

System Modeling and Implementation of MPEG4 Encoder Using Fine-Granular- Scalability Framework

EE 382C Embedded Software Systems

Dr. Brian L. Evans

Team: Wei Li and Zhenxun Xiao

Scalability Problem

- **Purposes of Internet Streaming video**
 - provide quality of service through channels of different bandwidths
 - provide quality of service to receivers with different processing capability
 - provide quality of service under best-effort IP network
- **Scalable profiles in MPEG2 (base layer & enhancement layer)**
 - Data partitioning
 - SNR Scalability
 - Spatial Scalability
 - Temporal Scalability
- **These solutions can not solve scalability problem completely**
 - They are still oriented to specific bandwidth
 - The receiver needs all the information from enhancement layer, otherwise, it can not use it at all

Solution: FGS with bit-plane coding

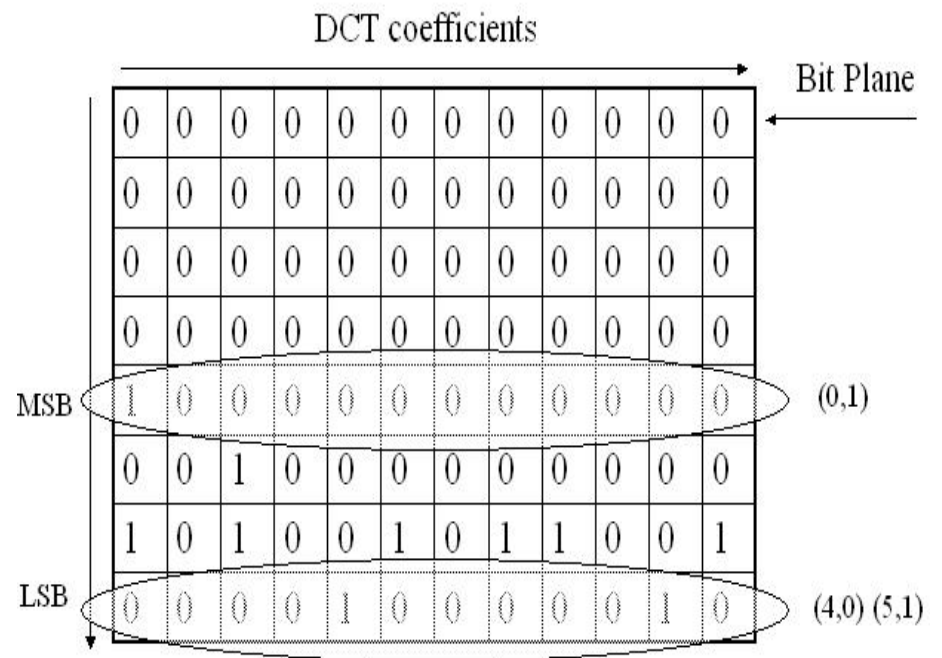
- **FGS framework in MPEG4**

- FGS: fine granular scalability
- Base layer uses non-scalable coding to reach the lower bound of the bit-rate range
- Enhancement layer is to code the difference between the original picture and the reconstructed picture using bit-plane coding of the DCT coefficient
- Bit stream of FGS enhancement layer may be truncated into any number of bits.
- Being able to enhance base layer using partial information from enhancement layer
- The limited bandwidth can be used to transmit the bits which influence the image quality most
- Key issue: bit-plane encoding

Bit-plane Coding

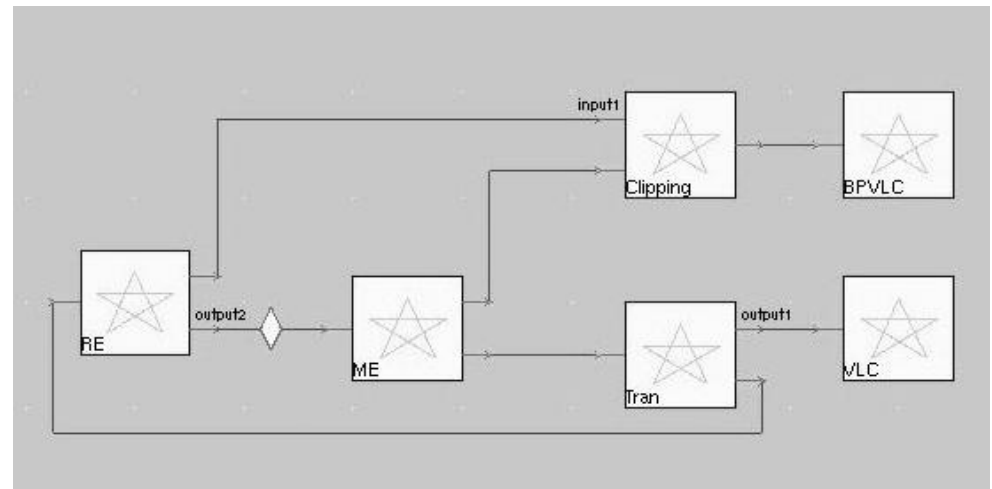
Compared to run-level coding

- Code bit planes starting from the most significant bit
- Coded content is scalable
 - Based on bit plane
- Coding is more efficient
 - all zero bit plane is represented by a special symbol All-ZERO
 - bit planes coding are more efficient than conventional RLC (column by column)



Model and Implementation

- Video encoder is data intensive application
- Also, data flows in single rate
- Homogeneous SDF model
- Development environment
 - Ptolemy
- Starting Point
 - referential implementation of MPEG2 (MSSG)
- Granularity consideration (why so coarse?)
 - Buffer management mechanism in Ptolemy
 - Want to be more generic, since MPEG4's new commercial model



Evaluation and Results

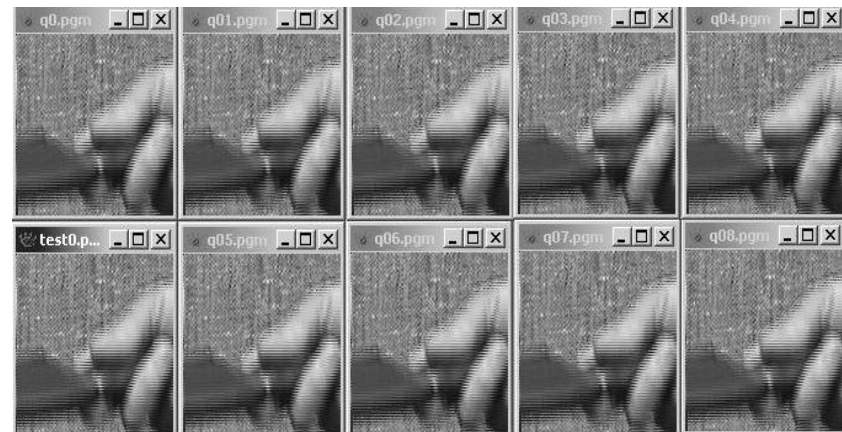
Study the trade-off of
FGS features

quality vs. overhead

Test case

From referential MPEG2
implementation of
MSSG

Picture quality 8-bit,
128 x 128 grayscale



Base	8 bit planes	7 bit planes	6 bit planes	5 bit planes
Origin	4 bit planes	3 bit planes	2 bit planes	1 bit planes

Conclusion and Future Work

- Implemented a video encoder with FGS feature, similar work has been carried with H.263+ too
- SDF is a good modeling language for multi-rate data intensive application
- Can we abstract the model and provide a generic model that can utilize FGS feature with all scalability profiles?