Configuring ISDN Backup for WAN Links Using Floating Static Routes

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Introduction

This sample configuration shows you how to back up a frame relay link with Integrated Services Digital Network (ISDN) by using floating static routes and dial–on–demand (DDR) routing.

Prerequisites

Requirements

There are no specific requirements for this document.

Components Used

This configuration was developed and tested using the software and hardware versions below.

- Cisco 2503 Routers
- Cisco IOS® Software Release 12.2(7b) was running on both routers

The information presented in this document was created from devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If you are working in a live network, ensure that you understand the potential impact of any command before using it.

Conventions

For more information on document conventions, see the Cisco Technical Tips Conventions.
Background Theory

One implementation goal of WAN links is to provide a way to back up the link, should it fail. ISDN frequently provides this backup. Cisco provides backup strategies that can achieve the same functionality but in different ways. If routing information is passed across the frame relay link, a floating static route can bring up the backup link if the frame relay link stops passing information.

Note: This example shows a backup for Frame Relay using floating static routes. However, you can also use this method to backup any WAN link.

Other solutions can employ a backup interface (See Configuring a Backup Interface for a Subinterface) or Dialer watch. If you use the backup interface command approach, point-to-point subinterfaces are advantageous because the main or multipoint interfaces can remain in an up/up state even if permanent virtual connections (PVCs) go down with frame relay.

For more information on configuring DDR backup, refer to the document Configuring and Troubleshooting DDR Backup. You can also refer to the document Evaluating Backup Interfaces, Floating Static Routes, and Dialer Watch for DDR Backup for more information on the various DDR backup methods.

Configure

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

Note: To find additional information on the commands used in this document, use the Command Lookup tool for IOS.

Network Diagram

This document uses the network setup shown in the diagram below.

![Network Diagram](image)

Configurations

This document uses the configurations shown below.

This configuration was tested using Cisco IOS Software Release 12.2(7b) on 2500 series routers. The same
configuration concepts would apply to a similar router topology or other Cisco IOS releases.

```
Router1 (Cisco 2503 Router)

Current configuration:

version 12.2
!
hostname Router1
!

!−−− This username password pair is used for
!−−− PPP CHAP authentication
username Router2 password 0 letmein
ip subnet-zero
no ip domain-lookup
!

isdn switch-type basic-5ess
!
interface Ethernet0
  ip address 172.16.1.1 255.255.255.0
  no ip route-cache
  no ip mroute-cache
!
interface Serial0

!−− Primary Link.
!−− The bandwidth is adjusted to allow for rapid backup of the link.

!−− This adjusts the EIGRP Hello interval and
!−− Hold time for rapid convergence.
!−− The bandwidth command does not actually change the bandwidth of the link,
!−− it only adjusts the routing protocol bandwidth parameter.

  bandwidth 2048
  ip address 172.16.2.1 255.255.255.128
  encapsulation frame-relay
  no ip route-cache
  no ip mroute-cache
  clockrate 64000
!
interface Serial1
  no ip address
  no ip route-cache
  no ip mroute-cache
  shutdown
!
interface BRI0

! −− Backup link.

  ip address 172.16.3.1 255.255.255.0

! −− The backup link is in a different subnet.
! −− The BRI interface on the peer should also be in this subnet.

  encapsulation ppp
  no ip route-cache
  no ip mroute-cache
  dialer map ip 172.16.3.2 name Router2 broadcast 5552000

! −− Dialer map for the peer. Note the IP address and name.
! −− The name must match the authenticated username of the peer.
```
A floating static has been configured for Router1. The floating static route has an assigned administrative distance of 200. A route for the same subnet will also be learned over the frame relay link via the Enhanced Interior Gateway Routing Protocol (EIGRP), which emphasizes the additional or redundant nature of the floating route. EIGRP learnt route will be installed in the routing table because of its lower administrative distance 90, compared to that of the static route’s 200. In the event of Frame Relay link failure, EIGRP route will disappear from the routing table, the floating static route is installed. Any interesting traffic to be sent across the ISDN connection brings up the line. When connectivity is restored over the frame relay, the route is learned again through EIGRP. This route replaces the static route and direct traffic once again over the frame.
Routing protocol traffic is marked as uninteresting in the dialer list so that it does not cause the ISDN line to connect or remain connected. However, once the link is up, EIGRP packets can cross the link and the two routers can exchange routing information. The `broadcast` keyword has been included in the dialer map statement to allow the passage of routing protocol traffic over the ISDN link. If you do not want EIGRP to exchange routing information even if the ISDN link is up, do not include the `broadcast` keyword in the dialer map statement.

The `dialer load-threshold` command sets a load that will trigger a concurrent call to be placed on the second B channel. Multilink Point-to-Point Protocol (PPP) has been configured (`ppp multilink`) so that both ISDN B channels can be bundled together as one Virtual-Access interface for aggregate bandwidth.

In the current configuration, only Router1 is configured to place a call. Router2 receives calls from Router1. If you want both sides to bring up the link, add `dialer map` and `dialer load-threshold` commands to the configuration of Router2.

```
Router2 (Cisco 2503 Router)

Current configuration:

version 12.2
!
!
hostname Router2
!
username Router1 password 0 letmein
ip subnet-zero
no ip domain-lookup
!
isdn switch-type basic-5ess
!
interface Ethernet0
  ip address 172.16.4.1 255.255.255.0
!
interface Serial0
  bandwidth 2048
  ip address 172.16.2.2 255.255.255.128
  encapsulation frame-relay
  clockrate 64000
!
interface Serial1
  no ip address
  shutdown
  clockrate 64000
!
interface BRI0
  ip address 172.16.3.2 255.255.255.0
!
  -- IP address of backup interface.
  !-- This router accepts the call. Note the IP address matches both the
  !-- dialer map floating static router nexthop on the peer.

  encapsulation ppp
  dialer-group 1
  isdn switch-type basic-5ess
  ppp authentication chap
  ppp multilink

  !--- The missing dialer map command disables
  !--- this router from making the call.
```
Verify

This section provides information you can use to confirm your configuration is working properly.

Routing Table Changes

Note: Certain show commands are supported by the Output Interpreter tool, which allows you to view an analysis of show command output;

Observe the routing tables below from Router1. Notice that the floating static route replaced the EIGRP learned route, after Router2 became unreachable over the Frame Relay link.

Shown below is the routing table of Router1, when the Frame Relay link is up.

```
Router1# show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

172.16.0.0/16 is variably subnetted, 4 subnets, 2 masks
[ D 172.16.4.0/2490/1787392] via 172.16.2.2, 00:06:56, Serial0

!--- EIGRP learned route over Frame Relay link

C 172.16.1.0/24 is directly connected, Ethernet0
C 172.16.2.0/25 is directly connected, Serial0
C 172.16.3.0/24 is directly connected, BRI0
```

When connectivity over the frame relay link is lost, Router1 installs the floating static route in its routing table as shown below.

```
Router1# show ip route
```
Any interesting traffic to the network 172.16.4.0/24 now brings up the ISDN connection. For example, from Router1, a ping to 172.16.4.1 brings up the ISDN link as shown below.

**Note:** If you make the routing protocol interesting, then the periodic traffic brings up the link automatically. The downside of this is that the link will remain up indefinitely, possibly resulting in high toll charges.

Since the ISDN line is up, EIGRP now starts exchanging routing information over the ISDN connection. This causes Router1 to install the EIGRP route into its routing table, pointing to the next-hop 172.16.3.2.
Interesting traffic is the traffic that will initiate the ISDN call and is defined by the **dialer-list** command. In the above configuration, the dialer-list points to the access-list number 100 which permits all IP packets except EIGRP packets. This means, all IP packets, except EIGRP packets, can bring up the ISDN connection. Once the connection is made, any traffic, including EIGRP traffic, is allowed to go across the link. But if no interesting traffic crosses the ISDN link for the duration of the **dialer idle timer**, the link will be brought down and no EIGRP routes will be exchanged. At this point, floating static route will again be installed in Router1’s routing table.

**Troubleshoot**

For information on troubleshooting the floating static route refer to the document Configuring and Troubleshooting DDR Backup. This document addresses common symptoms such as:

- The Backup link is not dialed when the primary link goes down.
- The Backup link dials but does not connect to the other side.
- The backup link is not deactivated when the primary link recovers.
- The backup link is not stable (for example, it flaps) when the primary interface is down.

For Frame Relay specific troubleshooting refer to Configuring Frame Relay Backup

The following commands can help to troubleshoot the backup link:

- **debug dialer events** – To see dial-on-demand routing activity.
- **debug dialer packets** – To see dialer interesting traffic information.
- **show ppp multilink** – To check multilink status after the backup has come up.

Before attempting any of the above **debug** commands, please see Important Information on **Debug** Commands.

**Debug Output**

Routing protocol traffic (EIGRP) is marked as uninteresting by the **dialer list** command, so it will not bring up the link or keep it up. However, when the link is active, routing updates will be exchanged. The **debug dialer packet** command can verify if the correct traffic can bring up a link. Output is shown below.

```
Router1# debug dialer packets
Dial on demand packets debugging is on
Router1#
3d22h: BR0 DDR: ip (s=172.16.3.1, d=224.0.0.10), 60 bytes, outgoing uninteresting (list 100)
     !--- EIGRP packet

3d22h: BR0 DDR: sending broadcast to ip 172.16.3.2 -- failed, not connected
     !--- EIGRP packet does not bring up the link

3d22h: BR0 DDR: ip (s=172.16.3.1, d=224.0.0.10), 60 bytes, outgoing uninteresting (list 100)
     !--- EIGRP packet

3d22h: BR0 DDR: sending broadcast to ip 172.16.3.2 -- failed, not connected
```
EIGRP packet does not bring up the link

Interesting traffic (Internet Control Message Protocol (ICMP) echoes in this case) will reset the idle timer and keep the link up as below. Uninteresting traffic is passed but will not keep the link up if the idle timer expires.

Router1#ping 172.16.4.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.4.1, timeout is 2 seconds:
!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 40/51/80 ms
Router1#

Though marked as uninteresting, EIGRP packets cross the ISDN link, because the connection is already made by the interesting ICMP traffic.

Related Information

- Configuring and Troubleshooting DDR Backup
- Evaluating Backup Interfaces, Floating Static Routes, and Dialer Watch for DDR Backup
- Configuring Frame Relay Backup
- Configuring Legacy DDR Hubs
- Configuring Peer to Peer DDR with Dialer Profiles