Solution Brief

Military Operations
Edge Computing

SMART Embedded Computing Server Targets Military Edge Computing

RG1000 1U rugged high-performance COTS bladed server brings 2nd generation Intel® Xeon® Scalable processors to mission-critical military applications

Because of the nature of military operations, technology used by branches of the armed forces must meet very high performance and reliability metrics. In the past, this has meant using closed, purpose-built systems.

But for many years military agencies have made a measured shift to commercial off-the-shelf (COTS) systems based on open systems architectures to support emerging applications in weapons systems control, drone control, and autonomous vehicle control. Beginning in the 1980s, these systems improved in reliability and the cost differential between open and closed systems widened to the point that agencies could no longer justify the cost of the closed systems.

One of the first technologies to be embraced in this shift was Versa Module Europa (VME), a flexible open-ended bus system that became an ANSI/IEEE standard. Other buses and interconnects continued to be implemented as the shift toward COTS took place with the adoption of Multibus II cards designed by Intel and the embrace of CompactPCI-based modules.

VPX came in 2004 and provides support for switched fabrics over a high-speed connector in a familiar form factor to users of VMEbus-based systems. AdvancedTCA (ATCA)—an open, bladed architecture—is also used by military agencies based on its high-performance and reliable network computing.

Though some of these technologies have been used by military agencies for a long time and are not considered obsolete, these agencies are now moving toward COTS servers. A major driver in that shift is that the technology can be easily adapted to fit the needs of a particular defense application, which results in reduced costs and deployment times. As older systems are being retired, agencies are now moving rapidly toward using COTS servers for edge computing.

These servers, however, must be able to meet the challenging environments of defense applications such as battlefield command, AI inference, signal processing, and flight radar control and communications. For this reason, ruggedized off-the-shelf (ROTS) servers have become the preferred solution to ensure high reliability in these harsh environments.

Military Edge Applications

Now these systems are being used for a growing number of edge applications. Edge computing is a fast-growing computing architecture that places high-performance cloud servers in points-of-presence, base stations, and other locations so that computing and analytics are completed closer to the source of data creation, as opposed to relying on a data center that could be thousands of miles away.

Edge computing has grown in popularity because it reduces latency, enables real-time data processing, and enables cost savings and reduced bandwidth needs. In the case of the military, where operations can be spread out across ships, in airplanes, and on the ground in mobile units, the ability to process data locally can be critical to tactical decision making. In military applications, such as shipboard advanced command and control or weapons control, real-time data processing is imperative.

But defense edge applications may expose these servers to extended temperatures, shock or vibration, and even battle situations. The ruggedized COTS/ROTS servers delivering the edge computing must be able to maintain high performance while tolerating the stress of any or all of these conditions.

While military agencies have a technology insertion cycle that runs every four years, they also prefer solutions that have long life cycles. From a longevity standpoint, military agencies prefer implementing the latest processor technology during the technology insertion cycles.

Military agencies are looking to mimic the commercial world and deploy rack-mounted servers as opposed to a rugged vehicle-borne solution like VPX.

Intel® Network Builders ecosystem partner SMART Embedded Computing has developed a 1U rugged COTS server that brings the latest 2nd generation Intel® Xeon® Scalable processors to military applications. Through its experience with supplying high performance COTS bladed servers to a range of sea, land, and airborne defense programs, SMART Embedded Computing identified a need for a compact, rugged, rack-mounted server that is at the leading edge of commercial processor technology while supporting the long life cycles demanded by armed forces agencies.

SMART Embedded Computing COTS Server

For many years, SMART Embedded Computing has provided the military with ATCA chassis-based systems that provided a foundation for high-performance embedded computing platforms. ATCA lends itself to an evolution from a bladed server architecture to a rack-mounted server architecture.

Now, the company has developed its RG1000, a 1U rugged COTS server. The server is designed to be rack-mounted and has been ruggedized to meet the challenging extended temperature, shock, and vibration environments of military applications, such as signal processing in shipborne weapons control, for example.

The RG1000 COTS server is hardened in a variety of ways, including having an operating temperature range of 0°C to 55°C (32°F to 131°F) and a storage operating temperature range of -40°C to 70°C (-40°F to 158°F). The server can withstand a temperature change of ±0.5°C/minute and has an operating humidity range of 5 percent to 90 percent, non-condensing. The server can withstand operational shock pulses from front-to-back, side to side, and vertical in the range of 30.5G for 25 ms half sine pulse in both directions, and vertical shock in the range of 40G for 5 ms half sine pulse in both directions.[1]

In terms of altitude, the RG100 can work up to 12,500 feet (3,810 meters) operational and 40,000 feet (12,192 meters) transport.

Two full height, three-quarter length PCI Express slots allow for additional general-purpose processing, specialized processing, or I/O. The server provides front-panel access for up to four hot-swappable solid-state disks using the Enterprise and Data Center SSD Form Factor (EDSFF E1.S).

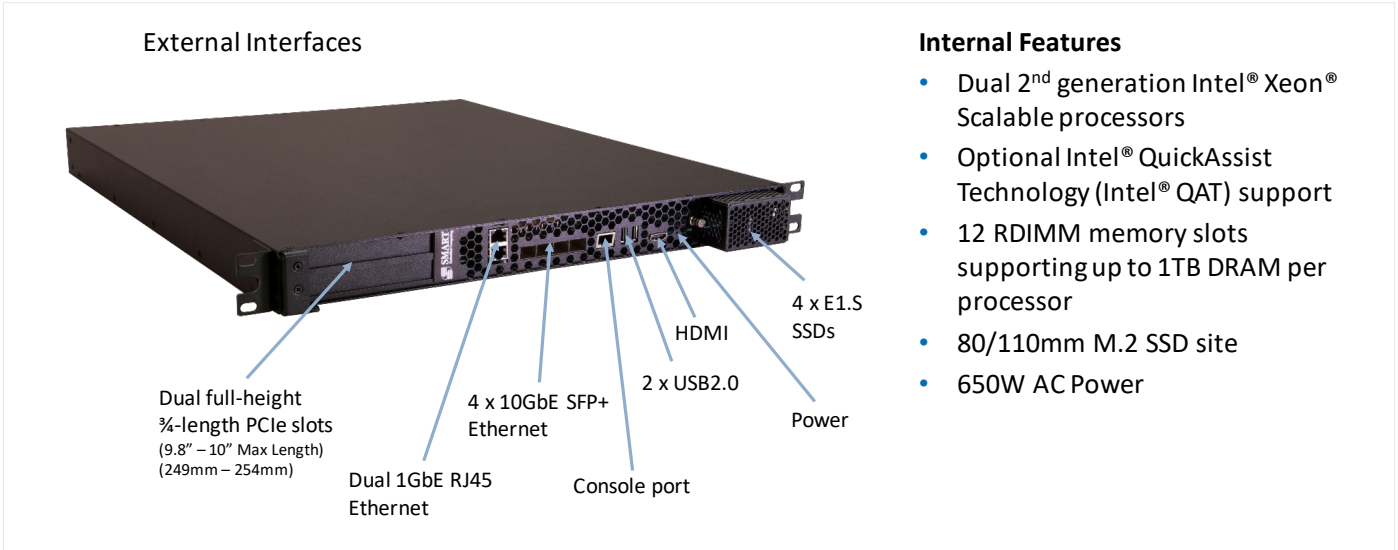

Figure 1. SMART Embedded Computing RG1000 Rugged Server.

Intel® QuickAssist Technology (Intel® QAT) is built into the host bridge, accelerating and compressing cryptographic workloads by computing the data on hardware capable of optimizing those functions. Intel QAT encryption improves information assurance in military networks and improves data throughput in tactical systems.

The RG1000 can be configured with a variety of software offerings, from firmware-only to fully integrated and verified software operating environments. The server has a pre-installed BIOS and BMC firmware that allows for the installation of operating systems and integration with hardware platform management. The RG1000 also features a board management controller (BMC). The BMC provides interfaces for hardware

platform management that allow monitoring status, event logging, and recovery control of the server.

The RG1000 rugged COTS server is designed to be compatible with a range of operating systems, including CentOS, Ubuntu, RedHawk, Red Hat, Microsoft Windows, and VMware ESXi.

Based on Intel® Xeon® Processors

The RG1000 is based on 2nd generation Intel Xeon Scalable processors because they deliver industry-leading, workload-optimized performance with built-in AI acceleration, providing a seamless performance foundation to help speed data's transformative impact, from the multi-cloud to the intelligent edge and back.[2]

The RG1000 COTS server utilizes 2nd generation Intel Xeon Scalable processors, either Intel Xeon Gold or Intel Xeon Silver processors embedded, with up to 1 TB of DDR4 memory per CPU across 12 DIMM sockets, supporting commercial or SMART Rugged DRAM modules, which exceed the standards of standard commercial memory.

With support for the higher memory speeds, and enhanced memory capacity, Intel Xeon Gold processors deliver significant improvement in performance, advanced reliability, and hardware-enhanced security. Intel Xeon Silver processors deliver essential performance, improved memory speed, and power efficiency. They offer the hardware-enhanced performance required for entry data center computes, network, and storage.[3]

Supply Chain Security

The RG-1000 is designed and built by SMART Embedded Computing in the United States with an end-to-end supply chain that is optimized for secure sourcing. The sourcing and supply chain management is done internal to the company using its ISO 9001-based quality management system. The company first qualifies all of its vendors by auditing their engineering, supply chain, finance, and quality systems. Next SMART Embedded Computing's product development process is strictly controlled with the bill of materials vetted internally by the engineering department. All hardware validation and compliance is done in-house and product firmware is controlled by SMART Embedded Computing's secure Software Configuration Management Library (SCML) system.

Conclusion

As closed systems are retired, military agencies are looking to implement COTS servers for edge computing. These servers must be ruggedized to meet the challenging environments of defense applications, while maintaining the high performance needs of the military's most important edge computing applications. The operating system and I/O options of the RG1000 will help to ensure a seamless upgrade path from existing systems and the server provides the tools and flexibility necessary for new deployments.

Learn More

SMART Embedded Computing website

SMART Embedded Computing RG1000

2nd generation Intel® Xeon® Scalable processors

Intel® Edge Computing website

SMART Embedded Computing is a member of the Intel® Network Builders ecosystem

Notices & Disclaimers

[1] Data provided by SMART Embedded Computing, October 2020.

[2] https://www.intel.com/content/www/us/en/products/docs/processors/xeon/2nd-gen-xeon-scalable-processors-brief.html

[3] https://www.intel.com/content/www/us/en/products/processors/xeon/scalable/gold-processors.html, https://www.intel.com/content/www/us/en/products/processors/xeon/scalable/silver-processors.html

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