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AdvancedTCA Building Blocks
for Next Generation Telecommunications

Headquarters

ADLINK TECHNOLOGY INC.
凌華科技股份有限公司
235 台北縣中和市建一路166號9樓
9F, No. 166 Jian Yi Road, Chungho City
Taipei, Taiwan
Tel: +886-2-8226-5877
Fax: +886-2-8226-5717
E-mail: service@adlinktech.com

ADLINK TECHNOLOGY AMERICA, INC.
8900 Research Drive
Irvine, CA 92618
U.S.A.
Toll Free: +1-866-4-ADLINK
Fax: +1-949-727-2099
E-mail: info@adlinktech.com

ADLINK TECHNOLOGY SINGAPORE PTE LTD
84 Genting Lane #07-02A
Cityneon Design Center, Singapore 349584
Tel: +65-6844-2261
Fax: +65-6844-2263
E-mail: singapore@adlinktech.com

ADLINK TECHNOLOGY BEIJING
(北京凌華)
中國北京海淀區上地信息產業基地創業中路8號
群英科技園5號樓3層東
郵政編碼: 100085
Tel: +86-10-6296-2789
Fax: +86-10-6296-2796
E-mail: beijing@adlinktech.com

ADLINK TECHNOLOGY SHANGHAI
(上海凌華)
中國上海市漕河涇高科技開發區欽江路333號39幢4層
郵政編碼: 200233
Tel: +86-21-6495-5210
Fax: +86-21-5450-0414
E-mail: shanghai@adlinktech.com

ADLINK TECHNOLOGY SHENZHEN
(深圳凌華)
深圳市南山區登良路南油天安工業區3座1樓
郵政編碼: 518054
Tel: +86-755-2643-4858
Fax: +86-755-2640-3054
E-mail: shenzhen@adlinktech.com

ADLINK TECHNOLOGY INC.

http://www.adlinktech.com

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AdvancedTCA

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AdvancedTCA

- The new standards for high performance, high availability computing in next generation telecommunication platforms

Introduction to AdvancedTCA

In December of 2002, the PICMG (PCI Industrial Computer Manufacturers Group) released a series of specifications, PICMG 3.0 and Advanced Telecom Computing Architecture (AdvancedTCA), which was amended by ECN001 in January 2004. The PICMG 3.0 specification is 460 pages long and its development consumed five-person years.

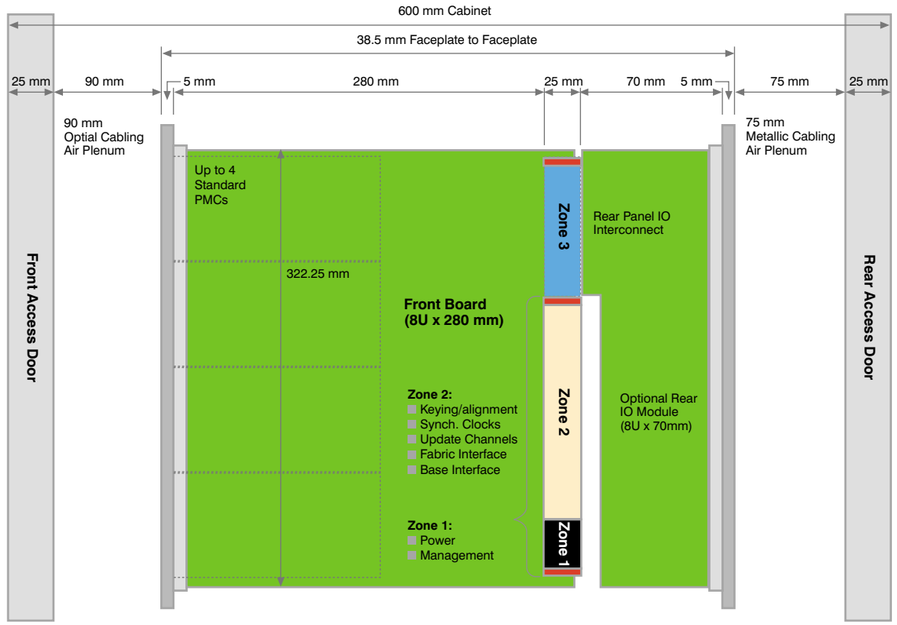
The heart of AdvancedTCA (ATCA) is PICMG 3.0 which defines the mechanical, power, cooling, interconnect, and system management aspects of the ATCA family of specifications. A series of subsidiary specifications overlay a transport onto the interconnect defined in the PICMG 3.0 specification. In essence, the PICMG 3.0 specification defines the point to point connections used for boards to communicate and the subsidiary specifications define the protocols used over those interconnects.

AdvancedTCA Subsidiary Specifications

Currently, four subsidiary specifications have been approved: 3.1 Ethernet and Fiber channel Transport, 3.2 InfiniBand Transport, 3.3 StarFabric Transport, and 3.4 PCI-Express and Advanced Switching Transport. An additional subsidiary specification, PICMG 3.5 Advanced Fabric Interconnect / Serial RapidIO Transport, is under development.

AdvancedTCA Form Factor

AdvancedTCA mechanical requirements are largely derived from space utilization studies performed with 600mm ETSI and 19" EIA standard cabinets. AdvancedTCA Front Boards are 8U high and 280mm deep; optional Rear Boards are 8U high and 70mm deep. The board to board spacing is 1.2". A 19" EIA cabinet can support 14 slots and a 600mm ETSI cabinet can support 16 slots.



Comparison between ATCA/CPSB/CPCI

Attribute	PICMG2/CPCI	PICMG2.16/CPSB	PICMG3/ATCA
Board Size	6U x 160mm x 0.8" 57sq in + 2Mez	6U x 160mm x 0.8" 57sq in + 2Mez	8U x 280mm x 1.2" 140sq in + 4Mez
Power Consumption / Per Slot	35-50W	35-50W	150-200W
Backplane Bandwidth	~4Gb/s	~40Gb/s	~2.4Tb/s
Network Bandwidth	OC-3/OC-12	OC-12/OC-48	OC-192/OC-768
Power System	Central Converter 5, 12, 3.3V Backplane	Central Converter 5, 12, 3.3V Backplane	Distributed Converters Dual –48V Backplane
Functional Density of Shelf	Low	Moderate	High
Clock, Update, Test Bus	No	No	Yes
Management	Limited	OK	Advanced

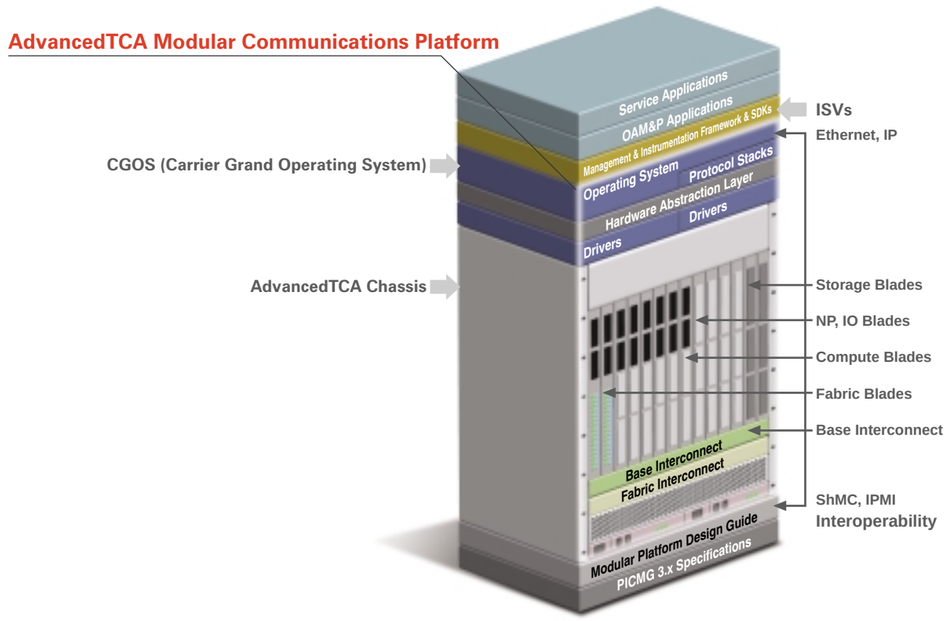
AdvancedTCA Architecture Overview

The PICMG 3.0 specification enables products from multiple vendors to be used together in architecting a modular platform. Standards-based modular equipment ensures broad interoperability and quick time-to-market.

AdvancedTCA Modular Communications Platform Architecture

Important elements required to create a standards-based AdvancedTCA modular communications platform of interoperable components include the following:

- PICMG 3.0 compliant AdvancedTCA Shelf (ADLINK ATCA-8014)
- PICMG 3.0 compliant Computing Blades (ADLINK ATCA-6890)
- PICMG 3.0 compliant Fabric Switch Blades supporting the Base and Fabric Interface (ADLINK ATCA-3100/3120)
- PICMG 3.0 compliant Shelf Manager with an RMCP interface (ADLINK ATCA-SM-414)
- PICMG 3.0 compliant Network Processing/IO Blades, or Storage
- CGOS supporting standards-based hardware platform interfaces for AdvancedTCA and Ethernet IP for the Base Interface



The ATCA specification contains multiple data transports. These transports provide system management, control plane, and data plane connectivity. The electrical interconnect and topology of the data transports are different and dependent on the needs of the particular transport. All of the transports in ATCA are architected for high availability. The multiple transports were chosen to allow separation of management, control, and data traffic.

System Management

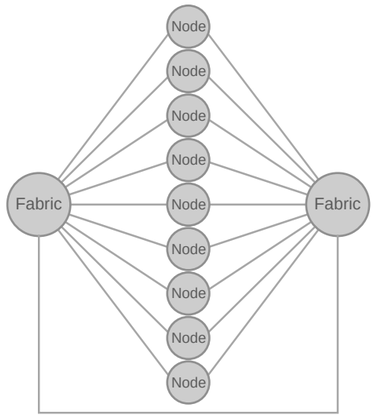
The System Management transport is used to manage an ATCA Shelf and its blades. This includes power management, electronic keying, and thermal monitoring of the shelf. The management functions are performed by the Shelf Management Controller (ShMC). The physical transports for the System Management infrastructure is based in the I2C interface (IPMB). The ATCA specification requires two. The IPMBs can be implemented as dual bus or dual star configuration. Two IPMBs are required to improve the availability of the System Management subsystem. The IPMBs are used to connect the ShMC to ATCA Boards and other field replaceable units (FRUs) in an ATCA Shelf.

Base Interface

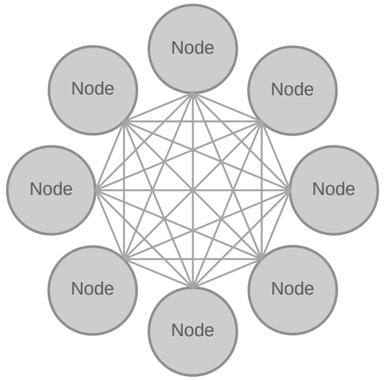
The Base Interface provides an IP transport in ATCA Shelves. The Base Interface is a dual star architecture that supports 10/100 and 1000 BASE-T Ethernet. An ATCA Shelf contains two Fabric Slots which can contain the switches for the Base Interface. The dual star architecture provides two connections between each ATCA Board and the Base Interface switches. The ATCA Specification mandates that the backplane contain the Base Fabric interconnect. ATCA Boards are not required to support the Base Interface but are required to provide an IP-based transport. The specification also allows for a connection between the Fabric and ShMC slots. If the Fabric Interface supports an IP transport then an ATCA Board does not need to support the Base Interface. The requirement for IP based services is intended to provide a base level of data transport in an ATCA Shelf. The IP-based services could be used for network booting, remote monitoring, or high level system management.

Fabric Interface

The Fabric Interface is the main data transport in an ATCA Shelf. The ATCA specification defines up to 15 communication channels on each board. The communications channels can be configured as a full mesh dual-dual star or dual star topology. In a dual star topology each board has a channel to two different fabric boards. The fabric boards act as the hub in the shelf. In a full mesh architecture, every board has a connection to every other board. The figure below shows the interconnects in a dual star and full mesh configurations.



Dual Star Interconnects



Full Mesh Interconnects

Data Transport Support Multiple Protocols

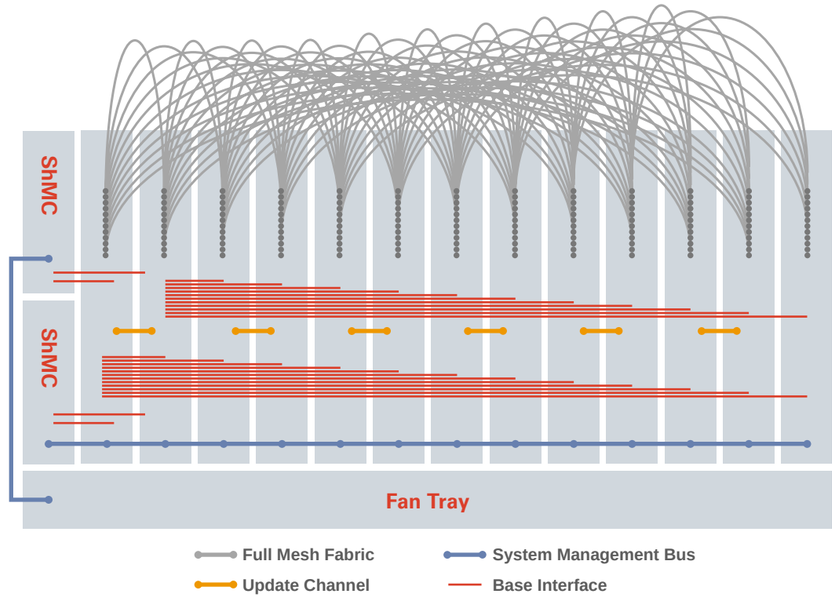
Each Fabric communications channel is made up of eight pairs of Low Voltage Differential Signaling 3.125GHz connections. A channel is made of four ports with each port containing two pairs. In summary, one port is two pairs of connections four ports (eight pairs) make one channel. Each pair can support signaling rates of 3.125GHz so one port can support 6.250GHz and one channel can support 25GHz of traffic. When used with typical signaling encoding schemes a channel can support 20Gb/sec full duplex or 10Gb/sec half duplex. Electronic keying is used to ensure that connections between two ATCA boards are not enabled unless compatible technologies are on both ends of the interconnect. ATCA currently supports Ethernet and fibre channel, star fabric, and PCI Express fabrics.

Update Channel

The Update Channel provides 10 pairs of differential signals between two adjacent ATCA boards. The transport implemented for the Update Channel is not specified and is up to the designer. It is expected that two similar boards will use the Update Channel to share state information in redundant applications. Electronic keying is used to ensure that the Update Channel is only enabled when boards with identical capabilities are on each end of the channel. Backplanes are required to support the Update Channel and board support is optional.

Backplane Interconnects

The management, Base Interface, full mesh Fabric Interface, and update channel interconnects are shown in the following diagram.



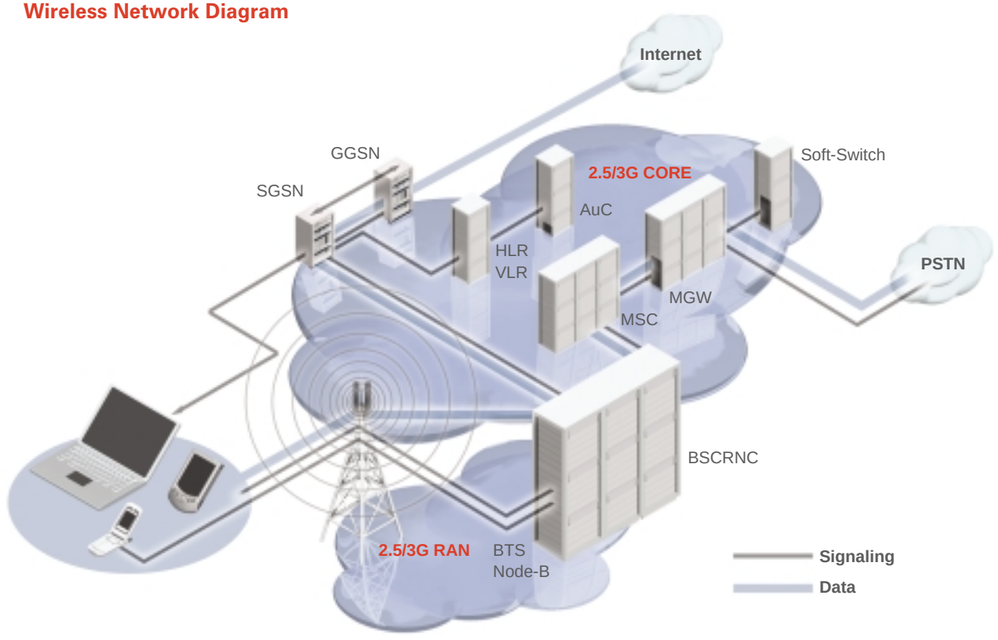
AdvancedTCA Target Applications

AdvancedTCA platforms are ideally suited for applications that can take advantage of the IP data transports. These include wireless access devices, video over IP as well as high end firewall and security applications.

AdvancedTCA Application in 3G Wireless Radio Network Controller

The evolving wireless infrastructure is a mix of 2G and 3G equipment. The newer 3G platforms have greater data processing capabilities and can provide higher bit rate services for Web access and high-quality images. In the network below, 2G is represented by a base transceiver station (BTS), base station controller (BSC), and mobile switching center (MSC) combination. In a 3G Universal Mobile Telecommunication System (UMTS), the BTS is replaced by a Node B transceiver, which in turn connects to a radio network controller (RNC). These platforms can share the back-end infrastructure, which includes home location registers (HLR), 3G service GPRS support nodes (SGSN) and gateway GPRS support modes (GGSN). The purpose of the new platforms is to facilitate access to back office data services as shown below.

Wireless Network Diagram

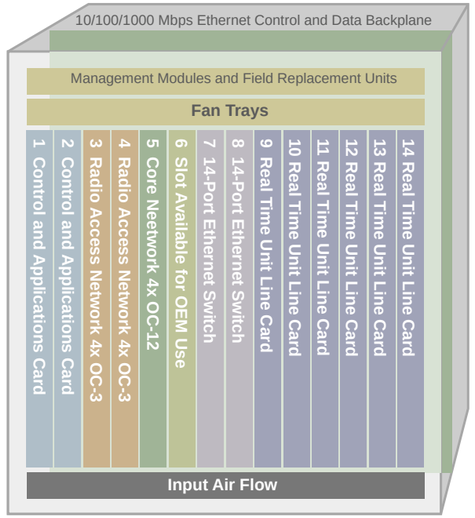


The RNC performs traditional wireless voice communications functions such as:

- Node B concentration
- Link connections with Node B and core network
- Termination of the control signal from Node B and core network
- Termination of layer 2 radio interface
- Call connection control with mobile station
- Diversity of hand-over control
- Traffic data collection/statistics
- Resource management of radio network

In addition, the RNC provides bridging functions for connecting to IP packet-switched networks. Not only does the RNC support traditional ATM AAL2 (voice) and AAL5 (data) functions, but also IP over ATM (IPoA) and Packet over SONET (POS). In addition, the high growth of wireless users has put greater demands on IP technology, which means future platforms have to support both IPv4 and IPv6. Next-generation network processors are a perfect fit for this rich multi-protocol environment.

A RNC based on AdvancedTCA technology is shown as follows. This design complies with PICMG 3.1, which specifies a Gigabit Ethernet backplane in a 14-slot chassis consisting of two switch modules and 12 nodes in a 19-inch rack.



Radio Network Controller Platform

AdvancedTCA Applications in Softswitch (Media Gateway Controller)

A Softswitch or Media Gateway controller (MGC) is based around the MGC protocol software suite and interfaces to a Signaling Gateway, Media Gateway, SIP Server or H.323 Gatekeeper, and end users, IP protocol over Ethernet or OC-x/PoS defines the required interfaces. “99.999%” availability of the service and computing performance is very important for the application.

With ATCA, a MGC can be efficiently implemented using a redundant Base Channel, Fibre Channel infrastructure, and a range of ADLINK’s ATCA-6890 Dual-Xeon ATCA blades with connection to FC storage blades. If NAT and gateway features are required, an optional set of Network Processor blades can be added, either with onboard IP interfaces or to bridge between the Base and Fabric Channel networks.

AdvancedTCA Applications in HLR

Home Location Register (HLR) and Visitor Location Register (VLR) are services for mobile networks to identify the presence and roaming of users. The service is controlled by the SS7 network and requires database access. Therefore, this is a server application with SS7. The ATCA implementation would be comprised of Base Channel infrastructure with switch, Dual-Xeon SBCs for application processing, a SS7 Blade with 1-4 intelligent AMCs for MTP-1 and -2, and 2 storage blades. A Fabric Channel hub may not be required unless the storage requirements exceed the 300GB of the 2 blades.

The signaling Link Sets would be configured for a redundant pair of SS7 blades. With the MTP-2 layer running on the AMC module, which is independent of the MTP-3 and upper layers, the automatic SS7 re-routing to a different MTP-2 or MTP-3 entity, respectively, is provided.

ADLINK - AdvancedTCA Building Blocks Provider Advantages

Technology Leadership

ADLINK Technology is an active participant and has played a vital role in the development of the ATCA blueprint since its inception. ADLINK’s CTO has chaired the PICMG 3.0 specifications committee with other industry leaders to drive the development of this important standard for the next generation telecommunication platforms. As a prominent Intel Communication Alliance partner, ADLINK gained early access to advanced Intel technologies which yielded the world’s first 64-bit ATCA single board computer, the ATCA-6890. Our extensive work with the blade server platform led to the creation of the 10U ATCA shelf ATCA-8014, providing the highest density of ATCA boards in a 42U rack. With ADLINK products, customers can always expect cutting-edge technology.

Dedicated and Experienced Team of Engineers

ADLINK’s R&D and manufacturing engineers are highly educated and trained to design products of the best quality and performance. Our products have won design and quality awards worldwide. Our senior managers often share their knowledge by submitting technical articles for industry publications and serving as guest speakers at various technical conferences. They help to foster growth in the technical community. ADLINK also leverages its extensive experience in the specification, integration, and support of complex systems by partnering with companies to design the most innovative telecommunication systems.

- ATCA Hardware Solutions
- SBCs & RTMs
- Switches
- Chassis
- Backplanes
- Shelf Management Modules
- AC & DC Power Entry Modules
- AMC Cards
- AdvancedTCA Development Platform

ADLINK ATCA-8014 10U ATCA Shelf

Introduction

The ATCA-8014 is a 10U ATCA Shelf that supports 14 ATCA Boards. A shared plenum approach allows stacked chassis to share a plenum. This architecture supports 4 10U shelves in a 42U rack - the highest density available for AdvancedTCA from any vendor. The chassis supports rear transition modules for all 14 ATCA Front Boards. Multiple power entry modules are available providing the option of -48V power or 110/220 AC power input. Dual front pluggable 4U shelf management controllers provide management for the shelf. Multiple backplanes are available including dual star, dual-dual star and full mesh.

Key Features

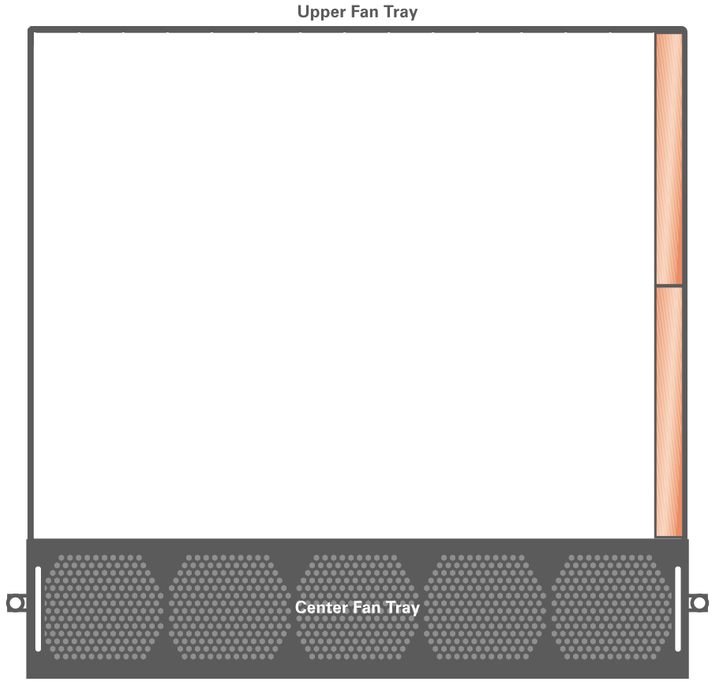
- 10U Shared Plenum Design, enables 4 shelves per telecom frame
- 14 ATCA Front Boards (12 nodes + 2 fabric)
- 14 Rear Transition Modules
- 200 Watts Power Dissipation per Slot
- 4U Front Pluggable Shelf Management Controller Based on Pigeon Point Systems Shelf Manager
- Dual Bused IPMB Interface
- Dual Redundant -48V Power Entry Modules
- Optional 110/220 AC Input Power Entry Module

Backplane Wiring Diagram

Specifications

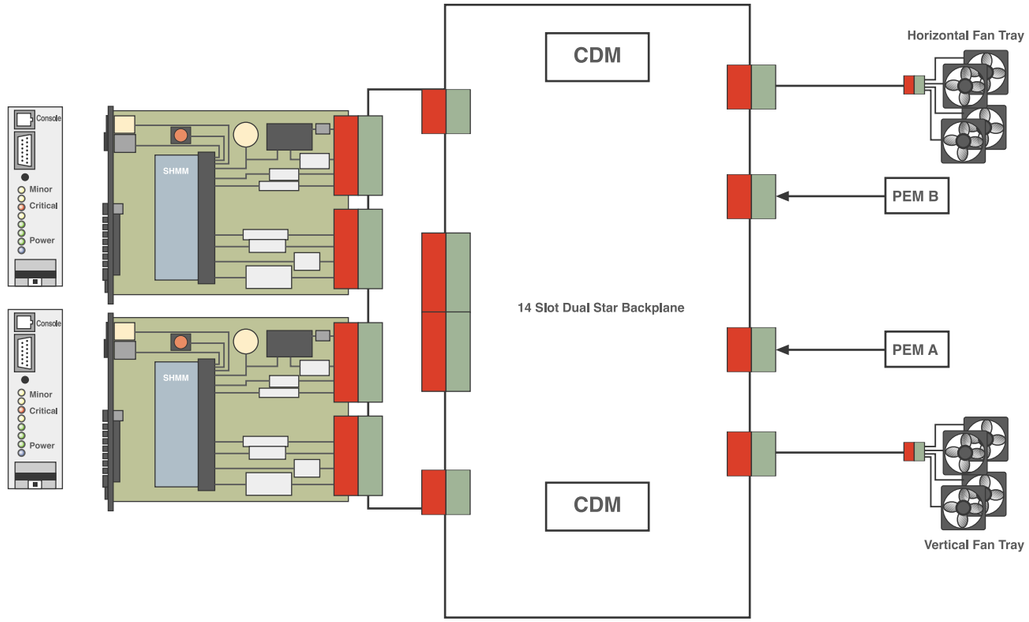
Mechanical Specifications	■ 10U Height rackmount enclosure ■ 14 slots (12 nodes + 2 fabrics) ■ Designed for 19” wide racks ■ Fit inside a 600mm deep cabinet (including cable bend area) ■ Supports full height (8U) rear transition module
Backplane	■ ATCABP-14S: 14 slot, Dual Star Backplane ■ ATCABP-14D: 14 slot Dual-Dual Star Backplane ■ 10/100/1000 BASE-T dual star Base Interconnect ■ Dual Star Fabric Interface (eight differential pairs per channel) handles up to 3.125Gbps per differential pair ■ Update channel interfaces for active/standby synchronization ■ Radial IPMB connection to each node ■ Dual bus IPMB connection to peripherals ■ Fiber Channel over the fabric interfaces
Shelf Manager/Fan Controller	■ Redundant hot swappable with on-board CPLD assist, up to 2 shelf managers per chassis ■ Based on Pigeon Point shelf management technology ■ Shelf manager form factor 4Ux280mm deep ■ Includes fan electronics for fan control and monitoring ■ Supports multiple management interfaces including: ● Remote Management Control Protocol (RMCP) ● Remote Procedure Calls (RPC) ● Simple Network Management Protocol (SNMP) ● Command Line Interface (CLI) ● Web-based Interface ■ Two 10/100Mbit Ethernet controllers with LED indicator controls ■ Up to 16MB flash for program, data and FRU information storage ■ Two serial interfaces, one with modem control, CMOS & RS-232/RS-485 levels ■ Dual Redundant & buffered IPMB ■ JTAG interface for processor debugging ■ Flash and CPLD programming
Power Supply	■ Dual Redundant -48V Power Entry Modules ■ Capable of dissipating 200W per slot ■ Power conditioning is included in PEM
Cooling System	■ Redundant, hot-swappable modular fan tray for efficient front-to-rear cooling up to 200W per front slot and 30W per rear slot. ■ Front to back air flow ■ Easily removable/replaceable air filter
Weight	44 kg/96.9 lbs
Operating Temp.	0 to 55ºC (depending on system configuration)
Storage Temp.	-20 to 80ºC
Humidity	5% to 95%, non-condensed
Dimension	DxWxH: 17.29” x 19” x 10U
Compliance	AdvancedTCA Specification PICMG 3.0 R1.0
Target Certifications	FCC ,CE,UL,NEBS Level 3 (design)

ATCA-8014 10U Chassis Architecture

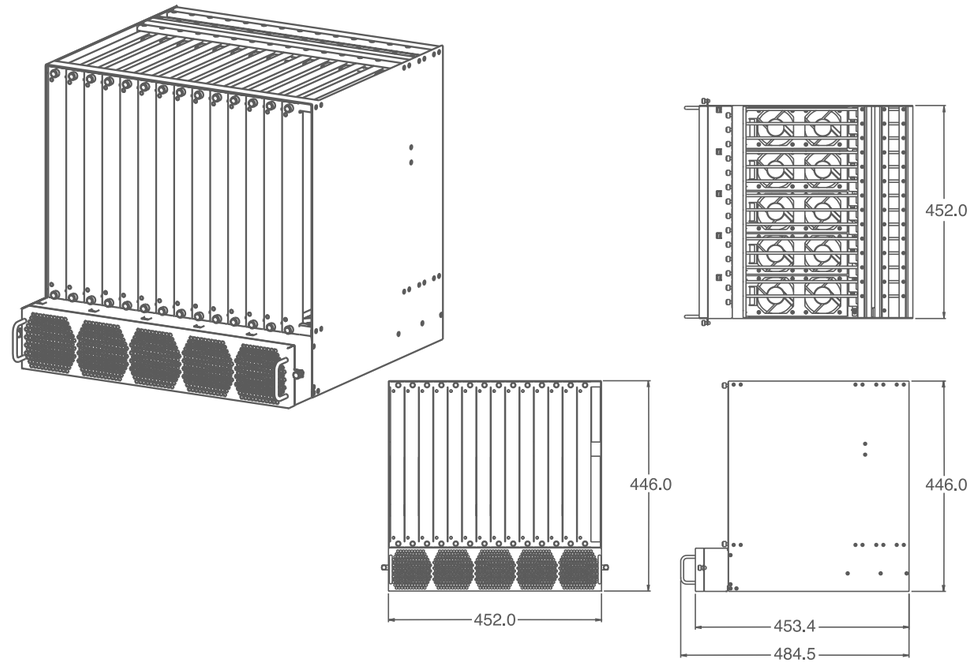


10U Height

AdvancedTCA Shelf Manager Connection



ATCA-8014 3D Drawing



Why 10U AdvancedTCA Chassis?

- Share 2U input/exhaust plenum between 2 chassis
- PICMG3.0 standard compliant chassis
- Stacked height= 2U + (10 U x N) (N= no. of chassis)
- 4 Chassis in one telco frame, increase frame density 33% - 50%