Big Data Use Cases:
“The Size of the Data does not define Big Data”

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Uncharted Territory on Path to Discovery
In Science and Engineering
We Struggle to Define Big Data..

**Traditional View of Data**
- **Volume**: Gigabytes to Terabytes
- **Velocity**: Occasional Batch – Complex Event Processing
- **Variety**: Centralized, Structured i.e. Database
- **Value**: The Data itself is the end (a lot of HADOOP stuff)

**Big Data**
- **Petabytes and beyond**
- **Real-Time Data Analytics**
- **Distributed, Unstructured Multi-format**
- **Insight Derived from Data** (Find the Cancer Cure)

But does THIS MATTER?
Not Unlike we Struggle to Define HPC!

When is a computation requirement “high performance”? The canonical definitions are problematic… because they ignore temporal contextuality

HPC is defined by not only the processing… But the fact that processing is connected together to work on a single problem seamlessly.

…. Interconnection (fabric) is essential to HPC’s nature.
What will be big tomorrow?

Does Big Data having anything to do with the size or structure of the data?

We struggle because we try to define The opportunity from an irrelevant attribute of the storage architecture!

More important than HOW BIG..

Is the impact HOW BIG has to WHERE the data is.. And how we reach it. (interconnect is essential to nature)
“Big Data” is a class of insight opportunities where the data brought to the problem is multisourced, distributed or of such a scale that significant processing capability is required to derive insight from it.

(An Oil field is defined by how you reach the oil)
HPC is Essential to Big Data

Four “Use Case Classes”:

Data Aggregation:
Find a specific group of records that comply with a set of requirements.

Data Analytics:
Computation of common characteristics or key regression characteristics in data aggregated for the analysis.

Data Visualization:
Construct a Visual representation of a computationally-derived model of data aggregated for analysis.

Interactive Visualization and Simulation
Command adaptive analysis through manipulation and simulation of aggregated data. Insight from Human Derived Optimization Points.
Big Data – A Foundation For Delivering Big Value

Intel Leverages the Power of Big Data

**Chip Design Validation:**
Cut Product Time to Market by 25%

- Faster analysis process for validating results
- Streamlined debug process through analysis of large volumes of historical test data
HPC Insights from Big Data

- Better Medical Therapies
- Fastest Route Through Traffic
- Urban Planning and Simulation
- Improved Security (Scary guys)
Graph Data

Analytic problems with Data with a graph structure:
• Match Genomes of tumors
• Find the bomber in the haystack?

Some of these graphs are...
HUGE.

Data for the compute is ~never where you want it from a computation efficiency point of view.
*Rarely here, rarely low latency to access.*
What can you do with the data?

Crowdsourcing + physical modeling + sensing + data assimilation to produce:
Intel’s view of the world - Enabling Discovery through Big Data

Example: Life Sciences Applications
Many (most) applications are single threaded, single address space..

*Intel is working with app/code developer, upstream code changes*

Some algorithms have quadratic scaling with the size of the problem, so are the needs for larger working data sets resulting in compute capacity constraints

*Technology innovations in compute, storage, and data fluidity*

Databases are distributed, data is siloed and will likely stay that way

*Tools like hadoop, lustre, graphlab, in-memory etc.*

**Big Data needs Balanced Infrastructure**
Genomics for Translational Medicine using Intel® Distribution for Apache Hadoop - NextBio

- **Challenge:** Derive new value added patient discovery services while bringing down genome processing costs
- **Solution:** Dynamically partition & scale correlation of patient data to all public data using Hadoop and Hbase
- **Benefits:** Contributes to 800x reduction in cost to process 4 Million genome variants
HPC Compute Technology and Big Data

- HPC transforms Big Data From Batch orientation to Mission critical and real time orientation
- Data moves from target of static search to constructed in a pipeline of intelligent agents
- This requires shift form simple storage architecture to Greater Intelligence in the Storage System
- Cluster computation for rapid/accurate real time answers to real time data
- Fabric Performance becomes Essential to Insight delivery
Big Data Architecture Framework changing over next 2 years

Data Aggregation, Ingestion, Integration and Processing Services

- Distributed High Performance Data Processing
  - Hadoop MapReduce
- Integration Tools

Data Location, Access, Storage and Distribution

- NAS - SAS and Distributed Storage
- 10GBe Fast Fabric
- Databases
  - DBMS / NoSQL
- MPP Databases
  - DW Appliances

Data Sources

- Log Files
- Social Media
- Medical Records
- GIS

Data Access
- User Authentication

Visualization

- GIS
- Diagnostic Images
- Surveillance and Medical Device Streaming Data

Data Analytics

- Data as a Services
  - Distributed: Event, Message
  - Virtual: Real-Time, Cached, Federated
  - Persistence: EDW, Marts

Data Aggregation Model and Simulation

IS360.. Internally generated data.
Computation of Insight from Big Data

Big Data:
Acquire Data and Information for Analysis and Decision Making

HPC:
Analysis, Modeling, and Simulation Information

IN-SIGHT
Parallelism is Your Path to the Future

Intel is ..more than ever.. Your Roadmap
“HPC is key for extracting value from Big Data...HPC will move Big Data from the target of static searches to a pipeline of intelligent agents.”

John Hengeveld, Intel  
(Intel Developer Forum, September 2012)
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