

BCP Support on MLPPP

This feature module describes how to configure Bridge Control Protocol (BCP) Support over Multilink PPP (MLPPP).

Note This feature is only applicable for Cisco ASR 900 RSP2 Module.

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Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information for BCP Support on MLPPP section.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for BCP Support on MLPPP

- Cisco IOS XE Everest 16.5.1 or a later release that supports the BCP Support on MLPPP feature must be installed previously on the Cisco ASR 900.

Restrictions for BCP Support on MLPPP

- IPv6 is not supported.
- Routing is not supported, hence, BDI is also not supported on BCP over MLPPP.

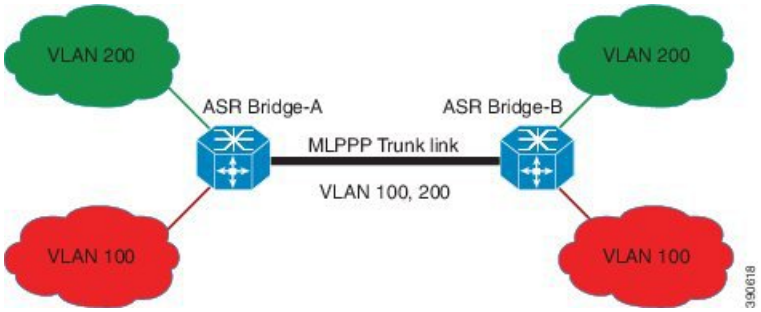
- Spanning Tree Protocol (STP) and Resilient Ethernet Protocol (REP) are not supported.
- Jumbo frames are not supported.
- Supports 16 T1/E1 and OC3 IM only. A maximum number of 16 (0-15) links per MLPPP bundle are supported, where traffic rate is not beyond MLPPP bandwidth. For E1 link, 16 E1 serial interfaces can be in one MLPPP bundle. For T1, 16 T1 links can be in one MLPPP bundle.
- The following encapsulations are not supported: **QinQ**, **dot1ad**, and **dot1ad-dot1q** .
- You cannot configure **default** or **untagged** encapsulations on two different multilinks. When **default** is configured on a multilink, you can configure another EFP as **untagged** on the same multilink. For **untagged**, the same multilink cannot have another EFP configured as **untagged**.
- Two different multilinks cannot bridge the same encapsulated VLAN.
- The same bridge domain cannot be configured twice on the same interface.
- Connectivity Fault Management (CFM), Y.1731, and Layer 2 protocol forward tagged are not supported.
- Set qos-group is not supported in the output policy of physical Gigabit interface and EVC of the multilink interface. Set qos-group on ASR 903 will not mark the packet. The scope of the set qos-group is limited to the router.
- QoS policy is not supported on multilink at the interface level. However, it is supported on different EVCs of the multilink interfaces.
- Qos-group classification will work only on the egress interface or EFP interface.
- The MLPPP interface bundle supports only a maximum of 64 EVCs.
- A miximum of 64 VLANs are supported across all the MLPPPs.
- Layer 3 traffic with default encapsulation is not supported.
- Multicast and IGMP is not supported.
- For ingress classification to work, it should be classified based on “match cos inner <>” or “match vlan inner <>”.
- Layer 2 QoS behavior is supported only on tagged/priority tagged packets. It is not supported for untagged packets.
- Only 1r2C policer is supported at the egress.
- With BCP on MLPPP, the COS bits in the paylod are not preserved end to end.

Information About BCP Support on MLPPP

The BCP, as described in RFC 3518, is responsible for configuring, enabling and disabling the bridge protocol modules on both ends of the point-to-point link. The BCP feature enables forwarding of Ethernet frames over serial networks, and provides a high-speed extension of enterprise LAN backbone traffic through a metropolitan area.

When BCP is supported on MLPPP, it enables transport of Ethernet Layer 2 frames through MLPPP. In the following diagram, Bridge-A is connected to Bridge-B using MLPPP. The MLPPP bundle acts as a trunk link connecting Bridge-A and Bridge-B, transporting multiple VLANs. Using this feature, the hosts in VLAN 100, who are connected to Bridge-A, can talk to the hosts in VLAN 200, who are connected to Bridge-B.

Figure 1: BCP over MLPPP



Supported Profiles and Protocols

- Ethernet II frames
- 802.1Q tagged frames
- IPv4 packets
- Frame sizes from 64 to 1522 octets

Quality of Service

The Ethernet Layer 2 traffic is classified on the egress at the EVC of the Multilink interface based on IP DSCP or VLAN CoS bits. Based on this classification, egress policing (bandwidth percent or priority percent) is achieved. You can also re-mark the QoS field. The following table lists the options available for re-marking.

Table 1: Re-Marking Options

IP DSCP	VLAN CoS or PCP Bits
Set IP DSCP (re-mark IP DSCP)	Set IP DSCP
Set VLAN CoS or Priority Code Point (PCP) Bits	Set VLAN CoS Bits (re-mark VLAN CoS or PCP Bits)
Bandwidth Percent or Priority Percent	Bandwidth Percent or Priority Percent

How to Configure BCP Support on MLPPP

Configuring Multiple EFPs Bridged Through the Same Link

To bridge multiple EFPs through the same multilink, you should create two EFPs and add them to the multilink.

To configure an EFP and a multilink, complete the following tasks:

Configuring an EFP

To configure an EFP, complete the following steps:

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Router(config)# interface GigabitEthernet 0/0`	Specifies an interface type and number, and places the device in interface configuration mode.
Step 4	**service instance** *number* **ethernet** **Example:** `Router(config-if)# service instance 10 ethernet`	Configures an EFP (service instance) and enters service instance configuration mode. • *number*—EFP identifier; an integer from 1 to 4000.
Step 5	**encapsulation dot1q** *vlan-id* **Example:** `Router(config-if-srv)# encapsulation dot1q 50`	Configures encapsulation type for the service instance. • *vlan-id*—Virtual LAN identifier. The valid range is from 1 to 4094.
Step 6	**rewrite ingress tag pop 1 symmetric** **Example:** `Router(config-if-srv)# rewrite ingress tag pop 1 symmetric`	Specifies that encapsulation modification occurs on packets at ingress.
Step 7	**bridge-domain** *bridge-id* **Example:** `Router(config-if-srv)# bridge-domain 100`	Configures the bridge domain ID. • *bridge-id*—Bridge domain number. The valid range is from 1 to 4094.

Adding an EFP to a Multilink

To add an EFP to a multilink, complete the following steps:

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Router(config)# interface Multilink 5`	Specifies an interface type and number, and places the device in interface configuration mode.
Step 4	**service instance** *number* **ethernet** **Example:** `Router(config-if)# service instance 10 ethernet`	Configures an EFP (service instance) and enters service instance configuration mode. • *number*—EFP identifier; an integer from 1 to 4000.
Step 5	**encapsulation dot1q** *vlan-id* **Example:** `Router(config-if-srv)# encapsulation dot1q 60`	Configures encapsulation type for the service instance. • *vlan-id*—Virtual LAN identifier. The valid range is from 1 to 4094.
Step 6	**rewrite ingress tag pop 1 symmetric** **Example:** `Router(config-if-srv)# rewrite ingress tag pop 1 symmetric`	Specifies that encapsulation modification occurs on packets at ingress.
Step 7	**bridge-domain** *bridge-id* **Example:** `Router(config-if-srv)# bridge-domain 100`	Configures the bridge domain ID. • *bridge-id*—Bridge domain number. The valid range is from 1 to 4094.
Step 8	**exit** **Example:** `Router(config-if-srv)# exit`	Exits service instance configuration mode and enters the interface configuration mode. **Note** Repeat Step 4 to Step 7 to add another EFP to the Multilink.

Configuring Multiple Encapsulated VLANs Bridged Through Different Multilinks

You should create two encapsulated VLANs and add them to two multilinks for this configuration to work.

To configure multiple encapsulated VLANs bridged through different multilinks, complete the following tasks:

Adding an Encapsulated VLAN to Multilinks

To add an encapsulated VLAN to separate multilinks, complete the following steps:

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Router(config)# interface Multilink 5`	Specifies an interface type and number, and places the device in interface configuration mode.
Step 4	**service instance** *number* **ethernet** **Example:** `Router(config-if)# service instance 10 ethernet`	Configures an EFP (service instance) and enters service instance configuration mode. • *number*—EFP identifier; an integer from 1 to 4000.
Step 5	**encapsulation dot1q** *vlan-id* **Example:** `Router(config-if-srv)# encapsulation dot1q 60`	Configures encapsulation type for the service instance. • *vlan-id*—Virtual LAN identifier. The valid range is from 1 to 4094.
Step 6	**rewrite ingress tag pop 1 symmetric** **Example:** `Router(config-if-srv)# rewrite ingress tag pop 1 symmetric`	Specifies that encapsulation modification occurs on packets at ingress.
Step 7	**bridge-domain** *bridge-id* **Example:** `Router(config-if-srv)# bridge-domain 100`	Configures the bridge domain ID. • *bridge-id*—Bridge domain number. The valid range is from 1 to 4094.
Step 8	**exit** **Example:** `Router(config-if-srv)# exit`	Exits service instance configuration mode and enters the interface configuration mode. **Note** Repeat steps 3 to 7 to create another multilink and add the VLAN information.

Configuring QoS for BCP Support on MLPPP

The egress policy at the EVC of the multilink interface matches the IP DSCP value and VLAN CoS bits. Based on this classification it re-marks these values and performs egress policing (Priority percent or Bandwidth percent), shaping, priority shaper, BRR/BRP.

To configure QoS for BCP Support on MLPPP, complete the following tasks:



Note Define a QoS policy, and apply it to the MLPPP interface, and configure a matching policy on the EFP interface.

Defining a QoS Policy

To define a QoS policy, complete the following steps:

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**class-map match-any** *class-map-name* **Example:** `Router(config)# class-map match-any dscpaf11`	Creates a class map to be used for matching packets to a specified class and enters QoS class-map configuration mode. • *class-map-name*—Name of the class for the class map. The class name is used for both the class map and to configure a policy for the class in the policy map.
Step 4	**match ip dscp** *dscp-list* **Example:** `Router(config-cmap)# match ip dscp af11`	Matches IP DSCP packeting using Assured Forwarding (AF) by entering the binary representation of the DSCP value.
Step 5	**class-map match-any** *class-map-name* **Example:** `Router(config-cmap)# class-map match-any qos-group3`	Creates a class map to be used for matching packets to a specified class.
Step 6	**match qos-group** *qos-group-value* **Example:** `Router(config-cmap)# match qos-group 3`	Identifies a specific quality of service (QoS) group value as a match criterion. • *qos-group-value*—The exact value used to identify a QoS group value. The valid range is from 0 to 7.
Step 7	**policy-map** *policy-map-name* **Example:**	Creates a policy map that can be attached to one or more interfaces.

	Command or Action	Purpose
	`Router(config-cmap)# policy-map bcpmlpppqos`	• *poliicy-map-name*—Name of the policy map.
Step 8	**class** *class-name* **Example:** `Router(config-pmap)# class dscpaf11`	Specifies the name of the class whose policy you want to create or change. Alternatively, is used to specify the default class (commonly known as the class-default class) before you configure its policy. • *class-name*—Name of the class to be configured or whose policy is to be modified. The class name is used for both the class map and to configure a policy for the class in the policy map. .
Step 9	**priority percent** *percentage* **Example:** `Router(config-pmap-c)# priority percent 20`	Provides priority to a class of traffic belonging to a policy map. • *percentage*—Total available bandwidth to be set aside for the priority class. The valid range is from 1 to 100.
Step 10	**set ip dscp** *ip-dscp-value* **Example:** `Router(config-pmap-c)# set ip dscp ef`	Marks a packet by setting the IP DSCP value in the type of service (ToS) byte. • *ip-dscp-value*—IP DSCP value; The valid values are from 0 to 63.
Step 11	**class** *class-name* **Example:** `Router(config-pmap-c)# class qos-group3`	Specifies the name of the class whose policy you want to create or change. Alternatively, is used to specify the default class (commonly known as the class-default class) before you configure its policy.
Step 12	**bandwidth percent** *percentage* **Example:** `Router(config-pmap-c)# bandwidth percent 20`	Specifies the bandwidth allocated for a class belonging to a policy map. • *percentage*—Specifies the percentage of guaranteed bandwidth based on an absolute percent of available bandwidth to be set aside for the priority class or on a relative percent of available bandwidth. The valid range is from 1 to 100.
Step 13	**set qos-group** *group-id* **Example:** `Router(config-pmap-c)# set qos-group 4`	Sets a QoS group identifier (ID) that can be used later to classify packets. • *group-id*—group-id—Group ID number. The valid range is from 0 to 99.

Applying a QoS Policy on an MLPPP Interface

To apply a QoS policy on an MLPPP interface, complete the following steps:

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Router(config)# interface Multilink 5`	Specifies an interface type and number, and places the device in interface configuration mode.
Step 4	**service instance** *number* **ethernet** **Example:** `Router(config-if)# service instance 20 ethernet`	Configures an EFP (service instance) and enters service instance configuration mode. • *number*—EFP identifier; an integer from 1 to 4000.
Step 5	**service-policy output** *policy-map-name* **Example:** `Router(config-if)# service-policy output bcpmlpppqos`	Attaches a policy map to an input interface, a virtual circuit (VC), an output interface, or a VC that will be used as the service policy for the interface or VC. • *policy-map-name*—The name of a service policy map (created using the **policy-map** command) to be attached.
Step 6	**encapsulation dot1q** *vlan-id* **Example:** `Router(config-if-srv)# encapsulation dot1q 50`	Configures encapsulation type for the service instance. • *vlan-id*—Virtual LAN identifier. The valid range is from 1 to 4094.
Step 7	**rewrite ingress tag pop 1 symmetric** **Example:** `Router(config-if-srv)# rewrite ingress tag pop 1 symmetric`	Specifies that encapsulation modification occurs on packets at ingress.
Step 8	**bridge-domain** *bridge-id* **Example:** `Router(config-if-srv)# bridge-domain 100`	Configures the bridge domain ID. • *bridge-id*—Bridge domain number. The valid range is from 1 to 4094.

Verifying BCP Support on MLPPP

To display the Multilink PPP bundle information on various interfaces on a router, use the **show** command, as described in the following example:

```
Router# show ppp multilink interface multilink 1

Multilink1
  Bundle name: ASR1
  Remote Endpoint Discriminator: [1] ASR1
  Local Endpoint Discriminator: [1] ASR2
  Bundle up for 17:06:50, total bandwidth 20480, load 6/255
  2 receive classes, 2 transmit classes
  Receive buffer limit 123040 bytes per class, frag timeout 1000 ms
  Bundle is Distributed
  Receive Class 0:
    0/0 fragments/bytes in reassembly list
    0 lost fragments, 0 reordered
    0/0 discarded fragments/bytes, 0 lost received
    0xB9026C received sequence
  Receive Class 1:
    0/0 fragments/bytes in reassembly list
    0 lost fragments, 0 reordered
    0/0 discarded fragments/bytes, 0 lost received
    0x5D2E8F received sequence
  Transmit Class 0:
    0x5CBA5 sent sequence
  Transmit Class 1:
    0x146FA1 sent sequence
 Distributed MLP. Multilink in Hardware.
 Distributed Fragmentation is on. Fragment size: 256.
 Bundle status is: active
  Member links: 10 active, 0 inactive (max 255, min not set)
    Se0/6:0, since 01:36:49, 7680 weight, 256 frag size
    Se0/2:0, since 01:26:26, 7680 weight, 256 frag size
    Se0/5:0, since 01:25:18, 7680 weight, 256 frag size
    Se0/9:0, since 01:25:17, 7680 weight, 256 frag size
    Se0/1:0, since 01:24:25, 7680 weight, 256 frag size
    Se0/4:0, since 01:24:20, 7680 weight, 256 frag size
    Se0/0:0, since 01:24:18, 7680 weight, 256 frag size
    Se0/7:0, since 01:24:17, 7680 weight, 256 frag size
    Se0/8:0, since 01:23:09, 7680 weight, 256 frag size
    Se0/3:0, since 01:23:08, 7680 weight, 256 frag size
```

Configuration Examples for BCP Support on MLPPP

Example: Configuring an EFP

The following are the examples of two ways in which you can configure an EFP.

Method 1

```
enable
configure terminal
interface GigabitEthernet 0/0
service instance 10  ethernet
encapsulation dot1q 50
```

```
rewrite ingress tag pop 1 symmetric
bridge-domain 100
```

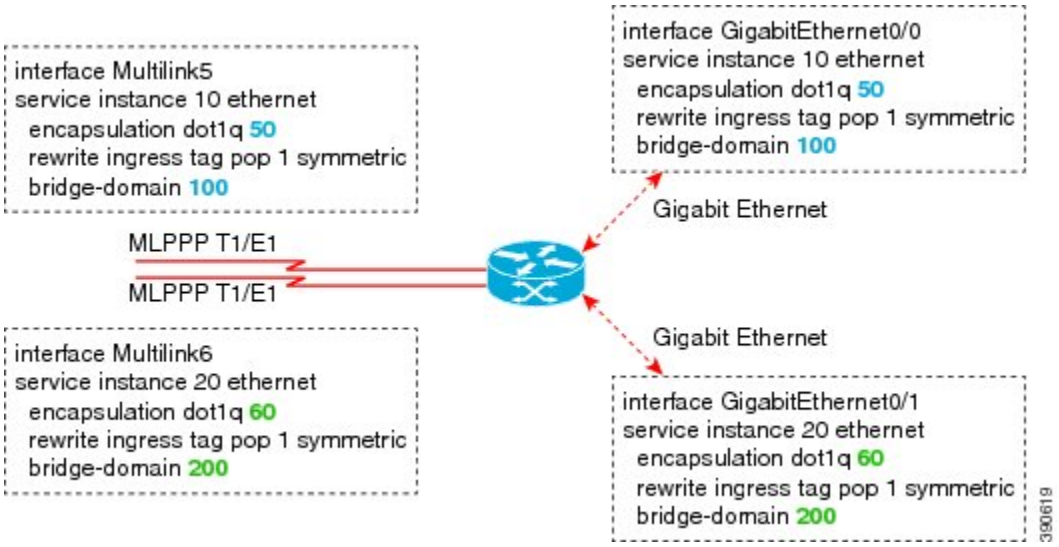
Method 2

```
enable
configure terminal
interface GigabitEthernet 0/0
service instance 10  ethernet
encapsulation dot1q 50
rewrite ingress tag pop 1 symmetric
exit
configure terminal
bridge-domain 100
member Multilink1 service-instance 100
```

Example: Multilink with a Single EFP

The following is a sample configuration of a multilink with a single EFP.

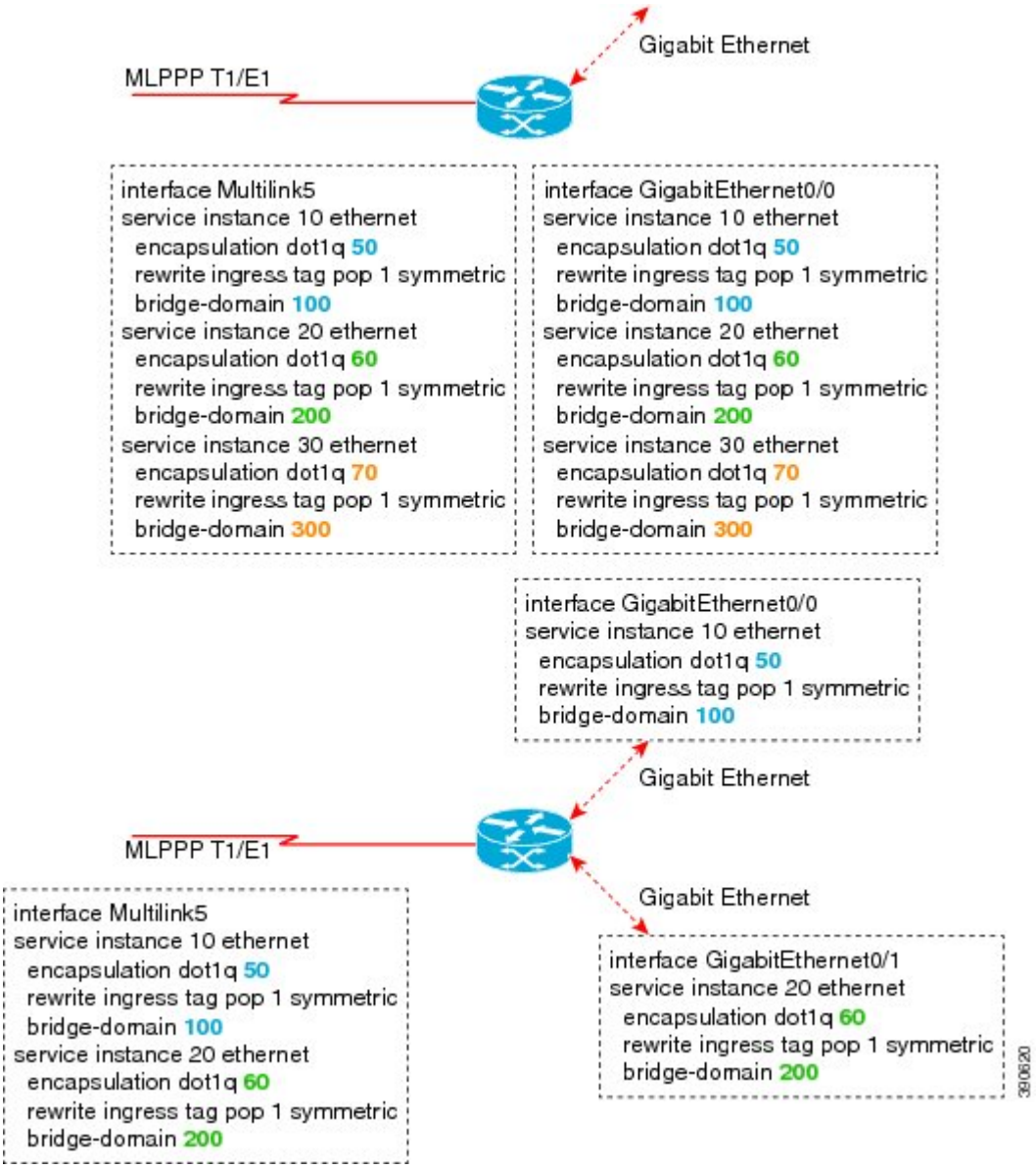
Figure 2: Multilink with a Single EFP



Example: Multilink with Multiple EFPs

The following is a sample configuration of a multilink with multiple EFPs.

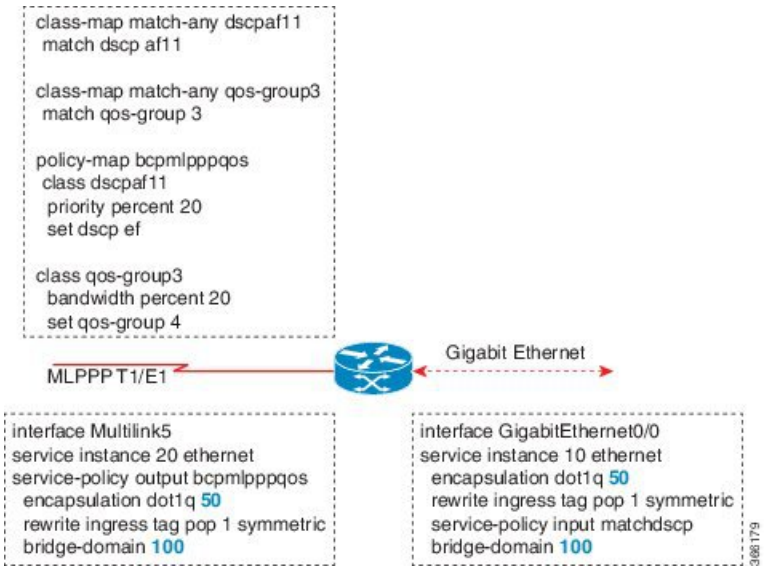
Figure 3: Multilink with Multiple EFPs



Example: Multilink with QoS

The following is a sample configuration of Multilink with QoS:

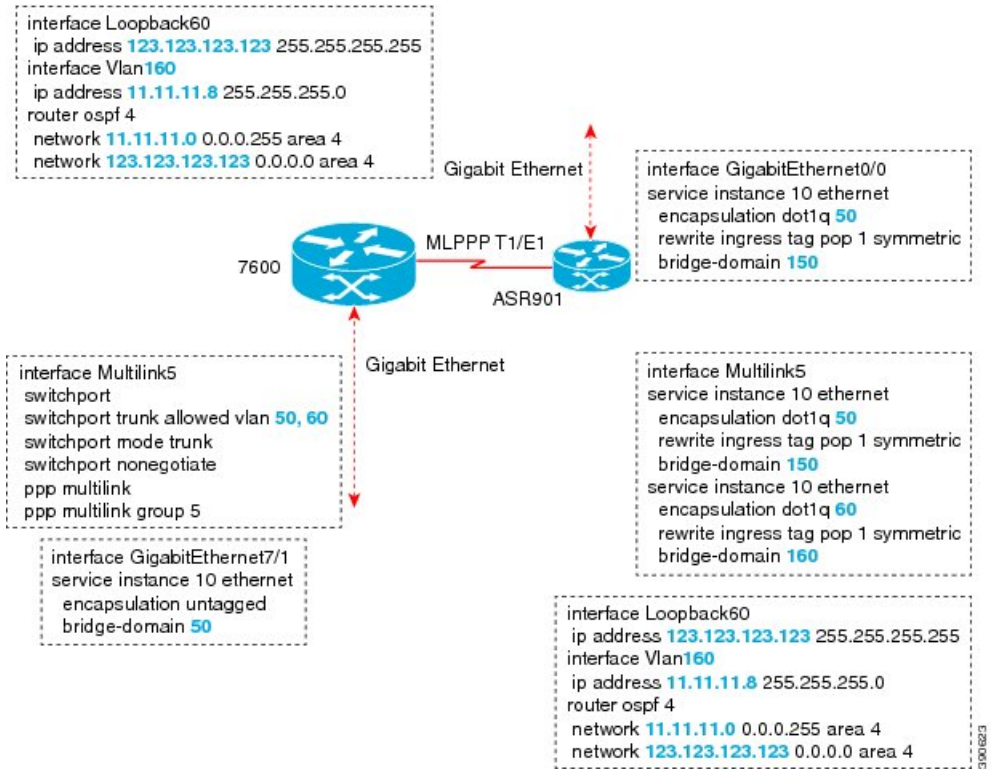
Figure 4: Multilink with QoS



Example: Multilink Between Cisco ASR 903 Series Routers and Cisco C7600 Series Routers

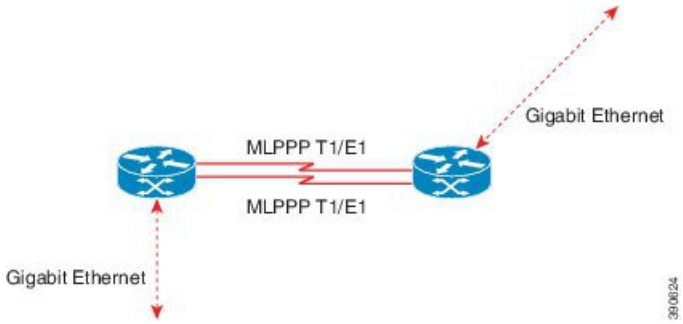
The following is a sample configuration of multilink between a Cisco ASR 903 Series Routers and Cisco C7600 Series Routers:

Figure 5: Multilink Between Cisco ASR 903 Series Routers and Cisco C7600 Series Routers



Example: Multilink with Maximum 10 Links

The following is a sample configuration of multilink with maximum 10 links.



The following sample configurations show how to configure multilink with maximum 10 links.

Policy Map 1

```
class-map match-any qos-group1
match qos-group 1
class-map match-any qos-group2
match qos-group 2
class-map match-any qos-group3
```

```
match qos-group 3
class-map match-any qos-group4
match qos-group 4
class-map match-any qos-group5
match qos-group 5
class-map match-any qos-group6
match qos-group 6
class-map match-any qos-group7
match qos-group 7

policy-map bcpmlpppqos
class qos-group1
priority percent 20
set qos-group 2
class qos-group2
bandwidth percent 20
set qos-group 3
class qos-group3
bandwidth percent 10
set qos-group 4
class qos-group4
bandwidth percent 5
set qos-group 5
class qos-group5
bandwidth percent 30
set qos-group 6
class qos-group7
bandwidth percent 15
set qos-group 1
```

Policy Map 2

```
class-map match-any dscpaf11
match ip dscp af11
class-map match-any dscpaf12
match ip dscp af12
class-map match-any dscpaf21
match ip dscp af21
class-map match-any dscpaf31
match ip dscp af31
class-map match-any dscpcs1
match ip dscp cs1
class-map match-any dscpef
match ip dscp ef
class-map match-any dscpdefault
match ip dscp default

policy-map bcpmlpppdscp
class dscpaf11
priority percent 20
set ip dscp af12
class dscpaf12
bandwidth percent 20
set ip dscp af13
class dscpaf21
bandwidth percent 10
set ip dscp af22
class dscpaf31
bandwidth percent 5
set ip dscp af32
class dscpcs1
bandwidth percent 30
```

```
set ip dscp cs2
class dscpef
bandwidth percent 10
set ip dscp cs7
class dscpdefault
bandwidth percent 5
set ip dscp cs5
```

MLPPP-GIG - 1

```
interface Multilink1
service instance 1 ethernet
service-policy output bcpmlpppqos
  encapsulation  untagged
    bridge-domain 3000

interface Multilink2
service instance 1 ethernet
service-policy output bcpmlpppqos
  encapsulation   dot1q  50
    bridge-domain 2000
service instance 2 ethernet
  encapsulation  dot1q  60
    bridge-domain 2001

interface gigabitethernet 0/5
service instance 1 ethernet
  encapsulation   dot1q  50
    bridge-domain 2000
service instance 2 ethernet
  encapsulation  dot1q  60
    bridge-domain 2001
service instance 3 ethernet
  encapsulation  untagged
    bridge-domain 3000
```

ADD-MLPPP-GIG - 1

```
interface Multilink1
service instance 2 ethernet
service-policy output bcpmlpppqos
  encapsulation   dot1q  70
    bridge-domain 3001

interface gigabitethernet 0/5
service instance 4 ethernet
  encapsulation   dot1q  70
    bridge-domain 3001
```

MLPPP-GIG-2

```
interface Multilink1
service instance 1 ethernet
service-policy output bcpmlpppdscp
  encapsulation  untagged
    bridge-domain 3000
```

```
interface Multilink2
service instance 2 ethernet
service-policy output bcpmlpppdscp
  encapsulation  dot1q  any
    bridge-domain 3001

interface gigabitethernet 0/5
service instance 1 ethernet
  encapsulation  untagged
    bridge-domain 3000
service instance 2 ethernet
  encapsulation  dot1q any
    bridge-domain 3001
```

MLPPP-GIG-3

```
interface Multilink1
service instance 1 ethernet
service-policy output bcpmlpppdscp
  encapsulation  default
    bridge-domain 3000

interface gigabitethernet 0/5
service instance 1 ethernet
  encapsulation  default
    bridge-domain 3000
```

Sample Configuration of MLPPP Bundled 10 Member Links

```
interface Multilink1
 no ip address
 load-interval 30
 ppp pfc local request
 ppp pfc remote apply
 ppp acfc local request
 ppp acfc remote apply
 ppp multilink
 ppp multilink interleave
 ppp multilink group 1
 ppp multilink fragment size 256
 ppp multilink multiclass
 service instance 102 ethernet
 service-policy output bcpmlpppqos
  encapsulation dot1q 102
  rewrite ingress tag pop 1 symmetric
  bridge-domain 102
 !

interface Serial0/0:0
 no ip address
 encapsulation ppp
 ppp multilink
 ppp multilink group 1
interface Serial0/1:0
 no ip address
 encapsulation ppp
 ppp multilink
```

```
 ppp multilink group 1
interface Serial0/2:0
 no ip address
 encapsulation ppp
 ppp multilink
 ppp multilink group 1
interface Serial0/3:0
 no ip address
 encapsulation ppp
 ppp multilink
 ppp multilink group 1
interface Serial0/4:0
 no ip address
 encapsulation ppp
 ppp multilink
 ppp multilink group 1
interface Serial0/5:0
 no ip address
 encapsulation ppp
 ppp multilink
 ppp multilink group 1
interface Serial0/6:0
 no ip address
 encapsulation ppp
 ppp multilink
 ppp multilink group 1
interface Serial0/7:0
 no ip address
 encapsulation ppp
 ppp multilink
 ppp multilink group 1
interface Serial0/8:0
 no ip address
 encapsulation ppp
 ppp multilink
 ppp multilink group 1
interface Serial0/9:0
 no ip address
 encapsulation ppp
 ppp multilink
 ppp multilink group 1
```

Additional References

The following sections provide references related to BCP Support on MLPPP feature.

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases

MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://tools.cisco.com/ITDIT/MIBS/servlet/index

RFCs

RFC	Title
RFC 3518	*Point-to-Point Protocol (PPP) Bridging Control Protocol (BCP)*

Technical Assistance

Table 2: Technical Assistance



Feature Information for BCP Support on MLPPP

Feature Name	Releases	Feature Information
BCP Support on MLPPP	Cisco IOS XE Everest 16.5.1	This feature was introduced on the Cisco ASR 903 Series Routers.