

VoDTV – A VoD Platform for the ISDB-Tb Digital Television System

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Outline

- 1 Introduction
- 2 Video-on-Demand
- 3 VoDTV
 - Video Transcoding Process
 - Adaptive Modulation and Coding for Video Transmission
- 4 Conclusions and Next Steps



Introduction

- The availability of broadband network technologies and advanced compression techniques allowed the dissemination of high quality multimedia content over the Internet;
- Video-on-Demand (VoD) has gained much attention and penetration in the market
 - VoD enables a subscriber to watch a selected video from a library at any time;
 - This scheme is different from pure broadcast in the sense that it provides the subscriber the control to receive some video content according to his interests.



Video-on-Demand

- Video-on-demand has experienced an increasingly expansion due to its potential of application:
 - Entertainment (e.g., movies, sports);
 - Education (e.g., distance learning, corporate training);
 - Business (e.g., advertisement, pay-per-view);
- One of the main requirements to provide VoD in TV systems is the need of a return channel for interaction with the broadcaster
 - To inform the broadcaster about the subscriber demands;
 - To receive content not distributed by the broadcast channel;
- ISDB-Tb system is a promising candidate to provide VoD services, since a return channel is available.



VoD – Classification

- *No VoD (NoVoD)* – TV transmissions, based on broadcast;
- *Quasi VoD (QVoD)* – takes selective subscription by multicasting media content to groups of users;
- *Near VoD (NVoD)* – multiple channels are used to transmit the same media content shifted in time (simulate VCR operations);
- *True VoD (TVoD)* – the VoD system serve each subscriber with an individually allocated channel;
- *Interactive VoD (IVoD)* – an extension of the TVoD system to provide an individual exhibition control, being capable of executing VCR operations.



VoDTV (Video-on-Demand for Digital Television)

- Multi-institutional effort to provide a VoD platform for the ISDB-Tb by means of its return channel;
 - VoDTV is in research at the Federal University of Campina Grande (UFCG) and Federal Institute of Maranhão (IFMA);
- When used on one-seg devices, VoDTV use a context-aware approach to adapt the multimedia content to the channel and device characteristics
 - This approach avoids the waste of computer and network resources;
- Investigation of advanced transmission techniques:
 - Adaptive modulation and coding techniques;
 - The use of cognitive radio technology for the return channel (IEEE 802.22).

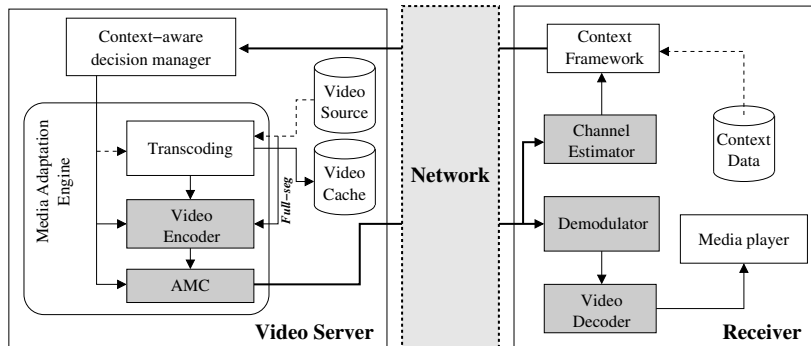


VoDTV – Subprojects

- 1 Video transcoding;
- 2 Adaptive modulation and coding;
- 3 Study of the cognitive radio technology for the return channel (IEEE 802.22);
- 4 A framework for capturing and processing context information;
- 5 A client-server VoD application and video catalog (developed with Ginga).



VoDTV – Architecture



Video Transcoding

- The restrictions of one-seg devices sometimes make difficult for a video to be comfortably viewed on a mobile device;
- Video transcoding is the operation of converting a video from one format into another with different features
 - A format is defined by characteristics such as bit rate, frame rate, spatial resolution, etc.
 - This model is used to adjust the video content to network characteristics, terminal capabilities, and user preferences;
- Currently, the only parameter whose adaptation is being investigated is the spatial video resolution.



Spatial Video Transcoding

- It consists of a down-sampling process by a factor in the horizontal and vertical directions
- A filtering operation is used to downsample the signal and consists of substituting pixels in the original video
 - Pixels inside an $M \times M$ block are substituted by a single pixel;
 - The new pixel value is calculated by a mathematical operation (filter).



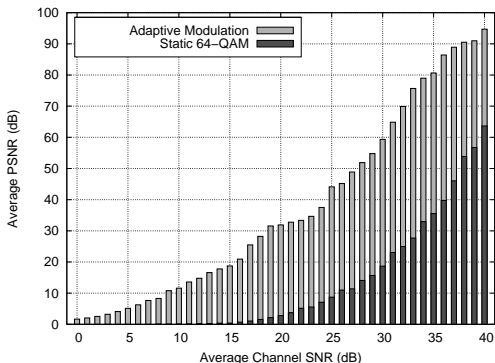
Adaptive Modulation and Coding for Video Transmission

- The adoption of adaptive modulation and coding (AMC) schemes makes it possible to perform robust and spectrally efficient transmissions
 - The main goal of AMC is to adapt the transmission parameters (transmission and coding rates) to channel fluctuations;
- The receiver estimates the channel characteristics and sends this information back to the server, to allow the adaptation on both sides;
- The effect of adapting the data rate in video transmissions (objective and subjective quality) is currently under investigation.



Average PSNR values for a static 64-QAM modulation and adaptive modulation (target BER)

- Experiment:
 - Foreman video (with CIF resolution);
 - Encoded using the H.264/MPEG-4 AVC format (Baseline profile), a bitrate of 347 kbit/s and GOP size of 30 frames;
 - No outer or inner coding schemes used.



Conclusions and Next Steps

- VoDTV project is in its preliminary stage, but it has a potential for application in the Brazilian digital television system
 - Is a multi-institutional effort to provide VoD services for the ISDB-Tb;
- The next steps of the project include:
 - Evaluation of new video parameters for the transcoding process;
 - Adoption of adaptive inner and outer coding in the AMC scheme;
 - Development of a context framework to obtain and process information about the receiver and the channel;
 - Development of a client-server application to allow the user to request and download media content.



Acknowledgments

