

Temporal Scalability using P-Pictures

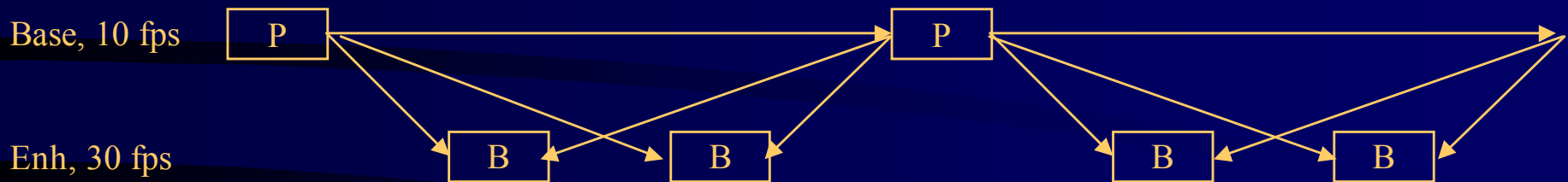
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The Problem

- Interactive Applications: low latency
 - 300 ms one-way delay the absolute tolerable maximum
- Video Coding is based on Inter-Picture Prediction
 - minimum algorithmic delay: two pictures
 - at fixed 10 fps: 200 ms
- Temporal Scalability based on B-pictures is not helpful
 - B-pictures do improve temporal resolution,
 - but NOT the overall latency

(Traditional) B-pictures



Layering scheme

Frame-rate

Latency

Base layer only

10 fps

200 ms

Base + Enhancement layer

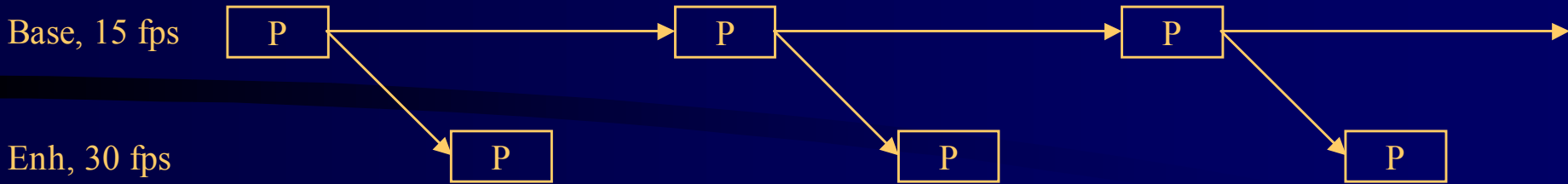
30 fps

200 ms

P-Picture Scalability

- Problem: Bi-directionally predicted nature of the Enhancement layer
- Solution: use only forward prediction
 - Advantages
 - “Latency” scalability
 - Straightforward implementation
 - Disadvantages
 - Lower coding efficiency (?)
 - Syntax of current video standards does not allow that (?)

P-Picture Scalability



Latency Base: 132 ms

Latency Base+Enhancement: 66 ms



Latency Base: 200 ms

Latency Base+Enhancement: 66 ms

Disadvantage 1: Coding efficiency

- QCIF, fixed Quantizer value 13 for base, 16 for enhancement layers, H.263+, bitrates in kbit/s

Sequence	Base 10 fps	Base 30 fps	B-picture	P-picture	Overhead
Foreman	43.8	108.5	73.7	89.5	21%
Coastguard	60.5	113.0	79.2	86.4	9%
Paris	58.6	106.6	83.9	119.1	42%

Disadvantage 2: lack of syntax

- True for MPEG 1, MPEG 2, MPEG 4 V. 1
 - But still possible using out-band signaling
 - (e. g. in the corresponding RTP-payload header)
- False for H.263+, MPEG 4 V. 2
 - Reference Picture Selection mode
 - In a P-picture other than the previous picture can be selected as Reference Picture

Summary

- P-Picture temporal scalability allows for
 - Scalable latency for real-time systems
 - Users can “buy” lower latency
 - Simple implementation of temporal enhancement layers
- At a cost of
 - 10% to 40% coding efficiency
 - need for the implementation of Reference Picture Selection
 - for older video coding standards: a new RTP payload spec.

Good bye

- Thank you for your attention
- Your questions please...