Cell Broadband Engine Architecture Computing Platforms from IBM: Quick Reference Guide

Executive summary

This paper introduces IBM® Cell Broadband Engine™ Architecture (CBEA)-based products and can help you determine the appropriate IBM CBEA-based platforms to consider to meet your industry needs.

The following IBM CBEA platforms are introduced and compared in this paper:

- IBM BladeCenter® QS21
- IBM BladeCenter QS22
- IBM PowerXCell™ 8i Processor Accelerator Board

These platforms are compared by using such factors as industry considerations, performance, reliability, availability, maintenance, and software development environment.

The appendix of this paper includes public information about the following non-IBM platforms:

- Mercury Computer Systems, Inc. (Mercury) Cell Accelerator Board
- Mercury 1U Dual Cell-Based System 2
- Sony® Computer Entertainment (Sony) PlayStation® 3

What CBEA is

The Cell Broadband Engine Architecture defines a new processor structure based upon the 64-bit Power Architecture® technology, but with unique features directed toward distributed processing and media-rich applications. This architecture defines a single-chip multiprocessor that consists of one or more Power Processor Elements (PPEs) and multiple high-performance single-instruction, multiple-data (SIMD) Synergistic Processor Elements (SPEs). While each SPE is an independent processor running its own application programs, a shared, coherent memory and a rich set of direct memory access (DMA) commands provide for seamless and efficient communications between all CBEA processing elements.

The first generation of the Cell Broadband Engine (Cell/B.E.™) processor was the genesis of the new family of microprocessors that conform to the CBEA. The CBEA is a new architecture that extends the 64-bit Power Architecture technology. The CBEA and the Cell/B.E. processor are the result of collaboration between Sony Computer Entertainment, Toshiba Corporation, and IBM that formally started in early 2001. In addition, the IBM PowerXCell 8i processor, which was introduced in 2008, is a performance enhanced implementation of the CBEA that was developed by IBM for our line of high performance computing platforms.

Although the Cell/B.E. processor was initially intended for application in game consoles and media-rich consumer-electronics devices, the architecture and the Cell/B.E. implementation have been designed to overcome some of the fundamental limitations to processor performance. A much broader use of the architecture and the processors is starting to emerge.

The Cell/B.E. processor is packaged in multiple solutions including Mercury Cell Accelerator Board, Mercury 1U Dual Cell-Based System 2, Sony PlayStation 3 (PS3), and BladeCenter QS21. The new PowerXCell 8i processor is used in the BladeCenter QS22 and the PowerXCell 8i Processor Accelerator Board.

IBM BladeCenter QS21 blade server

The BladeCenter QS21 blade server is based on the innovative Cell/B.E. processor and provides a new level of parallelism and performance for targeted workloads.

The Cell/B.E. processor uses a multi-core architecture that is optimized for high-performance computing and media-rich applications. The QS21 Cell/B.E. technology-based system is designed for businesses that need the dense computing power and unique capabilities of the Cell/B.E. processor, tackling tasks involving graphic-intensive, numeric applications.

The QS21 blade server (shown in Figure 1) is particularly well suited for image, video, and signal processing applications. The system uses the Cell/B.E. processor to help accelerate key algorithms, such as three-dimensional (3-D) rendering, compression, and encryption, and to help enable companies to create and run highly visual real-time applications.

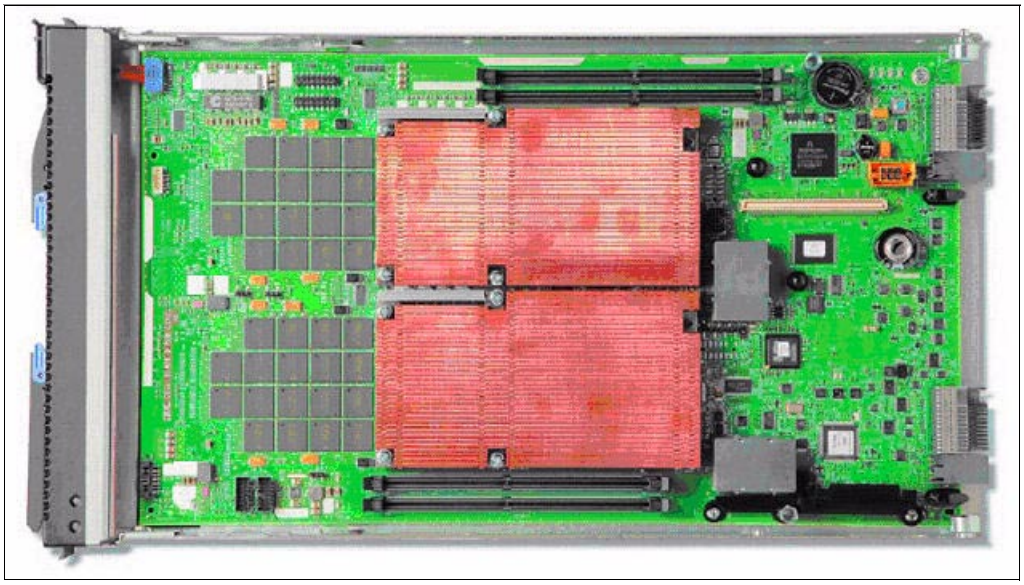

Figure 1 IBM BladeCenter QS21 blade server

The QS21 blade server provides high performance in a standard blade form factor:

- 460 single-precision (SP) GFLOPS or 42 double-precision (DP) GFLOPS per blade
- 6.4 TFLOPS SP or 0.6 TFLOPS DP peak in a single BladeCenter chassis
- 25.8 TFLOPS SP and 2.3 TFLOPS DP peak performance per rack in a standard 42U rack with 56 blades installed

The QS21 blade server includes the following key features, which are explained further in the sections that follow:

- Two 3.2 GHz Cell/B.E. processors
- 2 GB XDR memory
- Integrated dual GB Ethernet
- IBM enhanced input/output (I/O) bridge chips
- Optional two or four 512 MB VLP DIMMs as the I/O buffer
- Optional InfiniBand® adapter
- Optional SAS adapter
- Serial over LAN
- Advanced power management including over subscription and thermal throttling

- Single-wide blade for BladeCenter H chassis
- Supported by IBM SDK for Multicore Acceleration V3.0
- Supported operating system of Red Hat Enterprise Linux® (RHEL) Version 5.1

Processor

The BladeCenter QS21 server uses Cell/B.E. processors. All QS21 models have two processors installed that are directly mounted to the planar board.

Processor memory

The memory subsystem consists of 18 extreme data rate (XDR) memory modules per processor, creating 1 gigabyte (GB) of error checking and correction (ECC) memory per processor. The XDR modules are soldered on the planar for fixed memory configurations.

Special purpose I/O buffer memory

The QS21 blade server supports two or four optional very low profile (VLP) double-data-rate two (DDR2) dual inline memory modules (DIMMs) to act as an I/O buffer. There are two I/O buffers, one for each Cell/B.E. companion processor. Each buffer is implemented as two DIMM sockets. Only 512 megabyte (MB) DIMMs are supported, and they must be installed so that the two buffers have the same amount of memory. The function of I/O buffer memory is unlike typical processor memory in that applications must be written or modified to use these memory DIMMs, which are attached to the IBM I/O bridge chips on the blade.

Onboard network controllers

The QS21 blade server has a dual channel Gigabit Ethernet Broadcom 5704S processor. These two Ethernet interfaces are routed to bays 1 and 2 through a midplane, providing a foundation for fault-tolerant network setups.

Integrated systems management processor

The QS21 blade server has an integrated service processor that provides the following functions:

- Baseboard management controller (BMC), Intelligent Platform Management Interface (IPMI) compliant code stack
- Serial over LAN
- Wake on LAN®
- Power management functions
- Light path diagnostics support (Lightbox LEDs)
- Automatic server restart (ASR)
- Error logging
- Environmental monitoring (voltages and temperature on the system board)

BMC: This onboard BMC cannot be accessed externally through a dedicated port or be daisy-chained to other servers or blades. The BMC forwards information to the Management Module (MM) within the BladeCenter chassis.

The MM is a single point of control for hardware management of all server and switch components that are contained within the chassis.

BladeCenter chassis

The QS21 blade server is supported in the BladeCenter H chassis. QS21 blades can be used in the same chassis as Intel® processor-based HS20/HS21/HS40 blades, Opteron processor-based LS20/LS21/LS41 blades, IBM PowerPC® processor-based JS20/JS21/JS22/JS12 blades, and the QS22 blade.

A blade server has access to as many as 20 communication switches and bridges in one BladeCenter H chassis. Switches, bridges, and interface cards are currently available from such vendors as Brocade, Cisco Systems, Intel, Nortel, QLogic® Corporation, and others, in addition to IBM.

IBM BladeCenter QS22

The IBM BladeCenter QS22 is based on the innovative multi-core IBM PowerXCell 8i processor. With extraordinary double-precision floating point processing power, the QS22 blade server can yield application results faster and with more fidelity. Organizations that use the QS22 blade server can obtain information faster to facilitate important business decisions. The QS22 blade server offers five times the double-precision processing performance of the QS21 blade.

The new BladeCenter QS22 blade server (see Figure 2) is a high performance blade that extends and deepens the IBM high performance computing (HPC) solution portfolio by providing a new level of parallelism and performance to targeted workloads. The PowerXCell 8i multi-core processor architecture helps the QS22 to accelerate key algorithms (such as 3-D rendering, compression, and encryption). It also enables companies to create and run highly visual real-time applications. This performance offers significant potential benefits to companies in aerospace and defense, health care, life sciences, chemical and petroleum, financial markets, digital media, electronics, government, education, and other industries.

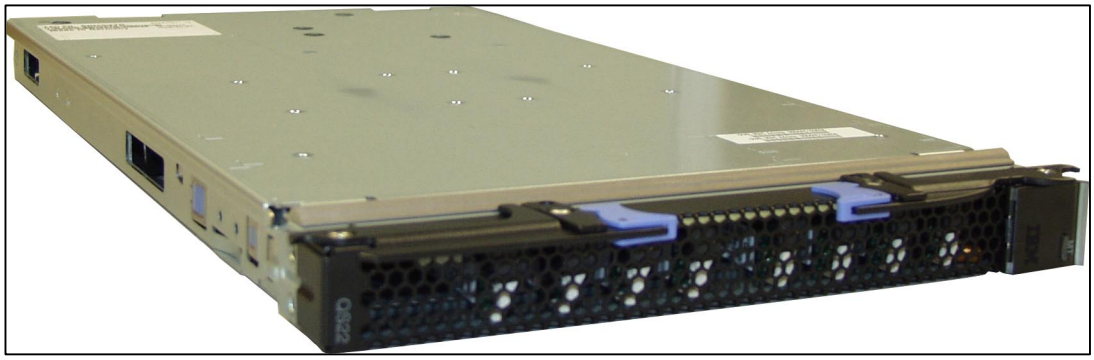

Figure 2 IBM BladeCenter QS22

The QS22 blade server provides high performance in a standard blade form factor:

- 460 single-precision GFLOPS or 217 double-precision GFLOPS per blade
- 6.4 TFLOPS single-precision or 3.0 TFLOPS double-precision peak in a single BladeCenter chassis
- 25.8 TFLOPS single-precision and 12.18 TFLOPS double-precision peak performance per rack in a standard 42U rack with 56 blades installed

The QS22 includes the following key features:

- Two 3.2 GHz IBM PowerXCell 8i processors
- Up to 32 GB DDR2 memory
- Integrated dual GB Ethernet
- IBM Enhanced I/O Bridge Chips
- Optional 1 GB VLP DIMMs as I/O buffer (quantity 2)
- Optional InfiniBand adapter
- Optional SAS adapter
- Optional 8 GB Flash Drive Module (FDM)
- Serial over LAN
- Advanced power management including over subscription and thermal throttling
- Single-wide blade for BladeCenter H chassis
- Supported by IBM SDK for Multicore Acceleration V3.0
- Supported operating system of RHEL Version 5.2

Figure 3 shows the BladeCenter QS22 blade server with the cover removed.

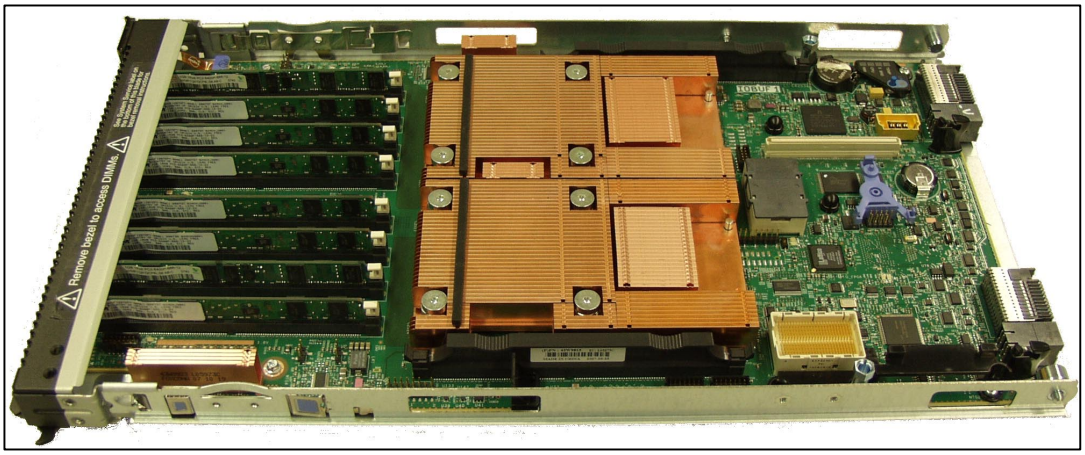

Figure 3 IBM BladeCenter QS22 blade server without a cover

Processor

The QS22 blade server relies on two 3.2 GHz PowerXCell 8i processors. The PowerXCell 8i processor's breakthrough multi-core architecture and ultra high-speed communications capabilities deliver vastly improved, real-time response. By incorporating advanced multiprocessing technologies, the processor is especially suitable for high performance workloads.

The PowerXCell 8i processor (see Figure 4 on page 7) is an asymmetric multicore processor that is optimized for parallel processing and streaming applications. The processor is designed to offer high performance and fast response. It includes a PPE and eight highly optimized enhanced double-precision SIMD engines SPEs.

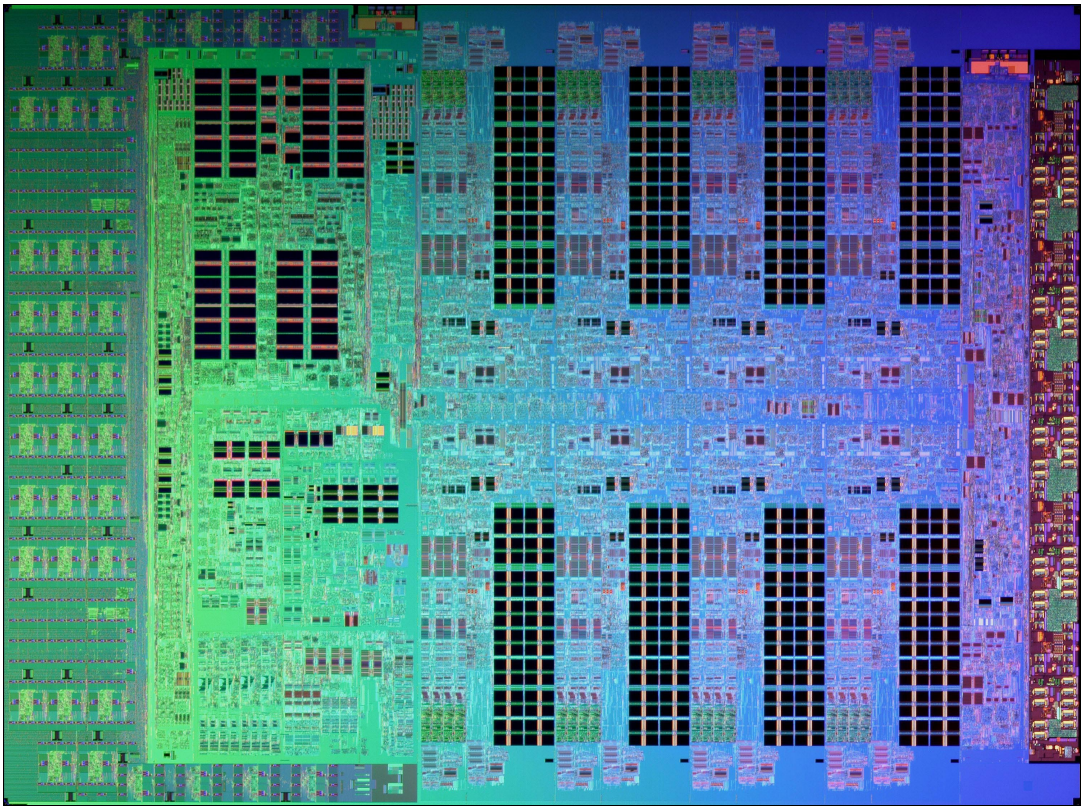

Figure 4 PowerXCell 8i processor

Processor memory

The QS22 blade server has flexible memory configurations that are available in three base models:

- QS22 with 8 GB Memory (8 x 1 GB DIMMs) - MTM 0793-38y
- QS22 with 8 GB Memory (4 x 2 GB DIMMs) - MTM 0793-39y (projected availability starting in the second half of 2008)
- QS22 with 16 GB Memory (4 x 4 GB DIMMs) - MTM 0793-40y

With four available DIMM slots, if desired, optional memory can be added to the 39y and 40y models to build configurations of 12 GB, 16 GB, 20 GB, 24 GB, and 32 GB. Highest memory bandwidth and, therefore, optimal performance can be achieved when all DIMM sockets are populated. Therefore, these two models are intended to be the starting point for configuring QS22 blades with additional memory. Memory must be added four DIMMs at a time. The following optional memory kits are available:

- 2 GB (2 x 1 GB) VLP PC2-6400 DDR-2 Memory (46C501)
- 4 GB (2 x 2 GB) VLP PC2-6400 DDR-2 Memory (46C509) (projected availability starting in the second half of 2008)
- 8 GB (2 x 4 GB) VLP PC2-6400 DDR-2 Memory (46C510)

Special purpose I/O buffer memory

The IBM BladeCenter QS22 blade server also supports an option to add special purpose I/O buffer memory. If desired, two 1 GB VLP DIMMs can be added. This optional memory is sold in kits of two VLP DIMMs and can be purchased from Options by IBM under Part Number 46C0501. The function of I/O buffer memory is unlike typical processor memory in that

applications must be written or modified to use these memory DIMMs, which are attached to the IBM I/O bridge chips on the blade.

Onboard network controllers

The QS22 blade server has a dual-channel Gigabit Ethernet Broadcom 5704S processor. These two Ethernet interfaces are routed to bays 1 and 2 through a midplane, providing a foundation for fault-tolerant network setups.

Integrated systems management

Each QS22 blade server has an Advanced Management Module to provide the following additional systems management capabilities:

- Web-based out-of-band control
- Virtual floppy and CD-ROM support
- Microsoft® Windows® “blue screen” error capture
- Lightweight Directory Access Protocol (LDAP) and Secure Sockets Layer (SSL) support
- Remote redirection of video, text, keyboard, and mouse

The QS22 blade server has integrated industry-standard IPMI 1.5 support working with the BMC to alert IBM Director to anomalous environmental factors, such as voltage and thermal conditions. It also supports highly secure remote power control.

In addition, IBM Systems Director Active Energy Manager™, an IBM-exclusive software tool, is designed to take advantage of new system power management features, by monitoring actual power usage and providing power consumption capping features. More accurate power usage data helps with data center construction planning and the sizing of power and cooling needs, as well as provides the ability to use available power more efficiently.

IBM Director is included for proactive systems management and works with both the blade’s internal BMC and the chassis' management module. It comes with a portfolio of tools, including IBM Systems Director Active Energy Manager, Management Processor Assistant, RAID Manager, Update Assistant, and Software Distribution. IBM Director also offers extended systems management tools for additional server management and increased availability. When a problem is encountered, IBM Director can issue administrator alerts via e-mail, pager, and other methods. It can also automate operating system installation and basic input output system (BIOS) updates remotely with IBM Director tools.

BladeCenter chassis

The QS22 blade server is supported in the BladeCenter H chassis. QS22 blades can be used in the same chassis as Intel processor-based HS20/HS21/HS40 blades, Opteron processor-based LS20/LS21/LS41 blades, IBM PowerPC processor-based JS20/JS21/JS22/JS12 blades, and QS21 blades.

A blade server has access to as many as 20 communication switches and bridges in one BladeCenter H chassis. Switches, bridges, and interface cards are currently available from such vendors as Brocade, Cisco Systems, Intel, Nortel, QLogic Corporation, and others, in addition to IBM.

IBM BladeCenter form factor

A single-wide blade form factor of the QS21 and QS22 blade server provides extraordinary computing density. This feature combined with the CBEA processors offers extreme performance to accelerate compute-intensive tasks (such as image processing, signal processing, and graphics rendering) and provides an extremely highly performing and reliable operations environment. Users can build a complex multi-platform environment in a highly efficient architecture.

BladeCenter remains an innovative platform for running business solutions and builds on the IBM commitment of integrating server, storage, and networking functionality with technology exchange and heterogeneous management. BladeCenter offers the ease, density, availability, affordability, and scalability that are central to the blade technology promise.

Blade servers have captured the industry focus because of their modular design, which can reduce costs with a more efficient use of valuable floor space, and its simplified management, which can help to speed up such tasks as deploying, reprovisioning, updating, and troubleshooting hundreds of blade servers. In addition, blade servers provide improved performance by doubling current rack density. By integrating resources and sharing key components, costs can be reduced and availability can be increased.

IBM BladeCenter H chassis

The BladeCenter QS21 and QS22 blade servers are supported in the IBM BladeCenter H chassis. The IBM BladeCenter chassis (see the front view shown in Figure 5) delivers high performance, extreme reliability, and ultimate flexibility to even the most demanding IT environments. In 9U of rack space, the IBM BladeCenter H chassis can contain up to 14 blade servers, 10 switch modules, and four power supplies to provide the necessary I/O network switching, power, cooling, and control panel information to support the individual servers.

Figure 5 IBM BladeCenter H front view

The chassis supports up to four traditional fabrics by using networking switches, storage switches, or pass-through devices. The chassis also supports up to four high-speed fabrics for support of protocols such as 4X InfiniBand or 10 Gigabit Ethernet. The built-in media tray includes light path diagnostics, two front Universal Serial Bus (USB) inputs, and a DVD drive.

The front of the IBM BladeCenter H offers the following key features:

- A media tray at the front right, with a DVD drive, two USB v2.0 ports, and a system status LED panel
- One pair of 2,900-watt (W) power modules

  An additional power module option that contains two 2,900-watt power modules is available
- Two hot swap fan modules

  Two extra hot swap fan modules are included with the additional power module option.
- 14 hot swap blade server bays supporting different blade server types

Figure 6 shows the rear view of IBM BladeCenter H chassis.

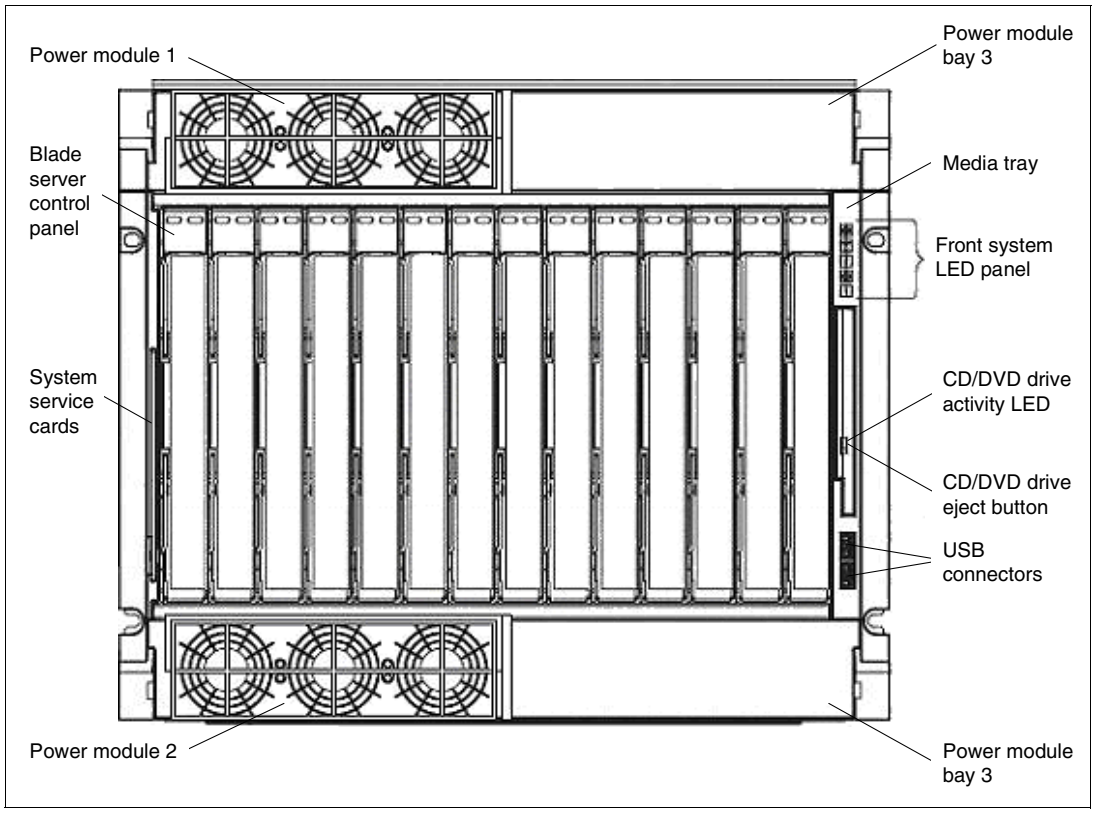

Figure 6 IBM BladeCenter H rear view showing the key features of the chassis

The rear of the IBM BladeCenter H chassis has the following key features:

- Two hot-swap blower modules as standard
- Two hot swap management-module bays, with one management-module as standard
- Four traditional fabric switch modules
- Four high-speed fabric switch modules
- Serial port breakout connector to give direct serial connection to installed blades (for those blades with the functionality)

The IBM BladeCenter H chassis allows for either 14 single-slot blade servers or seven double-slot blade servers. However, you can mix different blade server models in one chassis to meet your requirements.

The IBM BladeCenter H chassis ships standard with one Advanced Management Module. This module provides the ability to manage the chassis and provides the local keyboard video mouse function. The optional redundant Advanced Management Module provides the IBM BladeCenter H with higher levels of resiliency. While in the chassis, the second module is in passive or standby mode. If the active or primary module fails, the second module is automatically enabled with all of the configuration settings of the primary module. This function provides clients with easy remote management and connectivity to the IBM BladeCenter H chassis for their critical applications.

PowerXCell 8i Processor Accelerator Board

PowerXCell 8i Processor Accelerator Board is an industry standard Peripheral Component Interconnect (PCI) Express (PCIe) form factor board that complies with the PCIe 150W Specification. This reference board is double-wide with integrated fan or heat sinks. The PowerXCell 8i Processor Accelerator Board (shown in Figure 7) can function in either root complex or endpoint mode.

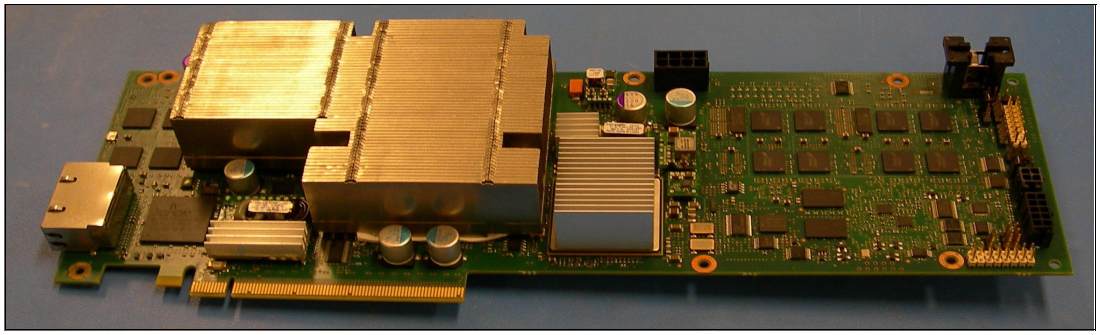

Figure 7 PowerXCell 8i Processor Accelerator Board

Figure 8 shows the components of the PowerXCell 8i Processor Accelerator board.

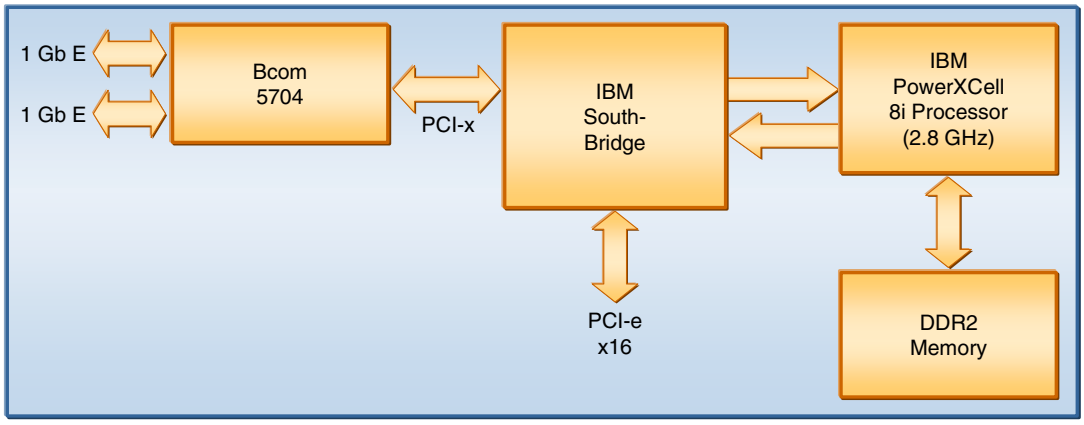

Figure 8 PowerXCell 8i Processor Accelerator Board components

The IBM PowerXCell 8i Accelerator Board is a limited availability offering for OEM engagements. IBM can customize the product to include the OEM client logo, special packaging, special labeling, and documentation. IBM can also provide a number of engineering services, such as those in the following list, to assist OEM clients in their efforts to build a complete solution based on the accelerator board:

- Testing to verify the board in the clients hardware or software environment
- Firmware customization
- Application porting and optimization
- Device driver work
- A range of consulting services

Processor and memory

The PowerXCell 8i Accelerator Board features a 2.8 GHz processor with a 201 GFLOPS single-precision or a 95 GFLOPS double-precision peak performance. It uses standard DDR2 memory, which is available in configurations of 2 GB, 4 GB, and 8 GB.

Input/output processors

The PowerXCell 8i processor supports one PCIe x16 bus, two 1 Gigabit Ethernet, and eight general purpose I/O processors.

Software/ firmware

The firmware that is included with board delivery has a board support package that includes hardware initialization and PCIe initialization or setup. Also included is the Slimline Open Firmware (SLOF), which boots from supported sources, along with PCIe discovery and device tree creation.

Fedora Core 7 has been tested and runs on the PowerXCell 8i Accelerator Board.

The software environment supports single host Linux to single PowerXCell 8i Processor Accelerator Board Linux interaction. Host system to PowerXCell 8i Processor Accelerator Board communications are performed via a Virtual Ethernet Driver over PCIe.

The IBM Software Development Kit (SDK) Version 3.0 is available for program development. Availability is subject to licensing terms and conditions.

Product considerations

This section discusses IBM CBEA products in terms of the following factors:

- Industry considerations
- Performance highlights
- Reliability, availability, and serviceability
- Virtualization
- Software development environment
- Future view

Industry considerations

Industries can have unique workloads that put demands on the processing power and computational capabilities of their systems. Figure 9 on page 13 shows a table with the optimal alignment of the CBEA platforms “best fit” for specific market segments.

Market Segment	QS21	QS22	PowerXCell 8i Processor Accelerator Board
Usage Attributes	• 2 GB memory adequate • SP performance critical • DP performance not critical • Small to large clusters	• > 2 GB memory needed • SP performance important • DP performance critical • Small to large HPC clusters	• PCIe form factor needed • Embedded/OEM applications • Mix of SP/DP requirements • Small systems
Digital Video Surveillance	✓		
Digital Content Distribution	✓		
Electronic Design Automation	✓		
Healthcare and Life Sciences	✓	✓	
Aerospace and Defense (A&D)	✓	✓	✓
Financial Services Sector		✓	✓
Digital Content Creation		✓	✓
Seismic		✓	
Public Sector HPC and A&D IT		✓	
✓ = Best Fit			

Figure 9 Industry considerations for IBM CBEA platforms

Performance highlights

Although the offerings from Mercury, Sony, and IBM have the Cell/B.E. processor, there are differences in the number of SPEs, amount of memory, and the interfaces to the Cell/B.E. processor, leading to differences in performance. Both the Sony PlayStation 3 and the Cell/B.E. technology-based blade allow direct access to the Cell/B.E. processor, while the Mercury Cell Accelerator Board offering only allows access through a host system.

By design, the QS21 and QS22 blade servers have 16 SPEs that are available to applications versus the six SPEs that a PS3 can offer. Therefore, most single-precision and double-precision floating-point benchmarks, such as Fast Fourier Transform (FFT), matrix multiply, and LINPACK (performed by IBM internal benchmarks) should show a much better performance on these blade systems.

Most of these benchmarks are parallel and take advantage of the SPEs that are available on the blade. The QS21 and QS22 blade servers also offer more memory than the PS3. The QS22 blade server has up to 32 GB of memory per blade, and the QS21 blade server has up to 2 GB. With this amount of memory, the input sizes of applications that run on the blades can be much larger than the same applications that run on PS3. The QS22 blade server, with the PowerXCell 8i processor, offers a vastly improved double-precision floating point pipeline, compared to the Cell/B.E processor (the processor in the QS21 and the PS3).

The parallelism of the application and the size of the data that is used are both important considerations when making a decision between the various the CBEA platforms available.

Figure 10 provides design specifications of the QS22, QS21, and PS3 platforms.

CBEA Platforms	QS22	QS21	PS3
Number of processors	2	2	1
SPEs available to an application	16	16	6
Total memory available (maximum in GB)	32	2	0.25
Memory available per chip (maximum in GB)	16	1	0.25
Type of memory	DDR2	XDR	XDR
Peak single precision performance (gigaflops)	460	460	179
Peak double precision performance (gigaflops)	217	42	17

Figure 10 QS22, QS21, and PS3 design specifications

Reliability, availability, and serviceability

The IBM BladeCenter platforms with the Cell/B.E. processor provide a highly efficient way of managing a single hardware, its operating system, and many heterogeneous hardware and software implementations in a single, consolidated, integrated set up. A high level of reliability, availability, and serviceability can be achieved in this environment. It can be realized at two levels: component-level and blade-level.

The component level includes the following features:

- Transparent CPU Hardware error recovery
- ECC for XDR and DDR2 memory
- Cell system buses and interconnects are protected via packet level CRC checks

  All transient errors are recorded and recoverable.
- Memory scrubbing on XDR system memory
- XDR system memory failure isolation for memory errors to a single memory interface (Cell BE-0 or Cell BE-1 attached)
- DDR2 I/O buffer memory failure isolation to a single DIMM
- PCI bus parity

The blade level includes the following features:

- Degraded boot for both XDR and DDR2 memory errors

  XDR memory errors can create holes in the memory map.
- Automatic server recovery and restart
- Environmental monitors and alerts
- System Management Services (SMS) menu support
- Checkstop detection with data logging and automated reboot
- Light path diagnostics, which provide true hardware-based monitoring and alerting

Virtualization

Another important perspective of offering selection is virtualization or resource optimization. This is especially significant if the IT infrastructure of an organization is large and complex with many different hardware and software platforms.

A BladeCenter H chassis allows for either 14 single-slot blade servers or seven double-slot blade servers. The QS21 and QS22 blade servers each only take one single slot. You can mix other IBM POWER™ technology-based or Intel-based blade servers in the remaining 13 slots. This means that you can build a truly integrated environment by creating a heterogeneous network of Windows, Linux, AIX® 5L™, and i5/OS® operating systems, all in a single integrated BladeCenter chassis.

The new BladeCenter QS22 blade server with PowerXCell 8i RHEL Version 5.2 offers industry leading security, auditing, file system, and virtualization capabilities to support your applications.

Software development environment

IBM has released IBM Software Development Kit for Multicore Acceleration Version 3.0, which is referred to as IBM SDK 3.0. The IBM SDK 3.0 is a complete package of tools that can help you create applications for hardware platforms built on the Cell Broadband Engine Architecture. The IBM SDK 3.0 is composed of run-time tools (such as the Linux kernel), development tools, software libraries and frameworks, performance tools, a system simulator, and example source files, all of which fully support the capabilities of the CBEA.

The IBM SDK 3.0 is supported only on RHEL Version 5.1 and 5.2 platforms and is planned to be supported on subsequent releases of RHEL. The IBM SDK 3.0 has been verified on Fedora Core 7 but is not supported by IBM. The IBM SDK 3.0 product package provides access to IBM support and is intended for production purposes. The product package is purchased by using the IBM Passport Advantage® program, while the developer and the extras package are downloadable after an IBM user ID and a password are created. IBM SDK 3.0 for Fedora Core 7 is a development version and is available from IBM developerWorks® at the following address:

http://www.ibm.com/developerworks/power/cell/downloads.html

For the latest information about the IBM SDK 3.0, refer to the following Web address:

http://www.ibm.com/technology/cell/software.html

IBM SDK documents are available from the following Web address:

http://www.ibm.com/chips/techlib/techlib.nsf/products/IBM_SDK_for_Multicore_Acceleration

The IBM SDK 3.0 includes two new tools for application development for the Cell/B.E. processor:

- Data Communication and Synchronization (DaCS), which provides a set of services that ease the development of applications and application frameworks in a heterogeneous multi-tiered (for example, memory-hierarchy) system
- Accelerator Library and Framework (ALF), which provides a programming environment for data- and task-parallel applications and libraries

The IBM SDK 3.0 includes an Eclipse-based integrated development environment (IDE), libraries and frameworks, performance tools, and example code. In addition, the IBM XL

C/C++ compiler and IBM XL Fortran compiler have been optimized for Cell/B.E. processor and PowerXCell 8i processor code development.

The RHEL operating system, the IBM SDK 3.0, and the IBM compilers have been closely integrated to make it easier than ever to leverage the power of the PowerXCell 8i processor.

Figure 11 shows the customer software support matrix.

Deployment Platform	IBM SDK 3.0 (3.0.0.3) Support Matrix	
	Forum Support Developer Version (develperWorks)	Formal Support GA Version (800-IBM-SERV)
IBM BladeCenter QS22		
RHEL 5.2	Yes	Yes
RHEL 5.1	No	No
Fedora 7	IBM SDK 3.0 only *	No
IBM BladeCenter QS21		
RHEL 5.2	Yes	Yes
RHEL 5.1	Yes	Yes
Fedora 7	IBM SDK 3.0 only *	No
IBM PowerXCell 8i Accelerator Board		
RHEL 5.2	No	No
RHEL 5.1	No	No
Fedora 7	No	No

* The IBM SDK fixpack (3.0.0.3) is not available for the trial version of the SDK so forum support is only available for IBM SDK 3.0.

Figure 11 Customer software support matrix

Future view

IBM plans to continue to support the gaming industry with the Cell/B.E. platform as well as to enhance the CBEA processors (as illustrated in Figure 12 on page 17) by continually increasing the performance and capabilities of these products. Major enhancements to the CBEA processor family are driven by IBM plans for higher performance blades for use in both homogeneous and hybrid clusters that are being deployed for the execution of a wide range of high performance computing workloads.

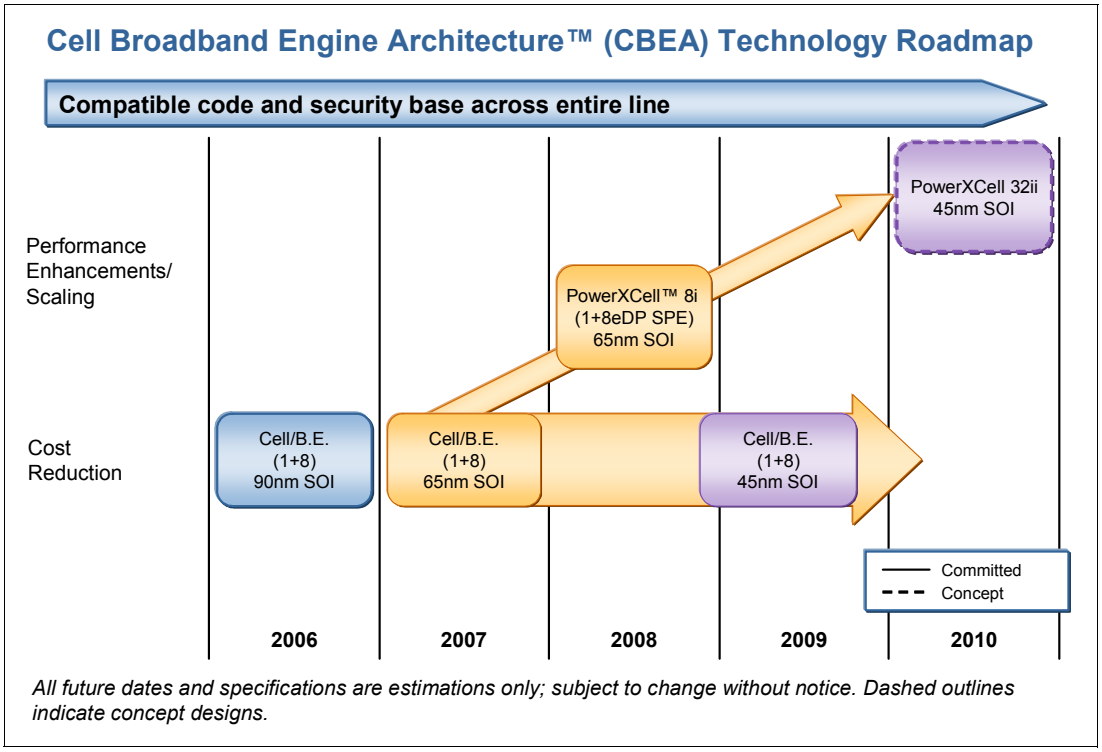

Figure 12 Cell Broadband Engine Architecture technology roadmap

Summary

There are multiple solutions for using CBEA technology. The paper has discussed IBM platforms and provided information about the following key areas:

- Industry considerations
- Performance highlights
- Reliability of stabilized environment
- Availability of hardware resources including processors and applications
- Serviceability of hardware resources and maintenance of software resources
- Virtualization of your heterogeneous IT resources
- Software development environment
- Adaptation of future technology and products

With this information, you have a better understanding of the IBM CBEA products and how they can meet your needs.

Appendix: Non-IBM platforms

A wide variety of products are available based on the CBEA, from consumer products to HPC systems, with IBM focusing on HPC systems. This appendix introduces a sampling of non-IBM CBEA products.

Mercury Cell Accelerator Board

The Mercury Cell Accelerator Board is a PCI Express accelerator card based on the Cell/B.E. processor. This solution offers Mercury customers the advantages of the Cell/B.E. processor in a hosted environment via a workstation.

For more information about the Mercury Cell Accelerator Board, refer to the following Web page:

http://www.mc.com/products/productdetail.aspx?id=2590

Mercury 1U Dual Cell-Based System 2

The Mercury 1U Dual Cell-Based System 2 is a solution based on the Cell/B.E. processor. The 1U Dual Cell-Based System 2 has two Cell/B.E. processors. Each processor runs at 3.2 GHz.

For more information about the Mercury 1U Dual Cell-Based System 2, refer to the following Web page:

http://www.mc.com/products/productdetail.aspx?id=10596

Sony PlayStation 3

Sony PlayStation 3 (PS3) is the third home video game console produced by Sony Computer Entertainment and a successor to the PlayStation 2 in the PlayStation series. Although the PS3 can be used as a computational platform, it uses six SPEs compared to the full eight SPEs of the Cell/B.E. processor that are used in many system offerings. In addition, PS3 comes with 256 MB of RAM.

For more information about Sony PlayStation 3 and other Sony products, refer to the following Web site:

http://www.sony.com/

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