Live Video Transcoding Launch

Aaron Behman
Director of Video Product Marketing,
Data Center Group
Live Video Streaming Sees Meteoric Growth
COVID-19 Will Drive Additional Demand

Global Live Video Streaming TAM ($B)

Source: https://mhojhosresearch.com/2020/05/01/global-virtual-event-market-is-growing-annually-by-22/

Twitch and YouTube Gaming have a larger audience than many entertainment platforms

Source: SuperData, Goldman Sachs Global Investment Research

Video is 90%+ of the network, the live component is BIG and the computationally INTENSE, this is Xilinx’s domain
30% Less Bandwidth Saves Millions of Dollars

<table>
<thead>
<tr>
<th>Encoded Bitrate</th>
<th>Data Per Mth. (TB) Per Stream</th>
<th>Cost Per Mth. ($0.05 per GB)</th>
<th>Monthly Cost @ 100K Streams</th>
<th>Annual Cost (100K Streams)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4Mbps</td>
<td>1.21</td>
<td>$60.48</td>
<td>$6,048,000</td>
<td>$72,576,000</td>
</tr>
<tr>
<td>2.8Mbps</td>
<td>0.85</td>
<td>$42.34</td>
<td>$4,234,000</td>
<td>$50,808,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Annual Savings</td>
<td>$21,768,000</td>
</tr>
</tbody>
</table>
“Bandwidth costs rose by 40% to $32.4 million during last QTR 2019. This was due to an increase in users and effort to improve video quality.”

No. 1 Game Live Streaming Platform in China
The Live Video Transcoding Problem

Volatile and Dynamic Composition
Small number of streams with large viewership demands higher VQ transcoding

Massive Volume
High volume of broadcasters with smaller number of viewers demands high density transcoding

Note: Twitch has publicly shared numbers that they deal 30,000 live broadcasters on average and stream to millions of viewers (circa 2015)

https://blog.twitch.tv/twitch-engineering-an-introduction-and-overview-a23917b71a25#.on6z0qngl
Introducing the Xilinx Real Time (RT) Server Reference Architecture - Transcoding Editions

Bitrate Optimized

High Channel Density
Application Focus

- Live Broadcast
- Telemedicine
- Distance Learning
- eSports / Live Gaming
- Live Streaming
- Social Video Networking
- Live Sports Broadcast
Xilinx Has A Solution For All Video Workloads

Cost per bit optimized

Xilinx: Two Pronged Strategy

Cost per channel optimized

Transcoding

Alveo U50
Bitrate Optimized

Minimize Cost/Stream (recurring cost)
Lower Gbps for Same Quality $/GB

OPEX

Alveo U30
High Channel Density

Overwhelming cost is buying enough accelerator cards to support 1000's of streams that need to be encoded.

$/Channel
CAPEX

eSports
Live Video

Safe City
Smart Retail

eSports
Live Video

OPEX

Lowest Bitrate
Video Quality

Reduce CAPEX
High Channel Count
U30 High Density PCIe Solution

- High density media processing & machine learning
  - Half Height / Half Length, Single Slot

- Supports:
  - 2 x 4kp60 simultaneous transcodes per card
  - 8 x 1080p60 simultaneous transcodes per card
  - 16 x 1080p30 simultaneous transcodes per card
  - 36 x 720p30 simultaneous transcodes per card

- Support for both H.264 & HEVC

- HDR and 10 bit support

- Ability to support ultra low latency encoder/decoder

- Low power full solution sub 40W

- Future support for Machine Learning and AI
Solution Delivery

Targeted Appliances

Validated Containers

HEVC (H.265)
- 1080p100
- Full ABR Ladder
- x265 Slow

AVC (H.264)
- 1080p120
- Full ABR Ladder
- x264 Very Slow

Deploy OnPrem or Cloud

Nimbix OnPrem

Deploy or Evaluate Now!

HEVC & AVC
- 16 1080p30 channels
- x264 Faster
- x265 Faster

Deploy or Evaluate Now!

Bitrate Optimized

High Density
Optimized Software Solution Stack

FPGA h.264 Encode Plugin
FPGA HEVC Encode Plugin
Xilinx h.264 Decode Plugin
Xilinx ABR Scaler Plugin

FFmpeg (Video Codecs, Scalers, Compositing, etc.)

Xilinx Media Acceleration API (XMA)
Xilinx Run-Time API (XRT)

Xilinx Accelerator Binary (XCLBIN)

Xilinx Alveo Accelerator Card

X86 Server
No FPGA Experience Needed!

```
ffmpeg \n-f rawvideo -pix_fmt yuv420p -s:v 1920x1080 -r 30 -an -i
/home/ffmpeg/VU9P/TestSequences/Kimono1_1920x1080_24.yuv \n-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 \n-f rawvideo -pix_fmt yuv420p -s:v 1920x1080 -r 30 -an -i
/home/ffmpeg/VU9P/TestSequences/Kimono1_1920x1080_24.yuv \n-frames 240 -b:v 4000k -g 30 -c:v xilinx_h264_enc-hq -f h264 -y ./hw_outdir/out0_br4000k.h264
```

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

As simple as changing 20 characters to get acceleration

https://trac.ffmpeg.org/wiki/EncodingForStreamingSites
Wowza Streaming Engine
Xilinx ISV Partner

- Web GUI solution to manage live streaming workloads
- Integrated into RT Server and VAR offerings*
- Enables a complete turnkey solution for live video streaming

* Integration planned for Q3 this year
# Alveo Live Transcoding Features

## Alveo U50: H.264 and/or HEVC
- 2x Full HD (1080p60) encoding (AVC/H.264)
- 2x Full HD (1080p100) encoding (HEVC/H.265)
- 32x Channels of sub-resolutions for ABR

VQ Equivalent to x264 very slow (H.264), x265 slow (HEVC)

12x Faster encoding speed than the comparable software-based x264/x265 on x86

8x Lower power vs software equivalent
8x Lower price vs software equivalent

Latency: High Quality – 1 Second; Balanced – 100ms; Ultra-Low Latency: Sub 25ms (same for U30)

## Alveo U30: H.264 and HEVC
- 2x 4KP60 Ultra-HD transcoding in real-time
- Subdivide resolutions to support up to 48 channels

VQ equivalent to x264, x265 Faster

Highest density and better compression efficiency over ASIC or GPU solutions

### FPGA Architecture Extends Product Life
- Future support for HDR, HDR to SDR and SDR to HDR
- Machine Learning and AI supported late 2020

Sub 40W power enables higher density per RU and effective for “Edge Solutions”

## Bitrate Optimized
Note: VQ measured in both objective and subjective tests
4KP30 also supported on the Alveo U200 card.

## Easy integration with

## High Channel Density

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TCOs & Value Proposition

- **Quality/Bitrate Optimized (U50)**
  - Highest Quality, real-time streaming
  - 30% bitrate reductions vs any real-time competitor
  - “Few sources with many viewers”

- **Density (U30)**
  - Equivalent to NVIDIA T4 on Quality
  - Higher Density
  - 20% the Power of a T4
  - “Many sources with few viewers”

<table>
<thead>
<tr>
<th>Device</th>
<th>H.264</th>
<th>HEVC</th>
</tr>
</thead>
<tbody>
<tr>
<td>NVIDIA T4</td>
<td>10 strm</td>
<td>4 strm</td>
</tr>
<tr>
<td>Xilinx U30 (2x ZU+)</td>
<td>16 strm</td>
<td>16 strm</td>
</tr>
</tbody>
</table>

(accessed 3 Jun 2020)
U50 Live Video Transcoding – 1080p120 HEVC

x265 Slow

5x Throughput Per Node
6x Lower Hardware Cost
3x Lower Power

5x HPE ProLiant DL380 Servers
10x Intel 8275CL 3.0GHz CPUs
‘Slow’ Quality HEVC
14x ABR @ 1080p30

One HPE ProLiant DL385 Server with Alveo U50
8x Alveo U50s, Dual AMD EPYC 7262
‘Slow’ Quality HEVC
14x ABR @ 1080p30

Alveo HEVC Supports Up To 60 FPS Ladder
U30 Live Video Transcoding – 1080p480 HEVC
NVENC “medium”

CAPEX Savings
- 4x Throughput Per Card
- 6x Lower Hardware Cost
- 5x Lower Power Cost

4 HPE ProLiant DL380 Servers
- 32x Nvidia T4 Accelerators, Dual Intel
- ‘medium’ Quality HEVC
- 64x ABR @ 1080p30
- 58W / Card

One Xilinx RT Server
- 8x Alveo U30 Accelerators, Dual Intel
- ‘Medium’ Quality HEVC
- 64x ABR @ 1080p30
- 35W / Card
## Where to Buy?

<table>
<thead>
<tr>
<th>VAR/OEM</th>
<th>Configuration</th>
<th>Market</th>
<th>Availability</th>
</tr>
</thead>
</table>
| Hewlett Packard  | ‣ ProLiant Gen 10+  
                      | ‣ DL380 / DL385  
                      | ‣ 8x Alveo U50s  | Worldwide           | Available Now!     |
| Wistron          | ‣ Transformer G2E  
                      | ‣ 8x Alveo U30s  | APAC               | Available Now!     |
| Hypertec         | ‣ Edge 2U Appliance – 7x U30s  
                      | ‣ 2U Appliance – 10x U30s  | Worldwide           | Summer 2020        |
| Boston           | ‣ Supermicro 1RU  
                      | ‣ 8x Alveo U30s  | EMEA               | Summer 2020        |
Introducing the Xilinx RT Server
Transcoding Editions

Evaluate the RT Server Today!
Thank You