Applicability and performance of Cell BE as a mobile GIS high performance platform

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Agenda

- Current computational landscape
- Maturing of HPC
- Mobility with high performance
- Introducing Cell Broadband Engine
- Cell BE for mobility
- Cell BE and GRASS
Current GIS mobility landscape

- Data collection on field
- Data Processing-Off field
- Framework
  - Mobile nodes
  - Communication infrastructure
  - Computational hubs
- Reliability and topological stability questionable

Centralized computing
Future of GIS and computing

- Future applications – resource and computation hungry
- Relevance of GIS expanding
- Community based computing challenges current paradigms
- Mobility gaining importance
- Computation amalgamating with mobility
GIS computation timeline

GIS
Computation
Increased computational requirements
Sequential speedups not sufficient
High performance computing
High performance computing

- Current scenario
  - Natural progression of current computing
  - Accepted by Computing community
  - Corresponding wide spread haste

- Practical issues
  - Non Trivial
  - Highly dependent on architecture
  - Research community trying to bridge the gap
GIS and High Performance computing

- Traditional computation model -> Centralized computing
- High performance computing -> Clusters
- Massive transition in HPC
  - Custom Hardware - GPU and Cell BE
  - Massive performance to cost ratio
  - Very good performance to power ratio
- Bottlenecks
  - Legacy software and practices
Parallel software

- Parallel software development non trivial
  - Hardware Architecture dependent
    - Architectures evolve
    - Software plays catch up
  - No standard parallel application development standard
    - OpenCL awaiting acceptance
Parallel software cont...

- Algorithms in sequential != parallel
- Parallel algorithms dependent on architecture
- Parallel algorithms don’t work well on all architectures
- Research required
Mobility for GIS

- Features of mobile GIS:
  - Creation
  - Access
  - Processing
  - Storage
  - Communication
- Requirement for processing increasing over time
- Bottlenecks
  - High Power consumption
  - Low battery life
Mobility for GIS....

- Practical features
  - Capabilities
  - Price
  - Size
  - Weight
  - Battery Life
Advantages of amalgamation of HPC and mobility

- Real time computation
- On-field analysis of data
- Reduction of response time
- Suitable for disaster prevention and management
  - Communication not a bottleneck
  - Efficient and fast response
  - Real time updates possible
- Can nurse expansion of role of GIS
CELL Broadband Engine

- General purpose computing platform
- Jointly developed by Sony, Toshiba and IBM
- Features for mobility
  - Capabilities - substantial
  - Price - low
  - Size - compact
    - Bigger than handhelds
  - Weight - light
  - Battery Life - low power design

- Computing hub of playstation
  - Also found in Blade servers and roadrunner supercomputer
General features of Cell BE

- 8 low power cores
- One PowerPC core
- High Memory bandwidth
- High computational throughput
- Architecture designed to scale beyond known bottlenecks
- Low power cores
Open Source and GIS

- GRASS GIS favoured open source distribution
- Well documented sequential code
- Large body of applications
- Stable performance across sequential platforms
- Starting point for our work
Few Parallelized GRASS applications

- **Mapcalc**
  - Fundamental set of application
  - Building block for multiple applications
  - Embarrassingly parallel application
  - Speedup of 5-6X over a sequential implementation

- **Terracost**
  - Speedup gained 6X over sequential.
Thank You

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