The H.263 coding standard

Ifi, UiO
Norsk Regnesentral
Vårsemester 2003
Lars Aarhus

Today

• H.263 video coding standard
Standards so far

- **Video**
  - H.261
  - MPEG-1
  - MPEG-2 (H.262)
  - (MPEG-4)
  - M-JPEG

- **Image**
  - JPEG

- **Audio**
  - PCM
  - MP3 (MPEG-1)
  - GSM
  - A-law/u-law (G.711)

- **Others**
  - MPEG-7: meta data
  - (MPEG-21: framework)

H.263

- ITU-T approved standard
  - “Video coding for low bit rate communication”
  - v1 1996
  - v2 1998 = H.263+; focus today
  - v3 ? H.263++/H.26L

- Unspecified, variable bit rate (<28.8 kbps)
- Developed for low delay environments
H.263 block diagram

H.263 sampling blocks

- 4:2:0 sampling
  - luminance Y to chrominance C_B, C_R

- Block:
  - 8 x 8 pixels

- Macroblock (MB):
  - 4 Y + C_B + C_R blocks

- Group of blocks (GOB):
  - One or more rows of MBs
  - In GOB header: resynchronization
H.263 resolutions

• Five standardized resolutions
  – CIF: 352 x 288 (as in H.261)
  – QCIF: 176 x 144 (as in H.261)
  – Sub-QCIF: 128 x 96
  – 4CIF: 704 x 576 (little used?)
  – 16CIF: 1408 x 1152 (little used?)
• Custom resolutions negotiable
  – multiple of 4 in both directions

H.263 frames

• Two (six) frame types:
  – I-frames: intra
  – P-frames: predictive (inter)
  – B-frames (optional): bidirectional predicted
  – PB-frames (optional): decoded B and P frame as one unit
  – EI-frames (optional): enhanced I-frame
  – EP-frames (optional): enhanced P-frame
H.263 coding

- Spatial redundancy (intra coding):
  - DCT
  - Variable length coding (Huffman)
  - Quantisation
- Temporal redundancy (inter coding):
  - Motion compensation
    - Block-based comparison (MB or block)
    - Nonintegral motion vector values (half-pixel)
  - Motion estimation

H.263 coding options (1)

- 16 modes, *negotiable* at session start:
  - Efficiency / improved picture quality (10)
    - Unrestricted Motion Vector
    - Syntax-Based Arithmetic Coding
    - Advanced Prediction!
      - Four Motion Vectors per Macroblock
      - Overlapped Block Motion Compensation
    - PB Frame
    - Advanced Intra Coding
    - Alternate Inter VLC
    - Modified Quantization
    - Deblocking Filter
    - Improved PB Frame
H.263 coding options (2)

- Error robustness (3) (lossy channel)
  - Slice-Structured
  - Reference Picture Selection
  - Independent Segment Decoding
- Scalability!
  - Temporal, signal-to-noise ratio (SNR), spatial
- Reference Picture Resampling
- Reduced Resolution Update

H.263 levels

- Preferred combination of supported options (profiles)
  - Level 1: advanced intra coding, deblocking filter, full-frame freeze, modified quantization
  - Level 2: unrestricted motion vector, slice-structured, reference picture resampling + level 1
  - Level 3: advanced prediction, improved PB frames, independent segment decoding, alternate VLC + level 2
H.263 summary

• Baseline core similar to other codecs
• Flexible, many new options
• Developed for variable bit rates, low delay
• Specifies bitstream format only