ATM
What is ATM?

Cell-based Multiplexing and Switching Technology

Utilizes Fixed-Length Cells

Industry Standard Cell Format
Characteristics of ATM

Fixed-length cells allow for very fast switching based in hardware (Vs software)

Low overhead due to small header size (compared to the data payload size)

Able to integrate voice, data, audio, and video
Where Will ATM Be Used?

Local Area Networks

Metropolitan Area Networks

Wide Area Networks

Broadband Integrated Services
Digital Network (B-ISDN)
Advantages of ATM

- Suitable for transmission of data, voice, video and image
- High Performance
- Unlimited bandwidth
- Lowest Latency
# ATM Infrastructure

<table>
<thead>
<tr>
<th>(Control)</th>
<th>(User)</th>
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<th>(User)</th>
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<tbody>
<tr>
<td>Signaling</td>
<td>Connection</td>
<td>Connectio</td>
<td>Video</td>
<td>Voice</td>
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<td></td>
<td>-less Data</td>
<td>n Oriented</td>
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<td></td>
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<td>Data</td>
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- **ATM Adaptation Layer (AAL)**
- **ATM Layer**
- **Physical Layer**
ATM Adaptation Layer

- AAL provides adaptation between the higher layers and the ATM layer
- Assigns ATM service classes based on three parameters:
  - Timing (required or not required)
  - Bit Rate (constant or variable)
  - Connection Mode (connection oriented or connectionless)
## AAL Service Classes

<table>
<thead>
<tr>
<th>Service Parameters</th>
<th>Class A</th>
<th>Class B</th>
<th>Class C</th>
<th>Class D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timing Between Source and Destination</td>
<td>Required</td>
<td>Not Required</td>
<td></td>
<td></td>
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<tr>
<td>Bit Rate</td>
<td>Constant</td>
<td>Variable</td>
<td></td>
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</tr>
<tr>
<td>Connection Mode</td>
<td>Connection-Oriented</td>
<td></td>
<td>Connection-less</td>
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*Adaptation Layer*
AAL Service Class

Examples

"A" - Circuit Emulation (DS1, DS3)

"B" - Variable Bit Rate Video

"C" - Connection Oriented Data Transfer (Frame-Relay)

"D" - Connectionless Data Transfer (SMDS - Switched Multimegabit Data Service)

Adaptation Layer
ATM Layer

Provides the means to multiplex virtual connections onto a single physical interface

Provides the means to support management functions associated with the virtual connections

ATM Layer
ATM Cell Format

5 Octet Header
48 Octet Payload (User data)

ATM Layer
<table>
<thead>
<tr>
<th>Generic flow control</th>
<th>Virtual Path identifier</th>
</tr>
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<tbody>
<tr>
<td>Virtual path identifier</td>
<td></td>
</tr>
<tr>
<td>Virtual Channel identifier</td>
<td></td>
</tr>
<tr>
<td>Payload type</td>
<td>CLP</td>
</tr>
<tr>
<td>Header error control</td>
<td></td>
</tr>
</tbody>
</table>

**User - Network interface**

![ATM Cell Format](image_url)

**Information Field**

(48 octets)
ATM Header Format

GFC = Generic Flow control
VPI = Virtual Path Identifier
VCI = Virtual Channel Identifier
PAY = Payload Type (cell type)
CLP = Cell Loss Priority
HCS = Header Check Sequence
VP/VC Relationship

2 Levels of Multiplexing & Switching

- "Course" Virtual Path Level
- "Finer" Virtual Circuit Level

ATM Layer
Physical Layer

Defines the manner in which the ATM cells are mapped into the physical layer payload

Defines the operations and maintenance (OAM) functions required at the physical layer
Physical Layer Options

- "Pure ATM Mapping
  - Physical layer OAM performed by the ATM cells
  - Vendor support remains to be determined
- DS1 (1.544 MB)
- DS3 (45MB)
- SONET STS-1 (51.84 MB)
- SONET STS-3c (155.52 MB)
- SONET STS-12c (622.08 MB)

SONET = Synchronous Optical Network
Sample Mapping of ATM Cells into STS-3C

- Physical Layer OAM performed by SONET
STS-3c Data Rates

- **STS-3c Total Data Rate**
  - Frame size = 270 Octets x 9 Octets = 2,430 Octects = 19,440 Bits
  - 19,440 Bits X 8,000 Frames/Second = 155.52 MB/Second

- **STS-3c Usable Payload Rate**
  - Frame size = 260 Octets X 9 Octets = 2,340 Octects = 18,720 Bits
  - 18,720 Bits X 8,000 Frames/Second = 149.76 MB/Second
ATM Centric view

ATM

ATM

ATM

ATM

R

Token ring

Ethernet

FDDI

R

Token ring

Ethernet

FDDI

R

Token ring

Ethernet

FDDI
ATM Centric View

ATM node serves as the back bone.
Router becomes the access vehicle to the network.

ATM-centric view is a typical view of future architecture if ATM deployment is expected in the public network.
Balanced View Architecture
Transition to ATM based LAN

Phase 1: FDDI is replaced by ATM switch to provide a switched environment compared to FDDI’s bus based architecture. The purpose is to provide dedicated connection between LANs on demand.

Phase 2: ATM switch is used to connect the outside world at the interface. Example: University Campus Environment.

Phase 3: Tokening or bus LANs disappear and all the terminals or workstation are directed towards the ATM switch.
Today’s LAN Environment

Bus based LAN

10 Mbps

16 Mbps

50 Mbps

Router

Engineering Workstation

File Server

Ring based LAN

File Server

SERVER

SERVER

SERVER

SERVER
Phase 1 Transition to ATM based LAN

- File Server
- Engineering Workstation
- Router
- ATM SWITCH
  - Bus based LAN: 10 Mbps
  - Ring based LAN: 16 Mbps, 50 Mbps
  - File Server
Phase 2 Transition to ATM based LAN

Bus based LAN

File Server

100 Mbps

OC 3

16 Mbps

Ring based LAN

File Server

ATM SWITCH

10 Mbps

OC 3

ATM SWITCH

100 Mbps

Engineering Workstation

TO WAN

ATM SWITCH

DS 3

100 Mbps

OC 3
Phase 3 of Transition

- Video File Server
- Server
- Engineering Workstation
- ATM SWITCH
- Public Network
- DS 3
- Remote Site
- OC 3
- 100 Mbps
- ATM SWITCH
- Server
- Engineering Workstation
- ATM SWITCH
- OC 3
- 100 Mbps
- Engineering Workstation
- ATM SWITCH
- Server
- Engineering Workstation
ATM Myths

• ATM is only used for new networks - not to upgrade or replace existing infrastructure.
• ATM never upgrades Ethernet
• Organizations that use Fast Ethernet switches would not use ATM
• ATM is only used for special apps - like video
• Organizations with ATM use it for very particular purposes.
Fact: ATM is Primarily an Upgrade

Over 70% of ATM customers installed ATM as an upgrade to an existing LAN.
Fact: ATM Upgrades Ethernet

ATM most often upgrades existing Ethernet networks

- Ethernet: 66%
- Token Ring: 42%
- FDDI: 35%
- Other: 18%
- Fast Ethernet: 13%
- Don't know: 2%
Fact: ATM Customers Have A Variety of Switches

Nearly 60 percent have Fast Ethernet switches

- Gigabit Ethernet: 2%
- Token Ring: 37%
- 100 MBps Ethernet: 58%
- 10/100 Ethernet: 58%
- 10 Mbps Ethernet: 79%
Fact: ATM is used for Regular Data
In the average ATM-using organization, 83% of ATM traffic is data traffic.
Fact: ATM has Multiple Roles

While many organizations may start using ATM in the campus, it is often used in more than one place:

- **In the campus backbone**: 85%
- **To connect servers**: 44%
- **In the wide area**: 28%
- **Between workgroups**: 24%
- **At the desktop**: 14%
LAN Environment

ATM customers have multiple LAN types deployed

- 10 Mbps Ethernet: 95%
- Fast Ethernet: 62%
- FDDI: 58%
- Token Ring: 53%
- Other: 11%
- Gigabit Ethernet: 2%
Use LAN Switches

ATM customers use various types of LAN switches

- 10 Mbps Ethernet: 77%
- 10/100 Ethernet: 53%
- 100 Mbps Ethernet: 55%
- Token Ring: 32%
- Gigabit Ethernet: 2%
Protocols in Use

Network Protocols Used

- TCP/IP: 97%
- IPX: 84%
- SNA: 54%
- Netbios: 54%
- Apple Talk: 46%
- Other: 3%
ATM Traffic Types

Regular data traffic dominates - ATM is not restricted to delay-sensitive traffic

Current ATM Traffic Type (Average)
- High-volume data traffic: 83%
- Delay-sensitive traffic: 17%

Future ATM Traffic Type (Average)
- High-volume data traffic: 72%
- Delay-sensitive traffic: 28%
ATM Traffic Increasing

54% of ATM customers report that the majority of their LAN traffic will run over ATM within 2 years

- Over 75%: 54%
  - Over ATM within 2 yrs.: 54%
  - Currently Over ATM: 15%

- 26-75%: 34%
  - Over ATM within 2 yrs.: 34%
  - Currently Over ATM: 50%

- Up to 25%: 12%
  - Over ATM within 2 yrs.: 12%
  - Currently Over ATM: 35%

Chart legend:
- Green: Over ATM within 2 yrs.
- Blue: Currently Over ATM
Most Common ATM Drivers

- Need for more bandwidth: 78%
- Support for delay-sensitive traffic: 71%
- Support for high-volume data applications: 68%
- Support for LAN vendors: 66%
- Need for multiple-protocols support: 62%
Deterrents

- Was choosing ATM difficult?
  - 52% say yes
- Cost of ATM switches
- Standards Issue
- Perceived as “unproven”
- Anticipated complexity
Expected Vs Realized

- Seamless LAN-WAN integration
  - Achieved: 37%
  - Expected: 54%

- Support of delay-sensitive applications
  - Achieved: 39%
  - Expected: 63%

- Support of high speed/bandwidth peripherals
  - Achieved: 45%
  - Expected: 72%

- More network scalability
  - Achieved: 51%
  - Expected: 74%

- Improved network performance
  - Achieved: 66%
  - Expected: 83%

- Support of high volume data traffic
  - Achieved: 67%
  - Expected: 87%