Power Systems Trends & Directions

Freddy Alves Vaquero
Power Systems Director, Latinamerica
Oct. 2011

IBM

Designed for data: Big Data
Remove barriers to harnessing all available information and unlock insights to make informed choices.

Tuned to the task: Optimized Systems
Remove financial barriers by driving greater performance and efficiency for each workload.

Managed in the Cloud: Cloud
Remove barriers to rapid delivery of new services and reinvent business processes to drive innovation.

Optimized Systems

Cloud

Virtuous Cycle

Big Data

Smarter Computing

IBM
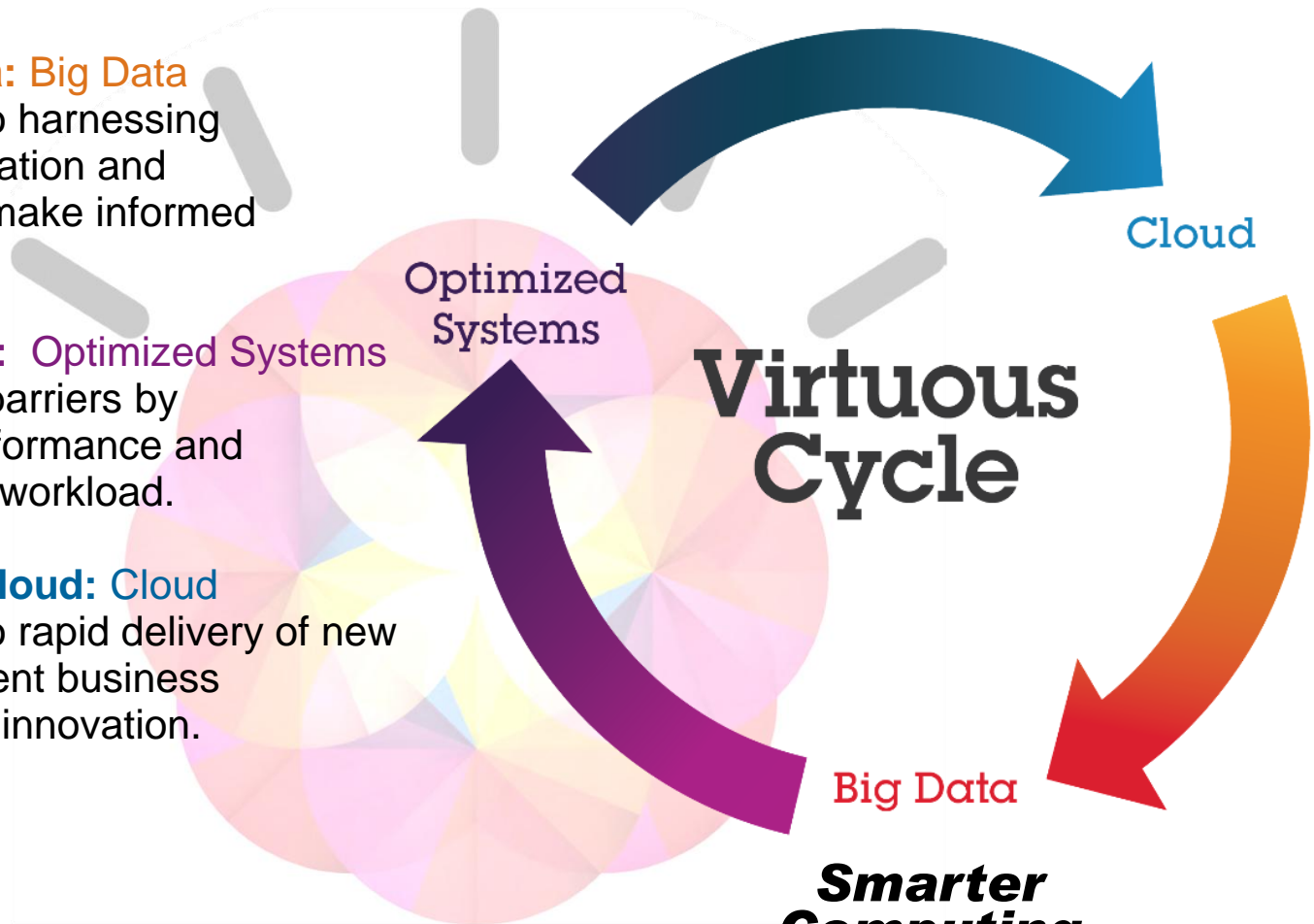
Watson answers a grand challenge

Can we design a computing system that rivals a human's ability to answer questions posed in natural language, interpreting meaning and context and retrieving, analyzing and understanding vast amounts of information in real-time?

From battling humans at Jeopardy! to transforming business

To compete at Jeopardy!, humans and computers need to:

Watson-like capabilities can now be applied to your business:

Tap into a broad, open domain of clues	→ Manage massive amounts of data from business operations and an instrumented world
Parse complex human language	→ Deal with structured and unstructured data to gain insight into your business
Be highly precise at finding the answer and put a confidence behind that answer	→ Have a high level of confidence in analytics to make key business decisions
Do all of that in under three seconds	→ Do it at the speed of business, in real time

IBM Smart Analytics System 7700 & 7710

supports the most extreme workloads

> *We are talking about processing and integrating hundreds of millions of data records… We needed a solid foundation to support rapid decisions!*
>
> - Matthias Wunderlich, Head of Business Intelligence, TUI Germany

VISA Visa chose IBM over Oracle Exadata due to IBM's superior performance during a challenging 100TB on-site POC . This win firmly plants IBM as the cornerstone of Visa's five year roadmap to transform Visa's vast transaction data stores and analytic infrastructure for the future. *(Not for external use)*

- Integrated Cognos & InfoSphere Warehouse
- In-database cubing and mining
- Modular application interfaces
- Choice of platform and OS
- On-demand scalability
- Autonomic tuning

- Extraordinary versatility
- Extensible growth
- Extreme concurrent query volumes
- Efficiency for complex and mixed workloads

> the **IBM Smart Analytics System is,** in our opinion, **superior to Oracle Exadata**: it is easier to manage and tune, easier to install, more flexible and costs (at least notionally) less money..
>
> - Philip Howard, Bloor Research

Smarter Computing
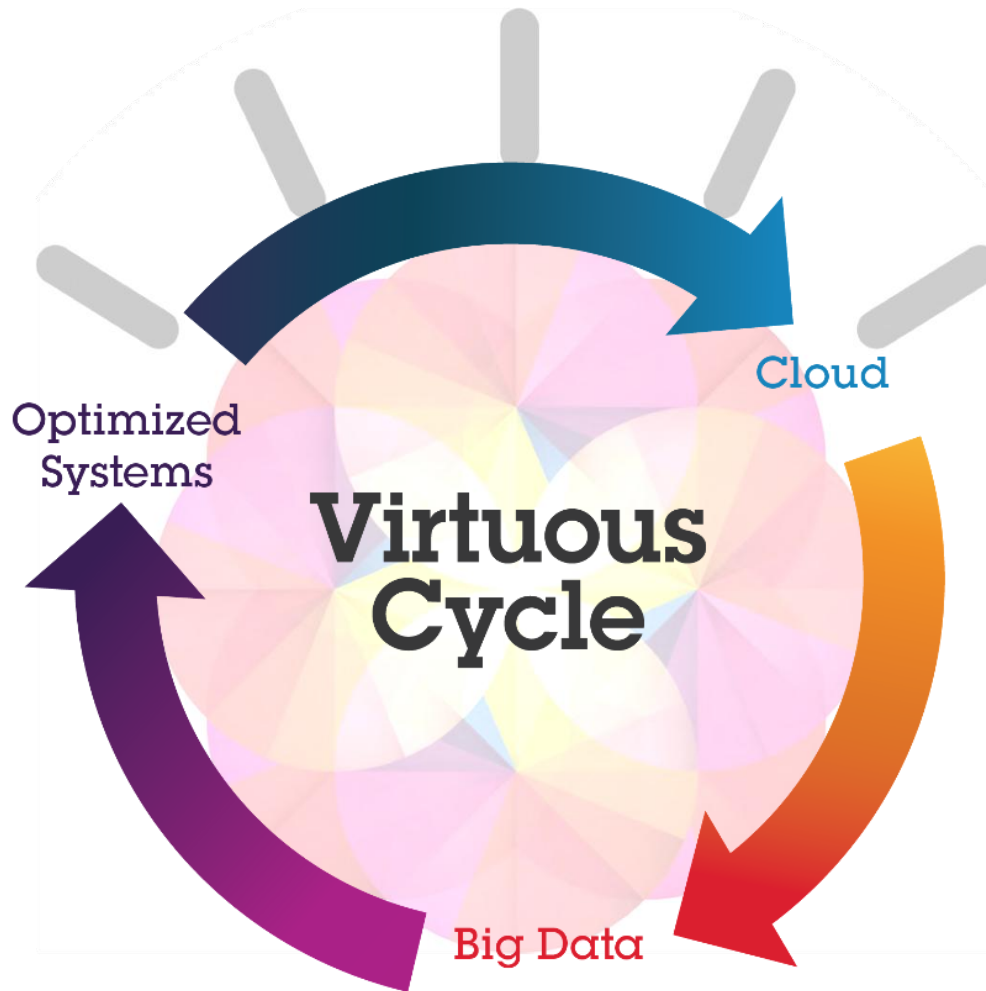
The journey to cloud-delivered infra starts with virtualization…

Virtualize
Server, storage &
network devices to
increase utilization

- Assess & plan
- Health & status
- Inventory
- VM management
- Policy-based optimized placement and re-balancing

Provision & Secure
Automate provisioning
of resources

- High scale
- Auto restart
- Self-service UI
- Resource reservation
- Image catalog & Management
- Policy controlled access & isolation
- Logging and auditing

Monitor & Manage
Provide visibility
of performance of
virtual machines

- Availability and performance management across server, storage, network, hypervisor, apps
- Service level agreements

Orchestrate Workflow
Manage the process
for approval of usage

- Service-aware provisioning
- Process management, policies & approvals
- Mobility of services across clouds
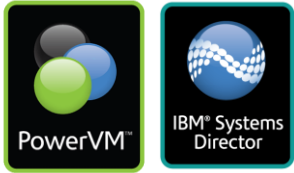
Meter & Rate
Track usage
of resources

- Service aware accounting
- Track, allocate and invoice by department, user, etc.
- Collect, analyze and bill based on usage

IBM

Power Cloud Solutions
Deliver services with higher quality for private and secure deployments

Infrastructure Integration

Secure for isolated multi-tenancy of virtual servers
Scalable for your smallest to largest workloads
Dynamic for automated, optimum resource allocation and superior economics
Reliable for high qualities of service across the cloud

Integrated Cloud
for fastest time to value

IBM CloudBurst
IBM Service Delivery Manager

Totally Integrated, pre-configured system delivering all capabilities

Custom Cloud
for the most flexible solution

Cloud Foundation, PowerHA
Starter Kit for Cloud

Pre-integrated software stack for customized deployment or integration with existing environment:

- Automated IT service deployment
- Self-service
- Usage and accounting capabilities
- Resource monitoring for service availability

Cloud Foundation
for core capabilities

POWER7, PowerVM,
IBM Systems Director,
IBM VMControl,
AIX, IBM i, Linux

- Secure, isolated multi-tenancy
- Scalable for any size workload
- Dynamic resource allocation
- Pooling of multiple systems

Time to Value

IBM Starter Kit for Cloud
Entry level cloud solution built on top of the virtualization foundation

Entry cloud solution that provides affordable, easy-to-install and easy–to-use capabilities to allow clients to **more rapidly move to a cloud model**

- ✓ **Fast time to value** with a solution that is simple to deploy, easy to use and works with existing infrastructure

- ✓ Accelerate infrastructure delivery and speed service deployment to **quickly respond to changing business needs**

- ✓ **Dramatically increase IT efficiency** with standardization and lower operations cost

- ✓ Scale as needed to **improve quality and meet demand** with continuous availability

- ✓ **Enable self service** with a simple interface that provides oversight

- ✓ **Expandable** to advanced Cloud offerings

More information: http://www.ibm.com/systems/power/solutions/cloud/onpower/starterkit.html

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IBM Starter Kit for Cloud Capabilities

Create Images

- **Easily create** new golden master images and software "appliances" using corporate standard OS

- **Convert images** from physical systems or between various hypervisors to use cheaper tooling

- **Reliably track** images to ensure compliance and minimize security risks

- **Conserve resources**, reducing both the number of images and the storage required for them

Deploy VMs

- **Deployment** of application images across compute and storage resources

- **End user self service** for improved responsiveness

- **Ensure security** through resource and VM isolation, project-level user access controls

- **Easy to use** - no need to know all the details of the infrastructure

- **Protect your investment** through full support of your current virtualization environment

- **Optimize performance** on IBM systems with dynamic scaling, expansive capacity and continuous operation

Operate Your Cloud

- **Delegate provisioning** to authorized 'users' to improve productivity

- **Maintain full oversight** to ensure an optimally running and safe Cloud through automated approval / rejection

- **Standardize deployment** and configuration to improve compliance and reduce errors by setting policies, defaults and templates

- **Simplify administration** with an intuitive interface for managing projects, users, workloads, resources, budgeting, approvals & metering

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Simplify storage of thousands of images

35:1 Slash time to market for new apps from four months to just two or three days

Cut costs with efficient operation

Smarter Computing
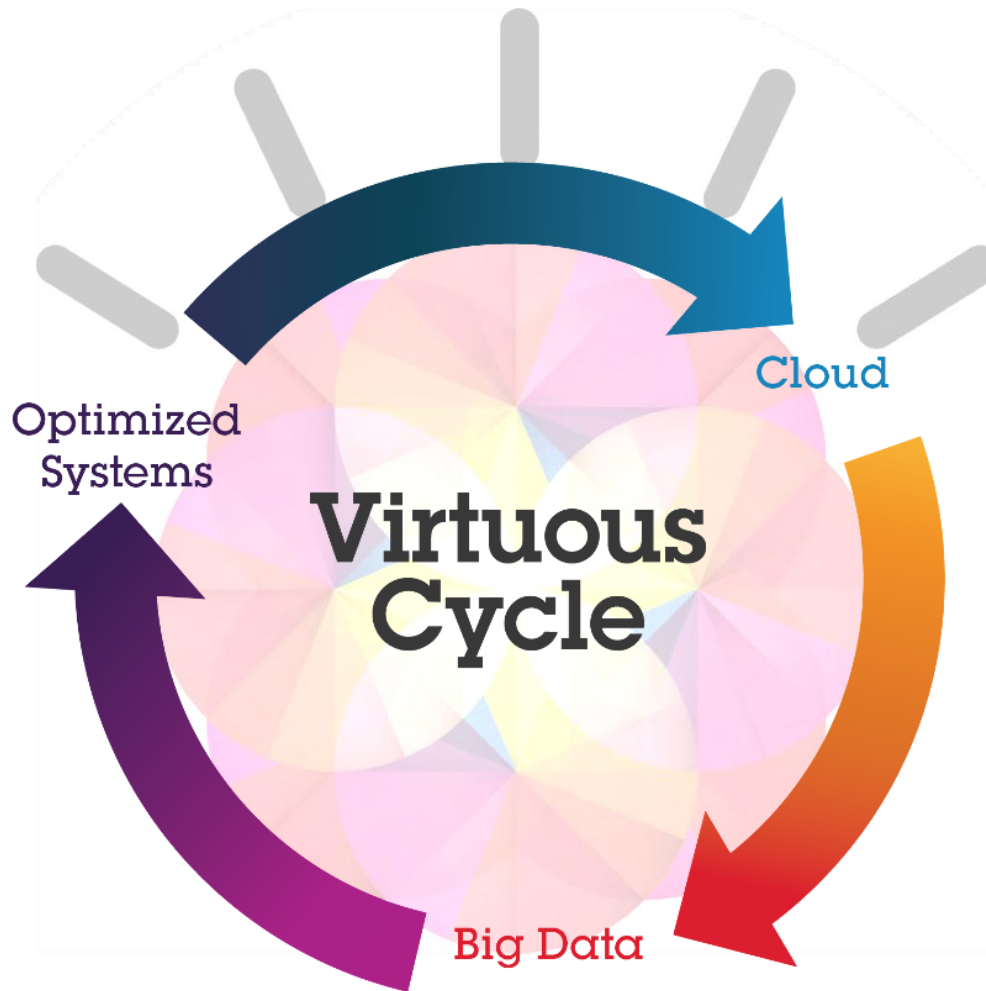
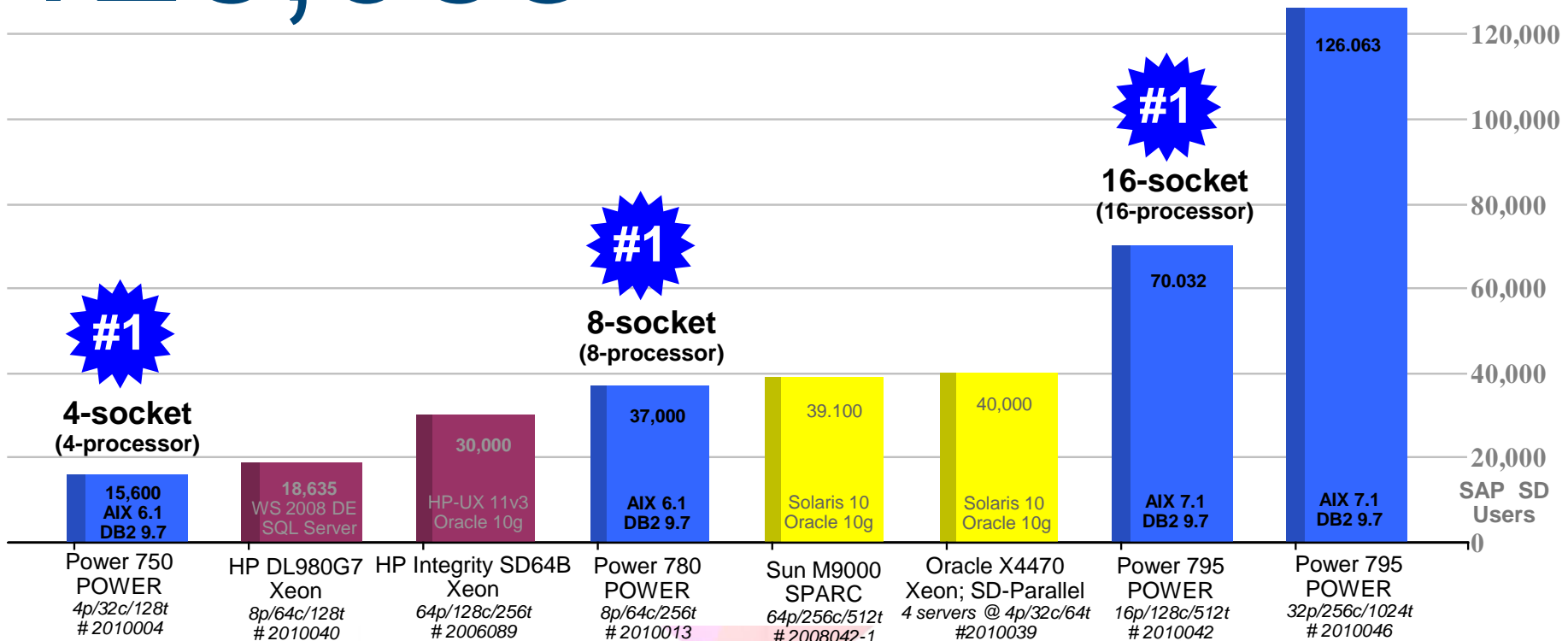# Single POWER7 system tops all others in SAP Sales and Distribution Standard Application 2-Tier benchmark

126,063

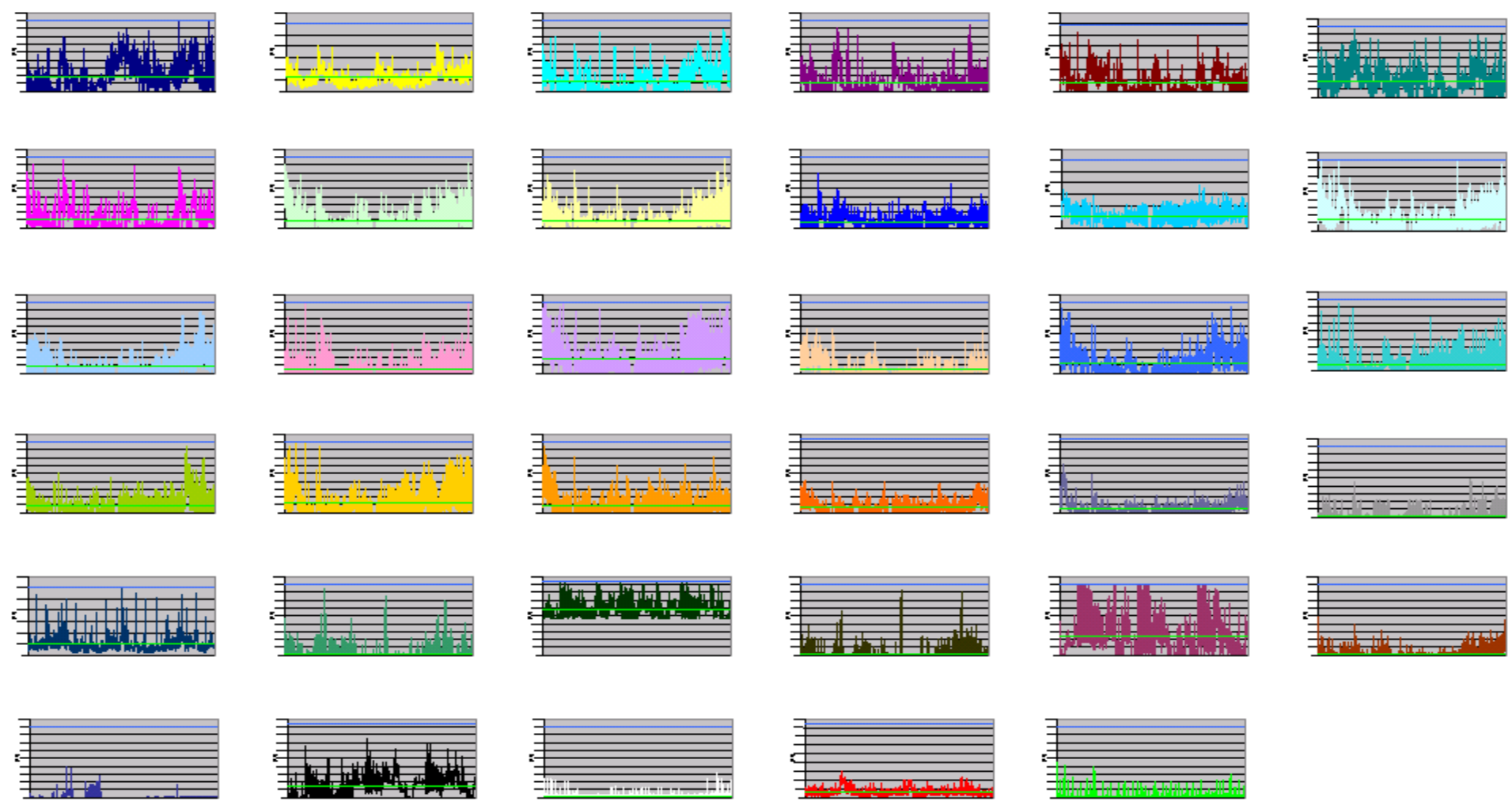Power 795 with DB2®   SAP SD Users

#1 Overall

#1
16-socket
(16-processor)

#1
8-socket
(8-processor)

#1
4-socket
(4-processor)

Chart bars (SAP SD Users):
- Power 750 POWER — 15,600 — AIX 6.1 DB2 9.7
- HP DL980G7 Xeon — 18,635 — WS 2008 DE SQL Server
- HP Integrity SD64B Xeon — 30,000 — HP-UX 11v3 Oracle 10g
- Power 780 POWER — 37,000 — AIX 6.1 DB2 9.7
- Sun M9000 SPARC — 39.100 — Solaris 10 Oracle 10g
- Oracle X4470 Xeon; SD-Parallel — 40,000 — Solaris 10 Oracle 10g
- Power 795 POWER — 70.032 — AIX 7.1 DB2 9.7
- Power 795 POWER — 126.063 — AIX 7.1 DB2 9.7

Y-axis: 0, 20,000, 40,000, 60,000, 80,000, 100,000, 120,000 SAP SD Users

Power 750 POWER	HP DL980G7 Xeon	HP Integrity SD64B Xeon	Power 780 POWER	Sun M9000 SPARC	Oracle X4470 Xeon; SD-Parallel	Power 795 POWER	Power 795 POWER
4p/32c/128t	8p/64c/128t	64p/128c/256t	8p/64c/256t	64p/256c/512t	4 servers @ 4p/32c/64t	16p/128c/512t	32p/256c/1024t
# 2010004	# 2010040	# 2006089	# 2010013	# 2008042-1	#2010039	# 2010042	# 2010046

(1) All results shown used SAP Enhancement pack 4 for ERP 6.0, except HP # 2006080 and Sun # 2009042-1, which used SAP ERP 6.0.
(2) All results are SAP SD 2-Tier single instance except Oracle #2010039 which is SAP SD-Parallel
Source: http://www.sap.com/solutions/benchmark/sd2tier.epx   All results valid as of 11/15/2010.   Additional details on next page.

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Insight tool analysis

After tuning and recommendations

Legend: zhapda01, zhapda02, zhmscaqg, zhndvaci, zhnpda03, zhnpda06, zhnpda09, zhnqaaci

Physical processors used per LPAR on 10-4BC9C for 2006-09-27
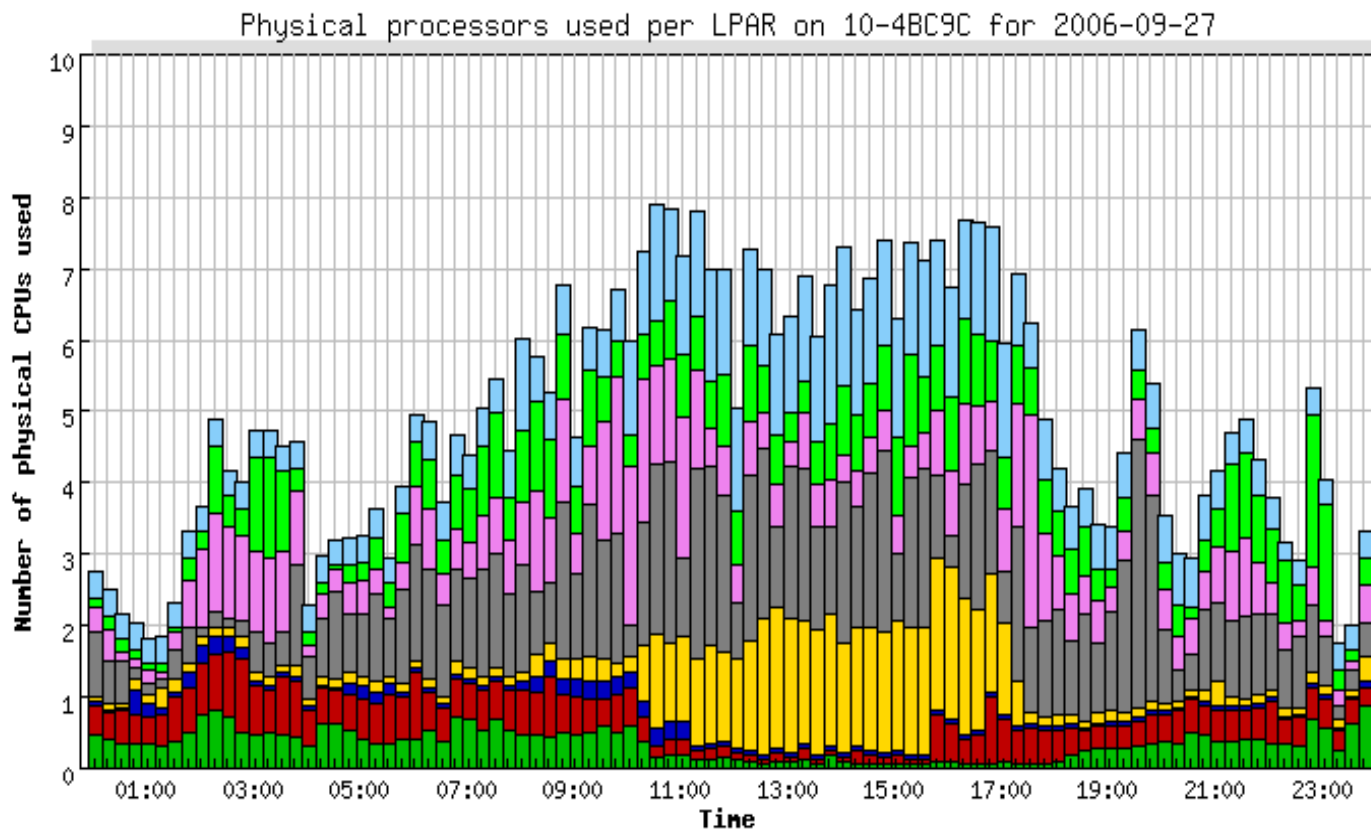
Power & DB2 for SAP

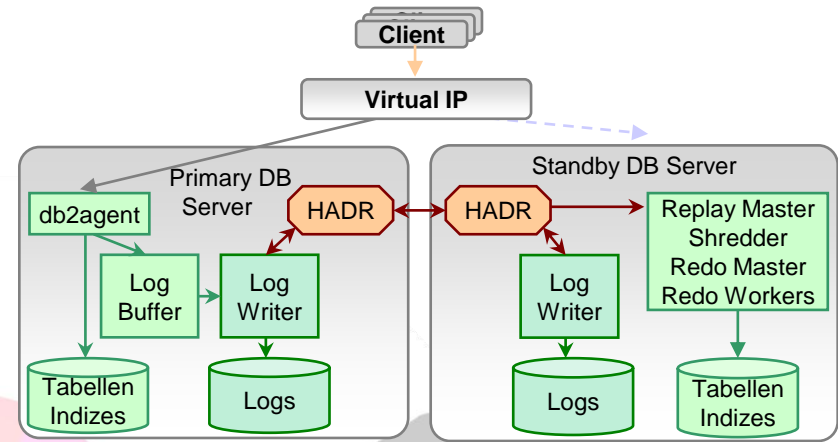Deep Compression

Very fast recovery at minimal cost
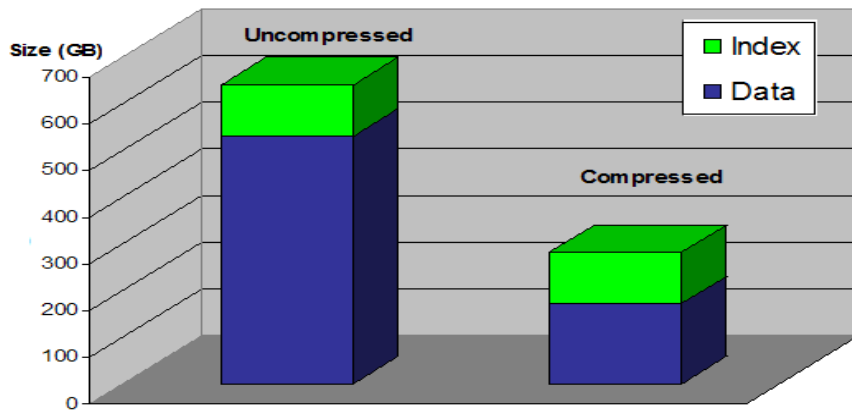
DB2 "Deep Compression":
OLTP (ERP) + OLAP (SAP BW) supported - SAP Note 930487
Data table **compression (instead page based)**
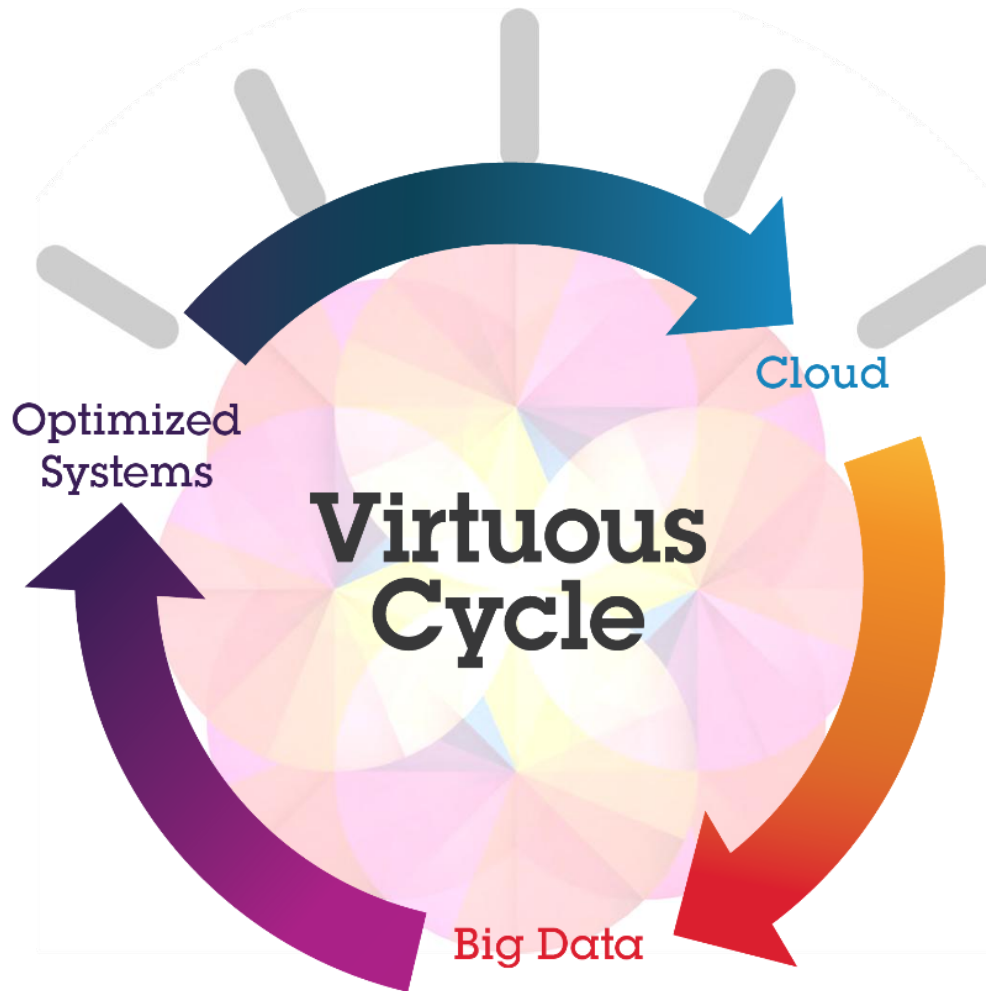**Continuous compression** - global dictionary per table
High & stable compression rate
Less administration required to compress the tables
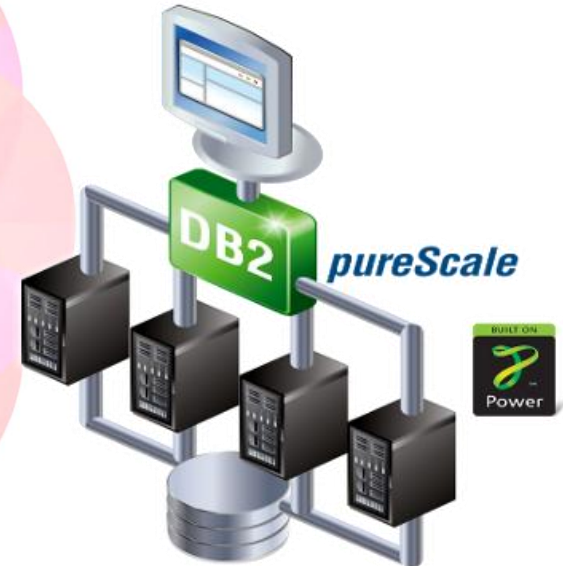
Smarter Computing

Oracle's Misleading Marketing Claims
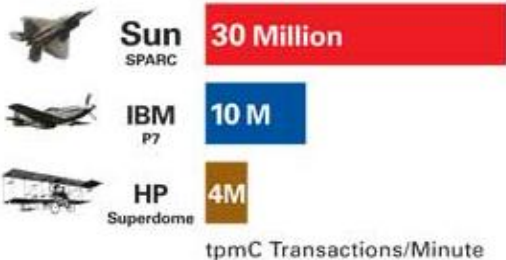
Less than "full" disclosure on pricing and performance

Oracle says …
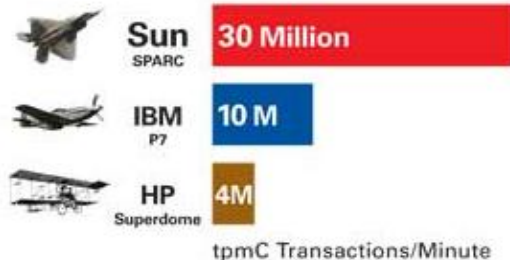
The facts …

- Oracle used **9x** as many SPARC cores as IBM did POWER cores on the TPC-C benchmarks Oracle compared to achieve just **3x** the performance

- Oracle priced software and support offerings that do not represent typical customer deployments in order to reduce benchmark prices:

- Ex 1: Software: Oracle priced leased (term) software rather than perpetual software licenses, which IBM priced.

- Ex 2: Software support: Oracle priced support that **does not include** mission critical 24x7 voice support, unlimited problem resolution, upgrade protection, and limits the Oracle software you can use (such as encryption, Data Guard, and so on).

    - The IBM TPC-C benchmark *included* 24x7 unlimited mission critical direct-to-engineer support and upgrade protection.

    - If you adjust for these two factors, the price / performance for Oracle / Sun would actually be *higher* than DB2 on IBM Power

Note: Sales Alert on the TPC-C Benchmark attached on Slide 25

Power Systems marketplace momentum

3,900+

successful Power migrations to date.

- The pace is accelerating:
  500+ migrations to Power in 2009,
  over 1,000 in 2010, over 330 in 2Q
  2011

- Most come from HP-UX or Oracle/Sun
  Solaris, along with some x86
  consolidations

- 1Q competitive wins were roughly 2/3
  from Oracle/Sun and 1/3 from HP

"Ellison drops iceberg in front of HP's unsinkable Itanic
Oracle users rush for the lifeboats"

The Register

March 23, 2011

JSC Riamata Banka migrates from Oracle DB on Sun SPARC to DB2 on Power…achieves 3 to 30 times faster query responses and reduces costs 20-30%

"IBM has become a key technology partner for NACG, providing support during a difficult period of total transformation of our IT infrastructure."

- David Booth, CIO
North American Construction

IBM

Power TCO in a Dell x86 environment

PROD

ECC + CI + BW + PI

APP SERVERS

23.000 SAPS x2

23.000 SAPS x4

QA

BW + PI + ECC + CI

APP QA

DEV

BW + PI + ECC + CI

APP DEV

12.000 SAPS

6.000 SAPS

12.000 SAPS

6.000 SAPS

TCO x86 – New Environment

QA
20.000 SAPS

DEV
20.000 SAPS

Recursos

APP PRD
46.000 SAPS

APP PRD
46.000 SAPS

Recursos

ECC
23.000 SAPS

CI + ECC HA
23.000 SAPS
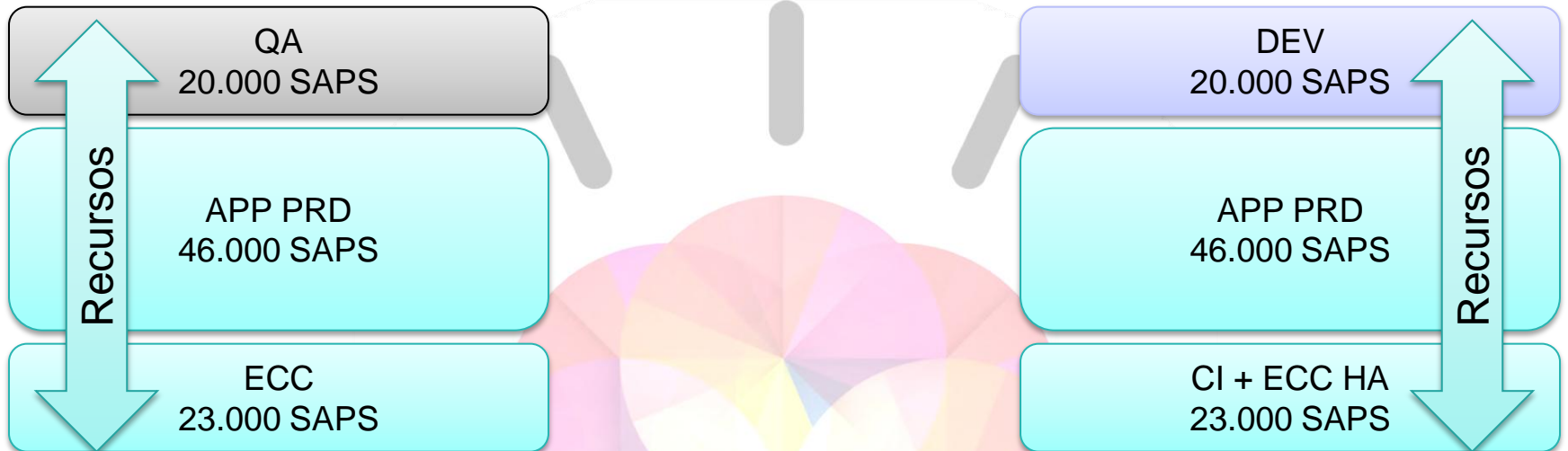
POWERVM ENTERPRISE

POWER 750
32 cores
85.000 SAPS

IBM®

TCO Power vs x86

x86		Power
10 servers	-80%	02 servers
6.342 Watts	-76%	1.500 Watts
19.422 BTU/h	-76%	4.594 BTU/h
20 Rack Units	-60%	8 Rack Units
20 Ports Gigabit	-80%	4 Ports Gigabit
8 Ports Fiber Channel	50%	4 Ports Fiber Channel
92 cores (several model)	-30%	64 cores POWER7

IBM
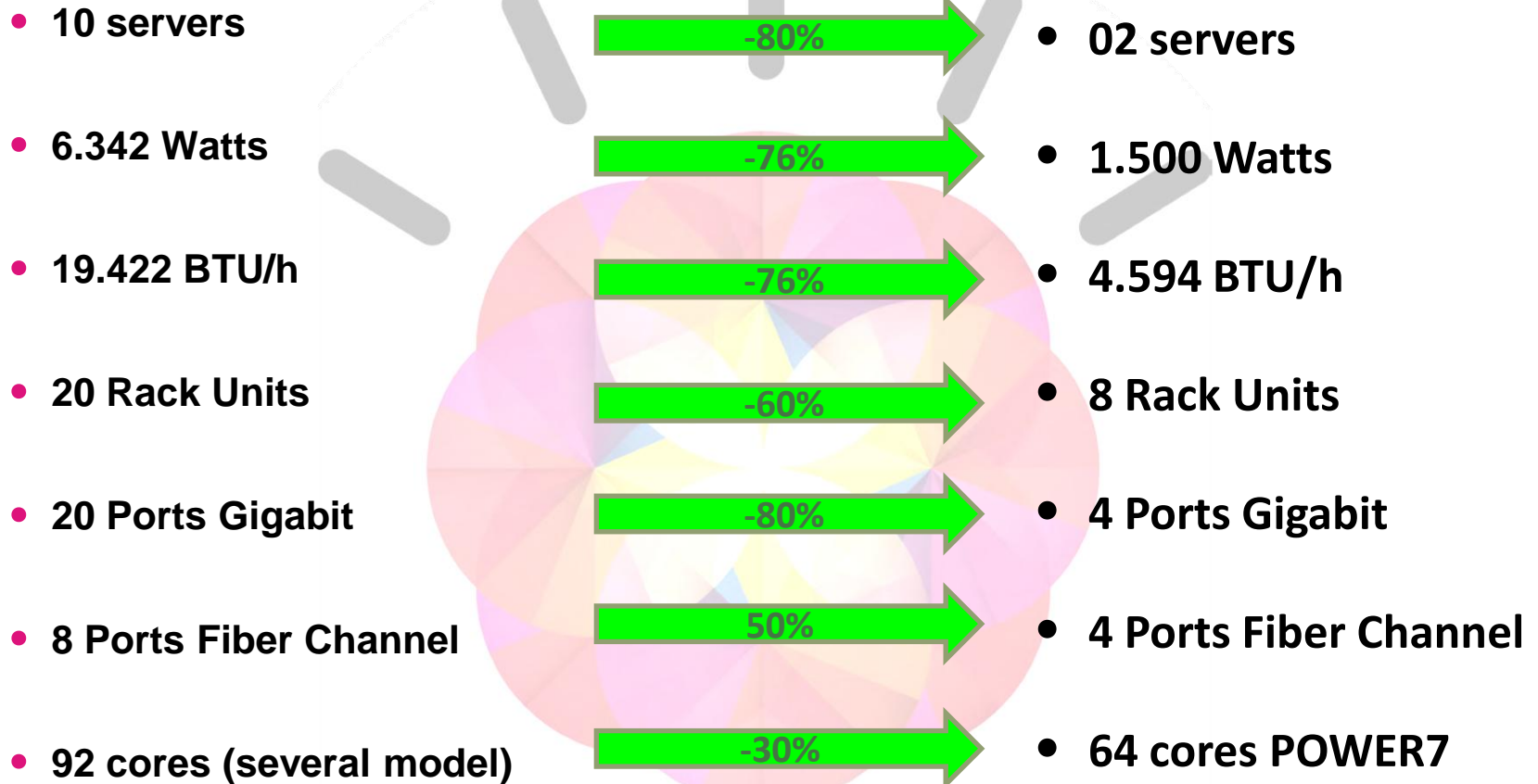
Power TCO in a multi-UNIX environment

P595
64 cores P6
512GB RAM

P595
64 cores P6
328GB RAM

P570
8 cores P6
128GB RAM

Superdome PA-RISC
44 cores
92GB RAM

Superdome PA-RISC
34 cores
72GB RAM

Superdome ITANIUM
16 cores
128GB RAM

Superdome ITANIUM
16 cores
128GB RAM

High-end

37 x P510
2 cores P5
24GB RAM

Low / Mid-Range

3 x RP3440
2 x L3000
1 x L2000
1 x A500
3 x N4000
4 x RX7620
1 x RX7420
1 x RP4400

2 x V890

3 x V245

IBM

TCO Unix – New Environment

ON-DEMAND
08 cores Power7
4.0GHz + 220 GB RAM

ON-DEMAND
08 cores Power7
4.0GHz + 220 GB RAM

BACKUP
03 cores Power7
4.0GHz
64GB RAM

BACKUP
03 cores Power7
4.0GHz
64GB RAM

IBM
85 cores Power7
4.0GHz
1216 GB RAM

IBM
85 cores Power7
4.0GHz
1216 GB RAM

IBM POWER 795
88 cores ativos + 8 cores On Demand
1.280 GB RAM ativos + 220GB ON Demand
20 Dual FC 8Gbps
20 Dual Ethernet 1Gbps

IBM POWER 795
88 cores ativos + 8 cores On Demand
1.280 GB RAM ativos + 220GB ON Demand
20 Dual FC 8Gbps
20 Dual Ethernet 1Gbps

28/10/2011

IBM

TCO Power vs Unix

- **66 servers** → **-96%** → - **02 servers**
- **138.837 Watts** → **-88%** → - **16.000 Watts**
- **473.986 BTU/h** → **-89%** → - **49.120 BTU/h**
- **257 Rack Units** → **-100%** → - **0 Rack Units**
- **4 Racks Superdome** → **-100%** → - **0 Racks Superdome**
- **2 Racks Power 595 (24")** → **=** → - **2 Racks Power 795 (24")**
- **418 cores variados** → **-57%** → - **176 cores POWER7**

IBM
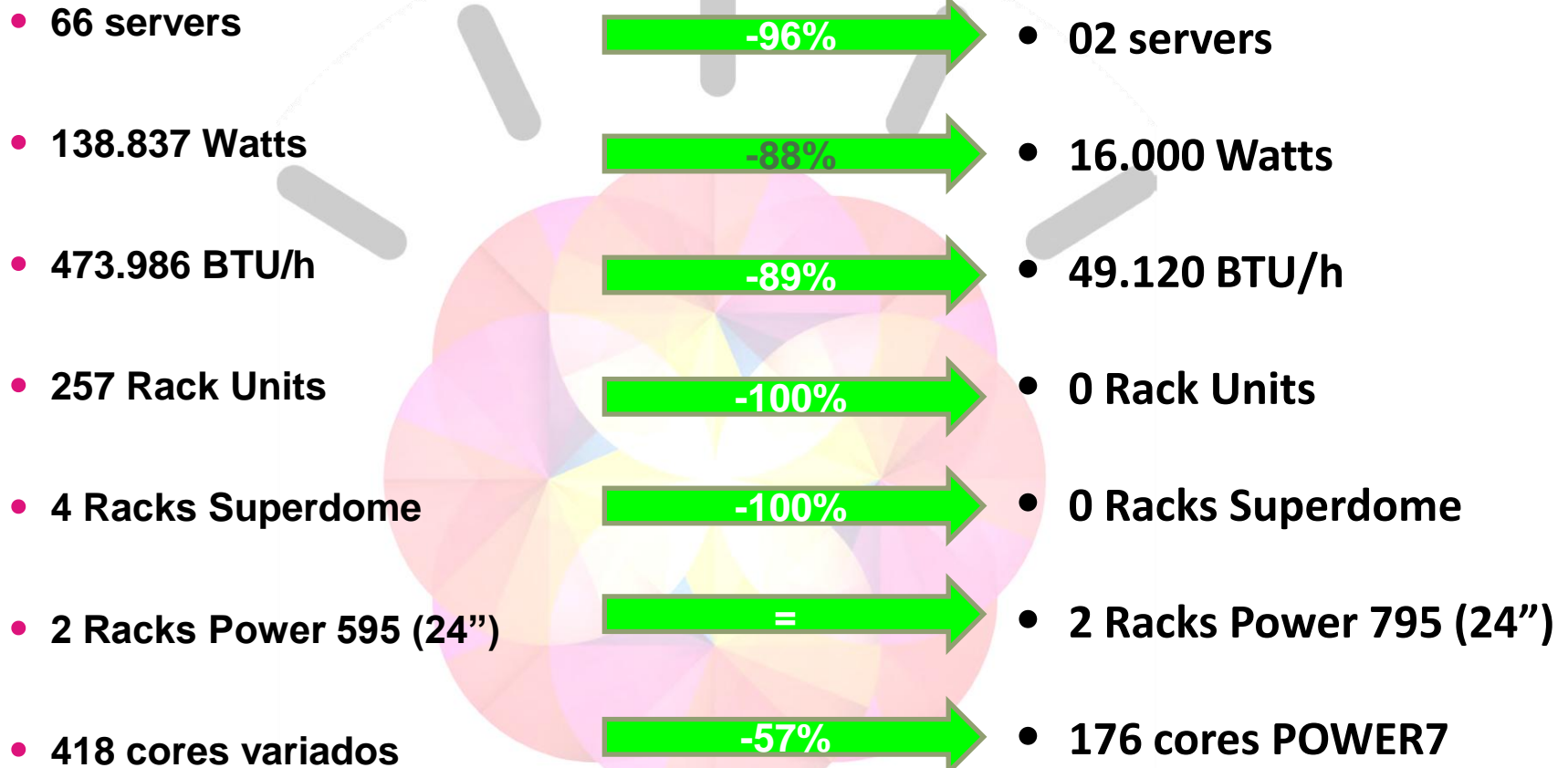
Smarter Computing
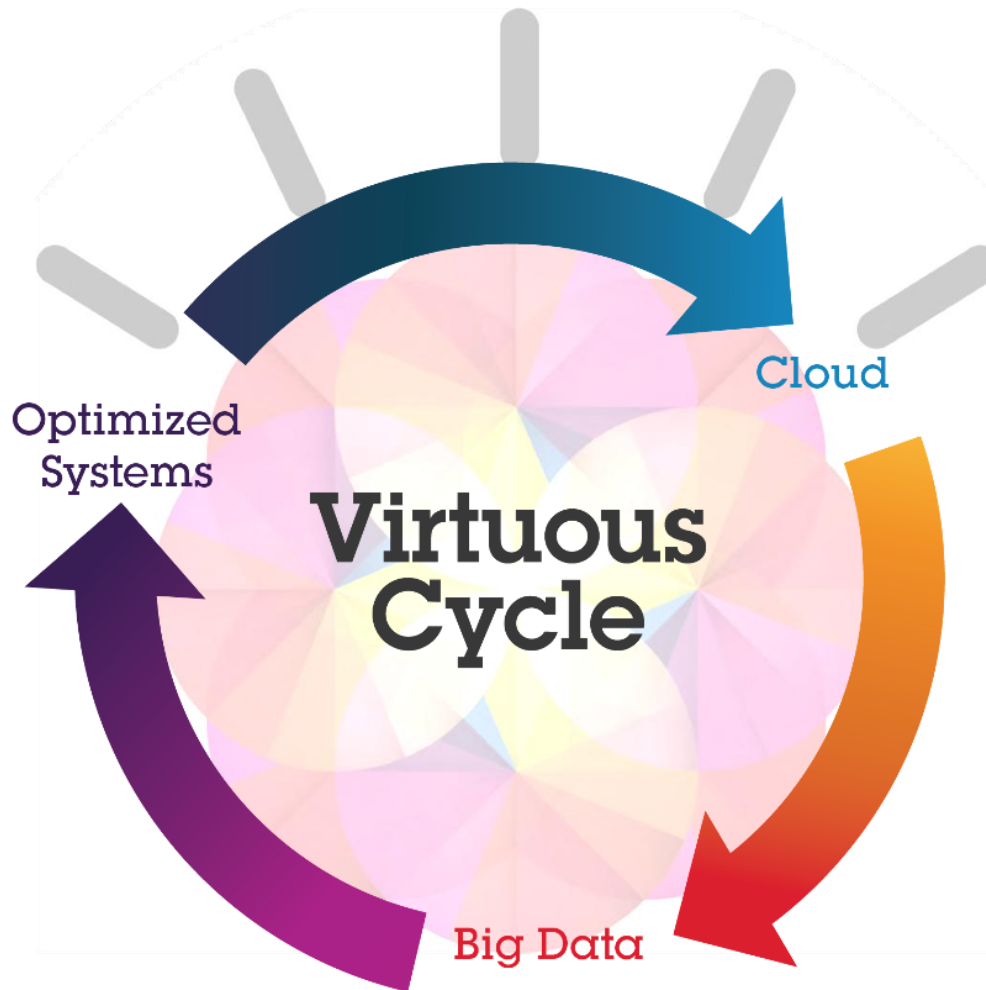
IBM POWER Processor Roadmap

POWER8
22 nm

POWER7/7+
45 / 32 nm

POWER6/6+
65 nm

POWER5/5+
130 / 90 nm

POWER4/4+
180 nm

IBM is the leader in Processor and Server design

Increased core density
Larger Cache
4th Generation SMT
(Intelligent Threads)
Imbedded accelerators
Dynamic TurboCore
Enhanced Resiliency & Security
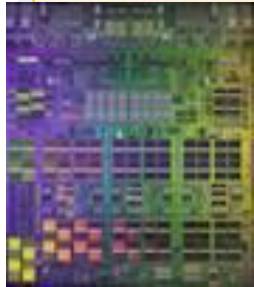
First Dual Core in Industry

- Dual Core
- Chip Multi Processing
- Distributed Switch
- Shared L2
- Dynamic LPARs (32)
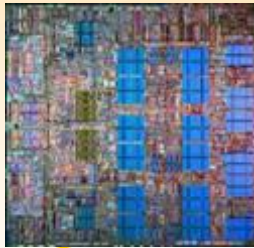
Hardware Virtualization for Unix / Linux

- Dual & Quad Core
- Enhanced Scaling
- Two Threads (SMT2)
- Distributed Switch +
- Core Parallelism +
- FP Performance +
- Memory bandwidth +
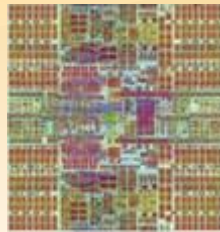
Fastest Processor in Industry

- Dual Core
- High Frequencies
- Virtualization +
- Memory Subsys.+
- 2 Thread SMT +
- Altivec, DFP
- Instruction Retry
- Protection Keys
- Dynamic Energy Mgmt
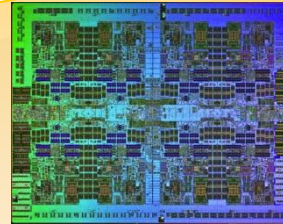
Most POWERful & Scalable Processor in Industry

- 4,6,8 Core
- 32MB On-Chip eDRAM
- Intelligent Threads (SMT4)
- Energy Optimized Cores
- Mem Subsystem ++
- Reliability +
- Protection Keys+
- VSM & VSX

IBM

Power is Performance Redefined

Deliver new services faster

– Deploy partitions with integrated system/storage administration
– Faster migrations of multiple partitions

Deliver higher quality services

– Simplified cluster security
– New Security and Compliance tools

Deliver services with superior economics

– Improve utilization of storage, memory and I/O
– Simplifies administration and reduces management costs

Virtualization without Limits
- *Shared Storage Pools*
- *Live Partition Mobility Enhancements*
- *Active Memory Deduplication*

Resiliency without Downtime
- *Federated Security*
- *SAP Hot standby*
- *Enterprise Editions support for XIV & V7000*

Security and Compliance
- *Trusted Boot*
- *Trusted Network Connect*
- *Trusted Logging*

PowerSC
providing security and compliance tools to protect data centers

▪Business Requirements

▪Compliance and Audit

▪Guarantee that the OS has not been hacked or compromised in any way

▪Ensure that every Virtual System has appropriate security patches

▪Compliance and Audit to External Standards

Trusted Logging
The SVM/VIOS capture all LPAR audit log information in real time.

Trusted Boot
Boot images and OS are cryptographically signed and validated using a virtual Trusted Platform Module (vTPM)

Trusted Network Connect and Patch Management
With the Trusted Network Connection protocol imbedded in the VIOS, we can detect any system attempting to access the network and determine if it is at the correct security patch and update level.

Security Compliance Automation
Pre-built compliance profiles that match various industry standards such as Payment Card Industry, DOD and Sox/Cobit. Activated and Reported on centrally using AIX Profile Manager

Capabilities

✔**Tamper-proof logs**

✔**Defense against tampering**

✔**Notification of unpatched systems**

✔**Compliance automation and reporting**

PowerVM – VIOS 2.2
Extending Storage Virtualization Beyond a Single System
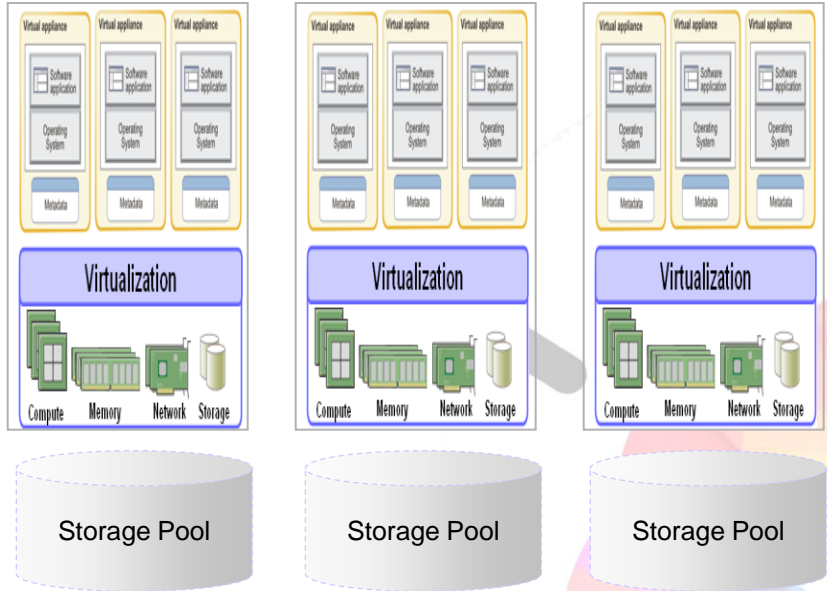
vSCSI Classic – storage virtualization

- Storage pooled at VIOS for a single system

- Enables dynamic storage allocation

- Supports Local and SAN Storage, IBM and non-IBM Storage
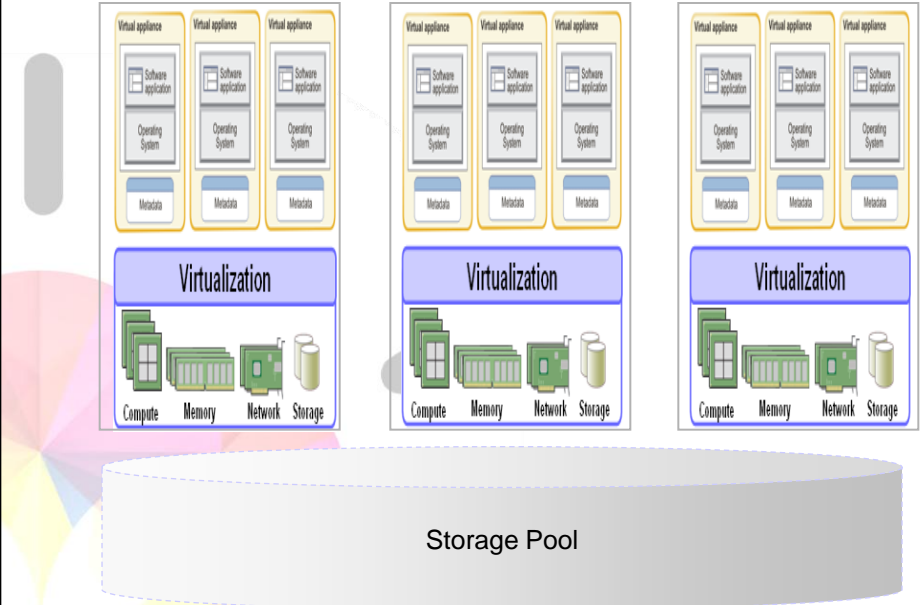
vSCSI NextGen – clustered storage virtualization

- Storage pool spans multiple VIOS's and servers

- Enabler for federated management

- Location transparency

- Advanced capabilities

- Supports SAN and NAS, IBM and non-IBM Storage

Active Memory Mirroring
for Hypervisor improves system availability

Eliminate system outages due to uncorrectable errors in hypervisor memory

- **Maintains two identical copies of the system hypervisor memory at all times**

- **Both copies are simultaneously updated with any changes**

- **In the event of a memory failure on the primary copy, the second copy will be automatically invoked and a notification sent to IBM via the Electronic Service Agent (ESA)**

Partition	Partition	Partition

Mirrored Memory Pool	Non-Mirrored Memory Pool	Mirrored Memory Pool

Protected Hypervisor

Size of Mirrored Pool Can Grow or Shrink Based on Client Needs
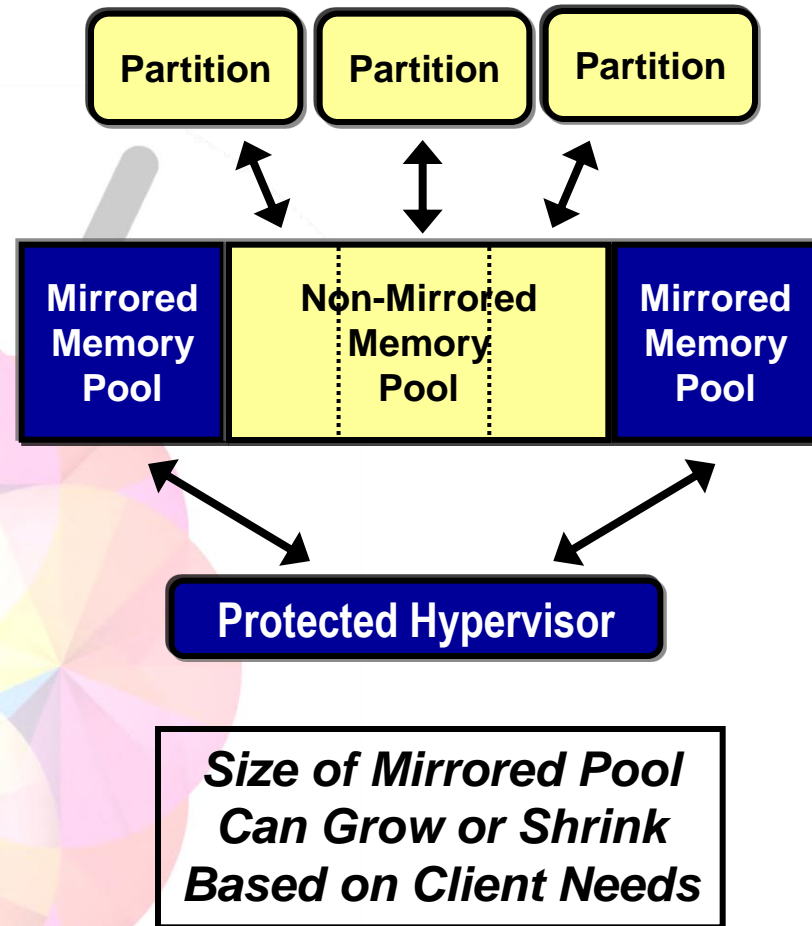
Standard on the new Power 780, optionally available on the new Power 770

IBM®

Active Memory Sharing + Active Memory Deduplication
Saves Memory for Similar Workloads

PowerVM

Current Use Case

Peaks at different Times

Asia
Americas
Europe

Night
Day
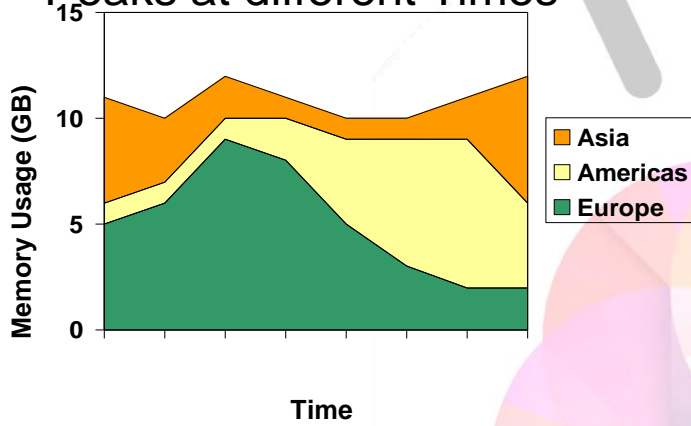
New Use Case

Similar Schedules

GA
FL
NY
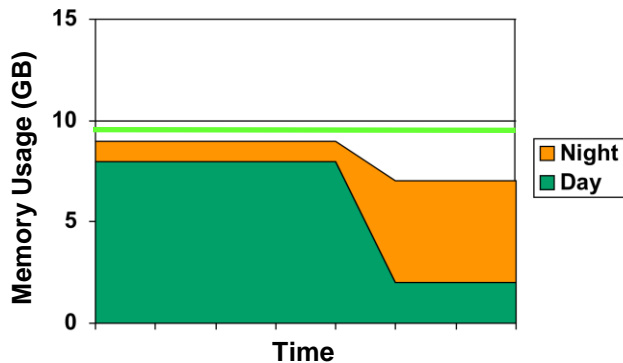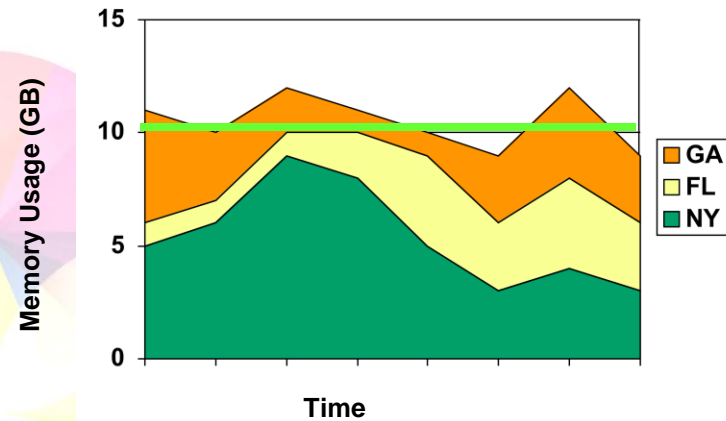
Active Memory Deduplication removes duplicate Memory Pages which allows the similar workloads to fit within the physical memory constraints through optimization.

IBM

PCIe Gen2
delivers higher performance, greater efficiency and more flexibility

- Performance
  - 2X the bandwidth for workloads requiring extreme performance
  - Support of 40 Gb QDR Infiniband, and future 40 Gb Ethernet and 16 Gb Fibre Channel networks coming in 2012

- Efficiency and Flexibility
  - Leverage the performance and density by sharing I/O slots across more VMs
  - More flexibility to add VMs without having to add new I/O adapters
  - Reduce the need to add additional I/O capacity with I/O drawers

| LPAR 1 | LPAR 2 | LPAR 3 | LPAR 4 |

Reduce Adapters
Add more VMs
Improved I/O Performance

| LPAR 1 | LPAR 2 | LPAR 3 | LPAR 4 | LPAR 5 | LPAR 6 |

Gen 1   Gen 1   Gen 1

Gen 2   Gen 2

IBM
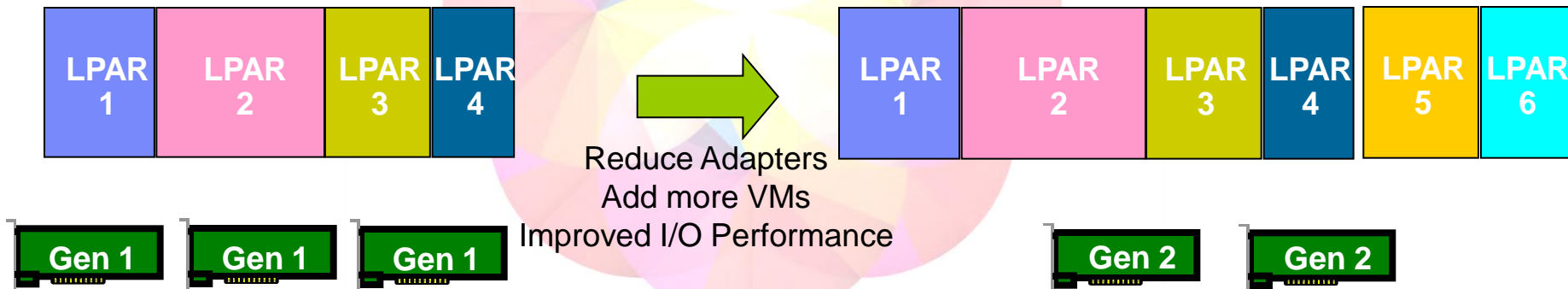
Power Express new capabilities

✳ Gen2 I/O bandwidth available with every PCIe slot
- PCI Gen2 doubles the bandwidth compared to PCI Gen1
- Enables higher data rates, more ports per adapter
  - Quad Ethernet 2x 1Gb / 2x 10GB or 4x 1GB Linux only
  - Dual port 10Gb Ethernet
  - 4-port Fiber Channel 8Gbps
  - 6 Gbps SAS RAID Controller w/ Cache
  - Dual port QDR IB Adapter
- Power 730 I/O drawer attachment support

✳ Twice the memory – additional granularity
- New 16 GB DIMMs double the memory capacity
- 4GB feature adds granularity options
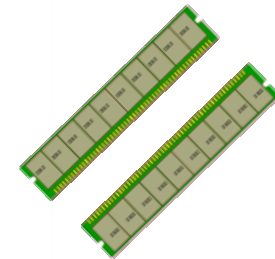
✳ Integrated RAID 0, 1 and 10 capabilities

✳ Upgrades supported from existing Power 520 systems

Power 770 & 780 introduce new capabilities

Twice the I/O bandwidth
- PCI Gen2 doubles the bandwidth compared to PCI Gen1

Twice the memory
- New 64 GB DIMM doubles the memory capacity to 4 TB
- Up to 64 GB per core with 8-core processors

Twice the sockets
- New 780 option doubles the number of sockets
- Combined with a new 6-core processor @ 3.44 GHz
- Fully configured 780 system increases to 96 cores

Two copies of the hypervisor memory
- Active memory mirroring improves availability

Clock speed increases
- Power 770 grows to 3.3 and 3.7 GHz
- Power 780 grows to 3.92 GHz

Upgrades from existing systems, including POWER6 570s

IBM Power Systems & Linux

Middleware Software	python, php	hadoop	openstack, mongoDB, MySQL, DB2, **WebSphere**
Systems Software	PowerVM	• PowerVM 2.2	IBM Systems Director, • IBM Systems Director 6.2.1, • VMControl 2.3.1
Linux Dist's	redhat	• RHEL 5.6, • RHEL 6	suse, • SLES 11 SP1, • SLES 10 SP4
Storage	• DS3512	• N3000	• V7000
Servers		Linux, POWER7 BUILT ON Power	

IBM
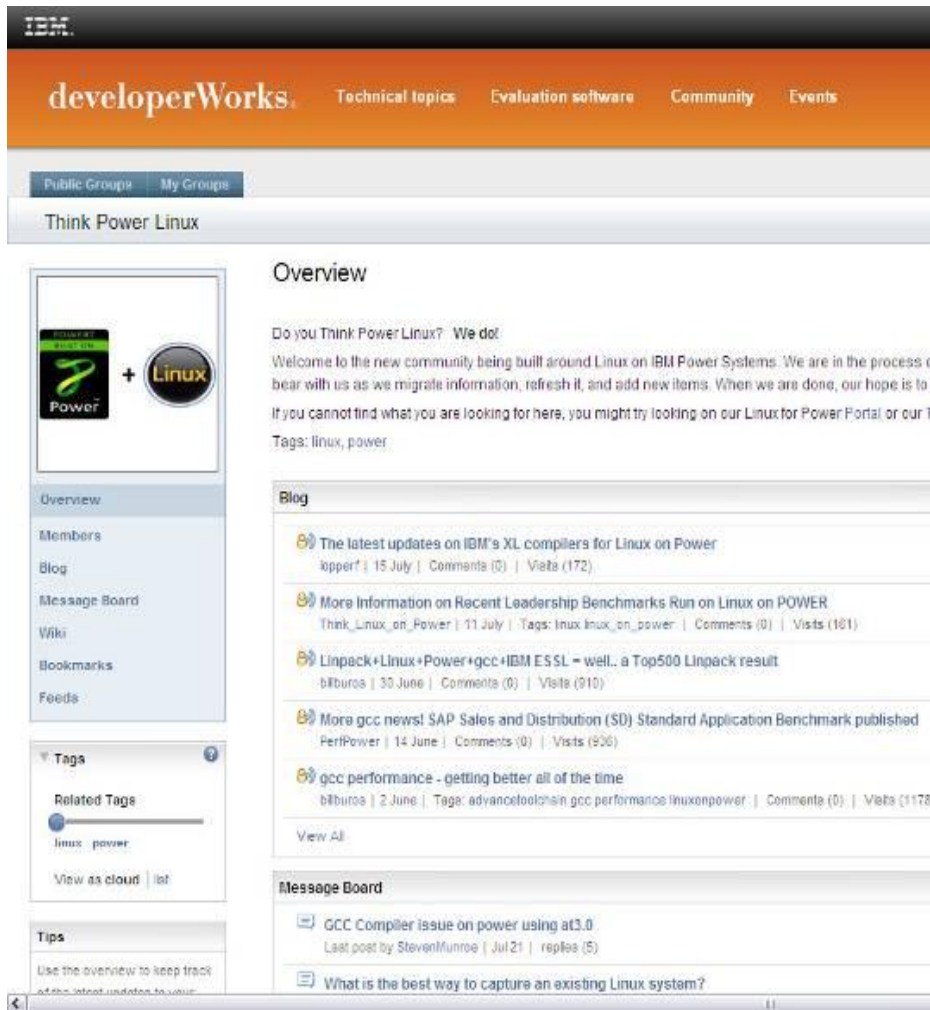
Think Power Linux developer portal

www.ibm.com/developerworks/group/tpl

- **Community site available today**
  - Technical resources for Linux developers
  - Information sharing among Power Linux clients, ISVs, and community and IBM experts
  - Hints and tips
  - Links to all external Power Linux resources

- **Initiating Open Source community membership drive**
  - LinuxCon NA, August 17-19

- Ongoing marketing and continuous new news

PERFORMANCE

VIRTUALIZATION

CLOUD

PRICE

RAS

HISTORY

CUSTOMERS

...THANKS ! ! !

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Special notices

Special notices (cont.)

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