Token Ring Inter-Switch Link

Feature Summary

The Token Ring Inter-Switch Link (TRISL) feature is a Cisco protocol for interconnecting multiple routers and switches and maintaining VLAN information as traffic goes between routers and switches. The TRISL feature provides a method to transport native Token Ring frames from multiple VLANs across a 100 MB Fast Ethernet link.

The following Cisco routers support the transmission of Token Ring frames from multiple VLANs across a 100 Mbps Fast Ethernet link:

Cisco 7500 or Cisco 7200 routers installed with any one of the following port adapters:

- Two-port Fast Ethernet/ISL 100BaseTX
- Two-port Fast Ethernet/ISL 100BaseFX
- One-port Fast Ethernet 100BaseTX
- One-port Fast Ethernet 100BaseFX

The two-port Fast Ethernet/ISL port adapters support frame sizes up to 17800 bytes and the one-port Fast Ethernet port adapters support a frame size of 1500 bytes.

TRISL provides a bridging technology between switches and routers that will transport traffic from both types of LANs.

The TRISL feature provides the following new functions for routers and switches:

- Inter-VLAN routing for fast switched IP and IPX routing protocols between Token Ring or Ethernet LANs for traffic with or without RIF.
- Source-route bridging (SRB), transparent bridging, source route translational (SRT), and source route translational (SR/TLB) bridging between ISL or TRISL VLANs and interfaces that are enabled for bridging. These interfaces can include Token Ring, Ethernet, FDDI, TR-LANE, Ethernet-LANE, and any other media with encapsulations that support transparent bridging.

TRISL uses a Fast Ethernet interface to provide connectivity between routers and switches or between switches and extends the VLAN capabilities of a switch by tagging the standard Token Ring frame with the necessary VLAN information.

For detailed information on how Token Ring switching is implemented on switches, refer to the *Catalyst Token Ring Switching Implementation Guide*.

Overview of TRISL

This section contains the following overview information:

- Token Ring VLANs
- Duplicate Ring Protocol (DRiP)

Note VLAN Trunk Protocol (VTP) is currently not supported for TRISL on the routers.

Token Ring VLANs

A VLAN is a logical group of LAN segments, independent of physical location, with a common set of requirements. If the end stations are located close to one another, they can be grouped into a LAN segment. If any of the end stations are on a different LAN segment, they can be grouped into a VLAN that has the same attributes as a LAN even though the end stations are not all on the same physical segment.

Because a VLAN is essentially a broadcast domain, a Token Ring VLAN is slightly more complex than an Ethernet VLAN. In transparent bridging, there is only one type of broadcast frame and therefore only one level of broadcast domain, but in source routing there are multiple types of broadcast frames that fall into two categories:

- Those that are confined to a single ring
- Those that traverse the bridged domain

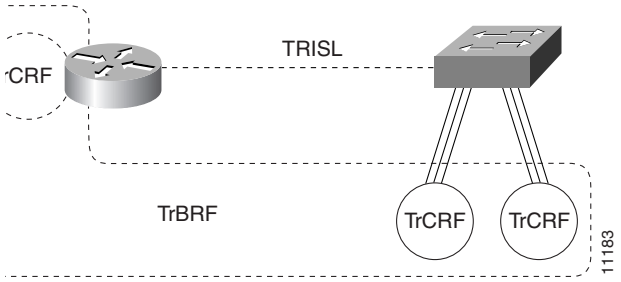
These two categories of broadcast frames result in a broadcast domain that is hierarchical in nature, as a local ring domain can exist only within a domain of all the interconnected rings.

In a Token Ring VLAN, logical ring domains are formed by defining groups of ports that have the same ring number. The IEEE calls such a port group a Concentrator Relay Function (CRF). On Cisco routers and Catalyst switches, such a grouping of Token Ring ports is called a Token Ring CRF (TrCRF).

The domain of interconnected rings is formed using an internal multiport bridge function that the IEEE calls a Bridge Relay Function (BRF). On Cisco routers and Catalyst switches, such a grouping of logical rings is called a Token Ring BRF (TrBRF).

Figure 1 illustrates a TrBRF which contains TrCRFs that exist in a router and a switch.

Figure 1 TrCRFs in a TrBRF



TrCRFs

A TrCRF is a logical grouping of ports.Within the TrCRF, source-route switching is used for forwarding based on either MAC addresses or route descriptors. Frames can be switched between ports within a single TrCRF.

A TrCRF is specified on a router with a ring number and a unique VLAN ID number for the local ring on the router's interface. On switches, TrCRFs comprise one or more physical Token Ring ports. A TrCRF does not contain any physical ports on a router. A TrCRF is confined to the router's physical chassis and is not distributed across a TRISL link. However, if only one TrCRF is defined for a TrNET VLAN, it may be distributed.

A TrBRF on the router can have only one TrCRF. If routing is performed with RIF, the **multiring trcrf-vlan** command is used to specify the TrCRF for the local ring. If there is a need to cache RIFs for routed traffic bridged across a subinterface, the **multiring** command is used.

TrBRFs

A TrBRF is a logical grouping of TrCRFs. The TrBRF is used to join different TrCRFs existing in a network of routers and switches that are connected via high-speed links on a TRISL backbone.

A TrBRF is specified with a bridge number and VLAN ID number. The bridge number is used to identify the bridge which interconnects all logical rings (TrCRFs) that have the same parent TrBRF.

A TrBRF can function as an SRB or SRT bridge running either the IBM or IEEE Spanning-Tree Protocol. If SRB is used, duplicate MAC addresses can be defined on different logical rings.

Frame Tagging in TRISL

A standard Token Ring ISL packet contains a frame that is encapsulated with a header that transports VLAN IDs between routers and switches. A Token Ring ISL packet must have a VLAN ID for each logical ring (TrCRF) and a VLAN ID for the entire Token Ring bridged network (TrBRF).

A packet can originate from one TrCRF and have a destination to a different TrCRF that is contained within the same TrBRF. This second level of VLAN IDs requires the ISL header to contain a destination VLAN ID and a source VLAN ID. The destination VLAN ID is used for forwarding and the source VLAN ID is used for learning. The destination VLAN ID can be a TrBRF or a TrCRF.

The Token Ring ISL frame encapsulation is 35 bytes.

Duplicate Ring Protocol (DRiP)

The Cisco Duplicate Ring Protocol (DRiP) runs on Cisco routers and switches that support switched VLAN networking and is used to identify active Token Ring VLANs (TrCRFs).

Through packet advertisements, DRiP maintains the status of TrCRFs. It then uses this information to determine whether there are multiple TrCRFs active in a TrBRF. A single DRiP database exists in a Cisco router.

DRiP information is used for the following:

- All-routes explorer (ARE) filtering

  To enable the switch to filter out excessive ARE frames, the switch must be aware of the TrCRFs that are attached to the distributed bridge (TrBRF). The DRiP information is used in conjunction with the local configuration to determine which of the TrCRFs configured within a TrBRF have active ports. This information is used on the base switch to correctly filter AREs and on the ISL module to discard AREs that have already been on an attached ring.

- Detecting the configuration of duplicate TrCRFs across routers and switches, which would cause a TrCRF to be distributed across ISL trunks

  The DRiP information is used in conjunction with the local configuration information to determine which TrCRFs are already active on the switches. If a TrCRF is enabled on more than one switch, the ports associated with the TrCRF are disabled on all switches. A router will not disable the port, instead it generates the following error message indicating that two identical TrCRFs are existing:

  ```
  DRIP conflict with CRF <vlan-id>
  ```

Note As VLAN IDs are unique throughout the Token Ring VLAN (TrNetVLAN) network, DRiP does not need to understand the parent/child relationship of a TrCRF to a TrBRF.

How DRiP Works

DRiP sends advertisements to a multicast address so the advertisements are received by all neighboring devices (but they are not forwarded by normal bridging procedures). The advertisement includes VLAN information for the source device only. The DRiP database in the router is initialized when TRISL encapsulation is configured, at least one TrBRF is defined, and the interface is configured for SRB or for routing with RIF.

On any subinterface configured with TRISL encapsulation, there can be two different CRF VLANs. If SRB is enabled in the router with TRISL, a VLAN ID is specified for the CRF of the virtual ring. If routing is enabled on the router, a VLAN ID is specified for the CRF of the pseudo-ring.

When a switch receives a DRiP advertisement from a router, it compares the information in the advertisement with its local configuration to determine which TrCRFs have active ports and then denies any configuration that would allow a TrCRF that is already active on another box to be configured on the local switch.

If there is a conflict between two identical TrCRFs, all ports attached to the conflicting TrCRFs are shut down in the switches and the router's ports remain active. If a TrCRF is configured on two devices that share the same TrBRF for bridging between them, and if ports are assigned to these TrCRFs simultaneously, each switch or router will send a DRiP advertisement. The switch with the higher MAC address will disable the port and the router displays an error message.

If a trunk connection is lost and the router does not get DRiP advertisements on that trunk port for two minutes, all entries associated with that trunk port are removed.

DRiP Advertisements

A DRiP advertisement is sent at periodic intervals (30 seconds) by the router. Even if no change in status or configuration has taken place, the configuration revision number is updated. The periodic message will indicate that nothing has changed and the new revision number is provided.

A router also generates a DRiP advertisement when one of the following occurs:

- TRISL configuration is deleted from a router interface. The router updates its configuration revision number and the DRiP advertisement is sent on all ISL trunks.
- The periodic timer for 30 seconds expires. The DRiP advertisement is sent on all TRISL trunks.
- The router receives a DRiP advertisement with a revision number less than its own and the advertisement contains conflicting information about a TrCRF that is in use on that trunk port. The router does not update its revision number; it generates its own advertisement, sends it on the ISL trunk from which the original DRiP advertisement was received, and updates its database.

How DRiP Advertisements are Transmitted

Advertisements are transmitted on the fast Ethernet port default VLAN (VLAN1) which corresponds to the type of trunk link. Thus, only one copy is transmitted on a trunk port, no matter how many VLANs are defined.

DRiP Frame Format

DRiP is assigned the Cisco HDLC protocol type value 0x0102. A Cisco-proprietary SNAP value is used.

The SNAP format is as follows:

- LLC—0xAAAA03
- Org ID—0x00000C
- HDLC protocol type—0x0102

Benefits

Following are the benefits of TRISL:

- Expands the capability of Cisco routers to support routing between Token Ring VLANs.
- With TRISL support, no change is required to existing Token Ring end stations, applications, protocol stacks, or source-route bridges to take advantage of a 100 Mbps backbone. Clients and servers continue to use Token Ring and SRB protocols without change, minimizing implementation cost and protecting investments in installed equipment.
- TRISL provides a high-speed link between routers and switches or between switches. TRISL forwards the data across the high-speed link without breaking the frames. The entire frame is sent intact across the TRISL connection.
- TRISL is less expensive than ATM and avoids the need for LAN emulation (LANE) services. It is primarily intended for network managers who do not want an ATM backbone for their campus.
- Broadcasts are controlled by groups of client and server end stations across TRISL by creating multiple broadcast domains via multiple VLANs. Catalyst 5000 switching modules and the Catalyst 3900 stackable Token Ring switches support media-speed filtering by protocol on their Token Ring switch ports. As a result, it is possible to completely direct broadcast traffic between clients and servers using broadcast control by VLAN across a switched campus and using protocol filtering on each Token Ring port within the VLAN.

List of Terms

- **all-routes explorer (ARE)**—Explorer packet that traverses an entire SRB network, following all possible paths to a specific destination. Sometimes called all-rings explorer packet.
- **backbone**—The part of a network that acts as the primary path for traffic that is most often sourced from, and destined for, other networks.
- **bridge number**—Number that identifies each bridge in an SRB LAN. Parallel bridges must have different bridge numbers.
- **Fast Ethernet**—Any of a number of 100-Mbps Ethernet specifications. Fast Ethernet offers a speed increase ten times that of the 10BaseT Ethernet specification, while preserving such qualities as frame format, MAC mechanisms, and MTU. Such similarities allow the use of existing 10BaseT applications and network management tools on Fast Ethernet networks. Based on an extension to the IEEE 802.3 specification.
- **Token Ring Inter-Switch Link (TRISL)**—A Cisco-defined protocol that enables full-length frames from multiple Ethernet or Token Ring VLANs to be transmitted simultaneously across the same 100 Mbps Fast Ethernet link. The ISL protocol is supported between Cisco switches and routers and servers using NICs that support ISL proprietary link for interconnecting switches. ISL uses 100-Mbps Ethernet and allows the multiplexing of multiple VLANs over a single link.
- **Token Ring Bridge Relay Function (TRBRF)**—As defined by the IEEE, an internal bridge function on a Token Ring switch that is responsible for forwarding frames between port groupings with the same logical ring number (CRFs). Within a BRF, SRB or source-route transparent bridging can be used to forward frames.

- **Token Ring Concentrator Relay Function (TrCRF)**—A TrCRF is a frame forwarding function based on MAC addresses and Route Descriptor fields in source routed frames within a logical ring of switch ports. In a router, a TrCRF is confined to the physical chassis and is not distributed within a TRISL link. However, if there is only one TrCRF defined for a TrNET VLAN, it may be distributed.
- **routing information field**—Field in the IEEE 802.5 header that is used by a source-route bridge to determine which Token Ring network segments a packet must be sent through. A RIF contains ring and bridge numbers as well as other information.

Platforms

The TRISL feature is supported in Cisco IOS Release 11.3(4)T in the following software images:

- c7200-js-mz
- c7200-js40-mz
- c7200-js56i-mz
- rsp-jsv-mz
- rsp-jsv40-mz
- rsp-jsv56i-mz

The following routers installed with Cisco IOS Release 11.3(4)T support the TRISL feature:

- Cisco 7500 or Cisco 7200 routers installed with Cisco IOS Release 11.3(4)T software and any one of the following port adapters:
  - Two-port Fast Ethernet 100Base TX
  - Two-port Fast Ethernet 100Base FX
  - One-port Fast Ethernet 100Base TX
  - One-port Fast Ethernet 100Base FX

Configuration Tasks

To configure routing between any number of TRISL VLANs in your network, perform the following tasks:

- Enable the protocol on the interface
- Enable the protocol on the router
- Define the encapsulation method as TRISL on the TRISL subinterface
- Customize the protocol according to the requirements for your environment.

To configure and monitor TRISL in your network, perform the following tasks:

- Configure IP Routing over TRISL
- Configure IPX Routing over TRISL
- Configure a Pseudo-ring on the TRISL Subinterface to Cache RIF
- Enable Use of the RIF with Routed Protocols
- Attach TrCRF to the Router's Ring Group

- Enable the Automatic Spanning-Tree Function
- Clear DRiP
- Display DRiP
- Clear VLAN Statistics
- Display VLANs

Configure IP Routing over TRISL

The IP routing over TRISL VLANs feature extends IP routing capabilities to include support for routing IP frame types in VLAN configurations.

Enable IP Routing

IP routing is automatically enabled in the Cisco IOS software for routers. To reenable IP routing if it has been disabled, perform the following task in global configuration mode:

Task	Command
Enable IP routing on the router.	**ip routing**

Once you have IP routing enabled on the router, you can customize the characteristics to suit your environment. If necessary, refer to the IP configuration chapters in the *Network Protocols Configuration Guide*, *Part 1* for guidelines on configuring IP.

Define the VLAN Encapsulation Format

To define the encapsulation format as TRISL, perform these tasks in interface configuration mode:

Task		Command
Step 1	Specify the subinterface on which TRISL will be used.	**interface** *type slot/port.subinterface-number*
Step 2	Define the encapsulation for TRISL.	**encapsulation tr-isl trbrf-vlan** *vlanid* **bridge-num** *bridge-number*

The DRiP database is automatically enabled when TRISL encapsulation is configured, and at least one TrBRF is defined, and the interface is configured for SRB or for routing with RIF.

Assign IP Address to Network Interface

An interface can have one primary IP address. To assign a primary IP address and a network mask to a network interface, perform the following task in interface configuration mode:

Task	Command
Set a primary IP address for an interface.	**ip address** *ip-address mask*

A mask identifies the bits that denote the network number in an IP address. When you use the mask to subnet a network, the mask is then referred to as a *subnet mask*.

Note TRISL encapsulation must be specified for a subinterface before an IP address can be assigned to that subinterface.

Configure IPX Routing over TRISL

The IPX Routing over ISL VLANs feature extends Novell NetWare routing capabilities to include support for routing all standard IPX encapsulations for Ethernet frame types in VLAN configurations. Users with Novell NetWare environments can configure either SAP or SNAP encapsulations to be routed using the TRISL encapsulation across VLAN boundaries. The SAP (Novell Ethernet_802.2) IPX encapsulation is supported for VLAN traffic.

NetWare users can now configure consolidated VLAN routing over a single VLAN trunking interface. With configurable Ethernet encapsulation protocols, users have the flexibility of using VLANs regardless of their NetWare Ethernet encapsulation. Configuring Novell IPX encapsulations on a per-VLAN basis facilitates migration between versions of Netware. NetWare traffic can now be routed across VLAN boundaries with standard encapsulation options (*sap* and *snap*) previously unavailable. Encapsulation types and corresponding framing types are described in the "Configuring Novell IPX" chapter of the *Network Protocols Configuration Guide, Part 2*.

Note Only one type of IPX encapsulation can be configured per VLAN (subinterface). The IPX encapsulation used must be the same within any particular subnet: A single encapsulation must be used by all NetWare systems that belong to the same LANs.

To configure Cisco IOS software to exchange different IPX framing protocols on a router with connected VLANs, perform these tasks in the order in which they appear.

Enable NetWare Routing

To enable IPX routing on TRISL interfaces, perform this task in global configuration mode:

Task	Command
Enable IPX routing globally.	**ipx routing** [*node*]

Define the VLAN Encapsulation Format

To define the encapsulation format as TRISL, perform these tasks in interface configuration mode:

Task		Command
Step 1	Specify the subinterface on which TRISL will be used.	**interface** *type slot/port.subinterface-number*
Step 2	Define the encapsulation for TRISL.	**encapsulation tr-isl trbrf-vlan** *trbrf-vlan* **bridge-num** *bridge-num*

Configure NetWare on the Subinterface

After you enable NetWare globally and define the VLAN encapsulation format, you need to enable the subinterface by specifying the NetWare network number (if necessary) and the encapsulation type. Perform this task in interface configuration mode:

Task	Command
Specify the IPX encapsulation.	**ipx network** *network* **encapsulation** *encapsulation-type*

Note The default IPX encapsulation format for Cisco IOS routers is "novell-ether" (Novell Ethernet_802.3). If you are running Novell Netware 3.12 or 4.0, the new Novell default encapsulation format is Novell Ethernet_802.2 and you should configure the Cisco router with the IPX encapsulation format "sap".

Configure a Pseudo-ring on the TRISL Subinterface to Cache RIF

You can configure the Cisco IOS software so that it will append RIF information to the routed protocols. This allows routed protocols such as IP or IPX to be bridged across a source-route bridged network.

To enable the use of RIF for specific VLANs on a subinterface, perform the following task in interface configuration mode:

Task	Command
Enable collection and use of RIF information on a TRISL subinterface.	**multiring trcrf-vlan** *vlanid* **ring** *ring-number*

Enable Use of the RIF with Routed Protocols

To enable collection and use of the RIF information on TRISL subinterfaces on the router, perform the following task in interface configuration mode:

Task	Command
Enable collection and use of RIF information with routed protocols.	**multiring** {*protocol-keyword* [**all-routes** | **spanning** | **all** | **other**}

If you enabled RIF for a TRISL subinterface, you must also enable RIF with the protocols used on the TRISL subinterfaces.

For more information on configuring RIF and bridging routed protocols, see the chapter "Configuring Source-Route Bridging" in the Cisco IOS Release 11.3 *Bridging and IBM Networking Guide*.

Attach TrCRF to the Router's Ring Group

To attach a TrCRF to the router's ring group, perform the following task:

Task	Command
Attach to the router's virtual ring.	**source-bridge trcrf-vlan** *vlanid* **ring-group** *ring-number*

If SRB or SR/TLB is used on the router, you must attach TrCRFs to the ring group.

Enable the Automatic Spanning-Tree Function

The automatic spanning-tree function supports automatic resolution of spanning trees in SRB networks, which provides a single path for spanning explorer frames to traverse from a given node in the network to another. Spanning explorer frames have a single-route broadcast indicator set in the routing information field. Port identifiers consist of ring numbers and bridge numbers associated with the ports. The spanning-tree algorithm for SRB does not support Topology Change Notification BPDU.

Although the automatic spanning-tree function can be configured with SR/TLB, the SRB domain and transparent bridging domain have separate spanning trees. Each Token Ring interface can belong to only one spanning tree. Only one bridge group can run the automatic spanning-tree function at a time.

To enable the automatic spanning-tree function for a specified group of bridged interfaces in SRB or SR/TLB, perform the following task in interface configuration mode:

Task	Command
Enable the automatic spanning-tree function on a group of bridged interfaces.	**source-bridge spanning** *bridge-group***.**

Clear DRiP

To clear DRiP counters, perform the following task:

Task	Command
Clear DRiP counters.	**clear drip**

When DRiP counters are cleared, the counter is reset to 0. When the DRiP counters begin to increment, it indicates that the router is receiving packets.

Display DRiP

To display DRiP information, perform the following task:

Task	Command
Display DRiP information.	**show drip**

Clear VLAN Statistics

To clear VLAN statistics, perform the following task in privileged EXEC mode:

Task	Command
Remove VLAN statistics from any statically or system configured entries.	**clear vlan statistics**

Display VLANs

To display a summary of VLAN subinterfaces, perform the following task in privileged EXEC mode:

Task	Command
Display a summary of VLAN subinterfaces.	**show vlans**

Configuration Examples

The following sections provide TRISL configuration examples:

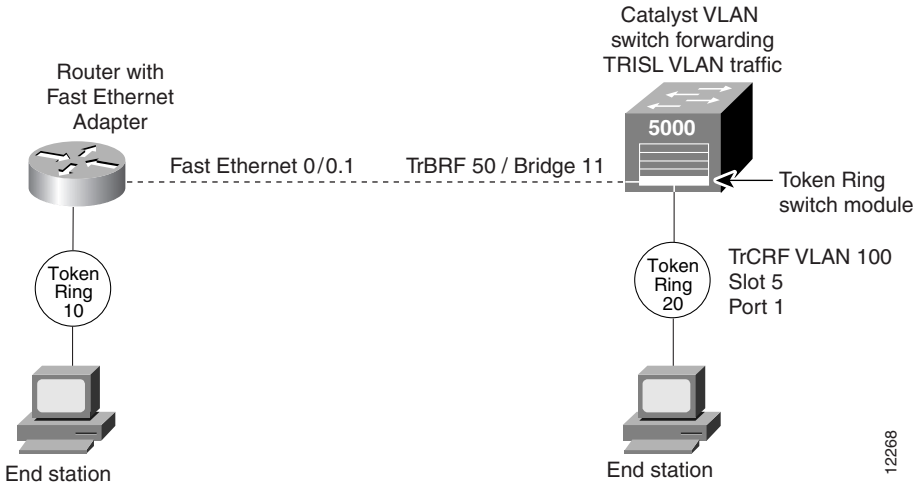
- Transparent Bridging between Token Ring and TRISL VLAN
- SRB between Token Ring and TRISL VLAN
- SRB between TRISL VLANs
- SR/TLB between a TRISL VLAN and an Ethernet Interface
- SR/TLB between a TRISL VLAN and an Ethernet ISL VLAN
- Routing with RIF between a TRISL VLAN and a Token Ring Interface
- IP Routing with RIF between TrBRF VLANs
- IP Routing between a TRISL VLAN and an Ethernet ISL VLAN

Note Because the VLAN Trunk Protocol (VTP) is not supported on the router, the TrCRF configuration on the router must also be specified in the Catalyst 5000 switch configuration.

Transparent Bridging between Token Ring and TRISL VLAN

Figure 2 illustrates transparent bridging between a router's Token Ring interface and a TRISL VLAN.

Figure 2 Transparent Bridging between Token Ring and TRISL VLAN



The following is the configuration for the router:

```
bridge 1 protocol ieee
!
interface Tokenring0
 bridge-group 1
!
interface FastEthernet0/0.1
 encapsulation tr-isl trbrf-vlan 50 bridge-num 11
 bridge-group 1
```

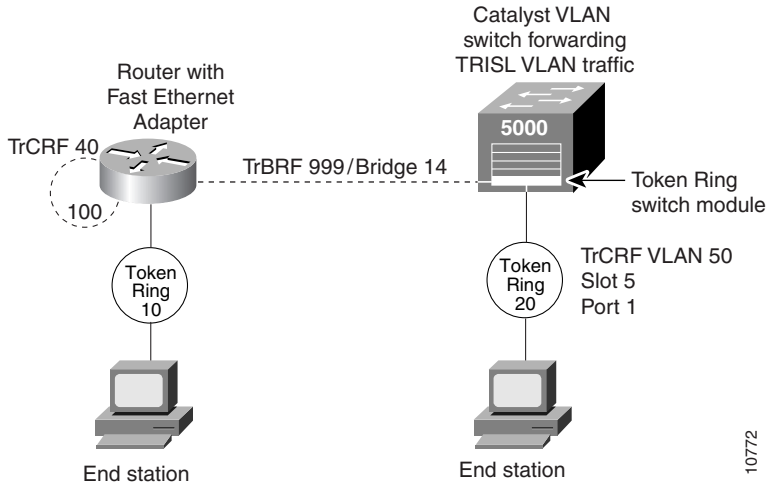
The following is the configuration for the Catalyst 5000 switch with a Token Ring switch module in slot 5:

```
#vtp
set vtp domain trisl
set vtp mode server
set vtp v2 enable
#drip
set set tokenring reduction enable
set tokenring distrib-crf disable
#vlans
set vlan 50 name trbrf50 type trbrf bridge 0xb stp ieee
set vlan 100 name trcrf100 type trcrf ring 0x64 parent 50 mode srt
#enable trunk
set trunk 1/2 on
#add token port to trcrf 100
set vlan 100 5/14
```

SRB between Token Ring and TRISL VLAN

Figure 3 illustrates SRB between a Token Ring interface on a router and a TRISL VLAN.

Figure 3 SRB between a Token Ring Interface and TRISL VLAN



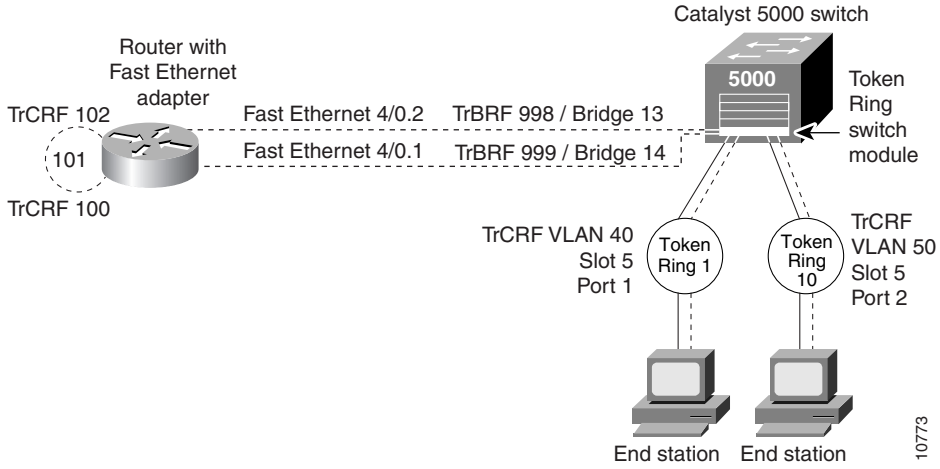
The following is the configuration for the router with the Token Ring interface:

```
source-bridge ring-group 100
!
interface TokenRing3/1
  ring speed 16
  source-bridge 10 1 100
  source-bridge spanning
!
interface FastEthernet4/0.1
  encapsulation tr-isl trbrf-vlan 999 bridge-num 14
  source-bridge trcrf-vlan 40 ring-group 100
  source-bridge spanning
!
```

SRB between TRISL VLANs

Figure 4 illustrates SRB between two TrCRF VLANs. Each VLAN belongs to a different Token Ring VLAN.

Figure 4 SRB between TRISL VLANs



The following is the configuration for the router:

```
source-bridge ring-group 101
!
interface FastEthernet4/0.1
  encapsulation tr-isl trbrf 999 bridge-num 14
  source-bridge trcrf-vlan 100 ring-group 101
  source-bridge spanning
!
interface FastEthernet4/0.2
  encapsulation tr-isl trbrf 998 bridge-num 13
  source-bridge trcrf-vlan 102 ring-group 101
  source-bridge spanning
```

The following is the configuration for the Catalyst 5000 switch with the Token Ring switch module in slot 5. The Token Ring port on 5/1 is assigned to TrCRF VLAN 40 and the Token Ring port on 5/2 is assigned to TrCRF VLAN 50.

```
#vtp
set vtp domain trisl
set vtp mode server
set vtp v2 enable
#drip
set set tokenring reduction enable
set tokenring distrib-crf disable
#vlans
set vlan 999 name trbrf type trbrf bridge 0xe stp ibm
set vlan 100 name trcrf100 type trcrf parent 999 ring 0x65 mode srb
set vlan 40 name trcrf40 type trcrf parent 999 ring 0x1 mode srb
set vlan 998 name trbrf type trbrf bridge 0xd stp ibm
set vlan 102 name trcrf102 type trcrf parent 998 ring 0x65 mode srb
set vlan 50 name trcrf50 type trcrf parent 998 ring 0x0a mode srb
#add token port to trcrf 40
set vlan 40   5/1
```

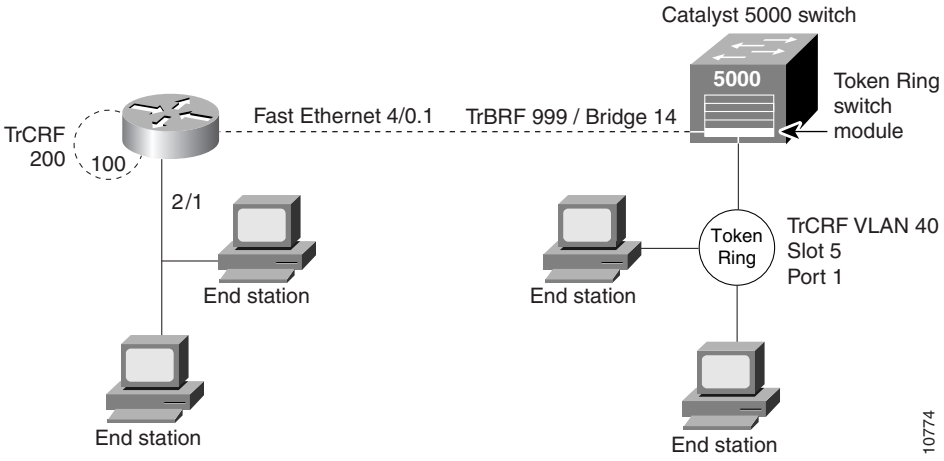
```
#add token port to trcrf 50
set vlan 50   5/2
#enable trunk
set trunk 1/2 on
```

In this configuration, the keyword *name* is optional and *srb* is the default mode.

SR/TLB between a TRISL VLAN and an Ethernet Interface

Figure 5 illustrates SR/TLB between a TRISL VLAN and an Ethernet interface.

Figure 5 SR/TLB between a TRISL VLAN and an Ethernet Interface



The following is the configuration for the router:

```
source-bridge ring-group 100
source-bridge transparent 100 101 6 1
!
interface Ethernet2/0
  ip address
  bridge-group 1
!
interface FastEthernet4/0.1
  encapsulation tr-isl trbrf-vlan 999 bridge-num 14
  source-bridge trcrf-vlan 200 ring-group 100
  source-bridge spanning
!
bridge 1 protocol ieee
!
```

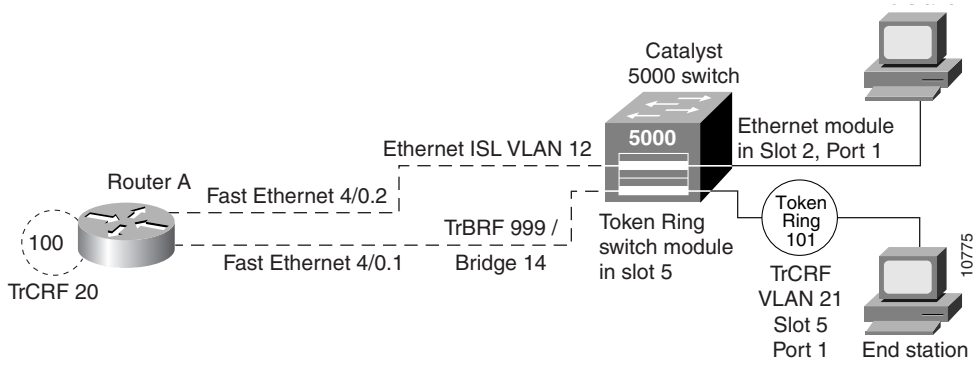
The following is the configuration for the Catalyst 5000 switch with an Ethernet card in module 5 and using port 1. The Token Ring port on 5/1 is assigned to TrCRF VLAN 40.

```
#vtp
set vtp domain trisl
set vtp mode server
set vtp v2 enable
#drip
set set tokenring reduction enable
set tokenring distrib-crf disable
#vlans
set vlan 999 name trbrf999 type trbrf bridge 0xe stp ibm
set vlan 200 name trcrf100 type trcrf parent 999 ring 0x64 mode srb
set vlan 40 name trcrf40 type trcrf parent 999 ring 0x1 mode srb
#add token port to trcrf 40
set vlan 40   5/1
#enable trunk
set trunk 1/2 on
```

SR/TLB between a TRISL VLAN and an Ethernet ISL VLAN

Figure 6 illustrates SR/TLB between a TRISL VLAN and an Ethernet ISL VLAN.

Figure 6 SR/TLB between a TRISL VLAN and an Ethernet ISL VLAN



The following is the configuration for the router:

```
source-bridge ring-group 100
source-bridge transparent 100 101 6 1
!
interface FastEthernet4/0.1
  encapsulation tr-isl trbrf-vlan 999 bridge-num 14
  source-bridge trcrf-vlan 20 ring-group 100
  source-bridge spanning
!
interface FastEthernet4/0.2
  encapsulation isl 12
  bridge-group 1
!
bridge 1 protocol ieee
```

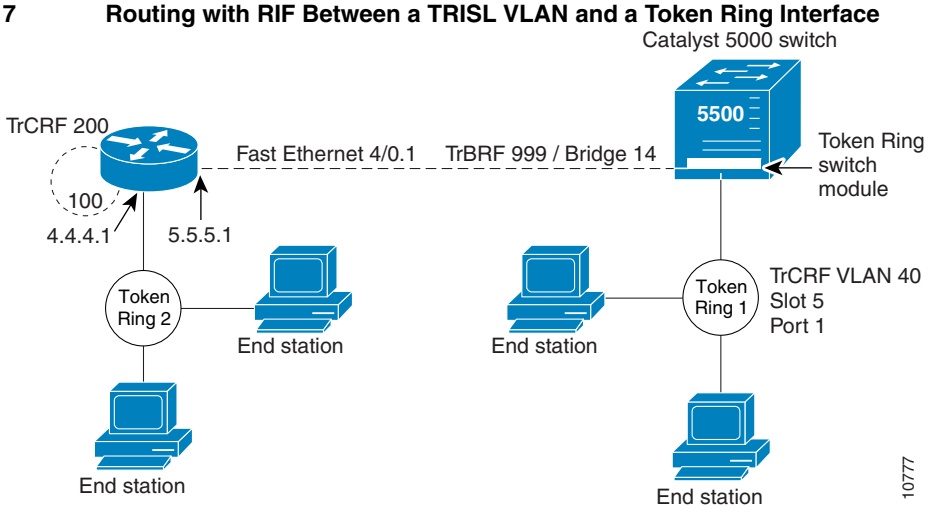
The following is the configuration for the Catalyst 5000 switch with an Ethernet module in slot 2 and a Token Ring switch module in slot 5. In this configuration, the Token Ring port 101 is assigned with the TrCRF VLAN 21, and the Token Ring port 100 is assigned with TrCRF VLAN 20.

```
#vtp
set vtp domain trisl
set vtp mode server
set vtp v2 enable
#drip
set set tokenring reduction enable
set tokenring distrib-crf disable
#vlans
set vlan 999 type trbrf bridge 0xd stp ibm
set vlan 20 type trcrf parent 999 ring 0x64 mode srb
set vlan 21 type trcrf parent 999 ring 0x65 mode srb
#add token port to trcrf 21
set vlan 21 5/1
#add ethernet
set vlan 12 type ethernet
set vlan 12 2/1
set trunk 1/2 on
```

Routing with RIF between a TRISL VLAN and a Token Ring Interface

Figure 7 illustrates routing with RIF between a TRISL VLAN and a Token Ring interface.

Figure 7 Routing with RIF Between a TRISL VLAN and a Token Ring Interface



The following is the configuration for the router:

```
source-bridge ring-group 100
!
interface TokenRing 3/1
  ip address 4.4.4.1 255.255.255.0
!
interface FastEthernet4/0.1
  ip address 5.5.5.1 255.255.255.0
  encapsulation tr-isl trbrf 999 bridge-num 14
  multiring trcrf-vlan 200 ring-group 100
  multiring all
```

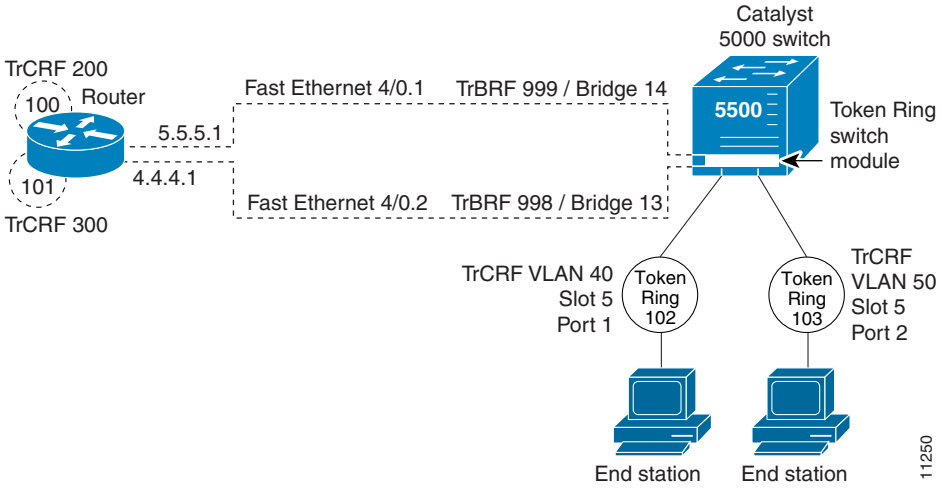
The following is the configuration for the Catalyst 5000 switch with the Token Ring switch module in slot 5. In this configuration, the Token Ring port 1 is assigned to the TrCRF VLAN 40.

```
#vtp
set vtp domain trisl
set vtp mode server
set vtp v2 enable
#drip
set set tokenring reduction enable
set tokenring distrib-crf disable
#vlans
set vlan 999 name trbrf type trbrf bridge 0xe stp ieee
set vlan 200 name trcrf200 type trcrf parent 999 ring 0x64 mode srt
set vlan 40 name trcrf40 type trcrf parent 999 ring 0x1 mode srt
#add token port to trcrf 40
set vlan 40   5/1
set trunk 1/2 on
```

IP Routing with RIF between TrBRF VLANs

Figure 8 illustrates IP routing with RIF between two TrBRF VLANs.

Figure 8 IP Routing with RIF between TrBRF VLANs



The following is the configuration for the router:

```
interface FastEthernet4/0.1
  ip address 5.5.5.1 255.255.255.0
  encapsulation tr-isl trbrf-vlan 999 bridge-num 14
  multiring trcrf-vlan 200 ring 100
  multiring all
!
  interface FastEthernet4/0.2
  ip address 4.4.4.1 255.255.255.0
  encapsulation tr-isl trbrf-vlan 998 bridge-num 13
  multiring trcrf-vlan 300 ring 101
  multiring all
```

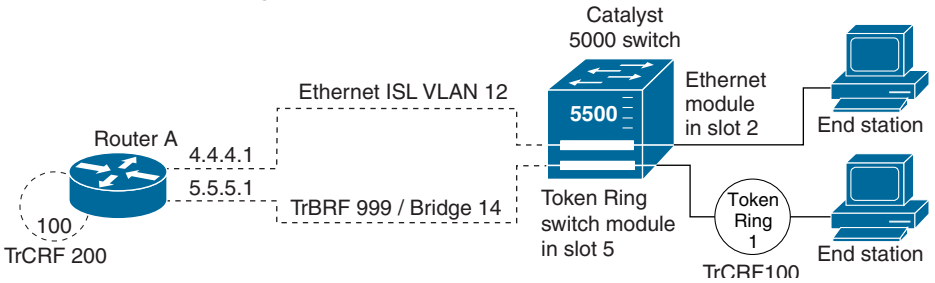
The following is the configuration for the Catalyst 5000 switch with the Token Ring switch module in slot 5. In this configuration, the Token Ring port 102 is assigned with TrCRF VLAN 40 and the Token Ring port 103 is assigned with TrCRF VLAN 50.

```
#vtp
set vtp domain trisl
set vtp mode server
set vtp v2 enable
#drip
set set tokenring reduction enable
set tokenring distrib-crf disable
#vlans
set vlan 999 name trbrf type trbrf bridge 0xe stp ieee
set vlan 200 name trcrf200 type trcrf parent 999 ring 0x64 mode srb
set vlan 40 name trcrf40 type trcrf parent 999 ring 0x66 mode srb
set vlan 998 name trbrf type trbrf bridge 0xd stp ieee
set vlan 300 name trcrf300 type trcrf parent 998 ring 0x65 mode srb
set vlan 50 name trcrf50 type trcrf parent 998 ring 0x67 mode srb
#add token port to trcrf 40
set vlan 40   5/1
#add token port to trcrf 50
set vlan 50   5/2
set trunk 1/2 on
```

IP Routing between a TRISL VLAN and an Ethernet ISL VLAN

Figure 9 illustrates IP routing between a TRISL VLAN and an Ethernet ISL VLAN.

Figure 9 IP Routing between a TRISL VLAN and an Ethernet ISL VLAN



The following is the configuration for the router:

```
interface FastEthernet4/0.1
 ip address 5.5.5.1 255.255.255.0
 encapsulation tr-isl trbrf-vlan 999 bridge-num 14
 multiring trcrf-vlan 20 ring 100
 multiring all
!
interface FastEthernet4/0.2
 ip address 4.4.4.1 255.255.255.0
 encapsulation isl 12
```

The following is the configuration for the Catalyst 5000 switch with the Ethernet module in slot 2 and a Token Ring switch module in slot 5. In this configuration, the Token Ring port is assigned with TrCRF VLAN 100 and the Ethernet port is assigned with VLAN 12.

```
#vtp
set vtp domain trisl
set vtp mode server
set vtp v2 enable
#drip
set set tokenring reduction enable
set tokenring distrib-crf disable
#vlans
set vlan 999 name trbrf type trbrf bridge 0xe stp ibm
set vlan 100 name trcrf100 type trcrf parent 999 ring 0x64 mode srb
set vlan 20 name trcrf20 type trcrf parent 999 ring 0x64 mode srb
set vlan 12 name default type eisl12
#add token port to trcrf 100
set vlan 100 5/1
#add ethernet
set vlan 12 2/1
set trunk 1/2 on
```

Command Reference

This section documents the following new TR-ISL configuration commands. All other commands used with this feature are documented in the Cisco IOS Release 11.3 Command Reference.

- **clear drip counters**
- **encapsulation tr-isl**
- **multiring trcrf-vlan**
- **show drip**
- **source-bridge trcrf-vlan**

clear drip counters

Use the **clear drip counters** privileged EXEC command to clear DRiP counters.

clear drip counters

Syntax Description

None.

Command Mode

EXEC

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3(4)T.

Use the **clear drip counters** command if you want to check whether the router is receiving any packets. The counters will start at 0. If the counters are incrementing, DRiP is active on the router.

Examples

In the following example, the **clear drip counters** command is used:

```
router#clear drip counters
router#
```

Related Commands

encapsulation tr-isl
show drip

encapsulation tr-isl

Use the **encapsulation tr-isl** subinterface configuration command to enable TRISL, a Cisco proprietary protocol for interconnecting multiple routers and switches and maintaining VLAN information as traffic goes between switches.

encapsulation tr-isl trbrf-vlan *vlanid* **bridge-num** *bridge-number*

Syntax Description

vlan-id	Number identifying the VLAN.
bridge-number	Keyword that specifies the identification number of the bridge number on the ISL trunk. Possible values are 01 to 4095.

Command Mode

Subinterface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3(4)T.

Examples

In the following example, TRISL is enabled on a Fast Ethernet interface:

```
interface FastEthernet4/0.2
encapsulation tr-isl trbrf-vlan 999 bridge-num 14
```

Related Commands

clear drip counters
clear vlan statistics
multiring
multiring trcrf-vlan
show drip
show vlan
source-bridge trcrf-vlan

multiring trcrf-vlan

Use the **multiring trcrf-vlan** interface configuration command to configure a pseudo-ring for the subinterface enabled to cache RIFs and the associated TrCRF VLAN ID number. Use the **no** form of this command to disable the caching of RIFs on the subinterface.

multiring trcrf-vlan *vlanid* **ring** *ring-number*
no multiring trcrf-vlan *vlanid* **ring** *ring-number*

Syntax Description

vlanid	VLAN ID number.
ring-number	Keyword that specifies the logical ring number for Token Ring VLANs.

Command Mode

Interface configuration

Default

Disabled

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3(4)T.

Use the **multiring trcrf-vlan** command to configure a TrCRF VLAN and the ring associated with it for routed traffic on Token Ring connections on routers.

The **multiring** command is used for SRB traffic across TrBRFs. When the command is configured, RIFs are cached.

Examples

In the following example, the **multiring trcrf-vlan** command is used to configure a pseudo-ring for the subinterface:

```
interface FastEthernet4/0.1
  ip address 5.5.5.1 255.255.255.0
  encapsulation tr-isl trbrf-vlan 999 bridge-num 14
  multiring trcrf-vlan 1000 ring 100
```

Related Commands

clear drip counters
rif
multiring
show drip
show rif
show vlan

show drip

Use the **show drip** privileged EXEC command to display the status of the DRiP database.

show drip

Syntax Description

None.

Command Mode

Privileged EXEC

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3(4)T.

Examples

In the following example, the output for the **show drip** command is shown:

```
72-1#show drip

DRIP Database for Mgmt Domain FastEthernet4/0
---------------------------------------------------
Mac Address 0010-A6AE-B440
Vlan     100    Status    30 : l-active, l-config,

Mac Address 0010-2F72-C800
Vlan      20    Status    0C : r-active, r-config,
Vlan    1003    Status    0C : r-active, r-config,

Statitics:
Advertisements received            126
Advertisements processed           1
Advertisements transmitted         131
Last revision transmitted          0x84
Last changed revision transmitted  0x2
```

Related Commands

encapsulation tr-isl
clear drip counters
show vlan

source-bridge trcrf-vlan

Use the **source-bridge trcrf-vlan** privileged EXEC command to attach a VLAN to the router's virtual ring. Use the **no** form of the command to disable the attachment of a VLAN to the router's virtual ring.

source-bridge trcrf-vlan *vlanid* **ring-group** *ringnum*

Syntax Description

vlanid	VLAN ID number.
ringnum	Ring number of the virtual ring.

Command Mode

Privileged EXEC

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3(4)T.

Prior to attaching a VLAN to the router's ring, use the **encapsulation tr-isl** command for the subinterface.

Examples

Following is an example of the **source-bridge trcrf-vlan** command for an interface where the VLAN ID number and ring group number is specified:

```
interface FastEthernet4/0.2
source bridge trcrf-vlan 100 ring-group 101
```

Related Commands

show source-bridge
source-bridge ring-group
encapsulation tr-isl

Debug Commands

Following are the debug commands for TRISL:

- **debug drip event**
- **debug drip packet**

debug drip event

Use the **debug drip event** privileged EXEC command to display debug messages for DRIP events. Use the **no** form of this command to disable debugging output.

debug drip event
no debug drip event

Default

Debugging is disabled for DRiP events.

Command Mode

Privileged EXEC

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3(4)T. When a Fast Ethernet subinterface is configured for TRISL encapsulation and a TrCRF is defined, the DRiP protocol is activated. The DRiP protocol adds the VLAN ID specified in the router command to its database and recognizes the VLAN as a locally configured, active VLAN.

Sample Debug Output

Following is an example of debug output for the **debug drip event** command:

encapsulation tr-isl trbrf-vlan *vlanid* **bridge-num** *bridge-number*

```
"DRIP :"

75-2(config-subif)#encapsulation tr-isl trbrf-vlan 999 bridge-num 9
```

DRiP is initiated when a local VLAN is added to the DRiP database:

```
DRIP : init
```

The VLAN ID is added locally when TRISL is configured:

```
DRIP : configure vlanNo = 100
DRiP is configuring the VLAN:
```

VLAN 100 is activated in the database:

```
DRIP : local status active for vlanNo = 100
DRIP : resolve local - DRIP_VLAN_ACTIVE
```

DRiP acknowledges that a VLAN is active and is now capable of printing any debug information, if necessary:

```
DRIP Change notofication active vlan 100
DRIP : State notification
DRIP Change notofication active vlan 100
```

DRiP logs the new VLAN ID:

```
DRIP : configure - ADD_ID 2
```

DRIP will send an advertisement on all its trunk ports:

```
DRIP : configure - send_adv = TRUE
```

DRiP provides information of the trunk port and the length of the packet:

```
DRIP : transmit on 0000.0c50.1900, length = 24
```

DRiP gets a packet from the network:

```
612B92C0: 01000C00 00000000 0C501900 0000AAAA  .........P....**
612B92D0: 0300000C 00020000 00000100 0CCCCCCC  ............LLL
612B92E0: 00000C50 19000020 AAAA0300 000C0102  ...P... **......
612B92F0: 01010114 00000002 00000002 00000C50  ...............P
612B9300: 19000001 04C00064 04                 .....@.d.
```

DRiP gets a packet from the network:

```
Recvd. pak
```

DRiP recognizes that the VLAN ID it is getting is a new one from the network:

```
6116C840:                       0100 0CCCCCCC            ...LLL
6116C850: 00102F72 CBFB0024 AAAA0300 000C0102  ../rK{.$**......
6116C860: 01FF0214 0002E254 00015003 00102F72  ......bT..P.../r
6116C870: C8000010 04C00014 044003EB 14        H....@...@.k.
DRIP : remote update - Never heard of this vlan
```

DRiP attempts to resolve any conflicts when it hears of a new VLAN. The value action = 1 means to notify the local platform of change in state:

```
DRIP : resolve remote for vlan 20 in FastEthernet0/0/0
DRIP : resolve remote - action = 1
```

The local platform is notified of change in state:

```
DRIP Change notification active vlan 20
```

Another new VLAN ID was received in the packet:

```
DRIP : resolve remote for vlan 1003 in FastEthernet0/0/0
```

No action is required:

```
DRIP : resolve remote - action = 0
```

Thirty seconds have expired, and DRiP sends its local database entries to all its trunk ports:

```
DRIP : local timer expired
DRIP : transmit on 0000.0c50.1900, length = 24
612B92C0: 01000C00 00000000 0C501900 0000AAAA  .........P....**
612B92D0: 0300000C 00020000 00000100 0CCCCCCC  ............LLL
612B92E0: 00000C50 19000020 AAAA0300 000C0102  ...P... **......
612B92F0: 01FF0114 00000003 00000002 00000C50  ...............P
612B9300: 19000001 04C00064 04                 .....@.d.
```

debug drip packet

Use the **debug drip packet** privileged EXEC command to display debug messages for DRiP packets. Use the **no** form of this command to disable debugging output.

debug drip packet
no debug drip packet

Default

Debugging is not enabled for DRIP packets.

Command Mode

Privileged EXEC

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3(4)T.

Before you use this command, you can optionally use the **clear drip** command first. As a result the DRiP counters are reset to 0. If the drip counters begin to increment, the router is receiving packets.

Sample Output

Following is sample output for the **debug drip packet** command.

The following type of output is displayed when a packet is entering the router and you use the **show debug** command:

```
039E5FC0:     0100 0CCCCCCC 00E0A39B 3FFB0028    ...LLL.`#.?{.(
039E5FD0: AAAA0300 000C0102 01FF0314 0000A5F6  **............%v
039E5FE0: 00008805 00E0A39B 3C000000 04C00028  .....`#.<....@.(
039E5FF0: 04C00032 044003EB 0F                 .@.2.@.k.
039FBD20:                  01000C00 00000010          ........
```

The following type of output is displayed when a packet is transmitted by the router:

```
039FBD30: A6AEB450 0000AAAA 0300000C 00020000  &.4P..**........
039FBD40: 00000100 0CCCCCCC 0010A6AE B4500020  .....LLL..&.4P.
039FBD50: AAAA0300 000C0102 01FF0114 00000003  **..............
039FBD60: 00000002 0010A6AE B4500001 04C00064  ......&.4P...@.d
039FBD70: 04                                   .
```

Related Commands

encapsulation tri-isl
debug drip event

Error Messages

Following is an error message associated with TRISL.

Error Message `DRIP conflict with CRF %.`

Explanation A DRiP conflict has occurred. The virtual ring's CRF is being reused in the network.

Recommended Action Make sure that the CRF VLAN ID number of the virtual ring is unique in the network.