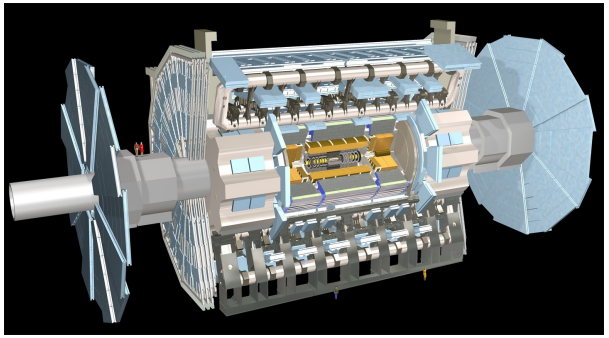

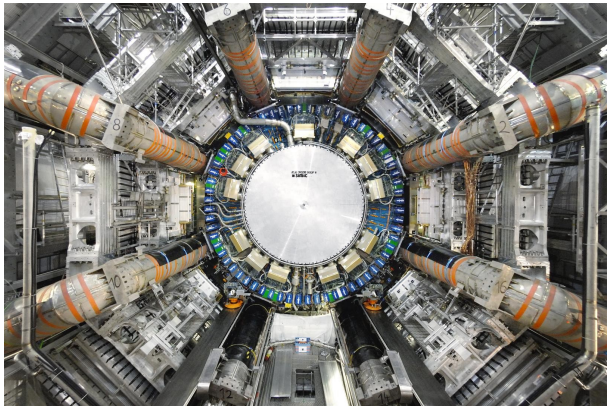

Introduction to ATCA

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 *u*TCA are <u>different</u> 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

fans

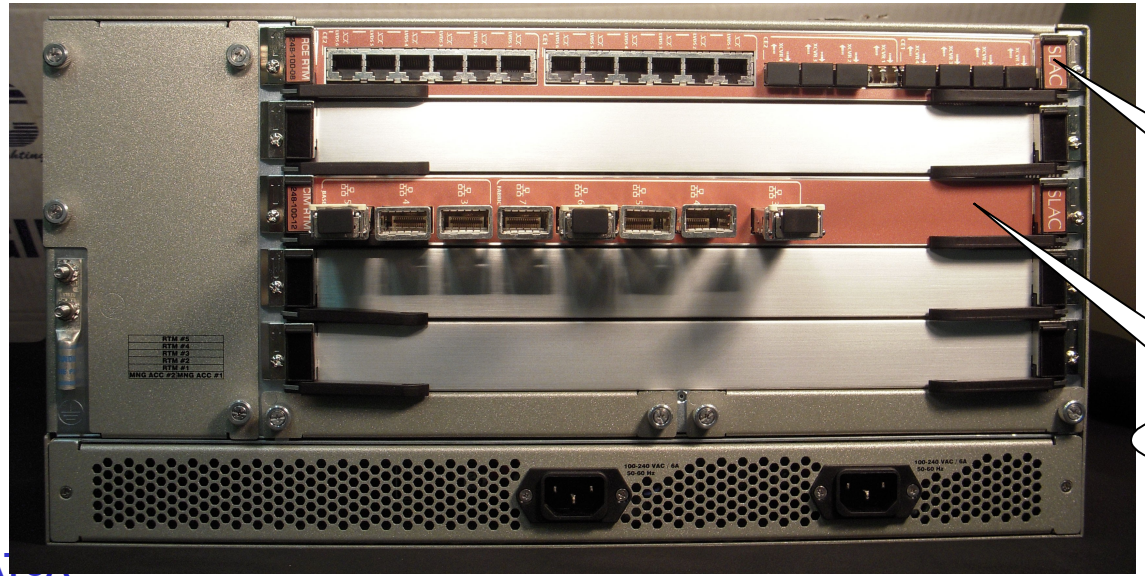
front board

Shelf manager

front board

Power supplies

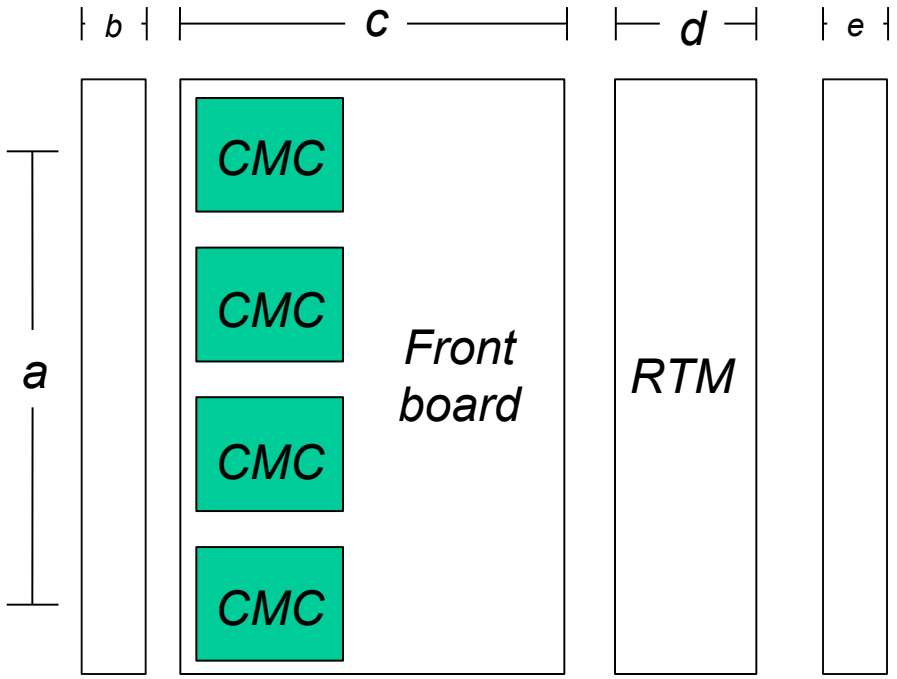
Back



RTM

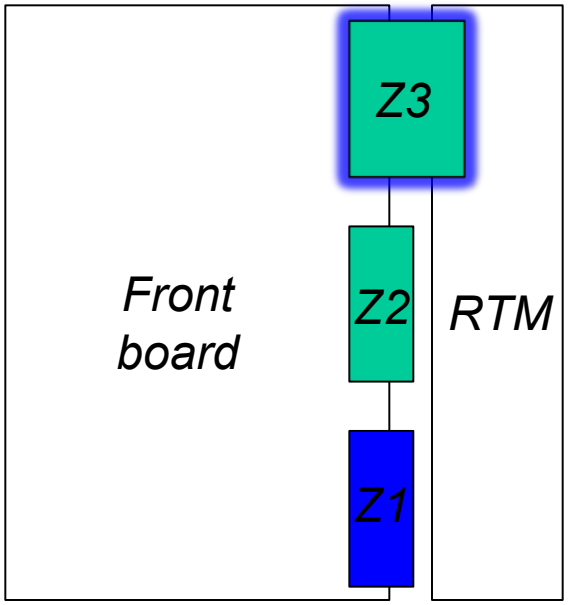
RTM

ATCA - Mechanical



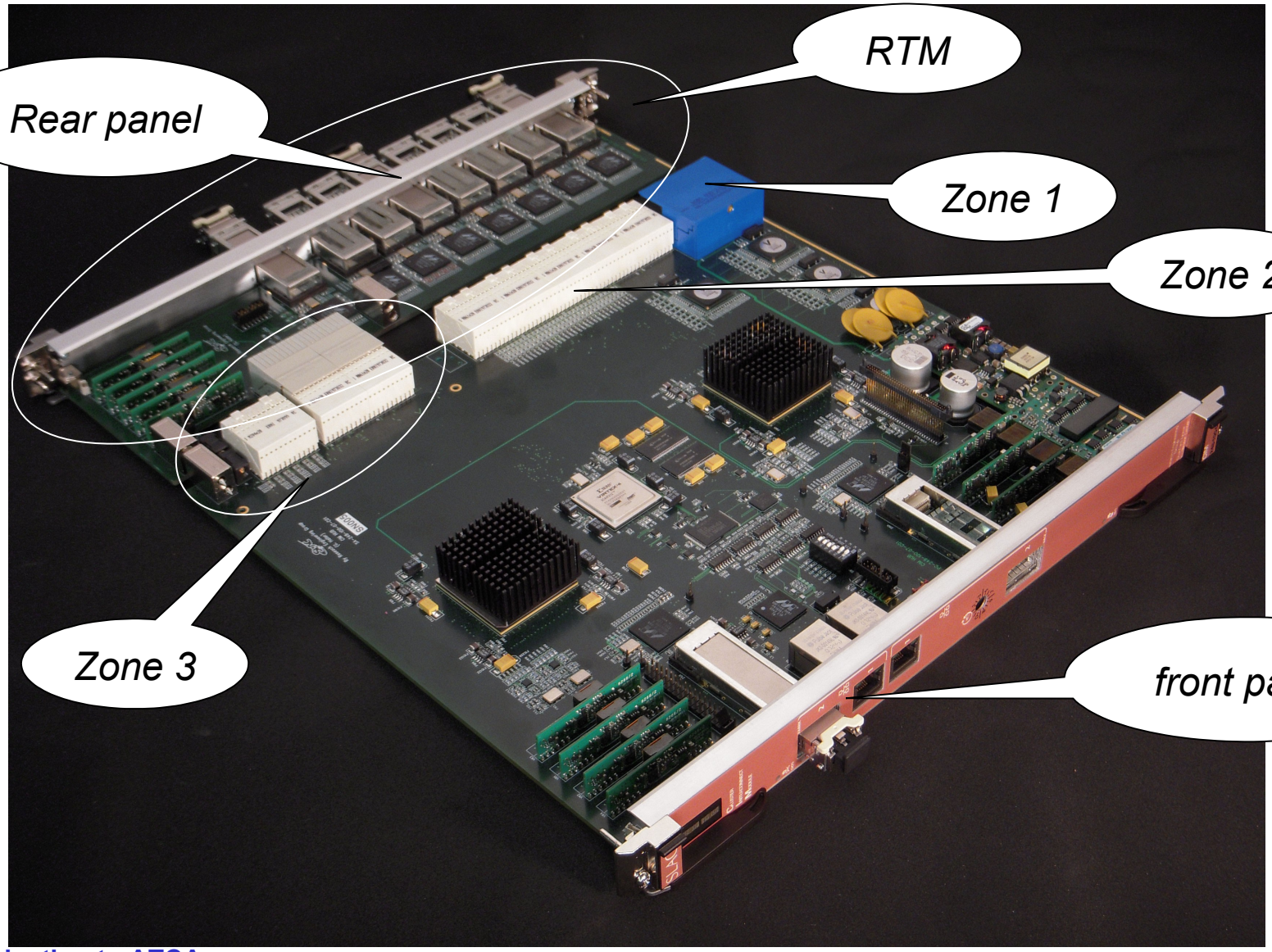
- Front Board
  - Fixed height (a) 8U
  - Pitch (b) 30.48 mm
  - Fixed depth (c) 280 mm
- RTM
  - Fixed height (a) 8U
  - Fixed pitch (d) 30.48 mm
  - Variable depth (e) ~70 mm
- Common Mezzanine Card (CMC)
  - Maximum of four
  - 75 mm width
  - Standard PMC sizes
  - ATCA compliant CMCs are Front Boards for uTCA

ATCA - Electrical



- Zone 1
  - Power
    - -48 VDC
    - Allows rack *aggregation* of power
  - System management
    - I^2C
  - 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

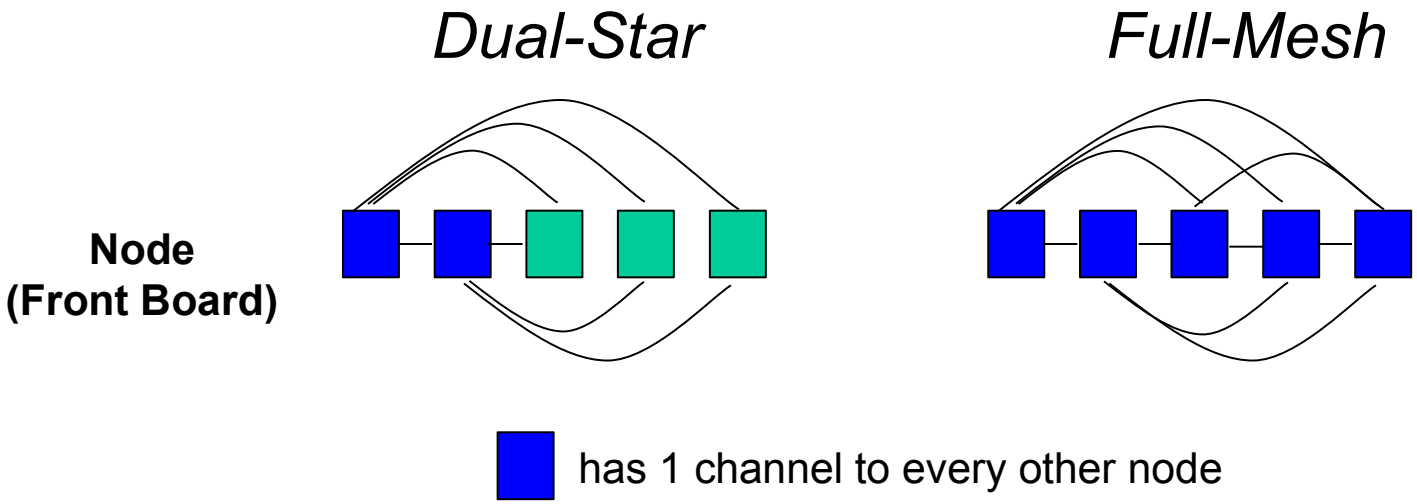


ATCA - Data transport

- 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

ATCA - Data Transport (cont)

- Topology of the Fabric network may vary…



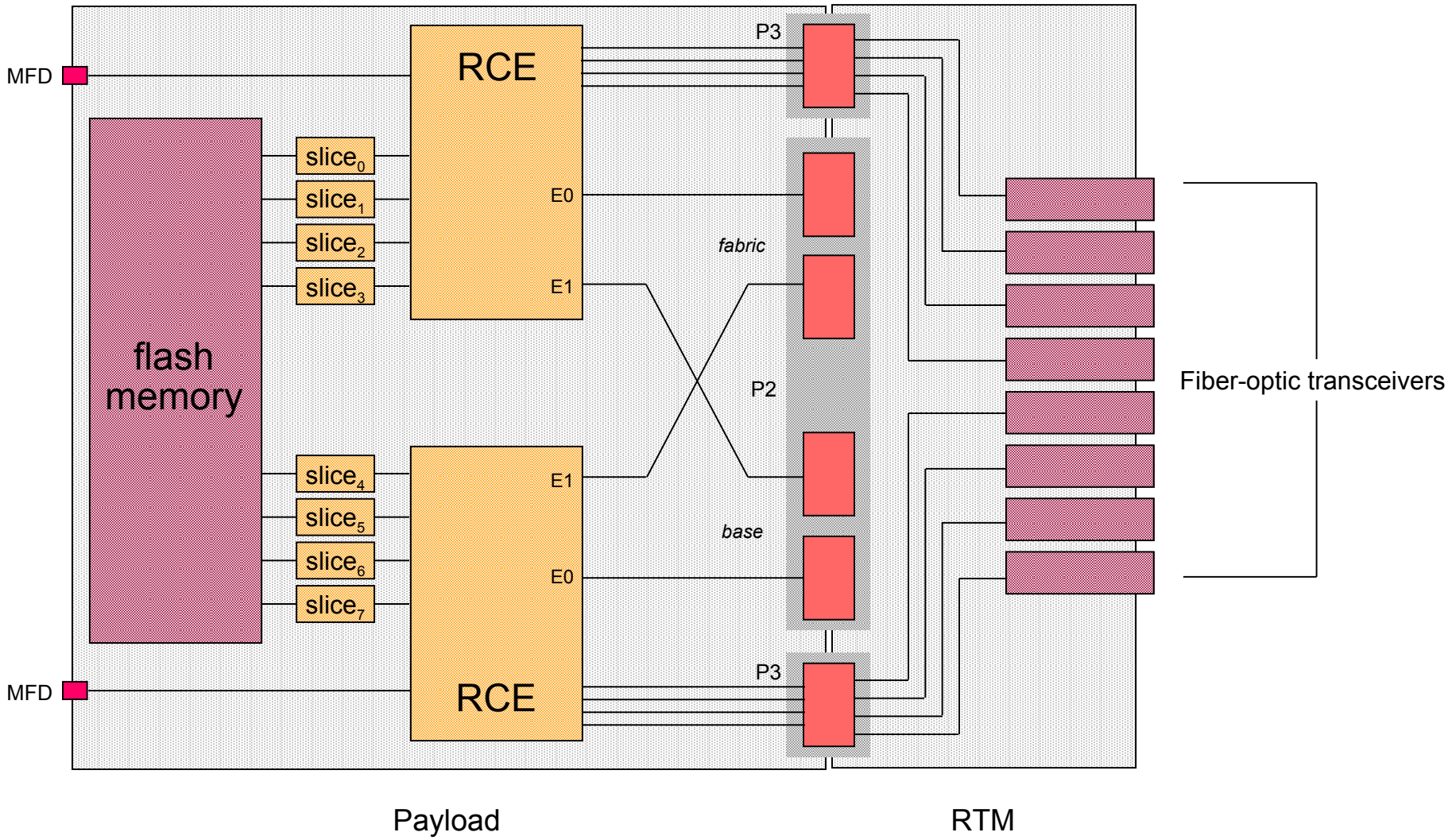
  - Dual Star is a subset of Full Mesh
  - Replicated Mesh is also possible in small shelves (typically 2-5 slots) where each node has N channels to every other node

- Base network is always Dual Star

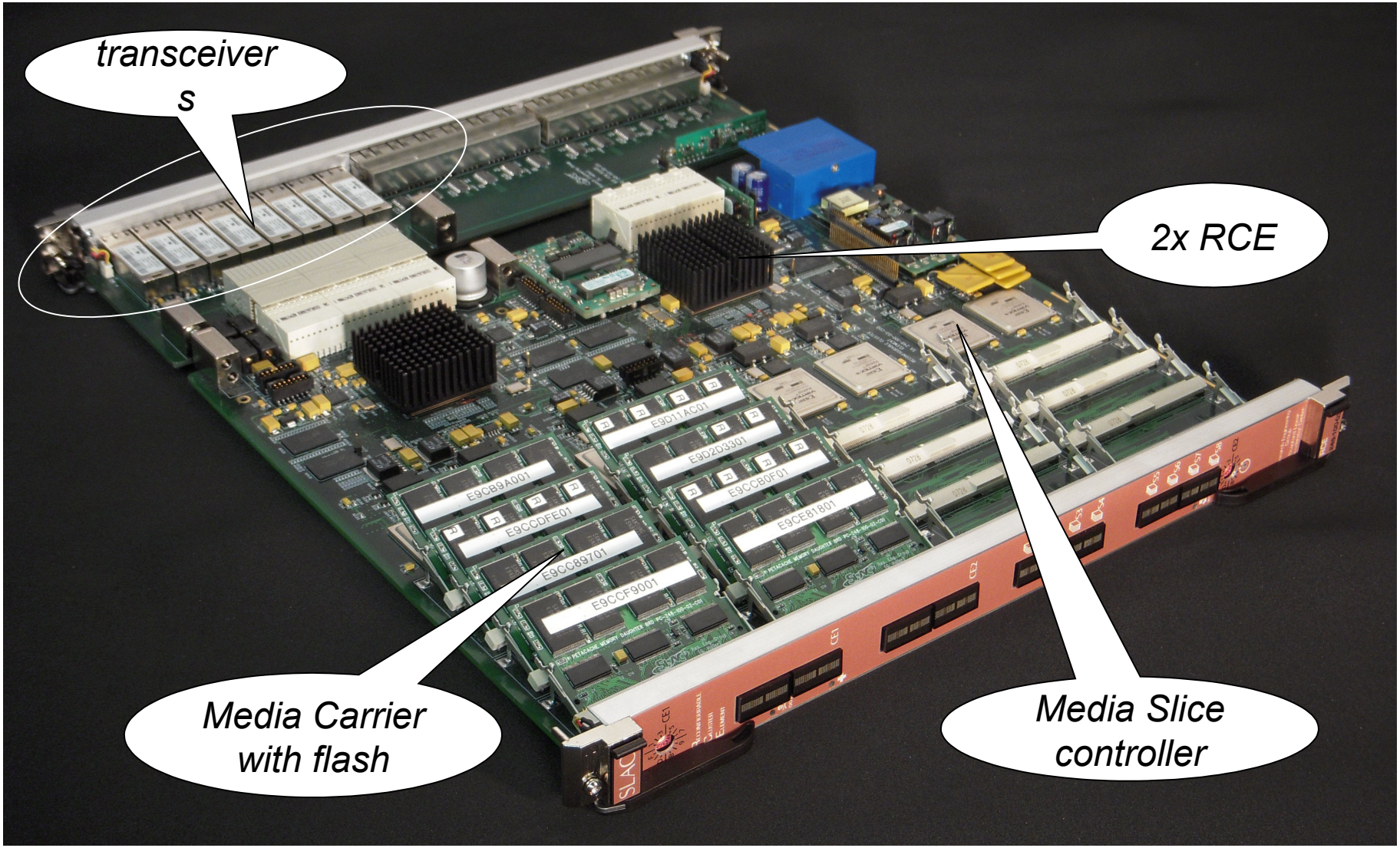
ATCA- Shelf Management

- The *Shelf Manager*
  - The VME standard has no corresponding element
  - Performs active monitoring and management of the shelf
  - Internally:
    - Uses I^2C 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.

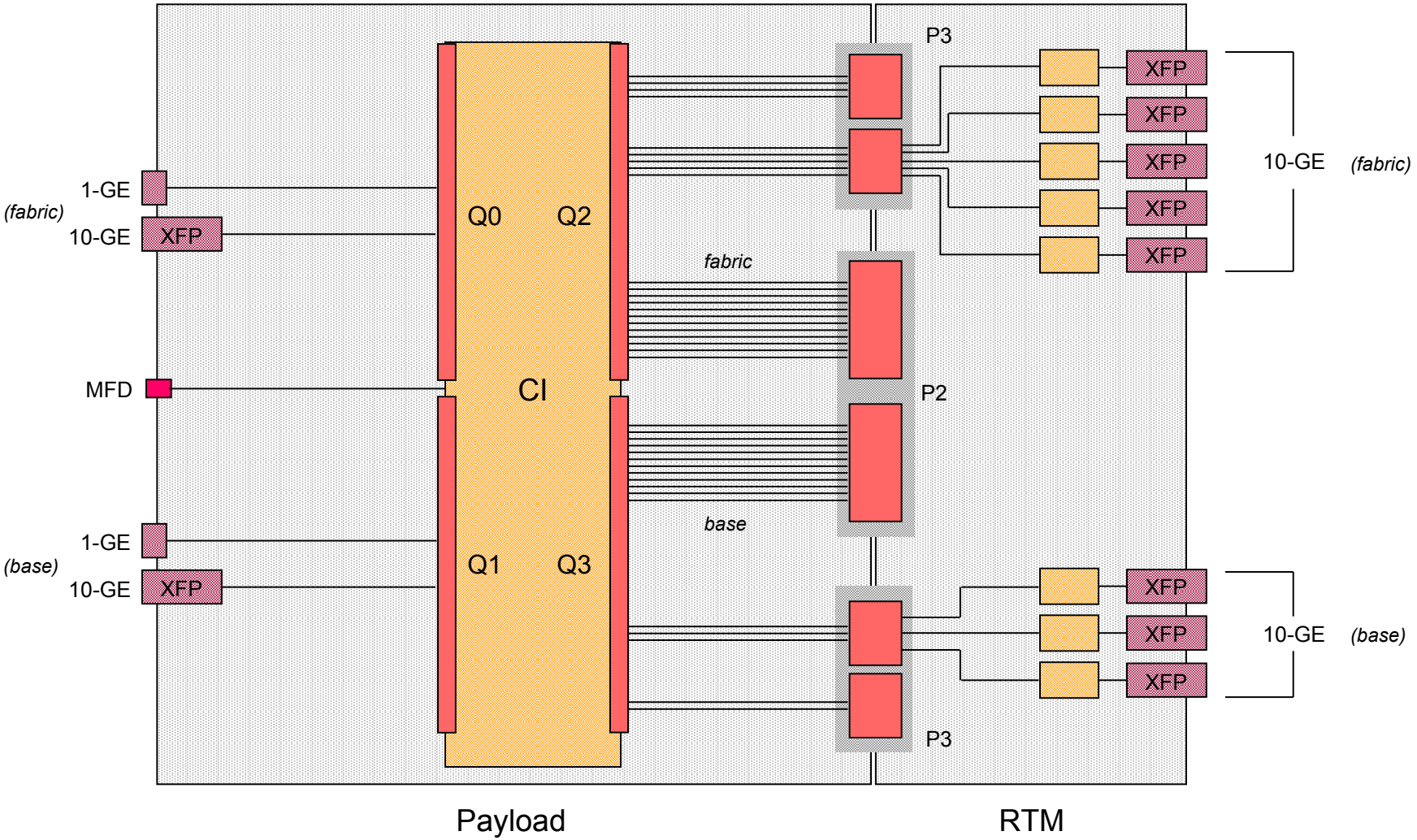
RCE board + RTM (Block diagram)



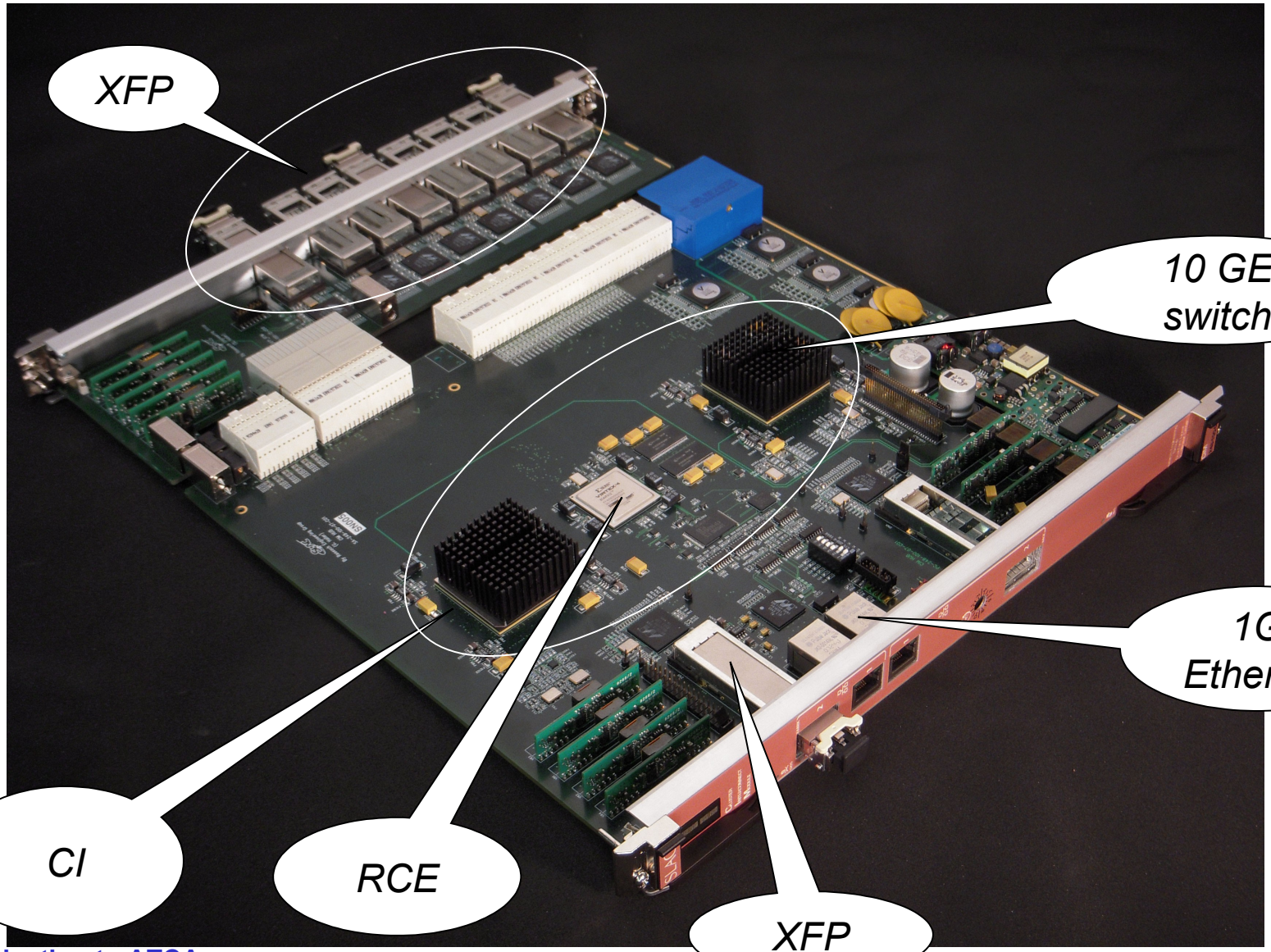
RCE board + RTM



Cluster Interconnect board + RTM (Block diagram)



Cluster Interconnect board + RTM



Summary

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