AdvancedTCA®

Tutorial

June 23, 2004

Introduction

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Agenda:

9:00 – 9:05	Welcome and Introductions	Chuck Byers	Lucent
9:05 - 9:15	Requirements of Platforms	Chuck Byers	Lucent
9:15 – 9:45	Mechanical and Power	Michael Thompson	Pentair/Schroff
9:45 – 10:00	Thermal	Eike Waltz	Rittal
10:00 – 10:20	Shelf Management	Mark Overgaard	Pigeon Point
10:20 – 10:40	Data Transport & Subsidiary Specs	Jay Gilbert	Intel
10:40 – 10:50	Application Examples & Wrap-up	Chuck Byers	Lucent
10:50-11:00	Q&A	All Presenters	

Goals

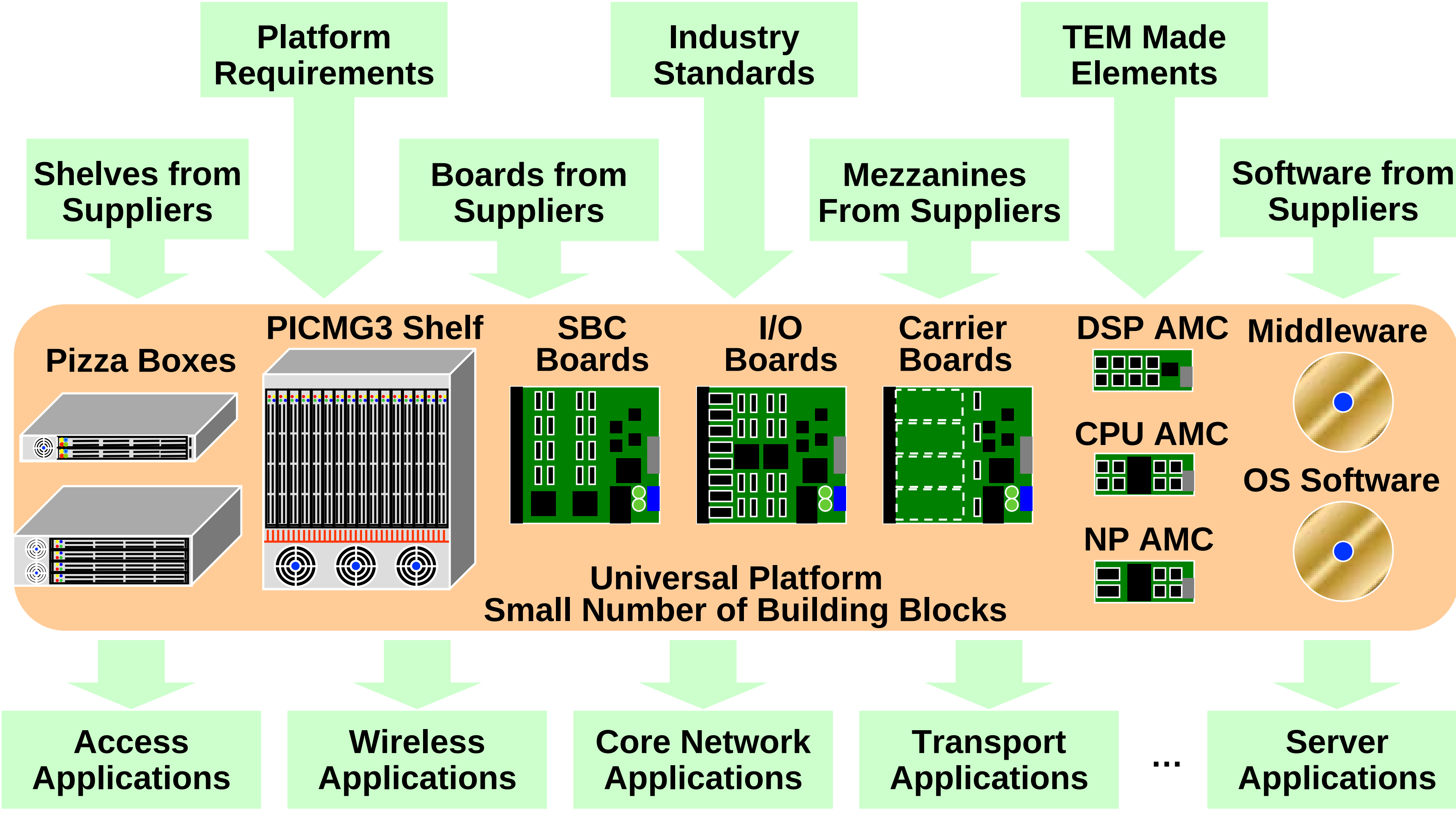
- Understand the requirements of a modular platform
- Learn the technical details of the AdvancedTCA spec
- Study applications of AdvancedTCA
- Help you make informed decisions about creating, specifying, or adopting AdvancedTCA technologies.
- Help you appreciate the AdvancedTCA Pavilion
- Answer your questions.

Overview: What is AdvancedTCA?

- Advanced Telecommunication Computing Architecture
- Also known as the PICMG3 family of standards or ATCA
- Covers shelves, boards, mezzanines, and management
- Valuable as the basis for a standards-based modular platform, on which many applications can be built

- Primary application focus:
  – Telco Carrier Grade applications based on standard fabric solutions
- Secondary application focus:
  – Data Center Modular Servers

Platform Building Blocks



Programmable Processors in AdvancedTCA

Call Processing

- RISC & CISC CPUs
- Operate once per "call"
- Responsible for feature richness
- Heavy SW investment in C code

Server Farm

Softswitch

Edge Switch

Service Node

Industrial Control

Medical

Router

FttX

Military

Base Station

Optical Transport

RNC

DSLAM

Voice Gateway

Packet Processing

- Network Processors, NSEs, etc.
- Operate once per "packet"
- Responsible for network performance
- Standard and custom protocol stacks

Signal Processing

- DSPs and FPGAs
- Operate once per "sample"
- Responsible for media stream quality
- Standard and proprietary algorithms

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PICMG

What does the marketplace need from a platform standard?

- Scalable shelf capacity to 2.5Tb/s
- Scalable system availability to 99.999%
- Multi-protocol support for interfaces up to 40Gb/s
- Robust power infrastructure and large cooling capacity
- High levels of modularity and configurability
- Ease of integration of multiple functions and new features
- The ability to host large pools of DSPs, NPs ,processors, and storage
- Convergence of telecom access, core, optical, and datacenter functions
- Advanced software infrastructure providing APIs and OAM&P
- High security and regulatory conformance
- World-class element cost and operational expense
- A healthy, dynamic, multi-vendor, interoperable “eco-system”
- Available now, with a design-in life through at least 2010

AdvancedTCA Standards

- Kickoff of informal “Santa Barbara” group 7/20/2001
- Officially incorporated as PICMG3 11/13/2001 with 105 companies
- Subteams: Form Factor, Backplane/Fabric, RASM
- Base Spec (PICMG3.0) covers mechanical, power, cooling, interconnect, and RASM properties of the AdvancedTCA family of specs
  - 430 pages
  - ratified 12/30/2002
- Subsidiary specs:
  - 3.1: Ethernet and Fiberchannel Transport
  - 3.2: InfiniBand Transport
  - 3.3: StarFabric Transport
  - 3.4: PCI Express Transport
  - 3.5: Serial RapidIO
- Additional PICMG efforts:
  - AMC: Advanced Mezzanine Card
  - CompactTCA
  - Product Classification Working Group
  - System Fabric Plane / Internal Time Division Multiplexing (SFP / ITDM)

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Mechanical Packaging and Power Distribution

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Pentair/Schroff
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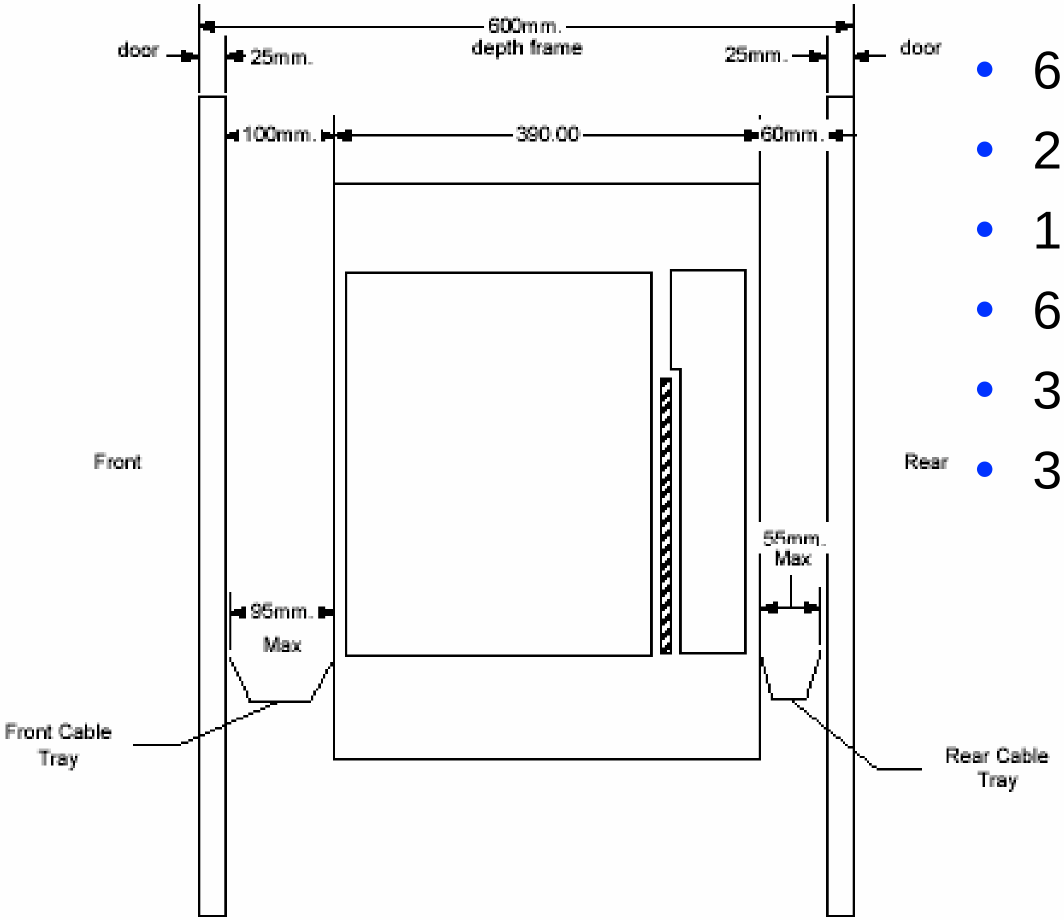
http://www.a-tca.com

ATCA Mechanical Requirements

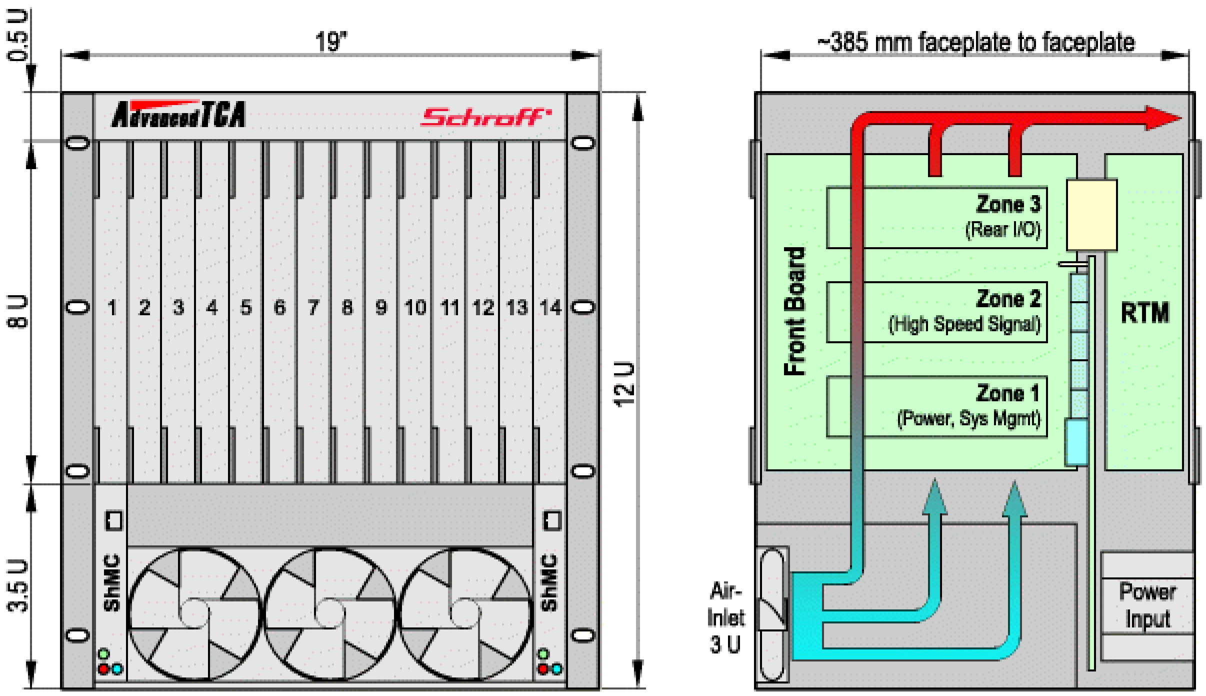
- Targeted for 16 slot shelves in 600 mm ETSI cabinets
  - 14 slots will fit in an EIA 19” cabinet
  - 23” telecom cabinets also supported
- Large enough board for future requirements
- Increased board pitch and room for SMT components on rear side
- Cooling for 200W per board
- No exotic (expensive) cooling systems
- Reliable mechanics
  - Serviceability, shock and vibration
- EMC

Chassis Mechanics, Depth

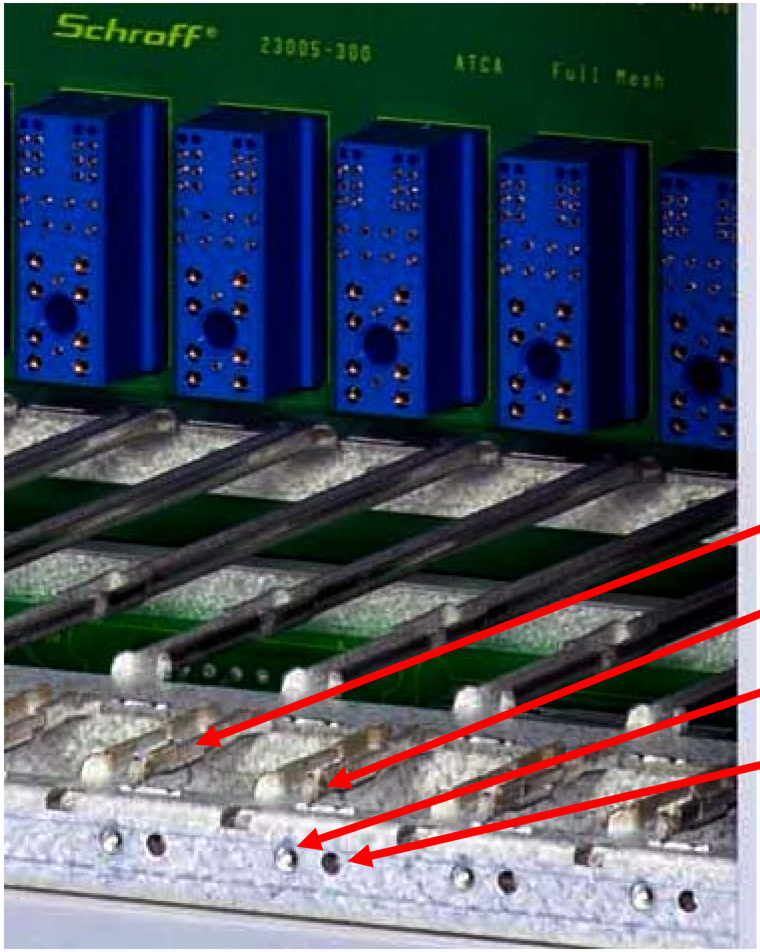


- 600 mm cabinet depth
- 25 mm thick doors
- 100 mm front cable/air area
- 60 mm rear cable/air area
- 390 mm remains for chassis
- 385 Faceplate to Faceplate

Chassis Mechanics



Chassis Mechanics, Sheet Metal



- Sheet Metal construction
  - Lower cost in high volume
  - Looser tolerances
  - Earthquake performance
  - 1.6 mm to 2.4 mm board PCB thickness

ESD clip

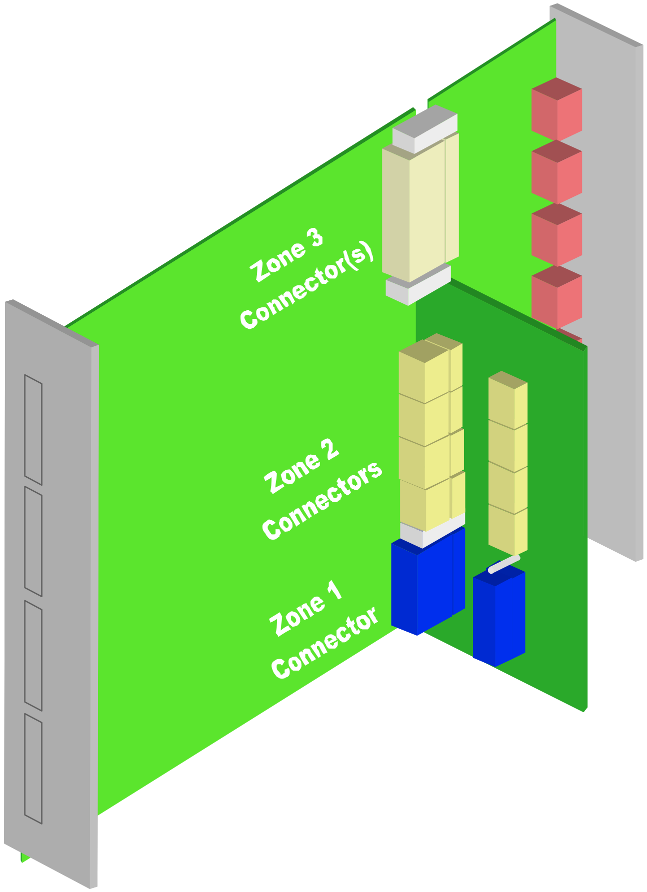
Guide Rail funnel

Retention Screw receptacle

Alignment Pin receptacle

Schroff AdvancedTCA®

Board Mechanics

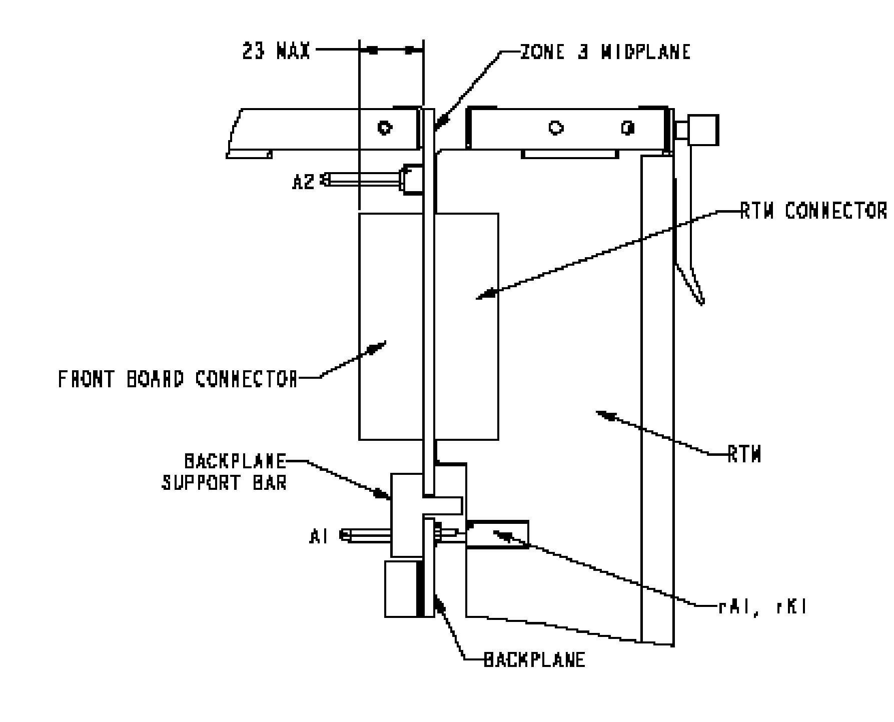


- Front board size 8U x 280 mm
- Rear board size 8U x 70 mm
  - Connects directly to front board
- Board width 6HP (1.2”)
- PCB thickness: 1.6mm - 2.4 mm allowed
- Simplified Telecom Packaging
- Provisions for 4 PMCs
- Provisions for 8 AMCs
- Alignment/Key pins

Board Mechanics, Face Plate

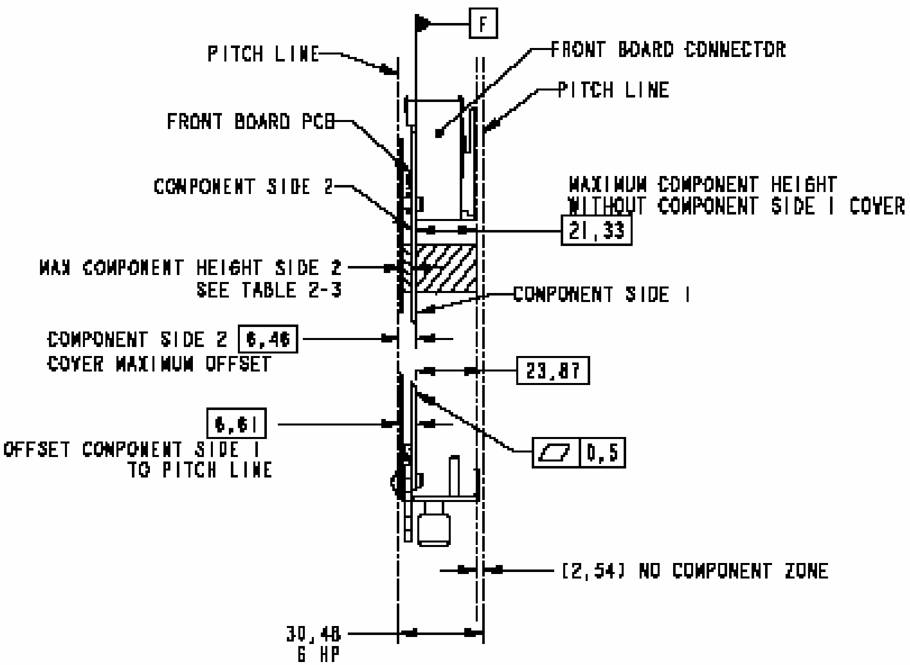
- Sheet metal solution
- EMC gasket on left side
  - Less prone to damage
- M3 retaining screw
  - No tool required
- Handle actuated micro switch for Hot Swap
- PCB offset 0.1” for all boards
- Alignment/Ground pin on Front Panel

Board Mechanics, RTM



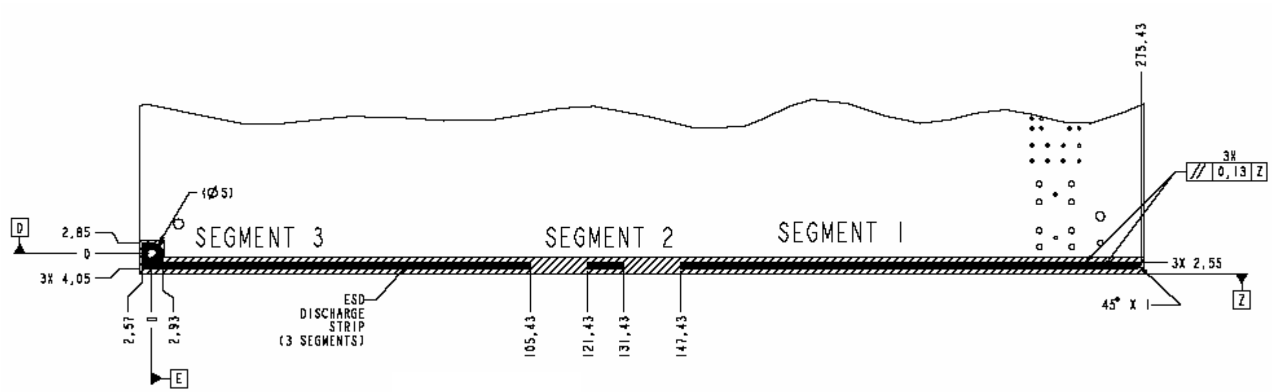
- 8U x 70 mm form factor
- Same mechanics as front board
  - (Mirror image)
- Includes alignment and keying
  - Key/Alignment to backplane
  - Key/Alignment to Front Board
- Front board to RTM connector undefined
- RTM does not connect to backplane

Board Mechanics, Component Height



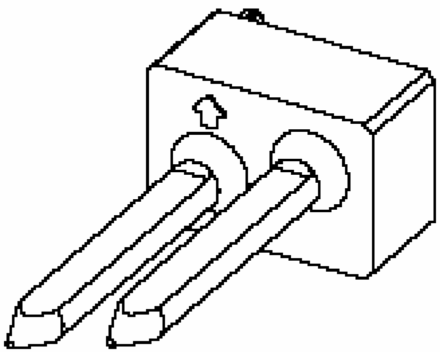
- 21.33 mm maximum component height on side 1
- maximum component height on side 2 depends on the board design
- ~1.99 mm with flexible side 2 cover and 1.6 mm PCB
- ~1.19 mm with flexible side 2 cover and 2.4 mm PCB
- ~2.45 mm with 1 mm rigid side 2 cover and 1.6 mm PCB
- ~1.65 mm with 1 mm rigid side 2 cover and 2.4 mm PCB

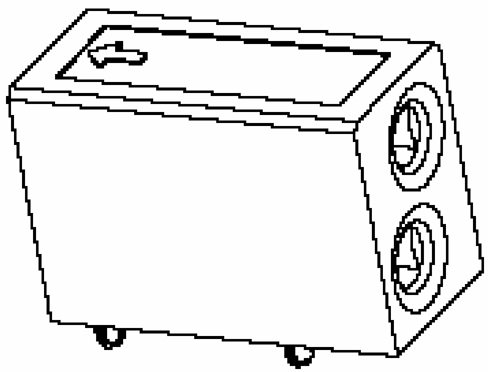
Board Mechanics, ESD Discharge Strips



- ESD discharge strips on bottom edge of Front Board and RTM
- Segment 1: 10 MOhms to Face Plate
  - Discharges installer
- Segment 2: 10 MOhms to Logic Ground
  - Discharges board
- Segment 3: 0 Ohms to Face Plate
  - Solid ground even if the board is not mated with the backplane
- Keep out area for isolation

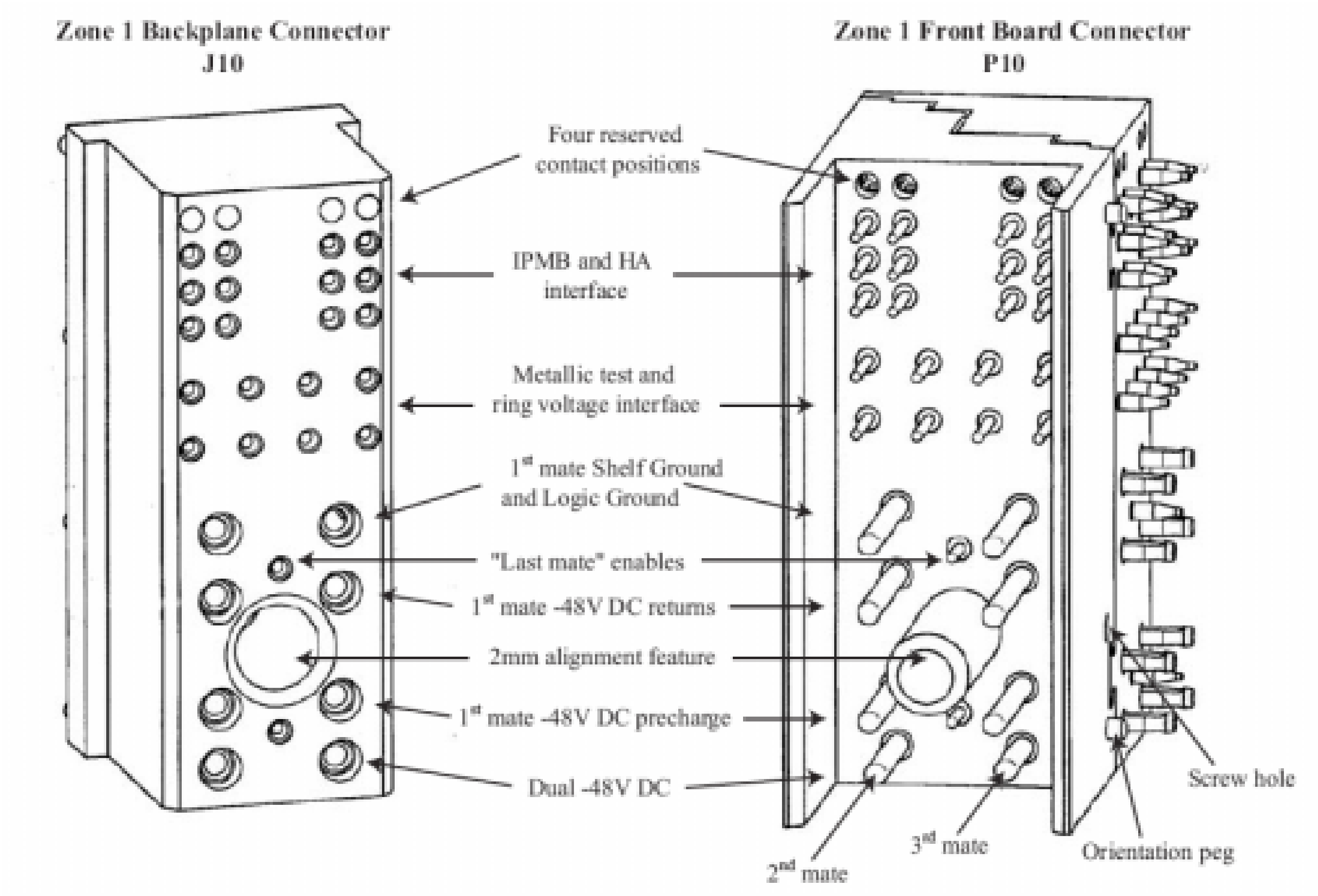
Board Mechanics, Alignment & Keying



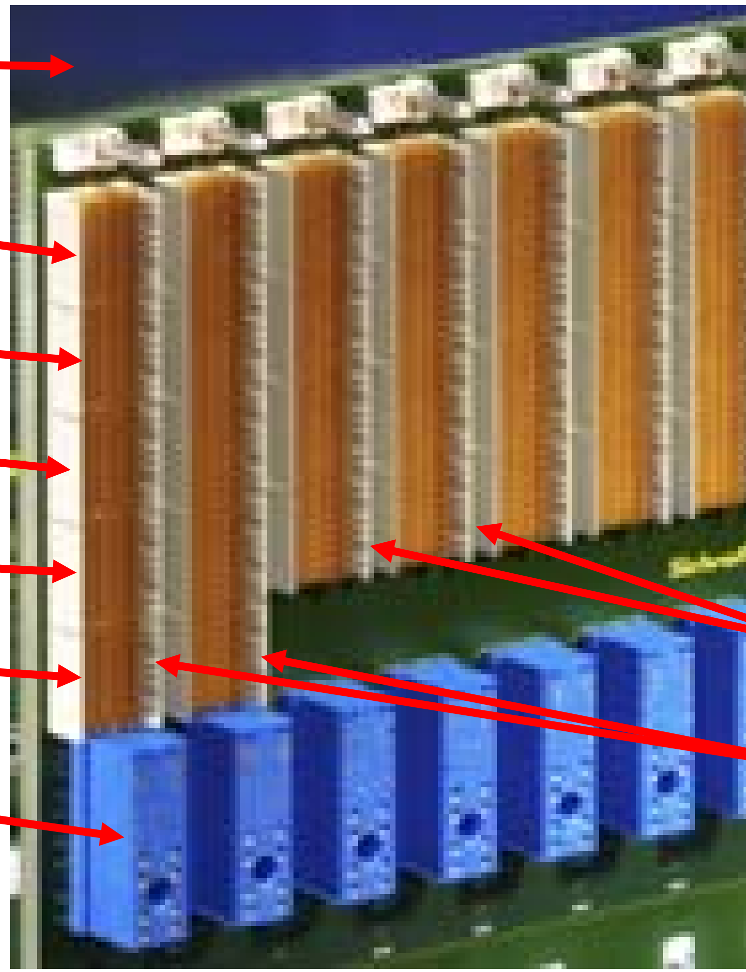


- Four stages of alignment
  - Subrack Guide Rails
  - Backplane alignment/key pins
  - Front Panel alignment/key pins
  - Connectors
- Front Board key (A1)
- RTM key (rA1)
- Front Board to RTM key (A2)
- Keys and receptacles have a flat side
- Eight key and receptacle positions
  - 64 possible combinations

Board Mechanics, Zone 1 Connector



Backplane

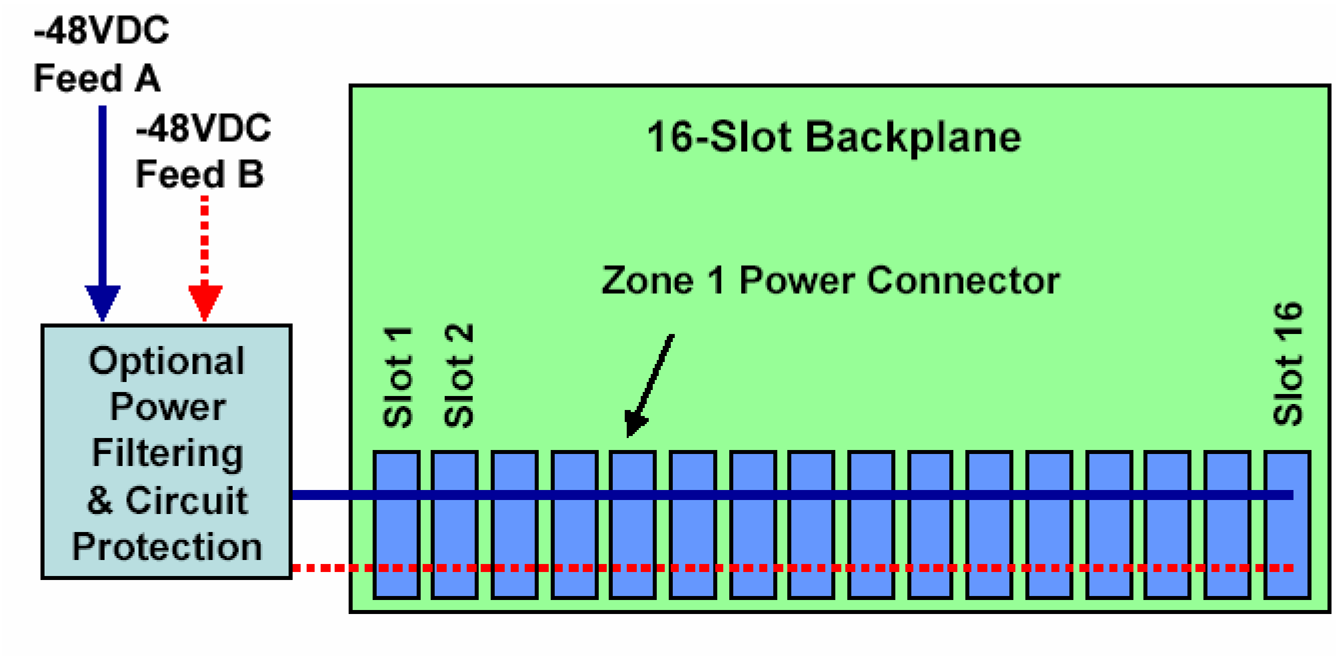


- The connector population depends on the architecture of the Fabric
- This is a Full Mesh backplane

Power Requirements

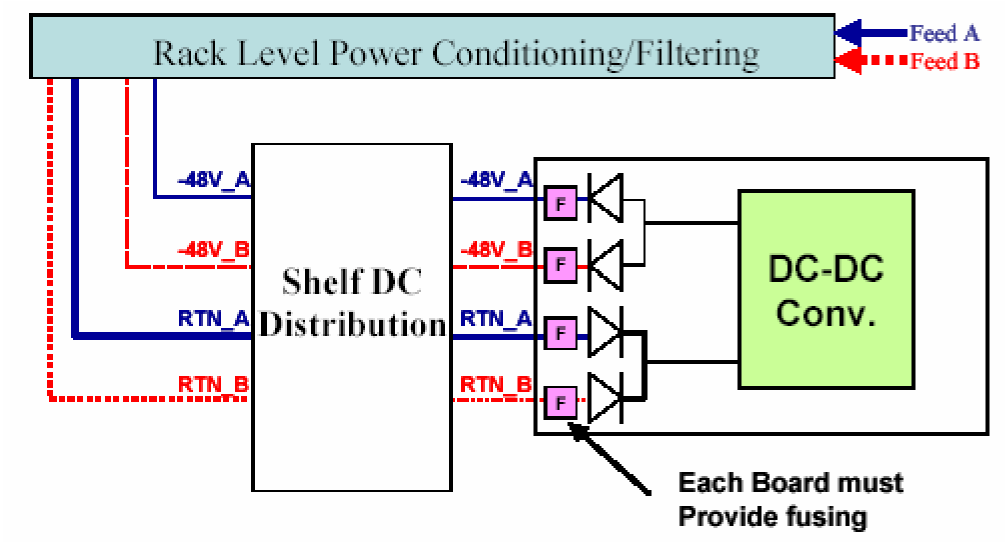
- -48/-60 VDC power input
  - -40.5 to -57 VDC, -50 to -72 VDC
- Redundant power inputs
- Distribution of ringing voltages
- Capacity of over 3,200 Watts per shelf
- Local power conversion
  - DC-DC converters on each board

Power Distribution



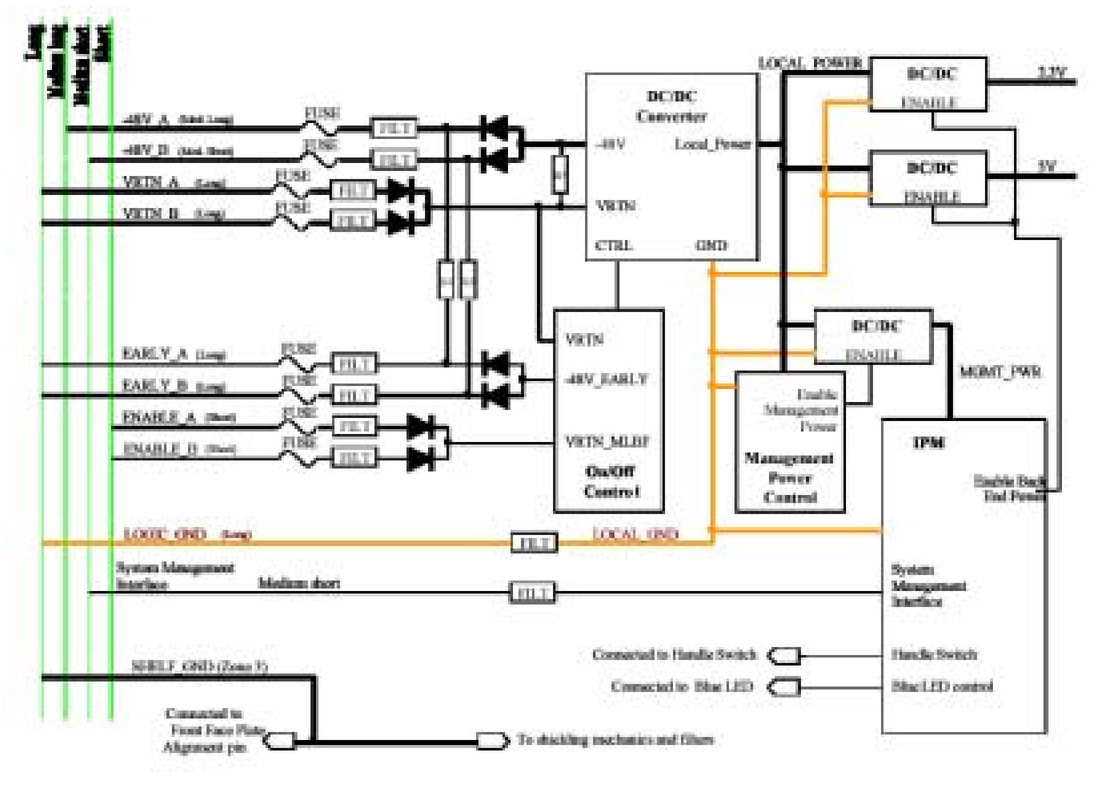
- Redundant power inputs
- Positronic Power connector with sequenced pins
- Other power distribution architectures are allowed

Board Power, Simple



- Board power can be from one DC-DC converter fed through four diodes from both DC inputs
- Board power can be from two DC-DC converters fed from both DC inputs (with or without diodes)
- Inrush current limiting and fusing required

Board Power, Complete

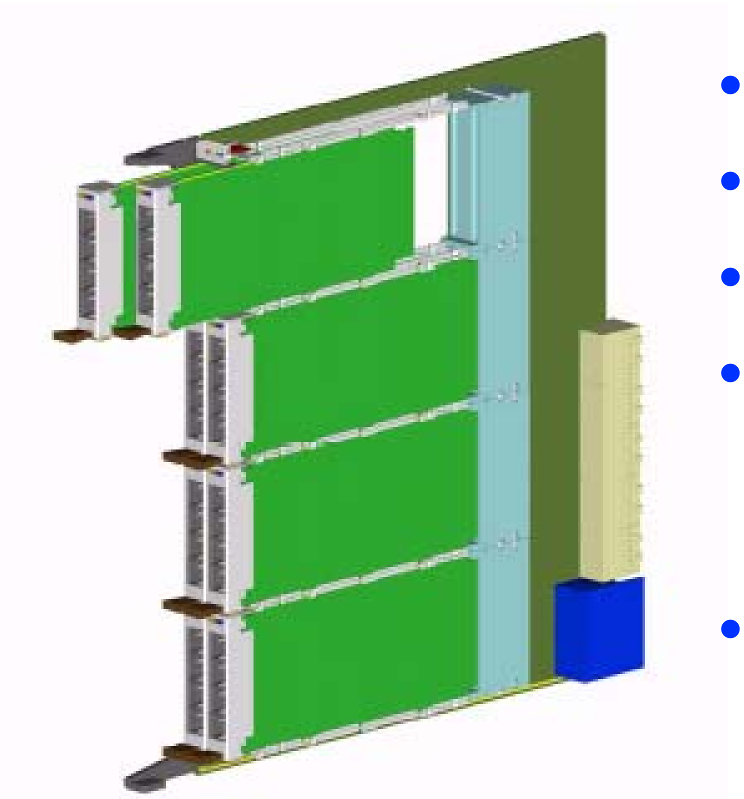


- A board can only consume 10W until more power is negotiated with the Shelf Manager

Grounding

- Front panel to chassis ground pin
- ESD ground strip on each Front Board and RTM
- Ground clip in card guide
- Provisions to tie Logic Ground to Shelf Ground
- Both mesh (2 wire) or single point return (3 wire) grounding systems supported

AMC Mechanics



- New mezzanine for ATCA carriers
- 12V power source
- 60 W maximum dissipation
- 181.5 mm deep modules
- Single/double width module
  - 73.8 mm wide for single width
  - 148.8 mm wide for double width
- Half/full height modules
  - 13.88 mm high for half height
  - 28.95 mm high for full height

Thermal

SuperComm 2004

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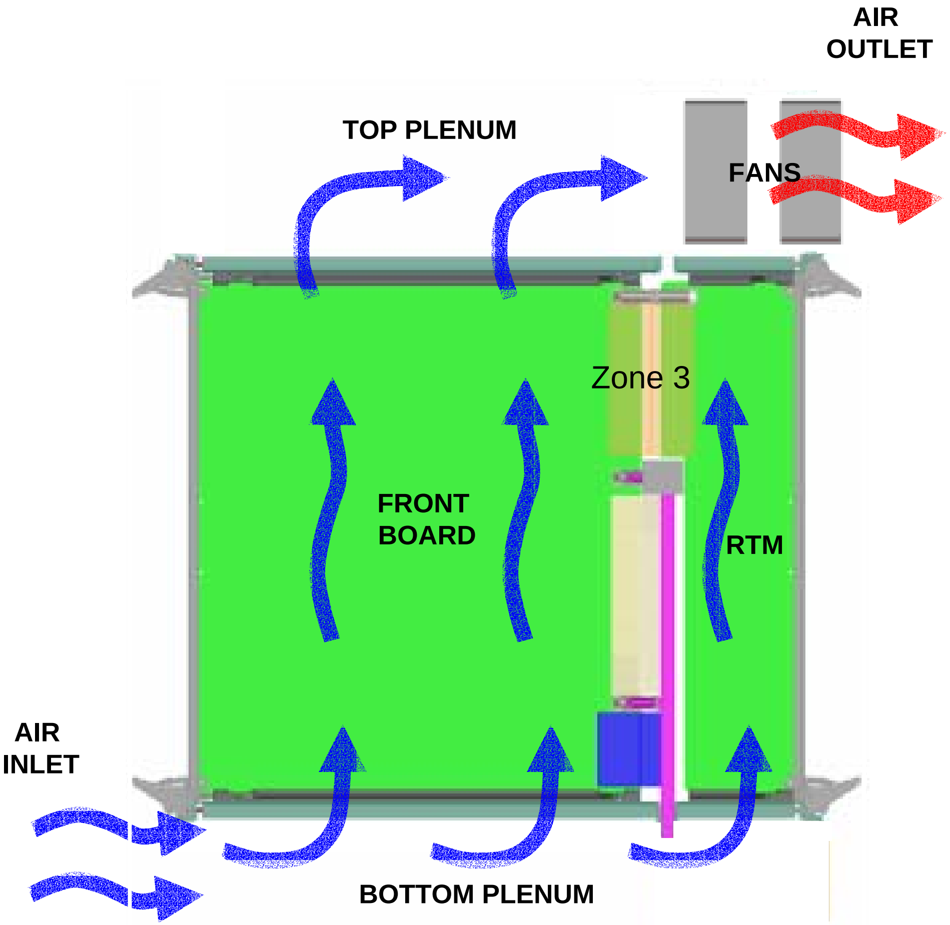
A Typical AdvancedTCA Shelf

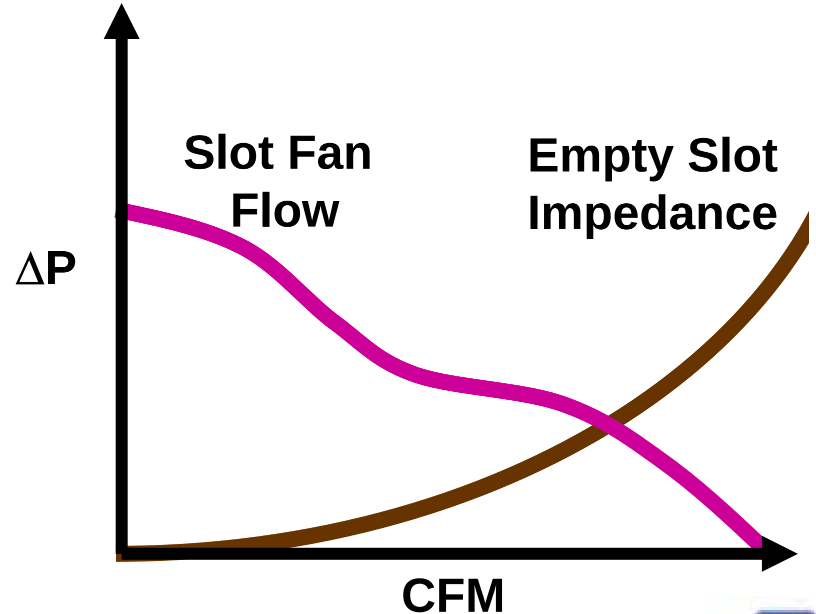
ATCA Shelf Variations:

- •14slots
- •16slots
- •X slots
- •19inch compatible
- •ETSI compatible
- •Backplane types
- •Cooling schemes
- •ShMC types
- •With or w/o RTM's
- •Height variations
- •Vertical / horizontal
- •etc

Shelf – Cooling

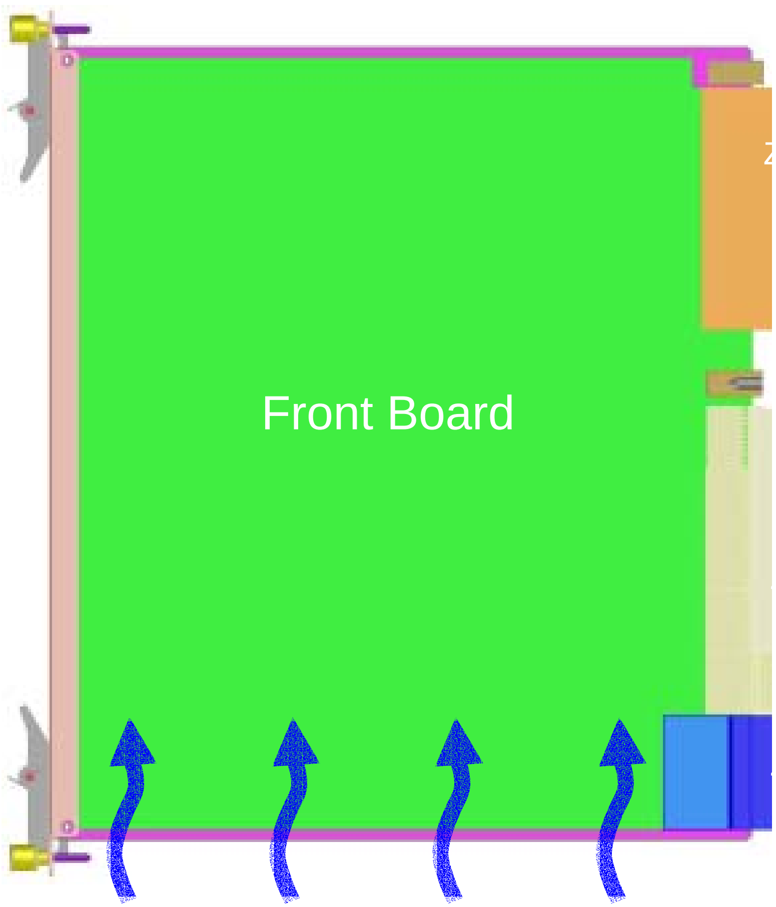
- **Front to rear airflow** "should"
- **Side to side airflow** "may"
- **Zone 3 Airflow Seal**
- **NEBS Air Filter**
- **Cooling arrangement not specified**
- **Flow Curve Requirements**
  - **Pressure Drop vs. Flow Rate**



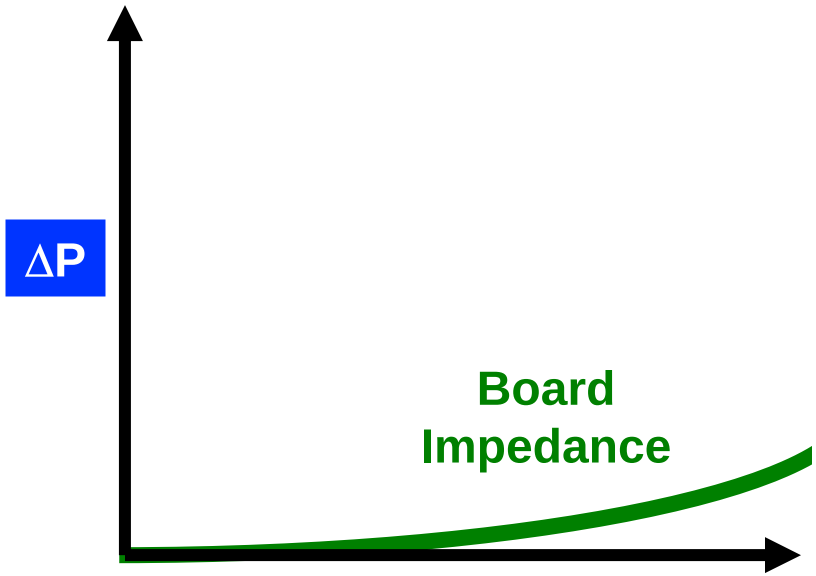


Front Board - Cooling

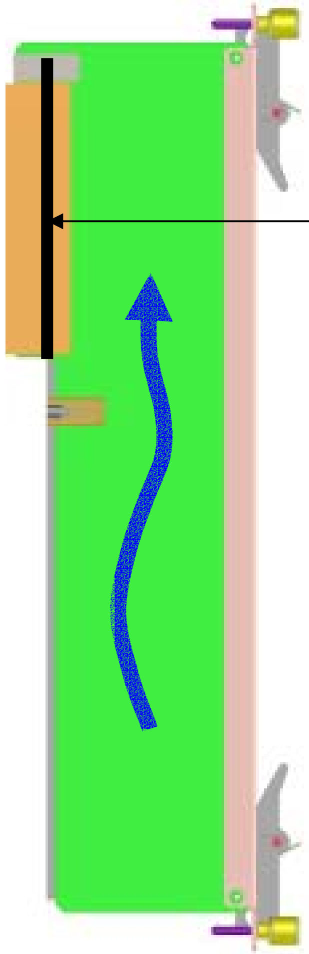
- 200 Watts per slot
  - Dual slot up to 400 Watts
- Airflow Direction
  - Bottom to top
  - Right to left (front view)
- Cooling Requirements
  - CFM = f(power) @ 10 °C
  - Pressure Drop vs. Flow Rate



Even inlet airflow distribution



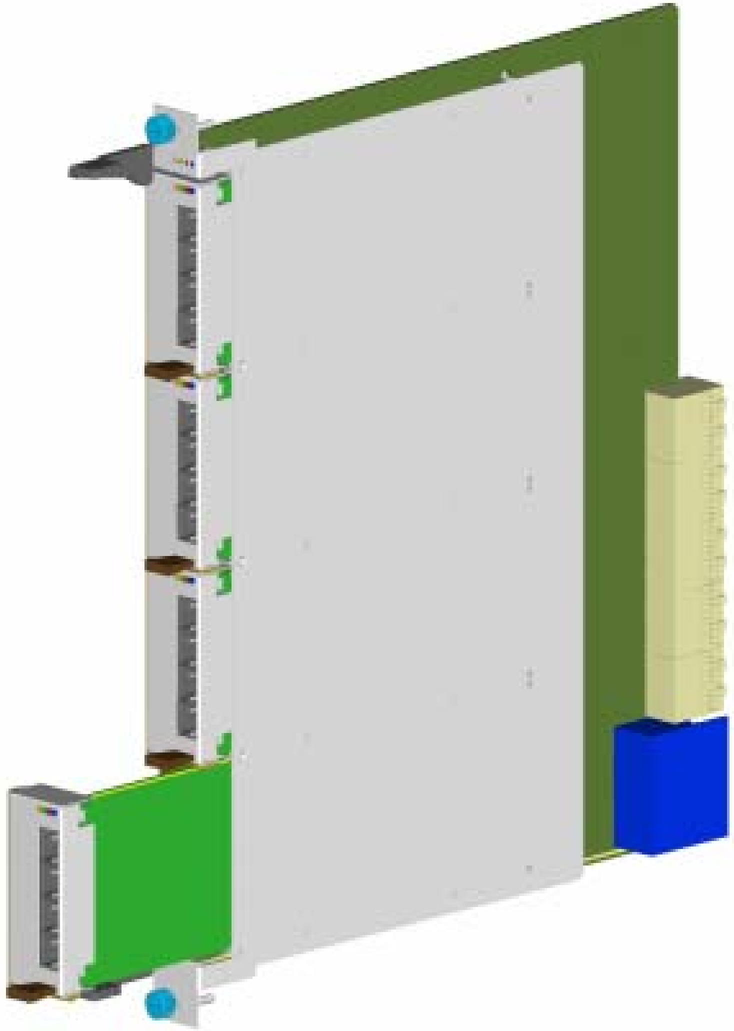
RTM - Cooling



- **Minimum requirement to support 5 W RTMs**
  - **5 W for natural convection**
  - **Do not burden shelves which do not require active cooling**
  - **Zone 3 Airflow Seal**
- **Air Flow Direction**
  - **Bottom to top**
  - **Right to left (front view)**
- **If active cooling is provided, cooling requirements**
  - **CFM = f(power) @ 10 C**
  - **Pressure Drop vs. CFM**

AdvancedTCA and Advanced Mezzanine Card (AMC) Cooling

AMC Module choices:
•Single-Width, Full-Height
•Single-Width, Half-Height
•Double-Width, Full-Height
•Double-Width, Half-Height

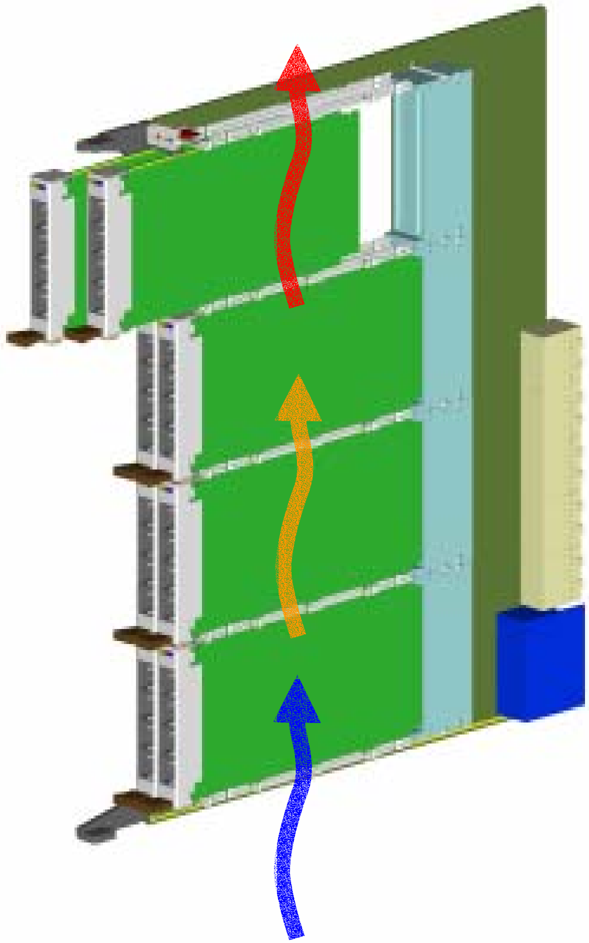


Single-Width Full – Height AMC Module shown

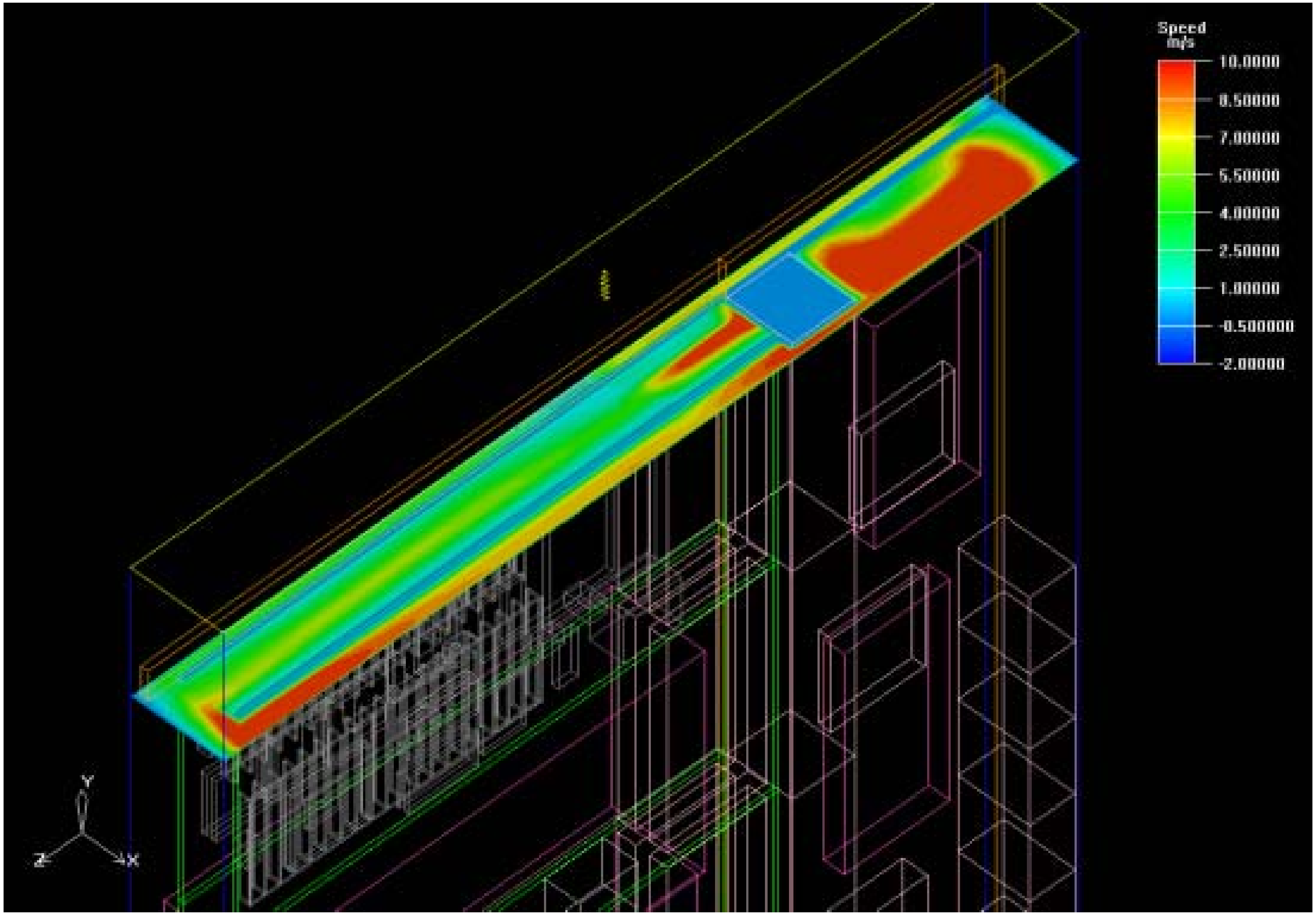
35W each

AMC Carrier with 8 Single-Width, Half-Height AMC Modules

A reference board
will be available
for simulation



AMC simulation - Velocity



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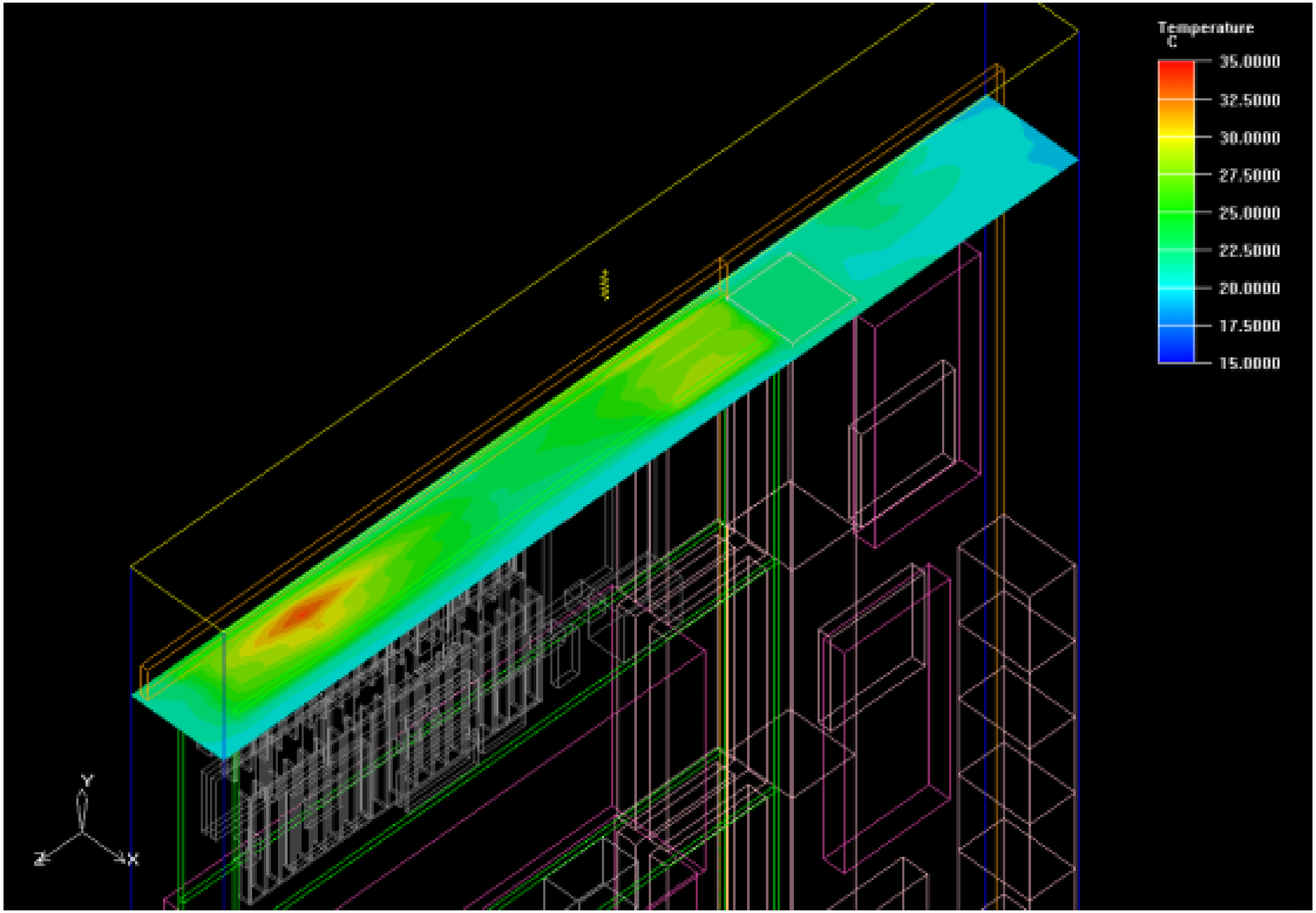
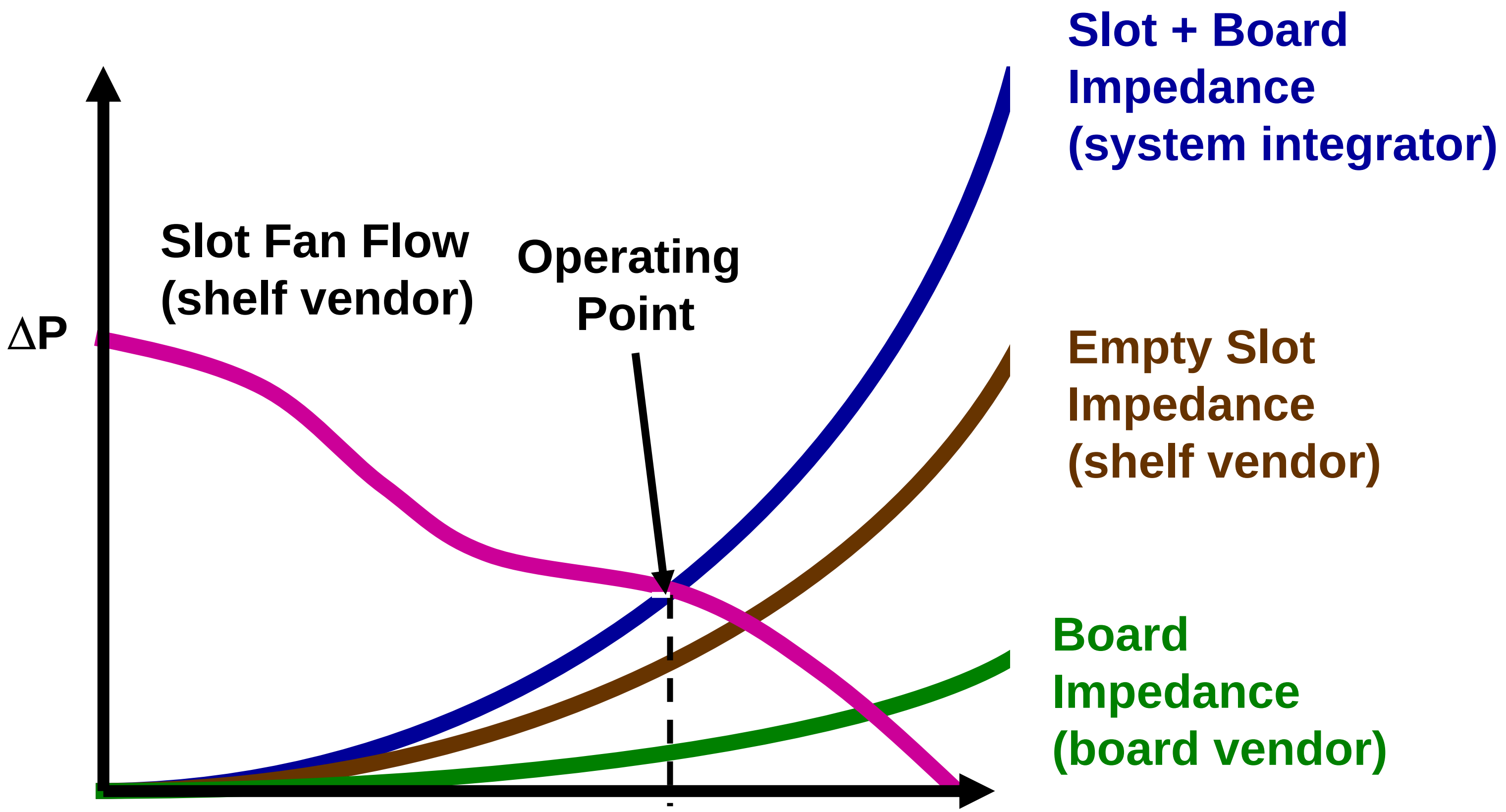
AMC simulation - Temperature



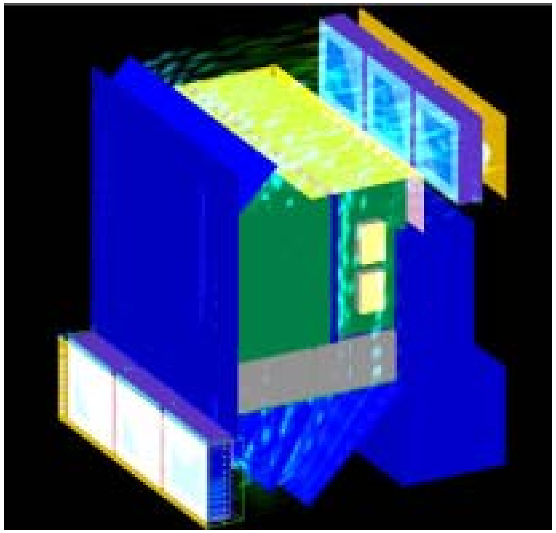
How much flow per slot

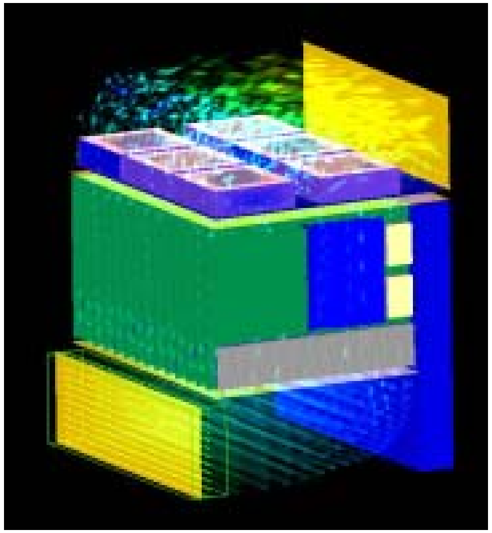
- System integrator incorporates data from shelf and board vendors.
- Simple Pass/Fail test based on flow (not temperature)

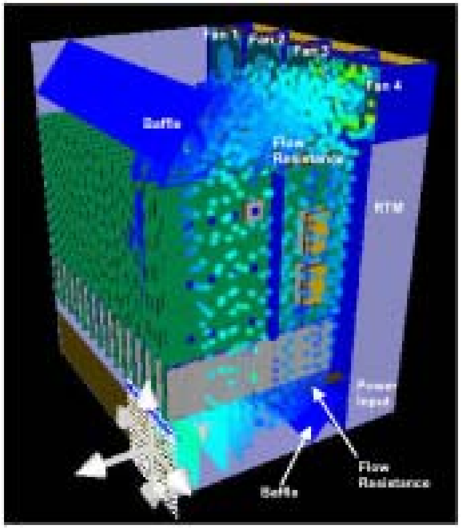


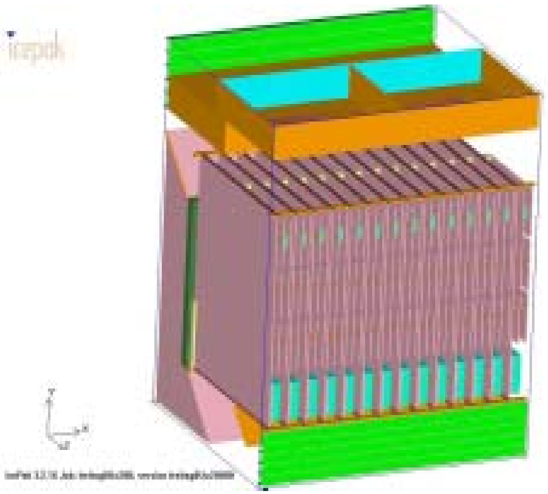
Even inlet airflow distribution

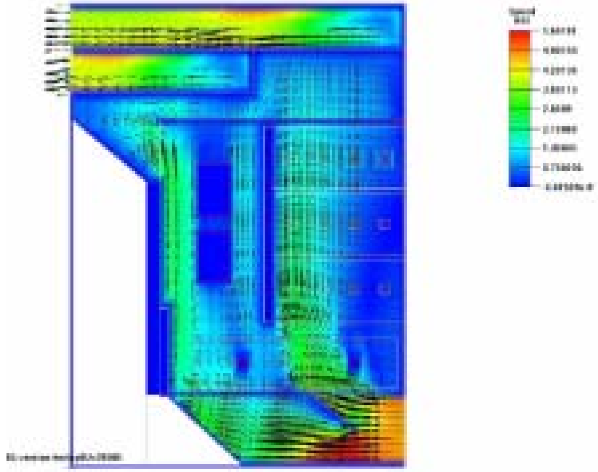
Simulation Examples









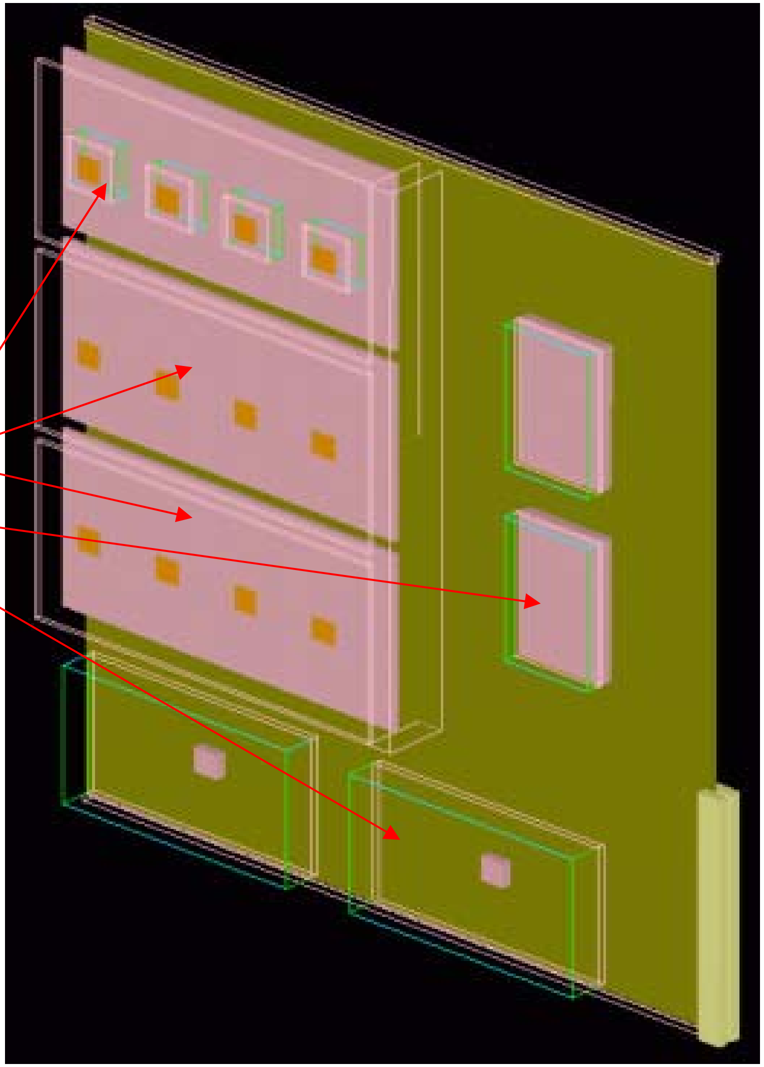


- Motorola
- Rittal
- Intel

8U x 280mm Board Design

- Reference Boards, 200W each. The processors were modeled as high conductivity material (little temp. distinction between case and junction)

Component	Power (each)	Qty	Power (total)
Mezzanines	10	6	60 W
DC-DC	15	2	30 W
Processors	40	2	80 W
Base Board	30	1	30 W
		Total Power	200 W



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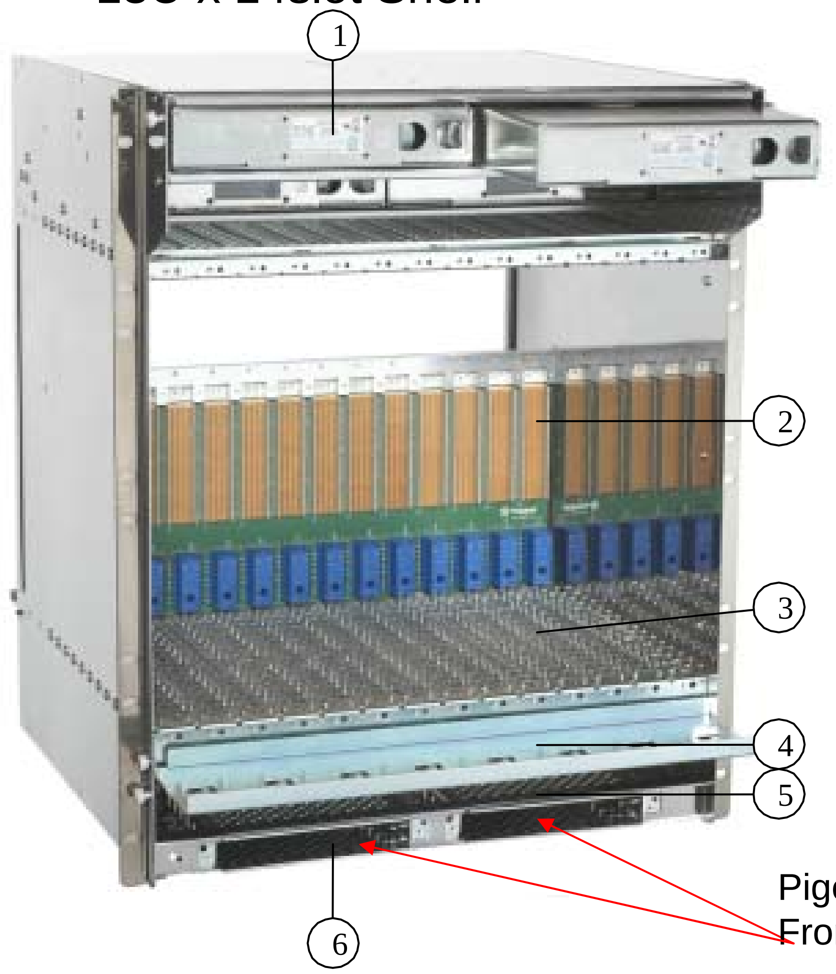
A typical AdvancedTCA Shelf simulated

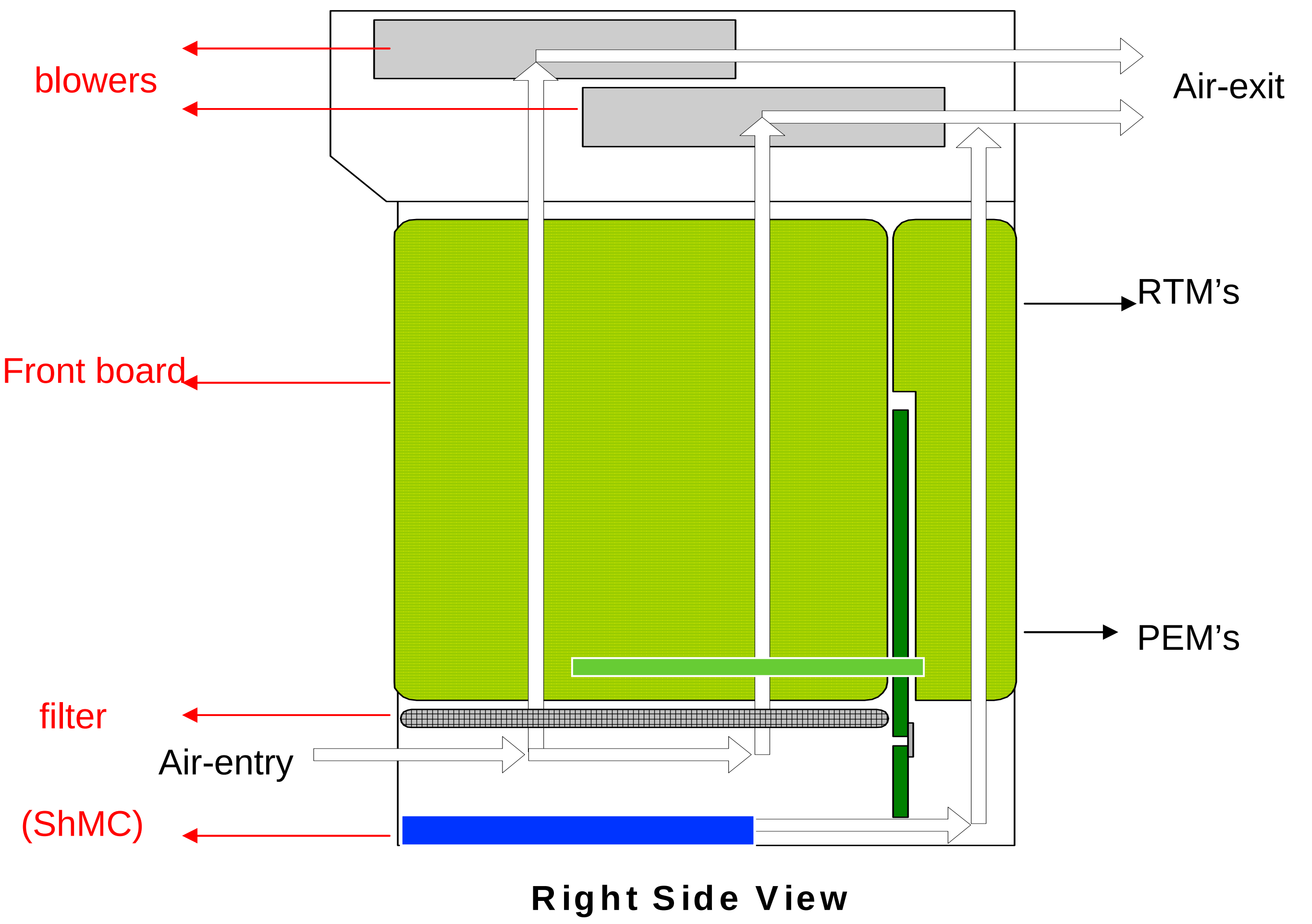
13U x 14slot Shelf



Pigeon Point or Intel ShMC
Front loaded

CFD Simulations

Front removable



CFD Simulations

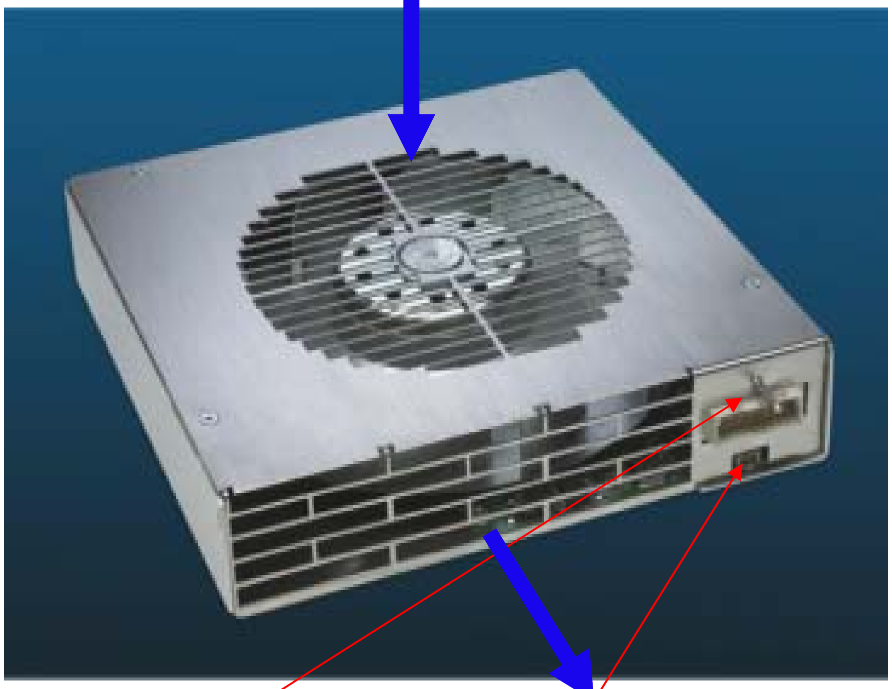
- RiCool-2 blower FRU

Stainles steel body

Handle holes

Blue Red LED

Hot swap switch



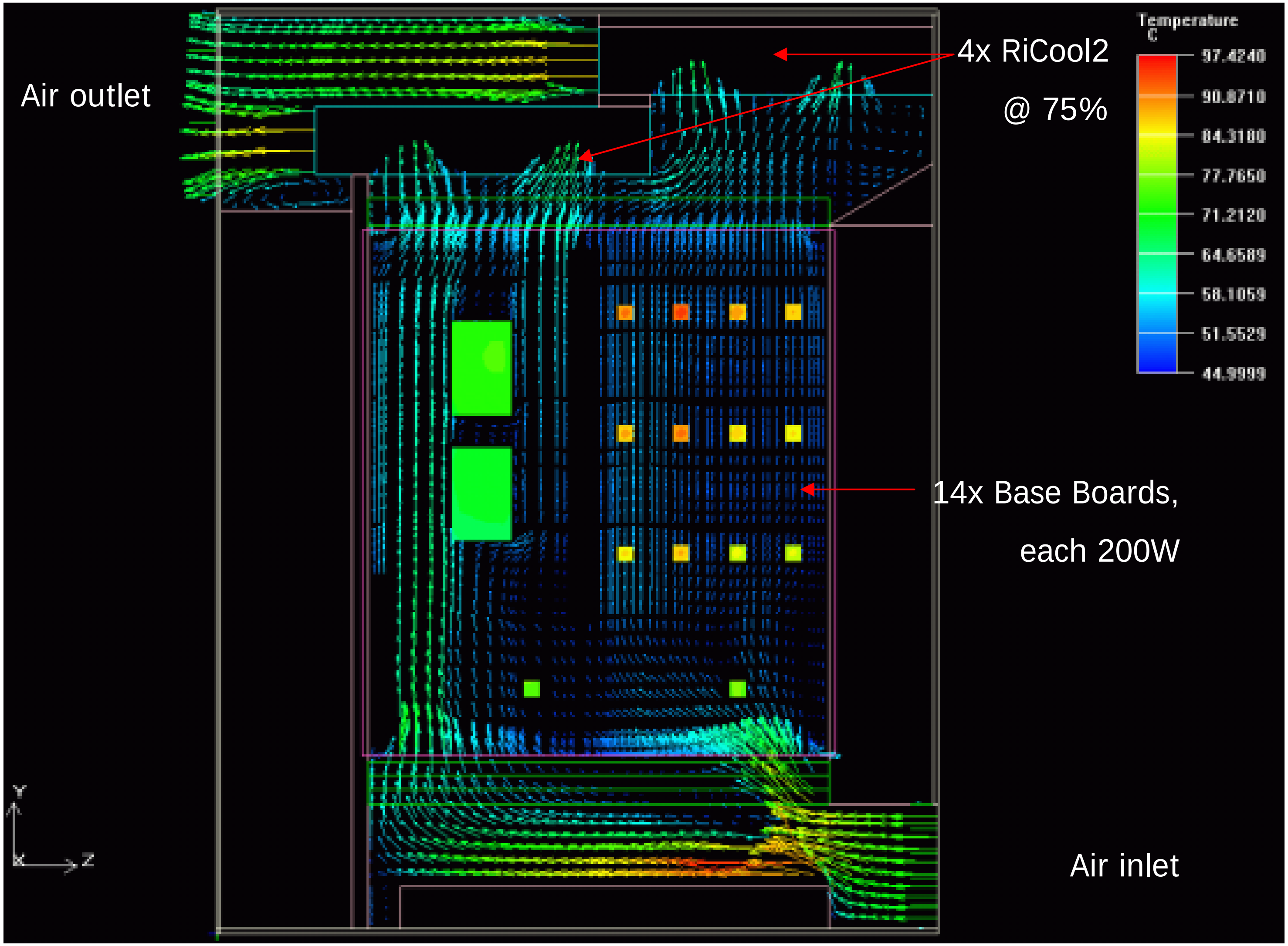
30pin staged connector

programming

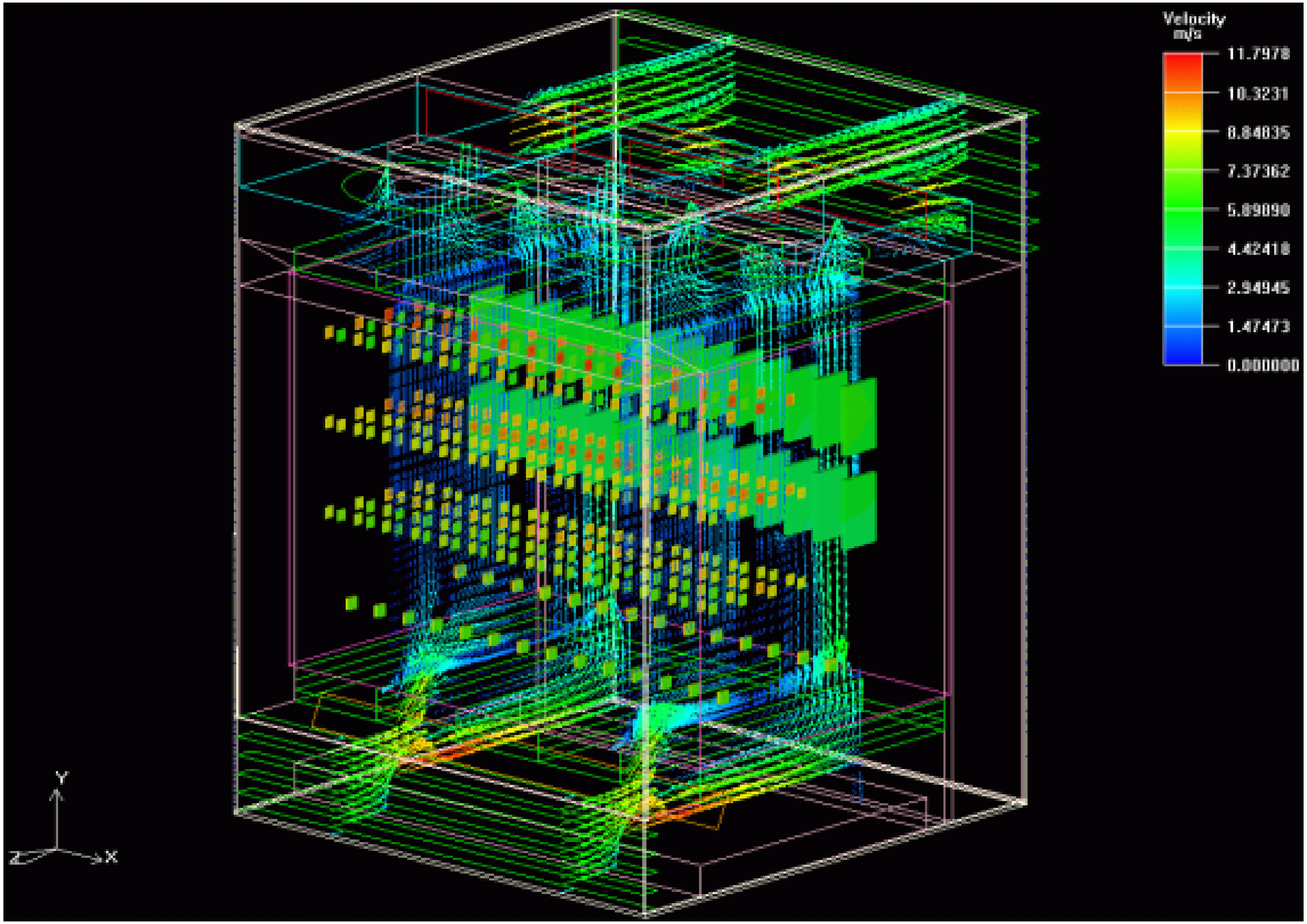
CFD Simulations

- **The CFD Model is based on the initial PICMG 3.0 Thermal Study** undertaken by Rittal and submitted to PICMG Jan. 2002
- **Simulation Software Tool:** IcePak
- **Changed Requirements:**
  - Shelf design now 13U (at 12U Zone 3 was available for F-Board air-flow)
  - Zone 3 not available for Front Board air-flow
  - 180cfm RiCool-2 blowers at 3inch H^2O at zero flow
  - RTM at 5W/slot convection cooled
  - Air-filter 80% dust arrestant, NEBS Level 3
- **Simulation undertaken :**
  - 1x Normal operation at 45°C, all blowers 75% of rpm
  - 1x Temp. Failure at 55°C, all 4 blowers 100% rpm
  - 4x Fan Failures at 45°C, 3 blowers 100% rpm (1 each position failed)
- **Altitude:** sea level

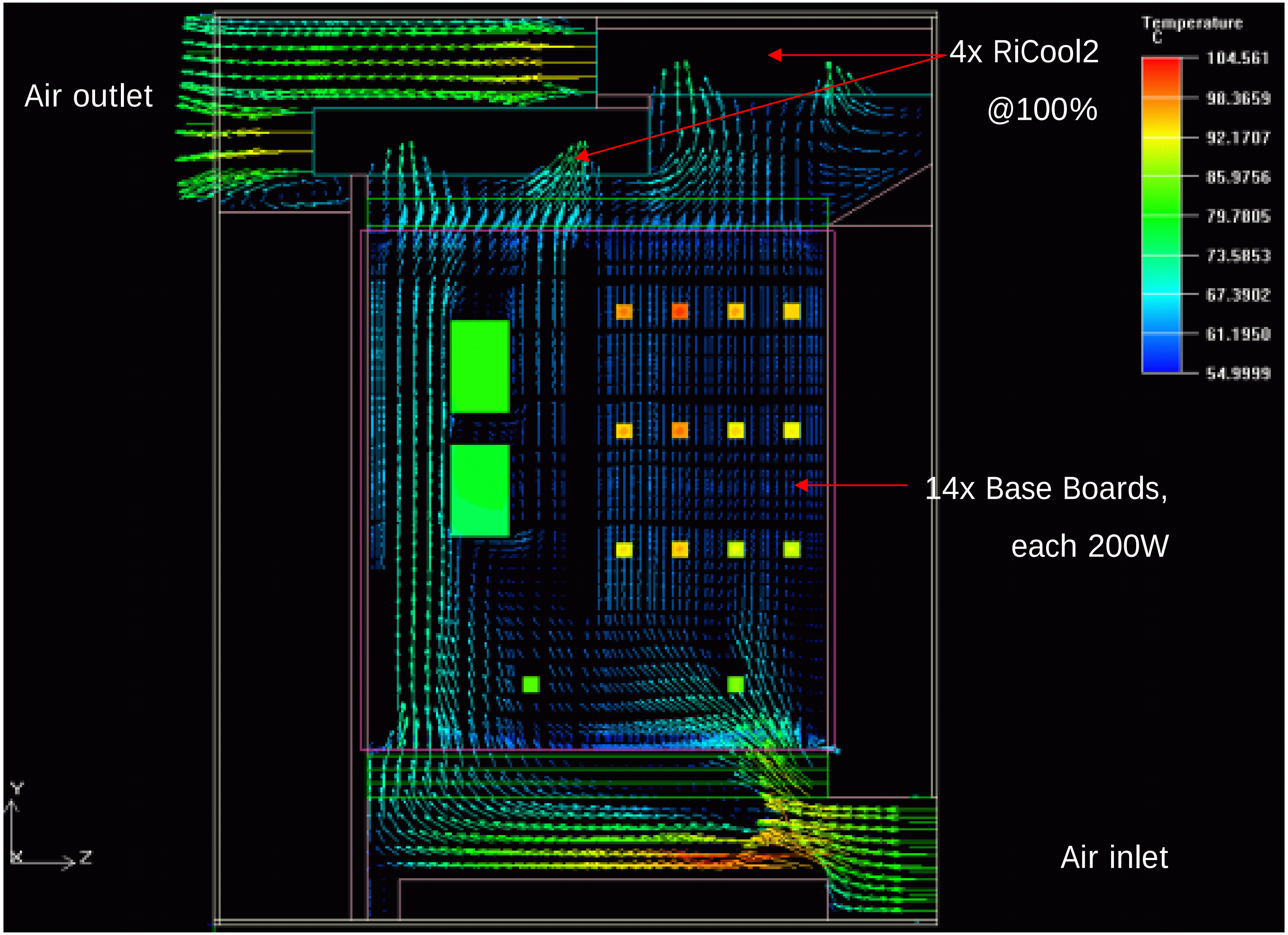
Normal op. 45°, all blowers 75%: Component Temperature Board 1, Airflow Board 4



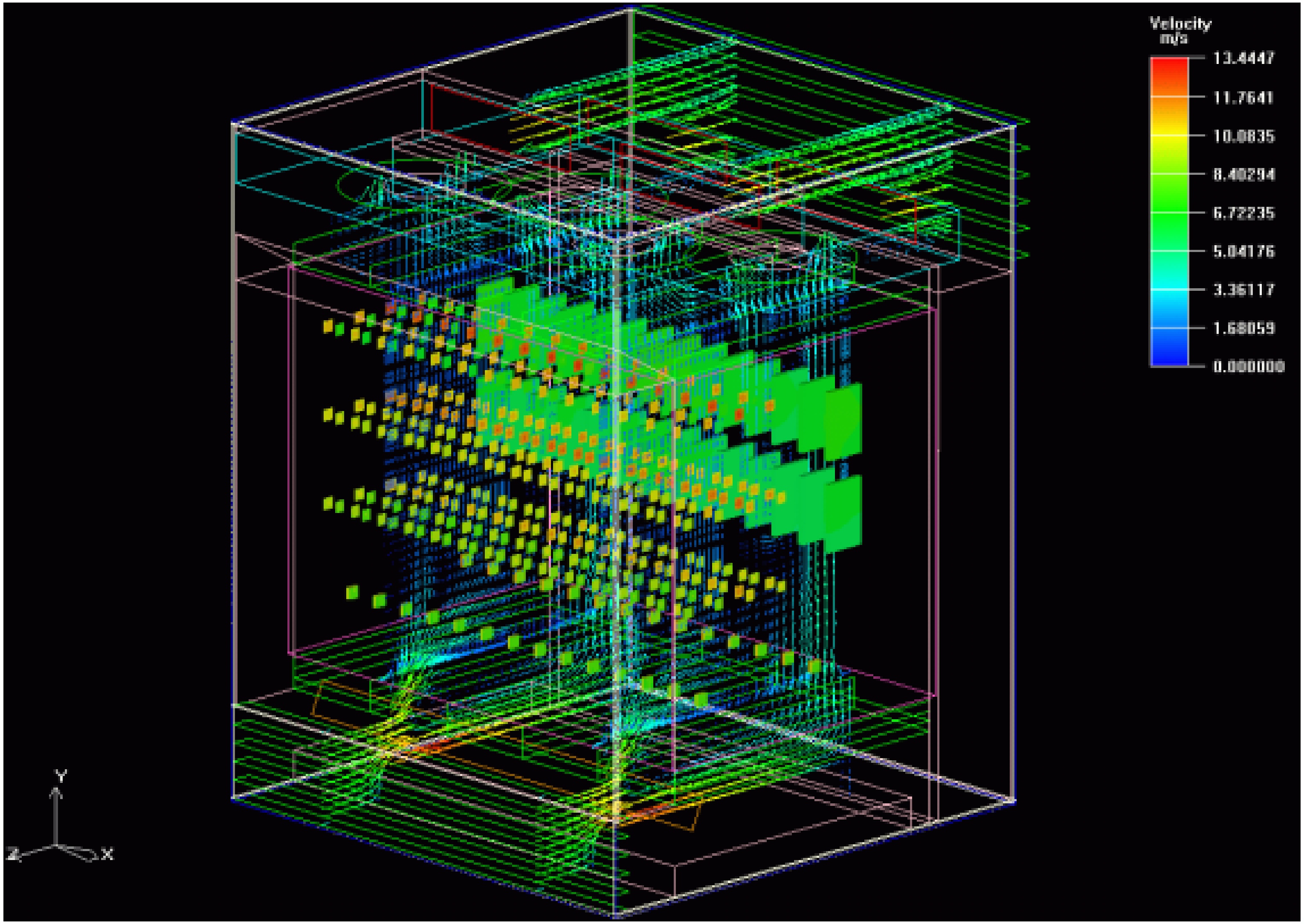
Normal op. 45°, all blowers 75%: System Air flow and Component Temperatures



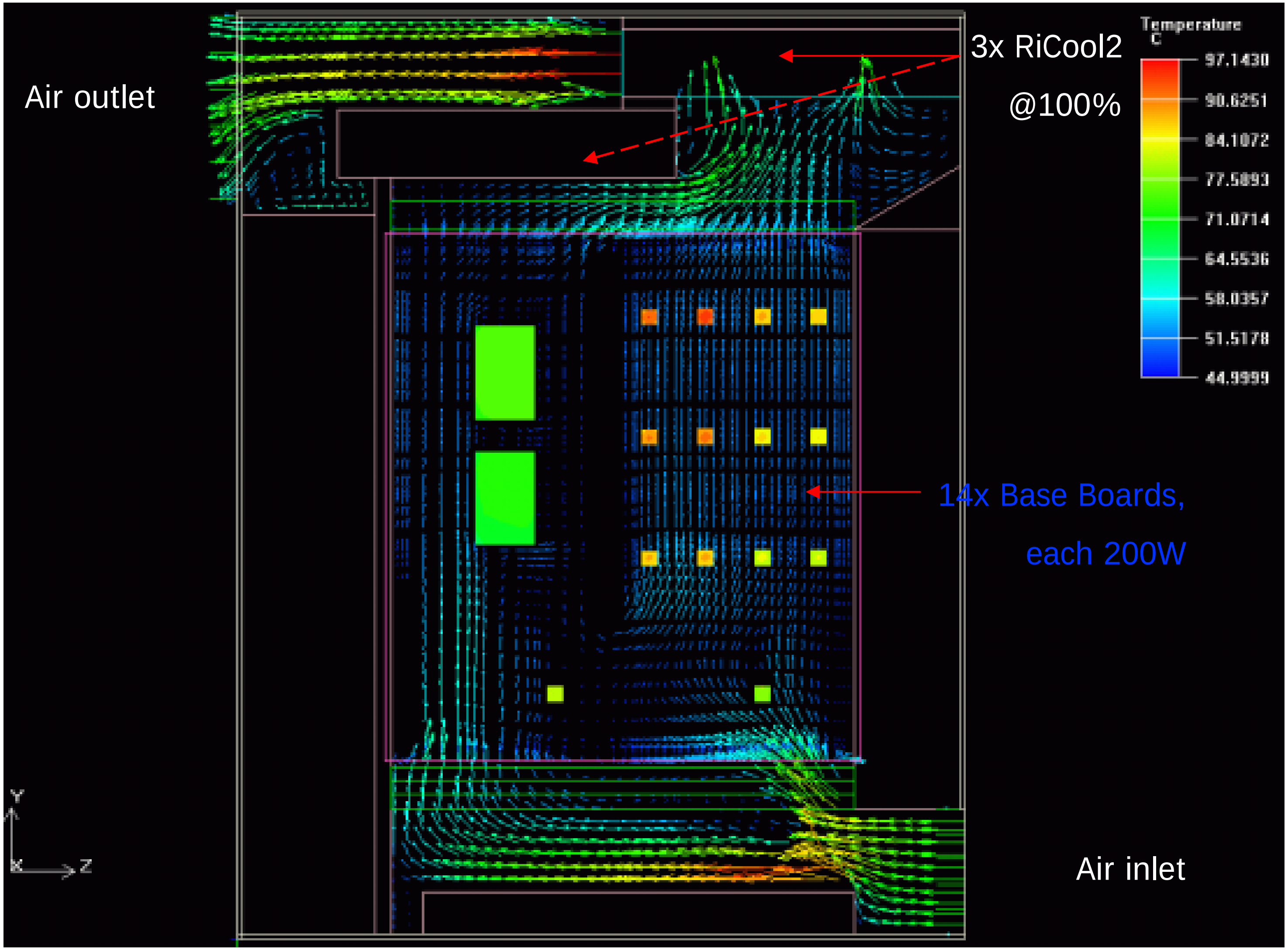
Temp Failure 55°, all blowers 100%: Component Temperature Board 1, Airflow Board 4



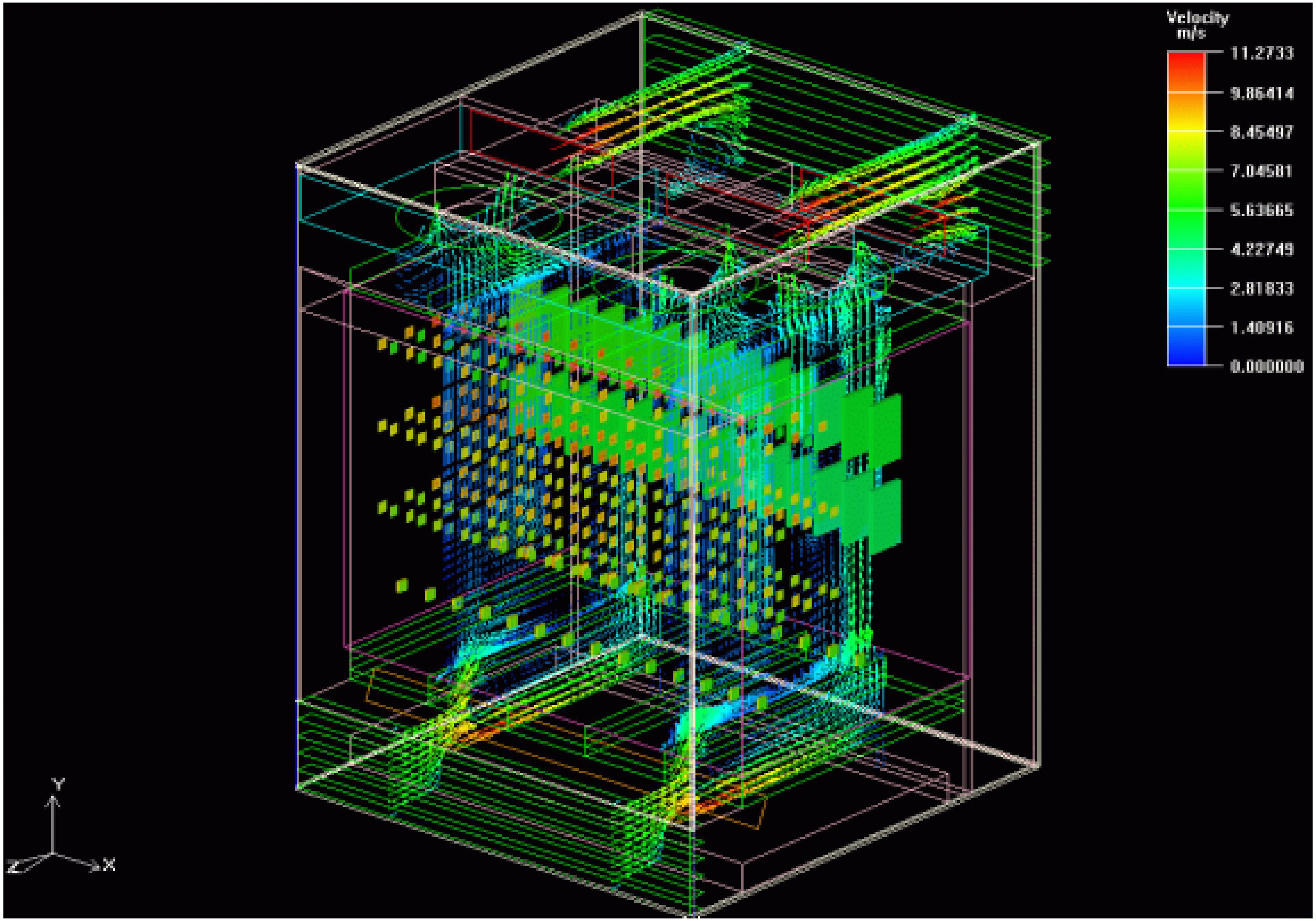
Temp Failure 55°, all blowers 100%: System Air flow and Component Temperatures



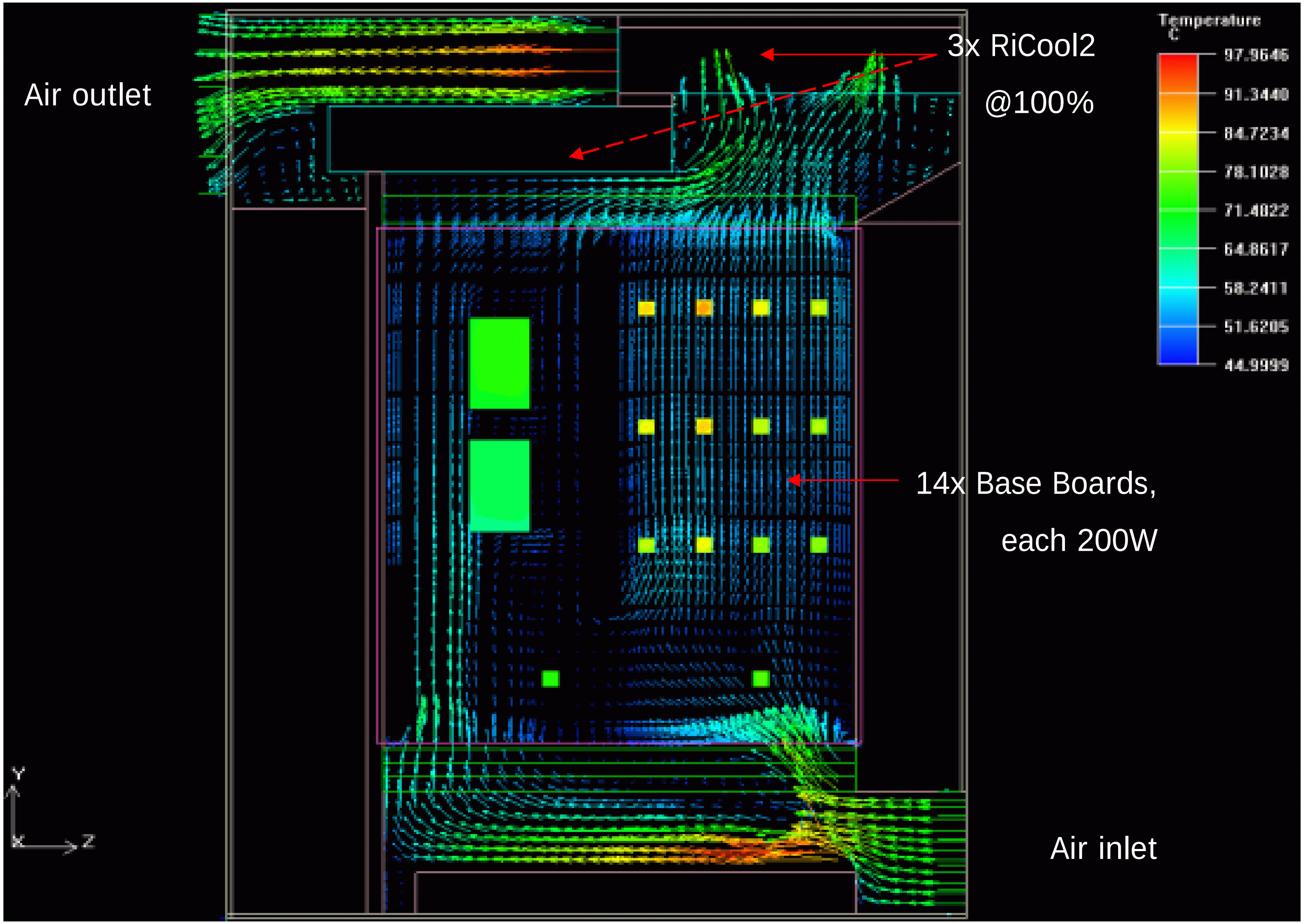
Fan Failure rl 45°, 3 blowers 100%: Component Temperature Board 1, Airflow Board 4



Fan Failure rl 45°, 3 blowers 100%: System Air flow and Component Temperatures



Fan Failure rr 45°, 3 blowers 100%: Component Temperature Board 1, Airflow Board 11



Summary Reports

- In normal operational mode (45°C, all blowers @75%), all temperatures remain below 100°C.
- Fan failures at the rear (right - rr, left - rl), all temperatures remain below 100°C of the chosen Reference Board.
- At a front Fan failures (right - fr, left - fl) some active components in the Mezzanine Card area showed a max temperature slighty above 100°C. However, the mean temperature remains below 100°C. This result was typical for the chosen Reference Board.
- In all cases, CPU mean temperatures are below 100°C

	Shelf Temperature		Total Shelf	Total Shelf Volume Flow		Average/	CPU Temp
	In/Out [°C]	Rise [°C]	Mass Flow [kg/s]	[m³/s]	[cfm]	Slot [cfm]	Min/Max [°C]
Normal	45,1/56,9	11.8	0.248	0.213	451.3	32.20	77,9/83,1
Temp Fail	55,1/65,9	10.8	0.282	0.243	514.9	36.80	86,3/91,3
Fan Fail rl	45,1/57,9	12.8	0.232	0.200	423.8	30.30	77,1/87,8
Fan Fail rr	45,1/57,9	12.8	0.231	0.199	421.7	30.10	76,1/89,3
Fan Fail fl	45,1/57,8	12.7	0.233	0.200	423.8	30.30	77,8/83,2
Fan Fail fr	45,1/57,6	12.5	0.233	0.201	425.9	30.40	77,7/83,2

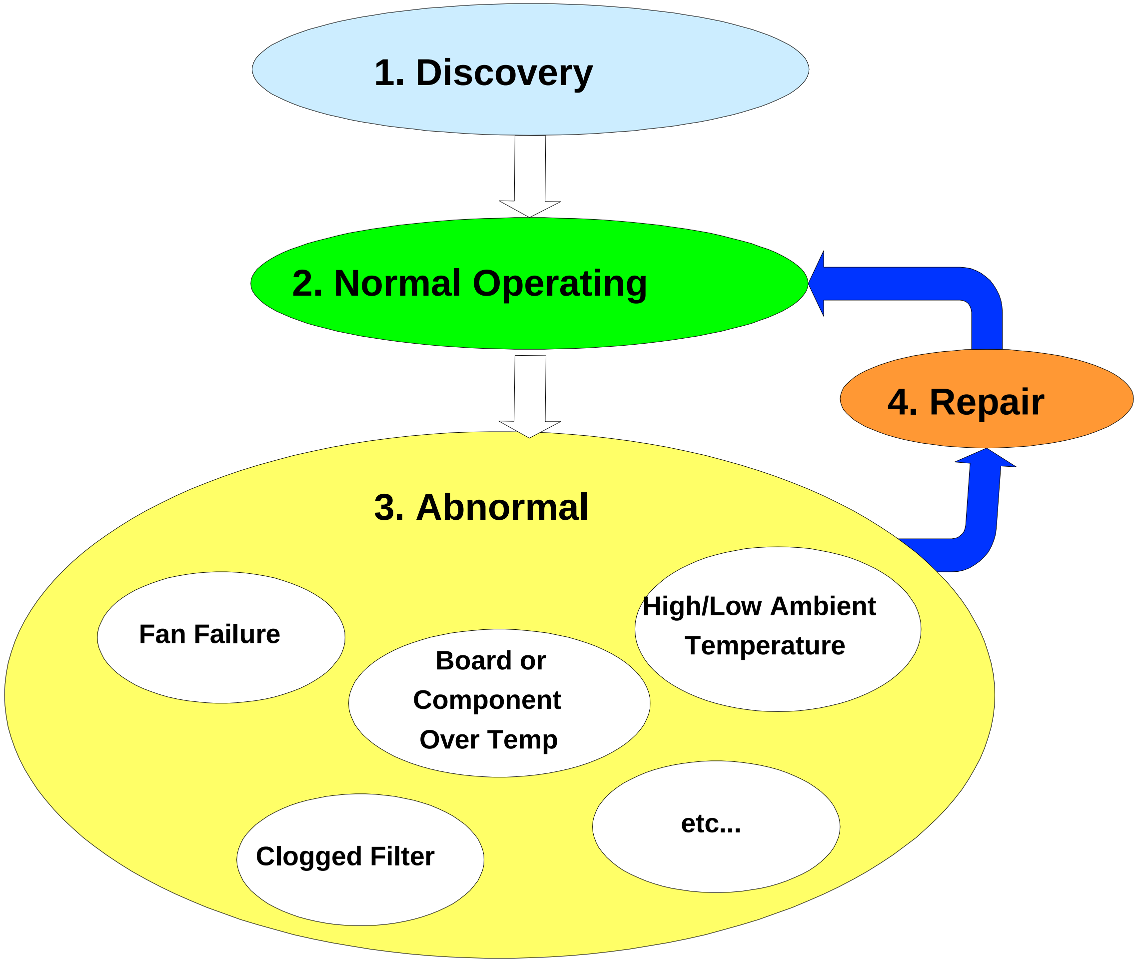
Conclusion of CFD Analysis

- AdvancedTCA Boards have to be designed with good air-flow in mind.
- It has to be understood that effective air flow depends on the actual Board design. Therefore other board designs may require other shapes/positions of the air baffle(s) in the air-inlet area.

Central Office Thermal Environments

- Section 5 of PICMG 3.0 written with central office environmental focus
- Data center environmental usually subset of CO environmental
- NEBS (Class 3, GR-63-CORE)
  - High Ambient Temperature (45°C operating - 55°C short term)
  - Altitude (sea level - 1800 m ASL - 4000 m ASL)
  - Acoustic Noise (65 dBA single frame - 60 dBA line up - @ 0.6m)
- ETSI
  - Many ETSI environmental specs
  - The following are similar to NEBS Class 3: (Storage Class 1.2, Transportation Class 2.3, Operating Class 3.2)
- 10 kW Frame
  - GR-3028 supersedes GR-63-CORE and provides guidelines
- N+1 Cooling
- Air Filters 80% dust arrestant (GR-063, GR-078)

Thermal Management



AdvancedTCA Cooling

Several Technologies are available to cool AdvancedTCA

- **Forced air**
- **Cabinet Cooling with Chillers**
- **Chip Cooling with liquid or heat pipe adaptors**
- **Etc**

Thank You

AdvancedTCA® Shelf Management

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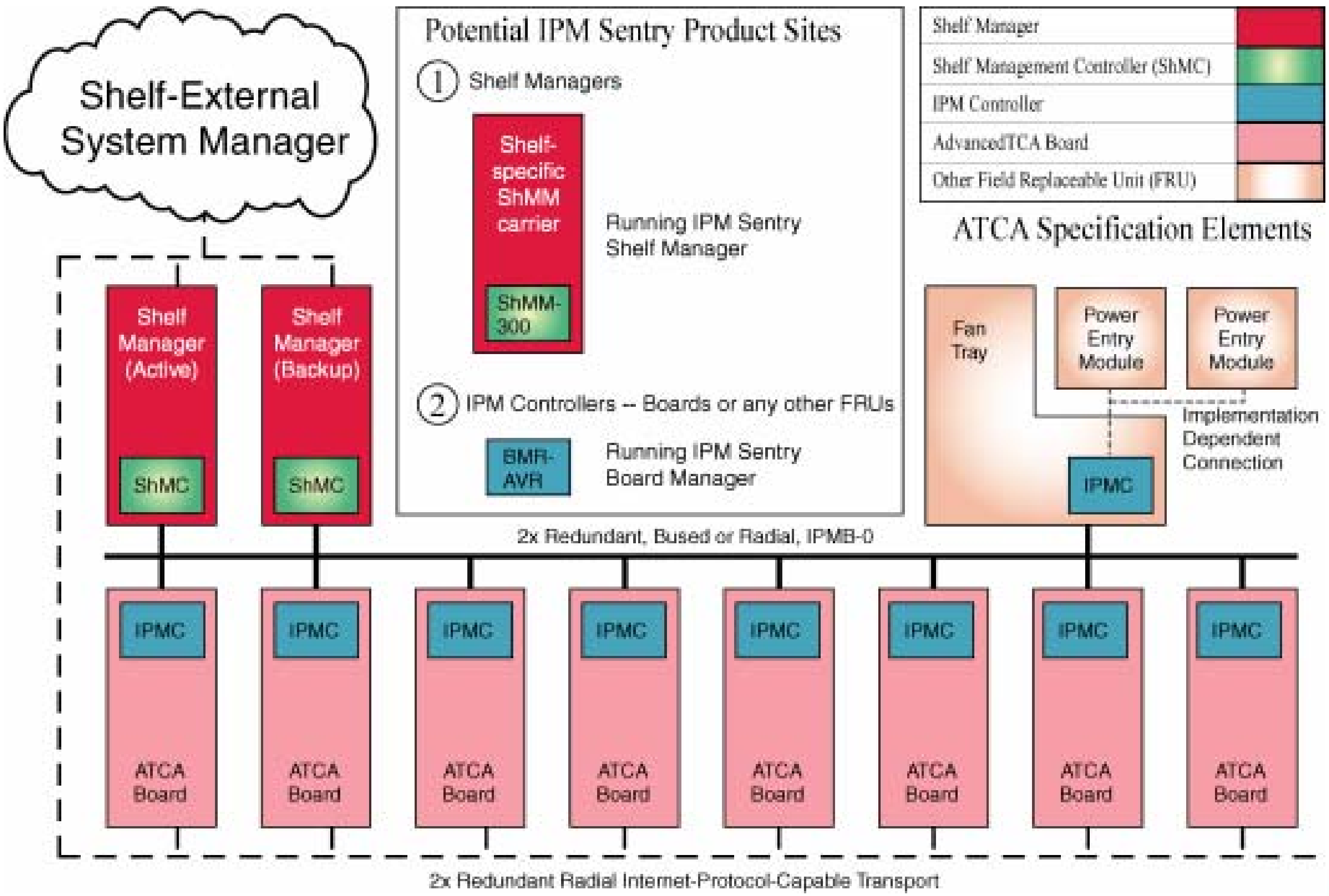
Overall Purpose of ATCA™ Shelf Management

- Monitor & control low-level aspects of ATCA boards and other Field Replaceable Units within a shelf
- Watch over basic health of the shelf, report anomalies, take corrective action when needed
- Retrieve inventory information & sensor readings
- Receive event reports and failure notifications from boards and other intelligent FRUs
- Manage power, cooling & interconnect resources in the shelf
- Enable visibility into a shelf for a logical *System Manager*—some mix of software + "swivel chair folk"

Overall Approach to ATCA Shelf Management

- Focus on low level h/w management
  - Required on all boards and shelves
  - Monitor/control of FRUs in shelf
- Adopt Intelligent Platform Management Interface (IPMI) 1.5 Revision 1.1 as foundation
  - IPMI widely used in PC and Server industry
- Emphasize interoperability among independently implemented components
  - PICMG-sponsored interoperability workshop series under way
  - Using off-the-shelf management components can be a win for product developers focusing on their value adds
  - Example components mentioned in this presentation are from Pigeon Point Systems' IPM Sentry line:
    - Shelf level: ShMM-300 Shelf Management Controller
    - Board level: BMR-AVR Board Management Reference design

ATCA Shelf w/ Dedicated Shelf Management Controllers



AdvancedTCA Shelf Manager: Key Services

- Access to inventory information for all FRUs
- Manage power consumption and backplane interconnects
  - Using self-describing requirements in FRU info
- Implement simple framework for cooling management: responding to FRU-configured temperature threshold events
- Manage distributed collection of sensors
  - Self describing in Sensor Data Records (SDRs)
- Collect events in a persistent store and optionally perform configurable actions in response; IPMI facilities include:
  - Non-volatile System Event Log that stores N event records intended for interpretation via SDRs
  - Platform Event Filtering (PEF) that provides mechanism for configurable actions on events (such as pages or SNMP traps)
- Provide visibility to System Manager on all the above as desired

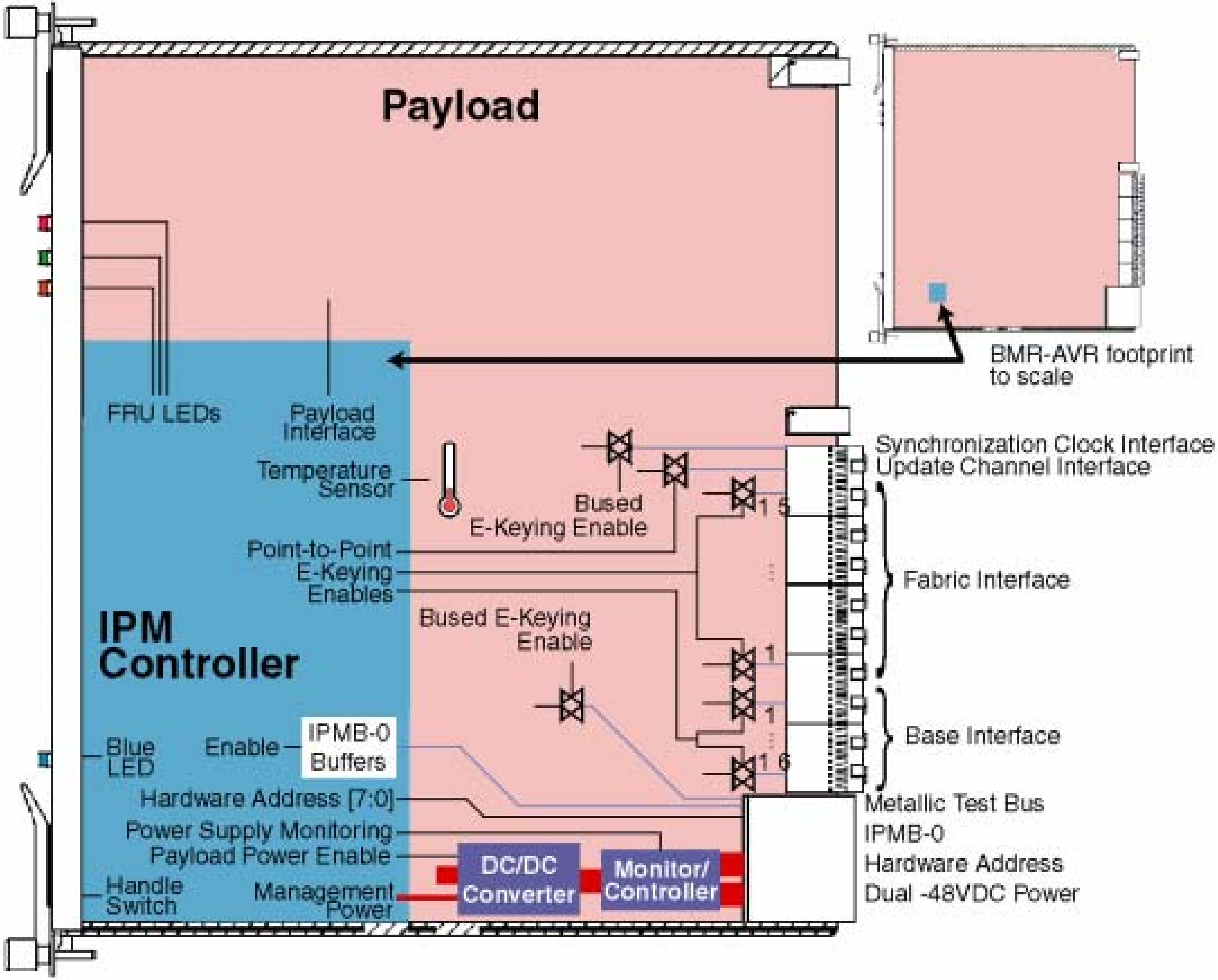
AdvancedTCA Shelf Manager: Key Services (Cont.)

- System Manager Interface: logical connection to shelf-external management
  - Required for interoperability:
    - IPMI LAN Interface, including Remote Management Control Protocol (RMCP)
  - Likely Shelf Manager-specific additions: command line & SNMP interfaces
- Optional dual redundant Shelf Manager
  - Assumed from same vendor; coordination protocols not specified
- Specification allows broad implementation freedom for logical Shelf Manager function

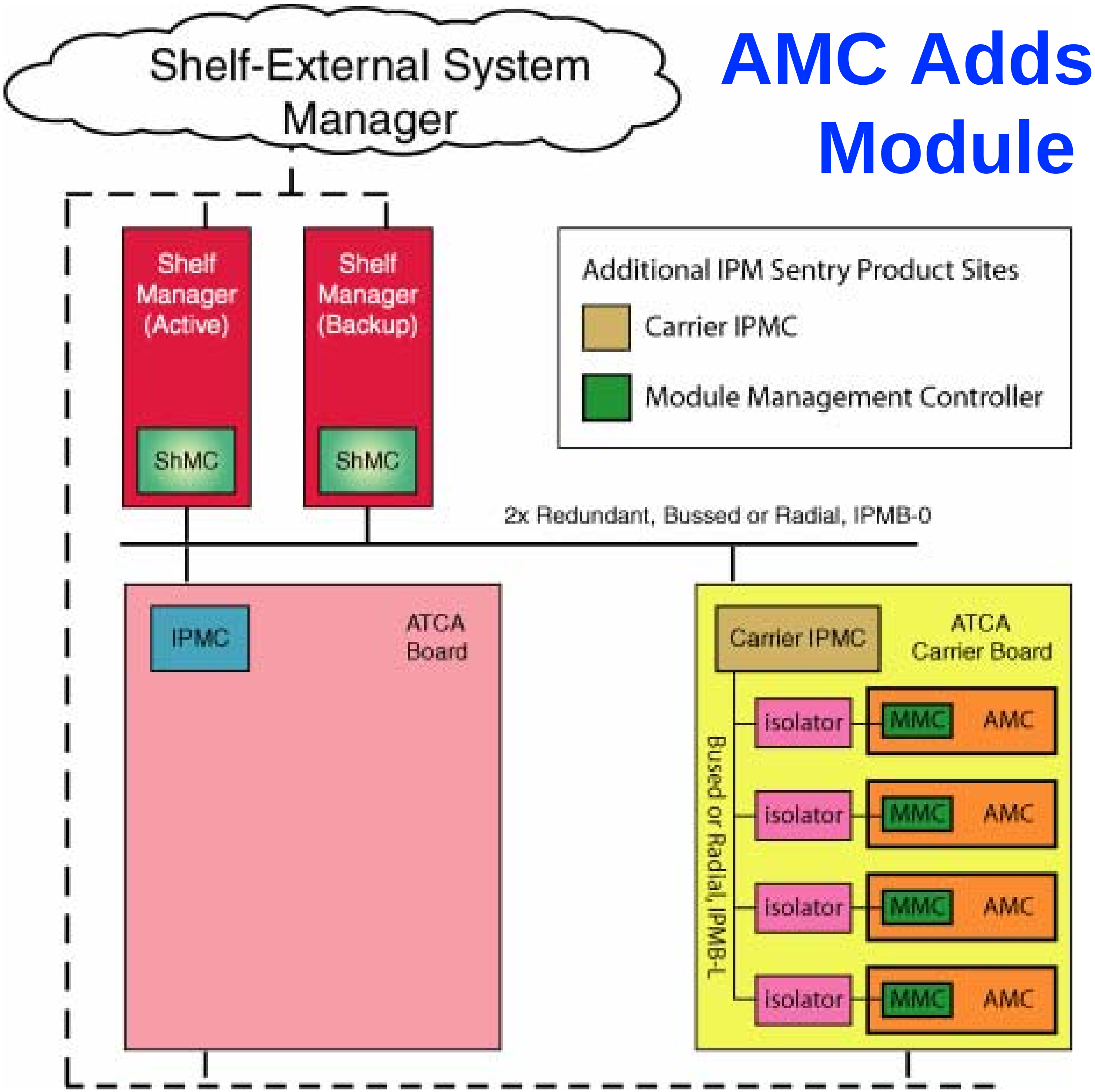
AdvancedTCA IPM Controller (IPMC): Key Facilities

- IPMI-1.5-specified commands and FRU Information
- Key AdvancedTCA extensions:
  - Dual redundant IPMB-0 connection to shelf manager
  - Hot swap state management for FRUs (including represented FRUs)
  - Electronic keying (commands + FRU Info) for point-to-point & bused backplane interconnects
  - LED management, including color, lamp test
  - Fan control for interoperable fan trays
  - Payload power control & negotiation w/ shelf

IPM Controller Interfaces



AMC Adds Carrier & Module Layers



Overall Approach to AMC Management

- Fit smoothly into established PICMG 3.0 conventions
- Avoid impacting PICMG 3.0 R1.0 Shelf Managers w/ AMC.0
- Reduce requirements on Module Management Controller (MMC) to limit its cost and footprint; example:
  - Simplified hot swap implementation and power management
- Require Carrier IPM Controller (IPMC) to represent MMC as a full-fledged ATCA FRU to ShMC; examples:
  - Carrier IPMC does power negotiation on AMC's behalf
  - Carrier IPMC does AMC E-Keying similarly to ATCA, but without involvement of Shelf Manager
  - Carrier IPMC makes Module SDRs visible to Shelf Manager
- Preserve IPMI foundation in MMC; example:
  - Full IPMI sensor infrastructure is optionally available for MMC sensors

Key Extensions to IPMI FRU Information

- Shelf FRU information
  - Address Table: FRU types and IPMB addresses
  - Shelf Power Distribution: Internal/external current capacities, “feed to FRU” maps
  - Shelf Activation and Power Management: FRU site power capacity and activation controls
  - Shelf Manager IP Connection
  - Backplane Point-to-Point Connectivity
- Board FRU info: Board Point-to-Point Connectivity for use in Electronic Keying

Tackling the Management Aspects of ATCA Products

- ATCA Section 3, “Shelf Management” accounted for 130 of 430 pages in PICMG 3.0 R1.0
  - …and it’s 30 pages larger with Jan ’04 adoption of ECN-001!
  - …with 60+ more pages of management in AMC.0 specification!
- Recommendations for ATCA board and shelf developers:
  - Strongly consider using off-the-shelf management components to allow focus on your value adds
  - Pick components that are validated and interoperability-tested
    - IPMI Conformance Test Suite (ICTS) freely available, but needs significant extensions for ATCA
    - PICMG-sponsored ATCA Interoperability Workshops (AIWs): 7 already, more planned
    - AIW testing identified several of the issues fixed in ECN-001
  - Participate in AIWs with your own products when available

Summary: AdvancedTCA Shelf Management…

- Represents a significant PICMG effort to:
  - Define interoperable extensions to IPMI
  - Maintain and enhance these extensions through interoperability testing and further specification work
    - Most recently, this involves adding support for AdvancedMCs
- Complements the “future proof” fabric-agnostic Fabric Interface with self-describing management visibility
- Constitutes a serious engineering project at either Shelf Manager or IPM Controller levels
  - Even if development starts from existing PICMG 2.9 or conventional IPMI components
- Can significantly benefit from the use of off-the-shelf components that are validated and interoperability-tested

Data Transport Interfaces

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June 23, 2004
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AdvancedTCA Data Transport Goals

- **Improve upon existing Modular Open System Compute standards**
  - Network connected independent Rack-mount Servers (pizza box)
  - Bus connected modular compute elements (CompactPCI)
- **Ensure performance headroom**
  - Differential signaling capable of 10 Gbps (XAUI) today
  - 5+ Gbps differential signal capacity
- **Design flexibility to address many markets**
  - Single backplane supports many fabric technologies and topologies
  - Cost reduced configurations
- **No single point of failure for any/all system interconnects (Carrier Grade)**

AdvancedTCA Specifications

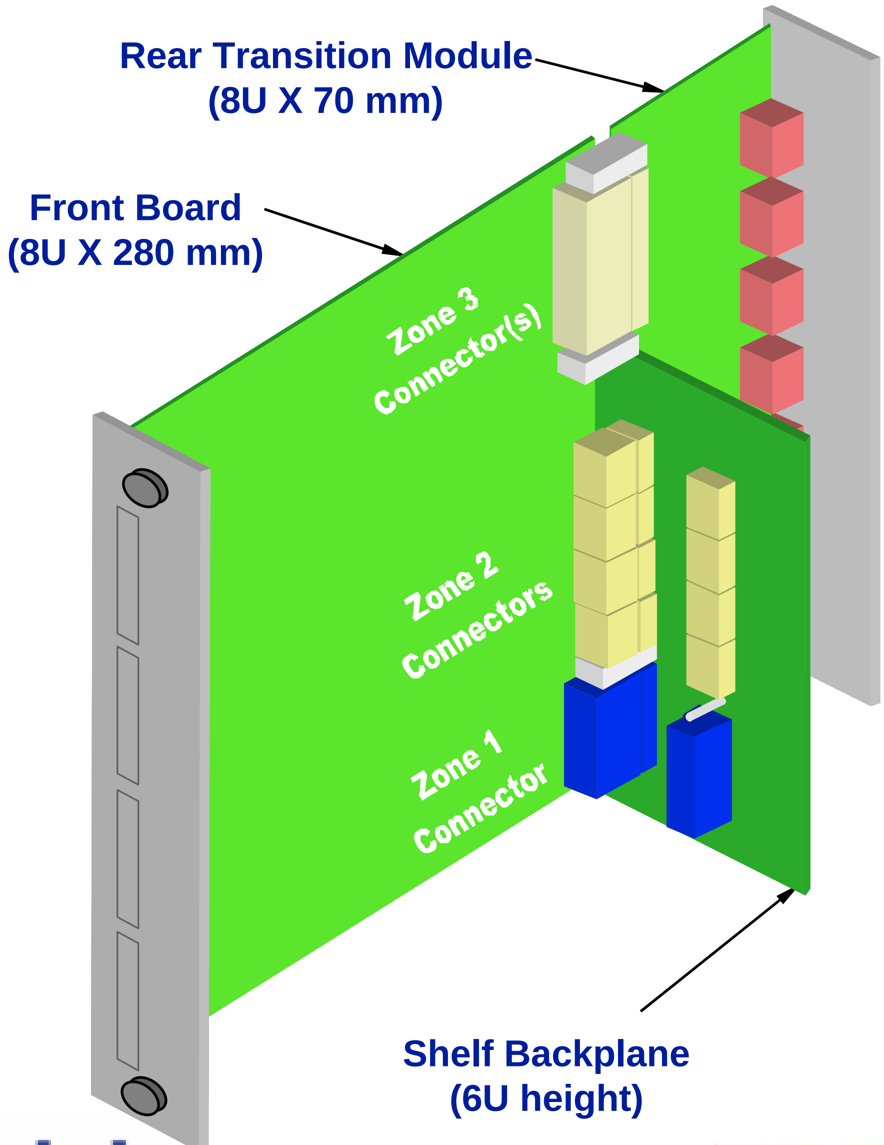
PICMG 3.1 Specification	PICMG 3.2 Specification	PICMG 3.3 Specification	PICMG 3.4 Specification	PICMG 3.5 Specification
Ethernet & Fibre Channel	InfiniBand*	StarFabric*	PCI-Express* & Advanced Switching	S-RapidIO*

PICMG 3.0 Base Specification

- Power Distribution
- Mechanical Elements
- System Management
- Regulatory Guidelines
- Connector Zones and type
- Fabric Topology
- Thermal Management Guidelines

Backplanes are fully defined in the PICMG 3.0 specification
Interoperable Boards are defined in Subsidiary specifications

AdvancedTCA – Backplane Framework



Zone 2 Backplane Interfaces:

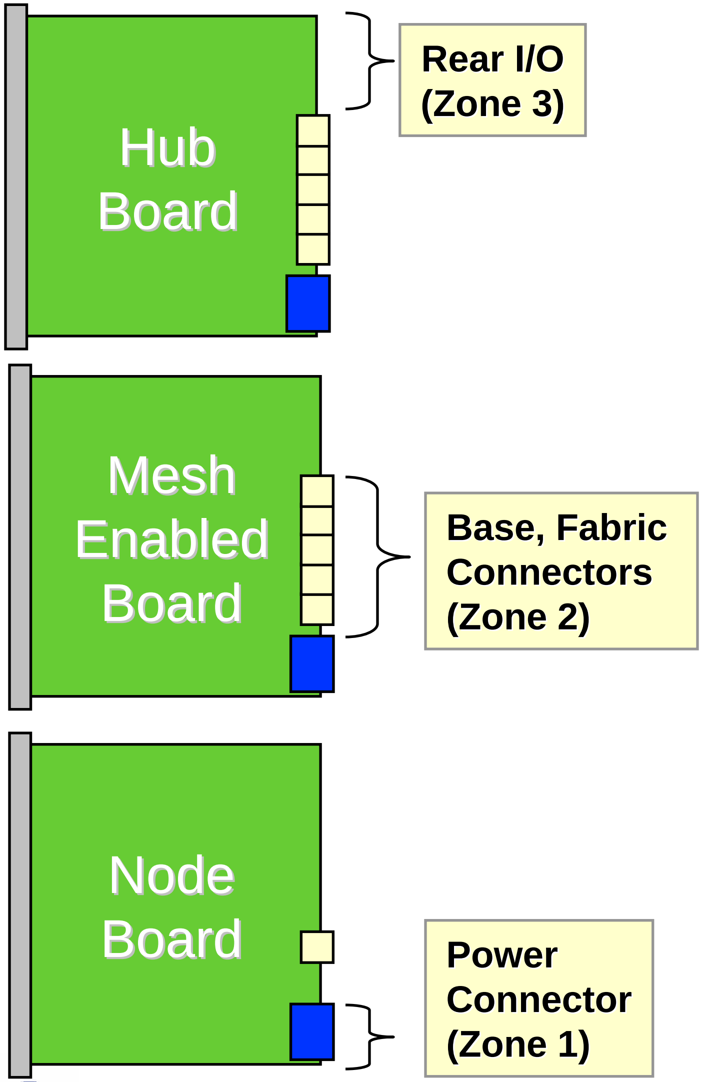
Base Interface
- 10/100/1000 BASE-T Ethernet
- Dual Star fabric topology

Fabric Interface
- SERDES (3.125 Gbps min)
- 1x, 2x, or 4x Channels
- Star or Mesh fabric topology
- Interoperability defined by subsidiary specifications

Synchronization Interface
- Three dedicated clock interfaces (8kHz, 19.44 MHz, user defined)
- Redundant buses
- MLVDS signaling

Update Channel
- Point to point connection between two slots

AdvancedTCA Board Configurations

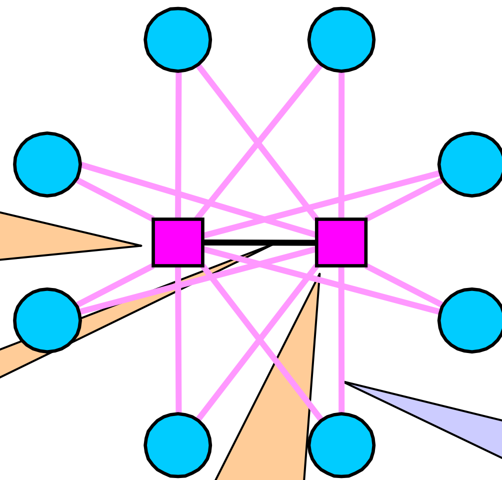


Hub Board
- Supplies switching connective Boards in the shelf
- Installed in designated Hub slots

Mesh Enabled Board
- Direct connection to all Boards in the shelf
- Installed into any slot

Node Board
- Single, Dual, Many Star connections possible
- Installed into any Node slot

Fabric Topologies – Dual Star



Redundant Switches increase system availability, eliminates single point of failure

Nodes support redundant links, one to each switch

Link between switches facilitates coordination, fail-over

Two dedicated system slots for switching resources

Number of routed traces remains low keeping backplane costs down

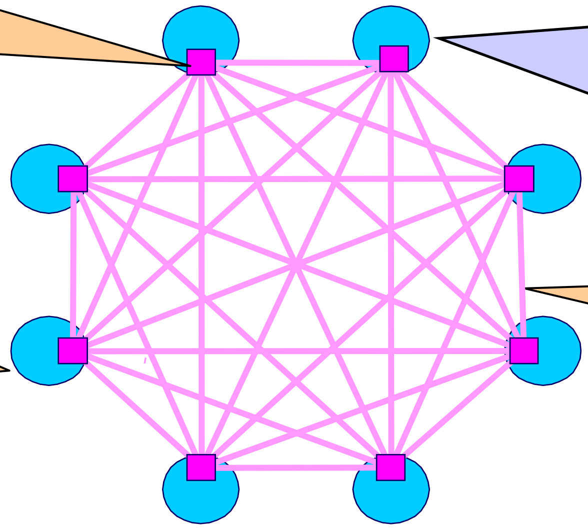
<u>Application Target</u>

Carrier Grade applications with non-latency sensitive data requirements (e.g. modular server). Unified approach reduces cost, complexity

Fabric Topologies – Mesh

Switching services and mgmt are distributed across all system slots

All system slots are identical. No dedicated Hub slots. All slots are Hub capable



Data throughput capacity scales with each added Node board, large capacities possible

Fabric links are inherently redundant, highly available

<u>Application Target</u>

Carrier Grade apps with large data throughput requirements (routers).

Nodes provide simple layer 2 switching and higher level services.

Highly redundant and scalable.

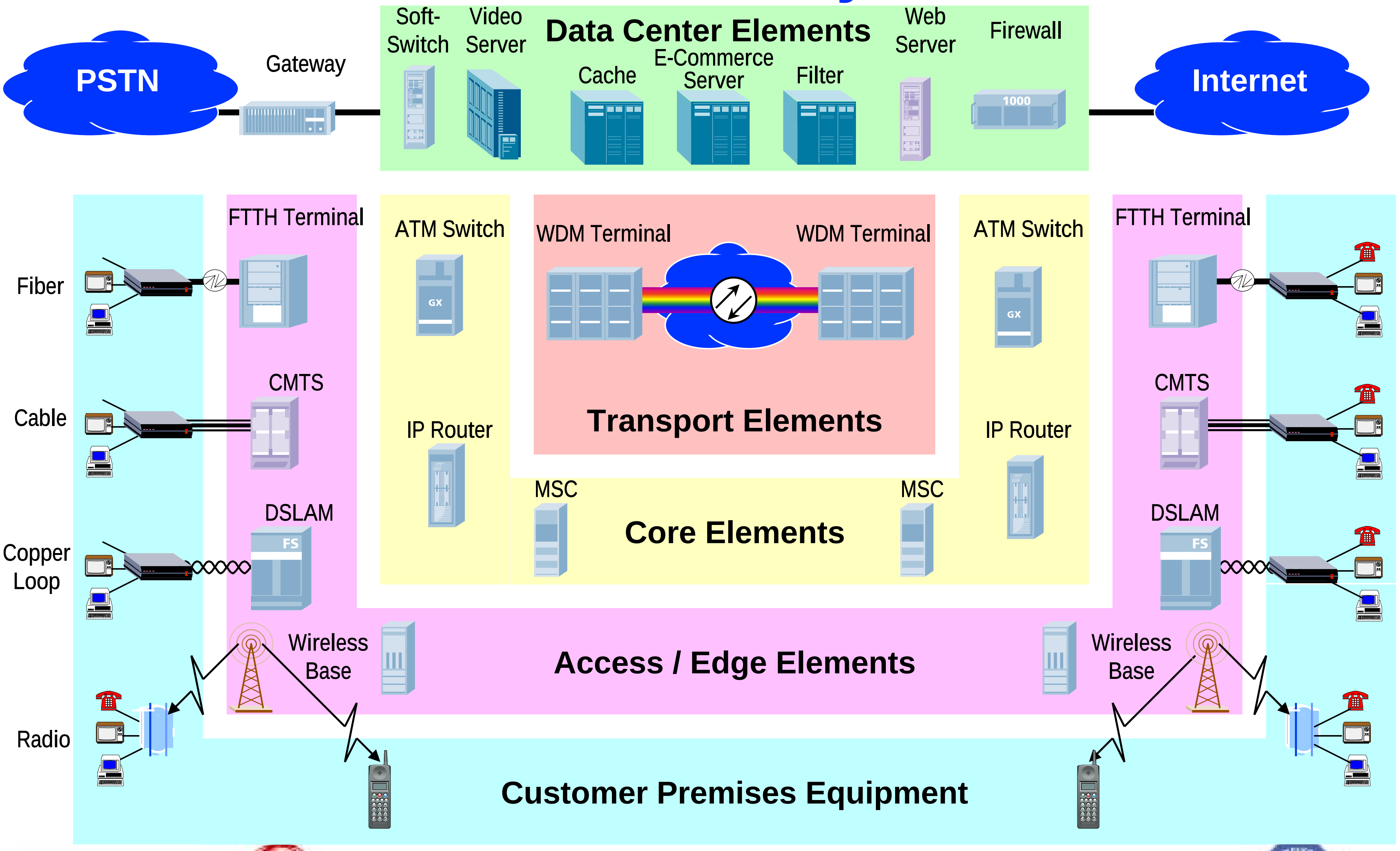
Summary

- AdvancedTCA provides a robust connectivity environment for many compute/communications applications
  - "Network in a box" connectivity via differential signaling switch fabric technology
  - Backplanes support 10Gb connections today with signaling headroom for future
  - Full Mesh or Star topologies suited for the application
- PICMG 3.x subsidiary specifications define Board design requirements for interoperable fabric implementations

Applications Studies

Chuck Byers
Bell Labs Fellow
Lucent Technologies

Network Architecture Today



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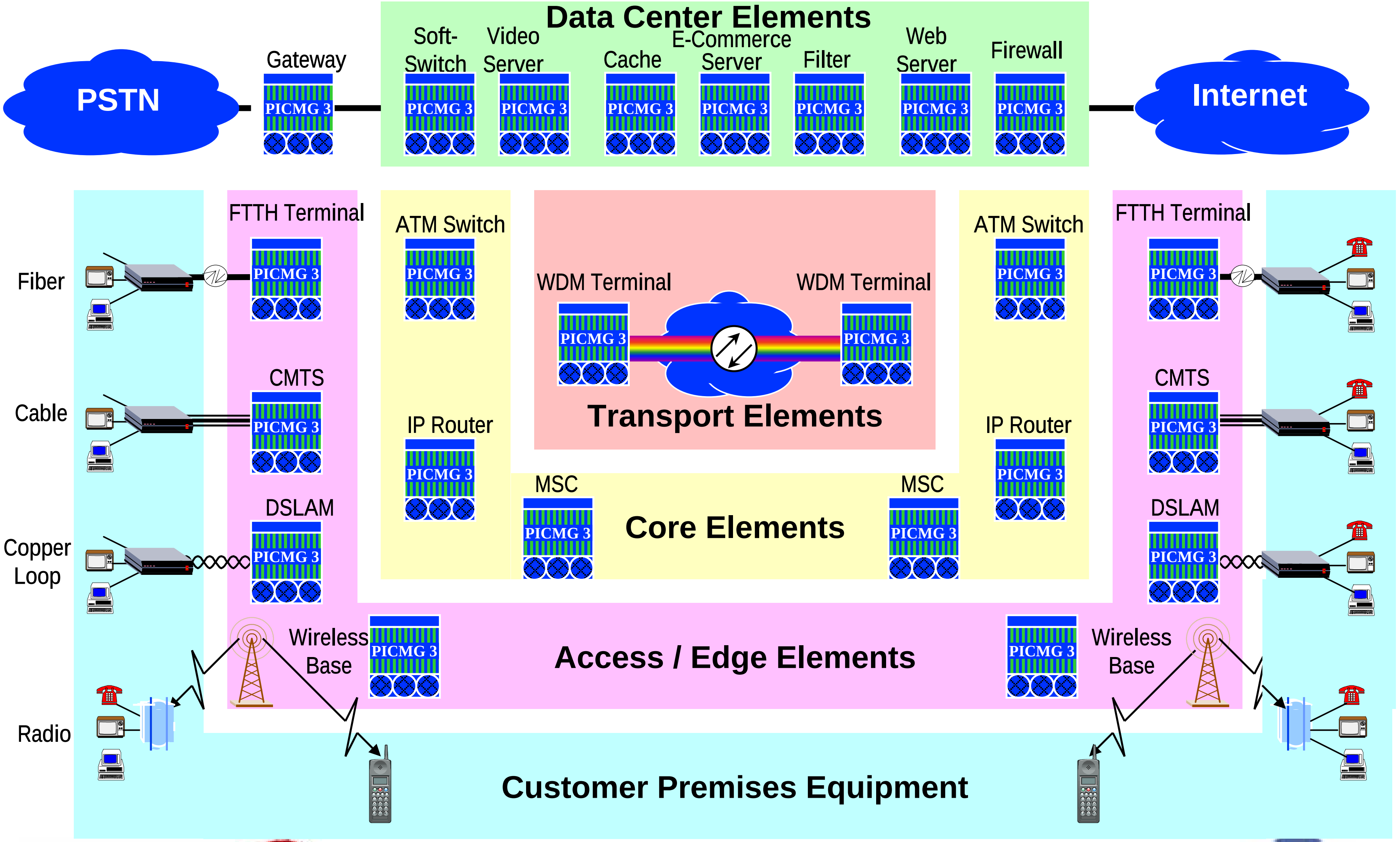
Network Architecture Tomorrow



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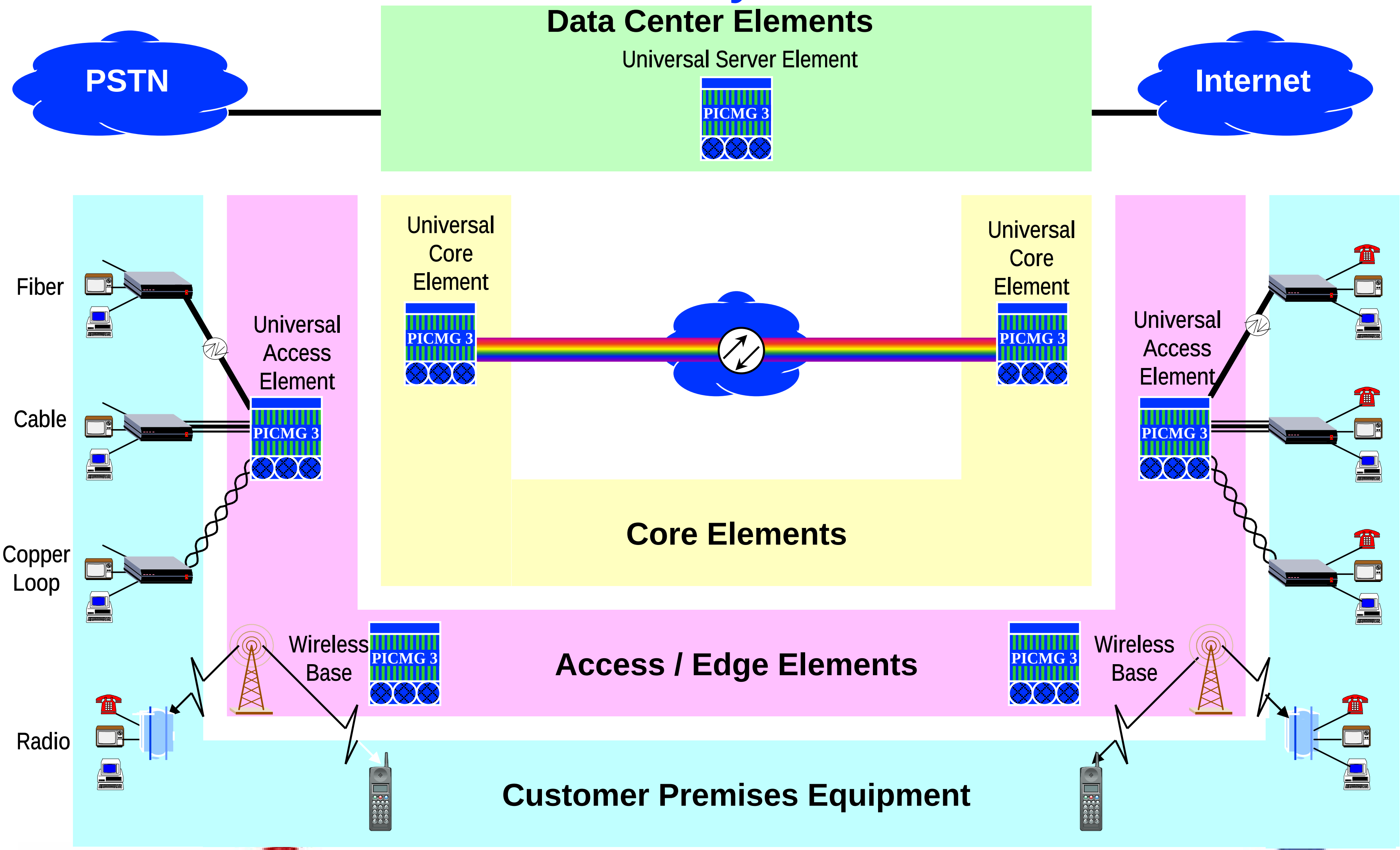
Network Architecture the Day After Tomorrow



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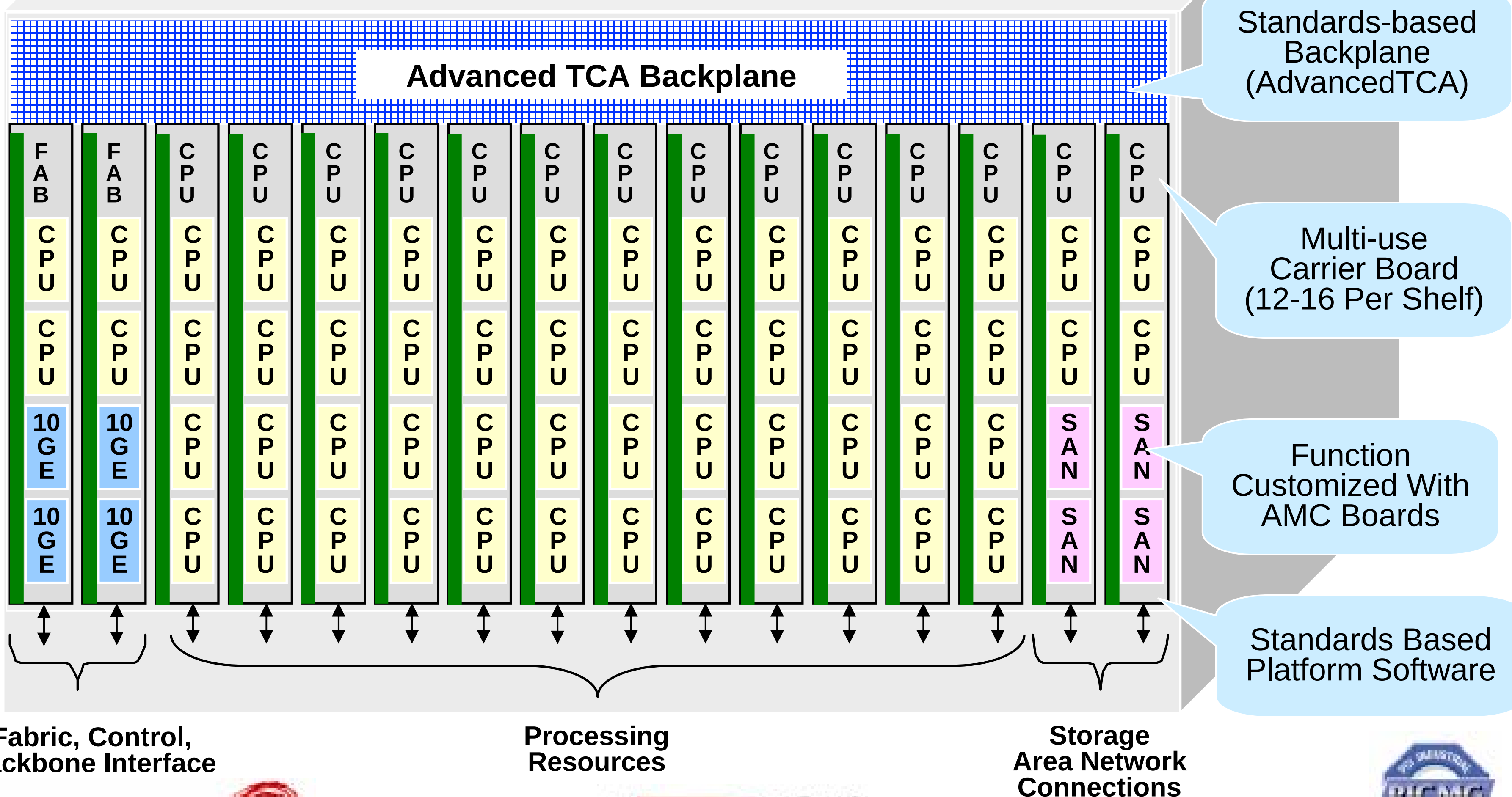
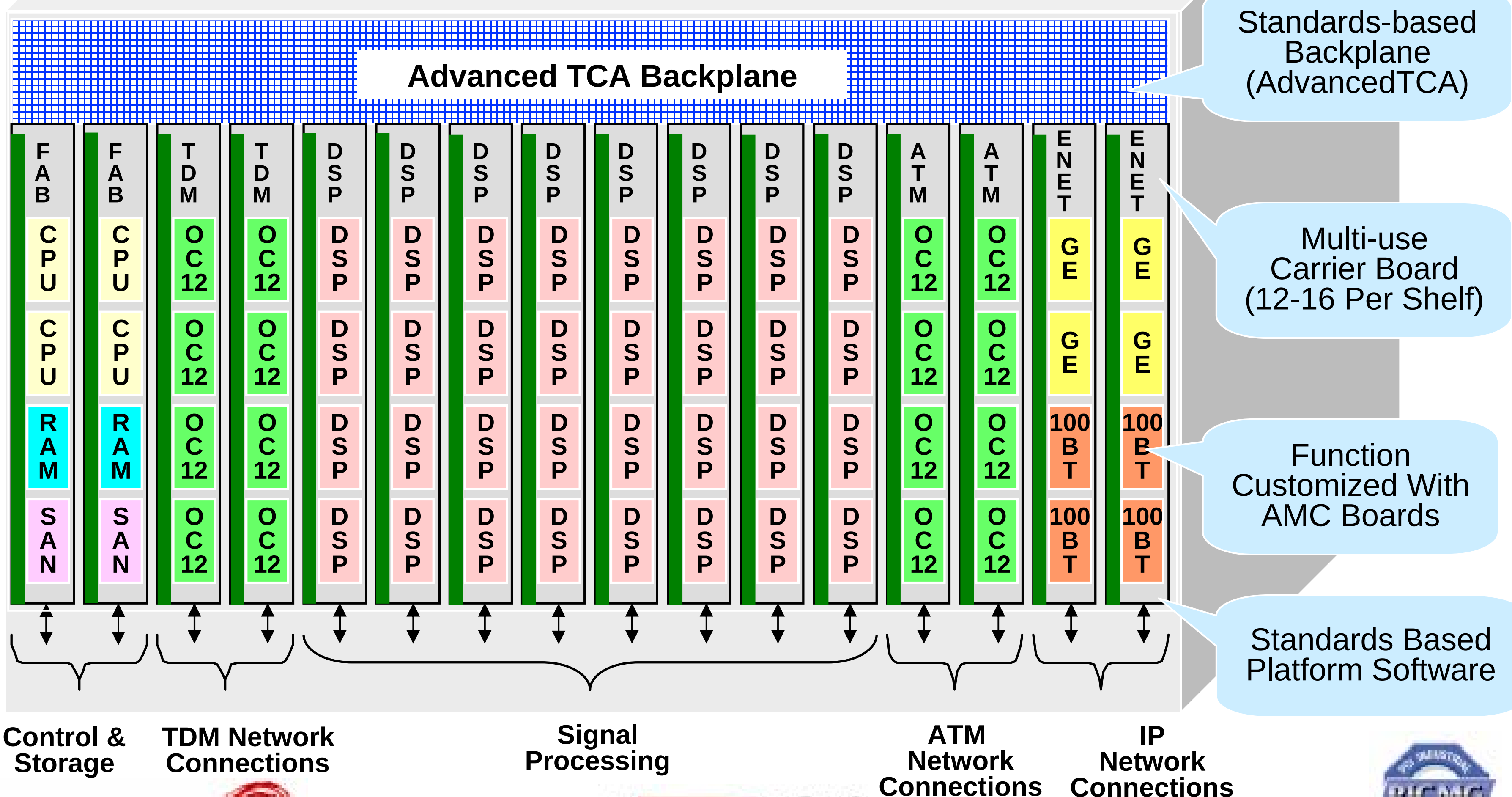
Design Example: Server Farm

- Provides server farm and storage functions
- CPU intensive application
- 40Gb/s of network interconnect bandwidth, quad SAN connections
- Up to 56 servers per shelf



Design Example: Voice Gateway

- Interconnects Voice over Internet Protocol or ATM (VoIP, VoATM) with existing telephone network
- DSP intensive application, with DSP Pool N+1 spared
- Capacity up to 64K connections per AdvancedTCA shelf



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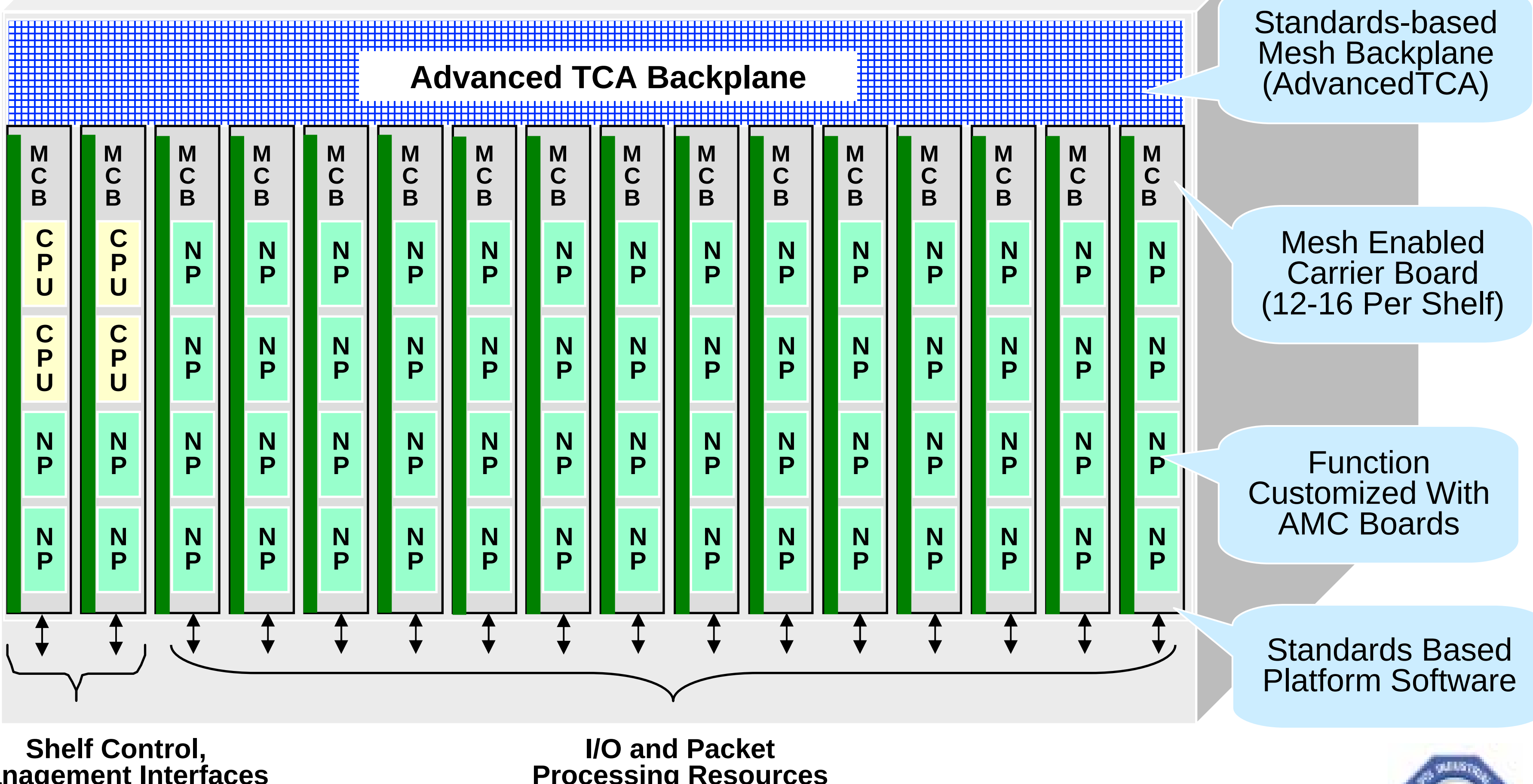
Design Example: Router

- Core network Router / Switch
- Network Processing intensive application
- Each Network Processor AMC can support 10Gb/s of I/O and protocol processing
- Total capacity: 560Gb/s, scalable to 2.2Tb/s



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Conclusions & Wrap-up

Chuck Byers
Bell Labs Fellow
Lucent Technologies

Why Advanced TCA is an Ideal Universal Network Element Platform

- High backplane capacity: Up to 2.5Tb/s
- High functional density: up to 200W and 400 square inches per slot; 16 slots per shelf, three shelves per frame
- Ready for next generation integrated circuits and components
- Lots of packaging, partitioning, cooling and cabling options
- Reliable, full redundancy support
- Scalable and flexible
- RASM features to greatly improve uptime and cost of ownership
- Distributed 48V power system
- Support for Telecom features: Clocks, Metallic test bus, Ringing voltage distribution, Update buses
- Regulatory conformance: NEBS, UL, CSA, EU, etc.
- Viable, multi-source ecosystem, with many off-the-shelf products currently available

Conclusions

- AdvancedTCA is ready today!
- It is ideally suited to address the platform needs of many different telecom and datacom applications
- Using AdvancedTCA, the lifecycle costs of systems can be greatly reduced, and their capacity, performance, reliability, feature richness and time to market can be greatly enhanced.
- AdvancedTCA improves upon the shortcomings of previous standards (including power, board area, cooling, reliability, RASM, bandwidth and cost).
- Multiple vendors are already producing interoperable hardware and software in support of the standard
- Be sure to check out the AdvancedTCA Pavilion on the exhibition floor
- For more information, see: http://www.advancedtca.org

Thank You!

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