Acorn Replay

Compression
Process Overview

Abstract

The recent convergence of computer, audio and video technologies has brought about innovations in the world of Multimedia, but has also resulted in a situation where the computer literate developer is confronted with the complex technology of the audiovisual production field, and the skilled film producer is required to replace emulsion or analogue storage mechanisms with digital media.

The production of Acorn Replay movies is typical of this situation in that it requires an appreciation of several technologies, and involves the assimilation of those skills and expertise needed to successfully maintain and operate the complex equipment which is associated with each of these technologies:

Assuming that video materials are available with the appropriate content, this document outlines the skills, technologies and processes which are necessary to translate that footage into high quality Acorn Replay movies which will be suitable for publishing within the education and training environments:

Video Materials

Consumer video formats such as VHS and Sony Video 8 provide perfectly acceptable results for use in the home, but do not produce the necessary levels of luminance and chrominance required for professional use: Equally, Replay movies produced using consumer equipment can be compressed to provide reasonable quality digital video, but only professional quality video equipment is capable of producing results which are acceptable for the publication of CD ROMS. Consult your local audio visual specialist for details of suitable recording equipment.

Preprocessing

Professional audiovisual engineers will routinely compress the dynamic range of both audio and video materials to ensure that the quality of the signal is maximised and that noise is kept to a minimum: This results in digital video which shows a reduced level of quantisation and pixelation, and audio which has a low noise content and yet is clear and well defined. Although not essential for the production of most Multimedia titles, this form of preprocessing adds a professional veneer to high quality Replay movies:

Video Data

At present, commercially available video digitiser boards have the ability to capture distortion free still images direct from a video camera or video cassette recorder, and to then save the image off to disk for subsequent processing: The amount of data required to represent the raw image is too great to allow real time capture at anything approaching video refresh rates (eg 25 frames per second), and therefore some method is needed to freeze and capture a sequence of individual frames in order to produce Replay movies:

Unfortunately, it is not sufficient to simply use the freeze frame facility found on most video recorders, as the quality of the still image is so low *as* to produce an unuseable result when subsequently compressed (digitiser boards are genlocked to the video, the pause button on a domestic VHS recorder is not!):

Broadcast quality videotape recorders such as the Betacam SP (£15,000) can be used to capture still images at the appropriate level of quality for Replay movies. These recorders index each individual frame with SMPTE (Society of Motion Picture and Television Engineers) timecode, which can then be used to trigger a digitiser board whenever a frame with the required index code is being displayed: As the digitiser board does not capture to disc in real time, the videotape is played several times, with different frames being captured on each pass:

The captured frames are sorted into SMPTE timecode order, and are then processed by the Replay compressor to produce a set of compressed video frames and difference data which will be combined with any audio tracks to produce the finished Replay movie.

Audio Data

Audio data which is to be incorporated in a Replay movie (including "audio only movies") can be captured using any audio digitiser which is capable of generating sound module files for the Archimedes: If movies of more than a few seconds are to be produced, it is essential to use a digitiser which is capable of capturing audio data directly to disk:

Information captured by the digitiser is translated into Replay format and interleaved with compressed video data, and is then concatenated with a text file definition of the movie and a start up sprite to produce the final version of the Replay movie:

Data Storage Requirements

The production of Replay movies (or any other Full Motion Video) requires the availability of large amounts of data storage in order to hold the intermediate and final versions of the product, with one minute of video requiring approximately 60Mb to store raw data, and finished movies requiring 9Mb per minute:

Winchester drives or magneto-optical drives of 600Mb to 1Gb are recommended for the development of Replay titles.

CD-ROM is recommended as the publishing medium for applications containing Replay movies:

Compression Service Providers

Replay movies can be produced from video and audio sources such as VHS videotape, by Compression Service Providers (CSPs) who own and operate appropriate broadcast quality video and audio equipment, and who are licensed to use the Acorn Replay compression software: CSPs can also add value to the production process by utilising their audio visual production skills to suggest ways in which the product can be improved.

Currently, Acorn have licensed Uniqueway as our sole Compression Service Provider:

Future Capture and Compression Techniques

A great deal of resources are being focussed on the use of JPEG (Joint Photographic Experts Group) and other forms of compression process which will reduce the processor and I/O bandwidths necessary to process video and audio data, and several developers are currently working an a new generation of digitisers which will be capable of capturing video and audio data to disk in real time where they can be further compressed using the Replay compressor:

Digitisers offering real time capture are expected to be available from our third party suppliers towards the end of 1992, and will allow Replay movies to be created using domestic video cameras and recorders, resulting in a rapid increase in the availability of educationally viable video materials:

Advances in audio compression techniques will allow audio data to be stored more effectively on disc and will minimise I/O bandwidth requirements significantly: Current work on ADPCM format audio will typically allow a 50% reduction in these areas:

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