MPEG-1

The compression standard that changed the world!

MPEG-1

- The History
- The Standard
- The Affect
- The Conclusion

History

- Moving Pictures Experts Group established
- Presented the standard in 1992
- ISO 11172-3 (1993) approved
- MUSICAM for digital audio broadcasting
- ASPEC for audio over ISDN

Standard

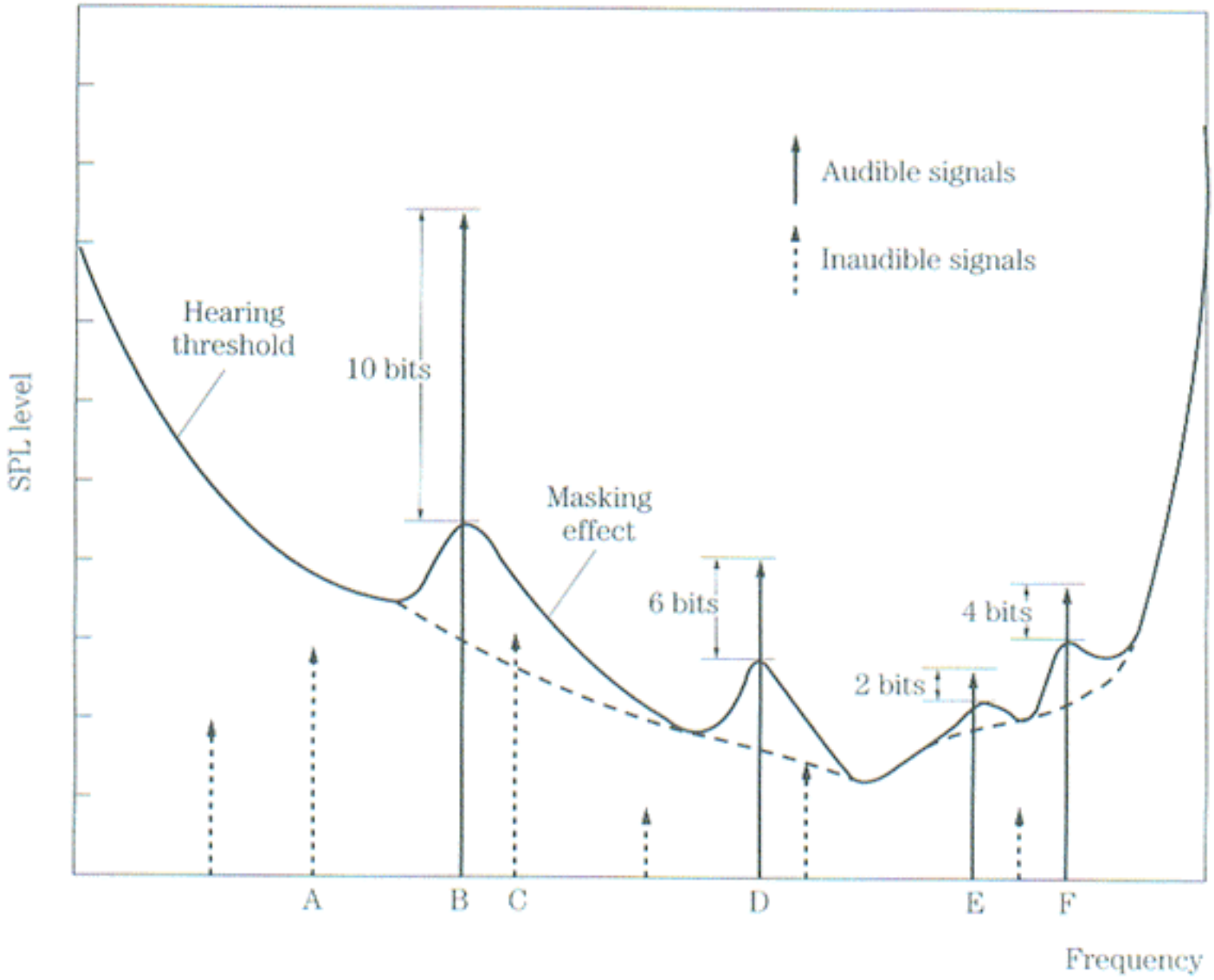
- 3 layers - I being simplest, III being most complicated
- “Lossy”

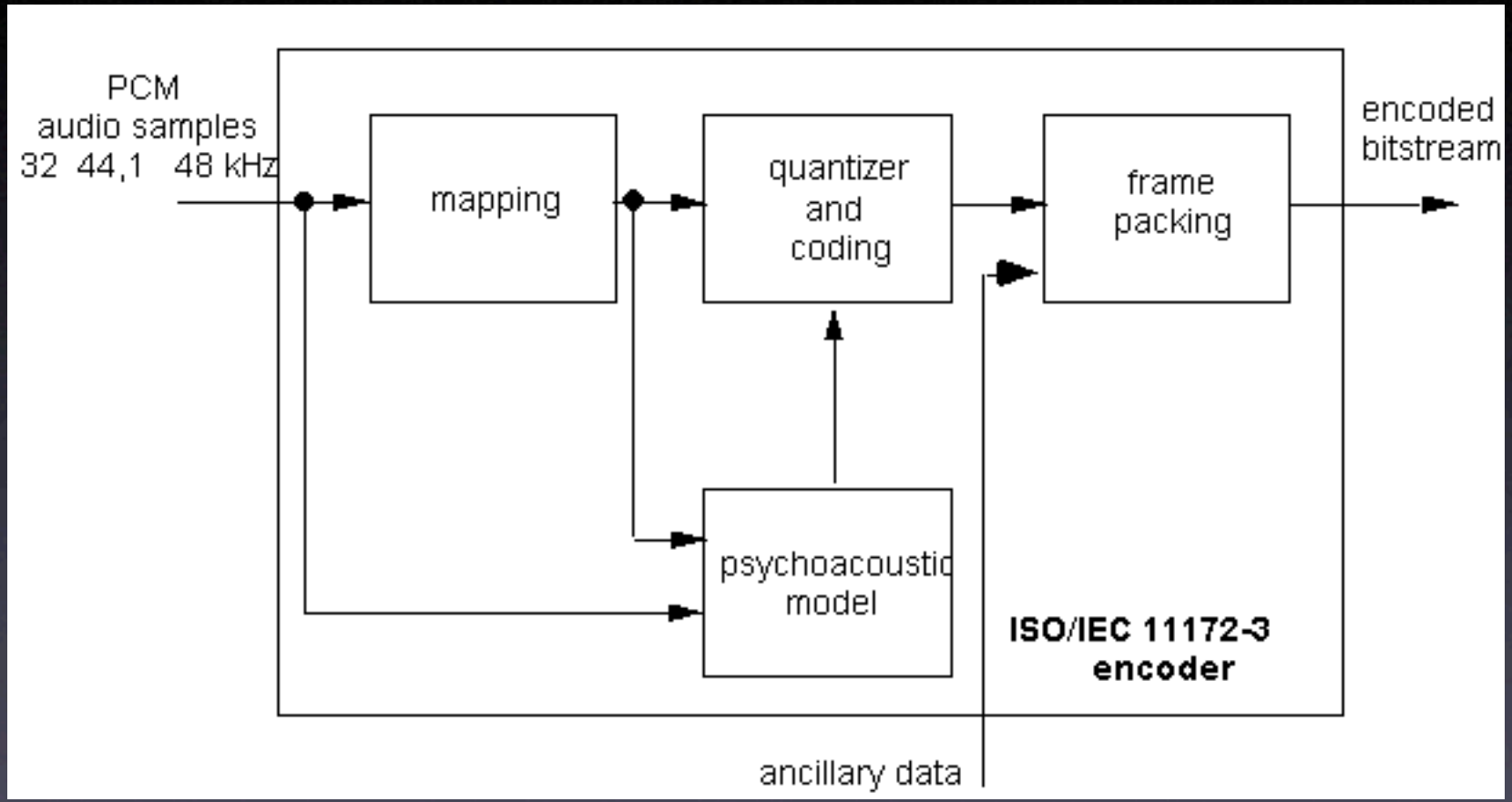
Enocoder

- Uses perceptual models
- Layer I - simplified MUSICAM
- Layer II - MUSICAM
- Layer III - Combination of MUSICAM and ASPEC

Layer I + II

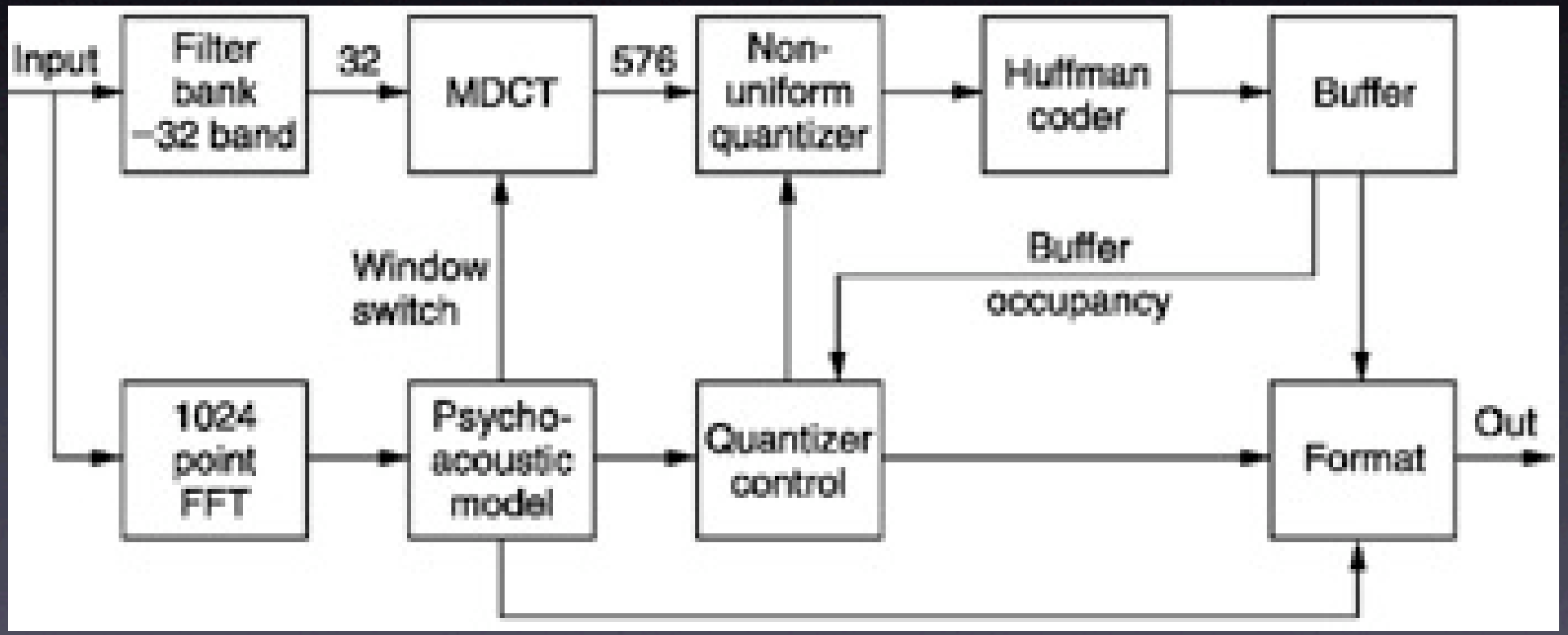
- Input is passed through a 32 band polyphase filter
- Bands emulate critical bands of hearing
- Masking threshold is calculated using a 512 point FFT (1024 in layer II)
- Cuts off at 16 kHz


Audible signals
Inaudible signals
Hearing threshold
10 bits
Masking effect
6 bits
4 bits
2 bits
SPL level
A
B
C
D
E
F
Frequency


PCM
audio samples
32 44,1 48 kHz
mapping
quantizer
and
coding
frame
packing
encoded
bitstream
psychoacoustic
model
ISO/IEC 11172-3
encoder
ancillary data

Layer III (MP3)

- 1024 point FFT to calculate masking thresholds
- Adds Modified Discrete Cosine Transform
- Variable Bit Rate
- Huffman Encoding


Input
Filter bank –32 band
32
MDCT
576
Non-uniform quantizer
Huffman coder
Buffer
Window switch
Buffer occupancy
1024 point FFT
Psycho-acoustic model
Quantizer control
Format
Out

Layer III

- CD bitstream 1411.2 kB/s
- MP3 bitstream 8 kB/s to 320 kB/s
- Input sampling rates 32, 44.1, 48 kHz
- Output Sampling rates 8 - 48 kHz

Joint Stereo

- Removes other redundancies
- High frequencies are summed
- Option at the encoding stage

Decoder

- Puts the encoded data back together
- Implementation not defined
- Data stream defined in Standard

ID3

- Adds important metadata
- Original implementation limited
- Current version ID3v2.4.0 very flexible

MP3 Revolution

- Small file size
- + Peer to Peer
- = Napster
- 2000 pay services introduced
- 2003 iTunes store

Intellectual Property

- Audio Home Recording Act (1992)
- Fraunhofer IIS patents (1989 + 1996)
- Thompson patents (1990)
- RIAA Activities

Conclusion

- Good Concept for compression
- Huge implications for music industry
- Made public aware of intellectual property