

**DEPARTMENT OF BUSINESS, ADVANCED MANUFACTURING AND LOGISTICS**

ICT50220 Diploma of Information Technology

Assessment

**Learner**

**ICTNWK543 Install, operate and troubleshoot medium enterprise switches**

Assessment Book

Assessment Task 3: Configuring Rapid PVST, PortFast, and BPDU Guard

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| --- | --- |
| Course code and name | **ICT50220 Diploma of Information Technology** |
| Unit code and name | **ICTNWK543 Install, operate and troubleshoot medium enterprise switches** |
| Due date | ….. / ….. / …… (See on Moodle) |
| Resources  required | * Learner resource ICTNWK543 * Cisco Netacad.com curriculum * Access to computer and Internet * Access to Moodle * Access to Cisco Packet Tracer simulator * Access to routers and switches * Microsoft Word Application * MP Tech Solutions Profile.docx * MP Tech Solutions ICT Policies.docx * 3 Switches (Cisco 2960 with Cisco IOS Release 12.2(25)FX image or comparable) * 2 PCs (Windows 7, Vista, or XP with terminal emulation program, such as Tera Term) * Console cables to configure the Cisco IOS devices via the console ports * Ethernet cables as shown in the topology |
| Decision making rules | To achieve an overall satisfactory result for this assessment task:   * All questions must be answered satisfactorily * Learners must achieve a satisfactory result for each item in the Assessment Checklist. |
| Learner Instructions | This is scenario based lab project assessment composed of practical tasks and written questions. There are 5 parts to this tasks   * Part 1: Build the network and configure basic device settings * Part 2: Configure VLANs, native VLAN, and trunks * Part 3: Configure the root bridge and examine PVST+ convergence * Part 4: Configure Rapid PVST+, PortFast, BPDU Guard, and examine vonvergence * Part 5: Short answer questions   For this task you will:   * Complete it individually. * Write answers to all questions * Complete it in class at a time determined by your assessor. * Have time to read and review the assessment task in class. * You must submit your assessment electronically via Moodle and use the following naming convention: “Student ID\_Student Name\_ Assessment Task 3: Lab Project - Configuring Rapid PVST, PortFast, and BPDU Guard”   **Example:** “s123456\_Sathish\_ Assessment Task 3: Lab Project - Configuring Rapid PVST, PortFast, and BPDU Guard**.pkt**”  “s123456\_Sathish\_ Assessment Task 3: Lab Project – Configuring Rapid PVST, PortFast, and BPDU Guard**.docx**   * You must agree (by clicking on the ‘I confirm radio button) with the assessment submission terms and conditions in Melbourne Polytechnic Moodle prior to the submission   If you have any questions about the task or concerns about your ability to complete the task, please discuss this with your Assessor. |

## Scenario

The Per-VLAN Spanning Tree (PVST) protocol is Cisco proprietary. Cisco switches default to PVST. Rapid PVST+ (IEEE 802.1w) is an enhanced version of PVST+ and allows for faster spanning-tree calculations and convergence in response to Layer 2 topology changes. Rapid PVST+ defines three port states: discarding, learning, and forwarding, and provides multiple enhancements to optimize network performance.

In this lab project, you will configure the primary and secondary root bridge, examine PVST+ convergence, configure Rapid PVST+ and compare its convergence to PVST+. In addition, you will configure edge ports to transition immediately to a forwarding state using PortFast and prevent the edge ports from forwarding BDPUs using BDPU guard.

Note: The switches used with CCNA hands-on labs are Cisco Catalyst 2960s with Cisco IOS Release 15.0(2) (lanbasek9 image). Other switches and Cisco IOS versions can be used. Depending on the model and Cisco IOS version, the commands available and output produced might vary from what is shown in the labs.

Note: Make sure that the switches have been erased and have no start-up configurations. If you are unsure, contact your Assessor.

## Topology

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***Topology diagram for configuring Rapid PVST+, PortFast, and BPDU Guard***

*By netacad.com*

#### Addressing Table:

|  |  |  |  |
| --- | --- | --- | --- |
| **Device** | **Interface** | **IP Address** | **Subnet Mask** |
| S1 | VLAN 99 | 192.168.1.11 | 255.255.255.0 |
| S2 | VLAN 99 | 192.168.1.12 | 255.255.255.0 |
| S3 | VLAN 99 | 192.168.1.13 | 255.255.255.0 |
| PC-A | NIC | 192.168.0.2 | 255.255.255.0 |
| PC-C | NIC | 192.168.0.3 | 255.255.255.0 |

#### VLAN Assignments:

|  |  |
| --- | --- |
| **VLAN** | **Name** |
| 10 | User |
| 99 | Management |

## Part 1: Build the network and configure basic device settings

In Part 1, you will set up the network topology and configure basic settings, such as the interface IP addresses, device access, and basic configuration such as hostname, passwords etc.

The Packet Tracer file that you are creating is the evidence of creation of the topology and corresponding configuration. You will have to submit Packet Tracer file together with this word document file as evidence.

Once you are finished with the entire Assessment, please contact your Assessor to demonstrate the network.

**Step 1**: Read “ICT Policies” of MP Tech Solutions and follow the policies accordingly.

**Step 2:** Cable the network as shown in the topology.

**Step 3:** Analyse the numerical information that is provided on the Addressing Table, specifically with the IP addresses and its corresponding subnet masks and the gateway. Utilise the provided numerical information while building the topology so that desired performance and interoperability of network can be achieved.

**Step 4:** Configure PC hosts.

**Step 5:** Initialise and reload the switches as necessary.

**Step 6:** Configure basic settings for each switch:

* 1. Disable DNS lookup.
  2. Configure the device name as shown in the topology.
  3. Assign cisco as the console and vty passwords and enable login.
  4. Assign class as the encrypted privileged EXEC mode password.
  5. Configure logging synchronous to prevent console messages from interrupting command entry.
  6. Shut down all switch ports.
  7. Copy the running configuration to start-up configuration.

## Part 2: Configure VLANs, native VLAN, and trunks

In Part 2, you need to create VLANs, assign switch ports to VLANs, configure trunk ports, and change the native VLAN for all switches.

**Step 1:** Create VLANs 10 and 99 on all the switches. Name VLAN 10 as User and VLAN 99 as Management.

**Step 2:** Enable user ports in access mode and assign VLANs. For S1 F0/6 and S3 F0/18, enable the ports, configure them as access ports, and assign them to VLAN 10.

**Step 3:** Configure trunk ports and assign to native VLAN 99. For ports F0/1 and F0/3 on all switches, configure them as trunk ports, and assign them to native VLAN 99.

**Step 4:** Configure the management interface on all switches. Using the Addressing Table, configure the management interface on all switches with the appropriate IP address.

**Step 5:** Verify configurations and connectivity.

* Use the show VLAN brief command on all switches to verify that all VLANs are registered in the VLAN table and that the correct ports are assigned.
* Use the show interfaces trunk command on all switches to verify trunk interfaces.
* Use the show running-config command on all switches to verify all other configurations.
* Verify connectivity between PC-A and PC-C. If your ping was unsuccessful, troubleshoot the configurations until the issue is resolved.

Note: It may be necessary to disable the PC firewall to successfully ping between PCs.

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| Q1 | What is the default setting for spanning-tree mode on Cisco switches? | | |
|  | | **Satisfactory** | **Unsatisfactory** |
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## Part 3: Configure the Root Bridge and Examine PVST+ Convergence

In Part 3, you will determine the default root in the network, assign the primary and secondary root, and use the debug command to examine convergence of PVST+.

**Step 1:** Determine the current root bridge.

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| Q1 | Which command allows a user to determine the spanning-tree status of a Cisco Catalyst switch for all VLANs? Write the command in the space provided. | | |
|  | | **Satisfactory** | **Unsatisfactory** |
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| Q2 | What is the bridge priority of switch S1 for VLAN 1? | | |
|  | | **Satisfactory** | **Unsatisfactory** |
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| Q3 | What is the bridge priority of switch S2 for VLAN 1? | | |
|  | | **Satisfactory** | **Unsatisfactory** |
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| Q4 | What is the bridge priority of switch S3 for VLAN 1? | | |
|  | | **Satisfactory** | **Unsatisfactory** |
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| Q5 | Which switch is the root bridge? | | |
|  | | **Satisfactory** | **Unsatisfactory** |
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| Q6 | Why was above switch elected as the root bridge? | | |
|  | | **Satisfactory** | **Unsatisfactory** |
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**Step 2:** Configure a primary and secondary root bridge for all existing VLANs.

1. Configure S2 to be the primary root bridge for all existing VLANs.
2. Configure switch S1 to be the secondary root bridge for all existing VLANs.

Having a root bridge (switch) elected by MAC address may lead to a suboptimal configuration. In this lab project, you will configure switch S2 as the root bridge and switch S1 as the secondary root bridge.

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| Q7 | What command did you use to make switch S2 the primary root bridge for all existing VLANs? | | |
|  | | **Satisfactory** | **Unsatisfactory** |
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| --- | --- | --- | --- |
| Q8 | What command did you use to make switch S1 to be the secondary root bridge for all existing VLANs? | | |
|  | | **Satisfactory** | **Unsatisfactory** |
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| Q9 | What is the bridge priority of switch S1 for VLAN 1? | | |
|  | | **Satisfactory** | **Unsatisfactory** |
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| --- | --- | --- | --- |
| Q10 | What is the bridge priority of switch S2 for VLAN 1? | | |
|  | | **Satisfactory** | **Unsatisfactory** |
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| Q11 | Which interface in the network is in the blocking state? | | |
|  | | **Satisfactory** | **Unsatisfactory** |
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**Step 3:** Change the Layer 2 topology and examine (troubleshoot) the convergence.

Examine the PVST+ convergence, create a Layer 2 topology change while using the debug command to monitor spanning-tree events.

***[For Packet Tracer(PT) users, skip steps a and b as some of commands are not available on PT. However, using the provided debug output of* “ S3# debug spanning-tree events ” *below, you should answer the questions that are being asked below.]***

**a.** Enter the debug spanning-tree events command in privileged EXEC mode on switch S3

**b.** Create a topology change by disabling interface F0/1 on S3.

S3(config)# **interface f0/1**

S3(config-if)# **shutdown**

**Output of “ S3# debug spanning-tree events ”**

|  |
| --- |
| \*Mar 1 00:58:56.225: STP: VLAN0001 new root port Fa0/3, cost 38  \*Mar 1 00:58:56.225: STP: VLAN0001 Fa0/3 -> listening  \*Mar 1 00:58:56.225: STP[1]: Generating TC trap for port FastEthernet0/1  \*Mar 1 00:58:56.225: STP: VLAN0010 new root port Fa0/3, cost 38  \*Mar 1 00:58:56.225: STP: VLAN0010 Fa0/3 -> listening  \*Mar 1 00:58:56.225: STP[10]: Generating TC trap for port FastEthernet0/1  \*Mar 1 00:58:56.225: STP: VLAN0099 new root port Fa0/3, cost 38  \*Mar 1 00:58:56.225: STP: VLAN0099 Fa0/3 -> listening  \*Mar 1 00:58:56.225: STP[99]: Generating TC trap for port FastEthernet0/1  \*Mar 1 00:58:56.242: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to down  \*Mar 1 00:58:56.242: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan99, changed state to down  \*Mar 1 00:58:58.214: %LINK-5-CHANGED: Interface FastEthernet0/1, changed state to administratively down  \*Mar 1 00:58:58.230: STP: VLAN0001 sent Topology Change Notice on Fa0/3  \*Mar 1 00:58:58.230: STP: VLAN0010 sent Topology Change Notice on Fa0/3  \*Mar 1 00:58:58.230: STP: VLAN0099 sent Topology Change Notice on Fa0/3  \*Mar 1 00:58:59.220: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to down  \*Mar 1 00:59:11.233: STP: VLAN0001 Fa0/3 -> learning  \*Mar 1 00:59:11.233: STP: VLAN0010 Fa0/3 -> learning  \*Mar 1 00:59:11.233: STP: VLAN0099 Fa0/3 -> learning  \*Mar 1 00:59:26.240: STP[1]: Generating TC trap for port FastEthernet0/3  \*Mar 1 00:59:26.240: STP: VLAN0001 Fa0/3 -> forwarding  \*Mar 1 00:59:26.240: STP[10]: Generating TC trap for port FastEthernet0/3  \*Mar 1 00:59:26.240: STP: VLAN0010 sent Topology Change Notice on Fa0/3  \*Mar 1 00:59:26.240: STP: VLAN0010 Fa0/3 -> forwarding  \*Mar 1 00:59:26.240: STP[99]: Generating TC trap for port FastEthernet0/3  \*Mar 1 00:59:26.240: STP: VLAN0099 Fa0/3 -> forwarding  \*Mar 1 00:59:26.248: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to up  \*Mar 1 00:59:26.248: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan99, changed state to up |

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| Q12 | Based on above debug output, through which port states do each VLAN on F0/3 proceed during network convergence? | | |
|  | | **Satisfactory** | **Unsatisfactory** |
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## Part 4: Configure Rapid PVST+, PortFast, BPDU Guard, and examine convergence

You will configure Rapid PVST+ on all switches. You will configure PortFast and BPDU guard on all access ports, and then use the debug command to examine Rapid PVST+ convergence.

**Step 1a**: Configure Rapid PVST+ .

**Step 1b.** Verify configurations with the “ **show running-config | include spanning-tree mode “** command on all the switches**.**

S1# **show running-config | include spanning-tree mode**

S2# **show running-config | include spanning-tree mode**

S3# **show running-config | include spanning-tree mode**

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| Q1 | What command did you use to configure Rapid PVST ? | | |
|  | | **Satisfactory** | **Unsatisfactory** |
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| Q2 | What was the “show running-config | include spanning-tree mode “result for Switch 1. | | |
|  | | **Satisfactory** | **Unsatisfactory** |
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**Step 2:** Configure Rapid PVST+, PortFast, BPDU Guard, and Examine Convergence

PortFast is a feature of spanning tree that transitions a port immediately to a forwarding state as soon as it is turned on. This is useful in connecting hosts so that they can start communicating on the VLAN instantly, rather than waiting on spanning tree. To prevent ports that are configured with PortFast from forwarding BPDUs, which could change the spanning tree topology, BPDU guard can be enabled. At the receipt of a BPDU, BPDU guard disables a port configured with PortFast.

1. Configure interface F0/6 on S1 with PortFast.
2. Configure interface F0/6 on S1 with BPDU guard.
3. Globally configure all non-trunking ports on switch S3 with PortFast
4. Globally configure all non-trunking PortFast ports on switch S3 with BPDU guard. If global command is not available on your switch, then you should try on individual ports.

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| --- | --- | --- | --- |
| Q3 | What command did you use to configure PortFast on Int F0/6? | | |
|  | | **Satisfactory** | **Unsatisfactory** |
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| --- | --- | --- | --- |
| Q4 | What command did you use to configure BPDU guard on Int F0/6? | | |
|  | | **Satisfactory** | **Unsatisfactory** |
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| --- | --- | --- | --- |
| Q5 | What command did you use to ensure you globally configured all non-trunking ports on switch S3 with PortFast? | | |
|  | | **Satisfactory** | **Unsatisfactory** |
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| Q6 | What command did you use to ensure you globally configured all non-trunking PortFast ports on switch S3 with BPDU guard? | | |
|  | | **Satisfactory** | **Unsatisfactory** |
|  | |  |  |

**Step 3:** Examine (troubleshoot) Rapid PVST+ convergence.

NOTE:

For Packet Tracer users, skip steps a and b. However, using the provided debug output below, you should answer the questions that are being asked below.

**a.** Enter the **debug spanning-tree events** command in privileged EXEC mode on switch S3.

**b.** Create a topology change by enabling interface F0/1 on switch S3.

S3(config)# **interface f0/1**

S3(config-if)# **no shutdown**

|  |
| --- |
| \*Mar 1 01:28:34.946: %LINK-3-UPDOWN: Interface FastEthernet0/1, changed state to up  \*Mar 1 01:28:37.588: RSTP(1): initializing port Fa0/1  \*Mar 1 01:28:37.588: RSTP(1): Fa0/1 is now designated  \*Mar 1 01:28:37.588: RSTP(10): initializing port Fa0/1  \*Mar 1 01:28:37.588: RSTP(10): Fa0/1 is now designated  \*Mar 1 01:28:37.588: RSTP(99): initializing port Fa0/1  \*Mar 1 01:28:37.588: RSTP(99): Fa0/1 is now designated  \*Mar 1 01:28:37.597: RSTP(1): transmitting a proposal on Fa0/1  \*Mar 1 01:28:37.597: RSTP(10): transmitting a proposal on Fa0/1  \*Mar 1 01:28:37.597: RSTP(99): transmitting a proposal on Fa0/1  \*Mar 1 01:28:37.597: RSTP(1): updt roles, received superior bpdu on Fa0/1  \*Mar 1 01:28:37.597: RSTP(1): Fa0/1 is now root port  \*Mar 1 01:28:37.597: RSTP(1): Fa0/3 blocked by re-root  \*Mar 1 01:28:37.597: RSTP(1): synced Fa0/1  \*Mar 1 01:28:37.597: RSTP(1): Fa0/3 is now alternate  \*Mar 1 01:28:37.597: RSTP(10): updt roles, received superior bpdu on Fa0/1  \*Mar 1 01:28:37.597: RSTP(10): Fa0/1 is now root port  \*Mar 1 01:28:37.597: RSTP(10): Fa0/3 blocked by re-root  \*Mar 1 01:28:37.597: RSTP(10): synced Fa0/1  \*Mar 1 01:28:37.597: RSTP(10): Fa0/3 is now alternate  \*Mar 1 01:28:37.597: RSTP(99): updt roles, received superior bpdu on Fa0/1  \*Mar 1 01:28:37.605: RSTP(99): Fa0/1 is now root port \*Mar 1 01:28:37.605: RSTP(99): Fa0/3 blocked by re-root \*Mar 1 01:28:37.605: RSTP(99): synced Fa0/1  \*Mar 1 01:28:37.605: RSTP(99): Fa0/3 is now alternate  \*Mar 1 01:28:37.605: STP[1]: Generating TC trap for port FastEthernet0/1  \*Mar 1 01:28:37.605: STP[10]: Generating TC trap for port FastEthernet0/1  \*Mar 1 01:28:37.605: STP[99]: Generating TC trap for port FastEthernet0/1  \*Mar 1 01:28:37.622: RSTP(1): transmitting an agreement on Fa0/1 as a response to a proposal  \*Mar 1 01:28:37.622: RSTP(10): transmitting an agreement on Fa0/1 as a response to a proposal  \*Mar 1 01:28:37.622: RSTP(99): transmitting an agreement on Fa0/1 as a response to a proposal  \*Mar 1 01:28:38.595: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up |

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| Q7 | Using the time stamp from the First and Last RSTP debug message, calculate the time that it took for the network to converge. | | |
|  | | **Satisfactory** | **Unsatisfactory** |
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## Part 5: Short answer questions

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| Q1 | What is the main benefit of using Rapid PVST+? | | |
|  | | **Satisfactory** | **Unsatisfactory** |
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| --- | --- | --- | --- |
| Q2 | How does configuring a port with PortFast allow for faster convergence? | | |
|  | | **Satisfactory** | **Unsatisfactory** |
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| --- | --- | --- | --- |
| Q3 | What protection does BPDU guard provide? | | |
|  | | **Satisfactory** | **Unsatisfactory** |
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Note:

The Packet Tracer file that you are creating is the evidence of creation of the topology and corresponding configuration. You will have to submit Packet Tracer file together with this word document file as evidence.

Once you are finished with the entire Assessment, please contact your Assessor to demonstrate the network.

1. Assessment Checklist - Task 3: Configuring Rapid PVST, PortFast, and BPDU Guard

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Learner name** | |  | **Student ID** | |  | |
| **Assessor name** | |  | **Date** | |  | |
| Assessment checklist  assessor to complete the following | | | | | | |
| Observation and demonstration | | | | | | |
| **The LEARNER:** | | | | **SATISFACTORY** | | **NOT SATISFACTORY** |
|  | In part 1:   * Built the network and configured the devices. * Cabled the network as per the topology. * Analysed the numerical information in the address table to achieve the desired performance. * Configured the PV hosts. * Initialised and reloaded the switches as required. * Shut down all the switch ports. * Copied the running configuration to the start-up configuration. | | |  | |  |
|  | In part 2:   * Configured and verified the VLANS, native VLANS and trunks. * Created and named VLANS as per instructions. * Enabled he user ports as per instructions. * Configured the trunk ports as per instructions. * Configured the management interface as instructed. | | |  | |  |
|  | In part 3:   * Determined the default root in the network. * Assigned the primary and secondary root. * Used the debug command to examine convergence of PVST+. | | |  | |  |
|  | In part 4:   * Configured Rapid PVST+ on all switches. * Configured PortFast and BPDU guard on all access points. * Used the debug command to examine Rapid PVST+ convergence. | | |  | |  |
|  | In part 5:   * Successfully answered the short answer questions. | | |  | |  |
|  | * Correctly answered all questions throughout this task. * Provided a Packet Tracer File supporting all items in this assessment task. | | |  | |  |
| **Feedback -** Assessor must include feedback and learner responses | | | | | | |
|  | | | | | | |

# Assessment Task Summary – Task 3: Configuring Rapid PVST, PortFast, and BPDU Guard

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| --- | --- | --- | --- | --- | --- | --- | --- |
| Trainer/Assessor to complete the following:  **THE LEARNER:** | | | | | | Yes | No |
| 1. | Satisfactorily completed Part 1 | | | | |  |  |
| 2. | Satisfactorily completed Part 2 | | | | |  |  |
| 3. | Satisfactorily completed Part 3 | | | | |  |  |
| 4. | Satisfactorily completed Part 4 | | | | |  |  |
| 5. | Satisfactorily completed Part 5 with observation / demonstration. | | | | |  |  |
| feedback **-** Assessor must include feedback | | | | | | | |
|  | | | | | | | |
| OVERALL TASK result | | | | | | | |
| Satisfactory  Not Satisfactory (resubmission required) – Due date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | | | | | | |
| Date Assessment Returned | | |  | | | | |
| Trainer/assessor Name | | |  | | | | |
| Trainer/Assessor signature | | | X | | | | |
| **LEARNER DECLARATION**: Please read and sign below | | | | | | | |
| I, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ have been advised of the outcome of this assessment task.  PRINT NAME | | | | | | | |
| LEARNER Signature | | X | | Date |  | | |