

Troubleshooting ATM Links on the 7x00 IMA Port Adapter

Document ID: 10463

Introduction

Prerequisites

Requirements

Conventions

To Understand Show Ima Output

Status of the State Machine

IMA Group Current Configuration

IMA MIB Information

IMA Group Counters

Physical Link Counters

IMA Link Counters

To Understand Show Controllers Output

Known Issues

Line Protocol Down on Physical Interface

Active-Links-Minimum for Bandwidth

Supported MIBs

Related Information

Introduction

Before you can ping across an inverse-multiplexing-over-ATM (IMA) interface, you need to ensure that both the IMA logical interface and the physical interfaces that make up that IMA logical interface are up and active. In some cases, these interfaces do not show as up/up in the output of the **show interface** command. There are two key commands to help determine the error condition:

- **show ima interface atm{mod}/ima{group#} detail** – Provides IMA-specific information on both the IMA group interface and the composing physical interfaces.
- **show controllers atm {mod/port}** (7200 Series) or **show controller vip <slot#> tech** (7500 Series) – Provides detailed information on the physical interfaces and the ATM segmentation and reassembly (SAR).

This document explains the values you can see in the output of these commands. Much of the information used in this document is defined in Appendix A of AF-PHY-0086.001, which is the specification for the IMA of the ATM Forum. Click here to download the IMA and other approved specifications.

Prerequisites

Requirements

There are no specific requirements for this document.

Conventions

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

To Understand Show Ima Output

The **show ima interface atm** command displays four sets of information that can help troubleshoot IMA link problems:

- Near end status, far end status, and group status
- IMA group current configuration
- IMA MIB information
- IMA group counters

```
Router#show ima interface atm 1/ima0 detail
  ATM1/ima0 is up
    ImaGroupState:NearEnd = operational, FarEnd = operational
    ImaGroupFailureStatus = noFailure
  IMA Group Current Configuration:
    ImaGroupMinNumTxLinks = 2      ImaGroupMinNumRxLinks = 2
    ImaGroupDiffDelayMax = 25     ImaGroupNeTxClkMode = common(ctc)
    ImaGroupFrameLength = 128     ImaTestProcStatus = disabled
    ImaGroupTestLink = 0          ImaGroupTestPattern = 0xFF
  IMA MIB Information:
    ImaGroupSymmetry = symmetricOperation
    ImaGroupFeTxClkMode = common(ctc)
    ImaGroupRxFrameLength = 128
    ImaGroupTxTimingRefLink = 0     ImaGroupRxTimingRefLink = 0
    ImaGroupTxImaId = 0             ImaGroupRxImaId = 0
    ImaGroupNumTxCfgLinks = 2       ImaGroupNumRxCfgLinks = 2
    ImaGroupNumTxActLinks = 2       ImaGroupNumRxActLinks = 2
    ImaGroupLeastDelayLink = 1      ImaGroupDiffDelayMaxObs = 0
  IMA group counters:
    ImaGroupNeNumFailures = 78      ImaGroupFeNumFailures = 68
    ImaGroupUnAvailSecs = 441453   ImaGroupRunningSecs = 445036
```

These sections explain each of the subsections in more detail.

Status of the State Machine

Both physical ATM T1 interfaces and the IMA virtual group interface follow a state machine, in which the interface moves through several states before it becomes active. IMA group interfaces start in the Not Configured state and then enter the Start-up state.

Note: The state machine is defined separately for both the near end the far end.

```
  ATM1/ima0 is up
    ImaGroupState:NearEnd = operational, FarEnd = operational
    ImaGroupFailureStatus = noFailure
```

State	Description
Not Configured	The IMA group does not exist.
Start-up	The near end waits to receive indication that the far end is in Start-up. The IMA group

	moves to the Start-up-Ack state when it can communicate with the far end and has recorded IMA ID, group symmetry, and other IMA group parameters.
Start-up-Ack	When both sides of the link are enabled, they move through this state to the Insufficient-Links state.
Config-Aborted	The far-end uses unacceptable configuration parameters, such as an unsupported IMA frame size, an incompatible group symmetry, or an unsupported IMA version.
Insufficient-Links	The near end has accepted the far end group parameters, but the far end does not have sufficient links to move into the Operational state.
Blocked	The group is blocked, even though sufficient links are active in both directions.
Operational	The group is not inhibited and has sufficient links in both directions. The IMA interface can receive ATM layer cells and pass them from the IMA sublayer to the ATM layer.

IMA Group Current Configuration

This output provides the equivalent SNMP object ID of a configuration setting for your ATM IMA interface. Each parameter uses a default setting.

IMA Group Current Configuration:

```

ImaGroupMinNumTxLinks = 2      ImaGroupMinNumRxLinks = 2
ImaGroupDiffDelayMax = 25     ImaGroupNeTxClkMode = common(ctc)
ImaGroupFrameLength = 128     ImaTestProcStatus = disabled
ImaGroupTestLink = 0          ImaGroupTestPattern = 0xFF

```

MIB Value	Explanation
ImaGroupMinNumTxLinks	Minimum number of transmit links required to be Active for the IMA group to be in the Operational state.
ImaGroupMinNumRxLinks	Minimum number of receive links required to be Active for the IMA group to be in the Operational state.
ImaGroupDiffDelayMax	Maximum number of milliseconds of differential delay among the links that can be tolerated on this interface. If a link delay exceeds the specified maximum, the link is

	dropped.
ImaGroupNeTxClkMode	<p>The transmit clocking mode used by the near-end IMA group has two modes:</p> <ul style="list-style-type: none"> • Common – If all the links in the group share a clock source. • Independent – If all the links use a different clock source.
ImaGroupFrameLength	Number of ATM cells in a single IMA frame. The default value is 128. IMA frames are numbered sequentially, and each contains an IMA Control Protocol (ICP) cell at a specific position.
ImaTestProcStatus	Status of test pattern procedure tests. Use the ima test [link port] [pattern pattern-id] command to enable the test procedure tests on your PA-A3-8T1IMA adapter. Click here for more information.
ImaGroupTestLink	Designates an interface as the test link for use in the test pattern procedure.
ImaGroupTestPattern	Specifies the transmit test pattern in an IMA group loopback operation. A value in the range of zero to 255 designates a specific pattern.

IMA MIB Information

IMA MIB Information:

```

ImaGroupSymmetry           = symmetricOperation
ImaGroupFeTxClkMode       = common(ctc)
ImaGroupRxFrameLength     = 128
ImaGroupTxTimingRefLink   = 0           ImaGroupRxTimingRefLink = 0
ImaGroupTxImaId           = 0           ImaGroupRxImaId           = 0
ImaGroupNumTxCfgLinks     = 2           ImaGroupNumRxCfgLinks    = 2
ImaGroupNumTxActLinks     = 2           ImaGroupNumRxActLinks    = 2
ImaGroupLeastDelayLink    = 1           ImaGroupDiffDelayMaxObs  = 0

```

MIB Value	Explanation
ImaGroupSymmetry	Group symmetry mode, which can be one of three states. The default mode is symmetric configuration and operation, in which the router only can use

	links for which both the transmit and receive state on each end is Active.
ImaGroupFeTxClkMode	Transmit clocking mode used by the far-end IMA group.
ImaGroupRxFrameLength	Value of IMA frame length as received from the far-end.
ImaGroupTxTimingRefLink	Interface index (ifIndex) of the transmit timing reference link to be used by the near-end for IMA data cell clock recovery from the ATM layer.
ImaGroupRxTimingRefLink	Interface index (ifIndex) of the transmit timing reference link to be used by the near-end for IMA data cell clock recovery toward the ATM layer.
ImaGroupTxImaId	IMA ID currently in use by the near-end IMA function.
ImaGroupRxImaId	IMA ID currently in use by the far-end IMA function.
ImaGroupNumTxCfgLinks	Number of links that are configured to transmit in this IMA group.
ImaGroupNumRxCfgLinks	Number of links that are configured to receive in this IMA group.
ImaGroupNumTxActLinks	Number of links that are configured to transmit and are currently in the Active state in this IMA group.
ImaGroupNumRxActLinks	Number of links that are configured to receive and are currently in the Active state in this IMA group.
ImaGroupLeastDelayLink	Interface index (ifIndex) of the member link which has the smallest link propagation delay. A value of zero can be used if no link has been configured in the IMA group, or if the link with the smallest link propagation delay has not yet been determined.
ImaGroupDiffDelayMaxObs	Latest maximum differential delay observed (in milliseconds) between the links that has the

<p>least and the most link propagation delay, among the receive links that are currently configured in the IMA group.</p>

IMA Group Counters

IMA group counters:

```

ImaGroupNeNumFailures = 78      ImaGroupFeNumFailures = 68
ImaGroupUnAvailSecs   = 441453 ImaGroupRunningSecs = 445036

```

MIB Value	Explanation
ImaGroupNeNumFailures	Number of times that a near-end group failure has been reported since power-up or reboot. Failure states include Config-Aborted, Insufficient-Links, and other states described in the table in the Status of the State Machine section.
ImaGroupFeNumFailures	Number of times that a far-end group failure has been reported since power-up or reboot. Failure states include Config-Aborted, Insufficient-Links, and other states described in the table in the Status of the State Machine section.
ImaGroupUnAvailSecs	Number of one-second intervals where the IMA group traffic state machine was down.
ImaGroupRunningSecs	Amount of time in seconds since this IMA group has been in the Operational state.

Physical Link Counters

An IMA interface builds an IMA link table that contains status information about a link, which is part of an IMA group. Each link is assigned an interface index (IfIndex), which network management stations use to poll for statistics or set configuration parameters.

```

ATM1/0 is up
  ImaLinkRowStatus = LinkRowStatusUnknown
  ImaLinkIfIndex   = 0          ImaLinkGroupIndex= 0
  ImaLinkState:
    NeTx = active
    NeRx = active
    FeTx = active
    FeRx = active
  ImaLinkFailureStatus:
    NeRx = noFailure
    FeRx = noFailure
  ImaLinkTxLid     = 0          ImaLinkRxLid = 0
  ImaLinkRxTestPattern = 65    ImaLinkTestProcStatus = disabled

```

MIB Value	Explanation
ImaLinkTxLid	Outbound link ID (LID) used currently on the link by the local end. This value has significance only if the link belongs to an IMA group.
ImaLinkRxLid	Inbound link ID used currently on the link by the remote end as reported through IMA control protocol (ICP) cells. This value has significance only if the link belongs to an IMA group.
ImaLinkRxTestPattern	Specifies the transmit test pattern in an IMA group loopback operation. A value in the range of zero to 255 designates a specific pattern.
ImaLinkTestProcStatus	Status of test pattern procedure tests. Use the ima test [link port] [pattern pattern-id] command to enable the test procedure tests on your PA-A3-8T1IMA adapter. Click here for more information.
ImaLinkRelDelay	Latest measured delay on this link relative to the link, in the same IMA group, with the least delay.

An IMA interface follows a state machine, in which the interface moves through several states before it becomes active. Special cells, called IMA control protocol (ICP) cells, carry the state information between the two ends. This table explains the possible states:

IMA Link State	Explanation
Not in group	The link is not configured to be an IMA group member.
Unusable	The link is configured to be an IMA group member, but it is not in use due to fault, inhibition, etc. Link error conditions, such as physical links or IMA errors, and vendor-dependent conditions, such as the exceedance of a certain bit error rate (BER), can lead to an unusable state.
Usable	The link is ready to operate but waits for the other end to be usable or active.
Active	The link can pass ATM layer cells to and from the ATM layer.
Blocking	(Receive state only.) The link transitions to the Unusable state. The sub-state Blocking allows a graceful transition into the Unusable state without a

loss of ATM cells.

When the near end reaches a Usable receive state, it moves into an Active receive state only if the far end (FE) reports a Usable transmit state. Similarly, when the near end reaches a Usable transmit state, it moves into an Active transmit state only if the far end reports an Active receive state.

Note: IMA defines separate states for the transmit and receive directions at each end, and each end can report a different state.

IMA Link Counters

IMA Link counters :

ImaLinkImaViolations	= 1		
ImaLinkNeSevErroredSec	= 41	ImaLinkFeSevErroredSec	= 34
ImaLinkNeUnavailSec	= 441505	ImaLinkFeUnAvailSec	= 28
ImaLinkNeTxUnusableSec	= 2	ImaLinkNeRxUnUsableSec	= 441542
ImaLinkFeTxUnusableSec	= 74	ImaLinkFeRxUnusableSec	= 57
ImaLinkNeTxNumFailures	= 0	ImaLinkNeRxNumFailures	= 15
ImaLinkFeTxNumFailures	= 4	ImaLinkFeRxNumFailures	= 3

In order to understand the counters in the table requires you to understand these terms:

- Unavailable second (UAS) – A second in which the interface was not available because the router detected 10 contiguous severely errored seconds or a condition that led to a failure.
- Severely errored second (SES) – A second with one or more out of frame defects or a detected alarm indication signal (AIS) defect.
- Unusable – An ATM physical interface enters the UnusableFailed state when it is configured to be a member of an IMA group, but it cannot be used because of one of these fault conditions:
 - ◆ Link Defects – Interface experiences loss of signal, loss of frame, alarm indication signal, or loss of cell delineation.
 - ◆ Loss of IMA Frame (LIF) – Interface experiences an out of IMA frame (OIF) or loss of synchronization state for at least two IMA frames. When this fault condition is active, the IMA sublayer replaces all received data cells with filler cells.
 - ◆ Loss of Delay Synchronization (LODS) – Interface has detected that the timing delay between this link and other links in the IMA group has exceeded the configured maximum value. This value ranges from 25 to 250 milliseconds. Normally, the IMA protocol adjusts for differences in delay so that all links in a group actively carry network traffic. Otherwise, an ATM interface that exceeds the differential timing delay max value is removed from the IMA group. Refer to Troubleshooting Bouncing IMA Links for more information.

IMA Link Counter	Explanation
ImaLinkImaViolations	Number of errored, invalid, or omitted ICP cells, except within severely errored second (SES) or unavailable seconds (UAS) fault conditions.
ImaLinkNeSevErroredSec	Number of one-second intervals with one of these fault conditions: <ul style="list-style-type: none">• 30% or more invalid ICP

	<p>cells</p> <ul style="list-style-type: none"> • Link defects such as loss of signal, loss of frame, alarm indication signal, or loss of cell delineation • IMA defects such as loss of IMA framing (LIF) or loss of delay synchronization (LODS)
ImaLinkNeUnavailSec	Number of unavailable seconds at the near end. Unavailability begins when ten contiguous severely errored seconds are recorded by the ATM interface.
ImaLinkNeTxUnusableSec	Number of transmit unusable seconds at the near end.
ImaLinkFeTxUnusableSec	Number of transmit unusable seconds at the far end.
ImaLinkNeTxNumFailures	Number of times that a near-end transmit failure alarm condition has been entered on this link (that is, some form of implementation-specific transmit fault).
ImaLinkFeTxNumFailures	Number of times the far-end transmit failure alarm condition has been entered on this link (that is, some form of implementation-specific transmit fault).
ImaLinkFeSevErroredSec	Number of one-second intervals with one or more remote defect indicator (RDI) defects.
ImaLinkFeUnAvailSec	Number of unavailable seconds at the far end. Unavailability begins when ten contiguous severely errored seconds are recorded by the ATM interface.
ImaLinkNeRxUnusableSec	Number of receive unusable seconds at the near end.
ImaLinkFeRxUnusableSec	Number of receive unusable seconds at the far end.
ImaLinkNeRxNumFailure	Number of near-end receive failure alarm conditions.
ImaLinkFeRxNumFailures	Number of far-end receive failure alarm conditions.

To Understand Show Controllers Output

The PA-A3-8T1IMA uses the ATMizer II segmentation and reassembly (SAR) chip. The name of the SAR is displayed in the output of **show controllers atm**.

```
7200-2#show controller atm 3/0
Interface ATM3/0 is up
Hardware is ENHANCED ATM PA - DS3 (45Mbps)
Lane client mac address is 0030.7ble.9054
Framer is PMC PM7345 S/UNI-PDH, SAR is LSI ATMIZER II
Firmware rev: G119, Framer rev: 1, ATMIZER II rev: 3
  idb=0x61499630, ds=0x6149E9C0, vc=0x614BE940
  slot 3, unit 2, subunit 0, fci_type 0x005B, ticks 73495
  400 rx buffers: size=512, encap=64, trailer=28, magic=4
[snip]
```

This simple diagram illustrates the path that bits take when they are received from the physical wire at the PA-A3-8T1IMA.

Note: There are various locations inside the system where cells and reassembled packets are stored.

```
DS1 -> PMC PM734 S/UNI-PDH -> ATMizer II SAR Rx cell buffer -> PCI bus -> RX host buffers
```

The **show controllers interface atm{mod#}/ima{group#}** command displays several important values. These values are highlighted in bold:

```
Curr Stats:
  rx_cell_lost=0, rx_no_buffer=0, rx_crc_10=0
  rx_cell_len=0, rx_no_vcd=0, rx_cell_throttle=0, tx_aci_err=0
```

Counter	Explanation
rx_cell_lost	Number of times that the SAR detected lost or misinserted cells through a comparison of the accumulated payload length, X, with the payload length, LenCell, extracted from the length field of the AAL5 trailer. The accumulated payload length is the number of received cells since the last cell with the end-of-AAL5-PDU bit set to one multiplied by 48. (The third bit of the payload type identifier (PTI) field indicates whether the cell is the final cell of a higher-layer data frame.)
rx_no_buffer	Number of times that a packet buffer was not available to store an inbound cell. In this condition, the router drops the complete packet inside the onboard memory of the PA-A3. Note: The packet never makes it to the host memory on the Network Processing Engine (NPE) or Versatile Interface Processor (VIP).
rx_crc_10	Number of times that an ATM cell failed the CRC-10 checksum used by operation,

	administration, and maintenance (OAM) cells, RM cells, and AAL3/4 packets.
rx_cell_len	Number of times that the received cell payload length was less than 48 bytes.
rx_no_vcd	Number of times that the PA–A3 received a cell without a correspondent virtual circuit descriptor (VCD) in its local VC table.
rx_cell_throttle	Number of times that the PA–A3 microcode cannot handle the inbound cell rate and proactively dropped cells. Internally, the PA–A3 owns 73 cell buffers and starts to throttle the interface if the total cell buffer usage exceeds the preset high water mark.

Known Issues

Line Protocol Down on Physical Interface

Before Cisco IOS® Software Release 12.0(11)S and 12.1(3)E, ATM physical interfaces configured as a member of an IMA group were able to have a "line protocol is down" status even though the IMA interface was up/up and passed traffic without any problems. This state was able to occur on the Cisco 7200 Router Series because the ATM interfaces are the raw links, and all protocol–related configuration is done on the virtual IMA interface. Cisco Bug ID CSCdr22203 changed this default behavior on the 7200 Router. On the Cisco 7500 and 3600 Series, the line protocol status on the ATM physical interfaces is brought up when the links are operational.

Active–Links–Minimum for Bandwidth

Originally, the bandwidth of an IMA group interface was limited to the minimum number of active IMA links needed to keep the IMA interface up. The command to define this value is **ima active–links–minimum**. For example, if four physical ATM interfaces are configured as members of IMA group zero and the **ima active–links–minimum** value is set to one, the bandwidth is equal to one T1 or 1.5Mbps, not 6 Mbps.

Cisco Bug ID CSCdr12395 changes this behavior. Now the PA–A3–8T1IMA adapter uses the bandwidth of all up/up ATM physical interfaces configured as IMA group members.

Cisco bug IDs CSCdt67354 and CSCdv67523 are subsequent enhancement requests to update the IMA group VC bandwidth when an interface is added or removed from the IMA group, shut/no shut, or bounces due to a link failure or change at the remote end. The changes implemented in CSCdr12395 configure the IMA group bandwidth to the total bandwidth of its member links only when the IMA group comes up. Changes to the IMA group after the initial up status are not reflected.

Supported MIBs

The IMA port adapter supports the IMA MIB and the DS1 MIB (Request for Comments [RFC] 1406) when used in either the 7200 Series or 7500 Series. (We recommend that you use Cisco IOS 12.2 or 12.2T for the latest functionality.) Refer to the Cisco MIBs page.

In this sample output, we use the **snmpwalk** command from a UNIX workstation to poll the IMA MIB variables on a router with an IP address of 10.1.1.1.

```
# snmpwalk -m all 10.1.1.1 public imaGroupNumber
enterprises.atmForum.atmForumNetworkManagement.atmfIma.atmfImaMib.atmfImaMib
Objects.imaGroupNumber.0 = 1

# snmpwalk -m all -O s 10.1.1.1 public atmfImaMibObjects
imaGroupNumber.0 = 1
imaGroupRowStatus.126 = active(1)
imaGroupIfIndex.126 = 126
imaGroupNeState.126 = operational(9)
imaGroupFeState.126 = operational(9)
imaGroupFailureStatus.126 = noFailure(1)
imaGroupSymmetry.126 = symmetricOperation(1)
imaGroupMinNumTxLinks.126 = 1
imaGroupMinNumRxLinks.126 = 1
imaGroupNeTxClkMode.126 = ctc(1)
[output omitted]
imaLinkInvalidIntervals.2 = 0
imaLinkInvalidIntervals.3 = 0
imaLinkTimeElapsed.1 = 0
imaLinkTimeElapsed.2 = 0
imaLinkTimeElapsed.3 = 0
```

Related Information

- [Understanding ATM over E1 Framing Formats on IMA Interfaces](#)
- [Inverse Multiplexing over ATM on Cisco 7X00 Routers and ATM Switches](#)
- [Tools and Utilities – Cisco Systems](#)
- [Technical Support & Documentation – Cisco Systems](#)

All contents are Copyright © 1992–2006 Cisco Systems, Inc. All rights reserved. Important Notices and Privacy Statement.

Updated: Jan 01, 2007

Document ID: 10463
