

Cell Accelerator Board 2

Order-of-Magnitude Faster Image and Signal Processing

- Outstanding processing of massive datasets
- Designed for distributed processing
- Optional Cell-optimized software for enhanced application performance and developer productivity
- More than 180 GFLOPS in a PCI Express® accelerator card



The Cell Accelerator Board 2 from Mercury Computer Systems is a PCI Express® accelerator card based on the Cell Broadband Engine™ (BE) processor. The Cell Accelerator Board 2 solution offers Mercury customers the advantages of the Cell BE processor in a package designed for high-performance environments. The board offers significantly improved performance for signal processing, image processing, and graphics rendering of massive datasets, as required in medical imaging and other similar applications – all at a lower power consumption per performance level in this second-generation offering. Performance scales dramatically when the application is distributed across multiple Cell Accelerator Boards in a cluster or across the network.

Superb Performance

Mercury's comprehensive and user-programmable Cell Accelerator Board 2 solution offers order-of-magnitude faster processing for graphics, image, and signal processing workloads. The Cell BE processor running at 2.8 GHz has 180 single-precision GFLOPS of performance in the SPE (synergistic processing element) array. Mercury has mapped key algorithms onto the solution, significantly increasing the performance advantages for high-performance computing applications. In this second-generation offering, SPE double-precision floating-point performance has been increased by nearly a factor of 8.

Multicomputer-on-a-Chip

The Cell BE processor architecture is essentially a multicomputer-on-a-chip. This architecture of heterogeneous high-performance processing elements on a common interconnect has a structure that is designed for distributed processing.

The Cell BE processor includes three main functional components:

- The Power™ processing element (PPE) has dual hardware multi-threading and a standard VMX vector processing engine. It has separate 32-KB L1 data and instruction caches and 512 KB of L2 cache. The processing power of the PPE is in addition to the 180 GFLOPS from the SPE array.
- In the array of eight synergistic processing elements (SPEs), each has a dual-issue pipeline, a 128-bit-wide vector processing engine, a very large register set (128 registers, each 128 bits wide), and 256 KB of local store (LS). Each SPE accesses system memory via its memory flow controller (MFC), which is a high-performance DMA engine.
- A high-speed data ring called the element interconnect bus (EIB) consists of two pairs of counter-rotating rings with a sustained aggregate bandwidth of 180 GB/s.

Additionally, each chip has high-bandwidth, low-latency memory and I/O interfaces.

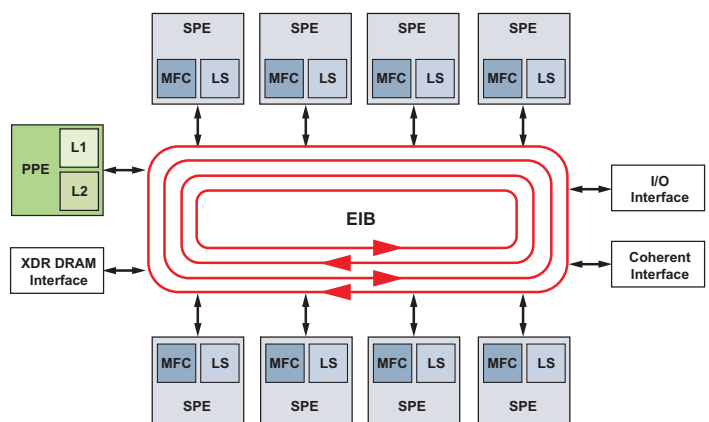


Figure 1. Cell Broadband Engine Processor block diagram

Cell Accelerator Board 2 Topology

The Cell Accelerator Board 2 has one Cell BE processor directly mounted on the board. A companion chip provides the high-speed bridge from the processor to a PCI Express x16 channel, a dual-channel DDR2 interface to 4 GB of DDR2 SDRAM memory, and a Gigabit Ethernet external connector.

CBE Attached Memory

The Cell Accelerator Board 2 has 4 GB of DDR2 DRAM directly attached to the Cell BE processor. This allows for a peak data rate of 22.8 GB/s. In addition, the board has 256 MB of DDR2 DRAM attached to the companion chip. Both DDR2 memories can be accessed via the Cell BE processor's MFC DMA engines, the companion chip's high-performance DMA engine, or an external PCI Express device or host.

PCI Express Interface

The PCI Express x16 interface provides a raw data rate of 4 GB/s in each direction. When plugged into the x16 interface of a high-end workstation, the Cell Accelerator Board operates as a PCI endpoint under the control of a 64-bit Windows® XP or Linux® host.

Gigabit Ethernet

Dual external Gigabit Ethernet ports are provided to support network boot and flexible network communication, whether in host or standalone operation.

Management Interface

Cell Accelerator Board 2 and host system software supports the following management operations.

Host operation:

- Operates under control of Windows XP64 or Linux host for 64-bit
- Host control of reset and boot
- Cell Accelerator Board 2 is PCI Express endpoint device

Boot options:

- Firmware boot from onboard flash
- Linux operating system boot from Ethernet
- Cell Linux operating system boot from host via PCI Express

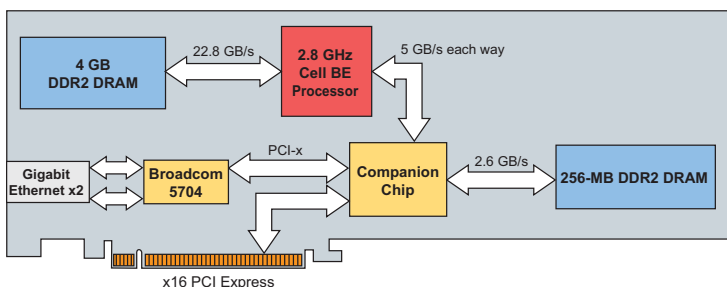


Figure 2. Cell Accelerator Board 2 block diagram

MultiCore Plus Cell SDK

The optional MultiCore Plus™ Cell SDK (Software Development Kit) is a suite of software products specifically designed for next-generation multicore processors such as the Cell BE processor.

MultiCore Plus™

The SDK includes a comprehensive programming framework, highly optimized math libraries, and plugins that integrate the MultiCore Plus software with the IBM IDE, based on the Eclipse IDE.

The focus of the MultiCore Plus Cell SDK is application performance and developer productivity. This seamless package of software development tools and libraries helps you take full advantage of the Cell BE processor's architecture to maximize your application's resources and boost performance.

The Ready for IBM Technology Mark certifies that the MultiCore Plus Cell SDK has met IBM-specified standards for compatibility with IBM Microelectronics products and services. Ready for IBM



Technology solutions are designed to help original equipment manufacturer (OEM) customers speed time to market, reduce development risk, lower development costs, and improve return on investment.

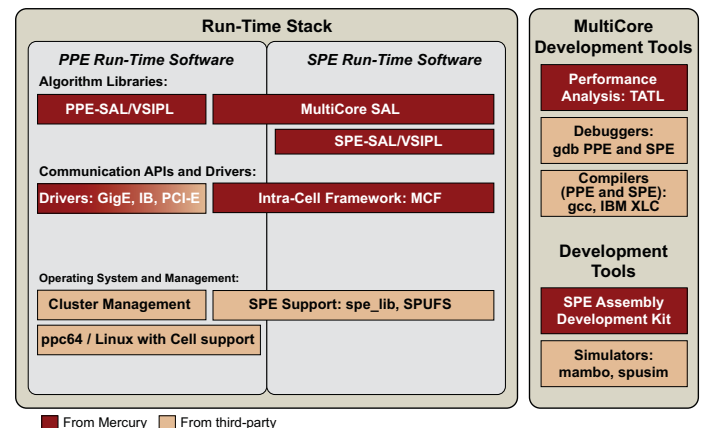


Figure 3. MultiCore Plus Cell SDK software stack for Cell Accelerator Board 2

Serviceability Features

Serviceability features include hardware verification during module initialization, on-board diagnostic LEDs, redundant boot flash image, and an RS-232 serial interface.

Mercury Professional Services

Customized configurations for the 4U Dual CAB 2 Server as well as the CAB 2 Workstation Development System are possible in addition to other customized systems offerings. Consult with Mercury's professional services team to discuss your unique needs and requirements. With over 20 years of experience in middleware development to handle multicomputer and multiprocessor complexities, Mercury can work with you to develop a custom solution as required by your application, with special emphasis on algorithm optimization and middleware framework development.

Mercury Support Services

Mercury's broad range of enhanced support services augment your internal capabilities and increase your effectiveness. For example:

- Installation and upgrade services cover the entire life span of the product's use from onsite installation and certification to post-installation upgrade configuration and testing.
- End-to-end network integration services start with a requirements assessment, include network integration design tailored to your environment, and culminate with the installation and configuration of your total system.
- Flexible product training offerings include one-on-one or classroom setup in small or large groups, with either instructor-led or learn-on-demand format for introductory or advanced classes, refresher training, or certification.
- On-going maintenance and repair services include remote and onsite support packages tailored to your business needs, standard and extended technical support coverage, and guaranteed response times and parts replacement.

Specifications

Cell BE Processor

PPE core	IBM® 64-bit Power Architecture™
L1 cache size	32 KB instruction; 32 KB data
L2 cache size	512 KB
SPEs	8
Local store	256 KB
Registers	128 x 128 bits wide
EIB	180 GB/s sustained aggregate bandwidth
Processor internal clock speed	2.8 GHz
Processor-to-memory bandwidth	22.8 GB/s

Memory

CBE	4 GB DDR2 DRAM, 2 DDR2 channels, 1 Gb x 8
ECC support	Single-bit correct; double-bit detect
Flash	2x16 MB
Companion chip	256 MB, 2 channels each, 512 MB x 16

Cell Accelerator Board 2 Software

Cell 64-bit Linux® operating system and drivers

Linux and Windows® XP64 drivers for host

In host operation

Operates with customer-supplied Windows XP64 or 64-bit Linux operating system.

Host Cross Tool Chain for development for Cell PPE and SPE

MultiCore Plus™ Cell SDK Software (Optional)

(32/64-bit application support)

MCF (MultiCore Framework)	PPE/SPE
TATL™ (Trace Analysis Tool and Library)	PPE/SPE
SAL (Scientific Algorithm Library)	PPE/SPE
MultiCore SAL SPE	PPE/SPE
PixL™ (Image Processing Algorithm Library)	PPE
SPEAD-K (SPE Assembly Development Kit)	SPE

Size

Length	312 mm (12.283 in)
Width	40.64 mm (1.6 in)
Height	113.15 mm (4.455 in)

The board dimensions are compatible with the PCI Express x16 Graphics 150W-ATX Specification 1.0.

Environmental

Ambient temperature	5°C to 35°C
Humidity	5-85% non-condensing
Altitude	3000 ft at 35°C 7000 ft at 32°C

Power

Cell Accelerator Board 2 with 4-GB DDR2 150W

Power is provided through the use of a single cable connector in addition to the 75W power provided through the PCI Express edge connector.

Qualified Chassis/Environments

Consult your Mercury sales representative for information on qualified chassis and environments.

Compliance

Safety	UL/CSA 60950-1 and IEC/EN 60950-1
EMC	EN 55022, EN 55024:1998
European Directive 2002/95/EC (RoHS Directive)	
FCC Part 15 Class A	
ICES/NMB-003 Class/Classe A	

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