Boost Your Productivity with GPGPUs and IBM Platform Computing Software

NVIDIA GTC 2013
Chris Porter, IBM
Agenda

• IBM Platform Computing offerings

• GPGPU Adoption in the HPC Market

• GPGPU Scheduling & Management
  - IBM Platform Computing Solutions for GPGPUs
  - Benefits from Intelligent GPU Scheduling & Management
  - Use Case Examples

• Summary
IBM PLATFORM COMPUTING OFFERINGS
IBM Platform Computing
*The leader in cluster, grid and HPC cloud management software*

- Acquired by IBM in 2012 as part of mainstream Technical Computing strategy
- 20 year history delivering leading workload and resource management software for technical computing and big data/analytics environments
- 2000+ global customers including 23 of 30 largest enterprises
- Market leading scheduling engine with high performance, mission-critical reliability and extreme scalability
- Comprehensive capability from ready-to-deploy complete cluster systems to large global grids to HPC clouds
- Large ISV and global partner ecosystem
- Global services and support coverage
IBM Platform Computing offerings

**Platform LSF Family**
- Scalable, comprehensive workload management suite for heterogeneous compute environments
- Unmatched experience through market share
- Powerful multi-policy scheduling engine
- Unmatched scalability through high end accounts
- Unmatched breadth of offering due to extent of add-ons

**Platform HPC for System x**
- Simplified, integrated, purpose-built HPC management software integrated with systems
- All-in-one integrated solution with leading web interface
- Applicable to the smallest of clusters
- Leverages Platform LSF technology base
- Hardware bundled for turnkey purchasing and deployment

**Platform Symphony Family**
- High-throughput, low-latency compute and data intensive analytics applications
- Leading experience due to 50%+ major investment banks as customers (translates to other industries)
- High scalability and better application performance due to fast, low latency processing (sub millisecond)
- Proven business model for sharing grid infrastructure
- Both compute and data intensive applications

**Platform Cluster Manager**
- Provisioning and management of HPC clusters
- Scalable offerings to simplify process of deploying and managing small clusters to global HPC clouds
- Broad heterogeneous support enables managing broad technologies and multiple workload managers
- Enables multi-tenant HPC clouds
The Application Accelerator Storm

• GPU adoption is increasing
  – 53 systems on the Top500 released in Nov, 2012 are using GPGPUs
  – GPGPUs are penetrating both high-end and mainstream HPC

• Nvidia is leading the accelerator race
  – 100’s of K’s of trained CUDA developers worldwide
  – 50 systems powered by Nvidia on the latest Top500 list

• Other accelerator technologies are emerging
  – Intel: Xeon Phi Coprocessor
  – AMD: FireStream
GPGPU ADOPTION IN THE HPC MARKET
Market Landscape: Technical Applications are Exploding

**Adoption Drivers**
- Creativity
- Productivity
- Visualization
- Quality

**Technical Applications**
- CAE
- GeoScience
- Financial
- Life-Sciences
- EDA
- Government & Education

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The Big Buzz in HPC: Hybrid Computing

• Hybrid Computing: CPUs and GPUs working together

When do I use them?
What is the ROI?
How do I schedule jobs to them?
How to maximize utilization, various published benchmarks showing dramatic performance increases?

• Applications Taking Advantage Of GPUs
  – Life Sciences
    • Unipro UGENE, Agile Molecule, many others
  – Financial Services
    • Volmaster FX, ClusterTech Financial Library, many others
  – Manufacturing
    • Fidesys, Ansys, 3ds, many others
  – Oil and Gas
    • Acceleware Seismic Solvers, many others
GPU SCHEDULING & MANAGEMENT
What do Intelligent GPU Scheduling and Management Bring to You?

• Improved application performance by allocating GPU suitable workloads on those resources and free up CPUs for other types of workloads.
• Reduced infrastructure cost by maximizing cluster utilization.
• Simplified system management via easy to use GUI and timely alerts.
• Increased productivity for administrators and application developers.
GPUs: Schedule, Monitor & Manage

• **DEPLOY:** Quickly deploy workload to GPU resources
  – Easy job submission to GPUs in a cluster via CUDA job submission wrappers
  – Install CUDA across a cluster is a couple of clicks

• **MANAGE:** Easily manage heterogeneous clusters
  – Deploy & manage both CPU & GPU resources in the same cluster
  – Remotely manage & view the status of your jobs

Take immediate advantage of the exceptional HPC performance provided by GPUs
GPUs: Schedule, Monitor & Manage

- **MONITOR**: Monitor GPU metrics
  - GPU slot utilization, temperature & status
  - Detect ECC error accumulation

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Scheduling to GPGPUs Today

- Managing latest GPGPUs and CUDA (V5.0) applications using:
  - IBM Platform LSF
  - IBM Platform HPC
  - IBM Platform Symphony

- GPU ELIM provides:
  - Monitoring and detection of GPUs
  - Group hosts with GPU(s) into a resource group
  - Compute slots on these hosts are user configured

- **GPU-enablement is the responsibility of the application developer**
USE CASES
Use Case #1: Simple Use Case

- Nvidia GPGPU only
- CUDA 5.0 and older
- Simple monitoring statistics
Use Case #2: Complex Use Case

- Multiple GPGPU / accelerators OR
- Use of newer CUDA features > 3.2 OR
- Monitoring of memory and GPU core utilization
Use Case #3: NUMA optimization within a single server
Use Case #3: NUMA Optimization within a single server

**Asymmetric bandwidth requires:**
- LSF: Non-GPU jobs to be scheduled to hosts without GPUs first
- LSF: Non-GPU jobs be scheduled to cores with low GPU bandwidth
- LSF: GPU jobs schedule to cores with maximum GPU bandwidth
Use Case #4: NUMA optimization for multi-server MPI jobs

MPI job optimization
– MPI selects optimal cores for multi-host job MPI processes
Use Case #4: NUMA Optimization for multi-server MPI jobs

**MPI based multi-server GPU and non-GPU jobs**

- LSF: Single servers – LSF scheduling plugin controls core placement
- LSF: Multiple servers – LSF scheduling plugin does nothing
- MPI: Single servers – MPI scheduler does nothing
- MPI: Multiple servers – LSF scheduling plugin controls core placement
SUMMARY
Reality and Conclusions

Don’t have application developed for GPUs?
- Many ISVs are working hard to adopt CUDA and/or openCL for their applications

IBM Platform Computing has available solutions for
- Managing both GPU and CPU resources in a cluster
- Monitoring & visualizing important parameters for GPUs
- Scheduling serial jobs to available and functional GPUs
- Scheduling parallel jobs to available and functional GPUs
- Scheduling & optimizing mixed mode serial and parallel workload
QUESTIONS?