Enterprise and Cloud Infrastructure (Secure, HA, Interoperable)

Public CloudCenter

Enterprise DataCenter

Supervisor/Partners

Remote/Branch Offices

Cellular

Wireless Endpoints

Home Networks

Web 2.0 Social Ntwks.
Facebook, Twitter, YouTube...
Cable/DSL...

Vertical Clouds

SaaS, PaaS, IaaS

VPN

Core optical

Edge

ISP

Core

Enterprise DataCenter

Enterprise CloudCenter

IntrDet

IntrDet

IntrDet

IntrDet

IntrDet
Market Segments by Applications

*IOs per second for a required response time (ms)

Bandwidth (MB/sec)

- eCommerce
- Transaction Processing
- OLTP
- Data Warehousing
- Business Intelligence
- Visual DB
- Scientific Computing
- Imaging
- Audio
- Video
- Web 2.0

(RAID - 0, 3)
(RAID - 1, 5, 6)
Corporate Data Usage

I/O Access Frequency vs. Percent of Corporate Data

- **Cache**
  - Logs
  - Journals
  - Temp Tables
  - Hot Tables

- **Disk Arrays**
  - Tables
  - Indices
  - Hot Data

- **Tape Libraries**
  - Back Up Data
  - Archived Data
  - Offsite DataVault

% of Corporate Data vs. % of I/O Accesses

1% 2% 10% 50% 100%

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Corporate Cloud Storage Usage

I/O Access Frequency vs. Percent of Corporate Data

- SSD
  - Logs
  - Journals
  - Temp Tables
  - Hot Tables

- SAS/FCoE Arrays
  - Tables
  - Indices
  - Hot Data

- Cloud Storage
  - SATA
    - Back Up Data
    - Archived Data
    - Offsite DataVault

- Cloud Storage
  - SATA
    - Back Up Data
    - Archived Data
    - Offsite DataVault
Rise of DB-in-Memory for BI / DataWarehousing

Scale In

Scale Up

Scale Out

Large DB Size Growth by Market Segment

Corporate Data Usage

I/O Access Frequency vs. Percent of Data

Virtual Tape Libraries
- Back Up Data
- Archived Data
- Offsite DataVault
HPC: Academia > BioMed > Wall St > Hollywood

- Earth Resources
  - Oil & Gas...
- Commercial Visualization
- Bioinformatics & Diagnostics
- Decision Support - Hedge Funds...
- Entertainment - VoD / U-Tube

- 100+ Teraflops
- Throughput: 100 GB/s
- Rendering (Texture & Polygons)
- Throughput: 1.2 GB/s
- Data rate & capacity
- Throughput: DSL/Cable

Data: IMEX Research & Panasas
Computing Dynamics – Memory Impact

- Cloud Computing
- Virtualization
- Power Efficiency
- Multicore
- Blades
- HPC Clusters
- Consumer Electronics - Visualization
- Hi Cap SSD/SATA
- VMs Memory Intensive
- New Techniques (Qiminda)
- 2-4GB Memory/Core
- Solid State Memory
- DRAM Capacity
- NAND Flash Capacity
- Lg. Addressable Space

Blade Servers – On a Fast Growth path

Scale In

Scale Out

Scale Up

Management Modules

Networking:

Storage: IP NAS, FC SAN

Cooling Fans

Power Supplies

Micro-Processors

Memory

DDR3 w ECC

Gbit Ethernet I/F

Processor Blades

Ww Blade Servers Market
(cum 2008-12)

Rev ~ 43 Billion
Units ~ 19 Million

Factory Rev $B

2008 2009 2010 2011 2012

$0 $2 $4 $6 $8 $10 $12

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NAND: Enabling Consumer to Enterprise Mkts

Cost Decreasing ~50% / GB / Year

Density Increasing 2X per Year

SSD 64-300 GB

NAND Fueling New Applications...

DSC Card 32MB ~ 4GB
USB Drive 64MB ~ 4GB
MP3 Player 512MB ~ 8GB
Cell Phone 512MB ~ 8GB

Source: Samsung & IMEX Research

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SSD Market Forecast by Application

Solid State Drive Revenue Forecast

- Rev ($M)
- $20,000
- Indt, Milt, Aero, Med
- Consumer
- Network Storage
- Mobile/ Desktop/Blade Servers

2007 2008 2009 2010 2011 2012

Solid State Drives Unit Forecast

- Units #K
- 120,000
- Indt, Milt, Aero, Med
- Consumer
- Network Storage
- Mobile/ Desktop/Blade Servers

2007 2008 2009 2010 2011 2012
Flash in Enterprise Storage Systems

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