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Oracle Solaris 11

The First
Cloud OS

Solaris 11 New Features

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Solaris 11. The First Cloud OS.

Next Generation of UNIX

- **#1 UNIX**
  - Industry leading availability, security and performance

- **Built for Cloud Infrastructures**
  - Breakthrough architecture to deploy, secure and manage enterprise clouds

- **Engineered for Oracle**
  - Optimized for Oracle software and hardware

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SOLARIS

The First
Cloud OS

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Oracle Solaris 11

World's First Cloud Operating System

Oracle Solaris 11

Simplified Administration

- 3x faster provisioning vs VMware

- 4x faster upgrades vs Red Hat

- 2.5x faster reboots vs Red Hat

- 46% fewer hardware outages using FMA

Designed-in Virtualization

- Fully virtualized: OS, network and storage

- Virtual network services built in

- 15x lower virtualization overhead vs VMware

- 4x lower latency vs. KVM

Scalable Data Management

- 10x storage savings for virtualization

- 2x storage compression
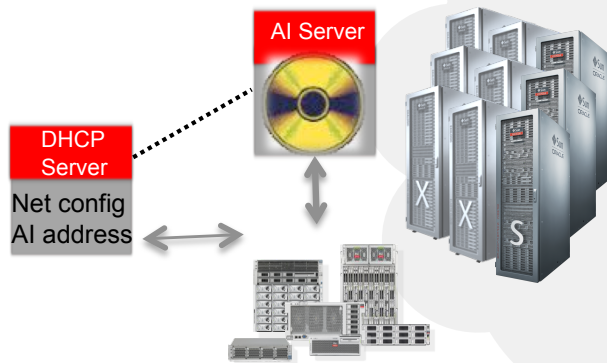
- 2x SPC-1 IOPs vs NetApp at ½ the cost

Advanced Protection

- Immutable root file system

- 4.3x faster OpenSSL vs AIX

- 3x faster ZFS encryption on SPARC vs Westmere x86

Simplified Cloud Deployments

Creating an Enterprise Cloud

Fool-proof updates with
Boot Environments and IPS Packaging

Rapid provisioning with
Automated Installer

Shrinking maintenance windows
High-skill patching
Risky updates

Active BE   Active BE   Old BE
                New BE   Updated BE

AI Server

DHCP
Server

Net config
AI address

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Rapid development, test and
deployment of Zones

ZONE
APPLICATION

ZONE
APPLICATION

ZONE
APPLICATION

ZONE
APPLICATION

ZONE
APPLICATION

APPLICATION
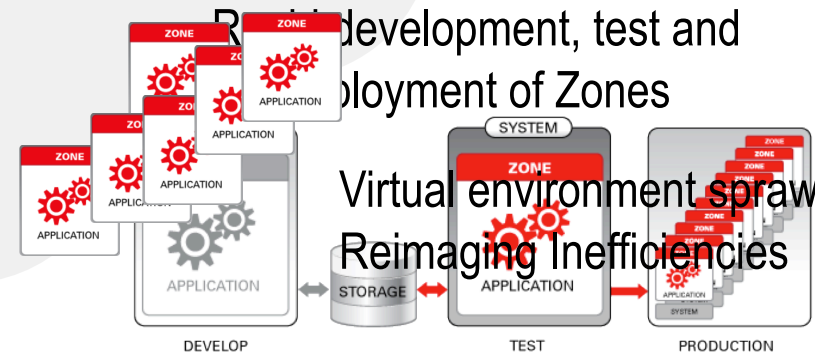
Virtual environment sprawl
Reimaging Inefficiencies

SYSTEM

ZONE
APPLICATION

ZONE
APPLICATION
SYSTEM

STORAGE

DEVELOP   TEST   PRODUCTION

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Unlimited Boot Environments

System Update Redefined. Only on Solaris.

- Safe rollback

- 4x faster updates than RHEL

- Powered by ZFS

    - Space and time efficient using clones

    - No adding disks or volumes

    - Upgrade while maintaining mirrored root
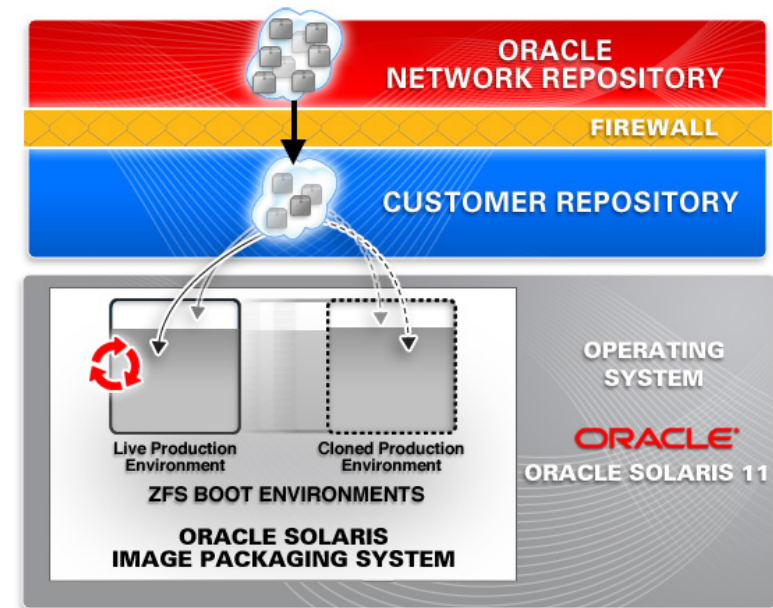
- Simple to create, list, and destroy

Active BE

Active BE
New BE

Old BE
Updated BE

Always safe OS updates, with integrated rollback

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Image Packaging System
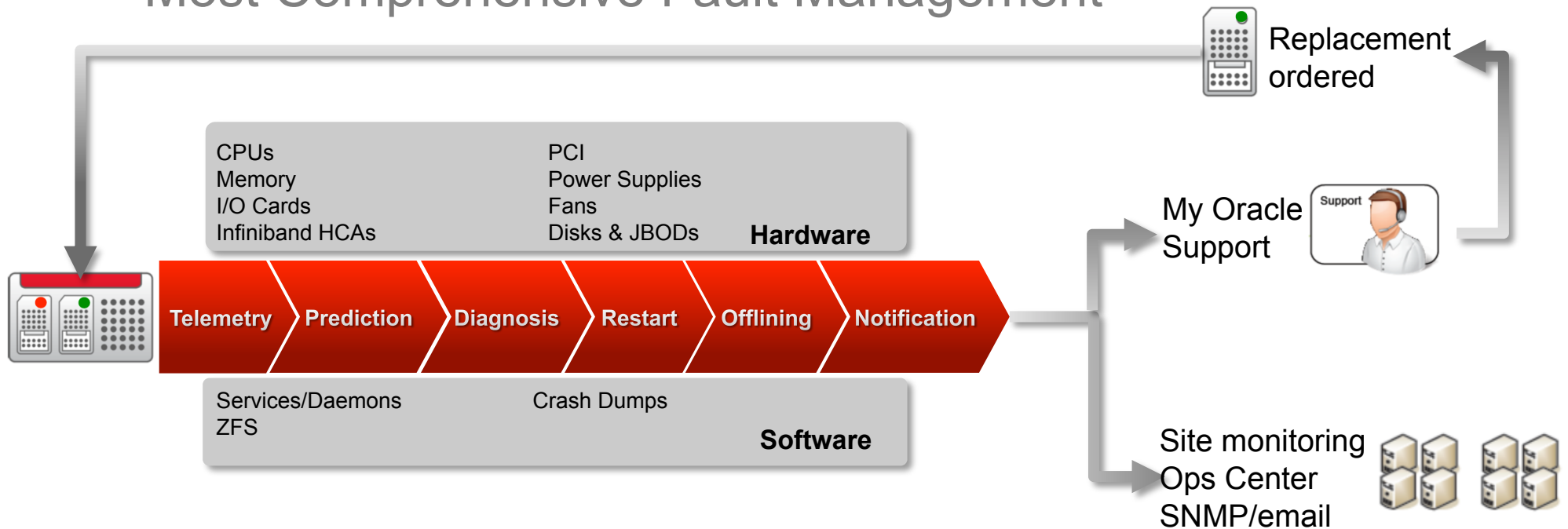
Change Management Built for the Enterprise

- Networked package repositories

- Cryptographically verified

- Complete set of tools

  - Package, version, and distribute your internal applications

- Easy to pilot and automate

  - *Best* practice is the *default* practice

  - Can't stray off track

Lightning fast updates at massive scale

ORACLE NETWORK REPOSITORY

FIREWALL

CUSTOMER REPOSITORY

Live Production Environment
Cloned Production Environment

ZFS BOOT ENVIRONMENTS

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IMAGE PACKAGING SYSTEM

OPERATING SYSTEM

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Self-Healing Systems

Most Comprehensive Fault Management

Replacement ordered

Hardware

CPUs
Memory
I/O Cards
Infiniband HCAs

PCI
Power Supplies
Fans
Disks & JBODs

Telemetry > Prediction > Diagnosis > Restart > Offlining > Notification

Services/Daemons
ZFS

Crash Dumps

Software

My Oracle Support

Support

Site monitoring
Ops Center
SNMP/email

**6 Socket, 192 GB system: 46% reduction in downtime**

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Built-in Virtualization
Oracle Solaris 11 Zones

- Secure, light-weight virtualization
- Scales to 100s of zones/ node
- Delegated administration
- ZFS datasets, boot environments
- Observability via `zonestat`
- Solaris 10 Zones
- NFS Server
- Network stack isolation and resource management

Co-engineered with installation, security, ZFS, networking, IPS, SPARC and x86 hypervisors
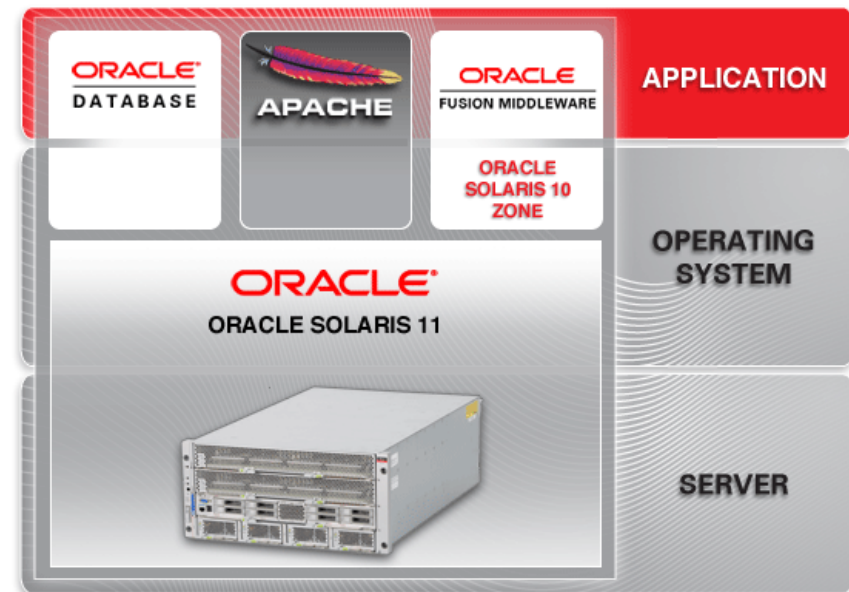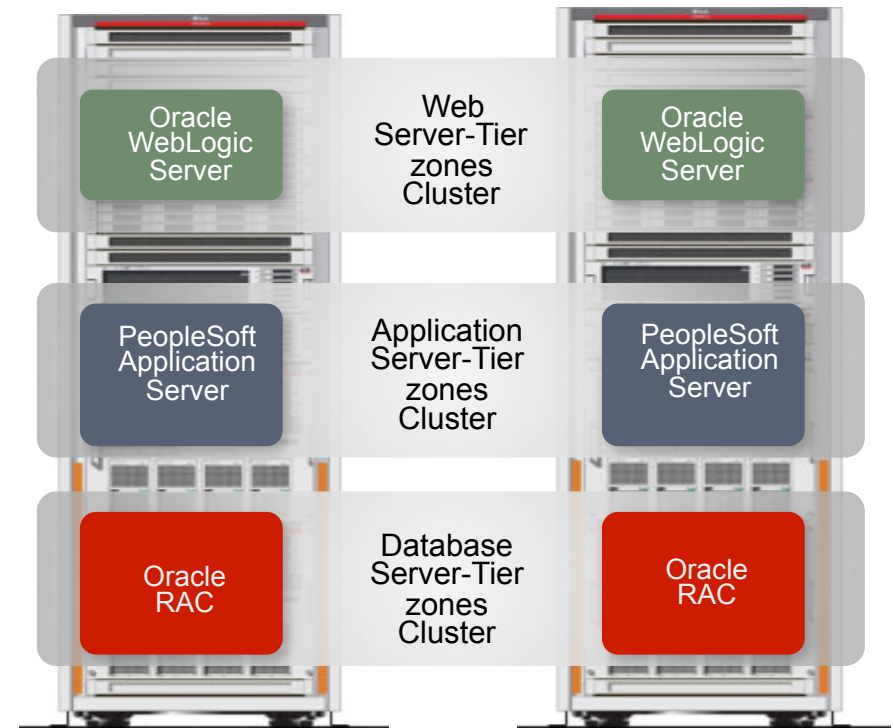

15x lower overhead vs. VMware
4x lower latency vs. KVM

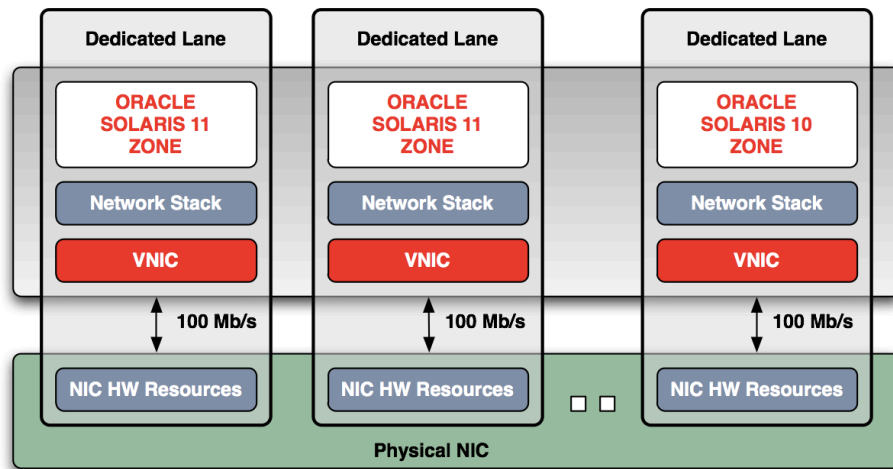# High Availability Using Oracle Solaris Cluster

## Mission Critical Meets Cloud

Virtualized AND highly available

- Industry's only application-specific failover solution for virtualized apps

- Continuous cloud service availability
  - Sub-second failover

Oracle WebLogic Server — Web Server-Tier zones Cluster — Oracle WebLogic Server

PeopleSoft Application Server — Application Server-Tier zones Cluster — PeopleSoft Application Server

Oracle RAC — Database Server-Tier zones Cluster — Oracle RAC

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# Cloud-Scale Networking Architecture

- Parallel networking stack. Built to scale.
  - Hardware assisted Network Resource Management and Quality of Service (QoS)
  - Optimized for performance at every level
- Ease of Use
  - *Automatic Networking* mode
  - Fine grained observability
  - VLAN isolation, dynamic VLAN provisioning
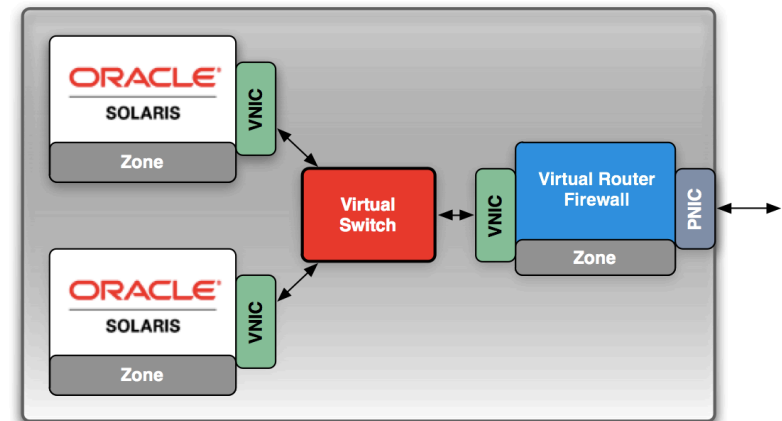
- Virtualize, consolidate network infrastructure
  - Increase performance and reduce costs
  - Secure Isolation
- Integrated functionality
  - Routing, Firewalling, Load Balancing, Bridging, High Availability
- 4x Lower Latency vs KVM

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ZFS Virtualized Pooled Storage
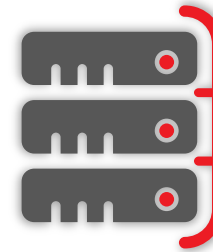
Scale Out Design. Built-in Data Services.
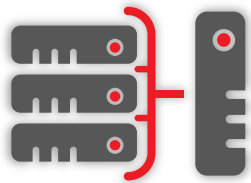
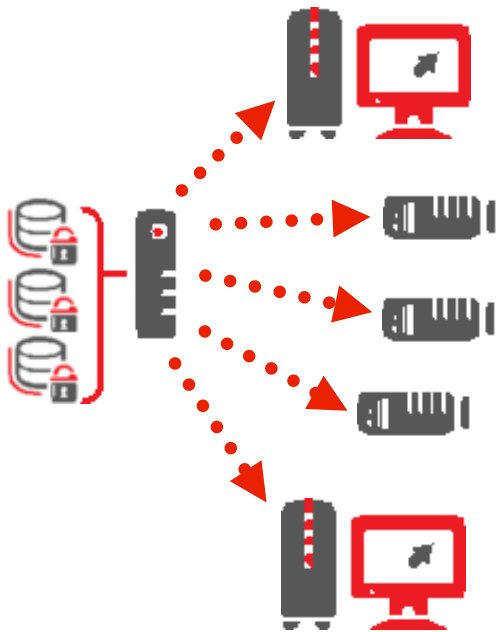| Flash-enabled virtual storage pools | Compression | Replication | Deduplication | Dataset Encryption |

10x Deduplication for Virtualized Environments
Rapid Provisioning of Virtualized Storage Resources
No Silent Data Corruption. Ever.

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Cloud Ready Data Sharing

Built-in, flexible, transparent, hardware assisted

- **File Sharing**
  – Unified User and Access Control with Active Directory integration: ZFS, NFSv4, CIFS, WebDAV, FTP(S), SCP/SFTP

- **Cloud Ready OS install**
  – Solaris boot from SAN, iSCSI and FCoE
  – Zones on iSCSI/FCoE ZFS pools

- **Block Storage Sharing**
  – Raw Disk & ZFS LUN: iSCSI, iSER, FCoE

Security Tailored for the Cloud

Built-in, flexible, transparent, hardware assisted

Application Runtime	Immutable Zones, Sandboxing: new basic privileges (net_access, file_write, file_read), further executable address space reduction. Network data-link & IP anti-spoofing for Zones.
Authentication	SSH X.509 Certificate support, Kerberos PKINIT (X.509). Kerberos data in LDAP. Root login disabled by default. Role auth via user password, Authentication caching.
Audit	Auditing on by default, audit policy in SMF, Secure remote audit trail.
Delegation	Sudo with auditing. Fine-grained user/password/RBAC management CLI with LDAP support.
Data Security	ZFS filesystem, swap, dump and zvol encryption, NFSv4/NT style ACLs, Multilevel security with file labeling. IPsec/IKE policy per zone. Per Zone NFS server and Kerberos Realm.
Cryptography	Transparent Hardware Encryption for Solaris, Java. OpenSSL 4x faster. Trusted Platform Module (TPM) keystore, file integrity scanner Signed binaries & packages, Oracle Key Manager appliance integration

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#1 UNIX. Engineered for Oracle.

Full Stack Development

One Engineering Team

- Co-engineering as a lifestyle
  - Enhanced performance, unique features, built-in robustness, observability, security
- Tested together
  - **150,000 machine hours every week, 10M+ machine hours annually**
- Coordinated patching
  - Easy, risk free updates
- Supported together
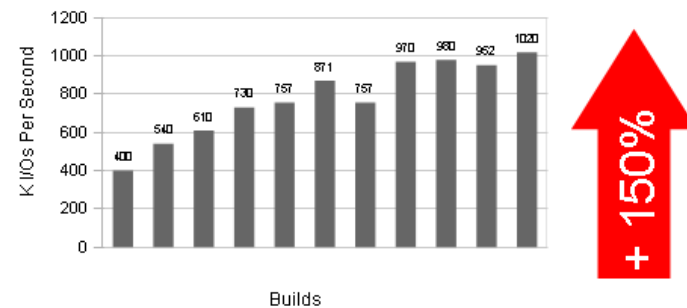 - Faster problem resolution

Solaris on Exadata
Engineered for Performance

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+

ORACLE® 11g
DATABASE

+

Engineered Systems
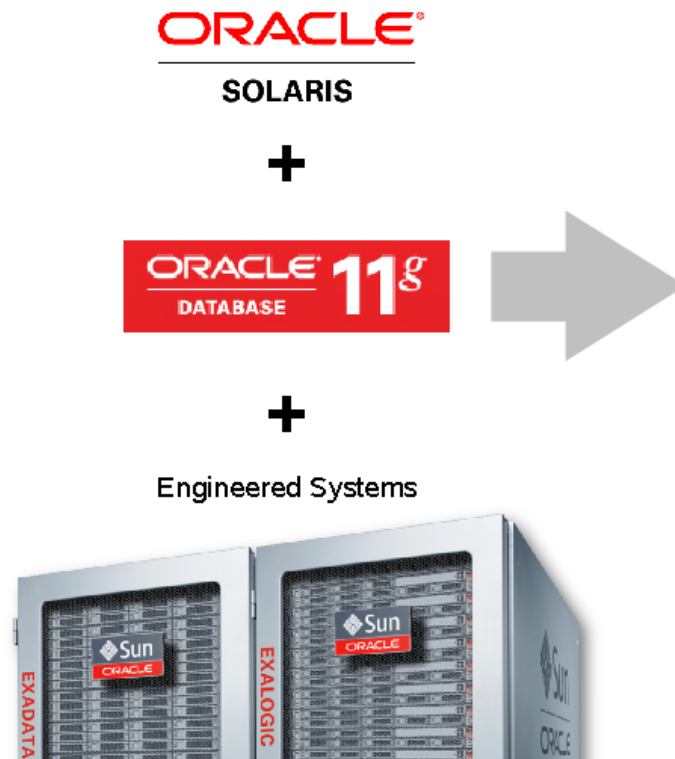
- `gethrtime()` **performance 5x**
  - Makes tracing much cheaper
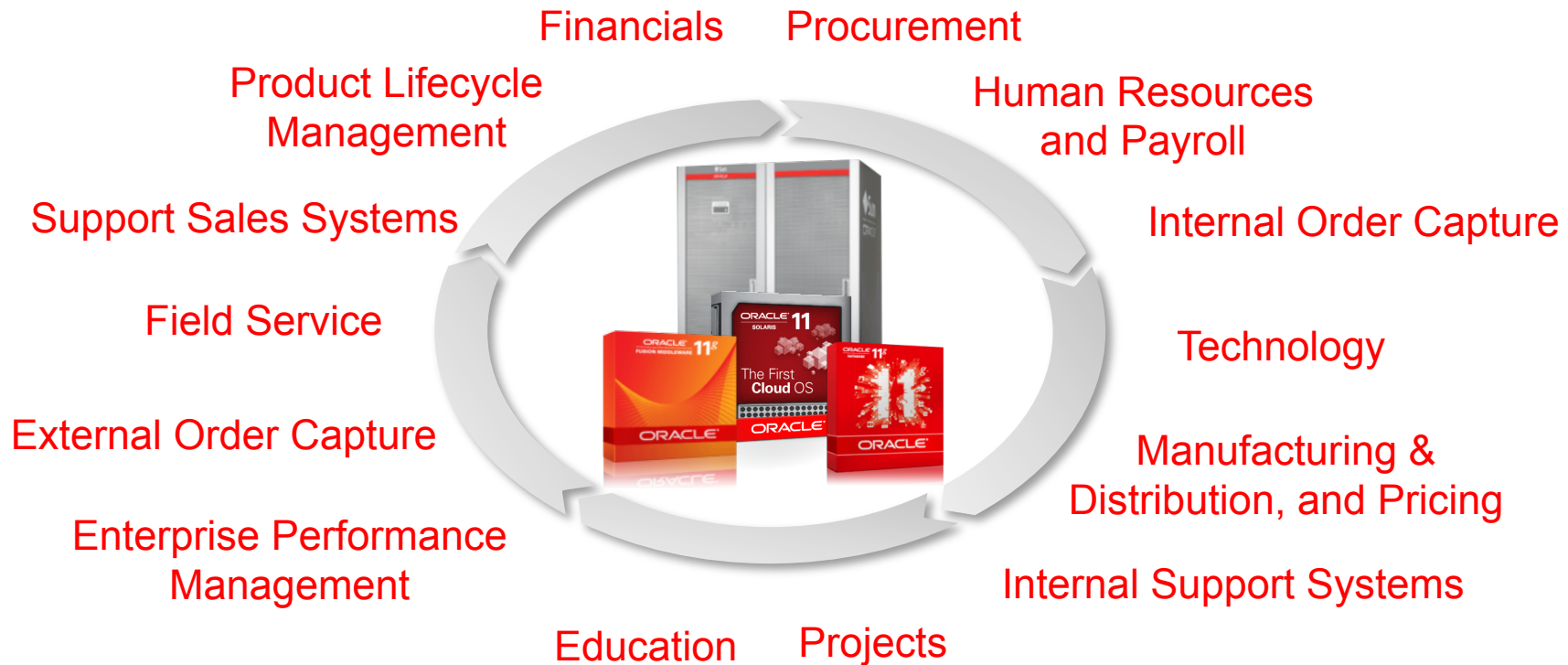- NUMA I/O framework
- Infiniband performance enhancements

DB Performance Improvement, 6 months engineering

+ 150%

Oracle Runs on Oracle

Key Business Functions on SPARC Solaris

Financials Procurement

Product Lifecycle Management

Human Resources and Payroll

Support Sales Systems

Internal Order Capture

Field Service

Technology

External Order Capture

Manufacturing & Distribution, and Pricing

Enterprise Performance Management

Internal Support Systems

Education Projects

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Unique Value for Oracle Engineered Systems

Exadata
- Optimized Shared Memory
- Integrated auditing
- InfiniBand optimizations
- 2.5x faster reboots

Exalogic
- 3x faster cloud deployments
- Integrated load balancer, router, firewall
- DTrace for Solaris and Java for unmatched observability
- Assignable network bandwidth per application
- InfiniBand and Zones integration

SPARC SuperCluster
- Zero overhead virtualization
- Subsecond application failover
- 4x faster encryption
- Deduplication for 10x storage savings
- 4x faster upgrades

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- Engineered for Oracle
  - Optimized for Oracle software and hardware

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Required Benchmark Disclosure Statement

T-series

SPEC and the benchmark name SPECjEnterprise are registered trademarks of the Standard Performance Evaluation Corporation. Results from www.spec.org as of 9/26/2011. SPARC T4-4, 40,104.86 SPECjEnterprise2010 EjOPS; Cisco UCS B440 M1, 17,301.86 SPECjEnterprise2010 EjOPS; IBM Power 780, 16,646.34 SPECjEnterprise2010 EjOPS.Focusing on the critical JEE server hardware & OS, the IBM result includes a JEE server with a list price of $1.30 million. The Oracle JEE servers have a list price of $0.47 million. The JEE server price versus delivered EjOPs is $77.97/EjOP for IBM versus $11.67/EjOP for Oracle. Oracle's $/perf advantage is 6.7x better than IBM ($77.97/$11.67). Pricing details for IBM, IBM p780 512GB based on public pricing at http://tpc.org/results/FDR/TPCH/TPC -H_1TB_IBM780_Sybase-FDR.pdf. Adjusted hardware costs to license all 64 cores. AIX pricing at: http://www-304.ibm.com/easyaccess3 /fileserve?contentid=214347 and AIX Standard Edition V7.1 per processor (5765-G98-0017 64*2,600=$166,400). This gives application tier hardware & OS Price/perf: $77.97/EjOPS (1297956/16646.34) Pricing details for Oracle, four SPARC T4-4 512 GB, HW acquisition price from Oracle's price list: $467,856 http://www.oracle.com. This gives application tier hardware & OS Price/perf: $11.67/EjOPS (467856/40104.86) The Oracle application tier servers occupy 20U of space, 40,140.86/20=2007 EjOPS/U. The IBM application tier server occupies 16U of space, 16,646.34/16=1040 EjOPS/RU. 2007/1040=1.9x

TPC-H, QphH, $/QphH are trademarks of Transaction Processing Performance Council (TPC). For more information, see www.tpc.org. SPARC T4-4 201,487 QphH@1000GB, $4.60/QphH@1000GB, avail 10/30/2011, 4 processors, 32 cores, 256 threads; SPARC Enterprise M8000 209,533.6 QphH@1000GB, $9.53/QphH@1000GB, avail 09/22/11, 16 processors, 64 cores, 128 threads; IBM Power 780 QphH@1000GB, 164,747.2 QphH@1000GB, $6.85/QphH@1000GB, avail 03/31/11, 8 processors, 32 cores, 128 threads; HP Integrity Superdome 2 140,181.1 QphH@1000GB, $12.15/QphH@1000GB avail 10/20/10, 16 processors, 64, cores, 64 threads.

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