



Oracle on the Enterprise Linux Server

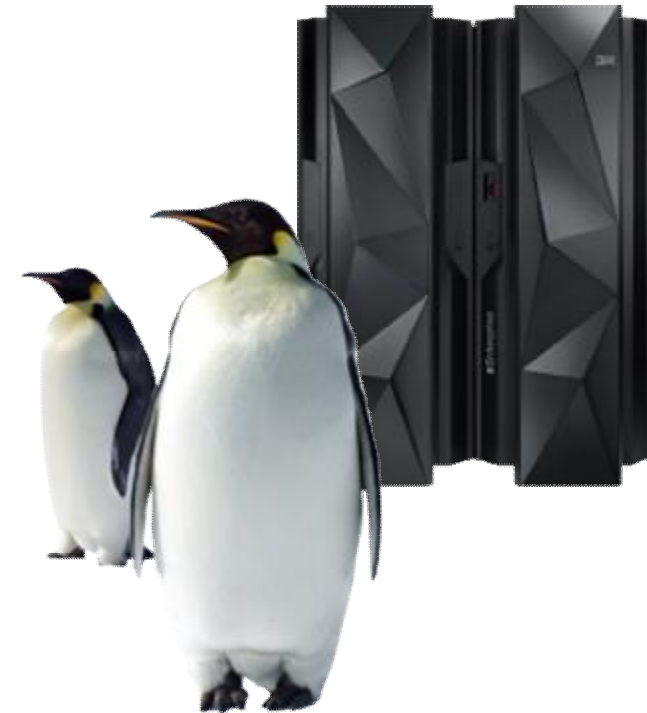
*Reducing operational cost
through consolidation*



WAVV Conference
Covington, Kentucky
April 7-10, 2013

Discussion Topics

- § **The IBM & Oracle relationship**
- § **Business case for Oracle consolidation**
- § **System z virtualization**
- § **High-availability and Disaster Recovery**
- § **References**



The IBM & Oracle Relationship



Sustaining Partnership

- Oracle 24 Yrs, PeopleSoft 21 Yrs, JD Edwards 32 Yrs, Siebel 10 Yrs.

Oracle is an IBM *“Integrated Account”* (since 2005)

- Regular Executive Reviews – Global and Geographic
- Named Oracle Sponsor: Charles Phillips, Oracle’s Co-President
- Dedicated IBM executive-led alliance team

Over 19,000 Joint Customers Worldwide

- Hardware and Software support via Apps Unlimited

Vibrant Technology Relationship

- Substantial investment in skills and resources
- **Dedicated International Competency Center**

Market Leading Services Practice

- IBM’s GBS is Oracle’s #1 SI Partner (4900 Joint Projects!)
- 9,500 skilled, of which 5,500 are dedicated to Oracle Practice

Unrivalled Customer Support Process

- Dedicated On-Site Resources
- Significant Program Investments

IBM and Oracle business relationship

§ Oracle Software Stack certification and support [Oracle reference Doc ID: 417770.1]

- Oracle products have been **certified to run with Oracle VM**.
- Oracle Products are **not** certified to run on Virtual Machines/guests provided by Xen or KVM offerings by Red Hat, Novell or XenSource; Hyper-V offerings by MicroSoft; VMware vSphere (ESX Server). **Oracle has not certified any of its products on VMware virtualized environments [ID 249212.1]**
- Oracle software stack is certified and supported on certified distributions of Linux (RHEL, SLES) running natively in LPARs or as a guest OS in z/VM Virtual Machines deployed on IBM System z 64-bit servers.
- Oracle Linux is supported as a guest OS under Oracle VM VirtualBox **for demo and development purposes**.

§ Products certified for the System z platform qualify for the same level of support as any other certified Oracle platform.

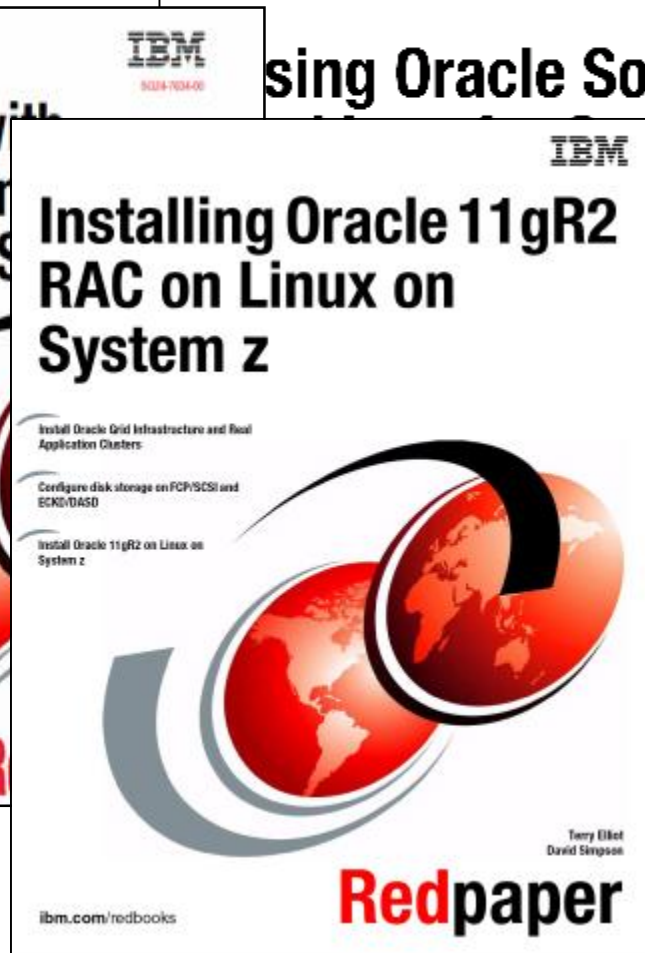
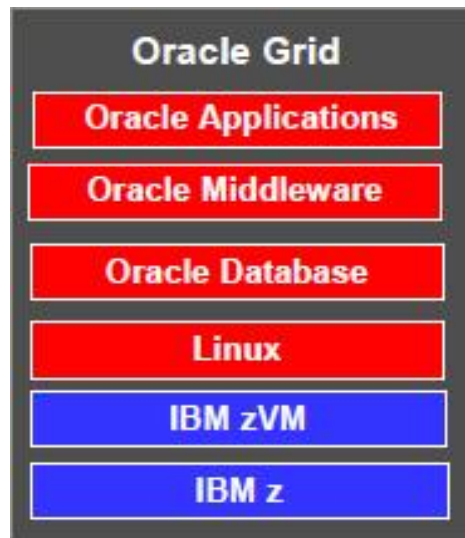
§ There is a dedicated Oracle team @ Oracle specially trained to support customers running Oracle with Linux on System z servers.

§ IBM and Oracle Business Relationship:

- The IBM and Oracle Web site hosted by IBM at: <http://www.ibm.com/solutions/oracle>
- The IBM Partner Relationship Web site hosted by Oracle at: <http://solutions.oracle.com/partners/ibm>
- Frequently asked questions from IBM and Oracle customers about Linux on IBM System z <http://www.ibm.com/support/techdocs>

Oracle and Linux on System z – IBM & Oracle working together

- § Linux on System z is Oracle's platform for the mainframe
- § Oracle database 11g R2 available on Linux on System z (since 1Q2011)



Why System z for Oracle

- § High Availability Requirements
- § Open Standards and Linux
- § Disaster Recovery Requirements
- § Customer Data on Mainframe
- § Increased Performance Requirements
- § Economics of Linux (IFL) Specialty Engines
- § TCO versus Total Cost of Acquisition
- § 'Green' Value from Mainframe
- § zEnterprise servers can virtualize everything with up to 100% utilization rates
- § zEnterprise is the only Heterogeneous platform in the industry
- § System z has the highest security rating or classification for any commercial server

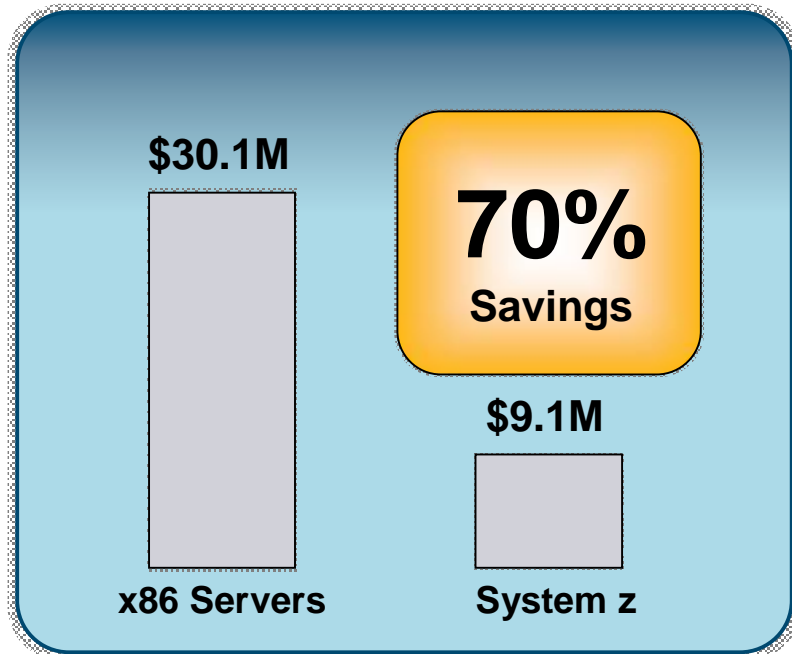


Discussion Topics

- § The IBM & Oracle relationship
- § **Business case for Oracle consolidation**
- § System z virtualization
- § High-availability and Disaster Recovery
- § References



A Government Organization Consolidates Applications and Data to Drive Down Costs of Hardware, Software, and Management by 70%!



Top three reasons for savings

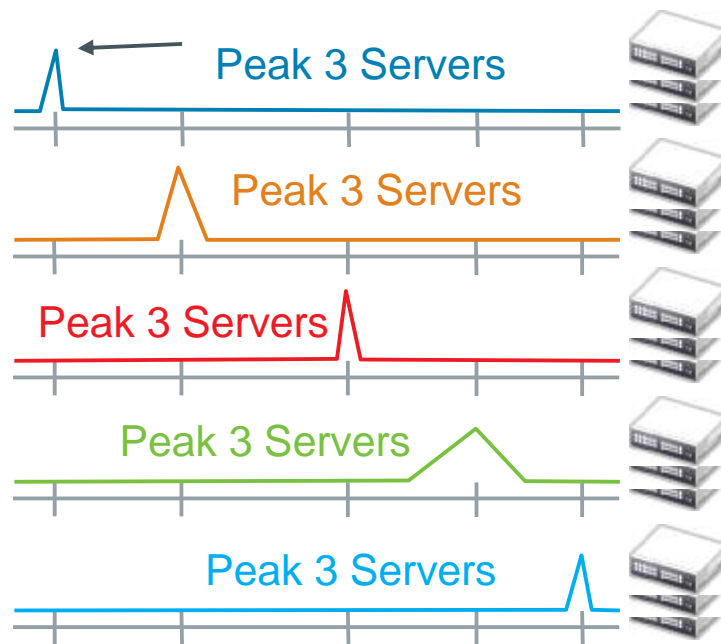
- Consolidated 292 Oracle servers to one System z
- System administration costs reduced 90%
- Subscription and support licenses reduced over 95%

Customer: A regional North American government organization

Other benefits:
Superior resiliency and security
Single administrator productivity
Infrastructure simplification
Lower energy costs

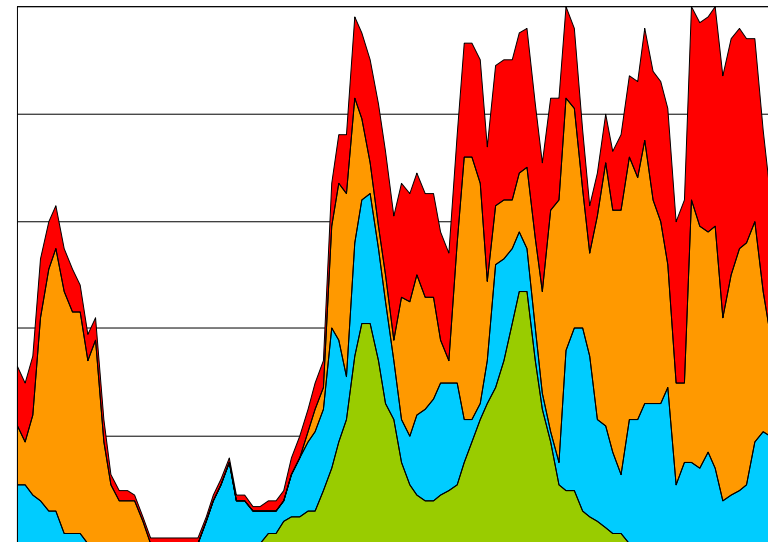
Why High-End Servers?

Utilization on x86 systems



According to a study by Gartner, data centers that do not use virtualization have an average server CPU utilization rate of only 15%.

Mixed Utilization on IBM High End Servers



IBM High End Server: Up to 100% utilization

- Highly virtualized and shared resources
- Fewer servers, less power, cooling & admin
- Optimized use of SW assets

High Core-to-Core Ratios for Consolidations

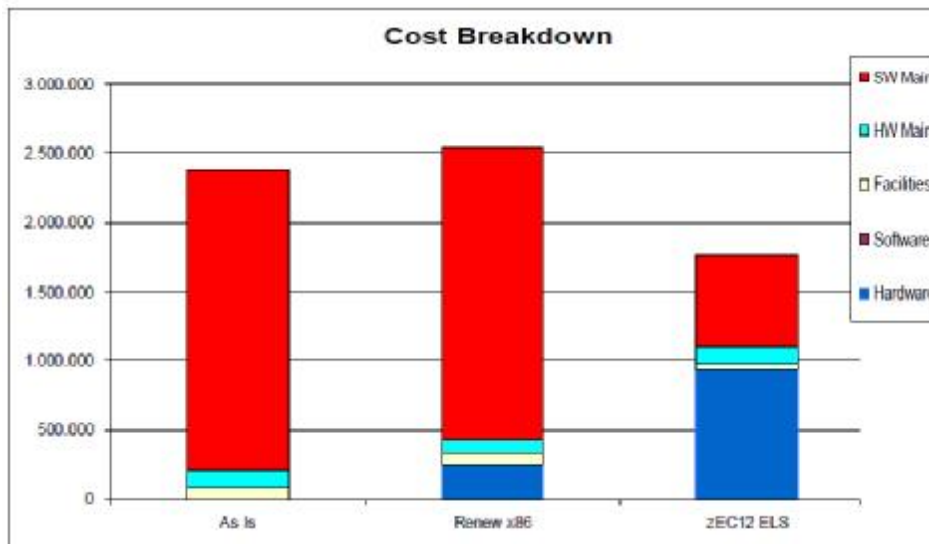
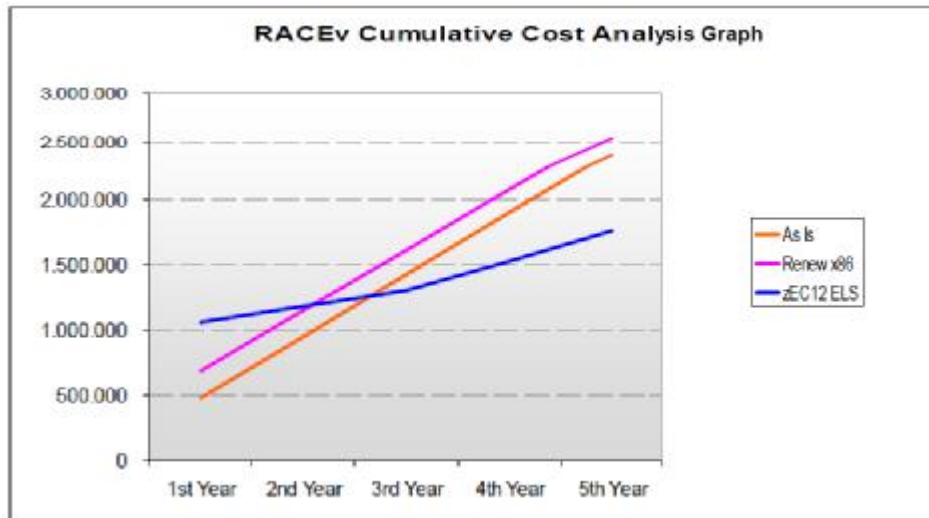
From Distributed IT-Environments to ELS

Real customer examples with real workloads!

Industry	Distributed Cores	IBM Enterprise Linux Server™ Cores	Core-to-Core Ratio*
Public	292	5	58 to 1
Banking	111	4	27 to 1
Finance	442	16	27 to 1
Banking	131	5	26 to 1
Insurance	350	15	23 to 1
Insurance	500+	22	22 to 1
Banking	63	3	21 to 1
Finance	854	53	16 to 1
Health care	144	14	10 to 1
Transportation	84	9	9 to 1
Insurance	7	1	7 to 1

* Client results will vary based on each specific customer environment including types of workloads, utilization levels, target consolidation hardware, and other implementation requirements.

Oracle database consolidation example



ProLiant BL260c G5 Xeon E5430
 Quad Core 2.66GHz (1ch/4co)

- 50 physical Linux servers
 - 10 servers @ 25% utilization
 - 20 servers @ 15% utilization
 - 20 servers @ 10% utilization
- Oracle DB Standard Edition



Renewal: ProLiant BL280c G6 Xeon X5672 Quad Core 3.2GHz (1ch/4co)

Reducing software cost through consolidation

Example: Oracle database

§ License and annual Software Update License & Support is based on processor cores

§ A “processor core factor” is applied to adjust for different technologies



<http://www.oracle.com/us/corporate/pricing/technology-price-list-070617.pdf>

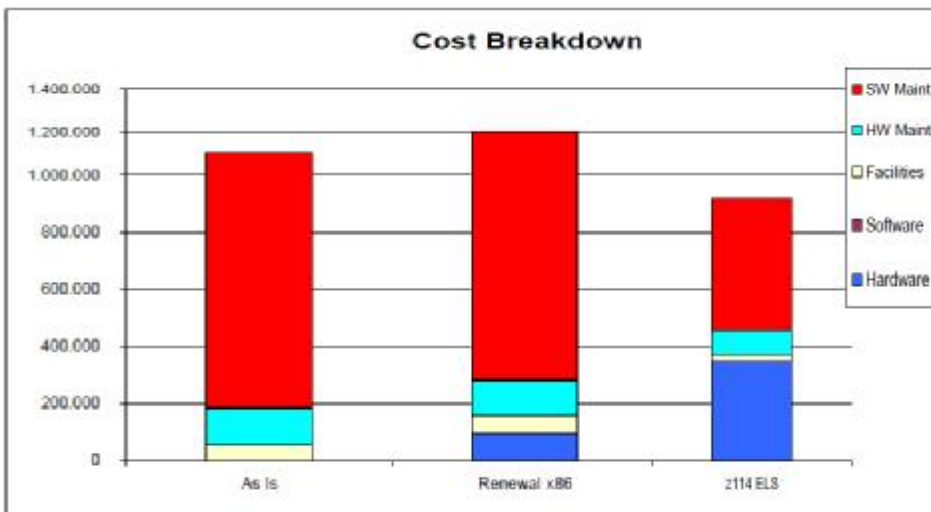
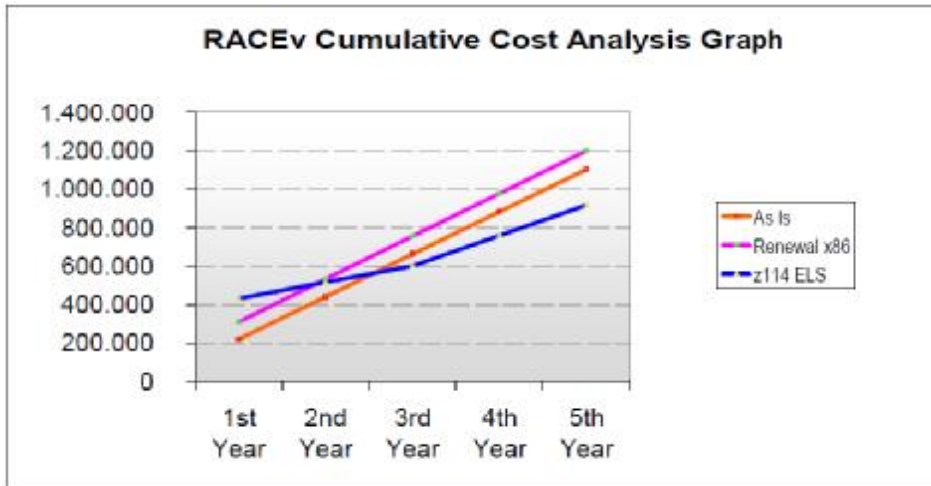
Software Update Licenses & Support (annually) is typically 22% of Processor License (one time charge)



Vendor and Processor	Core Processor Licensing Factor
Intel Xeon Series 56XX, Series 65XX, Series 75XX, Series E7-28XX, Series E7-48XX, Series E7-88XX, Series E5-24XX, Series E5-26XX, Series E5-46XX, Series E5-16XX, Series E3-12XX or earlier Multicore chips	0.5
Intel Itanium Series 93XX (For servers purchased on or after Dec 1st, 2010)	1.0
IBM POWER6	1.0
IBM POWER7	1.0
IBM System z (z10 and earlier)	1.0
All Other Multicore chips	1.0

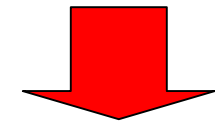
<http://www.oracle.com/us/corporate/contracts/processor-core-factor-table-070634.pdf>

Oracle database consolidation example



ProLiant ML150 G5 Xeon E5430
 Quad Core 2.66GHz (1ch/4co)

- 20 physical Linux servers
 - 10 servers @ 15% utilization
 - 10 servers @ 10% utilization
- Oracle DB Standard Edition



New z114 ELS (Enterprise Linux Server)

- with
- 4 IFLs
 - z/VM hypervisor
 - 20 Linux servers
 - Oracle DB Standard Edition

...plus further savings on system admin, floor space, network, etc.



Renewal: ProLiant ML150 G6 Xeon X5540 Quad Core 2.53GHz (1ch/4co)

Enterprise Linux Server – Entry Configuration (real customer!)



Tangible benefits:

	Existing 4 HP Alpha Server ES45 + HP disks 4x3 CPU Alpha 21264C 9x1 core Oracle license	IBM BladeCenter H 2 HS22 w/2 proc. 4-core IBM Storwize V7000 disks 16x0.5 core Oracle license	IBM BladeCenter H 2 IBM P7 PS700 4-core IBM Storage DS5020 8x1 core Oracle DB license	IBM System z10 ELS 1 IFL IBM Storwize V7000 1 Oracle EE license
1st year	164,234	219,998	242,888	234,040
2nd year	164,234	74,234	74,234	8,248
3rd year	164,234	74,234	74,234	8,248
Total (3 years)	€492,701	€368,465	€391,355	€250,537

Prices based on actual European market prices (Euro). Local pricing and conditions will vary!

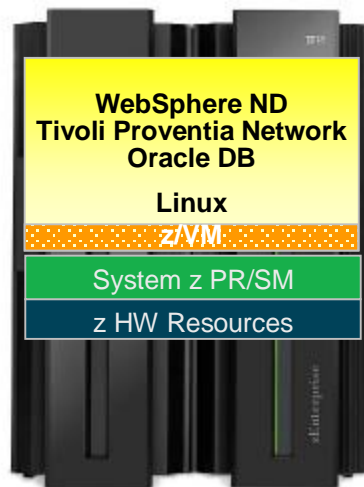
Intangible benefits:

- Improved security – no information leak during data copy between servers
- Improved availability – no network routers or switches
- Highest reliability and centralized systems management

Deploy IBM Software to Utilize Oracle DB on System z

Government Client - USA

- § Rapidly growing DB workload, rich in Sun servers, running out of space and power!
- ▶ Solution: z196, z/VM, Linux, WebSphere Application Server Network Deployment, Tivoli Proventia Network
 - ▶ Net result: 106 Solaris/Sun cores down to „just 6“ on z196



IBM internal reference

Build new and replace existing apps utilizing Oracle DB on Linux on z.

- ü Consolidated DB environment with reduced operating costs and improved performance metrics
- ü Latency between the Oracle and Solaris environments was greatly reduced
- ü Long running batch jobs that had took 30hours in the Sun environment were running in just 15minutes on the z196
- ü Server footprint was sharply reduced, giving up valuable floor space while saving energy, maintenance and software licensing costs

Dundee City Council

Dundee City Council delivers value through new technologies

Creating a cost-effective IT architecture with IBM System z and IBM XIV Storage System technologies

Overview

Business challenge

Like all UK local authorities, Dundee City Council needs to handle increasing demand for IT and eGovernment services, while also reducing costs in line with central government targets. When the lease on its server and storage hardware needed to be renewed, the Council saw an opportunity to enhance its capabilities and increase value for money.

Solution

Dundee worked with IBM to upgrade its mainframe environment with two powerful IBM System z10 servers, and introduced the IBM XIV Storage System to replace a mixed storage environment. The new infrastructure runs a range of Linux applications and Oracle databases – supporting key systems such as social services 24x7.

Dundee is Scotland's fourth largest city, home to 145,000 people. A former industrial centre, Dundee has transformed itself into a UK centre for life sciences and digital media. As a result, the city has been named one of the world's top seven intelligent communities for three of the past four years (see www.intelligentcommunity.org).

Dundee City Council employs around 10,000 people, and provides a wide range of municipal services for citizens, many of which rely on IT support. The council runs numerous applications to support both internal processes and public-facing systems, such as its Web portal (www.dundee.gov.uk), which provides information and online services.

Linux on System z

For several years, the council has run all its core IT systems (mostly Oracle databases and applications) on SUSE Linux Enterprise Server, running on IBM System z servers.

"Running Linux on the System z platform is a cost-efficient approach, especially for software like Oracle, which is licensed on a per-processor basis," explains Tim Simpson, IT Support Manager at Dundee City Council. "We can run 60 virtual machines on just four System z processors – whereas an equivalent x86-based architecture might require several processors for each server! So the savings can be considerable."

Leasing leading-edge hardware

The council's existing servers – a pair of z9 Business Class machines – were leased from IBM, and the existing lease was due to expire.

"The best thing about our leasing strategy is that it allows us to continually upgrade to the latest, fastest IBM hardware, while maintaining our costs at a steady level," says Simpson. "When our latest lease was coming up for renewal, we realised it was a good opportunity to rethink our storage architecture too."

At the time, the council's storage infrastructure was based on a mixture of SGI and IBM storage arrays, virtualised using a solution from LSI.

For several years, the council has run all its core IT systems (mostly Oracle databases and applications) on SUSE Linux Enterprise Server, running on IBM System z servers.

"Running Linux on the System z platform is a cost-efficient approach, especially for software like Oracle, which is licensed on a per-processor basis," explains Tim Simpson, IT Support Manager at Dundee City Council.

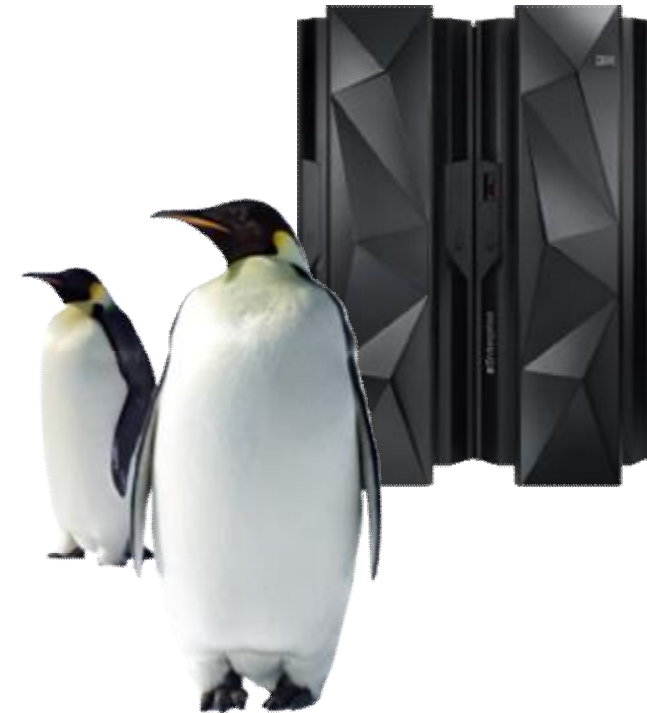
The z10 BC machines each contain two IFL processors, and run approximately 60 virtual Linux servers in total.

"We can run 60 virtual machines on just four System z processors – whereas an equivalent x86-based architecture might require several processors for each server!
So the savings can be considerable."



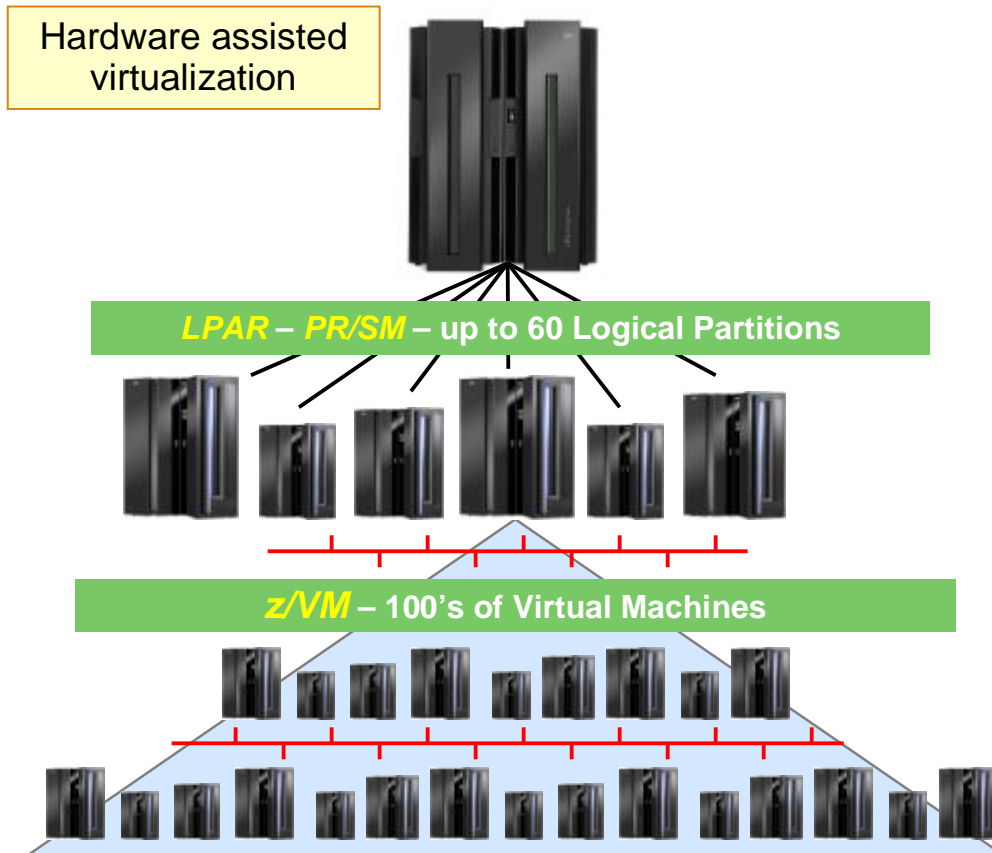
Discussion Topics

- § The IBM & Oracle relationship
- § Business case for Oracle consolidation
- § **System z virtualization**
- § High-availability and Disaster Recovery
- § References



System z – Extreme Virtualisation

Build-in and Shared Everything Architecture



System z

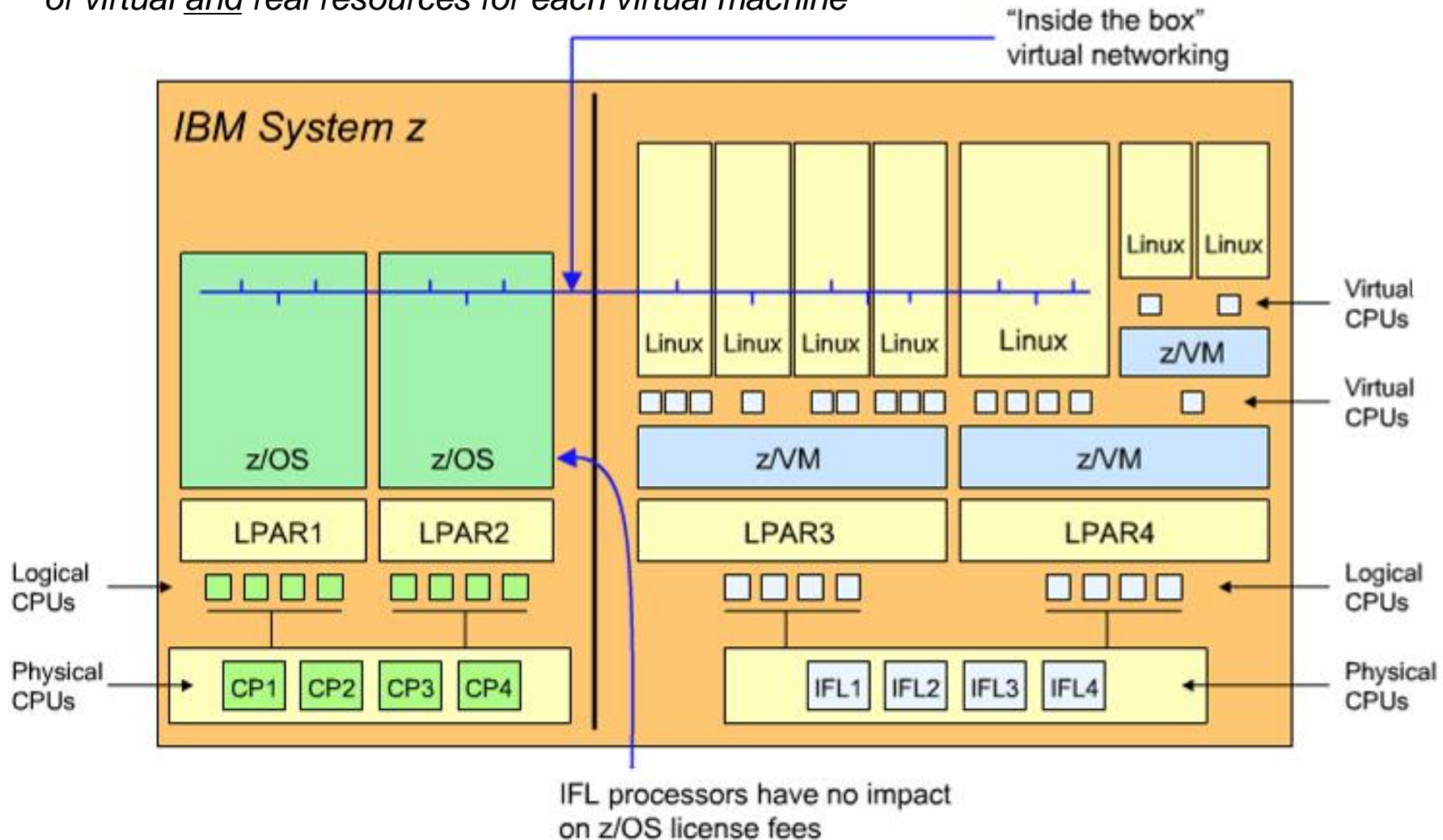
- Provisioning of virtual servers in seconds
- High granularity of resource sharing (<1%)
- Upgrade of physical resources without taking the system down
- Scalability of up to 1000's of virtual servers
- More with less: more virtual servers per core, sharing of physical resources
- Extensive life-cycle management
- HW-supported isolation, highly secure (EAL5 or EAL4+ certified)

Distributed platforms

- Limited virtual server scalability per core
- Scaling requires additional physical servers
- Operational complexity increases with growth of virtual server images
- VMware, Xen, Hyper-V focus on x86, no HW management across multiple platforms

Extreme Virtualization with z/VM

z/VM can massively scale a virtual server environment with a mix of virtual and real resources for each virtual machine

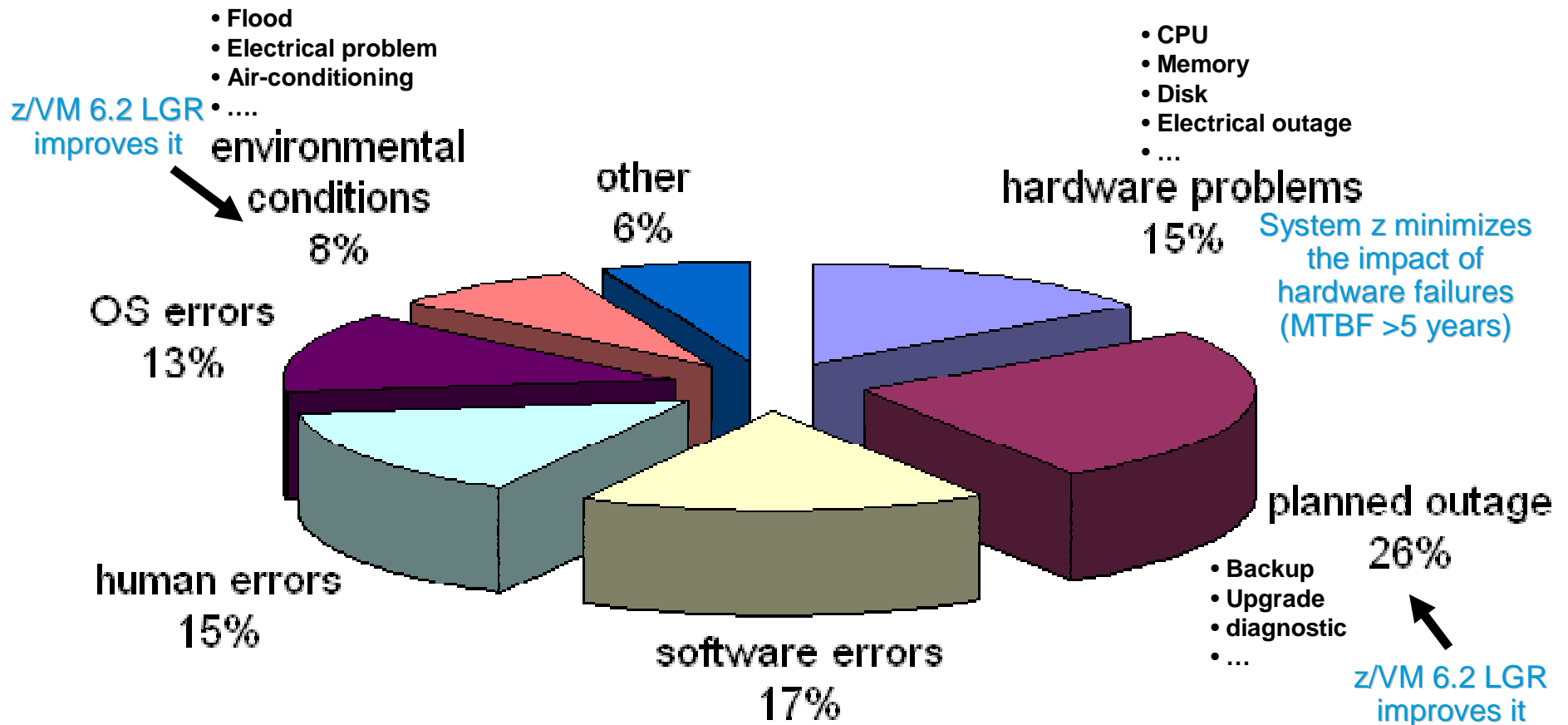


Discussion Topics

- § The IBM & Oracle relationship
- § Business case for Oracle consolidation
- § System z virtualization
- § **High-availability and Disaster Recovery**
- § References



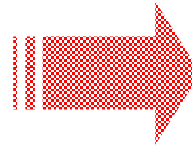
The causes of unavailability



LGR = Live Guest Relocation

Oracle HA with System z

Server provided HA

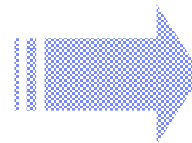


- RAC
- Data Guard
- Flashback
- CRS
- Grid Control

Operating system HA

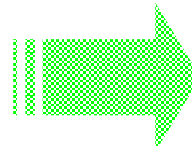
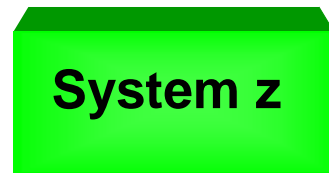


- Linux Clustering



- Mature Hypervisor
- Hardware assist
- z/VM SSI/LGR

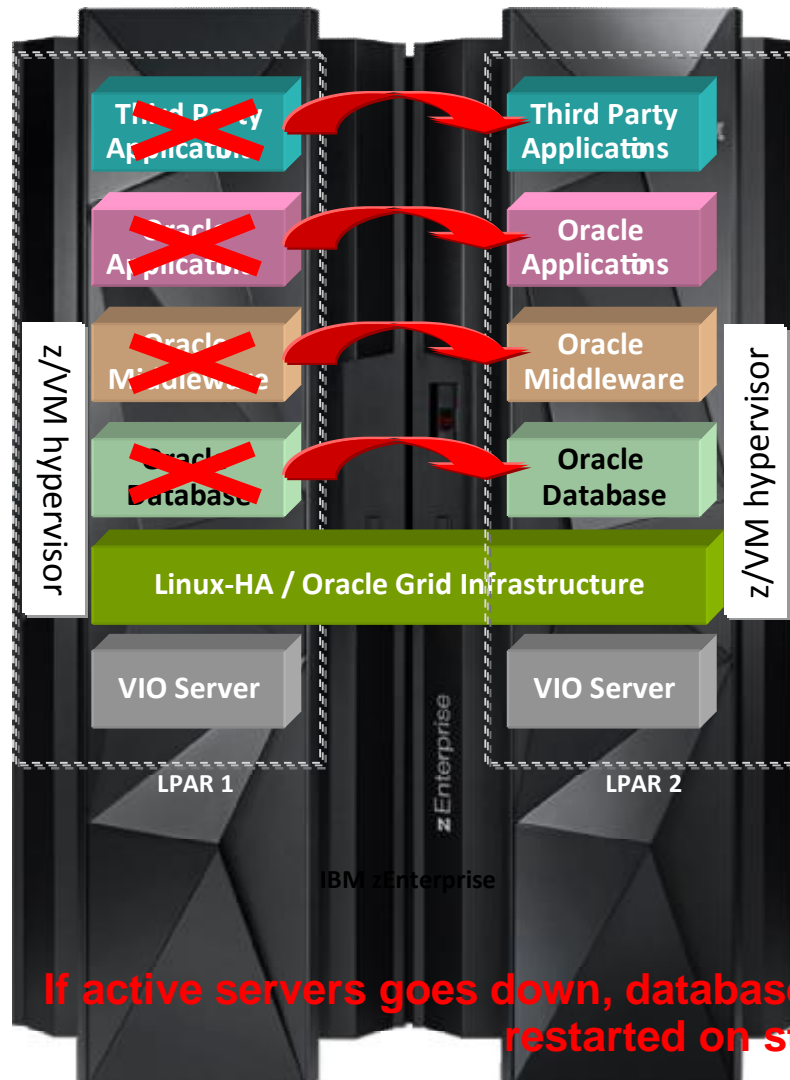
Hardware provided HA



- Spare CPUs
- N+1 power supplies
- Chip sparring in memory
- Concurrent maintenance
- 50 years MTBF (system fail.)

HA step 1: Active/Passive is cold fail-over solution

Cold Fail-Over Infrastructure



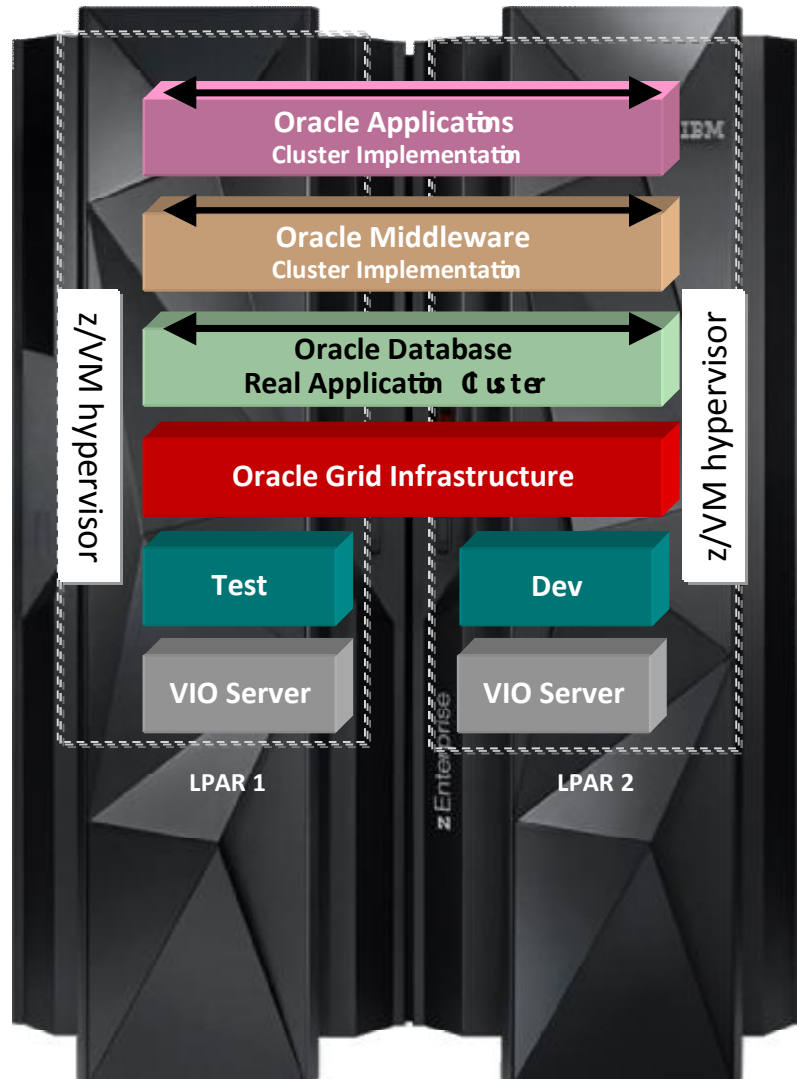
If active servers goes down, database and application will be automatically restarted on standby servers.

Protect all components

- Third Party Applications
 - Oracle Applications
 - Oracle Middleware
 - Oracle Database
- **Cold Failover with downtime**
 - Linux-HA for any product and/or Oracle Clusterware for Oracle products or RACOne Node

HA step 2: Active/Active increases applications / DB availability

Active/active mode with Real Application Cluster for High Availability



§ Provide High Availability

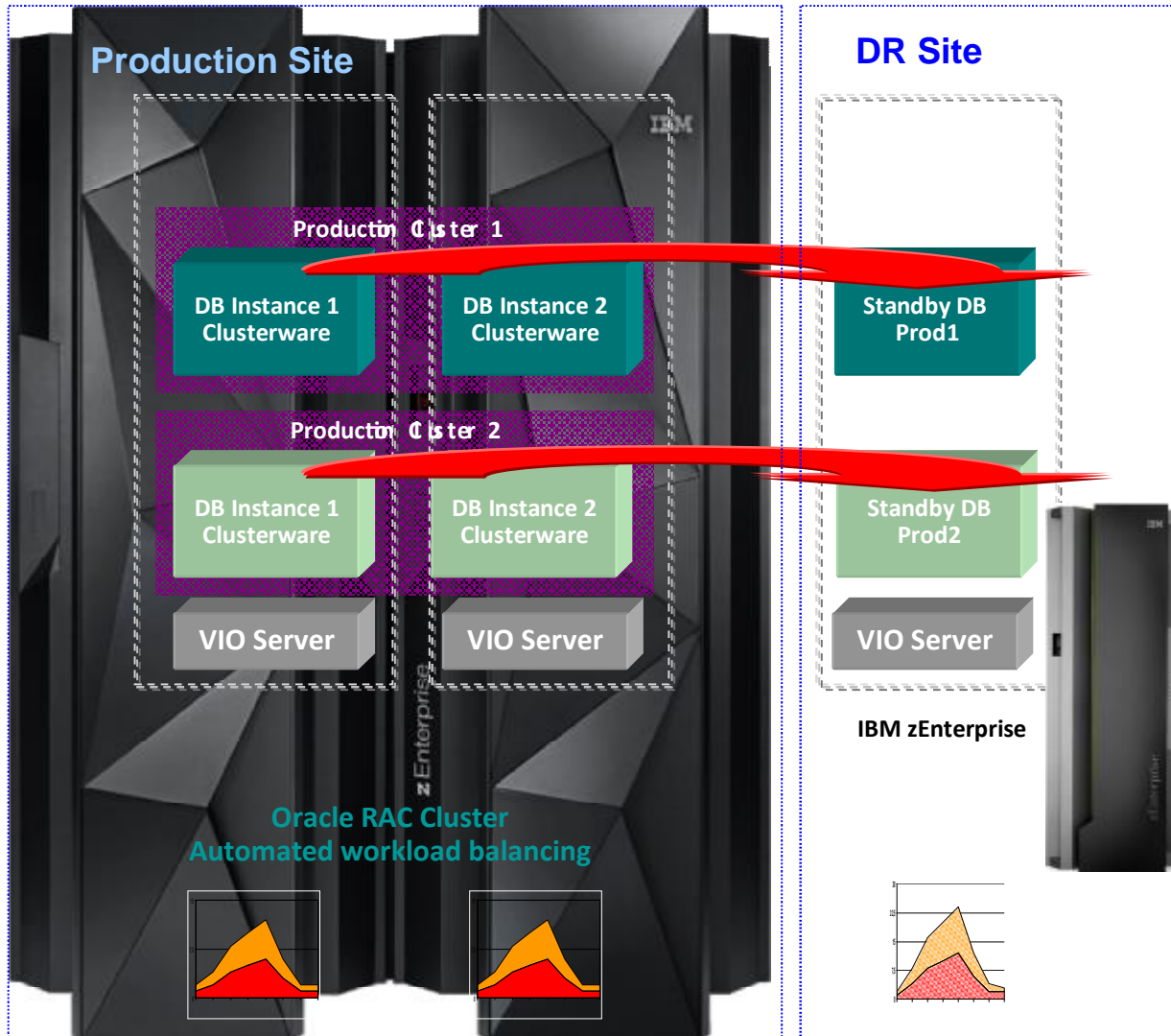
- No downtime on node failure
- Rolling Upgrade Patching
- Increase Workload treatment by adding nodes with no downtime

§ Oracle Real Application Cluster (RAC) is flexible architecture

- Workload balancing across the nodes (partitions) of the servers
- Easy maintenance as 1 node can be stopped without Application disruption

If one server goes down, database will be still available, no disruptions.

HA Step 3: Combine IBM System z, Active/Active Oracle RAC + DR



Reduce downtime and delay the fail-over process

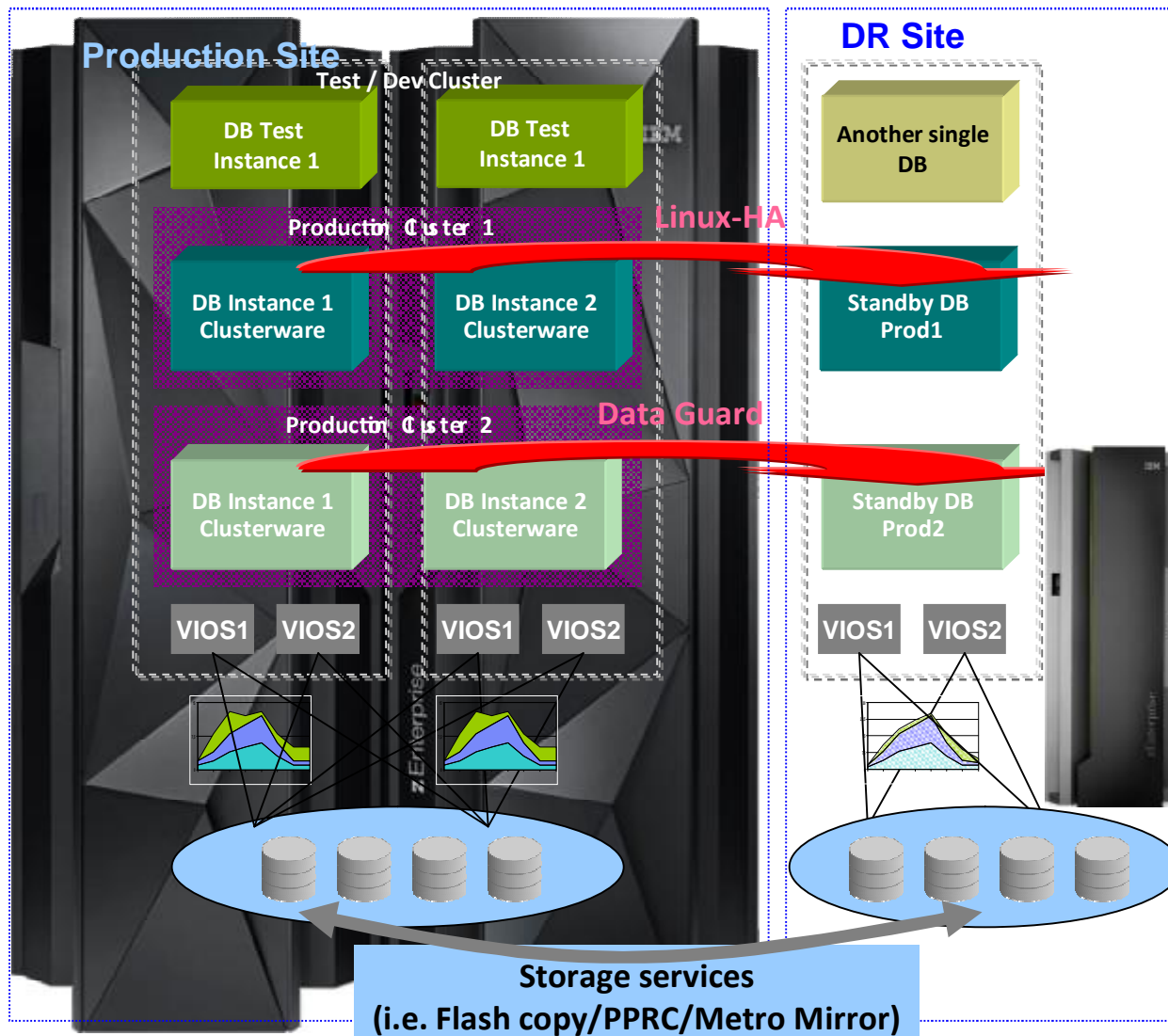
- Easy maintenance as cluster nodes can be stopped with **minimum** disruption

But does not include disk storage

- Storage and Network HA need to be included
- Could be more flexible infrastructure for provisioning, maintenance and failover operations
- Free resources are reserved in DR server (capacity on demand) to get the additional workload in case of a node failure/maintenance

Do not host only RAC(s) DB in the server ...

HA/DR: The Global Picture



- Test and Development are different workloads profiles than production

- Mix production/DR and test environment to optimize resources
- Define test and development workloads as less priority without impact on activities
- Less hardware resources

• Simplified and Flexible IT infrastructure

- Less administration and maintenance

Oracle Data Guard

Requires a minimum downtime of the DB

- Linux-HA can be combined with storage replication solution.
- CPU and Memory resources for the passive server are not wasted, they are reserved and can be automatically activated with Capacity on Demand

Optimize the overall infrastructure with consolidation of other workloads (i.e. Development, Test, ...) and Capacity on Demand

Deploying RAC for High Availability

RAC – Real Application Cluster –

§ Active/Passive configuration

- One node processes work
- The other node waits for the first node to fail

§ Active/Active configuration

- All nodes process work
- If any node fails the cluster is re-mastered.

§ Besides availability, RAC can be used for workload distribution

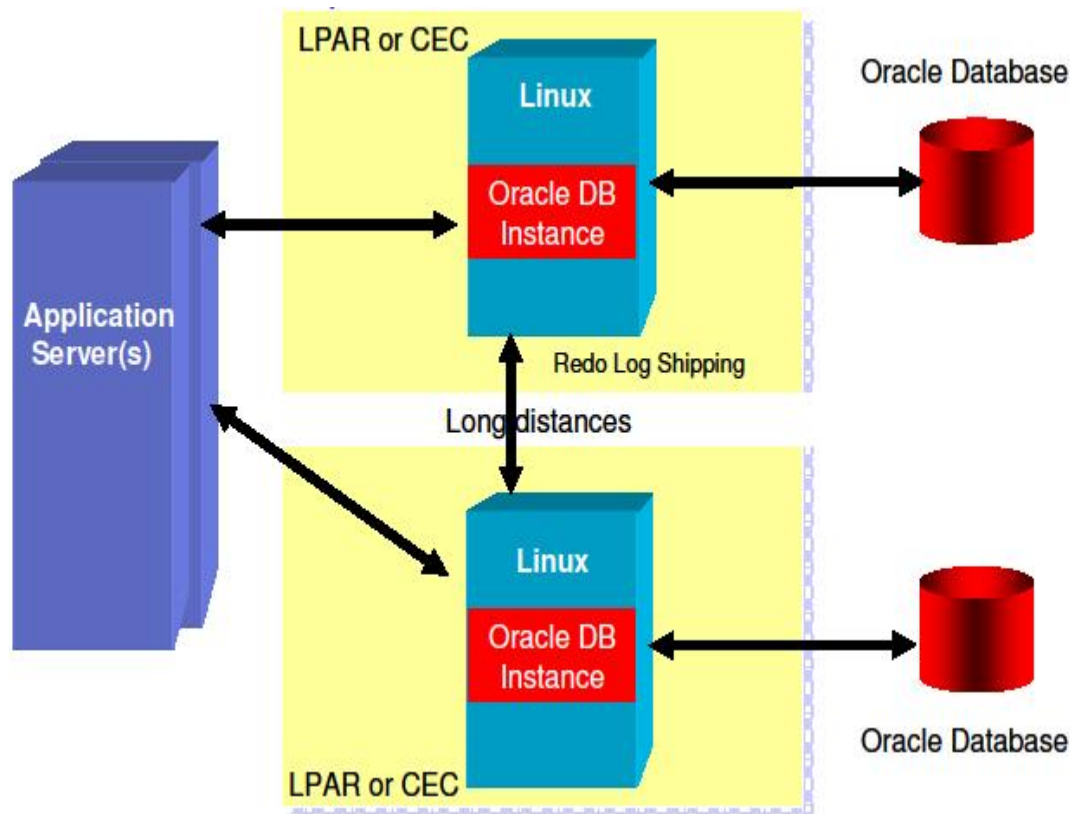
- All work does not have to go through all nodes

§ Deploy

- In the same LPAR for test/dev applications
- Across LPARs for LPAR maintenance or software failures (most common implementation)
- Across CECs when taking entire systems down is a “common” occurrence

Disaster Recovery (DR) with Oracle Data Guard

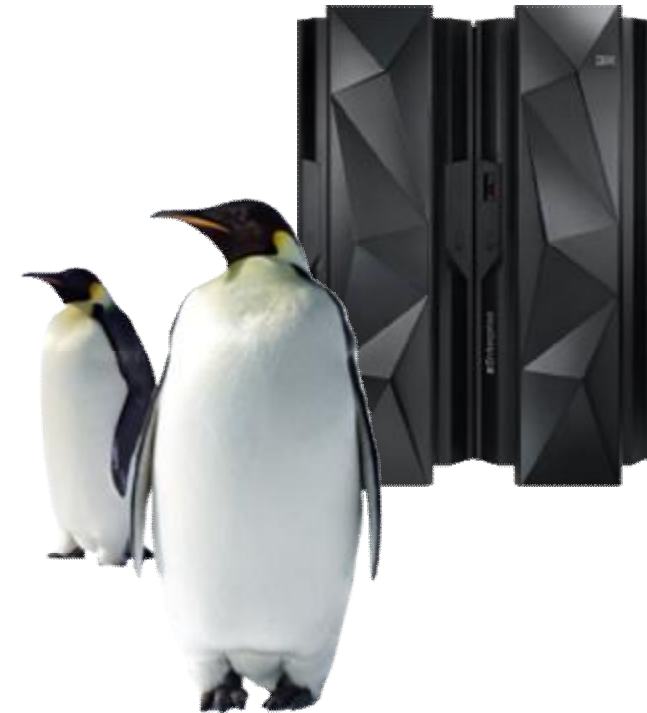
Standby – replication to standby database



- Uses redo log shipping for log apply or SQL Apply
- Less data transmitted than replication
- Sync or async
- Various configurations of logical and physical standby databases
- Data Guard generally deployed between CECs

Discussion Topics

- § The IBM & Oracle relationship
- § Business case for Oracle consolidation
- § System z virtualization
- § High-availability and Disaster Recovery
- § **References**



Sparda Datenverarbeitung eG chooses IBM zEnterprise



“Oracle has been consolidated on this platform we are using right now only Oracle on the z196 platform,”

Bernd Bohne, Sparda-Datenverarbeitung e.G., Manager,
Central Systems

“Over the years, the mainframe transformed from traditional workloads, quite simple, to a universal platform for new workloads as well.

And we see a lot of new applications that are coming to this platform.

Especially for Linux, it's perfect.

The z/Enterprise platform is perfect for consolidating Linux workloads because of the high I/O bandwidth, business continuity with capacity backup features.”

Watch and listen to

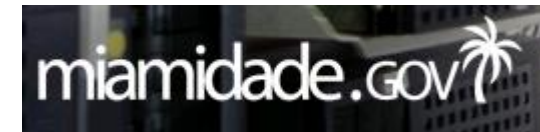
§ Bernd Bohne, Sparda-Datenverarbeitung e.G., Manager, Central Systems

§ Marie Wieck, IBM, General Manager, Application Integration Middleware

§ Steve Mills, IBM, Senior Vice President & Group Executive, Software & Systems

Reference Customers

Linux on System z with Oracle



When consolidating Oracle database servers –

- § Understand your requirements (and cost implications)
 - High Availability (how much money is at stake if your system is down x minutes/hours?)
 - Disaster Recovery (what is your RTO by application/database?)
- ❌ **Select architecture choices according to requirements**
- § Low utilization servers and mix of different peak times are best candidates
 - Selected databases with sustained high CPU utilization may not be good candidates
- § Databases with high I/O stress will benefit from System z architecture
- § Tune migrated database servers to the virtualized environment
 - Right size servers (memory, number of vCPUs, direct I/O)
 - System z may behave differently compared to x86
- § Monitor your system behavior
 - Typically performance behavior is not static
 - Test before and after changes are applied
- § Consider Capacity on Demand (CoD) for peak load times

Why System z for Oracle

- § High Availability Requirements
- § Open Standards and Linux
- § Disaster Recovery Requirements
- § Customer Data on Mainframe
- § Increased Performance Requirements
- § Economics of Linux (IFL) Specialty Engines
- § TCO versus Total Cost of Acquisition
- § 'Green' Value from Mainframe
- § zEnterprise servers can virtualize everything with up to 100% utilization rates
- § zEnterprise is the only Heterogeneous platform in the industry
- § System z has the highest security rating or classification for any commercial server



Questions?



Siegfried Langer
*Business Development Manager
z/VSE & Linux on System z*



*IBM Deutschland Research
& Development GmbH
Schönaicher Strasse 220
71032 Böblingen, Germany*

Phone: +49 7031 - 16 4228

Siegfried.Langer@de.ibm.com

Notices

This information was developed for products and services offered in the U.S.A.

Note to U.S. Government Users Restricted Rights — Use, duplication or disclosure restricted by GSA ADP Schedule Contract with IBM Corp.

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to: IBM Director of Licensing, IBM Corporation, North Castle Drive Armonk, NY 10504-1785 U.S.A.

The following paragraph does not apply to the United Kingdom or any other country where such provisions are inconsistent with local law: INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this information to non-IBM Web sites are provided for convenience only and do not in any manner serve as an endorsement of those Web sites. The materials at those Web sites are not part of the materials for this IBM product and use of those Web sites is at your own risk.

IBM may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you.

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

This information contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products. All of these names are fictitious and any similarity to the names and addresses used by an actual business enterprise is entirely coincidental.

Notice Regarding Specialty Engines (e.g., zIIPs, zAAPs and IFLs):

Any information contained in this document regarding Specialty Engines ("SEs") and SE eligible workloads provides only general descriptions of the types and portions of workloads that are eligible for execution on Specialty Engines (e.g., zIIPs, zAAPs, and IFLs). IBM authorizes customers to use IBM SE only to execute the processing of Eligible Workloads of specific Programs expressly authorized by IBM as specified in the "Authorized Use Table for IBM Machines" provided at www.ibm.com/systems/support/machine_warranties/machine_code/aut.html ("AUT").

No other workload processing is authorized for execution on an SE.

IBM offers SEs at a lower price than General Processors/Central Processors because customers are authorized to use SEs only to process certain types and/or amounts of workloads as specified by IBM in the AUT.

COPYRIGHT LICENSE:

This information contains sample application programs in source language, which illustrates programming techniques on various operating platforms. You may copy, modify, and distribute these sample programs in any form without payment to IBM, for the purposes of developing, using, marketing or distributing application programs conforming to the application programming interface for the operating platform for which the sample programs are written. These examples have not been thoroughly tested under all conditions. IBM, therefore, cannot guarantee or imply reliability, serviceability, or function of these programs. You may copy, modify, and distribute these sample programs in any form without payment to IBM for the purposes of developing, using, marketing, or distributing application programs conforming to IBM's application programming interfaces.

TRADEMARKS:

This presentation contains trade-marked IBM products and technologies. Refer to the following Web site:

<http://www.ibm.com/legal/copytrade.shtml>