XDF XILINX DEVELOPER FORUM

Video Acceleration in the Cloud Using FPGAs

Presented By

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Marketing Mgr., Cloud Video

Johan Janssen
Chief Video Architect

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The market is recognizing us and our technology…

Dan Rayburn is key industry analyst & veteran

https://www.streamingmediablog.com/2018/07/fixing-the-ott-problem.html

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Xilinx enabling all live applications

Social Media Streaming

Video Transcoding

Cloud Video Game

Live Streaming

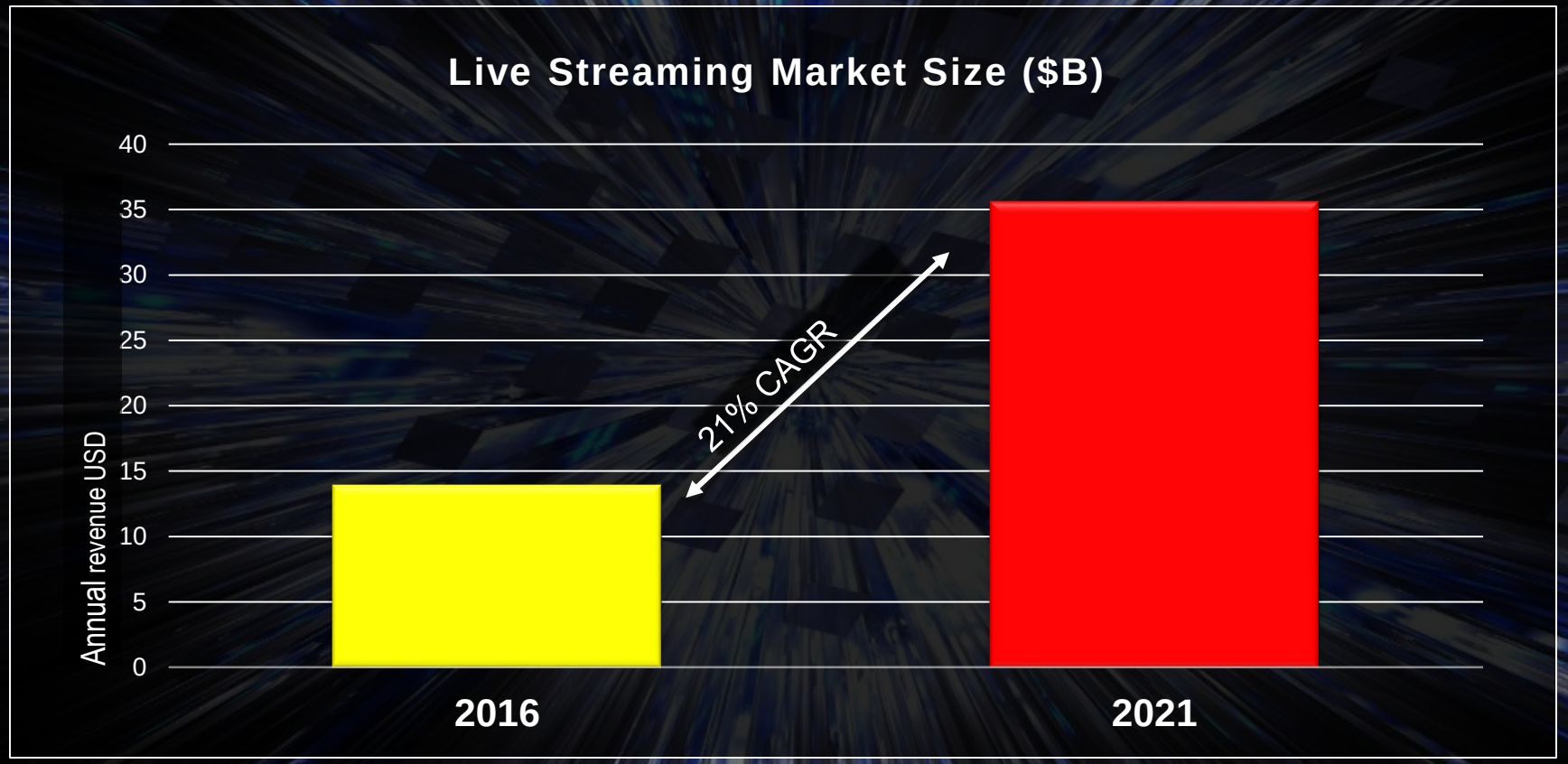
VSaaS

Virtual Desktop

VCaaS

Cloud VR

Live streaming seeing explosive growth



Markets & Markets report

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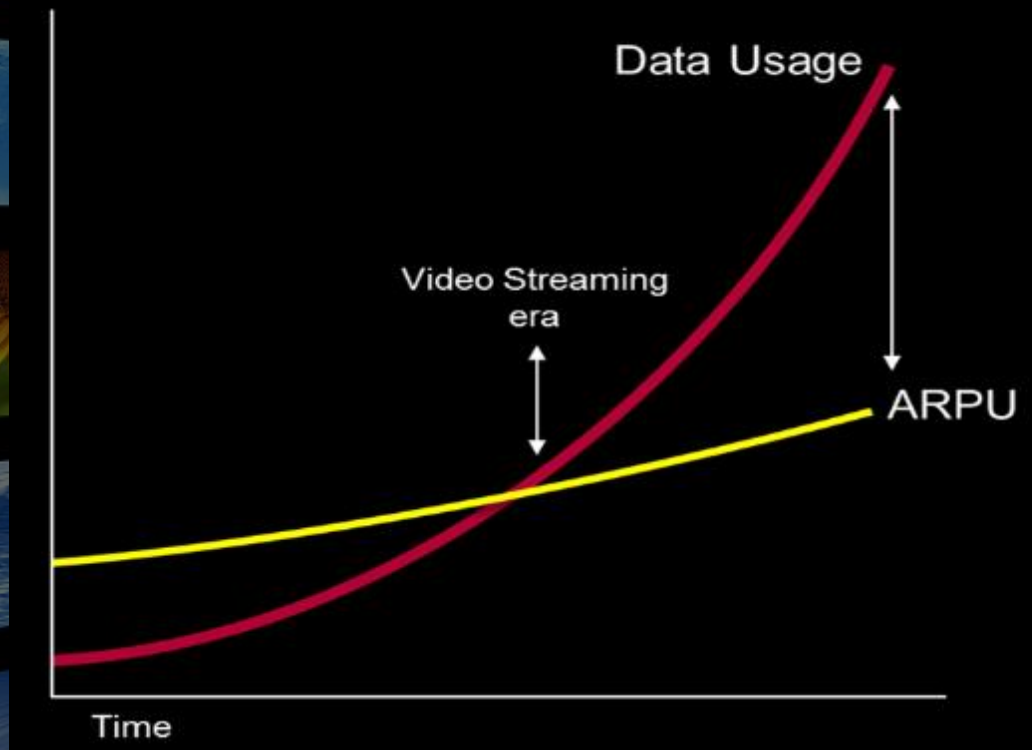
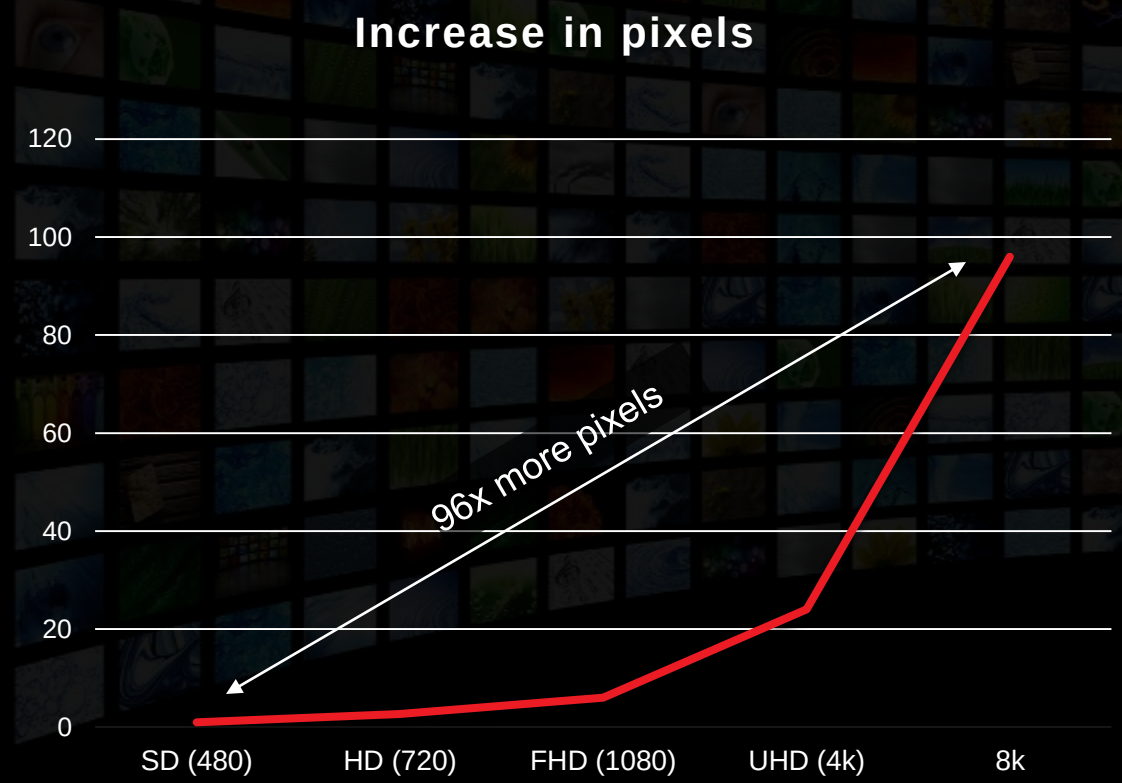
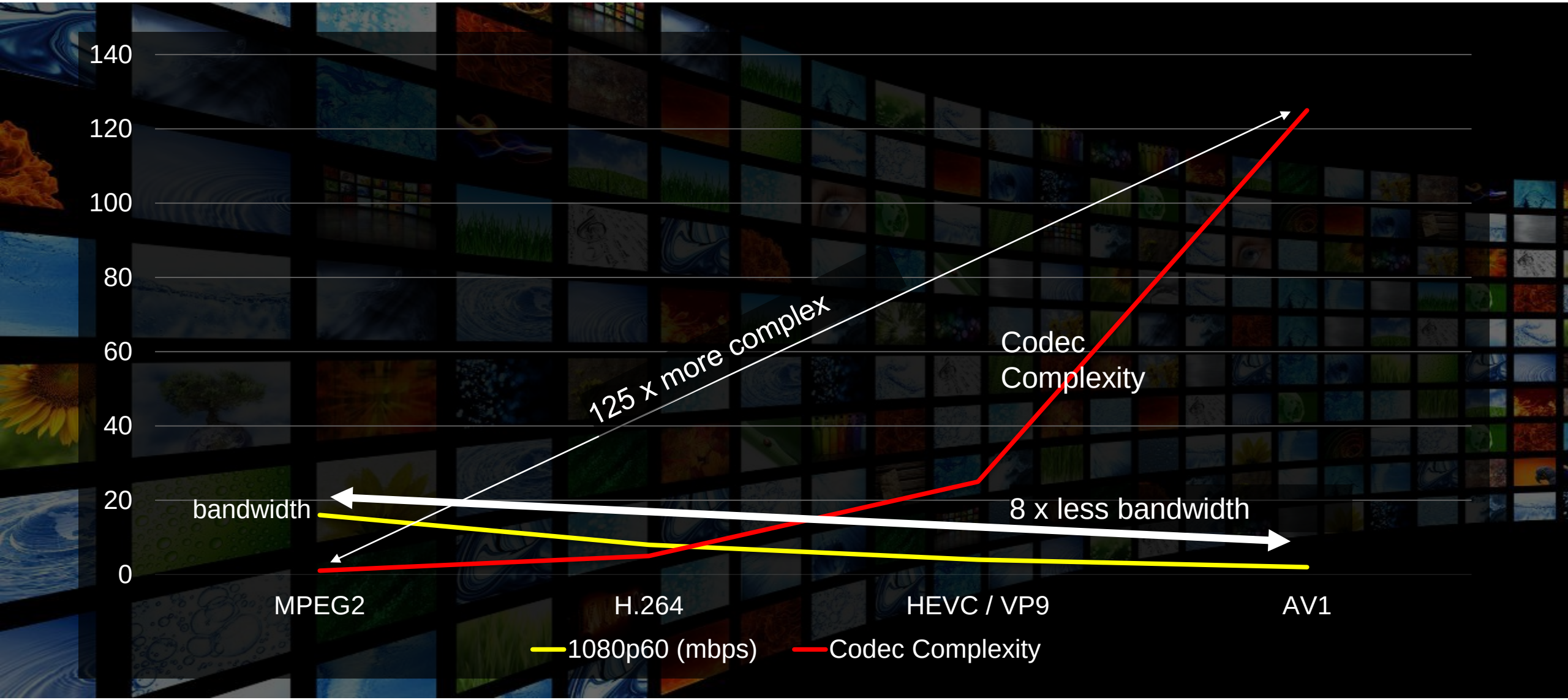
Live video demands a new approach

- Video will be 82% of all internet traffic by 2021 - Cisco VNI report
- Video will be 73% of all wireless traffic by 2023 - Ericsson Mobility report





New codecs help one hand…



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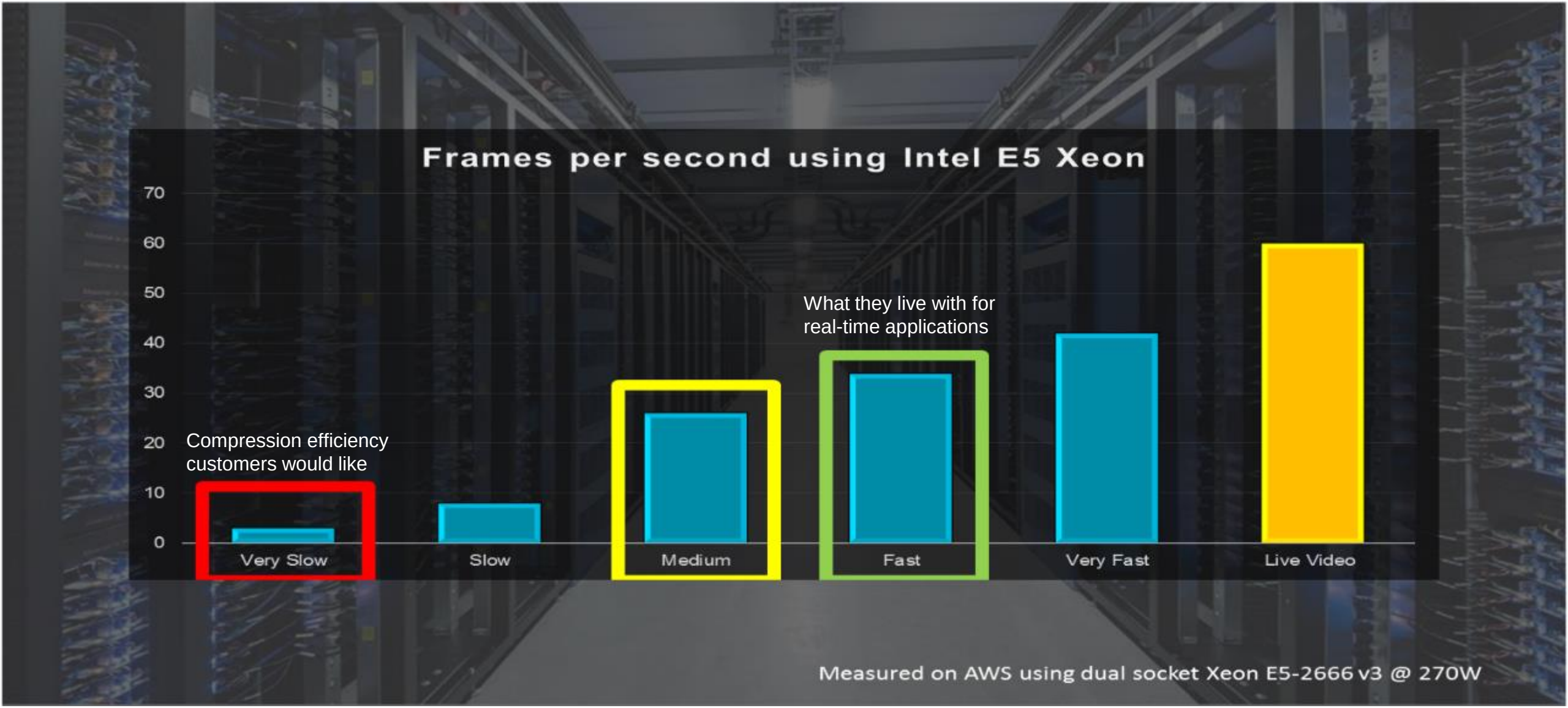
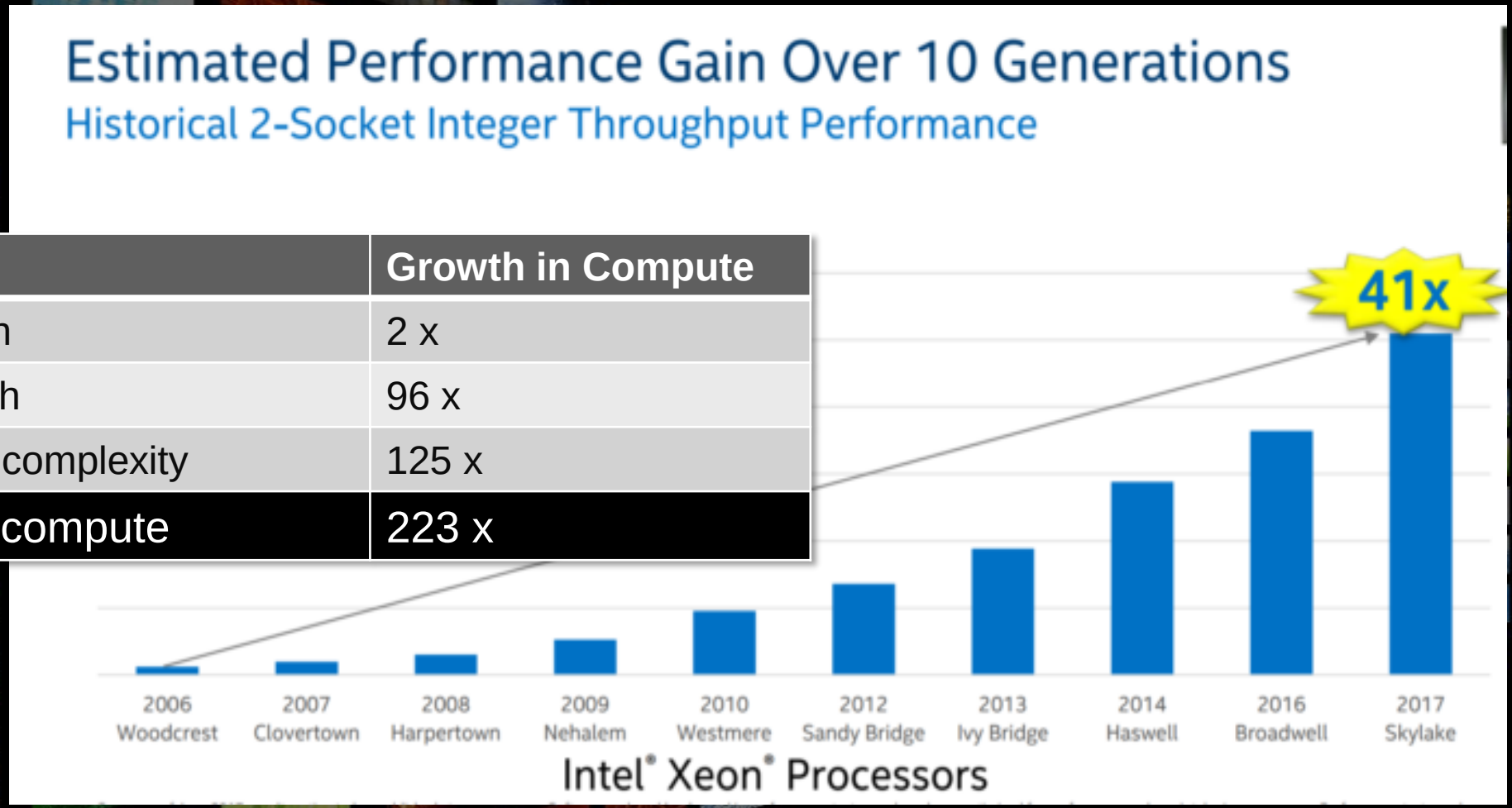
CPUs are too slow for live video…



Intel performance scaling not keeping up

Description	Growth in Compute
Live video growth	2 x
Resolution growth	96 x
Growth in codec complexity	125 x
Total growth in compute	223 x



Slide taken from Intel XDF presentation

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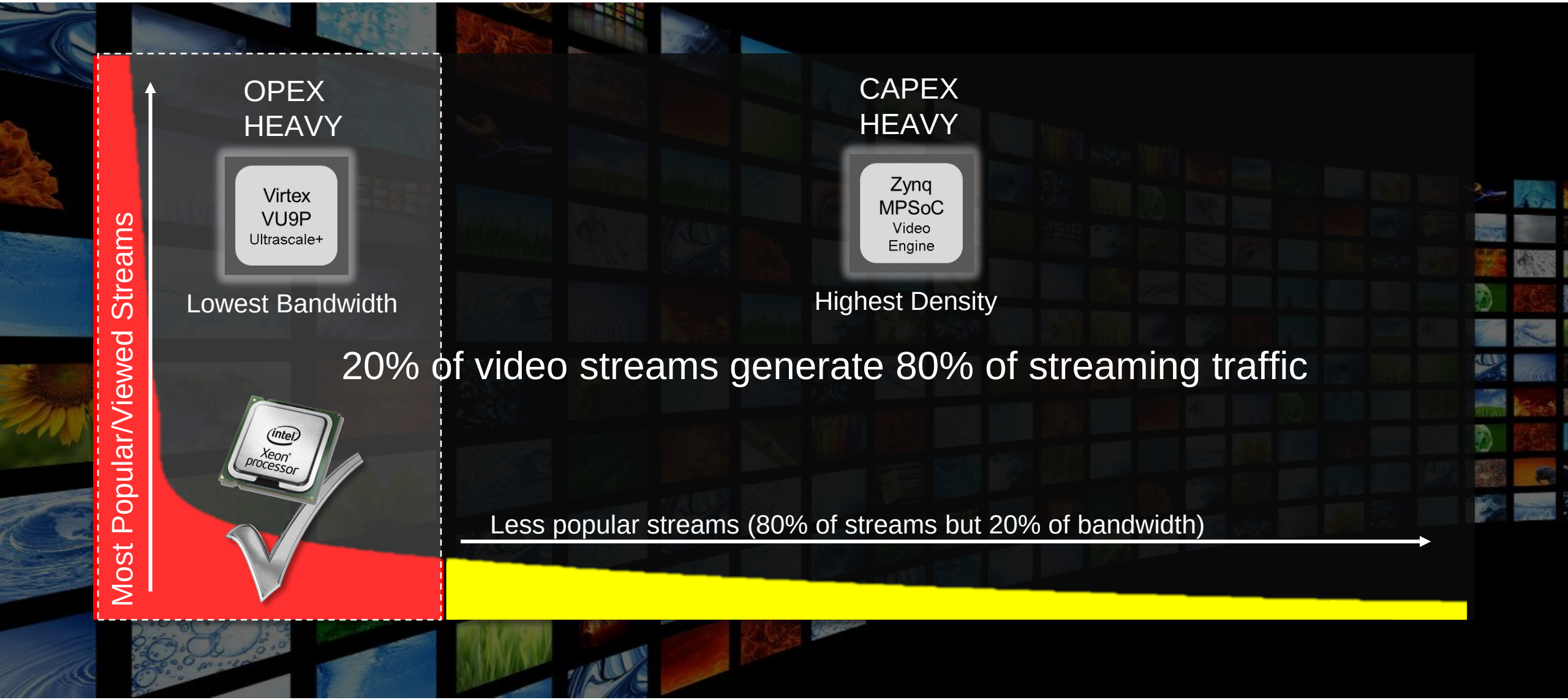
The “Pareto Principle” of live video distribution



Together Xilinx & NGCodec can save on streaming costs

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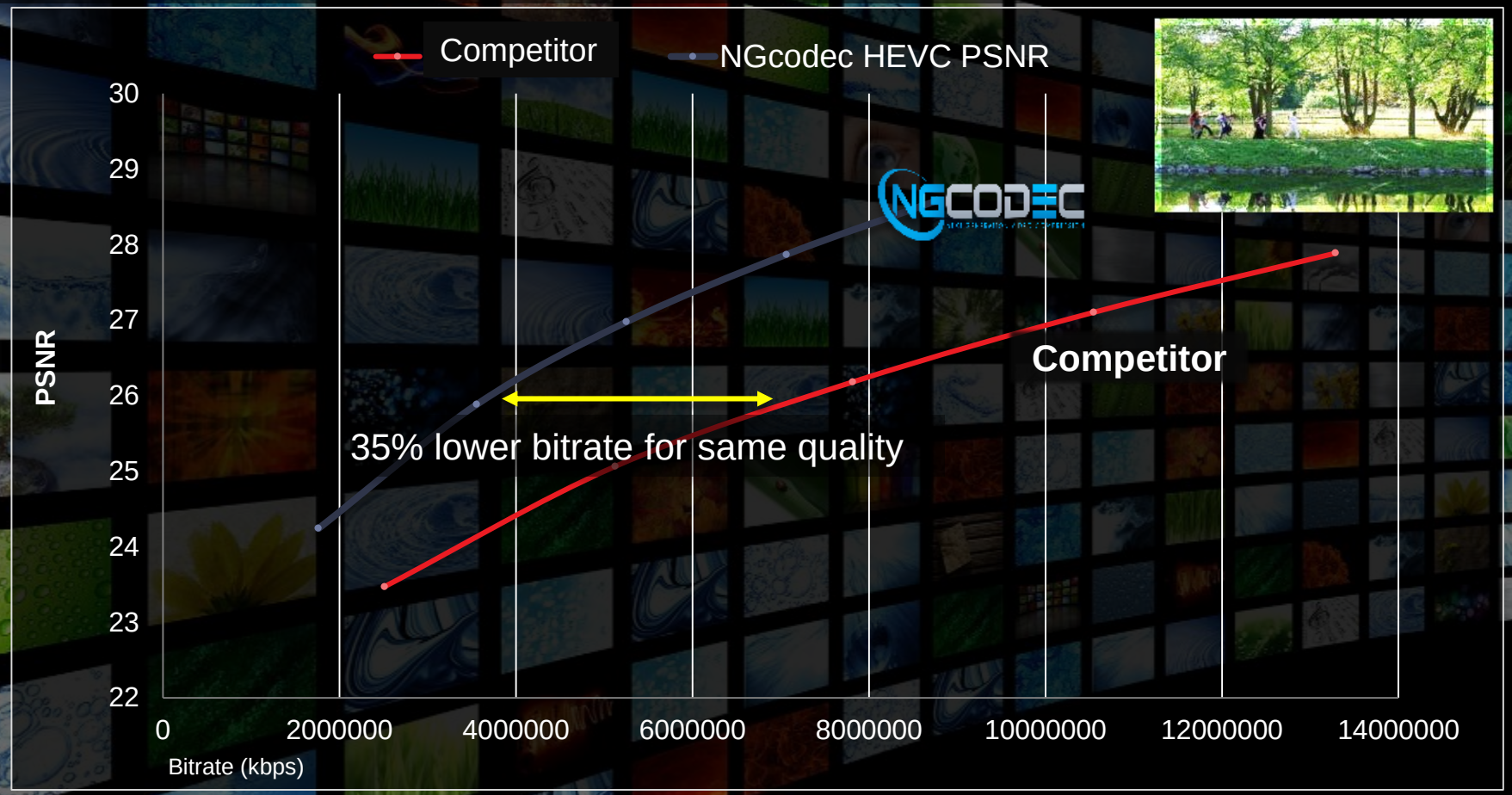
The difference compression performance makes

Encoded Bitrate	Data per Mth. (TB) Per Stream	Cost per Mth ($0.05 per GB)	Monthly Cost @ 100k Streams	Annual Cost (100k Streams)
4Mbps	1.21	$60.48	$6,048,000	$72,576,000
2.8Mbps	0.85	$42.34	$4,234,000	$50,808,000
			Annual Savings	**$21,768,000**

Hardened solutions come at a cost

Encoder saves significant OPEX costs for bandwidth on egress traffic



Virtex VU9P Ultrascale+

Measured June 2018 SDK

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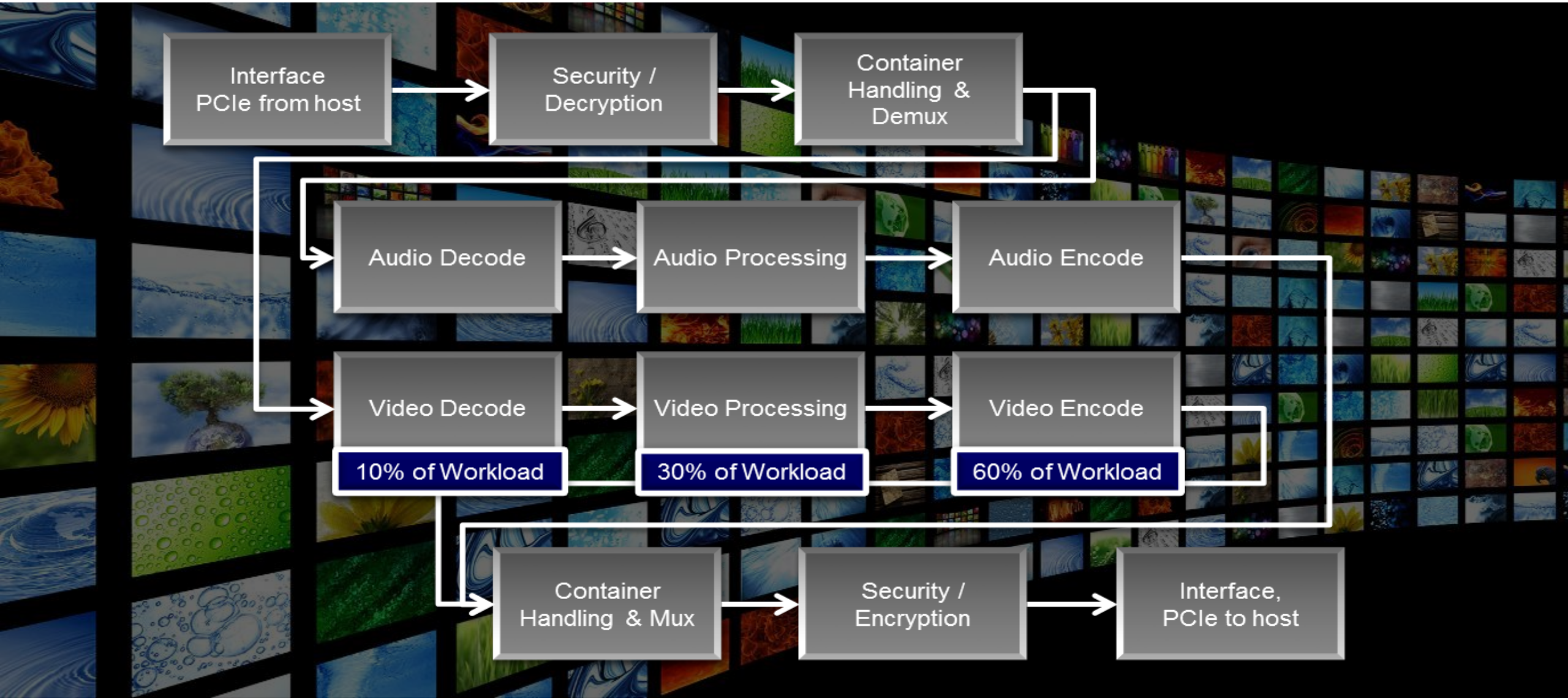
Overview of FPGA Video Acceleration

> Johan Janssen

> Chief Video Architect

What to Accelerate?



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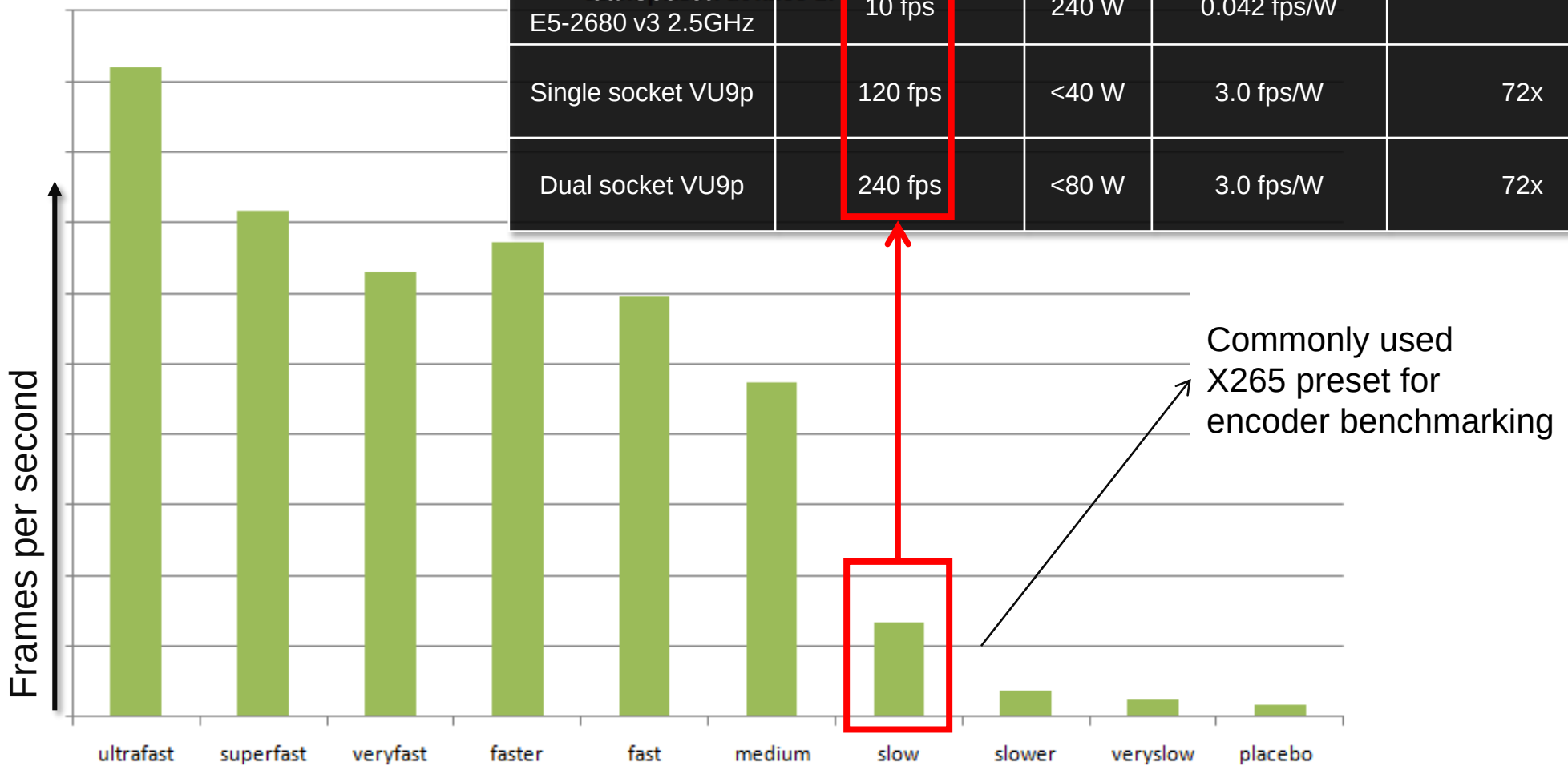
FPGA HEVC encode vs. x265 encoding configurations

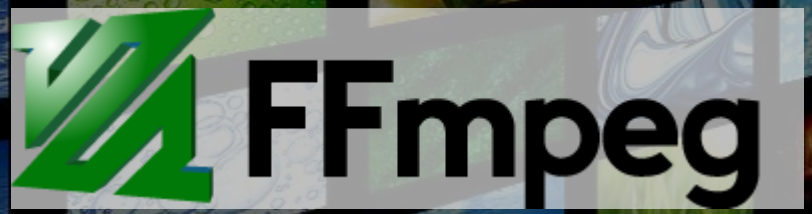
HEVC encode comparison	1080p fps @ x265-slow preset	Device Power	performance/W	performance/W Improvement	Available
Dual Socket E5-2680 v3 2.5GHz	10 fps	240 W	0.042 fps/W		
Single socket VU9p	120 fps	<40 W	3.0 fps/W	72x	Dec 2018
Dual socket VU9p	240 fps	<80 W	3.0 fps/W	72x	Dec 2019



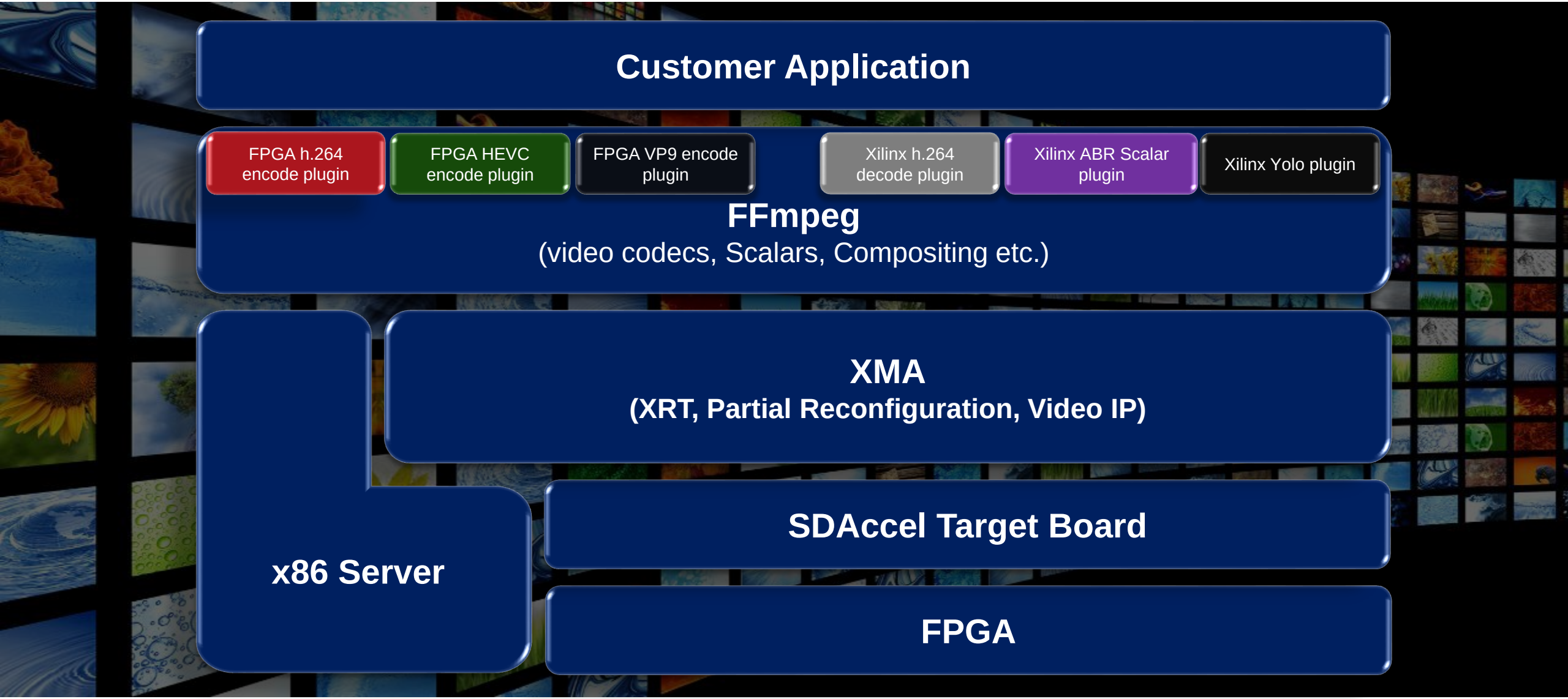
http://x265.ru/wp-content/uploads/2014/12/diff-presets.png

About FFmpeg

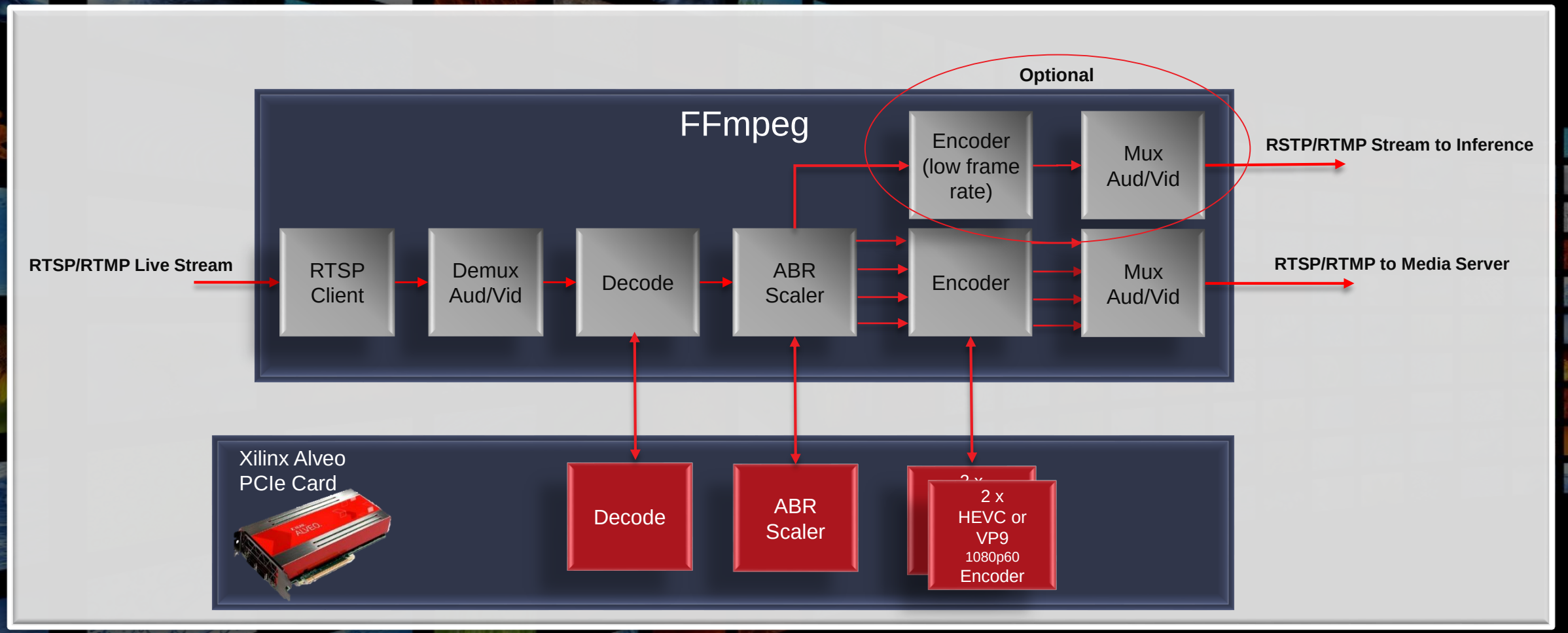
- **Source: https://www.ffmpeg.org/about.html**
- **FFmpeg is the leading multimedia framework, able to decode, encode, transcode, mux, demux, stream, filter and play pretty much anything that humans and machines have created**
  - It supports the most obscure ancient formats up to the cutting edge
  - Highly portable: FFmpeg compiles, runs, across Linux, Mac OS X, Microsoft Windows, under a wide variety of build environments, machine architectures, and configurations



Integration into FFmpeg framework: building the ecosystem



Video Transcoding ABR Example (Single VU9p)



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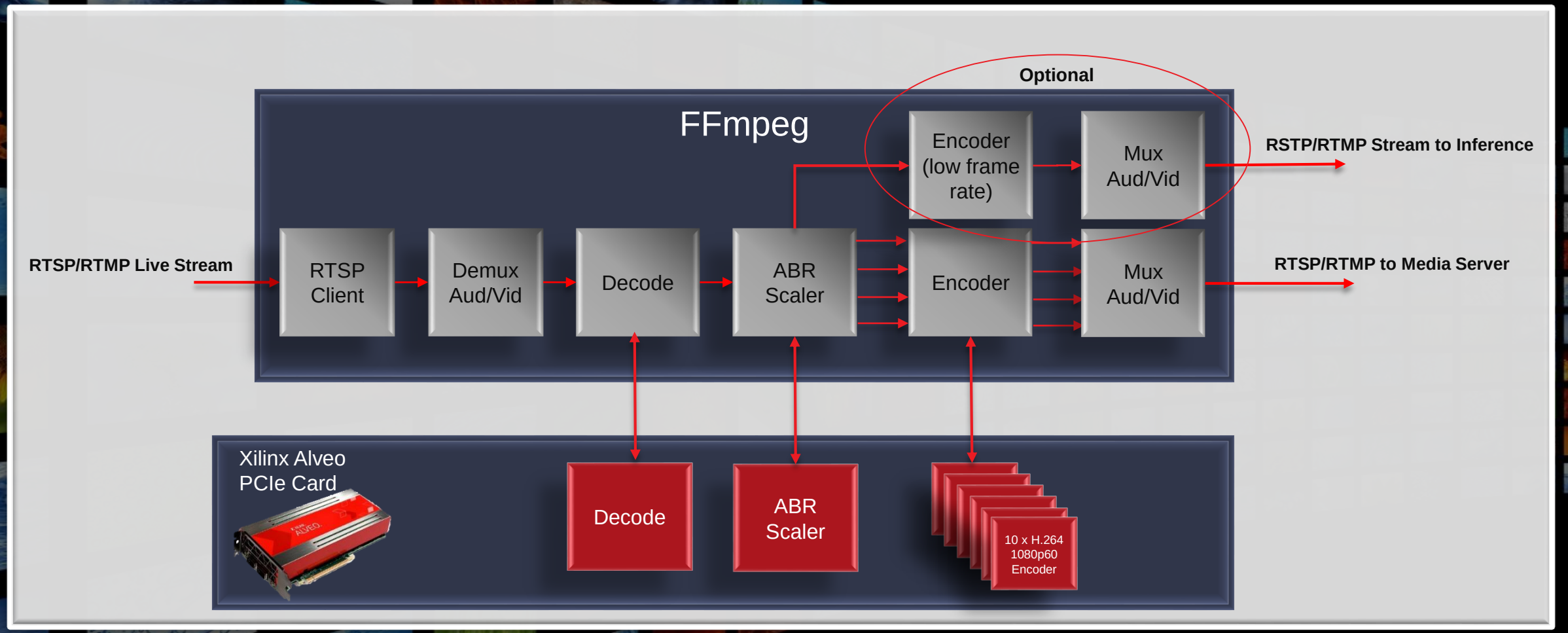
Video Transcoding ABR Example (Single VU9p)



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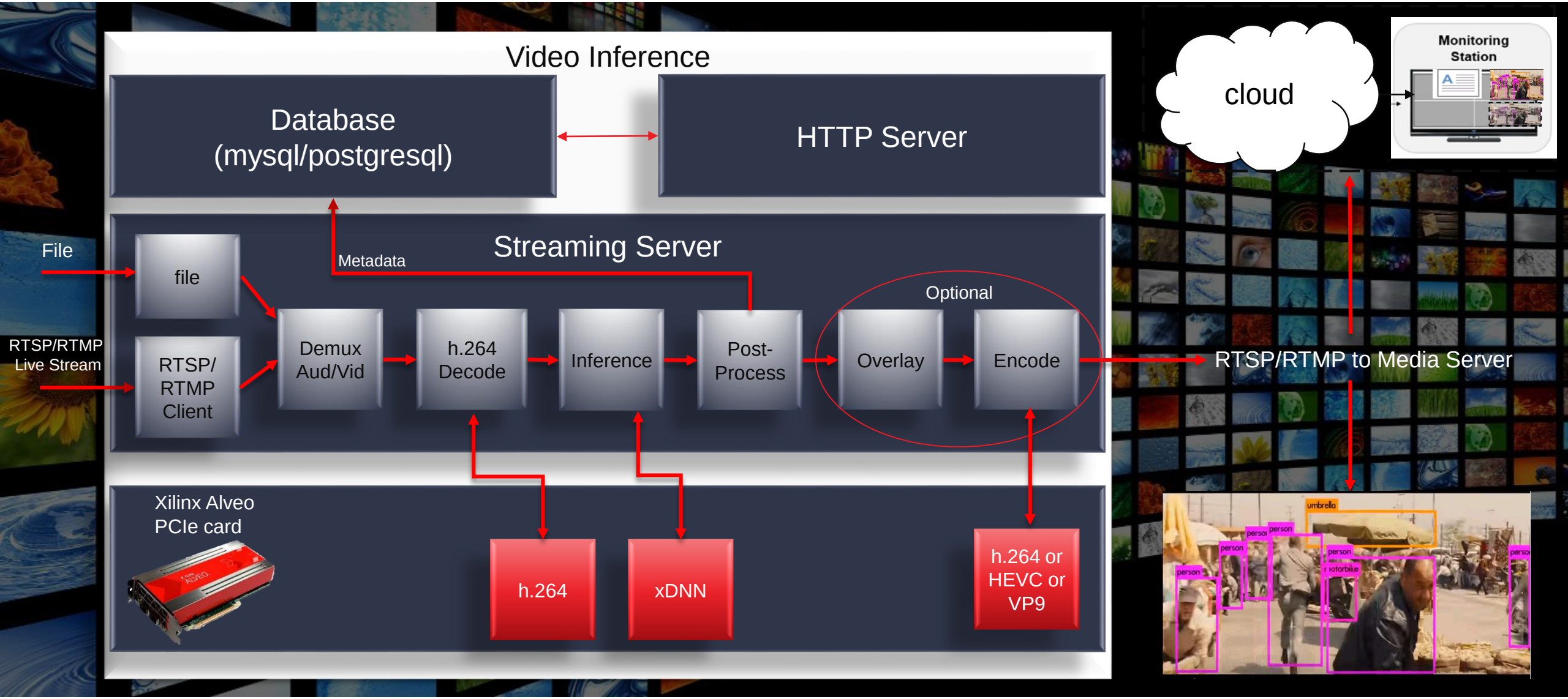
“Edge-to-Cloud Video Analytics”



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Integrating accelerators into FFmpeg framework

```
ffmpeg \
-f rawvideo -pix_fmt yuv420p -s:v 1920x1080 -r 30 -an -i
/home/ffmpeg/VU9P/TestSequences/Kimono1_1920x1080_24.yuv  \
-frames 240 -c:v libx264 -preset medium -profile:v high -crf 23 -bf 4 -refs 3 -g 30 -b:v 4000k -maxrate 4000k -bufsize
8000k -f h264 -r 30 -y ./sw_outdir/x264_medium_out0_br4000k.h264
```

```
$ ffmpeg \
-f rawvideo -pix_fmt yuv420p -s:v 1920x1080 -r 30 -an -i
/home/ffmpeg/VU9P/TestSequences/Kimono1_1920x1080_24.yuv \
-frames 240 -b:v 4000k -g 30 -c:v xlnx_h264_enc-hq -f h264 -y ./hw_outdir/out0_br4000k.h264
```

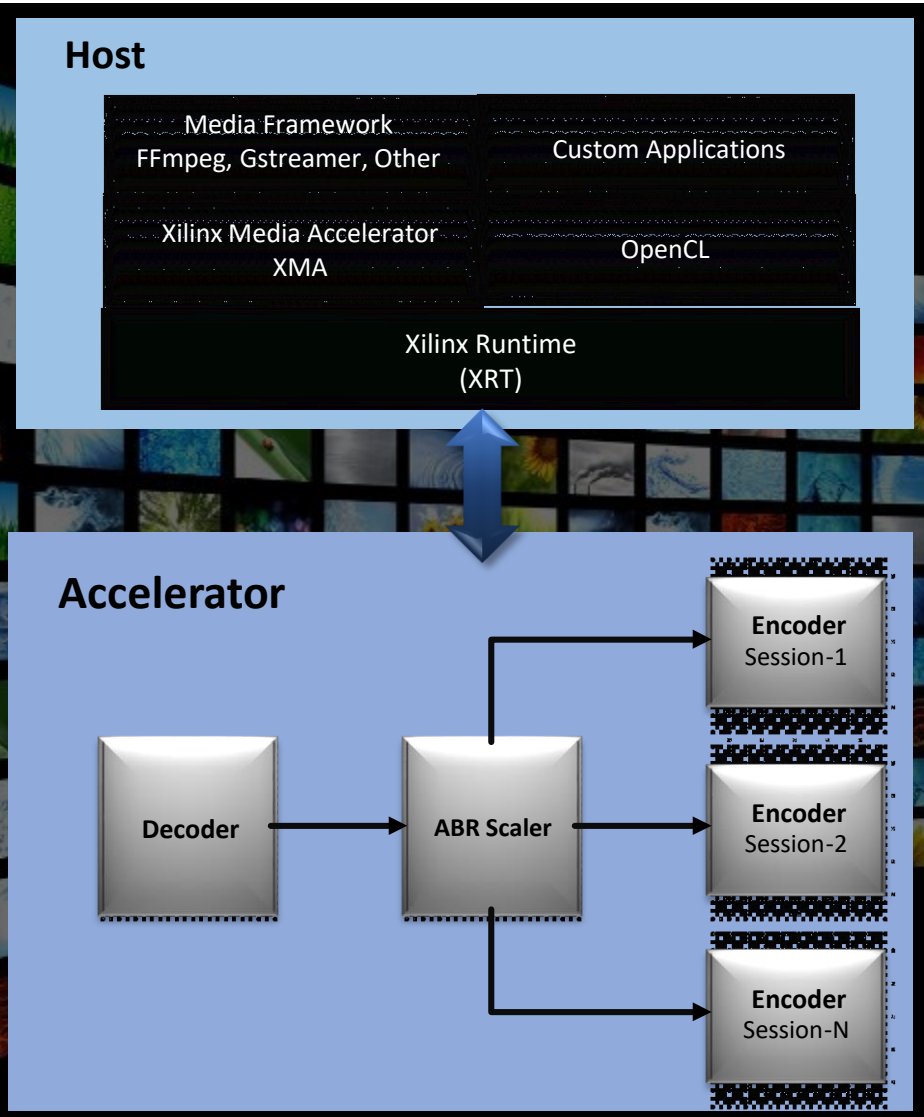
```
$ ffmpeg \
-f rawvideo -pix_fmt yuv420p -s:v 1920x1080 -r 30 -an -i
/home/ffmpeg/VU9P/TestSequences/Kimono1_1920x1080_24.yuv \
-frames 240 -b:v 4000k -g 30  -c:v xlnx_HEVC_enc -f h265 -y ./hw_outdir/out1_br4000k.h264
```

Change 20 characters to get acceleration

https://trac.ffmpeg.org/wiki/EncodingForStreamingSites

XMA Architecture

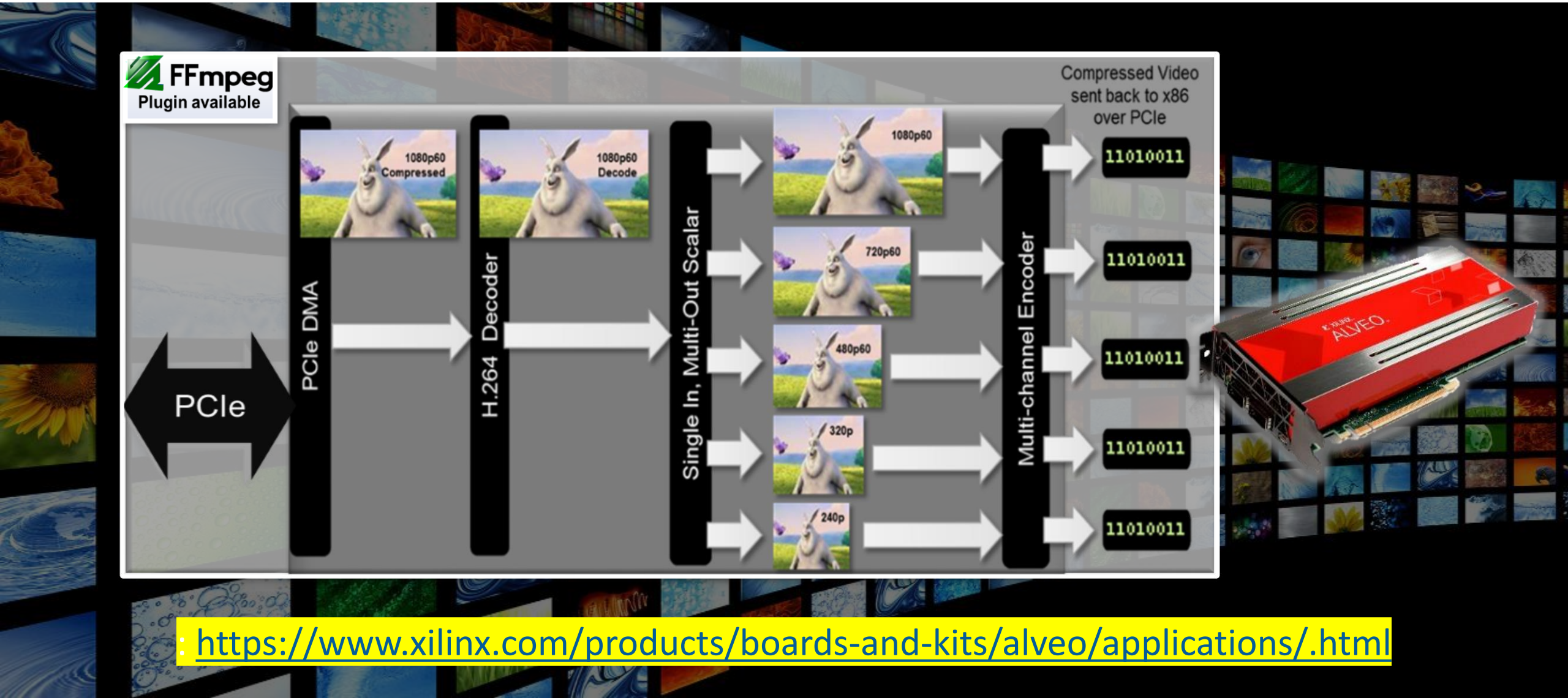
- **Key features**
  - Video domain specific interfaces with seamless integration with FFmpeg
  - Low-level plugin can be reused with any media framework
  - Supports multiple processes sharing different kernels on the same device
  - Supports multiple channels on a single kernel
  - Ensures a kernel resource is reserved for the lifetime of a video session



Video IP Offering (each IP has FFmpeg plugin)

Codec	Partner	Description	# of 1080p (VU9P)	Availability
H.264 HDE	Alma	High Density Encoder	12 x 1080p60	Today
H.264 HQE	IDT	High Quality Encoder	1 x 1080p60 (3 in Mar)	Today
H.264 HDD	VYU Synch	High Density Decoder	12 x 1080p60	Today
HEVC-HDE	NGCodec	High Density Encoder	2 x 1080p60	Today
HEVC-HQE	NGCodec	High Quality Encoder	1 x 1080p60 (roadmap 2)	Today
HEVC-HDD	Path Partner	High Density Decoder (Up to 8 12bits 4:4:4)	6 x 4kp30	Today
HEVC-HEIFD	Path Partner	HEIF Decoder (Up to 60Mbps per core)	10 x 4kp15	Today
VP9-HQE	NGCodec	High Quality Encoder	1 x 1080p60 (roadmap 2)	Q2 CY2018
AV1	NGCodec/Xilinx	Future	Future	2019
Perseus+	V-Nova	**4x** density / bitrate improvement	Various	Q2 CY2018
WebP Enc.	Xilinx	High Density Encoder	Resolution dep.	Today
ABR Scalar	Xilinx	High Density Scalar		Today

Xilinx Alveo ABR video transcoding solution



: https://www.xilinx.com/products/boards-and-kits/alveo/applications/.html

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Xilinx has a solution to address all workload needs

Video Optimized platforms

ADVANTECH

Form Factor	Details — Sampling Aug 2018
Low Profile	Power 75W Suitable for any server form factor Low power with passive cooling Lowest cost option

24 x 1080p30 H.264 encodes in real-time
24 x 1080p30 H.264 decodes in real-time
4 x 1080p60 HEVC encodes in real-time
10 x 1080p60 HEVC decodes in real-time

Form Factor	Details — ES Oct 2018
FH/ ¾ Length	Power 225W Highest density per slot Ability to mix workloads Video + ML / AI

2 x performance of single VU9P