CELL Programming Workshop
Welcome Session

27 June 2006
Cupertino, CA, USA
Cell Ecosystem Solutions Enablement

Welcome to the Cell Broadband Engine Programming Workshop!

Workshop Objectives

- **At the end of this workshop you should know**

  - The Cell Broadband Engine (CBE) architecture, software model, and software development environment

  - How to write programs that exploit the performance of the CBE

Trademarks - Cell Broadband Engine ™ is a trademark of Sony Computer Entertainment, Inc.

Schedule

Session	Time	Topics
00	8:15-8:45	Registration (Tanaz Sowdagar)
01	8:45-8:55	Welcome (Duc Vianney)
02	8:55-9:15	Cell overview (Duc Vianney)
03	9:15-10:00	Cell architecture (Duc Vianney)
	10:00-10:15	Break
04	10:15-11:00	Cell software model (Max Aguilar)
05	11:00-11:45	Cell software development environment (Max Aguilar)
06	11:45-12:00	Build cell-based partnerships with IBM (Fred Christensen)
	12:00-1:00	Lunch
07	1:00-1:45	Running your first cell program - hello world (Max Aguilar)
08	1:45-2:30	SIMD programming (Hema Reddy)
	2:30-2:45	Break
09	2:45-3:30	Cell communication - DMA and mailboxes (Hema Reddy)
10	3:30-4:15	Using the SDK sample programs - euler (Hema Reddy)
	4:00-4:15	Break
11	4:15-5:00	Cell programming tips and techniques (Hema Reddy)
12	5:00-5:30	Closing session (Duc Vianney)

So let's get started!

Where to get CBE information?

Web Sites

- **Cell resource center at developerWorks**
  - http://www-128.ibm.com/developerworks/power/cell/
- **Cell developer's corner at power.org**
  - http://www.power.org/resources/devcorner/cellcorner/
- **The cell project at IBM Research**
  - http://www.research.ibm.com/cell/
- **The Cell BE at IBM alphaWorks**
  - http://www.alphaworks.ibm.com/topics/cell
- **Cell BE at IBM Engineering & Technical Services**
  - http://www-03.ibm.com/technology/
- **IBM Power Architecture**
  - http://www-03.ibm.com/chips/power/
- **Cell BE documentation at IBM Microelectronics**
  - http://www-306.ibm.com/chips/techlib/techlib.nsf/products/Cell_Broadband_EngineCell
- **Linux info at the Barcelona Supercomputing Center website**
  - http://www.bsc.es/projects/deepcomputing/linuxoncell/

Standards and Documentation at developerWorks
http://www-128.ibm.com/developerworks/power/cell/downloads_doc.html

- **Cell Broadband Engine Programming Handbook**
  Get information for developing applications, libraries, middleware, drivers, compilers, or operating systems for the Cell Broadband Engine processor.

- **Cell Broadband Engine Hardware Initialization Guide**
  This document describes the sequences for initializing a Cell Broadband Engine processor, from Power-On Reset (POR) through calibration of the memory and I/O interfaces and the PowerPC Processor Element (PPE) firmware.

- **Cell Broadband Engine Linux Reference Implementation Application Binary Interface Specification**
  This document defines a standard interface that allows compiled objects to be linked and run on the Linux Reference Implementation for the Cell Broadband Engine without recompilation or recoding.

- **Cell Broadband Engine Registers**
  This document describes the CBE memory-mapped I/O registers used by the PowerPC Processor Element (PPE), the Synergistic Processor Elements (SPEs) and other units.

Standards and Documentation at developerWorks
http://www-128.ibm.com/developerworks/power/cell/downloads_doc.html

- **Cell Broadband Engine Architecture V1.0**
Like the Power Architecture, but different -- the CBE Architecture builds upon knowledge contained in the Power Architecture "books" and describes the app-level User Mode Environment (UME) and the OS-level Privileged Mode Environment (PME) in astonishingly rich detail.

- **Synergistic Processor Unit (SPU) Instruction Set Architecture V1.0**
Somewhere between a general-purpose processor and special-purpose hardware lies the Cell SPU: designed to provide leadership performance in game, media, and broadband applications, this document describes the Instruction Set of the Synergistic Processor Unit (SPU). Get to know *all* of its instructions.

- **SPU Application Binary Interface Specification V1.4**
Including register usage and calling conventions, data type sizes and alignment, low-level system and language binding information, information on loading and linking, and coding examples, this specification defines the system interface for SPU-targeted object files to help ensure maximum binary portability across implementations.

- **SPU Assembly Language Specification V1.3**
Program directly to the SPU Instruction Set! This specification will prove an indispensable aid in your efforts as it takes you on a carefully-worded journey describing SPU assembly-level syntax and machine-dependent features for the GNU assembler (but serves as an example specification for other SPU assemblers as well).

Standards and Documentation at developerWorks
http://www-128.ibm.com/developerworks/power/cell/downloads_doc.html

- **SPU C/C++ Language Extensions V2.1**
  Unleash the full processing power of the SPUs. This specification extends the C and C++ languages with a rich set of vector data types, several programmer directives, and an extensive set of vector intrinics.

- **PowerPC Architecture Book, Version 2.01**
  This three-volume set (pdf), Version 2.01, defines the instruction and registers used by application programs, the storage models, privileged facilities, and related instructions for the POWER4 and POWER4+ processors.

- **PowerPC Architecture Book, Version 2.02**
  This three-volume set (pdf), Version 2.02, defines the instruction and registers used by application programs, the storage models, privileged facilities, and related instructions for the IBM POWER5 processor family.

- **PowerPC Microprocessor Family: Vector/SIMD Multimedia Extension Technology Programming Environments Manual Version 2.06c**
  Create software that is compatible across the family of 64-bit PowerPC processors, which have implemented the Vector/SIMD Multimedia Extension technology -- from the 970FX, to the Cell Broadband Engine -- and beyond.

IBM Full-System Simulator – XLC – Software Sample at alphaworks http://www.alphaworks.ibm.com/topics/cell

- **IBM Full-System Simulator for the Cell Broadband Engine Processor**

  – A full-system simulation infrastructure and tools for the Cell Broadband Engine processor.

- **XL C Alpha Edition for Cell Broadband Engine Processor**

  – A high performance C compiler for the IBM Cell Broadband Engine processor.

- **IBM Cell Broadband Engine Software Sample and Library Source Code**

  – Working examples and libraries that demonstrate programming techniques and performance of Cell Broadband Engine Architecture.

Linux on Cell at the Barcelona Supercomputer Center
http://www.bsc.es/projects/deepcomputing/linuxoncell/cbexdev.html

- **Cell Broadband Engine SDK for x86 installation script and open source packages**

  – The cross-hosted Cell Broadband Engine development environment contains packages from several sources. This page includes a primary install/build script for the Cell Broadband Engine SDK, an SPU/PPU toolchain package, a Fedora Core 4 for PowerPC run-time package for the GNU/Linux on Cell simulation environment, Cell BE kernel patches for the 2.6.14 Linux Kernel, and the source code for the SPE run-time management library.

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- **GCC Toolchain**
  - Contains the GCC compiler for the SPE implemented by SCE which also supports the standards defined in the SPU C/C++ Language Extensions V2.1, SPU Application Binary Interface Specification V1.4, and Synergistic Processor Unit (SPU) Instruction Set Architecture V1.0 documents (previously released). The associated assembler and linker additionally support the SPU Assembly Language Specification V1.3. The assembler and linker are common to both the GCC and XL C compilers.

- **Linux Kernel Patch**
  - This set of patches to the Linux operating system provides services needed to support the hardware facilities of the Cell Broadband Engine microprocessor.

- **Fedora Core 4 links**

- **SPE Management Library**
  - Contains an SPE thread programming model for CBEA applications.

- **SDK Installation Script**
  - The install script grabs the RPMs and builds the CBE programming environment

- **Linux on Cell**
  - Provides information about how to enable Linux on CBE platforms.