Accelerating Hadoop* Clusters with SSD Technologies

Christian D. Black
Datacenter Solutions Architect
NSG, Intel Corporation

*Other names and brands may be claimed as the property of others.
Agenda

- Whoami?
- Background - Hadoop*
- Distributions & Ecosystem
- Fitting Hadoop* into the Landscape
- Lots of businesses talking…
- Intel® SSDs for the datacenter
- Intel® SSDs and Hadoop*
- Where Intel® SSDs can best speed Hadoop*
- Main Clusters & Intel® Cache Acceleration Software
- Your Workload Really Matters
- Info, Contacts, and Questions

*Other names and brands may be claimed as the property of others.
whoami?

- Datacenter Solutions Architect, NSG
- Moved from Intel IT to NSG in Q1 ‘13
- Started on an Atari* 400 in 1980
  - Anyone recall Pilot* & Logo*?
- 20 years of Enterprise IT Experience
  - USAF Migration from Novell* to Windows NT*
  - MCSE*, SAP*, Datacenter Architecture, & IT Research/Pathfinding
  - Driving SSD into Enterprise IT @ Intel® for last 4 years
- Hadoop* experience…
  - 15x cluster builds w/5 different distros
  - 18 months supporting research & development internally
Background - Hadoop*

- Just over the peak of the hype cycle at 8 years old!
- Intel® reliable & long term commitment to ‘Big Data’
  - Intel® Distribution for Apache Hadoop* software Q4’12
  - Active contributions to Intel® Distribution for Apache Hadoop* software and Apache* open source projects
- Why Hadoop*?
- Hadoop* invented to download & index the Internet
- Application & software framework
  - HDFS (Hadoop* File System)
  - Map-Reduce (Distributed Compute Framework)
- Sift and store mountains of data at $/GB
Distributions & Ecosystem

- Infrastructure Vendors
  - Apache* – 100% Open Source
  - Intel® Distribution for Apache Hadoop*, Cloudera* (CHD)
  - Greenplum* (GDH), MapR* (MRH),
  - Hortonworks* (HDH),
  - + 8-10 or more…

- Differentiation
  - % of Open Source in codebase
  - Software, Services, and/or Support – Revenue Model
  - In ‘Big Data’ there are 100s of Companies building on…
  - 10-15 Open Source Projects

*Other names and brands may be claimed as the property of others.

# http://mattturck.com/2012/10/15/a-chart-of-the-big-data-ecosystem-take-2/
Fitting Hadoop* into the Landscape

- **Hadoop** augmented/expands current data systems...

![Diagram showing how Hadoop fits into the data landscape](image)

*Other names and brands may be claimed as the property of others.
Lots of businesses talking…

- Many are…
  - Sharing how they’re setup…
  - Sharing what they’ve learned…
- Nobody’s sharing ‘How’ they’ve got value!

---

**Big Data**

- Yahoo*, Facebook*, EBay*
- Cluster Size Range: 120 to 4500 Hosts

**Semi-Big Data**

- LinkedIn*, 40+ other Companies
- Cluster Size Range: 20 to 120 Hosts

**Tiny Big Data**

- Adobe*, Hulu*, and 100’s of others…
- Cluster Size Range: 2 to 20 Hosts

---

1. Source: Hadoop Wiki - Compilation courtesy of V. Saletore – IAG/DCSG Q4’12 Average Hadoop Cluster Size Industry Wide = 16 Hosts (servers)

*Other names and brands may be claimed as the property of others.
Intel® SSDs For The Datacenter

- Intel® SSD DC S3700 – High Endurance Product
  - Sequential Read @ 500 MB/s & Sequential Write @ 450 MB/s
  - 4k Random IOPS - 75k Read - 36k Write @ 45-65µs
  - Up to 14PB Endurance (800GB Drive)

- Intel® SSD DC S3500 – Standard Endurance Product
  - Sequential Read @ 500 MB/s & Sequential Write @ 450 MB/s
  - 4k Random IOPS @ 75k Read & 11.5k Write & 50-65µs
  - Up to 450TB Endurance (800GB Drive)

- Full data path protection – Parity, CRC, memory ECC, LBA tag validation, and power loss protection (PLI)

Abbreviations: CRC – Cyclical Redundancy Check, LBA – Logical block Address, PLI – Power Loss Imminent

Data based on Intel® SSD DC S3700 and DC 3500 Series data sheets. Results have been estimated based on internal Intel analysis and are provided for informational purposes only. Any difference in system hardware or software design or configuration may affect actual performance. Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as Iometer®, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. Source: Internal Testing Configuration: See http://www.intel.com/go/ssd for detailed products specifications and testing configurations.

*Other names and brands may be claimed as the property of others.
Intel® SSDs and Hadoop*

- Hadoop* from the disk perspective
  - 128MB-256MB sequential IO operations
  - Write once, read many, occasional re-balance
  - Perfect for $.04/GB 7k RMP spinning rust @ 130-150MB/Sec
  - Temp intermediate/spillover data creates disk contention

- SSDs provide SSD 450-500MB/Sec Sustained

- Intel internal testing shows ‘pure SSDs’ provide up to 80%¹ performance increase for 1TB Terasort* in Hadoop*

- $1-$2.35/GB for SSD…
  Due to cost per GB… SSDs are perceived as a tough sell with typical enterprise IT financial constraints

---

¹ Results have been estimated based on internal Intel analysis and are provided for informational purposes only. Any difference in system hardware or software design or configuration may affect actual performance. Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as Terasort or HiBench, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. Source: Internal Testing Configuration: Intel® Xeon 5600 & E5, 7200 RPM HDD & Intel® 520 Series SSD, Intel® 1GbE and 10Gb Ethernet, and open source Apache Hadoop® & Intel® Distribution for Apache Hadoop®

*Other names and brands may be claimed as the property of others.
So where do SSDs make sense?
Hadoop Development Clusters

- Subset of a company’s ‘Big Data’, typically <20 servers
- Java*/MapReduce*/Hadoop* developers time critical
  - Up to 97%¹ accelerated development with a combination of current Intel® products over last generation of Intel® products
- Balanced node resources with the right mix of Intel® SSD + Intel® Xeon® E5 processor + Intel® 10Gb Ethernet
- Intel® SSD DC S3700 Series
  - Frequent Cluster Refresh
- Intel® SSD DC S3500 Series
  - Moderate Cluster Refresh

¹ Results have been estimated based on internal Intel analysis and are provided for informational purposes only. Any difference in system hardware or software design or configuration may affect actual performance. Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as Terasort or HiBench, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. Source: Internal Testing  Configuration: Intel® Xeon 5600 & E5, 7200 RPM HDD & Intel® 520 Series SSD, Intel® 1GbE and 10Gb Ethernet, and open source Apache Hadoop * & Intel® Distribution for Apache Hadoop*

*Other names and brands may be claimed as the property of others.
Specialized RTQ Clusters

- Subset of a company’s ‘Big Data’, typically <20 servers
  - Impala*, Hbase*, or other Real-Time Query Clusters
  - Fast Query Returns Business Critical
- Up to 97%¹ accelerated development with a combination of current Intel® products, over last generation of products
- Balanced node resources with the right mix of Intel® SSD + Intel® Xeon® E5 processor + Intel® 10Gb Ethernet
- Intel® SSD DC S3700 Series
  - Frequent Cluster Refresh
- Intel® SSD DC S3500 Series
  - Moderate Cluster Refresh

¹ Results have been estimated based on internal Intel analysis and are provided for informational purposes only. Any difference in system hardware or software design or configuration may affect actual performance. Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as Terasort or HiBench, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. Source: Internal Testing  Configuration: Intel® Xeon 5600 & E5, 7200 RPM HDD & Intel® 520 Series SSD, Intel® 1GbE and 10Gb Ethernet, and open source Apache Hadoop* & Intel® Distribution for Apache Hadoop*
But what about ‘Main’ clusters?

- **Main Hadoop Clusters > 20 Servers**
  - MapReduce* Intermediate Data (Temp/Intermediate) + 1x Intel® SSD DC S3700 Series per host
    - Intermediate Data written to SSD (Hadoop* .xml Setting)
    - Alleviates contention on HDDs by moving temp/intermediate to SSD
    - Product selection based on estimated max generated spillover

- **Main Hadoop Clusters > 20 Servers**
  - Intel® Cache Acceleration Software + 1x Intel® SSD DC S3700 Series/host or 1x Intel® SSD 910 Series PCIe*/host
    - Read/Write Caching for all Data Disks
    - ¹Accelerates Terasort* jobs up to 42%
    - Product selection based on write and working dataset size

---

1 Results have been estimated based on internal Intel analysis and are provided for informational purposes only. Any difference in system hardware or software design or configuration may affect actual performance. Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as Terasort or HiBench, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. Source: Internal Testing Configuration: Intel® Xeon E5, 7200 RPM HDD & Intel® SSD DC S3700 Series, Intel® 10Gb Ethernet, Intel® Distribution for Apache Hadoop* & Intel® Cache Acceleration Software

*Other names and brands may be claimed as the property of others.
Your workload really matters!

- Know your workload, is it?
  - IO, CPU, Network, or Memory intensive & when?
  - Generates lots or little intermediate data?

- Intel® SSDs provide 450-500MB/Sec Sustained Bandwidth and handle both Sequential and Random IO gracefully
  - Hadoop* relies on bandwidth/throughput
  - 2x400GB (1GB/Sec) better than 1x800GB SSD (500MB/Sec) for Hadoop*

- Increasing the IO capabilities of Hadoop* nodes
  - Unleashing IO can require a rebalance
  - May require more/faster cores and a faster network

- Your workload really matters!

---

1 Data based on Intel® SSD DC S3700 and DC 3500 Series data sheets. Results have been estimated based on internal Intel analysis and are provided for informational purposes only. Any difference in system hardware or software design or configuration may affect actual performance. Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as Iometer*, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. Source: Internal Testing Configuration: See http://www.intel.com/go/ssd for detailed products specifications and testing configurations.

---

*Other names and brands may be claimed as the property of others.
Business Contacts

- Please work with identified NSG BDMs
- for Intel® SSD + Hadoop* design wins!

<table>
<thead>
<tr>
<th>Expertise</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Datacenter Solutions Architecture, Big Data &amp; HPC</td>
<td>Christian Black, DSA, NSG</td>
</tr>
<tr>
<td>Intel® SSD + Intel® CAS SW Marketing Support</td>
<td>Carolyn Hanley, PME, NSG</td>
</tr>
<tr>
<td>Intel® Distribution for Apache Hadoop* software</td>
<td>David Collins, IDH Director of Sales, IAG/DSD</td>
</tr>
</tbody>
</table>

*Other names and brands may be claimed as the property of others.
Open Questions…

☐ Thanks for attending!