ATM

Teldat Dm740-I

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Chapter 1 The ATM protocol

1.1 Introduction

This chapter describes the ATM protocol and software and contains the following sections:

- General overview of the ATM protocol.
- Transmitting frames through the ATM network.
- ATM service categories.

1.2 General Overview of ATM protocol

ATM has risen to become the base technology for the new generation of communication systems. ATM is able to meet the demands for real-time communication in emerging multimedia applications and the increasing demand for a wider bandwidth in current installations.

The current bottleneck in communications is no longer the physical medium, but the processing speed of network nodes (which require quick and simple protocols). ATM has emerged in response to this need and has evolved from Frame Relay (ATM is also known as *Cell Relay*).

Transfer modes

	Circuit switching	**Message switching**	**Packet switching**
PROS	- Fixed delay - Sequence is not lost	- Fixed Overhead	- Since the packet size is fixed, switches can be simplified - Reduces end-to-end delay
CONS	- Preset bandwidth	- Variable delay - Since the message size is variable, switches need to be more complex	- Require reassembling - Variable Overhead Datagram: - each packet through a path - sequencing is required Virtual Circuit: - requires establishing - Does not require sequencing

ATM can be viewed as a transfer mode for virtual circuit packet switching with the following characteristics:

- The packet has a fixed size of 53 bytes (5 making up the header and 48 dedicated to the payload) known as a cell.
- Transfer is carried out in asynchronous mode i.e. at irregular intervals.

These characteristics generate the following:

- Enormous flexibility when assigning bandwidth (in order to achieve the widest bandwidth for a communication, greater number of cells per time unit).
- Optimal bandwidth use (as this is asynchronous, if the resources are not used by one communication, they can be used by another).
- Quality of Service (QoS is the subjective view that the user has of the service offered i.e. the combined effect of the service performance determining the degree of satisfaction): based on statistics, multiplexing can respond to a request for a wider bandwidth than is actually available (provided that the traffic has a certain discontinuity – bursty traffic).

1.2.1 Reference Model

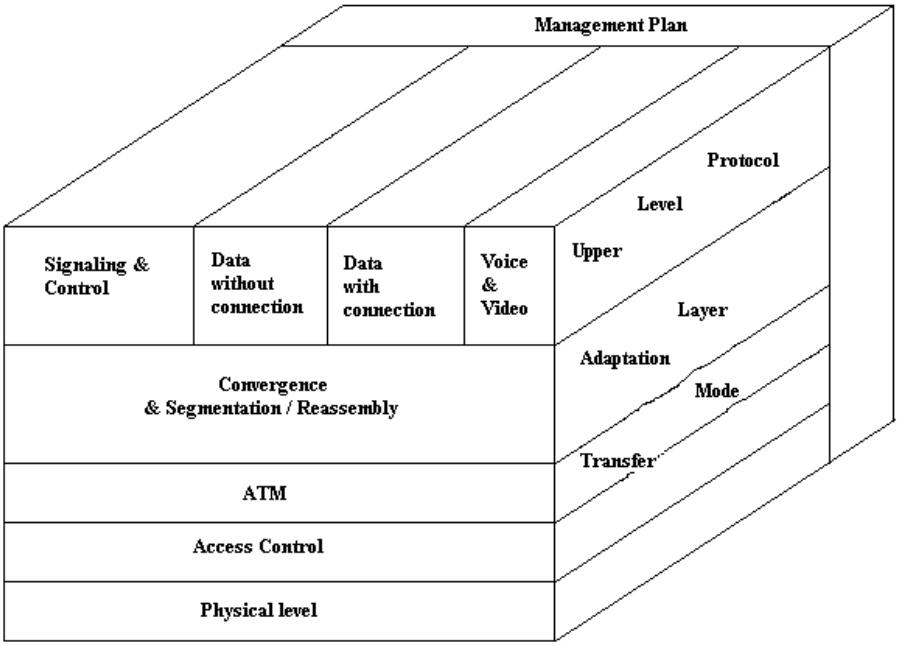


Fig. 1: ATM reference model

1.2.2 Physical Layer

This is responsible for relaying the cells between two entities guaranteeing header integrity up to a certain degree. It is also responsible for the specific functions at the physical layer (connectors, electric layers etc.).

This is subdivided into two parts:

- Physical media dependent or PMD (timer at a bit layer and line codification).
- Transmission convergence or TC (generation and verification of the HEC, cell and frame synchronization and insertion / extraction of idle cells to guarantee continuous bits stream in the physical media).

International organizations have proposed diverse physical layers, grouped as:

- Pure ATM, where there is a continuous cell stream between the ATM layer and the physical layer (DS3, 155/100Mbps multimode fiber, etc.).
- SDH (Synchronous digital hierarchy), the cells are embedded in SDH frames (e.g. SONET STS-3).

1.2.3 ATM Layer

This is independent to the physical layer and common to all higher layer services. It manages cell multiplexation and routing through the VPI/VCI and handles cell sequencing.

This does not execute any retransmission task for lost or erroneous cells. This task falls upon the higher layers.

Given that the service is orientated to an inherent ATM connection, the end-to-end connections must be established before initializing the cell stream between both entities.

The ATM layer has a management layer associated to it, with an information unit made up of **OAM cells** grouped in streams. This provides fault management (alarms, connection verification, detection of cells with incorrect VPI/VCI) and traffic monitoring (guaranteeing proficient use of the resources and protecting them from abuse from a connection).

1.2.3.1 ATM Cell

An ATM cell is made up of a header and a payload, both fixed-sized. Table 2 shows the ATM cell format.

ATM cell format

Octet	8	7	6	5	4	3	2	1
1	GFC				VPI			
2	VPI				VCI			
3	VCI							
4	VCI				PTI			CLP
5	HEC							

Cell header

Octet	8	7	6	5	4	3	2	1
6	Data							
7	Data							
52	Data							
53	Data							

Data

1.2.3.1.1 GFC (Generic Flow Control)

This is used for flow control between the user and network; therefore this is only implemented in the UNI (User Network Interface) [1].

1.2.3.1.2 VPI (Virtual Path Identifier)

This is an 8 bits identifier (or 12 bits if not UNI). Together with the VCI, this provides routing information. This only has local significance (i.e. no end-to-end value).

The ITU defines a **virtual path** as **unidirectional** transport of cells between two nodes pertaining to **virtual channels** associated to the same VPI.

There is a predefined route associated to each VPI in the physical network and each virtual path has a determined bandwidth available divided between the different virtual channels.

1.2.3.1.3 VCI (Virtual Channel Identifier)

ITU defines a virtual channel as the unidirectional transport of cells between two nodes associated to a common VCI; i.e. each VCI identifies a distinct connection between two ends.

This only has local significance (no end-to-end value).

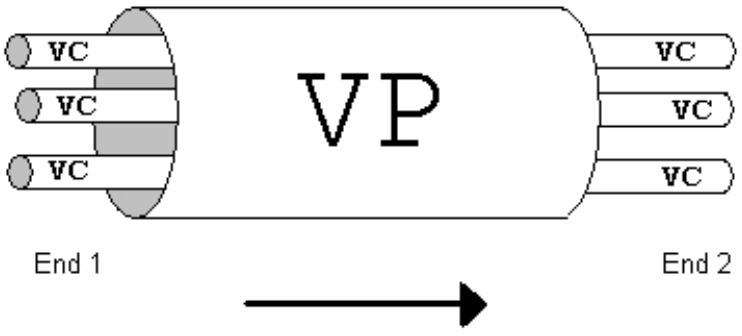


Fig. 2: Grouping of VCs in a VP

VPI/VCI en el UNI

Type	**VPI**	**VCI**
Inactive	0	0
Invalid	>0	0
Reserved	Any	1 to 31
User	Any	>31

[1] User Network Interface

Various interfaces are defined in ATM: UNI, NNI, PNNI, … whose characteristics vary according to their different locations and functions within the ATM network; the UNI is the interface specification for the ATM network in terminal or user devices.

Inactive	0	0
Invalid	>0	0
Reserved	Any	1 to 31
User	Any	>31

The real number of VPI and VCI bits used for routing is negotiated between the user device and the network. However, these are always (for the VPI and VCI) the least significant contiguous bits.

1.2.3.1.4 PTI (Payload Type Indicator)

This field indicates the type of information transported by the cell.

Meaning of the PTI field

Codification	Cell content
000	User data The cell has not experienced congestion. Without user-user indication.
001	User data The cell has not experienced congestion. With user-user indication.
010	User data The cell has experienced congestion. Without user-user indication.
011	User data The cell has experienced congestion. With user-user indication.
100	OAM F5 Cell segment (1).
101	OAM F5 Cell end-to-end (1).
110	Resource Management Cell.
111	Reserved.

2

1.2.3.1.5 CLP (Cell Loss Priority)

This bit indicates whether the nodes processing the cell can discard the cell when the congestion conditions require this (the nodes must discard marked cells before unmarked cells).

1.2.3.1.6 HEC (Header Error Control)

This byte represents a cell header CRC-8 (x^8+x^2+x+1) and has two important functions:

- Detection of erroneous cells (permits bit error correction and reduces the possibility of accepting erroneous cells and is a powerful tool for detecting errors).
- Simplifies cell synchronization in the receptors or cell delineation (this can be made available by applying the so called **coset rules**, which consists of adding an eight bit format (0101 0101 is recommended) to the calculated test bits). We need to bear in mind that ATM is characterized by a **continuous** cell stream, data or idle, so there is always activity on the line.

To increase the robustness of the system, you can randomize the cell to avoid excessively long 0 or 1 sequences.

[2] (1) The OAM flows (**Operation And Maintenance**) consist of a special type of information used to detect errors in the ATM network, monitoring etc.

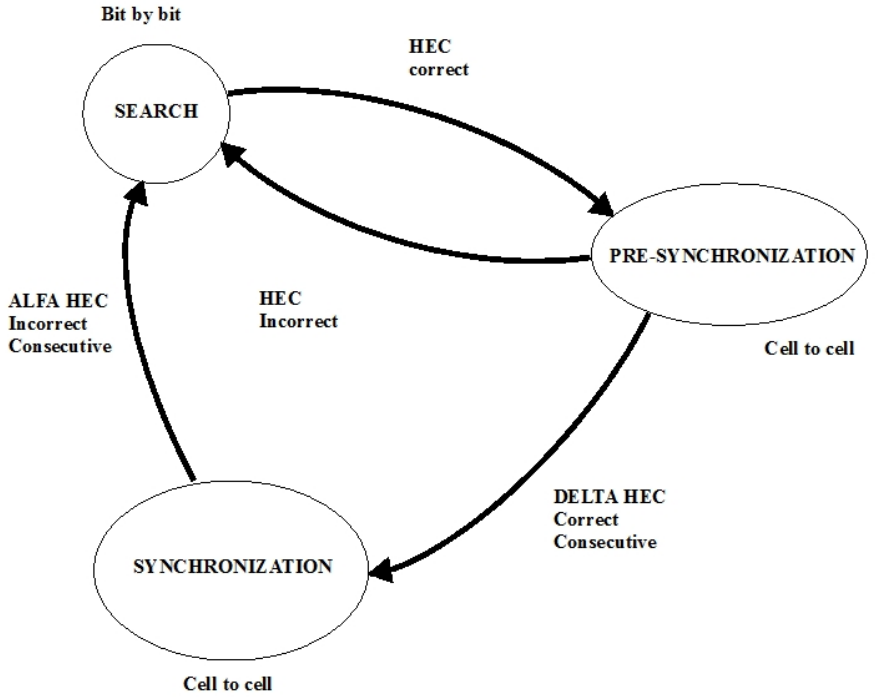


Fig. 3: Cell synchronization process complying with the ITU-T I.432 recommendation

1.2.3.1.7 Data

This field is made up of 48 octets and does not have, at the cell layer, any sort of error protection /detection. Current transmission methods offer very low error rates, meaning you can save information for error detection / correction and avoid the confirmation between intermediate nodes making the protocols more agile and less redundant.

In the specific case of an OAM cell, the payload portion has the following structure:

OAM cell format

Octet	8	7	6	5	4	3	2	1
6	OAM Type				Function			
7	Depends on the function							
52	Reserved						CRC-10	
53	CRC-10							

1.2.4 Adaptation Layer (AAL)

The ATM layer does not provide nor manage any type of information relating to the service clock frequency, nor detect incorrectly cells inserted (cells that did not originally pertain to a connection, become part of the cell stream for this), or lost cells or what information is being transported etc. It does not do this simply because not all the services require this information; we need to remember that the ATM layer is common to all possible services. Operations, therefore, required by the different types of services are grouped in small groups of classes that provide the source for the different ATM Adaption Layers (AAL), which in turn provide the services demanded by each type. Four basic service classes are defined (ITU and ATM Forum define distinct classes that have few differences):

Service classes

	Class A	**Class B**	**Class C**	**Class D**
Connection orientated	Yes	Yes	Yes	Yes
Bounded delay	Yes	Yes	No	No
Binary rate	Constant	Variable	Variable	Variable
AAL	1	2	3	4 and 5
Example	Voice and video	Compressed Video	Transfer of data with connection	LAN to LAN over WAN

The adaptation layers most commonly used are AAL 5 and AAL 2.

The adaptation layers are subdivided into a series of layers:

- **SAR** or **Segmentation And Reassembly** sublayer

  This handles fragmentation information provided by the higher layer in segments of 48 octets (cell payload) and re-assembly of the 48 octet segments provided by the ATM layer in a unit that can be read by the higher layer.
- **CS** or **Convergence Sublayer**

  Common part (**CPCS** or **Common Part Convergence Sublayer**).

  Specific part for the service (**SSCS** or **Service Specific Convergence Sublayer**).

  The SSCS in turn can subdivide into new layers.

AAL structure

<table>
<tr><td colspan="3">Layer 3 Protocol</td></tr>
<tr><td rowspan="3">ATM Adaptation Layer</td><td rowspan="2">Convergence Sublayer</td><td>SSCS</td></tr>
<tr><td>CPCS</td></tr>
<tr><td colspan="2">SAR</td></tr>
<tr><td colspan="3">ATM Layer</td></tr>
</table>

1.2.4.1 AAL5

1.2.4.1.1 CPCS

The CPCS AAL5 provides the higher layer data transport (in units known as CPCS-SDU or Service Data Unit, which are encapsulated in CPCS-PDU or Protocol Data Unit) from one CPSC entity to another. If AAL5 operates in an unsecure mode (a secure mode should be provided by the SSCS or higher layers), this can establish a CPCS entity communication to more than one remote entity through the ATM network (i.e. a point-multipoint ATM layer connection is required).

Two service modes are defined:

- **Message**: The layer above CPCS must provide a complete CPCS-SDU before the CPCS initiates transmission, and vice-versa.
- **Stream**: The higher level can provide the CPCS with CPCS-SDU fragments for transmission and must indicate which fragment is last (and vice-versa CPCS / higher layer). The functionality includes the possibility to abort (ABORT service) transmission or reception of a partially processed CPCS-SDU. This service mode has not been fully defined by the ITU.

Non-assured service for both modes means:

- A CPCS-SDU can be: delivered without errors, delivered with errors, or lost.
- Lost or incorrect CPCS-SDU are not retransmitted. There also exists the possibility that a portion of the CPCS-SDU received with errors is delivered to the higher layer (**Corrupted data delivery option**).

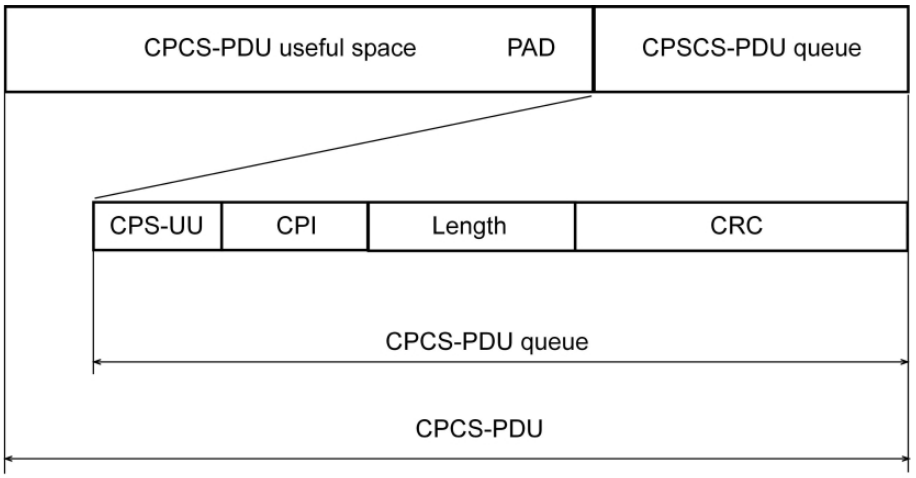
The CPCS service has the following characteristics:

- Variable CPCS-SDU size from 1 to 65535 octets.
- Correct delimitation and sequencing of the CPCS-SDU within a connection.
- Optional detection of errors and notification:

  - Error in the CPCS-SDU field size includes reception buffer overflow.

  - CPCS-SDU encapsulated in a CPCS-PDU with incorrect format.

  - Error in the CPCS-SDU CRC.
- Inclusion of a pad field in order to guarantee the total length for the CPCS-PDU in multiples of 48 (the CPCS-PDU format is explained further on).
- Bi-directional handling of the congestion and priority information.



PAD	Padding	(0 ... 47 octets)
CPCS-UU	CPCS user to user Indicator	(1 octet)
CPI	Common part Indicator	(1 octet)
Length	CPCS-SDU length	(2 octets)
CRC	Cyclical redundancy verification	(4 octets)

Fig. 4: CPCS-PDU format

Data

Contains the higher layer data and can vary from 1 to 65535 octets.

Pad

This field can vary from 0 to 47 octets, as long as the complete frame has a multiple length of 48 bytes i.e. (data + pad + trailer) = n*48

Any codification is valid for pad octets.

CPCS-UU (CPCS User to User Indication)

1 octet sized field, the first of the CPCS trailer. This is used to transparently transfer information between CPCS entities at both ends.

CPI (Common Part Indicator)

1 octet in length, the field's main task is to ensure the trailer has a multiple length of 64 bits; if this does not carry out any other function (future functions are being studied by the ITU) this value should be 0x00.

Length

Four octet field to indicate the data field length only.

The following should be noted. Given that the receiver does not know the true length of the data field, length error will only be detected in the following cases:

- If the indicated length is greater than the length of the received frame less 8 octets (the trailer octets).
- If the indicated length is less than the length of the received frame less 8 octets (trailer) and less 47 octets (maximum pad length).

Length error cannot be detected outside of these margins as the receptor does not know the real length of the pad (and cannot know it as codification is free).

This field also serves to indicate an abort event when its value is 0.

CRC-32

Contains the CRC-32 value calculated over the whole of the AAL5 frame i.e. including the pad and the first four octets of the trailer.

The AAL5-CPCS configurable parameters are:

- Significant end-to-end, the maximum CPCS-SDU length going to be exchanged between CPCS entities.
- With local significance and only at reception:

- Enabling corrupted delivery.

- Enabling and value of reassembly **timeout**.

1.3 Relaying frames over the ATM network

The Service Access Point (SAP) offered by ATM is identified with a number known as **AAL connection id** and its properties are configurable: type of circuit (permanent or switched), VPI and VCI going to be used, type of adaptation layer, configuration of the adaptation layer itself, transmission and reception rates etc. The higher layers request an identifier and packet transmission and reception is executed through this identifier. ATM encapsulates the data provided by the higher layers in adaptation layer frames, which are subsequently segmented in ATM cells. Over said encapsulation, the RFC2684 (RFC 1483 being obsolete) defines two modes to send traffic for diverse protocols through the ATM5 adaptation layer:

- Each type of higher layer traffic is transported in a different AAL connection without adding any type of header. This mode is known as **VC-multiplexing**.
- Diverse types of higher layer traffic share the same AAL connection in order to transport the data, inserting an LLC header to indicate the type of traffic contained in said frame. This operation mode is known as LLC-multiplexing (or SNAP encapsulation).

When the ATM protocol receives a packet for encapsulating (a CPCS_SDU), it compares the network address of this with the ARP (Address Resolution Protocol) cache entries. If the ARP cache contains the AAL connection number that coincides with the network address, then the packet is encapsulated in a frame and transmitted via the specified AAL connection. If the ARP does not match any of the cache values, the frame is dropped, except when the connection is point-to-point. In this case the ARP table is not checked.

1.3.1 Protocol addresses

The protocol addresses can be statically or dynamically assigned to the AAL connection identifiers through ARP. (The identifier significance is strictly local).

Note

The static protocol addresses can also be known as static entries in the ARP. A static address is added to the ARP through the **protocol_address** command.

Dynamic assignation is carried out through the Inverse ARP protocol.

1.3.2 ATM Subinterfaces

The transmission of higher protocol frames is carried out by the subinterfaces, leaving the ATM base interfaces to handle the connection and the sending of the AAL frames.

The subinterfaces allow diverse connection groups from the same ATM interface behave as completely distinct interfaces, which means for example (in the case of IP), they must belong to different subnets. This fact gives the ATM configuration enormous flexibility and greatly simplifies the implementation of Logical IP Subnetworks that comply with RFC 2225.

Therefore, all the higher layer data will be processed by the subinterfaces, which use the base interface services to transport said data through the corresponding AAL connection.

1.4 ATM service categories

This section describes the different ATM service categories (known as ATM Forum) or ATM transfer capacity (known as ITU-T).

Apart from those mentioned below, there are more types. However, these are less important.

1.4.1 Constant Bit Rate (CBR)/Deterministic Bit Rate (DBR)

The CBR service is characterized by offering a constant rate for the configured value whatever the congestion conditions of the ATM network might be, i.e. this offers a guaranteed rate so that the network resources are used even when there is no available information to transmit.

This can be understood as a conventional circuit where a portion of the physical medium capacity is taken and re-

mains permanently assigned to said communication.

The configurable parameter is the circuit rate, represented by the Peak Cell Rate (PCR).

This type of service is orientated towards real time applications i.e. those that require delays and variations in low delays such as voice, video and circuit emulation.

1.4.2 Variable Bit Rate (VBR) / Statistical Bit Rate (SBR)

The VBR service is characterized by offering two speeds that are adequate for traffic whose rate requirements are variable. Two types are defined: one for real time applications (with restrictions in delay and variation) such as voice with silence suppression and compressed video, and another one for applications with transmission bursts without bounded delay.

The configurable parameters are those for the PCR (Peak Cell Rate), sustained cell rate (SCR) and the maximum burst size (MBS), which determine, after a long period of silence, the device can transmit at PCR for X time (this time is determined by the PCR, SCR and the MBS), to subsequently transmit at SCR; during periods of silence, the device gains “credit” so when it needs to transmit, it can again transmit at PCR for a determined time.

1.4.3 Available Bit Rate (ABR)

The ABR service is characterized by its adaptation to the available bandwidth conditions in the line and therefore aimed at applications that can dynamically increase or diminish their needs and whose requirements can be expressed in acceptable ranges (maximum or minimum). The ATM network dynamically varies the resources assigned to this type of circuit through a closed loop control protocol using **Resource Management** cells.

1.4.4 Unspecified Bit Rate (UBR)

The UBR service is a service known as **best effort**, geared towards applications that do not have bounded delay (or a variation of this) and do not require specific QoS parameters (which lower the cost of the contract). It is aimed at applications generating non-continuous bursty traffic that provides a high level of statistic multiplexing.

The UBR service usually has a single configurable parameter, the PCR, which determines the speed that the circuit using this service cannot exceed.

Typical applications are data transfer, messaging, etc.

Chapter 2 ATM Protocol Configuration

2.1 ATM Base Interface Configuration

Access the configuration menu through the **network <ATM interface>** command from the general configuration menu.

```
*p 4

Config>list devices
Interface            Connector     Type of interface
ethernet0/0          FE0/LAN1      Fast Ethernet interface
serial0/0            SERIAL0/WAN1  X25
bri0/0               BRI/ISDN1     ISDN Basic Rate Int
x25-node             ---           Router->Node
atm0/0               SLOT1         Generic ATM

Config>network atm0/0
-- ATM interface configuration --
atm0/0 config>
```

There are certain commands that are common to all device interfaces. These commands are described in the Teldat Dm772-I Common Configuration Interfaces manual.

2.2 Base Interface configuration commands

This section lists and describes the ATM base interface configuration commands.

Command	Function
? (HELP)	Lists the available commands or their options.
AAL-CONNECTION	Configures an AAL connection.
DESCRIPTION	See Teldat Dm772-I manual.
LINE-RATE	Sets the ATM interface transmission rate.
LIST	Deprecated command.
*MAX-CIRCUIT-RATE**	Establishes the maximum configurable rate in a circuit.
*MAX-NUMBER-OF-CIRCUITS**	Establishes the maximum number of configurable circuits.
*MAX-TO-MIN-RATIO**	Establishes the minimum configurable rate in a circuit through a ratio relative to the maximum rate.
*MIN-CIRCUIT-RATE**	Establishes the minimum configurable rate in a circuit.
MTU	Configures the ATM+ interface MTU.
NO	Negates a command or sets its default value.
*OAM-TO-DATA-COEFFICIENT**	Establishes the relation of OAM traffic with respect to the normal traffic.
PHY	Provides access to the physical layer configuration menu.
*PRIORITY-LEVELS**	Establishes the number of traffic priorities to be managed.
PVC	Configures a PVC (permanent virtual circuit).
SHUTDOWN	See Teldat Dm772-I manual.
*TX-WATCHDOG**	Sets the operating mode for the watchdog, which supervises the blocks in transmission.
UPDATE	See Teldat Dm772-I manual.
*UTOPIA-CLOCK-FREQUENCY**	Configures the clock frequency used in the UTOPIA bus.
*UTOPIA-LEVEL**	Configures the UTOPIA mode (level 1 or level 2).
EXIT	Exits the ATM base interface configuration menu.

Note

Commands marked with an * are available depending on the hardware.

2.2.1 [NO] AAL-CONNECTION

Defines and configures the characteristics for an AAL connection.

```
atm0/0 config>aal-connection <id> pvc <vpi> <vci>

atm0/0 config>aal-connection <id> monitoring oam-loopback <success-up> <fail-down>
                                 &lt;segment| ent-to-end&gt;
                                 [frequency <frequency> retry <retry>]

atm0/0 config>aal-connection <id> monitoring oam-loopback no-strict-mode
```

Note

Always associate the AAL connection to a PVC.

id	Identifier number used in reference to this connection. It cannot appear twice in the same ATM interface.
pvc <vpi> <vci>	Associates a permanent VCC, identified by its VPI and VCI, to the AAL connection.
monitoring	Allows monitoring, independently of the state of the physical interface.
oam-loopback	Carries out monitoring through the OAM loopback cells.
<success-up>	Consecutive number of loopback cells that must be answered by the end segment or final destination in order to consider the AAL connection active after a loss of connectivity.
<fail-down>	Consecutive number of loopback cells without response in order to consider the AAL connection inactive.
<segment | end-to-end>	Indicates the type of loopback cell used for monitoring. Segment type: this should respond to the first ATM device found in the path. End-to-end type: this should respond to the last ATM device found in the path.
frequency <f>	Optional Command. When the AAL connection state is stable (sufficient consecutive cells have been received or sufficient consecutive cells have been lost), a cell is sent each *<frequency>* seconds. (As the state is known, the purpose of this cell is to check that nothing has changed and therefore sending can be spaced out). Default is 6 seconds.
retry <r>	Optional Command. When a cell is lost while the AAL connection is in UP or a cell is received when said connection is DOWN, cells are sent each <retry> seconds to try and find out as soon as possible any change in the AAL connection status. (Logically, *<retry>* should be less than *<frequency>*). Default is 6 seconds.
no-strict-mode	Optional command. By default, monitoring through OAM loopback cells operate in strict mode, i.e. if a response to consecutive *<fail-down>* cells has not been received, the AAL connection is declared DOWN. On activating the no strict mode, the above condition is necessary but not sufficient: if valid traffic has been received from the user, the AAL connection is considered OK, even when the loopback cells fail.

2.2.2 [NO] LINE-RATE

Configures the transmission rate the ATM interface will adjust to in Kbps. The value configured can be less than that available at the physical layer. In this case, the device will operate as if the configured rate is the only one available. Value **0** is reserved to indicate the interface is dynamic and, therefore, the speed should be detected each time the interface is established. This is the most common method and the one used by default.

Please see *Transmission rate management* on page 29.

2.2.3 [NO] MAX-CIRCUIT-RATE

Configures the highest speed that allows a circuit belonging to the interface to operate at. Value **0** is reserved to indicate that this parameter must take the value of the *LINE-RATE* parameter (if this is dynamically configured, then it takes the speed value available on restarting the interface). This is the most common method and the one used by default.

Any circuit involving transmission rates higher than that configured through this parameter will not be created in effective mode.

This availability depends on the hardware. If it is not available, the value is automatically calculated.

Please see *Transmission rate management* on page 29..

2.2.4 [NO] MAX-NUMBER-OF-CIRCUITS

Configures the maximum number of circuits that can be simultaneously established in this interface; please note that you can have many PVCs configured, however only those linked to the AAL connections will really establish. The maximum limit is currently 31 PVCs. Default is 1.

This availability depends on the hardware and if it is not available, you can assume the value is automatically calculated.

2.2.5 [NO] MAX-TO-MIN-RATIO

Configures the speed ratio between the fastest and the slowest virtual circuit permitted in the device. This parameter is only significant if **min-circuit-rate** is set to zero. Default is 25.

This availability depends on the hardware. If it is not available, the value is automatically calculated.

Please see *Transmission rate management* on page 29.

2.2.6 [NO] MIN-CIRCUIT-RATE

Configures the lowest speed that allows any circuit pertaining to the interface to operate at. Value **0** is reserved to indicate that this parameter must take the value of the **max-circuit-rate**, divided by the value of the **max-to-min-ratio**. This is the most common method and the one used by default.

Any circuit involving lower transmission rates than that configured through this parameter will not be created in effective mode and will remain in a transmission stopped state, with the corresponding ATM event (if these are enabled).

This availability depends on the hardware. If this is not available, the value is automatically calculated.

Please see *Transmission rate management* on page 29.

2.2.7 [NO] MTU

Determines the maximum length of the higher level frames to be transmitted. Default is 1536.

2.2.8 [NO] OAM-TO-DATA-COEFFICIENT

Determines the maximum number of OAM cells that are inserted for each hundred user cells where user traffic is consistent.

The value of this parameter should not be modified except when expressly indicated by qualified personnel.

This availability depends on the hardware. If this is not available, the value is automatically calculated.

2.2.9 PHY

Accesses the specific configuration options for the physical interface depending on the type of card installed in the device. These commands are described in the manual corresponding to the type of interface used.

2.2.10 [NO] PRIORITY-LEVELS*

Determines if this is going to operate with one (real-time or no-real-time) or two traffic priority levels (real-time and no-real-time). Default is 1.

This availability depends on the hardware and if it is not available, you can assume the value is automatically calculated.

2.2.11 [NO] PVC

Defines and configures the characteristics for a PVC.

```
atm0/0 config>pvc <vpi> <vci> default


atm0/0 config>pvc <vpi> <vci> tx-traffic
```

```
                                cbr <pcr> [<cdvt>]
                                ubr <pcr> [<cdvt>]
                                vbr-rt <pcr> <scr> <mbs> [<cdvt-pcr> <cdvt-scr>]
                                vbr-nrt <pcr> <scr> <mbs> [<cdvt-pcr> <cdvt-scr>]

atm0/0 config>pvc <vpi> <vci> tx-ring <size> <batch>

atm0/0 config>pvc <vpi> <vci> rx-ring <size> <batch>
```

Note

Two PVCs in the same interface cannot have identical VPI and VCI.

Note

Only the PVCs associated to an AAL connection are really active.

default	Configures the PVC with default values (UBR at the line rate).
tx-traffic	Configures the transmission profile.
cbr	Constant bit rate.
vbr-rt	Variable bit rate Real Time.
vbr-nrt	Variable bit rate no Real Timer.
ubr	Unspecified bit rate.
<pcr>	Peak rate in Kbps.
<scr>	Sustained rate in Kbps (only VBR-RT and VBR-NRT).
<mbs>	Maximum burst size in cells (only VBR-RT and VBR-NRT).
<cdvt>	Optional. Cell Delay Variation Tolerance in microseconds. Depending on its value (defined by the network carrier) this sends cells in back-to-back mode (GRCA algorithm), reducing the traffic shaping task load through software (in interfaces where traffic shaping software is necessary).
tx-ring	Configures the transmission ring (available depending on the hardware).
<size>	Ring size in number of packets.
<batch>	Number of packets processed in each iteration.
rx-ring	Configures the reception ring (available depending on the hardware).
<size>	Ring size in number of packets.
<batch>	Number of packets processed in each iteration.

2.2.12 [NO] TX-WATCHDOG

Configures the watchdog operating mode that supervises blocks in transmission.

```
atm0/0 config>tx-watchdog <disable | phy | sar>
```

disable	Disables the watchdog. Supervision is still carried out but no action is taken.
phy	In cases where problems are detected the physical layer and acted on (resynchronization, etc.).
sar	If problems are detected, the SAR layer is acted on.

2.2.13 [NO] UTOPIA-CLOCK-FREQUENCY

Configures the UTOPIA bus clock frequency.

The value of this parameter should not be modified except when expressly indicated by qualified personnel.

This availability depends on the hardware.

2.2.14 [NO] UTOPIA-LEVEL

Configures the UTOPIA bus compatibility level, i.e. level 1 or level 2.

The value of this parameter should not be modified except when expressly indicated by qualified personnel.

This availability depends on the hardware.

2.2.15 EXIT

Returns to the *Config*> prompt.

2.3 ATM interface commands: Summary

no aal-connection <id>

aal-connection <id> pvc <vpi> <vci>

aal-connection <id> monitoring oam-loopback <up> <down> <segment | end-to-end>

[frequency <seconds> retry <seconds>]

aal-connection <id> monitoring oam-loopback no-strict-mode

no line-rate

line-rate <kbps>

no max-circuit-rate*

max-circuit-rate* <kbps>

no max-number-of-circuits*

max-number-of-circuits* <num>

no max-to-min-rate-ratio*

max-to-min-rate-ratio* <ratio>

no min-circuit-rate*

min-circuit-rate* <kbps>

no mtu

mtu <bytes>

no oam-to-data-coefficient*

oam-to-data-coefficient* <coeff>

no priority-levels*

priority-levels* <levels>

no pvc <vpi> <vci>

pvc <vpi> <vci> default

pvc <vpi> <vci> tx-traffic cbr <pcr> [<cdvt>]

pvc <vpi> <vci> tx-traffic ubr <pcr> [<cdvt>]

pvc <vpi> <vci> tx-traffic vbr-rt <pcr> <scr> <mbs> [<cdvt-pcr> <cdvt-scr>]

pvc <vpi> <vci> tx-traffic vbr-nrt <pcr> <scr> <mbs> [<cdvt-pcr> <cdvt-scr>]

pvc <vpi> <vci> tx-ring* <size> <batch>

pvc <vpi> <vci> rx-ring* <size> <batch>

no tx-watchdog <disable | phy | sar>

no utopia-clock-frequency*

utopia-clock-frequency* <MHz>

no utopia-level*

utopia-level* <1..2>

* Available commands depend on the hardware

2.4 Configuring the ATM subinterface

Before configuring a subinterface, you need to create it through the following command:

```
Config>add device atm-subinterface <ATM base interface> <subinterface id>
```

Note

Two subinterfaces belonging to the same base interface cannot have the same ID.

The following command is used to eliminate an ATM subinterface:

```
Config>no device <subinterface id>
```

An ATM subinterface is a grouping of one or more AAL connections, which behave (to all effects) as any router interface as it is possible to assign IP addresses to it, monitor the state, etc.

The interfaces may be point-to-point or point-to-multipoint. If point-to-point, these have a direct connection with a single remote device so a single AAL connection is used. If the subinterface is point-to-multipoint then there are various devices that can be directly reached through it. This means it is necessary to establish a mechanism to resolve which AAL connection should be used to reach each possible remote device. To do this, configure the protocol address (**protocol-address** command) or by activating inverse ARP.

Run **network <ATM subinterface** command (general configuration menu) to access the configuration:

```
*p 4

Config>add device atm-subinterface atm0/0 1

Config>list device
Interface            Connector     Type of interface
ethernet0/0          FE0/LAN1      Fast Ethernet interface
serial0/0            SERIAL0/WAN1  X25
bri0/0               BRI/ISDN1     ISDN Basic Rate Int
x25-node             ---           Router->Node
atm0/0               SLOT1         Generic ATM
atm0/0.1             ---           ATM subinterface
Config>network atm0/0.1

-- ATM subinterface configuration --
atm0/0.1 config>
```

There are certain commands that are common to all the device interfaces. These commands are described in the interfaces common configuration manual (Teldat Dm772-I Common Configuration Interfaces).

2.5 Subinterface Configuration Commands

This section lists and describes the ATM subinterface configuration commands.

Command	Function
? (AYUDA)	Lists the available commands or their options.
AAL-CONNECTION-REQUESTED	Associates the subinterface with a base interface AAL connection.
BDF	See Teldat Dm772-I manual.
DESCRIPTION	See Teldat Dm772-I manual.
INVERSE-ARP	Configures Inverse ARP operating.
IP	See Teldat Dm772-I manual.
LINK-TYPE	Configures the type of link making up the subinterface.
LIST	Deprecated command.
MTU	Configures the MTU.

MULTIPLEXATION-METHOD	Configures the type of RFC1483 multiplexing to use.
PROTOCOL-ADDRESS	Configures a static association.
SHUTDOWN	See Teldat Dm772-I manual.
UPDATE	See Teldat Dm772-I manual.
EXIT	Exits the ATM subinterface configuration menu

2.5.1 [NO] AAL-CONNECTION-REQUESTED

Allows you to associate an AAL connection to the subinterface.

```
atm0/0.1 config>aal-connection-requested <aal connection id> default
```

AAL connection id	AAL connection identification number within the ATM base interface over which the subinterface is assembled.

2.5.2 [NO] INVERSE-ARP

Run **inverse-arp** to dynamically learn which address is reached by a determined AAL connection.

Note

Inverse ARP only operates over AAL connections operating in LLC multiplex mode.

(Please see the “Multiplexation configuration” section)

INVERSE-ARP protocol configuration has two parts: one to define the behavior at the subinterface layer and the other to define the behavior of each AAL connection associated to the subinterface.

2.5.2.1 Configuring INVERSE-ARP at the subinterface layer

```
atm0/0.1 config>inverse-arp default-value <enable | disable>

atm0/0.1 config>inverse-arp global-value <enable | disable | default>
```

default-value	Determines the default value that Inverse-ARP configurations configured with default take.
disable	
enable*	
global-value	Determines the state of INVERSE-ARP for the subinterface in this group.
disable	All the associated connections have INVERSE-ARP deactivated irrelevant of the individual configuration.
enable	The associated connections have INVERSE-ARP in the state indicated by the individual configurations.
default*	The status for the subinterface is defined by the value configured in **default-value**

(*) Default value

2.5.2.2 Configuring INVERSE-ARP at the associated AAL connection level

```
atm0/0.1 config>aal-connection-requested <aal connection id>
                                        inverse-arp <enable | disable | default>
```

disable	The connection has INVERSE-ARP deactivated.
enable	The connection has INVERSE-ARP activated provided that this is globally enabled.
default	The connection will have INVERSE-ARP activated or deactivated depending on the value configured in the **default-value Inverse-ARP** configuration variable.

2.5.3 [NO] LINK-TYPE

Configures the type of link created by the subinterface. A point-to-multipoint subinterface has more than one associated AAL connection. Each is allowed to access distinct destinations.

```
atm0/0.1 config>link-type <point-to-point | point-to-multipoint>
```

2.5.4 [NO] MTU

Determines the maximum size of the higher layer frames (IP, PPP, etc) to be transmitted.

```
atm0/0.1 config>mtu <bytes>
```

The default value is the one inherited from the base interface.

2.5.5 [NO] MULTIPLEXATION-METHOD

The traffic forwarded by a subinterface can be encapsulated in two ways: LLC mode and VC mode; the first allows distinct traffic types over the same subinterface as the LLC header permits these to be differentiated; the second only permits one type of traffic over the subinterface and this traffic must be specified as IP, PPP or PPPoE.

```
atm0/0.1 config>multiplexation-method <llc | vc-ip | vc-ppp | vc-pppoe>
```

2.5.6 [NO] PROTOCOL-ADDRESS

Adds a static association between the AAL connection identifier and the address of the higher layer directly reached through said connection.

```
atm0/0.1 config>protocol-address <IP host address> <aal connection id>
```

- IP host address:

  IP address reachable through the AAL connection.

  Normally this is the address of a gateway that accesses a subnet.

- AAL connection id:

  Identifier of an AAL connection associated to the subinterface.

Note

For point-to-point subinterfaces, where there is only one AAL connection, it is unnecessary to establish an entry in this section as all the packets leaving the interface must exit through the only existing connection.

2.6 ATM subinterface commands: Summary

no aal-connection-requested <id>

aal-connection-requested <id> default

aal-connection-requested <id> inverse-arp <enabled | disabled | default>

inverse-arp default-value <enable | disable>

inverse-arp global-value <enable | disable | default>

no link-type

link-type <point-to-point | point-to-multipoint>

no mtu

mtu <bytes>

no multiplexation

multiplexation <llc | vc-ip | vc-ppp | vc-pppoe>

no protocol-address <ip address>

protocol-address <ip address> <aal connection id>

Chapter 3 Monitoring ATM interfaces

3.1 Introduction

The ATM interface and subinterface monitoring commands are described in this chapter. The following sections are included here:

- Displaying the ATM interface monitoring prompt.
- ATM interface monitoring commands.
- ATM subinterface own monitoring commands.
- ATM interfaces and the GWCON interface command.

For further information on the ATM protocol, please see Chapter 1 “The ATM interface”.

3.2 Displaying the ATM monitoring prompt

Access the monitoring menu by running **network <ATM interface>** (general monitoring menu).

```
*p 3
+network atm0/0
-- ATM interface monitor --
atm0/0 monitor+
*p 3
+network atm0/0.1
-- ATM subinterface monitor --
atm0/0.1 monitor+
```

3.3 ATM monitoring commands

The ATM monitoring commands are listed and described in this section. Use these commands to obtain information on the ATM interface.

Command	Function
? (HELP)	Displays the available commands or their options.
ATM-PING	Sends OAM LOOPBACK cells.
CLEAR	Deletes the statistics.
LIST	Displays different aspects of the ATM interface.
PHY	Accesses the physical layer monitoring.
UPGRADE-FW	Allows the in-card firmware upgrade and log dump.
EXIT	Returns to the GWCON (+) prompt.

Command history:

Release	Modification
11.01.10	The **upgrade-fw** command was introduced as of version 11.01.10.

3.3.1 ? (HELP)

Displays a list of available commands and their options.

```
atm0/0 monitor+ ?
  atm-ping    Generate OAM loopback cells
  clear       Clear statistics
  list        List statistics
  phy         Access to phy monitoring
  upgrade-fw  Upgrade FW related commands
  exit
atm0/0 monitor+
```

3.3.2 ATM-PING

Generates OAM LOOPBACK cells at the VCC or VPC layer, segment as well as end-to-end. Cell generation can be detained by striking any key or when the requested cells have been transmitted.

```
atm0/1 monitor+ATM-PING <SEGMENT | END-TO-END> < VCC vpi vci | VPC vpi > <number>
atm0/1 monitor+atm-ping segment vcc 8 32 2
VPI=8 VCI=32 Segment OAM F5 loopback successful: 14 ms
VPI=8 VCI=32 Segment OAM F5 loopback successful: 16 ms

                        OAM Loopback VCC (8..32) statistics
 ---------------------------------------------------------------------------
 Successful segment loopbacks 2/2
 Time in ms (min 14/avg 15/max 16)
```

3.3.3 CLEAR

Deletes statistics.

```
atm0/0 monitor+CLEAR ?
  aal-connection    Clear an AAL connection statistics
  all               Clear all statistics
  interface         Clear interface statistics
```

3.3.3.1 CLEAR AAL-CONNECTION

Deletes the statistics for an AAL connection.

```
atm0/0 monitor+CLEAR AAL-CONNECTION <aal id>
```

3.3.3.2 CLEAR ALL

Deletes the statistics for all AAL connections and the interface.

```
atm0/0 monitor+CLEAR ALL
```

3.3.3.3 CLEAR INTERFACE

Deletes the interface statistics.

```
atm0/0 monitor+CLEAR INTERFACE
```

3.3.3.4 CLEAR RAW

Deletes the Raw channel statistics.

```
ATM monitor+CLEAR RAW
RAW statistics cleared
ATM monitor+
```

3.3.4 LIST

Displays information on the ATM interface, the AAL connections and the ATM protocol.

```
atm0/0 monitor+LIST ?
  all               List all statistics
  aal-connection    List AAL connection statistics
  interface         List interface statistics
```

3.3.4.1 LIST ALL

Displays statistics for the AAL connections and the interface.

3.3.4.2 LIST AAL-CONNECTION

3.3.4.2.1 list aal-connection <aal id> all

Displays all the information on the AAL connection.

3.3.4.2.2 list aal-connection <aal id> global

Displays detailed information on the AAL connection statistics.

```
atm0/0 monitor+list aal 1 global

AAL connection id: 1
AAL type:          AAL5 NULL SSCS
VCC assigned:      PVC PHY:0 VPI:8 VCI:32

Status:          LOCAL UP      for     0/01:41:26 (days/hh:mm:ss)
Flags:           0x00000000

---- AAL statistics ----
Tx SDU ok           =     202631         Rx SDU ok           =     216619
  with CI           =          0           with CI           =          0
  with LP           =          0           with LP           =          0
  payload bytes     =   78180204           payload bytes     =   84385130
Tx SDU err          =          0         Rx SDU err          =          0
  payload bytes     =          0           payload bytes     =          0
Tx SDU drop         =      57975         Rx SDU drop         =          0
  payload bytes     =   22092241
Tx max resource use =          2         Rx max resource use =          5
Tx max pending conf =          0         Rx max pending proc =          0
Tx last 5 min (kbps)=        102         Rx last 5 min (kbps)=        180
                                         Rx buffer denies    =          0
Tx SDU in soft queue=          0 (max 2)
Tx SDU in phy queue =         19 (max 20)
```

Status	Indicates the status of the AAL connection.
LOCAL DOWN	Local problems (physical layer down, etc.).
LOCAL UP	Capable of transmitting and receiving.
END TO END DOWN	Some type of monitoring indicates problems at the ATM layer (connection not available for transmission).
END TO END UP	Capable of transmitting and received with ATM layer guarantees.
Flags	Flags indicating status and cause of said status.
0x00000001	Physical down.
0x00000002	Monitoring based on OAM loopback detects error.
0x00000004	AIS End to End status declared.
0x00000008	AIS Segment status declared.
0x00000010	RDI End to End status declared.
0x00000020	RDI Segment status declared.
0x00000040	RDI End to End at VP layer status declared.
0x00000080	RDI Segment at VP layer status declared.
Tx SDU err	Frames where a local error in transmission has occurred and consequently do not arrive at the destination correctly.
Rx SDU err	Frames where an error has been detected at reception (CRC, etc.).
Tx SDU drop	Transmission requests, which have been denied due to lack of resources (the lower layer is saturated and cannot queue more frames for this layer).
Rx SDU drop	Lower layer reception indications, which could not be met due to lack of resources.
Tx max resource use	Maximum number of transmission resources simultaneously used.
Rx max resource use	Maximum number of reception resources simultaneously used.

Tx max pending conf	Maximum number of transmission resources pending release.
Rx max pending proc	Maximum number of reception resources pending processing.
Rx buffer denies	Buffer petitions for reception, which could not be answered as the resources are being used.
Tx SDU in soft queue	Frames in the software transmission queue.
Tx SDU in phy queue	Frames in the physical transmission queue.

You can obtain more in-depth information on the frames (errors in the frames received with error etc.) The counters may vary slightly from the previous screen given that some time would have lapsed in the interval between showing one list and this one.

```
More detail about data(Yes/No)? y
---- AAL5 CPCS statistics ----
Tx ok               =     202744         Rx ok               =     216726
Tx err              =          0         Rx err              =          0
  purged            =          0           protocol aborts   =          0
  user aborts       =          0           remote aborts     =          0
                                           CRC32 errors      =          0
Tx drop             =          0           length errors     =          0
  too long          =          0           too long          =          0
  by SAR            =          0           reassembly tout   =          0
                                           invalid CPI       =          0
                                           corrupted deliver =          0
```

You can also obtain information at the SAR level:

```
AAL5 SAR statistics(Yes/No)? y
---- AAL5 SAR statistics ----
Tx ok               =          0
Tx err              =          0
  purged            =          0
Tx cells in queue   =          0
```

You can also view information on the hardware level (depending on the SAR used.)

```
Hardware statistics(Yes/No)? y
---- MPC860SAR dependent stats ----
   Tx underruns                 =          0
   Tx deferred header blocked   =          0
   Tx APC bypass deferred       =          0
   Uncompleted TX stop commands =          0
   Uncompleted RX stop commands =          0
```

3.3.4.2.3 list aal-connection <aal id> management

Displays information on the management plan (OAM layer) for the AAL connection, both at the VCC and the VPC layers.

"**Seg**" represents "segment".

"**E2E**" represents "end to end".

"**drops**" indicates transmission attempts that could not be executed.

```
VCC:    PVC PHY:0 VPI:8 VCI:32

---- GLOBAL statistics ----
Rx unexpected user cells                                =          0
Rx future VC function cells                             =          0
Rx VC resource management cells                         =          0

---- OAM errors statistics ----
Rx OAM CRC10 errored cells                              =          0
Rx OAM unknown Fault Management function cells          =          0
Rx OAM unknown Performance Monitoring function cells    =          0
Rx OAM unknown ACT/DEACT function cells                 =          0
Rx OAM unhandled System Management function cells       =          0
Rx OAM unknown type                                     =          0
```

```
---- AIS ----
Seg tx cells        =          0         E2E tx cells        =          0
Seg tx drops        =          0         E2E tx drops        =          0
Seg rx cells        =          0         E2E rx cells        =          0
Seg defect          =       NONE         E2E defect          =       NONE

---- RDI ----
Seg tx cells        =          0         E2E tx cells        =          0
Seg tx drops        =          0         E2E tx drops        =          0
Seg rx cells        =          0         E2E rx cells        =          0

---- LOOPBACK ----
Seg tx cells        =          2         E2E tx cells        =          0
Seg tx drops        =          0         E2E tx drops        =          0
Seg tx loop request =          2         E2E tx loop request =          0
Seg failed loop     =          0         E2E failed loop     =          0
Seg rx cells        =          2         E2E rx cells        =          0
Seg rx loop request =          0         E2E rx loop request =          0
Seg rx uncorrelated =          0         E2E rx uncorrelated =          0
Seg rx unexpected   =          0         E2E rx unexpected   =          0

Virtual Path management information(Yes/No)? y

VPC:    PVP PHY:0 VPI:8

---- GLOBAL statistics ----
Rx future VP function cells                                =          0
Rx VP resource management cells                            =          0
Rx meta signalling cells                                   =          0
Rx general broadcast signalling cells                      =          0
Rx point to point signalling cells                         =          0

---- OAM errors statistics ----
Rx OAM CRC10 errored cells                                 =          0
Rx OAM unknown Fault Management function cells             =          0
Rx OAM unknown Performance Monitoring function cells       =          0
Rx OAM unknown ACT/DEACT function cells                    =          0
Rx OAM unhandled System Management function cells          =          0
Rx OAM unknown type                                        =          0

---- AIS ----
Seg tx cells        =          0         E2E tx cells        =          0
Seg tx drops        =          0         E2E tx drops        =          0
Seg rx cells        =          0         E2E rx cells        =          0
Seg defect          =       NONE         E2E defect          =       NONE

---- RDI ----
Seg tx cells        =          0         E2E tx cells        =          0
Seg tx drops        =          0         E2E tx drops        =          0
Seg rx cells        =          0         E2E rx cells        =          0

---- LOOPBACK ----
Seg tx cells        =          0         E2E tx cells        =          0
Seg tx drops        =          0         E2E tx drops        =          0
Seg tx loop request =          0         E2E tx loop request =          0
Seg failed loop     =          0         E2E failed loop     =          0
Seg rx cells        =          0         E2E rx cells        =          0
Seg rx loop request =          0         E2E rx loop request =          0
Seg rx uncorrelated =          0         E2E rx uncorrelated =          0
Seg rx unexpected   =          0         E2E rx unexpected   =          0
```

3.3.4.2.4 list aal-connection <aal id> historic

Displays a history on the changes in the connection status, indicating the time the state was entered, the connection flags (previously detailed) and the status description.

```
 Id   Timestamp     Flags      Status    Id   Timestamp     Flags      Status
 -- -------------- -------- ------------ -- -------------- -------- ------------
```

```
  0 05/09 17:50:09 00000001   LOCAL DOWN  1 05/09 17:50:33 00000000 L UP/E2E UNK
```

3.3.4.2.5 list aal-connection <aal id> bit-rate

Offers an average throughput calculation per second at the ATM layer. Strike any key to detain this.

```
atm2/0 monitor+list aal-connection 1 bit-rate

 Tx rate (bps)   =          0     Rx rate (bps)   =          0
```

3.3.4.3 LIST INTERFACE

3.3.4.3.1 list interface all

Displays all information on the ATM interface.

3.3.4.3.2 list interface global

Displays detailed information on all the ATM interface statistics.

```
atm0/0 monitor+list interface global

Description: ADSL over ISDN Annex B (ADI Eagle) over Motorola MPC860 SAR

---- Status ----
Transmission:       ENABLED     Phy rate:        128 kbps
Reception:          ENABLED     Phy rate:        512 kbps
Status:                  UP     for       0/02:10:49 (days/hh:mm:ss)

---- Statistics ----
Tx user cells        =    2316332         Rx user cells        =    2260247
Tx no user cells     =          2         Rx no  user cells    =          2
                                          Rx HEC errored       =          0
                                          Rx invalid           =          0
                                          Rx missinserted      =          8
                                          Rx future functions  =          0
Tx bytes             =  122765702         Rx bytes             =  119793621
Tx last 5 min (kbps) =        125         Rx last 5 min (kbps) =         96

Linked structs (G)   =        100 (20 free)
Segment. structs (G) =          0 (0 free)
```

Status:	Interface status (INTERNAL DOWN, ADMIN DOWN, DOWN and UP).
Tx/*Rx user cells*:	Transmitted/received user cells
Tx/*Rx no user cells*:	OAM cells, reserved VPI/VCI etc.
Rx misinserted:	User cells that do not pertain to any configured VCC.

3.3.4.3.3 list interface aal

Statistics at the interface layer, grouped by AAL type. Check the information on AAL connection monitoring for further information.

```
---- AAL5 statistics ----
Tx SDU ok            =     256440         Rx SDU ok            =     271220
Tx SDU err           =          0         Rx SDU err           =          0
Tx SDU drop          =      75994         Rx SDU drop          =          0
Tx deferrals         =    9587579         Rx buffer denies     =          0
Tx ok/err/drop       =   77/ 0/22         Rx ok/err/drop       =   99/ 0/ 0
```

3.3.4.3.4 list interface hardware

Statistics based on the SAR (these are less important).

```
---- MPC860SAR dependent statistics ----
```

```
  RAW channel reception buffers =         10
  APC Level 1 overruns          =          0
  APC Level 2 overruns          =          0
  Received cells with HEC error =          0
  UTOPIA INT queue overflows    =          0
  UTOPIA cell sync changes      =          0
  UTOPIA cell sync locks        =          0

---- FireStream dependent statistics ----
Confirm pending Packets   =        0
Available RX buffers      =       64
Available Raw buffers     =       64
Tx interrupt unknown      =        0
Rx interrupt unknown      =        0
Tx interrupt simultaneous =        0
Rx interrupt simultaneous =        0
```

3.3.4.3.5 list interface historic

ATM interface history where the start and end time for a connection is indicated. (The "*Rs*" field is reserved for future use.)

```
 Id Connection str Connection end Rs  Id Connection str Connection end Rs
 -- -------------- -------------- --  -- -------------- -------------- --
  0 05/09 17:50:33
```

3.3.4.3.6 list interface bit-rate

Offers an average throughput calculation per second at the ATM layer. Strike any key to stop this.

```
atm2/0 monitor+list int  bit

 Tx rate (bps)   =          0     Rx rate (bps)   =          0
```

3.3.5 PHY

Physical interface monitoring consists of a series of commands described in the manual corresponding to the interface installed in the device.

```
atm0/0 monitor+PHY
--- ADSL Monitor ---
atm0/0:adsl0 monitor+
atm0/0 monitor+PHY
--- SHDSL Monitorization ---
atm0/0:shdsl0 monitor+
```

3.3.6 UPGRADE-FW

Use this command to upgrade the embedded firmware used by some DSL cards.

This command is only available for DSL cards that need it and the file required for the upgrade is only available on demand (upgXXXXX.upf).

Firmware upgrade files have to be loaded, through an FTP connection, into a temporal buffer belonging to the host router (i.e., without using the **quote site savebuffer** FTP command).

This is important because the file can be too big to fit into the host router's available Flash memory.

Once the upgrade process has finished, the temporal buffer should be released.

Warning

Switching off or rebooting the device during the upgrade process may corrupt the memory and make a port unable to boot.

```
atm1/0 monitor+UPGRADE-FW ?
          show-log       Show upgrade log
          release-mem    Release memory holding upgrade file
```

```
start          Start upgrade
```

Command history:

Release	Modification
11.01.10	The **upgrade-fw** command was introduced as of version 11.01.10.

3.3.6.1 UPGRADE-FW SHOW-LOG

Displays the upgrade firmware procedure log.

```
atm1/0 monitor+upgrade-fw show-log

----- UPGRADE FW LOG BUFFER START (302) -----

Locking FTP buffer
Upgrade file len 17168384 bytes
Upgrade file version 1.0.0.0 0.0.0.0
Upgrade file checksum verification ok
UBoot Version '2' (2)
OS Version '2' (2)
About to set upgrade OS mode
Wait until the command finishes
File transfer OK
File transfer OK
Wait for upgrade checking
Upgrade verified
Done!
Unlocking FTP buffer

----- UPGRADE FW LOG BUFFER END -----
```

3.3.6.2 UPGRADE-FW RELEASE-MEM

Releases the RAM memory allocated to the temporal FTP buffer that is holding the upgrade firmware.

The buffer may be kept if more than one port or card using the same firmware are installed in the system and are to be upgraded.

```
atm1/0 monitor+upgrade-fw release-mem
File erased!
```

3.3.6.3 UPGRADE-FW START

This command performs the upgrade that:

- Checks the version installed is the card is older than the one to be installed.
- Upgrades those elements of the firmware that need to be so.
- Reboots the card and checks the new firmware has been installed successfully.
- If the firmware installation has failed, the previous firmware is activated and a new procedure should be started.

```
atm1/0 monitor+upgrade-fw start
Locking FTP buffer
Upgrade file len 17168384 bytes
Upgrade file version 1.0.0.0 0.0.0.0
Upgrade file checksum verification ok
UBoot Version '2' (2)
OS Version '2' (2)
About to set upgrade OS mode
Wait until the command finishes
```

```
          File transfer OK
          File transfer OK
          Wait for upgrade checking
          Upgrade verified
          Done!
          Unlocking FTP buffer

          Do you want to erase upgrade file from memory?(Yes/No)? n
```

The upgrade process may take some time but the procedure should be allowed to finish to avoid memory corruption.

3.3.7 EXIT

Returns to the monitoring prompt.

```
atm0/0 monitor+EXIT
+
```

3.4 ATM subinterface monitoring commands

The ATM subinterface monitoring commands are numerated and described in this section. Use these commands to obtain information on the ATM subinterface.

Command	Function
? (HELP)	Displays the available commands or their options.
CLEAR	Deletes the statistics.
EXIT	Returns to the GWCON (+) prompt.
LIST	Displays the different aspects of the ATM subinterface.

3.4.1 ? (HELP)

Displays a list of available commands and their options.

```
atm0/0.1 monitor+ ?
  clear    Clear subinterface statistics
  list     List subinterface statistics
  exit
```

3.4.2 CLEAR

Deletes statistics.

```
atm0/0.1 monitor+CLEAR
```

3.4.3 EXIT

Returns to the monitoring prompt.

```
atm0/0.1 monitor+EXIT
+
```

3.4.4 LIST

Displays information on the ATM subinterface.

```
atm0/0.1 monitor+LIST

---- Status ----
Status:     DOWN for     0/00:00:00 (days/hh:mm:ss)
MTU:          1522
```

```
---- Statistics ----
Tx packets          =          0        Rx packets          =          0
Tx bytes            =          0        Rx bytes            =          0
Tx errors           =          0        Rx errors           =          0
Tx too long to encap=          0        Rx bad encap or prot =          0
```

Appendix A Transmission rate management

A.1 Transmission rates (MPC860SAR/PQSAR only)

The ATM characteristics control transmissions in distinct circuits. This is essential to offer and manage the quality of service.

The transmission controller must be configured with a range of transmission rates that it can handle in an interface.[3] Any circuit that implies a higher rate than the **max-circuit-rate**, o a lower rate than the **min-circuit-rate**, cannot be efficiently configured and its transmission may remain stopped. (An ATM event occurs when this circumstance prevents a circuit from being created). I.e. if you set a maximum of 1000 kbps and a minimum of 250 kbps, configure a CBR whose PCR is outside these ranges, or a VBR whose PCR and/or SCR are out of these ranges or a UBR whose PCR is below the minimum (due to best effort, no problems are created with rates higher than the maximum as this is limited to the maximum) the circuits will not be created.

The most important parameter is the relation between **max-circuit-rate** and **min-circuit-rate**, as said relation implies a certain resource reserve in the system: given that the system resources are scarce and they must be shared among the rest of the interfaces, protocols etc., not all configurations are possible. A high value for this ratio may mean the interface will not start up, as the controller has not been able to allocate the necessary resources to handle this range.

If the minimum rate is not configured in an absolute form, there is **a max-to-min-ratio** parameter available to configure said rate with respect to the speed configured in **max-circuit-rate** (which in turn can be configured in a relative form to the physical interface).

In short, the max-circuit-rate and min-circuit-rate relationship determines the range of transmission rate the ATM controller is able to manage. Said range is:

- Possible or impossible (high value for said relationship increase the possibility that it cannot be handled).
- When possible, any circuit that implies out of range rates will not be created.

[3] Different interfaces may have distinct ranges.

Appendix B Configuration Example

B.1 ADSL Connection with PPPoE

Configuration for a typical Internet connection scenario using ADSL over PPPoE.

```
log-command-errors
no configuration
add device ppp 1
add device atm-subinterface atm0/0 1
;
network atm0/0
; -- ATM interface configuration --
   aal-connection 1 pvc 8 32
   pvc 8 32 default
   phy
      open-mode ansi-t1.413 annex A
   exit
exit
;
network atm0/0.1
   aal-connection-requested 1 default
exit
;
network ppp1
   ppp
      authentication sent-user myuser ciphered-pwd mypassword
      ipcp local address assigned
   exit
   base-interface
      base-interface atm0/0.1 link
   exit
   pppoe
      enable pppoe
   exit
exit
;
protocol ip
   address ethernet0/0 192.168.0.1 255.255.255.0
   address ppp1 unnumbered
   route 0.0.0.0 0.0.0.0 ppp1
   rule 1 local-ip ppp1 remote-ip any
   rule 1 napt translation
   rule 1 napt tcp-adjust-mss mss_clamping
   classless
;
exit
dump-command-errors
end
```

B.2 ADSL Connection with fixed IP encapsulated VC

Configuration for a typical Internet connection scenario using ADSL over IP.

```
log-command-errors
no configuration
add device atm-subinterface atm0/0 1
;
network atm0/0
; -- ATM interface configuration --
   aal-connection 1 pvc 8 32
   pvc 8 32 default
   phy
      open-mode ansi-t1.413 annex A
```

```
   exit
exit
;
network atm0/0.1
   aal-connection-requested 1 default
   multiplexation-method vc-ip
exit
;
protocol ip
   address ethernet0/0 192.168.0.1 255.255.255.0
   address atm0/0.1 80.33.23.12 255.255.255.252
   route 0.0.0.0 0.0.0.0 atm0/0.1
   rule 1 napt translation
   classless
;
exit
dump-command-errors
end
```

B.3 Fixed IP SHDSL Connection in bridge/routing mode

Configuration for a scenario where the device that executed bridging between the SHDSL and an Ethernet is replaced by a router that finalizes bridge, offering IP to the clients connected to its Ethernet.

```
log-command-errors
no configuration
add device atm-subinterface atm0/0 1
add device bvi 0
;
network atm0/0
; -- ATM interface configuration --
   aal-connection 1 pvc 8 32
   pvc 8 32 default
   phy
      open-mode cpe g.shdsl annex B 4-wire-enhanced
      line-rate 4608
   exit
exit
;
network atm0/0.1
   aal-connection-requested 1 default
exit
;
protocol asrt
   bridge
   irb
   port atm0/0.1 1
   no stp
   route protocol-ip
exit
;
protocol ip
   address ethernet0/0 192.168.0.1 255.255.255.0
   address bvi0 80.33.23.12 255.255.255.252
   route 0.0.0.0 0.0.0.0 bvi0
   rule 1 napt translation
   classless
;
exit
dump-command-errors
end
```

B.4 SHDL Connection in manageable bridge mode

Configuration for a scenario where the device behaves as a transparent bridge between SHDSL and Ethernet, but with the possibility of managing the device through IP.

```
log-command-errors
no configuration
add device atm-subinterface atm0/0 1
add device bvi 0
;
network atm0/0
; -- ATM interface configuration --
   aal-connection 1 pvc 8 32
   pvc 8 32 default
   phy
      open-mode cpe g.shdsl annex B 4-wire-enhanced
      line-rate 4608
   exit
exit
;
network atm0/0.1
   aal-connection-requested 1 default
exit
;
protocol asrt
   bridge
   irb
   port ethernet0/0 1
   port atm0/0.1 2
   no stp
   route protocol-ip
exit
;
protocol ip
   address bvi0 80.33.23.12 255.255.255.252
   classless
;
exit
dump-command-errors
end
```

Appendix C Bibliography and glossary

C.1 Bibliography

I.150	ITU-T B-ISDN ASYNCHRONOUS TRANSFER MODE FUNCTIONAL CHARACTERISTICS
I.361	ITU-T B-ISDN ATM LAYER SPECIFICATION
I.610	ITU-T B-ISDN OPERATION AND MAINTENANCE PRINCIPLES AND FUNCTIONS
I.363.5	ITU-T B-ISDN ATM ADAPTATION LAYER SPECIFICATION: TYPE 5 AAL
AF-NM-0122.000	ATM FORUM AUTO-CONFIGURATION OF PVCS
AF-ILMI-0065.000	ATM FORUM ILMI SPECIFICATION VERSION 4.0
RFC 1483	Juha Hienanen – Telecom Finland Network Working Group Multiprotocol Encapsulation over ATM Adaptation Layer 5
RFC 2225	M. Laubach – Com21, Inc. J. Halpern – Newbridge Networks, Inc. Network Working Group Classical IP and ARP over ATM

C.2 Glossary

16-CAP

Carrierless Amplitude/Phase Modulation with 16 constellation points.

The modulation technique used in the 51.84 Mb Mid-Range Physical Layer Specification for Category 3 Unshielded Twisted-Pair (UTP-3).

64-CAP

Carrierless Amplitude/Phase Modulation with 64 constellation points.

AAL ATM Adaptation Layer

The standards layer that allows multiple applications to have data converted to and from the ATM cell. A protocol used that translates higher layer services (PDU) into the size and format of an ATM cell and vice versa.

AAL-1 ATM Adaptation Layer Type 1

Specialized AAL functions in support of constant bit rate (CBR), time-dependent traffic such as voice and video.

AAL-2 ATM Adaptation Layer Type 2

Specialized layer for variable bit rate (VBR) traffic (mainly for video).

AAL-3/4 ATM Adaptation Layer Type 3/4

AAL functions in support of variable bit rate, delay-tolerant data traffic requiring some sequencing and/or error detection support. Originally two AAL types, i.e. connection-oriented and connectionless, which have been combined.

AAL-5 ATM Adaptation Layer Type 5

AAL functions in support of variable bit rate, delay-tolerant connection-oriented data traffic requiring minimal sequencing or error detection support.

ABR Available Bit Rate

ABR is an ATM layer service category so the limiting ATM layer transfer characteristics provided by the network may change subsequent to connection establishment. A flow control mechanism is specified that supports several types of feedback to control the source rate in response to changing ATM layer transfer characteristics. Cell delay variation (CDV) is not controlled in this service.

Address Prefix

A string of 0 or more bits, up to a maximum of 152, that is the lead portion of one or more ATM addresses.

ADPCM Adaptive Differential Pulse Code Modulation

A reduced bit rate variant of PCM audio encoding. This algorithm encodes the difference between an actual audio sample amplitude and a predicted amplitude and adapts the resolution based on recent differential values.

ADSL Asymmetric Digital Subscriber Line

Technology permitting modems attached to twisted pair copper wiring to transmit from 1.5 Mbps to 9 Mbps downstream (to the subscriber) and from 16 kbps to 800 kbps upstream (or to the network), depending on line distance.

AIS Alarm Indication Signal

Signal sent down or up stream by a device when it detects an error condition or receives an error condition or receives an error notification from another unit in the transmission path.

AMI Alternate Mark Inversion

A line coding format used on T1 facilities that transmits ones by alternate positive and negative pulses.

ANSI American National Standards Institute

A U.S. standards body.

APON ATM Passive Optical Network

Passive optical network transporting ATM.

ARP Address Resolution Protocol

The procedures and messages in a communications protocol that determine which physical network address (MAC) corresponds to the IP address in the packet.

ATM Asynchronous Transfer Mode

Very high speed data transmission protocol based on cells and can be established over ADSL.

ATM is capable of transporting and switching voice, data, images and video over the same infrastructure.

ATM25

ATM Forum defined 25.6Mbit/s cell based user interface based on IBM token ring network.

ATM Layer Link

A section of an ATM Layer connection between two adjacent active ATM Layer entities (ATM-entities).

ATM Link

A virtual path link (VPL) or a virtual channel link (VCL).

ATM Peer-to-Peer Connection

A virtual channel connection (VCC) or a virtual path connection (VPC).

ATM Traffic Descriptor

A generic list of traffic parameters that can be used to capture the intrinsic traffic characteristics of a requested ATM connection.

ATU-C / ATU-R ADSL Transmission Unit, Central or Remote

Device located at the end of the ADSL line between the line itself and the first user device or the first telephone switch device. The ATU-C can be integrated in the access node.

BER Bit Error Rate

A measure of quality transmission. It is generally shown as a negative exponent, (e.g., 10-7, which means 1 out of 107 bits are erroneous, or 1 out of 10,000,000 bits are).

B-ISDN Broadband Integrated Digital Network

A digital network with ATM switch operating at speeds above 1.544 or 2.048 Mbps.

Broadband

A service or system requiring transmission channels capable of supporting rates greater than the Integrated Services Digital Network (ISDN) primary rate.

CBR Constant Bit Rate

An ATM service category that supports a constant or guaranteed rate to transport services such as video or voice, as well as circuit emulation. This category requires rigorous timing control and performance parameters.

CDV Cell Delay Variation

CDV is a component of cell transfer delay, induced by buffering and cell scheduling.

Cell

A unit of transmission in ATM. A fixed-size frame consisting of a 5-octet header and a 48-octet payload.

CLP Cell Loss Priority

This bit in the ATM cell header indicates cell priority. CLP=0 cells are higher priority than CLP=1 cells. CLP=1 cells may be discarded during periods of congestion to preserve the CLR of CLP=0 cells.

AAL connection

Association established by the AAL between two or more next higher layer entities.

Semi-permanent connection

A connection established via a service order or via network management.

CPCS Common Part Convergence Sublayer

The portion of the convergence sublayer of an AAL that remains the same regardless of the traffic type.

CPI Centro Proveedor de Internet

See ISP.

CRC Cyclic Redundancy Check

A mathematical algorithm that computes a numerical value based on the bits in a block of data. This number is transmitted with the data. The receiver uses this information and the same algorithm to ensure the data are duly delivered by comparing the algorithm results and the number received.

CS Convergence Sublayer

The general procedures and functions that convert between ATM and non-ATM formats (FR, SMDS etc), executed above the ATM layer.

CTD Cell Transfer Delay

This is defined as the time that lapses between a cell exit event at a given point and the corresponding cell entry event at a given point for a particular connection. The cell transfer delay between two measurement points is the sum of the total inter-ATM node transmission delay and the total ATM node processing delay.

DS0 Digital Signal 0

The 64 kbps rate that is the basic building block for both the North American and European digital hierarchies.

DS1 Digital Signal 1

Twenty-four voice channels packed into a 193 bit frame and transmitted at 1.544 Mbps. The unframed version or payload is 192 bits at a rate of 1.536 Mbps.

DS2 Digital Signal 2

Four T1 frames encapsulated in a higher layer frame transmitted at 6.312 Mbps.

DSLAM Digital Subscriber Line Access Multiplexer

Device that concentrates a determined number of ADSL lines in a single ATM line.

E1

The 2.048 Mbps rate used by European CEPT carrier to transmit 30 64 kbps digital channels for voice or data calls, plus a 64 kbps signaling channel and a 64 kbps channel for framing and maintenance.

EOM End of Message

An indicator used in the AAL that identifies the last ATM cell containing information from a data packet that has been segmented.

ETSI European Telecommunications Standards Institute

The primary telecommunications standards organization.

FDDI Fiber Distributed Data Interface

A 100 Mbps Local Area Network standard that was developed by ANSI that is designed to work on fiber-optic cables, using techniques similar to token-ring.

FEC Forward Error Correction

An error detection and correction technique used in a digital data stream.

FEXT Far End CrossTalk

Interference between two signals at the remote end of a telephone switch.

FTTCab Fibre To The Cabinet

Network architecture where an optical fiber connects the telephone switch to a street-side cabinet where the signal is converted to feed the subscriber over a twisted copper pair.

FTTH Fibre To The Home

Network architecture where an optical fiber runs from the telephone switch to the subscriber's premises or home.

FTTK or FTTC Fiber To the Kerb

Network architecture where an optical fiber runs from the telephone switch to a kerbside distribution point close to the subscriber where it is converted to a copper pair.

GFC Generic Flow Control

GFC is a field in the ATM header used to provide local functions (e.g., flow control).

HDSL High data rate Digital Subscribe Line

Technology permitting E1/T1 transmission rates over a twisted pair.

HEC Header Error Control

Using the fifth octet in the ATM cell header, ATM equipment may check for an error and corrects the contents of the header. The check character is calculated using a CRC algorithm that allows a single bit error in the header to be corrected, or multiple errors to be detected.

HFC Hybrid Fibre Coax

A system (usually CATV) where fiber is run to a distribution point close to the subscriber and then the signal is converted to run to the subscriber's premises over a coaxial cable.

IDU Interface Data Unit

The unit of information transferred to/from the upper layer in a single interaction across the SAP. Each IDU contains interface control information and may also contain the whole or part of the SDU.

IEEE Institute of Electrical and Electronics Engineers

A worldwide engineering publishing and standards-making body for the electronics and telecommunications industry.

IEEE 802.3

A LAN protocol suite commonly known as Ethernet. Ethernet has either a 10 Mbps or 100 Mbps throughput and uses Carrier Sense Multiple Access bus with Collision Detection CSMA/CD and bus topology.

IEEE 802.5

A Local Area Network protocol suite commonly known as Token Ring. A standard originated by IBM for a token passing ring network that can be configured in a star topology. Versions supported are 4 Mbps and 16 Mbps.

IETF Internet Engineering Task Force

The organization that provides the coordination of standards and specification development for TCP/IP networking.

IP Internet Protocol

Originally developed by the Department of Defense to support interworking of dissimilar computers across a network. This protocol works in conjunction with TCP and is usually identified as TCP/IP. A connectionless protocol that operates at the network layer (layer 3) of the OSI model.

ISO International Organization for Standardization

An international organization for standardization, based in Geneva, Switzerland, which establishes voluntary standards (not binding but recommendable).

ITU-T International Telecommunications Union Telecommunications

ITU-T is an international body of member countries whose task is to define recommendations and standards relating to the international telecommunications industry.

Previous known as CCITT.

ISP Internet Service Provider

Organization offering and providing Internet services to the public and that have their own servers to provide these services.

JPEG Joint Photographic Experts Group

An ISO Standards group that defines how to compress still pictures.

LAN Local Area Network

A network designed to move data between stations within a campus.

Typical technologies are Ethernet, FastEthernet and Token Ring.

LANE LAN Emulation

The set of services, function groups and protocols, for the emulation of LANS utilizing ATM as a backbone to allow connectivity among LAN and ATM attached end stations.

LAPD Link Access Procedure D

A layer 2 protocol defined by ITU-T. This protocol reliably transfers blocks of information across a line.

LOC Loss of Cell Delineation

A condition at the receiver or a maintenance signal transmitted in the PHY overhead indicating that the receiving equipment has lost cell delineation.

LOF Loss of Frame

A condition at the receiver or a maintenance signal transmitted in the PHY overhead indicating that the receiving equipment has lost frame delineation.

Loop Qualification

Process where you can configure (or not) a line to supply a determined type of DSL transmission at a given rate.

LOS Loss of Signal

A condition at the receiver or a maintenance signal transmitted in the PHY overhead indicating that the receiving equipment has lost the received signal.

MIB Management Information Base

A definition of management items for some network component that can be accessed by a network manager. A MIB includes the names of objects it contains and the type of information retained.

MPEG Motion Picture Experts Group

An ISO Standards group dealing with video and audio compression techniques and mechanisms to multiplex and synchronize various media streams.

MPOA Multiprotocol over ATM

An effort taking place in the ATM Forum to standardize protocols for the purpose of running multiple network layer protocols over ATM.

Multiplexing

A function within a layer that interleaves the information from multiple connections into one connection.

NEXT Near End CrossTalk

The interference between pairs of lines at the telephone switch end.

N-ISDN Narrowband ISDN

See ISDN.

NNI Network Node Interface

Interface between ATM switches.

Access Node

Points on the access network boundary that concentrate individual access lines in a lesser number than trunk lines.

Access nodes can perform various types of protocol transformation. Typical access nodes are: Digital Loop Carrier, which concentrates individual voice lines in T1/E1 lines, mobile phone antenna centers, PBXx and Optical Network Units.

NSP (Network Service Provider)

Term used to describe an organization that provides value-added network services in a telecommunications network.

nx64K

This refers to a circuit bandwidth or speed provided by the aggregation of nx64 kbps channels.

OAM Operations Administration and Maintenance

A group of network management functions that provide network fault indication, performance information, and data and diagnosis functions.

OC3 Optical Carrier 3

Name given to the optical fiber line transporting 155 Mbps.

OSI Open Systems Interconnection

A seven (7) layer architecture model for communications systems developed by the ISO for the interconnection of data communication systems.

PBX Private Branch eXchange

PBX is the term given to a device that provides private local voice switching and voice-related services within the private network.

PCR Peak Cell Rate

The Peak Cell Rate, in cells/sec, is the cell rate the source may never exceed.

PDU Protocol Data Unit

A PDU is a message of a given protocol comprising payload and protocol-specific control information, typically contained in a header.

PDUs pass over the protocol interfaces that exist between the layers of protocols (per OSI model).

PLL Phase Lock Loop

Phase Lock Loop is a mechanism whereby timing information is transferred within a data stream. The receiver derives the signal element timing by locking its local clock source to the received timing information.

PMD Physical Media Dependent

This sublayer defines the parameters at the lowest level, such as speed of the bits on the media.

PNNI Private Network-Network Interface

A routing information protocol that enables extremely scalable, full function, dynamic multi-vendor ATM switches to be integrated in the same network.

POTS Plain Old Telephone Service

Name given to the analog telephone basic service that occupies the lowest bandwidth, 4KHz, over a twisted pair. Any service sharing the line with POTS must use frequencies above POTS or convert POTS into a digital signal and carry out multiplexing with other digital signals.

PTI Payload Type Indicator

Payload Type Indicator is the Payload Type field value distinguishing the various management cells and user cells.

PTT

Acronym used in Europe used to indicate public telephone companies.

PVC Permanent Virtual Circuit

This is a link with static route defined in advance, usually by manual setup.

PVCC Permanent Virtual Channel Connection

A Permanent VCC that is provisioned through some network management function and left up indefinitely.

PVPC Permanent Virtual Path Connection

A Permanent VPC that is provisioned through some network management function and left up indefinitely.

QoS Quality of Service

Quality of Service: Quality of Service is defined on an end-to-end basis in terms of the following attributes of the end-to-end ATM connection: CLR (Cell Loss Ratio), CTD (Cell Transfer Delay) and CDV(Cell Delay Variation).

RADSL Rate Adaptive ADSL

Version of ADSL where the modems test the line and adjust their rate to the highest possible.

Access Network

Portion of the switched public network, which communicates the access nodes with the individual subscribers. Currently the access network mainly consists of twisted copper passive pair.

RFC Request For Comment

The development of TCP/IP standards, procedures and specifications is done via this mechanism. RFCs are documents that progress through several development stages, under the control of IETF, until they are finalized or dropped.

RISC Reduced Instruction Set Computing

A computer processing technology in which a microprocessor understands a few simple instructions thereby providing a fast and predictable instruction flow.

RM-Cell Resource Management Cell

ATM cell for the exchange of information on the network state such as the available bandwidth, congestion, etc.

Router

A physical device capable of forwarding packets based on network layer information.

SAAL Signaling ATM Adaptation Layer

This resides between the ATM layer and the Q.2931 function. The SAAL provides reliable transport of Q.2931 messages between Q.2931 entities (e.g., ATM switch and host) over the ATM layer; two sublayers: common part (CPCS) and service specific part (SSCS).

SAP Service Access Point

SAP is used for the following purposes:

(a) When the application initiates an outgoing call to a remote ATM device, a destination_SAP specifies the ATM address of the remote device, plus further addressing that identifies the target software entity within the remote device.

(b) When the application prepares to respond to incoming calls from remote ATM devices, a local_SAP specifies the ATM address of the device housing the application, plus further addressing that identifies the application within the local device.

SAR Segmentation and Reassembly

Method that allows two entities with distinct PDU sizes to communicate.

SCR Sustainable Cell Rate

The SCR is an upper bound on the conforming average rate of an ATM connection over time scales, long compared to those PCR is defined for.

SDH Synchronous Digital Hierarchy

The ITU-TSS International standard for transmitting information over optical fiber.

SDT Structured Data Transfer

An AAL1 data transfer mode where data is structured into blocks that are then segmented into cells for transfer.

SDU Service Data Unit

A unit of interface information whose identity is preserved from one end of a layer connection to the other.

SDSL Symmetric Digital Subscriber Line

HDSL and POTS over an individual telephone line.

SHDSL Symmetric High Bit Rate Digital Subscriber Line

Technology permitting connection of a modem to a twisted copper pair and symmetrically transmit from 192K to 2304, depending on the distance of the line.

Segment

A single ATM link or group of interconnected ATM links of an ATM connection.

SN Sequence Number

SN is a 4 octet field in a Resource Management cell to sequence such cells.

SNA Systems Network Architecture

IBM's seven layer, vendor specific architecture for data communications.

SNMP Simple Network Management Protocol

SNMP is the IETF standard management protocol for TCP/IP networks.

SONET Synchronous Optical Network

An ANSI standard for transmitting information over optical fiber. This standard is a variation of the SDH International standard.

Splitter

Filter used to separate the ADSL and POTS signals to prevent mutual interference.

SRTS Synchronous residual Time Stamp

A clock recovery technique where difference signals between source timing and a network reference timing signal are transmitted to allow reconstruction of the source timing at the destination.

SSCF Service Specific Coordination Function

SSCF is a function defined in Q.2130 for Support of Signaling at the User-to- Network Interface (UNI).

SSCOP Service Specific Connection Oriented Protocol

An adaptation layer protocol defined in ITU-T Specification: Q.2110.

SSCS Service Specific Convergence Sublayer

The portion of the convergence sublayer dependent upon the type of traffic that is being converted.

STM Synchronous Transfer Module

STM is a basic building block used for a synchronous multiplexing hierarchy defined by the ITU-T.

STM-1 Synchronous Transport Module 1

SDH standard for transmission over OC-3 optical fiber at 155.52 Mbps.

STM-n Synchronous Transport Module "n"

SDH standards for transmission over optical fiber (OC-'n x 3) by multiplexing "n" STM-1 frames, (e.g., STM-4 at 622.08 Mbps and STM-16 at 2.488 Gbps).

STP Shielded Twisted Pair

A cable containing one or more twisted pair wires with each pair having a shield of foil wrap.

STS-1

SONET standard for transmission at 51.84 Mbps.

SVC Switched Virtual Circuit

A connection established via signaling. The user defines the endpoints when the call is initiated.

SVCC Switched Virtual Channel Connection

A Switched VCC is one established and taken down dynamically through control signaling.

SVPC Switched Virtual Path Connection

A Switched Virtual Path Connection is one established and taken down dynamically through control signaling.

Switch ATM

Device executing ATM switch functions based on the cell VPI.

T1

See DS1.

TC Transmission Convergence

The TC sublayer transforms the flow of cells into a steady flow of bits and bytes for transmission over the physical medium. On transmit, the TC sublayer maps the cells to the frame format, generates the Header Error Check (HEC), sends idle cells when the ATM layer has none to send. On reception, the TC sublayer delineates individual cells in the received bit stream, and uses the HEC to detect and correct received errors.

TCP Transmission Control Protocol

A layer 4 protocol that provides end-to-end, connection-oriented, reliable transport layer functions over IP controlled networks. TCP performs the following functions: flow control between two systems, acknowledgements of packets received and end-to-end sequencing of packets.

TDM Time Division Multiplexing

A method where a transmission facility is multiplexed among a number of channels by allocating the facility to the channels on the basis of time slots.

Traffic Management

Set of ATM procedures for traffic and congestion control; the ATM traffic control consists of a set of actions executed by the network to avoid congestion conditions as well as intensity, reach and duration.

Trailer

Protocol control information located at the end of a PDU.

Transit Delay

The time difference between the instant at which the first bit of a PDU crosses one designated boundary and the instant at which the last bit of the same PDU crosses a second designated boundary.

Traffic Shaping

Traffic Shaping is a mechanism that alters the traffic characteristics of a stream of cells on a connection to achieve better network efficiency, while meeting the QoS objectives, or to ensure conformance at a subsequent interface.

Traffic shaping must maintain cell sequence integrity on a connection.

Time Stamp

Time Stamping is used on OAM cells to compare time of entry of cell to time of exit of cell to be used to determine the cell transfer delay of the connection.

UBR Unspecified Bit Rate

UBR is an ATM service category that does not specify traffic related service guarantees. Specifically, UBR does not include the notion of a per-connection negotiated bandwidth. No numerical commitments are made with respect to the cell loss ratio experienced by a UBR connection, or as to the cell transfer delay experienced by cells on the connection.

UDP User Datagram Protocol

This protocol is part of the TCP/IP protocol suite and provides a means for applications to access the connectionless features of IP. UDP operates at layer 4 of the OSI reference model and provides for the exchange of datagrams without acknowledgements or guaranteed delivery.

UME UNI Management Entity

The software residing in the ATM devices at each end of the UNI circuit that implements the management interface to the ATM network.

Unassigned Cell

A cell identified by a standardized virtual path identifier (VPI) and virtual channel identifier (VCI) value that has been generated and does not carry information from an application using the ATM Layer service.

UNI User-Network Interface

An interface point between ATM end users and a private ATM switch, or between a private ATM switch and the public carrier ATM network; defined by physical and protocol specifications per ATM Forum UNI documents.

UTOPIA Universal Test & Operations Interface for ATM

Refers to an electrical interface between the TC and PMD sublayers of the PHY layer.

UTP Unshielded Twisted Pair

A cable with one or more twisted pairs, but with no shield per pair.

VADSL (Very high speed ADSL)

See VDSL.

VBR Variable Bit Rate

An ATM Forum defined service category, which supports variable bit rate data traffic.

VC Virtual Channel

A communications channel that provides for the sequential unidirectional transport of ATM cells.

VCC Virtual Channel Connection

A concatenation of VCLs that covers the points where ATM service users access the ATM layer. The points at which the ATM cell payload is passed to, or received from, the users of the ATM Layer (i.e., a higher layer or ATM-entity) for processing signify the endpoints of a VCC. VCCs are unidirectional.

ATM connection where switching is carried out based on the VPI and VCI of each cell.

VCI Virtual Channel Identifier

A unique numerical tag as defined by a 16 bit field in the ATM cell header that identifies a virtual channel, the cell is to travel over.

VCL Virtual Channel Link

A means of unidirectional transport of ATM cells between the point where a VCI value is assigned and the point where that value is translated or removed.

VCO Voltage Controlled Oscillator

An oscillator whose clock frequency is determined by the magnitude of the voltage presented at its input.

VDSL Very high data rate Digital Subscriber Line

Technology permitting operations over a twisted pair at rates between 12.9 and 52.8 Mbps with a maximum reach between 900 and 1.500 m over AWG24.

Virtual Channel Switch

A network element that connects VCLs. It terminates VPCs and translates VCI values.

Virtual Path Switch

A network element that connects VPLs. It translates VPI (not VCI) values.

VLAN Virtual Local Area Network

Work stations connected to an intelligent device, which provides the capabilities to define LAN membership.

VP Virtual Path

A unidirectional logical association or bundle of VCs.

VPC Virtual Path Connection

A concatenation of VPLs between Virtual Path Terminators (VPTs).

ATM connection where switching is only carried out based on the VPI of each cell.

VPCs are unidirectional.

VPI Virtual Path Identifier

An eight bit field in the ATM cell header, which indicates the virtual path the cell should be routed over.

VPL Virtual Path Link

A means of unidirectional transport of ATM cells between the point where a VPI value is assigned and the point where that value is translated or removed.

VPT Virtual Path Terminator

A system that unbundles the Vcs of a VP for independent processing of each VC.

VTOA Voice and Telephony Over ATM

The ATM Forum voice and telephony over ATM service interoperability specifications focus on three applications to carry voice over ATM networks; desktop (or LAN services), trunking (or WAN services), and mobile services.

WAN Wide Area Network

This is a network that spans a large geographic area relative to LAN office and campus environment. WAN is characterized by having much greater transfer delays due to laws of physics.