

The IBM Software Development Kit (SDK) for Multicore Acceleration



Highlights

- **Port and optimize applications and algorithms for the Cell Broadband Engine architecture**
- **Facilitate programming for multi-core and multi-processor architectures**
- **Shorten software development cycles**

Robust and easy to use

Systems based on multi-core microprocessors offer outstanding processing performance over conventional processors. Those companies willing to modify their applications to take full advantage of the Cell Broadband Engine™ (Cell/B.E.™) architecture can benefit from these high-performance processors to leap ahead of their competitors.

To help you optimize your applications quickly using your existing software development staff, IBM has developed a software development kit that facilitates multi-core programming.

IBM® Software Development Kit (SDK) for Multicore Acceleration V3.x¹ contains the essential tools required for developing programs for Cell/B.E.-based servers—the IBM BladeCenter® QS21 and the BladeCenter QS22—with libraries, frameworks and application development tools.

IBM SDK for Multicore Acceleration is a highly reliable and easy-to-use development tool kit with IBM warranty and support. It provides debugging tools, performance-tuning tools and an integrated development environment, all of which run on enterprise-level Linux®. Using this SDK, you can plug in third-party ISV libraries, helping your software ecosystem to integrate and grow.

The target execution platform for applications created using SDK V3.1 is the BladeCenter QS21 and QS22. The target Linux distribution is a Red Hat Enterprise Linux 5 operating system. A minimum version level of 5.2 is required for BladeCenter QS21 and QS22.

¹ For detailed technical specifications, refer to ibm.com/technology/cell/software.html

The IBM SDK for Multicore Acceleration includes the following components:

- *Eclipse-based integrated development environment (IDE)*
- *Development libraries and frameworks*
- *GNU toolchain*
- *Performance tools*
- *Example codes and tutorials*

Eclipse-based IDE

The Eclipse-based IDE is a tool for building, compiling and debugging applications using the compilers, programming model frameworks and analysis tools of the SDK.

Development libraries and frameworks

The Accelerated Library Framework (ALF) provides a programming environment for data and task parallel applications and libraries. The ALF API provides library developers with a set of interfaces to simplify library development in heterogeneous multi-core systems. Library developers can use our provided framework to offload

the computationally intensive work to the accelerators. More-complex applications can be developed by combining the several-function offload libraries.

The Data Communication and Synchronization (DaCS) library

provides a set of services that facilitate the development of applications and application frameworks in a heterogeneous multi-tiered system (for example, memory hierarchy). The DaCS services are implemented as a set of APIs that provide a layer of architecture neutrality for application developers in a variety of multi-core memory hierarchy systems.

BLAS (Basic Linear Algebra

Subroutines) is an API for commonly used linear algebra operations in high-performance computing (HPC) and other scientific domains. It is widely used as the basis for other high-quality linear algebra software such as LAPACK (Linear Algebra Package),

which is also supported by the SDK.

The SDK implementation of BLAS and LAPACK provide all of the functions for the PPE, and the most commonly used single-precision and double-precision routines are performance optimized using SPE acceleration.

The FFT (Fast Fourier Transform) library

provides one-dimensional (1D) and two-dimensional (2D) FFTs on vectors and matrices respectively. The 1D FFT is for single precision only but can support very large vectors up to 131072 elements. The 2D FFT is supported for both single-precision and double-precision matrices up to 2048 by 2048.

Standardized SIMD math libraries are provided for the PPE Vector and SIMD Multimedia Extensions and for the SPEs. By computing multiple results at one time, SIMD math functions help programmers obtain much higher performance from their PPE and SPE programs than would be possible from a corresponding traditional scalar math library.

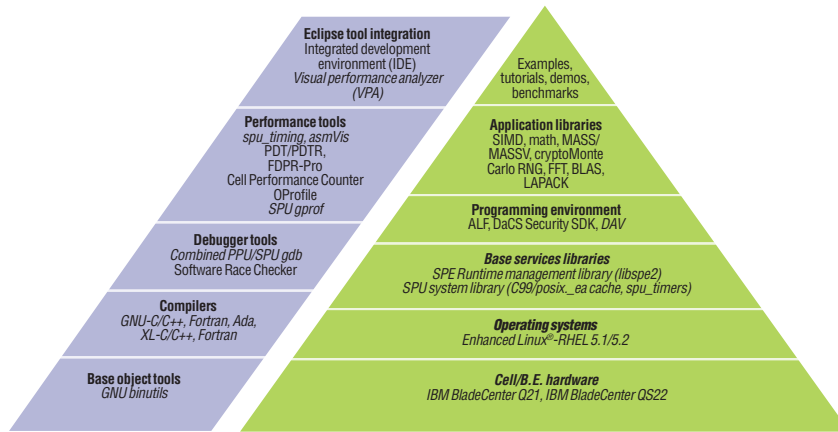
A Random Number Generator and Transform library provides different types of random-number generators and distributions for use in Monte Carlo simulations and other types of applications that require random numbers. Commonly used generators such as Mersenne Twister and Sobol are available for both PPE and SPE applications.

GNU toolchain
 The GNU toolchain provides core functionality for program execution (in overlays and library support), debugging, GNU C/C++ compiler functionality and performance enhancements. IBM has also developed this SDK with increased programming language support for SPEs.

Performance tools
FDPR-Pro offers tools for performing feedback-directed optimizations. This component is a performance-tuning utility used to improve the execution time and the real memory utilization of user-level application programs, based on their run-time profiles.

Performance Debugging Tool (PDT) is a tool that provides the means to analyze the execution of Cell/B.E. applications to identify performance bottlenecks and optimize code.

Additional offerings to help enhance Cell/B.E. programming
 The SDK also includes example source code with samples, libraries, workloads and prototype code. These demonstrate the use of tools, libraries and hardware features. There is also a tutorial that walks a user through the creation of an application.



IBM Software Development Kit for Multicore Acceleration (items in italics are not included in the SDK)

An unsupported development version of the IBM SDK is available for the Fedora 9 operating system. This development version is available at the IBM developerWorks® Web site.

Also available separately from the IBM SDK: the IBM XL C/C++ for Multicore Acceleration for Linux and IBM XL Fortran for Multicore Acceleration for Linux compilers. These optimized compilers improve the process for creating applications for the Cell/B.E. environment. The compilers include specific optimization features that are tailored to exploit the unique performance capabilities of Cell Broadband Engine processors, including specialized data types and highly optimized built-in functions.

Inclusive of these optimization features is the automatic Single Instruction Multiple Data (SIMD) vectorization of program code. In addition, the compilers include automatic code overlay support, which helps

SDK v3.1 component descriptions	Passport Advantage part number
Physical Media Pack	BH03MEN
Toolkit Concurrent User License and Maintenance (1 yr)	D61JWLL
Toolkit Concurrent User Annual Maintenance Renewal (1 yr)	E042CLL
Toolkit Concurrent User Maintenance Reinstatement (1 yr)	D61JXLL
Runtime License and Maintenance (1 yr)	D61JULL
Runtime Annual Maintenance Renewal (1 yr)	E042BLL
Runtime Maintenance Reinstatement (1 yr)	D61JVLL

developers create SPE programs that would otherwise be too large to fit in the local memory store of the SPEs.

Ordering information

IBM SDK for Multicore Acceleration is available for purchase through IBM Passport Advantage®, IBM sales representatives and IBM Business Partners. Using Passport Advantage, clients can acquire licenses, software maintenance and renewals online. To start using Passport Advantage visit: ibm.com/software/passportadvantage

Red Hat Enterprise Linux 5.x

The IBM SDK for Multicore Acceleration is closely aligned with the distribution of Red Hat Enterprise Linux—the Linux kernel and libSPE are enabled for Cell/B.E. environments. Red Hat Enterprise Linux is supported for all IBM server and software brands that work with the Linux operating system. Having Cell/B.E. technology integrated into Red Hat Enterprise Linux is in line with the IBM cross-brand Linux support strategy. In addition, the alignment provides further opportunities for IBM Linux software products, such as DB2®, Rational® and WebSphere® programs, running on the Cell/B.E. platform.

For detailed technical specifications, refer to ibm.com/technology/cell/software.html



The toolkit is used for development, test, debug and optimization of software for Cell Broadband Architecture processors, and the Runtime includes the software components of an execution environment for applications.

SDK product summary

The toolkit is typically purchased for the development phase of your project and is sold on a per-developer (“Concurrent User”) basis. The Runtime is typically purchased for the deployment phase of your project and is sold on a per-processor basis. See value unit licensing strategy for more information:

ibm.com/software/lotus/passportadvantage/pvu_licensing_for_customers.html

For more information

To learn more about the IBM SDK for Multicore Acceleration, contact your IBM representative, IBM Business Partner, or visit: ibm.com/technology/cell/software.html

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