
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

<table>
<thead>
<tr>
<th>Origin</th>
<th>4 bit planes</th>
<th>3 bit planes</th>
<th>2 bit planes</th>
<th>1 bit planes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base</td>
<td>8 bit planes</td>
<td>7 bit planes</td>
<td>6 bit planes</td>
<td>5 bit planes</td>
</tr>
</tbody>
</table>

```
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?