CoaXPress標準化に向けて

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日本インダストリアルイメージング協会
次世代IF分科会CoaX Press TFリーダ
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CoaXPress is a revolutionary new digital interface technology -

- Single coax cable
- High speed
- Long length
- Power and Control
From Analog Coax (1950)

Digital Camera Link (2000)
From Camera Link (2000) to Coax again! (2009)
CoaXPressの接続

- Image data
- Control
- Communication
- Triggering
- Power (13W)

All on one coaxial cable!
### CoaXPressのバージョン

<table>
<thead>
<tr>
<th>CoaX Press version</th>
<th>Camera Link equivalent</th>
<th>Capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base</td>
<td>Base</td>
<td>3.125 Gbps</td>
</tr>
<tr>
<td>Full</td>
<td>Base, Medium, Full</td>
<td>6.25 Gbps</td>
</tr>
<tr>
<td>Dual Full (2 cables)</td>
<td></td>
<td>12.5 Gbps</td>
</tr>
<tr>
<td>Quad Full (4 cables)</td>
<td></td>
<td>25 Gbps</td>
</tr>
<tr>
<td>N cables</td>
<td></td>
<td>N * 6.25 Gbps</td>
</tr>
</tbody>
</table>

N * 6.25 Gbps 40 meters
CoaXPressの特長

- Digital video, control, communication, triggering and power over one cable
- Coax ease of use, flexibility and reliability
- Camera Link timing accuracy
- Camera Link speed and higher
- GigE cable length
- Support of legacy coax cables (analog systems)
- Plug and Play
CoaXPressの標準化に向けて

- Goal of Consortium was to make first version of the specification and then transfer for standardization
  - In order to be successful CoaXPress needs to be a World Wide standard!

- Japan Industrial Imaging Association (JIIA) will host CoaXPress standardization
  - AIA and EMVA are invited to adopt through G3 agreement

- Formal transfer to JIIA during ITE show in Yokohama (Early December 2009)
CoaXPressの詳細

- EqcoLogic EQCO62X20 chipset in standard CMOS
- EQCO62T20 = High speed cable driver with integrated low speed receiver
- EQCO62R20 = High speed receiver with integrated low speed driver
- Video data, camera control and power over single coaxial cable
- Low voltage (1.2V), low power (<70 mW) operation
High Speed channel

- 1.25Gb/s up to 6.25Gb/s from camera to frame grabber
- Differential input/output to FPGA in camera/frame grabber
- 8B/10B coded data
- EQCO62T20 = Coax line driver
- EQCO62R20 = Receiver with integrated auto-adaptive equalizer
ケーブル特性への対応

75Ω cable attenuation / 100m

- frequency (Hz)
- attenuation (dB)

- RG11 DCR=1.5Ω
- RG6 DCR= 3Ω
- RG59 DCR=5Ω
イコライザの動作

- Fully auto-adaptive operation for all types of 75Ω coax cables (RG6, RG11, RG59, …)
- Optimal compensation for both high and low frequency attenuation
- Very robust operation (temperature, transmit amplitude,…) compared to competitors
Low speed uplink

- 0-20Mbps uplink channel from frame grabber to camera
- Single ended interface to FPGA in camera/frame grabber
- High resolution trigger with accuracy up to 4ns
電源供給

- Power supply over coax cable from frame grabber to camera
- 24V, 13 Watts per cable
- Automatic detection of CoaXPress cameras
- Short circuit protection
- No need for power brick for camera
CoaXPress Protocol Highlights

- **Bitrate**
  - Base: 1.25 – 3.125 Gbps
  - Full: 1.25 – 6.25 Gbps
  - Through link aggregation: N x 6.25 Gbps

- **Data integrity**
  - Redundant coding
  - CRC32
  - Link test

- **Trigger**
  - Fixed latency of 3.4 µs, +/- 4 ns accuracy

- **Communication**
  - Down: 20 Mbps typical (at 5% of bandwidth at 3.125 Gbps)
  - Up: Maximum 20 Mbps (shared with trigger)

- **Plug & Play**
  - Auto bitrate, link setup, device detection, data packing format, bit depth, etc
Downlink Protocol

Defines the succeeding line data packets

- Header packet
  - framing: 0x01 (first)

- Line data packet
  - framing: 0x00 (intermediate)

- Line data packet
  - framing: 0x02 (last)

- Line data packets

- Line data packet
Uplink protocol

- TxD
  - (rising) 3x K28.4
  - 255
  - Cnt
  - Trig
  - 0

- RxD
  - 59 59 59
  - 59
  - 196 196 196
  - 0

- Trig
  - (rising) (falling)
  - 59
  - 196
  - 196
  - 196
## Comparison with Other Standards

<table>
<thead>
<tr>
<th></th>
<th>CoaXPress</th>
<th>Camera Link</th>
<th>GigE Vision</th>
<th>USB-3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Single Speed</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.125 Gbps</td>
<td>2 Gbps</td>
<td>1 Gbps</td>
<td>5 Gbps</td>
<td></td>
</tr>
<tr>
<td>6.25 Gbps</td>
<td>(Base, 1 cable)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Max Speed</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N x 6.25 Gbps</td>
<td>6 Gbps</td>
<td>1 Gbps</td>
<td>5 Gbps</td>
<td></td>
</tr>
<tr>
<td>(N cables)</td>
<td>(Full, 2 cables)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td><strong>Complexity</strong></td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td><strong>Cabling</strong></td>
<td>Coax</td>
<td>Custom multi-core</td>
<td>Cat-6</td>
<td>Complex, mass produced</td>
</tr>
<tr>
<td><strong>Max Length</strong></td>
<td>100m / 50m</td>
<td>10m / 7m</td>
<td>100m</td>
<td>3m</td>
</tr>
<tr>
<td><strong>Data Integrity</strong></td>
<td>CRC</td>
<td>None</td>
<td>CRC / Resend</td>
<td>CRC</td>
</tr>
<tr>
<td><strong>Real Time Trigger</strong></td>
<td>Yes, +/- 4 ns</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
Cable solutions(1)

- A wide selection of Coaxial cables can be used, depending on requirements
  - Focus on long distance
  - Focus on flexibility
  - Focus on cable diameter
- Currently 2 cable vendors have been selected, Belden and Gepco
  - We will test using their cables (length, EMC/EMI etc)
  - Many other cable vendors will be added
- Consortium is also looking at multi-cable assemblies
## Cable solutions (2)

<table>
<thead>
<tr>
<th>Type</th>
<th>Diameter</th>
<th>Use</th>
<th>CoaXPress Max length at 3.125 Gbps</th>
<th>CoaXPress Max length at 6.25 Gbps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gepco VHD1100</td>
<td>10 mm</td>
<td>Long distance</td>
<td>155 m</td>
<td>60 m</td>
</tr>
<tr>
<td>Gepco VSD2001</td>
<td>7 mm</td>
<td>General (long)</td>
<td>110 m</td>
<td>40 m</td>
</tr>
<tr>
<td>Gepco VPM2000</td>
<td>6 mm</td>
<td>General</td>
<td>80 m</td>
<td>30 m</td>
</tr>
<tr>
<td>Gepco VHD2000M</td>
<td>6 mm</td>
<td>Flexible</td>
<td>55 m</td>
<td>20 m</td>
</tr>
<tr>
<td>Gepco VDM230</td>
<td>4 mm</td>
<td>Thin</td>
<td>50 m</td>
<td>20 m</td>
</tr>
</tbody>
</table>

Example of 5 cable solution
(CXP quad + extra trigger)
CoaXPress Products on the market

- First products on the Vision Show now
  - Cameras
  - CoaXPress to Camera Link converters
  - Frame Grabbers
  - Cable solutions
- Q1 first production shipments
- Later in 2010 products of many companies expected
- During ITE in Yokohama (December), Japanese partners will show first products
おわりに

ご静聴ありがとうございました。

ご質問をお受けいたします。
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