

DVB + MPEG-4 = ?

New Options for Baseband Systems

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Overview of the Presentation

Current Compression standards within DVB

- MPEG-1 and MPEG-2

New Options available today

- MPEG-4 parts 2 and 3

New Options available within a year

- JVT video (aka H.26L aka MPEG-4 part 10)
- MPEG-4 audio compatible extensions

Inclusion of new options in DVB



MPEG-1

ISO/IEC 11172 (in 5 parts)

Coding of moving pictures and associated audio for digital storage media at up to about 1.5Mbit/s

- Targeted at sub broadcast quality applications (e.g. CD-ROM)

3 main parts published in 1993:

1. Systems
2. Video
3. Audio - Layer I, Layer II and Layer III (MP3)



MPEG-2

ISO/IEC 13818 (in 9 parts)

Generic coding of moving pictures and associated audio

- | Targeted at standard definition TV and HDTV

3 main parts published in 1995:

1. Systems - Transport Stream, PSI etc.
2. Video - common text with ITU-T Rec. H.262
3. Audio - closely based on MPEG-1

Non backwards-compatible audio published 1997

7. Advanced Audio Coding (AAC)

MPEG-2 in DVB

TR 101 154

- | Implementation guidelines for the use of MPEG-2 Systems, Video and Audio in satellite, cable and terrestrial broadcasting applications
 - u Systems: MPEG-2 Transport Stream
 - u Video: MPEG-2 Main Profile (SDTV and HDTV)
 - u Audio: MPEG-1 Layer II (plus options)

TR 102 154

- | Implementation guidelines for the use of MPEG-2 Systems, Video and Audio in contribution and primary distribution applications



Coding Efficiency

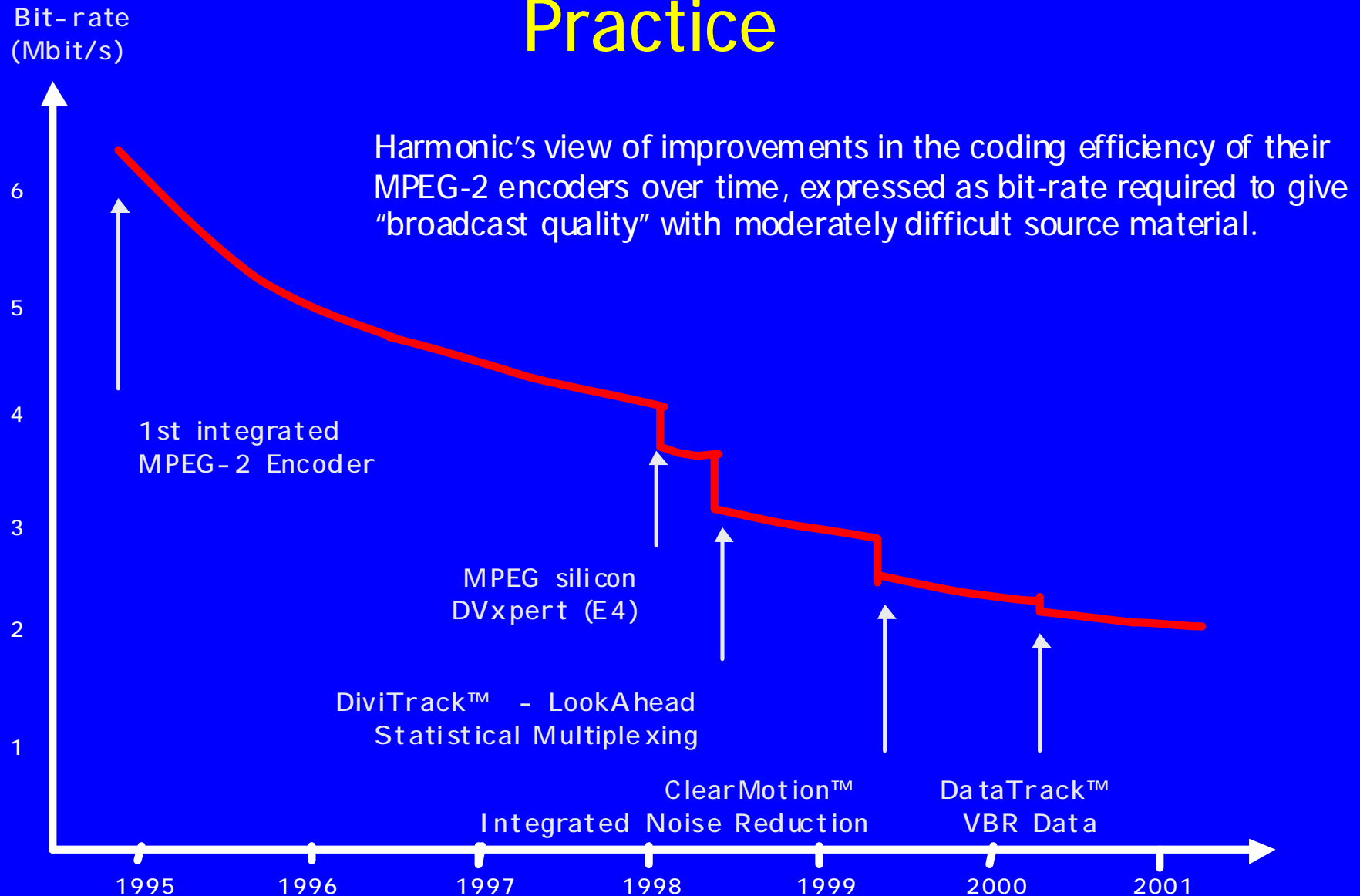
MPEG standards define bitstream syntax and semantics, not encoder implementation

- | more complex or better tuned encoders can give significant improvements with the same decoder
- | MPEG-2 video encoder efficiency has more than doubled since 1995

Health warning: encoder efficiency is difficult to measure!

- | can measure picture signal-to-noise ratio (PSNR)
- | still no real replacement for subjective tests using ITU-R Rec. 500

MPEG-2 Video Encoding Efficiency in Practice



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MPEG-4: New Options available today

ISO/IEC 14496 (in 10 parts)

Coding of audio-visual objects

- | provides object-based structure that supports the integration of natural and synthetic elements
- | improved coding efficiency

MPEG-4 first published 1999

1. Systems
2. Visual
 - u later amendments gave additional video profiles
3. Audio
 - u high quality audio is based on MPEG-2 AAC



MPEG-4 Natural Video

Very similar architecture to MPEG-2 / H.262

- | motion compensated discrete cosine transform (DCT)
 - u ¼ pixel motion compensation
 - u global motion compensation
 - u shape-adaptive DCT

Profiles to define sub-sets, like MPEG-2

- | 19 Profiles for natural, synthetic or hybrid visual content, including:
 - u Main Profile
 - u Advanced Coding Efficiency Profile (ACE)
 - u Advanced Simple Profile (ASP)

Video Coding Efficiency Improvements

Highly dependent on:

- | the source material
- | details of the encoder implementation

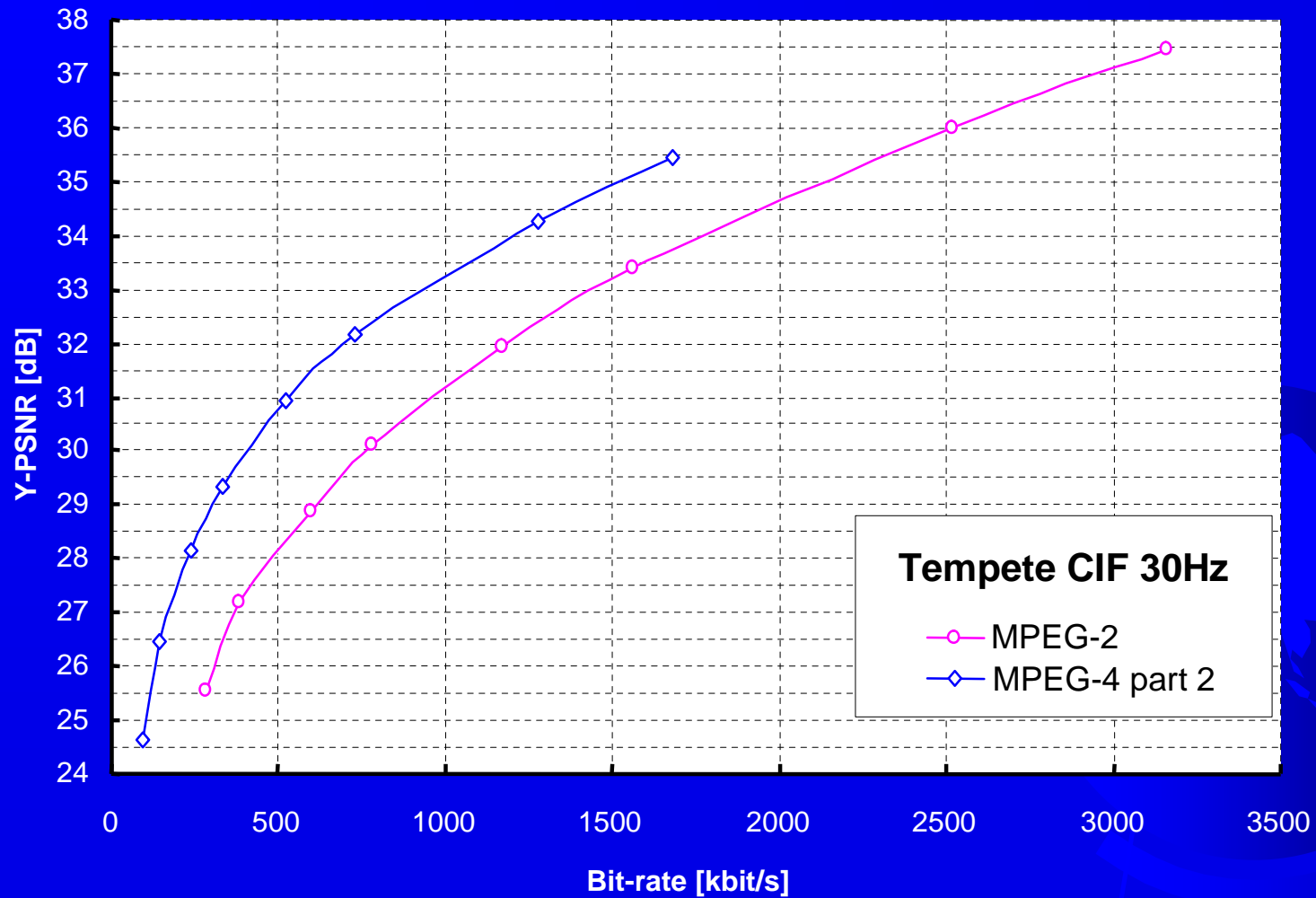
Bit-rate reduction likely to be about:

- | 15 to 20% at full broadcast quality (2 to 4 Mbit/s)
- | 20 to 30% at lower quality (1 to 2 Mbit/s)
- | 30 to 50% at under 1 Mbit/s

More complex encoder and decoder



Comparison of MPEG-4 part 2 and MPEG-2



MPEG-4 High Quality Audio

Closely based on MPEG-2 AAC

- | some enhancements

Bit-rate requirements

- | 128 kbit/s Transparent for stereo
- | 64 kbit/s High quality stereo music

Roughly twice as efficient as MPEG-1 Layer II

- | More complex encoder and decoder



MPEG-4 Audio and JVT Video: New Options Within a Year

Audio

- | MPEG-4 Audio Compatible Extensions
 - u MPEG-4 part 3 (2001) Amendment 1

Video

- | Joint Video Team (JVT) with ITU-T
 - u Published by ITU-T as H.26L
 - u Published by ISO/IEC as MPEG-4 part 10



MPEG-4 Audio Compatible Extensions

Schedule for Amendment 1 to part 3

- | May 2002: Initial Committee Draft
- | October 2002: Final Committee Draft
- | May 2003: Published ISO/IEC Amendment

Anticipated Improvements in Coding Efficiency

- | negligible for transparent audio (still 128 kbit/s)
- | about 30% improvement for high quality stereo
 - u probably 64kbit/s → 48kbit/s

JVT

H.26L / MPEG-4 part 10

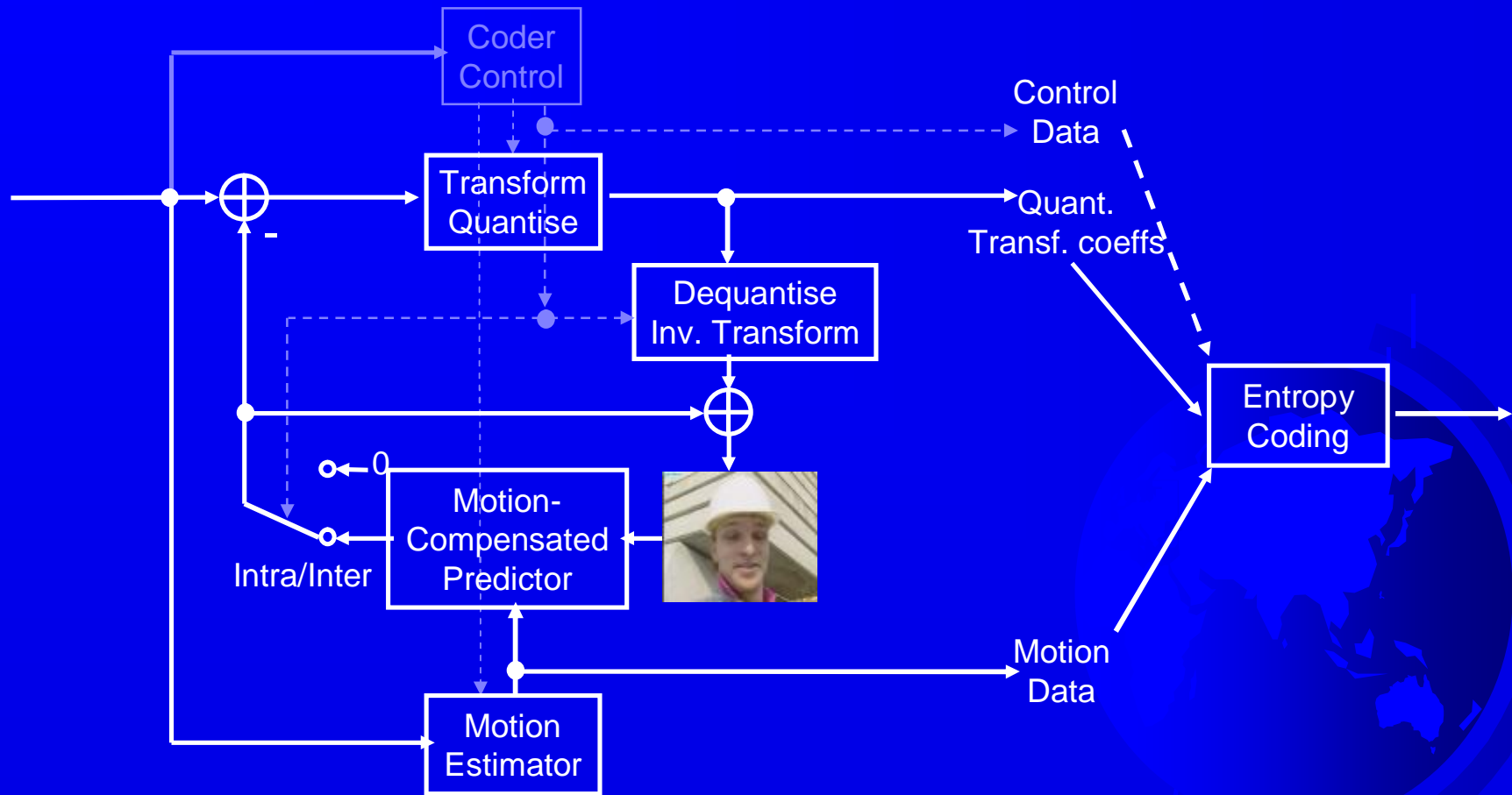
Schedule:

- | August 1999: 1st H.26L test model (TML-1)
- | December 2001: Formation of the Joint Video Team (JVT) between ITU-T and MPEG
- | February 2002: Last major feature adoptions
- | November 2002: Final approval by JVT
- | December 2002: ITU-T Recommendation
- | February 2003: ISO/IEC International Standard

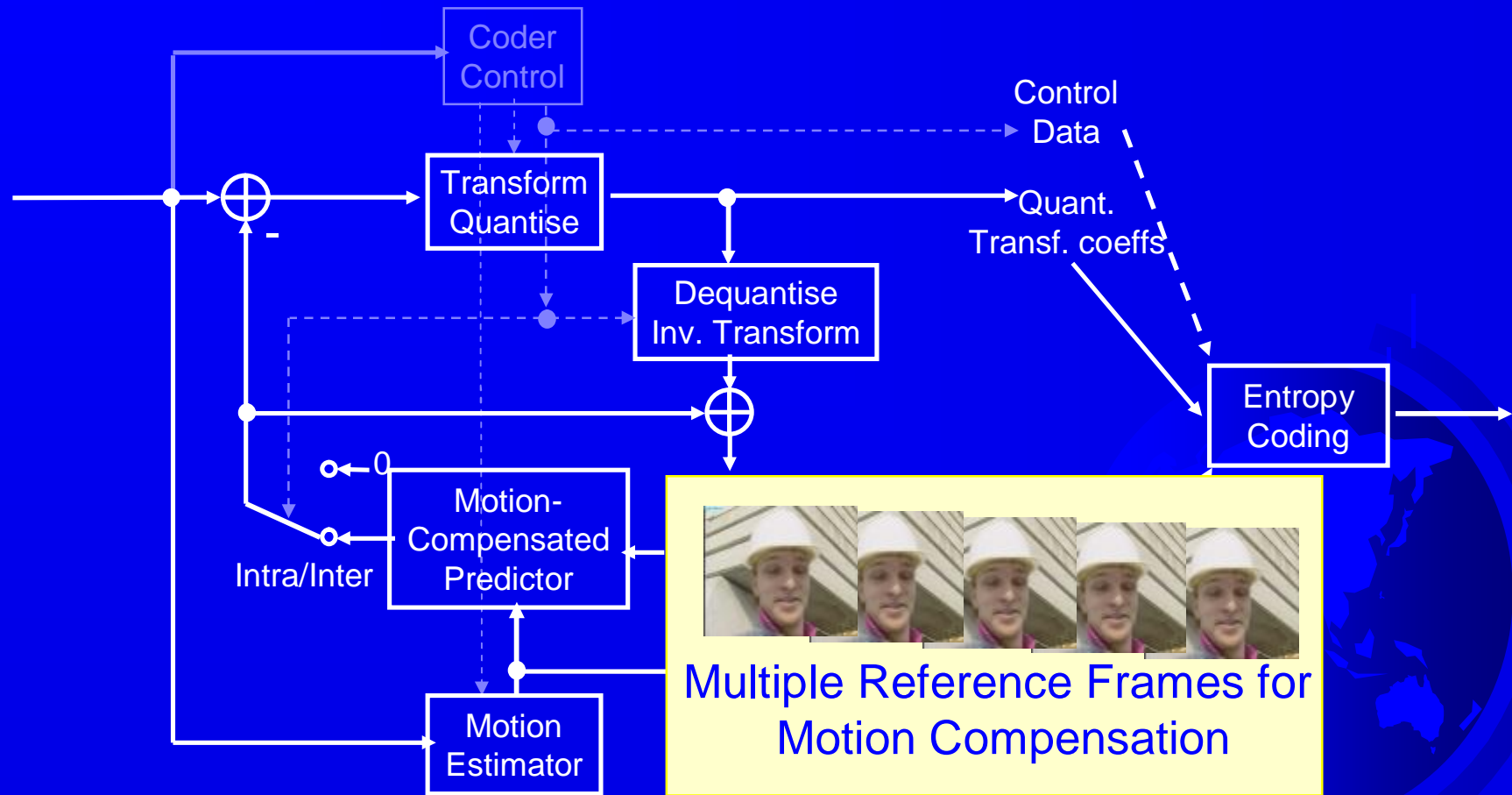
Similar architecture to MPEG-2 / H.262

- | motion compensated block transform

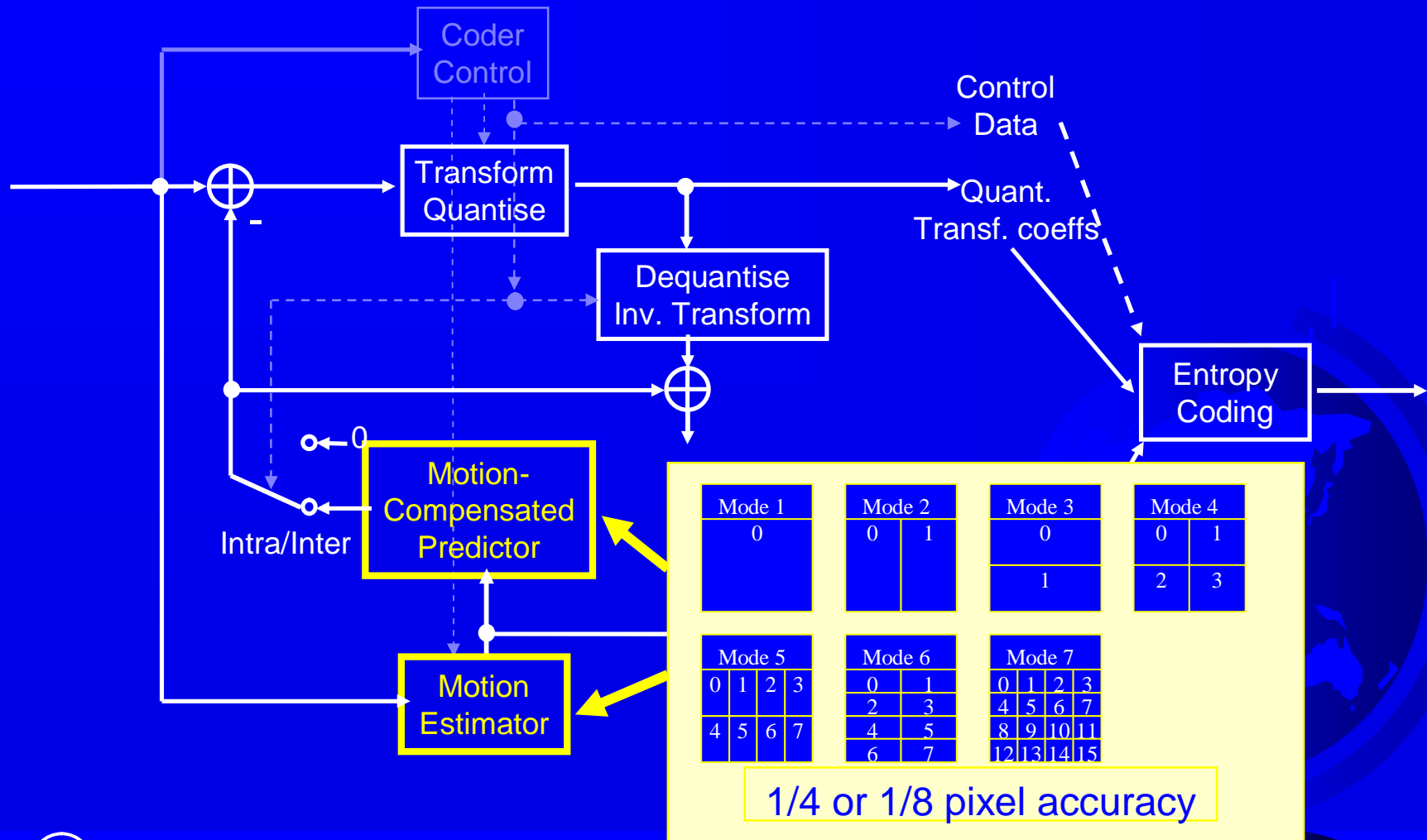
JVT Video Coder Architecture



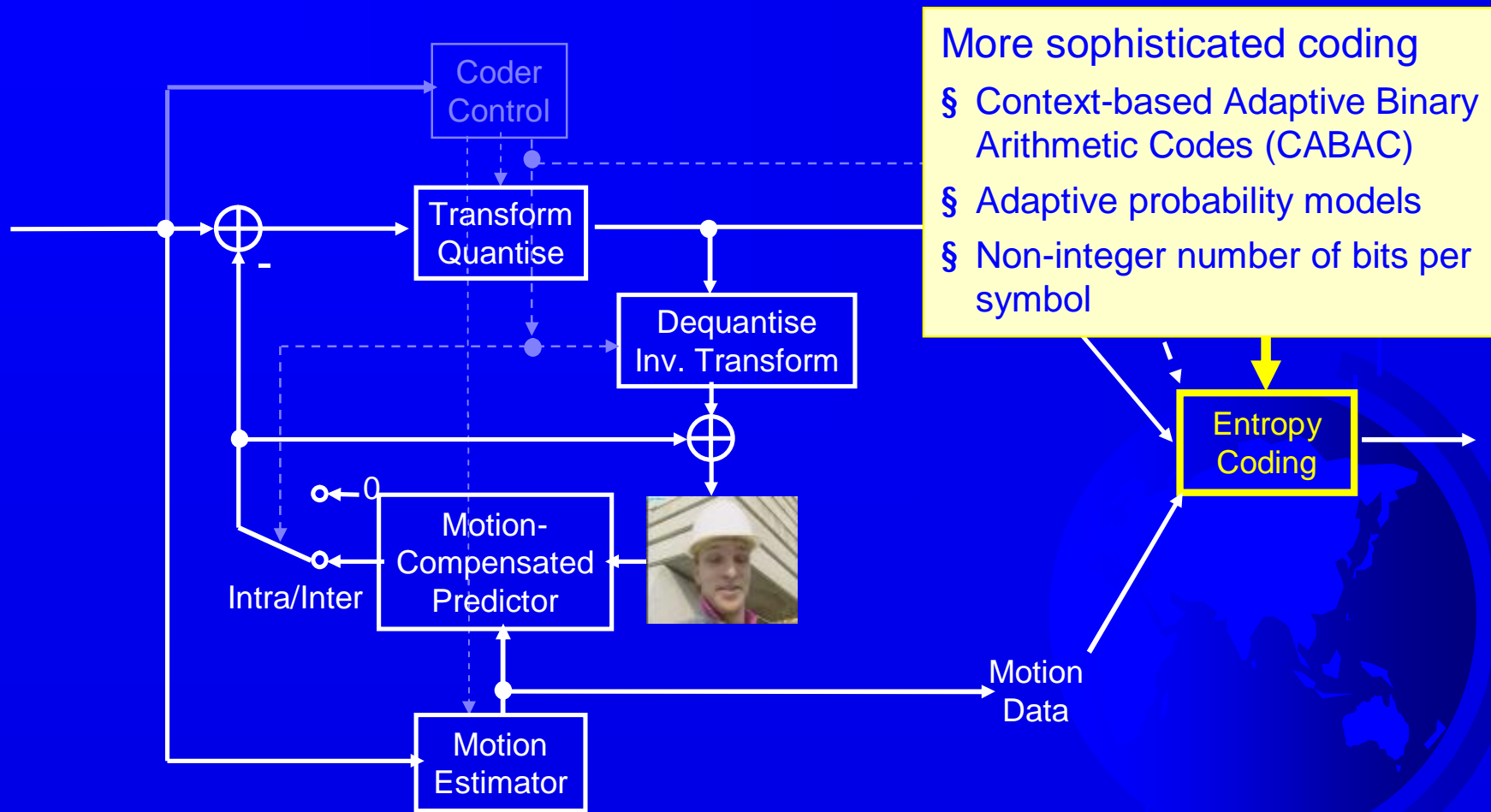
JVT Video Coder Architecture



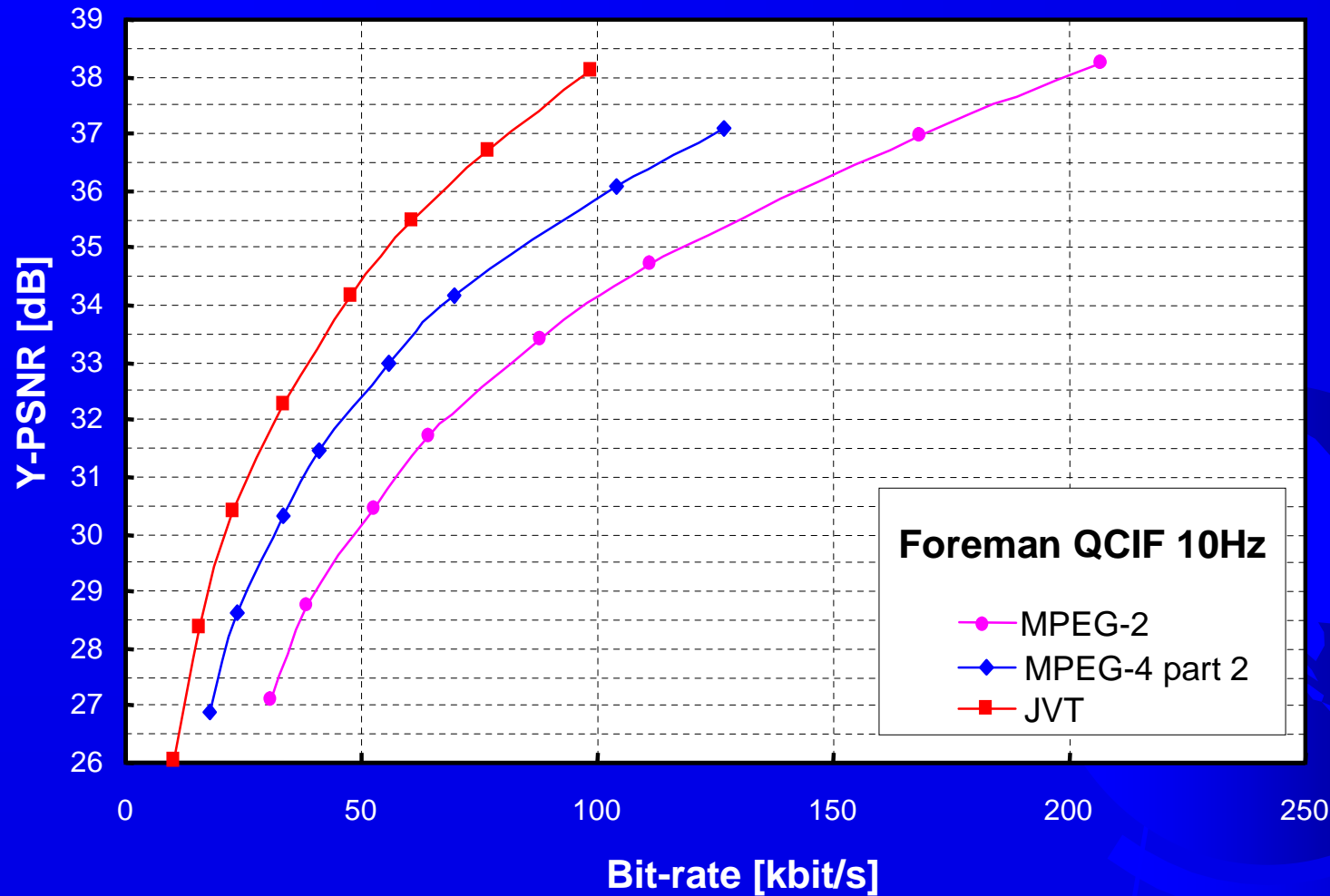
JVT Video Coder Architecture



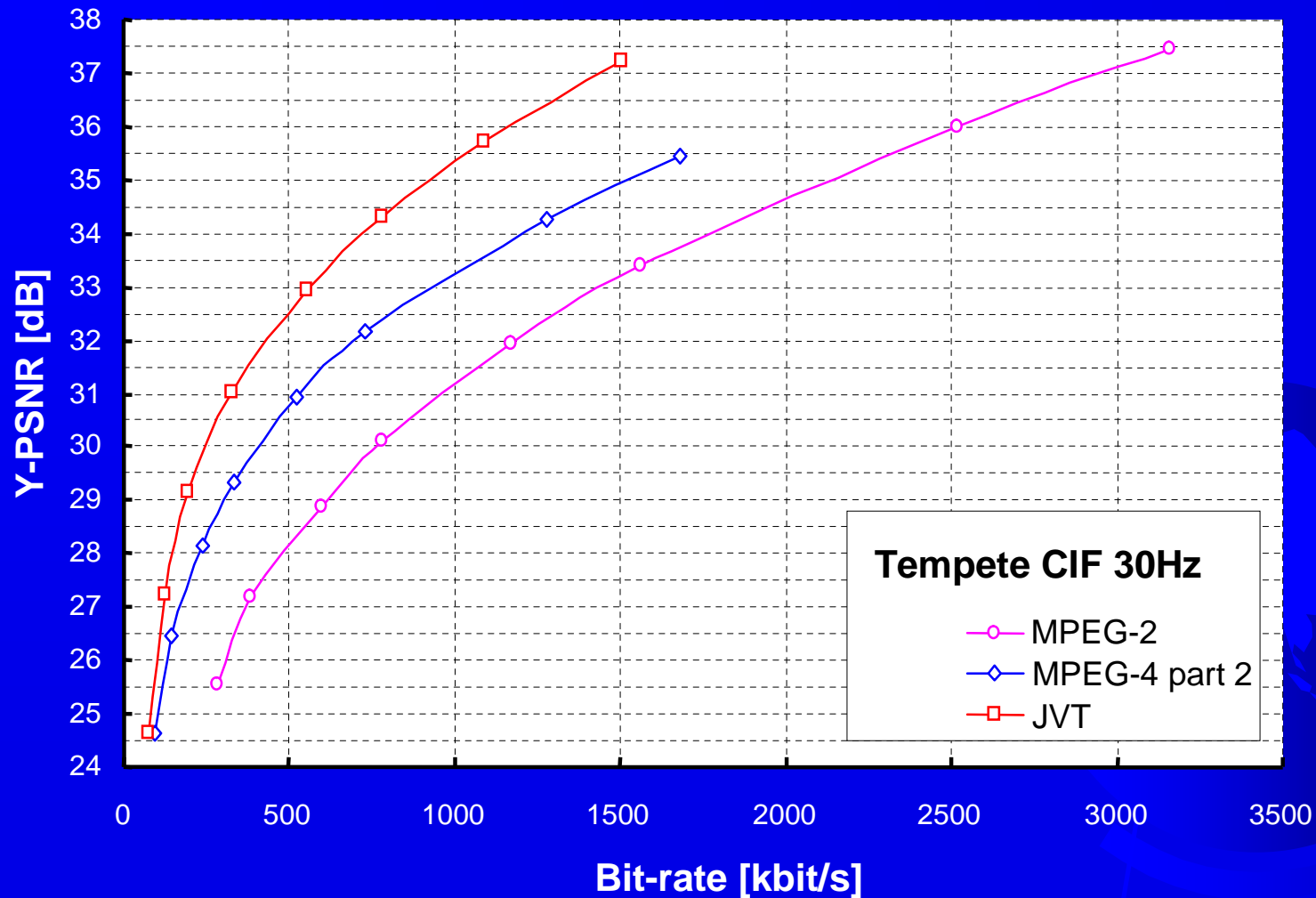
JVT Video Coder Architecture



Comparison of JVT, MPEG-4 p2 and MPEG-2



Comparison of JVT, MPEG-4 p2 and MPEG-2



Inclusion of new options in DVB

DVB specifications will be based on MPEG-4 audio extensions and JVT video

- | New TR giving implementation guidelines for DVB services over IP
- | due in April 2003

Revision of existing specifications to include MPEG-4 audio and JVT video as options

- | TR 101 154 - broadcasting applications
- | TR 102 154 - contribution and primary distribution

Categories of Application

Application Category	Typical Bit-rate	Typical Implementation	Other Standards Bodies
QCIF	50 – 200 kbit/s	UMTS phone PDA	3GPP
CIF	0.25– 1 Mbit/s	mobile receiver PC	ISMA
SDTV	1 – 4 Mbit/s	Set-top box Integrated TV	
HDTV	5 – 20 Mbit/s	Projection TV Plasma screen	

Considerations

Trade-off between compression efficiency and implementation cost

- | decoder is particular concern
- | MPEG-2 decoder was dedicated hardware
- | JVT decoder implementation could be:
 - u dedicated hardware
 - u pure software
 - u programmable video processor

Compatibility with other standards

- | ISMA
- | 3GPP



Conclusions

New options for compression are appearing that give about twice the coding efficiency

- | MPEG-4 audio and JVT video

The increased efficiency comes at the price of increased complexity

- | about 3 times more complex ???

DVB specifications will include these new compression algorithms in 2003

- | DVB services over IP will be new TR
- | revise existing specifications to include options

Acknowledgements

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