Multimedia Systems

[TOC]

1. Definitions / Concepts

- **Multimedia Timing Requirements**
  - Multimedia data must be accessed within specific timing requirements (for e.g. 24-30 fps)
  - **Continuous media data** is data with specific rate requirements.
- **Streaming** has 2 types:
  - Progressive Download: content stored on client's computer (Youtube, ESPN, CNN)
  - Realtime Streaming: content not stored on client's computer (TV broadcast, Internet Radio, etc.)
    - Live Streaming
    - On-Demand Streaming

2. Characteristics of Multimedia Systems

> Large, very high data rates, and sensitive to timing delays during playback.

3. Quality of Service (QoS)

Requires both **CPU**, **Disk**, and **Network**. **Rate requirements** are most important to QoS.

3.1. Compression

Compress or Encoded can be lossy or lossless.

3.1.1. Definition

- **Lossy**:
  - **Image**: some pixel data is lost.
  - **Audio**: some very high freqs or very low freqs (undetectable by human ear) are omitted.
  - **Video**: stores on differences between frames.
- Lossless: decodable to original form.

3.1.2. Lossy Compression Schemes

Using MPEG Compression techniques.

- Layer 3 for audio.
- Layer 2 for video.
- Layer 1 for timing information synching between audio and video.

There are 3 or 4 MPEG schemes

- **MPEG-1**:
  - Used for low-res video, 1.5Mbps.
  - MP3 audio
  - Compression ratio 200:1
- **MPEG-2**:
  - Used for DVD and HDTV local playback.
  - Higer level (res) and profile (quality) video compression, 1.5Mbps to 15Mbps.
- ~~MPEG-3 (discontinued)~~
- **MPEG-4**:
  - Used for transmitting audio/video via internet.
  - Scalable quality.

3.2. QoS Levels

- **Best Effort**: no guarantee of requirements, mostly used in traditional OS.
- **Soft QoS**: priorize certain traffic streams, but still no guarantee of requirement.
- **Hard QoS**: guarantee the quality requirements.

3.3. QoS Parameters

- **Throughput**, i.e. data rate.
- **Delay**, delay of stream data delivery.
- **Jitter**, delays during playback.
- **Reliability**: errors rate in transmission and processing of data.

Parameters are negotiated between Client and Server, usually data rate.

Guarantee of QoS is provided by **Admission Control**.

- Using Semaphores: simple admission control policy.
- Using Resource Managers: used for each type of resource.
  - **CPU Scheduling**: soft real-time, and hard real-time (requires critical process to be serviced within a guaranteed period of time)
  - **Disk Scheduling**
    - using EDF, i.e. Earliest Deadline First, similar to Shortest Seek Time First, order requests by

deadline. EDF may have higher seek times.

- using SCAN-EDF, similar to EDF but grouping and order requests with relatively close deadlines. *Batch reordering must ensure request being served within deadline*.

- **Network Management**
  - Protocols: RTP/RSTP, HTTP (stateless)
    - RTSP/RTP: Use HTTP to transfer the meta file, and RTP/RTSP for content delivery. RTSP commands include SETUP, PLAY, PAUSE, TEARDOWN.
  - Methods: Unicast, Broadcast, and Multicast. Unicast is most common.