



Welcome to  
EVT 10GigE Training  
**2016**

# 10 GigE Cameras

Speed is everything.



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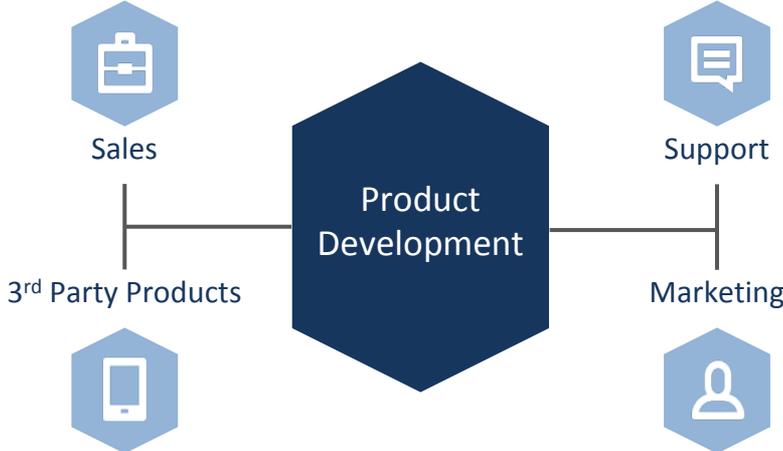
10 **Questions**

# Company Background



**Est. 2007, Vancouver Canada  
Engineering Services Company  
30+ years of Imaging  
Experience**

**Saw potential of  
10GigE**  
Next great Interface



# What is 10GigE?

10GigE (a.k.a. 10 Gigabit Ethernet) is the successor to GigE (1 Gigabit Ethernet) which is the leading interface for machine vision applications. 10GigE, as the successor, provides all the same benefits of GigE but with a ten-fold increase in data-rate which leads to a ten-fold increase in frame rate.

10GigE, as with GigE, is an **industry standard** which has been around for years and is managed/produced by the IEEE 802.3 working group. The standard is used in applications such as:

1. Telecom
2. Data Communications
3. Industrial
4. Military

And now we leverage the benefits of this globally accepted cross-industry technology for machine vision applications.



# What is 10GigE? (...continued)

- ❑ Maximum bandwidth available for 10GigE is 10Gbps or 1,250 Mbytes/s. Usable bandwidth is 9.5Gbps or 1,180 Mbytes/s
- ❑ 10GigE is 10x faster than GigE and 3x faster than USB 3.0
- ❑ Copper or Fiber cable options
  - (Copper up to 100M)
  - (Fiber up to 10KM)



# Why 10GigE?



1. Ultra High Data/Frame Rates
2. Flexible Cabling Options
3. Camera Network Support and Accurate multi-camera synchronization to sub 1 micro second
4. Option for multiple cameras on 1 card AND Multiple NIC Cards in one PC
5. No need for Fiber Converters or Frame Grabbers
6. Low CPU Overhead, Low Latency, and Low Jitter
7. Competitive cost/performance which will only get better as 10GigE is further adopted
8. Industry acceptance due to IEEE and AIA standardization
9. GigE Vision and Gen*i*cam Compliant



- ✓ 2MP (338fps), 4MP (179fps), 12MP (84fps) and 20MP (32fps)
- ✓ SFP+ Connection  
(Copper Direct Attach to 10M or Fiber via transceivers to 10KM)
- ✓ Multi camera synchronization to sub 1 microsecond
- ✓ GigE Vision and Gen*i*cam Compliant



Model	HR-2000M/C/N	HR-4000M/C/N	HR-12000M/C/N	HR-20000M/C
Sensor	CMV2000	CMV4000	CMV12000	CMV20000
Resolutio	2048 x 1088	2048 x 2048	4096x3072	5120x3840
Megapixels	2MP	4MP	12MP	20MP
Sensor Type	2/3" CMOS	1" CMOS	28mm CMOS	35mm CMOS
Max Frame Rate	338 fps	179 fps	84 fps	32 fps
Cell Size	5.5 μm	5.5 μm	5.5μm	6.4μm
Standard Mount	C Mount	C Mount	F, M42	F, M52
Dimensions	97 x 58 x 59	97 x 58 x 59	97 x 58 x 70	97 x 58 x 80

- ✓ 2MP (338fps), 4MP (179fps), 12MP (84fps) and 20MP (32fps)
- ✓ RJ45 Connection ~ (CAT6A Cable to 100M)
- ✓ Sync in milliseconds or microseconds
- ✓ Smaller form factor then HR Series



Model	HT-2000M/C/N	HT-4000M/C/N	HT-12000M/C/N	HT-20000M/6
Sensor	CMV2000	CMV4000	CMV12000	CMV20000
Resolutio	2048 x 1088	2048 x 2048	4096x3072	5120x3840
Megapixels	2MP	4MP	12MP	20MP
Sensor Type	2/3" CMOS	1" CMOS	28mm CMOS	35mm CMOS
Max Frame Rate	338 fps	179 fps	84 fps	32 fps
Cell Size	5.5 $\mu\text{m}$	5.5 $\mu\text{m}$	5.5 $\mu\text{m}$	6.4 $\mu\text{m}$
Standard Mount	C Mount	C Mount	F, M42	F, M52
Dimensions	88 x 58 x 59	88 x 58 x 59	88 x 58 x 70	88 x 58 x 80

# SONY Pregius



- ✓ 3.2MP (216fps), 5MP (163fps), 8.9MP (93fps), 12MP (68fps)
- ✓ HR Series (SFP+) or HT Series (RJ 45) Options
- ✓ High Dynamic Range and QE
- ✓ 3.2MP and 5MP in production, 8.9MP and 12MP in production Jan 2017
- ✓ #1 inquiry is for the 12MP

Sensor	IMX252	IMX250	IMX255	IMX253
Resolution	2048 x 1536	2448 x 2048	4096 x 2160	4096 x 3000
Megapixels	3.2MP	5.0MP	8.9MP	12MP
Sensor Type	1/1.8" CMOS	2/3" CMOS	1" CMOS	1.1" CMOS
Max Frame Rate	216 fps	163 fps	93 fps	68 fps
Cell Size	3.45 μm	3.45 μm	3.45 μm	3.45 μm
Standard Mount	C Mount	C Mount	C Mount	C Mount
Dimensions	88 x 58 x 59			

# Cmosis 50MP



- ✓ 50MP – 7920x6004 (CMV50000)
- ✓ HR Series (SFP+) or HT Series (RJ 45) Options
- ✓ 23fps at full resolution
- ✓ Global Shutter
- ✓ ETA in production Qtr. 1 2017





## HR Series:

- 10G\_SGL\_NIC (1 Camera)
- 10G\_DUAL\_NIC (2 Cameras)
- 10G\_DUAL\_SYNC\_NIC (2 cameras with Sync Capability)
- 10G\_QUAD\_NIC (4 Cameras) – Coming Soon!



## HT Series:

- 10GBT\_SGL\_NIC (1 Camera)
- 10GBT\_DUAL\_NIC (2 Cameras)



MVA is included with each card that ships.

## What is MVA?

- ✓ Typical Intel cards offset the data from a GigE Camera to the PC to process
- ✓ With the amount of data, and the speed that comes off a 10GigE Camera, that operation would cripple most PCs on the market today
- ✓ EVT partnered with **Myricom** to design MVA so when the data comes off the camera it is processed directly on the card
- ✓ This leaves the PC free to do whatever processing a customer needs to do after the images are captured and provides a less than 1% CPU utilization.

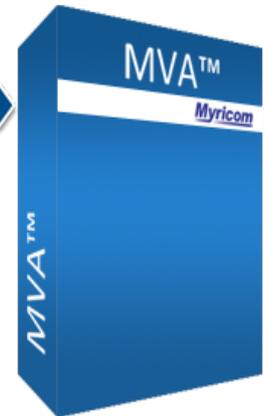
For GigE Vision-enabled devices

For machine vision application

Adapter-level load balancing

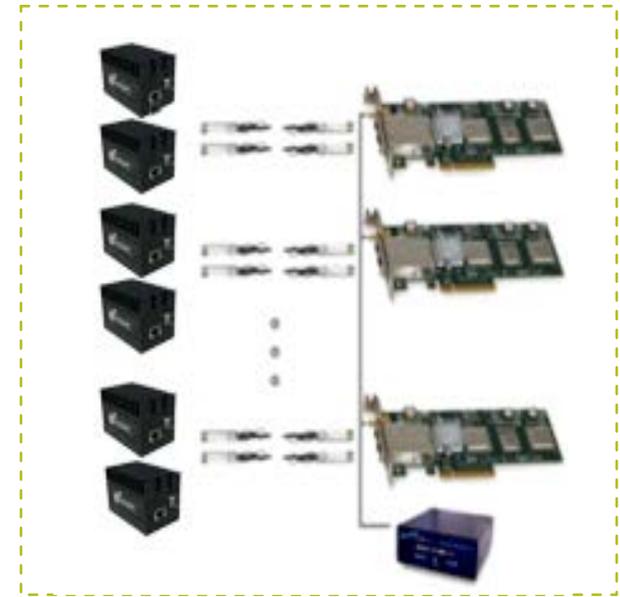
Threads for multiple device

Reduces CPU load



## How does Sync Capabilities of the Dual Sync NICs work?

- 2 cameras per card, 4-8 cards per PC (8-16 cameras tested successfully in 1 PC in the field)
- SYNC cards include an SMB IRIGB00X input in one or more PCs
- IRIGB00X Timecode Generator using either GPS or internal based timecode
- IRIG is often resident in many systems so it is only a matter of patching the IRIGB signal into the sync NICs w/very little added cost.
- 10G\_Dual\_Sync\_NIC is a great alternative to external triggering because it eliminates the wires that would run between cameras



## Some things to note:

- Sync Card only available for HR Series
- Direct Attach Copper Cables do not work w/Sync Cards
- 4 Port NIC Card coming soon for the HR Series
- 10G\_DUAL\_SYNC\_NIC allows synchronization of cameras to sub 1 microsecond

## Other options to Sync outside the Dual Sync NIC Cards



### Option 1

#### **Simply time-stamping frames at the application level**

- Any Myricom NIC is fine. No sync NIC required. No transceivers required, etc.
- Suitable for any length of cable
- Sync in Milliseconds



### Option 2

#### **Hardware Triggering**

- Any Myricom NIC is fine. No sync NIC required. No transceivers required, etc.
- Most suitable for shorter cable runs since trigger signals between Cameras required.
- Sync in 10s of us (Microseconds) accuracy

## HR Series Cable Options (SFP+ Connection)

Direct Attach Copper Cable options to 10M (if Sync NIC, do not use)

Fiber Cable from 1M to 10KM

## Transceivers

10G\_XCVR\_SR – SFP+ Short Range (<300m) Multi mode Fiber

10G\_XCVR\_LR – SFP+ Long Range (<10Km) Single mode Fiber

## HT Series Cable Options (RJ45 Connection)

CAT6A Copper Cable 1M to 100M



## Power Supplies for HR or HT Series:

- **PWR** – Plug in the wall power supply with mating connector
- **PWR\_BREAK** – Plug in the wall power supply with breakout for trigger (flying leads)
- **GPIO\_BREAK** – GPIO Breakout Cable
- **PWR\_BIRGER** – Plug in the wall power supply with breakout to Birger Mount
- **PWR\_BREAK\_BIRGER** – Plug in the wall power supply with breakout to Birger Mount and breakout for trigger
- **HR-Tripod Mount Adapter** or **HT-Tripod Mount Adapter**
- **HX-12000 F Mount Adapter**
- **HX-20000 F Mount Adapter**

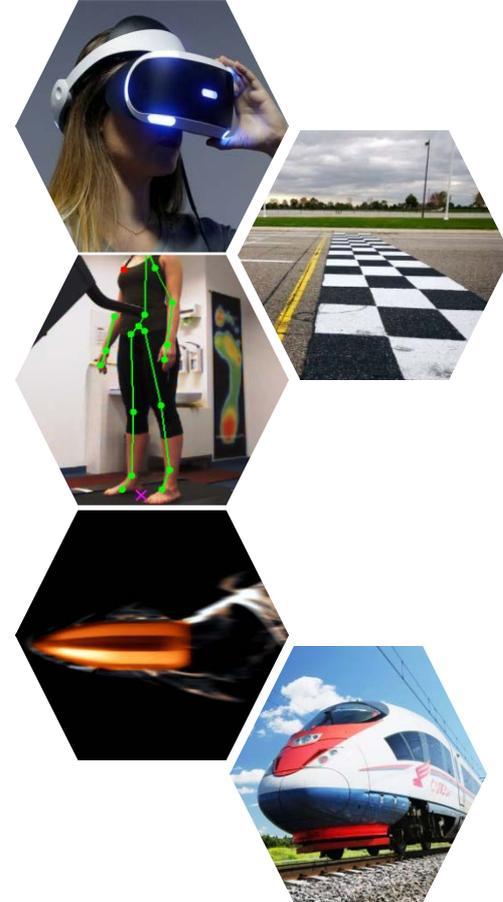


## What is the Birger Mount?

- Using a lens mount designed by Birger Engineering, customers can use Canon EF Mount lenses and control Iris and Focus through our API
- Canon EF Mounts available for all HT and HR Camera Models
- PWR\_BIRGER – Plug in the wall power supply with breakout to Birger Mount
- PWR\_BREAK\_BIRGER – Plug in the wall power supply with breakout to Birger Mount and breakout for trigger



1. Goal Line Technology
2. Virtual Reality
3. Immersive Sports
4. Broadcast and Media
5. Machine Vision
6. Markerless Motion Capture
7. Non-contact detection systems
8. Railway Inspection
9. Ballistics Testing



What is 10GigE?

Successor to GigE w/10x the speed, faster than USB 3.0

Does GigE Work with 10GigE?

Yes! 10GigE is GigE Vision and Gen<I>Cam Compliant



What is max bandwidth?

10Gbps or 1,250 Mbtes/s. Useable bandwidth is around 9.5Gpbs or 1,180 Mbytes/s

What are the Cable Options?

HR:

- Direct Attach Copper to 10M (Do not use with SYNC Card)
- Fiber with Transceivers from 1M to 10KM!

HT:

- CAT6A Cable to 100M

Why can't I use a 10GigE Card that I can buy online or one that comes with my Computer?

Off the shelf 10GigE NIC cards work like GigE Cards, offloading data from Camera to PC. With the speeds and data coming off a 10GigE Camera, this typical process of standard NIC cards will overload most PCs on the market today. EVT NICs work with the camera so all data is offloaded to the NIC providing the customer a less than 1% CPU utilization on their PC.

What is the benefit of using 10GigE for my application?

- Ultra high data/frame rates
- A large variety of accessory and cable options to cover any length
- Camera network support & accurate multi-camera sync
- Low CPU overhead, low latency, low jitter
- Very Competitive cost/performance which will improve as 10GigE is further adopted.
- Industry acceptance due to IEEE & AIA Standardization

## How does 10GigE compare to other interfaces?

EVT 10GigE Cameras and NIC card solutions, equals or out-performs other interfaces in every technical category and its price performance is in line with the best.

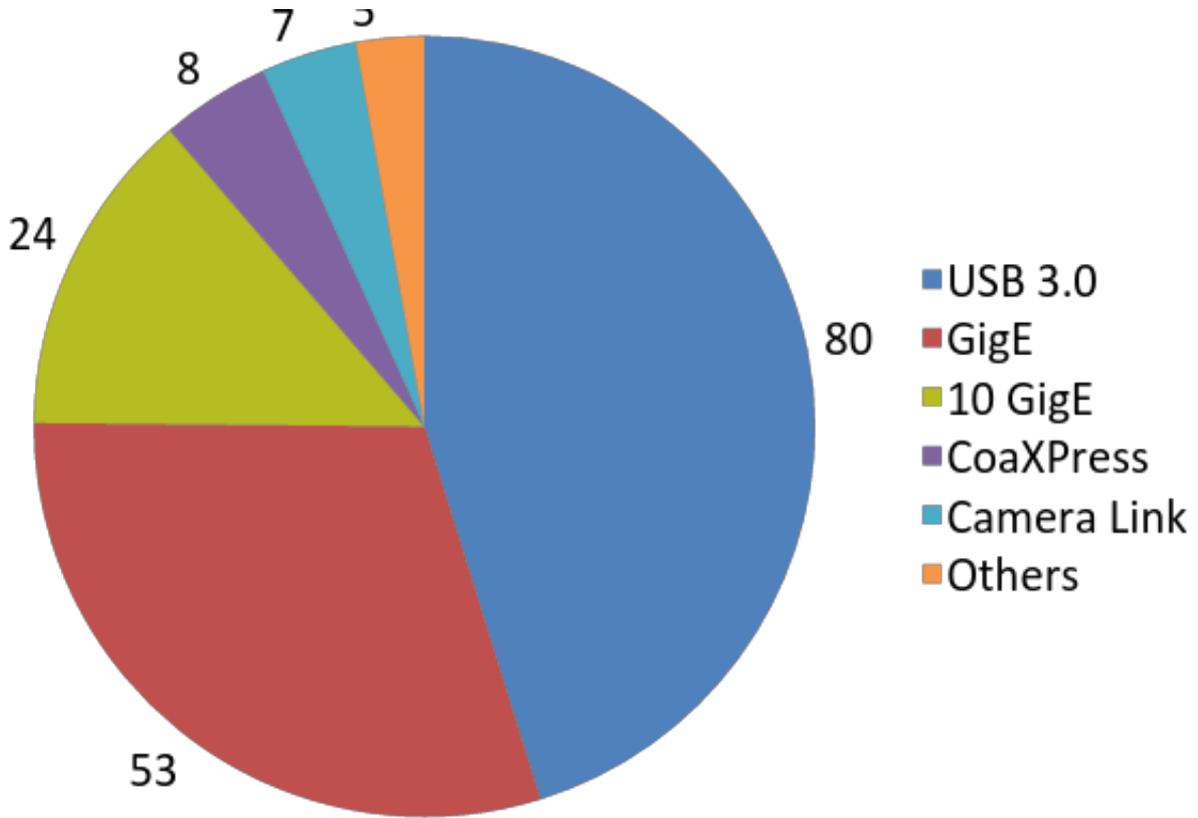
	1394-B	GigE	USB 2.0	USB 3.0	Camera Link	10GigE	Winner
Bandwidth	80MB/s	100MB/s	40MB/s	440MB/s	680MB/s	1180MB/s	10GigE
Cable Length	10m	100m	5m	3m	10m	10/300/Kms <sup>1</sup>	10GigE
Standard Support	Poor	Excellent	Poor	Good	Good	Excellent	10GigE <sup>2</sup>
Industry Adoption	Fair	Excellent	Fair	Excellent	Fair	Excellent	10GigE <sup>2</sup>
CPU Usage	Low	Medium	High	Low	Low	Low <sup>3</sup>	10GigE <sup>2</sup>
Latency/Jitter	Good	Poor	Fair	Excellent	Fair	Excellent <sup>3</sup>	10GigE
Price Performance	Good	Good	Good	Excellent	Fair	Excellent	10GigE

<sup>1</sup> Dependent on the accessory options chosen.

<sup>2</sup> Tie.

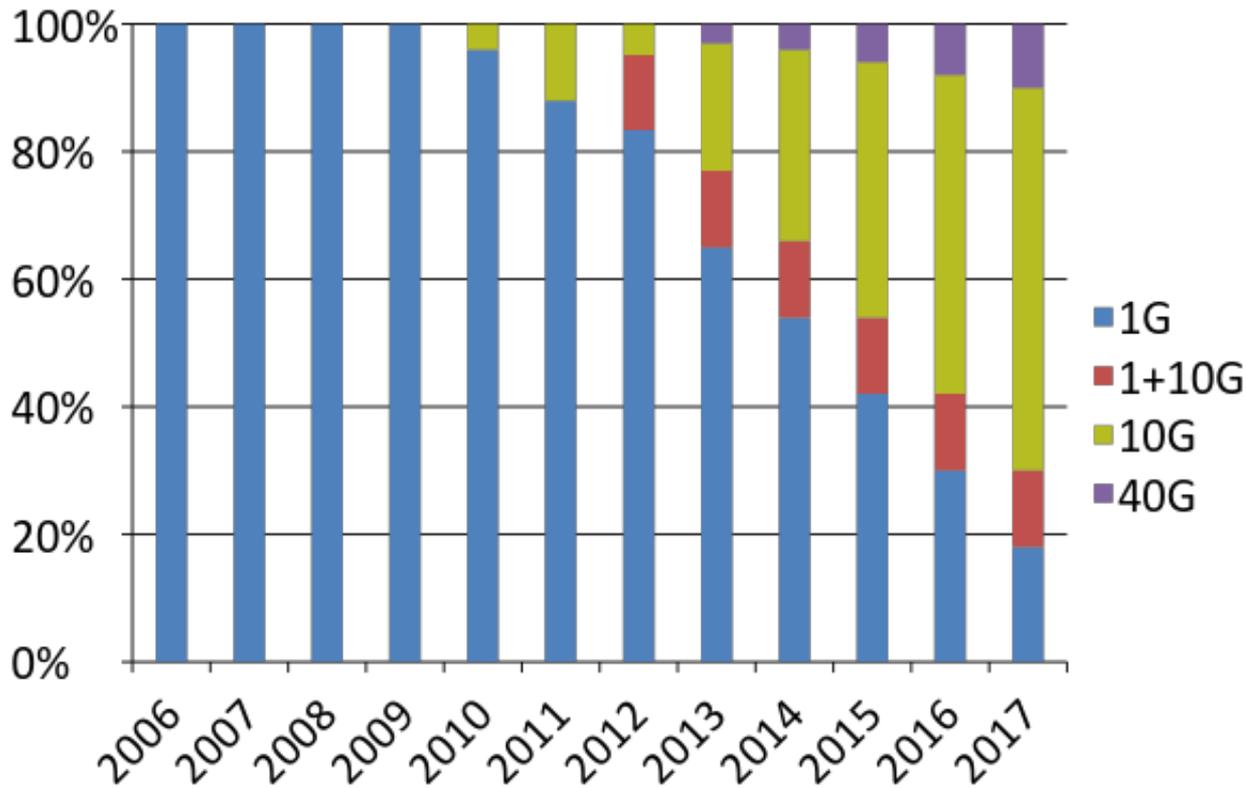
<sup>3</sup> Using Myricom's MVA

## Where will 10GigE be in the future?



Source: Vision Systems Design  
November 9, 2015  
Published Poll Results

## Adaption of 10GigE



Source: Dell' Oro

## How does 10GigE compare to USB 3.1?

- USB 3.1, when released, will incur the same cost for performance as 10GigE
- Offloading data from USB 3.1 will have the same implications as 10GigE
- 10GigE is already a standard USB 3.1 is not. 10GigE is already used in multiple industries

**10GiG**



What operating systems are supported?

Windows 7/8, and 10 by end of Summer 2016

Ubuntu Linux 12.04 LTS

What off the shelf components are available for 10GigE?

Cables, switches, network interface cards, PCs with SFP+ interfaces, etc.



**Thank You!**

We hope we enjoyed learning more about our 10 GigE Cameras!

