

ATM Label Edge Routing on the Enhanced ATM Router Module (ARM) Configuration Example

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Introduction

It is now possible to configure a Cisco Catalyst 8540MSR as a ATM Label Edge Router (ATM LER) with the Cisco IOS[®] Software version 12.1(10)EY. Previously, a Catalyst 8540MSR could only be configured as ATM Label Switch Router (ATM LSR). In other words, there were only "transit" VCs on a Catalyst 8540. As a result, a this device could not be at the head-end of a cell-based Label Switched path. That functionality had to be performed by other kinds of routers, such as the 7500.

The Catalyst 8540 can now be installed at the edge of a cell-based Multiprotocol Label Switching (MPLS) network. In order to achieve such functionality, it is necessary to use an Enhanced ATM Router Module (ARM) (also known as ARM2). The ARM2 acts as a "proxy" interface for every incoming and outgoing ATM interface (that is linked to an Enhanced ATM router module using the **mpls-forwarding** command) to do the MPLS packet processing.

This feature has some limitations:

- The ATM interface (main interface) can only be linked with the enhanced ATM router module main interface.
- VRF configuration on ATM OC-x interfaces is not supported.
- The class of service (CoS), label forwarding information base (LFIB) , and Label region in the Switching Database Manager (SDM) can be modified using the **sdm sram** command. But, the changes only take effect after a switch reload.
- Load Balancing between provider edge (PE) and provider (P) switches is not supported.
- Forwarding of VPN traffic is based only on the VPN routing table and not on the global routing table. If the VPN routing table lookup fails, the packets will be discarded.
- The Enhanced ATM router module internal link has a maximum capacity of 1.2 Gbps which could affect the number of interfaces associated with the Enhanced ATM router module.
- Only 2k terminating TAG VCs are supported per controlling Enhanced ATM router module hardware interface.
- Fragmentation based on MTU for IP to MPLS and MPLS to MPLS traffic is implemented in the route processors not on the interface modules.

Prerequisites

Requirements

There are no specific requirements for this document.

Components Used

- Procida is a Catalyst 8540MSR running Cisco IOS Software Release 12.1(10)EY and has an Enhanced ATM Router Module in slot 10 as can be seen in the show hardware output below.
- Bernard is a Cisco 7505 router running Cisco IOS Software Release 12.2(8)T with a PA-A.
- Fernet is a Cisco 2620 and Router is a Cisco 3620 used to inject routes to Bernard.

```
Procida#show hardware
```

```
C8540 named Procida, Date: 04:23:57 UTC Wed May 22 2002
```

Slot	Ctrlr-Type	Part No.	Rev	Ser No	Mfg Date	RMA No.	Hw Vrs	Tst	EEP
2/*	Super Cam	73-2739-03	B0	03170TC6	Apr 27 99	0	3.0		
2/0	155MM PAM	73-1496-03	A0	10988822	Dec 09 98	00-00-00	3.2	0	2
10/*	CMPM Card	73-3944-05	A0	04209F5M	Aug 31 00	0	5.0		
10/0	ARM2 PAM	73-5533-01	A0	0424A16L	Aug 31 00	0	5.1		
10/1	ARM2 PAM	73-5533-01	A0	0424A17V	Aug 31 00	0	5.1		
12/*	ETHERNET PAM	73-3754-04	A0	0246013S	Nov 19 98	0	3.2		

Fernet and Router are two CE routers. Procida acts as PE router and Bernard is a 7500 router.

Conventions

Refer to Cisco Technical Tips Conventions for more information on document conventions.

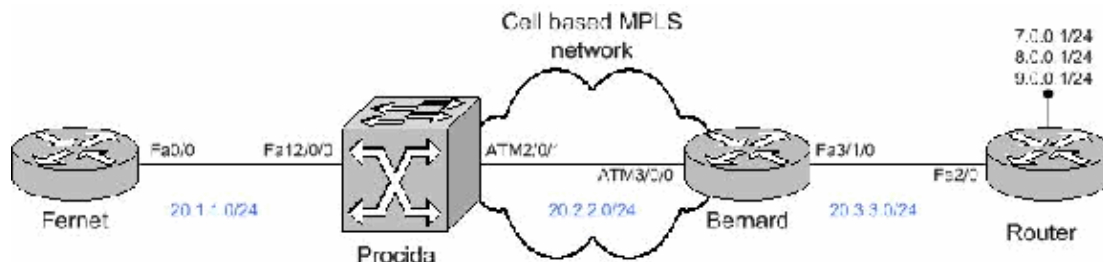
Configure

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

Note: Use the Command Lookup Tool (registered customers only) to find more information on the commands used in this document.

Network Diagram

The following network topology will be used to illustrate this document.



Quick Configuration Guide

For clarity purposes, only the configurations of Procida and Bernard will be shown.

1. Set up your network as usual (MPLS needs a standard IP connection in order to establish forwarding bases).
2. Ensure that the routing protocol (in this case OSPF) is working correctly.
3. Enable **ip cef** (for better performances use **ip cef distributed** when available) in the general configuration mode (shown in **bold** in the following configurations).
4. Enable **tag-switching ip** (or **mpls ip** on newer IOS versions) in the ATM interface (shown in **bold** in the following configurations).

Procida

Procida
<pre>ip cef ! interface FastEthernet12/0/0 ip address 20.1.1.2 255.255.255.0 ! interface ATM10/0/0 no shutdown ! interface ATM2/0/1 ip address 20.2.2.1 255.255.255.0 logging event subif-link-status no atm ilmi-keepalive tag-switching ip mpls-forwarding interface ATM10/0/0 ! router ospf 1 log-adjacency-changes network 20.1.1.0 0.0.0.255 area 0 network 20.2.2.0 0.0.0.255 area 0</pre>

Bernard

Bernard
<pre>ip cef ! interface ATM3/0/0.1 tag-switching ip address 20.2.2.2 255.255.255.0 no ip directed-broadcast no atm enable-ilmi-trap tag-switching ip ! interface FastEthernet3/1/0 ip address 20.3.3.1 255.255.255.0 ! router ospf 1 log-adjacency-changes network 20.2.2.0 0.0.0.255 area 0 network 20.3.3.0 0.0.0.255 area 0</pre>

Configuration Task for the 8540MSR

As mentioned in the Introduction, in order to act as an ATM LER, the ATM interfaces used in the MPLS forwarding must be configured for MPLS first and then linked to one of the ARM ATM interfaces using the

mpls-forwarding interface atm x/y/z command.

Note: Make sure that the ARM ATM interface used is up before configuring the **mpls-forwarding** command. In this case, the interface atm 2/0/1 is linked to the ARM interface atm 10/0/0.

Once MPLS is enabled on an ATM interface and the interface is linked to the enhanced ATM router module, all head-end, control, and tail-end VCs through that ATM interface terminate on the Enhanced ATM router module. All MPLS or IP packet processing is performed on the linked Enhanced ATM router module.

Verify

The show commands most commonly used for this type of configuration are:

- **show ip route**

```
Procida#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 10.48.72.1 to network 0.0.0.0
 4.0.0.0/32 is subnetted, 1 subnets
C       4.4.4.4 is directly connected, Loopback0
 20.0.0.0/24 is subnetted, 3 subnets
O       20.3.3.0 [110/2] via 20.2.2.2, 01:39:20, ATM2/0/1
C       20.2.2.0 is directly connected, ATM2/0/1
C       20.1.1.0 is directly connected, FastEthernet12/0/0
 7.0.0.0/32 is subnetted, 1 subnets
O       7.0.0.1 [110/3] via 20.2.2.2, 01:39:20, ATM2/0/1
 8.0.0.0/32 is subnetted, 1 subnets
O       8.0.0.1 [110/3] via 20.2.2.2, 01:39:20, ATM2/0/1
 9.0.0.0/32 is subnetted, 1 subnets
O       9.0.0.1 [110/3] via 20.2.2.2, 01:39:21, ATM2/0/1
```

- **show tag-switching tdp neighbor** Use the **show tag-switching tdp *** commands to verify the state of TDP. View neighbors by using the **show tag-switching tdp neighbor** command:

```
Procida#show tag-switching tdp neighbor
Peer TDP Ident: 20.3.3.1:1; Local TDP Ident 4.4.4.4:2
TCP connection: 20.2.2.2.11005 - 20.2.2.1.711
State: Oper; PIEs sent/rcvd: 13/13; Downstream on demand
Up time: 00:05:57
TDP discovery sources:
ATM2/0/1, Src IP addr: 20.2.2.2
```

- **show tag-switching forwarding-table** The tag-switching forwarding-table is the label switching equivalent of the IP routing table for standard IP routing. It contains incoming and outgoing labels and descriptions of the packets. You can check it by using the **show tag-switching forwarding-table** command:

```
Procida#show tag-switching forwarding-table
Local  Outgoing  Prefix          Bytes tag  Outgoing  Next Hop
tag    tag or VC   or Tunnel Id   switched  interface
16     51          20.3.3.0/24    0         AT2/0/1   point2point
17     48          7.0.0.1/32     0         AT2/0/1   point2point
18     49          8.0.0.1/32     0         AT2/0/1   point2point
19     50          9.0.0.1/32     0         AT2/0/1   point2point
```

- **show tag-switching bindings** Use the **show tag-switching atm-tdp bindings** to display the requested entries from the ATM TDP tag binding database.

```

Procida#show tag-switching atm-tdp bindings
Destination: 7.0.0.1/32
    Headend Switch ATM2/0/1 (2 hops) 1/33 Active, VCD=48
Destination: 8.0.0.1/32
    Headend Switch ATM2/0/1 (2 hops) 1/34 Active, VCD=49
Destination: 9.0.0.1/32
    Headend Switch ATM2/0/1 (2 hops) 1/35 Active, VCD=50
Destination: 20.3.3.0/24
    Headend Switch ATM2/0/1 (2 hops) 1/36 Active, VCD=51
Destination: 20.1.1.0/24
    Tailend Switch ATM2/0/1 1/33 Active -> Terminating Active, VCD=52

```

- **show ip cef**

```

Procida#show ip cef 20.1.1.1
20.1.1.1/32, version 40, connected, cached adjacency 20.1.1.1
0 packets, 0 bytes
  via 20.1.1.1, FastEthernet12/0/0, 0 dependencies
    next hop 20.1.1.1, FastEthernet12/0/0
    valid cached adjacency

Procida#show ip cef 7.0.0.1
7.0.0.1/32, version 50, cached adjacency to ATM2/0/1
0 packets, 0 bytes
  tag information set
    local tag: 17
    fast tag rewrite with AT2/0/1, point2point, tags imposed: {48(vcd=48)}
  via 20.2.2.2, ATM2/0/1, 0 dependencies
    next hop 20.2.2.2, ATM2/0/1
    valid cached adjacency
    tag rewrite with AT2/0/1, point2point, tags imposed: {48(vcd=48)}

```

```

Procida#show atm vc interface atm 2/0/1

```

Interface	VPI	VCI	Type	X-Interface	X-VPI	X-VCI	Encap	Status
ATM2/0/1	0	5	PVC	ATM0	0	44	QSAAL	UP
ATM2/0/1	0	16	PVC	ATM0	0	37	ILMI	UP
ATM2/0/1	0	32	PVC	ATM10/0/0	2	42	SNAP	UP
ATM2/0/1	1	33	TVC(O)	ATM10/0/0	2	48	MUX	UP
ATM2/0/1	1	33	TVC(I)	ATM10/0/0	2	52	MUX	UP
ATM2/0/1	1	34	TVC(O)	ATM10/0/0	2	49	MUX	UP
ATM2/0/1	1	35	TVC(O)	ATM10/0/0	2	50	MUX	UP
ATM2/0/1	1	36	TVC(O)	ATM10/0/0	2	51	MUX	UP

Example

The following example is based on the outputs above. Upon reception of a packet destined for 7.0.0.1 on the interface fast-ethernet 12/0/0, the 8540 (Procida) will forward the packet to the controlling ARM2 interface (atm10/0/0) which in turn sends the packet on to the appropriate Tag VC (TVC) (in this case 2/48) which is then switched by the fabric to the TVC 1/33 on atm 2/0/1 (as shown in the output above). Upon reception of a packet for 20.1.1.1 on the interface atm 2/0/1, this packet will be forwarded to the controlling ARM2 which in turn forwards it to the appropriate interface. The Enhanced ARM interface is acting as a "proxy" interface.

Troubleshoot

There is currently no specific troubleshooting information available for this configuration.

Related Information

- [MPLS over ATM: VC Merge](#)
 - [Understanding Session Establishment and Route Exchange in an MPLS-Enabled ATM Core](#)
 - [Understanding Multiprotocol Label Switching \(MPLS\) Label Imposition in an ATM Environment](#)
 - [Implementing MPLS with the Cisco Catalyst 8540](#)
 - [Configuring Basic MPLS Using OSPF](#)
 - [Configuring MPLS over RFC1483 PVCs on the Enhanced ATM Router Module \(ARM\)](#)
 - [More ATM Information](#)
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