



Oracle Optimized Storage Solutions

For Datacenter Consolidation, Virtualization and Cloud

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Storage in Datacenter Transformation

Driving Factors



- **Explosive Data Growth**
 - 40% to 60% Yearly Growth
 - 29x Increase in the Digital Universe, 35,000 Exabytes by 2020¹
- **Virtualization and Cloud**
 - Immense diversity of server I/O needs
 - VM mobility and the end of dedicated app/system/storage silos
 - Application elasticity and self service
 - Multi-tenant security
- **Disaster Recovery, Compliance and Archiving**
 - Compliance requirements everywhere – SOX, HIPPA, FDA, etc
 - 68% of customers require 100 year archive²
- **Operations and Budgets**
 - Storage efficiency, server efficiency, management efficiency
 - Risks and costs of keeping everything online

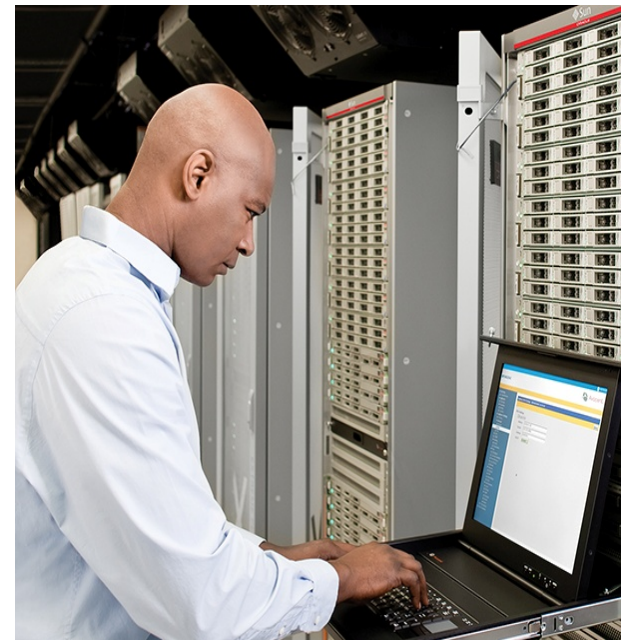
Sources: 1) IDC Digital Universe Study, 2011 2) SNIA 100 Year Archive Report



The Role of Storage in Your Datacenter Transformation

5 Key Questions to Ask

- Is your storage maximally **efficient**?
- Does your storage force the creation of **unconsolidated**, application specific silos?
- Does your storage enable mission critical applications to run at maximum **performance**?
- Does your storage support a migration to **virtualization and cloud**?
- Is your data really **protected**?



Oracle's Storage Strategy

**Engineered for Oracle Software, and
Best of Breed for Mixed Environments**



Seamless Integration

- Oracle applications **auto-provision and tune Oracle Storage**
- Single system interface for all statistics, alerts, analytics, provisioning
- Dynamic and **deterministic QoS** driven by Oracle applications

Highest Performance

- Oracle Database **dynamically exchanges I/O requirements** with Oracle Storage
- Database query pre-fetch and off-load with optimized data caching
- End-to-end data transport with zero buffer copies over InfiniBand fabrics

Most Efficient

- **Data compression without rehydration** from database to disk to tape
- Seamless automated backup and recovery across the entire Oracle stack
- Automated, policy-based **tiering** across flash, disk and tape



Hardware and Software
ORACLE
Engineered to Work Together



Oracle Storage Strategy

Engineered for Oracle Software / Best of Breed for Mixed Environments

Oracle Software
Runs Fastest and
Most Efficiently on
Oracle Storage



Oracle Database Hybrid Columnar Compression

Now Available for Oracle SAN and NAS Solutions

www.saoug.co.za

Exadata



Pillar Axiom



3x Less Disk Space

3x Less Energy Used

3x Lower Cost

Compared to NetApp and EMC NAS and SAN Storage

Sun ZFS Storage Appliance



Ideal for Data Warehousing, Database ILM, Test and Development

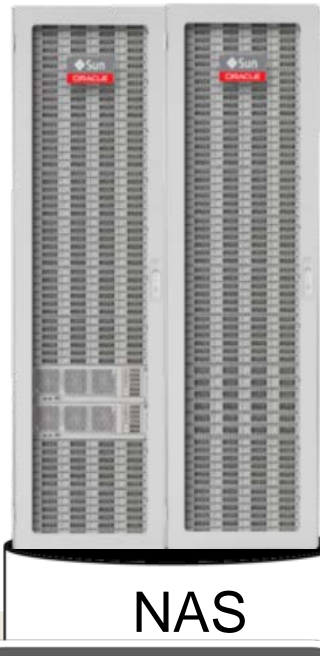


Oracle's Complete Storage Portfolio



Database

- Extreme Performance, 1.5M Database IOPS
- Extreme Efficiency, 10x – 50x with Hybrid Columnar Compression
- Engineered System Component



NAS

- Best NAS Performance
- Best Analytics
- 3x-5x More Efficient – Hybrid Columnar Compression
- Trusted: Oracle On Demand



SAN

- Patented Quality of Service
- Performance Scaling and Distributed RAID
- 3x-5x More Efficient – Hybrid Columnar Compression
- Storage Domains



Tape

- Best Enterprise Tape TCO
- Highest Reliability and Availability
- Best Investment Protection
- Security Integration with Oracle Database

Transformation Number 1: Mission Critical Database Consolidation





Mission Critical Database Storage

Oracle Exadata Database Machine and SPARC SuperCluster

www.saoug.co.za

Oracle Database Storage Grid

- Standard 2-socket servers for storage servers
- Oracle Exadata
 - Up to 168 standard hard disk drives
- SPARC SuperCluster
 - Up to 72 standard hard disk drives
- Identical systems and functionality
- Increase capacity with Oracle Exadata Expansion Storage Rack
 - Identical capabilities
 - Up to 216 standard hard disk drives



Oracle Exadata
Database
Machine



SPARC
SuperCluster



Oracle Exadata Storage

Better than EMC for Database I/O



	EMC Symmetrix	Oracle Exadata
Execute database queries in storage	No	Yes
Database archival compression in storage	No	Yes
Database-aware flash cache	No	Yes
Database IOs per second	~150K	1.5M
Average database archive compression factor	3x	10X
Database bandwidth, high-performance disks	64 GB/sec.	250 GB/sec.
Database cache usable capacity	0.5 TB	53 TB
Number of racks	5	1



Transformation Number 2: Predictable, Efficient, Scalable SAN Storage





Oracle's Pillar Axiom 600

Next Generation SAN Storage
that linearly scales both capacity and performance

SINGLE ACTIVE-ACTIVE
CONTROLLER WITH ONE
STORAGE BRICK



2 Control Units
13 Drives
12TB Capacity
48GB Cache

UP TO 4 ACTIVE-ACTIVE
CONTROLLERS WITH 64
STORAGE BRICKS

8 Control Units
Up to 832 drives
Up to 1.6PB Capacity
192GB Cache
128 RAID Controllers
SATA, FC, and SSD Storage
Classes



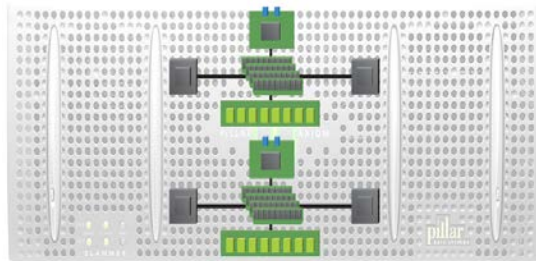
Pillar Axiom 600 features:

- ✓ Patented Quality of Service (QoS) Software
- ✓ Protocols: FC, iSCSI, CIFS, NFS
- ✓ Management: Application Profiles, Thin Provisioning, Storage Domains, MaxMan, Path Management
- ✓ Data Protection and Mobility: Copy Services (Vol Copy, Clones and Snapshots), SecureWORMfs, Replication
- ✓ Engineered integration with Oracle software: Oracle HCC, OEM, ASM, SAM, Oracle VM



Axiom 600 Terminology

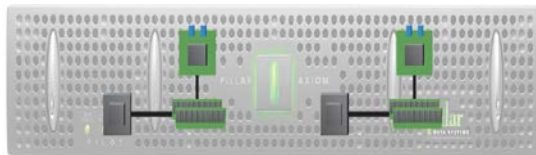
Basic Building Blocks



Storage controller - Slammer



Storage enclosure - Brick



Management controller - Pilot

Storage Controllers – Slammer (1 to 4 per Axiom)

- Active-Active SAN or NAS control units
- SAN: 4x 8Gbps FC, 4x 4Gbps FC, 8x 1GbE iSCSI
- NAS: 4x 10GbE, 8x 1GbE
- Redundancy for High Availability

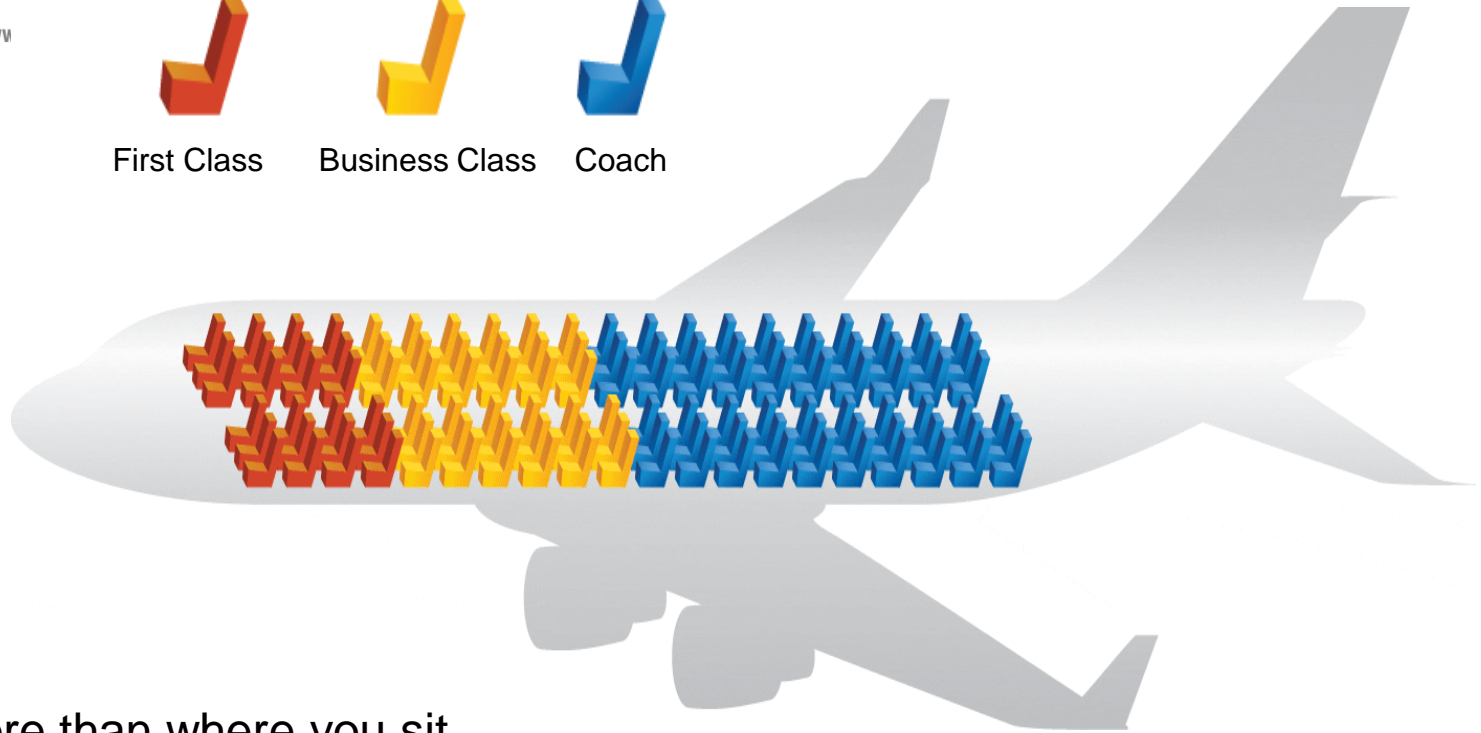
Storage Enclosure – Brick (1 to 64 per Axiom)

- Dual RAID controllers
- Embedded RAID-5 and RAID-10
- SATA, Fibre Channel and SSD drives
- Built in hot spare
- Hot-swappable drives and RAID Controllers

Management Controller - Pilot (1 per Axiom)

- Dual control units
- Active/Standby - High Availability Cluster
- (2) Hard drives for Configuration and Log Cache
- (6) 10/100/1000 Base-T Ethernet

What is Quality of Service?



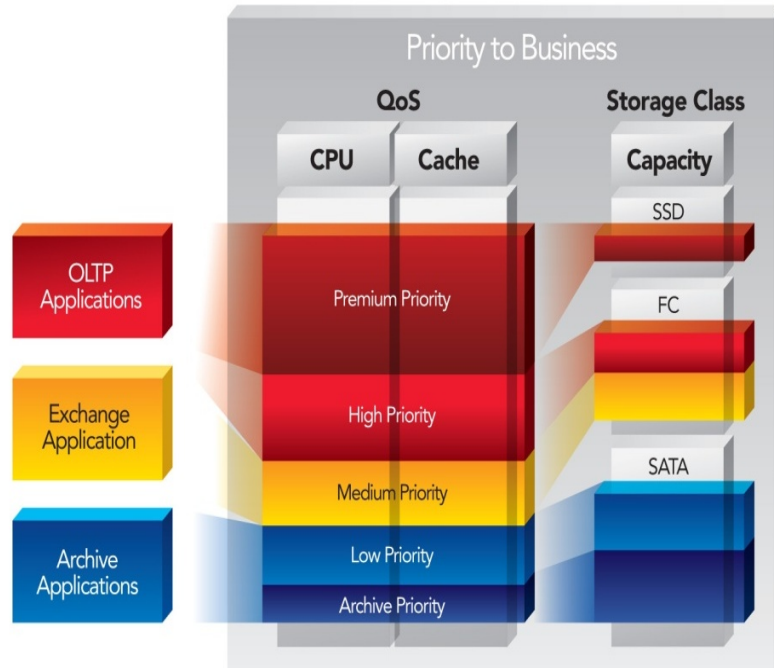
QoS is more than where you sit,
it's also the priority and class of service you get

- How fast you board and exit
- The number of attendants per passenger
- The seat size and leg room
- The entertainment selections



Deterministic Performance with Pillar Axiom Quality of Service

5 Classes of Service, 3 Storage Types, Multiple Storage Domains

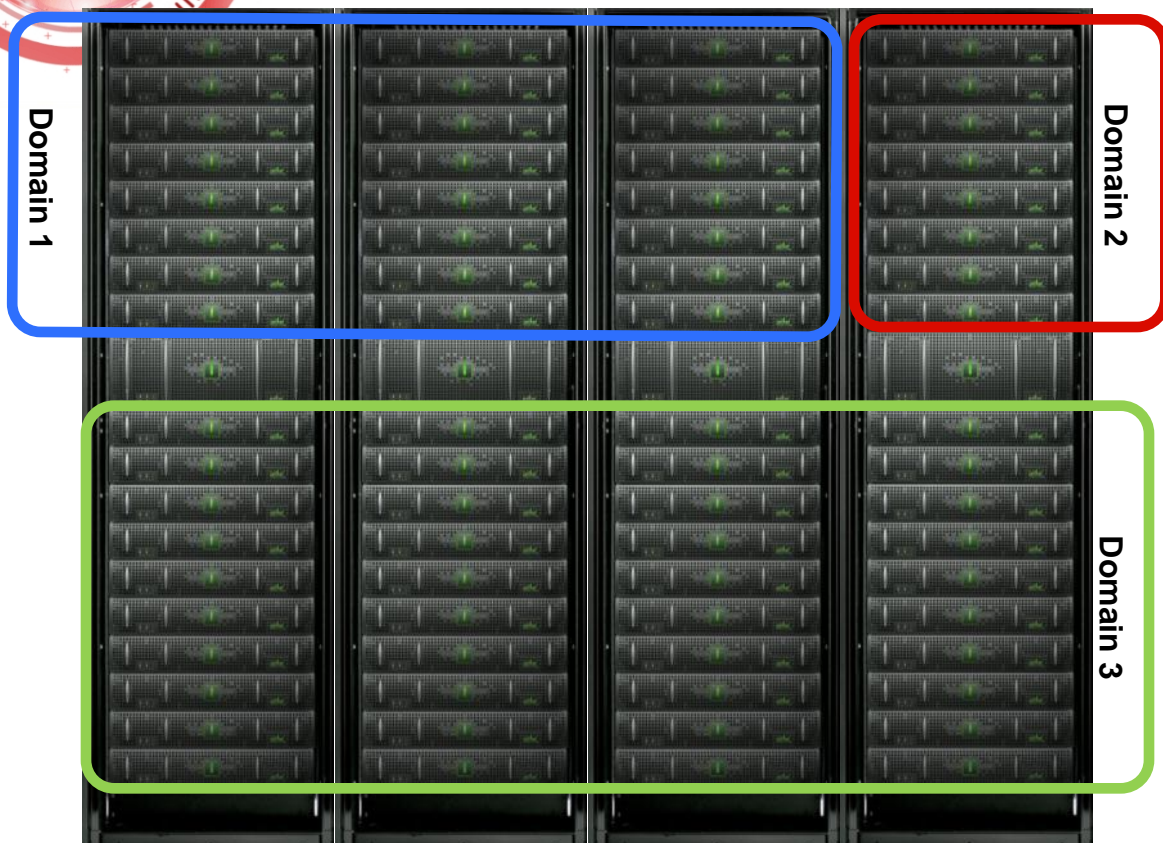


Pillar Axiom QoS manages multiple attributes:

- Deterministic IO prioritization
- Cache, CPU, and bandwidth resources
- Drive type, count and data location
- Read/write bias and RAID type



Extending QoS with Storage Domains



Create up to 64 Physical Domains in a Single Axiom

- Refresh Legacy or Aging Bricks without Disruption
- Isolate Application Data or Workloads to Physical Location
- Separate User Groups or Departments to Physical Location
- Separate Protocols



Pillar Axiom 600 enables IT Administrators to
utilize 80% of storage capacity with minimal
to no performance degradation
-- twice the industry average --

Source: IDC, Gartner Dataquest

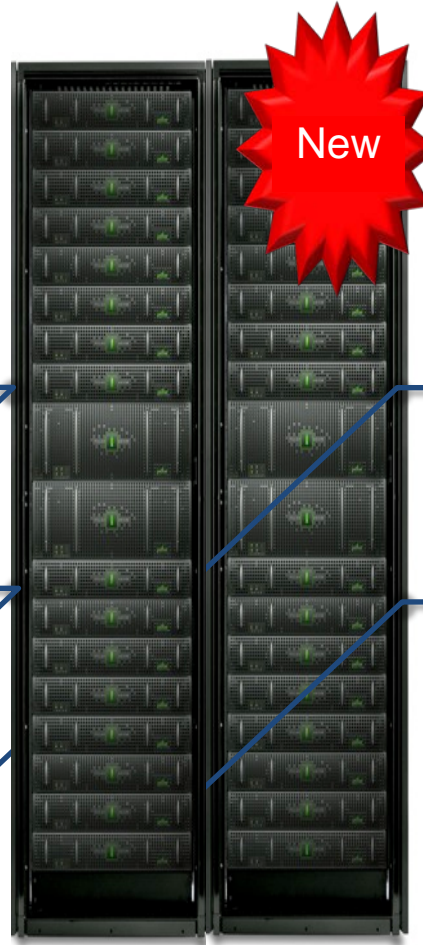
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Pillar Axiom 600 Storage System

4x More Scalable and 3x More Efficient than EMC VNX



Patented Quality of Service

Deterministic IO queue management aligned to business importance

New

Most Efficient

5x less disk space, energy usage, and cost than competition

Best Modular Scalability

Elastic system-wide scaling without forklift upgrades

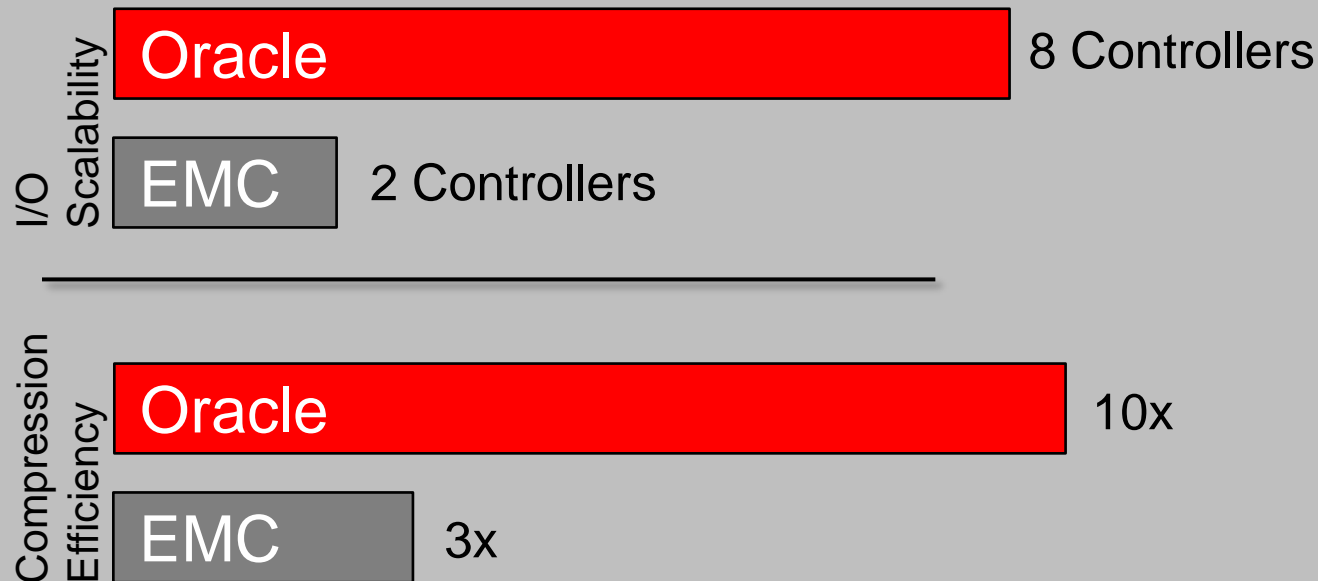
Distributed RAID

Linearly scale performance and capacity without disruption



Pillar Axiom 600 Storage System

4x More Scalable and 3x More Efficient than EMC VNX



Source: public product specifications (Pillar Axiom 600 vs. EMC VNX5700)



Transformation Number 3: Enterprise NAS with Oracle Integration





Sun ZFS Storage Appliance

Oracle's Enterprise-Class NAS Storage Solution

www.saoug.co.za

7120



SINGLE CONTROLLER

Scales to 100TB
Scales to 96GB Flash

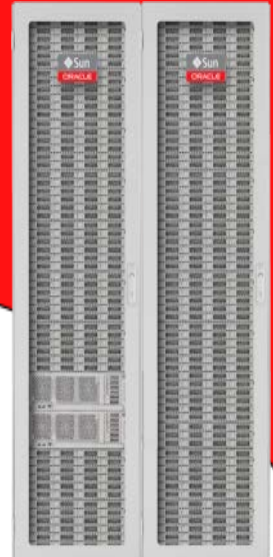
7320



DUAL OR SINGLE CONTROLLERS

Scales to 200TB
Scales to ~5TB Flash

7420



ACTIVE-ACTIVE CONTROLLERS

Scales to over 1PB
Scales to ~6TB Flash

Enterprise Storage Software

- ✓ All NAS Protocols: CIFS, NFS, InfiniBand, WebDEV, etc.
- ✓ Concurrent SAN Capabilities: Fibre Channel, iSCSI
- ✓ Data Reduction Software: Thin provisioning, Compression, Deduplication
- ✓ Data Protection Software: Replication, Snapshot, Mirroring
- ✓ Industry-leading Storage Analytics
- ✓ Engineered Integration with Oracle software



Sun ZFS Storage Appliances

2x Faster and 2x Better Price/Performance than NetApp



Best Analytics

Visualize and resolve issues up to 50% faster than with NetApp

New with
Gen. 3

Most Efficient

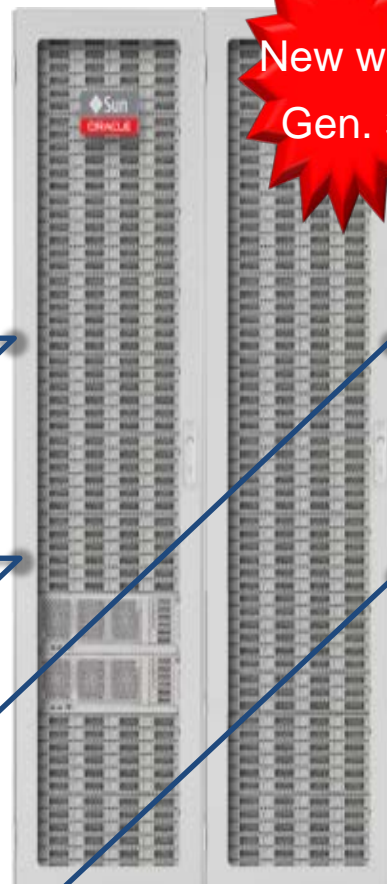
3x – 5x better storage efficiency with Hybrid Columnar Compression

Best Performance

Small-block and streaming performance up to 2x faster than NetApp^{1,2}

Trusted by Oracle IT

Oracle runs on ~300 ZFS Storage Appliances (40PBs-50,000 shares)



Small-block performance based on SPC-1 results as of October 3, 2011. Source: Storage Performance Council

(1) Oracle Sun ZFS Storage Appliance: http://www.storageperformance.org/results/benchmark_results_spc1#a00108

(2) NetApp FAS 3270A: http://www.storageperformance.org/results/benchmark_results_spc1#ae00004

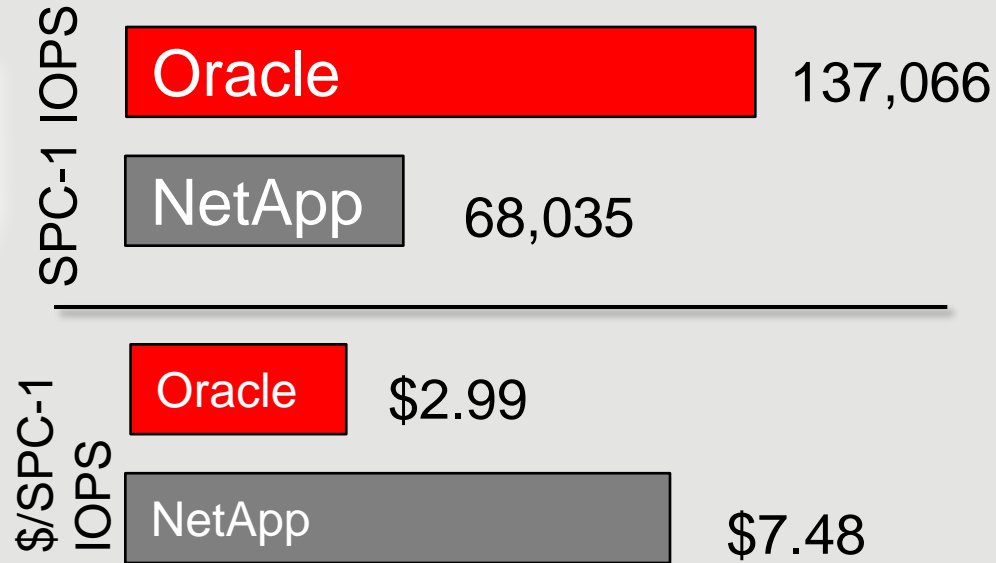
Streaming performance based on published Exadata backup performance



Sun ZFS Storage Appliances

2x Faster and 2x Better Price/Performance than NetApp

**SPC-1
Benchmark**
storage benchmark
that represents a
typical database
workload



**New with
Gen. 3**

SPC-1 results as of October 3, 2011. Source: Storage Performance Council

- (1) Oracle Sun ZFS Storage Appliance: http://www.storageperformance.org/results/benchmark_results_spc1#a00108
- (2) NetApp FAS 3270A: http://www.storageperformance.org/results/benchmark_results_spc1#ae00004



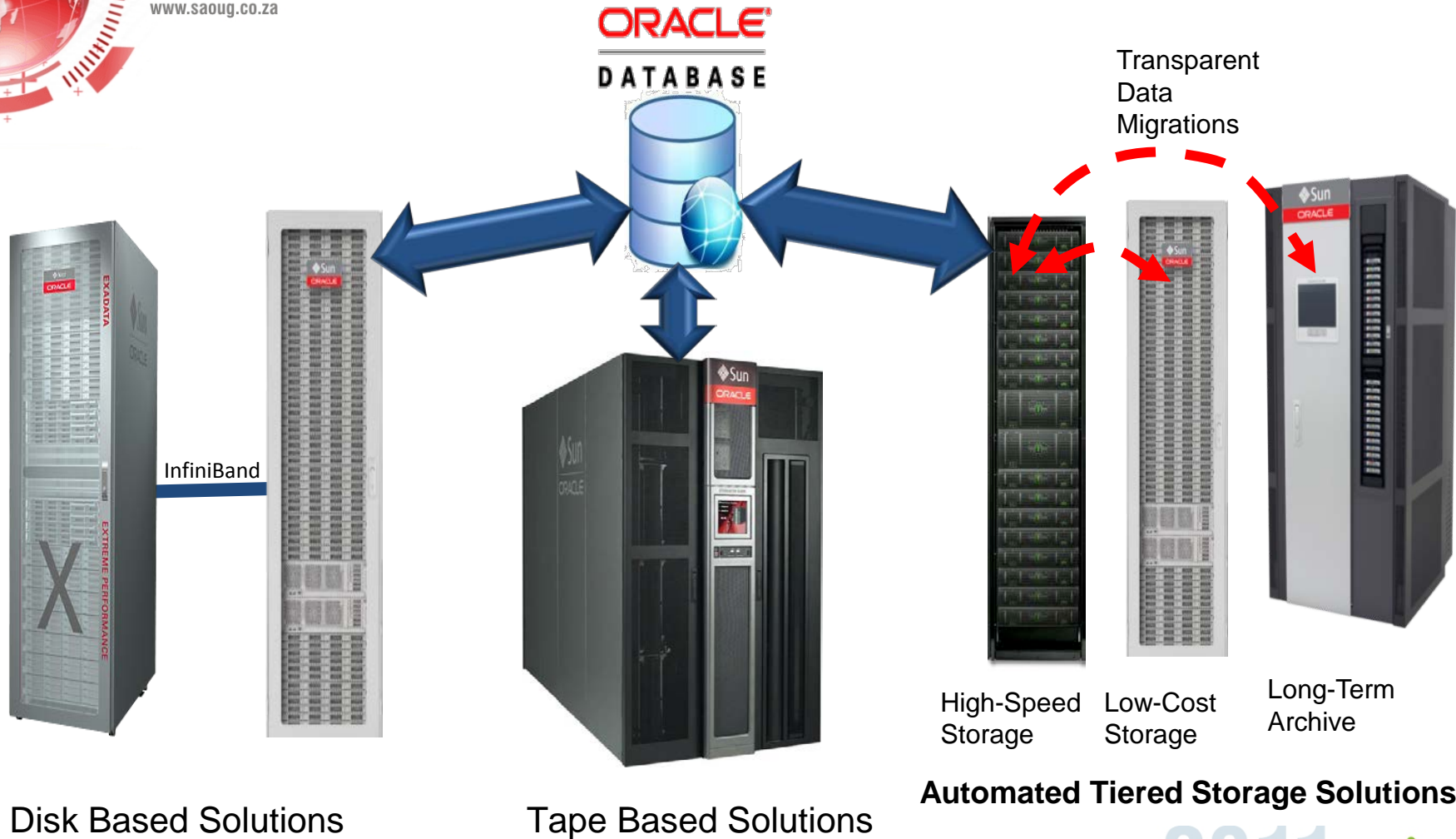
Transformation Number 4: Reliable Data Protection and Archiving



Oracle Data Protection and Archiving Options

Powerful Suite of Solutions

Optimized for Oracle Database and Mixed Environments





Oracle's StorageTek Tape Beats IBM's Best

Oracle T10000C and SL8500/SL3000



VS.



Conclusion

Oracle Offers Differentiated Storage for Your Toughest Requirements

Engineered for Oracle Software,
Best of Breed for Mixed Environments



- Oracle storage supports your strategy for datacenter transformation.
 - Database I/O
 - NAS for File I/O
 - SAN for Block I/O
 - Tape for Archive and Compliance
- Industry leading performance, efficiency and innovation
 - Best-in-class database and NAS performance
 - 3x to 5x advantages with Hybrid Columnar Compression
 - The market leader with Axiom Quality of Service, ZFS Hybrid Storage Pools, ZFS DTrace Analytics, and Tape Data Integrity
- Oracle storage solutions simplify deployments and automate management to deliver leadership TCO in Oracle and mixed environments.





Oracle Storage

**Only Storage
Engineered for
Oracle Software**

**Oracle Software
Runs Fastest and
Most Efficiently on
Oracle Storage**



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Q&A



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