MPEG Unified Speech and Audio Coding

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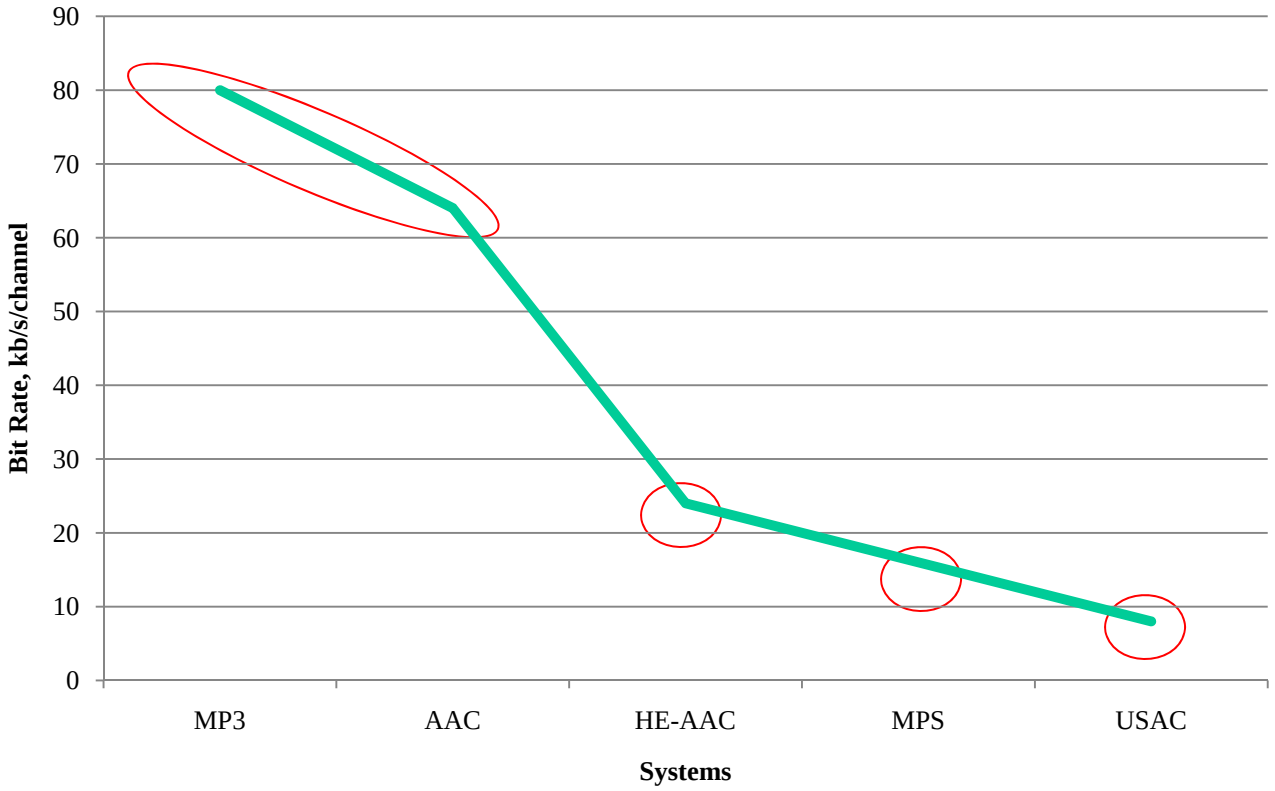
“Dimensions” of MPEG Audio Compression

- Perception Models
  - SNR
    - Perceptually shaped quantization noise
    - MPEG-1 Layer III (MP3); MPEG-2 Advanced Audio Coding (AAC)
  - Frequency
    - Bandwidth replication
    - MPEG-4 High Efficency AAC (HE-AAC)
  - Space
    - Perceptual soundstage coding
    - MPEG Surround
- Production Models
  - Speech production
  - Unified Speech and Audio Coding (USAC)

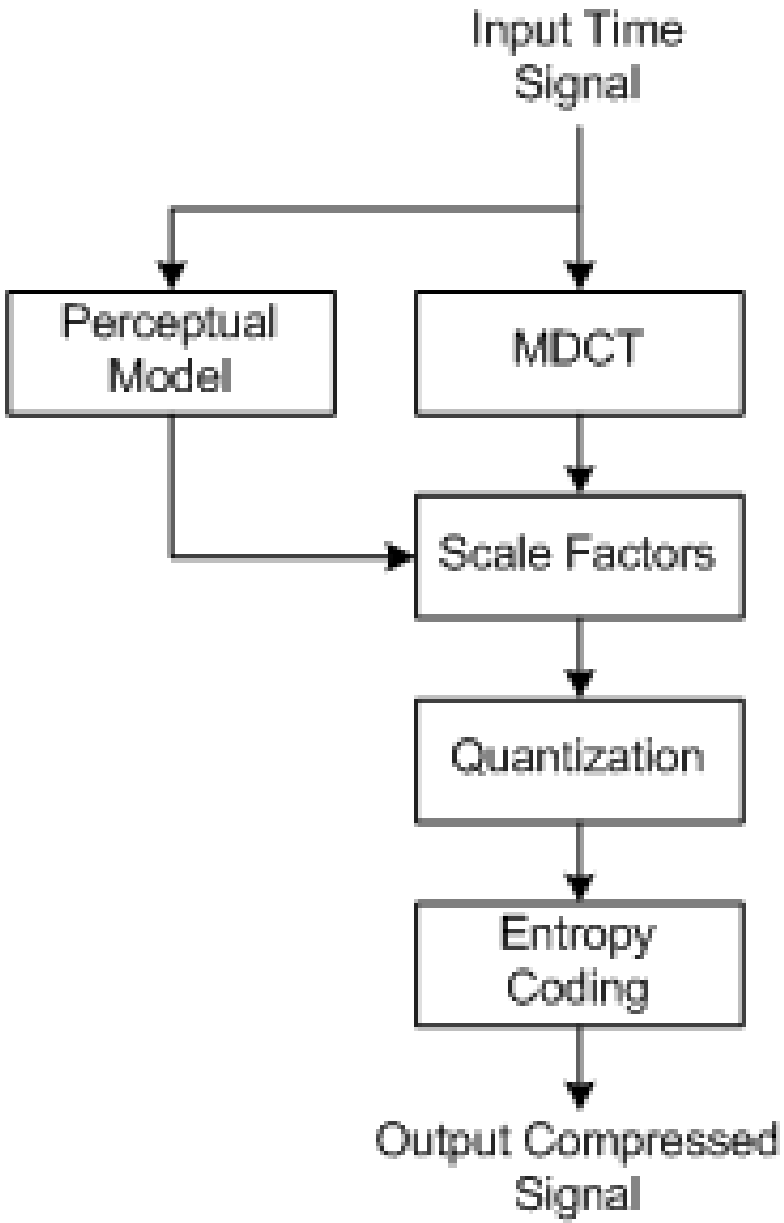
Compression Performance



USAC Philosophy

- Adaptively select encoding mode
  - at each coding frame boundary (e.g. 20 ms)
- Coding modes are
  - Frequency Domain
    - AAC
    - TCX
  - Time Domain
    - ACELP
- Need architecture that incorporates all of these modes!

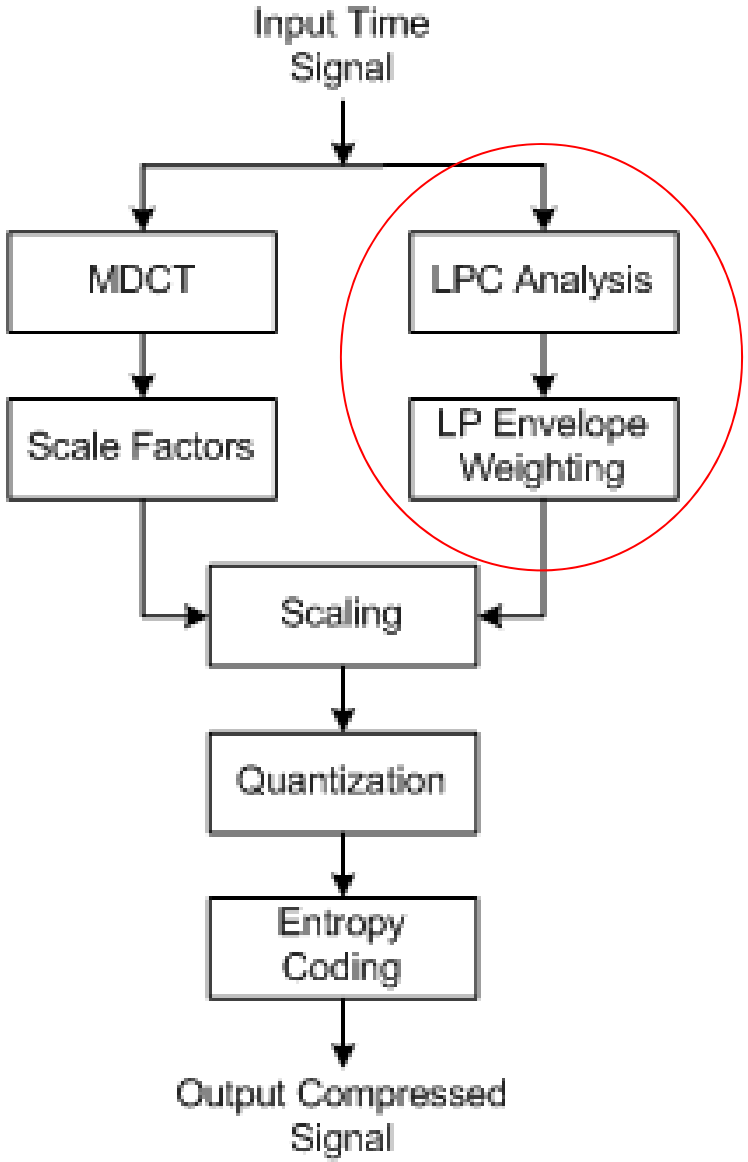
AAC Foundation



Speech Models - I

- MDCT coefficient scaling
  - Sets quantizer stepsize per psychoacoustic model
- AAC
  - Uses high-frequency resolution scalefactors
- USAC
  - Adds Transform Coded Excitation (TCX) variant to achieve medium-frequency resolution scaling via short-term LP-modeled spectrum
  - Much lower data rate!

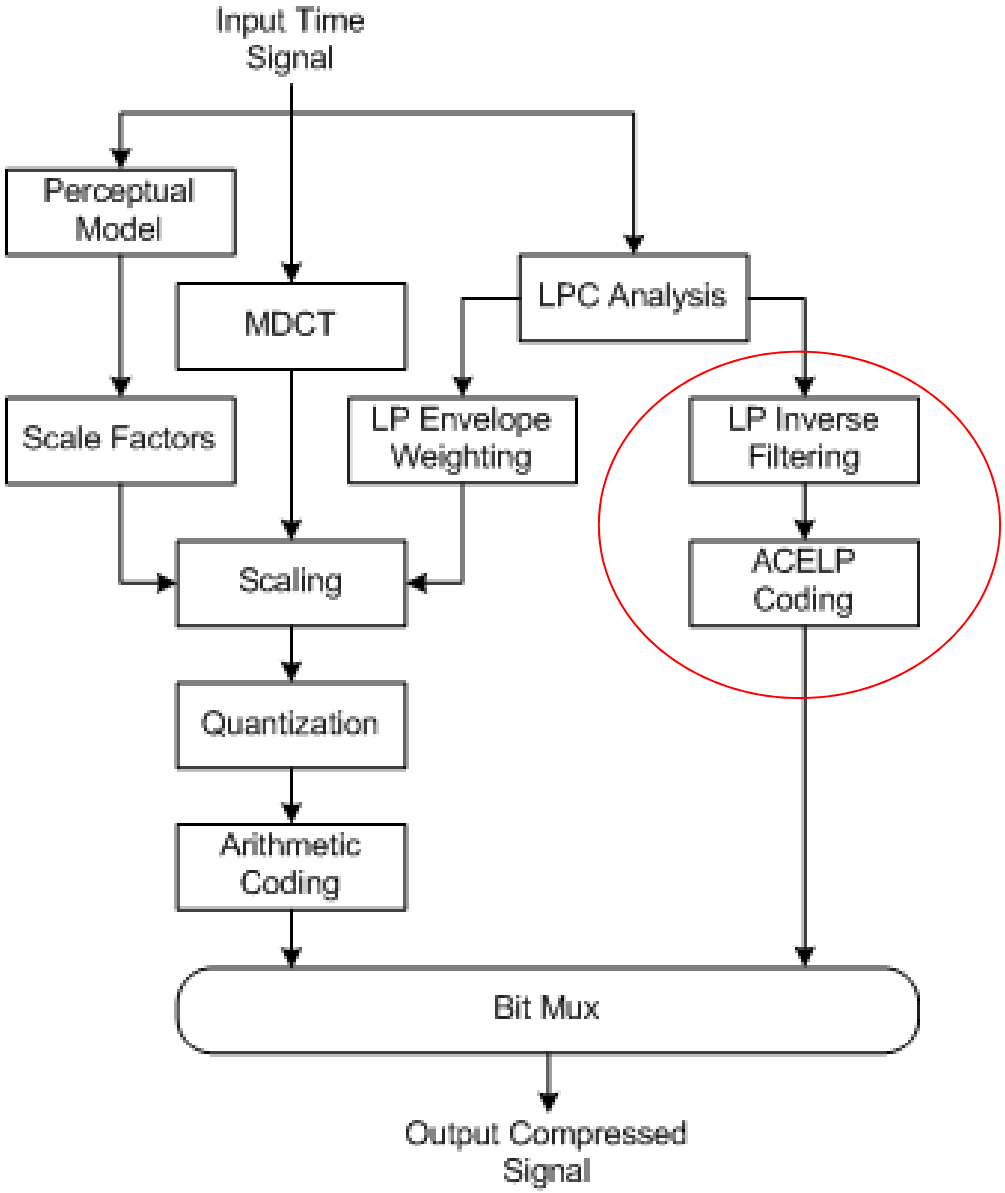
AAC + TCX


Input Time Signal
MDCT
LPC Analysis
Scale Factors
LP Envelope Weighting
Scaling
Quantization
Entropy Coding
Output Compressed Signal

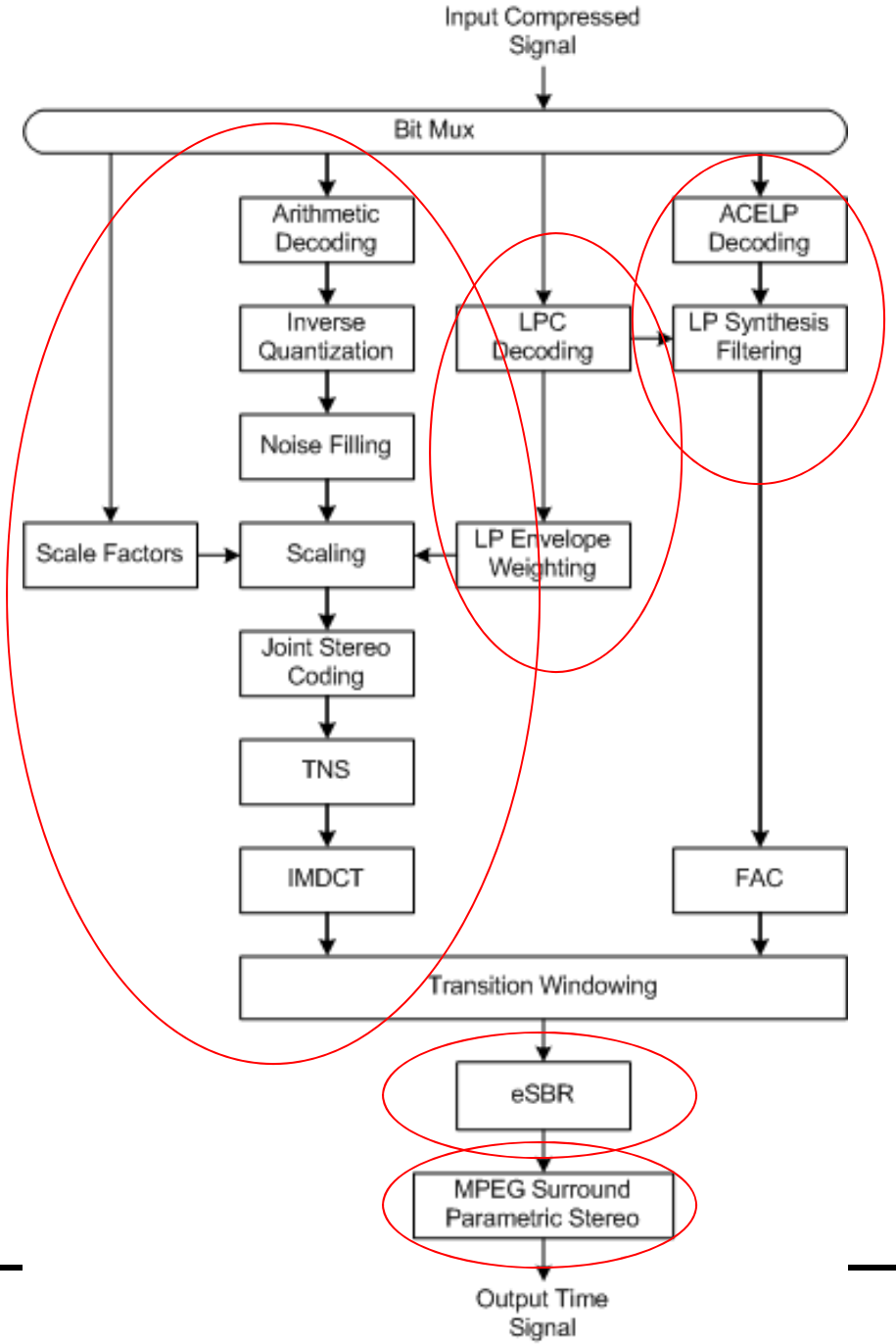
Speech Models - II

- Add time-domain Linear Prediction coding mode
  - Algebraic Coded Excitation Linear Prediction (ACELP)

AAC+
TCX+
ACELP



USAC Decoder



Performance