

Transcoding for Content Management Systems

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Project Report

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Abstract

The purpose of this project is to study transcoding techniques in the content management systems. Content management systems involves three main phases creation, preparation and delivery. The three phases are integrated to form content management system. One of the most important functions in the preparation phase is the transcoding, due to its importance for a wide range applications. Transcoding techniques are used in storage capacity, and transmission bandwidth reduction, especially in heterogeneous environments. How the transcoding can get use of the complete digital work flow to reduce its complexity. In this project, technical issues related to transcoding technology, the role of metadata in coding, coding standards, and the availability of free software were explored. The literature is full of transcoding techniques and software. Metadata as a tool for transcoding is going to have good future.

1 Introduction

The media industry is in the middle of an information revolution. Media services are now delivered to clients via different digital television platforms, news agencies and media service providers are using satellite transmission, fiber optic networks, and web services like FTP to deliver media content to their clients around the world simultaneously. These clients are looking for high quality services, which are timely, relevant, accurate, and cheap. In the news industry the accuracy and timely arrival of information is vital. Therefore, media service providers must ensure all services are of the highest quality. The real life content management challenges posed by media services, and news delivery are large. In order to satisfy client demands for constantly updated material, it takes a lot of manpower and time to manage the content manually, and this makes it impossible to reach wide range of clients on time, leading to bad profitability. For media service providers, an automated content management system is essential in order to reach the clients and make profit. Content management systems provides a mechanism for ensuring the quality and availability of content for different clients.

2 Transcoding in CMS

The media content management systems, is an integration of multiple operations to form an automated digital work flow. A content management system must manage a piece of content from the moment of its creation to its final destination in archive or transmission, through various applications and services, including metadata manipulation, transcoding creating multiple versions of the content all of which need to be managed. As the number of delivery formats, types of devices and content representation formats increase, interoperability between different systems and different networks is becoming more important. Therefore, Media management systems must provide the means for interaction between content

creation and consumption. Transcoding of video content one of the tools that makes this possible. Metadata is a key element used in the implementation and development of such systems.

2.1 Transcoding Architecture

Video transcoding performs one or more operations, such as bit rate and format conversions, to transform one compressed video stream to another. Transcoding can enable multimedia devices of diverse capabilities and formats to exchange video content on heterogeneous network platforms such as the Internet. The most straightforward transcoding architecture is to cascade a decoder and an encoder directly. In this architecture, the incoming source video stream is fully decoded, and then the decoded video is re-encoded into the target video stream with desirable bitrate or format. A more efficient solution to perform conversion between video bitstreams of the same standard - homogeneous transcoding - is open-loop transcoding. In an open-loop transcoder the process of video coding is reversed until the quantization step, a new quantizer value is calculated for lower bitrate, Open-loop transcoders are computationally efficient, but they suffer from the drift problem, where video picture is predicted from its reference pictures and only the prediction errors are coded. For the decoder to work properly, the reference pictures reconstructed and stored in the decoder predictor must be same as those in the encoder predictor. The open-loop transcoders change the prediction errors and, therefore, make the reference pictures in the decoder predictor different from those in the encoder predictor. The differences accumulate and cause the video quality to deteriorate with time.

2.2 Standardized Metadata for transcoding

As metadata is being easy to create and video material available together with the metadata describing its content. Encoders can exploit the metadata in the encoding process. Metadata-based encoding uses metadata descriptions related to the video content. Metadata can be used in various ways. In some situations, the encoder will make use of the metadata to simply optimize its encoding strategy and the resulting bitstream will still be compatible with metadata unaware decoders. That is, the decoder will not need any extra information to decode the received bitstream. Full exploitation of the metadata, the encoder will have to severely modify its encoding strategy and the bitstream compatibility with classical decoders will be broken. In that situations, the decoder will also need the metadata in order to correctly extract the video content from the bitstream. The use of standardized metadata to assist the transcoding, is central to the distribution of content to diverse and heterogeneous environments.

MPEG-7 “The multimedia content description interface” is a standard of the moving picture expert group allows the description of multimedia contents. The standards offers tools for wide range of descriptors like title of the content from one side and technical descriptors like color , and motion. Tools that

provide transcoding hints, and tools that indicate the available variations of media content. On the other hand,

MPEG-21 Digital Item Adaptation is standardizing tools to describe the usage environment, which includes terminal capabilities, network characteristics, user characteristics, as well as characteristics of the natural environment. These tools can be used in conjunction with each other to allow understanding between both source and destination, which in turn will steer the adaptation process to output content suitable for delivery and consumption within the given usage environment.

2.3 Technical Standards

Currently, several video compression standards exist for different multimedia applications. Each standard may be used in a range of applications, but is optimized for a limited range. Inter-compatibility between different systems and different platforms are becoming highly desirable. Transcoding is needed both within and across different standards to allow the interoperation of multimedia streams

GXF — General Exchange Format is a container format associated with SMPTE360.

H.263 — A low-bitrate codec originally designed for video conferencing.

H.264 — A scalable video codec designed to provide better quality at substantially lower bitrates than H.262, H.263 or the MPEG-4 Part 2 video codec. Also known as AVC and MPEG-4 Part 10.

HDV — An inexpensive high-definition video recording format that uses MPEG2 compression to fit HD content onto the same DV or MiniDV tapes originally developed for standard definition recording.

JPEG 2000 — Highly scalable waveletbased image compression standard supported by the Digital Cinema Initiatives for storing, distributing and exhibiting motion pictures.

MPEG-1 — A container format that includes three compression standards pertaining to synchronizing and multiplexing video and audio into a program stream; a codec for progressive, noninterlaced video; and an audio codec with three layers of complexity, the best known of which is MP3 (MPEG-1 Layer 3 audio). MPEG-1 was originally designed for use with video CDs.

MPEG-2 — A format that has two container types: TS (transport stream) and PS (program stream). The former is for video, audio and data used in broadcast applications. The latter is for more stable delivery environments such as DVDs. TS and PS both utilize the H.262 video codec, but impose different sets of constraints on parameters such as image resolution, frame rate and data rate to accommodate their respective delivery platforms' characteristics.

MPEG-4 — A container format with 23 parts, a number of which are still in development. MPEG-4 Part 2 is a video codec that has largely been superseded by MPEG-4 Part 10, aka AVC (Advanced Video Coding) or the H.264 video codec. MPEG-4 Part 2 is the codec of choice for DivX, Nero Digital and QuickTime 6; MPEG-4 Part 10, AVC/H.264 is the codec of choice for HD

DVD, Blu-ray Disc, QuickTime 7 and Flash 9 among others. MPEG-4 Part 3 is a set of audio codecs, including the Advanced Audio Coding (AAC) codec, which was carried over from the MPEG-2 standard. MPEG-4 is being used in delivery media ranging from mobile devices to high-definition disc formats, in broadcasting, and so on.

MXF — A container format — MXF stands for Material eXchange Format—designed to hold Advanced Authoring Format meta-data, enabling workflows between nonlinear editing systems that support AAF and cameras, servers and other systems that support MXF. Supported codecs include DV, IMX D10 and Broadcast WAV audio, among others.

QuickTime — A container format that can accommodate nearly any type of media including animation, music, speech, text, video and much more. H.264 and AAC are among the video and audio codecs supported.

VC-1 — Developed by Microsoft and at least 15 other companies, VC-1 a variation on the H.264 codec designed to a handle interlaced video content without first converting it to progressive. VC-1 decoding is required in both the HD DVD and Blu-ray Disc players. VC-1 is also the official video codec of the Xbox 360. Microsoft has implemented VC-1 in three different codecs: WMV3, WMVA and WVC1. WMV3 implements the Simple and Main profiles of VC-1 for streaming and downloading. It is used in Windows Media Video 9. HD movies released in the WMV HD format use VC-1 MP@ HL encoding. WMVA (the A stands for Advanced) was distributed as part of Windows Media Player 10 and is not fully VC-1 compliant. WVC1, also known as Windows Media Video 9 Advanced Profile, is reported to encode interlaced content of the same quality at one-third the bitrate of MPEG-2.

VOB — Video Object is a container format utilized in DVD-Video media. VOB is based on MPEG-2 program stream format.

2.4 Standardization Organisations

- SMPTE The Society of Motion Picture and Television Engineers
- ITU- International telecommunication union
- ISO- International standardization organization
- MPEG- Moving picture expert group

2.5 Software

Many open source transcoders are available, these transcoding softwares can perform transcoding and format conversion among all the available video formats.

2.5.1 FFmpeg Project

FFmpeg is a complete, cross-platform solution to record, convert and stream audio and video. It includes free software/open source LGPL-licensed library

- FFmpeg is a command line tool to convert one video file format to another. It can also grab and encode in real time from a TV card.
- FFserver is an HTTP and RTSP multimedia streaming server for live broadcasts. It can also time shift live broadcast.
- FFplay is a simple media player based on SDL(Simple DirectMedia Layer) and on the FFmpeg libraries.
- libavcodec is a library containing all the FFmpeg audio/video encoders and decoders. Most codecs were developed from scratch to ensure best performance and high code reusability.
- libavformat is a library containing demuxers and muxers for audio/video container formats.
- libavutil is a helper library containing routines common to different parts of FFmpeg.
- libpostproc is a library containing video postprocessing routines.
- libswscale is a library containing video image scaling routines.
- libavfilter is the substitute for vhook which allows the video to be modified or examined between the decoder and the encoder.

2.5.2 Transcode

Transcode is a command-line interface for Unix-like operating systems. It uses FFmpeg's libavcodec library, and supports numerous formats (such as DV, MPEG-2, MPEG-4 , H.264, etc.) .

2.5.3 MPlayer and MEncoder

MPlayer is a free and open source media player. The program is available for all major operating systems, including Linux and other Unix-like systems.MPlayer supports a wide variety of media formats and can also save all streamed content to a file.A companion program, MEncoder, can take an input stream or file and transcode it into several different output formats, optionally applying various transforms along the way.

3 Plan and Process

The project was planned to look into the complete content management systems, and its differnt phases in general. According to the time plan the study of the literature was assigned twenty hours in two weeks, but when i started reviewing the literature i found that it needs further study to cover the content management systems.I had plan to make some questionnaire to explore the media management systems used her in norway with cooperation with lillehammer

university college and NRK, but the shortage of time didnt help me to carry this out, and the project was limited to literature study. As a result the project was narrowed to transcoding of the video in content management systems. The output of this project is not what i intended it to be, due to bad estimation of the productivity in limited time, but i had good experience in how to set a goal. In this stage i can say that i entered a very interisting field of research, and may be my master thesis be in the same subject.

4 Conclusion

The transcoding of video content is core technology in video content management systems. Transcoding has high computational process which requires hardware and software resources, thats why differnt transcoding techniues compromise the video quality with computation complexity. The adoption of media to the new the technology , and the tools available to create and maniplate metadata, generated new digital workflows depend on metadata. The stanrdization of metatada created new transcoding techniques where metadata used as a tool in the transcoding process.

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