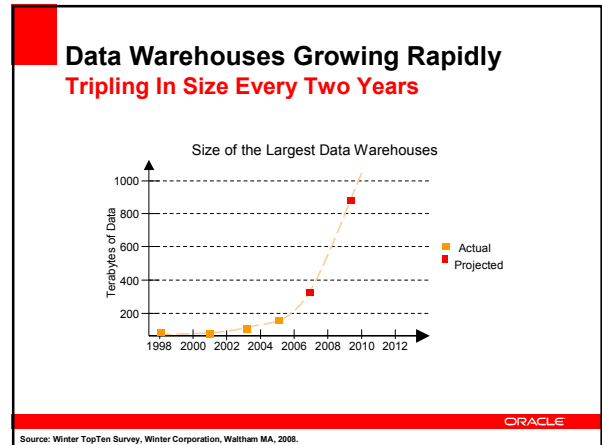
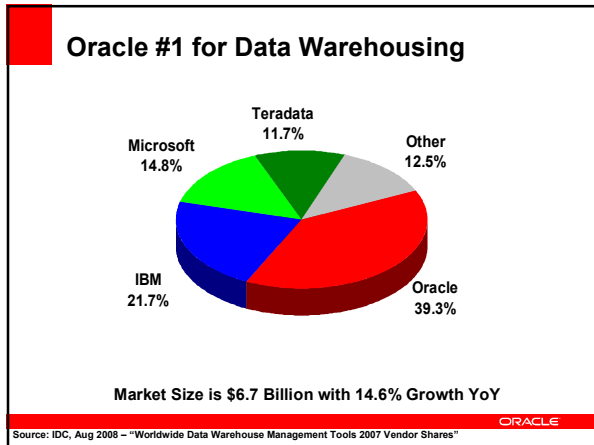


**HP Oracle Database Machine & Exadata Storage Server**  
**October 16, 2008**

Robert Stackowiak  
 Vice President, EPM & Data Warehousing Solutions, Oracle ESG



### What We Announced at OpenWorld

**Runs Oracle Data Warehouses 10x Faster**



**Announcing The World's Fastest Database Machine**

- Hardware by HP
- Software by Oracle

**Announcing The World's Fastest Database Machine**



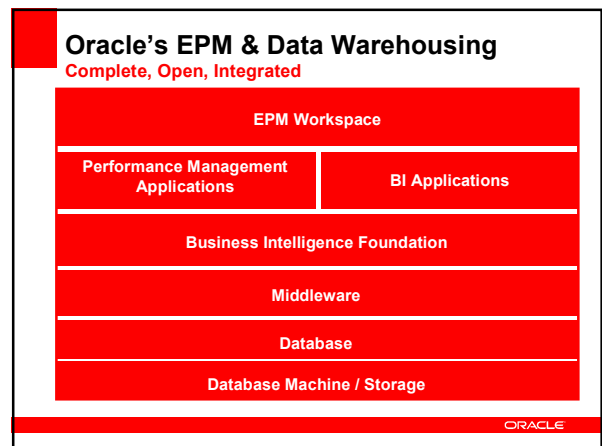
**Oracle Database Server Grid**

**Exadata Storage Grid Fast Query Processing**

**10x Faster Query Results**

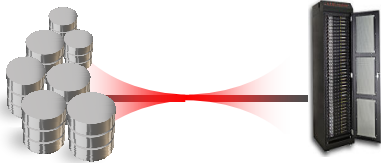
- Hardware by HP
- Software by Oracle

**Extreme Performance | Unlimited Scalability | Enterprise Ready**



## The Performance Challenge

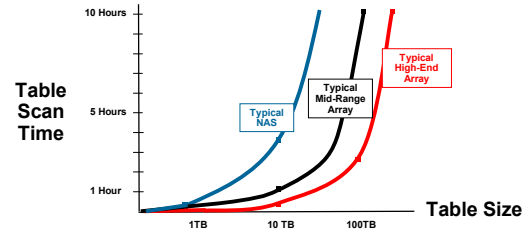
### Storage Data Bandwidth Bottleneck



- Current warehouse deployments often have bottlenecks limiting the movement of data from disks to servers
  - Storage Array internal bottlenecks on processors and Fibre Channel Loops
  - Limited Fibre Channel host bus adapters in servers
  - Under configured and complex SANs
- Pipes between disks and servers are 10x to 100x too slow for data size

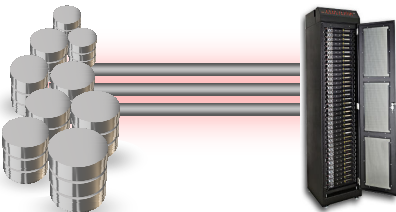
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## Data Warehouses Start Slowdown at 1TB



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## Solutions To Data Bandwidth Bottleneck



- Add more pipes — **Massively parallel architecture**
- Make the pipes wider — **5X faster than conventional storage**
- Ship less data through the pipes — **Process data in storage**

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## HP Oracle Database Machine: The next step in DW Hardware Solutions

Custom	Reference Configurations	Optimized Warehouse	HP Oracle Database Machine
<ul style="list-style-type: none"> <li>Complete Flexibility</li> <li>Any OS, any platform</li> <li>Easy fit into a company's IT standards</li> </ul>	<ul style="list-style-type: none"> <li>Documented best-practice configurations for data warehousing</li> </ul>	<ul style="list-style-type: none"> <li>Scalable systems pre-installed and pre-configured: ready to run out-of-the-box</li> </ul>	<ul style="list-style-type: none"> <li>Highest performance</li> <li>Pre-installed and pre-configured</li> <li>Sold by Oracle</li> </ul>

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## Products Announced

### HP Exadata Storage Server Hardware

- Paired with Oracle Exadata Storage Server Software
- Delivers database intelligence in storage tier
- Supported for Oracle Enterprise and Red Hat servers running Oracle Database 11g Enterprise Edition\*



### HP Oracle Database Machine

- Simplicity of appliance seamlessly integrated with the database
- Eliminates all bottlenecks preventing high performance data scans
- Includes Exadata Storage Server



**Dramatic performance improvement for data warehouses**

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\* Linux 6.1 releases with appropriate Infiniband drivers, Oracle Database 11g Enterprise Edition vers. 11.1.0.7

## The HP Oracle Database Machine

### Sales / Support Model

<ul style="list-style-type: none"> <li>System Delivery</li> <li>Hardware Service</li> </ul>	<ul style="list-style-type: none"> <li>System Sales</li> <li>System Support</li> </ul>
---	--

**Oracle Technology Sales Manager is the single point for sales**  
**Oracle is single point for Support**

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## HP Oracle Database Machine

**ANNOUNCING**  
The World's Fastest  
Database Machine



**Hardware  
by HP.  
Software  
by Oracle.**

## The HP Oracle Database Machine An Introduction...



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## HP Exadata Storage Server Hardware



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- 2 Intel processors, 8 cores
- 12 disk drives, up to 12 TB raw storage
- 2 Infiniband connections
- Oracle Enterprise Linux OS

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## SAS or SATA Disks in Exadata Servers

- Choice of either
  - 450 GB 15,000 RPM SAS disks
  - 1 TB 7,200 RPM SATA disks
- Choose SAS Based Servers for High Performance

SAS Advantages	SAS	SATA	Advantage
Throughput (MB/s)	1,000	750	1.33X
Average Seek Time (ms)	3.5	7.4	2.11X
Disk level read errors (per year)	6.3	63	10.00X
Years to disk failure	15.2	11.4	1.33X

- Choose SATA Based Servers for High Capacity

SATA Advantages	SAS	SATA	Advantage
Capacity (TB)	5.4	12	2.22X

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## Oracle Exadata Storage Server Software Reduces Data Going through the Pipes

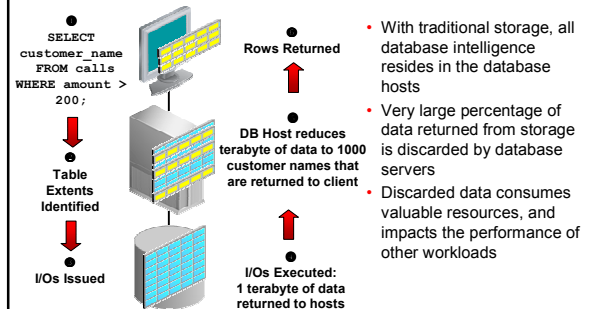


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- Intelligent storage server
  - Unique 'smart scan' technology
- Returns query result set
  - Not disk blocks

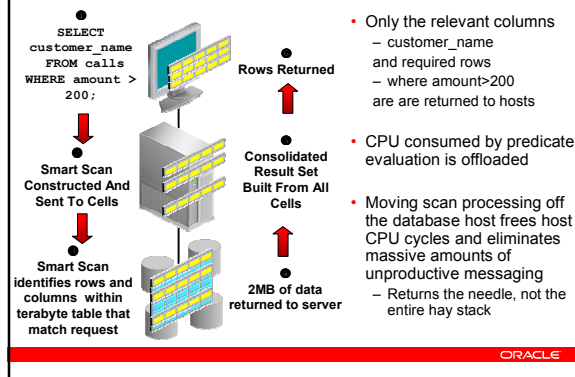
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## Traditional Scan Processing



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## Exadata Smart Scan Processing



## Additional Smart Scan Functionality

- Join filtering**
  - Star join filtering is performed within Exadata storage cells
  - Dimension table predicates are transformed into filters that are applied to scan of fact table
- Backups**
  - I/O for incremental backups is much more efficient since only changed blocks are returned
- Create Tablespace (file creation)**
  - Formatting of tablespace extents eliminates the I/O associated with the creation and writing of tablespace blocks

## Smart Scan Transparency

- 
- Smart scans are transparent to the application
    - No application or SQL changes required
    - Returned data is fully consistent and transactional
    - If a cell dies during a smart scan, the uncompleted portions of the smart scan are transparently routed to another cell
  - Smart Scans correctly handle complex cases including
    - Uncommitted data and locked rows
    - Chained rows
    - Compressed tables
    - National Language Processing
    - Date arithmetic
    - Regular expression searches
    - Partitioned tables
- High Throughput, Reduced Overhead, No Complex Tuning**

## HP Oracle Database Machine

### Pre-Configured High Performance Data Warehouse

- 8 HP ProLiant DL360 Oracle Database servers
  - 2 quad-core Intel Xeon, 32GB RAM
  - Oracle Enterprise Linux
- 14 Exadata Storage Cells (SAS or SATA)
  - Up to 21 TB uncompressed user data (SAS)
  - Up to 46 TB uncompressed user data (SATA)
- 4 InfiniBand switches
- 1 Gigabit Ethernet switch
- Keyboard, Video, Mouse (KVM) hardware
- Includes HP Hardware Install at Customer
- Includes Software Installation & Configuration
  - OEL, Exadata Storage Server Software, Database EE & Options
- Hardware Warranty
  - 3 YR Parts/3 YR Labor/3 YR On-site
  - 24x7, 4 Hour response time
- Software licenses sold separately



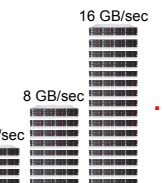
Add more racks for unlimited scalability

## Exadata Product Capacity

	Raw Storage	User Data	Data Bandwidth
HP Exadata Storage Server Hardware SAS 12x450	5.4 TB	1.5 TB	1 GB/s
HP Exadata Storage Server Hardware SATA 12x1000	12 TB	3.3 TB	0.75 GB/s
HP Oracle Database Machine Hardware SAS 450	75 TB	21 TB	14 GB/s
HP Oracle Database Machine Hardware SATA 1000	168 TB	46 TB	10.5 GB/s

## Massively Parallel Storage Grid

- Exadata Storage servers are organized into a massively parallel storage grid
- Scalable**
  - Scales to hundreds of storage servers
  - Data automatically distributed across storage servers by ASM
    - Transparently redistributed when storage servers are added or removed
  - Data bandwidth scales linearly with capacity
- Available**
  - Data is mirrored across storage servers
  - Failure of disk or storage server transparently tolerated
- Simple**
  - Works transparently - no application changes



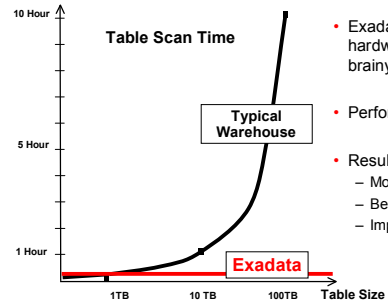
## Software Components

- **Recommended Software**
  - Oracle Database 11g Enterprise Edition\*
  - Oracle Exadata Storage Server Software\*
  - RAC\*
  - Partitioning Option\*
  - Advanced Compression Option
  - Enterprise Manager Packs: Diagnostics, Provisioning, Tuning
- **Additional Software**
  - OLAP Option
  - Data Mining Option
  - Advanced Security Option
  - Real Application Testing
  - Oracle Business Intelligence Enterprise Edition Plus

\* Required software.

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## Exadata Performance Scales

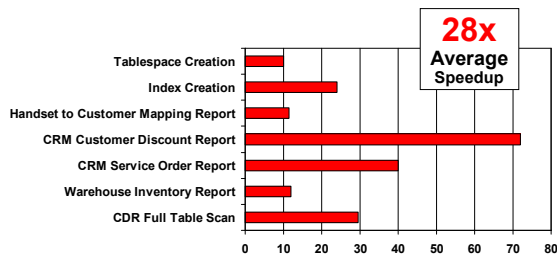


- Exadata delivers brawny hardware for use by Oracle's brainy software
- Performance scales with size
- Result
  - More business insight
  - Better decisions
  - Improved competitiveness

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## M-Tel Exadata Speedup

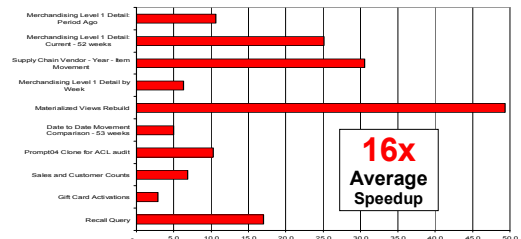
10X to 72X Performance Improvement



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## Giant Eagle Exadata Speedup

3X to 20X Performance Improvement



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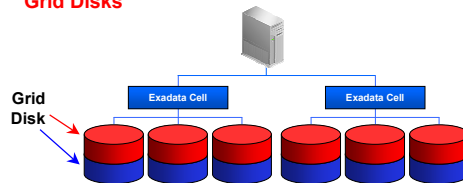
## Database Machine Comparison

	HP Oracle Database Machine	Netezza 10100	Toradata 2550
Footprint	1 rack	1 rack	1 rack
User data	21 TB	✓ 12.5 TB	12.6 TB
Disks	✓ 168 x 450GB disks	108 x 400GB disks	144 x 300GB disks
Database cores	64 DB Cores	✓ 4 DB Cores (?)	32 DB Cores
Storage cores	✓ 112 Storage Cores	108 Storage Cores*	0 Storage Cores
Total cores	✓ 176 Cores	112 Cores*	32 Cores
Interconnect	✓ 20Gb/sec Infiniband	1Gb/sec Ethernet	1 Gb/sec BYNET
Memory	✓ 368 GB	108 GB	128 GB
HW Architecture	Open	✓ Proprietary	Proprietary**

\* Netezza 10100 uses more than Intel Xeon cores  
\*\* Toradata BYNET Interconnect is proprietary

## Exadata Storage Layout Example

Grid Disks

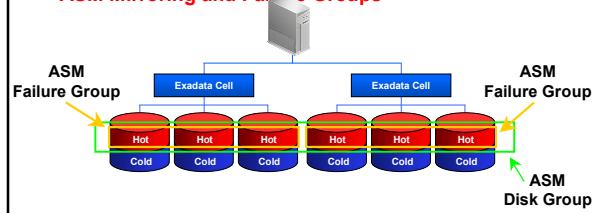


- Cell Disks are logically partitioned into Grid Disks
  - Grid Disk is the entity allocated to ASM as an ASM disk
  - Minimum of one Grid Disk per Cell Disk
  - Can be used to allocate "hot", "warm" and "cold" regions of a Cell Disk or to separate databases sharing Exadata Cells

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## Exadata Storage Layout Example

### ASM Mirroring and Failure Groups



- ASM mirroring is used protect against disk failures
- ASM failure groups are used to protect against cell failures

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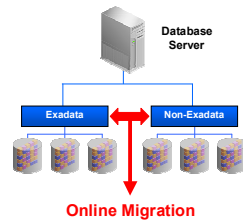
## Data Protection Solutions

- All single points of failure eliminated by the architecture
- Hardware Assisted Resilient Data (HARD) built into storage
  - Prevent data corruption before it happens
- Data Guard provides disaster protection & data corruption protection
  - Automatically maintained second copy of database
- Flashback provides human error protection
  - Snapshot-like capabilities to rewind database to before error
- Recovery Manager (RMAN) provides backup to disk
  - Archiving and corruption protection
  - Can be used with Oracle Secure Backup (OSB) or third party tape backup software
- These work just as they do for traditional non-Exadata storage
  - Users and database administrator use familiar tools

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## Exadata Co-Existence and Migration

- Databases can be concurrently deployed on Exadata and traditional storage
  - Tablespaces can exist on Exadata storage, traditional storage, or a combination of the two, and is transparent to database applications
  - SQL offload processing requires all pieces of a tablespace reside on Exadata
- Online migration if currently using ASM and ASM redundancy
- Migration can be done using RMAN or Data Guard



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## Where Can You Try It?

- North America Enterprise Technology Centers (ETC)
  - Atlanta, GA
    - Two HP Oracle Database Machines, each with 8 database server nodes and 14 HP Exadata Storage Server cells holding 12 drives of 1 TB in size each
    - Capacity of about 46 TB of uncompressed data / rack
  - Reston, VA
    - Three HP Oracle Database Machines, each with 8 database server nodes and 14 HP Exadata Storage Server cells holding 12 drives of 300 GB in size each
    - Capacity of about 14 TB of uncompressed data / rack

A queue has already formed!

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## How we are Prioritizing Interest

- Oracle Technology Sales Manager coordinates with Oracle data warehouse specialist Sales Consultants
- We are looking for:
  - Well-known companies or organizations who will be references
  - Oracle knowledgeable staff
  - Performance challenges likely due to unbalanced hardware
  - Budget and clear business need
  - Query profile will benefit from Oracle Exadata Storage Server Software
  - Interest in full HP Oracle Database Machine configuration

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## Oracle Consulting Services

- Oracle Data Warehouse Extreme Performance Workshop
  - Oracle Business Intelligence Extreme Performance Workshop
  - Oracle Extreme Performance Exadata Planning
  - Five Days Length each
- Other services
  - Data Warehouse Extreme Performance Assessment
    - Determine optimal solutions including Oracle's newest platform offerings and how to deploy successfully for new and existing data warehouses
    - Limited availability, one day in length

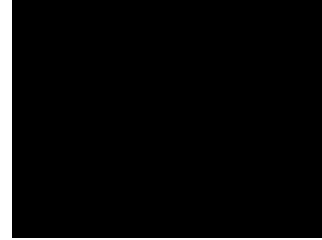
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## Exadata Benefits

- Extreme Performance
  - **10X** and more speedup for data warehousing
- Database Aware Storage
  - Smart Scans
- Massively Parallel Architecture
  - Dynamically Scalable to hundreds of cells
  - Linear Scaling of Data Bandwidth
  - Transaction/Job level Quality of Service
- Mission Critical Availability and Protection
  - Disaster recovery, backup, point-in-time recovery, data validation, encryption

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## Some Early Customer Comments...



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## Resources

- Oracle.com:  
<http://www.oracle.com/exadata>
- Oracle Exadata Technology Portal on OTN:  
<http://www.oracle.com/technology/products/bi/db/exadata>
- Oracle Exadata white papers:  
<http://www.oracle.com/technology/products/bi/db/exadata/pdf/exadata-technical-whitepaper.pdf>  
<http://www.oracle.com/technology/products/bi/db/exadata/pdf/migration-to-exadata-whitepaper.pdf>

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