

Real-time Supercomputing and Technology for Games and Entertainment

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Collaborative Innovation: Gaming Triple Crown



All IBM designed processors! All Power Architecture[™] based!

SPECINT





Hybrid

Multi-Core

Microprocessor Trends

- Single Thread performance power limited
- Multi-core throughput performance extended
- Hybrid extends performance and efficiency



Performance

Power

Single Thread



Traditional (very good!) General Purpose Processor



IBM Power5+



* Cell Broadband Engine is a trademark of Sony Computer Entertainment, Inc.



Memory Managing Processor vs. Traditional General Purpose Processor



AMD

Intel

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Cell Broadband Engine Architecture[™] (CBEA) **Technology Competitive Roadmap**



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Cell Broadband Engine[™] Blade – The first in a line of planned offerings using Cell Broadband Engine technology Performance



All future dates and specifications are estimations only; Subject to change without notice.

Cell BE Roadmap Version 5.1 7-Aug-2006

Cell BE based Systems: SCEI, IBM, Mercury, ...















(NY Times Sep. 7 2006)

I.B.M. to Build Supercomputer Powered by Video Game Chips

By JOHN MARKOFF

Published: September 7, 2006

- SAN FRANCISCO, Sept. 6 The Department of Energy said Wednesday that it had awarded I.B.M. a contract to build a supercomputer capable of 1,000 trillion calculations a second, using an array of 16,000 Cell processor chips that I.B.M. designed for the coming PlayStation 3 video game machine.
- The initial phase of the contract will be for \$35 million. There will be two more construction phases through the completion and installation of the system in 2008. The total cost is expected to be \$110 million.
- The choice of the Cell chip, which was initially designed with Sony and Toshiba for video game and animation applications, is indicative of how much the computer industry has been transformed in the last decade. It is now being driven largely by technologies originally intended for home and consumer applications.



Roadrunner Compute Rack



System Software Stack





early 100 million units over the likely five-year lifespan of BE one of the most successful microprocessors in "It was originally conceived as the microprocessor to

We chose the Cell BE as the best high-performance embedded processor of 2005 because of its innovative design and future potential....Even if the Cell BE accumulates no more design wins, the PlayStation 3 could drive sales to nearly 100 million units over the likely five-year lifespan of the console. That would make the Cell BE one of the most successful microprocessors in history.

15



-- Forbes

ICROPROCESSOR

Reed Electronics Group

/ THE INSIDER'S GUIDE TO MICROPROCESSOR HARDWARE _______

Cell Processor Isn't Just for Games.

Innovative Chip is best high-performance embedded processor of 2005





"It was originally conceived as the microprocessor to power Sony's [PS3], but it is expected to find a home in lots of other broadbandconnected consumer items and in servers too." -- IEEE Spectrum



Interactive Terrain Rendering Engine on Cell BETM Barry Minor, Gordon Fossum, Van To, IBM Satellite Input Data



TRE Rendered Output





RapidMind [™]/RTT

Real-time Ray Tracing

RTT AG provides a highperformance, real-time ray tracer, RealTrace, as part of DeltaGen, their software for complex 3D visualization. A leading global provider of visualization in the automotive, aerospace and consumer goods sector, RTT created the ray tracer using the RapidMind Development Platform running on graphics processing units (GPUs). This application was then demonstrated at SIGGRAPH 2006 on the Cell Broadband Engine, achieving excellent performance.





iRT: An Interactive Ray Tracer for the Cell BE[™] Processor Barry Minor, Mark Nutter, Joaquin Madruga, IBM





Last Year at Supercomputing ...





- During SC2005 in Seattle IBM and Fraunhofer showcase the first Cell based Cluster with Fraunhofers record breaking visualization software PV-4D. Interactive Volume rendering of a beating hearth and of a filling process are shown with high resolution and in stereo.
 - Dr. Carsten Lojewski e.a.









ADVANCED FEATURES FOR THE PS3

While the Cell microprocessor does most of the calculation processing of the simulation, the graphic chip of the PLAYSTATION 3 system (the RSX) displays the actual folding process in real-time using new technologies such as HDR and ISO surface rendering. It is possible to navigate the 3D space of the molecule using the interactive controller of the PS3, allowing us to look at the protein from different angles in real-time.

.... we will likely be able to attain performance on the 100 gigaflop scale per computer.

Courtesy Dr. V. S. Pande, folding@home Distributed Computing Project, Stanford University



www.digitalmedics.de

Multigrid Finite Element Solver. First of its kind technology with Cell BE™ processing power.

Researchers at Digital Medics and the University of Dortmund developed the first ever Finite Element solver on the revolutionary Cell BETM microprocessor manufactured by STI.

The solver is capable of computing dynamic non-linear problems from solid mechanics using a Newton-Krylov Multigrid algorithm with unprecedented performance. For example, on medium- to large-scale problems, the solver reached a sustained floating-point performance of **52 GFLOPS** per second on a single processor (using all 8 SPUs at once). Possible applications for the solver are in biomechanics, classical civil and mechanical engineering. Work on a fluid-dynamics solver has also been started and is expected to be finished in the next two months.



Courtesy Dr. Martin Wawro



Common Linux-based SDK For Cell BE from Game Consoles to Supercomputers



Cell BE Software Development Kit (SDK) Version 1.1

GNU Toolchain

IBM XL C/C++ Compiler

IBM Full System Simulator

Sysroot Image for System Simulator



Bergen Horrofe

S. S.a

Dawn of the age of interactivity

Gaming

- Highly interactive simulations
- A major driver of technology
- High-Performance Computing
 - Experimentation in real-time
- On the Web
 - Transition to interactive virtual 3D environments
- In the Living Room
 - TV won't be the same a few years from now

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