

Up to 48 GigE-Vision Cameras in 19inch 2U space
benefitting from the MicroTCA architecture

NAT-Vision

Vision Technologie
- Concepts and Solutions -



Agenda

- About N.A.T.
- Vision Applications
- GigE-Vision Modules by N.A.T.
- FPGA based Video processing
- Intercommunication inside and outside of MTCA chassis
- Synchronisation and Trigger
- GigE-Vision and MTCA – a perfect match



About N.A.T.

Network and Automation Technology

- Founded in 1990 privately owned
- Hard- and Software design and manufacturing
- Focus on **innovation in communication**
- international and worldwide operations
- Headquarters

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53227 Bonn

Germany

- Sales Contacts:
 - Dipl. Ing. Vollrath Dirksen vollrath@nateurope.com
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Innovation in Communication

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The brain of your MTCA.4 system

Higher bandwidth for Physics: the new NAT-MCH-PHYS80

Key features

- x16 PCIe Gen3 uplink at front panel
- 128Gbps link to local CPU/root complex
- special low latency and low jitter CLK module
- fully user accessible quad core Intel (R) Core i7
- new RTM for LLRF backplane
- complete product line

Let Your **Application** benefit



The brain of your MTCA system [read more ...](#)



**Accelerate
Media
Processing**
[read more ...](#)



**The brain of
your MTCA
system**
[read more ...](#)



**The QoriQ-
Family**
[read more ...](#)

Board Level Products



System Solutions



Upcoming Events

- ▶ **MTCA Workshop at DESY**
Dec 9th-10th, 2015, Hamburg
- ▶ **IBIC 2015**
Sept. 13-17th, Melbourne, Australia
- ▶ **Mobile World Congress**
Mar 2nd-5th, 2015, booth 6B40

Latest News

- ▶ **New product NAT-JSM**
Open JTAG switch module in AMC form factor
- ▶ **NAT-MCH firmware v2.17 and NATview v2.18**
New versions of firmware and GUI available
- ▶ **AMC module NAMC-ODSP**
New Media Acceleration Engine based on 8x OCT2224M DSPs
- ▶ **MicroTCA Concept**
Version IV now available

Applications

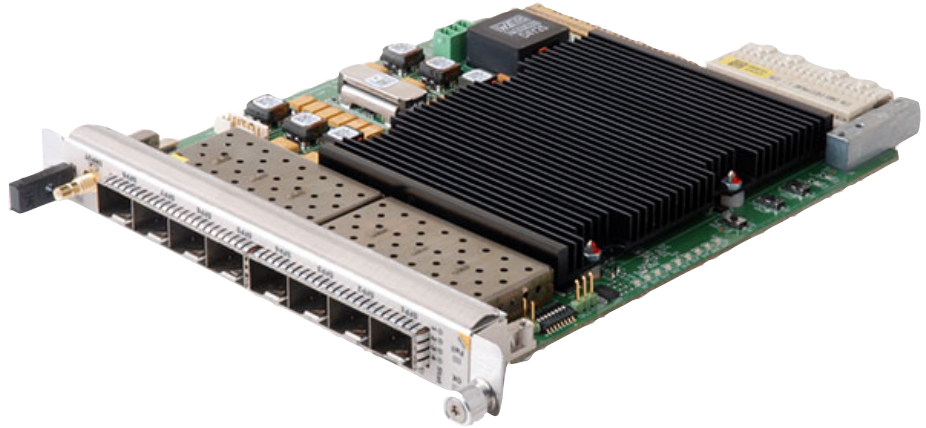
- Vision Inspection
 - Quality assurance, Failure detection
 - PCB assembly
 - Railway inspection
- Medical
 - Picture analysis and merging
- Video – public safety
 - Camera link aggregation
 - Filtering and analysis
 - Compression and re-coding

see also Presentation
Friedrich Fix
Session 8
tomorrow



Onboard video (pre-)processing by FPGA and ext. Intel-CPU

- 8 SFP/SFP+ Cages
- 8 GigE-Vision Cameras
- Kintex-7 FPGA
 - Data Collection
 - Pre-Processing
 - DMA to external CPU
- Intel-CPU does high level Video Processing
- **Improvements in**
 - scalability by using single AMC form factor
 - GigE-Vision but also other camera-interfaces, e.g. Camera Link
 - ARM processor inside the FPGA
 - usable in MTCA.4 but also in MTCA.0, MTCA.1 systems



see also Presentation
Sven Stubbe
Session 5
tomorrow

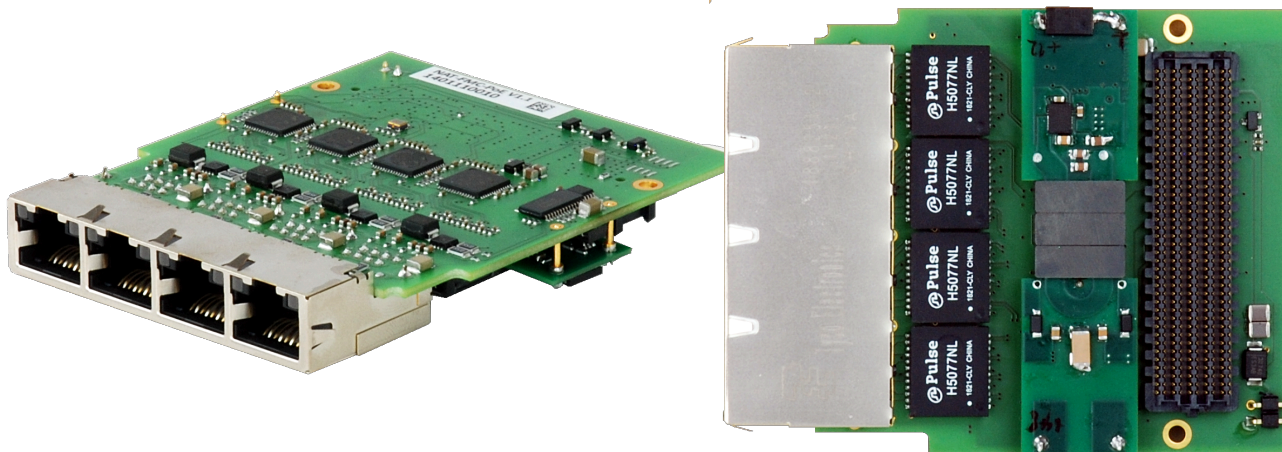
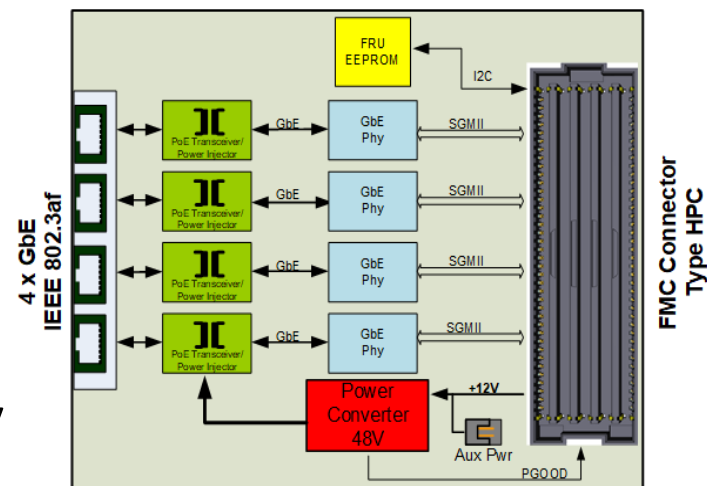
FMC-4GigE-PoE

- 4 GigE interfaces
- PoE Support (3/10W per Chan)

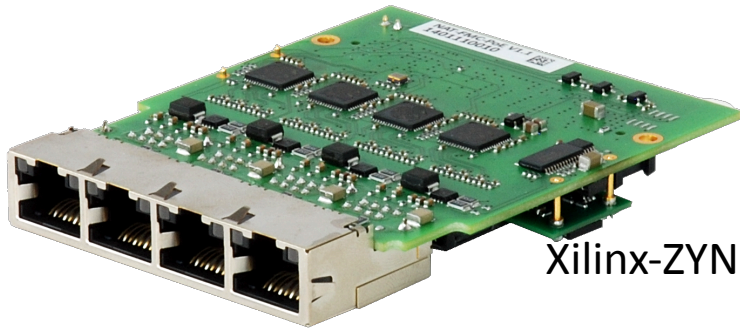
Targets:

- Onboard video (pre-)processing by FPGA or ARM CPU

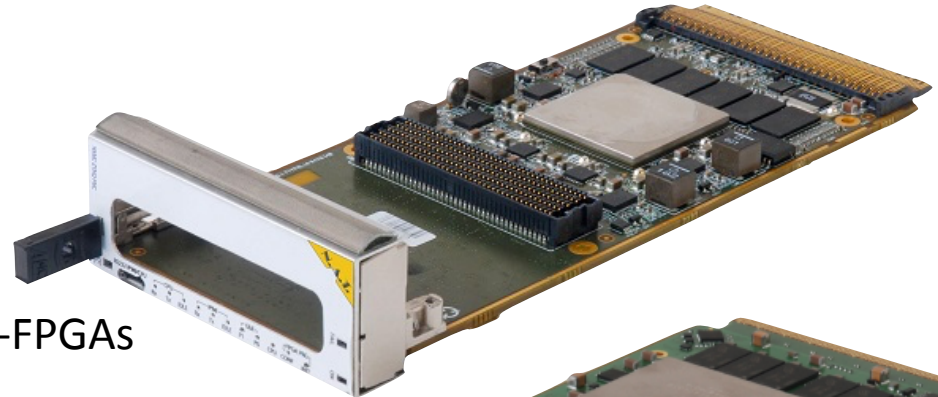
FMC-4GigE-PoE



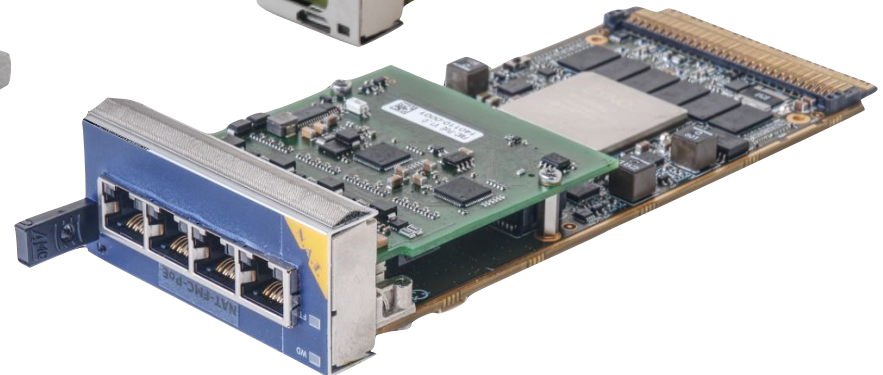
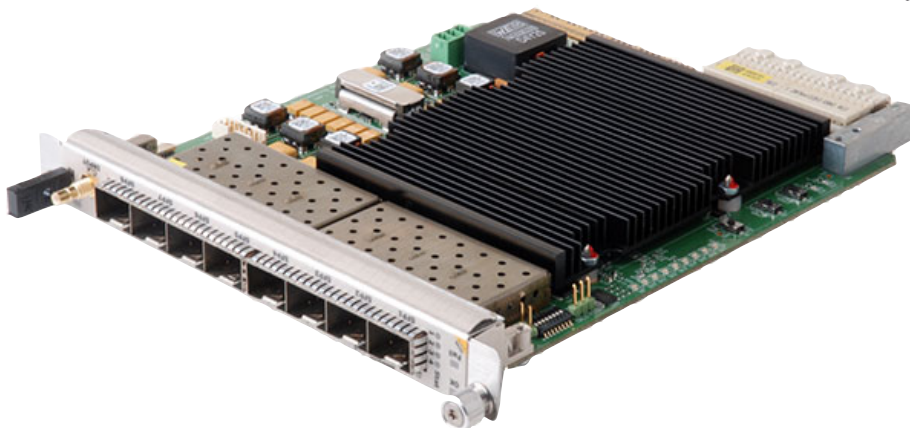
Onboard video (pre-)processing by FPGA or ARM CPU



Xilinx-ZYNQ-FPGAs



Intel-Altera-ARRIA10-FPGA

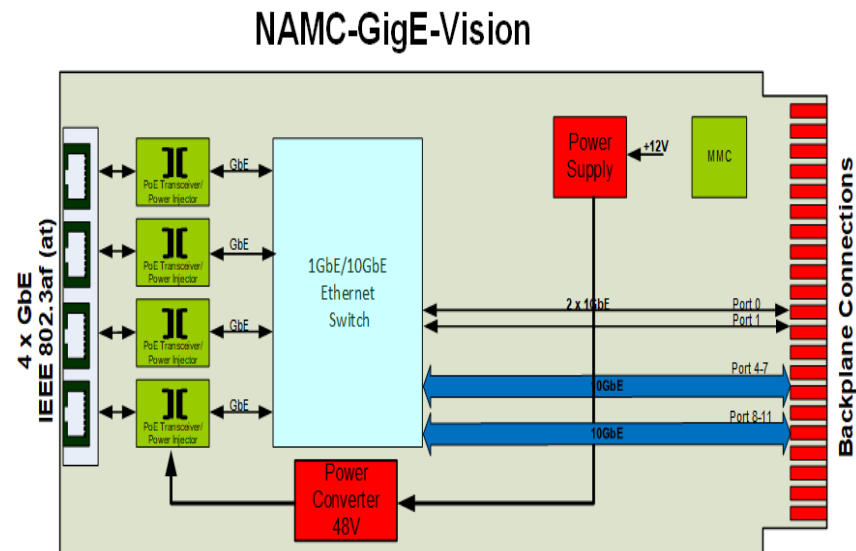


NAMC-4GigE-PoE

- 4 GigE interfaces
- PoE Support (10W per channel)
- 1/10/40G Ethernet Switch

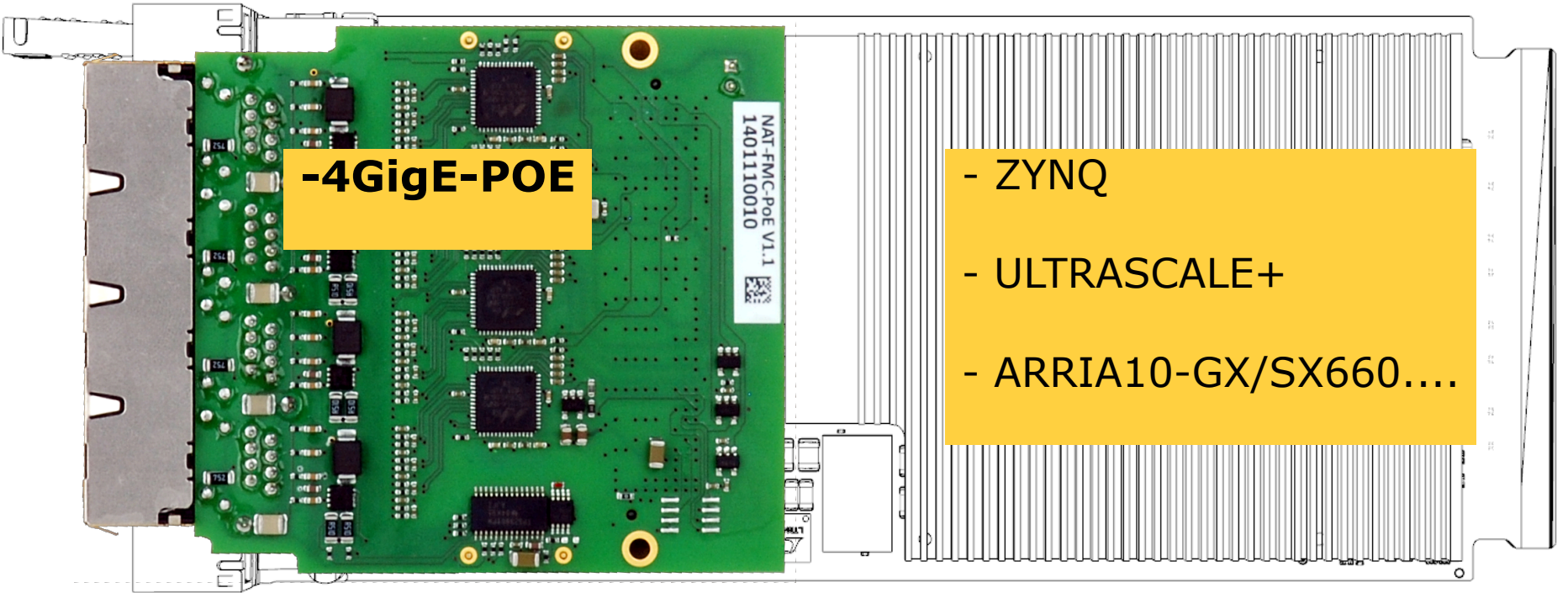
Targets:

- Aggregation of Video streams to higher bandwidth (10/40G)
- InSystem Video processing by FPGA/CPU/DSP/GPU
- External Video processing by Blade Server



NAT-AMC-FPGA-FMC-Options

NAT-AMC -FMC



-4GigE-POE

NAT-FMC-POE V1.1
1401110010

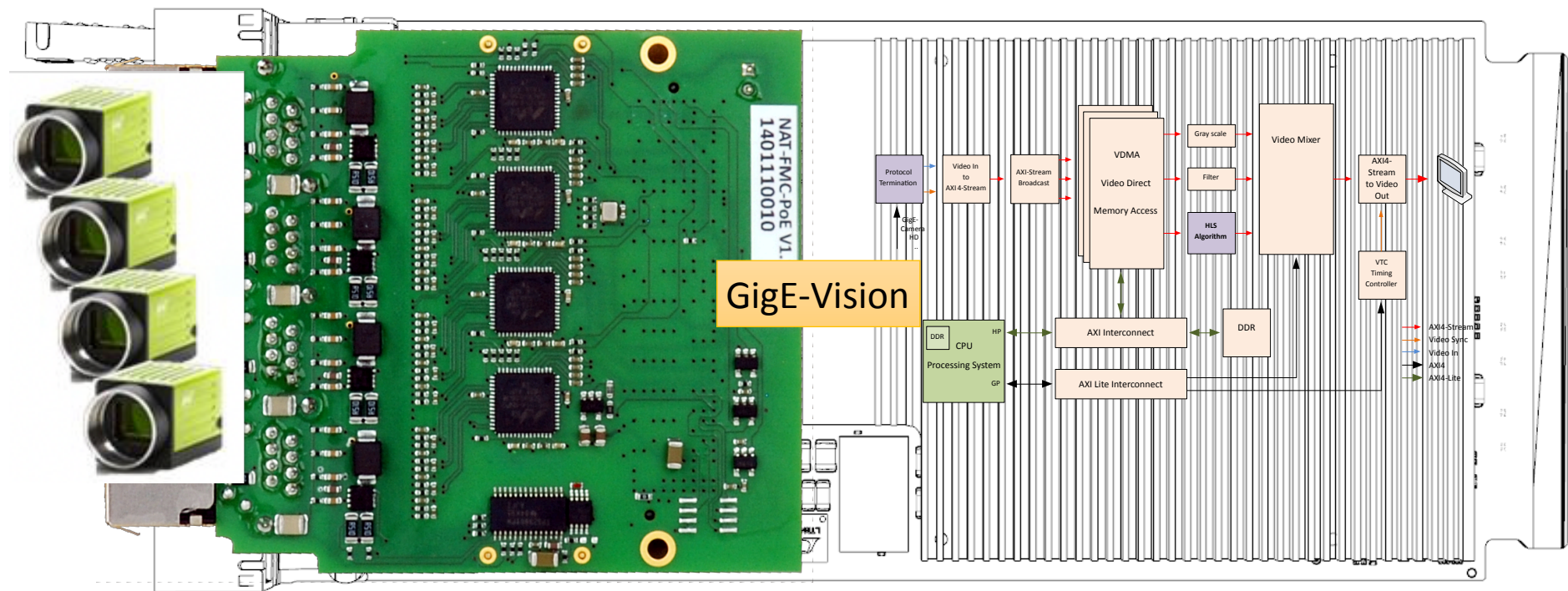
- ZYNQ
- ULTRASCALE+
- ARRIA10-GX/SX660....

FMC: Flexible IO

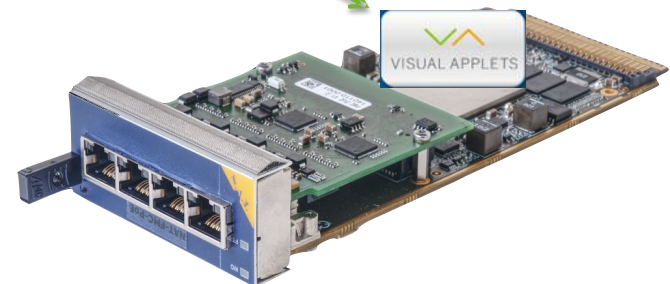
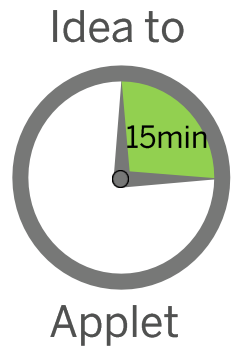
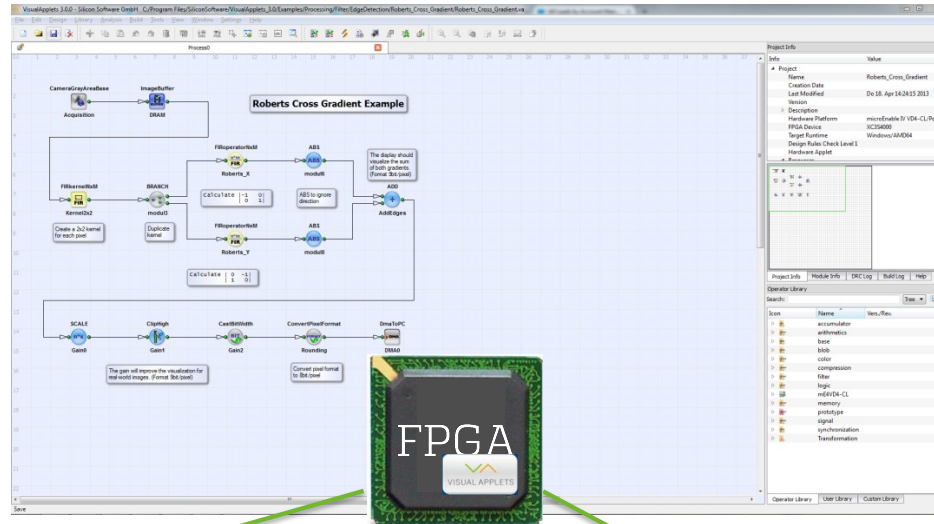
GigE-Vision with Power over Ethernet
Camera-Link
ADC,

ARM-CPU & FPGA

NATvision: FPGA Software



NATvision Software: High Level FPGA Programming

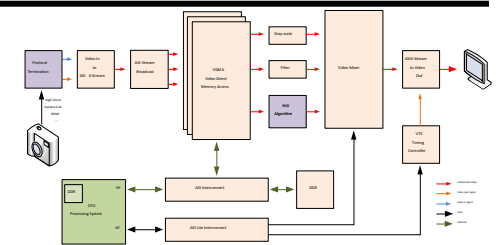


Source: Uwe Gieseler, Silicon Software, Company Presentation 2018, Speed up your Vision



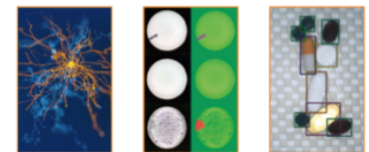
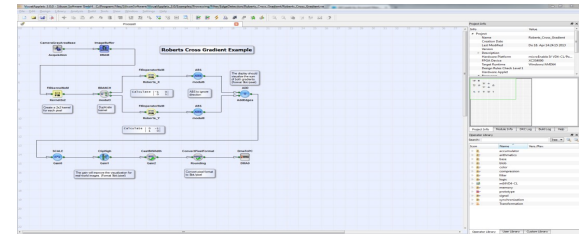
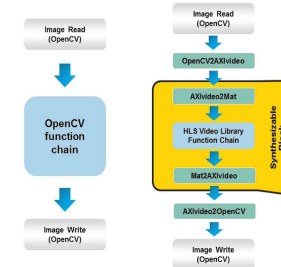
NATview: Software on All Levels

- Linux BSP for ARM Core with GigE-Vision protocol support
- OpenCV with Xilinx Reinvision
- High Level FPGA Programming: Software Solution Visual Applets
- High Level Image processing: Halcon

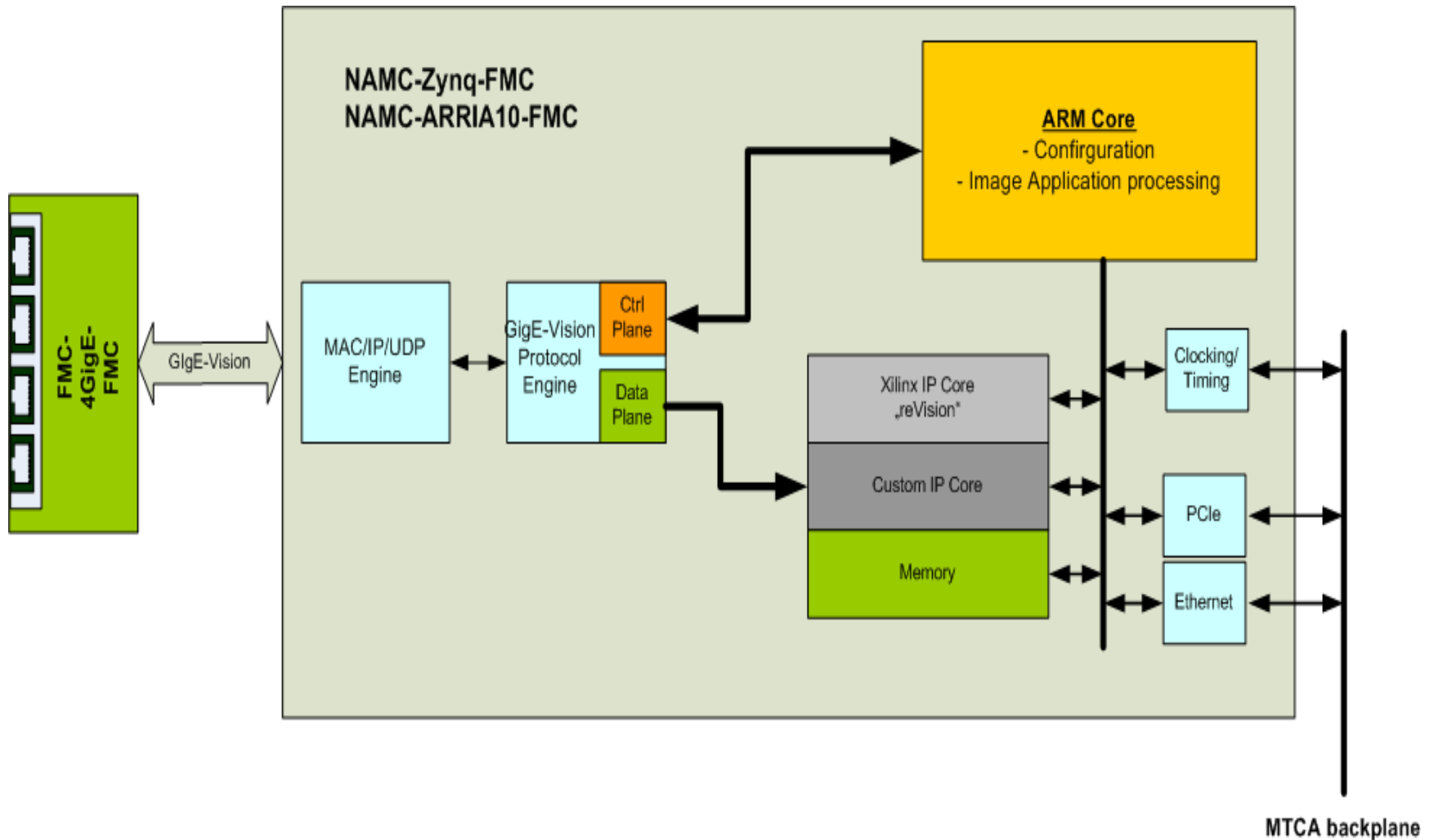


OpenCV Application

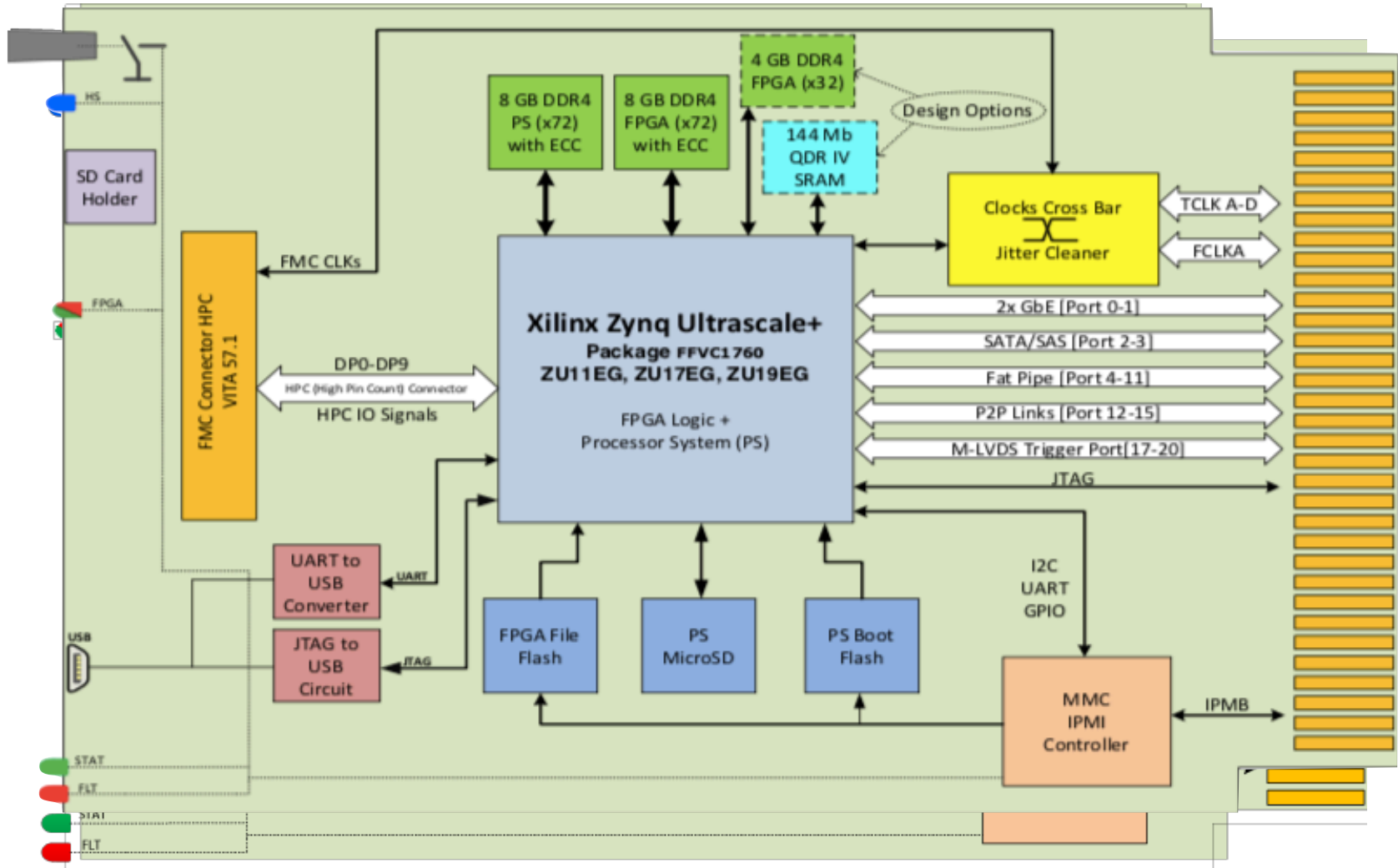
Video Library Application



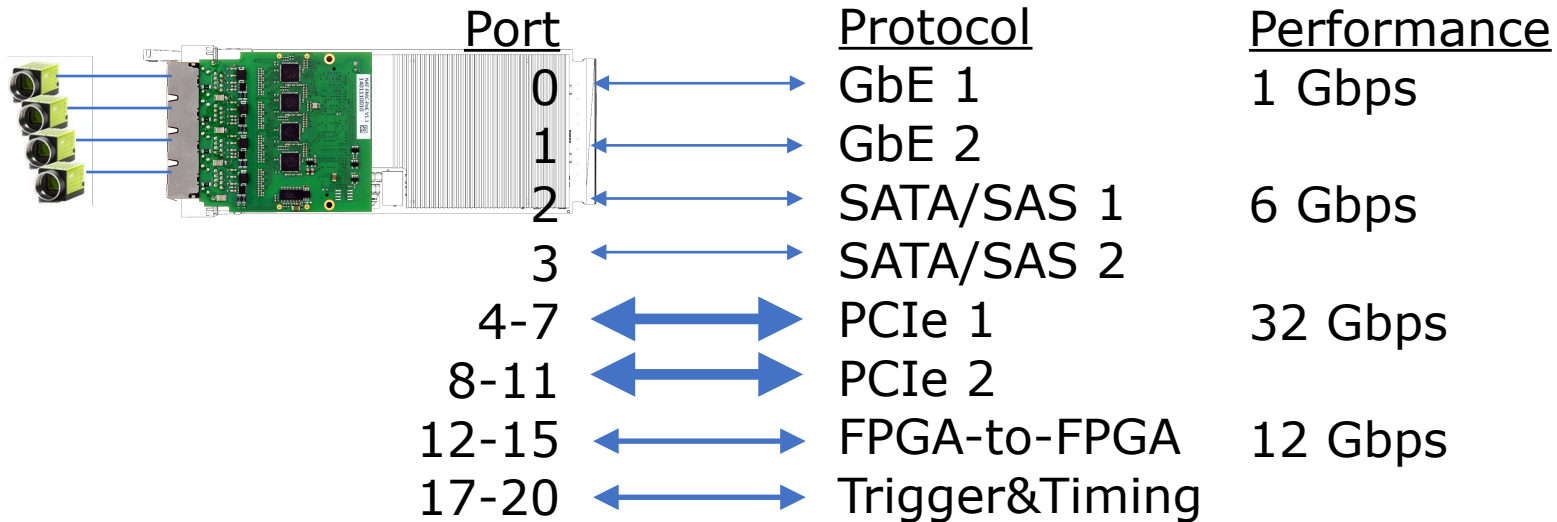
Off-Board Data Pathes



NAT-AMC-FPGA Off-Board Data Pathes



AMC Data Bandwidth: PCIeexpress



Port 4-7

PCIexpress Gen 3: 8GT/s per lane -> 32Gbps (Port 4-7) up to 64Gbps(Port 4-11)

SRIO Gen 2: 5 GT/s per lane

XAUI 2.5 GT/s per lane

Future

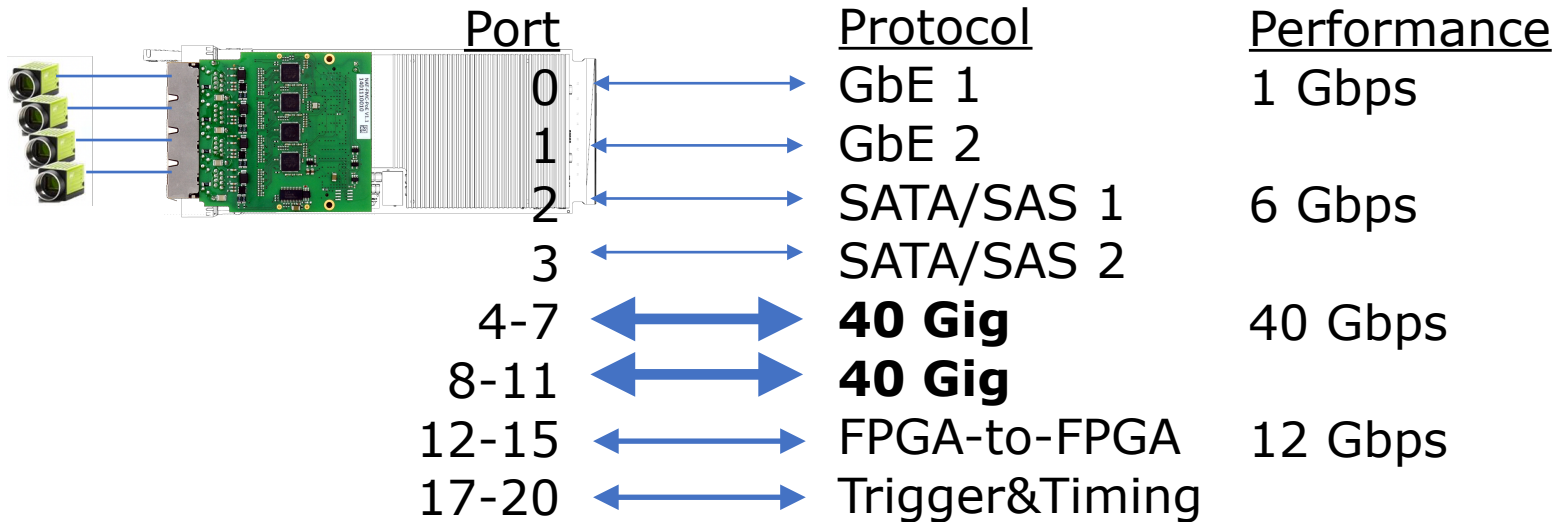
PCIe Gen4

SRIO Gen3

40Gig



AMC Data Bandwidth: 40Gig

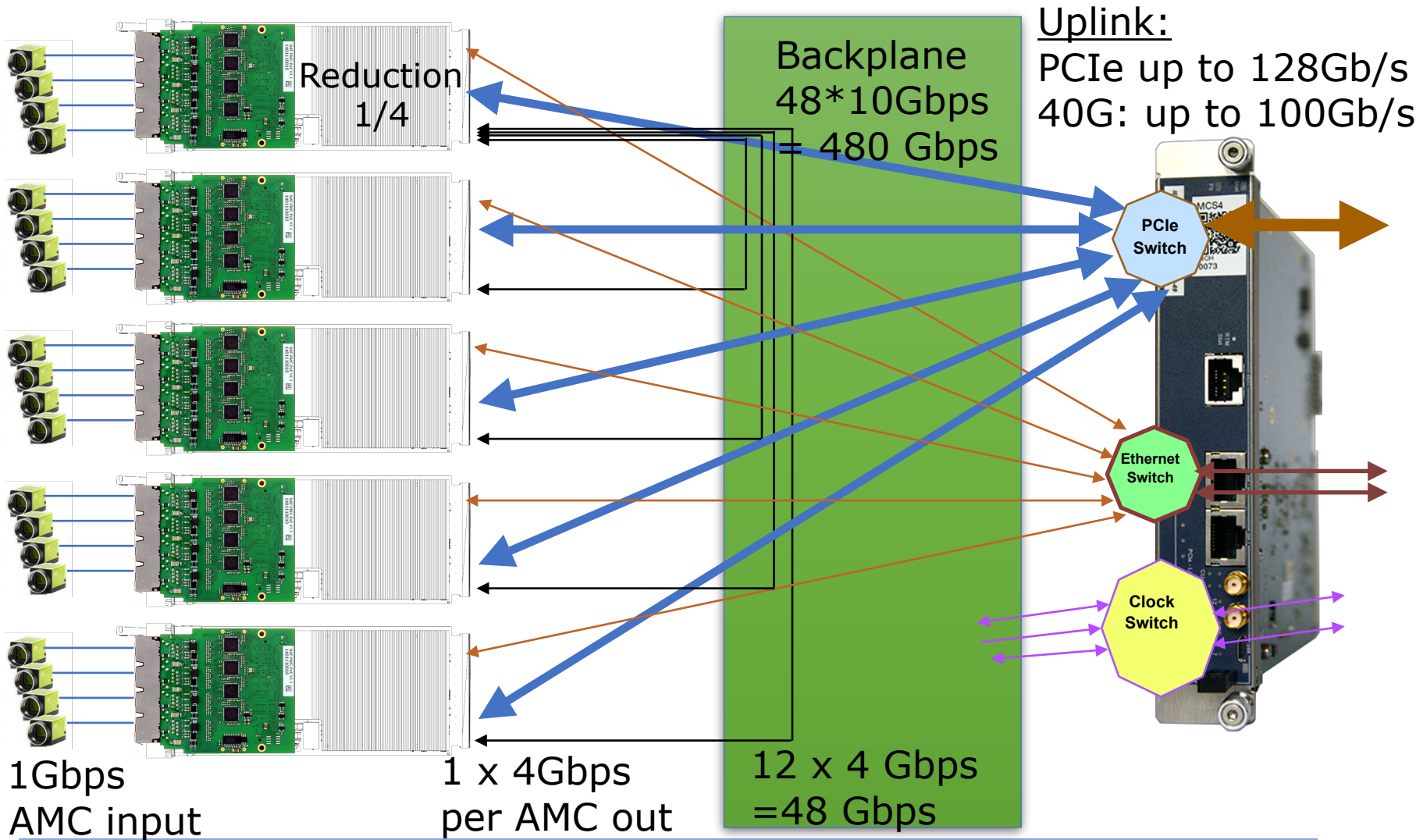


Question

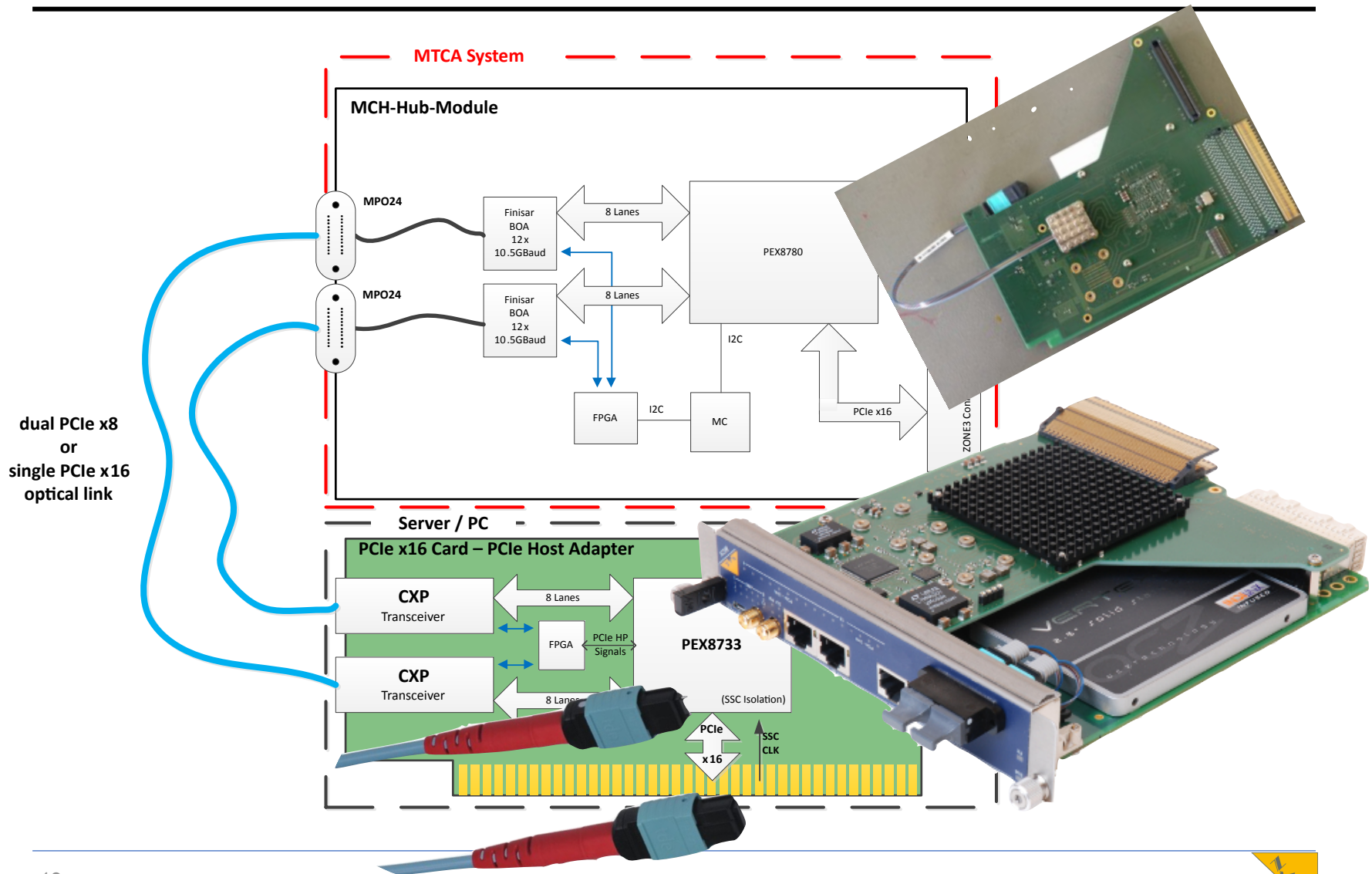
How to handle all this data inside a MicroTCA chassis and uplink to the outside World?



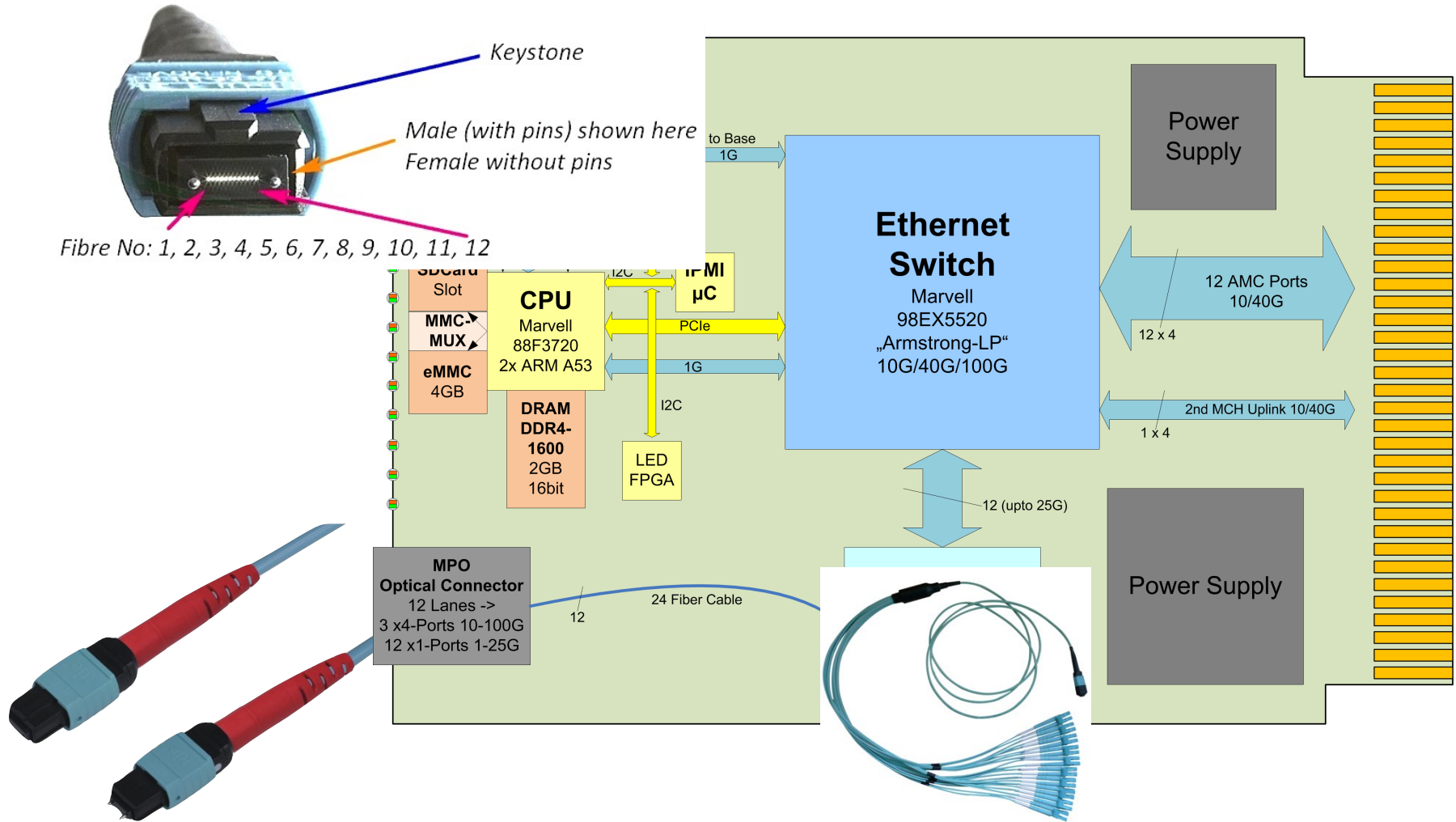
MTCA: Data Bandwidth



MTCA Uplinks: PCIeexpress

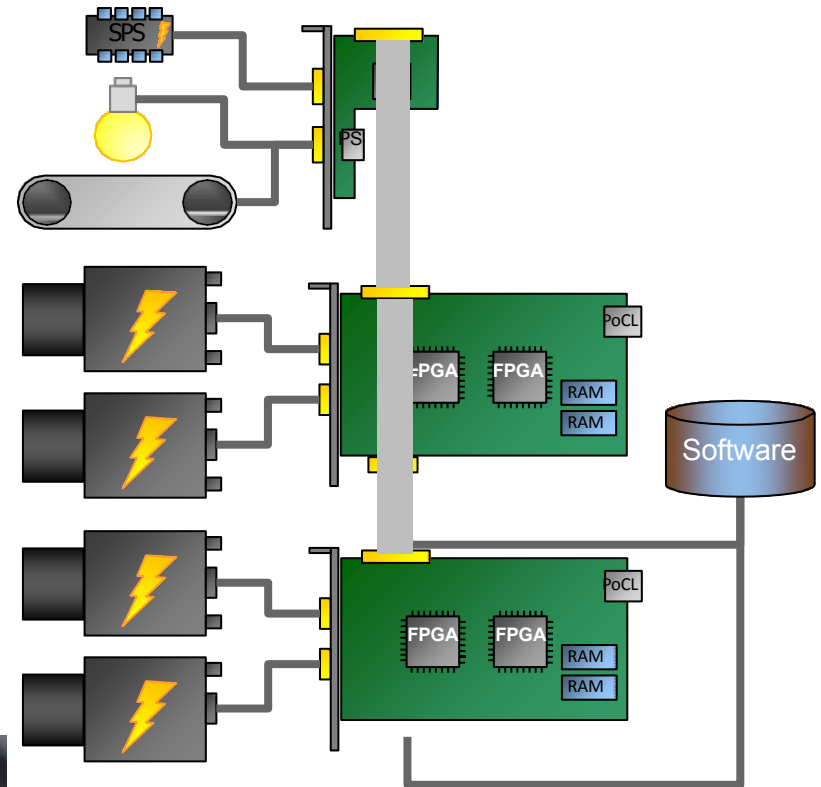
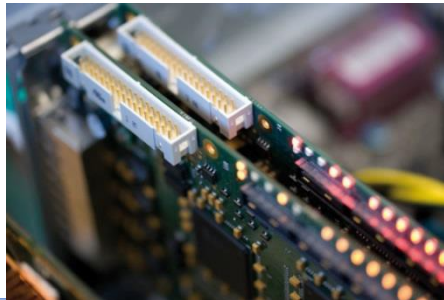


MTCA Uplinks: 40Gig -> 300Gig



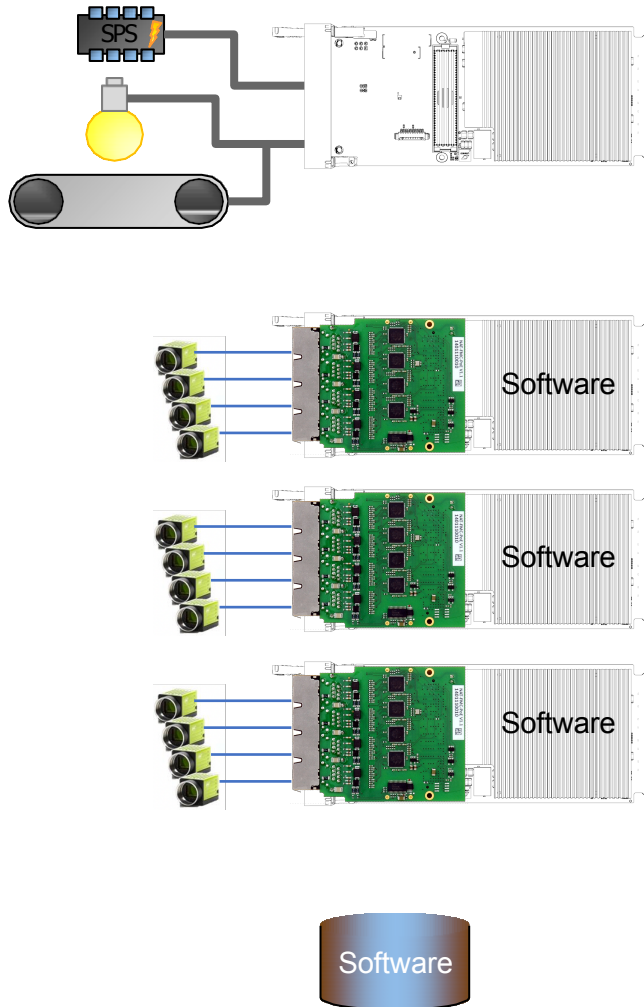
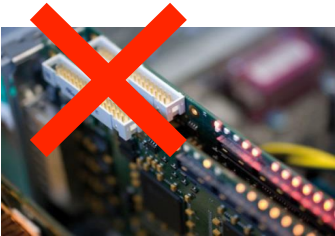
Synchronisation in the PC World

- Synchronized image acquisition
- Complex control of the framer grabber and its peripherals over the IOs
 - Daisy-chaining of multiple frame grabbers
 - Light control
 - Drives control
 - Shaft encoder control
 - ...



Synchronisation in the MTCA World

- Synchronized image acquisition
- Complex control of the framer grabber and its peripherals over the IOs
 - Daisy-chaining of multiple frame grabbers
 - Light control
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 - ...



Trigger&Timing
Port 17-20

**Low Latency
Interboard Com.**
Port 12-16

Data & Control
Port 0
Port 4-7
Port 4-11

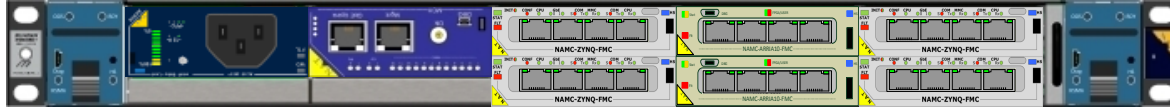
**Redundant
Data & Control**
Port 1
Port 8-11

Storage
Port 2,3

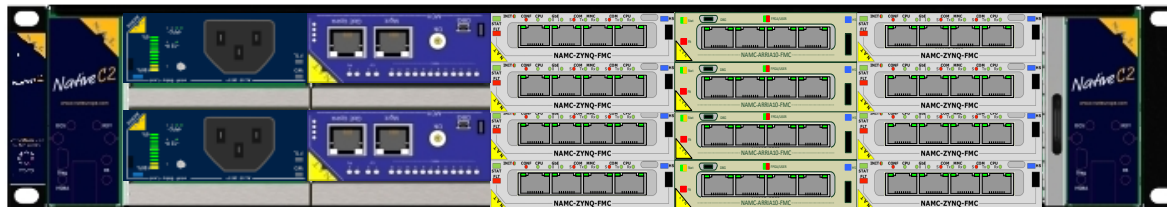
Backplane



GigE-Vision and MTCA - a perfect match



- High Speed P2P Links
 - 1G/10G/40G GbE Connectivity per Slot
 - Up to 100G Fiber Optical Uplink
- 1U and 2U MTCA Systems with up to 12 Slots – support for up to 48 cameras in one system
- Flexible choice of Video processing by CPU/FPGA/DSP/GPU boards or external Blade Servers



MTCA.4 Compared to MTCA.0

9U MTCA.4

12x NAMC-TCK7 = 96 GigE-Vision Cameras

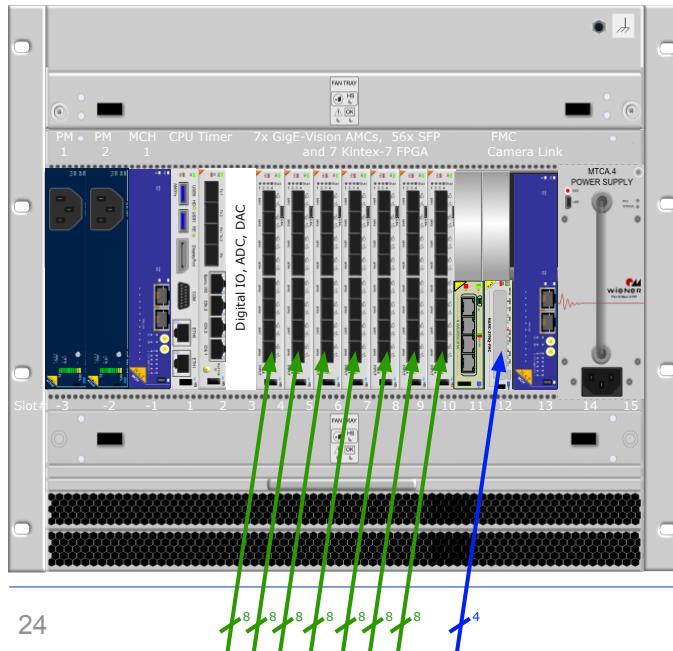
12x NAMC-FPGA-FMC = 48 Cameras

Mixture of NAMC-TCK7 & NAMC-FPGA-FMC

Timing&Triggerbus, Low-Latency P2P

Realtime-Fieldbus Master, e.g. EtherCat

4 USB-3 Cameras



2U MTCA.0

12x NAMC-FPGA-FMC= 48 Cameras

Mixture of NAMC-TCK7 & NAMC-FPGA-FMC



2U MTCA.4

6x NAMC-TCK7 = 48 GigE-Vision Cameras

6x NAMC-FPGA-FMC = 24 Cameras

Mixture of NAMC-TCK7 & NAMC-FPGA-FMC

Realtime-Fieldbus Master, e.g. EtherCat

Timing&Triggerbus, Low-Latency P2P

4 USB-3 Cameras



NATIVE-R2: 6-Slot MTCA.4.1 Crate

