The Storage Revolution

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The cost reduction scenarios described in this document are intended to enable you to get a better understanding of how the purchase of a given Intel product, combined with a number of situation-specific variables, might affect your future cost and savings. Nothing in this document should be interpreted as either a promise of or contract for a given level of costs.
The Storage Revolution

- The inflection point
- Industry response
- How Intel is helping
Data Center Storage
Inflection Point
The Amazing Shrinking Storage
The World is Changing

Information Growth
From now until 2020, the size of the digital universe will about double every two years

Security
Increase in avenues and attack surfaces

Complexity
What we do with data is changing, traditional storage infrastructure does not solve tomorrow’s problems

Cloud
Emergence of new IT solutions
Information is Exploding

48 HOURS VIDEO UPLOADED TO YOUTUBE
47,000 APPS DOWNLOADED
200 MILLION E-MAILS

EVERY MINUTE EVERY DAY
Why the sense of urgency

Data needs are growing at a rate unsustainably with today’s infrastructure and labor costs.

COST CHALLENGES CONTINUE TO GROW

Storage cost structure needs a fundamental shift

<table>
<thead>
<tr>
<th>Year</th>
<th>Storage Capacity (TB)</th>
<th>IT Budget (CAGR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>1</td>
<td>62%</td>
</tr>
<tr>
<td>2014</td>
<td>2</td>
<td>2%</td>
</tr>
<tr>
<td>2015</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>2019</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>2021</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>2022</td>
<td>77</td>
<td></td>
</tr>
<tr>
<td>2023</td>
<td>125</td>
<td></td>
</tr>
</tbody>
</table>

Source: IDC

IT PROS WILL SHOULDER A GREATER STORAGE BURDEN

<table>
<thead>
<tr>
<th>Year</th>
<th>Storage Capacity (GB)</th>
<th>IT Pros Worldwide</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>28</td>
<td>230 GB per IT PRO</td>
</tr>
<tr>
<td>2020</td>
<td>36</td>
<td>1,231 GB per IT PRO</td>
</tr>
</tbody>
</table>

Source: IDC, 2014

Storage cost structure needs a fundamental shift

A Tidal Wave is On the Way

Unstructured Data

Traditional Data
Storage Costs Are **Growing**, IT Budgets Are **Flat**
How we use Data is Changing

- From collecting to analyzing data
- Understanding unstructured data
- Valuable data resides outside the organization
Traditional Storage can Create a Service Delivery Bottleneck

Resource Requests

Internal Resources
The Industry’s Response
The Industry’s Response

1. INTELLIGENT STORAGE
2. SCALE-OUT
3. NON-VOLATILE MEMORY
4. SOFTWARE DEFINED
Intelligent Storage Services Increase Efficiency

**DEDUPLICATION**

- Flash/SSDs
- FC/SAS HDDs
- SATA Drives

**REAL-TIME COMPRESSION**

**INTELLIGENT TIERING**

**THIN PROVISIONING**
Scale-Out Storage Taps Volume Economics

SCALE-UP

SINGLE SYSTEM
INTERNAL NETWORK

SCALE-OUT

NODES WORKING TOGETHER
EXTERNAL NETWORK
### Improve Performance with NVM

<table>
<thead>
<tr>
<th>HDD Storage¹</th>
<th>SSD Storage²</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>POWER CONSUMPTION</strong></td>
<td><strong>PERFORMANCE</strong></td>
</tr>
<tr>
<td>Active Read: 18 watts</td>
<td>450,000 IOPS Random Read</td>
</tr>
<tr>
<td>Idle: 13 watts</td>
<td>High latencies average 2ms</td>
</tr>
<tr>
<td>More watts, more heat, more cost</td>
<td>Slow response</td>
</tr>
</tbody>
</table>

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2. Intel measured data, Intel® SSD DC P3700 Series

- **>50% FEWER WATTS**
- **2200x FASTER**
Software Defined Storage
Dynamic, policy driven management of storage resources

- **Abstraction** of SW from HW, provides flexibility and scalability
- **Aggregation** of diverse provider solutions
- ** Provisioning** of resources dynamically (pay-as-you-grow)
- **Orchestration** of diverse storage systems through an SLA to enable seamless application access
Intel is Helping With Innovation
How Intel is Helping

- Processor innovations
- Non-Volatile Memory (NVM)
- Networking and fabric
- Accelerate move to software-defined storage
What are Intel’s Storage Assets?

- Intel® QuickAssist Technology
- Intel® Storage Acceleration Library (ISA-L)
- Intel® Cache Acceleration Software
- PROCESSOR PLATFORMS
- SOFTWARE DEFINED STORAGE
- SSD’S AND NVM
- SOFTWARE ECOSYSTEM
- NETWORKING AND FABRIC
- REFERENCE ARCHITECTURES
Intel® Processors: The Heartbeat of Modern Storage Systems

- Intel® Platform Storage Extensions
- Intel® Storage Acceleration Libraries and DPDK
- Intel® QuickAssist Technology
Intel® Ethernet for Storage

Top of Rack
- High bandwidth, low-latency switch silicon
- Software Defined Networking

Shelf
- Embedded compute fabric
- Excellent performance

Node
- Higher bandwidth (10/40GbE) NICs and SOC Integration
- Unified Networking (LAN/SAN)
- Virtualization offloads and RDMA
Optimally Balance

Computing

- Intel® Xeon® Processor Family

Network

- Intel® 10Gb Ethernet Controllers and Adapters

Storage

- Intel® Xeon® Processor
- Solid-State Drive
- Tiered Intelligence
ACCELERATE MOVE to Software-Defined Storage

- Active involvement in OpenStack
- IA optimizations for storage workloads
- Driving standards for seamless communication interfaces

…………… and others
Capitalize On New Opportunities

Intel® processors and storage technologies are present at all junctures.
Solving Real-World Problems: Beginning with Intel’s own IT

$9.2 MILLION in savings

Storage footprint TRIMMED BY 50%

Storage growth reduced by 25% IN FIRST YEAR

Source: Thin Provisioning: Intel IT study “Solving Intel IT’s Data Storage Growth Challenges”, January 2012
Solving Real-World Problems:

**DEPLOYED**
**INTEL-BASED**
large object store

**DATA TRANSFER SPEEDS**
**3X FASTER**
THAN COMPETING SOLUTION

**REDUCED COSTS**
BY **43%**

Source: Intel Intelligent Storage Case Study “Intel®-based Large Object Store Reduces Disk Capacity Requirements and Associated Costs by 43 Percent”, January 2014

Note: Comparison testing with 1MB objects against competing cloud subject storage system
Solving Real-World Problems:

- **COST-EFFECTIVE** Block Storage
- **70%** REDUCTION in Capex and Installation Costs
- **3X** MORE STORAGE in the Same Physical Space
- SOFTWARE DEFINED Storage

**Source:** Case Study "New Storage Solution is Music to the Ears of Fast-Growing Digital Music Company"
Intel and Storage: A Bright Future Together