Access Circuit Redundancy Support for IMA

The Access Circuit Redundancy Support (ACR) for Inverse Multiplexing over ATM (IMA) feature provides a converged IP or Multiprotocol Label Switching (MPLS) access network for its mobile users that use Radio Access Network (RAN) aggregation.

Inverse Multiplexing over ATM (IMA) breaks up the ATM cell stream and distributes the cells over the multiple physical links of an IMA group and then recombines the cells into a single stream at the other end of the connection. In IP RAN 3G networks, ATM cells received on the access side are transported using Layer 2 Transport over an IP or MPLS cloud using MPLS pseudowires (PWs). SONET-APS is used to provide redundancy at the access side that connects the Base Transceiver Station (BTS) and the Circuit Emulation over Packet (CEoP) card in the aggregation router. The convergence time upon failure in this framework is in seconds. ACR provides ACR for SONET-based clients in a Single Router Automatic Protect Switching (SR APS) environment that ensures data traffic downtime of less than 500 milliseconds in case of switchover.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and 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 table at the end of this module.

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

Prerequisites for ACR Support for IMA

The Access Circuit Redundancy Support for Inverse Multiplexing over ATM feature is supported only on Cisco 7600 routers with Session Initiation Protocol (SIP) 400 line cards and Black Russian (BR) Shared Point Adapters (SPA) (SPA-1CHOC3-CE-ATM).

Restrictions for ACR Support for IMA

- ACR configuration is an extension of APS and works only with an APS configuration.
- ACR support is available only for SR APS.
- There is no provision for migration from the existing physical interface-based configuration, because the entire configuration is on a virtual interface.
- The maximum number of ACR groups is restricted to the maximum number of SONET controllers or BR SPAs supported on a Cisco 7600 router.
- There are only 11 slots of SIP 400 (2 for rendezvous point (RP)) available.
- The absence of dedicated primary and secondary line cards results in port-level redundancy. Each port has to be identified as a primary or secondary.
- ACR can be configured only after all the previous configurations are removed from the physical interface.
- Once a member controller of an ACR group is removed during the online insertion and removal (OIR) process, and replaced with another controller, it cannot be reinserted into the ACR group.

Information About ACR Support for IMA

The aggregation of multiple low-speed links (T1/E1) into one or more IMA groups provides IMA support. The ATM IMA interface appears as one logical ATM interface.

How to Configure ACR Support for IMA

Configuring ACR

Support for ACR has been provided using the **aps** command on the SONET controller. Perform the following steps to configure ACR:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **controller SONET** *slot* / *p-adapter* / *port*
4. **aps group acr** *acr-group-number*
5. **aps working** *channel*
6. **exit**
7. **controller SONET** *slot* / *p-adapter* / *port*
8. **aps group acr** *acr-group-number*
9. **aps protect** *circuit-number* **loopback** *ip-address*
10. **end**

DETAILED STEPS

	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	**controller SONET** *slot* / *p-adapter* / *port* **Example:** `Router(config)# controller SONET 4/1/0`	Selects and configures a SONET controller and enters controller configuration mode.
Step 4	**aps group acr** *acr-group-number* **Example:** `Router(config-controller)# aps group acr 1`	Configures the APS group for a SONET controller and enables the ACR functionality on top of an APS. • The *acr-group-number* range is from 0 to 255.
Step 5	**aps working** *channel* **Example:** `Router(config-controller)# aps working 1`	Configures a Packet over SONET (POS) interface as a working interface.

	Command or Action	Purpose
Step 6	**exit** **Example:** `Router(config-controller)# exit`	Exits controller configuration mode and returns to global configuration mode.
Step 7	**controller SONET** *slot* / *p-adapter* / *port* **Example:** `Router(config)# controller SONET 4/1/0`	Selects and configures a SONET controller and enters controller configuration mode.
Step 8	**aps group acr** *acr-group-number* **Example:** `Router(config-controller)# aps group acr 1`	Configures the APS group for a SONET controller and enables the ACR functionality on top of an APS. • The *acr-group-number* range is from 0 to 255.
Step 9	**aps protect** *circuit-number* **loopback** *ip-address* **Example:** `Router(config-controller)# aps protect 1 loopback 10.7.7.7`	Enables a POS interface as a protect interface.
Step 10	**end** **Example:** `Router(config-controller)# end`	Exits controller configuration mode and returns to privileged EXEC mode.

Configuring IMA Groups on a Virtual Controller

To configure the IMA group on a virtual controller, use the following commands:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **controller SONET-ACR** *slot* / *p-adapter* / *port*
4. **framing sonet**
5. **sts-1** *id-number*
6. **mode** *mode-name*
7. **vtg** *number* *interface interface-number* **ima-group** *group-number*
8. **exit**
9. **exit**
10. **interface IMA-ACR** *group-number* **/ima** *ima-group-id*
11. **pvc** *vpi* / *vci* **l2transport**
12. **xconnect** *peer-id* *vc-id* **encapsulation mpls**
13. **end**

DETAILED STEPS

	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	**controller SONET-ACR** *slot* / *p-adapter* / *port* **Example:** `Router(config)# controller SONET-ACR 4/1/0`	Selects and configures a SONET ACR controller and enters controller configuration mode.
Step 4	**framing sonet** **Example:** `Router(config-controller)# framing sonet`	Specifies SONET framing.

	Command or Action	Purpose
Step 5	**sts-1** *id-number* **Example:** `Router(config-controller)# sts-1 1`	Specifies the Synchronous Transport Signal (STS) identifier and enters STS controller configuration mode.
Step 6	**mode** *mode-name* **Example:** `Router(config-ctrlr-sts1)# mode vt-15`	Configures the STS-1 mode of operation.
Step 7	**vtg** *number* *interface interface-number* **ima-group** *group-number* **Example:** `Router(config-ctrlr-sts1)# vtg 1 t1 1 ima-group 1`	Configures the interface to run in IMA mode and assigns the interface to an IMA group.
Step 8	**exit** **Example:** `Router(config-ctrlr-sts1)# exit`	Exits STS controller configuration mode and returns to controller configuration mode.
Step 9	**exit** **Example:** `Router(config-controller)# exit`	Exits controller configuration mode and returns to global configuration mode.
Step 10	**interface IMA-ACR** *group-number* **/ima** *ima-group-id* **Example:** `Router(config)# interface IMA-ACR1/ima0`	Configures an IMA ACR group and enters interface configuration mode. • The **IMA-ACR** keyword specifies the virtual IMA interface. • The *group-number* argument specifies the ACR group ID. • The *ima-group-id*specifies the IMA group.
Step 11	**pvc** *vpi* / *vci* **l2transport** **Example:** `Router(config-if)# pvc 1/100 l2transport`	Assigns a name to an ATM permanent virtual circuit (PVC), specifies the encapsulation type on an ATM PVC, and enters interface ATM L2 transport PVC configuration mode.

	Command or Action	Purpose
Step 12	**xconnect** *peer-id vc-id* **encapsulation mpls** **Example:** `Router(config-if-atm-l2trans-pvc)# xconnect 10.1.1.1 1234 encapsulation mpls`	Binds an attachment circuit to a pseudowire, configures an Any Transport over MPLS (AToM) static pseudowire and enters interface ATM L2 transport PVC xconnect configuration mode.
Step 13	**end** **Example:** `Router(config-if-atm-l2trans-pvc-xconn)# end`	Exits interface ATM L2 transport PVC xconnect mode and returns to privileged EXEC mode.

Configuring an ATM PVC on an ACR Interface or Group

To create a virtual ATM ACR group or an IMA ACR interface and configure an ATM PVC, use the following commands:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface IMA-ACR** *group-number* **/ima** *ima-group-id*
4. **pvc** *vpi* **/** *vci* **l2transport**
5. **xconnect** *peer-id vc-id* **encapsulation mpls**
6. **end**

DETAILED STEPS

	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 IMA-ACR** *group-number* **/ima** *ima-group-id*	Configures an IMA ACR group and enters interface configuration mode.

	Command or Action	Purpose
	Example: `Router(config)# interface IMA-ACR 1/ima 0`	• The **IMA-ACR** keyword specifies the virtual IMA interface. • The *group-number* argument specifies the ACR group ID. • The *ima-group-id*specifies the IMA group.
Step 4	**pvc** *vpi* / *vci* **l2transport** **Example:** `Router(config-if)# pvc 1/100 l2transport`	Assigns a name to an ATM permanent virtual circuit (PVC), specifies the encapsulation type on an ATM PVC, and enters interface ATM L2 transport PVC configuration mode.
Step 5	**xconnect** *peer-id vc-id* **encapsulation mpls** **Example:** `Router(config-if-atm-l2trans-pvc)# xconnect 10.1.1.1 1234 encapsulation mpls`	Binds an attachment circuit to a pseudowire, configures an AToM static pseudowire and enters interface ATM L2 transport PVC xconnect configuration mode.
Step 6	**end** **Example:** `Router(config-if-atm-l2trans-pvc-xconn)# end`	Exits interface ATM L2 transport PVC xconnect mode and returns to privileged EXEC mode.

Configuring an ATM PVP on an IMA ACR Interface or Group

To create a virtual ATM ACR group or an IMA ACR interface and configure an ATM PVP, use the following commands:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface IMA_ACR** *group-number* **/ima** *ima-group-id*
4. **atm pvp** *vpi* **l2transport**
5. **xconnect** *peer-id vc-id* **encapsulation mpls**
6. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable**	Enables privileged EXEC mode.

	Command or Action	Purpose
	Example: `Router> enable`	• Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface IMA_ACR** *group-number* **/ima** *ima-group-id* **Example:** `Router(config)# interface IMA-ACR 1/ima 0`	Configures an IMA ACR group and enters interface configuration mode. • The **IMA-ACR** keyword specifies the virtual IMA interface. • The *group-number* argument specifies the ACR group ID. • The *ima-group-id*specifies the IMA group.
Step 4	**atm pvp** *vpi* **l2transport** **Example:** `Router(config-if)# atm pvp 100 l2transport`	Assigns a name to an ATM permanent virtual path (PVP), specifies the encapsulation type on an ATM PVP, and enters interface ATM L2 transport PVP configuration mode.
Step 5	**xconnect** *peer-id vc-id* **encapsulation mpls** **Example:** `Router(config-if-atm-l2trans-pvp)# xconnect 10.1.1.1 1234 encapsulation mpls`	Binds an attachment circuit to a pseudowire, configures an AToM static pseudowire and enters interface ATM L2 transport PVP xconnect configuration mode.
Step 6	**end** **Example:** `Router(config-if-atm-l2trans-pvp-xconn)# end`	Exits interface ATM L2 transport PVP xconnect mode and returns to privileged EXEC mode.

Configuration Examples for ACR Support for IMA

Example Configuring ACR and IMA Groups

The following example shows how ACR and IMA groups are configured:

Working ACR Member

```
controller SONET 4/1/0
framing sonet
clock source line
!
sts-1 1
mode vt-15
!
sts-1 2
mode vt-15
!
sts-1 3
mode vt-15
aps group acr 1
aps working 1
```

Protect ACR Member

```
controller SONET 4/3/0
framing sonet
clock source line
!
sts-1 1
mode vt-15
!
sts-1 2
mode vt-15
!
sts-1 3
mode vt-15
aps group acr 1
aps protect 1 10.2.2.2
controller SONET-ACR 1
framing sonet
!
sts-1 1
mode vt-15
!
sts-1 2
mode vt-15
!
sts-1 3
mode vt-15
vtg 1 t1 1 ima-group 0
interface IMA-ACR 1/ima 0
no ip address
pvc 2/34 l2transport
xconnect 10.3.3.3 1234 encapsulation mpls
!
end
```

Example Configuring an IMA ACR Interface on an ATM PVP

The following example shows how an IMA ACR interface on ATM PVP is configured:

```
interface ATM 1/0/0
 aps group acr 1
 aps working 1
!
interface ATM 1/0/1
aps group acr 1
aps protect 1 10.2.2.2
!
interface Loopback 1
 ip address 10.1.1.1 255.255.255.0
```

```
interface ATM-ACR 1
no ip address
atm pvp 10 l2transport
    xconnect 10.2.2.2 1234 encapsulation mpls
```

Example ACR show Command Output

The **show acr group**command lists the status of all active ACR groups:

```
Router# show acr group
ACR Group Working I/f Protect I/f Currently Active Status
-------------------------------------------------------------------------------
1 SONET 4/1/0 SONET 4/3/0 SONET 4/1/0
The show acr group

acr-group-number

command lists the status of a specific ACR group:
Router# show acr group 1
ACR Group Working I/f Protect I/f Currently Active Status
-------------------------------------------------------------------------------
1 SONET 4/1/0 SONET 4/3/0 SONET 4/1/0
```

The **show acr group** *acr-group-number* **detail** command lists the status and details of a specific ACR group:

```
Router# show acr group 1 detail ima
ACR Group Working I/f Protect I/f Currently Active Status
-------------------------------------------------------------------------------
IM1/ima0 ATM4/1/ima0 ATM4/3/ima0 ATM4/1/ima0
ATM PVC Detail
VPI VCI State on Working State on Protect
2 34 Provision Success Unknown
Router#
The show controllers SONET-ACR

slot
/
p-adapter
/
port

command lists the details of the active controllers:
Router# show controllers sonet 4/1/0
SONET 4/1/0 is up.
Hardware is SPA-1CHOC3-CE-ATM
Applique type is Channelized Sonet/SDH
Clock Source is Line
Medium info:
  Type: Sonet, Line Coding: NRZ,
 SECTION:
  LOS = 0          LOF = 0                          BIP(B1) = 13
SONET/SDH Section Tables
  INTERVAL       CV    ES   SES  SEFS
  06:13-06:28     0     0     0     0
  05:58-06:13     0     0     0     0
  05:43-05:58     0     0     0     0
  .
  .
  .
  23:43-23:58     0     0     0     0
  23:28-23:43     0     0     0     0
  06:13-06:28     0     0     0     0
Total of Data in Current and Previous Intervals
  06:13-06:28     0     0     0     0
LINE:
  AIS = 0          RDI = 0          REI = 351390     BIP(B2) = 23
Active Defects: None
Active Alarms: None
Alarm reporting enabled for: SLOS SLOF
```

```
Defect reporting enabled for: SF B1-TCA B2-TCA
BER thresholds:  SF = 10e-3  SD = 10e-6
TCA thresholds:  B1 = 10e-6  B2 = 10e-6
SONET/SDH Line Tables
  INTERVAL       CV    ES   SES   UAS
  06:13-06:28     0     0     0     0
  05:58-06:13     0     0     0     0
  05:43-05:58     0     0     0     0
  .
  .
  .
  Total of Data in Current and Previous Intervals
  06:13-06:28     0     0     0     0
High Order Path:
PATH 1:
  AIS = 0          RDI = 1          REI = 2302655982 BIP(B3) = 3659922183
  LOP = 0          PSE = 32         NSE = 0          NEWPTR = 0
  LOM = 0          PLM = 0          UNEQ = 0
Active Alarms: None
Active Defects: PRDI B3-TCA
Alarm/Defect reporting enabled for: PLOP LOM B3-TCA
TCA threshold:  B3 = 10e-6
Rx: S1S0 = 02, C2 = 02
    K1 = 00,   K2 = 00
    J0 = 01
Tx: S1S0 = 00, C2 = 02
    K1 = 00,   K2 = 00
    J0 = 01
PATH TRACE BUFFER : STABLE
  45 32 20 32 2F 33 2F 30 2E 31 00 00 00 00 E6 50     E2 2/3/0.1.....P
  45 32 20 32 2F 33 2F 30 2E 31 00 00 00 00 E6 50     E2 2/3/0.1.....P
  45 32 20 32 2F 33 2F 30 2E 31 00 00 00 00 E6 50     E2 2/3/0.1.....P
  45 32 20 32 2F 33 2F 30 2E 31 00 00 00 00 E6 50     E2 2/3/0.1.....P

SONET/SDH Path Tables
.
```

The **show ima**command lists the details of IMA activation on the active interfaces:

```
Router# show ima
ATM4/1/ima0 is up, ACTIVATION COMPLETE
Slot 4 Slot Unit 64 unit 256, CTRL VC 256, Vir -1, VC 4097
IMA Configured BW 1523, Active BW 1523
IMA version 1.1, Frame length 128
Link Test: Disabled
Auto-Restart: Disabled
ImaGroupState: NearEnd = operational, FarEnd = operational
ImaGroupFailureStatus = noFailure
IMA Group Current Configuration:
ImaGroupMinNumTxLinks = 1 ImaGroupMinNumRxLinks = 1
ImaGroupDiffDelayMax = 25 ImaGroupNeTxClkMode = common(ctc)
ImaGroupFrameLength = 128 ImaTestProcStatus = disabled
ImaGroupTestLink = None ImaGroupTestPattern = 0x0
ImaGroupConfLink = 1 ImaGroupActiveLink = 1
IMA Link Information:
ID Link Link State - Ctlr/Chan/Prot Test Status
---- -------------- ------------------------------ ---------------
0 VT1.5 3/1/1 Up Up Up Up disabled
ATM4/3/ima0 is up, ACTIVATION COMPLETE
Slot 4 Slot Unit 192 unit 256, CTRL VC 256, Vir -1, VC 4097
IMA Configured BW 1523, Active BW 1523
IMA version 1.1, Frame length 128
Link Test: Disabled
Auto-Restart: Disabled
ImaGroupState: NearEnd = startUp, FarEnd = groupStateUnknown
ImaGroupFailureStatus = startUpNe
IMA Group Current Configuration:
ImaGroupMinNumTxLinks = 1 ImaGroupMinNumRxLinks = 1
ImaGroupDiffDelayMax = 25 ImaGroupNeTxClkMode = common(ctc)
ImaGroupFrameLength = 128 ImaTestProcStatus = disabled
ImaGroupTestLink = None ImaGroupTestPattern = 0x0
ImaGroupConfLink = 1 ImaGroupActiveLink = 0
IMA Link Information:
```

```
ID Link Link State - Ctlr/Chan/Prot Test Status
---- -------------- ------------------------------ ---------------
0 VT1.5 3/1/1 Up Up Up Up disabled
IMA-ACR1/ima0 is up, CONFIG COMPLETE
Slot 14 Slot Unit 1 unit 256, CTRL VC 256, Vir -1, VC 4097
IMA Configured BW 1523, Active BW 1523
IMA version 1.1, Frame length 128
Link Test: Disabled
Auto-Restart: Disabled
ImaGroupState: NearEnd = operational, FarEnd = operational
ImaGroupFailureStatus = noFailure
IMA Group Current Configuration:
ImaGroupMinNumTxLinks = 1 ImaGroupMinNumRxLinks = 1
ImaGroupDiffDelayMax = 25 ImaGroupNeTxClkMode = common(ctc)
ImaGroupFrameLength = 128 ImaTestProcStatus = disabled
ImaGroupTestLink = None ImaGroupTestPattern = 0x0
ImaGroupConfLink = 1 ImaGroupActiveLink = 1
IMA Link Information:
ID Link Link State - Ctlr/Chan/Prot Test Status
---- -------------- ------------------------------ ---------------
0 VT1.5 3/1/1 Up Up Up Up disabled
```

The **show ima interface** *interface-name* **IMA-ACR**command lists the details of IMA-ACR activation on a specific interface:

```
Router# show ima interface IMA-ACR 1/ima 0
IMA-ACR1/ima0 is up, CONFIG COMPLETE
Slot 14 Slot Unit 1 unit 256, CTRL VC 256, Vir -1, VC 4097
IMA Configured BW 1523, Active BW 1523
IMA version 1.1, Frame length 128
Link Test: Disabled
Auto-Restart: Disabled
ImaGroupState: NearEnd = operational, FarEnd = operational
ImaGroupFailureStatus = noFailure
IMA Group Current Configuration:
ImaGroupMinNumTxLinks = 1 ImaGroupMinNumRxLinks = 1
ImaGroupDiffDelayMax = 25 ImaGroupNeTxClkMode = common(ctc)
ImaGroupFrameLength = 128 ImaTestProcStatus = disabled
ImaGroupTestLink = None ImaGroupTestPattern = 0x0
ImaGroupConfLink = 1 ImaGroupActiveLink = 1
IMA Link Information:
ID Link Link State - Ctlr/Chan/Prot Test Status
---- -------------- ------------------------------ ---------------
0 VT1.5 3/1/1 Up Up Up Up disabled
```

Additional References for ATM OAM Traffic Reduction

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
ATM commands	*Cisco IOS Asynchronous Transfer Mode Command Reference*

MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
None	--

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for ACR Support for IMA

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

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

Table 1: Feature Information for Access Circuit Redundancy Support for Inverse Multiplexing over ATM

Feature Name	Releases	Feature Information
Access Circuit Redundancy Support for Inverse Multiplexing over ATM	15.1(1)S	The Access Circuit Redundancy Support for IMA over ATM feature provides a converged IP or MPLS access network for its mobile users that use RAN aggregation.