CHAPTER 20

Asynchronous Transfer Mode

This chapter describes the level of support that Cisco ANA provides for ATM, as follows:

Technology Description

This section provides the following ATM technology descriptions:

Please see Part 1: Cisco VNEs in this guide for information about which devices support the various technologies.

ATM

ATM is a cell-switching and multiplexing technology that combines the benefits of circuit switching (guaranteed capacity and constant transmission delay) with those of packet switching (flexibility and efficiency for intermittent traffic). It provides data link (Layer 2) services with scalable bandwidth from a few megabits per second (Mb/s) to many gigabits per second (Gb/s), which usually run over SONET/SDH physical (Layer 1) links.

ATM networks consist of ATM switches interconnected by point-to-point ATM links or interfaces and are fundamentally connection oriented, which means that a virtual channel (VC) must be set up across the ATM network prior to any data transfer.

IMA

Inverse Multiplexing over ATM (IMA) involves inverse multiplexing and demultiplexing of ATM cells in a cyclical fashion among physical links grouped to form a higher bandwidth and logical link. The rate of the logical link is approximately the sum of the rate of the physical links in the IMA group. Streams of cells are distributed in a round-robin manner across the multiple T1/E1 links and reassembled at the destination to form the original cell stream. Sequencing is provided using IMA Control Protocol (ICP) cells.

The ATM cell stream received from the ATM layer is distributed on a cell-by-cell basis across the multiple links within the IMA group. At the far end, the receiving IMA unit reassembles the cells from each link on a cell-by-cell basis, recreates the original ATM cell stream, and passes it to the ATM layer.

IP over ATM, Ethernet over ATM (MPoA)

IP over ATM (MPoA 1483R) and Ethernet over ATM (MPoA 1483B) are both implementations of Multi protocol over ATM (MPoA), an ATM Forum standard that provides for routing of legacy protocols (such as IP and Ethernet) over ATM networks.

Based on ATM UNI signaling, and integrating LANE and Next Hop Resolution Protocol (NHRP), MPoA preserves the benefits of LANE while allowing intersubnet, internetwork layer protocol communication over virtual channel connections (VCCs). Unlike LANE, it requires no routers in the data path. MPoA provides a framework for effectively synthesizing bridging and routing with ATM in an environment of diverse protocols, network technologies, and IEEE 802.1 VLANs. MPoA can use routing and bridging information to locate optimal exits from the ATM cloud and allows the physical separation of internetwork layer route calculation and forwarding (virtual routing).

MPoA defines two components—MPoA Clients (MPCs) and MPoA Servers (MPSs)—and the protocols that are required to communicate and receive services. An MPS is a router component, and requires a Next Hop Server (NHS) and interfaces to one or more LAN Emulation Clients (LECs). This MPS route server performs the routing calculations and sends its results to the ATM switches and edge devices, which perform high-speed forwarding of IP datagrams and Ethernet packets.

ATM Cross Connect

ATM networks are based on virtual connections over a high-bandwidth medium. By using cross-connects to interconnect virtual path or virtual channel links, it is possible to build an end-to-end virtual connection.

An ATM cross-connect can be mapped at either of the following levels:

- Virtual path—Cross-connecting two virtual paths maps one Virtual Path Identifier (VPI) on one port to another VPI on the same port or a different port.
- Virtual channel—Cross-connecting at the virtual channel level maps a Virtual Channel Identifier (VCI) of one virtual channel to another VCI on the same virtual path or a different virtual path.

Cross-connect tables translate the VPI and VCI connection identifiers in incoming ATM cells to the VPI and VCI combinations in outgoing ATM cells.

Information Model Objects (IMOs)

This section describes the following IMOs:

- ATM Interface (IAtm)
- ATM Virtual Connection (IAtmVc)
- Inverse Multiplexing for ATM (IMA) Group (IIMAGroup)
- ATM Traffic Descriptor (IAtmTrafficDescriptor)
- ATM Traffic Shape Descriptor (IAtmTrafficShapingDescriptor)
- Virtual Connection Switching Entity (IVcSwitchingEntity)

ATM Interface

The data link layer ATM Interface object aggregates multiple ATM Virtual Connections by its VC Table attributes. It is bound by its Containing Termination Points attribute to a physical layer interface. It is accessed primarily by the VC Encapsulation Multiplexer bound by its Contained Connection Termination Points attribute.

Table 20-1 ATM Interface (IAtm)

Attribute Name	Attribute Description	Scheme	Polling Interval
ATM Address	ATM 20-byte address (*Address Prefix* | *MAC Address* | *Address Selector*)	Any	Configuration
Interface Type	ATM interface type (*N/A, UNI, Private UNI, Public UNI, NNI, Private NNI, Public NNI, STI, Unconfigured, VNNI, VUNI, EVNNI, EVUNI, VP TRUNK UNI*)	Any	Configuration
VP and VC Ranges	Numeric ranges of the allowed Virtual Path Identifier/Virtual Channel Identifier (VPI/VCI) values	Any	Configuration
VC Table	Array of ATM Virtual Connections	Any	Configuration
Cross Connect Table	Array of Virtual Cross Connections	Any	Configuration
IANA Type	Internet Assigned Numbers Authority (IANA) type of the sublayer	N/A	N/A
Containing Termination Points	Underlying termination points (connection or physical)	Any	N/A
Contained Connection Termination Points	Bound connection termination points	Any	N/A
Tx Allocated Bandwidth	ATM allocated transmit bandwidth	Product	Configuration
Tx Maximum Bandwidth	ATM maximum transmit bandwidth	Product	Configuration
Tx UBR Allocated Bandwidth	ATM allocated transmit bandwidth at unspecified bit rate	Product	Configuration
Tx CBR Allocated Bandwidth	ATM allocated transmit bandwidth at constant bit rate	Product	Configuration
Rx Allocated Bandwidth	ATM allocated receive bandwidth	Product	Configuration
Rx Maximum Bandwidth	ATM maximum transmit bandwidth	Product	Configuration
Rx UBR Allocated Bandwidth	ATM allocated transmit bandwidth at unspecified bit rate	Product	Configuration
Rx CBR Allocated Bandwidth	ATM allocated transmit bandwidth at constant bit rate	Product	Configuration

ATM Virtual Connection

The data link layer ATM Virtual Connection object is bound by its Containing Termination Points attribute to a data link layer ATM Interface object. It is accessed primarily by the Virtual Cross Connection and data link layer VC Encapsulation, but is not bound to any of them by any of its attributes.

Table 20-2 ATM Virtual Connection (IAtmVc)

Attribute Name	Attribute Description	Scheme	Polling Interval
Virtual Channel Identifier	Virtual Channel Identifier (VCI)	Any	Configuration
Virtual Path Identifier	Virtual Path Identifier (VPI)	Any	Configuration
Shaping Profile	Shaping profile (ATM Traffic Shape Descriptor)	Any	Configuration
Discarded and Received Input Data Counters	Discarded and received input octets and reassembled packet counters	Any	Topology L2
Dropped and Forward Output Data Counters	Dropped and forwarded output octets and reassembled packet counters	Any	Topology L2
Ingress Traffic Descriptor	Ingress traffic descriptor (ATM Traffic Descriptor)	Any	Configuration
Egress Traffic Descriptor	Egress traffic descriptor (ATM Traffic Descriptor)	Any	Configuration
Administrative Status	Administrative status (*Unknown, Up, Down*)	Any	Status
Operational Status	Operational status (*Unknown, Up, Down*)	Any	Status
IANA Type	Internet Assigned Numbers Authority (IANA) type of the sublayer	N/A	N/A
Containing Termination Points	Underlying termination points (connection or physical)	Any	N/A
Contained Connection Termination Points	Bound connection termination points	Any	N/A

Inverse Multiplexing for ATM (IMA) Group

The Inverse Multiplexing for ATM (IMA) Group object is bound to its multiple DS1 Physicals by its Containing Termination Points attribute. It is accessed by a single data link layer ATM Interface.

Table 20-3 Inverse Multiplexing for ATM (IMA) Group (IIMAGroup)

Attribute Name	Attribute Description	Scheme	Polling Interval
Administrative Status	Administrative status of the IMA Group interface (*Unknown, Up, Down, Testing*).	Any	Status
Operational Status	Operational status of the IMA Group interface (*Unknown, Up, Down, Testing, Dormant, Not Present*).	Any	Status
Group Number	The IMA Group number.	Any	Configuration
IMA Version	The configured IMA version (*1.0*, *1.1*).	Any	Configuration
Speed	The active bandwidth of the IMA Group.	Any	Configuration
Configured Bandwidth	The total bandwidth of the IMA Group (the sum of all individual links in the Group).	Any	Configuration
Number of Links	The number of DS1 links in the IMA Group.	Any	Configuration
Number of Active Links	The number of DS1 links active in the IMA Group.	Any	Configuration
Minimum Number of Transmit Links	The minimum number of transmit links needed for the IMA Group to be operational.	Any	Configuration
Minimum Number of Receive Links	The minimum number of receive links needed for the IMA Group to be operational.	Any	Configuration
Clock Mode	The IMA Group's clock mode (*CTC*, *ITC*).	Any	Configuration
Frame Length	The length of IMA frames.	Any	Configuration
Group Failure Status	Reason for the IMA Group failure (*noFailure*, *startup*, *invalidMValueNe*, *invalidMValueFe*, *failedAssymetricNe*, *failedAssymetricFe*, *insufficientLinksFe*, *insufficientLinksMe*, *blockedNe*, *blockedFe*, *invalidImaVersionNe*, *invalidImaVersionFe*, *otherFailure*).	Any	Configuration
Operational Status Last Change	Date of last operational status change.	Any	Configuration
Description	The IMA Group interface name (for example, *ATM8/0/IMA1*).	Any	Configuration
IANA Type	Internet Assigned Numbers Authority (IANA) type of the sublayer.	N/A	N/A
Containing Termination Points	Underlying termination points (DS1 Physicals).	Any	N/A

ATM Traffic Descriptor

The ATM Traffic Descriptor object describes the traffic of a single ATM Virtual Connection. It is aggregated by a Traffic Descriptor Container object (see Common Components).

Table 20-4 ATM Traffic Descriptor (IAtmTrafficDescriptor)

Attribute Name	Attribute Description	Scheme	Polling Interval
Traffic Descriptor Type	ATM traffic descriptor type (*Null, Best Effort, No CLP and no SCR, CLP with no tagging and no SCR, CLP with tagging and no SCR, No CLP with SCR, CLP with no tagging and with SCR, CLP with tagging and with SCR, CLP with no tagging and with MCR, CLP-transparent with no SCR, CLP-transparent with SCR, No CLP with tagging and no SCR, No CLP and no SCR with CDVT, No CLP with SCR and CDVT, No CLP and no SCR with CDVT, No CLP with SCR and CDVT*)	Any	Configuration
Service Category	ATM service category (*Unknown, UBR, UBR1, UBR2, CBR, CBR1, CBR2, CBR3, ABR, VBR, RT VBR, NRT VBR, VBR1RT, VBR2RT, VBR3RT, VBR1NRT, VBR2NRT, VBR3NRT, GFR*)	Any	Configuration
Cell Loss Priority	Cell loss priority (*Unknown, True, False*)	Any	Configuration
Cell Delay Variation	Cell delay variation	Any	Configuration
Cell Delay Variation Tolerance	Cell delay variation tolerance	Any	Configuration
Maximum High Priority and Aggregate Burst Sizes	Maximum high priority and aggregate (CLP=0 and CLP=0+1) burst sizes	Any	Configuration
Minimum High Priority and Aggregate Cell Rates	Minimum high priority and aggregate (CLP=0 and CLP=0+1) cell rates	Any	Configuration
Sustainable High Priority and Aggregate Cell Rates	Sustainable high priority and aggregate (CLP=0 and CLP=0+1) cell rates	Any	Configuration
Peak High Priority and Aggregate Cell Rates	Peak high priority and aggregate (CLP=0 and CLP=0+1) cell rates	Any	Configuration
Name	Traffic descriptor name	Any	Configuration
Index	Traffic descriptor index	Any	Configuration

ATM Traffic Shape Descriptor

The ATM Traffic Shape Descriptor object describes the traffic shape of a single ATM Virtual Connection. It is aggregated by a Traffic Descriptor Container object (see Common Components).

Table 20-5 ATM Traffic Shape Descriptor (IAtmTrafficShapingDescriptor)

Attribute Name	Attribute Description	Scheme	Polling Interval
Maximum Burst Size	Maximum burst sizes	Any	Configuration
Sustainable and Peak Cell Rates	Sustainable and peak cell rates	Any	Configuration
Cell Delay Variation	Cell delay variation	Any	Configuration
State	Descriptor state (*Null, Enabled, Disabled*)	Any	Configuration
Buffer Size	Buffer size	Any	Configuration
Cell Loss Priority Discarded Size	Cell loss priority discarded size	Any	Configuration
Name	Traffic descriptor name	Any	Configuration
Index	Traffic descriptor index	Any	Configuration

Virtual Connection Switching Entity

The Virtual Connection Switching Entity object describes the standard forwarding component of an ATM or Frame Relay Switch. It is bound by its Logical Sons attribute to all the data link layer objects (such as ATM Interfaces or Frame Relay Interfaces) for which this Virtual Connection Switching Entity is switching cells or frames.

Table 20-6 Virtual Connection Switching Entity (IVcSwitchingEntity)

Attribute Name	Attribute Description	Scheme	Polling Interval
Cross Connect Table	Array of virtual cross connections.	Any	Configuration
Cross Connect Table Size	Size of the cross-connect table.	Any	Configuration
Logical Sons	Array of all ATM Interfaces or Frame Relay Interfaces for which this Virtual Connection Switching Entity is switching cells or frames.	Any	N/A

Vendor-Specific Inventory and IMOs

Vendor-specific IMOs are implemented only for specific vendor devices. The following sections describe vendor-specific objects for this technology:

- Lucent ATM Trunk Interface
- Cisco or Lucent ATM Logical Interface
- Cisco or Lucent ATM Trunk Virtual Connection
- Cisco or Lucent ATM Soft Permanent Virtual Connection
- Alcatel ASAM ATM Interface
- ECI HiFocus ATM Interface
- Alcatel ASAM ATM Traffic Descriptor
- ECI HiFocus ATM Traffic Descriptor
- Lucent WAN Switch ATM Traffic Descriptor
- Alcatel ATM Access Traffic Descriptor
- Alcatel ASAM Access Traffic Descriptor

Lucent ATM Trunk Interface

The Lucent ATM Trunk Interface data link layer object aggregates multiple ATM Virtual Connections, to which it is bound by its VC Table attributes. It is bound by its Containing Termination Points attribute to a physical layer interface. It is accessed primarily by a Virtual Connection Switching Entity.

Table 20-7 Lucent ATM Trunk Interface (IAtmTrunk)

Attribute Name	Attribute Description	Scheme	Polling Interval
All attributes are the same as ATM Interface (IAtm)			

Cisco or Lucent ATM Logical Interface

The Cisco or Lucent ATM Logical Interface data link layer object aggregates multiple ATM Virtual Connections, to which it is bound by its VC Table attributes. It is bound by its Containing Termination Points attribute to a physical layer interface. It is accessed primarily by a Virtual Connection Switching Entity and data link layer VC Encapsulation bound by its Contained Connection Termination Points attribute.

Table 20-8 Cisco or Lucent ATM Logical Interface (IAtmLogicalPort/Trunk)

Attribute Name	Attribute Description	Scheme	Polling Interval
Resource Management Cell Termination	Resource management cell termination (*Unknown*, *CCRM Only*, *CCRM*, *BCM*)	Any	Configuration
Resource Management Cell Generation	Resource management cell generation (*Unknown*, *None*, *CCRM*, *BCM*)	Any	Configuration
Effective Check	Effective check (*Unknown*, *No*, *Yes*)	Any	Configuration
Input and Output Capacities	Input and output capacities	Any	Configuration
Administrative Status	Administrative status (*Null*, *Up*, *Down*, *Testing*)	Any	Status
Operational Status	Operational status (*Null*, *Up*, *Down*, *Testing*, *Unknown*, *Dormant*, *Not Present*)	Any	Status
All additional attributes are the same as ATM Interface (IAtm)			

Cisco or Lucent ATM Trunk Virtual Connection

The Cisco or Lucent ATM Trunk Virtual Connection and Cisco or Lucent ATM Soft Permanent Virtual Connection data link layer objects are bound by their Containing Termination Points attributes to an ATM Interface object. They are accessed primarily by a Virtual Cross Connection object, although they are not bound to it by any of their attributes.

Table 20-9 Cisco or Lucent ATM Trunk Virtual Connection (IAtmTrunkVc)

Attribute Name	Attribute Description	Scheme	Polling Interval
Destination Description	Destination party description	Any	Configuration
All additional attributes are the same as ATM Virtual Connection (IAtmVc)			

Cisco or Lucent ATM Soft Permanent Virtual Connection

Table 20-10 Cisco or Lucent ATM Soft Permanent Virtual Connection (IAtmSpVc)

Attribute Name	Attribute Description	Scheme	Polling Interval
Remote Virtual Channel Identifier	Remote Virtual Channel Identifier (VCI)	Any	Configuration
Remote Virtual Path Identifier	Remote Virtual Path Identifier (VPI)	Any	Configuration
Remote Network Service Access Point	Remote Network Service Access Point (NSAP), which is the destination ATM address	Any	Configuration
All additional attributes are the same as ATM Virtual Connection (IAtmVc)			

Alcatel ASAM ATM Interface

The Alcatel ASAM ATM Interface and ECI HiFocus ATM Interface data link layer objects aggregate multiple ATM Virtual Connections, which they are bound to by their VC Table attributes. They are bound by their Containing Termination Points attributes to a physical layer interface. They are accessed primarily by Virtual Connection Switching Entity and data link layer VC Encapsulation objects bound by their Contained Connection Termination Points attributes.

Table 20-11 Alcatel ASAM ATM Interface (IAsamAtm)

Attribute Name	Attribute Description	Scheme	Polling Interval
CAC Traffic Descriptor	Connection admission control (CAC) traffic descriptor (Alcatel ASAM ATM Traffic Descriptor)	Product	Configuration
Access Traffic Descriptor	Access traffic descriptor (Alcatel ASAM Access Traffic Descriptor)	Product	Configuration
All additional attributes are the same as ATM Interface (IAtm)			

ECI HiFocus ATM Interface

Table 20-12 ECI HiFocus ATM Interface (IHiFocusAtm)

Attribute Name	Attribute Description	Scheme	Polling Interval
CAC Traffic Descriptor	Connection admission control (CAC) traffic descriptor (ECI HiFocus ATM Traffic Descriptor)	Product	Configuration
Access Traffic Descriptor	Access traffic descriptor (Alcatel ATM Access Traffic Descriptor)	Product	Configuration
All additional attributes are the same as ATM Interface (IAtm)			

Alcatel ASAM ATM Traffic Descriptor

The following objects — Alcatel ASAM ATM Traffic Descriptor, ECI HiFocus ATM Traffic Descriptor, Lucent WAN Switch ATM Traffic Descriptor and Lucent WAN Switch ATM Traffic Descriptor — describe traffic of a single ATM Virtual Connection. They are aggregated by a Traffic Descriptor Container object.

Table 20-13 Alcatel ASAM ATM Traffic Descriptor (IAsamAtmTrafficDescriptor)

Attribute Name	Attribute Description	Scheme	Polling Interval
User VP and VC Ranges	Numeric ranges of the allowed user VPI/VCI values	Product	Configuration
All additional attributes are the same as ATM Traffic Descriptor (IAtmTrafficDescriptor)			

ECI HiFocus ATM Traffic Descriptor

Table 20-14 ECI HiFocus ATM Interface (IHiFocusAtm)

Attribute Name	Attribute Description	Scheme	Polling Interval
Service Category	ATM service category (*Unspecified*)	Product	Configuration
All additional attributes are the same as ATM Traffic Descriptor (IAtmTrafficDescriptor)			

Lucent WAN Switch ATM Traffic Descriptor

Table 20-15 Lucent's WAN Switch ATM Traffic Descriptor (ILucentWANSwitchAtmTrafficDescriptor)

Attribute Name	Attribute Description	Scheme	Polling Interval
Priority	Connection priority	Product	Configuration
Type	Connection type	Product	Configuration
All additional attributes are the same as ATM Traffic Descriptor (IAtmTrafficDescriptor)			

Alcatel ATM Access Traffic Descriptor

The Alcatel ATM Access Traffic Descriptor object describes access traffic of a single ATM Virtual Connection. It is aggregated by a Traffic Descriptor Container.

Table 20-16 Alcatel ATM Access Traffic Descriptor (IAtmAccessTrafficDescriptor)

Attribute Name	Attribute Description	Scheme	Polling Interval
Scope	Access scope (*Null*, *Local*, *Network*)	Product	Configuration
Maximum Active VPCs and VCCs	Maximum active virtual path and virtual channel connections	Product	Configuration
Maximum Supported VPI and VCI Bits	Maximum supported virtual path and virtual channel bits	Product	Configuration
Generic Flow Control Mode	Generic flow control mode (*Null*, *UNI*, *NNI*)	Product	Configuration
Police Mode	Police mode (*Null*, *None*, *VC Only*, *All*)	Product	Configuration
Name	Traffic descriptor name	Product	Configuration
Index	Traffic descriptor index	Product	Configuration

Alcatel ASAM Access Traffic Descriptor

Alcatel ASAM Access Traffic Descriptor object describes access traffic of a single ATM Virtual Connection. It is aggregated by a Traffic Descriptor Container.

Table 20-17 Alcatel ASAM Access Traffic Descriptor (IAsamAccessTrafficDescriptor)

Attribute Name	Attribute Description	Scheme	Polling Interval
Maximum Supported VPCs and VCCs	Maximum supported virtual path and virtual channel connections	Product	Configuration
Maximum Active VPI and VCI Bits	Maximum active virtual path and virtual channel bits	Product	Configuration
All additional attributes are the same as Alcatel ATM Access Traffic Descriptor (IAtmAccessTrafficDescriptor)			

Network Topology

Cisco ANA discovers ATM data link layer topology by searching for the same set of active ATM Virtual Connections in any remote side's ATM port VC table related to the same type of the local ATM port. This topology also applies to the underlying physical links.

In particular, Cisco ANA looks for harmony between the VC tables of participating ports based on the lowest active VC (registry default to 3). Further verification is done by matching the VC traffic signature of these ports using Cisco's confidential scheme, which requires a substantial amount of traffic to function correctly.

This mechanism supports configurations that have either the same VCs or the same VPs on both sides. It does not support a mixture of VCs on one side and VPs on the other side.

Service Alarms

The following alarms are supported for this technology:

- Cloud Problem, page 41-22
- Discard Packets, page 41-26
- Dropped Packets, page 41-27
- Link Down, page 41-42
- Port Down, page 41-51
- Rx Utilization, page 41-53
- Tx Utilization, page 41-57
- ATM IMA Service, page 41-5

Note that these alarms, apart from Cloud Problem, are related to the underlying physical interface (see Common Components).