Introduction to ATCA

RCE Training Workshop

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Outline

• ATCA
  - History, background & concepts
  - Mechanical
  - Electrical/thermal
  - Data transport
  - Shelf management
ATCA – History & concepts

• Advanced Telecommunication Computing Architecture (ATCA)
  - Electronics packaging standard
    • Crate based
    • “VME on steroids”
    • PICMG standard (PCI Industrial Computer Manufacturers Group)
  - Driven by telecom industry...
    • Targeted for warehousing & co-location centers
    • Intended to support many thousands of racks
    • Uptime (high availability) & performance are the key goals

• ATCA and uTCA are different standards
  - ATCA targeted to VME-like applications
    • Trigger & DAQ
  - uTCA targeted to Compact PCI-like applications
    • Control & monitoring
    • Subset of ATCA functionality + performance
    • Lower cost, smaller footprint

• Talk will focus on ATCA only...
ATCA-Notation

• **Subrack**
  - “Maps” to VME *Crate*
  - 2-16 slots
  - Horizontal or vertical orientation

• **Front Board**
  - “Maps” to VME *Cards*
  - *One* height (8U)

• **RTM (Rear-Transition-Module)**
  - No standard VME correspondence

• **Backplane**
  - Very different philosophy from VME

• **Thermal (cooling) mechanisms* (fans)**
  - How much different can they be?
  - Big emphasis on redundancy, monitoring & control

• **The Shelf** is the sum of:
  - Subrack, backplane, front boards, RTMs & (potentially) P/S
  - *Maps* to VME *chassis*
Typical (5 slot) shelf

Front
- front board
- fans
- Shelf manager

Back
- Power supplies
- RTM
- RTM
ATCA – Mechanical

- Front Board
  - Fixed height (a) 8U
  - Pitch (b) 30.48 mm
  - Fixed depth (c) 280 mm

- RTM
  - Fixed height (a) 8U
  - Fixed pitch (d) 30.48 mm
  - Variable depth (e) ~70 mm

- Common Mezzanine Card (CMC)
  - Maximum of four
  - 75 mm width
  - Standard PMC sizes
  - ATCA compliant CMCs are Front Boards for uTCA
ATCA – Electrical

- Zone 1
  - Power
    - -48 VDC
  - System management
    - I²C
  - Redundant power and control feeds
- Zone 2
  - Data transport
    - 200 differential pairs
    - May operate @ up to 10 gb/s
- Zone 3
  - Connected to RTM
  - Connectors not defined by standard...
- Maximum power dissipation
  - Front board
    - 200 (400) watts
  - RTM
    - At least 5 (typically 30) watts
Typical ATCA front board + RTM

- Rear panel
- Zone 1
- Zone 2
- Zone 3
- RTM
- Front panel
ATCA – Data transport

• Serial rather than parallel backplane
  - Protocol agnostic (no bus protocol)
• Simply many differential (LVDS) pairs
  - Connectors & backplane allow signaling on these pairs up to 10 gb/s
    • PCI express (multiple lanes)
    • Infiniband (multiple lanes)
    • 10-GE (XAUI or 10-GE)
    • 1-GE (most common)
• Two defined networks
  - “Base” network
    • Slow traffic for control/services
    • PICMG 3.1 – 10/100/1000 BaseT ethernet
  - “Fabric” network
    • Fast traffic for bulk data transport
    • PICMG 3.1 – 1Gb, 10Gb ethernet
• Topology of the Fabric network may vary...

- Dual Star is a subset of Full Mesh
- Replicated Mesh is also possible in small shelves (typically 2-5 slots) where each node has N channels to every other node

• Base network is always Dual Star
ATCA - Shelf Management

- **The Shelf Manager**
  - The VME standard has **no** corresponding element
  - Performs **active** monitoring and management of the shelf
  - Internally:
    - Uses I²C on the backplane
  - Externally:
    - *Ethernet* as a link-layer
    - *IPM* (Intelligent Platform Management)
    - This is a very pervasive standard independent of ATCA
  - **Functions:**
    - Watches managed devices and reports anomalous events
    - Handles hot-swap
    - Negotiates and sequences power for its managed devices
    - Provides thermal management (fan levels)
    - Provides logical (Electronic) keying - chooses how a given backplane channel will be used (PCI-e, Infiniband, Ethernet, ...) based upon end points.
RCE board + RTM (Block diagram)
RCE board + RTM

Media Carrier with flash

transceivers

2x RCE

Media Slice controller
Summary

• ATCA differentiating features...
  - Fixed board height and depth
  - RTM
  - External (DC) power
  - Shelf Management
  - Protocol agnostic
  - Various backplane topologies