ISO/IEC MPEG-4 Audio V2
Error Robustness tools

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What is Error Robustness in Audio all about?

• Useful especially for wireless applications:
  – Broadcasting
  – Music distribution
  – High quality conference systems

• Goal:
  – Best audio quality over error-prone channels with minimum redundancy
Error Robustness in MPEG-4

• One of the main requirements for Version 2 of the MPEG-4 audio standard

• Two approaches:
  – Channel coding: Error Protection (EP)
  – Source coding: Error Resilience (ER)
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Error Protection (EP)

• Standard provides an EP tool which supports all version 2 audio codecs
• The EP tool makes available:
  – FEC using convolutional and block codes
  – A wide range of CRCs
  – Equal EP and unequal EP (UEP)
  – Fixed-length and variable-length frames
  – Minimal overhead for each configuration
Error Resilient Bitstream Payload

- UEP requests a subdivision of the bitstream into parts with different error sensitivities
- All MPEG-4 audio version 2 codecs support this subdivision:
  - ER AAC LC
  - ER AAC LTP
  - ER AAC scalable
  - ER TwinVQ
  - ER BSAC
  - ER AAC LD
  - ER HVXC
  - ER HILN
  - ER Parametric
  - ER CELP

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Error Resilience (ER) Tools

- Error resilience tools are source coding related and thus codec specific
- Within MPEG-4 audio version 2, error resilience tools are provided for
  - Advanced Audio Coding (AAC)
  - BSAC (Bit-sliced Arithmetic Coding)
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ER AAC Tools

• Huffman Codeword Reordering (HCR)
  – to avoid error propagation within spectral data
• Reversible Variable Length Code (RVLC)
  – to avoid error propagation within scale factor data
• Virtual Codebooks (VCB11)
  – to detect serious errors within spectral data
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ER BSAC Mode

• Segmented Binary Arithmetic (SBA) Coding
  – to avoid error propagation within spectral data
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Demonstration - ER AAC LC

- ER AAC LC 96kbit/s@32kHz stereo
  - clear channel
- Channel: BER=1e-2, burst length = 1ms

- Synchronization & concealment
  - no concealment (limitation to –17dBfs)
  - muting
  - sophisticated

+ Error Protection & Error Resilience
  - EEP (overhead 11.1 %)
  - UEP & HCR & VCB11 (overhead 10.9 %)
Summary

• Error Robustness is important - vital for mobile applications!
• MPEG-4 audio provides a full range of error robustness tools within its version 2
• Error robustness performance has been proven by a formal MPEG verification test
• MPEG-4 audio offers attractive solutions, also for wireless applications