Asynchronous Transfer Mode

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1. **Introduction**
   - ATM is a switching and multiplexing technology for broadband ISDN.
   - It is supposed to be the 'ultimate on-premise' internetworking technology, connecting LANs and WANs at highest speeds.
   - The goal of ISDN (Integrated Services Digital Network) is to incorporate everything on one line: voice and data services, audio and video. This is not easy, it takes real-time capability on one hand and huge data throughput on the other.
   - The trick is to use short fixed length packets called cells. A cell is only 53 bytes long, consisting of a 5 byte header and a 48 byte information field.
   - The asynchronous packet switching approach assures efficient use of the whole bandwidth.
   - The short cell length assures that real-time applications are not really blocked.
2. **ATM**
   - During connection establishment phase, an application negotiates a contract with the network regarding the peak bandwidth, the duration of the peak bandwidth etc.
   - If the required bandwidth negotiation is successful a path is established. The path information is contained in the cell header in the form of a virtual path identifier and a virtual channel identifier. Multiple virtual paths make up a channel.

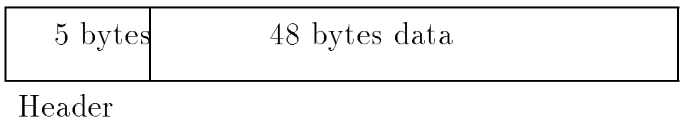

Figure 1: The ATM Cell - 53 bytes

- Cells traverse the same route in a virtual channel , so there's no need for packet resequencing and reassembly.
- At the heart of ATM is the ATM switch which maintains tables of VCIs and VPIs (identifiers of the virtual channel and the virtual path respectively). At the switch a packet enters on one of the n input ports. The switch changes the header (VCI and VPI information) and sends it on to the appropriate output port.
- The implementation of ATM requires 3 layers. They are :
  (a) The ATM adaptation layer which interacts with the OS and provides timing recovery service, handles loss and misdelivered cells, interleaves the packets and provides 4 classes of services (A- Constant bit rate, B- Variable bit rate, C- Connection oriented and D- Connectionless Data). These functions are performed by the convergence sublayer. The segmentation and reassembly layer reassembles frames.
  (b) The ATM layer is responsible for multiplexing and demultiplexing packets (also implemented in the switch), cell routing, and flow control.
  (c) The physical layer transports the ATM cells and gives timing related statistics to the upper layers.

3. **Advantages of ATM**
   - ATM does not specify any networking media (Ethernet, FDDI, X.25) but merely a protocol which can be used on a host of underlying hardware.
   - It provides a uniform protocol for LANs and WANs. It concentrates on switching packets coming from one channel onto another. So, at the ATM switch, cells could be brought by coaxial cables, fibre optic cables or packet switched lines (used in X.25). It can thus integrate the entire network.
   - The advantage of using ATM compared to leased lines is that if public data networks use ATM technology, a user can be billed by the actual usage of the network (in terms of number of packets that were switched), rather than a constant rate as is currently applicable for leased lines. This may provide a cost-effective utilisation.

4. **ATM switch**
   - The ATM switch provides the switching mechanism and is made up of the input port controller, the switch fabric and the output port controller. In addition to this it provides a network management control processor (for SNMP etc.). Its features are as follows :

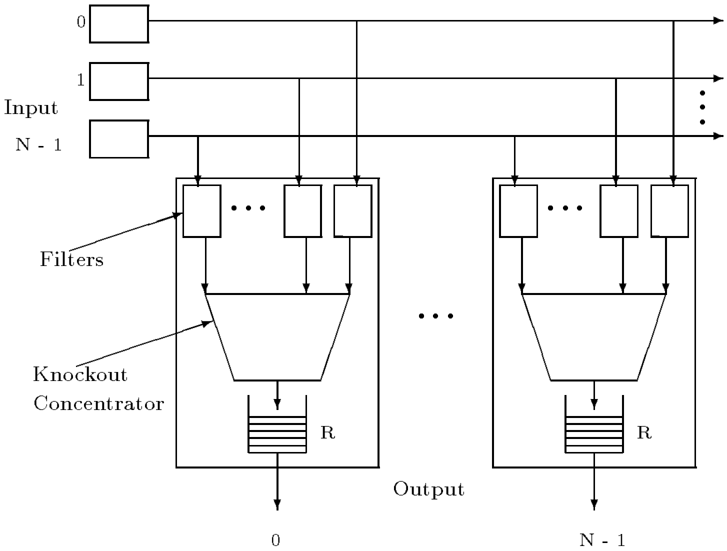

Figure 2: Sample ATM Knockout Switch with N inputs and R output buffers

(a) Buffering may be implemented at the input or output ports.

(b) It can support multicast by cell duplication and cell processing to change the header information in the cell and output it on the destination port.

(c) In a knockout switch output buffering is implemented where a number of cells vying for a single output cell are successively passed through a knockout concentrator and passed to the output buffer. Cells compete (as in a knockout tournament) for the k stages in the output buffer. The packet priority is used to determine which packet wins in a particular selection stage.

(d) The cell can be classified into Time or Space division multiplexing categories.

(e) In the switch fabric, multistage networks can be used instead of a cross bar switch (e.g., Delta network). In multistage networks, when contention takes place for an internal link, a sort network is added before the first stage to resolve the contention. If contention takes place for a single output port, a recirculation buffer is used to resolve the contention (sequence is maintained even with recirculation).

(f) All these features are combined in a single switch (Sunshine switch) which N input port controllers, with a trap network and a concentrator with recirculation of packets. The final stage consists of N parallel Banyan networks connected to the N output port controllers. So, it has all the features discussed so far.

5. **Conclusion**

The ATM technology provides a viable scheme for implementing multimedia services which require bandwidth on demand and can be used with the regular data services. The key to the success of ATM standard would lie in the way it would integrate these services in a LAN and WAN environment (public data networks) and co-exist with the existing LAN technologies and software components.

References

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