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Embedded & Communications
ENGINEERING

The INTEL STRATEGY for Processor Design Series

Intel's Innovation Facilitates

Open-Standard Network Transformation

Intel is uniquely positioned to support DoD's vision of deploying extensions to the Global Information Grid that facilitate network-centric operations and continuously implement advanced capabilities through rapid technology insertion.

The U.S. Department of Defense (DoD) is faced with the enormous task of ensuring consistent readiness of embedded computing and communications systems in the context of unprecedented technological advancement. Precipitated by Secretary of Defense William Perry's memo, "Specifications & Standards – A New Way of Doing Business," in June 1994, the use of commercial off-the-shelf (COTS) components represents the foundation of military, aerospace and government ability to access commercial, state-of-the-art technology.

Today, military force transformation is guided by a vision of network-centric operations (NCO), an effort to accelerate the use of technology to provide seamless communications, collaboration and situational awareness with legacy

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proprietary "silos," using a Global Information Grid (GIG), across all branches of service – securely and reliably.

The network-centric warfare (NCW) vision imposes significant system-level requirements. Many complex systems will need to interoperate and provide backward compatibility with current force systems. The system architecture must:

- Enable technology insertion
- Scale to meet ever-changing missions and force levels
- Meet form factor and environmental requirements
- Address the need for cost containment and timelines.

The benefits of using true commercial off-the-shelf products for the military include systems that are cheaper, faster and better, and require no systems engineering and no testing. While COTS products have the potential for cost-effective acquisition of components and advanced technology, they do not completely deliver on DoD's vision.

Open systems emphasize the use of standards and implementations that conform to those standards. The plug-and-play and multisource features of open systems provide a framework for the effective use of COTS products for military, aerospace and government applications. Open standards-based modular platform architecture provides a foundation capable of accelerating and sustaining force transformation.

Providing network-centric solutions

Intel's proven embedded computing, communications and networking solutions harness breakthrough innovations in processing performance, programmability and bandwidth. Intel's modular platforms include Intel® Architecture – embedded processors, networking communications processors, and platforms based on architectures like the Advanced Telecom Computing Architecture* (ATCA*) and MicroTCA*. Based on these communications platforms, DoD and its suppliers can

Intel Processors Meet Need for Speed

Moore's Law declares that the number of transistors per a certain area on the chip will double approximately every 18 months. As with transistors before them, the combined throughput of multiple cores delivers processing power greater than the maximum available today on a single-core processor, while dramatically reducing power consumption. The result is an increase in the capabilities of server platforms – as predicted by Moore's Law – while technology no longer pushes the outer limits of physical constraints.

At Intel, Moore's Law is alive and well, as it now describes a new and steeper performance vector while keeping power dissipation in check.

Intel has offered extended-life, embedded and network processor road maps for many years to address the requirements of the embedded and communications markets. The road maps offer a scalable choice of processing performance, power consumption and integrated features to deliver outstanding overall energy efficient performance.

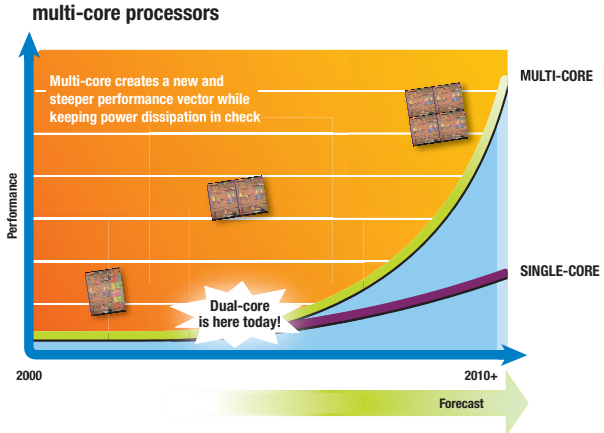
The road map includes a rapid increase in multicore processors, including the Dual-Core Intel® Xeon® processor LV 2.0 GHz, which allows military and aerospace designers to increase computing performance in very small, thermally constrained form factors. Its inherent computing performance can crunch, deliver and transmit more data – all from its miniaturized package. The resulting improvement in performance/watt enables aerospace and defense designers to maximize processor density within such thermally constrained environments as multiple single-board computer (SBC) and MicroTCA form factors.

The increasing demands of the military to transmit voice, video and data over wired and wireless tactical networks, including mobile command vehicles, airborne control centers and unmanned aircraft, requires the utmost in processing power and a decrease in space, weight and power consumption. Today, dual-core processors house two complete physical computer processors on a single chip. Tomorrow, multicore systems consisting of more than two processors will continually improve platform performance and continue to make inroads on reining in power consumption.

Low-voltage dual-core Intel® Xeon® processor core technology provides the ability to add a second processor with great ease and low complexity, maximizing computer density in thermally constrained environments. Low-voltage dual-core Intel Xeon processor-based network elements featuring lower power and thermals for use at the edge, access point and core of the Global Information Grid are an ideal fit for military command and control platforms.

Moore's Law Continues

Intel's embedded road map includes steep performance increases while maximizing performance per watt with multi-core processors



dramatically reduce program cycle time while maintaining interoperability with legacy systems.

The commercial market has spoken, and the adoption of ATCA has occurred at an extremely fast pace due to its tremendous value to the vendors and users of the technology. More than 100 communications industry leaders, along with the standards organization PICMG*, created platform architectures such as AdvancedTCA and MicroTCA, which are already used in commercial communications applications. In addition, they address the vision of a COTS-enabled military transformation, providing the performance and endurance required to meet the military's environmental challenges.

"Modularity will enable the network-centric vision put together by the DoD. Modularity is the only way that the DoD will be able to achieve network-centric systems," according to Joe Jensen, General Manager, Intel Communications Infrastructure Group, Intel Corporation.

The modular communications platform (MCP) approach consists of a high level of interboard communications and high-speed fabric connectivity in a bladed architecture. Intel processors provide highly flexible embedded network and communications platforms that offer a choice of processing performance, power consumption and integrated features to deliver outstanding overall performance, both for the price and per watt. An extensible architecture helps lengthen application lifespan, ensuring that platforms as defined by military, aerospace and government applications are scalable and upgradable.

From mobile computing devices to network infrastructure, Intel enables rapid and cost-effective deployment of systems that take advantage of next-generation voice, data and video. Available wireless broadband building blocks and solutions focus on standards, security and interoperability to ensure that military personnel are always connected.

The ultimate goal of the DoD is a ubiquitous IP-based network with every sensor, shooter and decision maker an independent IP address on a network. Intel's IP-based network products provide sufficient bandwidth to the soldier on the field to communicate critical information and receive timely support.

AdvancedTCA*'s (ATCA*) high-availability framework allows redundancy, shelf management, high computer density and maximum system uptime. It also provides 200 watts of power draw per slot to ensure the use and adequate cooling of high-performance processors. ATCA enables network evolution – replacing a single blade or card in a system, rather than having to design an entirely new system.

MicroTCA offers ATCA benefits for small and mobile applications. MicroTCA's form factor, which is for use in such applications as unmanned spacecraft, deploys systems that have tremendous processing power, but in a much smaller space and in a rugged form that stands up to the extreme requirements of a military, aerospace or government application.

Motorola* Helps Deliver MicroTCA Platform

MicroTCA solves a big problem. It provides reliable connectivity to military command centers by enabling embedded communications within small yet rugged form factors. In short, it is ideal for such applications as manned and unmanned ground-based vehicles, because it addresses the tight cost and size constraints of communications-centric applications at the edge of the tactical network.

"MicroTCA's extremely scalable architecture features a minimal fixed infrastructure represented by one module within a platform solution," says Paul Virgo, Director of Marketing, Motorola Embedded Communications Computing. Motorola is a leading company providing MicroTCA solution-level platforms. "All other functions are scalable, allowing the user to select and implement desired features and use such fabric architectures as Gigabit Ethernet*, PCI Express*, Serial RapidIO* and InfiniBand*."

MicroTCA is a derivative of the AdvancedTCA (PICMG 3.0) platform that was developed in 2001 and combined a hot-swappable, multi-protocol switched fabric with a large form factor and high power capability. ATCA is ideal for high-performance, high-density, high-availability, packet-based telecom systems. After its launch, PICMG (PCI Industrial Computer Manufacturers Group) rapidly began work on a complementary mezzanine standard, known as AdvancedMC* (PICMG AMC.0) that enhanced ATCA's flexibility by extending its interface to individual hot-swappable modules. Today, MicroTCA delivers a plug-in and hot-swappable modular backplane environment that results in a platform that is extremely serviceable and scalable.

Given the harsh environments where the equipment is used, Motorola and other companies with vast experience in building ruggedized systems formed a MicroTCA Ruggedization Special Interest Group (SIG). This group is currently defining enhancements to the basic specification that will be ratified this year, with backward-compatible ruggedization of MicroTCA.

Motorola is a communications server provider and application solution supporter working with ecosystem members including Intel® to make sure the necessary building blocks are in place. "Based upon the demanding requirements of the military, aerospace and government, a robust ecosystem is critical," Motorola's Virgo says. "Together, leading companies are showing the way for cost savings and rapid implementation based on MicroTCA."

Modular communications platforms include such advanced capabilities as the open source, standards-based Linux* operating system, Intel® Virtualization Technology and rack-mount servers. Not only do the platforms address the compatibility issues of legacy systems, they offer a combination of low power, maximum density and greater performance per watt to crunch, deliver and transmit more data.

WiMax is a broadband wireless technology that can provide fully mobile, multimegabit broadband Internet access over wide areas. A WiMax network can be deployed very quickly in an ad hoc fashion to provide a fast and flexible solution in areas without existing wireline infrastructure or where the wireline infrastructure is disrupted.

A WiMax network can be brought into a zero infrastructure environment and very quickly offer real-time video, voice and data communications over a vast area to a large number of personnel on the move. WiMax can also provide tens of megabits for an operations center and provide the backhaul for the whole network.

Vendor Community Involvement

The Intel® Communications Alliance ecosystem is a network of third-party hardware and software providers that deliver Intel technology-based solutions. This extensive vendor community provides high-performance, reliable, off-the-shelf components that add value to a broad range of industry form factors for both embedded and communications solutions. By teaming with Alliance members, Intel offers a rich set of tools, support and design services that provide the resources necessary to efficiently and cost-effectively solve the most difficult development and integration challenges facing customers. The Alliance consists of more than 200 members that offer supply chain flexibility with multiple products at various levels of integration.

The Intel Communications Alliance member mark symbolizes a trusted supply line of standards-based, interoperable, third-party developed products. There are a variety of industry leaders in the Alliance offering products for the military and government needs. Some of these include carrier-grade and real-time operating systems from Wind River, MontaVista and LynuxWorks, boards from RadiSys and Advantech, plus integrated products from SBS, Motorola, DTI and GE Fanuc. The focus is not just on silicon, but on complete solutions that are delivered, tested and ready for deployment.

Intel is promoting standards-based technologies that will allow end customers a choice of multiple suppliers. Systems designed on these open standards, including Advanced TCA and MicroTCA, can reduce design time and allow for more efficient upgrades during the life cycle. As these open standards continue to emerge, Intel and the Alliance members will continue to offer the best technology options for DoD, military, aerospace and government customers.

A large and mature community of vendors enables technology decision makers to leverage economies of scale and Intel's extensive R&D investment. The Intel Communications Alliance provides a single point of entry through which customers connect with Intel's world-class community of vendors and experience the depth and breadth of member offerings.

Why Intel for DoD?

Intel sees its role as helping to accelerate the adoption of standards-based building blocks to realize the DoD vision of net-centric warfare and net-centric operations. Intel's strong product and service capabilities establish it as a leader in embedded computing and communications segments. Its leadership role in a myriad of standards-based bodies and approaches has direct application to military requirements. Whether it's embedded computing platforms, standards-based communications solutions or wireless technologies such as WiFi or WiMax, Intel is a leader.

Intel delivers rigorous due diligence behind the scenes to ensure that vendors are financially stable and architecturally in line with Intel's road map for the future. DoD can trust the Intel Communications Alliance.

Intel enables DoD and its vendors to apply innovations that will implement the network-centric vision via Intel's proven leadership in modular embedded systems, communications and networking architectures. Intel is uniquely qualified to assist integrators in delivering standards-based commercial off-the-shelf solutions capable of accelerating the ongoing process of force transformation.

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