X3T10/94 075

ATM Tutorial & Comparison with SSA

StorageWorks

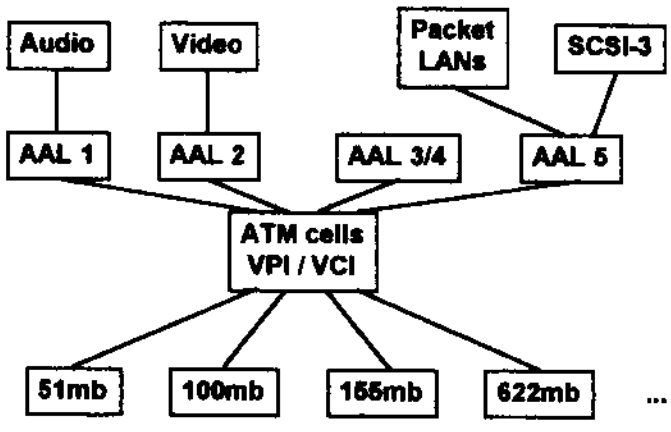
ATM History

- ATM was originally called B-ISDN
  B = Broadband = many megabits
- Begun in mid-1980s by Telco's
- "guiding premise seemed to be that raw speed could replace specialization... But a funny thing happened on the way to obscurity. ATM technology was hijacked by the data communications community and given new life outside the public network sphere... being developed as a multi-purpose LAN and WAN technology... the marketplace is essentially distancing the technology from its [CCITT] origins"

[redacted] Edward A. Gardner, 3/17/94, slide 1

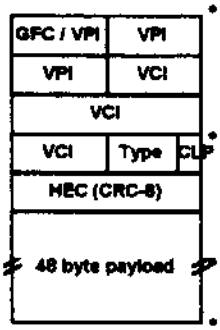
StorageWorks

ATM Layering



[redacted] Edward A. Gardner, 3/17/94, slide 2

ATM cells



- **GFC Generic Flow Control** **4 bits**
  - No accepted definition, various partially thought out proposals. Used to extend VPI field in environments that don't require GFC.
- **VPI/VCI Virtual Path/Channel Identifiers** **8-12/16 bits**
  - Two level heirarchical address. A virtual path encapsulates some number of virtual channels.
  - With most ATM interfaces today, VPI = 0 at end nodes, VCI designates the specific connection within an end node.
- **Type** **3 bits**
  - 0ab if cell contains user data.
    a is congestion indicator.
    b is ATM User Indication, used by AALs.
  - 1xx if Operations and Maintenance (OAM) or Resource Management cell.
- **CLP Cell Loss Priority** **1 bit**
  - Set means "discard this cell first"
- **HEC Header Error Check** **8 bits**
  - Eight bit CRC calculated on header only.

[redacted] Edward A. Gardner, 3/17/94, slide 3

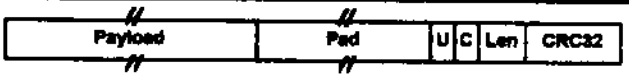
ATM Adaption Layers

- **AAL 1: Constant Bit Rate (CBR) data, e.g. isochronous audio or video.**
- **AAL 2: Timing sensitive Variable Bit Rate (VBR) data, e.g. compressed video.**
- **AAL 3/4: Packet data, excessively complex, essentially abandoned.**
- **AAL 5: A simpler replacement for AAL 3/4. The de facto standard for packet data.**
- **Essentially all ATM interfaces shipping today support AAL 5 with hardware, other AALs with software.**

[redacted] Edward A. Gardner, 3/17/94, slide 4

StorageWorks

AAL 5



- Total length is multiple of 48 bytes.
- Mapped to sequence of ATM cells, one VPI/VCI.
- ATM User Indications in cell header indicates boundaries. Set in last cell, clear in all others.
- Pad: aligns total length to multiple of 48.
- U: user field (reserved / vendor unique).
- C: common part indicator (reserved for future standardization).
- Len: payload length in bytes.
- CRC32: Autodin-II CRC (same as Ethernet™, FDDI, etc.) over payload, pad, U, C, and Len.

StorageWorks

ATM Physical Layers

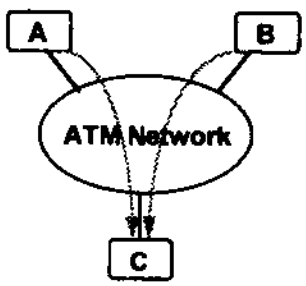
- **Shipping today:**
  - 100 mbits, based on FDDI PHY: optical, thinwire coax, STP
  - 155.52 mbits, based on SONET: optical, UTP-5 soon
- **Shipping this year (if not today):**
  - 622.08 mbits, based on SONET: optical and copper
- **Highest interest within industry:**
  - 51.84 mbits on UTP-3, 100 meters. Several competing proposals for signaling, each may be built by its proponents regardless of ATM Forum's decision.

ATM vs. SSA

	ATM	SSA
•	"cell"	"frame"
•	"virtual circuit"	"path"
• Cell payload	48 bytes	0-128 bytes
• Path	8-12 bits*	7-28 bits
• Connection	16 bits*	7-14 bits
– *ATM path / connection bit division varies		
• Cell Format	fixed	variable
• Error checks:	separate	combined
• Headers	Hop by hop	Hop by hop
• Data	End to end	Hop by hop
• Flow Control	Being standardized	Yes

Edward A. Gardner, 3/17/94, slide 7

Flow Control



- If both A and B try to send at full bandwidth, half the cells must be discarded. Flow control is the mechanism that tells A and B when to slow down.
- SSA flow control is called pacing, provided by RR and SAT fairness mechanisms.

Edward A. Gardner, 3/17/94, slide 8

StorageWorks

ATM Flow Control

- **Original feeling among B-ISDN designers: with so much bandwidth, congestion couldn't occur.**
- **Experience with early ATM products have demonstrated the fallacy of this assumption for LAN environments.**
- **Several ATM flow control schemes have been proposed and are being debated for standardization.**
- **Vendors are already shipping ATM products with flow control.**
- **Different physical links may use different schemes.**

Edward A. Gardner, 3/17/94, slide 9

StorageWorks

SSP Changes for ATM-SCSI

- **Assume cells will not be lost due to congestion.**
- **Application control messages (SCSI CDBs, Data Ready, etc.):**
  - SSA: 32 byte frame sent to channel 0.
  - ATM: 32 byte AAL5 packet sent to a specified channel.
- **Data transfers:**
  - SSA: sequence of 128 byte frames sent to a channel obtained via Data Ready.
  - ATM: sequence of 48 byte cells (comprising an AAL 5 packet) sent to a channel obtained via Data Ready. Long data transfers will use several AAL 5 packets.

Edward A. Gardner, 3/17/94, slide 10

StorageWorks

SSP Changes for ATM-SCSI

- **Payload errors or cell loss in data transfers can be recovered by re-requesting the data transfer or command.**
- **Payload errors or cell loss in control messages equivalent to loss of path in SSA.**
  - Tbd: may need a sequence number in control messages.