



Video Acceleration in the Cloud Using FPGAs

Presented By

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Chief Video Architect



The market is recognizing us and our technology...

Dan Rayburn is key industry analyst & veteran

YOUBORA
BUSINESS INTELLIGENCE SOLUTION FOR ONLINE VIDEO

StreamingMediaBlog.com The business behind the technology of online video.

Dan Rayburn, Blogger, Author, Consultant, Principal Analyst, **Frost & Sullivan** | 917-523-4562 | [Email](#) | [Subscribe](#)

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Better Video Compression Can't Fix The OTT Infrastructure Problem, Hardware Might

Dan Rayburn | Saturday July 7, 2018 | 12:39 PM | [3 Comments](#)

If the software and CPU platform, which has worked so well since the inception of the streaming video industry, cannot meet the future needs of the market, what can? Since the dawn of computing, the solution to insufficient software and CPU performance has been to offload the workload to a specialized piece of hardware. Examples of specialized hardware being utilized to enable higher performance include RAID cards in storage, TCP/IP offload engines in networking, and the ubiquitous GPUs which have revolutionized the world of computer graphics. Thanks to GPU's, a consumer today can watch 4K video streams on their selection of viewing devices, including televisions, computers, and mobile platforms. Given this track record of success, it seems clear that the innovation that is required is a piece of specialized hardware that can offload the heavy lifting of streaming video from the CPU and software. This technology exists and is now making its way to market thanks to the recent advances in Field Programmable Gate Array or FPGA technology.

ANNOUNCING THE NEW
STREAMING SUMMIT
by Dan Rayburn Make Video Matter

Streaming is the new business currency.
Stream at Full Speed

Download
Ericsson UDN's White Paper

WILL BE
HYPER-STREAMED
LEARN MORE

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

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XILINX

Xilinx enabling all live applications



Social Media Streaming



Video Transcoding



Cloud Video Game



Live Streaming



Data Center



VSaaS



Virtual Desktop

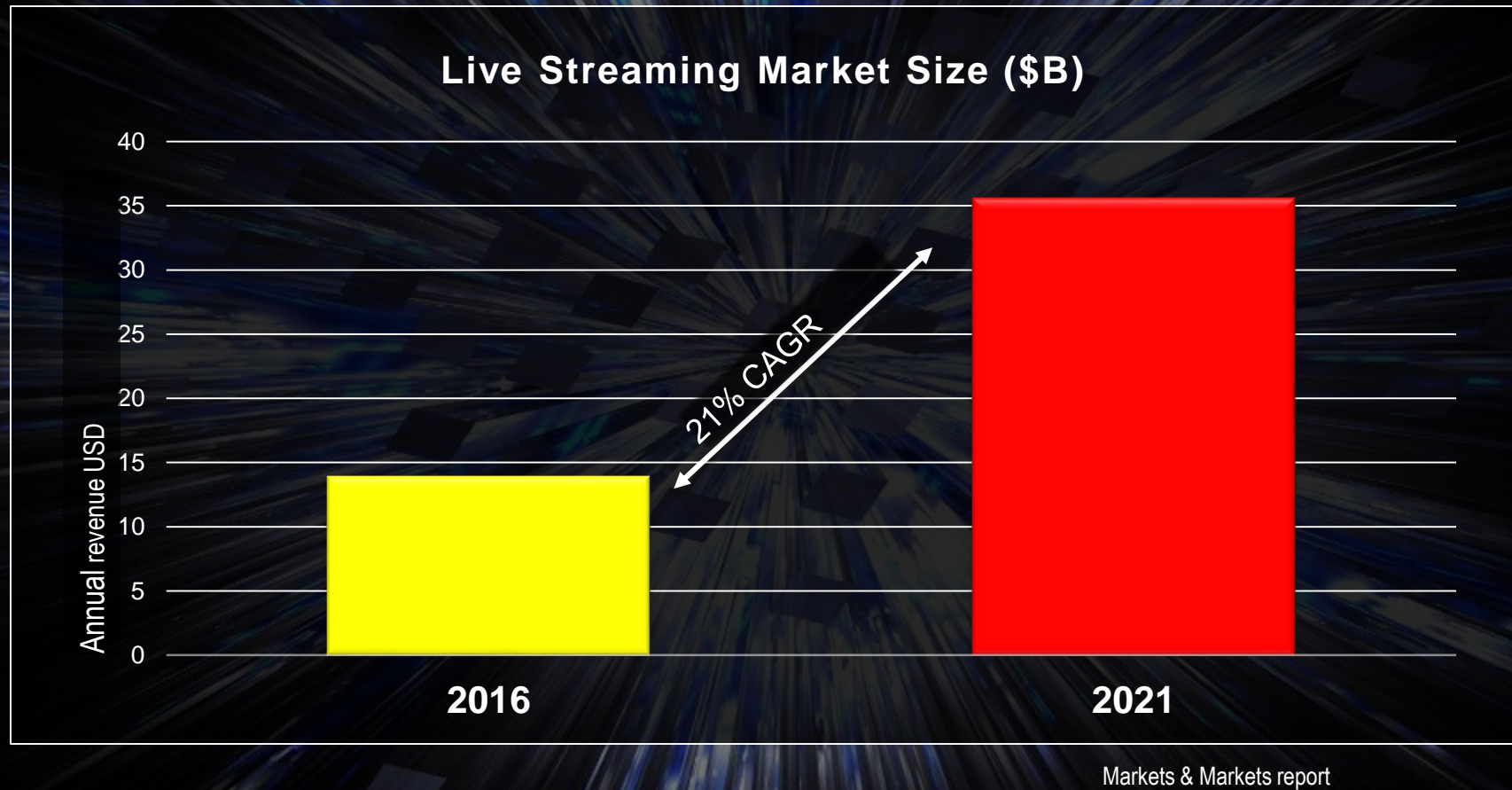


VCaaS



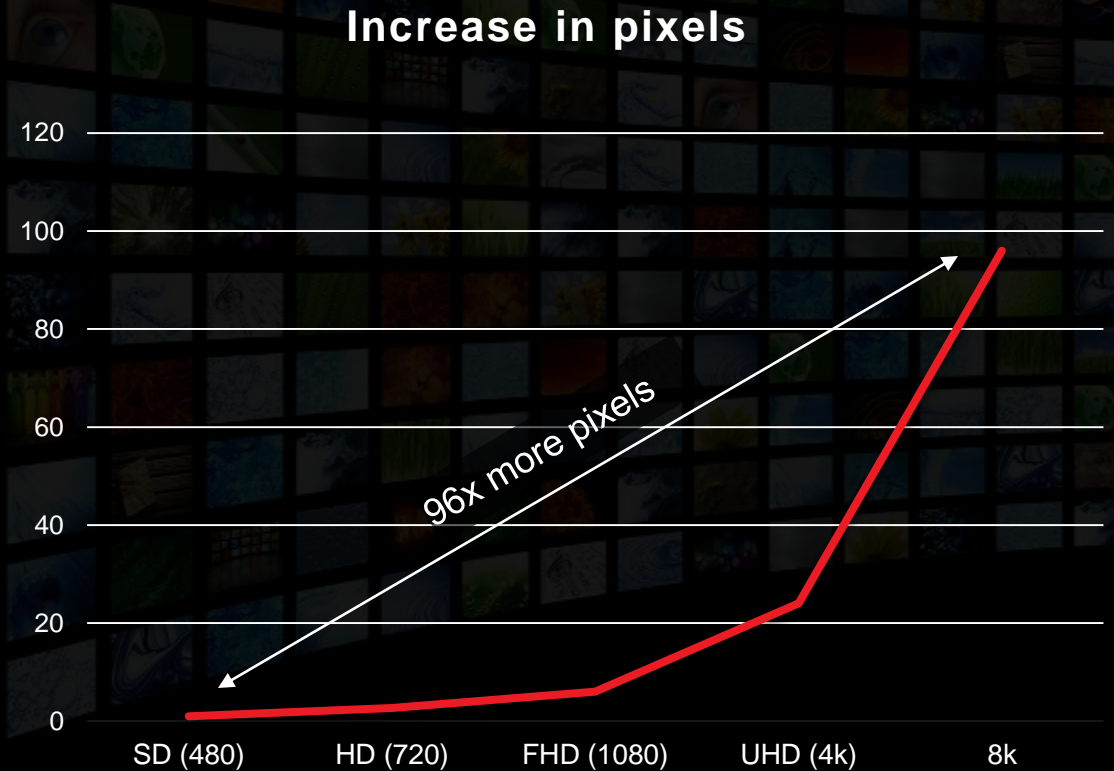
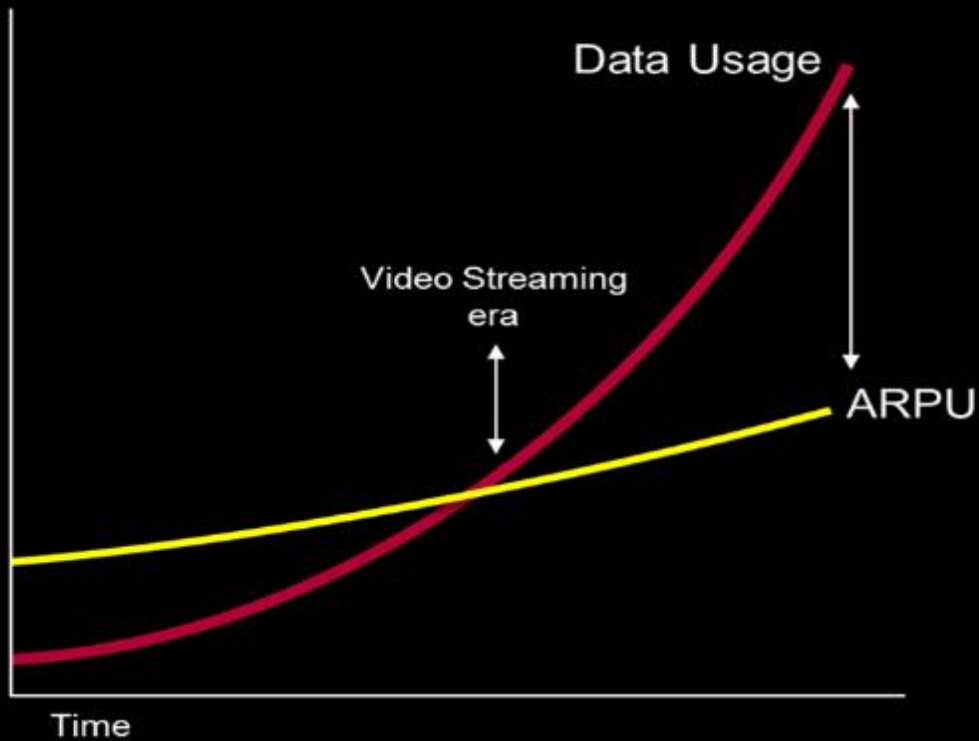
Cloud VR

Live streaming seeing explosive growth

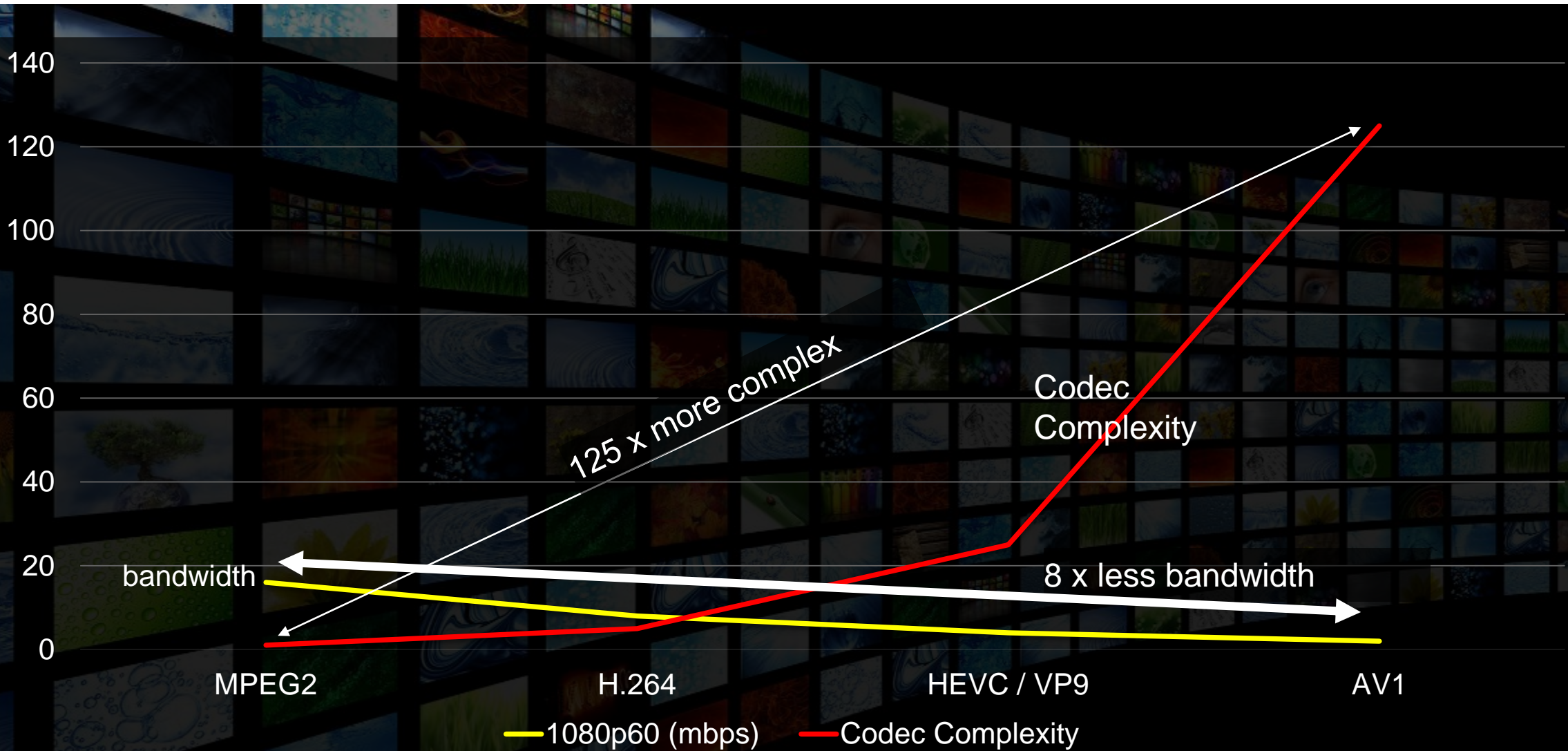


Live video demands a new approach

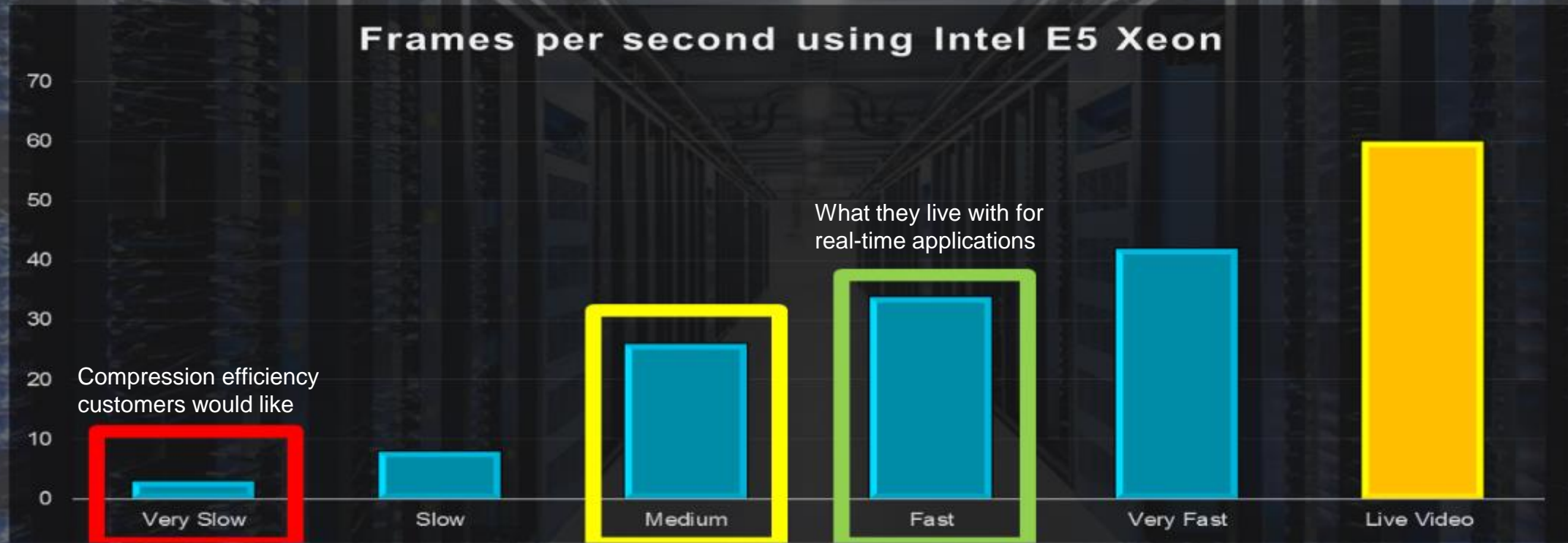
- Video will be 82% of all internet traffic by 2021 - Cisco VNI report
- Video will be 73% of all wireless traffic by 2023 - Ericsson Mobility report



New codecs help one hand...



CPUs are too slow for live video...

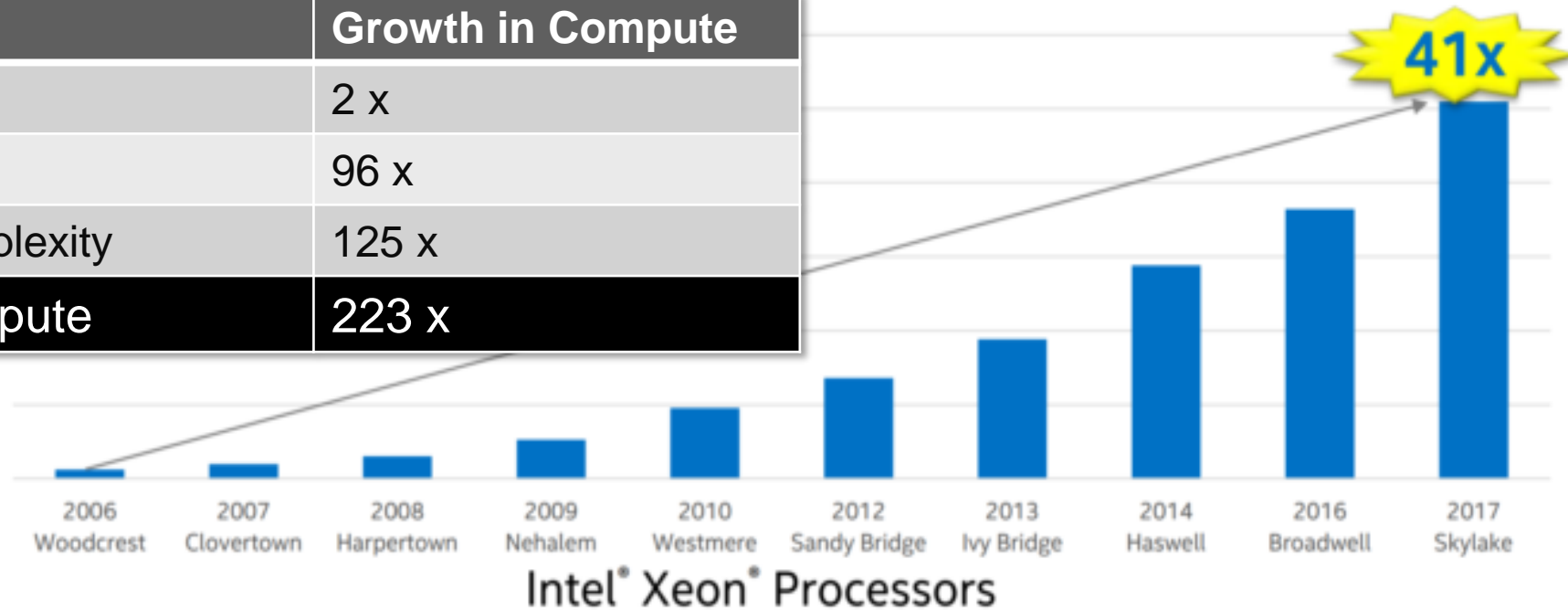


Measured on AWS using dual socket Xeon E5-2666 v3 @ 270W

Intel performance scaling not keeping up

Estimated Performance Gain Over 10 Generations Historical 2-Socket Integer Throughput Performance

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

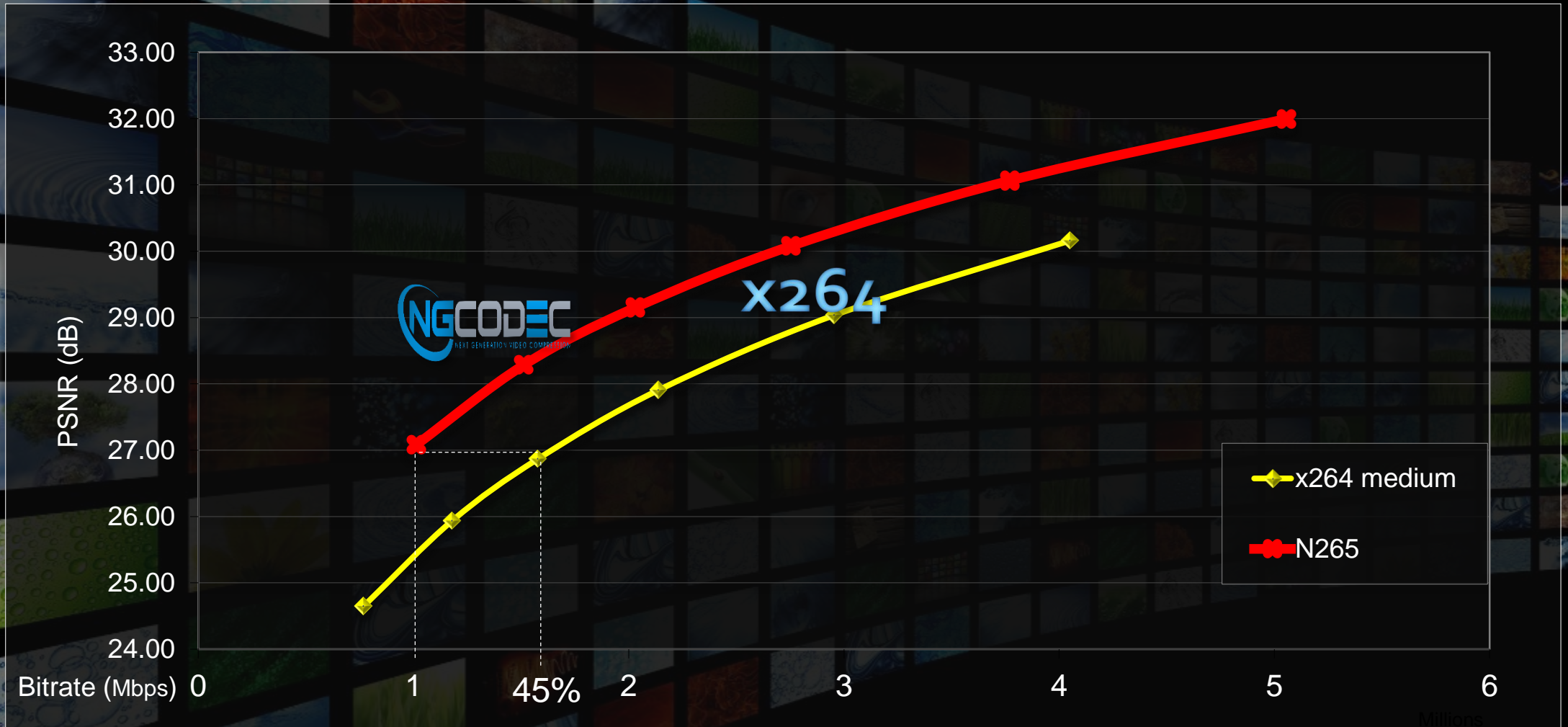


Slide taken from Intel XDF presentation

The “Pareto Principle” of live video distribution

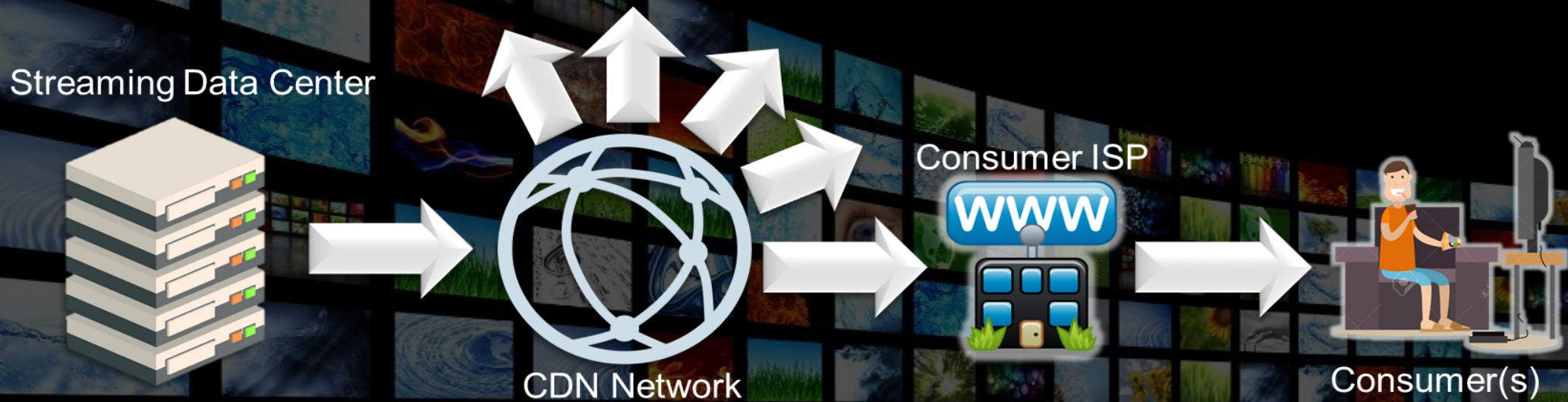


Together Xilinx & NGCodec can save on streaming costs



Virtex
VU9P
Ultrascale+

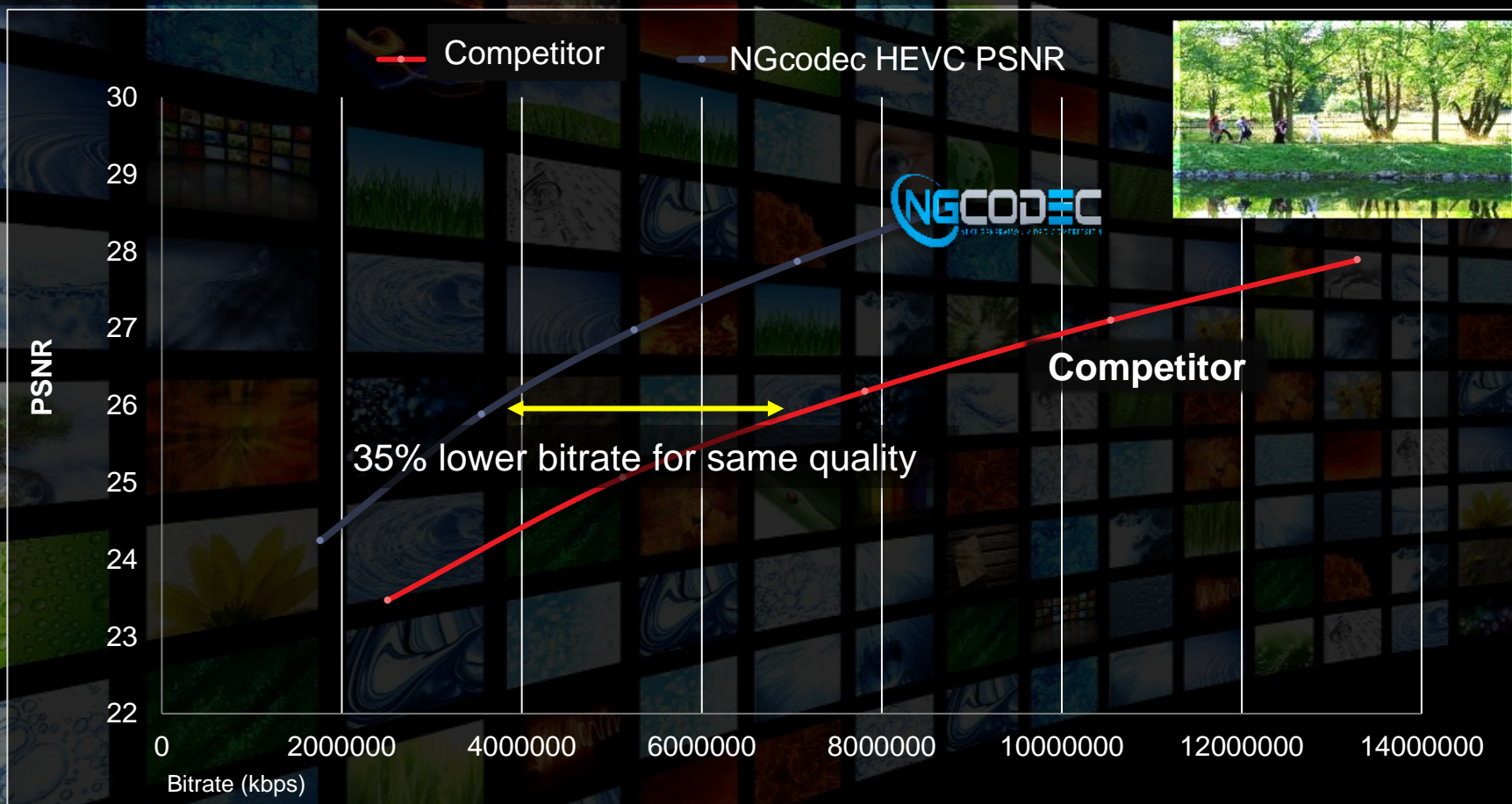
The difference compression performance makes



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+

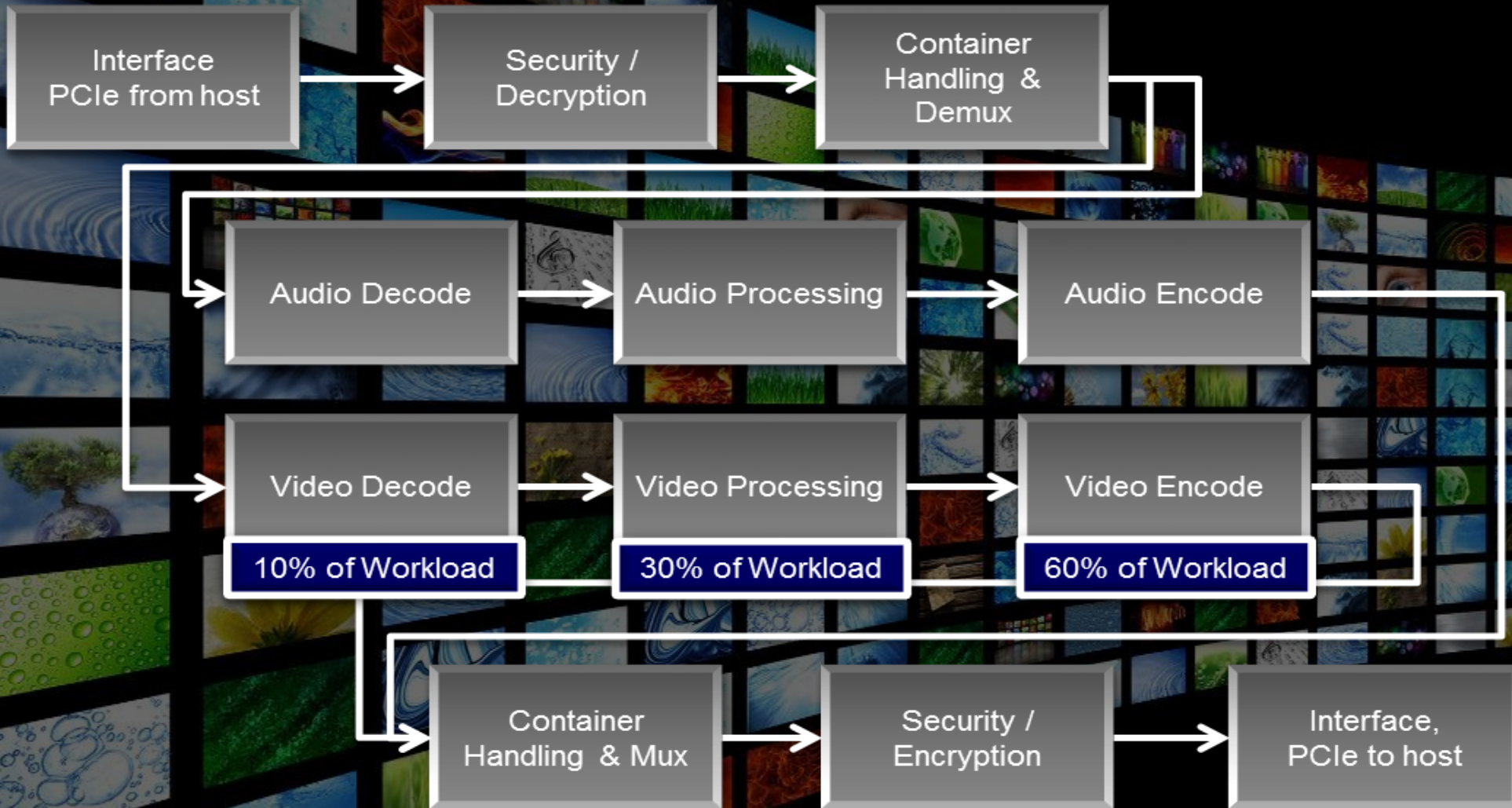
Measured June 2018 SDK

Overview of FPGA Video Acceleration

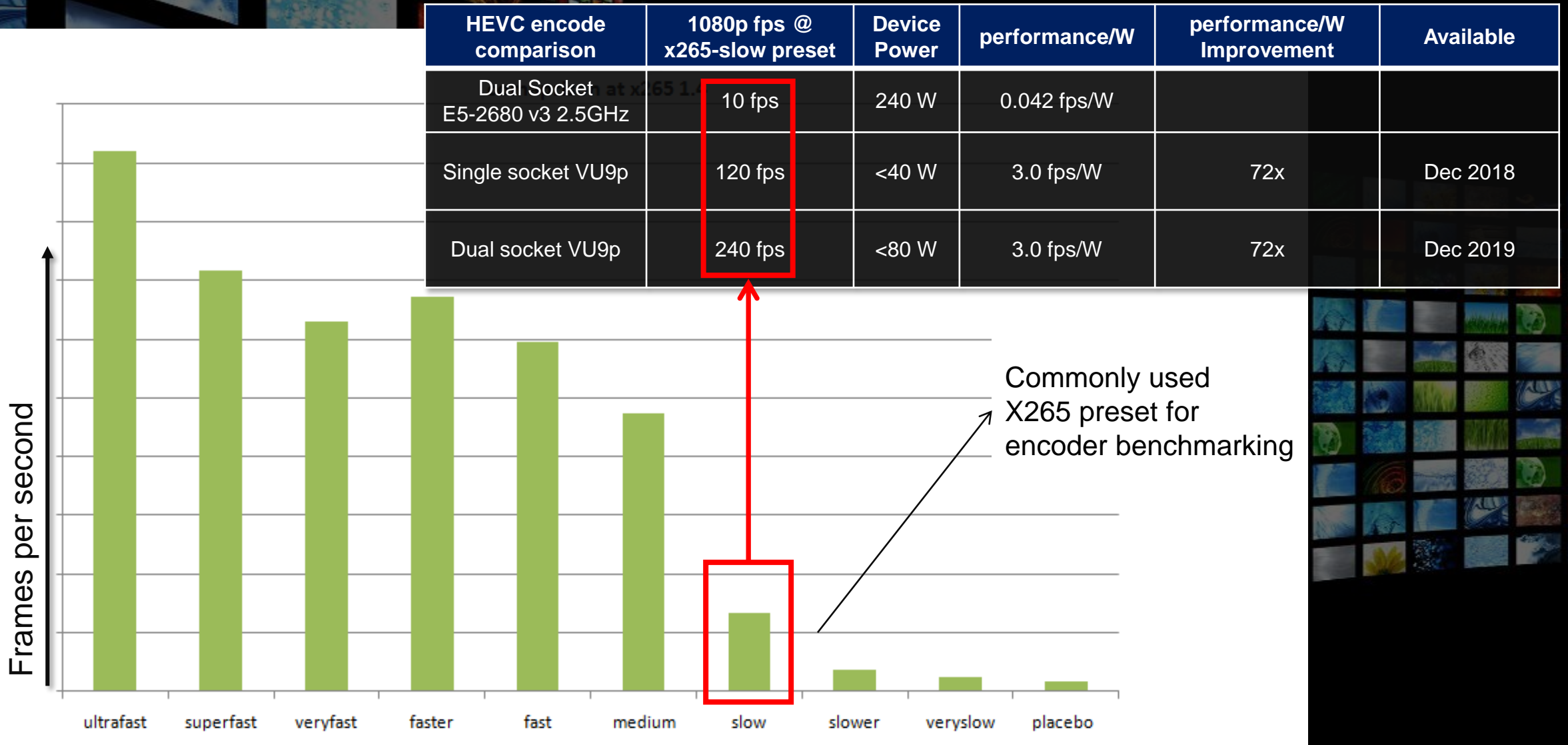


- > Johan Janssen
- > Chief Video Architect

What to Accelerate?



FPGA HEVC encode vs. x265 encoding configurations

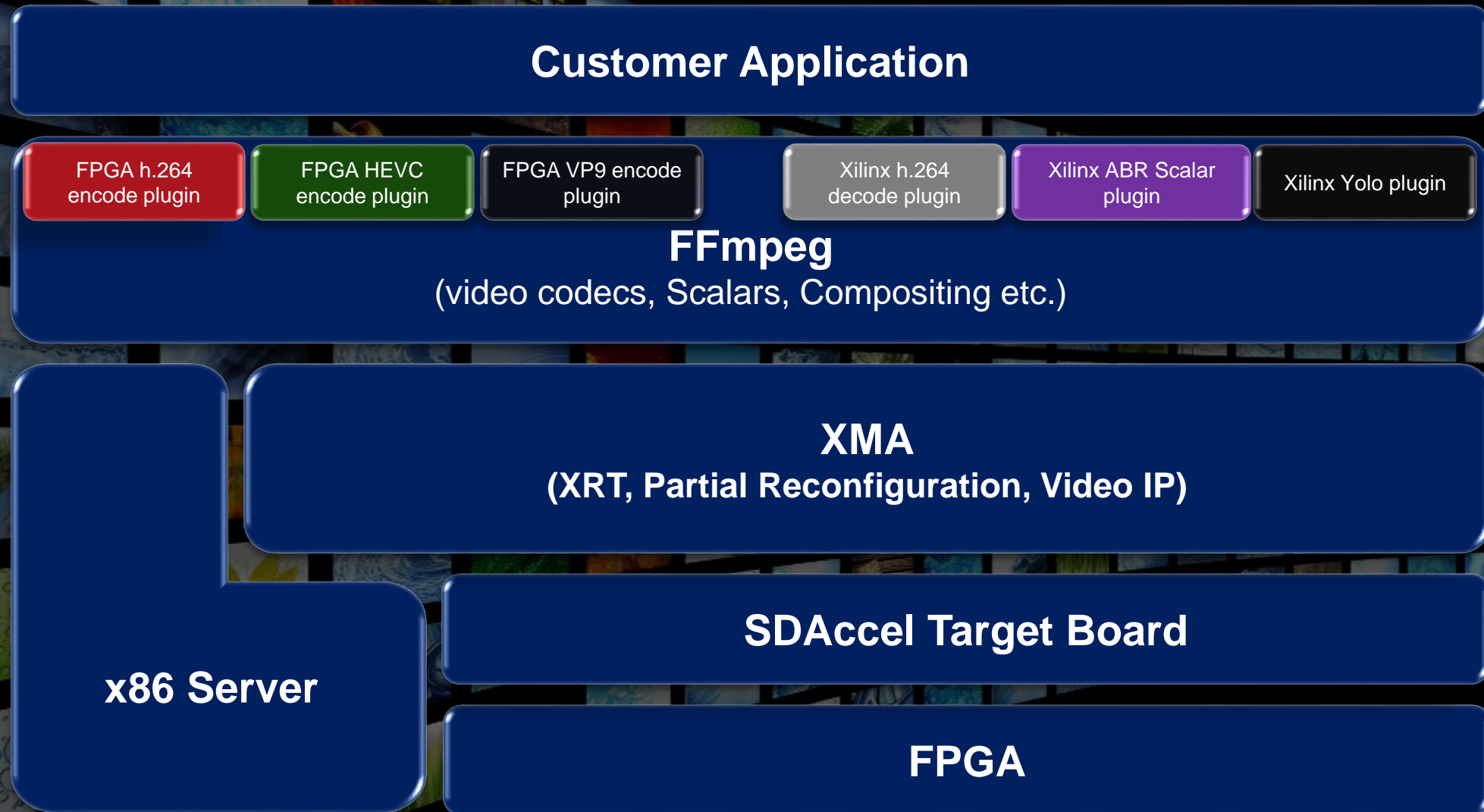


About FFmpeg

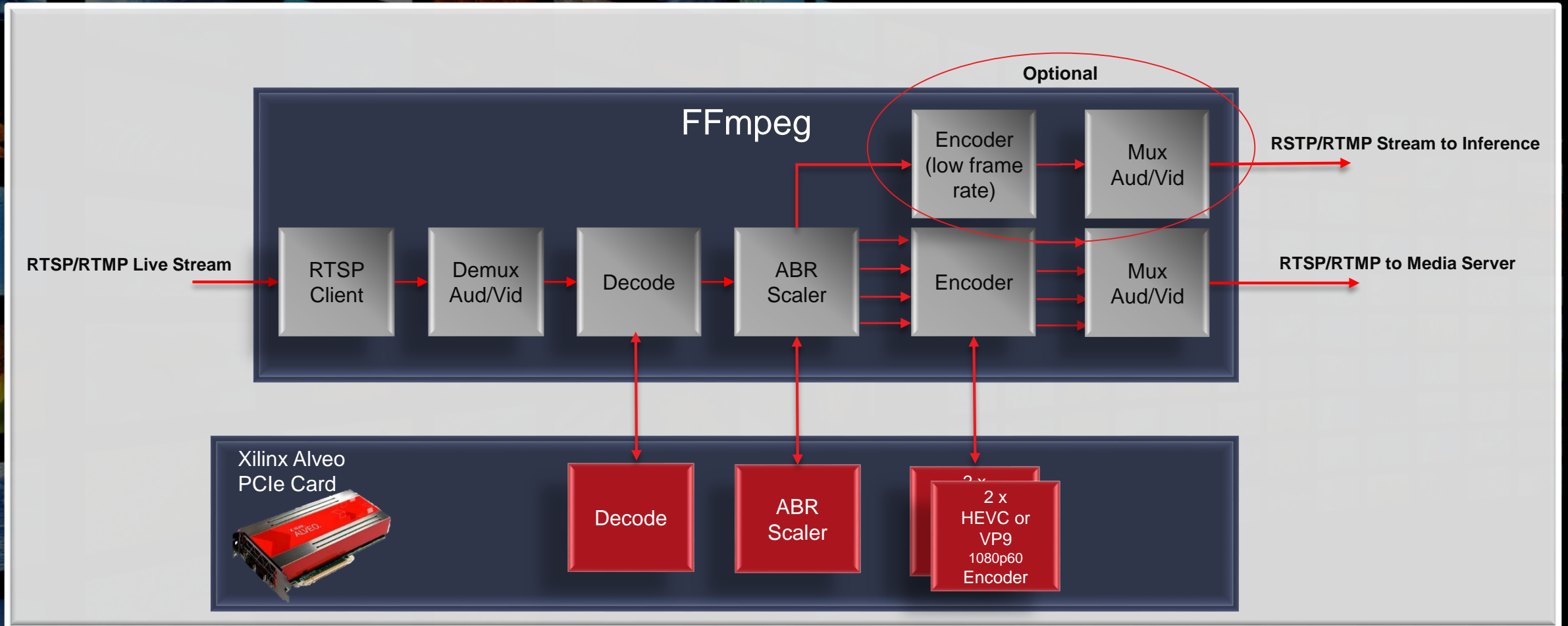
- > Source: <https://www.ffmpeg.org/about.html>
- > FFmpeg is the leading multimedia framework, able to decode, encode, transcode, mux, demux, stream, filter and play pretty much anything that humans and machines have created
 - >> It supports the most obscure ancient formats up to the cutting edge
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



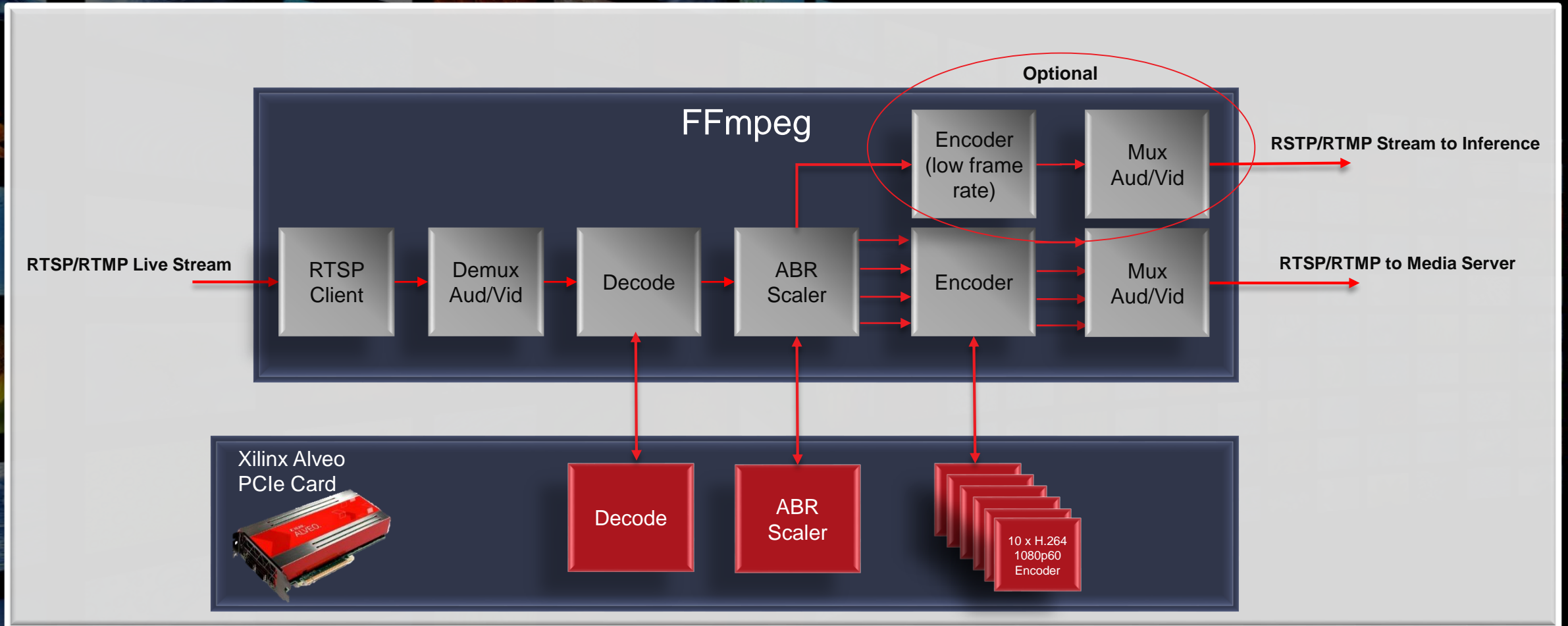
Integration into FFmpeg framework: building the ecosystem



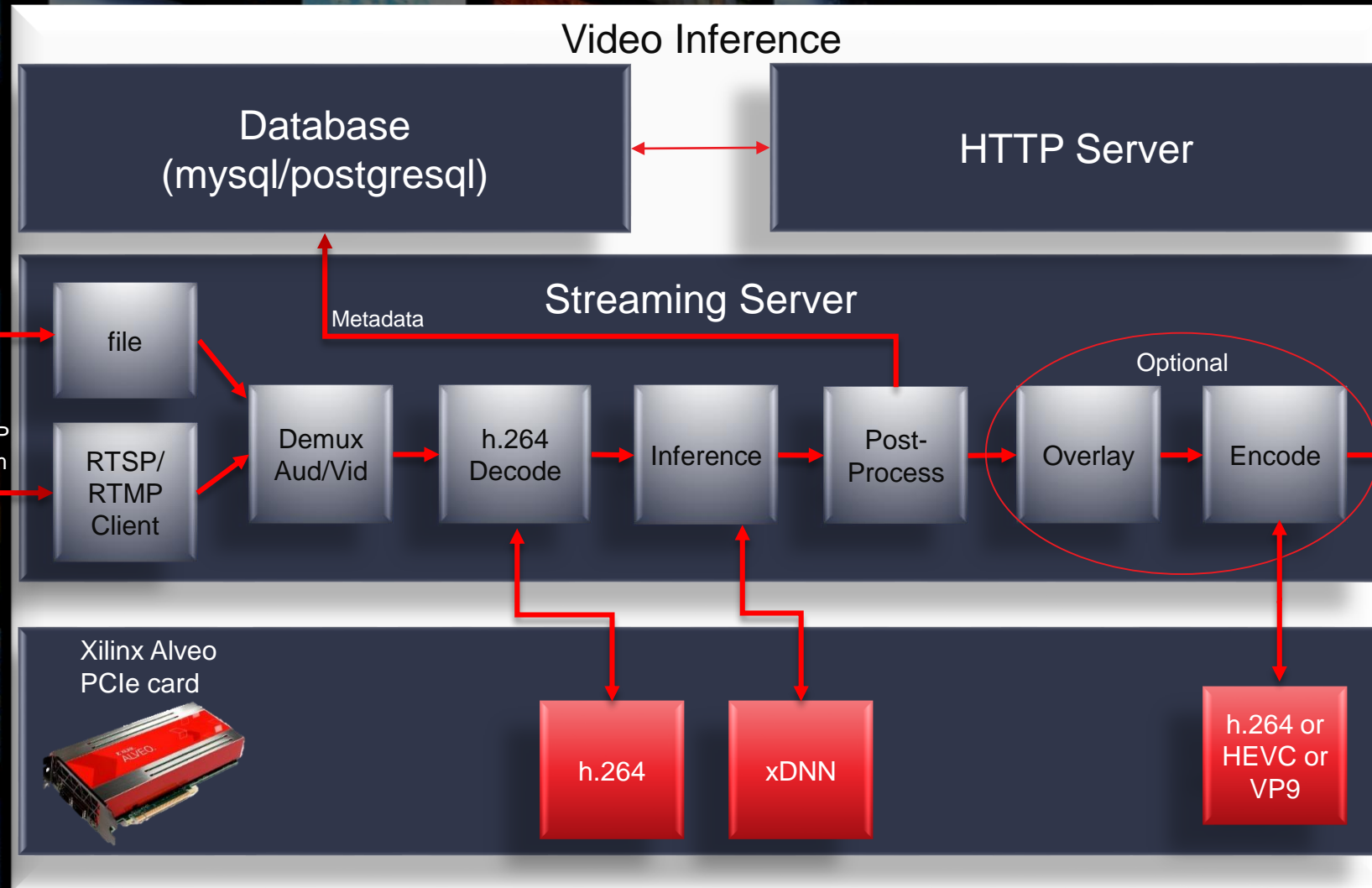
Video Transcoding ABR Example (Single VU9p)



Video Transcoding ABR Example (Single VU9p)



“Edge-to-Cloud Video Analytics”



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
```

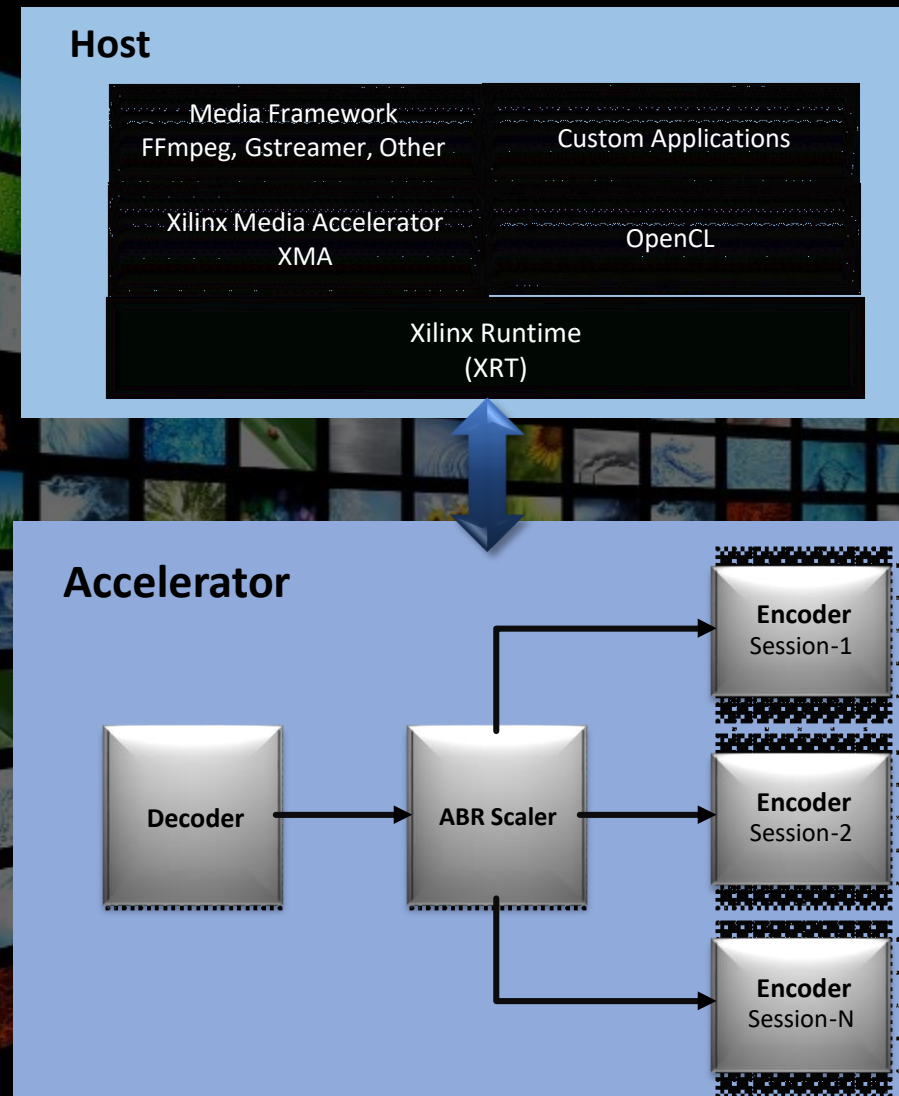
```
$ ffmpeg \  
-f rawvideo -pix_fmt yuv420p -s:v 1920x1080 -r 30 -an -i \  
/home/ffmpeg/VU9P/TestSequences/Kimono1_1920x1080_24.yuv \  
-frames 240 -b:v 4000k -g 30 -c:v xlnx_HEVC_enc -f h265 -y ./hw_outdir/out1_br4000k.h264
```

Change 20 characters to get acceleration

XMA Architecture

> Key features

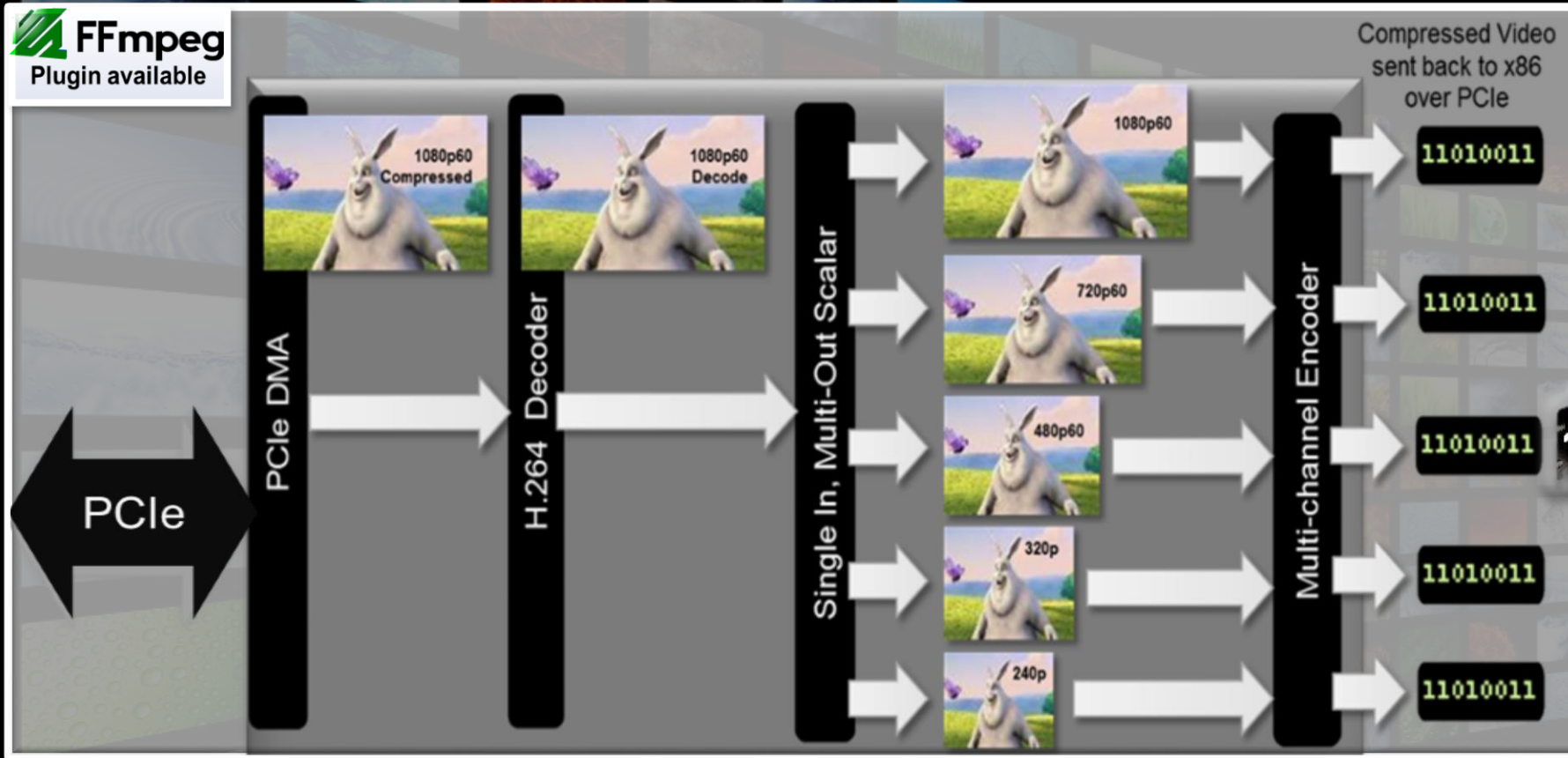
- >> Video domain specific interfaces with seamless integration with FFmpeg
- >> Low-level plugin can be reused with any media framework
- >> Supports multiple processes sharing different kernels on the same device
- >> Supports multiple channels on a single kernel
- >> Ensures a kernel resource is reserved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



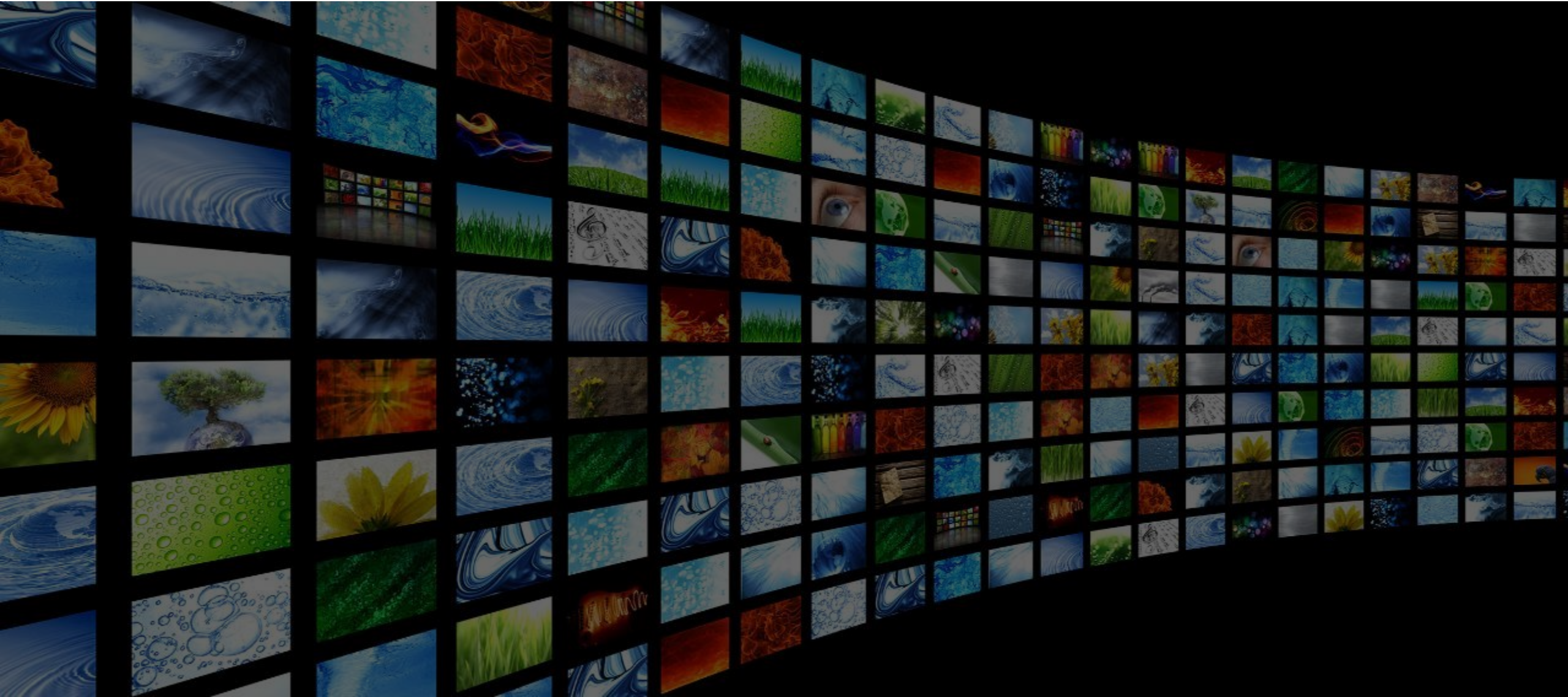
<https://www.xilinx.com/products/boards-and-kits/alveo/applications/.html>



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DEVELOPER
FORUM



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/ 3/4 Length	Power 225W Highest density per slot Ability to mix workloads Video + ML / AI	

2 x performance of single VU9P