Experience A Better World with Video

Ted Feng, VSD Cloud-IoT, Advantech
Thomas Lien, VSD Cloud-IoT, Advantech
- Market Trend
- VEGA Product Offering
- Successful Case Sharing
- Case Study
- Next Growth Engine
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82% Video Contents in Global IP Traffic
Trends in Internet Video Streaming

26% CAGR 2017–2022

Exabytes per Month

2017 2018 2019 2020 2021 2022

- Internet Video (55%, 71%)
- IP VOD/ Managed IP Video (20%, 11%)
- Web/Data (17%, 12%)
- File Sharing (7%, 2%)
- Gaming (1%, 4%)

* Figures (n) refer to 2017, 2022 traffic share
Source: Cisco VNI Global IP Traffic Forecast, 2017–2022
Consumers Want Bigger Screen & Higher Resolution

IHS Research says nearly all 50”+ TVs will be 4K by end of 2019

<table>
<thead>
<tr>
<th>Y/Y Unit Growth in Q2’19</th>
<th>Japan</th>
<th>North America</th>
<th>Western Europe</th>
<th>Eastern Europe</th>
<th>China</th>
<th>Asia Pacific</th>
<th>Latin America</th>
<th>Middle East &amp; Africa</th>
<th>WW</th>
</tr>
</thead>
<tbody>
<tr>
<td>10”-19”</td>
<td>↓ -19%</td>
<td>↓ -79%</td>
<td></td>
<td></td>
<td>↓ -42%</td>
<td>↓ -46%</td>
<td>↓ -67%</td>
<td>↓ -37%</td>
<td>↓ -38%</td>
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<tr>
<td>20”-29”</td>
<td>↑ 10%</td>
<td>↑ -43%</td>
<td>↓ -32%</td>
<td>↓ -30%</td>
<td>↓ -16%</td>
<td>↓ -4%</td>
<td>↓ -43%</td>
<td>↓ -8%</td>
<td>↓ -17%</td>
</tr>
<tr>
<td>30”-39”</td>
<td>↓ -7%</td>
<td>↑ -5%</td>
<td>↑ 4%</td>
<td>↓ 1%</td>
<td>↓ -25%</td>
<td>10%</td>
<td>↓ -25%</td>
<td>↓ -19%</td>
<td>↓ -9%</td>
</tr>
<tr>
<td>40”-44”</td>
<td>↓ -10%</td>
<td>↑ 29%</td>
<td>↑ 2%</td>
<td>↑ 6%</td>
<td>↓ -19%</td>
<td>4%</td>
<td>4%</td>
<td>↑ 7%</td>
<td>↑ 2%</td>
</tr>
<tr>
<td>45”-49”</td>
<td>↑ 10%</td>
<td>↓ -36%</td>
<td>↓ -44%</td>
<td>↓ -37%</td>
<td>↓ -58%</td>
<td>↓ -23%</td>
<td>↓ -56%</td>
<td>↓ -6%</td>
<td>↓ -42%</td>
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<td>50”-54”</td>
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<td>↑ 48%</td>
<td>↑ 46%</td>
<td>↑ 89%</td>
<td>↑ 35%</td>
<td>↑ 83%</td>
<td>↑ 86%</td>
<td>↓ -3%</td>
<td>51%</td>
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<tr>
<td>55”-59”</td>
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<td>↑ 20%</td>
<td>↓ -10%</td>
<td>↓ -6%</td>
<td>4%</td>
<td>8%</td>
<td>4%</td>
<td>↓ -8%</td>
<td>13%</td>
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<tr>
<td>60”-64”</td>
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<td>↓ -34%</td>
<td>↑ 13%</td>
<td>↑ 46%</td>
<td>↓ -36%</td>
<td>↓ -18%</td>
<td>49%</td>
<td>↓ 45%</td>
<td>↓ -22%</td>
</tr>
<tr>
<td>65”-69”</td>
<td>↑ 44%</td>
<td>↑ 52%</td>
<td>↑ 13%</td>
<td>↑ 26%</td>
<td>32%</td>
<td>24%</td>
<td>47%</td>
<td>42%</td>
<td>35%</td>
</tr>
<tr>
<td>70”-74”</td>
<td>↓ -52%</td>
<td>↓ -1%</td>
<td>↑ 50%</td>
<td>↑ 688%</td>
<td>67%</td>
<td>8%</td>
<td>-2%</td>
<td>46%</td>
<td>28%</td>
</tr>
<tr>
<td>75”-79”</td>
<td>↑ 50%</td>
<td>↑ 68%</td>
<td>↓ -2%</td>
<td>↑ 13%</td>
<td>238%</td>
<td>91%</td>
<td>59%</td>
<td>58%</td>
<td>71%</td>
</tr>
<tr>
<td>80”+</td>
<td>↑ 305%</td>
<td>↑ 135%</td>
<td>↑ 77%</td>
<td>↑ 109%</td>
<td>68%</td>
<td>112%</td>
<td>11%</td>
<td>101%</td>
<td>107%</td>
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<tr>
<td>Total</td>
<td>↓ 0%</td>
<td>↓ 14%</td>
<td>↓ -4%</td>
<td>↓ 0%</td>
<td>↓ -8%</td>
<td>6%</td>
<td>↓ -11%</td>
<td>↓ -5%</td>
<td>↓ -1%</td>
</tr>
</tbody>
</table>
AV Over IP Market Forecast

The Demand of Low Latency Video Transmission Increased in Many Vertical Market

AV Over IP Vertical Port Forecast – 2015-2023 – K Units – Shipments to Low-Latency Pro AV Applications

2018-2022 CAGR: 31.1%
AVoIP Forecast in Healthcare Industry
Video Distribution in Operation Room Drives the Future Growth of AVoIP

The healthcare industry is a niche, but rapidly growing, opportunity for AVoIP solutions. This industry is difficult for brands to enter, as sales here are solution-based, requiring requisite healthcare experience in which AVoIP is seen as just one aspect of the entire solution.

The healthcare market has stringent requirements for video distribution; this is particularly true for video distribution connecting operating theatres (a driver of significant future growth in the segment), which is considered mission critical. As such, there are high demands for quality, resolution, and latency here, with less emphasis placed on price. 10G solutions are being rapidly adopted in the segment, driven by specialist providers.
- Market Trend
- VEGA Product Offering
- Successful Case Sharing
- Case Study
- Next Growth Engine
Standard Product Portfolios in VSD
(VEGA Family Accelerates IP based Media Workflow)
Core Competence Possessed in VSD (Innovation & Differentiation in addition to Software/Hardware)

Most Advanced Codec support
H.264, H.265, AV1, VP9 From the most universally adopted to the most advanced

Future proof
From FHD, 4K to 8K with scalability & product offerings support resolution as high as 8K

Value-added Options
Chipset (ASIC): Socionext, Ambarella
FPGA: Xilinx, GPU: NVIDIA
* Advantech have dedicated FPGA team to support the development based on customer’s request

Customization
Flexible business model with customized experience for Tier1 customers
VSD Core Technology & Applications

**AMBALELLA**
H1/H2

**SOCIONEXT**
M30/M31

**XILINX MPSoC**
SoC + FPGA

**XILINX**
FPGA

**NVIDIA**
Jetson

Portable Encoders

4K / 8K Contribution Encoders

Medical Image Solutions

Data Center Acceleration

Video Analytics
Video Infrastructure Served by VEGA Portfolio

Low-Latency Live Video Creation, Production & Distribution

Live Event

- VEGA-2000
- VEGA-6300
- SDI
- 4G/LTE
- WiFi
- 5G

IP Studio

- MOBILE
- SATELLITE
- CABLE/OTT
- 1080p FHD
- 1080p/4K
- FHD/UHD
- 4K/8K
- UHD1/2

Video Cloud

- VEGA-4000
- VEGA-7000
- VEGA-3300

AdvanTech
Facilitate Video Streaming at Field
VEGA Encoders: Compact, Low Power, Compression Efficiency

News Gathering
Live Event Streaming
Medical Video Processing
Live Conferencing
VEGA Solution for Medical Video Application
Video Streaming throughout the Hospital and Minimally Invasive Diagnostics

<table>
<thead>
<tr>
<th>VEGA-6301M</th>
<th>VEGA-8300</th>
<th>VEGA-3312</th>
<th>VEGA-2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>4K/3D Live Streaming and Recording System</td>
<td>8K Live Streaming and Recording System</td>
<td>Dual Channel 4K Video Processing Card</td>
<td>HD/4K Live Encode &amp; Streaming Module</td>
</tr>
<tr>
<td>All-in-one compact 4K video capture, encode, record and live streaming appliance, ideal for use in equipment racks</td>
<td>8K video recording and live streaming over Wi-Fi/LAN using industry-leading 8K HEVC encoder</td>
<td>High performance 4K video encoding add-in PCI Express accelerator card for medical appliances and servers</td>
<td>High quality low latency live video capture, encode, and streaming in a tiny package</td>
</tr>
</tbody>
</table>

Ultra-High Definition
Highest 4K 4:2:2 10-bit HDR video processing to ensure every detail with sharper imagery

Ultra-Low Latency
Uncompressed or lossless compressed real-time IP video transport based on medical standards

Easy to Integrate
Efficient acceleration technology that can be integrated into compact medical devices

Ready for The Intelligent Future
3D, 8K and AI technologies available for next generation ultra-high presence solutions

Minimally Invasive Diagnostics and Telemedicine
Surgical Video Capture, Streaming & Recording
Live Video Sharing Throughout the Hospital

ADVANTECH
Versatile Video Features in One Box
VEGA Encoder Module Strengths

- **Multi Video I/O Interfaces**
  12G-SDI, 3G-SDI, HDMI, Display Port, …

- **Multi Streaming Protocols**
  RTMP, RTP, RTSP, HLS, TS, ST-2110, ST-2022, Zixi, Open-SRT, …

- **Multi Video Formats**
  8K, 4K UHD, FHD, SD, H.264, H.265, JPEG, VP8, VP9, …

- **Multi Software Features**
  WEB-GUI, RESTful API, LTE/WIFI Transport, 3D, Multi-Stream, …
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VEGA-2000 Video Encoder Use Case
1080p Wireless Video Streaming over LTE for News Gathering

100+ Cameras & Video Modules

Taiwan Presidential Election

Camera → SDI → VEGA Video Module → USB → 4G Dongle → LTE → Rx System
VEGA-2001 Empowers Live AR/VR over SoftBank 5G

5Gを活用したVR/AR観戦や自由視点視聴など未来のスポーツ観戦体験を提供

Contribution Encoder with VEGA-2001

「バスケットボール日本代表国際試合International Basketball Games 2019」で5Gプレサービスを提供
Taiwan Pro-Baseball League 4K Live TV
VEGA 7000/3311/MediaFlow Deploy to WINTV 2018

VEGA-7000
Video Server

VEGA-3311
4K Video Encoder

MediaFlow
Web-based Video Streaming
Incendium: VEGA2000 Capture & encode usage case for emergency news gathering
Intuitive Surgical Da Vinci Vision Cart Solution
Training Recorder & Operation Room Video Processing & Recorder

- Compact All-in-One system
- 4K & 3D video handling
- API/SDK to easy Integrate with DICOM System
- Upgradable to support ST2110

VEGA-6301M
4K & 3D Medical Video Encoder

VEGA SDK
Linux / Windows
VEGA-6301 Frame Wrapper – Multiple Video Record
Stereo Video to SDI Port 1/2 and Single Video from HDMI

VEGA-6301 – 4K HEVC Encoder
Pack Two Video for Record

Operation Room Video to HDMI
Stereo Surgical Video to SDI

Left Eye on SDI 1
Right Eye on SDI 2
OR Video on HDMI
Carl ZEISS 3D Medical Video Capture and Record
Stereo Video Source Record

VEGA-2002
4K Video Encode & Streamer
- Market Trend
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- Case Study
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VEGA-3310 Series Accelerates Cloud Encoding
Video Server Application Ready-To-Go

- Socionext MB86M30 embedded
- PCIe Adapter
- Support Encoding / Decoding / Transcoding

VEGA-3310/11
VEGA-3318
Deliver 512 Video Channels in Real Time
VEGA-3318 Cloud Transcoding Solution

- VEGA-3318 4K H264/H265 PCIe Accelerator
- 512 Full HD Video Streams per Intel Xeon + 4 * VEGA-3318
- 64 Watts per VEGA-3318
- cf. S/W Transcoder → 32 Full HD per Intel Xeon Server

VEGA-3318s Transcoding Farm

- RTP
- RTMP
- H.264
- H.265

Live Gaming

Intel Xeon Server

CDN
VEGA-3318 Cloud Transcoding Solution
Single Inbound / Multi-Formats Outbound Streams

HW Codec Formats:
Decoding: MP2/AVC/HEVC
Encoding: AVC/HEVC

<table>
<thead>
<tr>
<th>Input</th>
<th>Decoding (&lt;160Mbit total)</th>
<th>Scaling</th>
<th>Encoding</th>
<th>Outputs (N*M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4K</td>
<td>1 ch (AVC or HEVC only)</td>
<td>Up to 4 outputs</td>
<td>1-ch 4K or &gt;1080p</td>
<td>Max 20 per chip</td>
</tr>
<tr>
<td>M * 1080p60</td>
<td>M = up to 4 ch</td>
<td>1:N per input</td>
<td>4 x [1080p65 equiv]</td>
<td>Max 20 per chip</td>
</tr>
<tr>
<td>M * 720p</td>
<td>M = up to 8 ch</td>
<td>1:N per input</td>
<td>4 x [1080p65 equiv]</td>
<td>Max 20 per chip</td>
</tr>
</tbody>
</table>
Medical 4K Recorder Solution Ready Platform
Software Application Ready-To-Go

VEGA-3311
4K Video Encoder

SDD 4K OPELIO
Medical Video Recorder & Management System
Advanced Driver Assistance Systems (ADAS)
VEGA-2000 Series offer G2G Ultra Low Latency in 60ms Over 5G Network

Unmanned Car in Fukuoka (福岡)
VEGA-2002 encode the live video in 4K resolution and transmit to Tokyo where Thomas located and drove the car from.

VEGA-2002
4K Video Encode & Streamer
Railway Inspection by VEGA Video & AI Products
The Proven Solution Installed on JR Train -- VEGA-7000 + VEGA-3311 + VEGA SDK

- Total 8x 4K high speed camera capturing the power cable line and railway platform
- 2x VEGA-7000 & 8x VEGA-3311 installed in one train
- Record the outside environment and streaming to remote cloud for analytic
- AI platform now leverage the nVidia GPU AI platform

VEGA-7000 Video Server
VEGA-3311 4K Video Encoder
VEGA SDK Video Capture / Processing
VEGA-6304 Brings 8K over 5G Network

French Open Tennis Game 2019 via 5G network

- Compact 8Kp60 H.265 Encoder Appliance.
- Live video and audio ingress via 4 x SDI-12G inputs with 22.2ch audio capture.
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VEGA-4000 Reconfigurable FPGA Video Encoding
(Single Hardware w/ Multiple Futureproof Codec Options)

- VP9: Bandwidth-Save Video Codec
- AVC: High-Quality Video Codec
- AV1: Bandwidth-Save Video Codec
- Vyusync: High-Density Video Codec
25,000 Images Classified per Second on VEGA-4001

Highest Image Classification Rate on a Single PCIe Card

Caffe + Mipsology

Chart showing classification rates for CaffeNet, ResNet50, and InceptionV3 on different hardware configurations.
FPGA & ASIC Alternative to CPU/GPU
Increased Adoption for Machine Learning Inferencing Applications

Hitting the accelerator: the next generation of machine-learning chips

Deloitte Global predicts that

Annual sales of Machine Learning chips in global data centers:

2016: 100k-200k

2018: 800k

At least 25% of these chips

EASIER, CHEAPER & FASTER
These chips will increase the use of ML

FPGAs
Field Programmable Gate Arrays

ASICs
Application Specific Integrated Circuits
VEGA-4001 outperforms nVIDIA V100 at SC18**
25000 ips vs. 14000 ips

** Demonstrated on Mipsology booth at SuperComputing 2018 show
VEGA AVoIP Product to Different Vertical Market

Market forecast to reach 363K units in 2019
+42% YoY Growth in Volumes
30% CAGR between 2019 to 2023
Shipments to reach 1041K by 2023

AVoIP Currently Sits On The Verge Of The Early Majority Stage In The Adoption Lifecycle
Co-Creating the Future of the IoT World