Digital Audio - 1

Media type  Digital audio

Representation

- Sampling frequency
- Sample size and quantization
- Number of channels (tracks)
- Interleaving
- Negative samples
- Encoding
Encoding - 1

- PCM - *Pulse Code Modulation*
Encoding - 2

- **ADPCM - Adaptive Delta Pulse Code Modulation**
  - encodes differences between samples
  - used in CD-I and DVI
  - compression rates 4:1 to 2:1
  - standardized as G.721

- **A-law/μ-law**
  - telephony
### Digital Audio Formats

<table>
<thead>
<tr>
<th></th>
<th>CD audio</th>
<th>DAT</th>
<th>G.721</th>
<th>A-law/µ-law</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sampling rate (kHz)</strong></td>
<td>44.1</td>
<td>48</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td><strong>Sample size (bits)</strong></td>
<td>16</td>
<td>16</td>
<td>16/4</td>
<td>8</td>
</tr>
<tr>
<td><strong>Quantization</strong></td>
<td>Linear</td>
<td>Linear</td>
<td>Linear</td>
<td>Log</td>
</tr>
<tr>
<td><strong>Number of channels</strong></td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Data rate per channel</strong></td>
<td>705</td>
<td>768</td>
<td>32</td>
<td>64</td>
</tr>
<tr>
<td>(10^3 bit/sec)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Encoding</strong></td>
<td>PCM</td>
<td>PCM</td>
<td>ADPCM</td>
<td>PCM</td>
</tr>
<tr>
<td><strong>Quality</strong></td>
<td>Very high</td>
<td>Very high</td>
<td>Moderate</td>
<td>Telephone</td>
</tr>
</tbody>
</table>
Digital Audio - 2

Operations

Storage
Retrieval
Editing
Effects and filtering
Conversion
Digital Audio Effects & Filtering

- **Delay** - adds echoing and reverberation
- **Equalization** - modifies various frequency bands
- **Normalization** - scaling peak amplitudes
- **Noise reduction** - removes background hum or hiss
Digital Audio Effects & Filtering

- **Time compression/expansion** - Segment duration is changed without changing pitch
- **Pitch shifting** - pitch is changed without altering duration
- **Stereoization** - A single track is split into two stereo tracks
- **Acoustic environments** - ‘signatures’ of particular environments are applied.
Music

Media type Music

Representation
- Operational versus symbolic
- MIDI
- SMDL

Operations
- Playback and synthesis
- Timing
- Editing and composition
Animation

The depiction of objects as they very over time.
Animation - 1

Media type: Animation

Representation:

- Cel models
- Scene-based models
- Event-based models
- Key frames
- Articulated objects & hierarchical models
- Scripting & procedural models
- Physically based & empirical models
Animation - 2

Operations

Graphics operations
Motion and parameter control
Rendering
Playback
Other Media Types

- Extended Images
  - Virtual reality (QuickTime-VR)

- Digital Ink
  - Penbased (Newton)

- Speech
  - Recognition
  - Encoding
  - Synthesis