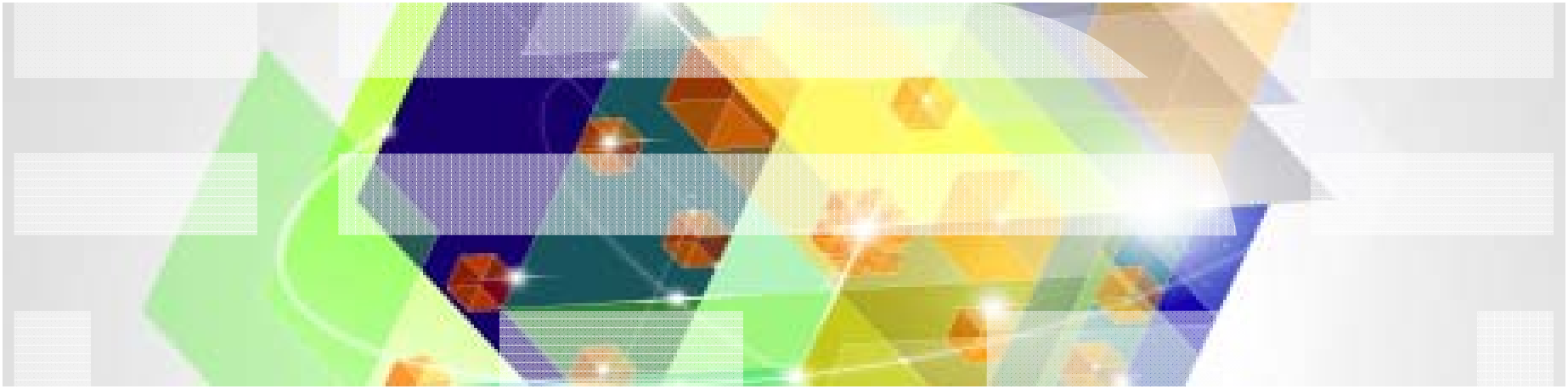
Jim Elliott
Consulting Sales Specialist – System z; zChampion: Linux Champion
IBM Canada Ltd.

Oracle Workloads on Linux on System z



IBM zEnterprise – Freedom by Design

IBM and Oracle commitment to Linux On System z

- **To meet the rapid growth of Linux, server virtualization and IT optimization, IBM and Oracle have increased development and support investments to deliver complete, open and integrated solutions to our customers.**
- **Specifically, IBM and Oracle have:**
  - Expanded porting resources to make Oracle technology infrastructure current and complete for Linux on System z
  - Dedicated resources to engage customers in design, proof-of-concept and benchmark activities.
  - IBM is investing in >40 development and tech staff to bring Linux on System z solutions to market
  - IBM is investing in hardware resources for Oracle development on Linux on System z
  - Aligned our technical support organizations to simplify problem resolution
    - Dedicated Oracle System z team in Oracle Support
  - Delivered 6 consecutive quarters of Parity of Oracle 10gR2 Database Patch Set (PSU) delivery on Linux on System z to other Oracle platforms
  - Published IBM and Oracle customer collateral covering various topics regarding Oracle on Linux on System z, some examples include:
    - Joint FAQ: http://www.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/PRS4016
    - Redbooks: http://www.redbooks.ibm.com/abstracts/sg247634.html

Complete solutions, collaborative partners

- **Enduring relationship**
  - Oracle 24 years, PeopleSoft 24 years, Siebel 14 years
  - Mission: Provide the strongest combination of solutions to maximize value of client investments
- **Mutual executive commitment**
  - Regular senior executive reviews, development and sales interlocks
  - Dedicated, executive-led IBM Alliance Team
- **Over 30,000 joint applications customers worldwide**
  - Hardware and software support via Applications Unlimited
- **Market Leading Services Practice**
  - ~5,500 successful Joint Services projects
  - >10,000 IBM consultants worldwide dedicated to Oracle Solutions
- **Vibrant technology collaboration**
  - Substantial investment in skills and resources
  - Dedicated International Competency Center
- **Unrivaled joint customer support process**
  - Dedicated on-site resources
  - Significant program investments

Customers running Oracle on Linux on IBM System z

- **Hundreds of customers running Oracle on Linux on IBM System z**
  - Various sizes and deployments
  - Across industries
  - Active volunteer led System z Oracle User Group (www.zseriesoraclesig.org)
- **Small System z customer example**
  - Oil and Gas industry services provider
  - Serves 4,200 companies, 44,000 users, $80B in transaction detail yearly
  - Was Windows, Dell, Linux
  - Issues – rapid company growth, server sprawl, cost control, hardware outages
  - Solution – z10 BC, 3 IFLs, 24 GB
    - SLES10, Oracle 10g EE
    - Databases: 7 production, 400 GB – 3 TB, 7 virtual servers/database

Customers running Oracle on Linux on IBM System z

- **Medium size System z customer example**
  - Scientific equipment retailer
  - Oracle Database on mostly UNIX (also z890 legacy, was considering 'move off mainframe')
  - Issues – Availability on UNIX, growth (without additional footprints), strong UNIX team
  - PoC – Linux on System z, revealed 3X performance increase over UNIX
  - Solution – z10 BC, 7 IFLs, 76GB
    - Global data warehouse, Oracle DB on Linux on System z
  - Migrated two more databases onto Linux on System z
  - COGNOS, home grown applications accessing the databases
  - In process of upgrading for additional Oracle database workloads

Customers running Oracle on Linux on IBM System z

- **Large System z customer example**
  - Large government installation
  - 100 IFLs, z10 EC Oracle RAC environment across 2 z10 EC servers with Oracle ASM
  - 35 TB Database and 45 TB Flash Recovery Area
  - Project is getting very high I/O throughput inserting 5.79 billion records in a 7 hour window and updating another 320 million records (exceeds 5 year SLA)

Customers running Oracle on Linux on IBM System z

- **Large System z customer example**
  - Leading systems integrator and IT consulting firm
  - z990 x 2, z9 EC S54 x 4, z10 EC E64 x 1 (192GB to 256GB per box)
  - 32 IFLs per z990, 54 IFLs per z9 EC, 64 IFLs per z10 EC
  - All Linux
  - 5 LPARs per CEC (4 for Oracle, 1 for management)
    - 16 shared IFLs per LPAR, 45 GB Memory per LPAR
  - 4 nodes RAC running on same CEC with HiperSockets interconnect
  - 2,000 – 3,000 transactions per second at peak
  - Response time less than 1 sec (threshold 5 sec)
  - DB Size – >5 TB for online and ~50 TB for data warehouse
  - Benefits – TCO, Extreme high availability, scalability
  - Planning z196 upgrade

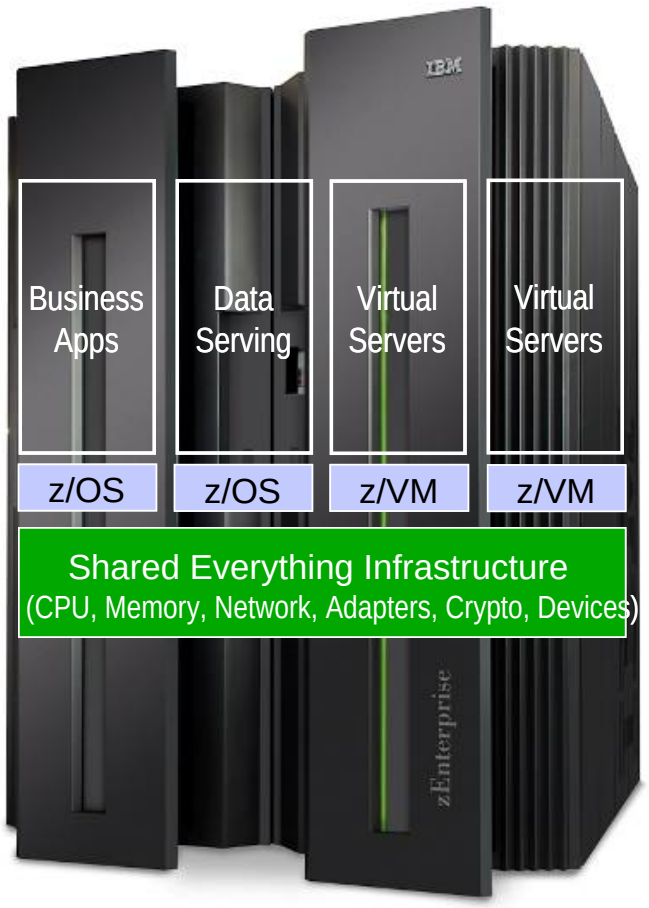
IBM System z IT Optimization and Consolidation

Helping clients save money, reduce complexity, improve service

- **Consolidate 3x or more* servers per core than virtualized x86 offerings: spend less on software, energy, floor space and disaster recovery**
- **Manage more server images with fewer people**
- **Exploit extensive z/VM facilities for life cycle management: provisioning, automation, monitoring, workload management, capacity planning, security, charge back, patching, backup, recovery, more …**
- **Deploy new servers and applications faster – in seconds instead of hours or days**

"From every perspective, running applications under Linux on System z makes sense for our organization. Performance, reliability, disaster recovery, server provisioning and cost efficiency have all seen dramatic improvements – helping us deliver better service and value to our members across the state."

Ted Mansk, Dir. of Infrastructure Engineering and Databases at Blue Cross Blue Shield of Minnesota

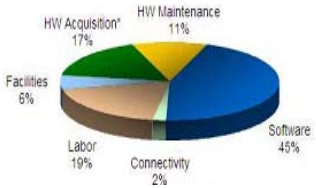


* Based on IBM "Friendly Bank" workload scenario

Value of Oracle consolidation with System z

Do more with less

- **Consolidate more servers, more networks, more applications, and more data with Linux running on z/VM**
- **Achieve nearly 100% utilization of system resources nearly 100% of the time**
- **Enjoy the highest levels of resource sharing, I/O bandwidth, and system availability**



Reduce costs on a bigger scale

- **Significant savings derived from reductions in server footprints, simplified infrastructure, lower software costs and a flexible and simplified infrastructure which is easy to manage.**
- **Consume less power and floor space**
- **Save on software license fees.**
  - Consolidating from 86 servers to a single IFL could potentially reduce licensing costs by as much as 97 percent.
- **Minimize hardware needed for business continuance and disaster recovery**

Manage growth and complexity

- **Exploit extensive z/VM facilities for life cycle management: provisioning, monitoring, workload mgmt, capacity planning, security, charge back, patching, backup, recovery, more...**
- **Add hardware resources to an already-running system without disruption – the epitome of Smarter Infrastructure**
- **Consolidation on a "scale up" machine like the Enterprise Linux Server means fewer cables, fewer components to impede growth**

More flexibility, minimize lead time for new projects

- **Consolidating Oracle and Linux environments to a single Enterprise Linux Server offers significant advantages in terms of flexibility**
- **Rapid provisioning reduces lead time for new IT projects, helping to increase business agility**

Questions for Oracle Database consolidation

General questions:

- Are you using more than 10 Oracle DB x86 servers?
- Is your department considering or complying with mandates to use open source software to help lower software licensing costs?
- Are you having difficulty meeting peak time demand and SLAs?
- Do you need higher levels of uptime for your customers?
- Would you like to increase the productivity of your IT staff and enable them to manage even more server images?
- Would you like to take advantage of many reliability and systems management best practices that do not exist on distributed systems platforms?

CIOs:

- What are you planning to do to reduce rising Oracle licensing costs?
- Are you aware that server consolidation can significantly reduce both hardware and software licensing costs?
- Can you support business needs for rapid change?
- How much cost and time does your organization spend on manual processes?
- Are you concerned about data centre growth in terms of space and power consumption?
- Are you currently able to leverage a single source of data and the business insight derived from that data?

Questions for Oracle Database consolidation

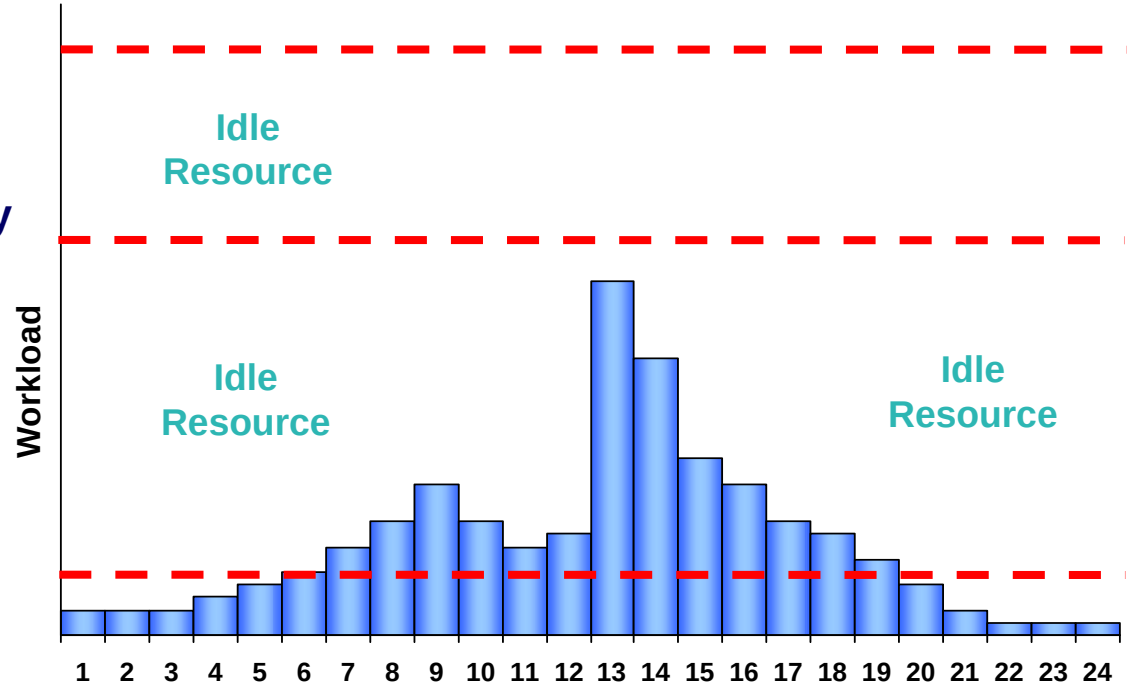
Architects:

- **Would you like to eliminate some network communication handoffs between systems, which can allow to transaction performance improvements, simplified integration, and ease of system support and administration?**
- **Do you need a stable and reliable infrastructure that gives developers the creativity to explore new ideas?**
- **Are you being asked to explore open source computing models to reduce costs, yet are concerned about security, availability ad reliability?**
- **Do you need an economical, reliable platform to deliver the ability to meet unpredictable peaks or growth within the business without required elongated procurement cycles?**
- **Would you like a more simplified and efficient hardware solution deployment, one that delivers on and off capacity on demand over the web?**

Developers / IT Managers:

- **Are you able to deliver everything the business asks for on time & in budget?**
- **Do you have to write custom code to connect processes internally or externally?**

Utilization of “distributed” servers



Server dedicated to one application

- Typical utilization of Microsoft Windows servers 5 – 10%
- Typical utilization of UNIX servers 10 – 20%
- Typical utilization of System z servers 85 – 100%

Oracle solutions delivered in 2008 and 2009

- **2008Q2**
  - Oracle Data Vault 10.2.0.3
  - PeopleSoft 9 PeopleTools 8.49 on Oracle DB 10g
- **2008Q3**
  - Siebel CRM 8.1 on Oracle DB 10*g*
  - Oracle E-Business Suite 12 split-tier on Oracle DB 10*g*
- **2008Q4**
  - Enterprise Manager Grid Control Agent 10.2.0.4
  - Oracle DB 10*g* 10.2.0.4 RHEL 5
- **2009Q1**
  - Oracle AS 10*g* 10.1.3.4 PS
- **2009Q3**
  - PeopleSoft PeopleTools 8.50 on Oracle DB 10*g*R2 RHEL 5 & SLES 10
  - Enterprise Manager Grid Control Agent 10.2.0.5
  - E-Business Suite 12.1.1 split-tier on Oracle DB 10*g*R2 RHEL 4,5 & SLES 9,10
  - Oracle AS 10*g*R2 10.1.2.3 PS
  - Oracle DB 10*g*R2 10.2.0.4 PSU 1
  - WebLogic Server 10.3.1
- **2009Q4**
  - Oracle DB 10*g*R2 10.2.0.4 PSU 2
  - Oracle AS 10*g*R3 10.1.3.5 PS

Oracle solutions delivered in 2010

- **2010Q1**
  - Oracle DB 10*g*R2 10.2.0.4 PSU 3
  - WebLogic Server 10.3.2
  - WebLogic Portal 10.3.2
- **2010Q2**
  - WebLogic Server 10.3.3
  - Oracle DB 10*g*R2 10.2.0.4 PSU 4
- **2010Q3**
  - Oracle DB 10*g*R2 10.2.0.4 PSU 5
  - E-Business Suite 12.1.2 native on Oracle DB 10*g*R2
- **2010Q4**
  - Oracle DB 10.2.0.4 PSU 6
  - E-Business Suite 12.1.3 native on Oracle DB 10*g*R2

Oracle solutions delivered and planned in 2011

- **2011Q1**
  - Oracle DB 10*g*R2 10.2.0.5 SLES 11
  - Oracle Tuxedo 11*g* R1
  - Oracle DB 10*g*R2 10.2.0.4 PSU 7
  - WebLogic Server 11*g*R1 PS3
  - SOA and WebCenter 11*g*R1 PS3
  - E-Business Suite native on Oracle DB 10*g*R2 10.2.0.5
  - Oracle DB 11*g*R2 11.2.0.2
- **2011Q2**
  - WebLogic Server, SOA and WebCenter 11*g*R1 PS4
  - Oracle DB 10*g*R2 10.2.0.4 PSU 8
  - E-Business Suite native on Oracle DB 11*g*R2 11.2.0.2
  - Oracle DB 10*g*R2 10.2.0.5 PSU 3
  - Oracle DB 11*g*R2 11.2.0.2 PSU 2
- **2011Q3**
  - Oracle DB 11*g*R2 PSU 3
  - Oracle DB 10*gR2* 10.2.0.5 PSU 4
- **Planned**
  - PeopleSoft V9 PT 8.51 on Oracle DB 11*g*R2

IBM zEnterprise for Oracle Database 11*g* Release 2

- **The zEnterprise is binary compatible with previous generations of System z**
- **Oracle certifies OS level only – not to hardware or hardware virtualization**
  - Any hardware running certified OS level implicitly supported
- **Oracle Database 11g Release 2 Linux supported distributions minimum levels certified, later service levels are also supported:**
  - SUSE SLES10 SP3 and SLES11 SP1
  - Red Hat RHEL 5.4

Oracle E-Business Suite on Linux for System z

Another workload for System z

- Enterprise Resource Planning
- Financials, HR, Project Management
- Supply Chain Management
- Manufacturing
- Technology (Oracle)
- CRM
- Procurement
- Asset Lifecycle Management
- Product Lifecycle Management

Cross industry solution with highest traction in:

- Financials Services
- Mfg (auto parts, packaging, electrical controls, engines, materials, mining)
- High Tech (both products and design companies , semiconductors)
- Asset Based Industries (like E&C, Utilities, Oil and Gas services)
- Telecommunications
- Travel and Transport
- Public Sector, etc.

Oracle Solutions available on IBM System z

		DB2 on z/OS or Linux	Oracle DB on Linux
ERP & CRM Solutions	**PeopleSoft Enterprise**	**PS 9.0, 9.1 / PT 8.50, 8.51 on DB2 8, 9, 10 for z/OS*** (Batch server supported on z/OS and Linux)	**PS 9.0, 9.1 / PT 8.5-, 8.51 on Oracle DB 10*g*R2***
	Siebel Enterprise	**Version 8.0 & 8.1.1 on DB2 v8, v9 for z/OS* and DB2 9.1, 9.7 for Linux***	**Siebel 8.0, 8.1.1 on Oracle DB 10*g*R2***
	E-Business Suite		**EBS 12.1.2, 12.1.3 on Oracle 10gR2, 11gR2 (10.2.0.5, 11.2.0.2)**
Insurance	**Insurance**	**Documaker 11.4, 11.5 on DB2 8, 9 for z/OS**	
	Cross-Industry		**Oracle Policy Automation 10.2 on Oracle 10*g*R2 on SLES10**

* Note: Multi-Platform “Split Tier” Configuration – Only the database runs on System z servers unless otherwise noted

Oracle Solutions available on IBM System z

		DB2 on z/OS or Linux	Oracle DB on Linux
Public Sector Solutions	**Enterprise Tax Management**	**2.2 on DB2 9 for z/OS, WAS 6.1 for z/OS (web Server only)**	
BIEE Solutions	**Oracle Business Intelligence Enterprise Edition**	**11*g*R1 11.1.1.3 with DB2 9.1, 9.5 as Data Source** ***DB2 9.7 supported as Data Source and Repository on Linux**	**11*g*R1 11.1.1.3 Oracle 10*gR2* (10.2.0.4, 10.2.0.5) and 11*g*R2 (11.2.0.2) as Data Source and Repository**
		10.1.3.4.1 with DB2 8, 9.1 as Data Source on z/OS ***DB2 9.1, 9.5 supported as Data Source on Linux**	**10.1.3.4.1 Oracle 10*gR2* (10.2.0.4, 10.2.0.5) and 11*g*R2 (11.2.0.2) as Data Source and Repository**

* Note: Multi-Platform “Split Tier” Configuration – Only the database runs on System z servers unless otherwise noted

Oracle technology available on IBM System z

	Oracle Solution	Version Available
Database	Oracle Database 10*g*R2	Oracle DB 10*g*R2 10.2.0.4, 10.2.0.5
	Oracle Data Vault 10*g*R2	Oracle Data Vault 10*g*R2 10.2.0.4
	Oracle Database 11*g*R2	Oracle DB 11*g*R2 11.2.0.2
Fusion Middleware	Oracle FMW 10*g*R2/10*g*R3 Application Server	Oracle AS 10gR2 10.1.2.3 10gR3 10.1.3.5
	Oracle FMW 11*g*R1	WebLogic Server 10.3.2, 10.3.3 WebLogic Portal 10.3.2 SOA 11*g*R1 WebCenter 11*g*R1 Tuxedo 11*g*R1
Enterprise Manager	Oracle Enterprise Manager Agent	Oracle Enterprise Grid Control Agent 10.2.0.5

Focusing on currency and parity

Delivered 2010 – Linux on System z Certifications and Product Currency

- **Oracle Database 10.2.0.4.3 PSU (1Q10)**
- **Oracle FMW 11 WebLogic Server 10.3.2 (1Q10)**
- **Oracle FMW 11 WebLogic Portal 10.3.2 (1Q10)**
- **Oracle Database 10.2.0.4.4 PSU, parity (2Q10)**
- **Oracle FMW 11 WebLogic Server 10.3.3 (2Q10)**
- **Oracle Haley Systems Policy Automation v10.1**
  - On SLES10, (Complex Modeling)
- **Oracle Database 10.2.0.4.5 PSU, parity (3Q10)**
- **E-Business Suite Full Port Native 12.1.2 (3Q10 – July 30th)**
- **E-Business Suite FMW 10gR3 10.1.2.3 External Certifications**
  - 12.1.2 OCC: Internet Directory (OID) (3Q10 – Aug 30)
  - 12.1.2 OCC Single Sign On (SSO) (3Q10 – Aug 30)
  - 12.1.2 Portal 10g (10.1.4.2) (4Q10 – Oct 5)
  - 12.1.2 Containers for J2EE (OC4J) (4Q10 - Oct 14)
  - 10.1.3.5 BPEL Process Manager (4Q10 - Nov 8 2010)
  - 10.2.1.3 Web Cache 10g (4Q10 – Dec 13 2010)
- **E-Business Suite 12.1.3 RUP (4Q10 – Oct 28)**

Delivered 2011 – Linux on System z Certifications and Product Currency

- **10g 10.2.0.5 Database (1Q11- Jan 3)**
- **10g 10.2.0.4 PSU 7 (1Q11- Jan 25)**
- **11g Release 2 11.2.0.2 (1Q11 – March 30)**
- **10g 10.2.0.4 PSU 8 (2Q11- April 26)**
- **10g 10.2.0.5 Database PSU 3 (2Q11- May 27)**
- **11g Release 2 11.2.0.2 PSU 2(1Q11 – June 3)**
- **E-Business Suite FMW 10gR3 External Certifications:**
  - Oracle Discoverer (1Q11 - Jan 20)
- **EBS 12.1.x on 10g 10.2.0.5 (1Q11 – March 22)**
- **EBS 12.1.x on 11g Release 2 (11.2.0.2) 1Q11 – May 2)**
- **Siebel 8.1 and 8.1 on Oracle DB 11gR2 (2Q11)**
- **FMW 11gR1: WebLogic Server PS3 (1Q11 - Jan 24)**
- **FMW 11gR1: SOA PS3 (1Q11 - Jan 24)**
- **FMW 11gR1: WebCenter PS3 (1Q11 - Jan 24)**
- **FMW 11gR1: WebLogic Server PS4 (2Q1 – May 12)**
- **FMW 11gR1: SOA PS4 (2Q11 – May 12)**
- **FMW 11gR1: WebCenter PS4 (2Q11 – May 12)**
- **Tuxedo 11gR1 (1Q11 – Jan 13)**

Delivered 2011 DB2 and z/OS Certifications

- **PeopleTools v8.49, 8.50 & 8.51 with DB2 v9 and DB2 v8 certified on z/OS 1.12 (2Q11 – April 6)**
- **PeopleSoft Version 9.0 & 9.1 /PeopleTools 8.50 & 8.51 certified on DB2 V10 for z/OS (2Q11 – April 29)**

Migration of Oracle E-Business Suite to Linux on System z

- **Customers first implemented in mixed architecture mode with the database on Linux on System z**
- **To implement the middle tier on Linux on System z, you must have the source platform on the same level as the target platform**
  - Oracle E-Business Suite 12.1.3
  - Oracle DB 11.2.0.2, 10.2.0.4, 10.2.0.5 or 11.2.0.2
  - Use the migration utility to move to Linux on System z
- **Oracle Fusion Middleware is the base infrastructure for Oracle E-Business Suite and can be used with other software**
  - AS 10g 10.1.2 and 10.1.3
    - Workaround needed on RHEL 5.5
  - WebLogic Server, WebCenter, WebPortal
- **Key document is Oracle E-Business Suite Installation and Upgrade Notes Release 12 (12.1.2) for IBM: Linux on System z [ID 1116895.1] (search IUN and zseries on My Oracle Support)**
- **Key contact is david.simpson@us.ibm.com**

Linux on System z and Oracle licensing

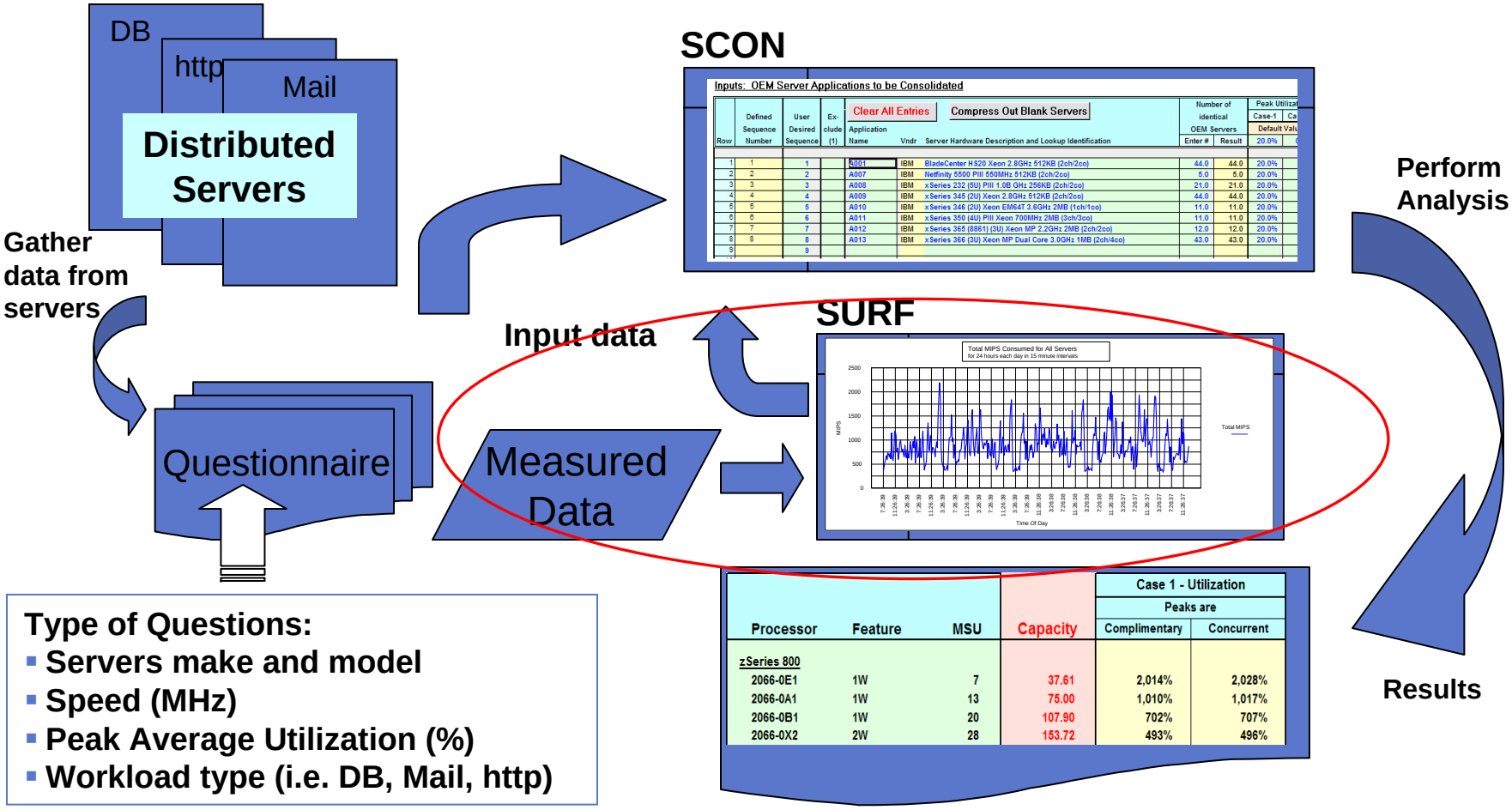
- An IFL is a specialty engine on a System z
- Oracle uses the term core for purposes of pricing
- From an Oracle licensing perspective an IFL = one core
- The System z10 and zEnterprise 196 have quad core processors but an IFL represents one core

High Availability with Oracle on Linux for System z

- **System z – highly available platform**
  - Attention to detail over decades of engineering
    - Fault tolerant (HA) design
    - Elimination of single points of failure
  - Driving to 100 years MTBF
- **Oracle Maximum Availability Architecture**
  - Best practices based on Oracle database technology
  - Best HA/DR in distributed database technology (Forrester, Oct 2006)
  - Constantly evolves with new releases
- **Synergistic**
  - Continue on your path with Grid using System z
  - Develop a Grid strategy for Oracle on Linux for System z
  - Take advantages of the HA/DR features of IBM and Oracle technologies

Sizing – the most important step

Sizing process – SCON with SURF, use RACE for TCO analysis



Type of Questions:

- **Servers make and model**
- **Speed (MHz)**
- **Peak Average Utilization (%)**
- **Workload type (i.e. DB, Mail, http)**

Projected Utilization on Mainframe

Oracle Database memory sizing

- **Obtain Oracle SGA and PGA sizes from all database instances**
  - Prefer Advisory sizes from multiple AWR reports
- **Calculate guest(s) virtual storage size (assume MB):**
  (SGA + PGA) + 256 MB for ASM + 512 MB for Linux*
- **Assume the sum all of the guest virtual sizes for production equals p and the sum of all guest virtual sizes for dev/qa/training equals t**
  Real memory for guests = p/.66 + t/(.33) for z/VM memory over commit
  - Assumes multiple guests are involved. Not correct for a one guest
- **System z memory = real memory for guests + memory for z/VM and expanded storage (2GB or 4 GB).**

* Increase estimate when Oracle SGA is large and there are expected to be hundreds of dedicated server connections or use hugepages with Oracle 11gR2. A large overall virtual storage requirement may result in larger Page Tables in Linux which require extra guest storage. Consider hugepages but no AMM.

Obvious comments about sizing

- Garbage in, garbage out
- Choose appropriate time frames that represent reasonable capacity usage
- Do not make guesses about the sizing input
- Get the IFL capacity, I/O subsystem setup, and the memory at the correct levels before any starting any testing
- Engage an IBM System z – Oracle specialist to assist with sizing

Oracle Database 11g Release 2 documentation

- **Oracle Documentation**
  - Database Client Quick Installation Guide for IBM: Linux on System z - E18190
  - Database Quick Installation Guide for IBM: Linux on System z - E18182
  - Oracle Database Release Notes 11g Release 2 (11.2) for Linux - E16778-09
  - Grid Infrastructure for Linux - E17212- 11
  - Oracle Real Application Clusters Installation Guide – E17214
- **My Oracle Support Notes**
  - 1306465.1 - Getting Started - 11gR2 Grid Infrastructure, ASM and DB (IBM: Linux on System z)
  - 1290644.1 - Requirements for Installing Oracle 11gR2 on SLES11 on IBM: Linux on System z (s390x)
  - 1306889.1 - Requirements for Installing Oracle 11gR2 on RHEL 5 on IBM: Linux on System z (s390x)
  - 1308859.1 - Requirements for Installing Oracle 11gR2 RDBMS on SLES 10 SP3 on IBM: Linux on System z (s390x)
  - 1086769.1 - Ensure you have prerequisite rpms to install Oracle Database and AS10g (midtier) on IBM: Linux on System z (s390x)
  - 169706.1 - Oracle Database on UNIX AIX,HP-UX, Linux, Mac OS X,Solaris,Tru64 UNIX Operating Systems Installation and Configuration Requirements Quick Reference (8.0.5 to 11.2)

IBM Resources

- **IBM Redbooks at http://ibm.com/redbooks**
  - SG24-7191-00 Experiences with Oracle 10gR2 Solutions on Linux for System z
  - SG24-7573-00 Using Oracle Solutions on Linux on System z
  - SG24-7634-00 Experiences with Oracle Solutions on Linux for IBM System z
- **IBM Oracle on System z portal**
  - http://ibm.com/systems/z/os/linux/solutions/zlo_gs.html

International zSeries Oracle SIG

- **Independent User Organization**
  - President, Mike Zechman
  - Worldwide user participation
  - No cost to be a member
  - Oracle and IBM Participation
- **Annual Conference**
  - Next is April 2012, Las Vegas
- **Communicates requirements and priorities to Oracle and IBM**
- **Longest running still active Oracle User Group**
- **Website www.zseriesoraclesig.org**
  - Presentations, Links, Bulletin Board

System z education on the Web

ibm.com/vm/devpages/jelliott/educate.html

- **On my education page, there are lots of links to education materials on System z**
  - IBM Training
  - IBM Webcasts
  - Non-IBM System z Training
  - Internet Discussion Lists
  - System z Academic Initiative
  - Information Centers and the Education Assistant
  - ABCs of z/OS System Programming
  - z/OS Communications Server
- **This web page is frequently updated and you can subscribe to change notifications**

Thanks!

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