Dreampact

AdvancedTCA

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What You Should Know About AdvancedTCA®

Overview

The evolution of telecommunications has resulted in a vast array of standards and protocols, each developed to address specific technical or marketing requirements. Increased bandwidth demand and interoperability issues have intensified the need for a common platform that provides the necessary bandwidth, flexibility, scalability and low development cost.

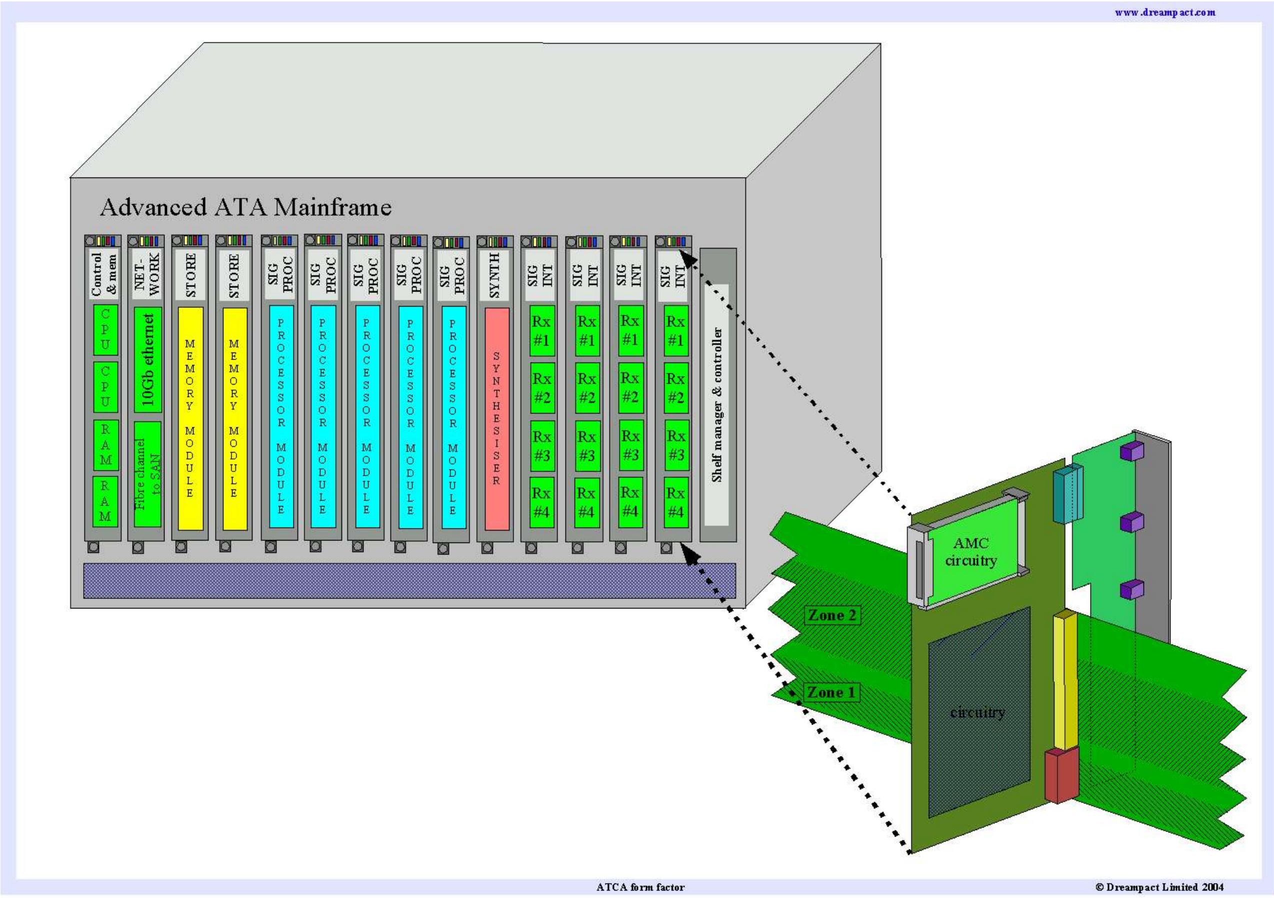
AdvancedTCA® (Advanced Telecommunication Computing Architecture) is the new common platform developed by the PCI Industrial Computer Manufacturers Group (PICMG®), a consortium of over 450 companies, aimed at the communications network infrastructure.

Some of the key objectives of the AdvancedTCA® architecture are to:

- reduce development time and costs
- reduce cost of ownership
- apply to wireless, wireline and optical network elements
- apply to edge, core, transport and data center
- provide high level of service availability – 99.999% and greater availability
- support scalable performance and capacity – the capacity is scalable to approximately 2.4Tb/s

In addition to network elements and infrastructure, other uses for the architecture include test equipment and applications where other platforms, such as VME or VXI, have been used. Features of AdvancedTCA®, such as board area, board power and bandwidth help alleviate the problems associated with trying to get ever faster higher bandwidth circuits into a limited space.

Architecture

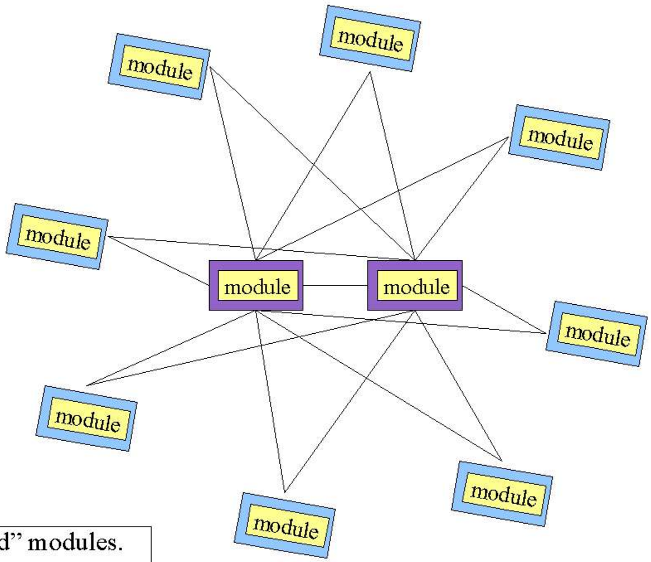


The basic elements of the platform are;

- Front Boards. These contain the electronic functions and connectors associated with those functions. These Front Boards themselves are large and may consist of multiple plug in (mezzanine) boards thus giving a huge amount of flexibility to any system design.
- Rear Transition Modules (RTM) which provide user defined input and output from the rear of the platform to its associated Front Board.
- The Backplane which provides connectors for power and input/output for the Front Boards. The backplane supports a maximum of 16 Slots, although it can support fewer.
- The Sub rack which provides attachment points for the Backplane and other mechanical support.

The Front Board containing the electronic functions has three connector zones:

- Zone 1 connects to the backplane and is used for shelf management and power, supplied through dual redundant -48VDC feeds. The zone 1 connectors include ringing generation and connections that can be used for testing.
- Zone 2 connects to the backplane and is used for data transport and consists of four interfaces, the *Base Interface*, the *Fabric Interface*, the *Update Channel Interface* and the *Synchronisation Clock Interface*.
    - The *Base Interface* is always configured as a Dual Star and is used to support 10/100/1000 BASE-T Ethernet connections amongst boards in the shelf.



Example of 10off "starred" modules.
Two hubs control
Zone 2 interface switching to the nodes

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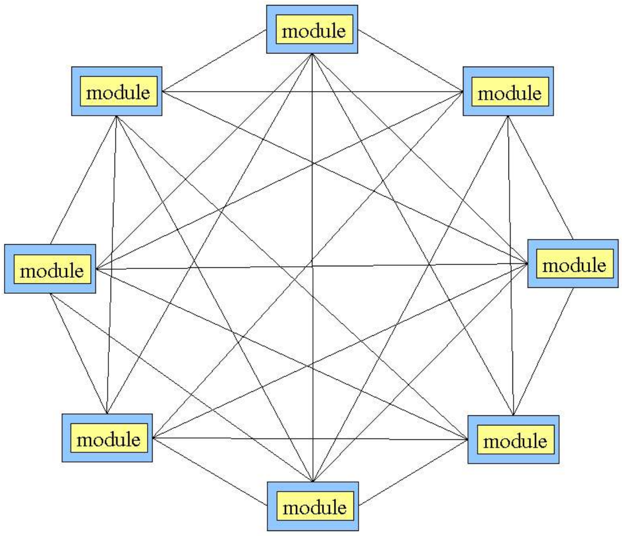
    - The *Fabric Interface* can be used to support topologies such as Dual Star or Full Mesh among all the boards, thus giving a large amount of flexibility. Different backplanes support the different topologies.



Example of 8off "meshed" modules
All modules have the same
Zone 2 interface

  - The *Update Channel Interface* comprises of 10 differential signal pairs in a point to point connection between two boards. It is typically used between adjacent slots in the backplane for example when two boards need to pass SONET/SDH data between them. A single differential pair of wires could carry STM-16 (2.5Gb/s) data, or eight pairs could carry bi-directional STM-64 (10Gb/s) data.
  - The *Synchronisation Clock Interface* has three separate groups of two differential signals. The first pair of signals provide a redundant 8KHz system clock – the fundamental frequency for digital telephony transmission. The second group of signals provide a redundant 19.44MHz system clock used as the common reference signal in SONET/SDH networks. The third pair of signals can be used as independent signals and driven by either a user defined application specific signal or an external reference clock but must be of a frequency less than 100MHz.
- Zone 3 connects to the optional RTM via a user defined connector and is used for custom input/output interconnect. These signals from the Front Board are taken outside the rear of the shelf via this connector. This avoids having to disconnect

cables when replacing boards as the RTM stays in position.

Hot-swappable

Boards are hot-swappable, necessary for in service maintenance and also preventing damage during the development of systems.

Power Dissipation

With increasing data rates and circuit densities power dissipation can often be a problem. AdvancedTCA® addresses this by allowing as much as 200W per Front Board, or where a Front Board occupies two slots it can dissipate up to 400W. Cooling guidelines other than air cooling are allowed but are not covered in the PICMG® specification.

As a comparison, typically, high-performance VXI instruments consume 25 W to 100 W of power in each slot.

The high power dissipation allowed for the Front Boards enables circuits to be built that would be inappropriate for other platforms.

Software Architecture

The AdvancedTCA® architecture provides an ideal platform for developing scalable software for a range of applications. By incorporating industry standard interfaces for board-board and shelf-shelf communication, as well as using common network topologies, readily available software modules can be reused and incorporated into new designs to expedite development and reduce integration and test times.

TE Applications

The features of the platform are attractive for test equipment manufacturers who face the same problems of power dissipation, ever increasing bandwidth and cost sensitivity as the telecommunication equipment makers themselves. The platform offers the chance for test equipment manufactures to develop scalable test equipment without the time and financial cost penalties of developing their own proprietary infrastructure.

Using the same platforms for both network and test equipment allows the easier integration of the two within a single location thus opening up more testing and real-time network monitoring opportunities.

Wireless Applications

Products based on the standard have already been developed. For example NEC announced the first working model of an AdvancedTCA® based commercial product in September 2003 which handles large volume IP packet applications for 3G services, such as video streaming and shipped over 100 units in 2004 (visit http://www.unstrung.com for more information).

Market

The telecommunication equipment market at which the specification is aimed was worth over US$200B/year in 2002, more than 10% of which represents platforms. The potential market of the platforms is therefore clearly very large.

A report by Crystal Cube Consulting and Metz International suggests that the AdvancedTCA® standard could generate more than $20 billion revenue by the end of 2007. They also believe that AdvancedTCA® will first support the wireless infrastructure with 2.5G and 3G being the initial focus. They also suggest that the value added proposition will shift to the software domain.

Other market analysis suggests that there will be broad market adoption of AdvancedTCA® from 2007. Very early adopters of the platform will tend to be startups with no legacy issues or established companies that need a more competitive platform than they currently have (visit http://www.unstrung.com for more information).

Major players, other than network manufactures, such as Intel are also developing product for AdvancedTCA® helping ensure it's future.

Xilinx have demonstrated 10Gb/s (STM64/OC192) signaling over an AdvancedTCA® backplane using a Virtex-II Pro X device. The availability of Field Programmable Gate Arrays that can interface directly to the backplane at these high rates only adds to the flexibility that can be built into the Front Boards.

AdvancedTCA® Links

The AdvancedTCA® specifications are available from the PICMG®. The backplane is fully defined in PICMG®3.0 and all interoperable boards are described in the following additional specifications:-

- PICMG®3.1, Ethernet and Fiber Channel
- PICMG®3.2, Infiniband
- PICMG®3.3, StarFabric
- PICMG®3.4, PCI-Express and Advanced Switching

- PICMG®3.5, Advanced Fabric Interconnect / S-RapidIO

Mezzanine boards are described in the Advanced Mezzanine Card specification,

Visit *www.picmg.org/newinitiative.stm* for more information.

About Dreampact

Dreampact Limited is a Scottish-based company providing design and consultancy services to clients seeking fast and reliable R&D outsourcing. Dreampact has experience in RF and analogue design, high speed digital design, VHDL and embedded/application software development. Dreampact has capabilities in the commercial, military/defence and telecommunications sectors.

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