Large Matrix-Matrix Multiply on PS3 clusters

15 September 2010

Mark Barnell, AFRL RITB
Mark.Barnell@rl.af.mil

Dennis Fitzgerald, ITT
dennis.fitzgerald@itt.com

Description

- **Matrix-Matrix multiplication of large matrices**
- **> 100k x 100k**
- **Parallelized over a number PS3s**
- **Maintained near peak performance on each Cell BE**

Challenges

- **Near peak computation rate on the Cell BE for small matrix sizes**

- **Data and thread coordination between PowerPC and Cell BE with near zero overhead**

- **Balanced IO with Cell BE's peak FLOPS to keep PS3 computationally busy**

- **Network performance sufficient to deliver enough data to many PS3s**

Approach

- **Core MM algorithm > 99% efficient (128x128)**
  - **Daniel Hackenberg – Dresden**
- **PowerPC code to coordinate larger rectangular matrices – Miriam Leeser – Northeastern**
- **Multi-buffering & semaphors to reduce wait time**
- **Blocked sub-matrix distribution with data sized to balance compute and IO**

Results

Matrix-Matrix Mutiply GFLOPS

Legend:
- 48k x 48k
- 48k x 240k
- PS3 Max GFLOPS (153)