

Workshop #19: Modern Hybrid Audio Coding

Sponsored by the TC on Coding of Audio Signals

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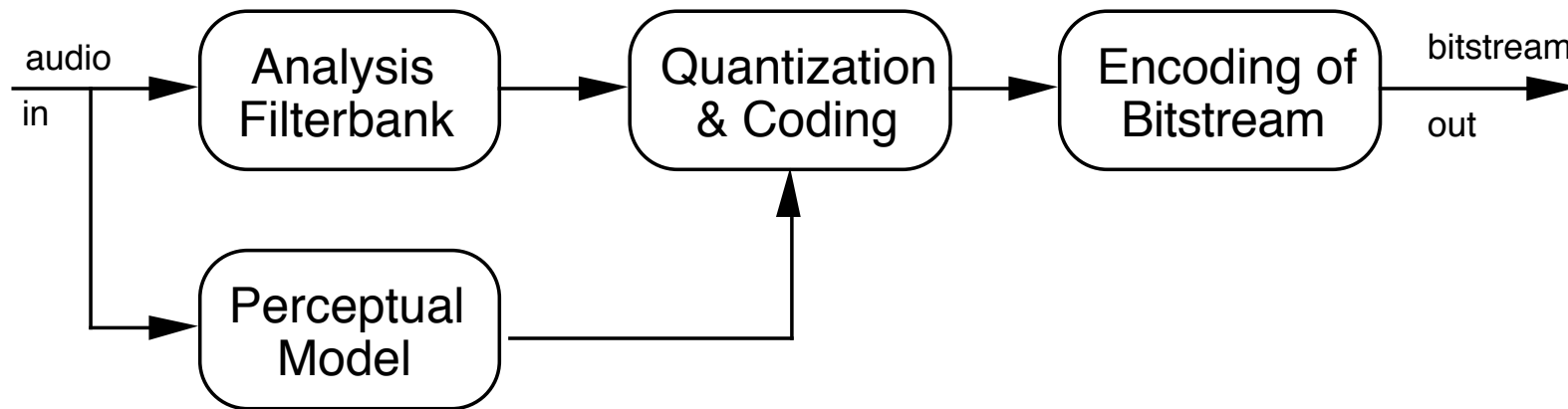
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Introduction

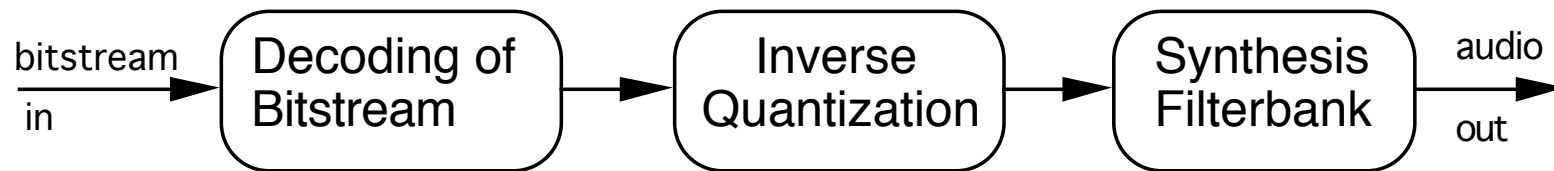
- Perceptual Audio Coding Technology is everywhere, practically in all media-enabled devices (computers, cell phones, DVD players, digital TV/radio receivers, ...)
- Schemes like mp3, AAC and Dolby Digital are ubiquitous
- All of these schemes rely on a single classic and tremendously successful concept, i.e. the paradigm of the filterbank-(FB)-based perceptual audio coder
 - Conversion into spectral components
 - Quantization according to perceptual criteria

The Basic Paradigm of Perceptual Audio Coding

Encoder:

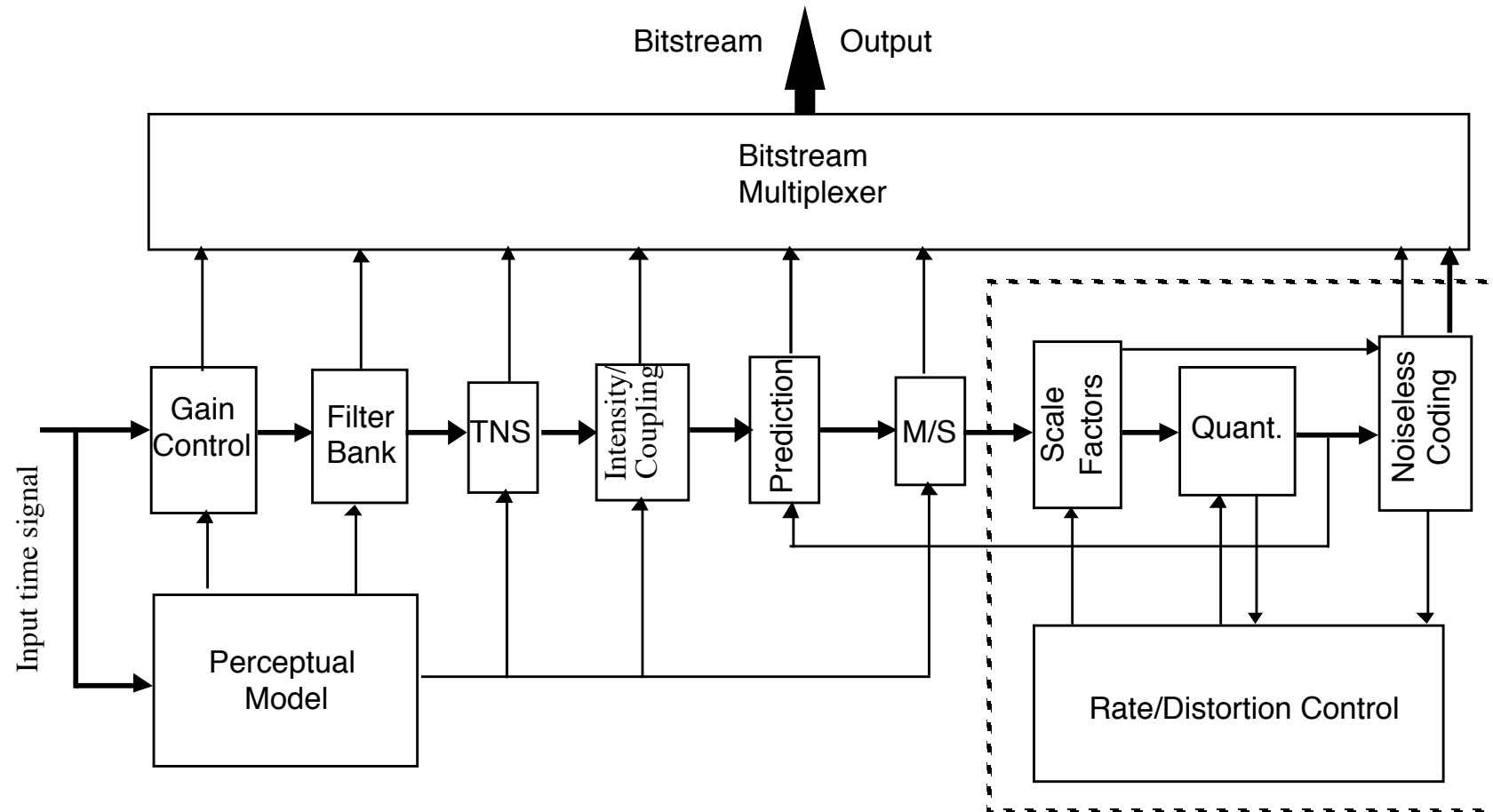


Decoder:



This structure resembles actual audio coders around 1990 ...

A Real Audio Encoder (MPEG-2 AAC, 1997)



Parametric Audio Coding: An Alternative Approach

- Idea: To represent the signal by decomposing it into certain elementary units. Transmit just parameters of these units ...
- Typical example: Sinusoidal coder [MacAulay & Quatieri]
 - Transmit frequencies & amplitudes of sinusoids
- Extensions for noise-like sounds (instead of many sinusoids)
- Extensions for transient sound parts (%)
- “Sweet spot”: Very low bitrates / intermediate quality
- Examples:
 - MPEG-4 HILN (2000) → Demonstration [Purnhagen, Edler 2000)
 - MPEG-4 High-Quality Parametric Audio Coding (SSC, 2004)

Filterbank Based vs. Parametric Audio Coding

- Since 1990, all commercially successful codecs (mp3, AAC, Dolby Digital, ...) were all FB-based
- Around 2000, parametric codecs (sinusoids etc.) were the subject of more research and started to become competitive to traditional FB-based technology
- Nonetheless they did not outperform or replace FB-based technology - the next-generation codecs still have the classic architecture ...!
- However: Both coder types have different key strengths

Hybrid: FB-Based plus Parametric Audio Coding

- Finding the best of both worlds: → Hybrid audio coding
 - FB-based codecs can transmit waveforms of high perceptual quality
 - Parametric codecs can convey certain signal aspects with intermediate quality at very low bitrates
- Hybrid coding has become tremendously successful in two cases since about 2000 – with much recent progress:
 - FB-based audio codec + parametric bandwidth extension
 - removes the dependency of bandwidth on bitrate
 - HE-AAC, USAC, MPEG-H 3DA, ...
 - FB-based audio codec + parametric multi-channel/object coding
 - removes the dependency of no. of channels on bitrate
 - HE-AAC v2, MPEG Surround, SAOC, ...

Workshop Overview – The Hybrid Audio Coding Story Continues

- Introduction (*Jürgen Herre*)
- Part 1: Bandwidth Extension
 - MPEG SBR & recent extensions at Dolby Laboratories (*Heiko Purnhagen*)
 - Recent MPEG bandwidth extension technology (*Andreas Niedermeier*)
- Part 2: Parametric Multi-Channel/Object Coding
 - MPEG parametric spatial coding technology (*Sascha Dick*)
 - Recent technology developments at Dolby Laboratories (*Heiko Purnhagen*)
- Summary (*Jürgen Herre*)