Introduction PICMG Europe

PICMG Europe is the neutral promoter of Open Modular Computing Specifications in Europe. The definition of the technical specifications is managed by the parent organization in the United States. The European branch office, PICMG Europe, was established in 1997.
The writing of the specifications is one aspect. Marketing of the technology and products is the necessary next step. PICMG Europe is a dedicated, independent association for supporting this goal.
By marketing these technical specifications as a group, we are stronger than a number of individually operating companies. Moreover, users expect from open environments that products from different manufacturers are compatible on the same back panel.
PICMG Europe is supported by its members, as well as it supports its members. For instance, every member receives all specifications, updates and changes, free of charge. With this they are sure they are using the latest versions only. Membership levels include suppliers, users and system integrators. As such, PICMG Europe is an organization to join if you are active in these markets.

The existing specifications can be divided in 3 series and a group of related specifications. This brochure gives an overview of all the existing specifications.

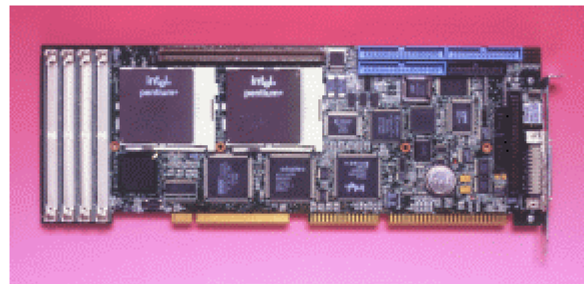
Series 1 – Passive Backplane Specifications

The Passive Backplane Standard was developed to adapt desktop PCI / ISA standards, as well as PCI Express Passive Backplane, for industrial applications by defining a CPU form factor and backplane connectors.

The passive backplane standard moves all of the components normally located on the motherboard to a single plug-in card. The "motherboard" is replaced with a simple "passive backplane" that has only connectors soldered to it. This backplane is simple and robust, with a very low likelihood of failure.

The basic specification in this series (denoted as PICMG 1.0) defines a CPU form factor and backplane connectors for PCI-ISA local bus specification.

The next specification (denoted as PICMG 1.1) defines the PCI-PCI Bridge Board Connector for Single Board Computer, including form factor and backplane connector layout.



The next specification (denoted as PICMG 1.2) standardizes the mechanical and electrical interface to support a standard form factor PCI computer system with either two PCI/PCI-X busses or a single PCI/PCI-X bus. This embedded PCI-X Specification (ePCI-X) is an evolutionary modification of the PICMG 1.0 PCI-ISA Specification; PCI-X capabilities are added to the PCI bus and the ISA bus is replaced by a second PCI-X bus. The board retains the same mechanical dimensions as PCI-ISA but the components move to the PCI side and the slot occupies a PCI position on a backplane.

The next specification, SHB Express, (denoted as PICMG 1.3) enhances the popular PICMG 1.0 (PCI) and 1.2 (PCI-X) specifications that defined passive backplane implementations of the desktop PC architectures. PICMG 1.3 continues that practice by mapping PCI Express onto a System Host Board (SHB) and an SHB Express backplane to accommodate the System Host Board and standard add-in cards. The specification defines the mechanical, signal mapping and power distribution requirements for System Host Boards and backplanes. In addition to providing support

for new PCI Express add in cards, an SHB Express system will also support legacy PCI and PCI-X add in cards. The specification defines systems that can range from two slots for deeply embedded applications to up to 20 slots for complex, high performance solutions.

This series of specification currently consists of:

1.0 R2.0	PCI ISA Card Edge Connector for Single Board Computer
1.1 R1.02	PCI-PCI Bridge Board Specification for Single Board Computer
1.2 R1.0	Embedded PCI-X specification
1.3 R1.0	System Host Board PCI Express specification

Series 2 – CompactPCI Specifications

CompactPCI®

The standard for PCI-based industrial computers is called CompactPCI. It is electrically a superset of desktop PCI with a different physical form factor. CompactPCI utilizes the Eurocard form factor.
Defined for both 3U (100mm by 160 mm) and 6U (160mm by 233 mm) card sizes, CompactPCI has the following advantages:

- Supports standard PC software through PCI compatibility
- Open bus – no royalties
- Large number of suppliers providing a wealth of choice and adds price-pressure and high innovation rate
- Suite of specifications encompass simple systems till high availability (99.999% uptime), hot swap, and telecom support
- High level of packaging considerations: EMC, cooling, shock and vibration, easy removal of boards, front and rear I/O, User I/O areas, extension busses
- Both 3U and 6U Eurocard form factors; ideally suited for severe environments cf. IEEE 1101.1 mechanical standards)
- Vertical card orientation for optimal cooling
- Staged power pins for hot swap capability
- Eight slots in basic configuration. easily expanded with PCI bridges

With the move from the parallel PCI bus to the serial busses, like PCIExpress, StarFabric, RapidIO, subsequent specifications were added to the CompactPCI family. For instance, 2.16 CompactPCI Packet Switching Backplane specification overlays a packet based switching architecture on top of CompactPCI to create an Embedded System Area Network. It provides a redundant, switched 10/100/1000 Ethernet network within a Compact PCI chassis providing connectivity between all slots using a star topology. It is intended to coexist with 64 bit CompactPCI and H.110. Special slot(s) for active switching fabric element(s), which may be redundant, are also specified.

The CompactPCI Express Specification, denoted EXP.0, brings the PCI Express technology to the CompactPCI form factor, while maintaining compatibility with CompactPCI hardware and software. The specification defines the connector, electrical, and mechanical requirements of 3U/6U System Boards, Peripheral Boards, Switch Boards, and Backplanes and leverages the Advanced Differential Fabric (ADF) connector used by AdvantedTCA to carry the PCI Express Signals. It maintains hardware compatibility with CompactPCI by allowing backplanes to have CompactPCI slots as well as Hybrid Slots, which support CompactPCI, PXI, and Compact PCI Express peripheral boards.
The specification defines the system slot and board to have up to 24 lanes and up to four links of PCI Express for up to 6 Gigabytes/second system bandwidth per direction. Type 1 peripheral slots and boards can have up to 16 lanes of PCI Express for up to 4 Gigabytes/second bandwidth per direction and Type 2 peripheral slots can have up to 8 lanes of PCI Express for up to 2 Gigabytes/second bandwidth per direction.
CompactPCI Express provides migration path for customers who use the highly successful CompactPCI form factor but want the added performance of PCI Express.

This full series of specification currently consists of:

2.0 R3.0	CompactPCI Core Specification
2.1 R2.0	CompactPCI Hot Swap Specification
2.2 R1.0	VME64x on CompactPCI Specification
2.3 R1.0	PMC on CompactPCI Specification
2.4 R1.0	IP on CompactPCI Specification
2.5 R1.0	CompactPCI Computer Telephony Specification
2.7 R1.0	Compact PCI 6U Dual System Slot Specification
2.9 R1.0	CompactPCI System Management Specification
2.10 R1.0	CompactPCI Keying of CompactPCI Boards and Backplanes
2.11 R1.0	CompactPCI Power Interface Specification
2.12 R2.0	CompactPCI Hot Swap Infrastructure Interface Specification
2.14 R1.0	CompactPCI Multi Computing Specification
2.15 R1.0	CompactPCI PCI Telecom Mezzanine/Carrier Card Specification
2.16 R1.0	CompactPCI Packet Switching backplane Specification
2.17 R1.0	CompactPCI StarFabric Specification
2.18 R1.0	CompactPCI Serial RapidIO Specification
2.20 R1.0	CompactPCI Serial Mesh Backplane Specification
EXP.0 R1.0	CompactPCI Express EXP.0 Specification

Series 3 – AdvancedTCA

PICMG developed an Advanced Telecommunication Computing Architecture, called AdvancedTCA or ATCA, in order to supports the high requirements from the high-end telecommunication industry, especially in the 99.999% system uptime.

Attribute	CompactPCI	AdvancedTCA
Board size	6U x 160 mm	8U x 280 mm
Distance between modules	0.8“ board pitch	1.2“ board pitch
Board area:	367 cm²	903 cm²
Power consumption per module:	35 - 50 W	150 - 200 W

With ATCA we enter a new era. With support for multiple CPUs on one module, one needs power. And power generates heat, which has to be dissipated. Thermal considerations are for this reason a very important factor in the specification process.

Comparison of CPCI, CPCI 2.16, and ATCA

Attribute	PICMG2 / CPCI	PICMG2.16 / CPSB	PICMG3 / ATCA
Board Size	6U x 160mm x .8” 57 sq in + 2 Mez	6U x 160mm x .8” 57 sq in + 2 Mez	8U* x 280mm x 1.2” 140 sq in +4 Mez
Board Power	35-50W	35-50W	150-200W
Backplane Bandwidth	~4Gb/s	~38Gb/s	~2.4Tb/s
# Active Boards	21	19	16
Power System	Centralized Converter 5, 12, 3.3V Backplane	Centralized Converter 5, 12, 3.3V Backplane	Distributed Converters Dual 48V Backplane
Management	OK	OK	Advanced
I/O	Limited	OK	Extensive
Clock, update, test bus	No	No	Yes
Multi-vendor support	Extensive	Building	Since end 2003
Base cost of shelf	Low	Low - Moderate	Moderate-High
Regulatory conformance	Vendor specific	Vendor specific	In standard
Functional density of shelf	Low	Moderate	High
Lifecycle cost per function	High	Moderate	Low
Standard GA Schedule	1995	2001	2H2003

This ATCA series of specification currently consists of:

3.0 R2.0	AdvancedTCA Base Specification
3.1 R1.0	AdvancedTCA Ethernet/Fibre Channel Specification
3.2 R1.0	AdvancedTCA InfiniBand Specification
3.3 R1.0	AdvancedTCA StarFabric/Advanced Switching Specification
3.4 R1.0	AdvancedTCA PCI Express/Advanced Switching Specification
3.5 R1.0	Serial RapidIO for AdvancedTCA Systems

Supporting Specification: System Fabric Plane, SFP

There are currently two SFP specifications: SFP.0 Core and SFP.1 TDM.
SFP.0 is a layer 2 ½ or “shim” protocol specification for low-overhead, high-speed generic encapsulation targeted at PICMG 3.1 Ethernet-based modular systems, but also has application for other PICMG 3.x & 2.16 fabric-based systems. SFP.0 is generic in the sense that it can be used to encapsulate all kinds of packet and cell-based traffic (e.g. Time Division Multiplexed (TDM) and Asynchronous Transfer Mode (ATM)) for transport between blades or chassis on a switched fabric.

SFP.1, also known as I-TDM (Internal TDM), is a companion protocol specification to SFP.0 that is optimized for TDM traffic over high-speed fabrics such as 1 and 10 Gigabit Ethernet (PICMG 3.1), Advanced Switching (PICMG 3.4), Infiniband (PICMG 3.2), etc. SFP.1 and SFP.0 together provide a complete encapsulation for TDM over Ethernet. This provides a functional replacement to the hardware-based H.110 & H.100 buses that existed in older telephony systems.

This series of specification currently consists of:

SFP.0 R1.0	System Fabric Plane Format
SFP.1 R1.0	Internal TDM

Other Specifications

Advanced Mezzanine Card

In order to provide extensions capabilities to the AdvancedTCA modules, PICMG defined the Advanced Mezzanine Card architecture, AdvancedMC or AMCs. These cards had to support also how swap and management functionalities, in order to realize the high availability of the ATCA modules and systems.

It is the first entirely new open mezzanine standard to be developed in more than a decade. AdvancedMC cards are switch fabric based, hot-swappable, and fully managed. The AdvancedMC series of specifications follows the numbering pattern set by AdvancedTCA, where AMC.0 creates the foundation for the Mezzanine Cards with definition of form factor, connector, power and thermal characteristics, management, clocking and base fabric. AMC.1 maps PCI-Express onto the extended fabric interface. Additional specifications to support Ethernet and SerialRapid I/O are near completion and will be released as AMC.2 and AMC.4 respectively.
Though the specifications were developed to meet stringent telecom requirements for reliability, availability, serviceability and manageability, AMC module characteristics are expected to appeal to many other markets as well.
While AdvancedMC was developed to be compatible with the AdvancedTCA architecture, AdvancedMC modules will be used in conjunction with other platform architectures, including some unique new systems that will consist exclusively of AdvancedMC modules. As its predecessors have shown, good mezzanine cards will be used wherever they can fit, which will encompass a wide range of carrier form factors and applications.

This series of specification currently consists of:

AMC.0 R2.0	Advanced Mezzanine Card Base Specification
AMC.1 R1.0	PCI Express and Advanced Switching on AdvancedMC
AMC.3 R1.0	Advanced Mezzanine Card Extension for Storage

MicroTCA Specification

MicroTCA is designed to address cost sensitive and physically smaller applications with lower capacity, performance, and perhaps less stringent availability requirements. MicroTCA preserves many of the important philosophies of AdvancedTCA, including basic interconnect topologies and management structure.

1. Based on high speed serial communication channels, supporting hot swap and providing reliability till 99,999% uptime
2. Scalable infrastructure – from one processor systems to 100’s
3. Small sized cards, suitable for a broad industry – from embedded to industrial control
4. Flexible systems by defining several packaging formats, suitable for different space requirements
5. System management functionality build in, providing the basis for remote diagnostics and maintenance
6. Ruggedized systems, yet low cost capabilities

With this remarkable combination, microTCA provides a basis for flexible, extendable, low cost controller platforms with high availability and remote maintenance, important to the industrial world. However, it also provides low cost communication controllers build on existing technology (PICMG Advanced Mezzanine Cards, or AMCs) for the telecommunication industry, outside of the typical telecom equipment manufacturers.

This series of specification currently consists of:

MTCA.0 R1.0	MicroTCA Base Specification

COM Express Specification

COM stands for Computer-On-Module. This approach puts an entire computer host-complex power on a small form factor (either 95mm x 125mm or 155mm x 110mm) module that can be mounted on larger carrier boards containing the application specific IO and power circuitry. It also allows flexibility in standard form factor boards that require upgradeable host functionality. This brings benefits to system designers, such as reduced time-to-market, cost-effective customization and lower product lifecycle costs.
COM Express supports a rich set of interfaces, including PCI Express up to 32 lanes, PCI Express Graphics, Serial ATA, Serial Attached SCSI, USB 2.0, LVDS, Serial DVO (digital video out), Ethernet, and GPIO, as well as enhanced system and power management features, making it suitable for many embedded computing applications. Support for PCI and parallel ATA further ensures that OEMs have a smooth transition path from existing systems.

This series of specification currently consists of:

COM.0 R1.0	COM Express Module Base Specification

For more information please contact:

http://www.picmgeu.org