggregated interface and LACP. Use the commands `show interface ae0 terse` and `show lacp interface` to verify your work.

```
lab@A-S1# run show interfaces ae0 terse
Interface      Admin Link Proto  Local          Remote
ae0            up    up
ae0.0         up    up    eth-switch

lab@A-S1# run show lacp interfaces
Aggregated interface: ae0
LACP state:
Role   Exp   Def   Dist   Col   Syn   Aggr   Timeout   Activity
ge-0/0/11 Actor No   No    Yes   Yes   Yes   Yes       Fast   Active
ge-0/0/11 Partner No   No    Yes   Yes   Yes   Yes       Fast   Passive
ge-0/0/12 Actor No   No    Yes   Yes   Yes   Yes       Fast   Active
ge-0/0/12 Partner No   No    Yes   Yes   Yes   Yes       Fast   Passive
LACP protocol:
          Receive   State   Transmit   State           Mux State
ge-0/0/11      Current   Fast   periodic   Collecting distributing
ge-0/0/12      Current   Fast   periodic   Collecting distributing
```

## Step 2.6

Use the **show vlans detail** commands to see if the VLANs are now assigned to the correct ports.

Question: What is the state of the VLANs?

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Answer: They are enabled and the assigned interfaces should also show in the output.

Question: How can you verify the operation of the trunk ports?

---

---

Answer: You can ping the other switch's VLAN addresses. If the pings are successful, the VLANs are assigned on at least one of the interfaces.

```
lab@A-S1> show vlans detail
VLAN: default, 802.1Q Tag: Untagged, Admin State: Enabled
Number of interfaces: 2 (Active = 2)
  Untagged interfaces: ge-0/0/0.0*, ge-0/0/1.0*
VLAN: v1, 802.1Q Tag: 1, Admin State: Enabled
  Primary IP: 10.1.1.1/24
Number of interfaces: 2 (Active = 2)
  Tagged interfaces: ae0.0*, ge-0/0/10.0*

VLAN: v2, 802.1Q Tag: 2, Admin State: Enabled
  Primary IP: 10.1.2.1/24
Number of interfaces: 2 (Active = 2)
  Tagged interfaces: ae0.0*, ge-0/0/10.0*

VLAN: v3, 802.1Q Tag: 3, Admin State: Enabled
  Primary IP: 10.1.3.1/24
Number of interfaces: 2 (Active = 2)
  Tagged interfaces: ae0.0*, ge-0/0/10.0*

VLAN: v4, 802.1Q Tag: 4, Admin State: Enabled
  Primary IP: 10.1.4.1/24
Number of interfaces: 2 (Active = 2)
  Tagged interfaces: ae0.0*, ge-0/0/10.0*
```

## **Part 3: Configuring the Spanning-Tree Interface**

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### **Step 3.1**

By default, RSTP is active on the EX Series switches. Use the **show spanning-tree interface** command to check the current state of the ports. One side of the ge-0/0/10 connection should be blocking.

```
lab@A-S1> show spanning-tree interface
Spanning tree interface parameters for instance 0
Interface  Port ID  Designated  Designated  Port  State  Role
           port ID  port ID      Bridge ID   Cost
ae0.0      128:1    128:1       32768.0019e25512c0  10000  FWD    ROOT
ge-0/0/10.0 128:523 128:523     32768.0019e25512c0  20000  BLK    ALT
```

### Step 3.1

In order for the MSTP to run you need to remove the RSTP protocol. Do not forget to commit the change.

```
lab@A-S1# delete protocols rstp
```

### Step 3.2

MSTP can be used to provide load balancing across links in spanning-tree scenarios. Configure MSTP so that VLAN v1 and v2 are blocked on one side of the ge-0/0/10 link, and that VLAN v3 and v4 are blocked on one side of the ae0 link.

```
lab@A-S1> show configuration protocols mstp | display set
set protocols mstp configuration-name lab_mstp
set protocols mstp revision-level 2
set protocols mstp msti 1 vlan v1
set protocols mstp msti 1 vlan v2
set protocols mstp msti 2 vlan v3
set protocols mstp msti 2 vlan v4
set protocols mstp msti 2 interface ge-0/0/10.0 cost 5000
```

Follow this step for verification:

Use the **show spanning-tree interface** command to see that the correct links are blocked on one side.

```
lab@A-S1> show spanning-tree interface
Spanning tree interface parameters for instance 0
Interface  Port ID  Designated  Designated  Port  State  Role
           port ID  port ID      bridge ID   Cost
ae0.0      128:1    128:1       32768.0019e25512c0  10000  FWD    ROOT
ge-0/0/10.0 128:523 128:523     32768.0019e25512c0  20000  BLK    ALT

Spanning tree interface parameters for instance 1
ae0.0      128:1    128:1       32769.0019e25512c0  10000  FWD    ROOT
ge-0/0/10.0 128:523 128:523     32769.0019e25512c0  20000  BLK    ALT

Spanning tree interface parameters for instance 2
ae0.0      128:1    128:1       32770.0019e25512c0  10000  BLK    ALT
ge-0/0/10.0 128:523 128:523     32770.0019e25512c0  5000   FWD    ROOT
```

## Part 4: Using VSTP to Provide Load Balancing

---

### Step 3.1

In order for the VSTP to run you need to remove the MSTP protocol. Do not forget to commit the change.

```
lab@A-S1# delete protocols mstp
```

## Step 4.1

Implement the same solution as in the previous step, but now using VSTP.

```
lab@A-S1> show configuration protocols vstp | display set
set protocols vstp vlan v1
set protocols vstp vlan v2
set protocols vstp vlan v3 interface ge-0/0/10.0 cost 5000
set protocols vstp vlan v4 interface ge-0/0/10.0 cost 5000
```

Follow this step for verification:

Use the **show spanning-tree interface** command to see that the correct links are blocked on one side. Note that the difference with the MSTP is that there is no CSTP (common) at this time for VSTP (JUNOS 9.4).

```
lab@A-S1> show spanning-tree interface
Spanning tree interface parameters for instance 0
Interface  Port ID  Designated  Designated  Port  State  Role
           port ID  port ID     bridge ID   Cost
ae0.0      128:1    128:1      32769.0019e25512c0  10000  FWD    ROOT
ge-0/0/10.0 128:523 128:523    32769.0019e25512c0  20000  BLK    ALT

Spanning tree interface parameters for VLAN 2
ae0.0      128:1    128:1      32770.0019e25512c0  10000  FWD    ROOT
ge-0/0/10.0 128:523 128:523    32770.0019e25512c0  20000  BLK    ALT

Spanning tree interface parameters for VLAN 3
ae0.0      128:1    128:1      32771.0019e25512c0  10000  BLK    ALT
ge-0/0/10.0 128:523 128:523    32771.0019e25512c0  5000   FWD    ROOT

Spanning tree interface parameters for VLAN 4
ae0.0      128:1    128:1      32772.0019e25512c0  10000  BLK    ALT
ge-0/0/10.0 128:523 128:523    32772.0019e25512c0  5000   FWD    ROOT
```

