American Portwell Technology

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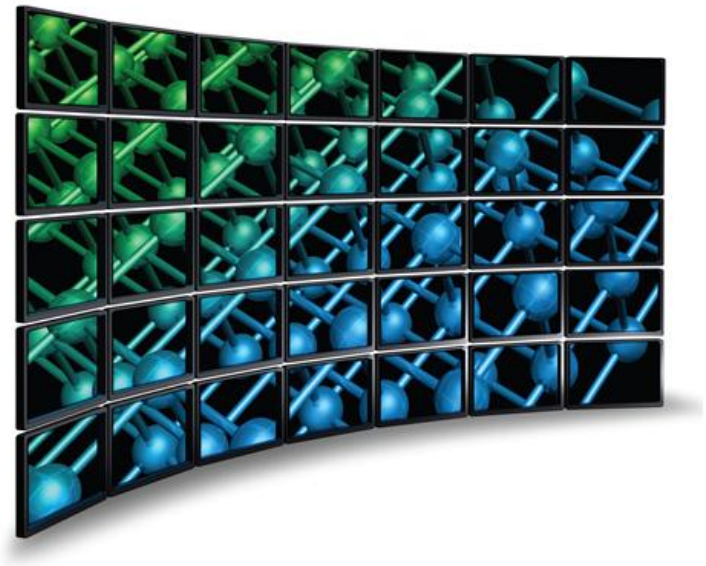

A HIGH-BANDWIDTH BACKPLANE WITH INTEL® ARCHITECTURE-BASED SYSTEM HOST BOARD FOR SURGERY ROOM and VIDEO WALL APPLICATIONS

A breakthrough 10-slot backplane available with Intel® Xeon® or Intel® Core™ processors based PICMG 1.3 System Host Board and efficient Matrox video cards provides a complete solution for capturing and displaying high-resolution images in medical surgery environments.

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Overview

Modern surgical operations are benefitting from advanced technologies adopted in hospital operating rooms and control rooms. A control room is where technicians help surgeons and nurses control various medical, surgical and diagnostic instruments in the operating room. To provide this aid, these technicians view multiple real-time images and video feeds from a variety of specialized equipment, such as C-arm, Endoscope, Intra Vascular Ultrasound (IVUS), Surgical Navigation Systems, Video Cameras, and more. For interactive training purposes, most of the established hospitals (particularly university hospitals) also display real-time images or videos on video walls in video conference rooms, auditoriums, or classrooms to enable medical students to view live surgery outside of the operating room. These video capabilities could also be used for grand rounds, live consultation, real-time collaboration, and co-diagnostics with physicians of various specialties, either locally or remotely.

To process the imaging and video feeds, long lifecycle computers are now taking a place among these technologies. To handle the demands of real-time image and signal processing, these computers rely on high-performance Intel® Core™ and Xeon® processors from Intel's embedded roadmap, along with powerful graphics cards to capture camera images and render precise graphics on large LCDs.

To help hospitals take full advantage of this trend and provide the requisite scalability, Portwell provides a critical building block for such a system: A PICMG 1.3 backplane with a PCI Express x16 switch and ten PCIe x16 expansion slots.

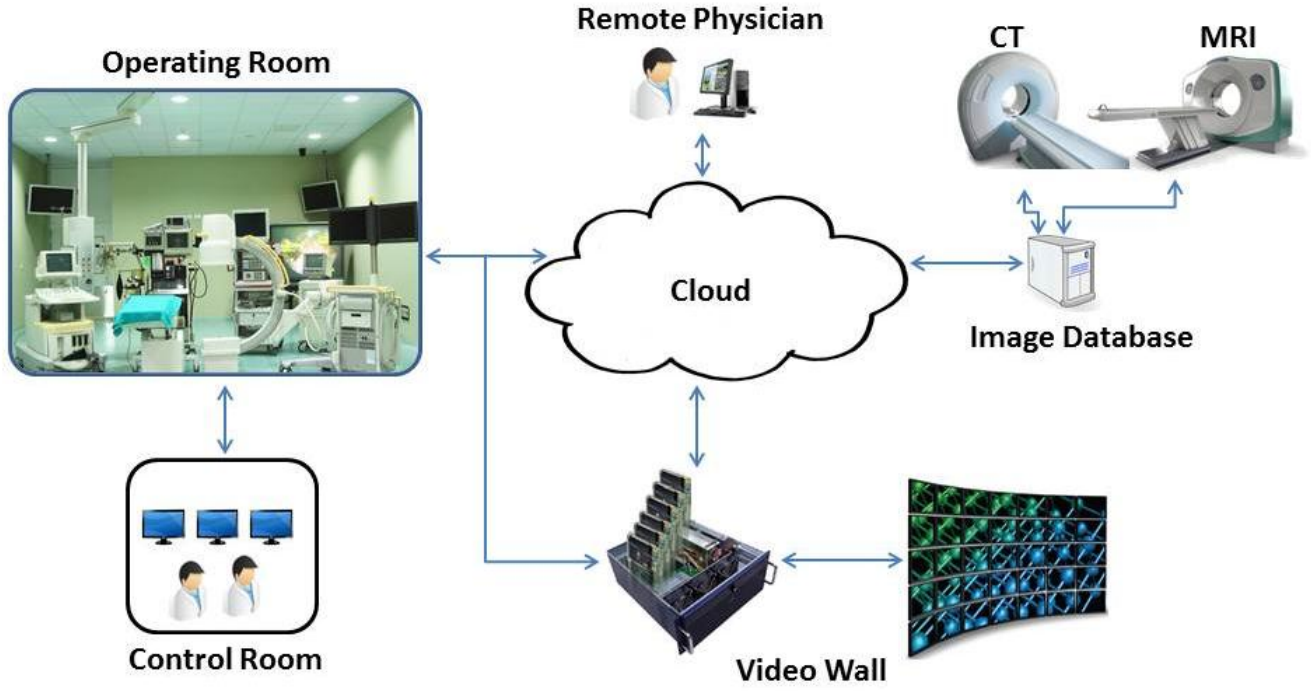

Figure 1 – Implementing a 19˝ 4U rackmount system with a high-bandwidth backplane and a PICMG 1.3 SHB for a video wall application in a surgery room environment

System Architecture

A building block architecture provides the needed scalability in the number of camera images that can be captured and the number of displays that can be driven. Most commercial-grade graphics cards can drive multiple displays, although sometimes with different interfaces (VGA, DVI, and HDMI). Better yet, certain purpose-built graphics cards can drive 2 to 4 displays of the same interface type. In fact, the Matrox Mura™ MPX Series video wall controller boards have enough GPU performance to accept up to 4 video inputs while driving 4 displays with the same or different images.

With a graphics card that is powerful and efficient enough to process 4 input and output streams while only imposing modest data demands upon the PCIe x16 interface, the next task is to design a scalable backplane and chassis with enough 12V DC power and airflow to function seamlessly while displaying real-time surgical images.

After sufficient system-level analysis, Portwell partnered with Matrox to implement and qualify a 4U rackmount solution that scales up to 10 slots for up to 40 input channels and 40 displays, as shown in Figure 2 below. Air is drawn in from the front by three powerful fans, and two redundant power supplies reside along the right edge.

Figure 2 – Complete solution scales up to support 40 cameras and/or displays

The High-Bandwidth Backplane

The configuration of the backplane, PBPE-11A-MT, from right to left in Figure 3 below, includes white ATX-style power connectors that can handle total current demands for 10 Mura graphics cards. The 10 black connectors next to the ATX power connectors are standard PCI Express x16 ("by 16") slots with standard spacing between each slot. Under the heat sink's enclosure, there are two PCIe switching chips to facilitate the communications between the 10 x16 PCIe and the PCIe bus of the Portwell System Host Board (SHB). The SHBs, with options of either single or dual processors in a variety of processing performance (described in the next sections), will be set in the PICMG 1.3 slot located at the left edge of the backplane.

For the expansion of I/O connectivity, the backplane also provides 4x USB 2.0 and 2x SATA Gen 2 on board.

Figure 3 – PBPE-11A-MT PICMG 1.3 Backplane with PCIe switch and 10 PCIe x16 expansion slots

Single-Processor System Host Board

Figure 4 shows Portwell's ROBO-8111VG2AR PICMG 1.3 System Host Board, which could be an ideal choice for up to 40 cameras and/or displays. The ROBO-8111VG2AR supports both the Intel® Xeon® processor E3-1200v2 series in an LGA-1155 package with the Intel® C216 PCH (Platform Controller Hub), and Intel® Core™ i7/i5/i3 processors with the Intel® Q77 PCH. It also features: memory support of up to 16GB DDR3 1333/1600 RAM in two DIMM sockets with ECC; integrated, enhanced graphics engine providing significant 3D performance up to DirectX 11 and OpenGL 3.1; and, for storage, two SATA 600 ports and two SATA 300 ports with RAID 0, 1, 5 and 10.

Both the Intel® C216 PCH server-class and Intel® Q77 PCH desktop-class chipsets provide rich I/O connectors and high-performance interfaces—two Gigabit Ethernet and USB 2.0 ports, as well as the legacy I/O interfaces needed in this market—serial ports, parallel port, and even a floppy disk drive (FDD). In addition, Intel® Active Management Technology 8.0 (Intel® AMT 8.0) is included in all processors mentioned above, except for the Intel® Core™ i3 processor family. Furthermore, multiple display capabilities are supported to accommodate both legacy analog monitors and new digital monitors with a DVI-I connector (DVI-D digital plus analog VGA signals on some of the pins) and HDMI on a header.

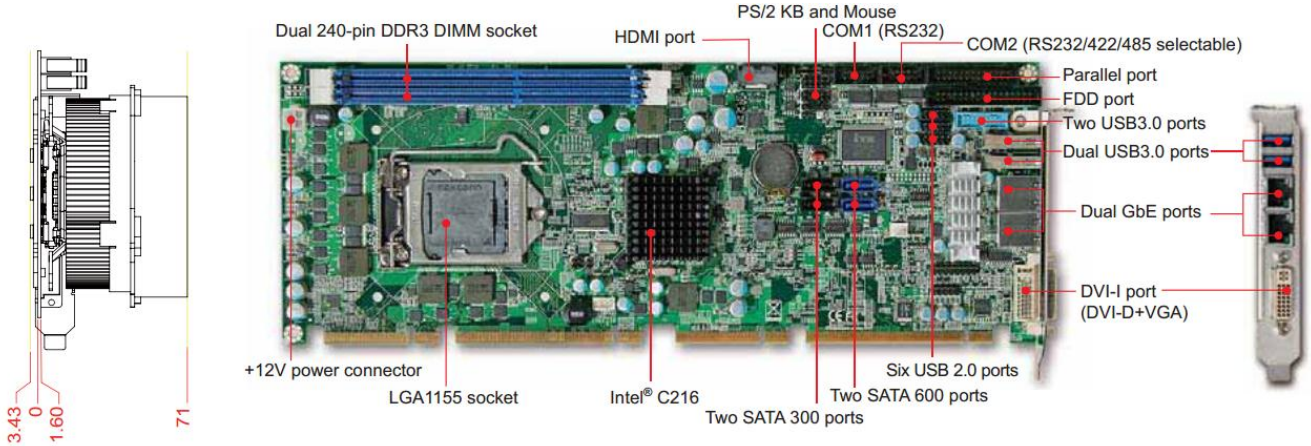

Figure 4 – ROBO-8111VG2AR PICMG 1.3 SHB brings the Intel® Xeon® processor's PCIe x16 interface to the backplane (gold-plated card edge)

Dual-Processor System Host Board

Another option is the Portwell ROBO-8120VG2R dual Intel® Xeon® processor-based SHB, shown in Figure 5. This option supports dual/quad-core server-class Intel® Xeon® processors in an LGA 1366 package, along with up to 32GB DDR3 1333/1066/800 SDRAM on four 240-pin DIMM sockets with ECC support. Six SATA 300 ports (with two SATA ports via backplane) are supported with RAID 0, 1, 5 and 10.

Intel's 3420 chipset was chosen because of its rich I/O— 2x 10/100/1000 Ethernet ports, 2x USB 2.0 ports, as well as the other interfaces, such as 2x serial ports (one RS232 and one selectable RS232/422/485), 1x parallel port, and even 1x floppy disk drive. In addition, support for Intel® AMT 7.0

is included. For display interface, this solution includes a dedicated onboard graphic engine and supports VGA bracket, as well as optional 2nd VGA or DVI-D interface.

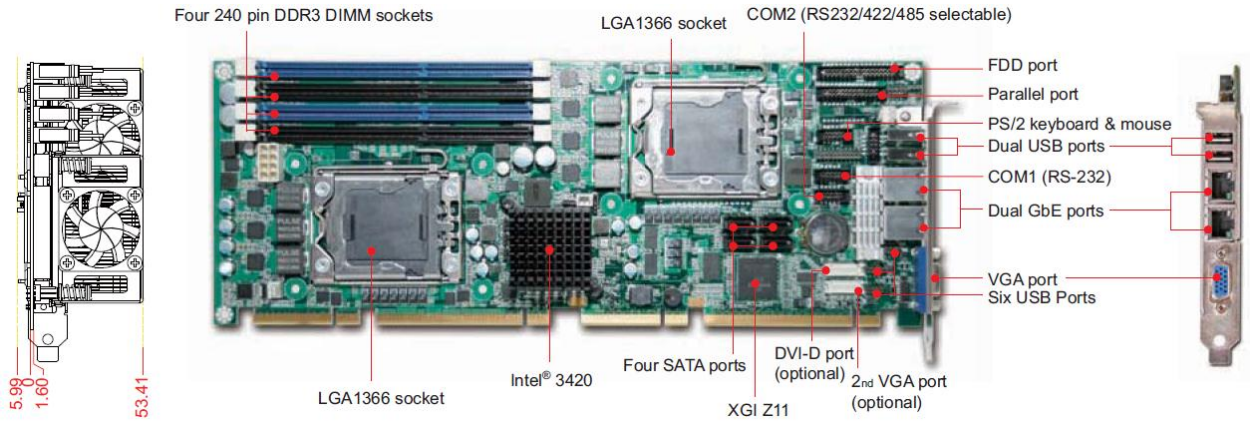

Figure 5 – ROBO-8120VG2R features two Intel® Xeon® processors to tackle higher data processing workloads

Intel Xeon and Core Processors

The specific single-core, dual-core and quad-core processors selected for the above described Portwell ROBO-8111VG2AR and Portwell ROBO-8120VG2R SHBs are included on Intel's embedded roadmap for a minimum 7-year availability before reaching end-of-life (EOL). Discussed below are the Intel Xeon processor E3-1200 series and Intel Core i7/i5/i3 processors. The processors are paired with specific Platform Controller Hubs to form the two-chip platforms.

Category	Processor	Micro Architecture (Codename)	Architecture Generation	Cache (MB)	Clock Speed (GHz)	Thermal Design Power (w)	PCH	Die Shrink
Server	Xeon E3-12xx	Ivy Bridge	3rd	8 - 6	3.5 - 3.1	95-77	C216	22nm
Workstation	Core i7	Ivy Bridge	3rd	8 - 4	3.4 – 1.7	77-17	Q77	22nm
Desktop	Core i5	Ivy Bridge	3rd	6 - 3	3.0 – 2.7	65-35	Q77	22nm
Desktop	Core i3	Ivy Bridge	3rd	3	3.3 – 1.6	55-37	Q77	22nm

Ivy Bridge microarchitecture is the codename for the third generation of the Intel Core and Intel Xeon processor series, *Ivy Bridge* is also used as the platform name for two-chip solutions for mobile-class, desktop-class and server-class computing. As a platform, it succeeds the *Sandy Bridge* second generation Intel Core and Intel Xeon processor series.

Per the table above, all desktop-grade and server-grade processors are socketed. *Ivy Bridge* embedded processors are socket-compatible and pin-compatible between desktop-grade and server-grade, and their corresponding PCHs (aka chipsets) Q77 and C216 are also pin-compatible. Furthermore, the Intel Xeon processors work with the Intel Q77 chipset and Intel Core processors work with the Intel C216 chipset. Using the same board and socket, customers could choose from a long list of processors based on performance, thermal, cache, number of cores and threads, and other special requirements. The benefit of such a compatibility is unprecedented scalability within a circuit board design.

Matrox Mura Graphics Card

The design of the Matrox Mura MPX Series single-slot video wall controller boards (Figure 6) includes both input and output on the same PCI Express x16 Gen2 board, leveraging 64 Gbit/s duplex data transfer for flawless display of HD input captures with no sacrifice to frame rate, color or resolution. The Mura MPX Series output/input boards feature highly flexible, universal input channel support for both digital and analog video (HD, DVI, RGB/VGA, Component, S-Video, & Composite) and capture and display these at full true color (24-bit) image quality. The Mura MPX Series supports bezel management as well as overlap for projectors in both landscape and portrait setups to create a seamless display surface with a large number of HD outputs sources. MPX video capture cards work together with the output/input boards to provide additional analog video Input.

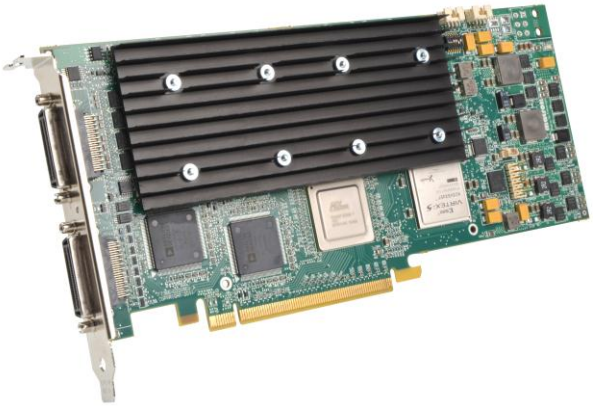

Figure 6 – A Matrox Mura video wall controller board

Wrapping It All Up

Portwell then packed all these elements into a 4U rackmount chassis and launched the Portwell M9020B (Figure 7). In addition to the 10x PCIe 2.0 x16 slots on the backplane and a SHB with Intel Core or Xeon processors, the Portwell M9020B system supports up to 10 Matrox Mura MPX series video wall controller boards, and includes a redundant 950w power supply, three 224 CFM high-speed fans, two front accessible 2.5” SATA HDD, and an optical drive.

While the M9020B system is originally designed with the Portwell ROBO-8110VG2AR PICMG 1.3 SHB (based on the 2nd generation Intel Core processor (formerly *Sandy Bridge*) and Intel QM67 Express chipset), users have the option to choose from one of the following Portwell SHBs, based on performance and other system requirements: ROBO-8111VG2AR, based on 3rd generation Intel Core and Xeon processor (formerly *Ivy Bridge*), ROBO-8120VG2R (dual Intel® Xeon® processor C5500/C3500 Series), and in year 2013, ROBO-8112VG2AR (based on the Intel *Haswell* architecture, a processor microarchitecture to be developed Intel as the successor to the *Ivy Bridge* architecture.)

With such scalable flexibility, users implementing the M9020B system solution will always benefit from the system's outstanding performance in their high-end, greater-scale capture and display applications. Moreover, this complete integrated system solution will enable customers to speed up time-to-market by simplifying the implementation of their large-scale video display walls.

Figure 7 – Portwell's M9020B 4U rackmount chassis offers sufficient cooling and dual redundant 950W power supplies

Conclusion

Portwell's breakthrough PCIe x16 10-slot backplane offers unprecedented data bandwidth for capturing and displaying high-resolution images on video-walls in various medical environments. Combined with the high-performance Intel Xeon and Intel Core processors, efficient Matrox video wall controller cards and a purpose-design 4U chassis, Portwell offers a complete solution with a 7-year lifecycle support for embedded system OEMs. What's more, Portwell has achieved ISO 13485 certification, which

represents the requirements for a comprehensive management system for the design and manufacture of medical devices, and is more stringent than ISO 9001.

Portwell's latest solutions provide OEMs and system integrators with a low-cost, high-performance value proposition to build truly amazing video-wall systems to meet the customer requirements.

Surgeons can now make use of these advanced technologies while conducting their life-saving procedures and display their activities in surgical rooms in real-time video format to collaborate with their colleagues in different specialties interactively, either locally and remotely, for the purpose of video-conferencing, education, training, and co-diagnostics.

About Portwell and Intel® Intelligent Systems Alliance

Portwell is a Premier member of the Intel® Intelligent Systems Alliance. From modular components to market-ready systems, Intel and the 200+ global member companies of the Alliance provide the performance, connectivity, manageability, and security developers need to create smart, connected systems. Learn more at: Intel.com/go/intelligentsystems-alliance. Explore Alliance products and services at: intel.com/embedded/solutionsdirectory.

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