Latest Technologies for Accelerator Instrumentation

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Accelerator Instrumentation

- High availability
- Redundancy
- Modular design
- Intelligent robust diagnostics and management platform (IPMI)
- Hot swap and minimum MTTR (Mean Time To Repair)
- Distributed CPU computing power

Advanced Telecom Computing Architecture (ATCA) main goal was to fulfill mentioned requirements. It was primarily intended for telecom industry.
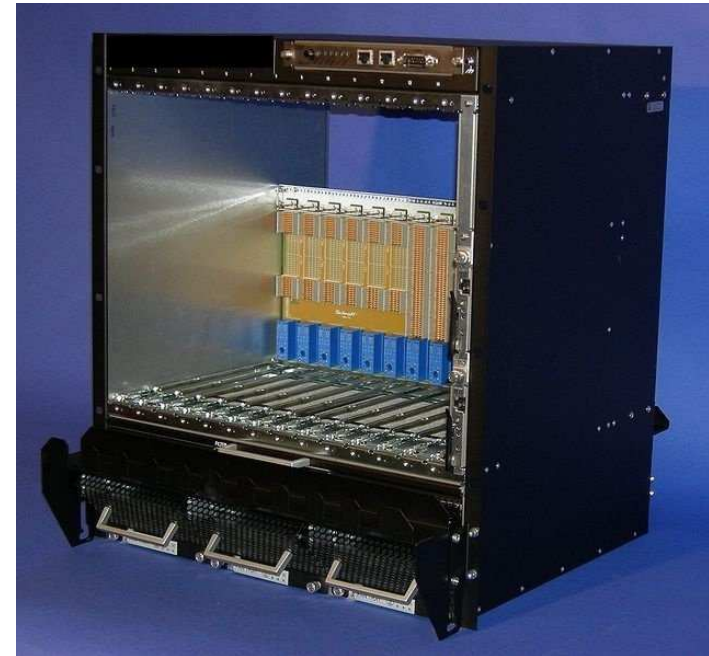
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VME vs. ATCA (µTCA)

VME:

- low bandwidth ~ 80MB/s
- no clock and synchronization signals over backplane
- only one CPU/crate
- hot pluggability is supported only for peripheral boards
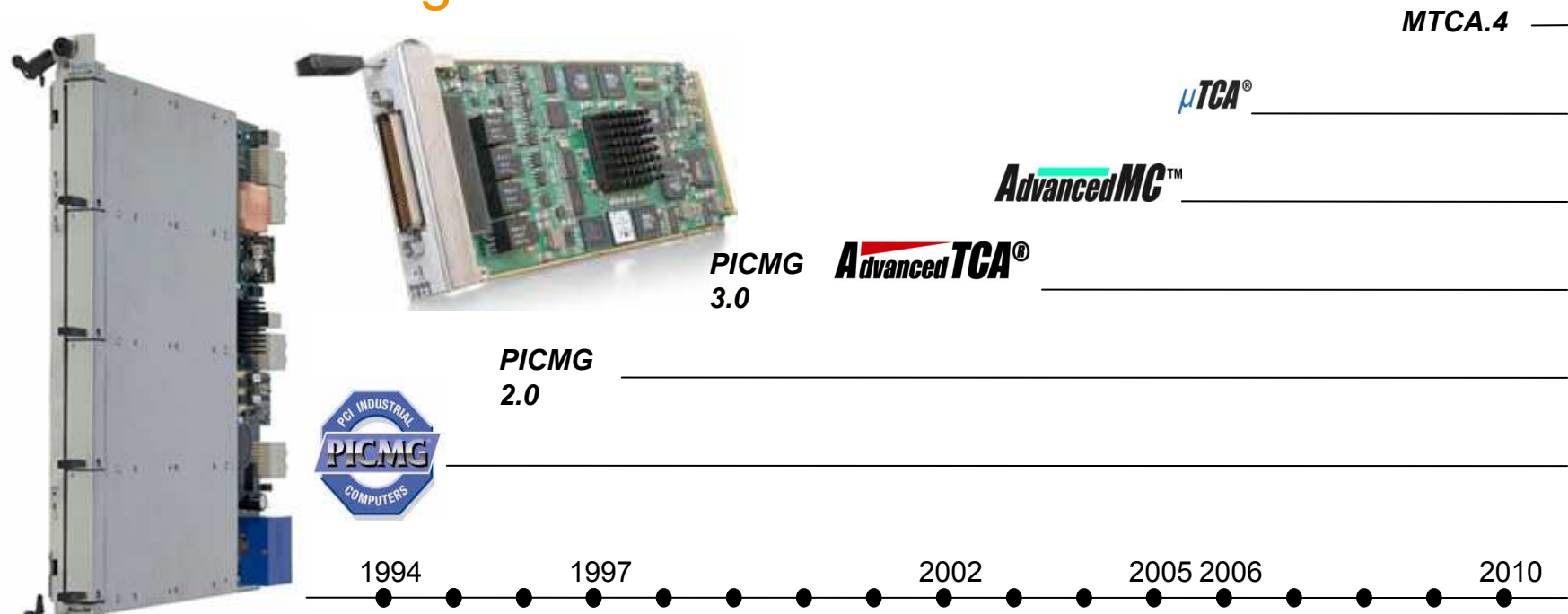- no management infrastructure
- bus oriented

ATCA:

- high bandwidth – few GB/s
- no direct connections between boards
- redundancy
- hot pluggable modules
- multiple CPUs possible
- module oriented

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AdvancedTCA Main Characteristics

- the boards (blades) are plugged in ATCA shelves
- offers very high throughputs over gigabit serial links (PCIexpress, Gigabit Ethernet, SATA, Infiniband, SeriaRapid IO)
- carrier blade accepts up to four Advanced Mezzanine Cards (AMC)
- it supports Rear Transition Module (RTM) connection from back side (zone 3)
- management and diagnostics is based on IPMI

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Historical Background

MTCA.4 —

μTCA® _____

AdvancedMC™ _____

PICMG 3.0   *AdvancedTCA*® _____

PICMG 2.0 _____

_____

| 1994 | 1997 | | | | | 2002 | | 2005 2006 | | | | 2010 |

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Advanced Mezzanine Card - AMC

- AMC offers ultimate computing power in small form factor
- high data troughput over high speed serial links:
  - Gigabit Ethernet,
  - PCIExpress,
  - SATA,
  - Serial Rapid IO,
  - Infiniband
- highly manageable via IPMI concept and interoperability check
- easy servicing through hot swap capability

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MicroTCA, uTCA, µTCA, MTCA.0

- MicroTCA enables AMC boards to operate without carrier board.
- this is desired especially where the processing power is major requirement
- MCH takes over the functions of ATCA carrier board and ATCA shelf manager
- faster development time
- scalable

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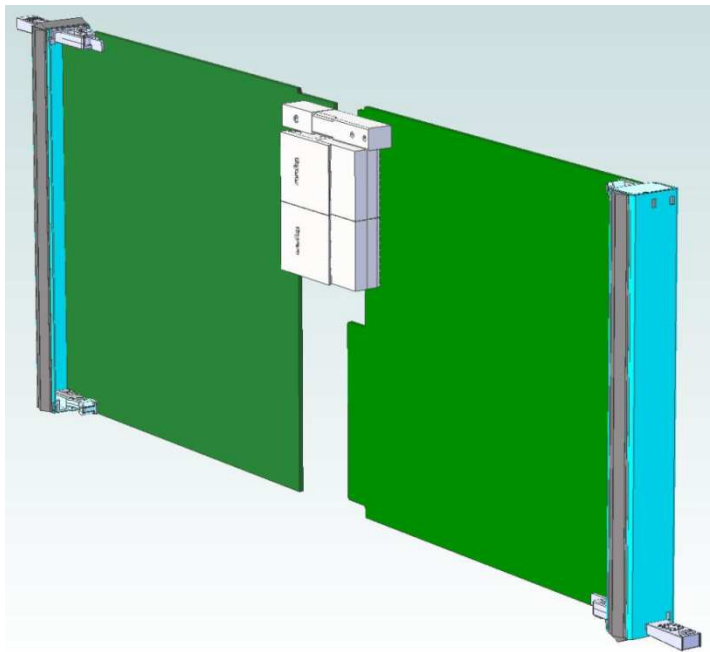Libera

MicroTCA for Physics, MTCA.4

- compatible with MTCA.0
- additional connector for µRTM
- additional signals on AMC connector

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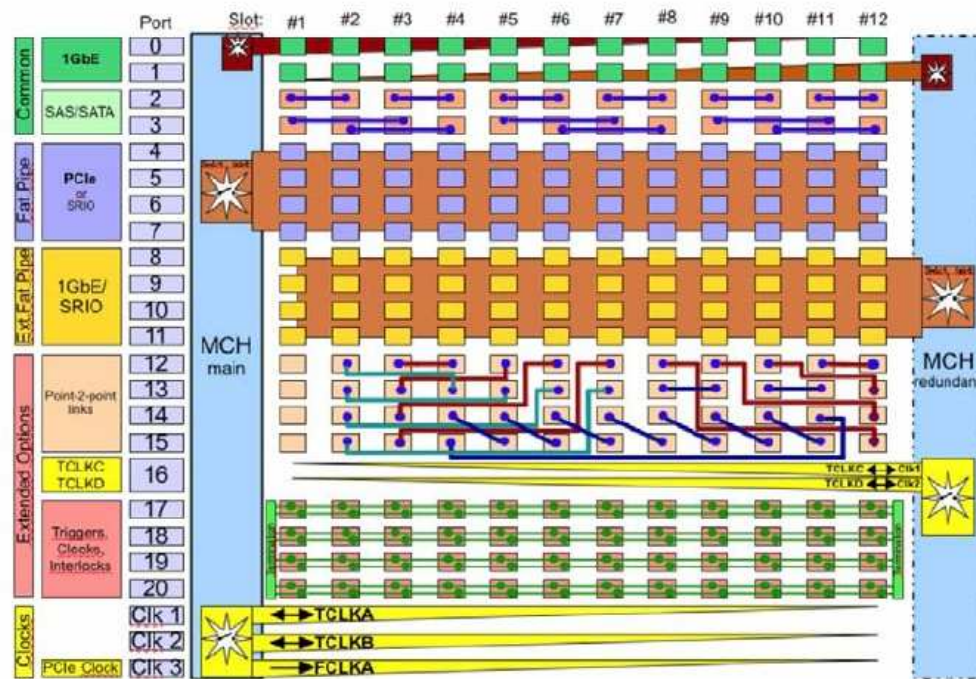
MicroTCA for Physics - AMC with µRTM

- connected directly to AMC over 60 shielded differential pairs
- more space for connectors and electronics
- power budget limitation
- mechanical keying
- e-keying

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MicroTCA for Physics Backplane Topology

- up to 12 slots
- 20 Signaling ports/slot
- two power supplies
- Ethernet
- SATA
- PCIExpress or SerialRapidIO
- Redundant fabrics
- point-to-point links
- MLVDS for trig and sync
- clocking

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Proprietary Solutions Based on MicroTCA


Employed when high performance is required.

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Libera Instruments on Platform B

- Platform B for more demanding applications.
- Designed in compliance with AMC.0 standard.
- Some features were added to achieve better performance for specific instrument.
- Modular design, offers more flexibility.
- Hot swap capable modules (MTTR)
- Instrument portfolio built on this platform:
    - Libera LLRF (various configurations)
    - Libera Brilliance +
    - Libera Single Pass H

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SW Architecture

- modular design
- platform management daemon
- PCIe via Linux Kernel Module
- common libraries (registry and signals)
- measurement and control interface (MCI)
- high-level application SW
- control system interface adaptors

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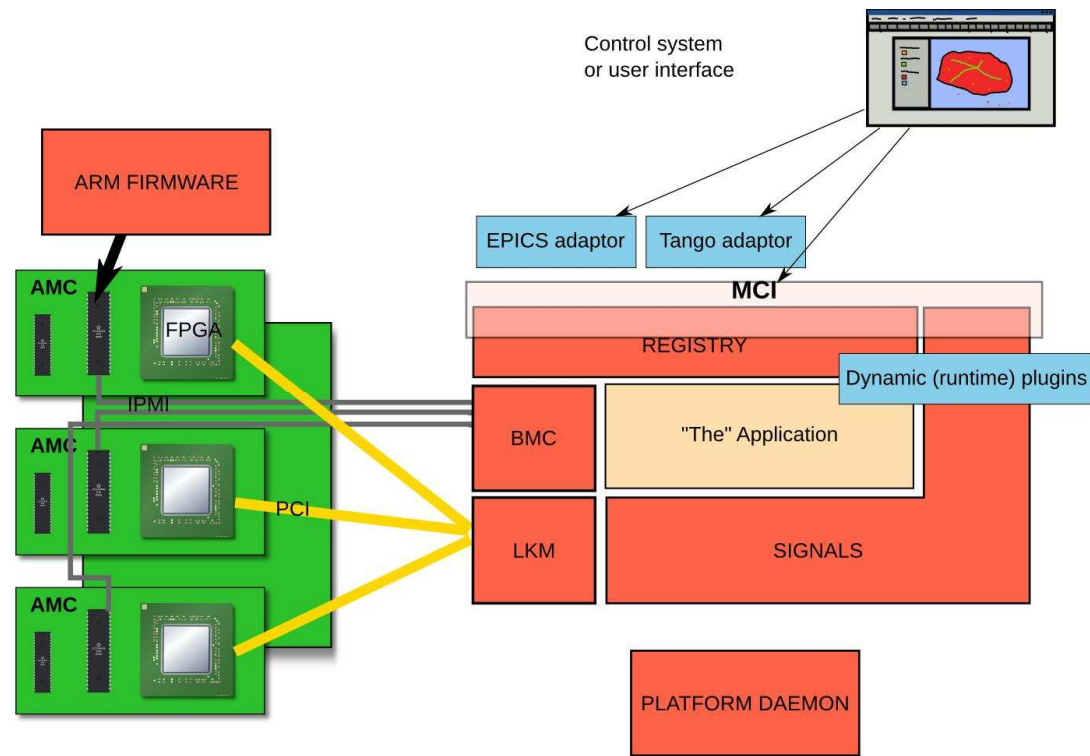
Summary

- Advanced applications on the accelerators demand:
  - High availability
  - High reliability
  - Short MTTR
  - Intelligent robust diagnostics and management
  - Powerful distributed computing

- µTCA for physics standard meets these demands.
- Instrumentation Technologies has the know-how and experience for prompt implementation!

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