Next Generation AdvancedTCA Solutions
Accelerating Network Platform Evolution with ATCA Blades, Systems and Services

- AdvancedTCA Systems
- AdvancedTCA Blades
- Fabric Mezzanine Modules
- eATCA Systems
- Design & Integration Services
- Remote Evaluation Services
- Global Services

ADVANTECH
Enabling an Intelligent Planet

www.advantech.com/nc
Empowering Breakaway ATCA Innovation

Advantech provides business critical hardware to the world’s leading networking equipment providers and telecom equipment manufacturers.

Our standard and customized products are embedded in OEM equipment that the world’s data communications network and telecommunications infrastructure depend upon.

Overview

Advantech was founded in 1983 and has become the world’s largest embedded manufacturer with a turnover of nearly 1B US$ thanks to the global trust placed in us by our customers. Advantech Networks & Communications Group began AdvancedTCA development in 2006 and now serves many of the world’s leading networking OEMs with standard and customized ATCA blades, as well as fully integrated systems.

AdvancedTCA at Advantech

Advantech’s ATCA business has grown significantly since the introduction of our Intel® Xeon® 5500 series blades in 2009 and we now offer a solid portfolio of products designed, manufactured and wholly owned by Advantech, augmented by specialized integration capabilities to meet the stringent needs of business critical networking applications.

Our Customers

Our closest customers are network and telecom equipment providers targeting a broad range of markets where performance, flexibility and scalability are fundamental to maintaining their technology leadership. They know they can gain outstanding time-to-market advantages by embedding Advantech blades and systems in their products. This drives the evolution of their systems in response to rapidly changing customer needs in fast-evolving networking markets.

In concert with our ecosystem partners we enable our customers with early access to the latest technology which accelerates their next generation product designs. It allows them to apply new technology sooner to gain first mover advantage and leapfrog competition.

For some OEMs, we are an integrated extension of their R&D team. For others we actually are their R&D team. In fact we’re also their global logistics operation. Imagine how that can scale for you.

Our ATCA design teams partner with the world’s smartest silicon and mechanical experts to design and build blades, boards and systems which reduce OEM equipment design cycles more than ever before. Through our close engagement with strategic software partners, OEMs can start developing and testing at the earliest possible stages.

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Enabling Industry Leading Solutions

Companies that provide market leading solutions have learned that working with smart partners who help them create value is one of the most critical contributors to continued leadership. Great partners provide expertise, access to technology and time-to-market benefits that every innovator can benefit from. Key to being a great partner is having the technology, products and resources that add value to the customer’s solution. Also critical are development and manufacturing strategies that encourage innovation, delivering complex ATCA products uniquely tailored to the customer’s needs without sacrificing the economy of scale offered by standard off the shelf products.

Advantech’s broad range of products and services allows us to adapt to the level of integration and customization appropriate to each customer’s requirements and business model. We provide the:

- **FLEXIBILITY** to differentiate your product with both Customized COTS and unique design impact
- **SCALABILITY** to future-proof your solutions to grow with market needs and accommodate new technology – the result is lower capital expense
- **TIME TO MARKET** leadership with a wide choice of standard products based on latest silicon from the world’s most recognized vendors

Customized COTS: A Mass Customization Approach

All OEMs want to build uniqueness into their solutions. This especially holds true for high performance, powerful platforms such as ATCA. Advantech understands this need for differentiation and plans for it: our design, development, integration, logistics and manufacturing processes have been honed over the years to allow customers to choose the level of customization appropriate to their differentiation strategy. Advantech’s approach is based on mass customization concepts adapted to standard ATCA platforms where:

- All solutions start with OEM-ready platforms that provide the foundation for customer solutions
- Base platforms are configured using COTS technologies for the customer’s target markets such as reference systems and blades (x86, DSP, NPU, Switch)
- Application-specific customization and configuration of off-the-shelf building blocks are based on standard AMC products or Advantech’s unique Fabric Mezzanine Modules (FMMs)
- Custom designed AMCs, FMMs and Rear Transition Modules (RTMs) provide the ultimate in differentiation

Advantech calls this approach Customized COTS. We start by using off-the-shelf technology to personalize a system solution, and then customize its more modular elements to meet unique customer needs without the costly overhead of an entire ATCA blade redesign. In addition, our modular design approach to platform management software makes customer-specific changes simpler and easier to maintain. All this allows us to deliver tailored solutions that approach the cost-effectiveness, time-to-market advantages and low risk of off-the-shelf solutions whilst retaining the flexibility to apply ODM-like customization, 3rd party IP integration and branding.

The flexibility of our Customized COTS strategy enables a broader range of market and application specific systems topologies for our customers whilst offering the economies of scale of our standard building blocks. Even better, Advantech’s strong commitment to its COTS product roadmap allows Customized COTS users to enjoy timelier technology upgrades at minimum cost.
Teamwork
By establishing a close relationship with our customer’s team based on trust and mutual understanding, we create a highly collaborative environment which is essential for the success of complex system level programs.

Advantech System Integration Services Team
Advantech’s ATCA Systems Integration Team (SIT) unites products engineered by our own hardware and software designers with trusted and tested ecosystem partner building blocks. Our customer focused architects work closely with networking and telecom OEMs to design systems from pre-tested ATCA elements with proven product interoperability. As technology evolves and markets move faster than ever, our integration teams facilitate the delivery of innovative solutions more rapidly to help network equipment OEMs overcome the capacity challenges they are facing and respond more effectively to ever increasing customer demand. By reducing project risk and complexity at the system level, our customers get to market faster and more affordably, with tested and dependable solutions. Moreover, Advantech’s SIT covers the whole system life cycle, not just the engineering phase.

The Local Program Manager is your front line interface applying our engineering resources to your project. He’s your main operational conduit to the Advantech team and organizer handling resources, schedule and budget. Based on system engineering inputs he’ll claim and chase the resources.

He facilitates the integration process and he’s critical for the project timing.

The System Architect will work closely with your team on system concepts, requirements and feasibility. From the outset he will be helping make sure your system design does what its meant to do and help optimize costs. He oversees requirements and acts as a cross function engineer with all the involved parties – his knowledge also allows him to play the systems engineer and system integrator role as he’s the overall guiding consultant. This role relates all the critical system performance parameters to design and to test and is the foundation of the integration schedule. Meeting your schedule is then a joint effort between the Local Program Manager and Systems engineering.

System Engineers deliver locally tested and working components, functions or subsystems. However, the responsibility of the engineers continues into the integration effort. They participate in integration tests, help in troubleshooting and consult with the Architect when needed.

Finally, the SIT is supported by a wealth of corporate resources that provide building block detailed knowledge to the last bit, covering behind-the-scenes logistics, administration and supply chain management. The SIT team will handle all the complexities to reduce your resource requirements and work like an extension of your own organisation to deliver quality product on time.
ATCA System Integration Services

<table>
<thead>
<tr>
<th>Architecture Consulting</th>
<th>System Engineering</th>
<th>System Diagnostics and Configuration</th>
<th>Qualification</th>
<th>Logistics</th>
<th>Life Cycle Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>• System architecture, building block and software selection</td>
<td>• Building block integration</td>
<td>• 3rd party Software Integration</td>
<td>• Compliance and Certification testing</td>
<td>• Integration, Shipment, Stocking, Warehousing</td>
<td>• Upgrade</td>
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<td></td>
<td>• Validation</td>
<td>• Validation</td>
<td>• Internal, external or customer selected test houses</td>
<td>• RMA and Field Service</td>
<td>• Engineering Changer Order</td>
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<tr>
<td></td>
<td></td>
<td>• System Diagnostics and Configuration</td>
<td></td>
<td></td>
<td>• End Of Life (Last time buy)</td>
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Main Project Phases
Project Engagement starts with a set of product needs and ideas, and results in a system that meets the customer’s needs. The main project phases are:

Engineering Phase
During the engineering phase many activities take place: feasibility studies, requirements capturing, design, engineering, contracting suppliers, testing and so on. Work is decomposed into manageable sub-tasks for easier distribution and to allow concurrent execution. Then the subtasks are integrated again to obtain the desired result. Integration is an ongoing flow of activities which shifts over time. Early in the project, technologies or components are integrated, while at the end of the project, the final system is built and verified.

The first phase of a project is definition, where a dedicated System Architect works with the customer’s team on ideas, requirements and feasibility. Later, a Local Program Leader participates in the System Architect’s definition of specs and requirements. This results in a statement-of-work; the golden thread of all ensuing activities. If Advantech reference systems can’t be utilized as Proof of Concept platforms, such platforms are built early on so customers can start porting and evaluating fast. These units are an important part of the customer feedback loop during the definition phase.

Implementation is where the main system engineering work takes place. The integration and test activity here is where the team searches for unknowns and resolves uncertainties. Testing is the activity where they operate a system or a part of it in a predefined manner and verify its behaviour. A test passes if the result fits the specified behaviour and performance, otherwise it fails.

When ready, the systems engineers will run an entire system level test suite. Often this still reveals unknowns and problems. The system test verifies both the external specification, as well as the internal design and when sufficient stability of system test is achieved the process moves from problem solving to verification and finishing.

Qualification really begins when the first overall verification test is performed by the product definition team itself to verify the original system spec. The beta test can then be started by unbiased internal stakeholders. Finally the external stakeholders, such as the customer’s customer test the product. Certification can start when all parties agree.

Deployment Phase
The deployment phase is critical and requires interaction with many different services and functions. This is where the local program manager plays a more active role than the system architect. Documentation and operating procedures are put into place as well as manufacturing test procedures and test runs. Logistics concepts and services are agreed upon before deployment begins. Advantech’s flexibility allows us to work out a tailored logistic process that adapts to customers’ needs and can grow as our customers’ business grows.

For repair, Advantech maintains a world class eRMA system for on-line repair requests. A centralized database links to our global bar-code tracking system while back-end systems offer a knowledge base to customers plus access to first line support people. Customers apply for RMA before returning products to the closest service center.

Sustaining Phase
Finally the sustaining phase takes care of life cycle management for deployed systems and new deliveries. Revision management administers changes, including timely customer notification and qualification of product upgrades, as well as performance upgrades and end of life replacements. Again, Advantech’s services can be tailored to meet a customer’s needs and support them to fulfill their service level agreements with their customers.
ATCA Reference Systems - The Netarium™ Series

**Systems Overview**

Advantech’s Netarium™ series of ATCA reference systems are specifically targeted to help network equipment providers reach superior levels of performance over traditional rackmount servers or appliances and extend their product range at the high end. The series represents a new generation of systems which offer superior performance, scalability and flexibility with the latest 40 and 100G switches and application blades. We optimize the systems to achieve the highest possible density at the rack level, with a maximum number of payload blades, network ports and switching capacity.

Each system is tailored for customers to rapidly deploy in data communication markets for applications which require faster and deeper packet processing such as policy and charging enforcement, network security, real-time traffic monitoring, load balancing, subscriber analytics and content optimization among others. As ATCA was designed to meet the carrier-grade constraints of the telecom industry, the systems integrate the chassis, cooling, power distribution and shelf management into an off-the-shelf platform solution capable of superior 5 NINES availability and reliability.

**Ultra-High Performance Systems**

Rising volumes of data traffic, media-rich applications and data center consolidation are driving the need for increased bandwidth scalability and high-speed connections. To meet these challenges, Advantech’s flagship Netarium™-14 and 14e target the high-end market where equipment providers require superior performance, scalability and deployment flexibility for their large enterprise, managed security service provider or carrier customers.

**Mid Range Requirements**

Netarium™-6 focuses on the high performance needs of large enterprise customers with a cost-effective system loaded with four dual Intel® Xeon® blades and 40G switches in a dual-star configuration. The system provides up to 1.28 Tbps switching capacity and each blade with RTM can accommodate up to 4 FMMs for over 100Gbps egress per blade with high-speed encryption using FMM-based acceleration modules. The system is an ideal platform for cloud-based security services in private or data center clouds.

**Entry-Level Flexibility**

Netarium™-2 is the ultimate in entry level flexibility. This 2-slot platform allows OEMs to redeploy common platform hardware which scales when needed. It packs more processing power than legacy 6-slot systems. With an increase in miniaturization and performance at the blade level it is accompanied by our fabric mezzanine concept to bring more I/O and acceleration closer to the processing cores. With blades optimized for workload consolidation and virtualized workloads, the Netarium™-2 is a great solution to integrate multiple applications into a small footprint at attractive system cost.

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**Advanced System Management**

The Netarium™ series is now available with Advantech’s Advanced System Management Module. See page 13 for details.
# Configurable ATCA Systems

## Configuration Flexibility

We know that each of our OEM customers is different which is why we built out ATCA Systems Integration Team (SIT) to create customized ATCA platforms and meet the application-specific needs of network solution providers. The team is geared to building fully tested, cost-optimized platform solutions utilizing blade and platform technology from Advantech and integrating it with 3rd party hardware and software. Advantech’s proven expertise in developing ATCA platforms is made available to equipment providers who need to outsource hardware integration in order to focus R&D investment on application value-add – or simply look at ATCA as an integrated networking platform like a high end appliance.

Advantech SIT delivers fully integrated and certified platforms which not only reduce your development time, but allow you to allocate a larger percentage of R&D budget to vertical market value-added development. We work closely with a strong global ecosystem of hardware and software vendors, including chipset, board, chassis, operating system and middleware in addition to our own product development. Ecosystem partners are selected based upon project, technology, logistic and geographic requirements and managed by the SIT team to provide highly optimized customer-specific solutions.

Our SIT Team offers the broadest choice of multi-core products for networking applications. With the ability to deliver x86, NPU, DSP and Switching technologies developed in-house, Advantech has full control over all the major building blocks for system level design. These services allow our customers to successfully face the challenges of converging networks and increasing bandwidth demand through improved time to market and a reduction of total cost of ownership as result of reduced maintenance and test efforts.

## System Configuration Examples

Integrating powerful, high performance ATCA systems has its constraints and can be a complex and lengthy process that’s not as simple as plug and play. ATCA requires many levels of expertise from platform software and hardware engineering, system, reliability and availability engineering, and from compliance and regulatory specialists. The ATCA standard and pre-established rules from PICMG along with their interoperability test suites certainly help to shorten the integration process, but functional teams have to ensure that software and hardware integration starts very early in the system design cycle to ensure timely and solid product rollout. With a multitude of component level permutations possible, each hardware payload needs to be carefully defined and tested to ensure it can meet final application software needs. Depending on the final operating environments, AC or DC powered systems may be required and shelf management software may be different.

The table below shows several examples of payloads which can be integrated into systems and configured to address many leading industry applications. These examples reveal what is possible with Advantech ATCA systems and serve as a basis for defining more precise application-specific solutions.

### 2-slots

<table>
<thead>
<tr>
<th>Application</th>
<th>Blades</th>
</tr>
</thead>
<tbody>
<tr>
<td>Media Gateway</td>
<td>1 x MIC-5344 dual Intel® Xeon® blade</td>
</tr>
<tr>
<td></td>
<td>1 x DSPA-8901 DSP blades</td>
</tr>
<tr>
<td>Packet Generation &amp; Test</td>
<td>1 x MIC-5344 dual Intel® Xeon® blade</td>
</tr>
<tr>
<td></td>
<td>2 x ATCA-7310 NPU blades</td>
</tr>
<tr>
<td>Single-box EPC</td>
<td>1 or 2 x MIC-5343 dual Intel® Xeon® blades</td>
</tr>
</tbody>
</table>

### 6-slots

<table>
<thead>
<tr>
<th>Application</th>
<th>Blades</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTE Network Test</td>
<td>1 x MIC-5344 dual Intel® Xeon® blade</td>
</tr>
<tr>
<td></td>
<td>1 x DSPA-8901 DSP blade</td>
</tr>
<tr>
<td></td>
<td>2 x Customer I/O blades</td>
</tr>
<tr>
<td>Lawful Intercept Probe</td>
<td>2 x MIC-5343 dual Intel® Xeon® blades</td>
</tr>
<tr>
<td></td>
<td>2 x ATCA-7310 NPU blades</td>
</tr>
<tr>
<td>Media Server</td>
<td>2 x MIC-5343 dual Intel® Xeon® blades</td>
</tr>
<tr>
<td></td>
<td>2 x DSPA-8901 DSP blades</td>
</tr>
<tr>
<td>100Gbs UTM</td>
<td>4 x MIC-5343 dual Intel® Xeon® blades</td>
</tr>
</tbody>
</table>

### 14-slots

<table>
<thead>
<tr>
<th>Application</th>
<th>Blades</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video Transcoding</td>
<td>2 x MIC-5345 single Intel® Xeon® blades</td>
</tr>
<tr>
<td></td>
<td>Up to 10 DSPA-8901 DSP blades</td>
</tr>
<tr>
<td>QoS / Policy Control</td>
<td>5 x MIC-5343 dual Intel® Xeon® blades</td>
</tr>
<tr>
<td></td>
<td>4 x ATCA-7310 NPU blades</td>
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</table>
Leading the Way with 40G and 100G ATCA Blade Innovation

Advantech’s ATCA blades are designed in unison with the leading silicon suppliers enabling OEMs with the earliest possible access to new technology.

The cornerstones of our ATCA product line are the blades designed in our own labs and manufactured on our own production lines. That way we manage the entire life cycle and control all our costs to give customers the best service at the right price. Our x86, NPU, DSP and switch blades are designed in unison with the leading silicon suppliers to give you early access to the very latest technology to accelerate your next generation product design and give you first mover advantage.

Application and Networking Blades
Our Intel® Xeon® blades are the application powerhouses. With 10 blades in 14-slots connected to four 40 Gigabit Ethernet switches across a dual-dual star backplane you can’t get faster network traffic in and out of an x86 blade. Advantech was the first to provide 160 Gigabits per second of aggregated bandwidth spread over four 40 Gigabit ports from a dual Intel® Xeon® blade. What’s more, our MIC-53xx series with their modular FMM concept add flexibility to personalize the blade with more I/O ports, acceleration and offload. You can configure them precisely for your application workload – so you get what you want and you pay only for what you need.

Network Processor Blades
The NPU blade based on Cavium’s Octeon II processor integrates application acceleration engines for DPI, compression/decompression and new security standards such as SNOW 3G. This makes it ideally suited for enterprise apps and 4G networks.

DSP For Media Processing
Our DSPA-8901 with twenty C6678 DSPs provides 160 cores of processing power to reach performance densities for the highest capacity media gateways. It reduces system cost and frees up slots in gateway elements for extra subscriber capacity and throughput. It adds outstanding image processing performance to solutions in Mobile, Web and IP TV markets.

40G Switching
The ATCA-9112 40 Gigabit switch is the backplane orchestra leader. Complemented by the T-HUB4 switch from Telco systems and their BiNOX™ load balancing and carrier class switch management suite, we offer high speed, managed solutions with up to 640 Gigabits per-second of switching capacity per switch blade.

100G Hub Blade
For applications that need the ultimate in switching throughput and 100G network connectivity, our ATCA-9223 offers up to 960 Gbps throughput based on the High Capacity StrataXGS® Trident II Ethernet Switch from Broadcom.
40G Switch + Your Application CPU

**ATCA-9112**

The ATCA-9112 switch blade provides 10/40GbE switching for up to 16 slots and 8 front panel uplinks with a 640Gbps non-blocking fabric switch from Broadcom.

Design for network security, LTE and DPI-centric applications, the ATCA-9112 offers the highest aggregate switching bandwidth within and ATCA chassis enabling support for up to 16-slot systems. A Broadcom BCM56846 ensures seamless integration through open standard hardware supporting 40GbE or 10GbE ATCA node blades. A Broadcom BCM56321 provides ATCA base interface connectivity.

The switch offers a flexible approach to hub blade functionality via a mid-size AMC site to host control plane, application processing, acceleration or offload functions. Advantech’s Freescale QorIQ™, P4080-based AMC-4201 or x86-based MIC-5603 PrAMC can be used to consolidate processing requirements.

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**MIC-5603**

Intel® Xeon® 3rd Generation Core-i7 AMC

**AMC-4201**

Freescale QorIQ® P4080 AMC

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100G Switch + Your FPGA Secret Sauce

**ATCA-9223**

The ATCA-9223 is Advantech’s brand new 100G Hub Blade leveraging the high capacity StrataXGS® Trident 2 Ethernet switch from Broadcom.

This highly scalable, feature-rich hub blade with dual 100G external ports (CFP2) and 8 external 10G ports (SFP+) switches 48x 10G serdes on the ATCA backplane and 10x 10G serdes on the rear transition module contributing to an overall capacity of more than 2 Terabits per second in a dual hub blade topology.

Designed to be highly programmable using an onboard Intel® Atom Processor C2000 for flexible control plane processing, the hub blade brings together a BCM56852 StrataXGS® Trident II with 960G switching capacity, a BCM56150 Hurricane 2 with 70G switching capacity and 2 Virtex 7-690 FPGAs for 2x 100G and 8x 10G inline processing between external ports and the switch.

For more detailed information on how you can leverage the FPGA capabilities on the ATCA-9223, please contact your local Advantech support team.
Designing with Fabric Mezzanine Modules

The FMM concept is one of the key elements in Advantech’s Customized COTS (C2OTS) strategy. FMMs are a new denominator for personalizing a common platform at the blade level and they scale extremely well for both I/O and acceleration functions. The MIC-5343 ATCA blade house three FMM sites on the front blade and between one and four FMM sites on the rear transition module enabling a wide variety of solutions.

FMMs also facilitate fabric interface flexibility allowing equipment providers to deploy the MIC-5343 into 40G or 10G topologies:

- A double-sized FMM carrying four i82599’s provides two fabric interfaces with four 10GBaseKR ports each.
- For designers requiring higher bandwidth 40GBaseKR4 interfaces to the backplane, a double-size FMM based on two Intel® X710 NICs supports dual dual-star configurations for up to 160Gbps connectivity per blade.
- Finally a single i82599 FMM makes it possible to adapt MIC-5343 with 10GbE in order to upgrade legacy systems in the field.

FMMs are based on a common specification defining the form factor, high speed interfaces and FRU management. A FRU EEPROM on the FMM describes its thermal & power requirements and zone 2 interface information, while all other aspects are managed by a BMC on the ATCA blade.

FMMs are compact, just 6.4 x 7.5 cm² and use FMC compliant connectors for high speed differential I/O. In fact, there is adequate space to fit 40mm BGA ASICs and FPGAs and associated components with a thermal budget < 20W. The I/O area provides overhang for connector support on front panels or rear transition modules (RTM) making FMMs a good fit for specialized processing close to the application I/O.

With a common platform for workload consolidation like the MIC-5343, up to 4 FMM sites provide a wide choice of PCIe I/O and acceleration:

- MIC-5343 3 FMMs (2 Fabric, 1 Front Panel)
- RTM-5104 1 FMM to Rear Panel

For example, there are sufficient FMMs to turn the MIC-5343 common platform into a 100G line card with crypto acceleration.

By adopting an FMM approach for standard and custom designs, OEMs can effectively redeploy them across form factors scaling from appliances to ATCA systems for functions such as:

- Proprietary acceleration hardware
- Specialized coding and transcoding algorithms
- Signal & image processing
- Military & commercial cryptography
Enabling Superior ATCA System Throughput

The FMM has become an essential element in ATCA system design flexibility, enabling node blade connectivity for 20, 40, 80 and 160Gbps connectivity to the backplane and beyond.

For customers that invest in the Intel path to workload consolidation, the FMM enables a common platform capable of unprecedented throughput. System platform solutions which may have been deployed across several blades are rapidly being consolidated onto just one. Today, there’s more packet processing power on our latest MIC-5343 ATCA blade, based on the Intel® Xeon® E5-2600 v3, than in a fully-loaded 6-slot system of 5-years ago. Advantech is enabling customers in this consolidation process by introducing a breakaway technology at the small mezzanine level in order to bring more I/O and acceleration closer to the processing core and enable flexible fabric connectivity to match increasing interconnect bandwidth demands.

ATCA System Topologies

Most standard ATCA systems incorporate two switch blades. Each of the node blades connects to each of the switch blades. This places the switch blades at the center of a star network connected to each of the node blades. The two switch blades form two stars, hence the name “dual star”. For many applications the improved packet and processing performance offered by Advantech’s MIC-534x series blades node blades starts to create the opportunity to leverage a new performance paradigm. In the past the ATCA system bottleneck was attributed to the iA-based node blades but now it’s shifting to the switch blades. Advantech’s Intel® Xeon® E5-2600 v3 –based blades are able to handle 100Gbps of traffic and more.

With ten blades in a system, applications requiring 600Gbps of system throughput are constrained by the lack of switching capacity in a dual-star ATCA topology. As state-of-the-art switching silicon saturates at around 900Gbps, the ATCA system’s switching capacity is limited to 1.8Tbps. For a 600Gbps system that means that packets can hop through the switches a maximum of three times. As two hops are typically consumed for ingress and egress traffic, three hops total presents an important performance challenge. Fortunately, the ATCA specification provides for the ability to use four switch blades to create four fabric networks known as a dual-dual-star topology. Four times 900Gbps yields 3.6Tbps switching capacity which allows an average of 6 hops for a packet in a 600Gbps system. The challenge, though, is that the node blades are now required to connect four network ports, one to each hub blade.

Many x86 blades available today have been designed for telecom networks with lower throughput rates, but datacom customers need this higher throughput enabled by dual-dual star topologies right now. To satisfy their needs Advantech has built dual-dual star capabilities in to its MIC-5343 blade to support four backplane network ports via FMMs. The MIC-5345 has one dual 40GbE controller down on the blade supporting two 40GbE ports to the backplane. On the MIC-5343, the backplane ports are connected to two FMM sites allowing the widest choice of 10GbE or 40GbE dual-dual star fabric interfaces available today and Advantech’s FlowNIC technology in the future.

FMMs are a new denominator for personalizing a common platform at the blade level. They scale extremely well for both I/O and acceleration functions. When coupled with the workload consolidation capabilities of the MIC-5343, they provide customers with a wider choice of flexible and scalable solutions for their next generation platform designs.
A Common Platform Approach to IPMI for xTCA Platform Management

Advantech Code Base
Advantech's IPMI adaptation is a cornerstone of our Customized COTS program. Most major customers require us to develop special features beyond the standards. Advantech's approach makes it easier to maintain multiple versions and offer branding options and differentiation to customers.

Advantech provides a flexible, modular solution which is:

- Easy-to-customize for faster development of customer specific or value-added features
- Easy-to-maintain for improved life-cycle management and faster bug fixes in the field
- Provides a common value add feature set to customers using ATCA and AMCs
- Ensures higher reliability through broader cross-platform use and testing, leading to faster time-to-maturity

ARM-based Design
Our IPMI implementation is built on a unified software platform supporting several CPU architectures from Cortex-M3 to ARM9. This allows us to source multiple vendors, offering a wider choice of devices for the product range. Choosing the proper CPU per design ensures enhanced scalability to balance cost and features while leaving sufficient headroom for future requirements or customization. Implementation of a well defined abstraction layer provides us with all the essentials needed, such as timers, semaphores, tasks and other features provided by a slim operating system, while it liberates us from code dependencies.

Customizable Code
PICMG 3.0, AMC.0, and MTCA.0 base their hardware management on IPMI 1.5 with PICMG-specific extensions. However, OEMs often require special features for legacy compatibility or management service enhancements for their customers. IPMI message handling and other key elements of our IPMI solution are designed to maximize flexibility. This allows us to add more features without rewriting a lot of code and makes custom feature implementation much easier.

As we share the same code base across different products and projects, it rapidly matures. If we implement a new feature on an ATCA blade, it is only a fraction of previous efforts to also make this available on an AMC, RTM or even our Shelf Manager - meaning more features in less time across a wider range of products. Rolling out new features, updates, and bug fixes has become simpler as testing efforts have significantly decreased.

Customers enjoy faster update cycles and benefit from resolutions in other projects. Advantech’s IPMI core has been tested against a variety of third-party Shelf Managers and blades in our labs and during PICMG Interoperability Workshops using industry standard compliance test suites from Polaris. All of our products carry a “Polaris Tested” stamp on their datasheet.

HPM.1 Support and Customized COTS Features
We support HPM.1-compliant updates for programmable components such as BIOS, firmware, FPGAs, and so on. Most firmware images are fully redundant, for example for dual BIOS chips, dual BMC firmware, and FPGA images; IPMI handles automatic rollback in case of update failures or integrity issues. HPM.1 support includes support for HPM.2 extensions allowing fast updates over LAN, reducing update times to a fraction of regular HPM.1 updates, as well as HPM.3 support for features like DHCP support.

For advanced remote configuration, Advantech-specific features can remotely modify BIOS settings or switch between sets of customer-defined settings. Serial-over-LAN also allows remote IPMI-based access to the system console. For maximum reliability we support automatic BIOS failover in case of startup problems with BIOS POST sensors logging the POST code where the board hangs. This information can be used to debug boot-up issues. We also implement features to improve crash analysis, for example, by dumping the last few KBs of system console output over IPMI for post-mortem debugging, accelerating debugging significantly.

Advantech’s time sync feature allows options for system time synchronization between OS, BMC, and other components like the ATCA Shelf Manager. For example, individual blades can run without battery (NEBS compliance) but acquire the time from the Shelf Manager upon startup.

Our robust and flexible IPMI offering is fully deployed in mission-critical rollouts worldwide. Advantech’s ability to adopt new features rapidly helps customers achieve their platform management goals for improved uptime and services, providing greater reliability in HA platforms. As we actively engage with more players in Security, Datacenter and Enterprise space, we’ll be introducing enhancements to simplify their approach to ATCA systems. Several enhancements are described on the next page.
eATCA & ATCA Platform Management... Appliance Style

Within any ATCA system the Shelf Manager is responsible for the health and wellness of the platform as a whole. By constantly monitoring sensors throughout the system all individual elements from the power supply and cooling fans to each processor or networking blade can be controlled through the Shelf Manager functions. Advantech’s approach to platform management is based on key standards such as IPMI (Intelligent Platform Management Interface) and HPM (Hardware Platform Management) and the integration of enhancements which greatly improve both functionality and usability.

The SMM-5060, a new breed of Advanced Shelf Management Module, brings added value system control and service processing to the Netarium™ ATCA v2-Series. Also deployed in the Netarium™ e-Series of eATCA systems, it brings a plethora of new capabilities to enhance customer’s platform management options.

Advantech understands the needs of their datacom customers who want a networking platform to be managed like a single network element rather than a collection of blades within one chassis. The SMM-5060, at the core of our ATCA platform management approach makes ATCA look like a big appliance and is able to support a consistent management view across our customers’ full product line. This means OEMs utilizing appliances for their entry and mid range networking gear will find it surprisingly easy to add an ATCA based system as an extension of their product line at the high end.

Advantech’s SMM-5060 ATCA Shelf Manager features an Intel® Atom™ processor C2000 which brings added value system control and service processing to ATCA and eATCA systems, and can be used as a centralized service access point or blade boot server. The new processor’s System On Chip (SoC) features enable encryption and decryption of external management traffic in business and mission critical systems. The SMM-5060 has been designed to maximize management flexibility in multi-blade systems with a software framework to facilitate the addition of customer and custom applications for specialized platform management in high-end networking gear.

Customizable shelf LCDs can be built into the chassis to further enhance the appliance-style look and feel. Connected to the active shelf manager and/or the x86 management node, LCD functionality is completely customizable and can display information such as system statistics or status to onsite technicians.

In fact Advantech offers an extensive set of customizable enhanced features to OEMs allowing them to adapt platform management functionality just the way they want it. The following two examples include SoL Proxy and Advanced BIOS Management (ABM).

Advantech SoL Proxy
Customers can now benefit from a single service access point connected to just one management port in their network. SoL Proxy runs on the Shelf Manager and establishes an SoL session with each individual blade inside the system. The software buffers all console output and forwards a single active console to an external client. The external client now only needs to establish a single protected SSH session with the SoL Proxy instead of manually establishing fourteen SoL sessions to the blades.

Advanced BIOS Management for NFV
All Advantech blades are able to store multiple BIOS configurations and the system manager is designed to select a specific pre-configured set to use for the next boot. For example, one set can be used to boot a BIOS optimized for control plane processing, one set for firewalling, one set for DPI and another for service/diagnostics. This feature gives the ability to dynamically distribute workloads across identical Intel® architecture ATCA blades and will help equipment vendors to build software definable network elements in Network Function Virtualization scenarios.
The challenge for architects and designers of next generation networking platforms is two-fold. The transition to an intelligent, software-driven network requires enhanced packet-processing capabilities and more processing power in order to meet the latency requirements of the communications network. When coupled with the forecasted 300% broadband increase in subscriber demands over the next 5 years, the performance and I/O capacity demands will increase exponentially. Even with the communications acceleration and offload functions built into newer processors, it is clear that the expected performance and cost enhancements of commercial multi-core processors alone will not be sufficient to deliver the required performance and capacity for high-end equipment handling millions of simultaneous subscribers.

The ability to scale Advantech’s new eATCA systems to multiple Terabits per second throughput hits the performance sweet spot targeted by customers deploying solutions at the high-end of today’s network computing and packet processing spectrum. By using commercial-off-the-shelf ATCA blades with enhanced I/O in systems with the big switching capabilities of ATCA, equipment providers can benefit from a wider supplier choice on a future-proofed architecture that can truly scale. Moreover, customers can gain distinct product differentiation through the ability to add their own hardware innovation more easily on an extended transition module.

Advantech’s new eATCA architecture is specifically targeted at network equipment providers building solutions for large enterprise network security systems or in datacenter and service provider environments where highest available performance and enhanced I/O are uncompromising factors of choice. eATCA systems integrate standard ATCA blades with a new extended rear transition module (eRTM) providing almost four times more real-estate than that currently offered by traditional commercial bladed systems suppliers or the ATCA ecosystem. The increased capacity supports more PCIe-based I/O connectivity and enables a new and simpler way to add special purpose acceleration hardware.
eATCA – For More High-End Real-Estate

Extended ATCA (eATCA) is a system architecture based on ATCA that delivers increased I/O and packet processing performance for networking platforms facilitating borderless enterprise, secure datacenter, and cloud computing applications (Figure 1 opposite). eATCA systems integrate standard ATCA blades with extended Rear Transition Modules (eRTMs), providing almost four times more real estate for PCIe-based I/O connectivity and enabling new capacity for acceleration and offload.

With a wide range of AMC, NMC, and FMM options currently available, OEMs are able to quickly tailor a platform for particular applications. Fully custom solutions can also be implemented by designing custom AMCs, NMCs, FMMs, and eRTMs with custom IP built right in at the hardware level.

An example would be the increase in demand for viewing and controlling networks based on “flows,” a unidirectional sequence of packets all sharing a set of common packet-header values. SDN and OpenFlow represent trends that require flow capabilities, and being able to easily build a specialized flow processor into a custom eRTM enables a differentiated platform for a wide variety of cybersecurity applications.

Software is defining and transforming the network, but more software requires more processing power. The preferred design strategy for implementing systems is shifting from a “do-it-yourself ASICs”-based approach to one that utilizes standard commercial processors with both on-chip and external co-processors to provide essential performance and I/O improvements.

To meet the needs of high-end network solutions providers, Advantech has designed the eATCA architecture with the necessary real estate to accommodate a wide range of acceleration, offload, and I/O options, allowing OEMs to rapidly build tailored solutions for their customers.
Advantech DQA - Design Quality Assurance

One of the reasons that network equipment providers and operators have aggressively adopted the AdvancedTCA architecture is the ecosystem’s dedication to delivering interoperability. At Advantech Networks and Communications Group (NCG), testing goes far beyond functional validation and interoperability. Signal integrity, power integrity and reliability are key items to guarantee our designs conform to the ATCA specifications.

Design engineers typically apply Intel Voltage Transient Tool (VTT) and other test gear to validate their designs. Advantech NCG goes one step further and employs a 40-strong dedicated DQA team of engineers each of whom bring added expertise in their particular domain in order to yield the highest possible product quality. We test all our designs to their limits and beyond, checking thermal profiles, signal integrity, shock and vibration. Our HALT (Highly Accelerated Life Test) capability allows us to stress equipment so customers rest assured that the equipment they deploy has been carefully designed using the most stringent processes.

DQA is much more than just meeting the limits. At Advantech, DQA is about maximizing design margin.

Advanced Testing Tools and Environment

Much of Advantech’s commitment to DQA is manifest in our investment in testing tools, equipment and facilities. Some of the advanced testing gear and procedures in our R&D Network Lab include:

**Network Test**
Spirent SmartBits, Test Center and IXIA Optixia test equipment are all employed to test, simulate, analyze, troubleshoot, develop, and in some cases certify each of the networking products we have under development. By employing industry leading traffic generation and analysis tools we are able to ensure that all high port density gigabit Ethernet, 10GbE and 40GbE designs are rigorously tested using typical network traces and loads.

**Walk-in Thermal Chamber**
As the size of our systems is increasing, we have installed an Espec thermal walk-in chamber which allows us to host a rack full of ATCA systems for temperature and humidity cycling tests. For ATCA system-level testing we have enhanced the power feeds to the devices under test in the chamber from 6kW to 10kW. An IR camera/scanner and thermocouples/datalogger allow us to perform thermal profiling of a board.

**High Speed Signal Measurement (HSSM) Chamber**
The amount of stray noise in a typical open environment which constitutes today’s wireless world makes precise high speed signal measurements impossible. At Advantech, we perform high speed measurements from within large EMI chambers to shield our high speed scopes and network analyzers from external noise. It’s only by investing in these higher levels of shielding that we are sure to obtain reliable and systematic test results and can ensure adequate design quality to our customers.

Housed within the HSSM chamber we employ tools such as Agilent N525A 10MHz to 50GHz network analyzers. Analyzers for insertion loss, return loss and crosstalk testing, Agilent 32GHz scopes to measure signal waveform quality and Agilent DSA-X 93204A 32GHz scopes for waveform eye diagram and jitter evaluations.

**Highly Accelerated Life Test (HALT)**
The lab’s high-end HALT chamber allows us to stress equipment, including individual boards or fully loaded 14-slot ATCA systems until they break, with temperatures between -100°C and +200°C, with temperature gradients as high as 60°C/minute and up to 50G shock or vibration. The HALT chamber is used in order to quickly determine the lowest and highest operating ambient conditions as well as the weakest mechanical design of the board or system.

**Interoperability**
Our ATCA test equipment from Polaris uses industry’s leading test software for PICMG3.0 interoperability evaluations.
The foundation of our ATCA systems business is built on world-class manufacturing, quality and integration processes that enable our customers to deploy reliable business-critical solutions worldwide with total confidence.

Deploying standards-based ATCA products that enable our OEM customers to create highly differentiated solutions requires a full suite of ATCA products, advanced customization technology, an extensive ATCA ecosystem and a full complement of life-cycle services. Advantech’s ATCA system and blade products, Customized COTS technology, ATCA Ecosystem and ATCA Global Services organization meet these needs perfectly. Advantech Global Services provide a comprehensive service package that integrates our key service models into a complete transaction process, from the manufacturing and system integration phase, global logistics and after-sales support. In order to create the maximum value for our customers, Advantech Global Services is the shortcut for transforming our customer’s ideas into reality.

Manufacturing Capabilities
Our world-class manufacturing centers in Taiwan and China both maintain precise quality control, and offer a full range of cost-effective, state-of-the-art production capabilities. To maximize the efficiency of operational procedures, we have implemented a cluster manufacturing system within our segmented manufacturing service units. This unique approach enables a direct, simplified, and highly streamlined design-to-manufacturing process. Our manufacturing centers utilize a customer-driven Enterprise Resource Planning (ERP) system to achieve high flexibility and just-in-time response. We pride ourselves on our:
• In-house board, chassis, and system production capabilities
• Dual world-class manufacturing centers which minimize business risks
• Advanced production capabilities and customizable processes
• Rigid quality assurance system
• Complete ISO standard coverage

We Build It Exactly as You Imagine It
Advantech provides full customization and branding services to integrate our innovative platforms with existing product lines and give them customers’ look and feel. With our Configure-To-Order-Services (CTOS) we provide cost efficient services to build different system SKUs in our logistic centers around the world. Through these services we bring our clients the benefits of greater flexibility, lower inventory, shorter lead times and global reach with local touch at work.

International Quality Standards
The Group Quality system is audited and compliant with ISO 9001. The Quality system covers all aspects of product design, component selection, design verification, manufacturing, quality control and customer satisfaction. From the board of directors down, each member takes pride in providing our customers with the highest level of quality in products and services. We also hold global certifications of ISO 13485, TL 9000, ISO 14001, OHSAS 18001 and IECQ QC 080000.

Global Logistics Services
With strong integrated ERP and SAP supply chain solutions, our worldwide logistics network offers a wide range of flexibilities to bring out different delivery models including local and global solutions that meet your unique needs and budget requirements. Advantech’s Logistics Service gives you the flexibility to simplify your logistical networks, bring your products to market on time, and enjoy a timely return on your investment.
• Optimized and flexible shipping solutions
• Integrated ERP and SAP supply chain solution with global distribution network
• Centralized plants with local delivery

Customer Support Services
Our global presence provides localizable, customizable, and reliable customer support services. We can create an optimized maintenance and support plan, leveraging the full power of our service portfolio to help reduce costs and proactively mitigate business risks to best meet your needs. In addition to our complete technical and repair support, we provide a variety of customizable after-sales services, including extended warranty, advance replacement, upgrade, fast repair, etc. With our knowledgeable local support groups, we enable a consistent support experience around the world and help keep your investment at peak performance and within your budget. Our local support centers are dedicated to supporting your high-value ATCA systems deployed in business-critical installations across the world.
• 24/7 technical support: hotline AE & online chat support
• Global deployment with local full-line repair capability
• Easy-to-use web-based repair and tracking system
• Various other value-added, after-sales support services
Rapid Development  Leveraging Interoperable Technology

Proven product interoperability means Network Equipment Providers and Telecom Equipment Manufacturers can readily integrate tested combinations of hardware and software components with total confidence. In a fast-paced market this allows them to evaluate, test and deliver innovative solutions more rapidly and respond more effectively to emerging customer needs.

Interoperability at Advantech starts with our ATCA ecosystem alliance program and our participation in key industry organizations like PICMG. Both are essential elements in our ATCA systems strategy. We collaborate with our alliance partners to meet customers’ application-specific needs by integrating selected leading-edge technologies into early access reference platforms and proof-of-concept systems. Together we run industry-standard interoperability tests then pre-load application-specific software packages to facilitate customer bring-up and enable the evaluation of new technology more efficiently.

When customers need fast access to the latest software tuned for new processor silicon, Advantech and its partners deliver the most comprehensive early reference platforms. Our Deep Packet series, for example, targets developers who want to consolidate workloads on x86-based architectures including Deep Packet Inspection and Network Intelligence. This reference platform series is based on the latest Intel® Xeon® processors and Intel’s Data Plane Developers Kit (DPDK). Our Intel DPDK enabled platforms incorporate acceleration software from our OS, middleware and network stack partners. The payloads are finely tuned to optimize packet processing throughput and enable the fastest packet movement in Deep Packet Inspection (DPI) applications. Moreover, the seamless scalability between our appliances and ATCA systems means customers can start their development and evaluation work on simpler turnkey appliances and later move to ATCA target platforms with ease.

Advantech continues to build its alliance of strategic partners made up of leaders in each of their respective areas of expertise. Together, these companies provide all of the essential components for developing, verifying, integrating and building high performance products to help network equipment customers gain first mover advantage.

Advantech Ecosystem Alliance Members

Silicon
- Intel
- Cavium
- Broadcom
- Freescale
- Texas Instruments
- Mellanox

Boards
- CommAgility
- Telco Systems
- Interphase
- PLDA
- Napatech
- Netronome

Chassis
- Elma
- ASIS
- Comtel
- Schroff

Operating Systems
- WindRiver
- ENEA
- Polycore

High Availability
- ENEA

Networking
- 6WIND
- Aricent
- Qosmos
- WindRiver
- Polaris
Accelerate New Technology Evaluation with our Remote Evaluation Services

Overview
Advantech’s Remote Evaluation Service (RES) is designed to help you get ahead of the technology curve and rapidly evaluate performance of the latest silicon from leading manufacturers on hardware platforms from our Networks & Communications Group (NCG). You can load your software onto Advantech ATCA and eATCA Reference Platforms, High Performance Servers and Network Appliances for:

• Early evaluation and benchmarking
• To perform functional testing
• To get an early start on development while you wait for your first systems to be delivered

The new service puts virtual control of your own test lab at your finger-tips. You no longer incur the costs of shipping heavy freight around the world, purchasing expensive test rigs or breaking your back installing equipment in a lab which you probably wouldn’t sit in anyway.

The program currently offers two levels of service:

LEVEL 1 ENTRY LEVEL
For preconfigured payloads a no-frills service with support based on best effort is available free-of-charge to pre-qualified customers. Available preconfigured payloads are described in the Platforms tab.

LEVEL 2 PREMIUM LEVEL
A premium program establishes close interaction between your development team and Advantech service engineers in order to agree on a bespoke system configuration, software load and overall network requirements.

The systems and platforms we propose are pre-integrated application ready platforms embedded in a qualified, dedicated, and secure network test environment. You can easily check out the performance gains achievable on next generation Intel® CPUs and NICs or see how their software scales across multiple blades in an ATCA system. You can measure the acceleration which Intel® DPDK and Intel® QuickAssist offload can bring or simply get a grasp of terabit throughput on Advantech eATCA.

Test Environment

The RES network is comprised of several elements, namely:

• RAS: Remote Access Server (RAS): A public IP and special port number is assigned to you with appropriate credentials. You also can upload applications via this server. The RAS has Ethernet and USB-to-Serial console ports for you to access the EUs.

• Netarium™ ATCA Reference Platforms: Systems include different combinations of ATCA blades, such as iA x86 blades, NPU blades, DSP blades and provide dual star Fabric Interface (FI) with 10Gbps or 40Gbps and dual star Base Interface (BI).

• ShMM: The Shelf Management Module allows you check status on each blade and activate/deactivate the blades as you like.

• Packet Generator: These are available as an option and support 10Gbps/40Gbps traffic.

Full details at: http://www.advantech.com/nc/newsletter/NCG/RES