Configuring MLPPP

SYSTEM ADMINISTRATOR GUIDE

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Contents

1 Overview

This document describes how to create, configure, monitor, and administer Multilink PPP (MLPPP) when it includes link-aggregated PPP-encapsulated DS0 (or groupings of DS0), DS1, E1 or DS3 channels.

Note: The system supports other types of MLPPP in which the links are not channels or channelized ports; these are listed in Section 1.1 on page 1.

MLPPP bundles provide increased bandwidth and availability. When ports (or channels) are bundled in a link group and one link in the bundle fails or is replaced, the other links take the traffic that was previously handled by the out-of-service link. Load balancing and load distribution over the ports in the link group result in increased bandwidth. See Section 1.2 on page 1.

1.1 MLPPP Types

- MLPPP using PPP-encapsulated DS-1 channels and E1 channels and ports; described in this document.

- MLPPP using PPP-encapsulated ATM PVCs; described in the *Configure MLPPP on ATM PVCs* section of *Configuring PPP and PPPoE*.

- MLPPP for Layer 2 Tunneling Protocol (L2TP) subscribers; described in the *Configure MLPPP for L2TP Subscribers* section of *Configuring PPP and PPPoE*.

- MLPPP using PPPoE; described in the *Configure MLPPP over PPPoE* section of *Configuring PPP and PPPoE*.

1.2 Load Balancing

When more than one physical link connects two routers, MLPPP load-balances the connection across all links in the bundle. Both ends of point-to-point links must support MLPPP connections. The two routers configure the data link by swapping Link Control Protocol (LCP) packets during a link establishment phase. If MLPPP is not successfully negotiated, the connection is not established and an error is logged.

The traffic load on a circuit in an MLPPP bundle is distributed round-robin, packet by packet over the multiple links in the link bundle.

For a complete discussion of load balancing, see *Load Balancing*.

1.3 Traffic Management

1.3.1 Policing

Policing policies are supported per channel and per MLPPP bundle.

1.3.2 Metering

Metering policies are supported per channel and per MLPPP bundle.

1.3.3 Queuing

A PWFQ policy can be applied to PPP channels and to MLPPP bundles. Up to 8 priority groups are supported. PWFQ is the only queuing policy supported.

1.3.4 Configuring Circuits for QoS

You can configure MLPPP bundles for policing, metering, and PWFQ. See *Configuring Circuits for QoS* for MLPPP configuration instructions, examples, and limitations. In addition to QoS-specific limitations, Section 2.1 on page 3 lists limitations that apply to all MLPPP bundles whether or not they are configured as part of the QoS provisioning.

1.4 APS

You can configure Automatic Protection Switching (APS) with MLPPP bundles as the working and backup ports. See *Configuring APS MSP* for MLPPP configuration instructions, examples, and limitations. In addition to APS-specific limitations, in Section 2.1 on page 3 lists limitations that apply specifically to all MLPPP bundles whether or not they are configured as part of the provisioning of APS.

1.5 Supported Standards and Recommendations

- PPP encapsulation—RFC 1661, *The Point-to-Point Protocol*, and RFC 1377, *The PPP OSI Network Layer Control Protocol (OSINLCP)*

- MLPPP features—RFC 1990, *The PPP Multilink Protocol (MLPPP)*

2 MLPPP Configuration Steps and Example

2.1 Configuration Restrictions and Limitations

- The MLPPP bundle links cannot span multiple line cards, but can span multiple ports within a line card, except when APS is configured. If APS is configured, the bundle must be contained within one port.

- The working and protect port configurations for APS must be on similar line cards and on similar ports; that is, the working and protect ports must be of the same type and on the same type of card in an APS protection group.

- The difference in speed between the slowest and fastest links in an MLPPP bundle cannot exceed the speed of a single DS0 channel (64 kbps).

- MLPPP supports packets in the range of 64 to 1500 bytes. Set the MTU to fragment packets larger than 1500 bytes to avoid dropping traffic.

- If you change your MLPPP configuration to add or remove links, some packets are dropped during the transition to the new configuration.

- When an APS switchover occurs, some packets are lost on the receive side while MLPPP synchronizes the active and backup ports.

- For channels in an MLPPP bundle, PWFQ policy should be applied to the MLPPP link group instead of individual channels.

- If you exceed the recommended maximum transmit scheduling rate for an MLPPP bundle managed by a PWFQ policy, the system throughput can be significantly degraded. See the *rate (PWFQ)* command for the formulas by which you can calculate the maximum rate.

2.2 MLPPP Bundle Configuration Steps

All channels (DS0 or groupings of DS0 channels, DS1, E1 or DS3 channels) in an MLPPP bundle must be configured on the same traffic card, must have identical configurations, and must have PPP encapsulation.

1. Specify the context and access context configuration mode by using the *context* command.

2. Create an interface for the MLPPP bundle and access interface configuration mode by using the *interface (context)*command.

3. Assign an IP address to the interface for the MLPPP bundle by using the *ip address (interface)* command.

4. Create an empty MLPPP bundle for PPP-encapsulated DS-1 channels, E1 channels, or E1 ports by using the *link-group (Group, DS-1, E1, Port Configuration Modes)* command.

   Specify the `mp` keyword to specify the MLPPP link group type.

5. Specify the minimum number of links that should be in the up state for the link group to be active by configuring the *minimum-links* command.

6. Specify the type of endpoint discriminator to be used for negotiation with an MLPPP bundle by using the *mp endpoint-discriminator* command.

7. Set the MRRU to be used for negotiation with an MLPPP bundle by using the *mp mrru* command.

8. Bind the MLPPP bundle to the interface by using the *bind interface* command.

Note: An MLPPP bundle is always enabled (operational). The shutdown command is not available in link group configuration mode for MLPPP bundles.

2.3 Adding Channels to an MLPPP Bundle

2.3.1 Configuration

To add channels (DS0 or groupings of DS0 channels, DS1, E1 or DS3 channels) to an MLPPP bundle:

1. Enter the configuration mode for the DS0, DS1, E1, or DS3 channel or channels you want to add to the link group.

2. Enter the *link-group (Group, DS-1, E1, Port Configuration Modes)* command, commit the configuration, and exit.

Note: To add a POS port to an MLPPP bundle, enter the *link-group (Group, DS-1, E1, Port Configuration Modes)* command in POS port configuration mode, with the links you want to add.

2.4 MLPPP Configuration Example

```
config
!
service multiple-contexts
!
software license
 all-ports password <plain text passcode> card ch-oc3oc12-8or2-port slot 2
!
!
context redkite1
!
 interface mp_pos_chstm1->chds3->ds1_1
  ip address 23.23.23.1/24
!
 interface mp_pos_chstm1->chds3->e1_1
  ip address 24.24.24.1/24
```

```
!
 interface mp_pos_chstm1->e1_1
  ip address 25.25.25.1/24
!
!
link-group mp1_pos_ds1_1 mp
 bind interface mp_pos_chstm1->chds3->ds1_1 redkite1
link-group mp1_pos_e1_1 mp
 bind interface mp_pos_chstm1->chds3->e1_1 redkite1
link-group mp1_pos_e1_2 mp
 bind interface mp_pos_chstm1->e1_1 redkite1
!
!
card ch-oc3oc12-8or2-port 2
 no shutdown
 clock-source global-reference
!
!
! Example for plain MLPPP, using SDH AUG mapping au3-no-tug to channelize:
! chSTM1 -> chDS3 -> MLPPP (DS1 member links)
! chSTM1 -> chDS3 -> MLPPP (E1 member links)
!
port channelized-stm1 2/1 pos
 no shutdown
 aug-mapping au3-no-tug
 clock-source card-reference
 !
 port channelized-ds3 2/1:2
  no shutdown
  clock-source card-reference
 !
 !
 ! MLPPP bundle over POS, 8 DS1 member links
 !
  port ds1 2/1:2:4
   no shutdown
   clock-source card-reference
   encapsulation ppp
   link-group mp1_pos_ds1_1
  !
  port ds1 2/1:2:5
   no shutdown
   clock-source card-reference
   encapsulation ppp
   link-group mp1_pos_ds1_1
  !
  port ds1 2/1:2:6
   no shutdown
   clock-source card-reference
   encapsulation ppp
   link-group mp1_pos_ds1_1
  !
  port ds1 2/1:2:7
   no shutdown
   clock-source card-reference
   encapsulation ppp
   link-group mp1_pos_ds1_1
  !
  port ds1 2/1:2:8
   no shutdown
   clock-source card-reference
   encapsulation ppp
   link-group mp1_pos_ds1_1
  !
  port ds1 2/1:2:9
   no shutdown
   clock-source card-reference
   encapsulation ppp
   link-group mp1_pos_ds1_1
  !
  port ds1 2/1:2:10
   no shutdown
   clock-source card-reference
   encapsulation ppp
   link-group mp1_pos_ds1_1
  !
```

```
    port ds1 2/1:2:28
     no shutdown
     clock-source card-reference
     encapsulation ppp
     link-group mp1_pos_ds1_1
    !
   !
  port channelized-ds3 2/1:3
   no shutdown
   clock-source card-reference
  !
  !
  ! MLPPP bundle over POS, 8 E1 member links
  !
   port e1 2/1:3:4
    no shutdown
    clock-source card-reference
    encapsulation ppp
    link-group mp1_pos_e1_1
   !
   port e1 2/1:3:5
    no shutdown
    clock-source card-reference
    encapsulation ppp
    link-group mp1_pos_e1_1
   !
   port e1 2/1:3:6
    no shutdown
    clock-source card-reference
    encapsulation ppp
    link-group mp1_pos_e1_1
   !
   port e1 2/1:3:7
    no shutdown
    clock-source card-reference
    encapsulation ppp
    link-group mp1_pos_e1_1
   !
   port e1 2/1:3:8
    no shutdown
    clock-source card-reference
    encapsulation ppp
    link-group mp1_pos_e1_1
   !
   port e1 2/1:3:9
    no shutdown
    clock-source card-reference
    encapsulation ppp
    link-group mp1_pos_e1_1
   !
   port e1 2/1:3:10
    no shutdown
    clock-source card-reference
    encapsulation ppp
    link-group mp1_pos_e1_1
   !
   port e1 2/1:3:21
    no shutdown
    clock-source card-reference
    encapsulation ppp
    link-group mp1_pos_e1_1
   !
  !
 !
 ! Example for plain MLPPP, using SDH AUG mapping au4-tu12 to channelize:
 ! chSTM1 -> MLPPP (E1 member links)
 !
port channelized-stm1 2/4 pos
 no shutdown
 aug-mapping au4-tu12
 clock-source card-reference
  !
  !
  ! MLPPP bundle over POS, 8 E1 member links
  !
  port e1 2/4:4
```

```
  no shutdown
  clock-source card-reference
  encapsulation ppp
  link-group mp1_pos_e1_2
 !
 port e1 2/4:5
  no shutdown
  clock-source card-reference
  encapsulation ppp
  link-group mp1_pos_e1_2
 !
 port e1 2/4:6
  no shutdown
  clock-source card-reference
  encapsulation ppp
  link-group mp1_pos_e1_2
 !
 port e1 2/4:7
  no shutdown
  clock-source card-reference
  encapsulation ppp
  link-group mp1_pos_e1_2
 !
 port e1 2/4:8
  no shutdown
  clock-source card-reference
  encapsulation ppp
  link-group mp1_pos_e1_2
 !
 port e1 2/4:9
  no shutdown
  clock-source card-reference
  encapsulation ppp
  link-group mp1_pos_e1_2
 !
 port e1 2/4:10
  no shutdown
  clock-source card-reference
  encapsulation ppp
  link-group mp1_pos_e1_2
 !
 port e1 2/4:63
  no shutdown
  clock-source card-reference
  encapsulation ppp
  link-group mp1_pos_e1_2
 !
!
!
end
```

2.4.1   Notes

- When you configure an MLPPP bundle on a Channelized OC-3/STM-1 or OC-12/STM-4 line card, the links of the bundle can span ports within a card, but cannot span cards. Each link can be an E1, DS1, DS3, or DS0 group.

    Note: The difference in speed between the slowest and fastest links in an MLPPP bundle cannot exceed the speed of a single DS0 channel.

- PWFQ is supported at the bundle level. All packets going out on an MLPPP bundle from a PPA2 POS card that supports MLPPP are always encapsulated with MLPPP.

3   MLPPP Monitoring and Debugging

To monitor and troubleshoot MLPPP link groups, perform the appropriate task in the following list . Enter the debug commands in exec mode; enter the show commands in any mode.

- Enable generation of debug messages for MLPPP-related events:

  debug ppp multilink

- Enable generation of debug messages for all PPP-related events:

  debug ppp `all`

- Display state and statistics information for one or all MLPPP bundles:

  — Show MLPPP session information in all contexts:

     show ppp multilink `all`

     This option is available only in the local context.

  — Show MLPPP session information in all contexts, and specify that context and MLPPP bundle information is displayed:

     show ppp multilink `all detailed`

     . This option is available only in the local context. Use the `detailed` keyword to display context and MLPPP bundle information.

  — Display state and statistics information for the specified MLPPP bundle:

     show ppp multilink `bundle` *`bundle-name`*

  — Display state and statistics information for the specified MLPPP session:

     show ppp multilink `bundle mp` *`session-id`*

- Display the state of one or more PPP sessions:

  show ppp `all` command

- Display statistics for PPP packets and session counters on the system:

  show ppp counters `detail`

Glossary

circuit
The term circuit is used in this library for both Layer 2 and Layer 3 circuits. As such, the term circuit can be used to mean the link-aggregated pseudocircuits in an MLPPP link group bundle or the channels in a channelized SONET/SDH port.

LCP
Link Control Protocol

link group
The term link group is used for both 802.1ad and MLPPP link-group types. The term is used to mean the links in a bundle, and in particular an MLPPP bundle.

MLPPP
Multilink PPP. An extension to PPP that allows a router to use more than one physical link for communication.

PWFQ
Priority weighted fair queuing.