Exploring AV over IP & Software Defined Video over Ethernet (SDVoE)

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Control moved to Ethernet two decades ago
Audio has moved to Ethernet (quickly!) in the last 5 years
Video over Ethernet transition well underway
- Ethernet bandwidth now exceeds requirements for mass market video formats
- Now possible to deliver video across Ethernet with zero latency
- 25G, 40G, 100G on the way to support 8K and beyond

10Gbe ports cost down from $1,200 in 2007 to below $100
- 48 port Ethernet switch has flexible I/O (copper and fiber) and fits in 1 RU

Software based platforms enable new levels of innovation and creativity

Pro AV is a hold out in the video world
- 1Gbe solutions emerging which trade off quality and latency for bandwidth
- 10GbE required to support 4K without compromise and offer true AV/IT convergence
## Comparison of Pro AV & Broadcast

<table>
<thead>
<tr>
<th>Broadcast</th>
<th>Pro AV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standards driven (e.g. SMPTE, ITU, AES)</td>
<td>Proprietary, de facto standards, not strictly adhered to</td>
</tr>
<tr>
<td>Fixed video formats (e.g. 720p, 1080i, 2160p)</td>
<td>Wild west! From VGA to 8K and everything in between</td>
</tr>
<tr>
<td>Fixed audio formats, typically AES @ 48 kHz</td>
<td>Intercom quality analog, SPDIF, mono, stereo, all flavors of surround (5.1 to Atmos)</td>
</tr>
<tr>
<td>Secure environments with closed networks not requiring content protection</td>
<td>HDCP mandatory but not always interoperable</td>
</tr>
<tr>
<td>Expert installers and system integrators</td>
<td>Expert installers and system integrators (primarily in the high end installer market)</td>
</tr>
<tr>
<td>Expert, trained users</td>
<td>Untrained masses</td>
</tr>
<tr>
<td>Equipment typically only used by broadcasters, film and television production, local TV stations</td>
<td>Equipment used in corporate, education, medical, government and military, leisure and hospitality, retail, residential</td>
</tr>
<tr>
<td>Vendor to vendor interoperability assumed</td>
<td>Interoperability only guaranteed with same vendor</td>
</tr>
</tbody>
</table>
AptoVision Introduction

- Audio-video (AV) processing chipset company
  - Disruptive technology for multi-billion $ AV signal distribution market
  - Leverage 10G IP technology to replace custom AV networks
- BlueRiver software defined platform applicable to broad range of product designs and Pro AV applications
- Only alternative to commoditized HDBaseT technology
- Deployed globally
  - USA, Canada, Japan, Taiwan, China, Australia, UK, EU
- Award winning technology for AV signal distribution
  - 2015 through to 2017 over 19 industry awards
- June 29th, 2017 – acquired by Semtech
  - Market leader for high performance semiconductors
BlueRiver Pro AV Applications

Multi-View Application
(Multiple Videos on One Display)

Matrix Switching Application
(Any Video to Any Display)

10GbE Switch

Video-Wall Application
(One Video Across Multiple Displays)
BlueRiver Products

- **BlueRiver NT1000**
  - Switching on COTS Ethernet
  - 4K/60 4:4:4, HDR up to 12-bit
  - Fiber or copper

- **BlueRiver NT2000**
  - NT1000 plus AV processor

- **BlueRiver API**
  - Software layer to manage and control systems of endpoints

- Systems may use a mix of NT2000 and NT1000 with common API control

<table>
<thead>
<tr>
<th></th>
<th>NT1000</th>
<th>NT2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>4K Support</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4K/60 8-bit 4:4:4</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>4K/60 10-bit 4:2:2</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>4K/60 12-bit 4:2:0 (HDR)</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Transport Medium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copper (10GBaseT)</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Multi-mode Fiber (SFP+)</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Single-mode Fiber (SFP+)</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>AV Processing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Custom scaling to display</td>
<td>✗</td>
<td>✔</td>
</tr>
<tr>
<td>Single-frame switching</td>
<td>✗</td>
<td>✔</td>
</tr>
<tr>
<td>Video wall</td>
<td>✗</td>
<td>✔</td>
</tr>
<tr>
<td>Multiview compositing</td>
<td>✗</td>
<td>✔</td>
</tr>
<tr>
<td>Audio downmixing</td>
<td>✗</td>
<td>✔</td>
</tr>
</tbody>
</table>

* Supported by combinations of NT1000 and NT2000
NT2000 includes the BlueRiver AV Processor
NT1000 does not include the BlueRiver AV Processor, only the 4K/60 CODEC.
BlueRiver Control Server

- BlueRiver Control Server manages BlueRiver devices and functions as proxy for GUI clients controlling BlueRiver devices
- Also, realization of BlueRiver API and abstraction layer between BlueRiver endpoint devices and Control Software
  - Abstracts control software from hardware implementation details and changes
  - Protects control software from changes to BlueRiver device protocol
  - Hides network complexities, including lower level network protocols (IGMP, ARP, etc.) from control software
- Provided as an executable binary (Windows, Linux x86, ARM, Mac OS)
BlueRiver Control Server

- BlueRiver Control Server can communicate with BlueRiver devices via a 10G or 1G network switch port, or through local BlueRiver device 1G port
- Client commands are single line text commands issued via TELNET
- All BlueRiver Control Server API command returns and event notifications are in JSON formats
- All client processes communicating with the BlueRiver Control Server must embed a TELNET Client and JSON Parser.
Network Switch & Message Types

- 10 GbE Layer 3 network switch with Multicast and IGMP v2 protocol required
- BlueRiver devices use Broadcast, Multicast and Unicast message types
- **Broadcast**
  - Broadcast addressing used to send ‘Hello’ packets (used for device discovery)
  - RS-232 and Infrared (IR) data also sent to all devices using broadcast
- **Multicast**
  - Multicast primarily used for audio and video transport
    - Transmitter devices send to multicast addresses
    - Receiver devices subscribe to multicast addresses
    - BlueRiver Control Server automatically assigns Multicast addresses to Transmitter devices (can be optionally managed via client application)
  - Multicast also used for RS-232 routing to all Receivers or all Transmitters
- **Unicast**
  - Unicast used to route RS-232 and IR between BlueRiver endpoints, and control messages between the BlueRiver Control Server and endpoints
Video Routing & Modes

- **Genlock mode**
  - Minimum latency mode (<120us)
  - Receiver output time locked to source
  - Typically used for matrix switch replacement application

- **Fast Switch mode**
  - Allows resolution scaling and/or frame rate conversion
  - Receiver output timing constant so display never needs to re-sync (clean switch)
  - Frame buffer required so latency of 1~2 frames

- **Genlock Scaling mode**
  - Combines low latency (no frame buffer) and source locking with output scaling
  - Supports format conversion *without* frame rate conversion
Video Routing & Modes

- **Video Wall mode**
  - Allows single video source to be stretched across multiple displays
  - Each receiver crops and scales region of interest according to its position in the wall matrix
  - Receivers are all locked to the source and thus to one another
    - Deterministic latency (1 frame)
    - No fast switching or frame rate conversion
Video Routing & Modes

- Multiview mode
  - Routes multiple independent sources from transmitters to a single receiver, who then composites them into a single output
  - Sources can have different resolutions and frame rates
  - Multiview adjusts and scales various source signals, placing them in a predefined layout of specific dimension, then composites the scene and generates a video signal of specified resolution and frame rate
Compression CODEC

- The BlueRiver platform makes use of a lightweight compression scheme when the original video source exceeds the available 10G network bandwidth
- Approximately 1.4:1 compression allows 4K to be distributed while maintaining high quality and low latency
- Artifact free, no chroma sub-sampling, no horizontal or vertical pre-filtering
- Video compression is applied to the following 4K video profiles:
  - 4K60 8-bit RGB and YCbCr 4:4:4
  - 4K60 10-bit YCbCr 4:2:2
  - 4K60 12-bit YCbCr 4:2:2
  - 4K60 12-bit YCbCr 4:2:0
  - 4K30 12-bit RGB and YCbCr 4:4:4
SDVoE Alliance

- Software Defined Video over Ethernet Alliance

- Mission statement
  - The SDVoE Alliance is a non-profit consortium of technology providers collaborating to standardize the adoption of Ethernet to transport AV signals, and to create a platform allowing software to define AV applications
SDVoE Alliance Goals

- Drive standardization in the video distribution and AV signal management space
- Leverage Ethernet to displace point-to-point extension as the market leading technology
- Market, promote, train, and educate the industry in order to drive this transition
SDVoE Technology

- Full stack solution for AV over IP applications
- Addresses all layers of the network stack, from infrastructure to applications
- The most widely adopted networked AV standard, SDVoE delivers AV with zero latency over Ethernet networks
- The SDVoE API is the interface to enable creative applications not yet conceived
Interoperability & Open API

- The SDVoE API is a standard interface to control switching, configuration and processing
- This API creates a platform that allows solutions providers to deliver applications efficiently
- Software vendors are part of an ecosystem
29 Members Accelerating Growth

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NETGEAR
SEMTECH
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Zy ZeeVee