Linux: The Journey, Milestones, and What's Ahead
Edward Screven, Chief Corporate Architect, Oracle

The following is intended to outline our general product direction. It is intended for information purposes only, and may not be incorporated into any contract.   It is not a commitment to deliver any material, code, or functionality, and should not be re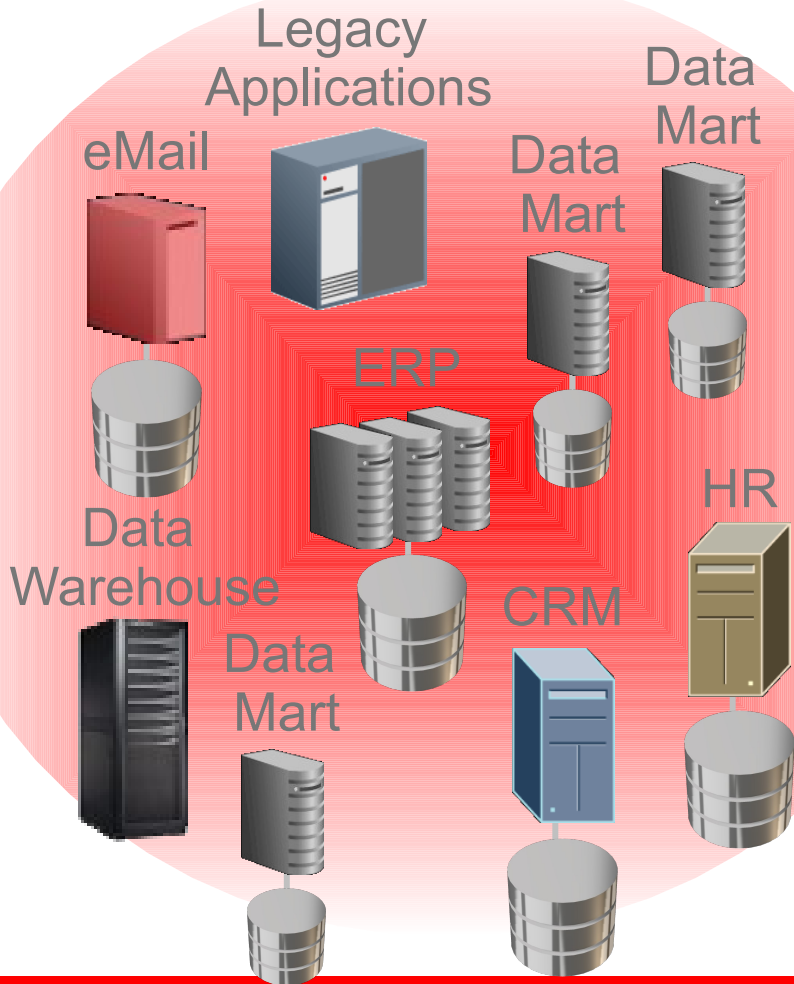lied upon in making purchasing decisions. The development, release, and timing of any features or functionality described for Oracle's products remains at the sole discretion of Oracle.

Why Does Oracle Care About Linux?
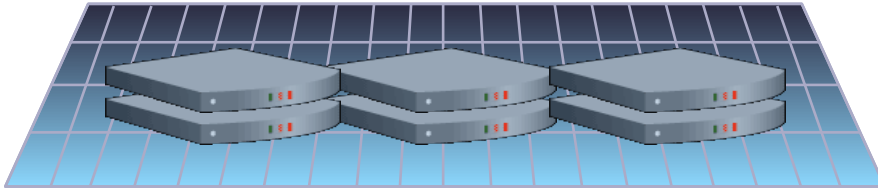
Customer Data Center Circa 1998
(including Oracle's)

- Multiple vendors products

- Lots of processor power

- Separate storage silos

- Different operating systems

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One Possible Approach: Standardize on shared pools of low-cost server and storage

Application Servers

Database Servers

Storage

Save money on hardware

Path to break down silos
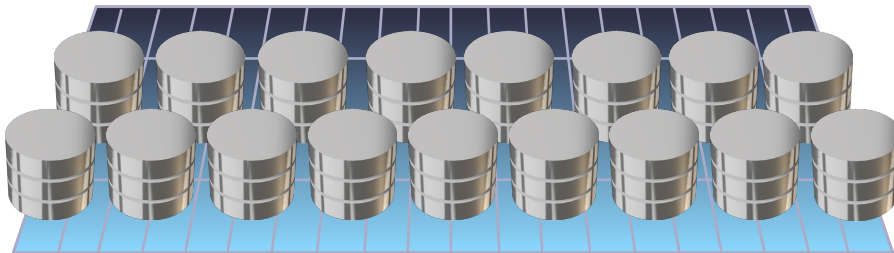
But

- Reliability?
- Performance?
- Management?
- High quality support?
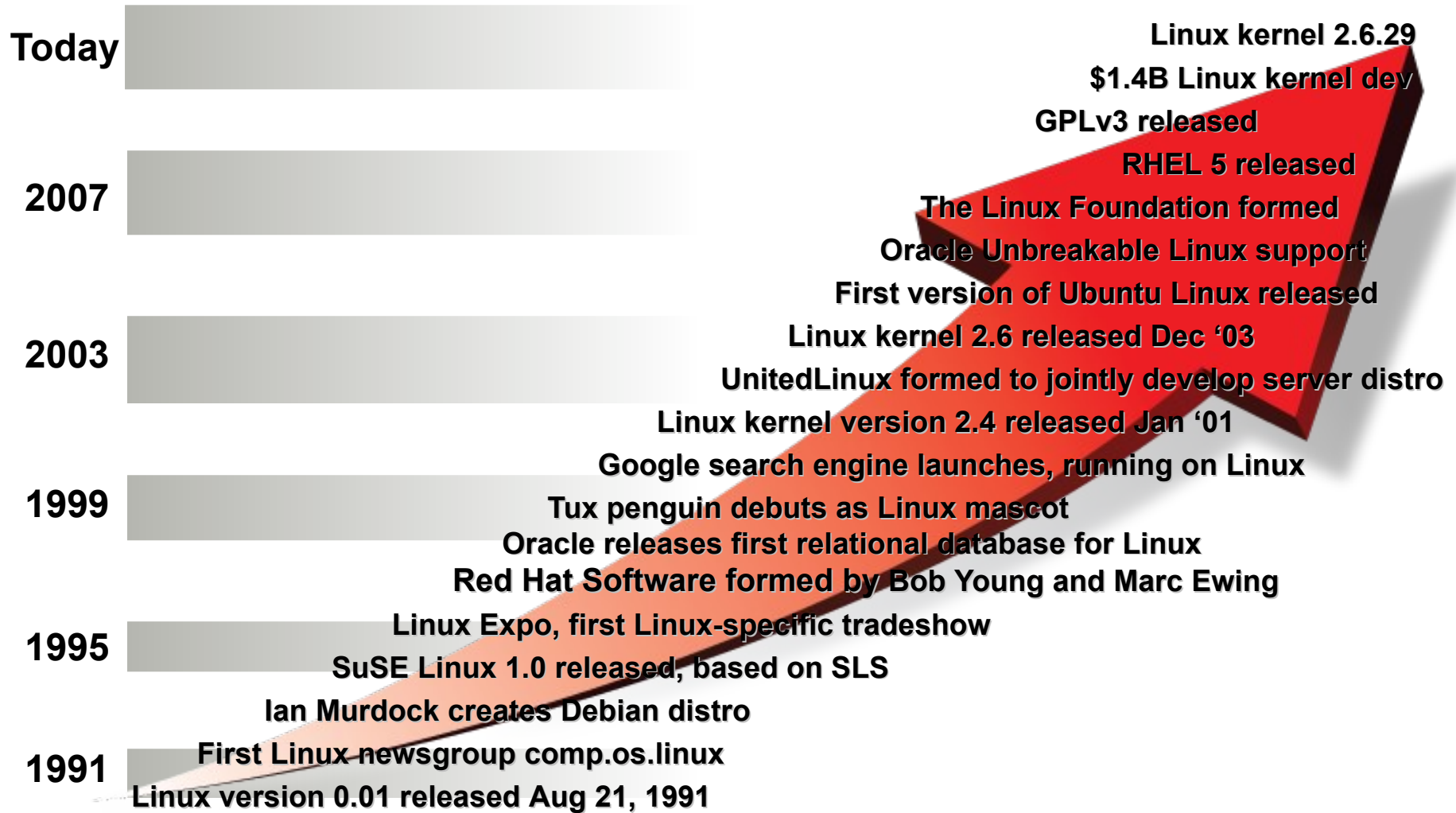- **What OS?**

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Oracle's Choice: Linux
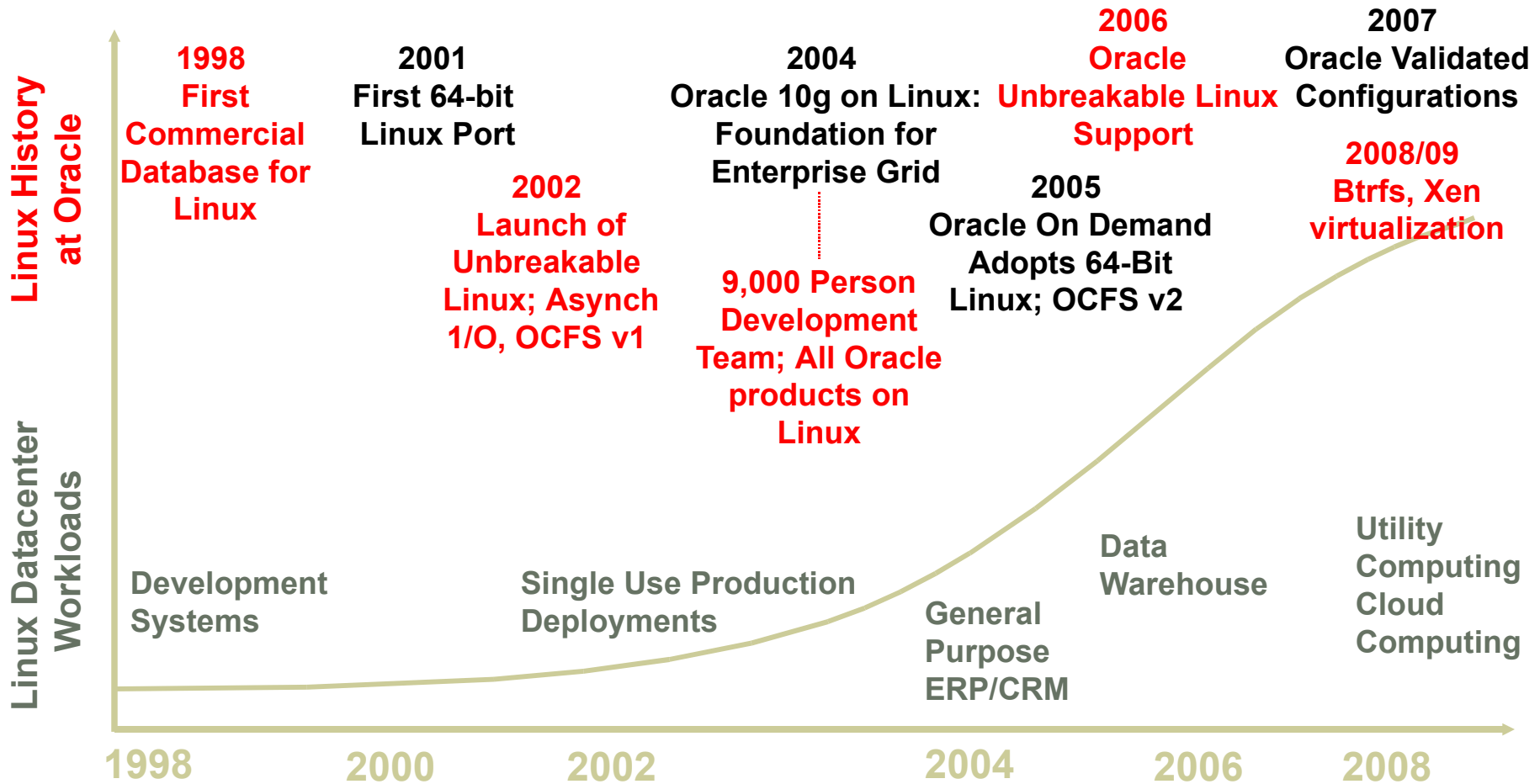
- Strategy: Combine Linux, commodity hardware, and Oracle products to deploy and deliver cost effective, reliable open standards based applications

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Obvious now, not so obvious in 1998

Today

Linux kernel 2.6.29
$1.4B Linux kernel dev
GPLv3 released
RHEL 5 released

2007

The Linux Foundation formed
Oracle Unbreakable Linux support
First version of Ubuntu Linux released
Linux kernel 2.6 released Dec '03

2003

UnitedLinux formed to jointly develop server distro
Linux kernel version 2.4 released Jan '01
Google search engine launches, running on Linux
Tux penguin debuts as Linux mascot

1999

Oracle releases first relational database for Linux
Red Hat Software formed by Bob Young and Marc Ewing
Linux Expo, first Linux-specific tradeshow

1995

SuSE Linux 1.0 released, based on SLS
Ian Murdock creates Debian distro
First Linux newsgroup comp.os.linux

1991

Linux version 0.01 released Aug 21, 1991

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Sources: Linux.org, Wikipedia, lwn.net, *Linux Journal*

Oracle's Commitment

1998
First Commercial Database for Linux

2001
First 64-bit Linux Port

2002
Launch of Unbreakable Linux; Asynch 1/O, OCFS v1

2004
Oracle 10g on Linux: Foundation for Enterprise Grid

9,000 Person Development Team; All Oracle products on Linux

2006
Oracle Unbreakable Linux Support

2005
Oracle On Demand Adopts 64-Bit Linux; OCFS v2

2007
Oracle Validated Configurations

2008/09
Btrfs, Xen virtualization

Linux History at Oracle

Linux Datacenter Workloads

Development Systems

Single Use Production Deployments

General Purpose ERP/CRM

Data Warehouse

Utility Computing Cloud Computing

1998　2000　2002　2004　2006　2008

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Oracle's Commitment

We ~~will~~ run our whole business on Linux."

Lawrence J. Ellison
LinuxWorld, 2002

Oracle's Commitment

"We will run our base development on Linux for all of our products."

Chuck Rozwat
LinuxWorld, 2003

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Oracle Enterprise Linux
Same Enterprise Class Support as Database

- Tracks Red Hat Linux exactly
  - Compiled from Red Hat source
  - Includes additional bug fixes
- Oracle's base development platform
  - We don't test or certify separately on Red Hat Linux
- Bundled management
- Bundled clusterware
- Full indemnification
- Low cost
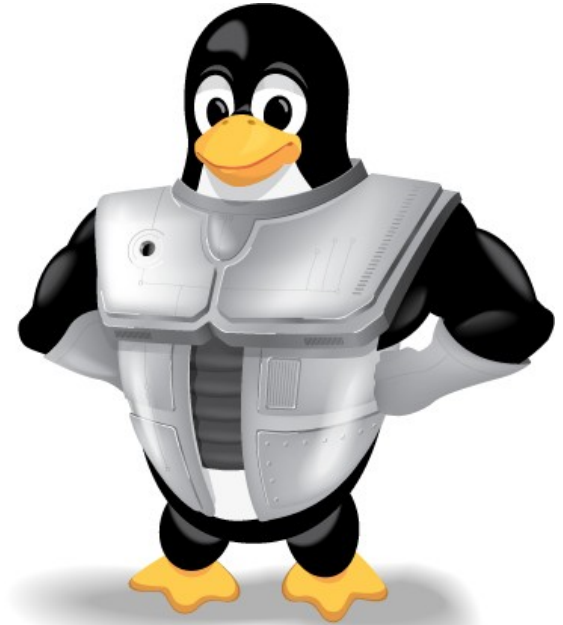
Unbreakable Linux
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Linux is Growing

Worldwide Paid/Subscription New License Linux Server Unit Shipments 2004-2012
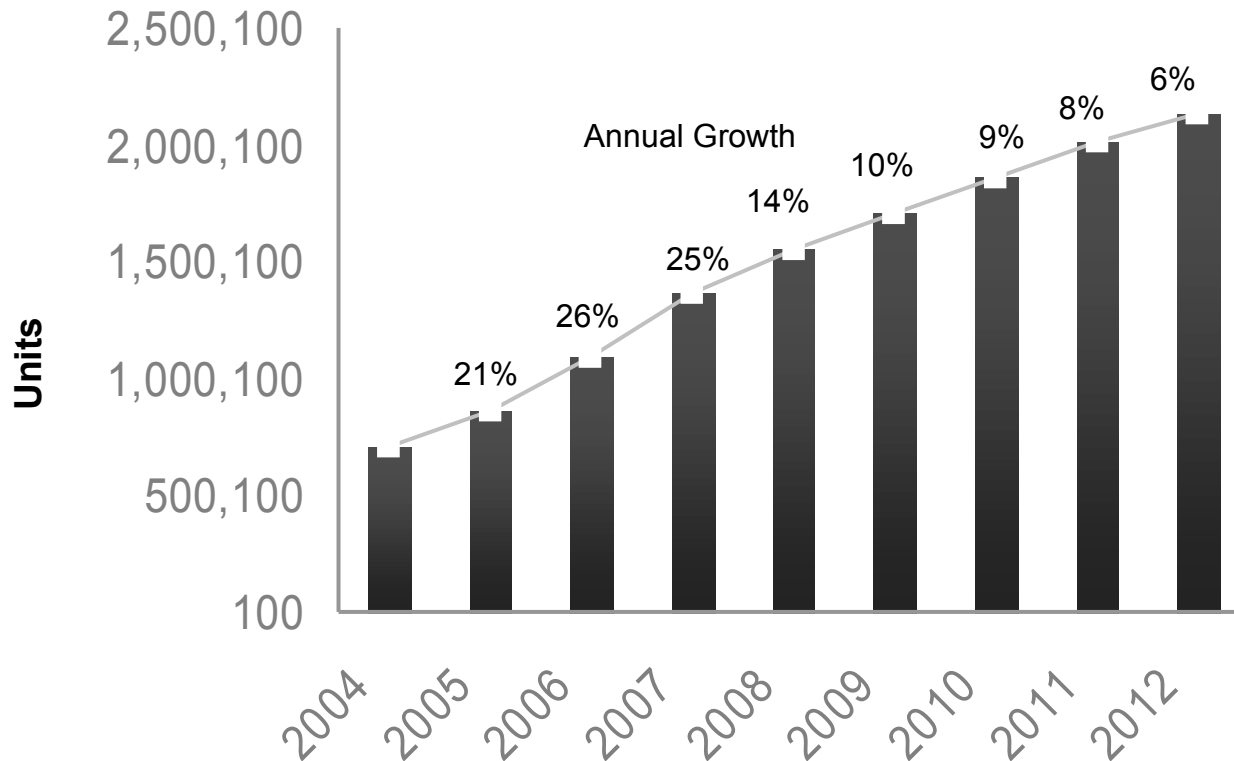
- 2007-2012 CAGR for Paid/Subscription Linux server shipments is 9.4%

- Paid/Subscription Linux server unit shipments will reach 2.13 M in 2012

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Adoption in the Data Center

- Linux servers are the fastest growing OS sub segment, growing 25.6% from
  - $954 million in 2006 to
  - $1.2 billion in 2007 (Gartner)
- 72% of IT executives are actively evaluating or have already decided to boost adoption of Linux in 2009 (IDC)
- Linux Services/support will grow from
  - 77% of the total Linux market in 2007 to
  - 81% of the market in 2012 (Ovum)
- Focus has shifted from business and departmental applications to data centers and computing clusters

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Oracle Database Development Runs on Enterprise Linux Grid

All automated testing jobs run on "The Farm"

- 1000 dual CPU machines

- 75% running Linux

- 2000 jobs run simultaneously

- 860 users

- Over 3 million test suites run

Grid Usage

100% Utilization

■ Running jobs

■ Queued jobs

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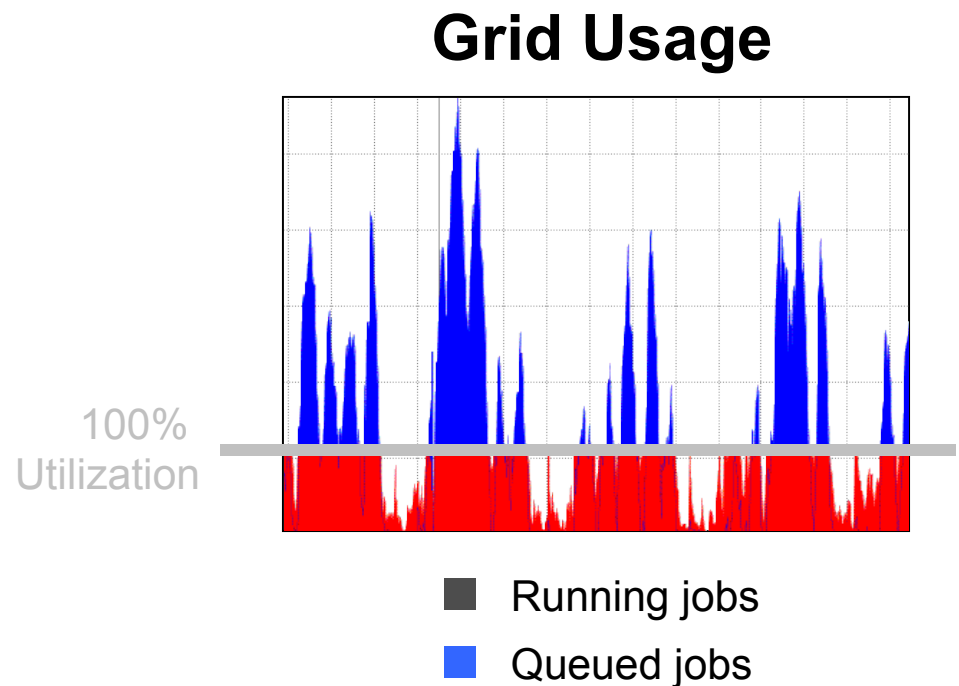
What Helps Linux Succeed in the Data Center?

- Cost Effective
    - Total cost and marginal cost
- Standards Based
    - Extensible
    - Third party support
- Enterprise Ready
    - Scalable
    - Reliable
    - Manageable
    - Tested configurations ready to deploy
- Enterprise-Class, Integrated Support

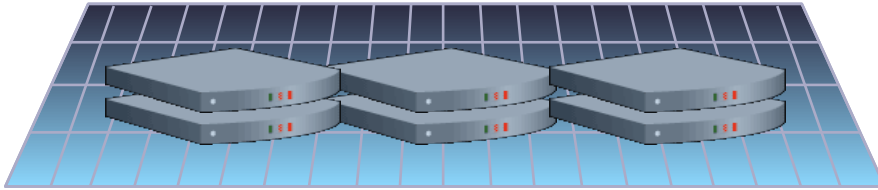# *Some* Customer Data Centers ca. 2009
(not Oracle's!)
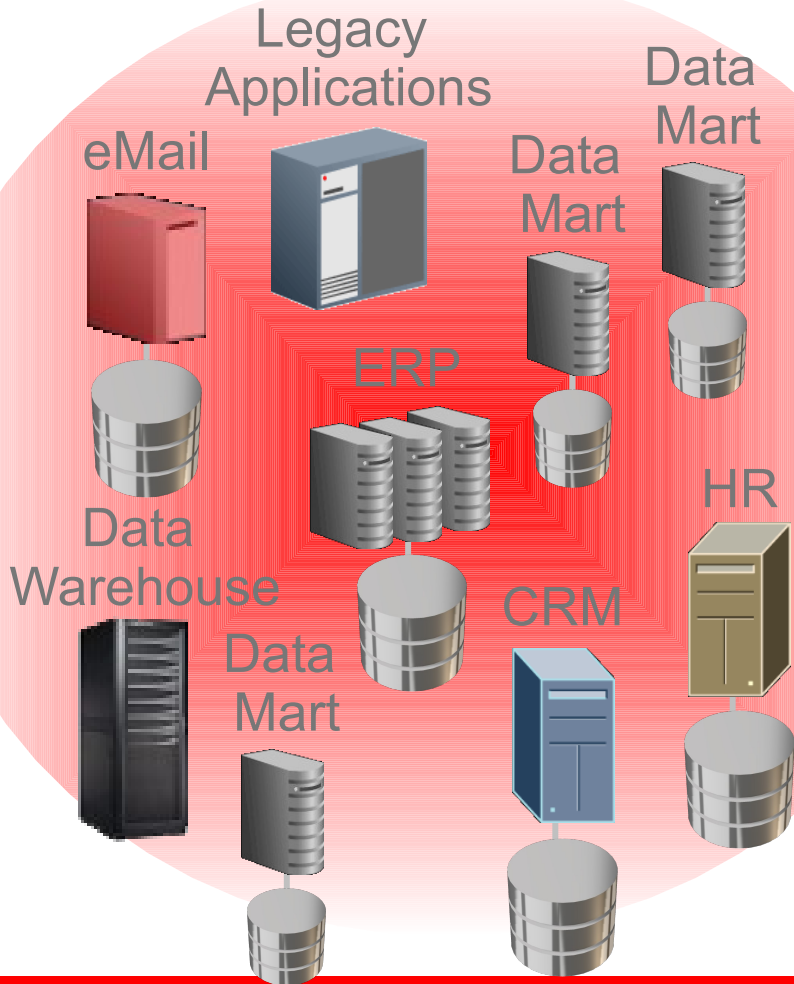
- Multiple vendors products

- Lots of processor power

- Separate storage silos

- Different operating systems

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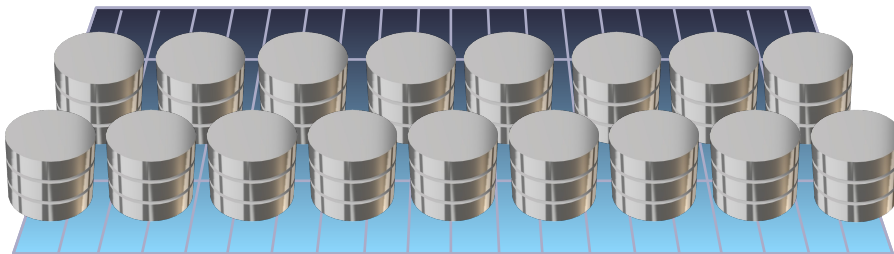# Didn't we solve this problem!?

Application Servers

Database Servers

Storage

- Inexpensive hardware

- Reliable, fast, open O.S.
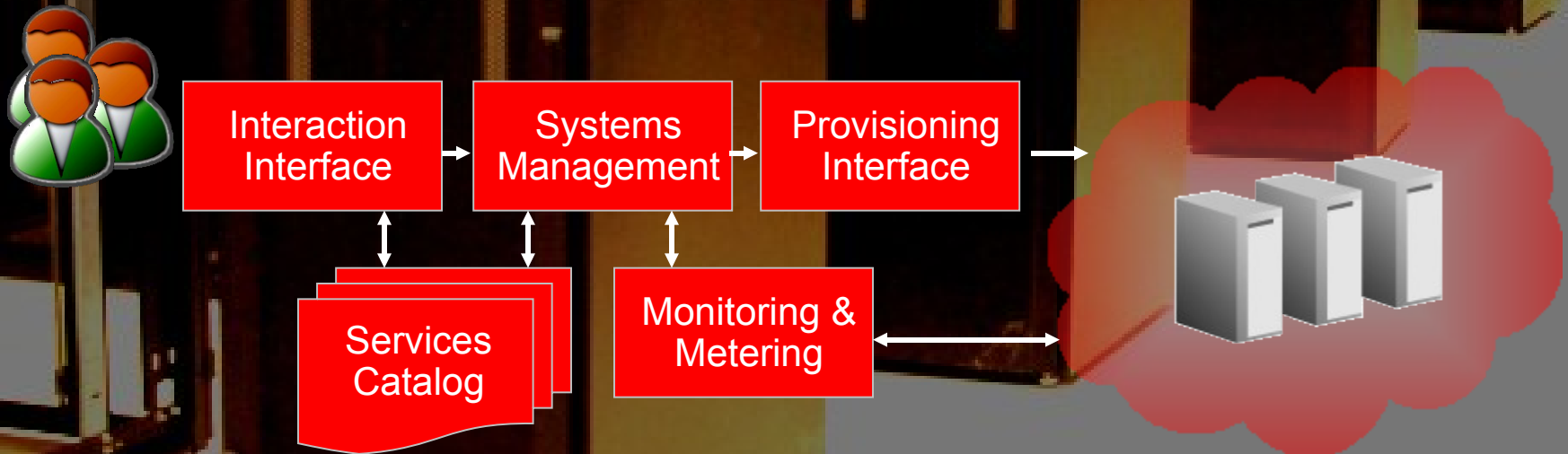
- Clustering for scalability

- **Managing complex enterprise apps deployed into a pool is hard for many customers**

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Virtualization Changes the Game

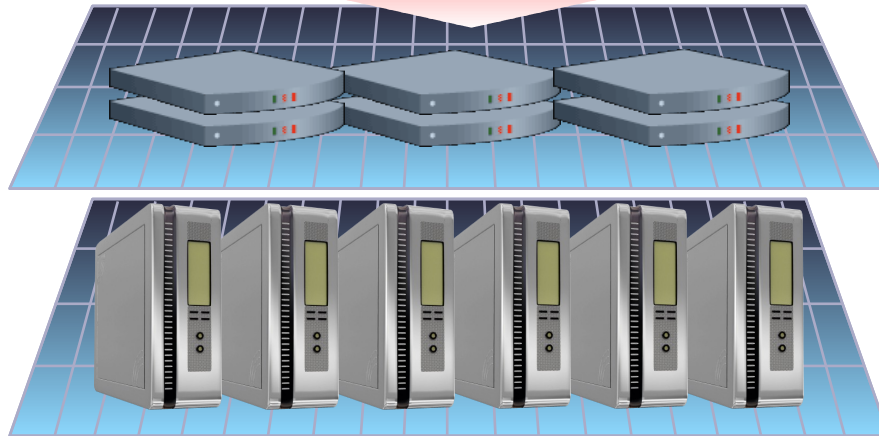- Turn computing infrastructure into a fungible resource

Oracle VM: Server Virtualization
Virtualize and share all compute resources

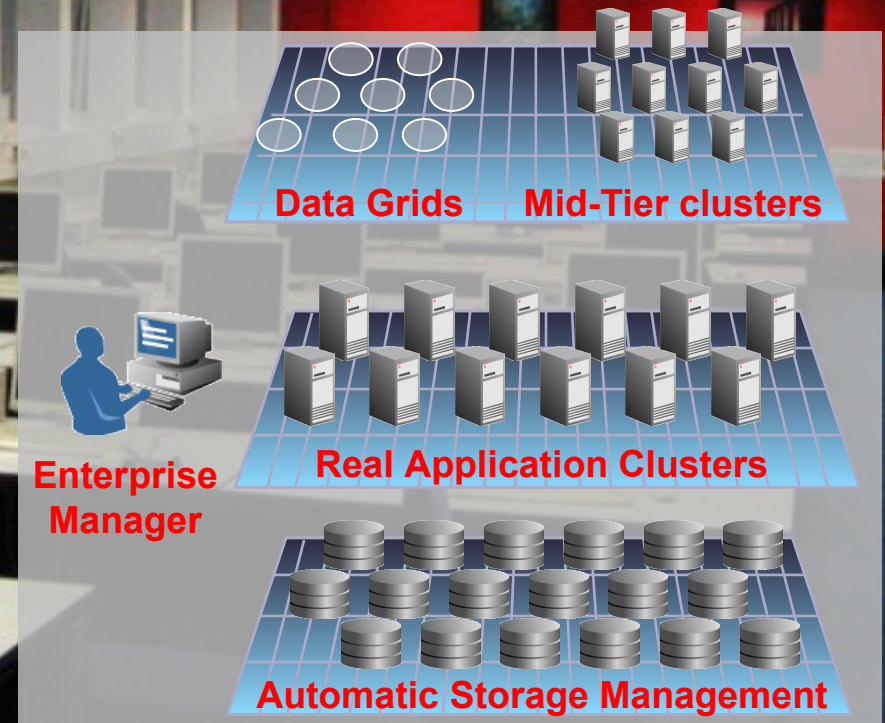| Oracle Database	Fusion Middleware	Oracle Applications	Non-Oracle Applications	Non-Oracle Applications
Enterprise Linux	Enterprise Linux	Enterprise Linux	Oracle/Red Hat Linux	Microsoft Windows

Oracle VM

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Virtualization: Oracle University

With Oracle VM:

- 1/6th the hardware

- CPU utilization increased from 7% to 73%

- Revenue per server increased 5X

- Servers to administrator ratio increased 10X

Data Grids   **Mid-Tier clusters**

Enterprise Manager

Real Application Clusters

Automatic Storage Management

Next Step: Make Linux into the Standard OS for the Data Center

- Virtualization

- Enhanced file system

- End to End Data Integrity

- System Management
  - Patching and upgrades

- High Availability and Security

- Support for large clusters

File System - btrfs

- General purpose file system
- Handle large storage
- Designed for repair and reliability
- Copy on write with efficient snapshotting and checksumming
- Manage multiple devices under the file system in raid striped and mirrored configurations.
- http://btrfs.wiki.kernel.org
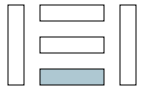- In kernel 2.6.29

Other Important Kernel Enhancements

- IPV6 Support
- Reliable Datagram Service
- Storage Validation (T10Dif)
- Virtualization (Xen)
- File systems (Btrfs, ocfs2)
- Server Power Management

- Memory fragmentation avoidance
- Scheduler Improvements for Real Time Mode
- Tracing
- Kernel crash dumps
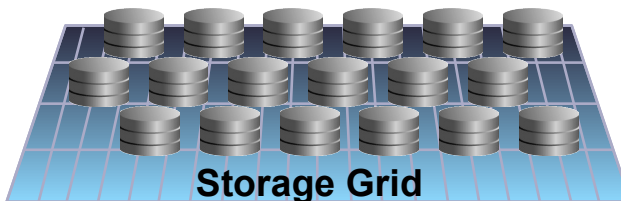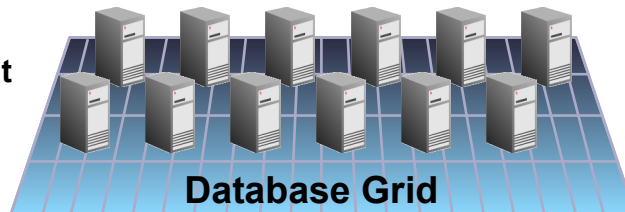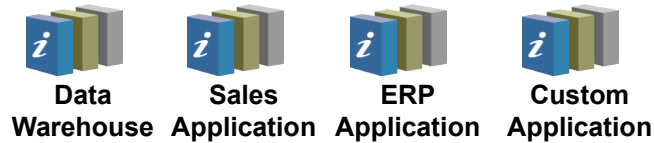- Multipathing
- Infiniband

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The True Linux Opportunity

- Become the standard data center OS
  - Highest performance, scalability and reliability
  - Highest security
  - Highest integrity
  - Largest workloads
  - Largest storage
- Drive the commoditization of the hardware platform
- Enable standards consolidation
- Deliver lower operational cost to our users
  - Support
  - Solutions
  - Best Practices

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Linux Grid Infrastructure
Virtualization, Clustering and Dynamic Provisioning

Data Warehouse
Sales Application
ERP Application
Custom Application

Middleware Application Grid

Management

Database Grid

Storage Grid

Virtualization and clustering throughout the stack

- Shared pools of resources for high efficiency/utilization

- Dynamic resource provisioning on demand

- Unlimited, incremental scale-out

- High availability
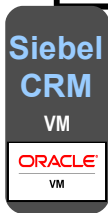
- Automated monitoring & management

- **Low Cost**

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Oracle VM Templates
Rapid Application Deployment

ORACLE E-Delivery

Download from Oracle
- Pre-built, pre-configured VM
- Complete app, middleware, DB installation
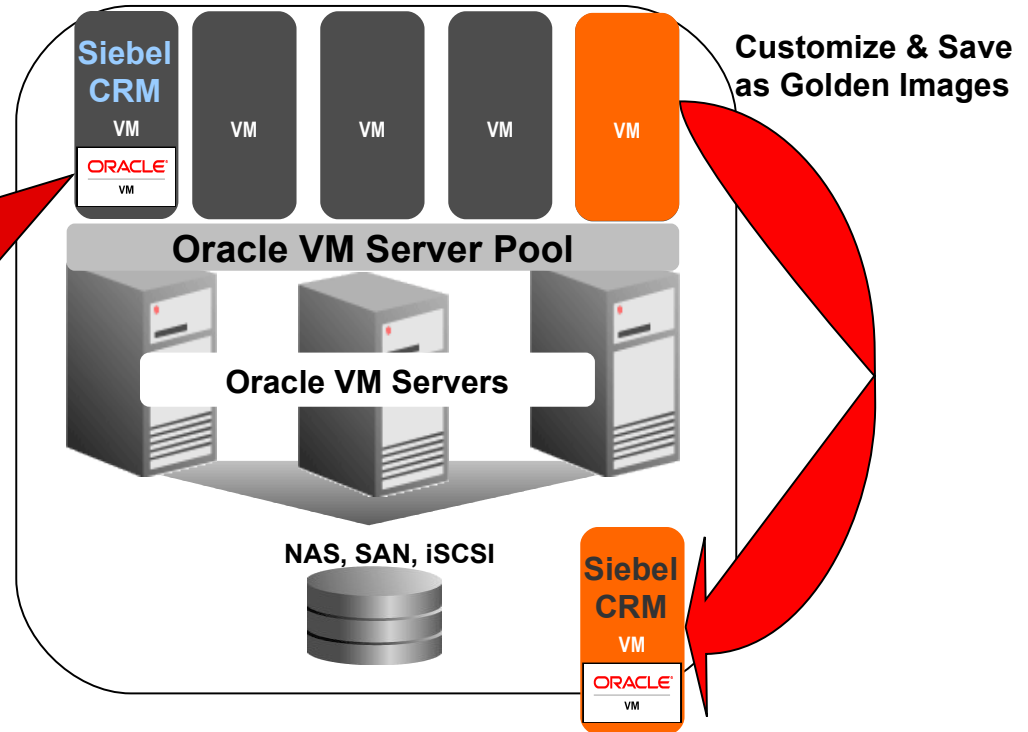- Siebel CRM, Database 11g, Enterprise Manager, Fusion Middleware, …

Siebel CRM
VM
ORACLE
VM

Import to Oracle VM Manager

Start-Up in Oracle VM Pool

Save days or weeks in installation and configuration time

Siebel CRM
VM
ORACLE
VM

VM   VM   VM   VM

Oracle VM Server Pool

Oracle VM Servers

NAS, SAN, iSCSI

Customize & Save as Golden Images

Siebel CRM
VM
ORACLE
VM

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Exadata - Extreme Performance, Unlimited Scalability
Linux Database Grid in a Box

**HP Oracle
Storage Server**

**HP Oracle
Database Machine**

Why Does Oracle Care About Linux?