IBM

IPL3221

Oracle and z Systems - a great combination

Siegfried Langer
Business Development Manager z/VSE and Linux on System z
IBM Germany Research & Development

2015

IBM Systems Technical University

IBM z Systems • IBM Power Systems • IBM Storage

October 5–9 | Hilton Orlando, Florida

Discussion topics

- Value of IBM z Systems for Oracle

- Oracle & IBM working together

- Consolidation examples

- Oracle HA considerations

- Consolidation made easy

  - *Some considerations: Exadata or z Systems*

  - *Data migration tools and services*

World's leading businesses run on the mainframe

92 of the top 100 worldwide banks

10 out of 10 of the world's largest insurers

23 of the top 25 US retailers

23 out of 25 of the world's largest airlines

Optimized for high performance data and transaction serving

Performance

- 141 high-performance cores
  - delivering 40% more capacity
  - move data 2X as fast
- 320 Separate channels of dedicated I/O

Speed

- Simultaneous multi-threading for up to 30% more throughput

Memory

- 10TB memory to eliminate I/Os for up to 70% faster response time to introduce new in-memory workloads

Optimized for Oracle high performance data serving

The Value of IBM z Systems for Oracle

Reduce cost by simplifying and optimizing your business process infrastructure with highly utilized Server resources designed for the digital economy

z Systems provide unsurpassed scalability and virtualization capabilities that can help to support Hundreds to thousands of virtual servers

Reduce the IT equipment footprint and maximize its efficiency with the simplicity of a single server Solution

Use automated failover and rapid recovery for business-critical applications and data

IBM z Systems are recognized as the most available, scalable, and secure platform[1]

1 Forrester: Secure The Enterprise With Confidence Using A Mainframe Infrastructure, March 2013

IBM z Systems

The right choice for Oracle mission critical workloads

IBM z Systems® z13

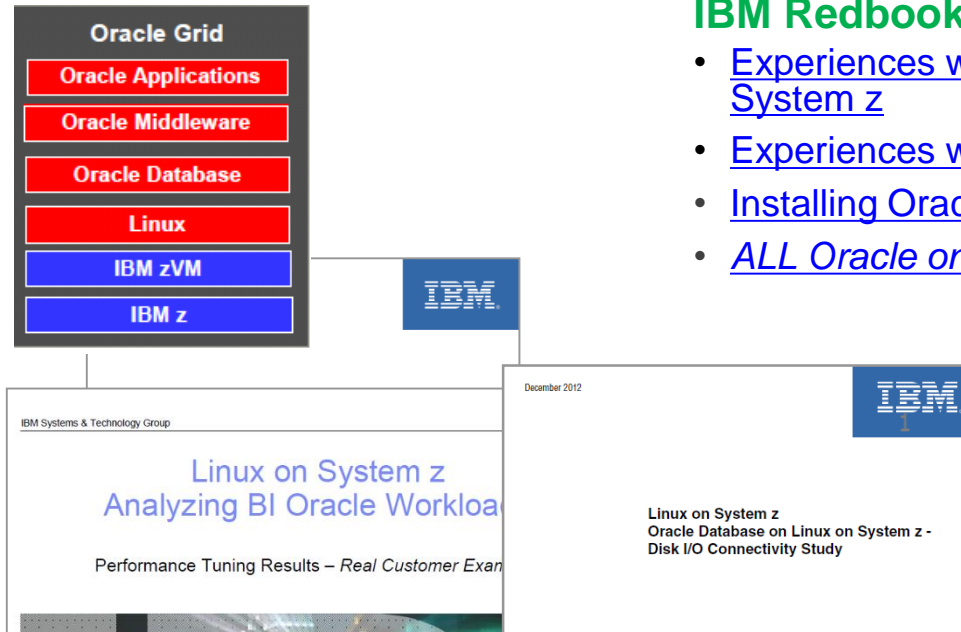IBM zEnterprise® BC12 (zBC12)

IBM and Oracle business relationship

- **Oracle Software Stack is certified and supported on certified distributions of Linux (RHEL or SLES) running natively in LPARs or as a guest operating system in z/VM virtual machines deployed on the System z platform. (My Oracle Support reference Doc ID: 417770.1).**
- 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.
- Oracle support policy for security patches for Linux on System z servers:
  - Security patches also known as "CPU patches" are now included in the quarterly PSU (Patch Set Updates) for all platforms.
- Products ported to Linux on System z servers will be supported according to the Oracle Lifetime Support Policy.

- 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

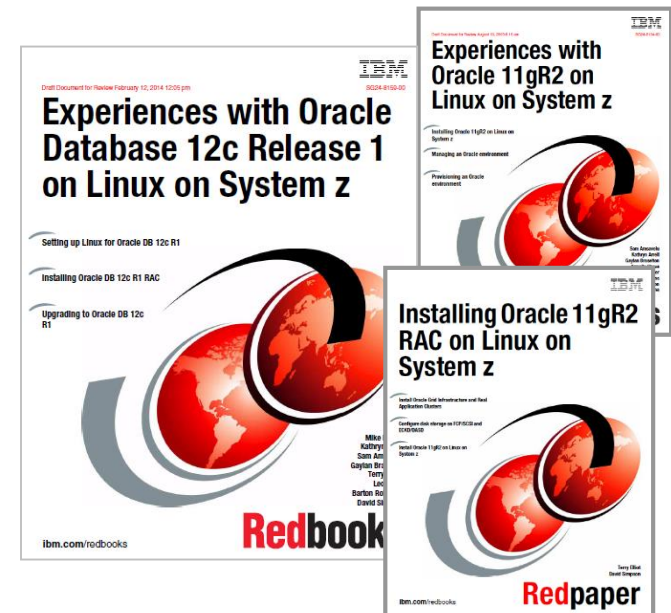# Resources: IBM & Oracle working together

IBM Redbooks:

- [Experiences with Oracle Database 12c Release 1 on Linux on System z](#)
- [Experiences with Oracle 11gR2 on Linux on System z](#)
- [Installing Oracle 11gR2 RAC on Linux on System z](#)
- *[ALL Oracle on System z Redbooks](#)*

IBM Performance Papers:

- [Oracle Database on Linux on System z - Disk I/O Connectivity Study](#)
- [Analyzing BI Oracle Workloads](#)
- [Oracle Real Application Clusters on Linux on IBM System z: Set up and network performance tuning](#)

Oracle on z Systems

" System z is the most cost-effective platform for large Oracle workloads. Whether our customers need to consolidate or isolate processes, our Oracle services would be impossible without it. "

- Lubo Cheytanov, founder and co-owner, L3C LLP

Read the full story ZSC03285USEN
http://www-03.ibm.com/software/businesscasestudies/us/en/corp?synkey=W133353R73108L21

Business need
L3C LLP needed to bring the robust reliability, security and affordability of the mainframe to its cloud customers, while also using the platform as a key differentiator for its managed services.

Solution
L3C deployed IBM® System z® servers running Linux to provide companies of any size—including small, midsized and very large enterprises—with scalable, cost-effective, high-performance cloud services.
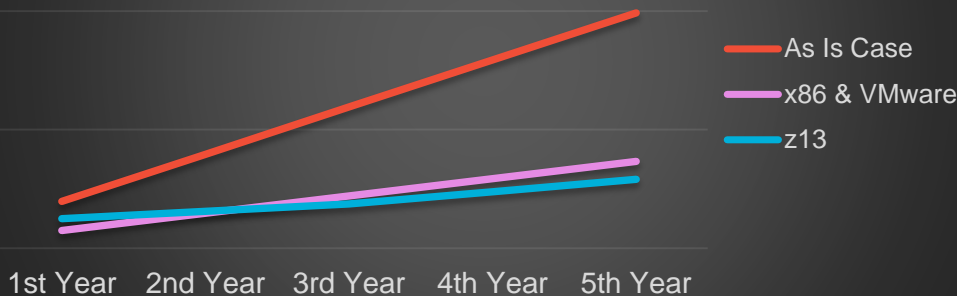
Benefits
L3C can now provide Infrastructure-as-a-Service (IaaS) options, with differentiated qualities of service and price performance, to help expand its reach and reduce costs for customers.

Delivers extreme reliability and cost savings to cloud customers using IBM z Systems
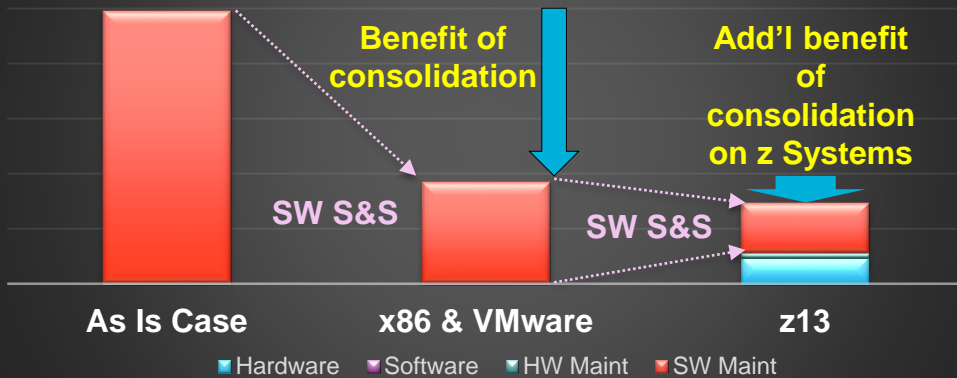
IBM Systems Technical University, October 5-9 | Hilton Orlando

Database consolidation example

RACEv Cumulative Cost Analysis Graph

- As Is Case
- x86 & VMware
- z13

1st Year   2nd Year   3rd Year   4th Year   5th Year

Cost Breakdown

Benefit of consolidation

Add'l benefit of consolidation on z Systems

SW S&S

SW S&S

As Is Case   x86 & VMware   z13

- Hardware - Software - HW Maint - SW Maint

Renewal: ProLiant DL580 Gen9 Xeon E7-8860v3 16-Core 2.2GHz (2ch/32co)

Sizing information based on IBM internal RACEv tool and US prices. Actual results may vary.

- **ProLiant BL280c G6 Xeon** E5649 Hex Core 2.53GHz (2ch/12co)
- 20 physical Linux servers
  - 5 servers @ 25% utilization (production with RAC)
  - 10 servers @ 10% utilization (production)
  - 5 servers @ 10% utilization (test/dev.)
- 240 cores total

New LinuxONE Emperor
- **9 IFLs (= 9 cores)**
- **z/VM hypervisor**
- **20 virtual Linux servers**
- **Oracle DB Enterprise Edition**
- **RAC**
- **DataGuard**
- **Tuning & Diagnostic Pack**

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

Sparda Datenverarbeitung runs Oracle on z

"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 zEnterprise platform is perfect for consolidating Linux workloads because of the high I/O bandwidth, business continuity with capacity backup features."

*"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

http://www.youtube.com/watch?v=c7Z19IB5AmE

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A DBA's view: Sparda Datenverarbeitung

Presented at DOAG 2014 (German Oracle User Group) conference

Experience report

8 Years of Oracle Databases on Linux on System z

Liebhard Bidner – DBA
November 20, 2014

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Sparda Datenverarbeitung

What benefits do we get from zLinux under z/VM?

- Fast provisioning of Linux guests via z/VM cloning mechanism

- Fast and simple extension of zLinux system resources (CPU, memory)

- High performance and security

- Simple licensing model and savings of Oracle SW costs

- Relocation of complete zLinux guest-systems to the other datacenter with z/VM Live Guest Relocation feature

- Mirrored disk storage subsystem between two datacenters

  - Disaster Recovery with GDPS / XDR in z/VM and Linux swaps disk mirror in case of failure automatically via HyperSwap

- Oracle database versions plus RAC are fully supported and certified by Oracle.

Welche Vorteile bietet uns z/Linux unter z/VM ?   SDV

- Schnelle Bereitstellung von z/Linux Gästen durch den z/VM Cloning – Mechanismus

- Schnelle und einfache Erweiterung von z/Linux Systemressourcen (CPU, Hauptspeicher)

- Hohe Performance und Sicherheit

- Einfaches Lizensierungsmodell und Einsparung bei den Oracle Softwarekosten

- Verlagerung des gesamten z/Linux Gastsystems mit z/VM Feature „live guest relocation" in das andere Rechenzentrum

- Gespiegeltes Plattensubsystem über zwei Rechenzentrumsstandorte
  Stichwort „Disaster Recovery" mit GDPS / XDR (Geographical Dispersed Parallel Sysplex und Cross Platform Disaster Recovery) im z/VM und z/Linux schwenkt der Plattenspiegel bei Ausfall einer Seite mittels Hyperswap automatisch auf die andere

- Oracle Database Versionen plus RAC auf System Z mit z/VM und z/Linux sind von Oracle voll unterstützt und zertifiziert.

Sparda-Datenverarbeitung eG 20.11.2014 – LB/SY- DBS   Seite 6

Sparda Datenverarbeitung

Conclusion – 8 years of Oracle under zLinux

Oracle is Oracle is Oracle …
also with Linux on System z

During the last 8 years of production of our Oracle databases there were no failures or problem situations where we had to apply any Oracle patch specific to our database version on zLinux.

If required, it were always platform independent fixes for failure or problem situations.

Our Oracle databases under zLinux run absolutely stable, reliable, performing, and secured.

For us as Sparda Datenverarbeitung and our existing mainframe architecture this was and is the most effective and lowest cost platform for consolidation and virtualization.

FAZIT – 8 Jahre Oracle unter z/Linux   SDV

Oracle ist Oracle ist Oracle…

auch auf z/Linux.
In den letzten 8 Jahren Betrieb unserer Oracle Datenbanken gab es keine Fehler- oder Problemsituationen in denen wir einen Oracle Patch speziell für unsere Datenbankversion unter z/Linux einsetzen mussten.
Wenn, dann waren es immer plattformunabhängige Fehler- oder Problemsituationen die behoben wurden.
Unsere Oracle Datenbanken laufen unter z/Linux absolut stabil, zuverlässig, performant und abgesichert.
Für uns als Sparda Datenverarbeitung eG, mit unserer vorhandenen Mainframe Infrastruktur war und ist es die effektivste und kostengünstigste Plattform für eine Konsolidierung und Virtualisierung.

Sparda-Datenverarbeitung eG 20.11.2014 – LB/SY- DBS   Seite 11

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Sparda Datenverarbeitung

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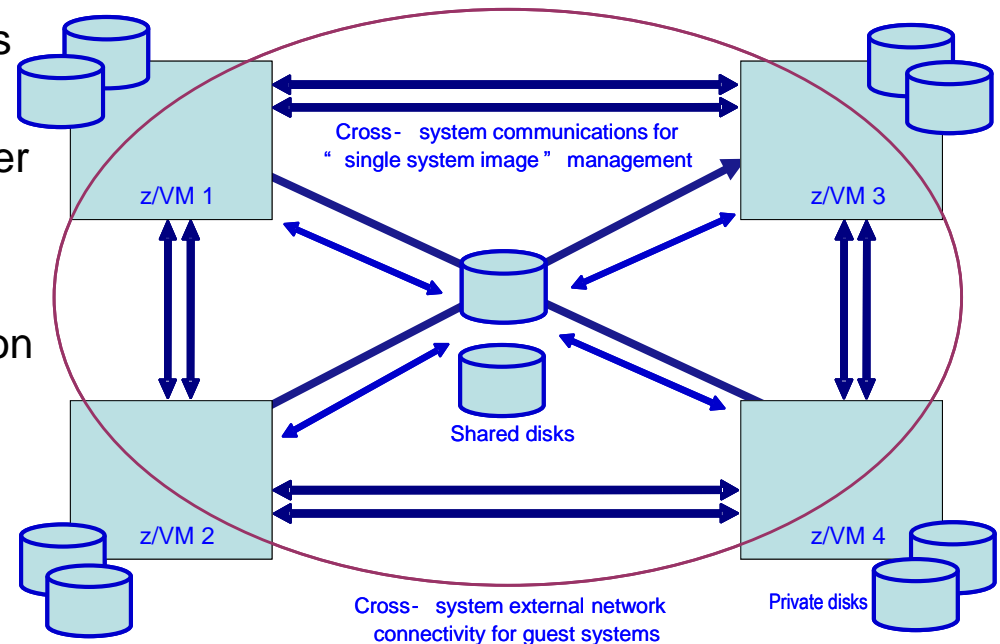
Sparda-Datenverarbeitung eG 20.11.2014 – LB/SY- DBS   Seite 11

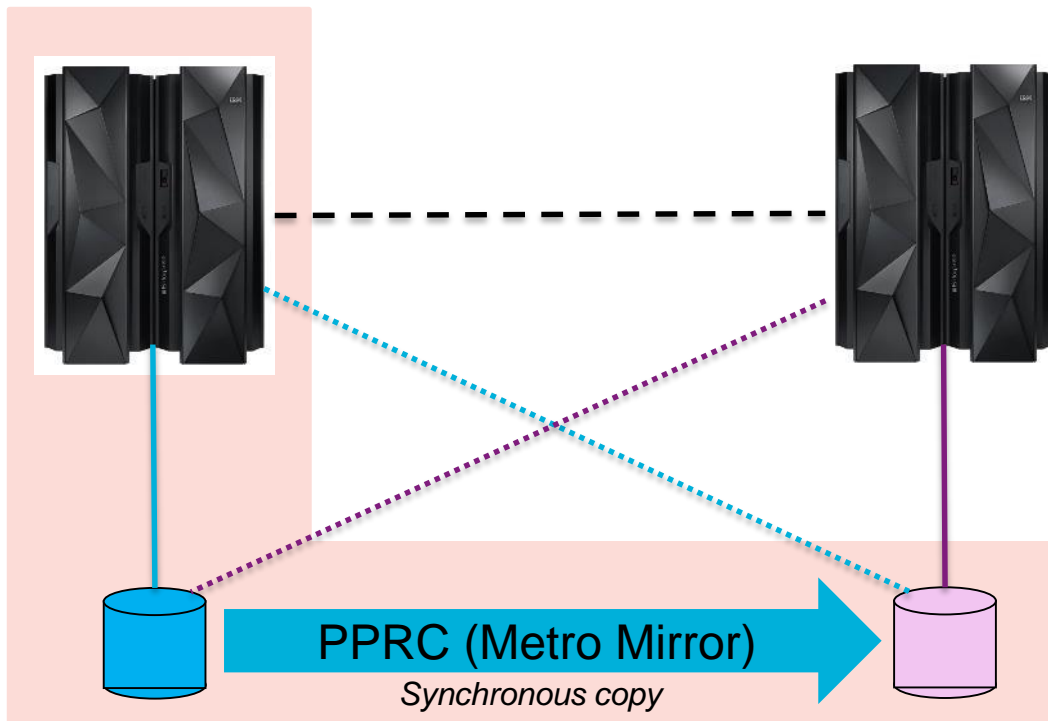# Single System Image Clustering with Live Guest Relocation

- Connect up to four z/VM systems as members of a Single System Image cluster
- Cluster members can be run on the same or different System z servers
- Simplifies management of a multi-z/VM environment
  - o Single user directory
  - o Cluster management from any member
    - ➢ Apply maintenance to all members in the cluster from one location
    - ➢ Issue commands from one member to operate on another
  - o Built-in cross-member capabilities
  - o Resource coordination and protection of network and disks
- Available on z/VM 6.2 or later

z/VM 1

z/VM 3

Cross- system communications for " single system image " management

Shared disks

z/VM 2

z/VM 4

Private disks

Cross- system external network connectivity for guest systems

IBM GDPS for Linux on z Systems

- **IBM GDPS can be used for Linux on z Systems, providing high availability in case of system, application or network failure**
- GDPS/Peer to Peer Remote Copy (GDPS/PPRC) multiplatform resiliency capability

- z/VM HyperSwap between sites
- GDPS integration provides for automation
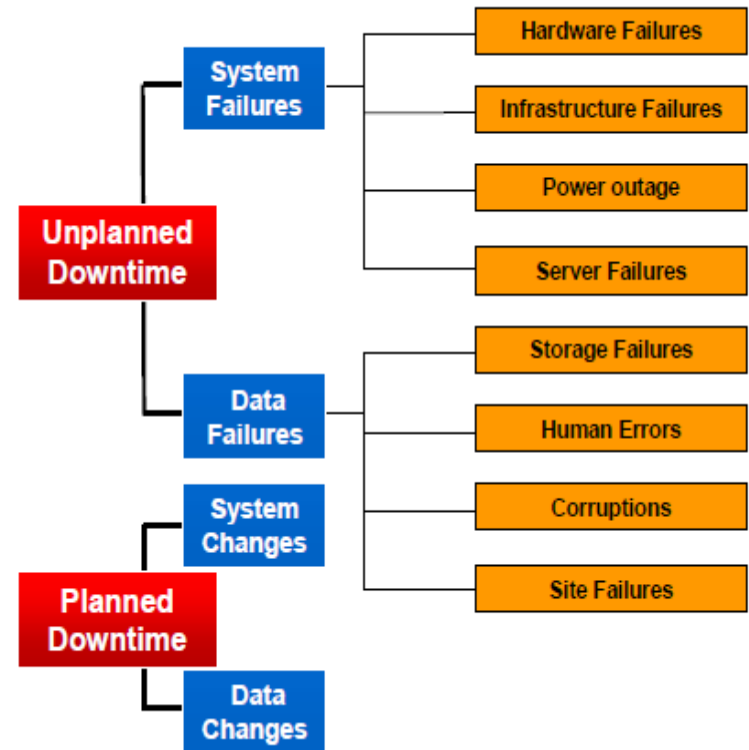- Requires IBM GDPS with z/OS or new GDPS appliance offering

PPRC (Metro Mirror)
Synchronous copy

About HA and DR ?

What is about High Availability ?

- *Prevent* outages before they occur
- *Tolerate* outages so they are transparent to the business

What is about Disaster Recovery ?

- *Recover* quickly if an outage does occur
- *Last Customer Insurance for its business*
- *Last insurance for customer Data Integrity*

HA and DR are not opposed, they are complementary !

HA solution should always have a DR solution to cover HA solution failure.
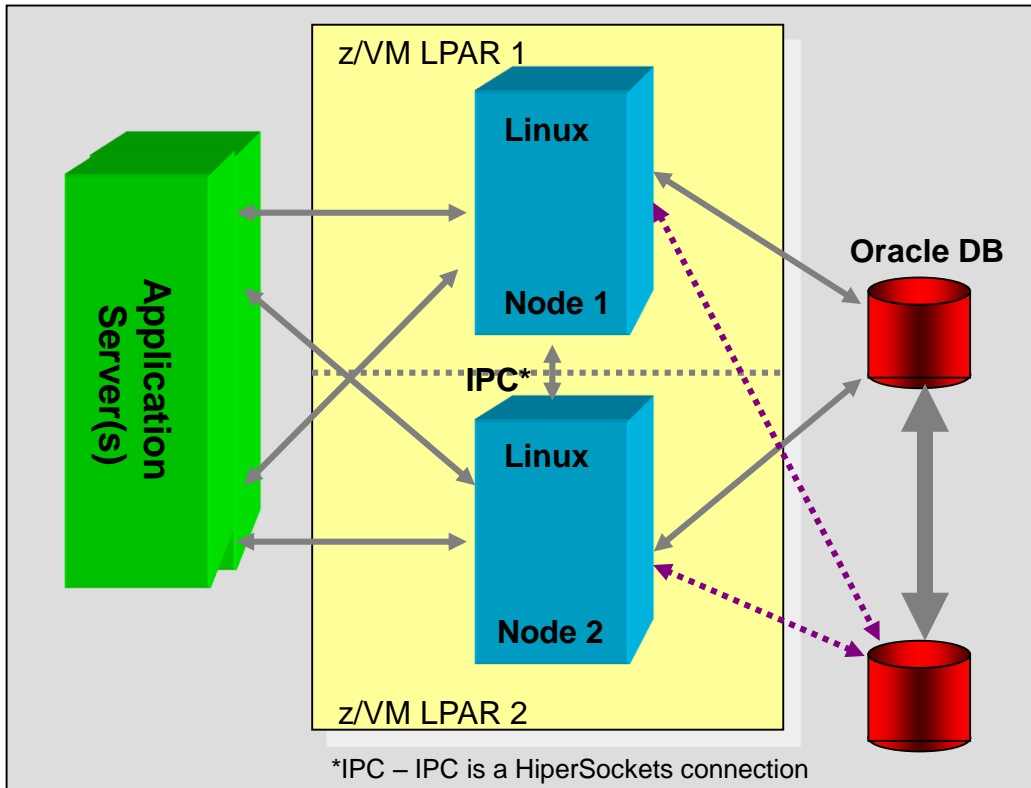
High-Availability & Disaster Recovery

- **Keep it simple**
  - Processes are part of HA
  - If the HA/DR architecture is too complex, it can be too difficult to manage with normal administrators skills
  - Avoid the necessity of expert skills to manage a disaster situation

- **Refrain from wanting everything**
  - RTO=0 (no outage)
  - RPO=0 (no data loss)
  - Long distance DR without performance concerns

- **Find the good balance**
  - Business needs versus costs and complexity

- **Think globally, for all your IT**
  - Avoid to use a different HA or DR solution for each of your application
  - Create and update HA/DR scenarios and procedures
  - Do not improvise during a crisis

Oracle HA with System z

Oracle RAC

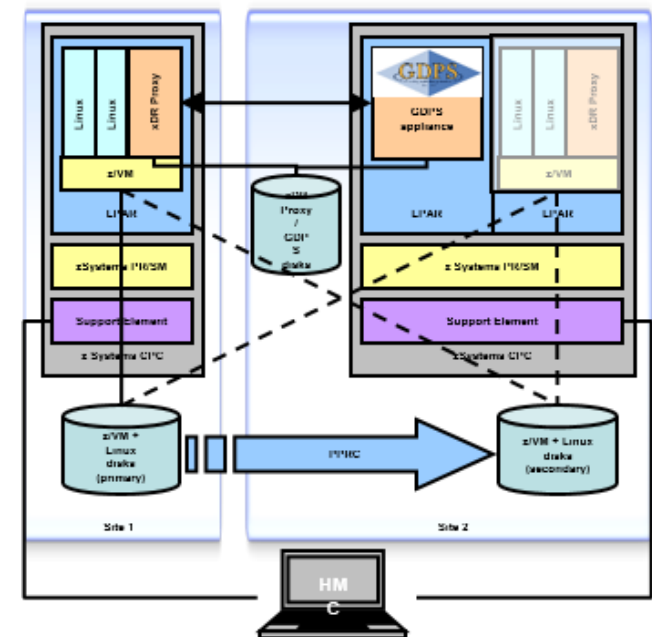|	
Server provided HA **Oracle** ➡	• RAC • Data Guard • Flashback • CRS • Grid Control
Operating system HA **Linux** ➡	• Linux Clustering
z/VM ➡	• Mature Hypervisor • Hardware assist • z/VM SSI/LGR
Hardware provided HA **System z** ➡	• Spare CPUs • N+1 power supplies • Chip sparring in memory • Concurrent maintenance • 50 years MTBF (system fail.)

- Guards against Linux failure, LPAR failure, z/VM failure, Oracle instance failure, LPAR maintenance
- Can be: Active/active, active/passive
- Not limited to two nodes

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IBM GDPS appliance for Linux on z Systems

- **The IBM GDPS appliance for Linux on z Systems provides high availability in case of system, application or network failure**

- GDPS/Peer to Peer Remote Copy (GDPS/PPRC) multiplatform resiliency capability for customers who do not run the IBM z/OS operating system in their environment.

- This solution is intended to provide IBM z Systems clients who run IBM z/VM and their associated guests, for instance, Linux on z Systems, with similar high availability and disaster recovery benefits to those who run on z/OS.

- **The implementation of the new GDPS Appliance for Linux will offer business continuity for Linux-only environments**.

IBM FlashSystem & Linux on z Systems
Highest Reliability, Maximum Performance

Now you can leverage the "Economies of Scale" of Flash

- Accelerate Application Performance
- Gain Greater System Utilization
- Lower Software & Hardware Cost
- Save Power / Cooling / Floor Space
- Drive Value Out of Big Data

IBM FlashSystem is certified ([see SSIC](#)) to attach to Linux on z to meet your business objectives

Performance of Linux on z with FlashSystem

I/O bound relational databases, like Oracle, can benefit from IBM FlashSystem over spinning disks.

- ➢ **21x reduction in response times***
- ➢ **9x improvement in IO wait times***
- ➢ **2x improvement in CPU utilization***

New FlashSystem 900 and z Systems FiconExpress16s I/O cards can provide an even higher throughput
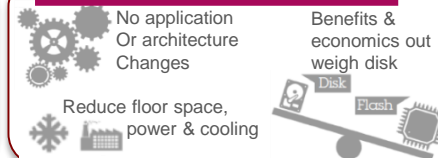
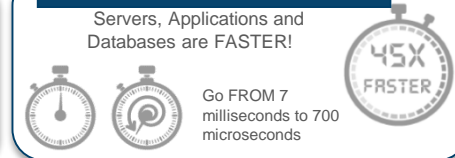## Why IBM FlashSystem for Linux on System z?

Extreme Performance
Cut IO Wait Time 80%+
Latency Under 100 Microseconds
3X increase IOPS

Enterprise Reliability
Highest Reliability levels
Purposed-built, Enterprise Architecture
Storage HD

Macro Efficiency
No application Or architecture Changes
Benefits & economics out weigh disk
Reduce floor space, power & cooling
Disk / Flash

IBM MicroLatency™
Servers, Applications and Databases are FASTER!
Go FROM 7 milliseconds to 700 microseconds
45X FASTER

* IBM internal test results with IBM FlashSystem 820 and FiconExpress4s
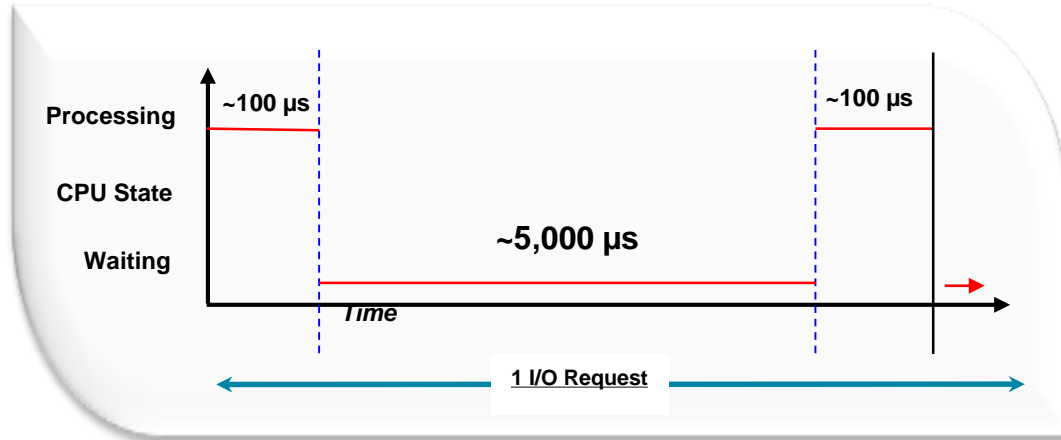
Micro-latency effects storage run time

I/O Serviced by Disk

1. Issue I/O request   ~ 100 µs
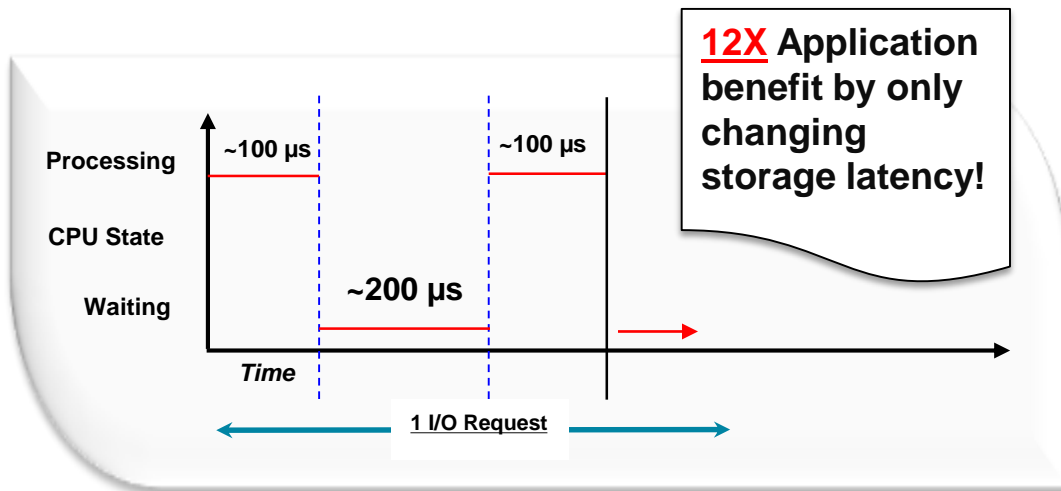2. Wait for I/O to be serviced   ~ 5,000 µs
3. Process I/O   ~ 100 µs

▪ Time to process 1 I/O request = 200 µs + 5,000 µs = **5,200 µs**

▪ CPU Utilization = Wait time / Processing time = 200 / 5,200 = **~4%**

Processing   ~100 µs   ~100 µs

CPU State

Waiting   **~5,000 µs**

Time

1 I/O Request

I/O Serviced by IBM FlashSystem

1. Issue I/O request   ~ 100 µs
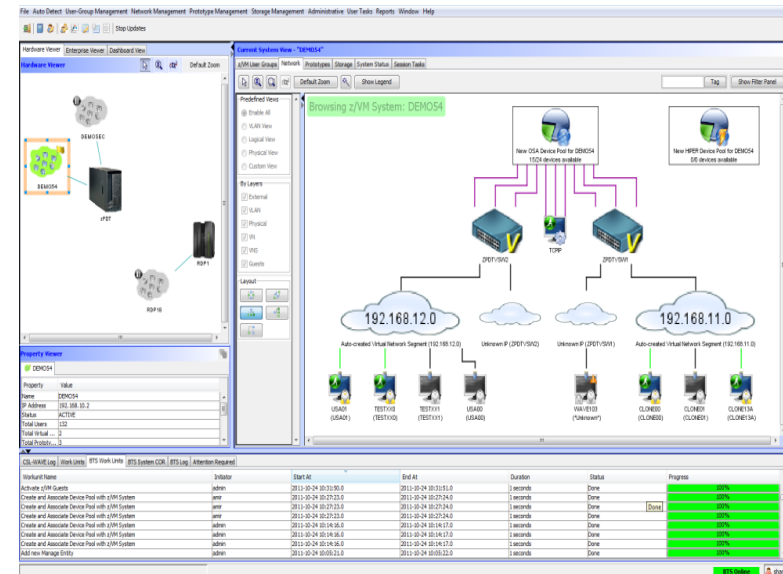2. Wait for I/O to be serviced   ~ 200 µs
3. Process I/O   ~ 100 µs

▪ Time to process 1 I/O request = 200 µs + 200 µs = **400 µs**

▪ CPU Utilization = Wait time / Processing time = 200 / 400 = **50%**

Processing   ~100 µs   ~100 µs

CPU State

Waiting   **~200 µs**

Time

1 I/O Request

12X Application benefit by only changing storage latency!

IBM

IBM Wave for z/VM (IBM Wave)

IBM Wave simplifies and helps automate management and administration of z/VM and Linux virtual servers, jumpstarting the steps needed to get to cloud. With its content rich interface IBM Wave extends the reach of your staff and lets you manage z/VM and Linux intuitively and cost effectively, reducing reliance on deep expert skills.

- Monitors and manages virtual servers and resources from a single interface

- Simplifies and automates administration and management tasks

- Provisions virtual resources (Guests, Network, Storage)

- Supports advanced z/VM capabilities such as Single System Image and Live Guest Relocation

- Allows delegation of administrative capabilities to the appropriate teams

A simple, intuitive graphical management, provisioning, and automation tool to help you fully leverage the power of System z virtualization on z/VM.
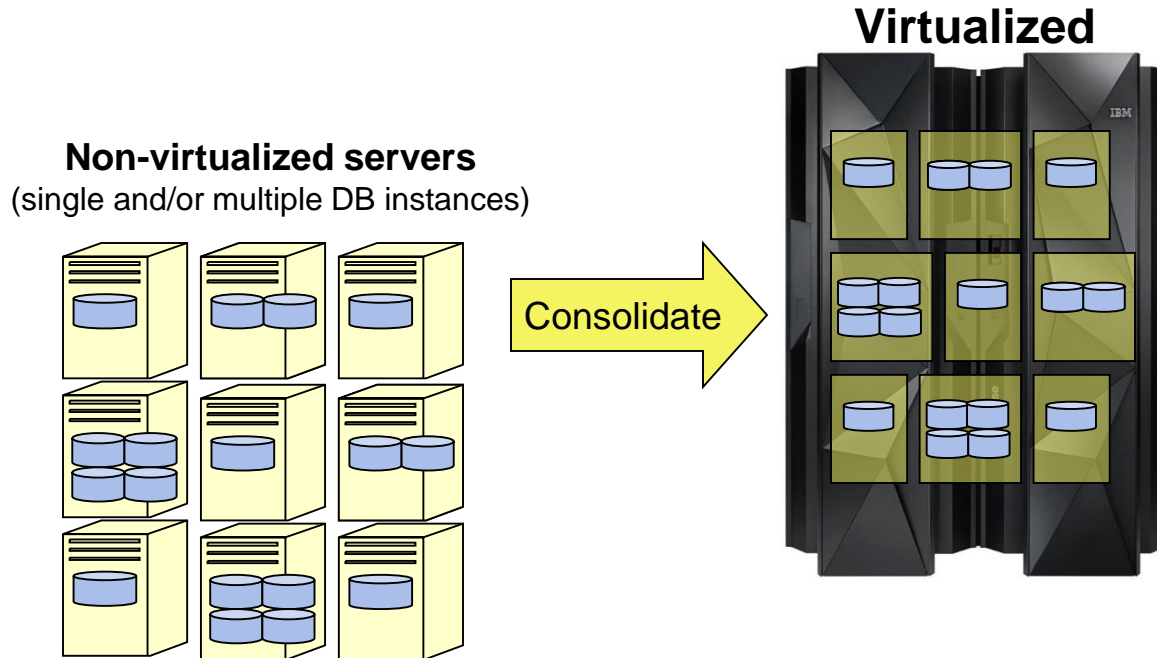
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IBM Wave with Oracle

Virtualization management for z/VM and Linux virtual servers

✓ Simplify the OS administrative and management of virtualized servers all from a single dashboard

✓ Reduce the time it takes to perform complex virtualization management tasks

✓ Extend the reach of existing skills to deploy images that host Oracle

✓ Improve the quality and consistency of operations with a current and accurate view of your system using IBM Wave discovery

✓ Reduce risk of errors by delegating management scope to the appropriate teams, allows DBA's to efficiently manage Oracle deployments

✓ Accelerate virtualization steps like virtual server cloning and provisioning to make the transformation to cloud easier

Consolidation – made easy

Virtualized

Non-virtualized servers
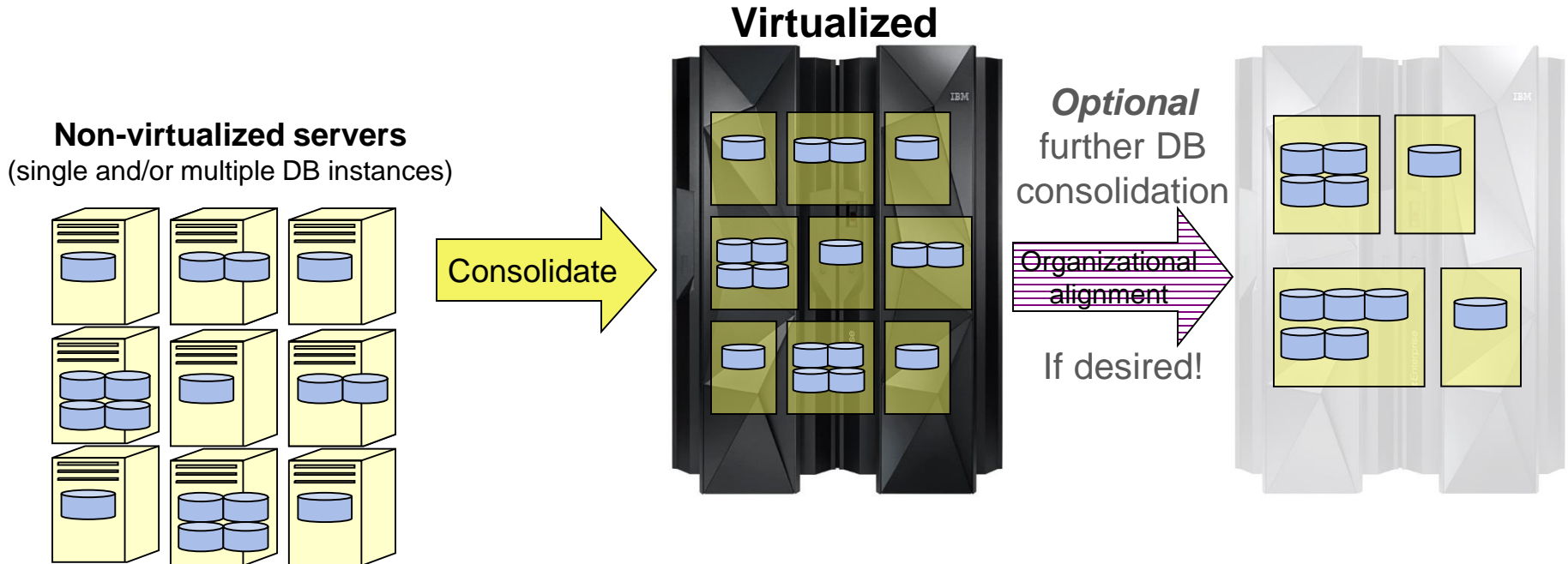(single and/or multiple DB instances)

Consolidate

Considerations:

- Migration time & effort
- Flexibility
- Separation of applications
- Workload management (SLAs)
- Accounting

Consolidation – made easy

Non-virtualized servers
(single and/or multiple DB instances)

Virtualized

Consolidate

Optional
further DB consolidation

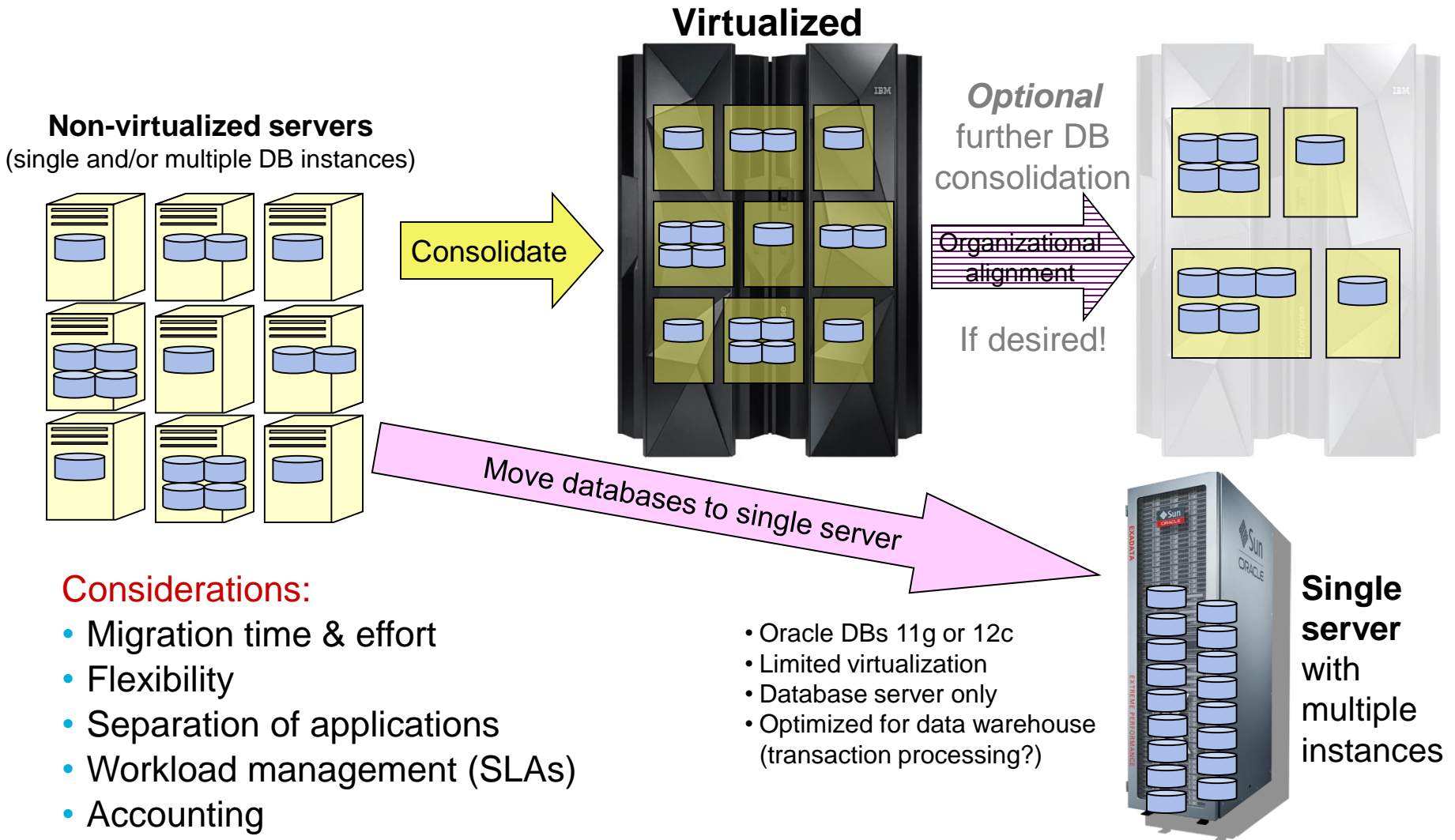Organizational alignment

If desired!

Considerations:
- Migration time & effort
- Flexibility
- Separation of applications
- Workload management (SLAs)
- Accounting

Consolidation – made easy

Virtualized

Non-virtualized servers
(single and/or multiple DB instances)

Consolidate

Optional further DB consolidation

Organizational alignment

If desired!

Move databases to single server

Single server with multiple instances

Considerations:
• Migration time & effort
• Flexibility
• Separation of applications
• Workload management (SLAs)
• Accounting

• Oracle DBs 11g or 12c
• Limited virtualization
• Database server only
• Optimized for data warehouse (transaction processing?)

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z Systems – Extreme Virtualisation

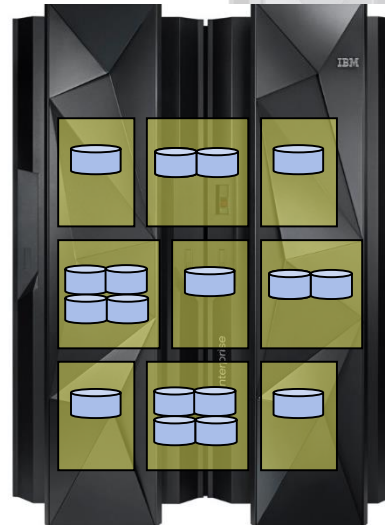*Build-in and Shared Everything Architecture*

Hardware assisted virtualization

Virtualized

Production and test & development on same box (separated by LPAR)

LPAR – PR/SM – up to 85 Logical Partitions

z/VM – 100's of Virtual Machines

Production

Test & Development

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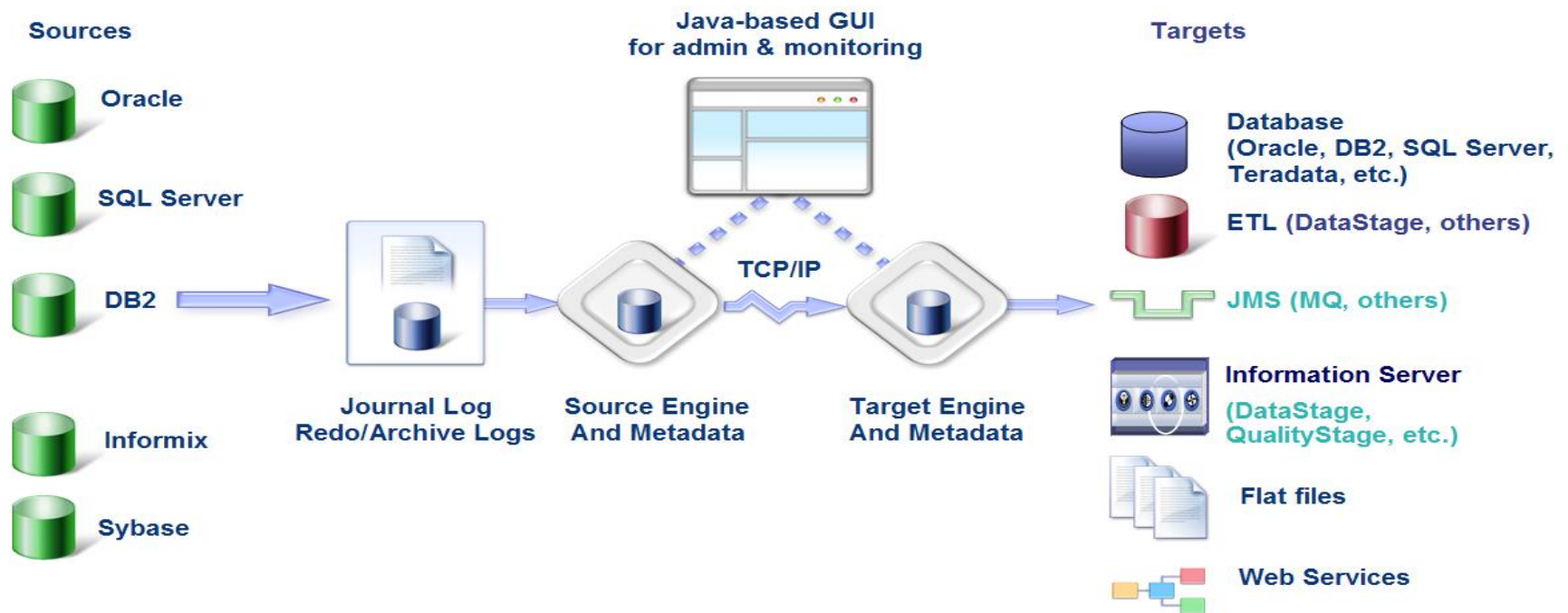
Continues Data Capture
IBM migration services

- Key benefits:
  - Low impact
  - Flexible implementation
  - Heterogeneous platform support

THE IBM MIGRATION FACTORY HELPS ANSWER KEY QUESTIONS

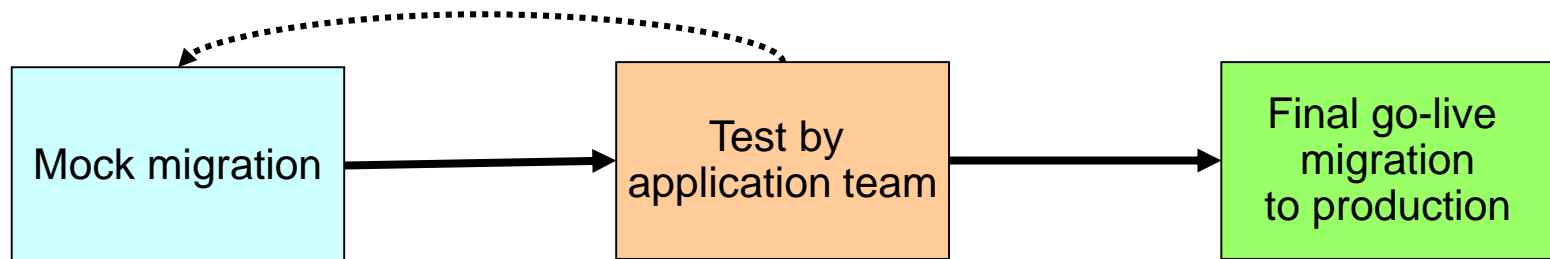"Can it be done?" - "How is it done?" - "What will it cost?"

"How long will it take?" - "What are the risks?"

DB Migration Approach
Supported by IBM Migration Factory

- Can be combined with continuous data replication - Change Data Capture (CDC)
  - Minimize outage time during go-live migration

- XenoBridge can handle database release migration (e.g. 10*g* to 11*g*)

Mock migration	→	Test by application team	→	Final go-live migration to production

Mock migration
- Take flash copy of DB
- Uses special tool (XenoBridge)
- Highly parallel copy to IFL environment
- Mock migration process can take several hours depending on DB size
- Short outage of production server to take flash copy

Test by application team
- Verify correct application functionality
- Customer task
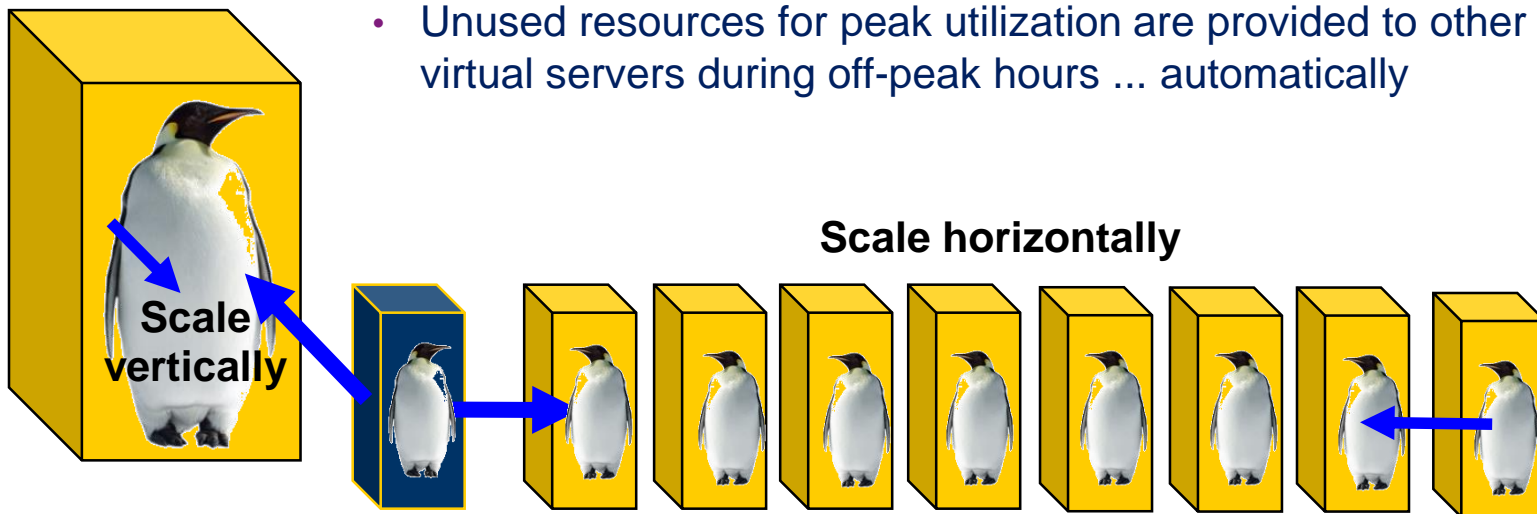
Final go-live migration to production
- Re-run of mock
- Uses special tool (XenoBridge)
- Highly parallel copy
- Mock migration process can take several hours depending on DB size
- Application not available during this time
- Switch IP address, assign source DB server IP (x86) to new server on IFL

Outstanding Scalability

Potential for economic growth and flexible configuration

- Highest levels of resource sharing – including the over-commitment, cooperative memory management, I/O bandwidth
- In-memory emulated storage achieves data transfers on memory-speed
- Very fast internal I/O connections, no external networking
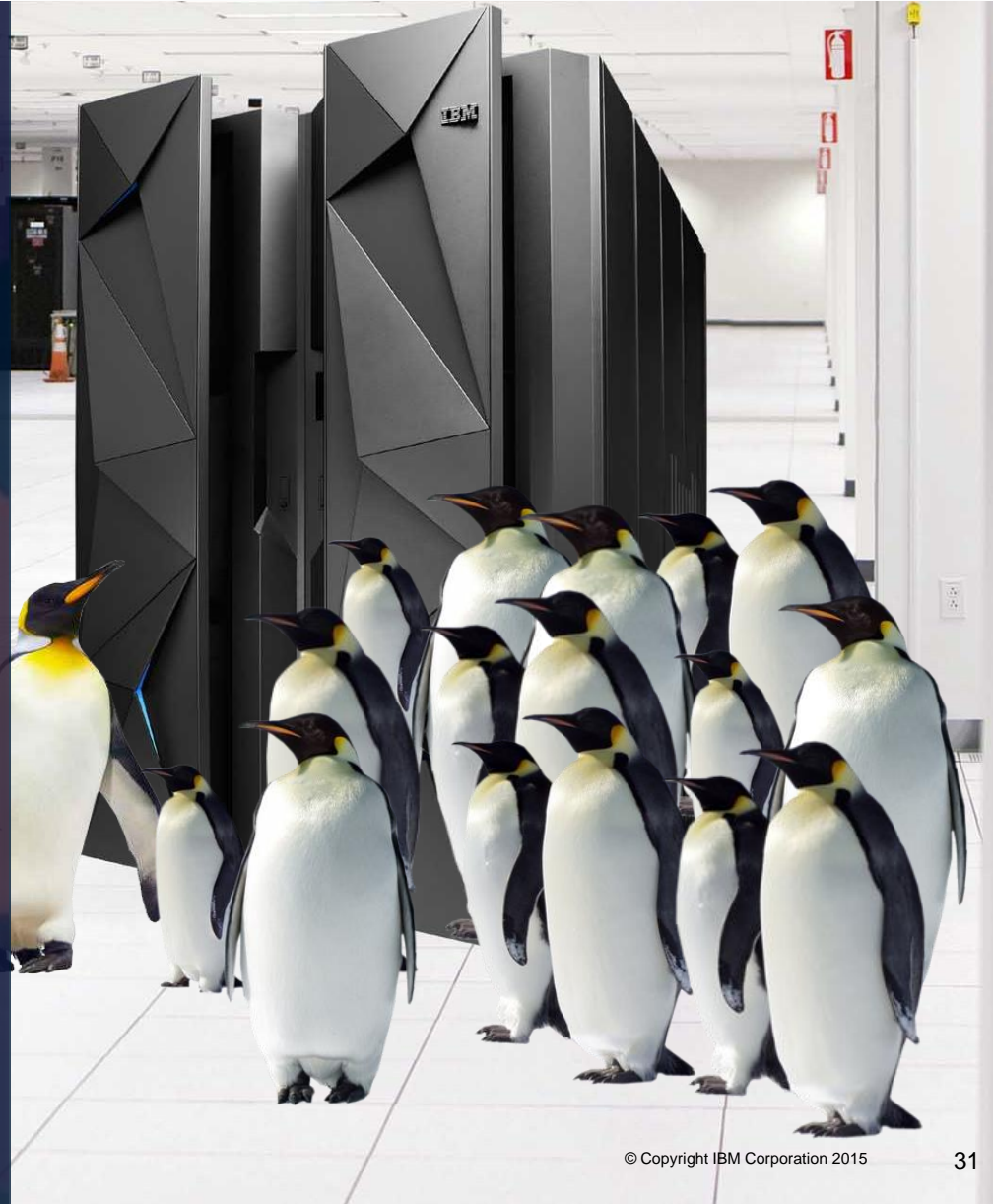- Dynamically add processors, memory, I/O adapters, devices and network cards … no disruption

- Unused resources for peak utilization are provided to other virtual servers during off-peak hours ... automatically

Scale vertically

Scale horizontally

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Linux on z Systems
means an enterprise grade Linux solution

While „Linux is Linux", z Systems server and virtualization technologies provide an enhanced Linux solution

Having an enterprise grade Linux solution brings:

- IT simplicity to run hundreds of workloads on one server
- Workload integration inside a single server
- Flexible server provisioning and growth inside the server
- High productivity through efficient life cycle management
- High utilization of shared resources
- Highest levels of security and quality of service – including business continuity

Linux on z Systems provides security, availability, and scalability to deploy (consolidate) all kinds of workloads

Questions

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

IBM

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& Development GmbH
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Siegfried.Langer@de.ibm.com

YOUR OPINION MATTERS!

1 **2** **3** **4**

Submit four or more session evaluations by 5:30pm Wednesday to be eligible for drawings!

*Winners will be notified Thursday morning. Prizes must be picked up at registration desk, during operating hours, by the conclusion of the event.

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