

Multilink PPP on Back-to-Back Routers with Multiple Serial Interfaces

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Introduction

In some environments, it may be necessary to bundle serial links to act as single aggregate bandwidth. This document describes how to configure a Cisco 2503 Access Server to bundle two serial interfaces with two different methods:

- Interface Dialer
- Virtual Template

These configurations can be used for routers connected by leased lines or routers that have the channel service unit or data service unit (CSU/DSU) or ISDN terminal adapter (TA) configured to dial. (Cisco routers have not been configured to dial telephone numbers.) You can add additional features to this configuration to suit your needs.

Prerequisites

Requirements

There are no specific requirements for this document.

Components Used

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

- Cisco 2503 routers
- Cisco IOS® Software Release 12.2(7b)

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.

Related Products

This configuration can be used with any two routers with two WAN serial interfaces each. You can use WIC-1T, WIC-2T, or fixed WAN serial interfaces.

Conventions

For more information on document conventions, refer to Cisco Technical Tips Conventions.

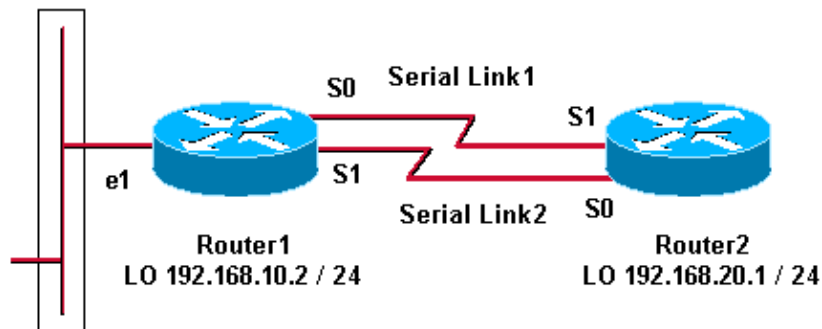
Configure

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 (registered customers only) .

Network Diagram

This document uses this network setup:



Configurations

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

Example 1: Interface Dialer

- Router1
- Router2

Example 2: Virtual Template

- Router1
- Router2

Example 1: Interface Dialer

Router1 – Cisco 2503

```
Current configuration:
version 12.2

hostname Router1
!
username Router2 password 0 abc

!--- This local username and password pair is used for PPP Challenge
!--- Handshake Authentication Protocol (CHAP) authentication.

ip subnet-zero
no ip domain-lookup
!
!
interface Loopback0
 ip address 192.168.10.2 255.255.255.0

!--- The loopback address is used by interface dialer 1.

!
!
interface Serial0
 no ip address
 encapsulation ppp
 dialer in-band
 dialer rotary-group 1

!--- Interface Serial0 is a member of rotary-group 1.
!--- The rotary group configuration is in interface dialer 1.

no fair-queue
pulse-time 1
!
interface Serial1
 no ip address
 encapsulation ppp
 dialer in-band
 dialer rotary-group 1
 no fair-queue
 pulse-time 1
!
interface Dialer1

!--- This is the configuration for rotary-group 1.
!--- The dialer interface number must exactly match the rotary group number.

 ip unnumbered Loopback0
 encapsulation ppp
 dialer in-band
 dialer idle-timeout 300
 dialer map ip 192.168.20.1 name Router2 broadcast
 dialer load-threshold 2 either
 dialer-group 1

!--- Apply interesting traffic definition from dialer-list 1.

no fair-queue
ppp authentication chap
ppp direction callout

!--- This is a hidden command; see the Notes section for more information.
```

```

ppp multilink

!--- Allow multilink for the dialer profile.
!--- Without this command, multilink is NOT negotiated.

!
ip classless
ip route 192.168.20.1 255.255.255.255 Dialer1
dialer-list 1 protocol ip permit

!--- The dialer-list defines the interesting traffic.

!
line con 0
line aux 0
  transport input all
line vty 0 4
  login
!
end

```

Router2 – Cisco 2503

```

Current configuration:
version 12.2
hostname Router2
!
!
username Router1 password 0 abc
ip subnet-zero
no ip domain-lookup
!
!
interface Loopback0
 ip address 192.168.20.1 255.255.255.0
!
!
interface Serial0
 no ip address
 encapsulation ppp
 dialer in-band
 dialer rotary-group 1
 no fair-queue
 clockrate 56000
 pulse-time 1
!
interface Serial1
 no ip address
 encapsulation ppp
 dialer in-band
 dialer rotary-group 1
 no fair-queue
 clockrate 56000
 pulse-time 1
!
!
interface Dialer1
 ip unnumbered Loopback0
 encapsulation ppp
 dialer in-band
 dialer idle-timeout 999
 dialer map ip 192.168.10.2 name Router1 broadcast
 dialer load-threshold 2 either
 dialer-group 1

```

```

no fair-queue
no cdp enable
ppp authentication chap
ppp multilink
!
ip classless
ip route 192.168.10.2 255.255.255.255 Dialer1
!
dialer-list 1 protocol ip permit
!
line con 0
line aux 0
line vty 0 4
!
end

```

Example 1 Notes

The **ppp direction callout** command is a hidden command used when a router is confused as to who dialed who (when connected back-to-back or connected by leased lines and the CSU/DSU or ISDN TA are configured to dial). The **ppp direction callin** command may also be used. Use either of these commands.

- For a local router, use **ppp direction callout**.
- For a remote router, use **ppp direction callin**.

If you do not use this command, the router connects for a moment and then disconnects.

The above configuration describes two routers, Router1 and Router2, which have two serial interfaces to be bundled to act as a single aggregate bandwidth. On both routers, **interface loopback** is configured and integrated with **interface dialer** using **ip unnumbered loopback0**. Both serial interfaces are configured for no IP address. Physical interfaces Serial0 and Serial1 are configured with **dialer rotary-group** and associated with a single logical interface dialer.

Dialer-list 1 defines the interesting traffic, which in turn triggers the **dialer-group 1** command on interface dialer 1 to bring up the link. The dialer map statement defined on both routers maps the interface dialer 1 to the peer router IP address, and the hostname defined serves in CHAP authentication. The static route defined routes the traffic to the destination.

The **ppp authentication chap** command enables the PPP negotiation. The **dialer load-threshold** command sets a load that triggers to bring the second serial line. The **ppp multilink** and **dialer rotary-group** commands have been configured so that both serial interfaces can be bundled together as one Virtual-Access interface for aggregate bandwidth. The **ppp direction callout** command determines which side has to make a callout during PPP negotiation and CHAP authentication.

Verify Example 1

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

Certain **show** commands are supported by the Output Interpreter Tool (registered customers only) , which allows you to view an analysis of **show** command output.

```

Router1# show ppp multilink
Virtual-Access1, bundle name is Router2
  Bundle up for 00:01:05
  Dialer interface is Dialer1
  0 lost fragments, 0 reordered, 0 unassigned
  0 discarded, 0 lost received, 1/255 load

```

```
0x0 received sequence, 0x0 sent sequence
Member links: 2 (max not set, min not set)
  Serial0, since 00:01:05, no frags rcvd
  Serial1, since 00:01:05, no frags rcvd
```

```
Router2# show ppp multilink
```

```
Virtual-Access1, bundle name is Router1
Bundle up for 00:03:25
Dialer interface is Dialer1
0 lost fragments, 0 reordered, 0 unassigned
0 discarded, 0 lost received, 1/255 load
0x0 received sequence, 0x0 sent sequence
Member links: 2 (max not set, min not set)
  Serial1, since 00:03:25, no frags rcvd
  Serial0, since 00:03:25, no frags rcvd
```

Troubleshoot Example 1

This section provides information you can use to troubleshoot your configuration.

Certain **show** commands are supported by the Output Interpreter Tool (registered customers only) , which allows you to view an analysis of **show** command output.

Note: Before issuing **debug** commands, refer to Important Information on Debug Commands.

debug Commands

On Router1, the **debug ppp authentication** command shows the success of CHAP.

```
May  8 17:52:19: Se1 PPP: Using configured call direction
May  8 17:52:19: Se1 PPP: Treating connection as a callout
May  8 17:52:19: Se0 CHAP: O CHALLENGE id 135 len 28 from "Router1"
May  8 17:52:19: Se1 CHAP: O CHALLENGE id 135 len 28 from "Router1"
May  8 17:52:19: Se0 CHAP: I CHALLENGE id 134 len 28 from "Router2"
May  8 17:52:19: Se0 CHAP: O RESPONSE id 134 len 28 from "Router1"
May  8 17:52:19: Se1 CHAP: I CHALLENGE id 134 len 28 from "Router2"
May  8 17:52:19: Se1 CHAP: O RESPONSE id 134 len 28 from "Router1"
May  8 17:52:19: Se0 CHAP: I SUCCESS id 134 len 4
May  8 17:52:19: Se0 CHAP: I RESPONSE id 135 len 28 from "Router2"
May  8 17:52:19: Se0 CHAP: O SUCCESS id 135 len 4
May  8 17:52:19: Se1 CHAP: I SUCCESS id 134 len 4
May  8 17:52:19: Se1 CHAP: I RESPONSE id 135 len 28 from "Router2"
May  8 17:52:19: Se1 CHAP: O SUCCESS id 135 len 4
5d05h: %LINK-3-UPDOWN: Interface Virtual-Access1, changed state to up
May  8 17:52:19: Vi1 PPP: Using configured call direction
May  8 17:52:19: Vi1 PPP: Treating connection as a callout
5d05h: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0, changed state to up
5d05h: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial1, changed state to up
```

On Router2, the **debug ppp authentication** command shows "Waiting for peer...."

```
5d02h: %LINK-3-UPDOWN: Interface Serial0, changed state to up
5d02h: Se0 PPP: Treating connection as a callin
5d02h: Se0 CHAP: O CHALLENGE id 132 len 28 from "Router2"
5d02h: Se0 CHAP: I CHALLENGE id 133 len 28 from "Router1"
5d02h: Se0 CHAP: Waiting for peer to authenticate first
5d02h: Se0 CHAP: I RESPONSE id 132 len 28 from "Router1"
5d02h: Se0 CHAP: O SUCCESS id 132 len 4
5d02h: Se0 CHAP: Processing saved Challenge, id 133
5d02h: Se0 CHAP: O RESPONSE id 133 len 28 from "Router2"
5d02h: Se0 CHAP: I SUCCESS id 133 len 4
```

5d02h: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0, changed state to up

Example 2: Virtual Template

Router1 – Cisco 2503

```
Current configuration
!
version 12.2
!
hostname Router1
!
!
username Router2 password 0 abc

ip subnet-zero
no ip domain-lookup
!

multilink virtual-template 1

!--- Applies the virtual interface template to the multilink bundle.

interface Loopback0
 ip address 192.168.10.2 255.255.255.0

!--- The loopback address is used by virtual-template 1.

interface Virtual-Template1

!--- Interface virtual-template is a logical interface that creates
!--- virtual access interfaces dynamically and applies them to
!--- physical serial interfaces.

 ip unnumbered Loopback0

!--- Always unnumber the virtual-template to an UP interface.
!--- Do not assign a static IP.

 ppp authentication chap
 ppp multilink

!--- Enables multilink PPP on the virtual-template interface.

interface Serial0
 no ip address
 encapsulation ppp
 pulse-time 1
 ppp multilink
!
interface Serial1
 no ip address
 encapsulation ppp
 pulse-time 1
 ppp multilink
!
!
ip classless
!
line con 0
line aux 0
```

```
transport input all
line vty 0 4
  login
!
end
```

Router2 – Cisco 2503

```
Current configuration :
!
version 12.2
!
hostname Router2
!
!
username Router1 password 0 abc

ip subnet-zero
no ip domain-lookup
!
multilink virtual-template 1
!
!
!
interface Loopback0
  ip address 192.168.20.1 255.255.255.0
!
!
interface Virtual-Template1
  ip unnumbered Loopback0
  ppp authentication chap
  ppp multilink
!
interface Serial0
  no ip address
  encapsulation ppp
  no fair-queue
  clockrate 56000
  pulse-time 1
  ppp multilink
!
interface Serial1
  no ip address
  encapsulation ppp
  no fair-queue
  clockrate 56000
  pulse-time 1
  ppp multilink
!
!
ip classless
!
!
line con 0
line aux 0
line vty 0 4
!
end
```

The configuration above describes the virtual template configured on Router1 and Router2. In this example, both routers are configured with virtual templates. The routers are connected back-to-back, and the multilink session does not idle out. No static routes are needed: a host route is installed after PPP negotiations.

Use Cisco IOS Software Release 11.3 or later to use virtual template for PPP multilink.

The **virtual template** command dynamically creates a virtual access interface and applies them to physical serial interfaces with the **multilink virtual-template** command. The parameters (such as **ppp authentication chap**) configured in interface virtual template are applied for both serial interfaces. The **ppp multilink** command in the interface virtual-template bundles the physical serial interfaces to form a virtual-access in order to aggregate the bandwidth.

Verify Example 2

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

Certain **show** commands are supported by the Output Interpreter Tool (registered customers only) , which allows you to view an analysis of **show** command output.

```
Router2# show ppp multilink

Virtual-Access1, bundle name is Router1

!--- Virtual Access interface used for the bundle

Bundle up for 00:20:38
0 lost fragments, 0 reordered, 0 unassigned
0 discarded, 0 lost received, 1/255 load
0x0 received sequence, 0x0 sent sequence
Member links: 2 (max not set, min not set)
    Serial1, since 00:20:39, no frags rcvd
    Serial0, since 00:20:39, no frags rcvd

!--- Note that there are two links (Se 0 and Se1) in the bundle
```

These commands may also help:

- **show ip route connected** To see if the IP route for the virtual-access is installed.
- **show interface virtual-access x** To check the status of a particular virtual-access interface. In the example above, the virtual-access interface number is 1.

Troubleshoot Example 2

This section provides information you can use to troubleshoot your configuration.

Certain **show** commands are supported by the Output Interpreter Tool (registered customers only) , which allows you to view an analysis of **show** command output.

Note: Before issuing **debug** commands, refer to Important Information on Debug Commands.

Configure timestamps in the global configuration as follows:

```
service timestamps debug datetime msec
service timestamps log datetime msec
```

Use these commands to troubleshoot:

- **debug ppp negotiation** To see if a client passes PPP negotiation. You can also check which options (callback, Multilink PPP [MLP], and so on) and which protocols (IP, IPX, and so on) are negotiated.
- **debug ppp authentication** To see if a client passes authentication.
- **debug vtemplate** To see what virtual-template configurations are used.
- **debug vprofile** To see what configuration options are applied to the virtual-access interface.

Related Information

- [Configuring Legacy DDR Hubs](#)
 - [Configuring Peer to Peer DDR with Dialer Profiles](#)
 - [Dial Technology Support](#)
 - [Technical Support – Cisco Systems](#)
-

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