

Configuring Token Ring and Ethernet VLANs on the Catalyst 5000 using an RSM

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Introduction

This document discusses how to configure Token Ring switching on the Catalyst 5000 and the Route Switch Module (RSM). In particular, this document focuses on the configuration of the Catalyst 5000 with the RSM to route IP in a source–route bridged environment, and the steps involved. It also gives an example configuration for communication between an Ethernet VLAN and a Token Ring VLAN through the RSM. This document also discusses some of the most frequently used **show** commands.

Prerequisites

Requirements

Cisco recommends that you have knowledge of these topics:

- Token Ring Switching concepts, including Token Ring Bridge Relay Function (TrBRF) and Token Ring Concentrator Relay Function (TrCRF).
- How to configure and manage Cisco routers and switches.

Components Used

The information in this document is based on these software and hardware versions:

- Catalyst 5505 with Supervisor Engine III Software version 4.5(6), with these installed:
 - ◆ Route Switch Module with Cisco IOS® Software Release 12.1(2) with IBM Feature Set
 - ◆ Ethernet Blade with software version 4.5(6)
 - ◆ Token Ring Blade with software version 3.3(2)

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

Conventions

Refer to Cisco Technical Tips Conventions for more information on document conventions.

Background Theory

Unlike Ethernet VLANs, where one VLAN effectively represents one physical Ethernet segment (for example, a broadcast domain), Token Ring switching uses multiple VLANs per broadcast domain. The central concept is the Token Ring Bridge Relay Function (TrBRF) VLAN. This is a VLAN which represents the bridging functionality in a Token Ring network. Under this TrBRF, or bridge, you configure one or more Token Ring Concentrator Relay Function (TrCRF) VLANs. These are analogous to the physical rings in a Token Ring network. As part of the definition, each must be assigned a unique ring number.

End devices on different TrCRFs can communicate with each other without any external bridge or router via the bridging functionality in the TrBRF. One switch may be configured with more than one TrBRF VLAN, each with its associated TrCRF VLANs. However, for communication between the TrBRFs, an external device such as a router is needed.

The TrBRF VLAN can be configured in two ways: either as a Transparent Bridge, or as a Source Route Bridge. Because typical Token Ring switches are installed in IBM shops which already use Source Route Bridging (SRB), the most common configuration of the TrBRF is as a Source Route Bridge.

Token Ring VLANs, like Ethernet VLANs, need to run a spanning tree algorithm to avoid loops. However, unlike Ethernet VLANs, they need to run two instances of this, one at the TrBRF level and one at the TrCRF level.

If the TrBRF is functioning as a Transparent Bridge (**mode srt** when you are setting up the dependent TrCRFs), then it must be configured to run IEEE as the Spanning Tree Protocol at the TrBRF level (**stp ieee**).

If the TrBRF is functioning as a Source Route Bridge (**mode srb** when setting up the dependent TrCRFs), then it must be configured to run IBM as the Spanning Tree Protocol at the TrBRF level (**stp ibm**).

The Spanning Tree Protocol that runs at the TrCRF level is automatically chosen based on the bridging mode. If the bridging mode is SRB (for example, the TrBRF is running the IBM Spanning Tree Protocol), then the IEEE Spanning Tree Protocol is run at the TrCRF level. If the bridging mode is Transparent Bridging (the TrBRF is already running the IEEE Spanning Tree Protocol, for instance), then the spanning tree protocol run at the TrCRF level is CISCO.

For more information on the concept of TrBRF and TrCRF, refer to Token Ring Switching Concepts.

Configure

In this section, you are presented with the information to configure the features described in this document.

Note: Use the Command Lookup Tool (registered customers only) to find more information on the commands used in this document.

Before you can configure any Token Ring VLANs, all Token Ring switches in the domain must be running VLAN Trunking Protocol (VTP) V2. In order to avoid a disruption of the existing VTP domain, you should configure newly added switches as Transparent or Client mode with this command:

```
set vtp domain cisco mode transparent v2 enable
```

For more information on VTP, refer to Configuring VTP. The default mode is **server**.

Next, set up the TrBRF VLAN or VLANs on the switch. In this example, there are two separate TrBRFs set up as Source Route Bridges, as this is the most common type of configuration.

1. Create the TrBRF VLANs on the switch.

This is the parent for the TrCRF VLANs which has ports with connected end devices assigned to it.

Note: Because you are doing Source Route Bridging, the Spanning Tree Protocol is set to **ibm**.

```
set vlan 100 type trbrf name test_brf bridge 0xf stp ibm
set vlan 200 type trbrf name test_brf2 bridge 0xf stp ibm
```

2. Create the TrCRF VLANs.

Note: The mode is set to SRB and the ring number can be entered in hexadecimal or decimal notation, as shown in the next example. However, when you display the configurations, the switch displays them in hexadecimal.

```
set vlan 101 type trcrf name test_crf101 ring 0x64 parent 100 mode srb
!--- All rings in hexadecimal.

set vlan 102 type trcrf name test_crf102 ring 0x65 parent 100 mode srb
set vlan 103 type trcrf name test_crf103 ring 0x66 parent 100 mode srb

set vlan 201 type trcrf name test_crf201 decring 201 parent 200 mode srb
!--- All rings in decimal.

set vlan 202 type trcrf name test_crf202 decring 202 parent 200 mode srb
set vlan 203 type trcrf name test_crf203 decring 203 parent 200 mode srb
```

3. Assign the VLANs to the ports intended in the switch network.

Assign the ports to the CRF VLANs in the same way that Ethernet ports are assigned.

For example, here you assign ports 8/1–4 to VLAN 101, which is ring number 100 (0x64). Because the default VLAN for all Token Ring ports is 1003 in the same way that VLAN 1 is the default for all Ethernet ports VLAN 1003 is also modified.

```
ptera-sup (enable) set vlan 101 8/1-4

VLAN 101 modified.
VLAN 1003 modified.
VLAN  Mod/Ports
-----
101   8/1-4

ptera-sup (enable) set vlan 201 8/5-8

VLAN 201 modified.
VLAN 210 modified.
VLAN  Mod/Ports
-----
201   5/1
      8/5-8
```

Once you have assigned all the required Token Ring ports to TrCRF VLANs, you have finished the configuration of the switch. Devices in TrCRFs under the same VLAN are now able to source route bridge between them.

For IP connectivity, because this is a bridged environment, all end devices must be part of the same IP network. However, because the TrBRF is functioning as a source route bridge, routers connected to different TrCRFs require the multi-ring option, to cache and use the Routing Information Field (RIF).

For example, an external router connected to TrCRF 101 would have its Token Ring interface configured similar to this:

```
source-bridge ring-group 2000
!
interface token-ring 0
 ip address 1.1.1.10 255.255.255.0
 multiring all
 source-bridge 100 1 2000

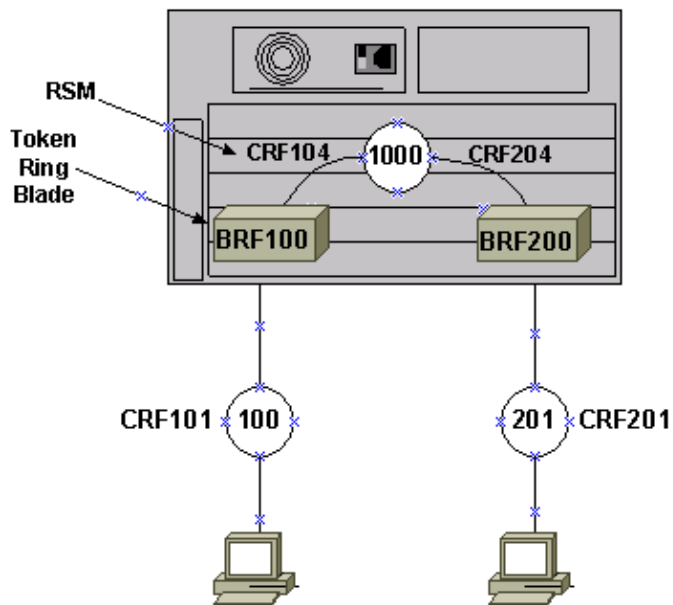
!--- The ring number is 100, to match CRF 101 ring number;
!--- and 2000 is the virtual ring number of the router.

source-bridge spanning
```

Configuring Token Ring with RSM for SRB and Multiring for IP

If you are routing IP in a source-route bridged network, you need to add multi-ring to your configuration as well as configure source-route bridging. This is because, with the RSM, you are extending the bridge from the switch to the RSM, and you must create a pseudo ring that the multi-ring code appends to the RIF. You create this pseudo ring when you create a TrCRF under the parent TrBRF that is assigned in the RSM under the multi-ring code.

Because you also need to configure source-route bridging for the RSM, you must tie the interface VLAN to the virtual ring of the RSM. This is done when you create a TrCRF under each TrBRF with a ring number that matches that of the virtual ring in the RSM. In fact, you can use the same TrCRF for both multi-ring and source route bridging purposes, provided they have the same ring number. See the next diagram:



In this example, you are going to set up the RSM as virtual ring 1000 with the global **source-bridge ring-group 1000** command.

1. Set up the corresponding pseudo-TrCRFs on the switch, one for each TrBRF, with these commands:

```
set vlan 104 type trcrf name test_crf104 decring 1000 parent 100 mode srb
set vlan 204 type trcrf name test_crf204 decring 1000 parent 200 mode srb
```

Note: The ring numbers for the above TrCRFs have to match the virtual ring in the RSM, 1000. Also, no ports are assigned to the pseudo-TrCRFs. The physical ports are assigned to TrCRF 101 and 201, as shown in the example in Step 3 of the main Configure section of this document.

2. Add an **interface vlan** command in the RSM for each TrBRF configured on the switch:

```
interface vlan100 type trbrf
interface vlan200 type trbrf
```

3. Add the multi-ring and source route bridging commands to the VLAN interfaces.

These tell the router what TrCRF VLAN has been assigned to map onto the virtual ring in the router. In this document example, it is VLANs 104 and 204, both with a ring number of 1000 to match the ring-group in the router.

You also need to add IP addresses to route IP traffic, so that you end up with this configuration:

```
source-bridge ring-group 1000
!
interface vlan100 type trbrf
 ip address 1.1.1.1 255.255.255.0
 multiring trcrf-vlan 104 ring 1000
 multiring all
 source-bridge trcrf-vlan 104 ring-group 1000
 source-bridge spanning
!
interface vlan200 type trbrf
 ip address 1.1.2.1 255.255.255.0
 multiring trcrf-vlan 204 ring 1000
 multiring all
 source-bridge trcrf-vlan 204 ring-group 1000
 source-bridge spanning
!
```

Note: IP protocol configurations are not shown in this example, for simplicity.

Communicating Between Ethernet and Token Ring VLANs on the Same Switch

You can configure Token Ring and Ethernet VLANs on the same switch, but you can only send traffic between them with an RSM or an external router.

If you have already configured the switch and the RSM as described earlier in this document, you could add an Ethernet VLAN and configure source bridge translational on the RSM, to bridge traffic between the two media:

1. Set up the Ethernet VLAN and assign ports to it with the **set vlan** command:

```
ptera-sup (enable) set vlan 500 3/1-5

Vlan 500 configuration successful
VLAN 500 modified.
VLAN 1 modified.
VLAN Mod/Ports
-----
500 3/1-5
```

2. Set up the VLAN interface on the RSM and put it in a transparent bridge-group:

```
interface vlan 500
bridge-group 1
```

```
bridge 1 protocol ieee
```

3. Configure source bridge translational with the **source-bridge transparent ring-group pseudo-ring bridge-number tb-group** command where:

- ◆ *ring-group* is the source-bridge ring-group virtual ring that is configured on the RSM. In this case, it is 1000.
- ◆ *pseudo-ring* is the ring number that is going to be assigned to this transparent bridging domain. You can choose any number, but it should be unique in the same way that real ring numbers should be unique within a source-route bridged network. In the previous example, the ring number is 3000.
- ◆ *bridge-number* is the bridge number that is used to form the RIF in frames that are coming from the transparent bridge group and are being sent to the source route bridged network. In this case, you are using 1.
- ◆ *tb-group* is the transparent bridge group number. In this case, it is 1.

```
source-bridge transparent 1000 3000 1 1
source-bridge ring-group 1000
!
interface vlan100 type trbrf
ip address 1.1.1.1 255.255.255.0
multiring trcrf-vlan 104 ring 1000
multiring all
source-bridge trcrf-vlan 104 ring-group 1000
source-bridge spanning
!
interface Vlan200 type trbrf
ip address 1.1.2.1 255.255.255.0
multiring trcrf-vlan 204 ring 1000
multiring all
source-bridge trcrf-vlan 204 ring-group 1000
source-bridge spanning
!
interface vlan 500
ip address 1.1.3.1 255.255.255.0
bridge-group 1

bridge 1 protocol ieee
```

Note: In this scenario, IP is being routed, not bridged.

Verify

Use this section to confirm that your configuration works properly.

The Output Interpreter Tool (registered customers only) (OIT) supports certain **show** commands. Use the OIT to view an analysis of **show** command output.

show vlan On the switch, you can check which VLANs are configured, the bridging mode, and the spanning tree.

```
ptera-sup (enable) show vlan
```

VLAN	Name	Status	IfIndex	Mod/Ports	VLANs
1	default	active	3	3/6-24 6/1-24 10/1-12	
100	test_brif	active	8	8	101, 102, 103, 104

```

105
101 test_crf101 active 10 8/1-4
102 test_crf102 active 11
103 test_crf103 active 12
104 test_crf104 active 13
105 test_crf105 active 14
200 test_brf2 active 9 9 201, 202, 203, 204
205
201 test_crf201 active 15 8/5-8
202 test_crf202 active 16
203 test_crf203 active 17
204 test_crf204 active 18
205 test_crf205 active 19
210 VLAN0210 active 98
500 VLAN0500 active 20 3/1-5
1002 fddi-default active 4
1003 trcrf-default active 7 8/9-16
1004 fddinet-default active 5
1005 trbrf-default active 6 6 1003

```

VLAN	Type	SAID	MTU	Parent	RingNo	BrdgNo	Stp	BrdgMode	Trans1	Trans2
1	enet	100001	1500	-	-	-	-	-	0	0
100	trbrf	100100	4472	-	-	0xf	ibm	-	0	0
101	trcrf	100101	4472	100	0x64	-	-	srb	0	0
102	trcrf	100102	4472	100	0x65	-	-	srb	0	0
103	trcrf	100103	4472	100	0x66	-	-	srb	0	0
104	trcrf	100104	4472	100	0x3e8	-	-	srb	0	0
105	trcrf	100105	4472	100	0x7d0	-	-	srb	0	0
200	trbrf	100200	4472	-	-	0xf	ibm	-	0	0
201	trcrf	100201	4472	200	0xc9	-	-	srb	0	0

!--- All ring numbers are displayed in hexadecimal.

202	trcrf	100202	4472	200	0xca	-	-	srb	0	0
203	trcrf	100203	4472	200	0xcb	-	-	srb	0	0
204	trcrf	100204	4472	200	0x3e8	-	-	srb	0	0
205	trcrf	100205	4472	200	0x7d0	-	-	srb	0	0
210	enet	100210	1500	-	-	-	-	-	0	0
500	enet	100500	1500	-	-	-	-	-	0	0
1002	fddi	101002	1500	-	-	-	-	-	0	0
1003	trcrf	101003	4472	1005	0xcc	-	-	srb	0	0
1004	fdnet	101004	1500	-	-	0x0	ieee	-	0	0
1005	trbrf	101005	4472	-	-	0xf	ibm	-	0	0

VLAN DynCreated

```

-----
1 static
100 static
101 static
102 static
103 static
104 static
105 static
200 static
201 static
202 static
203 static
204 static
205 static
210 static
500 static
1002 static
1003 static
1004 static
1005 static

```

```

VLAN AREHops STEHops Backup CRF 1q VLAN
-----
101 7 7 off
102 7 7 off
103 7 7 off
104 7 7 off
105 7 7 off
201 7 7 off
202 7 7 off
203 7 7 off
204 7 7 off
205 7 7 off
1003 7 7 off
ptera-sup (enable)

```

show spantree TrBRF vlan_number Displays important information, such as which ports are being connected and forwarding, and displays the spanning tree mode running at the TrBRF level.

```
ptera-sup (enable) show spantree 100
```

```

VLAN 100
Spanning tree enabled
Spanning tree type          ibm
Designated Root             00-10-1f-29-f9-63
Designated Root Priority    32768
Designated Root Cost        0
Designated Root Port        1/0
Root Max Age 10 sec        Hello Time 2 sec        Forward Delay 4 sec

Bridge ID MAC ADDR          00-10-1f-29-f9-63
Bridge ID Priority          32768
Bridge Max Age 10 sec        Hello Time 2 sec        Forward Delay 4 sec

Port,Vlan                    Vlan Port-State          Cost Priority Portfast Channel_id
-----
 5/1                          100 forwarding             5      4 disabled 0
101                           100 inactive              62      4 disabled
102                           100 inactive              62      4 disabled
103                           100 inactive              62      4 disabled
104                           100 inactive              62      4 disabled
105                           100 inactive              62      4 disabled
* = portstate set by user configuration.

```

Note: In that output, you see port 5/1 listed under TrBRF VLAN 100. This is because you have an RSM in slot 5 and because an ISL trunk is used to extend the bridge from the switch to the RSM automatically. For more information on Token Ring ISL, refer to TR-ISL Trunking Between Cisco Catalyst 5000 and 3900 Switches and Routers.

show spantree TrCRF vlan_number Displays important information, such as which ports are being connected and forwarding, and displays the spanning tree mode running at the TrCRF level.

```
ptera-sup (enable) show spantree 101
```

```

VLAN 101
Spanning tree enabled
Spanning tree type          ieee
Designated Root             00-10-1f-29-f9-64
Designated Root Priority    32768
Designated Root Cost        0
Designated Root Port        1/0
Root Max Age 10 sec        Hello Time 2 sec        Forward Delay 4 sec

```



```

Bridge ID MAC ADDR          00-10-1f-29-f9-64
Bridge ID Priority          32768
Bridge Max Age 10 sec      Hello Time 2 sec   Forward Delay 4 sec

```

```

Port                Vlan Port-State      Cost  Priority  Portfast  Channel_id
-----
 5/1                101 forwarding*        5     32 disabled  0
 8/1                101 not-connected      250    32 disabled  0
 8/2                101 not-connected      250    32 disabled  0
 8/3                101 not-connected      250    32 disabled  0
 8/4                101 not-connected      250    32 disabled  0

```

* = portstate set by user configuration or set by vlan 100 spanning tree.
ptera-sup (enable)

show port Verifies the existence of the ISL trunk.

```
ptera-sup (enable) show port 5/1
```

```

Port Name                Status      Vlan      Level  Duplex  Speed  Type
-----
 5/1                    connected trunk      normal   half   400  Route Switch

```

```

Port  Trap      IfIndex
-----
 5/1  disabled  81

```

```
Last-Time-Cleared
```

```

-----
Sat Jun 29 2002, 03:15:59
ptera-sup (enable)

```

show trunk Displays which ports are forwarding and which ones are inactive, and displays the spanning tree mode at the TrBRF level.

```
ptera-sup (enable) show trunk
```

```

Port      Mode      Encapsulation  Status      Native vlan
-----
 5/1      on        isl            trunking    1
 7/1-2    on        lane           trunking    1

```

```
Port      Vlans allowed on trunk
```

```

-----
 5/1      1-1005
 7/1-2    1-1005

```

```
Port      Vlans allowed and active in management domain
```

```

-----
 5/1
 7/1-2    1003

```

```
Port      Vlans in spanning tree forwarding state and not pruned
```

```

-----
 5/1      100-105,200-205
 7/1-2    1003

```

```
ptera-sup (enable)
```

show interface Displays the VLAN configurations on the RSM in the same way as physical interfaces on a router.

```
ptera-rsm# show interface
```

```
vlan100 is up, line protocol is up
```

```
Hardware is Cat5k Virtual Token Ring, address is 0009.fa18.3800 (bia0009.fa18.3800)
```

```

Internet address is 1.1.1.1/24
MTU 4464 bytes, BW 16000 Kbit, DLY 630 usec,
    reliability 255/255, txload 1/255, rxload 1/255
Encapsulation SNAP, loopback not set
ARP type: SNAP, ARP Timeout 04:00:00
Ring speed: 16 Mbps
Duplex: half
Mode: Classic token ring station
Source bridging enabled, srn 0 bn 15 trn 1000 (ring group)
    spanning explorer enabled
Group Address: 0x00000000, Functional Address: 0x08000100
Ethernet Transit OUI: 0x000000
Last input 00:00:01, output 00:00:55, output hang never
Last clearing of "show interface" counters never
Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
Queueing strategy: fifo
Output queue :0/40 (size/max)
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
    390 packets input, 21840 bytes, 0 no buffer
    Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    25 packets output, 6159 bytes, 0 underruns
    0 output errors, 1 interface resets
    0 output buffer failures, 0 output buffers swapped out
    3 transitions
Vlan200 is up, line protocol is up
Hardware is Cat5k Virtual Token Ring, address is 0009.fa18.3800 (bia0009.fa18.3800)
Internet address is 1.1.2.1/24
MTU 4464 bytes, BW 16000 Kbit, DLY 630 usec,
    reliability 255/255, txload 1/255, rxload 1/255
Encapsulation SNAP, loopback not set
ARP type: SNAP, ARP Timeout 04:00:00
Ring speed: 16 Mbps
Duplex: half
Mode: Classic token ring station
Source bridging enabled, srn 0 bn 15 trn 1000 (ring group)
    spanning explorer enabled
Group Address: 0x00000000, Functional Address: 0x08000100
Ethernet Transit OUI: 0x000000
Last input 00:00:00, output 00:08:43, output hang never
Last clearing of "show interface" counters never
Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
Queueing strategy: fifo
Output queue :0/40 (size/max)
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
    381 packets input, 21336 bytes, 0 no buffer
    Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    9 packets output, 783 bytes, 0 underruns
    0 output errors, 1 interface resets
    0 output buffer failures, 0 output buffers swapped out
    3 transitions
ptera-rsm#

```

show spanning-tree Displays information about which Spanning Tree Protocol is running on the RSM.

```

ptera-rsm# show spanning-tree

Bridge group 1 is executing the IEEE compatible Spanning Tree protocol
Bridge Identifier has priority 32768, address 0090.5f18.1c00
Configured hello time 2, max age 20, forward delay 15
We are the root of the spanning tree
Port Number size is 12
Topology change flag not set, detected flag not set

```

```
Times: hold 1, topology change 35, notification 2
       hello 2, max age 20, forward delay 15
Timers: hello 0, topology change 0, notification 0
bridge aging time 300
```

Port 12 (Vlan500) of Bridge group 1 is down

```
Port path cost 19, Port priority 128
Designated root has priority 32768, address 0090.5f18.1c00
Designated bridge has priority 32768, address 0090.5f18.1c00
Designated port is 12, path cost 0
Timers: message age 0, forward delay 0, hold 0
BPDU: sent 0, received 0
```

Port 13 (RingGroup1000) of Bridge group 1 is forwarding

```
Port path cost 10, Port priority 128
Designated root has priority 32768, address 0090.5f18.1c00
Designated bridge has priority 32768, address 0090.5f18.1c00
Designated port is 13, path cost 0
Timers: message age 0, forward delay 0, hold 0
BPDU: sent 0, received 0
```

```
ptera-rsm#
```

Troubleshoot

There is currently no specific troubleshooting information available for this configuration.

Related Information

- [Token Ring Route Switch Module](#)
- [TR-ISL Trunking Between Cisco Catalyst 5000 and 3900 Switches and Routers](#)
- [Token Ring Support Page](#)
- [IBM Technology Support](#)
- [Product Support](#)
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