

# Exploration work in MPEG Video

**Jens-Rainer Ohm**

**RWTH Aachen**

**Lehrstuhl und Institut für Nachrichtentechnik**

**ohm@ient.rwth-aachen.de**

**<http://www.ient.rwth-aachen.de>**

## Overview

- MPEG performs **technical exploration work** related to **prospective future applications** in a „pre-standardization“ phase
  - may or may not lead to standardization effort
- Present explorations in MPEG Video:
  - **3D AV coding / Free Viewpoint Video**
  - **Video Coding Tools Repository**
  - **Wavelet Video Coding**
  - *Inverse Discrete Cosine Transform* (not in this talk ..)
- Long-term ideas presented and discussed in **MPEG workshops on future video coding**
  - next event to be held in Nice (October 2005)

# 3D and Free-Viewpoint Video

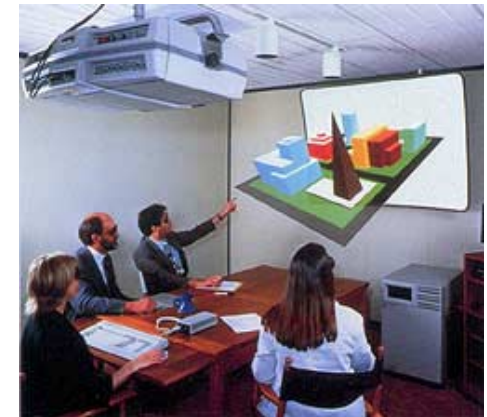
## 3DAV / FVV coding : History

- **Multi-camera compression is an old topic** – see e.g.
  - MPEG-2 Multiview profile
  - MPEG-4 2D/3D scene & object models
- **New applications envisaged by industry and driven by availability of new display types**
  - Stereo and 3D TV
  - Free-viewpoint video (FVV, almost free navigation)
  - Omnidirectional video (lookaround views)
- **Exploration started December 2001**
  - Analysis showed that many applications can be accommodated by existing standards and their tools
  - Open issues: Efficient multi-camera compression, linkages between coding and view interpolation in FVV

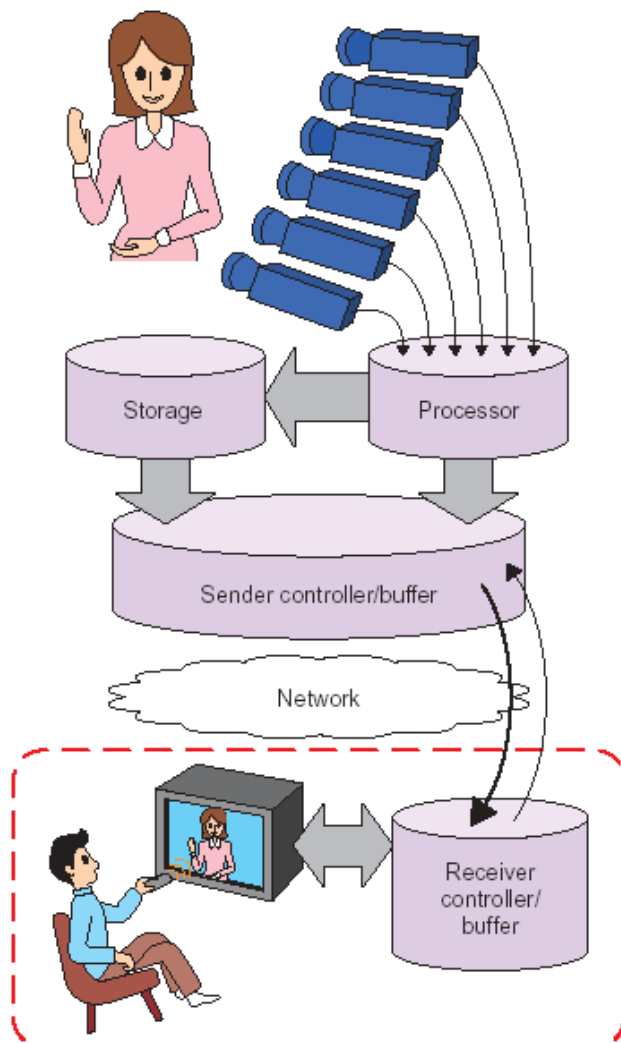
## Target Features & Applications

### ■ 3D Video

- Offers 3D depth impression of a scene based on multi-view video
- Requires special 3D display technology: many new products announced recently and being exhibited (e.g., CES, SID)
- Could be applied for broadcast TV, teleconference, cinema or other immersive video applications



## Target Features & Applications



### Free Viewpoint Video

- Provides the ability to change viewpoint freely
- Multiple views available; render one view (real or virtual) to legacy 2D display
- Useful for surveillance, broadcast TV, stored interactive video

## MPEG Call for Proposals on Multiview Video Coding

**Call for Evidence** brought information about the potential of multi-view compression technology (January 2005): 7 responses received, some showed same quality at half data rate as compared to AVC/H.264 simulcast

### Schedule of CfP

2005/04	Draft Call for Proposals
2005/07	Final Call for Proposals
2005/08/12	Pre-registration deadline
2005/09/12	Registration deadline
2005/09/30	Subjective assessment starts
2005/10/11	Submission of documents to MPEG Video Chair
2005/10/17-21	74th MPEG meeting - report of the subjective test and evaluation of responses

## Novelties of MVC (from Call for Evidence)

- **Prediction structure**
  - Prediction across different views
  - Different types of decompositions possible
  
- **Prediction Tools**
  - Illumination/color compensation across different views
  - Disparity/motion vector prediction
  - View interpolation



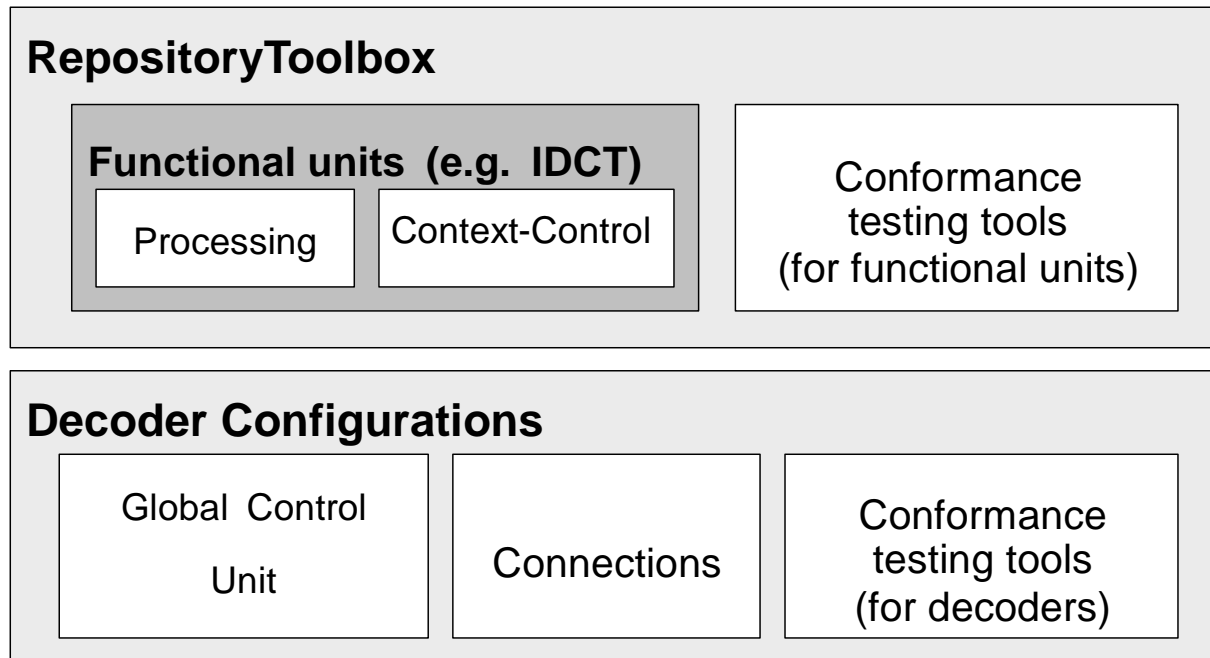
# Video Coding Tools Repository

## Problem Posed...

- Paradigm shifts in media coding
  - One tool-one functionality
    - ➔ Many tools-many codecs
  - One standard for each dedicated application
    - ➔ Many codecs housed in a single platform
  - Open standards dominance
    - ➔ Competitions of standard and proprietary codecs everywhere
  - “Maximize the use of standards!”
    - ➔ “Maximize the use of tools!”

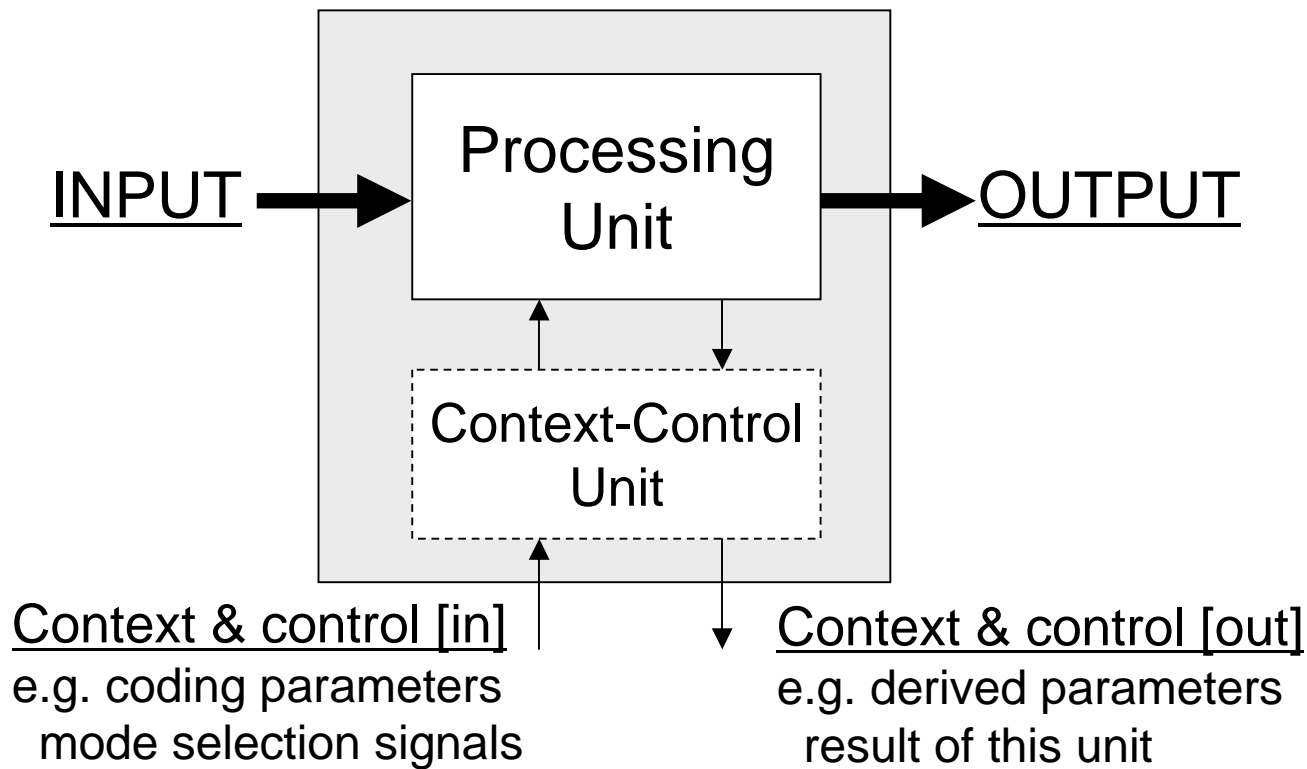
## What is VCTR?

- It would become a standard that defines conformance at tool-level instead of codec-level



## Basic Building Block: Functional Unit

- A codec is a **collection of functional units**.



## VCTR perspectives

- **What can be done by VCTR?**
  - Design of new codecs based on VCTR
  - Transcoding
  - Efficient HW implementation
  - FU-level conformance testing
  
- **Work plan:**
  - October, 2005: **First Demo of VCTR**
  - Standardization work item might be started in 2006

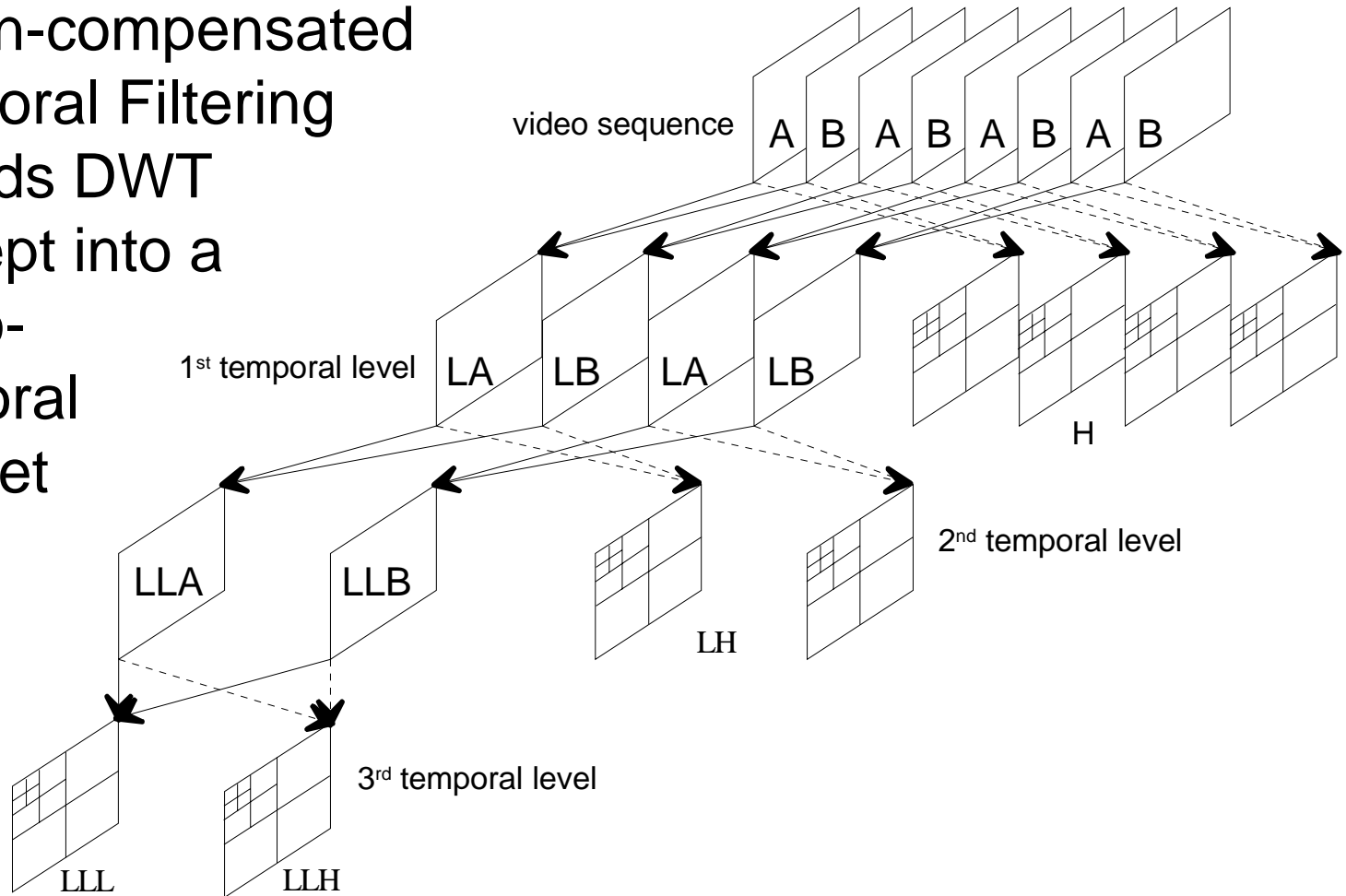
# Wavelet Video Coding

## Wavelet Video Coding Exploration

- Wavelet video technology thoroughly investigated in SVC Core experiments
- New **MPEG Exploration on Wavelet Video Coding** was started in Palma (Oct. 2004)
  - To explore further technical progress in the field of motion-compensated wavelet video coding
  - To identify possible application domains beyond those of emerging SVC standard, and benefits of wavelet tools that would justify to bring them into the standardization process
- The AHG decided on a **common software platform** for their investigations
  - Provided by MSRA, available to MPEG members

# MCTF & 3D Wavelet coding

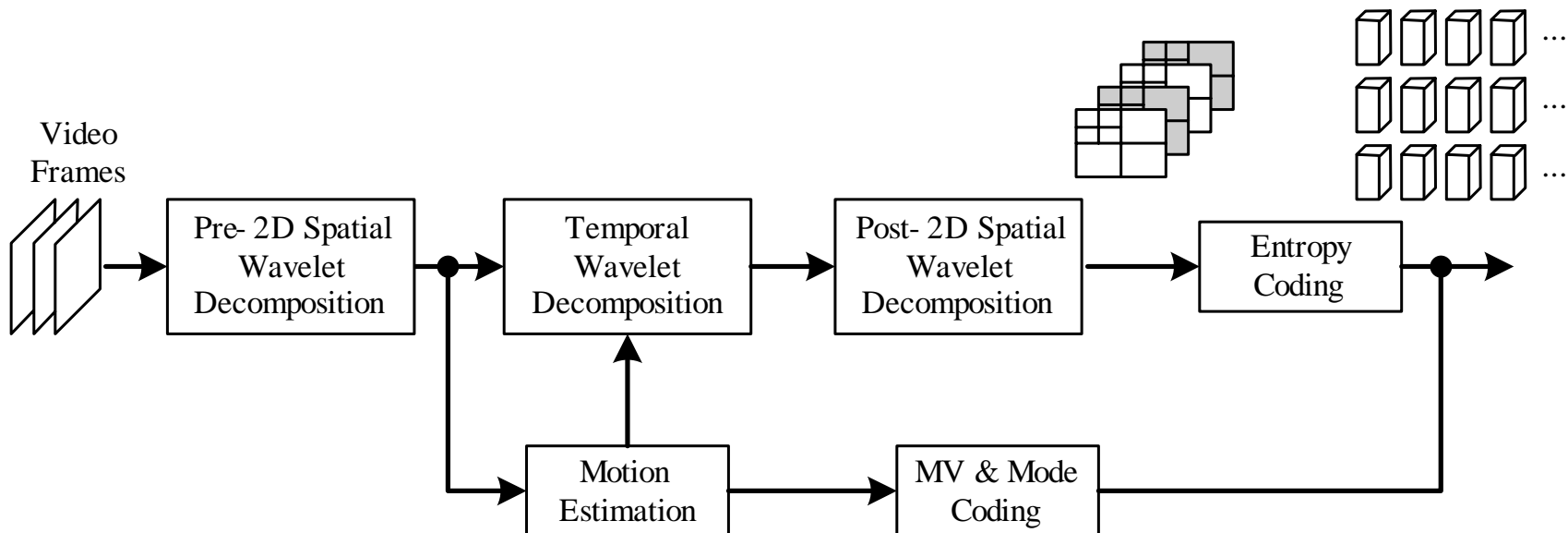
- Motion-compensated Temporal Filtering extends DWT concept into a spatio-temporal wavelet tree





## Wavelet Video Coding Exploration

- General framework allows different decompositions (2D+t, t+2D, 2D+t+2D)
- In-band MCTF (non-empty pre-composition) improved by overcomplete DWT



## Results achieved so far ...

- Improvement of compression (as compared to SVC Core Experiments performed last year) by
  - proper coding mode selection (sequence of spatial and temporal transform, base layer)
  - post-filter for de-ringing and de-blocking of the reconstructed frames
- More in-depth investigations necessary
  - how far it can improve
  - analysis of complexity
  - application domains (possibly beyond those of emerging SVC standard)

## Announcing ...

- **Future Video Coding Workshop in Nice, France**
  - Venue: Acropolis Nice on Sunday prior to MPEG meeting
  - a room with capacity of 100 has been reserved
- **Important dates**
  - **July 18th, 2005** Submission of abstract by sending an email to: [futurevideo@listes.epfl.ch](mailto:futurevideo@listes.epfl.ch)
  - **August 15th, 2005** Notification of accepted papers
  - **October 10th, 2005** Manuscripts due date
  - **October 16<sup>th</sup>, 2005** Workshop