An open-standard file format for forensic audio

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In this paper we discuss a proposal for an open standard for a forensic audio file format, to be used in the acquisition, processing, and archival of audio data as forensic evidence. This is an open file format deriving from and extending existing wave file formats, while remaining fully compatible with them. This standard can be used by audio specialists as well as vendors of audio recording hardware to include additional information that is useful for forensic and law enforcement purposes.

In conducting forensic audio analysis, the forensic expert has to take care to ensure the integrity of the audio data under consideration as evidence, and maintain records pertaining to the analysis. With modern audio-editing software it has become increasingly easy, inadvertently or otherwise, to alter an audio recording in ways that may make it unacceptable in the courts as evidence. In addition, searching for and retrieving specific desired audio recordings is becoming increasingly difficult as storage of digital audio evidence becomes more prevalent. There is a need, therefore, for standardization of an audio format that takes into consideration the requirements of forensic analysis, search and retrieval. These requirements include, among other things, checks to ensure that the integrity of the original sample is maintained, that the details of the case and the specialist examining the sample are logged at every stage, and that the audio data is appropriately tagged. This open standard proposed is closely aligned to the recommendations of the Audio Engineering Society (AES) for managing forensic audio recordings to 'ensure the chain of custody', 'to properly identify and maintain the physical integrity of the evidence' and 'to document technical and non-technical actions taken with the evidence' (AES27-1996).

In order to maintain the integrity of the evidence, the information about the audio data, as it was acquired, either as a first digitized capture of an audio recording or direct digital download from a recording device, should be encoded into the audio file. This information can be in the form of a cyclic redundancy check (CRC) for the entire recording or for portions of the recording. With recent advances in forensic recording hardware it is possible to record simultaneously with several channels, and the definition of the format should encompass multi-channel audio as well. The Resource Interchange File Format (RIFF), on which the popular 'wave' file format is based, defines a meta-format where data is ordered in chunks. The chunky 'wave' format allows for embedding additional information along with the audio data. The chunks embed information such as labeled text, cue information, data and silent regions, compression details, etc., in addition to the audio data samples. The case serial numbers, date and time of acquisition or receipt, identifying information of the specialist analyzing the case, call record information and details about the nature of the case are meta-information of interest, in addition to the technical details about the recording such as the sampling rate, the compression algorithm, the number of channels, and the number of bits used per sample. It is possible to encode meta-information pertaining to forensic analysis using the 'wave' audio format. We also propose 'signing' of the file by each specialist who performs the analysis or enhancement of the audio using digital signatures. This would make the audio evidence better searchable and manageable.

This forensic audio file format must be completely compatible with existing audio file formats, and the additional information embedded in it should not render it unusable by popular audio manipulation software. Thus, while forensically relevant information that is embedded into the software can be read, modified and written into the audio file, this additional information does not affect the playback or use of the file in any other software. In addition, it is possible to export the embedded meta-information about the case in an accompanying file that can be indexed and searched. A pro-

totype of this file format and its functioning will be presented. This design is envisioned as the first step towards an open standard that can be created, which forensic audio laboratories as well as the providers of forensic audio libraries can use.

References

AES27-(1996) AES Recommended practice for forensic purposes -- Managing recorded audio materials intended for examination, New York, Audio Engineering Society, 1996.