NOKIA

IMPLEMENTATION OF ENHANCED HEVC/H.265 ENCODERS

SUPPORTING NEW REQUIREMENTS AND FUNCTIONALITIES

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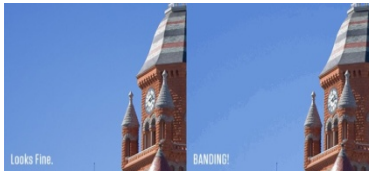
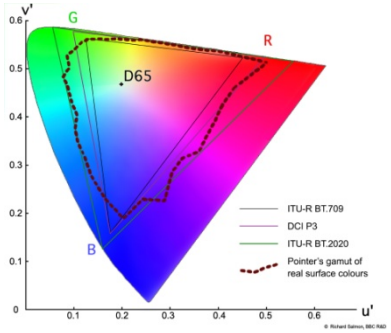
Requirements for more compelling experience and new profiles

Enhanced UHD might delivers more compelling experiences than UHD (4K)

- Higher bit depths (10 bits)
- Higher dynamic range (HDR)
- Wider color gamut (BT.2020)
- Higher frame rates (100/120 fps)





Possible these require:

- Higher fidelity profiles, or
- New scalable profiles to transition to enhanced services

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HEVC versions

HEVC version 1 was completed in January 2013

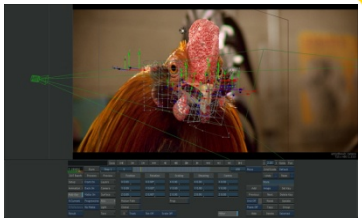
HEVC Range Extensions (RExt) and Scalable High Efficiency Video Coding (SHVC) were completed in July 2014

HEVC Screen Content Coding (SCC) is planned for Feb 2016

Range extensions (RExt)

HEVC Range Extensions provides:

- Better Chroma sampling 4:4:4 and 4:2:2
- Better quality:
  - Increased bit depths (more than 10 bits)
  - All-intra coding



Natural extensions to higher bit depth and chroma sampling

Small additional tools for better coding of mixed and screen content

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Scalability on HEVC (SHVC)

First generation UHDTV services *might* require upgrading:

- Simulcast: Using multiple independent streams
- Scalability: base and enhancement layers combined at decoder

  More interesting on SHVC/HEVC:

  - Higher number of services
  - Very simple extension to base HEVC

  Several types of scalability may be of interest and covered on SHVC

  - Resolution scalability
  - Color gamut scalability
  - HDR scalability
  - Bit-depth scalability
  - Frame rate scalability
  - Possible AVC to HEVC scalability
  - Bit rate scalability

Enhanced HEVC encoders

- First generation HEVC encoders are available:

  but not delivering all the possible benefits

- Enhanced encoders progressively will deliver:

  Higher compression efficiency:

  - Complexity of design - increased processing power
  - Smarter algorithms
  - More comprehensive use of the toolset

  Higher functionality

  - HDR
  - Wider color gamut
  - Higher frame rates

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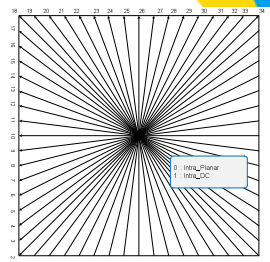
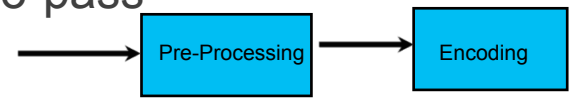
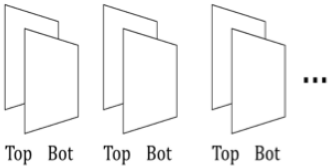
Implementation challenges



Challenges for delivering Higher compression

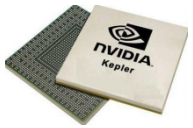
- Inter-picture prediction (ME) complexity
- Intra-picture prediction complexity
- Mode decision (RDO)
- Look-ahead mechanism, pre-processing and two-pass
- Efficient Interlace support

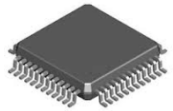




Encoder implementations (2160p)

2U form factor





	CPU software	CPU+GPU software	FPGA	ASIC/SOC
Available	2013	2014	2015	2016-7
Channels	1	1	8	16
Quality	★★★	★★★★	★★★★★	★★★★★
Cost	$$$$	$$$$$	$$$	$$$
Power	500W	1000W	30W	4W

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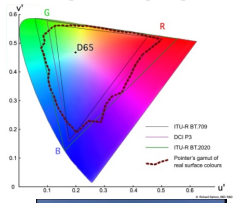
Conclusions

- HEVC can provide a great user experience and value
- Understand new requirements
- HEVC V1: **Main 10** deliver most of the experience:
  - 1080p @ 120 fps
  - 2160p @ 60 fps
  - Wide Color GAmut (BT.2020)
  - HDR



- Go ahead and set up the infrastructure (mostly decoders) and look for enhanced encoders

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Thank you – Q&A - Downloads

Slides available

http://ngcodec.com/ibc2014

ibc.org