

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).

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

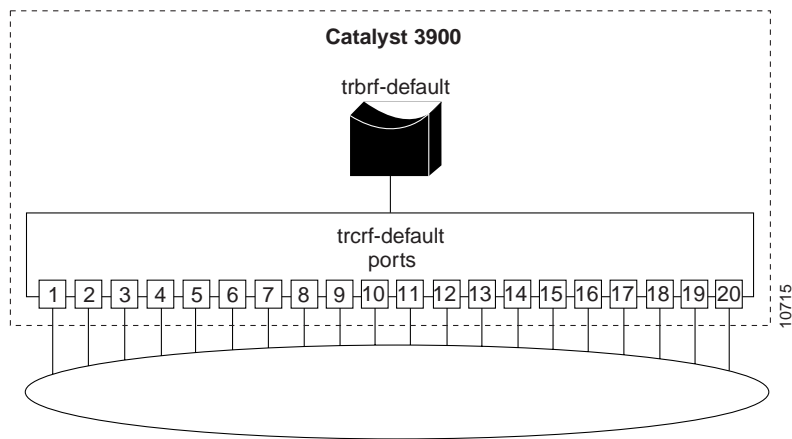
Note Instructions for creating a similar configuration using two Catalyst 5000 Series Token Ring switching modules are included in the “Microsegmenting the Rings on a Catalyst 5000” section.

Initial Network Configuration

In this scenario, yours is 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 7-1 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 7-1 Initial VLAN Configuration



Before Beginning

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

You have met with the IS department and have decided to create two new rings, with ring numbers 1 and 4, 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	CRF11
12	12	CRF14

The bridge will be assigned a VLAN ID of 100 and a VLAN name of BR100.

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. 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.

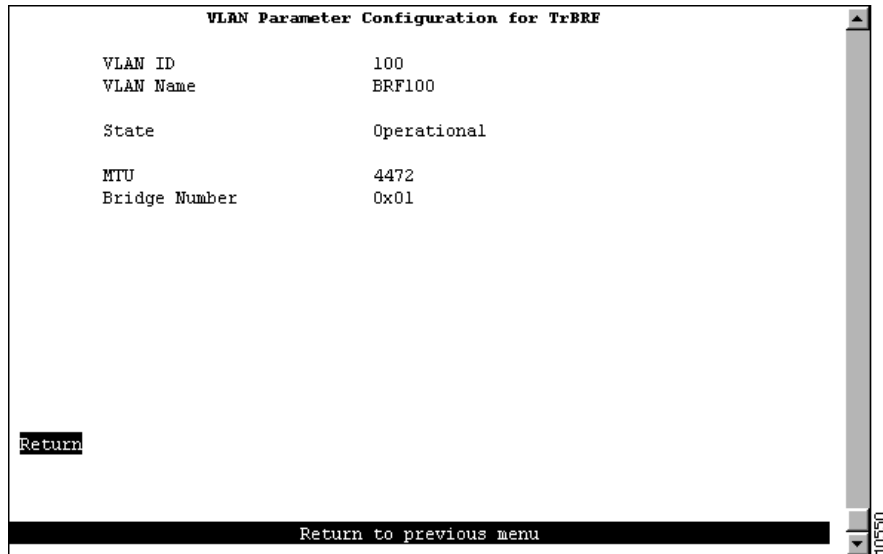
Defining the Bridges

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 is displayed.
- Step 7** On the VLAN Parameter Configuration for TrBRF panel, specify:
- VLAN Name of **BRF100**.
 - Bridge Number of **1**.

See Figure 7-2.

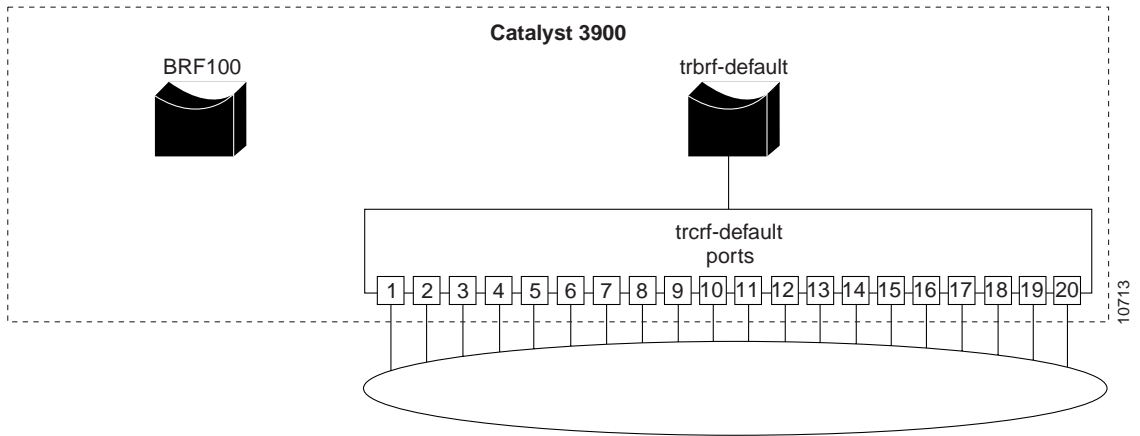
Figure 7-2 VLAN Parameter Configuration for TrBRF Panel



Step 8 Select **Return** to save your changes.

Figure 7-3 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 7-3 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 is displayed.

Step 4 On the VLAN Parameter Configuration for TrCRF panel, specify:

- VLAN Name of **CRF11**.
- Parent VLAN of **BRF100**.
- Ring Number of **11**.

See Figure 7-4.

Figure 7-4 VLAN Parameter Configuration for TrCRF Panel

```
VLAN Parameter Configuration for TrCRF

VLAN ID          11
VLAN Name        CRF11
Parent VLAN      BRF100
State            Operational

Ring Number      0x11
Bridging Mode    SRB
Max ARE Bridge Hop Count  7
Max STE Bridge Hop Count  7
Backup CRF       No

Return
```

Return to previous menu

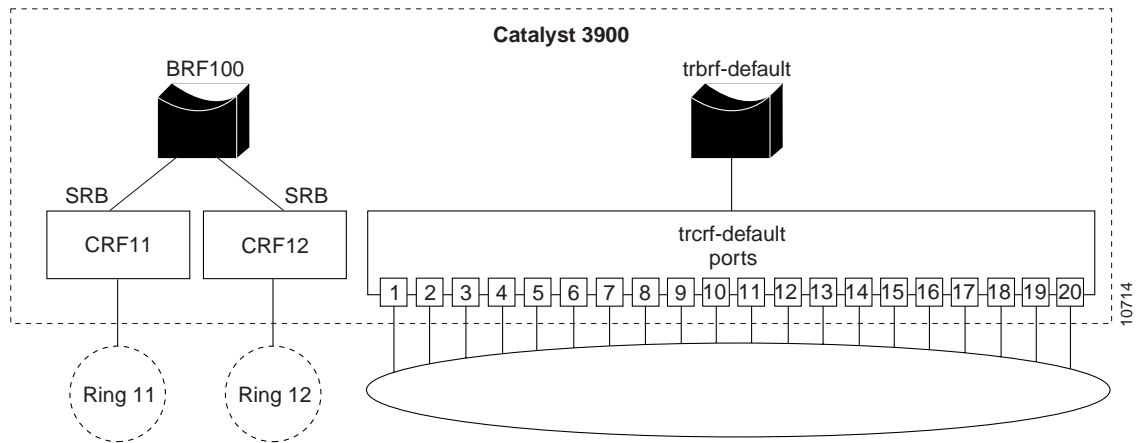
Step 5 Select **Return** to save your changes.

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 **CRF12**.
- Parent VLAN of **BRF100**.
- Ring Number of **12**.

Figure 7-5 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 7-5 Catalyst 3900 with Three Rings Configured

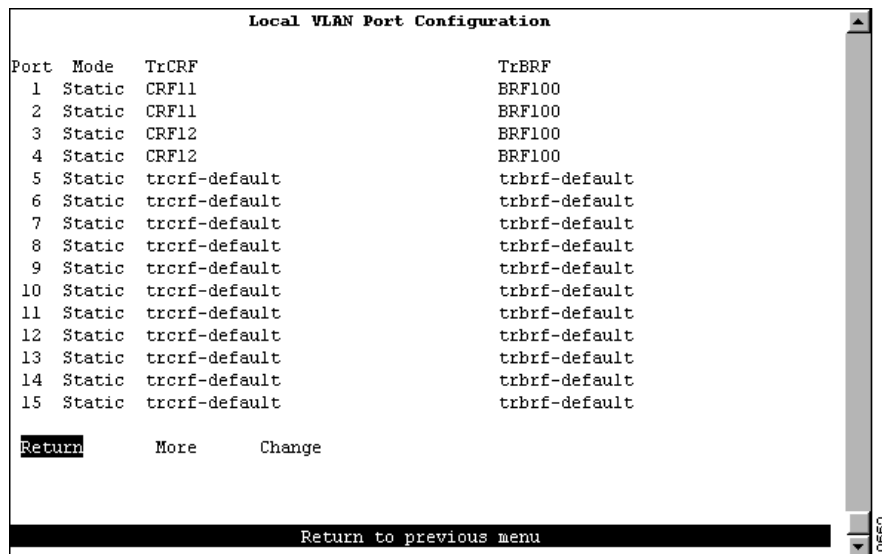


Assigning Ports to the Rings

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 **CRF11** 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. See Figure 7-6.

Figure 7-6 Local VLAN Port Configuration Panel

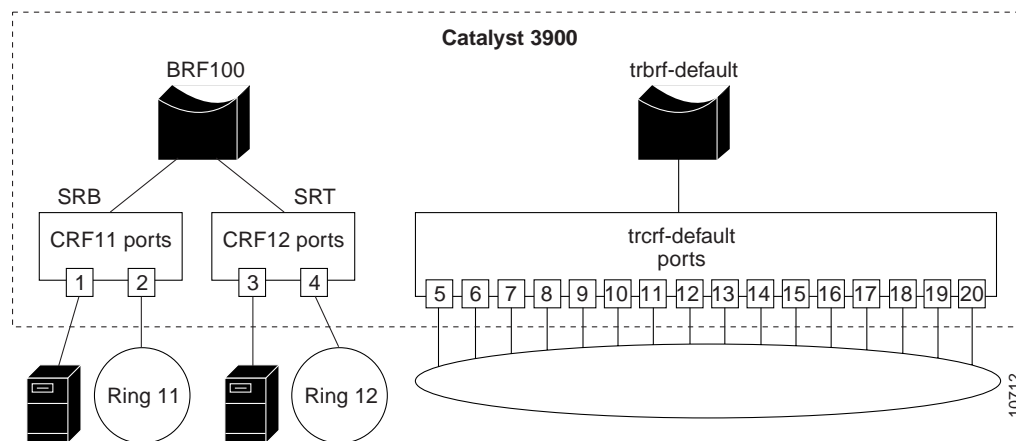


- Step 5** Repeat Step 2 through Step 4 for port 2.
- Step 6** Again, on the Local VLAN Port Configuration panel, select **Change**.
- Step 7** At the prompt enter port number **3**.
- Step 8** Select **CRF12** from the list of possible TrCRFs.
- Step 9** Repeat Step 6 through Step 8 for port 4.
- Step 10** Select **Return** to save the changes.

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. See Figure 7-7.

Figure 7-7 Final Network Configuration



Tips

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

Configuring the Spanning-Tree Protocol

If you install an external bridge to create a backup path between rings 1 and 4, you introduce possible loops into your network. You can use the Spanning-Tree Protocols to prevent these loops. By default, no Spanning-Tree Protocol is run at the bridge (TrBRF) or the ring (TrCRF) level, therefore, you must configure the Spanning-Tree Protocol.

To configure the Spanning-Tree Protocol for the bridge (TrBRF), complete the following steps:

- Step 1** On the Catalyst 3900 Main Menu, select **Configuration**.
- Step 2** On the Configuration panel, select **Spanning Tree** and select **BRF100**. The Spanning Tree for TrBRF panel is displayed.

- Step 3** On the Spanning Tree for TrBRF panel, set the STP Participation to **Base on Bridging Mode**. If the bridging mode is SRB, the IBM Spanning-Tree Protocol is used. If the bridging mode is SRT, the IEEE Spanning-Tree Protocol is used.

To configure the Spanning-Tree Protocol for the ring (TrCRF), complete the following steps:

- Step 1** While still on the Spanning Tree for TrBRF panel, select **TrCRF & Port Spanning Tree Parameters** and select **CRF11**. This is the SRB ring.
- Step 2** On the Spanning Tree for TrCRF panel, set the STP Participation to **IEEE**.
- Step 3** Select **Return**.
- Step 4** Repeat Steps 1 through Step 3 for **CRF12**.
- Step 5** Select **Return** again.

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, as shown in Figure 7-8, indicates that brf100 has been added but that it does not have any TrCRFs assigned to it yet.

Figure 7-8 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 crf11 type trcrf ring 11 parent 100 mode srb**.

Step 2 To verify the configuration of the new VLAN, enter **show vlan**.

The output, as shown in Figure 7-9, indicates that crf11 has been added but that 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 7-9 Output of Show VLAN Command

VLAN	Name	Status	Mod/Ports, Vlans
1	default	active	1/1-2 2/1-48
11	crf11	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 crf12 type trcrf ring 12 parent 100 mode srb**.

Step 2 To verify the configuration of the new VLAN, enter **show vlan**.

The output, as shown in Figure 7-10, indicates that crf12 has been added but that 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 7-10 Output of Show VLAN Command

VLAN	Name	Status	Mod/Ports, Vlans							
1	default	active	1/1-2 2/1-48							
11	crf11	active								
12	crf12	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, shown in Figure 7-11, 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 7-11 Output of Show VLAN Command

VLAN	Name	Status	Mod/Ports, Vlans							
1	default	active	1/1-2 2/1-48							
11	crf11	active	3/1-2							
12	crf12	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 Spanning-Tree Protocol

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

The Catalyst 5000 Token Ring switching module considers the combination of the IBM Spanning-Tree Protocol 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, CRF12) with a bridge mode of SRT, the Catalyst 5000 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 (see Figure 7-12.).

Figure 7-12 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.

