SGI® Big Data Ecosystem - Overview

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Big Data Benchmarking Community
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Speed and Scale

Finding Answers™

Subatomic  Atomic to Cellular  Human Scale  Astronomical

0  $10^{-15}$  $10^{-6}$  $10^{6}$  $10^{16}$  $10^{18}$  $10^{24}$

Femtometer  Light-year  Exascale  Yottascale

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Our Strategy and Focus

Business Applications

High Performance Computing

Business Computing

HPC

Redundancy  Speed & Scale

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Our Strategy and Focus

Business Applications

Big Data

High Performance Computing

Business Computing

HPC

Redundancy

Speed & Scale
Big Data: A combination of Structured, Semi-Structured & Unstructured Data

- **Structured Data:** Traditional Databases, Transactional systems
- **Semi-structured Data:** Logs, Social chat, twitter, email
- **Unstructured Data:** Documents, Sensors, Audio, Video, Images

Properties:
- **Volume**
- **Velocity**
- **Variety**
An *Intelligent* and *Dynamic* Big Data Ecosystem

Emerging technologies include *Data Integration*, *MapReduce*, *Data Analytics*, *Data Mining*, *Predictive Analytics and Visualization* to derive intelligence out of a dynamic data ecosystem.
SGI® Servers for Speed and Scale

**HPC**
- Commercial
- Scientific
- Modeling & Simulation

**Big Data**
- Hadoop
- In-Memory
- Analytics
- Archive

**Cloud**
- Public
- Private
- Government

SGI® ICE™
Rackable™
SGI® UV™
Rackable™
CloudRack™ C2

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SGI for an Intelligent and Dynamic Big Data Ecosystem

Continuously Managing and Deriving Value from Your Data

- Data ingest
  - The data wave arrives
  - SGI Rackable™

- Processing
  - Organize
  - SGI Hadoop Clusters (Scale-out)

- Analytics and Visualization
  - Analyze, Decide, Predict
  - SGI UV
  - SGI Rackable™ (Scale-up and out)

- Archiving
  - Archive, Retrieve, Comply
  - SGI Modular InfiniteStorage
  - ArcFiniti
Co-processing hybrid data is a challenge

Today’s Challenges:

• To analyze structured and unstructured data types simultaneously

  • While one leverages Hadoop for unstructured datasets, using on-hand database management tools on them become impossible, as the data grows. Difficulties include capturing, storing, searching, sharing, analyzing and visualizing data. Response times are high (mins to hrs).

  • While one maintains traditional data warehouses for analyzing structured data, dealing with the volume, velocity and variety of the influx of unstructured information becomes a challenge.

SGI Big Data Ecosystem:

• Implements a single software framework to access, process and analyze all structured, semi- and unstructured information moving across an organization to deliver actionable insight in real-time.

• Promotes Rackable and UV product line integrated with a modular, feature-rich, best-in-class software framework for extreme analytics on fused data types.
SGI co-processing hybrid data in a single dynamic workflow

Key Points:

- With a flexible scale-out and scale-up product portfolio, SGI fuses unstructured pre-processed information from Hadoop with structured data framework for dynamic post-processing and extreme analytics in real-time.

- SGI Mineset technology can provide additional capabilities for Predictive Analytics in near real-time combined with Visualization for Interactive BI.

- In a single workflow, SGI performs ingestion, query execution, aggregation and analytics across all information types and able to deliver actionable insight to users.

- With DMF, SGI can provide additional capabilities to archive massive amounts of information from Hadoop to tape devices and perform on-demand search for compliance.
**SGI Big Data Ecosystem: From Data to Actionable Insight**

**Key Points:**

- With a scale-out and scale-up product portfolio, SGI fuses unstructured, semi-structured, and structured data. Organization of incoming data from heterogeneous sources is performed using Hadoop on scale-out SGI Rackable clusters. This is followed by dynamic post-processing and extreme analytics on traditional databases on SGI UV or Rackable cluster, depending on whether the DB architecture is SMP or MPP.

- SGI provides additional capability for Predictive Analytics combined with Visualization for Interactive BI.

- In a single workflow, SGI can perform analytics across all information types and able to deliver actionable insight to users.
SGI Mineset for Visual Analytics: US Average Gross Income (Classification)

Key Points:

A Demographic View of US Avg. Gross Income by age group

4D View:

- Age, Education and Occupation are the 3 dimensions;
- Vary age group to see the change in gross income in the 4th dimension.
- Get avg. gross income in color (blue to red) in the 4th dimension;

One can view the change in the avg. gross income (called mining attribute) from age group 20- to 60+.
SGI UV2000 **Big Brain Computer**

**Modular Design, Configuration Flexibility**
**Supports GPU, Intel MIC**

**UV 2000**
- 42U 19” Destination Rack
- Up to 512 Intel Xeon cores (E5)
- Up to 16TB

**UV 20**
- Up to 128 Intel Xeon cores (E5)
- Up to 4TB

- Up to 32 Intel Xeon cores (E5)
- Up to 1.5TB

- SGI® NUMAlink™ 6 network
- Runs Linux SW off-the-shelf, unmodified
- Standard Management, Storage Interfaces
- SGI Infinite Storage Solutions
- Interface with common management software schemes

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SGI UV 2000

Single-node to manage, use – far less complex than scale-out systems with many nodes.

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<thead>
<tr>
<th>Commodity Scale-out/Cluster</th>
<th>SGI UV 2000 Big Brain</th>
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<tbody>
<tr>
<td>InfiniBand or Gigabit Ethernet</td>
<td>SGI NUMAlink® 6 Interconnect</td>
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<td>Mem ~64GB system + OS</td>
<td>Global shared memory to 64TB</td>
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<td>mem system + OS</td>
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Off-node data access requires inter-node messaging scheme

All data transparently accessible to all processors
Globally Shared Memory System

NUMAlink® 6 is the glue of UV2

To 64TB Cache-Coherent Shared Memory
SGI UV

World's Largest In-Memory System for Data-Intensive Applications

Proven for complex in-memory analytics, fraud/threat detection, graph databases, integrative simulation or analysis.

200TB space weather simulations protect power and satellite grids

Political revolt is predictable with fast analysis of 100M web postings

Graph databases leverage large shared memory to find relationships between people, places, orgs and events.

Cancer takes a hit as cell network simulation goes from weeks to hours

$Millions saved as 38X speedup makes fraud detection real-time
SGI® Hadoop Clusters
SGI Hadoop Background

• SGI has been one of the leading commercial suppliers of Hadoop servers since the technology was introduced
  • Leading technology users deploy on SGI Hadoop Clusters
  • SGI supplies customer optimized Hadoop Clusters to key US government agencies

• SGI has sourced Hadoop installations as large as 40,000 nodes and individual clusters as large as 4,000 nodes

• Start Up and GO!
  • Factory integrated Hadoop solutions
  • Cloudera’s Distribution (CDH) and Cloudera Enterprise
  • Direct delivery to production
SGI Hadoop Reference Implementations (RIs): Solving Big Data Challenges

• **Solve complexity of Hadoop deployment:**
  • With a factory-installed, optimized Hadoop integrated with the hardware, RIs allow customers to run complex analytical Applications atop Hadoop, out of the box.
  • RIs lead to little deployment effort, low maintenance cost, maximum Rack density.
  • Built on top of standard Apache Hadoop distributions, RIs provide a modular approach to various verticals.

• **Solve Hadoop optimization challenges with a predictable performance:**
  • RIs are pre-built for affordable price/performance, provide linear Terasort performance, optimal performance/watt - allowing organizations to focus on application development instead of performance tuning.

• **Solve challenges of volume, velocity, variety of data:**
  • RIs have raw capacity to support 100s of terabytes to petabytes of high velocity data in three densely-packed Rack configurations.
  • RIs can leverage Data management solutions for ingest and archive.

• **Solve challenges to find value in information:**
  • RIs have tested features jointly with ISVs for Import/Export, Search, Mine, Predict, creating Business Models, and Visualizing data for Business Intelligence.
SGI Hadoop Reference Implementations
Preconfigured half-rack, full rack, multi-rack systems

- Fastest time to production
- Purpose designed
- Performance optimized
- Factory integrated
- Cloudera certified

Multi-Rack: Petabytes useable capacity

10GigE

Import, Export, Search, Mine, Predict & Visualize data for Business Intelligence
Social Network Analytics with SGI Hadoop clusters

Key Points:

• The SNA technology extracts people, places, and organizations from text resource crawled from the web and stores into Hadoop/HDFS to find the statistical correlations between them.

• One can then export the filtered data from Hadoop into a MySQL database for further visualization.

• One can use the stored data in the MySQL database to connect to other resources, create relationship graph and also connect various resources to generate mashups.

• Mashup is generated from Social Network Analysis shows forty or so people, places, and organizations followed by 3D visualization of this particular mashup.
SGI® DataRaptor™ with MarkLogic®
SGI Data Fusion enhanced with *MarkLogic XML DB*

**Key Points:**

- SGI Fusion is enhanced with MarkLogic DB supporting XQuery directly on ingested data in real time.
- Direct ingestion and indexing in the DB eliminates the need of pre-processing on Hadoop and hence Hadoop infrastructure in total.
DataRaptor w/ MarkLogic: Value Proposition

- SGI brings to market a leading factory-integrated, flexible and easy-to-use Appliance for next-generation, mission-critical Big Data applications with the following features:
  - A factory-integrated content management framework
    - SGI system hardware integrated with ML database - a leading NoSQL database with XML data model; a Search Engine; an Application Server at Web scale (Big Data); a single system supporting both operational and analytics queries resulting in:
      - Real-time processing capabilities
      - Linear scalability
      - High TXN Rate and cost advantage
  - Availability in 2 flavors – one with High Performance drives and second with High Capacity drives, optimally tailored to be configurable for custom workloads;
  - An information management platform supporting structured, semi-structured and unstructured content;
  - Users can run their own analytical and transactional applications atop Appliance and visualize data for Information Intelligence.

- Disruptive value proposition addresses substantial market opportunity
SGI DataRaptor with MarkLogic: Use cases

Federal
- Real-time Situational Awareness by event correlation across varied sources to support a mission;
- Information aggregation for end-user delivery
- Cost-effective database, search and alerting platform for information sharing

Media
- Loading Metadata, and assets as is, Asset Management and Dynamic digital content delivery
- Search, discovery and automatic assembly of assets

Financial Services
- Loading and indexing data in a schema-agnostic NoSQL database for analysis of trades;
- Transactional data integrity, Risk management and analysis
- Govt-grade security
SGI® Management Center (SMC)
SGI® Management Center

Key Features

• Premier system management console with remote server monitoring and control
• Ease of use, full system management including GUI and CLI
• Policy driven, fine grained power load management for green computing
• Advanced fault, event, and alert management for improved reliability
• Advanced capabilities including GPU management, BIOS management and high availability
SGI® Software
for accelerating results
SGI Software Environment

Premier Software Environment for Technical Computing

- Complete, integrated Linux® environment across all SGI systems
- Highest level of scalability and performance while maintaining ISV compatibility
- Best of Breed solutions delivered with industry leading partners
SGI Performance Suite

- **SGI Accelerate**
  - Accelerate applications with optimized software libraries and tools
  - Tune applications without recompiling
  - Optimize performance with specialized algorithms

- **SGI MPI**
  - SGI’s scalable, high performance MPI environment
  - More than just an MPI library
  - Includes runtime MPI acceleration, profiling, checkpoint/restart and more

- **SGI REACT**
  - Hard real-time performance for Linux
  - Only hard real-time solution for standard distribution Linux
  - No custom Linux kernel needed

- **SGI UPC**
  - SGI’s optimized Unified Parallel C compiler environment
  - Scales across SGI Numalink and InfiniBand

**Top 500 level performance for standard distribution Linux**
SGI® as a member of the Big Data Benchmark Community (BDBBC)
Goals

- To understand and learn from what others in the industry are doing with respect to Big Data benchmarking

- Exchange ideas on new technology trends and how to leverage those for the Big Data community.

- To contribute to the development and execution of standard benchmarks for Big Data

- Publish benchmarks on SGI Appliances for customer satisfaction.

- Help the committee to maintain a best-in-class suite of benchmarks that simulate real-world big data applications that customers can benefit from.