

# **Audiovisual Multimedia Services (AMS)**

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# Multimedia over ATM

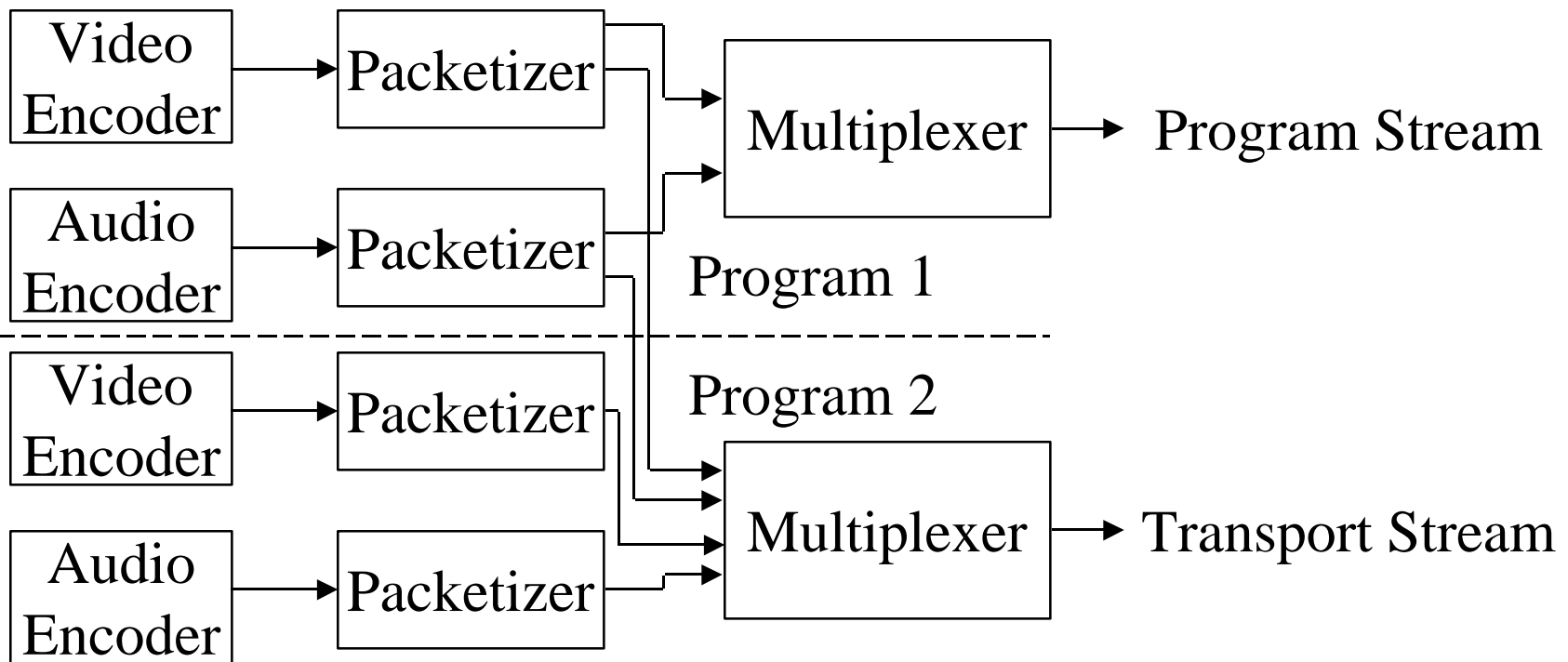
- q Service Aspects and Applications (SAA) Group
  - q Audiovisual Multimedia Services Phase 1: MPEG2 over ATM
- q Key Issues:
  - q What Applications?
  - q Which Service? CBR or VBR?
  - q Transport stream or program stream?
  - q Which ATM Adaptation Layer (AAL)?
  - q How to divide stream into AAL PDUs?
  - q What QoS parameter values to signal?

# What Applications?

- q MPEG-1 for VCR-quality video/audio
- q MPEG-2 for theater-quality video/audio
- q Video on Demand  $\Rightarrow$  High-quality  $\Rightarrow$  MPEG-2

# Program and Transport Streams

- q Program = multiple media with a common time base
- q Program stream = one program
- q Transport stream = Multiple programs, e.g., cable TV



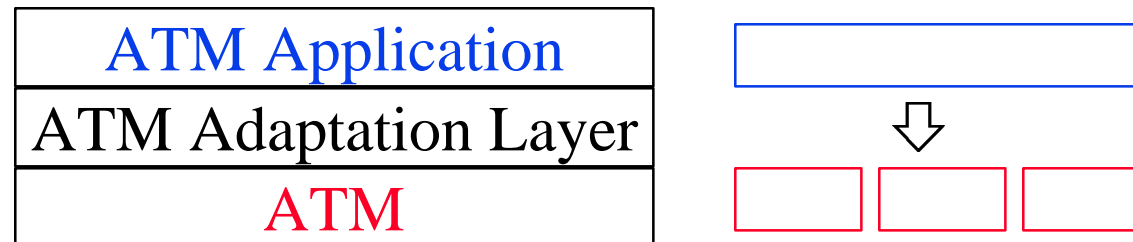
# Streams (Cont)

- q Program stream
  - q Variable length packets.
  - q Designed for lossless local video
- q Transport stream
  - q Fixed length 188-byte packets
  - q Designed to sustain errors/loss in remote transmission
  - q Contains program clock reference (PCR) for clock synch
  - q Signal scrambling and transmission of encryption keys
  - q Facilities to address individual set-top boxes
  - q TS is a complete stand-alone transmission system
    - ⇒ Can work without ATM

# CBR vs VBR

- q VBR encoding saves bandwidth
- q VBR bandwidth allocation is more difficult
- q Variance also causes more delay jitter
- q CBR encoded MPEG-2 transport streams are most common  
⇒ Use CBR

# Which AAL?



- q AAL1: Designed for CBR. Provides clock synchronization through synchronous residual timestamps (SRTS)
  - q Sequence numbers for lost cell detection
  - q Forward error correction option
  - q Less overhead than AAL5 for small PDUs
  - q Ideal fit: 188 byte MPEG-2 transport packet = 4 cells
  - q Common clock required for SRTS not always available  
⇒ MPEG-2 has its own clock synchronization

- q AAL5: Used for signaling and LAN emulation  
Implemented universally  $\Rightarrow$  Low cost
- q ATM Forum chose AAL5 for MPEG-2 over ATM  
ETSI chose AAL1 for MPEG-2 over ATM  
 $\Rightarrow$  ITU-T H.222.1 allows both options

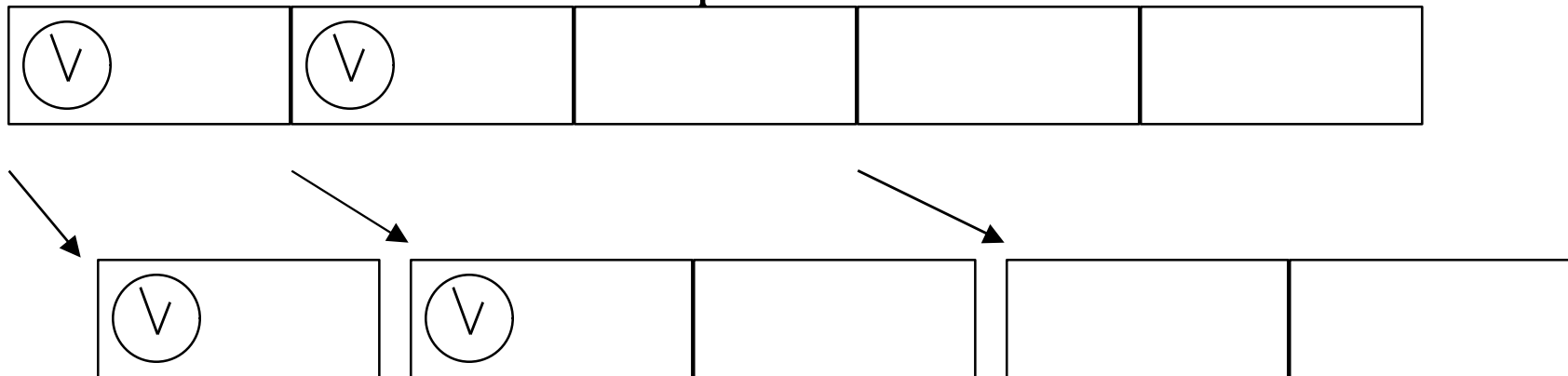
# MPEG-2 Clock Synchronization

- q To maintain audio/video synchronization (inter-media synchronization), video streams contain presentation timestamps
- q MPEG-2 Clock = 42-bit counter incremented at 27 MHz  
⇒ Upper 33 bits increment at 90 kHz  
90 kHz works well for both 25 and 30 frames/s systems.
- q The clock at receiver must run at the same rate as the sender  
⇒ Clock counter values sent periodically with the data  
⇒ Program Clock Reference (PCR)
- q A Phase-lock loop used at the receiver to synchronize  
⇒ If PCR is larger than local time, speed up local clock and vice versa

# AAL PDUs

- q MPEG-2 clock synchronization designed for fixed delay pipes
- q A few ms variation can affect quality
  - ⇒ Packets with PCRs are sent immediately
  - ⇒ PCRs occupy the last position in AAL5 PDU
- q This is known as *1-N PCR aware* scheme

MPEG2 Transport Stream



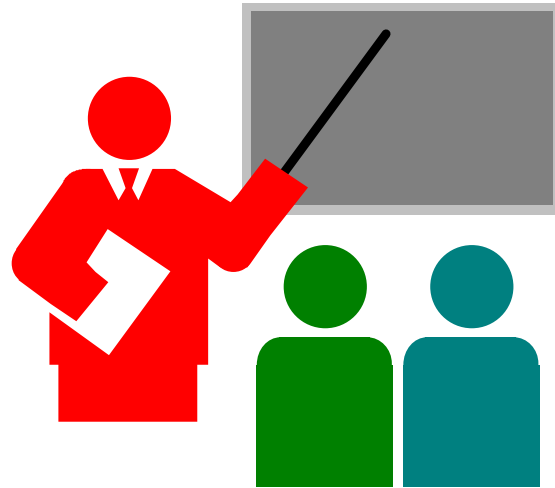
# AMS Phase 1: Key Decisions

- q First application = Video on demand  $\Rightarrow$  High quality
- q CBR encoded MPEG-2 transport stream over AAL5 CBR
- q N MPEG-2 transport stream packets on a single AAL5 PDU. N negotiated using signaling. Default = 2.
- q Optionally corrupted AAL5 PDUs are passed on to application with indication

# AMS Phase 2

- q Video conferencing, distance learning, multimedia desktop
- q VBR-encoded MPEG-2 over ATM
- q Interworking

# Summary



- q AMS Phase 1 focused on VOD
- q CBR encoded MPEG-2 transport stream over AAL5 CBR
- q ATM forum selected AAL5. ETSI selected AAL1.  
⇒ ITU-T (H.222.1) allows both.
- q AMS Phase 2 on videoconferencing

# Acronyms: MPEG-2 over ATM

- q AMS            Audiovisual Multimedia Services
- q BCOB-X        Broadband connection-oriented bearer service class X
- q PCR            Program clock reference
- q PES            Packetized elementary stream
- q PTS            Presentation time stamp
- q SRTS           Synchronous residual timestamp
- q STC            System time clock
- q VCO            Voltage controlled oscillator

# References: MPEG-2 over ATM

- q AMS VOD Spec V1.0
- q ITU-T H.310, Broadband audiovisual communication systems and terminals, January 1996.
- q H.222.0, Generic coding of moving pictures and associated audio information
- q H.222.1, Multimedia multiplex and synchronization for audiovisual communication in ATM environments, November 1995.
- q ANSI/TIA xxxx, Multimedia premises reference architecture, draft 1.0, September 1995.
- q H.221, Frame structure for a 64 to 1920 kbps channel in audiovisual teleservices, 1995.

- q Hewlett Packard, "MPEG-2 Digital Video Technology & Testing," BSTS Solution Note 5963-7511E, 1995. Call 800-452-4844.
- q S. Dixit and Paul Skelly, "MPEG-2 over ATM," IEEE Network, September/October 1995, pp. 30-40.
- q F. Fluckinger, "Back to Basics: Networking Requirements of audio and motion video," ConneXtions, January 1996, pp. 15-23.
- q D. M. Alley, I. Y. Kim, and A. Atkinson, "Audio services for an asynchronous transfer mode network," BT Journal, Vol. 13, No. 3, July 1995.