AVC: New directions and applications

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The History

- ☺ First there was MPEG-1 – small beginnings, but a solid design that permitted expansion to satellite TV and HD
- ☺ Then there was MPEG-2 – generally reckoned to be a success; probably >> 1 Billion decoders in the field!
- ?? Then there wasn't MPEG-3
- ☹ Then there was MPEG-4. Part 2 was video
- ☺ MPEG & ITU-T begat JVT
  JVT begat the Advanced Video Codec
  aka MPEG AVC, aka MPEG-4 Part 10,
  aka ITU-T Recommendation H.264

Early Problems with AVC

- Licensing terms
- Design was focused on small picture, low bitrate
- Licensing terms
- Complexity
- Licensing terms
- Non-stellar performance for HD
- Licensing terms
- VC-1

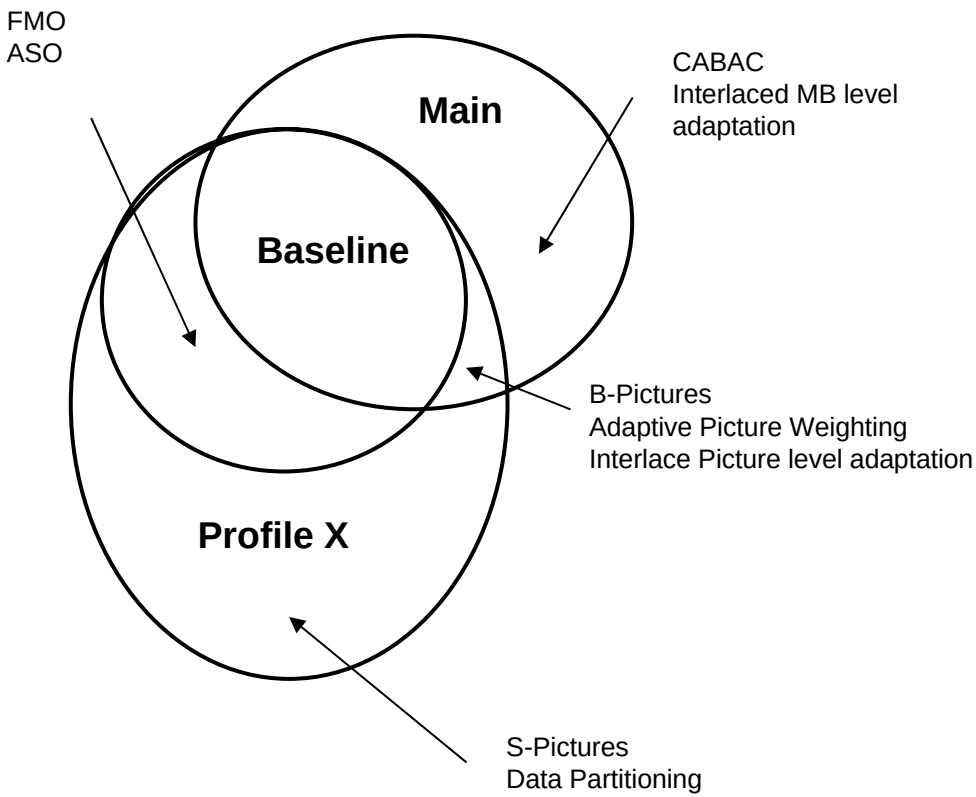
So, Why Was VC-1 Important?

- Better performance with large pictures, high bitrate
  Included 8x8 transform
- Lower complexity
- Licensing terms?
- Submitted as SMPTE Standard
- Encouraged by some big names

How to Respond?

- Fix AVC!
  - Improve performance for HD
  - Price it right
- Led to the development of Professional Extensions, later know as FRExt (Fidelity Range Extensions)
  - 8x8 transform
  - 4:2:2 & 4:4:4
  - Greater bit-depth

Original Profiles in H.264



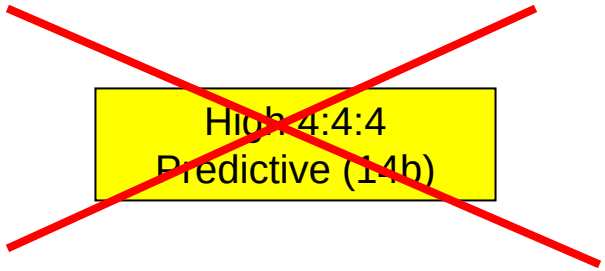
Fidelity Range Extensions (FRExt) Profiles

High 4:4:4
Predictive (14b)

High 4:2:2
Predictive (10b)

High 10
4:2:0 Predictive (10b)

Oops!



High 4:2:2
Predictive (10b)

High 10
4:2:0 Predictive (10b)

Problems of Original 4:4:4 Profile

- Used chroma tools for 2 of 3 channels
  (Much less efficient than luma tools, particularly for Intra)
- Used Residual Color Transform
- Confusion in verification testing
- Overly complex and not efficient
- Withdrawn

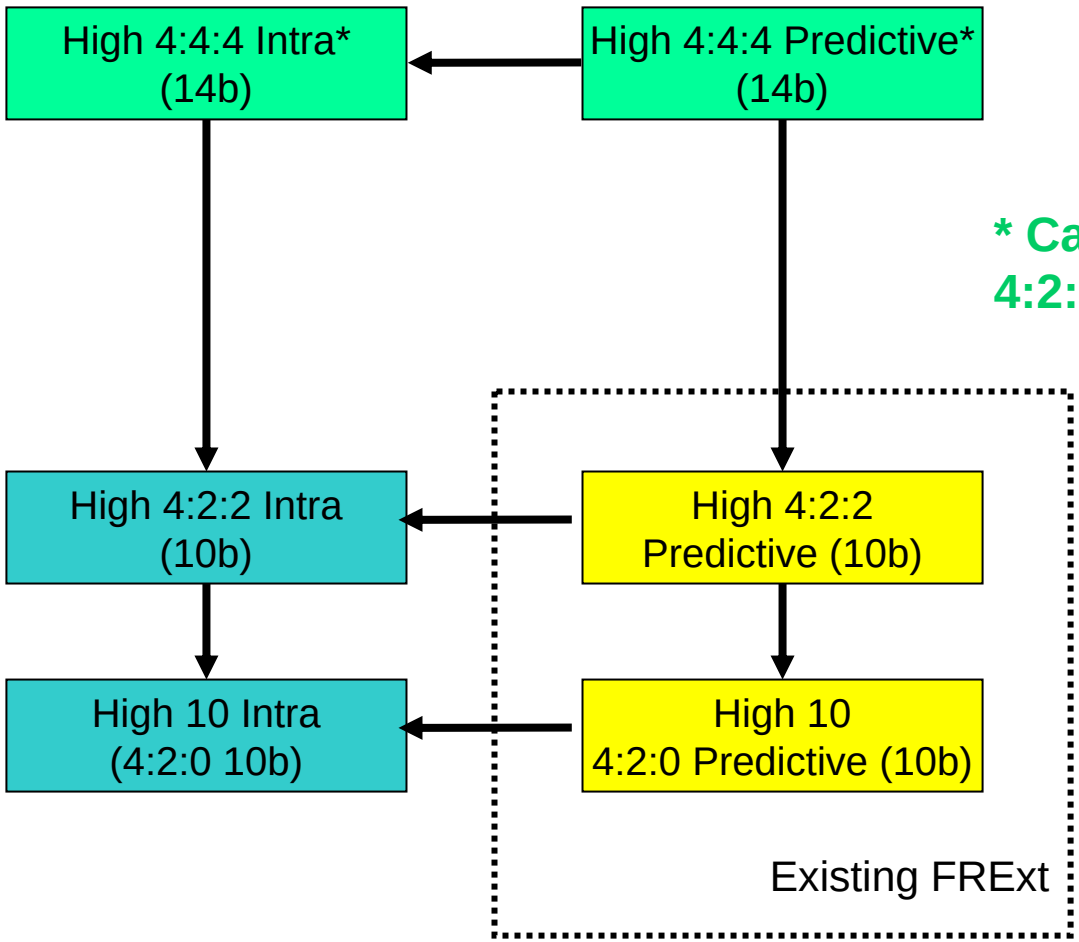
Why do we Need More New Profiles?

- Professional applications may require:
  - Mezzanine coding (i.e. another coding stage will follow)
  - High quality (4:2:2 or 4:4:4)
  - High bitrate
  - Low latency (intra coding)
  - Software decoding (e.g. laptop editing)
  - Low power (e.g. camcorders)
- But . . .
  - Most of these applications cannot justify custom silicon

What about JPEG2000?

- Chips available for full resolution, 10-bit
- Low power, low cost
- Royalty-free (maybe)
  - Only Part 1
  - Lurkers?
  - Motion J2k not royalty-free
- Intra only
- Requires high bitrate

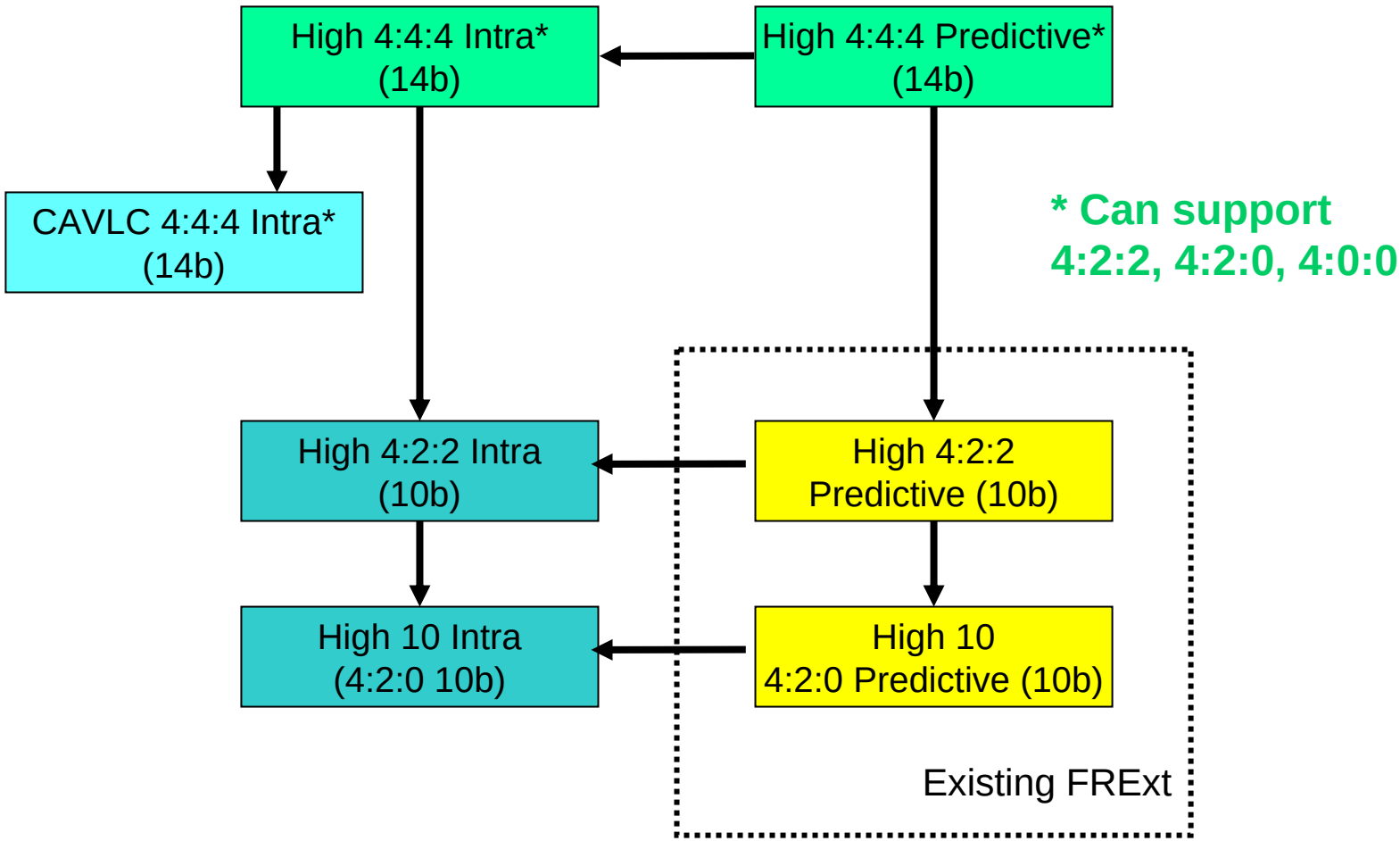
Proposed Amendment 2 (HangZhou October 2006)



One More, Please!

- SMPTE requested additional 4:4:4 without CABAC
  - Intended for applications that may require software (only) decoding – such as on a laptop
  - CABAC is “challenging” for general purpose processors
  - CAVLC is good alternative (but less efficient)

Amendment 2: “New Profiles for Professional Applications”



Pros & Cons of AVC

- Pros
  - Flexibility
  - Efficiency
- Questions
  - Complexity
  - Unclear licensing terms
  - Patent holders not in the pool
- But . . .
  - We do have the profiles we need!