17 October 2014

About H.265/HEVC.

Things you should know about the new encoding

www.axis.com

Axis view on H.265/HEVC

- Axis wants to see appropriate performance improvement in the H.265 technology before start rolling it out broader in the product portfolio
- H.264 and H.265 will co-exist many years
- Our initial H.265 products are high-end products
- Low-light situations and increasing resolutions are the main bandwidth challenges
- Axis will continue to work on other noise reduction methods and bit rate reduction in parallel with investigating new video coding

Broadcast industry drives the H.265 encoding

- UHD-TV viewers put pressure on global network bandwidth
- For television viewing, buffering and latency are no issues, when it comes to HDTV, we are used to accept strange artifacts in TV transmissions
- Optimal light conditions in TV production, low impact of noise or gain
- Computational complexity is not any issue for powerful servers

H.265

Marketing Message

(not Axis‘)

50% more efficient video encoding

Some Questions in this context:

Do you…

… believe in everything you read?

… think it will come for free?

… trust in our expertise to explain this a little bit more in detail?

50% MORE EFFICIENCY !!!!

50% more efficiency ????

As always, the reality is sligthly different.

Comparison table

Comparison h.264 – h.265

Tool	H.264	H.265 / HEVC
Partition size	16x16 (Macroblock)	8x8 to 64x64 (Coding unit)
Partitioning	Sub block down to 4x4	Intra: Down to 4x4 (symmetric) Inter 4x8 or 8x4 uni directional, larger symmetric/asymmetric (bi-di)
Transform	Integer DCT 8x8 4x4	Square IDCT from 32x32 to 4x4 + DST Luma Intra 4x4
Intra prediction	Up to 9 predictors	35 predictors
Motion prediction	Spatial Median (3 blocks)	Advanced Motion Vector Prediction spatial + temporal
Motion-copy mode	Direct Mode	Merge Mode
Motion precision	½ Pixel 6-tap ¼ Pixel bi-linear	¼ Pixel 7 or 8 tap Luma 1/8 Pixel 4-tap chroma
Entropy coding	CABAC or CAVLC	CABAC (with parallel operations)
Filters	Deblocking Filter	Deblocking Filter & Sample Adaptive Offset
Multi core tools	Slices	Wavefron Parallel processing, tiles, slices
Scalability tools	Through extensions	Temporal scalability included (others under discussion)

50% more efficiency…

How to achieve this?

How to get 50% more efficiency

The measurements have been done with

- Noise free
- High framerate
- High resolution

Video broadcast material,

encoded by software on a powerful server.

Challenge No. 1

Noise

Noise free video

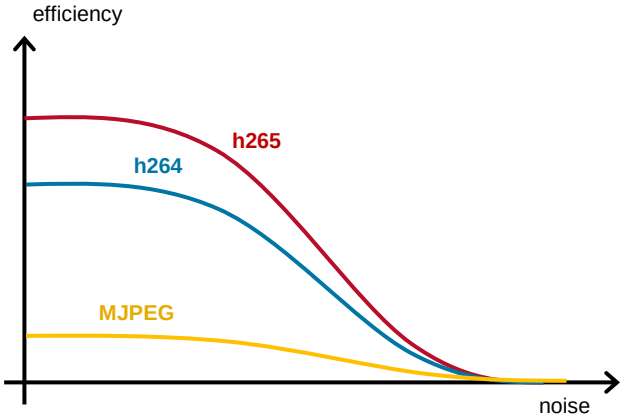
… is hardly possible with security cameras today

- 24/7 video surveillance
- Illumination not perfect
- Single sensor cameras with smaller sensors
- Low light for a camera starts way before it gets really dark

Noise reduces compression efficiency

> The more noise you have, the less efficient compression can be

> In a worst case scenario the compression efficiency of h.26x and MJPEG are similar



Problem No. 1

We cannot expect **noise-free video**...

Challenge No. 2

High Framerate

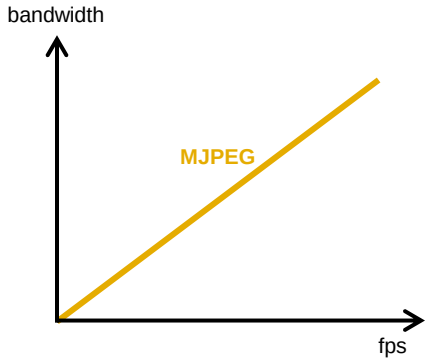
High framerate

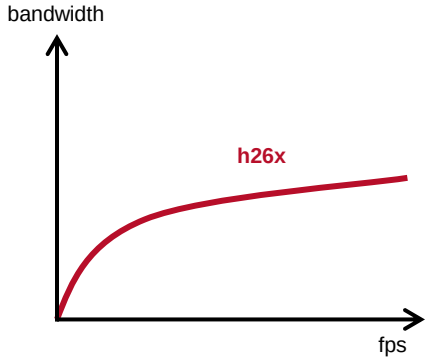
- 60 Fps are possible already today in the security industry
- Most applications use max. 25/30 Fps
  - live view only
- Recording is done with 5-15 Fps in most installations

Wikipedia.org

Relevance of high framerates

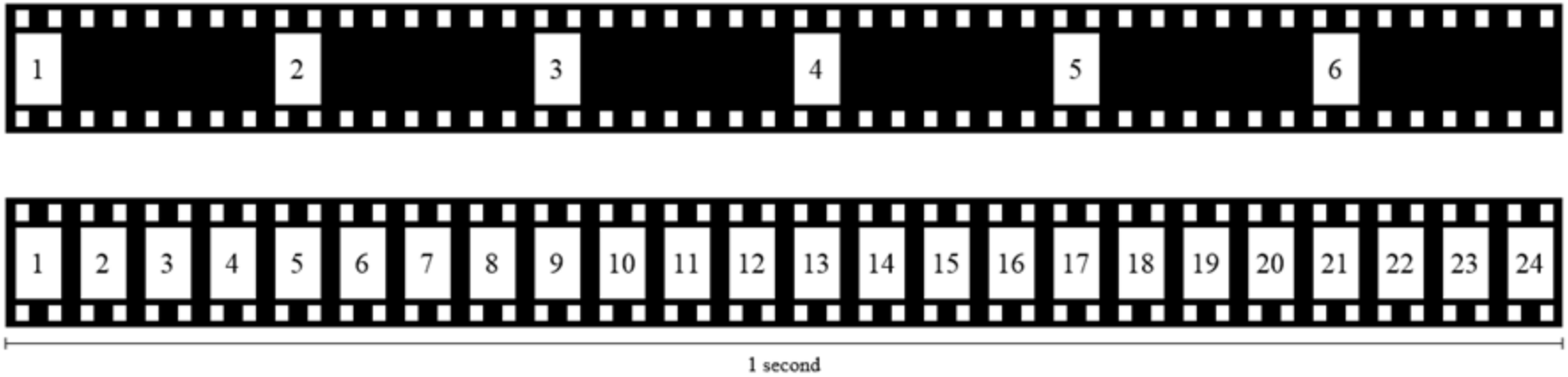
- h.264 and h.265 benefit from high framerate when it comes to efficiency
- The lower the framerate the less efficient they work
- Relation between framerate and consumed bandwidth in MJPEG is almost linear
- For h.26x is is slightly different





Problem No. 2

We cannot expect very high framerates...

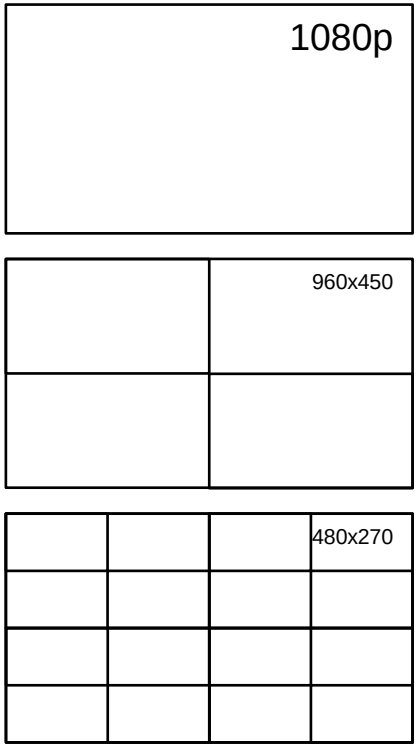


Challenge No. 3

High Resolution

High resolution

- 4K Ultra HD resolution is today the most common really highres material in the broadcasting industry
- Our industry uses max. 1080p for live view
  - 2x2 split 960x540
  - 4x4 split 480x270
- The recording is typically done with the highest possible resolution
  - But at a lower framerate



High resolution

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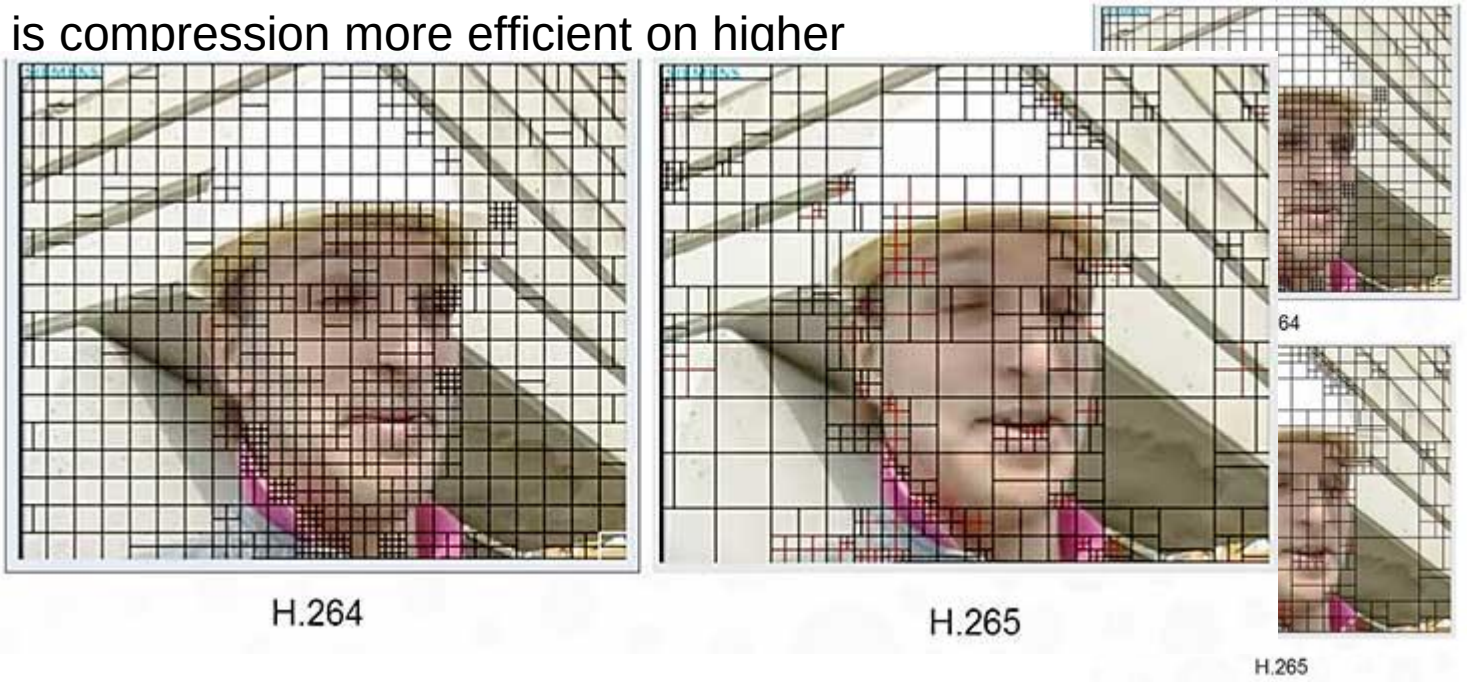


Problem No. 3

We cannot always expect to use the **highest resolution**...

Challenge No. 4+5

Encoding

Software encoding

- Software encoding for broadcasting is calculated on powerful high-end computers
- Realtime is not a requirement in the broadcasting industry
  - Opportunity to buffer
  - Usage of all different methods etc.
- Hardware realtime encoders typically cover only a subset of all possible functions due to limited resources

Pixabay, nemo

Problem No. 4+5

We cannot expect endless time

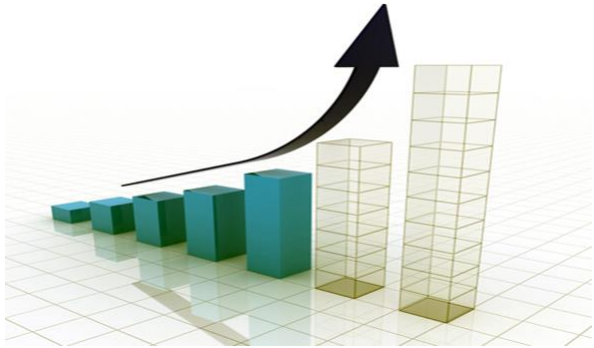
and processing power…

Challenge No. 6

Decoding

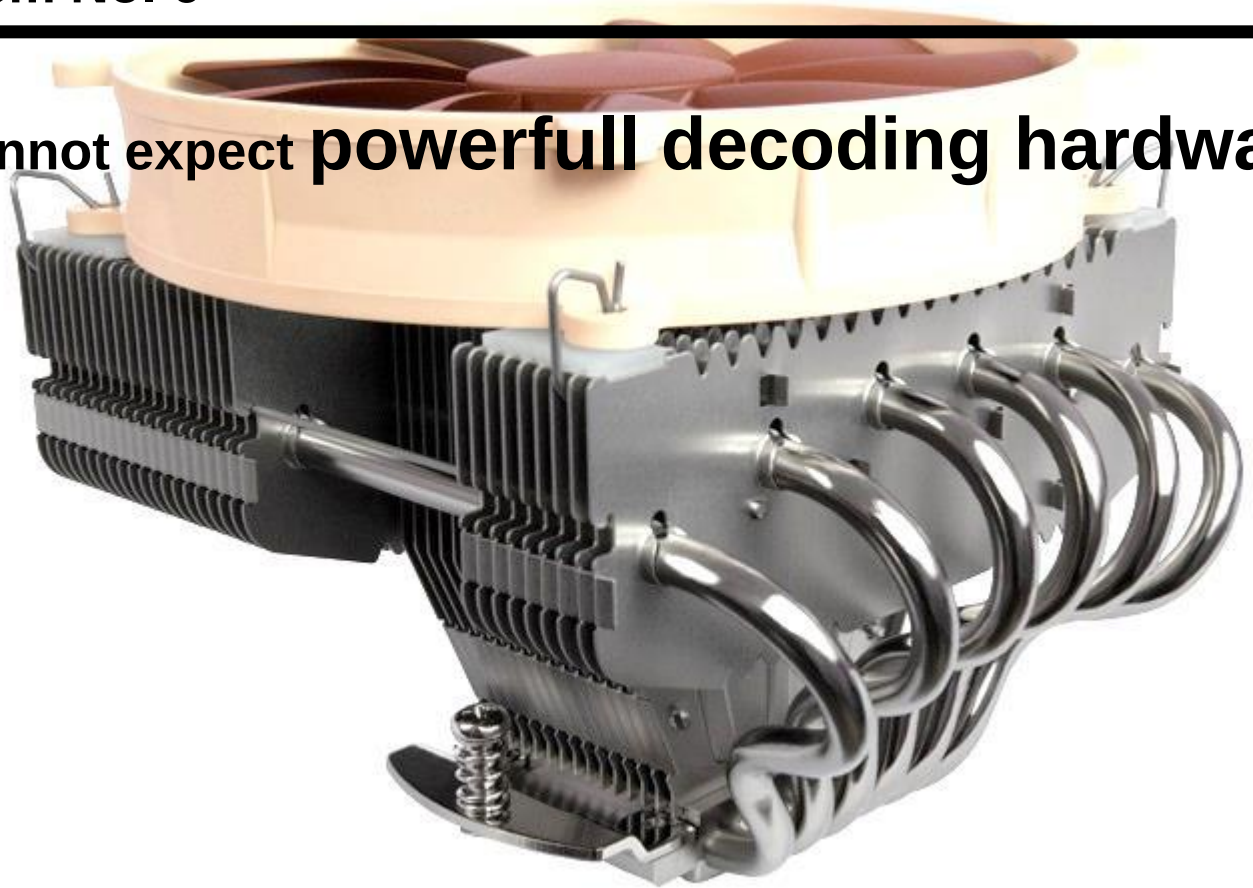
Decoding

- h.265 will require higher decoding performance over h.264. Just like we experienced 5 years ago when h.264 was introduced for surveillence cameras.
- Especially relevant for live monitoring
- Ratio between increased compression efficiency and higher investment for decoding hardware is today not really optimal



Problem No. 6

We cannot expect **powerfull decoding hardware**



Summary

Summary

- **Video surveillance is done in live environments**
  - Low light is requiring gain in the camera, this introduces noise in the image
  - Noise decreases the efficiency of every compression
- **Video surveillance framerate is often 5-15 fps or less**
  - The bigger the differences between each frame are, the less efficient is the advanced compression
- **Surveillance video uses small resolutions, *up* to 1080p**
  - Blocks of similar areas are small and benefit of managing large and dynamic encoding blocks is limited
- **Surveillance is real time video**
  - The computing power of a surveillance camera is limited
  - Buffering and complex calculations introduce latency and other negative aspects
- **Surveillance applications decode the video**
  - New and more powerful decoders are needed on the client side

Future outlook

- H.265/HEVC is the future
- It will take a while until the whole ecosystem is ready for it
- Noise reduction technology and bit rate control improvements will support the transition
- H.264 and h.264/HEVC will coexist for several years
- H.264 technology can still be improved
- Decoding hardware will get more powerful over time
- Optimistic marketing messages will continue to confuse the customers, as always, so be prepared

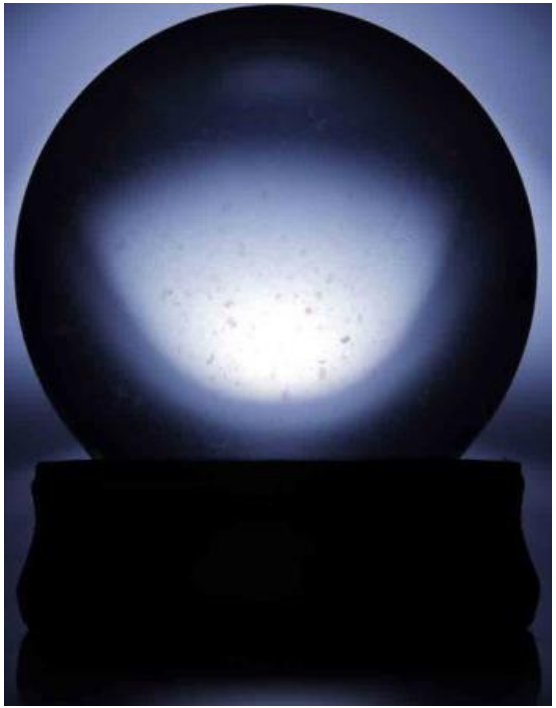
Expected efficiency?

Impossible to predict

But definitly not 50% !

We are planning to spend more time educating our partners how to manage bandwidth and how to counter dubious calculations.

Bandwidth calculation will stay a very complex topic in large projects.




Megapixel
Quality
Ease of use
Network video
Reliability
open
Innovation
Easy installation
Protect
Service
all the way
support
integration
Thank you!
Image
usability
Thermal
Convergence
HDTV
Access
control
Partners
World
Leader
Quality
Intelligent
Competence
Focus
Video
encoder
Safe
Cameras
Outdoor
Secure
Global