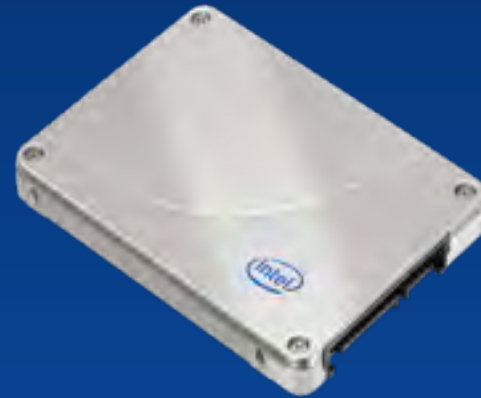


# SSDs Going Mainstream

*Do you believe?*



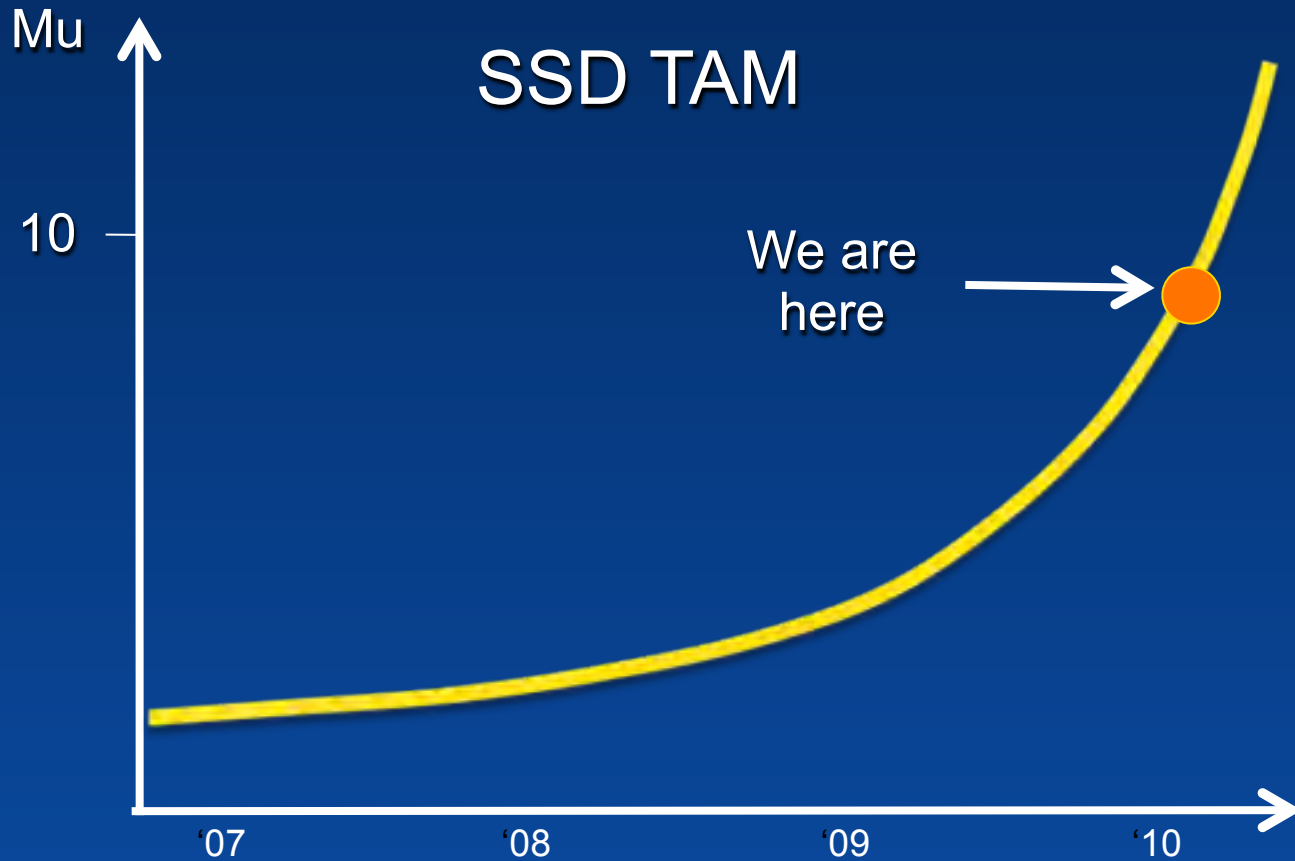
Tom Rampone  
Intel Vice President/General Manager  
Intel NAND Solutions Group



# Agenda

- Current SSD adoption in mainstream markets
- Innovations to go mainstream
  - Silicon innovation
  - SSD innovations
  - Software innovations
- Call to action for NVM Industry

# SSD Adoption – Where are we?





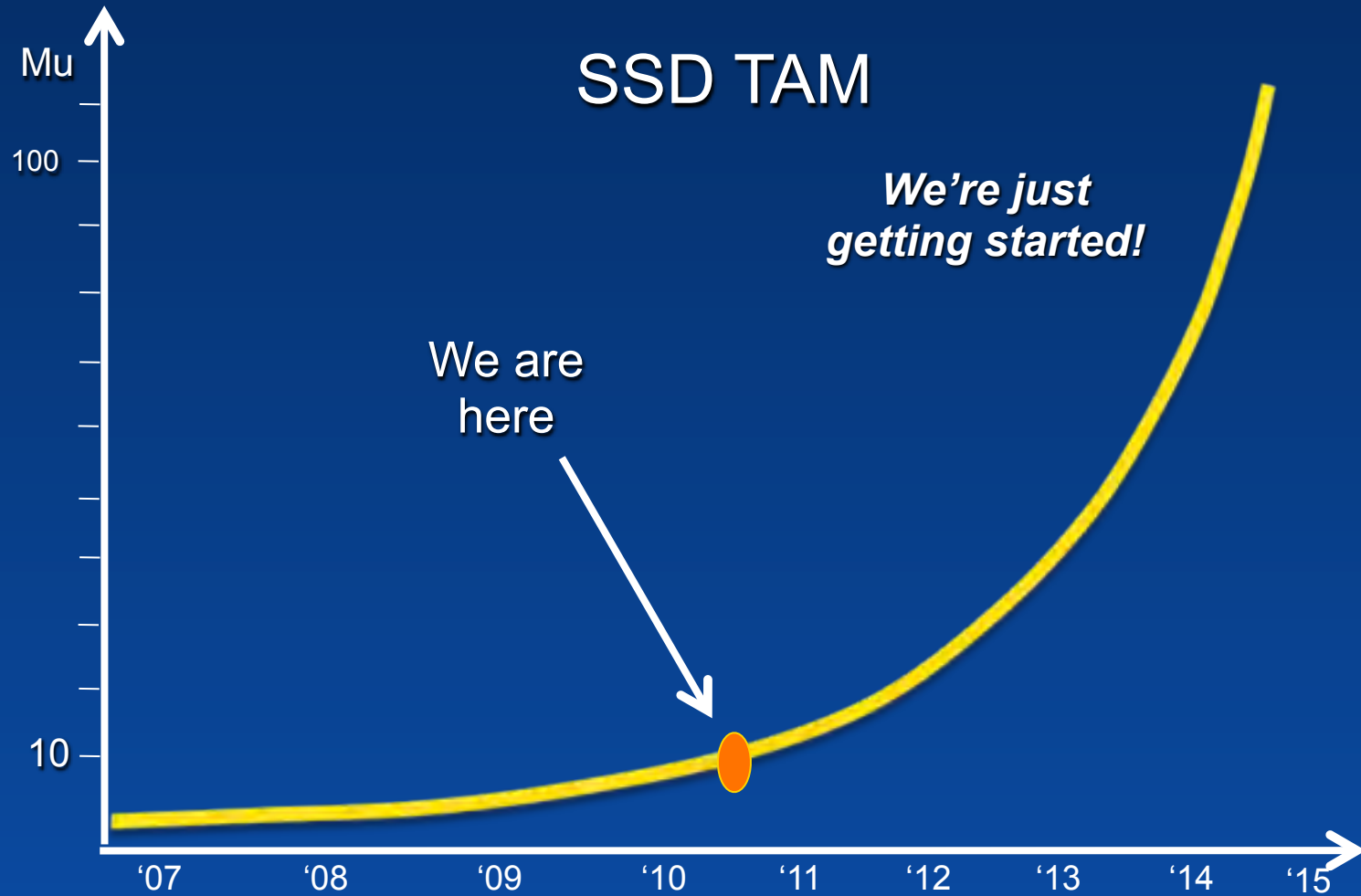
# SSD Adoption – Where are we going?

Santa Clara, CA  
August 2010

4

- Source, Gartner '09-'14 forecast

# SSD Adoption – Where are we going?



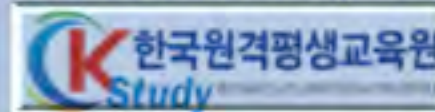


# Enterprise Adoption

# Enterprise Adoption

“Choosing Servers with Intel SSDs ...not only improved our processing performance, it also enhanced our overall organizational efficiencies and cut costs”

- Choi Won Seok, CEO, Kstudy



# Enterprise Adoption

“There is a major shift in storage. We’ve gone from hard disk drives that have been performing at 400 IO per second for 20 years to SSDs now performing at over 60,000 IOPS”

- Bob Weisickle, CTO, ZT Systems

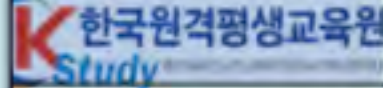


Systems

Server Solutions for the  
Precision-Fit Data Center

“Choosing Servers with Intel SSDs ...not only improved our processing performance, it also enhanced our overall organizational efficiencies and cut costs”

Lee Won Seok, CEO, Kstudy





# Enterprise Adoption

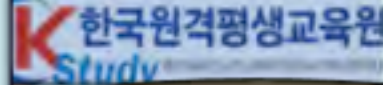
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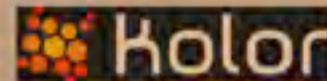
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- Ji Won Seok, CEO, Kstudy



“We completed the Paris-26-gigapixels rendering in three hours and 14 minutes. Two years ago, it took 48 hours to render the Harlem-13-gigapixel. In other words, we were able to process 2x the pixels 15x times faster!

- Alexandre Jenny, Founder, Kolor



# Enterprise Adoption

“Choosing Servers with Intel SSDs ...not only improved our processing performance, it also enhanced our overall organizational

“There is a major shift that has gone from hard drives to SSDs. We have been performing at a level for 20 years to SSDs now. We are now 60,000 IOPS. This is a major shift.”  
- Bob Weisickle,



“GridIron's products, designed with Intel SSD technology, have the scale, performance, efficiency and economics to handle large databases and enterprise workloads... improving our customers' system and application performance by at least 2x.”  
- David B. Wright, CEO, GridIron Systems



**12TB of SSDs  
per rack unit!**

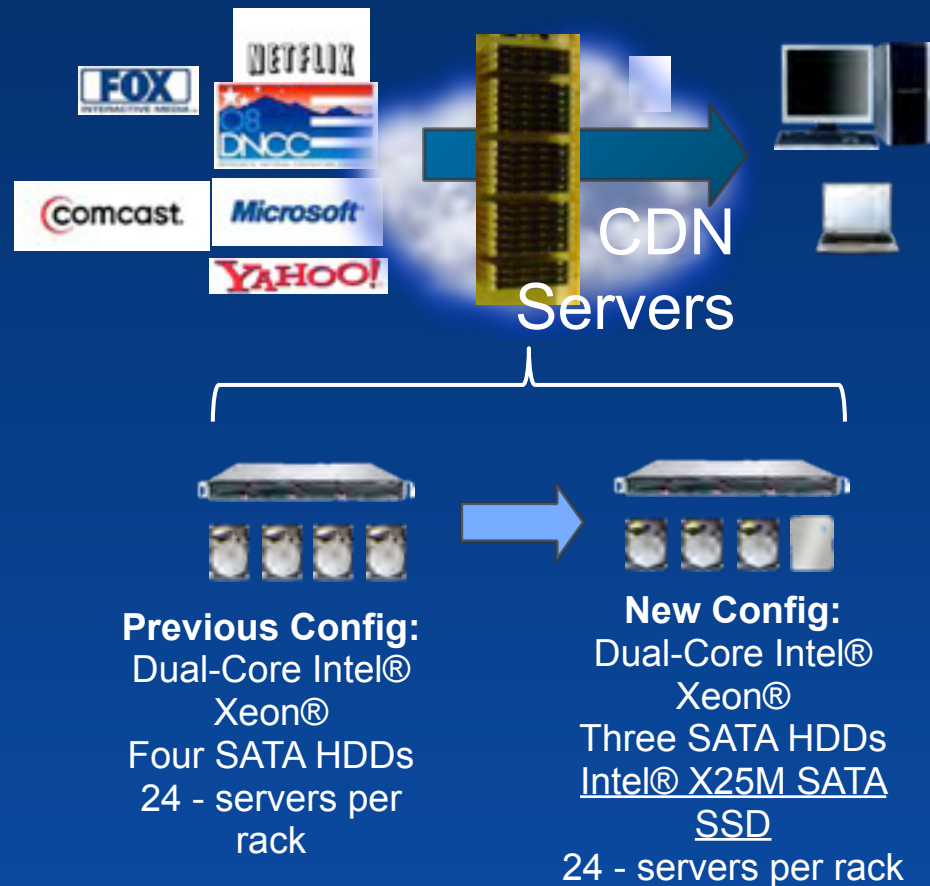
# Enterprise Adoption – Beyond Demos



## The Win

- 3x increase in transactions per server
- 25% reduction in storage power

### The Level 3 Network



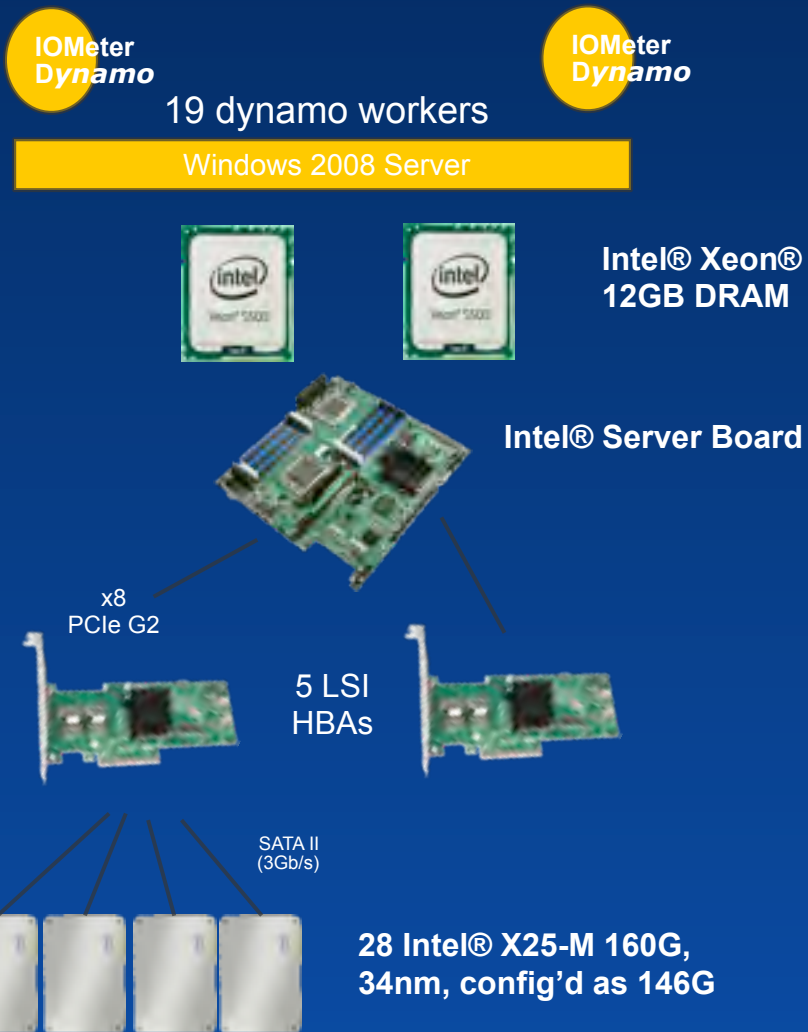
# Enterprise Adoption – Beyond Demos

## 1 Million IOPS system

- Workload exceeded 1 million IOPS and ~4GB/s throughput
- Commercial off the shelf components
- Meets the performance needs of the FSI segment

## The Win

- Performance Value
  - \$20K for a 1 million IOP system





# Corporate Client Adoption

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# Corporate Client Adoption

**“Benefits to IT include lower TCO, faster malware scans, better performance with less RAM, and extended battery life cycle”  
- Intel IT**



# Corporate Client Adoption



**“The Intel SSDs can deliver the strong performance and reliability we need... They easily met our technical specifications”**

**- Miki Dobray, IT Manager, Takeda Pharmaceuticals North America, Inc.**



**“Benefits to IT include lower TCO, faster malware scans, better performance with less power consumption, and extended battery life cycle”**  
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# Corporate Client Adoption



**“The Intel SSDs can deliver the strong performance and reliability we need... They easily met our technical specifications”**

**- Miki Dobray, IT Manager  
Pharmaceutical**

**“Benefits to IT include lower TCO, faster malware scans, better performance with less power consumption, and extended battery life cycle”**  
**- Intel IT**



**“It’s clear to us that high-performing Intel X-25-M SSDs offer a viable, cost-effective alternative to traditional spinning HDDs. They provide better performance, extended battery life, greater reliability as well as reducing technical support costs.”**  
**- Mike Smith, Chief Technology Officer, Managed Operations, Atos Origin UK.**



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# Consumer Adoption



**“an incredible change”**

- Consumer review, Newegg.com

**“Just buy it already!!!”**

- Consumer review, tigerdirect.com



**“...the best upgrade you can do to your laptop or desktop”**

- Consumer reviewer, Amazon.com

**“a revolution”**


- Consumer review, Newegg.com

**“Cannot live without it...once you experience it you'll never go back to traditional hard drives”**


- Consumer review, CompUSA.com

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# Reaching the Consumer

Sponsors of Tomorrow: 

Your hard drive alternative is here.  
Intel® Solid-State Drives.









Can you hear that?  
We didn't think so.  
Enjoy the silence of an Intel® Solid-State Drive.



Sponsors of Tomorrow: 

But it will  
take  
more...

 <p>Experience new levels of storage speed and reliability.</p> <p><a href="#">Learn more &gt;</a></p> 	 <p>Experience Intel's high-performance alternative to hard drives.</p> <p><a href="#">Learn more &gt;</a></p> 	 <p>Upgrade to breakthrough storage performance with an Intel® Solid-State Drive in your PC.</p> <p><a href="#">Learn more &gt;</a></p> 
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# Innovations to go Mainstream

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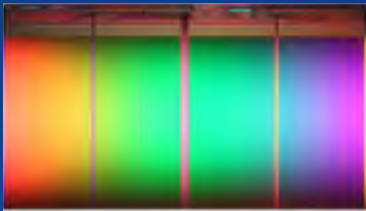
11

Tuesday, August 17, 2010

**INTEL, MICRON FIRST TO SAMPLE 3-BIT-  
PER-CELL NAND FLASH MEMORY ON  
INDUSTRY LEADING 25-NANOMETER  
SILICON PROCESS TECHNOLOGY**

**- *Today, August 17th***

- Lowering the cost
- Increasing capacity
- Setting the pace



8GB 2bpc on 25nm  
167mm<sup>2</sup>

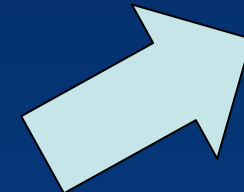


8GB 3bpc on 25nm  
131mm<sup>2</sup>

# Silicon Innovation Compute Quality NAND

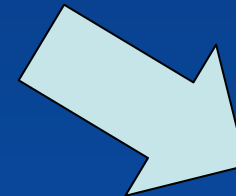


SLC/MLC



SSD and  
compute

3bpc  
TLC

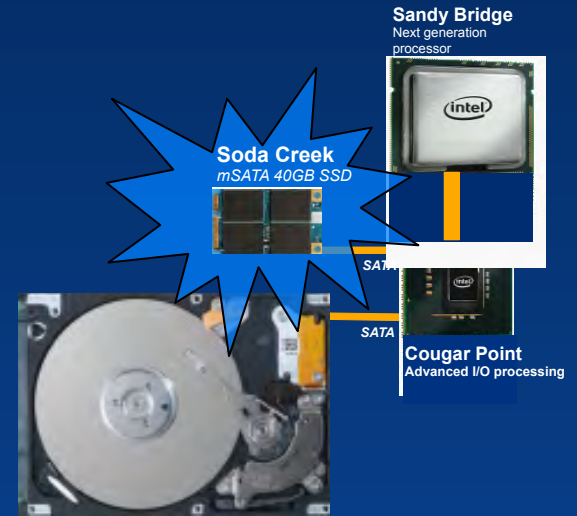


Consumer  
Electronics

# SSD (Platform) Innovation

## Dual-Drive SSD + HDD

- Platforms continue to shrink
  - Everyone wants ...
    - Portability
    - Fast responsiveness
    - Low cost storage
- SSDs offer performance and power efficiency
- HDDs offer capacity, lower \$/GB storage
- Best of both worlds...
  - Small form factor SSD ( mSATA) with Hard Disk Drive



# Promoting Software Innovation

- OS/Driver Optimizations
  - Trim, Power efficiencies
  - RAID – write back cache
  - Storage Tiering
- Software developers
  - Gaming optimizations
    - Visual fidelity
    - Faster responsiveness





# Accelerating Adoption

## Industry Call to Action

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16



# Industry Call to Action - Standards

- JEDEC on SSD Endurance
  - Specify the Endurance (Terabytes Written)
  - Verify the Specification (Endurance Verification Test)



- SNIA on SSD Performance
  - Call for Performance Rating
  - Currently under committee evaluation

- ONFi has and continues to deliver innovation & interoperability



- NVMHCI Workgroup – Driving Client and Enterprise solution specifications

# Industry call to Action – Reaching the Consumer

## Innovations for “Ease of Use”

- SSD Toolbox
- Cloning Software
- OS Detection
- SW Optimizations
- Endurance Concerns
- Performance Ratings
- Continued Education / Awareness



Must make SSDs “Easy” for consumers



# Industry Call to Action – Reaching Enterprise and Client IT

- Educate, Enable, Innovate
  - Tools to understand actual workload
  - Software to efficiently run on high performance SSDs
  - Storage Tiering
  - New Interfaces
- Total Cost of Ownership focus
  - Do more with less



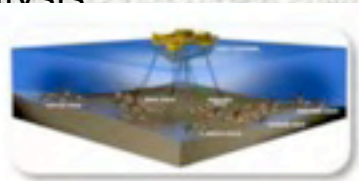
Financial Analysis



Datacenter Refresh



Web 2.0



Energy Exploration



Digital Content

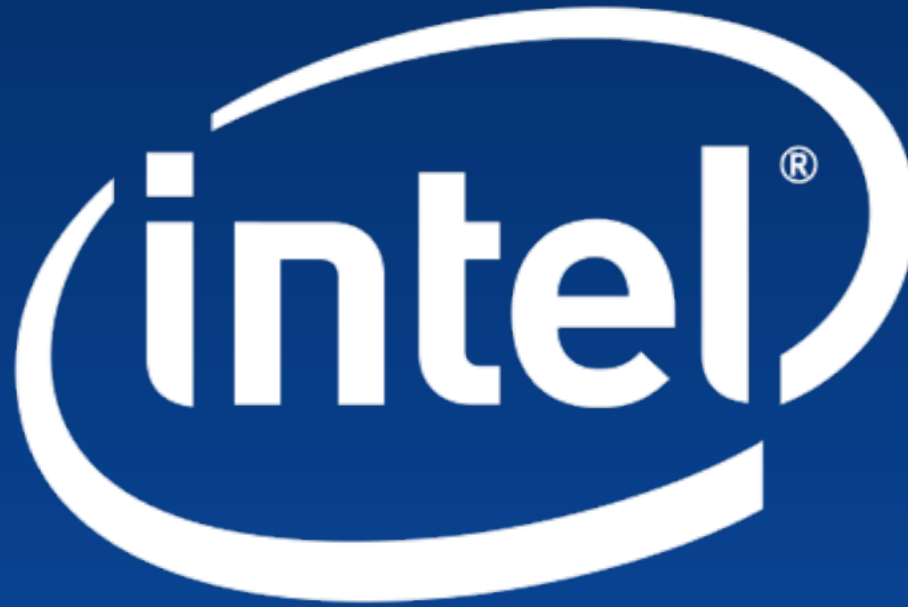


Cloud Computing

Santa Clara, CA  
August 2010

- SSDs are going mainstream. Period.

*Innovation must continue  
at every level, at every  
stakeholder*





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