OPEN MODULAR SOLUTIONS

THE NEW CONVERGED NETWORK

IMS networks on ASI-based modular platforms

Achieving high performance, cost-effective IMS network convergence using Advanced Switching Interconnect (ASI) and AdvancedTCA™ / AdvancedMC™ platforms

ACCESS

EDGE

CORE

TRANSPORT

DATA CENTER

kontron

Executive Summary

In a previous Kontron white paper, it was demonstrated how AdvancedTCA and AdvancedMC modular-based systems were ideal for the deployment of various IMS network elements. Conceived for Telecom Equipment Manufacturers (TEMs), the AdvancedTCA specification features a standardized backplane that opens the door to introduce the Advanced Switching Interconnect (ASI) as the switch fabric of choice for open modular communications platforms. This is a significant step to provide further flexibility by separating I/O and processing, which results in increased QoS, multi-protocol support and higher switching performance. This paper will illustrate the multiple advantages of using ASI in modular, distributed platforms as an ideal solution for the corresponding IMS network elements that support quality multimedia content delivery for the wireless multimedia subscriber services of today and tomorrow.

IMS networks and ASI-based open modular platforms

By Sven Freudenfeld

Telecom equipment manufacturers are rapidly changing their vision for new product developments. Why? Simply stated, open standard modular communication platforms are quickly becoming recognized as the concept of choice to introduce new products to market, faster. With COTS (commercial-off-the-shelf) platforms as a base, TEMs can devote more resources on their applications rather than investing R&D in platform and middleware design.

This open standard is Advanced Telecom Computing Architecture (AdvancedTCA) defined by more than 100 vendors involved with the PCI Industrial Computer Manufacturers Group (PICMG), and was conceived to meet the necessary carrier-grade, high performance requirements demanded by TEMs and their service provider customers.

An extension to this standard is the AdvancedMC (AMC) specification, which defines the next generation of mezzanine cards that are hot-swappable, field replaceable modules used for I/O, data processing and memory applications with AdvancedTCA platforms. This AdvancedTCA and AdvancedMC combination dramatically increases the level of flexibility and modularity for newly developed telecom gear.

Taking an "AMC everywhere" design strategy – namely the support of AMC modules with each ATCA processing, hub, and carrier board – provides even more flexibility and better cost savings for OAM&P. AMC modules are currently based on the AMC.1 specifications and route both Gigabit Ethernet and PCI Express (PCIe). The immediate benefits are easy manageability through IPMI, high availability, low power, ultra-dense processing, lower operating costs and, more significantly, equipment consolidation that dramatically reduces the need for real estate by combining applications for content, billing and transport. The end benefit to carriers is the unprecedented flexibility to swap-in and swap-out new wireless services with drastically lower costs, less risk and with no loss of service.

As the PICMG 3.x specification entails a standardized backplane, the next step is to standardize the switch fabric interface. The integration of Advanced Switching Interconnect (ASI) as a lean, high performance and low cost switching architecture for carrier grade systems is what will give system developers the flexibility they need to integrate new interfaces with high processing capabilities.

Advanced Switching Interconnect for cost-effective performance and scalability

Advanced Switching Interconnect is a standard ratified by the Advanced Switching Interconnect Special Interest Group (ASI SIG), and is to be part of the future PIGMG 3.4 and AMC.1 specifications for the fabric interface. ASI provides a lean, high performance, low cost switching architecture that is protocol agnostic and is a complementary extension of PCI-Express. Moreover, ASI is backwards compatible with PCI-Express, which expands system flexibility and modularity.

ASI is focused on shelf-to-shelf, board-to-board, and chip-to-chip interconnections, and offers many benefits such as multi-protocol support, QoS, redundant routing and higher switching performance in the star, dual star or mesh configuration.

Through an adaptation layer referred to as Protocol Interfaces (PIs), three different traffic types are adapted into the ASI protocol. Fabric services is the first one that defines protocols for device configuration, enumeration, discovery, and event handling. The second is tunneling, which allows ASI to encapsulate any protocol, including PCI Express, Ethernet, ATM, and iTDM, among others. With encapsulation, a bridge device on the edge of an ASI fabric takes the incoming native protocol and converts it into ASI packets by adding additional header information. This allows for a powerful switching capability that preserves existing hardware and software investments. The third traffic type includes native data movement protocols, which enables simple load/store (SLS) transactions, queue-based messaging (SQ), and socket based RDMA-like transport (SDT).

Unlike PCI Express, processors and devices interconnected through ASI are no longer bound by a hierarchical structure where there is an upstream host and downstream devices. Instead, communication channels between processors and from processors to devices can be independently created and removed.

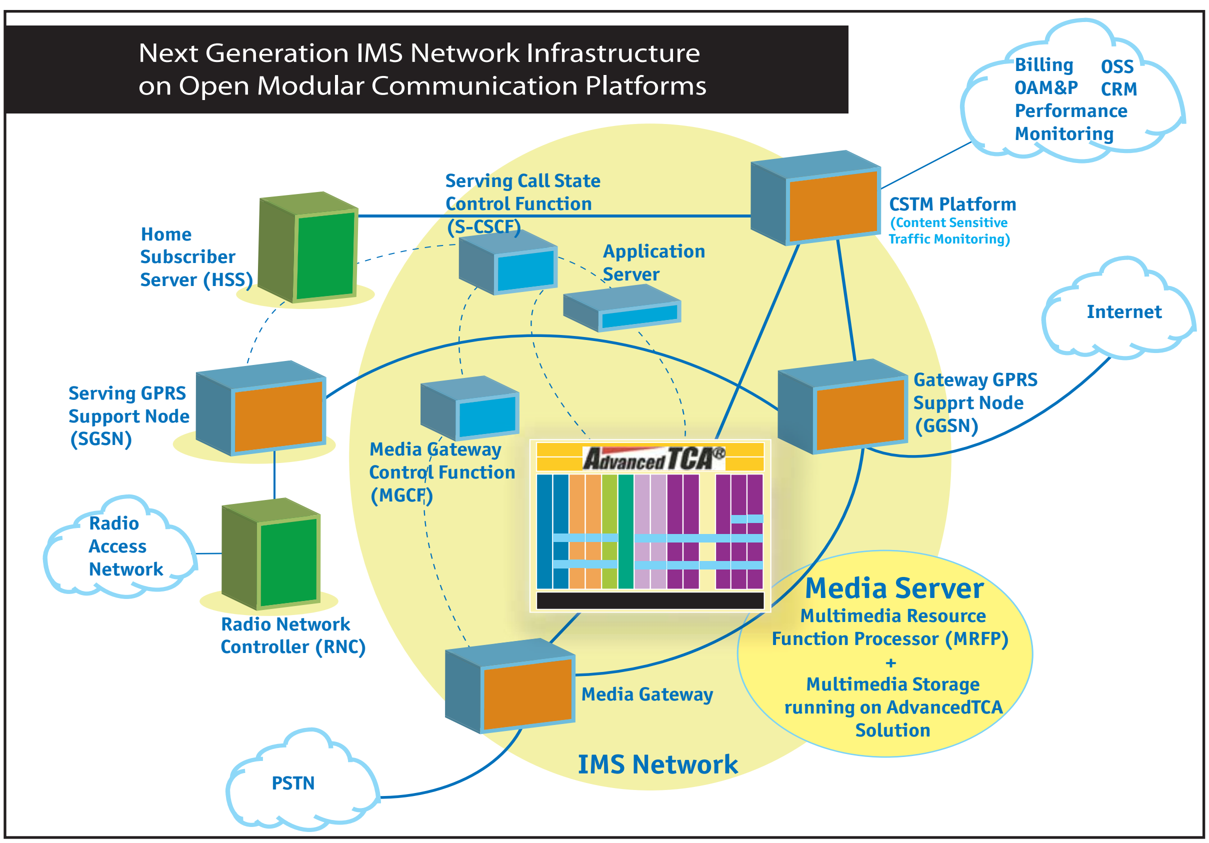
ASI / GbE for open modular-built IMS network elements

Advanced Switching is an ideal backplane interconnect for many of the emerging IP Multimedia Subsystem (IMS) network elements. Without standardization of the backplane interconnect however, the TTM and volume benefits of moving to a standards-based platform like ATCA will be difficult to materialize. In certain cases, GigE provides sufficient connectivity across a backplane but in order to provide maximum flexibility, a second interconnect such as ASI is also required.

Depending upon the element in the IMS infrastructure (i.e. security gateway, application server, media gateway, call session controller, etc.), the type and mix of processing and IO elements will change. By implementing Ethernet on AdvancedTCA's base channel and Advanced Switching on the fabric channel, developers can meet the performance, cost, flexibility, and high availability requirements of IMS platforms.

With an AMC Everywhere-enabled AdvancedTCA system with ASI and GbE interconnects, system designers have the ability to host large pools of DSPs, NPs, processors, and storage, making them ideal nearly throughout any network from access to transport segments.

The key advantage of ASI in an IMS platform application is its ability to tunnel PCI Express traffic. Protocol Interface 8 (PI-8) is an ASI SIG specified method for encapsulating PCI Express packets. A PI-8 binding can easily be established between a PCIe-enabled host CPU and one or more PCIe devices. Once the bindings are established, the PCI Express domain created within an ASI fabric can run legacy PCI/PCIe applications without any changes to BIOS, drivers, for example. Using this capability, IMS Platform developers can dis-aggregate their IO elements from



their processing elements, increasing design flexibility, modularity, and high availability while maintaining a clear path to migrate to more complex system architectures using native ASI features.

Multimedia network components in the IMS Infrastructure

One of the key drivers in IMS is multimedia content delivery for the mobile subscriber base. PSS (Packet-Switched Streaming), MMS (Multimedia Messaging Service) and MBMS (Multimedia Broadcast/Multi-cast Service) are all standardized by the 3GPP and are the key elements for data transport. To accomplish this service delivery platform with open modular components, the key elements required are:

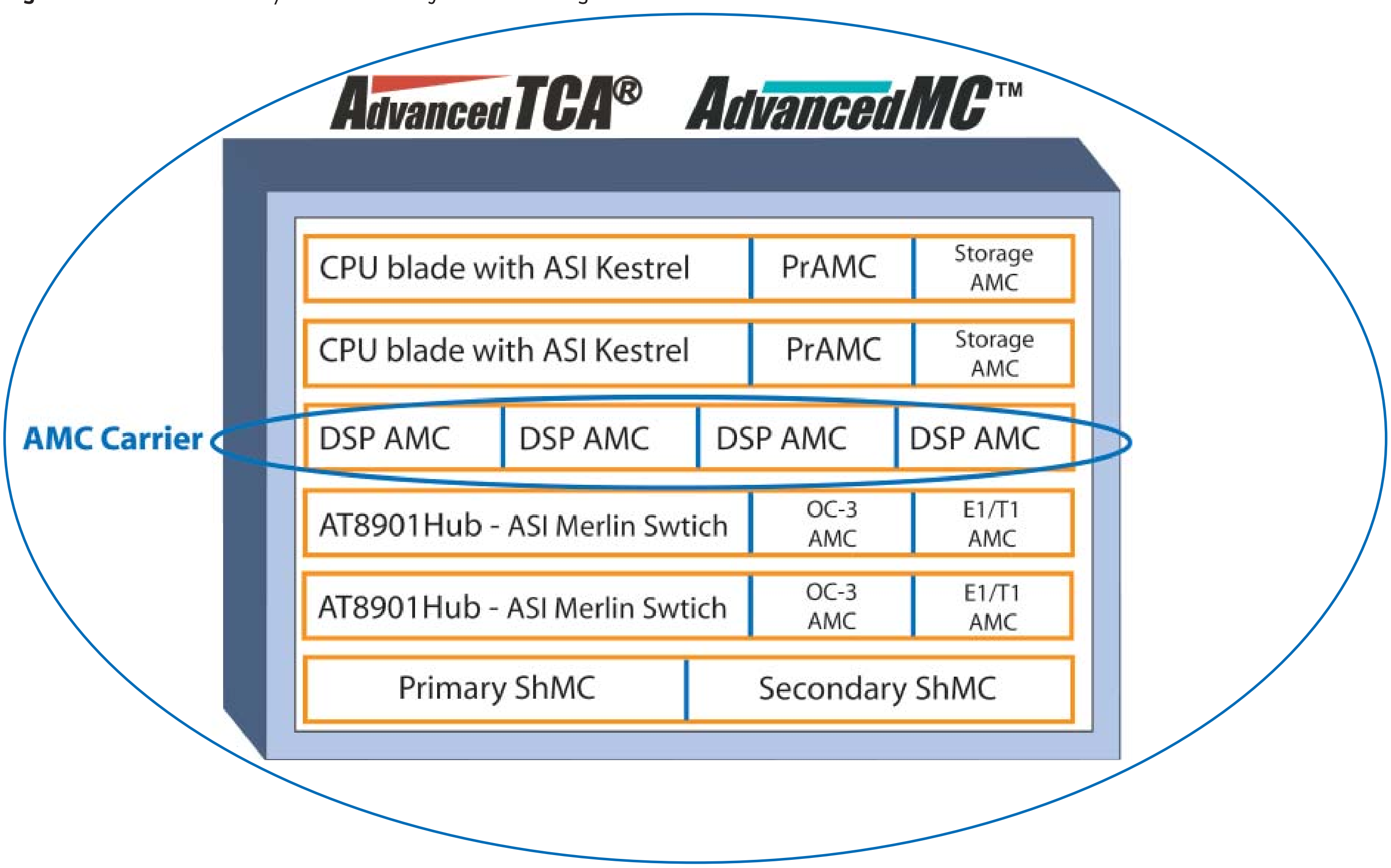
> Ethernet
> Network Processing
> TDM and ATM line interfaces
> Storage for content storage
> DSPs for digital signal processing

The multimedia service options for cellular subscribers are numerous, built to deliver server-to- user, user-to-user, or multi-user applications. In light of the traditional network deployment of dedicated servers per application, TEMs currently can offer advanced equipment (i.e.: AdvancedTCA/AdvancedMC) that consolidates the various content, billing and transport applications on far fewer platforms.

Figure (1) shows a sample IMS network element (Media Resource Function Platform combined with Media Gateway Control Function) as a 4U 5-slot AdvancedTCA chassis with CPU processing boards, hub boards, and an AMC carrier featuring storage, I/O and DSP AMC modules. This would be an example for streaming audio/video (PSS, MMS, MBMS), SMS, and transcoding, which handles the interoperability compliance of any file format to any file format, such as AMR, AMR-WB, AMR-WB+, AAC, AAC+, VMR-WB Codec, MPEG-4, MPEG-2, and JPEG, among others.

The AT8901 Hub in this example supports base interface via GigE and the fabric interface supports ASI by using a mezzanine card built with the StarGen Merlin 10 port ASI chipset, where 8 ports are connected to the Fabric Interface and 2 ports are routed to the two AMC modules. The two full-height AMC modules in this hub board are routed via the StarGen ASI piggyback to

Figure 1: 5U AdvancedTCA/AdvancedMC system featuring an ASI Interconnect.



the fabric interface, and the protocol interface used for the ASI is based on PI-8 and provides the ability to tunnel PCI-Express traffic.

For processing capabilities, the assumption is that the two AdvancedTCA CPU blades with 2 AMC modules are equally equipped with the StarGen Kestrel bridge as a PI-8 host device to communicate ASI via the Fabric Interface. The base interface will provide LAN connectivity to the other boards.

In the case of the AMC carrier board, also assume that the StarGen Merlin chipset is used for PCI-Express to ASI tunneling with PI-8. In an IMS environment, the system needs to interface with GigE, ATM such as E1/T1, TDM such as OC-3/STM1 AMC, and processes traffic with DSP AMCs or a Processor AMC. For the application and/or content storage, SATA storage AMCs or PATA drives are mounted onto the module. The DSP AMC and Processing AMC respectively operate both the transcoding application and digital signal processing functions such as echo cancellation.

Multimedia content (audio, video, pictures) can be encoded in various different formats supported by SIP and H.248 network infrastructures and may be stored in the SAN over several different networks. Content transcoding is an important part of the puzzle for the deployment of next generation services and requires high processing resources (MIPS) for quality operation.

Using the 4U 5-slot chassis with AMC supported AdvancedTCA carrier blades will keep the footprint, and therefore the cost, small. However, the ideal scenario would be to use a 12U or 13U AdvancedTCA chassis. With a single Merlin switch, a system is limited to a 9-slot fabric configuration. However, by implementing a non-blocking multiple switch topology on an ATCA fabric card, support for the larger 14 and 16 slot systems can be achieved.

Having this configuration, as in Figure 2, with ASI

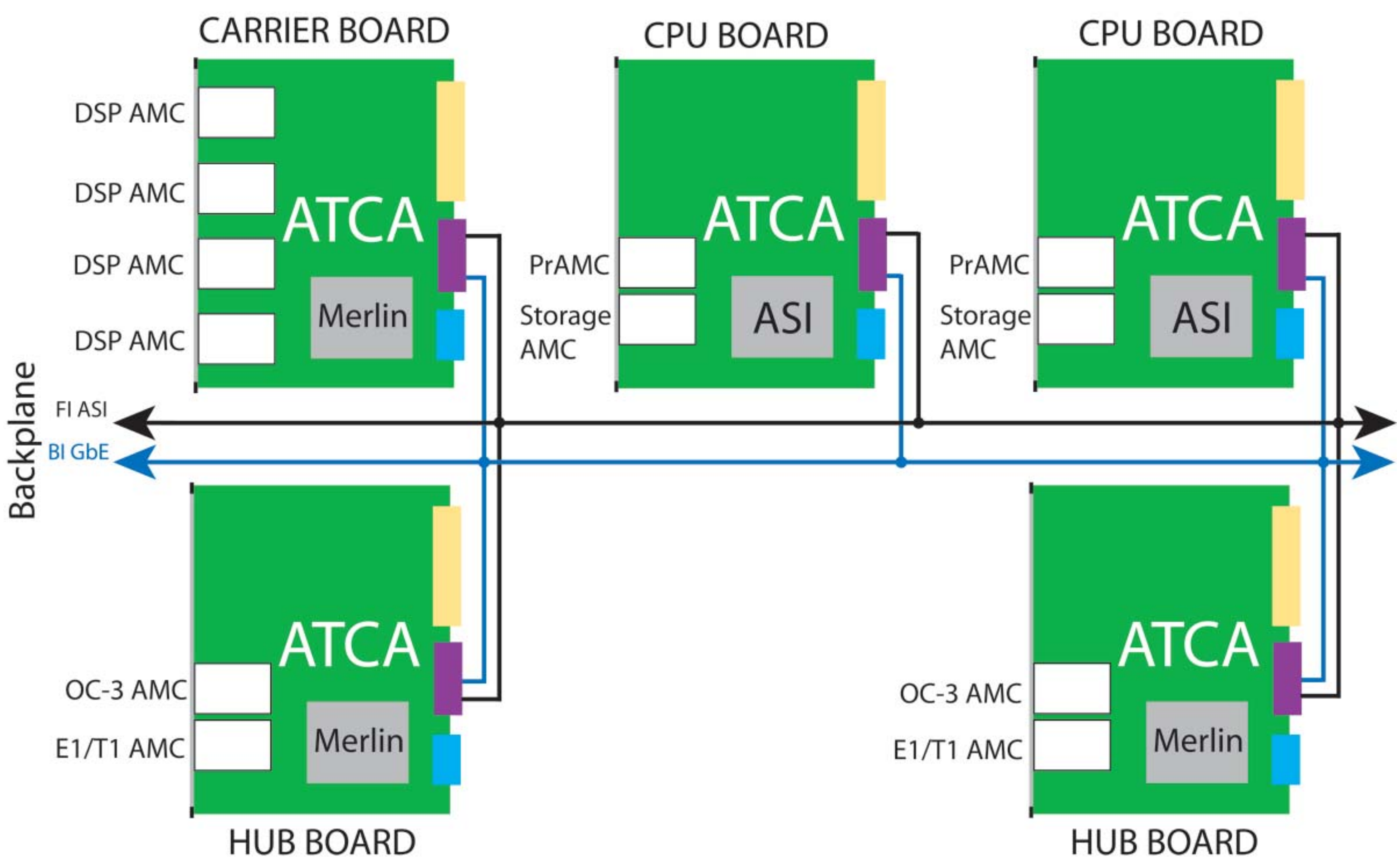


Figure 2: ASI tunneling supported in 5U AdvancedTCA IMS element

tunneling supported, the boards are linked together via GigE and PI-8 binding. This ASI architecture provides many benefits such as eliminating the need for over provisioning via congestion management, 2.5 Gb/s SerDes for more backplane granularity, guaranteed QoS for multiple protocol support, and backward compatibility to PCI-Express.

In addition, high availability is increased with this ASI interconnect architecture. The switch-over time is improved, and if a CPU blade fails or needs to be removed, the I/O AMC modules can be supported by a backup CPU blade. It is fully supported in dual star and full mesh configurations, while the quality of multimedia service delivery would be still be guarantied within a smaller footprint.

By combining ASI and GigE on the backplane, with PCI Express and Ethernet local to the blades, a flexible system architecture is possible that addresses IMS platform requirements for the foreseeable future. So essentially, ASI, with its backwards compatibility to PCI Express, enables an IO dis-aggregation from the processing engines without adding any software burden to the system developer.

Summary

Using Advanced Switching as the backplane interconnect for higher data rate protocols while maintaining GigE as the transport for control and low bandwidth data traffic, delivers many benefits including the following:

- Congestion management of ASI reduces over-provisioning requirement
- 2.5Gb/s SerDes rate provides more backplane granularity (2Gb/s, 4Gb/s, etc.)
- Robust QoS allows for real time delivery of multiple protocols
- Backwards compatibility to PCI Express expands system flexibility and modularity

Standardization of the backplane interconnect will improve the time to market and volume benefits of moving to a standards-based platform like AdvancedTCA. As one can see by the many product announcements, AdvancedTCA and AdvancedMC elements are taking advantage of the large ecosystem of PCI Express and Ethernet silicon. By combining ASI and GigE on the backplane, with PCI Express and Ethernet local to the blades, a flexible system architecture is possible that addresses the growing IMS platform requirements long into the future. K

About ASI SIG™

The Advanced Switching Interconnect (ASI SIG™) is a non-profit collaborative trade organization tasked with developing and supporting a switched interconnect and data fabric interface specification for communications, storage and embedded equipment, termed Advanced Switching Interconnect (ASI), based on the PCI Express* architecture. The ASI SIG's board of directors and members, comprised of industry leading equipment manufacturers and semiconductor and tools vendors, has surpassed 60 members to date. In addition to ongoing technical development of the specification, these member companies help to define, develop and market ASI. Different membership levels provide differing levels of influence, involvement and responsibility. The overall tasks performed by the members of the SIG include establishing broad industry awareness, ongoing technical development and enabling rapid industry adoption through training programs, ecosystem development and interoperability and compliance testing. More information can be found at www.asi-sig.org.

About Kontron

A leading global embedded computer technology company, Kontron supplies a diversified customer base of OEMs, system integrators and application providers in the communications, automation, transportation, medical, military, aerospace, and test and measurement markets. The company helps its customers to considerably reduce their time-to-market and to gain a competitive advantage with products including high-performance open computer platforms and systems, single board computers, man-machine interfaces and mobile computers. Kontron employs more than 1800 people worldwide and has manufacturing facilities in Europe, North America and Asia Pacific. The company is listed on the German TecDAX 30 stock exchange under the symbol "KBC". Kontron is a Premier member of the Intel Communications Alliance. For additional information on Kontron, please visit: www.kontron.com.

Glossary

3GPP	Third Generation Partnership Project
AAC	Advanced Audio Coding
AMR	Adaptive Multi-Rate (narrowband)
AMR-WB	AMR-Wideband
VMR-WB Codec	Variable Rate Multi-Mode Wideband
ATM	Asynchronous Transfer Mode
iTDM	Internal Time Division Multiplexing
MBMS	Multimedia Broadcast/Multi-cast Service
MGCF	Media Gateway Control Function
MIPS	Million Instructions Per Second
MMS	Multimedia Messaging Service
MRFP	Media Resource Function Platform
PICMG	PCI Industrial Computer Manufacturers Group
PSS	Packet-Switched Streaming
QoS	Quality of Service
SerDes	Serializer/deserializer
SIP	Session Initiation Protocol

AUTHOR'S BIO

Sven Freudenfeld is responsible for North American Business Development for the Kontron line of AdvancedTCA and AdvancedMC modular solutions. Sven possess more than 20 years experience with voice, data, and wireless communications, having worked extensively with Nortel Networks, Sanmina-SCI, and Deutsche Telekom.

www.kontron.com/ATCA
1-888-526-ATCA
EMEA: +49 8165 77 777
ASIA: +886 2 2910 3532
sales@kontron.com