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**Information technology — Coding of
moving pictures and associated audio for
digital storage media at up to about
1,5 Mbit/s —**

Part 3:
Audio

*Technologies de l'information — Codage de l'image animée et du son
associé pour les supports de stockage numérique jusqu'à environ
1,5 Mbit/s —*

Partie 3: Audio



Reference number
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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

International Standard ISO/IEC 11172-3 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Sub-Committee SC 29, *Coded representation of audio, picture, multimedia and hypermedia information*.

ISO/IEC 11172 consists of the following parts, under the general title *Information technology — Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbit/s*:

- *Part 1: Systems*
- *Part 2: Video*
- *Part 3: Audio*
- *Part 4: Compliance testing*

Annexes A and B form an integral part of this part of ISO/IEC 11172. Annexes C, D, E, F, G and H are for information only.

Introduction

Note: Readers interested in an overview of MPEG Audio should read this Introduction and then proceed to annex A (Diagrams) and annex C (The encoding process) before reading the normative clauses 1 and 2.

To aid in the understanding of the specification of the stored compressed bitstream and its decoding, a sequence of encoding, storage and decoding is described.

0.1 Encoding

The encoder processes the digital audio signal and produces the compressed bitstream for storage. The encoder algorithm is not standardized, and may use various means for encoding such as estimation of the auditory masking threshold, quantization, and scaling. However, the encoder output must be such that a decoder conforming to the specifications of clause 2.4 will produce audio suitable for the intended application.

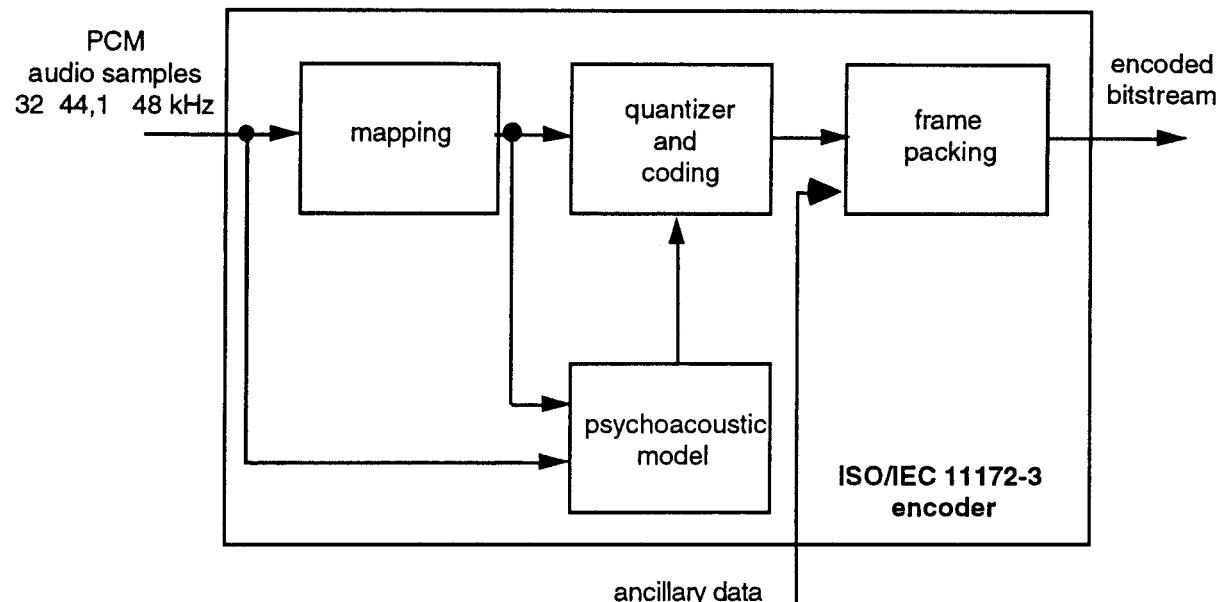


Figure 1 -- Sketch of the basic structure of an encoder

Figure 1 illustrates the basic structure of an audio encoder. Input audio samples are fed into the encoder. The mapping creates a filtered and subsampled representation of the input audio stream. The mapped samples may be called either subband samples (as in Layer I or II, see below) or transformed subband samples (as in Layer III). A psychoacoustic model creates a set of data to control the quantizer and coding. These data are different depending on the actual coder implementation. One possibility is to use an estimation of the masking threshold to do this quantizer control. The quantizer and coding block creates a set of coding symbols from the mapped input samples. Again, this block can depend on the encoding system. The block 'frame packing' assembles the actual bitstream from the output data of the other blocks, and adds other information (e.g. error correction) if necessary.

There are four different modes possible, single channel, dual channel (two independent audio signals coded within one bitstream), stereo (left and right signals of a stereo pair coded within one bitstream), and Joint Stereo (left and right signals of a stereo pair coded within one bitstream with the stereo irrelevancy and redundancy exploited).

0.2 Layers

Depending on the application, different layers of the coding system with increasing encoder complexity and performance can be used. An ISO/IEC 11172-3 Audio Layer N decoder is able to decode bitstream data which has been encoded in Layer N and all layers below N.

Layer I

This layer contains the basic mapping of the digital audio input into 32 subbands, fixed segmentation to format the data into blocks, a psychoacoustic model to determine the adaptive bit allocation, and quantization using block companding and formatting. The theoretical minimum encoding/decoding delay for Layer I is about 19 ms.

Layer II

This layer provides additional coding of bit allocation, scalefactors and samples. Different framing is used. The theoretical minimum encoding/decoding delay for Layer II is about 35 ms.

Layer III

This layer introduces increased frequency resolution based on a hybrid filterbank. It adds a different (nonuniform) quantizer, adaptive segmentation and entropy coding of the quantized values. The theoretical minimum encoding/decoding delay for Layer III is about 59 ms.

Joint Stereo coding can be added as an additional feature to any of the layers.

0.3 Storage

Various streams of encoded video, encoded audio, synchronization data, systems data and auxiliary data may be stored together on a storage medium. Editing of the audio will be easier if the edit point is constrained to coincide with an addressable point.

Access to storage may involve remote access over a communication system. Access is assumed to be controlled by a functional unit other than the audio decoder itself. This control unit accepts user commands, reads and interprets data base structure information, reads the stored information from the media, demultiplexes non-audio information and passes the stored audio bitstream to the audio decoder at the required rate.

0.4 Decoding

The decoder accepts the compressed audio bitstream in the syntax defined in 2.4.1, decodes the data elements according to 2.4.2, and uses the information to produce digital audio output according to 2.4.3.

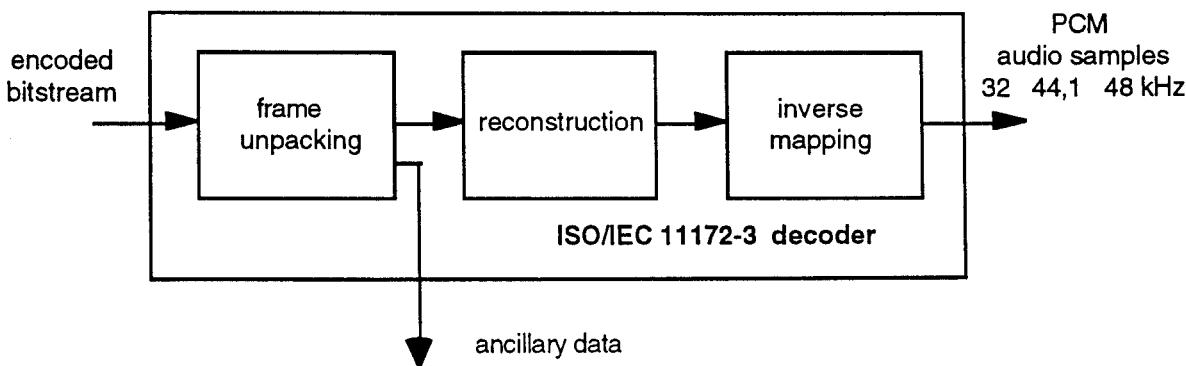


Figure 2 -- Sketch of the basic structure of a decoder

Figure 2 illustrates the basic structure of a audio decoder. Bitstream data is fed into the decoder. The bitstream unpacking and decoding block does error detection if error-check is applied in the encoder (see 2.4.2.4). The bitstream data are unpacked to recover the various pieces of information. The reconstruction block reconstructs the quantized version of the set of mapped samples. The inverse mapping transforms these mapped samples back into uniform PCM.

Information technology — Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbit/s —

Part 3: Audio

Section 1: General

1.1 Scope

This part of ISO/IEC 11172 specifies the coded representation of high quality audio for storage media and the method for decoding of high quality audio signals. The input of the encoder and the output of the decoder are compatible with existing PCM standards such as standard Compact Disc and Digital Audio Tape.

This part of the ISO/IEC 11172 is intended for application to digital storage media providing a total continuous transfer rate of about 1,5 Mbit/sec for both audio and video bitstreams, such as CD, DAT and magnetic hard disc. The storage media may either be connected directly to the decoder, or via other means such as communication lines and the ISO/IEC 11172 multiplexed stream defined in ISO/IEC 11172-1. This part of ISO/IEC 11172 is intended for sampling rates of 32 kHz, 44,1 kHz, and 48 kHz.

1.2 Normative references

The following International Standards contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 11172. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO/IEC 11172 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/IEC 11172-1:1993 *Information technology - Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbit/s - Part 1 Systems*.

ISO/IEC 11172-2:1993 *Information technology - Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbit/s - Part 2: Video*.

CCIR Recommendation 601-2 *Encoding parameters of digital television for studios*.

CCIR Report 624-4 *Characteristics of systems for monochrome and colour television*.

CCIR Recommendation 648 *Recording of audio signals*.

CCIR Report 955-2 *Sound broadcasting by satellite for portable and mobile receivers, including Annex IV Summary description of Advanced Digital System II*.

CCITT Recommendation J.17 *Pre-emphasis used on Sound-Programme Circuits*.

IEEE Draft Standard P1180/D2 1990 *Specification for the implementation of 8x 8 inverse discrete cosine transform*.

IEC publication 908:1987 *CD Digital Audio System*.