

Lecture 8 –Video Compression

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Admin

- HW 4 out
 - ◊ Due Wednesday – Hardcopy only

M

W_{HW4}



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H.261 - ITU

Defined for multiples of 64 kbps

$P=1 \rightarrow$ low quality "video" phone

$P>6 \rightarrow$ video conferencing



Common Interchange Format

CIF = 352×288 , 1:1, 7.5-30fps

QCIF \rightarrow quarter CIF
VHS quality

180×144 , 1:1, 7.5-30fps

Video frames

Intra-coded (I-frame) \rightarrow JPEG

Predictive-coded (P-frames) \rightarrow pred. w/r last frame



H.261 - Max-refresh \rightarrow 125 frames

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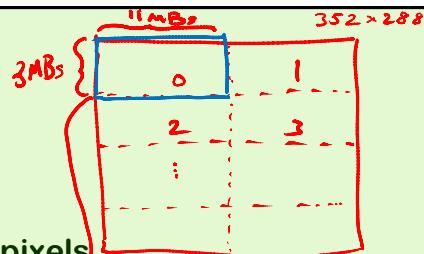
H.261

▫ Layered

- Pictures – 352×288 pixels

- Group of blocks

- 12 groups of blocks 176×48



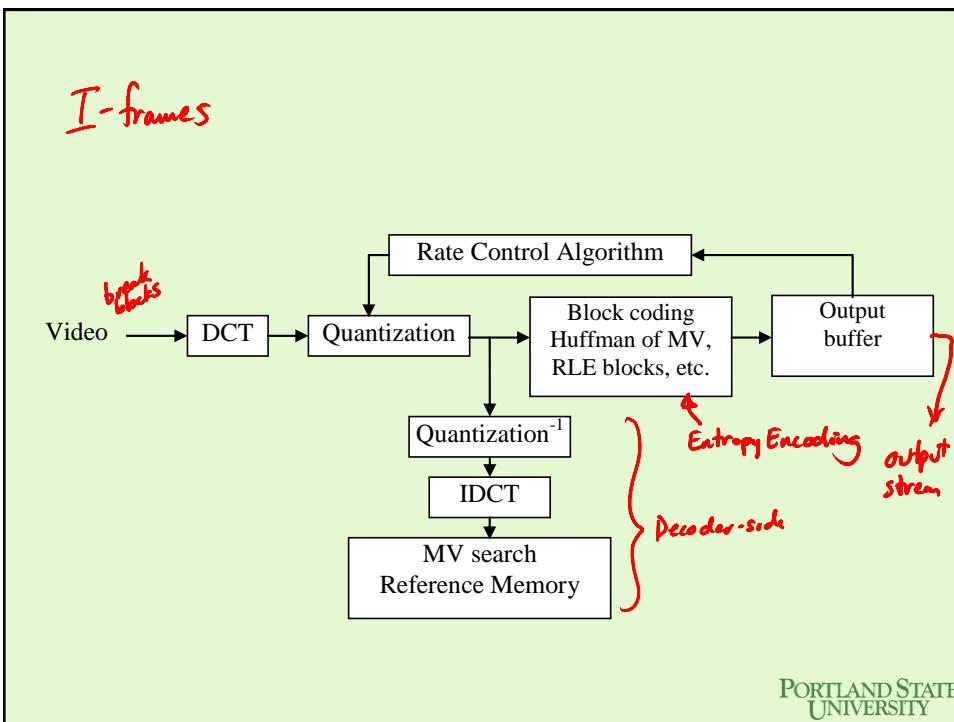
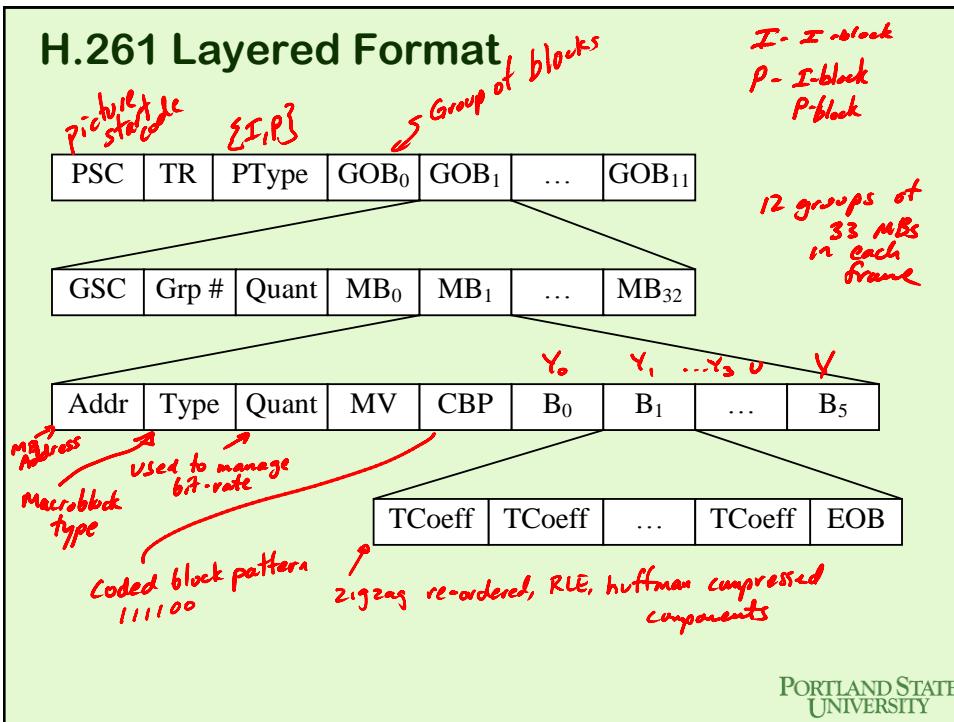
- Macroblock

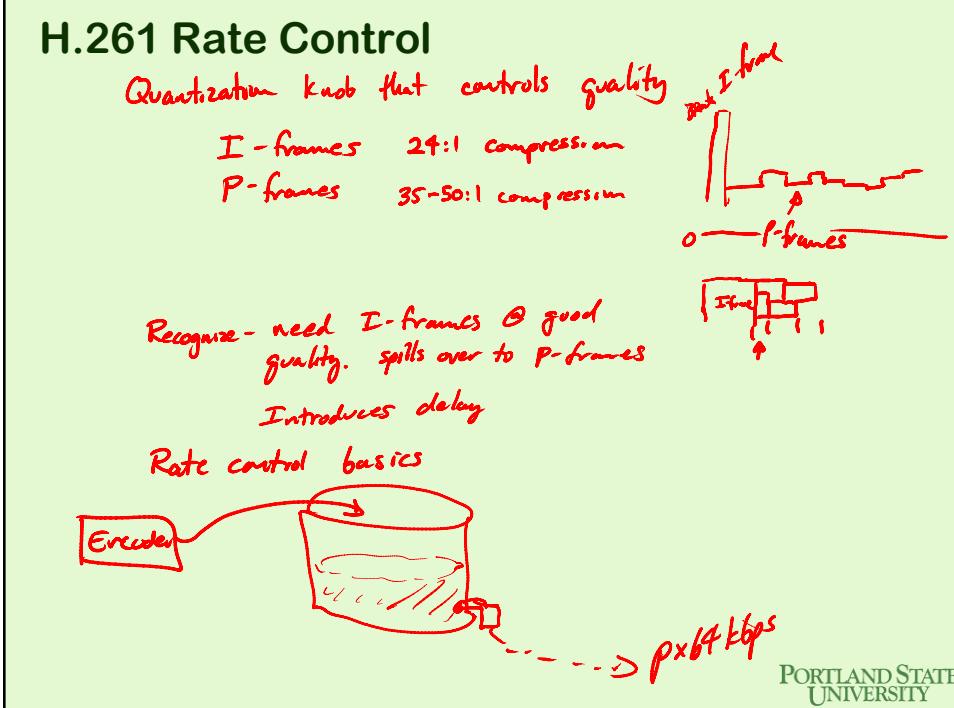
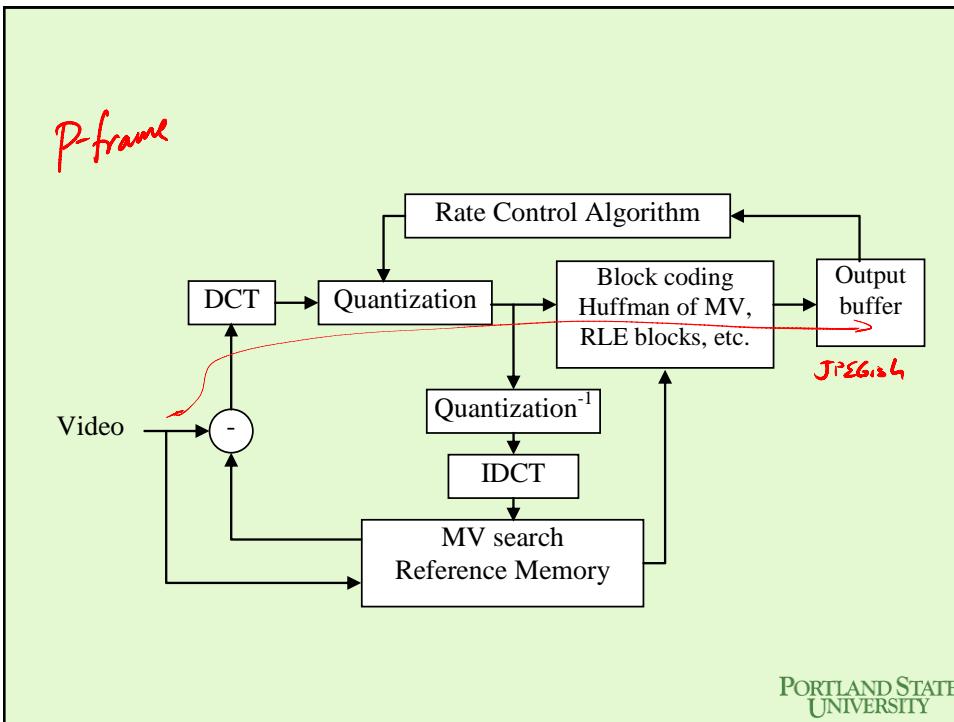
- 33 Macroblocks per GOB

- Blocks

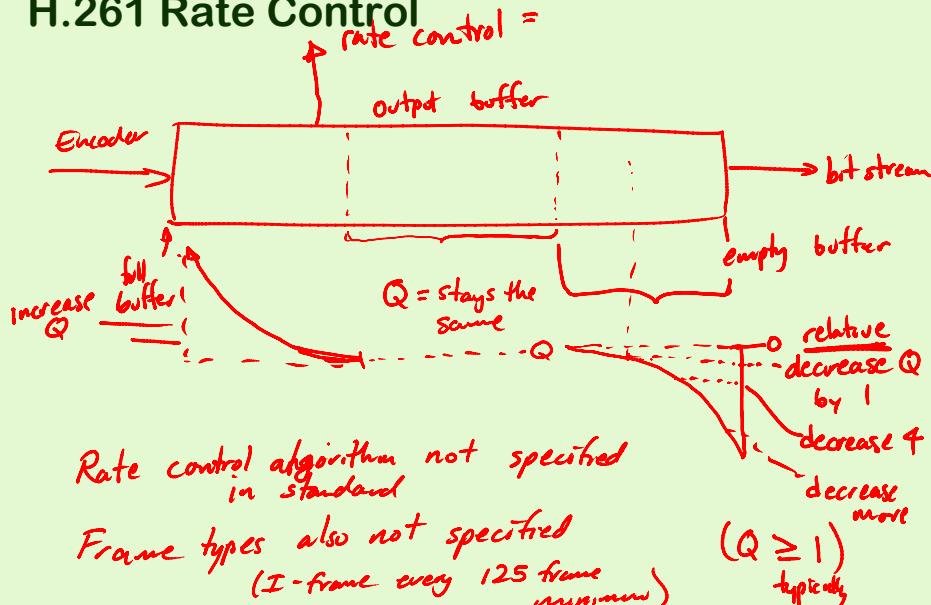
- 6 - 8x8 pixel blocks

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H.261 Rate Control



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MPEG-1 Compression

- Target: Stored Video
- NTSC < MDTV
~DVD quality
- Compression of VHS quality video and audio into 1.5 Mbps ~~lx CD-ROM speed~~
 - CIF ~ VHS quality
 - ~ one hour of video onto CD-ROM
 - Standard specifies what the format of the compressed bitstream is rather than how to get there

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MPEG-1 Parts

- **MPEG Video** - visual encoding
- **MPEG Audio** - audio
MP3 - layer 3 in MPEG-1 standard
- **MPEG System** - describes how to put together
 - Synchronization
 - Multiplex into stream

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MPEG-1 Requirements

- Random Access *access any part of stream & be able to start*
- FF / Rewind
- A/V Synchronization
- Robustness to error *bit errors occur in optical and magnetic disks*
- Coding Delay < 1 second
- Editability *want to be able to edit a compressed stream w/o too much change in video quality*
- Cost trade-off *done in a couple of chips.*

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Compression Challenge

- High compression ratio with good quality vs. Random access

I I I I I I I
↑
→) access any frame
→) low compression ratio

I P P P P P P P
↑
→) access only @ I
I-frame is the
independently
accessible frame
+) high compression ratio

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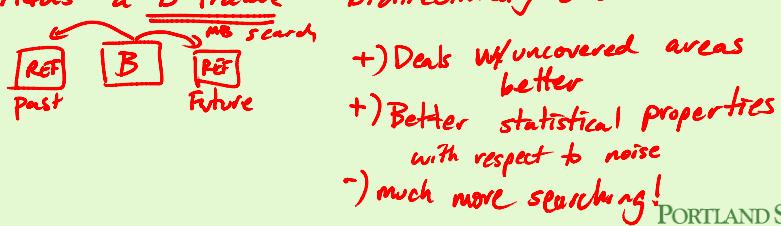
MPEG-1 Overview

- Motion compensation (if frame calls for it)
- DCT
- Quant, zigzag, RLE, Huffman

Compression

- Block-based Motion compensation
Very similar to H.261 except
MB are processed L to R, Top to bottom

Adds a B-frame - bidirectionally encoded frame



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MPEG-1 Frame Types

I-frames - Intra-coded

Random access

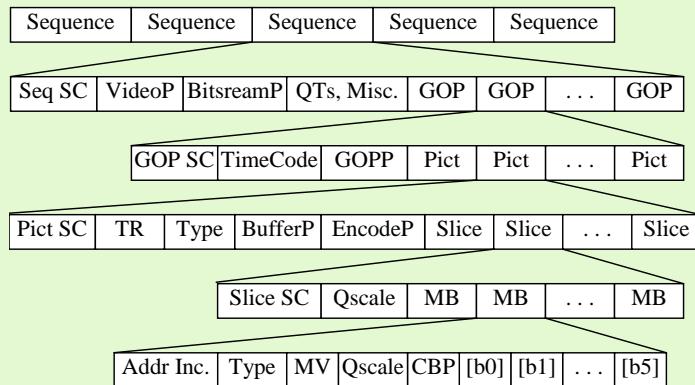
*Errors in I-frames propagate to dependent frames
25-50:1 compression*

*P-frames - Predicted from last P or I-frame
100-150:1 compression*

*B-frames - Require access to 2 reference frames
(last I or P, next I or P)
200:1-300:1*

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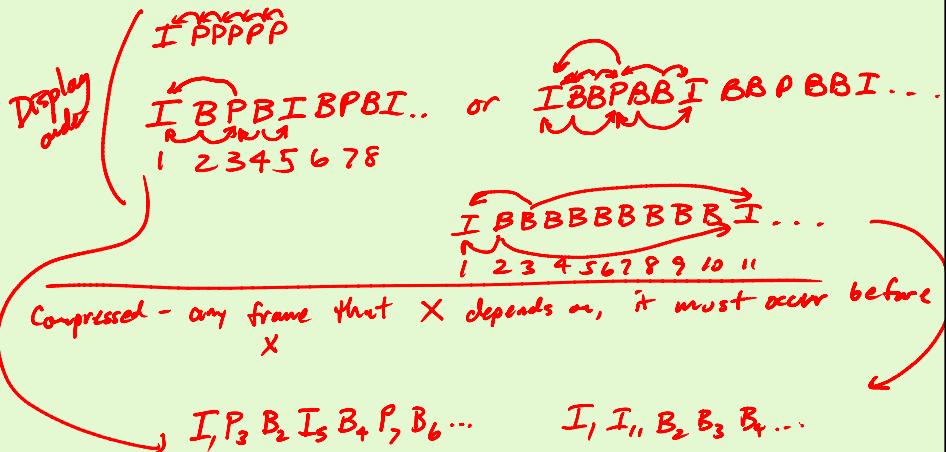
MPEG Structure



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Frame Patterns

Display order vs. compressed file order



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Frame Ordering

Patterns

Any frame pattern is legal (must start w/ I-frame)

$I B B B P P P I I B B P B I P I \dots$

Usually fixed

$I B B P B B I \dots \rightarrow$

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