

Using a Switch for Ring Microsegmentation

The Catalyst 3900 and the Catalyst 5000 Token Ring switching module are shipped with a default configuration that allows you to use the switch without modification in many small networks. One aspect of this default configuration is that the switch is configured as a single VLAN. However, for more complex networks, you can subdivide the Catalyst 3900 or Catalyst 5000 Token Ring switching module into multiple virtual rings (TrCRFs) that can be connected by one or more internal bridges (TrBRFs). Initially, all ports are assigned to the default ring (trcrf-default) and the default ring is associated with the default bridge (trbrf-default).

Note: The Catalyst 5000 series Token Ring module default VLAN configuration requires that VTP V2 be enabled on the switch. VTP V2 is always enabled on the Catalyst 3900.

To assist you in understanding how to subdivide your switch, this chapter provides an example of configuring two additional VLANs for a Catalyst 3900.

This chapter provides the following information:

- Initial Network Configuration
- Before Beginning
- Configuration Steps
- Resulting Network
- Tips
- Microsegmenting the Rings on a Catalyst 5000

Note: Instructions for creating a similar configuration using two Catalyst 5000 Series Token Ring switching modules are included in the “Microsegmenting the Rings on a Catalyst 5000” section.

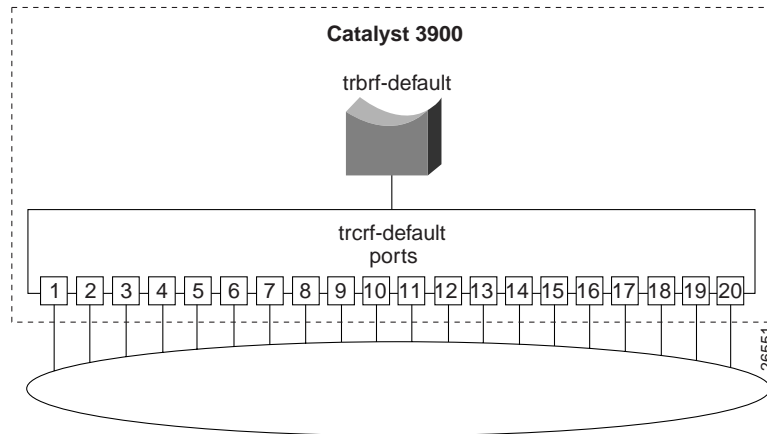
Initial Network Configuration

In this scenario, you have a small company that is growing. Last year, there were only 10 employees in the human resources and payroll departments. Now there are 34 employees. When there were only 10 employees, they could share a single server that contains a database of records. Now, however, each department needs a dedicated server.

Figure 6-1 illustrates the initial VLAN configuration of the Catalyst 3900.

You want to add a new ring that includes ports 1 and 2 for the employees of the Human Resources department and another ring that includes ports 3 and 4 for the employees of the Payroll department.

Figure 6-1 Initial VLAN Configuration



Before Beginning

Only the default ring (TrCRF) can be assigned to the default bridge (TrBRF). You cannot assign new rings to the default bridge. Therefore, you must first define a new bridge (TrBRF) and then you can define the new rings and assign ports to them.

You have met with the IS department and have decided to create two new rings, with ring numbers 11 and 12, and connect them with a bridge, which will have the bridge number of 1. Because the network contains a large number of Cisco devices, you are using VTP to distribute information about the VLANs in the network. You have decided to assign the VLAN IDs as follows:

Ring number	VLAN ID	VLAN Name
11	11	Human Resources Ring 11
12	12	Payroll Ring 12

The bridge will be assigned a VLAN ID of 100 and a VLAN name of BRF100.

Configuration Steps

Microsegmenting the ring involves creating multiple rings, which means you are creating multiple VLANs. You are going to put the users and their servers in separate TrCRFs and join them using a TrBRF.

Separating the Servers from the Users

You have physically separated the servers from the users. Next, you must attach the rings and the servers to separate ports on the Catalyst 3900 switches.

On both switches, do the following:

- Attach port 1 to the Human Resources ring.
- Remove the Human Resources server from the Human Resources ring and attach it to port 2.
- Attach port 3 to the Payroll ring.
- Remove the Payroll server from the Payroll ring and attach it to port 4.

The ports will automatically sense the speed and mode of the connection.

Configuring VLANs

Next, you must define the VLANs. As determined before beginning, you will need a new TrBRF and two TrCRFs; one for the Human Resources users and their server and one for the Payroll users and their server.

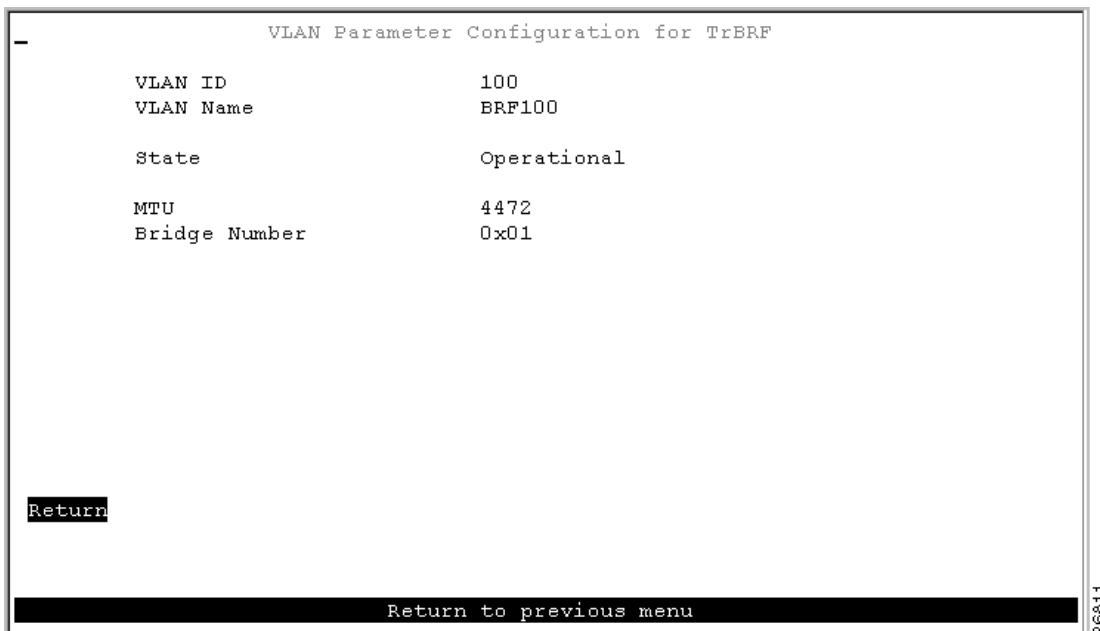
Note: For more information about Token Ring VLANs, see the “Token Ring VLANs and Related Protocols” chapter.

Defining the Bridges

To define a bridge (TrBRF), complete the following steps:

- Step 1. On the Catalyst 3900 Main Menu, select Configuration. The Configuration panel is displayed.
- Step 2. On the Configuration panel, select VLAN and VTP Configuration. The VLAN and VTP Configuration panel is displayed.
- Step 3. On the VLAN and VTP Configuration panel, select VTP VLAN Configuration. The VTP VLAN Configuration panel is displayed.
- Step 4. On the VTP VLAN Configuration panel, select Add.
- Step 5. At the prompt, enter a VLAN ID of 100.
- Step 6. At the prompt, select TrBRF. The VLAN Parameter Configuration for TrBRF panel (Figure 6-2) is displayed.
- Step 7. On the VLAN Parameter Configuration for TrBRF panel, specify:
 - VLAN Name of BRF100.
 - Bridge Number of 1.

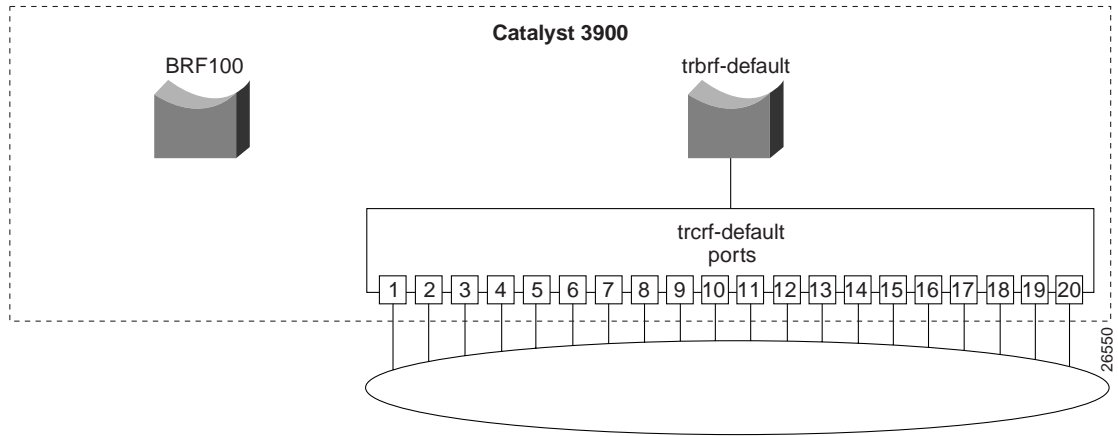
Figure 6-2 VLAN Parameter Configuration for TrBRF Panel



- Step 8. Select Return to save your changes.

Figure 6-3 illustrates the VLAN configuration of the Catalyst 3900 after the additional bridge has been configured. Notice that no rings are assigned to it yet.

Figure 6-3 Catalyst 3900 with Two Bridges Configured

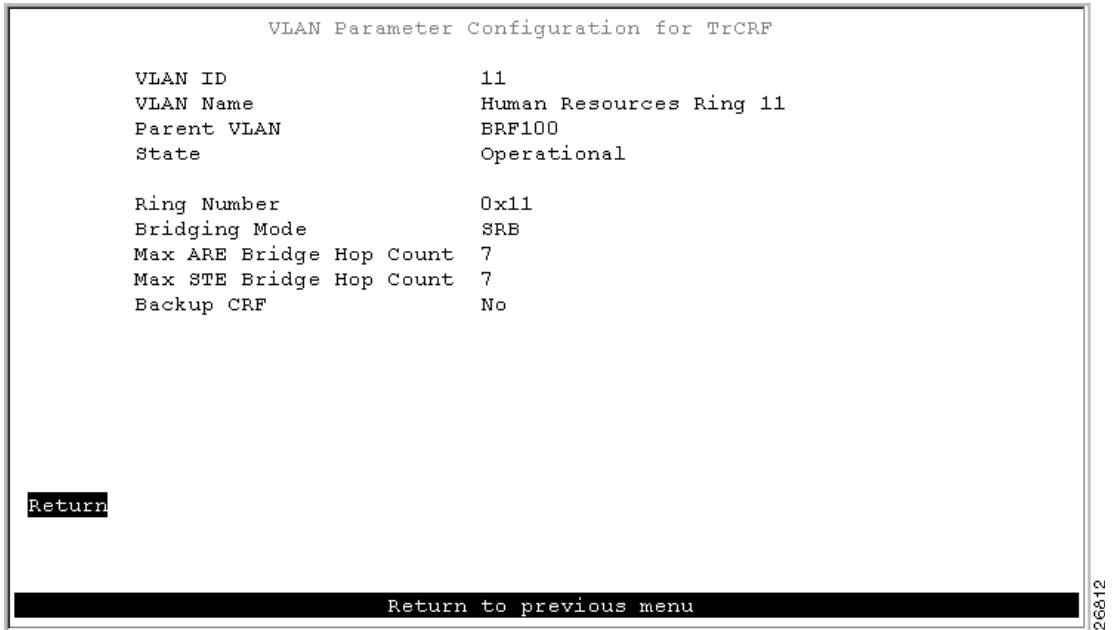


Defining the Rings

To define the ring (TrCRF) for the Human Resources users, complete the following steps:

- Step 1. On the VTP VLAN Configuration panel, select Add.
- Step 2. At the prompt, enter a VLAN ID of 11.
- Step 3. At the prompt, select TrCRF. The VLAN Parameter Configuration for TrCRF panel (Figure 6-4) is displayed.
- Step 4. On the VLAN Parameter Configuration for TrCRF panel, specify:
 - VLAN Name of Human Resources Ring 11.
 - Parent VLAN of BRF100.
 - Ring Number of 11.

Figure 6-4 VLAN Parameter Configuration for TrCRF Panel



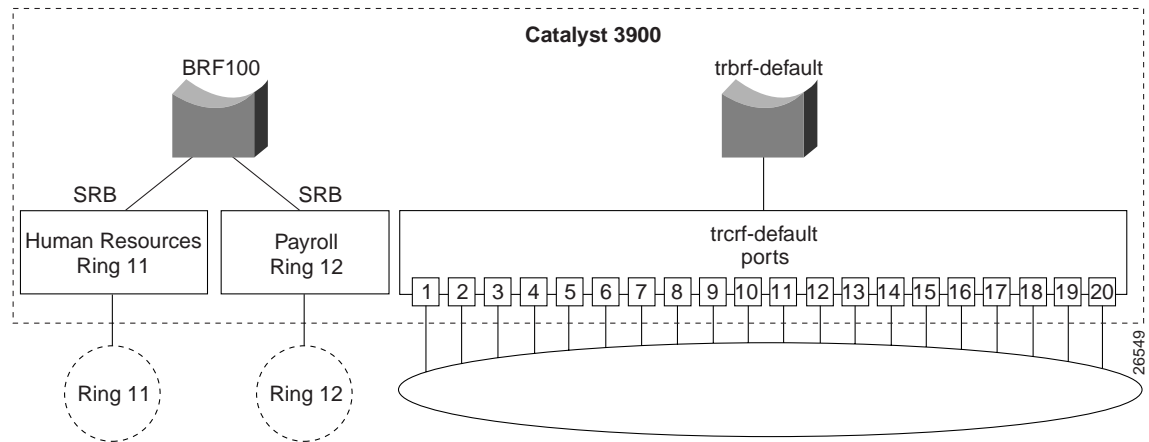
- Step 5. Select Return to save your changes.

To define the ring (TrCRF) for the Payroll users, repeat Step 1 through Step 4 and use the following values:

- VLAN ID of 12.
- VLAN Name of Payroll Ring 12.
- Parent VLAN of BR100.
- Ring Number of 12.

Figure 6-5 illustrates the VLAN configuration of the Catalyst 3900 after the additional rings have been configured. Notice that the rings are configured and associated with the bridge, but no ports are assigned to the rings.

Figure 6-5 Catalyst 3900 with Three Rings Configured



Assigning Ports to the Rings

Next, you must assign the ports to the appropriate rings (TrCRFs). On the Catalyst 3900, do the following:

- Step 1. On the VLAN and VTP Configuration panel, select Local VLAN Port Configuration. The Local VLAN Port Configuration panel is displayed.
- Step 2. On the Local VLAN Port Configuration panel, select Change.
- Step 3. At the prompt enter port number 1.
- Step 4. Select Human Resources Ring 11 from the list of possible TrCRFs. To select the TrCRF, use your cursor movement keys to highlight the desired TrCRF, press the space bar to select it, and press Enter to implement the change.
- Step 5. Repeat Step 2 through Step 4 for port 2.
- Step 6. Again, on the Local VLAN Port Configuration panel, select Change.
- Step 7. At the prompt enter port number 3.
- Step 8. Select Payroll Ring 12 from the list of possible TrCRFs.
- Step 9. Repeat Step 6 through Step 8 for port 4.
- Step 10. Select Return to save the changes.

Figure 6-6 displays the Local VLAN Port Configuration Panel after you have made your changes.

Figure 6-6 Local VLAN Port Configuration Panel

Local VLAN Port Configuration				
Port	Mode	TrCRF		TrBRF
1	Static	Human Resources	Ring 11	BRF100
2	Static	Human Resources	Ring 11	BRF100
3	Static	Payroll	Ring 12	BRF100
4	Static	Payroll	Ring 12	BRF100
5	Static	trcrf-default		trbrf-default
6	Static	trcrf-default		trbrf-default
7	Static	trcrf-default		trbrf-default
8	Static	trcrf-default		trbrf-default
9	Static	trcrf-default		trbrf-default
10	Static	trcrf-default		trbrf-default
11	Static	trcrf-default		trbrf-default
12	Static	trcrf-default		trbrf-default
13	Static	trcrf-default		trbrf-default
14	Static	trcrf-default		trbrf-default
15	Static	trcrf-default		trbrf-default

Return More Change

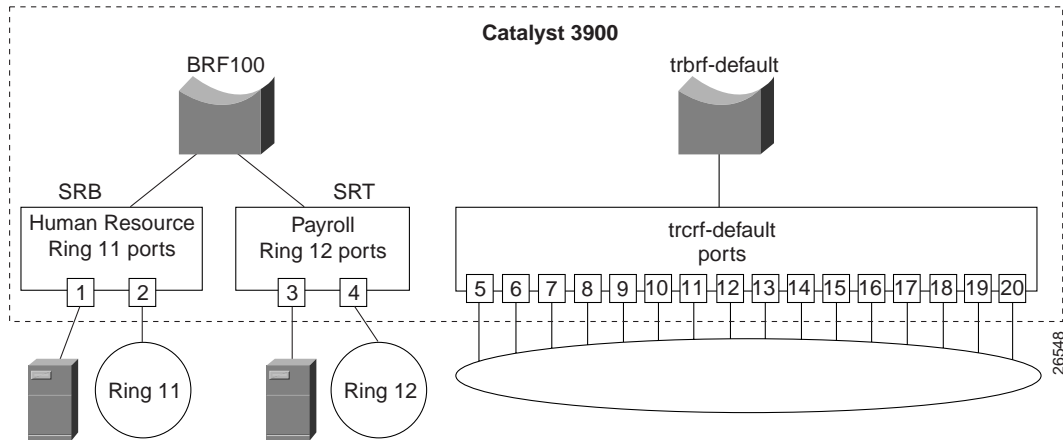
Return to previous menu

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Resulting Network

You now have a network with improved performance because the number of users per ring has been reduced and the servers have dedicated bandwidth (Figure 6-7).

Figure 6-7 Final Network Configuration



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Tips

This section contains tips that may be useful in creating a configuration similar to the one in this scenario.

Configuring the STP

If you install an external bridge to create a backup path between rings 11 and 12, you introduce possible loops into your network. However, STPs prevent these loops. By default, the TrBRF runs the IBM STP. The STP run on the TrCRF can be manually configured, though. By default the TrCRF STP is determined by the bridging mode. TrCRFs with a bridging mode of SRB will run the IEEE STP and TrCRFs with a bridging mode of SRT will run the Cisco STP.

Selecting VLAN Names and IDs

To aid in network management and network identification, we recommend that:

- The VLAN name of a TrCRF should include the ring number.
- The VLAN name for a TrBRF should include the bridge number.
- The VLAN ID of a TrCRF should be the same as the ring number.

Improving Performance

To further improve performance, if you have 16 Mbps connections and the server's NIC supports FDX, you can configure the ports connected to the servers to operate in FDX mode. To configure FDX:

- Step 1. Select Port Configuration on the Configuration panel.
- Step 2. Specify the port to which the server is attached. In this scenario, that would be either port 2 or 4.
- Step 3. On the Port Configuration panel, move to the Operation Mode and select a mode of FDX port.
- Step 4. Select Return.

Microsegmenting the Rings on a Catalyst 5000

You can create a similar configuration using two Catalyst 5000 series Token Ring switching modules. The Catalyst 5000 provides a command line interface rather than a menu-driven interface, so the steps are slightly different. This section provides an overview of the configuration steps to achieve a similar configuration using two Catalyst 5000 Token Ring modules.

Defining the Bridge

To define the bridge (TrBRF), complete the following steps:

- Step 1. At the Catalyst 5000 command prompt, enter enable.
- Step 2. At the enable prompt, enter set vlan 100 name brf100 type trbrf bridge 1.
- Step 3. To verify the configuration of the new VLAN, enter show vlan.

The output (Figure 6-8), indicates that brf100 has been added, but it does not have any TrCRFs assigned to it yet.

Figure 6-8 Output for show vlan Command

VLAN	Name	Status	Mod/Ports, Vlans
1	default	active	1/1-2 2/1-48
100	brf100	active	
1002	fddi-default	active	
1003	trcrf-default	active	3/1-16
1004	fddinet-default	active	
1005	trbrf-default	active	1003

Defining the Rings

To define the ring (TrCRF) for the Human Resource users, complete the following steps:

- Step 1. At the enable prompt, enter `set vlan 11 name hr-ring11 type trcrf ring 11 parent 100 mode srb`.
- Step 2. To verify the configuration of the new VLAN, enter `show vlan`.

The output (Figure 6-9) indicates that `hr-ring11` has been added, but it does not have any ports assigned to it yet. It also shows that `brf100` is the parent of the VLAN with the ID of 11.

Figure 6-9 Output of `show vlan` Command

VLAN	Name	Status	Mod/Ports, Vlans
1	default	active	1/1-2 2/1-48
11	hr-ring11	active	
100	brf100	active	11
1002	fddi-default	active	
1003	trcrf-default	active	3/1-16
1004	fddinet-default	active	
1005	trbrf-default	active	1003

VLAN	Type	SAID	MTU	Parent	RingNo	BrdgNo	Stp	BrdgMode	Trans1	Trans2
1	enet	100001	1500	-	-	-	-	-	0	0
11	trcrf	100110	4472	100	0x11	-	-	srb	0	0
100	trbrf	100100	4472	-	-	0x1	ibm	-	0	0
1002	fddi	101002	1500	-	0x0	-	-	-	0	0
1003	trcrf	101003	4472	1005	0xccc	-	-	srb	0	0
1004	fdnet	101004	1500	-	-	0x0	ieee	-	0	0
1005	trbrf	101005	4472	-	-	0xf	ibm	-	0	0

To define the TrCRF for the Payroll users, do the following:

- Step 1. At the enable prompt, enter `set vlan 12 name payroll-ring12 type trcrf ring 12 parent 100 mode srb`.
- Step 2. To verify the configuration of the new VLAN, enter `show vlan`.

The output (Figure 6-10) indicates that `payroll-ring12` has been added, but it does not have any ports assigned to it yet. It also shows that `brf100` is the parent of the VLAN with the ID of 12.

Figure 6-10 Output of show vlan Command

VLAN	Name	Status	Mod/Ports, Vlans
1	default	active	1/1-2 2/1-48
11	hr-ring11	active	
12	payroll-ring12	active	
100	brf100	active	11, 12
1002	fddi-default	active	
1003	trcrf-default	active	3/1-16
1004	fddinet-default	active	
1005	trbrf-default	active	1003

VLAN	Type	SAID	MTU	Parent	RingNo	BrdgNo	Stp	BrdgMode	Trans1	Trans2
1	enet	100001	1500	-	-	-	-	-	0	0
11	trcrf	100110	4472	100	0x11	-	-	srb	0	0
12	trcrf	100120	4472	100	0x12	-	-	srb	0	0
100	trbrf	100100	4472	-	-	0x1	ibm	-	0	0
1002	fddi	101002	1500	-	0x0	-	-	-	0	0
1003	trcrf	101003	4472	1005	0xccc	-	-	srb	0	0
1004	fdnet	101004	1500	-	-	0x0	ieee	-	0	0
1005	trbrf	101005	4472	-	-	0xf	ibm	-	0	0

Assigning Ports to the Rings

To assign the ports to the rings (TrCRFs), complete the following steps:

- Step 1. At the enable prompt, enter set vlan 11 3/1-2.
- Step 2. At the enable prompt, enter set vlan 12 3/3-4.

The output (Figure 6-11) shows that ports 1 and 2 on module 3 are assigned to crf11 and that ports 3 and 4 on module 3 are assigned to crf12.

Figure 6-11 Output of show vlan Command

VLAN	Name	Status	Mod/Ports, Vlans
1	default	active	1/1-2 2/1-48
11	hr-ring11	active	3/1-2
12	payroll-ring12	active	3/3-4
100	brf100	active	11, 12
1002	fddi-default	active	
1003	trcrf-default	active	3/5-16
1004	fddinet-default	active	
1005	trbrf-default	active	1003

Configuring the STP

By default, the TrBRF runs the IBM STP. The STP run on the TrCRFs is determined by the specified bridging mode. TrCRFs with a bridge mode of SRB will run the IEEE STP and TrCRFs with a bridge mode of SRT will run the Cisco STP.

The Catalyst 5000 Token Ring switching module considers the combination of the IBM STP at the TrBRF and the bridge mode of SRT to be incompatible. As a result, if you had configured one of the TrCRFs (for example, payroll-ring12) with a bridge mode of SRT, the Catalyst 500 Token Ring switching module would automatically block the logical port of the TrCRF that is configured for SRT. Use the show spantree command to view the state of the logical ports (Figure 6-12).

Figure 6-12 Output of the show spantree Command

```
VLAN 100
Spanning tree enabled
Spanning tree type          ibm

Designated Root             00-e0-1e-2f-6c-63
Designated Root Priority    32768
Designated Root Cost       0
Designated Root Port       1/0
Root Max Age 6 sec        Hello Time 2 sec    Forward Delay 4 sec

Bridge ID MAC ADDR          00-e0-1e-2f-6c-63
Bridge ID Priority          32768
Bridge Max Age 6 sec        Hello Time 2 sec    Forward Delay 4 sec

Port,Vlan Vlan  Port-State      Cost   Priority  Fast-Start  Group-method
-----
 1/2      100  forwarding      19     32     disabled
 11       100  forwarding      80     32     disabled
 12       100  blocking        80     32     disabled
* = portstate set by user configuration
```

You can then use the set spantree portstate command to change the forwarding mode of the logical port.