

Synchronization (data-stuffing) of several EtherCAT networks through µTCA

9th (1st virtual) MicroTCA Workshop for Industry and Research

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Herbert Erd

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EtherCAT Facts

- Data rate 100 Mbit/s
- Master / Slave concept
- 1 Frame up to 1.486 Bytes (Process Data)
- Jitter < 100 μsec
- I/O data stuffed into packets "on the fly"
- Cyclic transmission of I/O data
- Acyclic transmission of demand data
 - (parameters, diagnostics, device identification)
- Communication between slaves are possible
 - Broadcast, multicast and cross

Typical Ether**CAT** Ring



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NAT-AMC-ZYNQUP-ECAT



Solution

- Xilinx Zynq[®] Ultrascale+ based double-width mid-size AMC
- Frontpanel elements: •
 - 1x SFP port to optical ECAT network
 - 8x RJ45 sockets to ECAT networks
 - 4 ECAT slaves in ring architecture
 - 8 slaves in proprietary star or tree architecture
 - 1 USB port for update (JTAG)
- Backplane
 - 1GbE (ports #1 and #2)
 - x1 PCIe (ports #4 and #8)
 - PtP (port #12 #15 and #17- #20)
 - TCLKA-D
- Options •
 - ECAT master implementation possible utilizing integrated ARM cores
 - double width => single width with 4x RJ45 only (tbd.)

ECAT IP Core(s) IP Core(s) FPGA XILINX 2x R5 CPU Zynq MPSoC UltraScale+ 1SFVC784E XCZU2CG ECAT IP Core(s) FPGA ZX XILINX CPU Zynq MPSoC ÚltraScale+ 1SFVC784E XCZU2CG

KSZ805

KSZ805

LOOMbit PH KSZ8051

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NAT-AMC-ZYNQUP-ECAT



- Field requirement
 - establish a high-precision timing source via MTCA, simultaneously connected to up to eight ECAT networks (standard ECAT solutions usually connect to one ECAT network only)



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EtherCAT topology with NAT-AMC-ZYNQUP-ECAT



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Summary

- Simultaneous sync/clock and data-stuffing via MTCA to/from different EtherCAT networks
- Economic bridge between EtherCAT and MTCA
- Scalable number of EtherCAT slaves in MTCA
 - n* 4, n*8 /9 EtherCAT slaves per AMC card
 - More than 1 card per MTCA system possible
 - Sync via PCIe port 4 and/or 8
 - Sync via GbE port 1 and/or 2 plus update
 - Sync via PtP link Port 12-15 LVDS
 - Sync via Bus Port 17-20 MLVDS
- Joint development with XFEL
- First field customer will be XFEL (Q1 2021)





Thank you very much!

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