Breakout session
Architecture and Operation

29 January 2015

Questions

- What are the main differences and commonalities between the HPC and BDA requirements/technologies/working-assumptions in this area?
- Are there common needs/problems/interfaces could serve as the basis (or as stepping stones) along a path to (some reasonable level of) infrastructure and application convergence?
- Are there interdomain testbeds that combine BDA and HPC workflows in ways that could help uncover pathways toward convergence?
- What is/are the technology or new research that may be a game changer?
- What action would be your number one priority to be taken rapidly to ensure success of the converge of Extreme computing and Big Data infrastructures?
- What action would be your number one priority to be taken rapidly to ensure the emergence of efficient Extreme computing and Big Data applications?
- How would you measure the success of the BDEC initiative?

What are the main differences and commonalities between the HPC and BDA requirements/technologies/working-assumptions in this area?

- Data apps
  - Database, realtime, virtual machine, cloud, not waiting for resources, interactive data analytics, languages (e.g. Java), aggregate I/O, importance of time to solution rather than raw performance, shared memory machines, cloud, in-memory, integer performance (?), dynamic data, unstructured data
- Commonalities
  - Visualization, memory system convergence(?), data reduction capabilities
- HPC apps
  - Multi-many cores, arithmetic, Hadoop useful?, static data, structured data

Are there common needs/problems/interfaces could serve as the basis (or as stepping stones) along a path to (some reasonable level of) infrastructure and application convergence?

- Energy cost
- Data movements dominating energy
- New kinds of memories, persistent storage
- HPC output is a big data issue
- Workflow is more complex in BD apps (heterogeneous machines)
- Heterogeneous “data view” (same data different hardware)
- Common APIs energy aware
- Pathways for data movements:
  - New file systems
  - IO system useful for HPC and data analytics
  - Common flexible resiliency and consistency model
  - Heterogeneity (multi-physics), flexible hardware (including virtualization / scheduling), ability to specify compute and memory apps needs
  - data reduction capabilities

Are there interdomain testbeds that combine BDA and HPC workflows in ways that could help uncover pathways toward convergence?

- Climate modeling type workflows
  - Requires different types of resources
- HPC creates BD, BD reduces data
- Intelligent cities generates BD problems
- Testbeds
  - System with mix types of nodes, scheduling capabilities to access the different types in a coordinated manner
  - Interactive use of resources from desktops, batch jobs
  - Potentially different network topologies
  - Data reduction capabilities
  - Enabling studying (dynamic) tradeoff between re-compute vs store
  - Monitoring tools (performance, energy, IO, …)
  - Flexible repair modes (nodes and communication)
  - Hierarchical storage, flexible sub-systems composition, strongly and loosely coupled sub-systems
  - Scheduling / QoS / resources (interactive) management
  - Software stack issues aware

What is/are the technology or new research that may be a game changer?

- Research beneficial for HPC and BD
  - High capacity, high bandwidth cheap memories
  - Processors making use of 3D memory (string matching)
  - High speed to storage (HDD is a bottleneck)
  - Interconnects speed order magnitude (inter-processors, inter-clusters)
  - Novel data representation (floating point)
  - High level abstraction for computation and data
  - Percipient storage
- Research to promote convergence
  - High performance file systems
  - Speed in/off chips
  - Avoiding data movements using active storage
  - Software defined provisioning and management of resources
  - Co-existing VM in traditional HPC systems / software and application stack control in HPC
  - Ease of application validation in different environment
  - Methods for co-location of computation and data
  - Benchmark application models, traces
  - Automated, easier way to express optimal/efficient use of deep memory hierarchies, on-the fly data processing
  - Efficient graph libraries

What action would be your number one priority to be taken **rapidly** to ensure **success** of the converge of Extreme computing and Big Data infrastructures?

- 1 billion euros!
- New APIs
- HP file-object/storage systems
- Dynamic integration of memory and storage resources API
- Benchmark/mini-apps (HPC & BD workload)
- More collaboration between HPC and BD researchers
- Automated data movement
- Realizing convergence is not needed
- Knowledge dissemination between the communities
- HP virtualized I/O
- Virtualized high speed interconnect for all part of the system
- Energy efficient resource management
- **Elaborating a value proposition (ROI) for convergence**
- Work with selective set of applications to make them work
- - 1 billion euros
- Find a good example where such a convergence is useful/necessary

- HP virtualized memory & storage system with open API for transparent data movement and on-the-fly processing

What action would be your number one priority to be taken **rapidly** to ensure the emergence of **efficient** Extreme computing and Big Data applications?

How would you measure the success of the BDEC initiative?