Unleashing the Power of the Cell Broadband Engine

David A. Bader
Mission: grow the community of Cell Broadband Engine users and developers

• Fall 2006: Georgia Tech wins competition for hosting the STI Center

• First publicly-available IBM QS20 Cluster

• 200 attendees at 2007 STI Workshop

• Multicore curriculum and training

• Demonstrated performance on
  – Multimedia and gaming
  – Scientific computing
  – Medical applications
  – Financial services

http://sti.cc.gatech.edu

David A. Bader, Director
Cell Libraries: FFT and JPEG2000

- **FFTC: Fastest Fourier Transform on the Cell/B.E.**
  - 1-Dimensional single precision DIF-FFT optimized for 1K-16K complex input samples
  - Parallelize & optimize computation of a single FFT computation
  - Design high performance synchronization barrier using inter-SPE communication
  - Demonstrated superior performance of 18.6 GFlop/s for 8K complex input samples.

- **JPEG2000 on the Cell/B.E.**
  - Optimize coding/decoding by data decomposition / data alignment / vectorization
  - Demonstrated average speedup of 3.1 over Intel 3.2 GHz Pentium-4

The source code is freely available from our CellBuzz project in SourceForge [http://sourceforge.net/projects/cellbuzz/]
Cell Libraries: ZLIB and MPEG-2

- **ZLIB Data compression & decompression library**
  - Vectorize compute intensive kernels and parallelize to run on multiple SPEs
  - Extend the gzip header format while maintaining compatibility with legacy gzip decompressors
  - Demonstrated **speedup of 2.9** over high-end Intel Pentium-4 system

- **MPEG-2 Video Decoding**
  - First parallelization of a multimedia application on Cell/B.E.
  - Demonstrated a **speedup of 2** over Intel 3.2GHz Xeon using 8 SPEs. **Speedup of 10.55** over a PPE-only implementation

- Optimizing **NAS Parallel Benchmarks** on Cell/B.E. using the IBM XL C/C++ multicore acceleration single source compiler (SDK 3.0)

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Cell Applications: Financial Modeling

**Lets Talk about Money!**

Financial Modeling on the Cell/B.E.

- **Objective:** Demonstrate a competitive edge of the Cell/B.E. for Financial Services.
- **European Option Pricing.** Black - Scholes equation: \( dS(t) = \mu S(t)dt + \sigma S(t)dW(t) \)

- **Collateralized Debt Obligation (CDO) pricing**

- **Monte Carlo simulation**

- **Performance results:**
  - Speedup of 20 of our optimized implementation of Mersenne Twister random number generator on Cell/B.E. over most commodity processors.
  - European Option Pricing:
    - 1.5x over optimized CUDA implementation for NVIDIA G80.
    - 2x over optimized implementation for RapidMind on Cell.
    - Double precision is essential.