Audiovisual Multimedia Services (AMS)

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Multimedia over ATM

- Service Aspects and Applications (SAA) Group
  - Audiovisual Multimedia Services Phase 1: MPEG2 over ATM

- Key Issues:
  - What Applications?
  - Which Service? CBR or VBR?
  - Transport stream or program stream?
  - Which ATM Adaptation Layer (AAL)?
  - How to divide stream into AAL PDUs?
  - What QoS parameter values to signal?
What Applications?

- MPEG-1 for VCR-quality video/audio
- MPEG-2 for theater-quality video/audio
- Video on Demand $\Rightarrow$ High-quality $\Rightarrow$ MPEG-2
Program and Transport Streams

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

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Video Encoder → Packetizer → Multiplexer → Program Stream

Audio Encoder → Packetizer → Program 1

Video Encoder → Packetizer → Program 2

Audio Encoder → Packetizer → Multiplexer → Transport Stream
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Streams (Cont)

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

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

- **AAL1**: Designed for CBR. Provides clock synchronization through synchronous residual timestamps (SRTS)
  - Sequence numbers for lost cell detection
  - Forward error correction option
  - Less overhead than AAL5 for small PDUs
  - Ideal fit: 188 byte MPEG-2 transport packet = 4 cells
  - Common clock required for SRTS not always available
    ⇒ MPEG-2 has its own clock synchronization
- AAL5: Used for signaling and LAN emulation
  Implemented universally ⇒ Low cost
- ATM Forum chose AAL5 for MPEG-2 over ATM
  ETSI chose AAL1 for MPEG-2 over ATM
  ⇒ ITU-T H.222.1 allows both options
MPEG-2 Clock Synchronization

- To maintain audio/video synchronization (inter-media synchronization), video streams contain presentation timestamps

- 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.

- 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)

- 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

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

MPEG2 Transport Stream
AMS Phase 1: Key Decisions

- First application = Video on demand ⇒ High quality
- CBR encoded MPEG-2 transport stream over AAL5 CBR
- Optionally corrupted AAL5 PDUs are passed on to application with indication
AMS Phase 2

- Video conferencing, distance learning, multimedia desktop
- VBR-encoded MPEG-2 over ATM
- Interworking
AMS Phase 1 focused on VOD

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- ATM forum selected AAL5. ETSI selected AAL1.
  ⇒ ITU-T (H.222.1) allows both.

- AMS Phase 2 on videoconferencing
Acronyms: MPEG-2 over ATM

- **AMS** Audiovisual Multimedia Services
- **BCOB-X** Broadband connection-oriented bearer service class X
- **PCR** Program clock reference
- **PES** Packetized elementary stream
- **PTS** Presentation time stamp
- **SRTS** Synchronous residual timestamp
- **STC** System time clock
- **VCO** Voltage controlled oscillator
References: MPEG-2 over ATM

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

