AIX 7 Update

IBM Technical Forum & Executive Briefing

17 al 21 Octubre 2011

Imagine PODER Imagine CAPACIDAD

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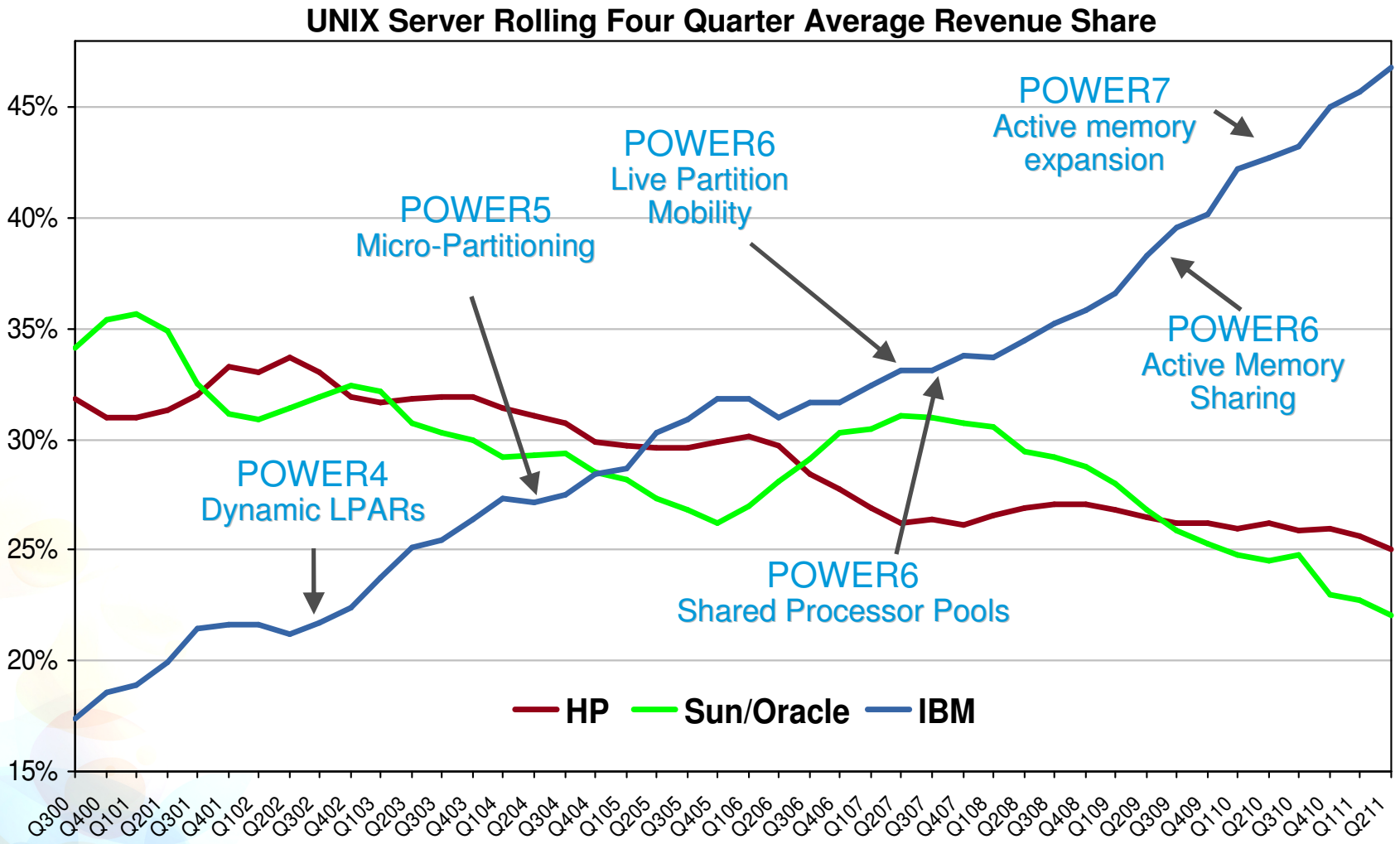
AIX®

IBM Power UNIX Leadership

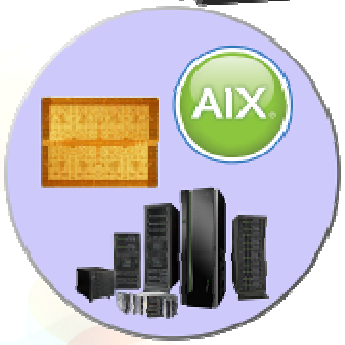


Source: IDC Server Tracker, 2Q11

Why AIX is the Premier UNIX® Platform Today

✓ **Outstanding Performance**

✓ **Improved Efficiency through Virtualization**



✓ **Innovation through integrated Development**

✓ **Strong, stable, non-disruptive roadmap**

Power Systems with AIX deliver 99.997% uptime

AIX & Power Systems delivers the best reliability of UNIX, Linux, and Windows

54% of IT executives and managers say that they require 99.99% or better availability for their applications

Reliability: The fewest unscheduled outages

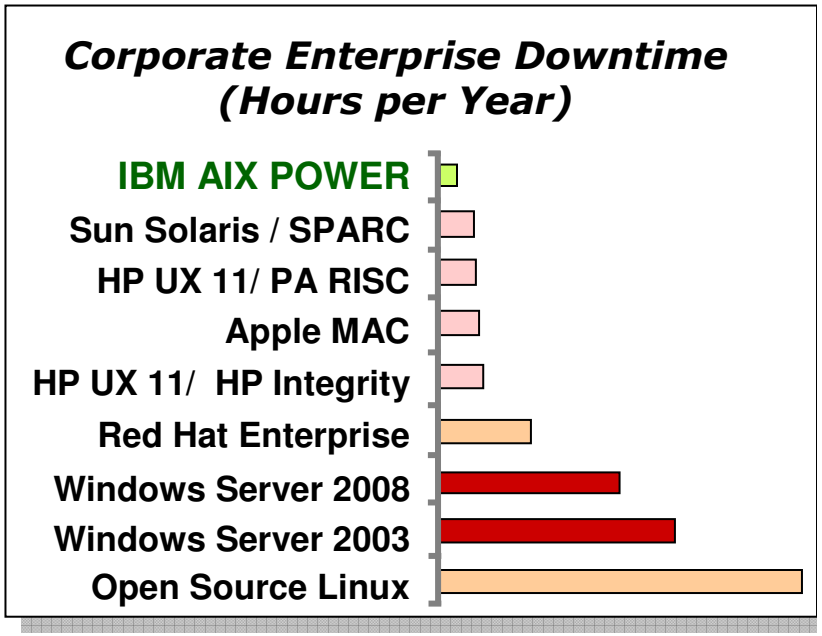
- Less than one outage per year

Availability: The least amount of downtime

- 15 minutes a year
- 2.3 times better than the closest UNIX competitor
- More than 10X better than Windows

Serviceability: The fastest patch time

- 11 minutes to apply a patch



Source: ITIC 2009 Global Server Hardware & Server OS Reliability Survey Results, July 7, 2009 Fully paper is available at ibm.com/aix

Power is performance redefined

Power Systems Reliability: Built on AIX capabilities *and* Power Systems hardware features

AIX RAS features

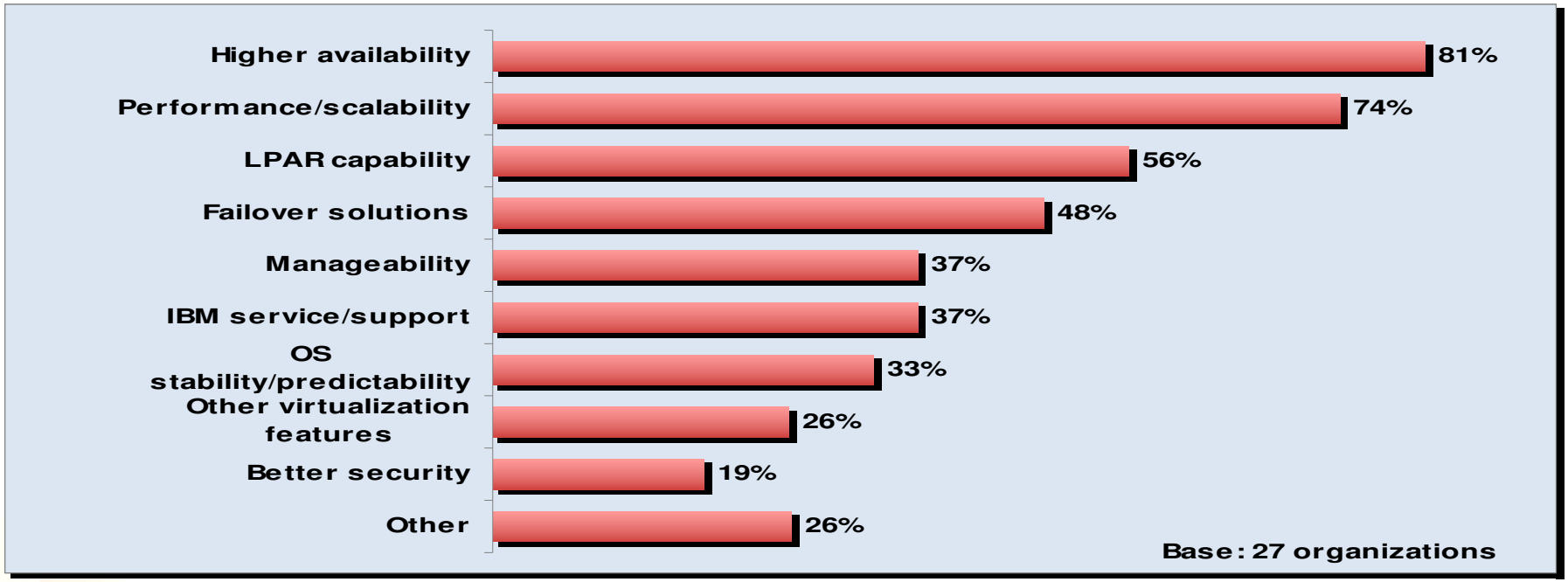
- Live Application Mobility
- Journaled Filesystem
- Storage mirroring
- System Trace
- Lightweight Memory Trace
- Component Trace
- MiniDump
- Parallel Dump
- Kernel exploitation of Storage Protection Keys
- Functional Recovery Routines
- Dynamic tracing with *probevue*
- RAS Component Hierarchy
- Live Dump
- Firmware Assisted Dump
- Kernel no-execute enhancements
- Kernel Stack Overflow enhancements
- Run Time Error Checking
- POSIX Trace
- Netmalloc debug

Power Systems Hardware RAS features

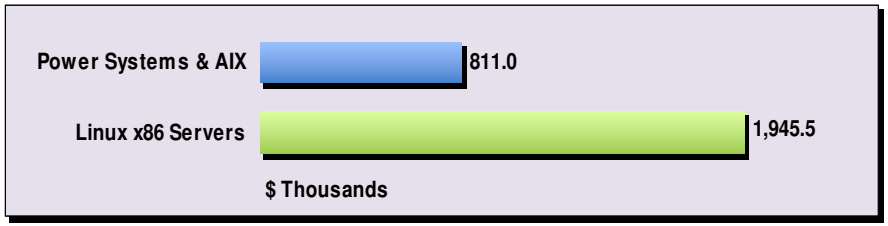
- Application/Partition RAS
  - *Live Partition Mobility*
  - *Partition Availability priority*
- System RAS
  - *OS independent First Failure Data Capture*
  - *Redundant System Interconnect*
  - *Storage Keys*
  - *Electronic Service Agent*
  - *Concurrent Firmware Updates*
  - *Redundent Clocks*
- Processor RAS
  - *Processor Instruction Retry*
  - *Alternate Processor Recovery*
  - *Dynamic Processor Deallocation*
  - *Dynamic Processor Sparing*
- Memory RAS
  - *Chipkill™*
  - *Redundant Memory*
- I/O RAS
  - *Extended Error Handling*
  - *Online diagnostics*

AIX/POWER versus Linux/Commodity x86

Advantages of Power AIX Systems Relative to Commodity Linux x86 Servers



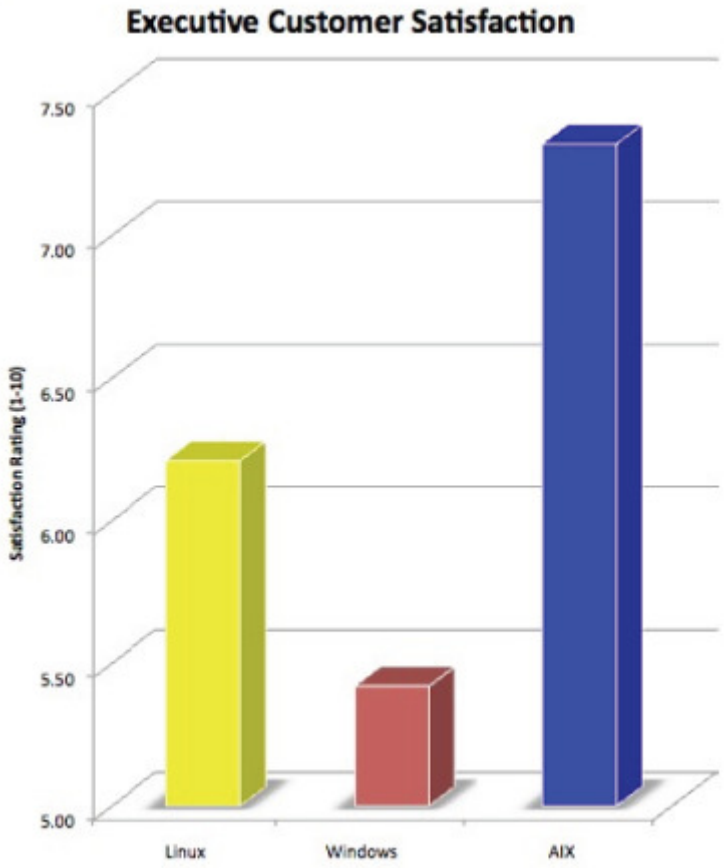
Systems Administration cost comparison



From "VALUE PROPOSITION FOR AIX ON IBM POWER SYSTEMS : OWNERSHIP EXPERIENCES COMPARED WITH LINUX ON COMMODITY X86-BASED SERVERS" *International Technology Group ©2010*

Available on ibm.com/AIX

AIX/Power Systems delivers end user satisfaction



PowerITpro

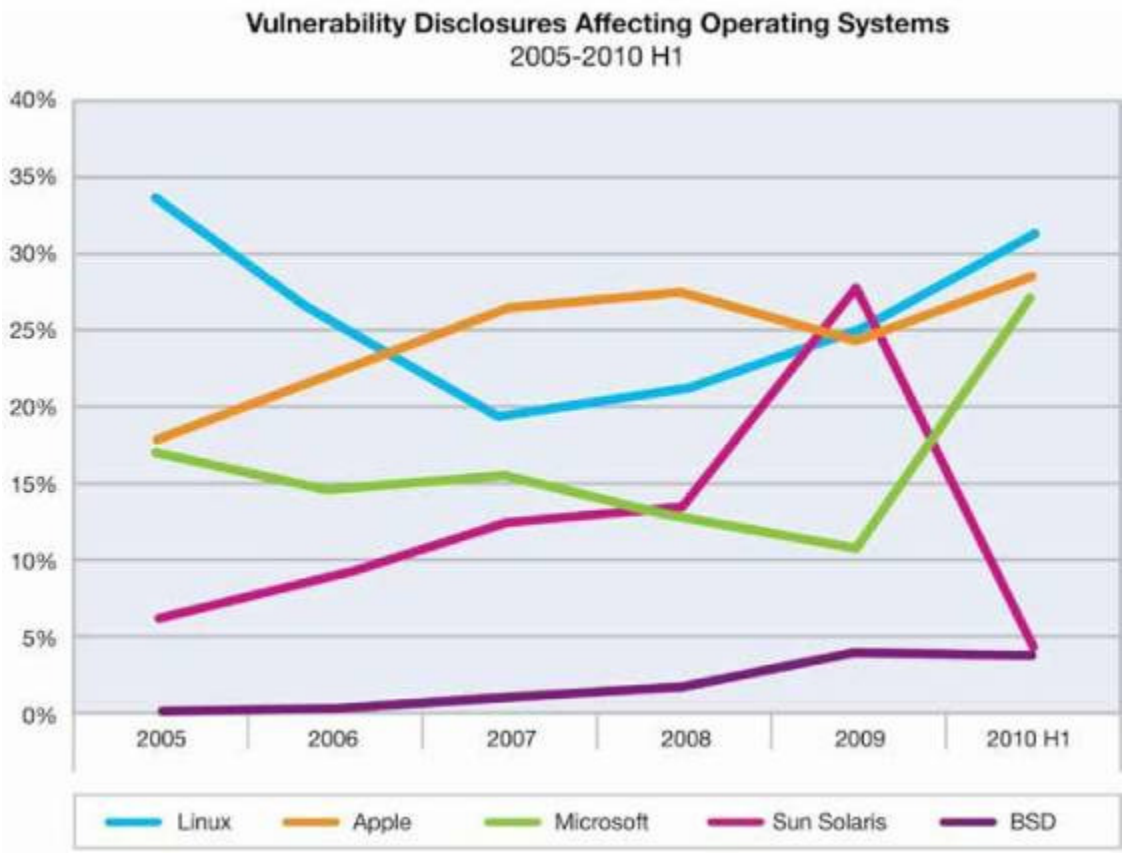
- **http://tinyurl.com/PowerITProFallAIX on November 15**

IBM

AIX Provides Leadership Security*

Operating System	Percentage of Critical and High	Percentage of all OS Vulnerabilities
Microsoft	73%	27%
Apple	9%	29%
Linux	16%	31%
HP-UX	2%	1%
Sun Solaris	0%	4%
BSD	0%	4%
IBM AIX	0%	2%
Others	2%	4%

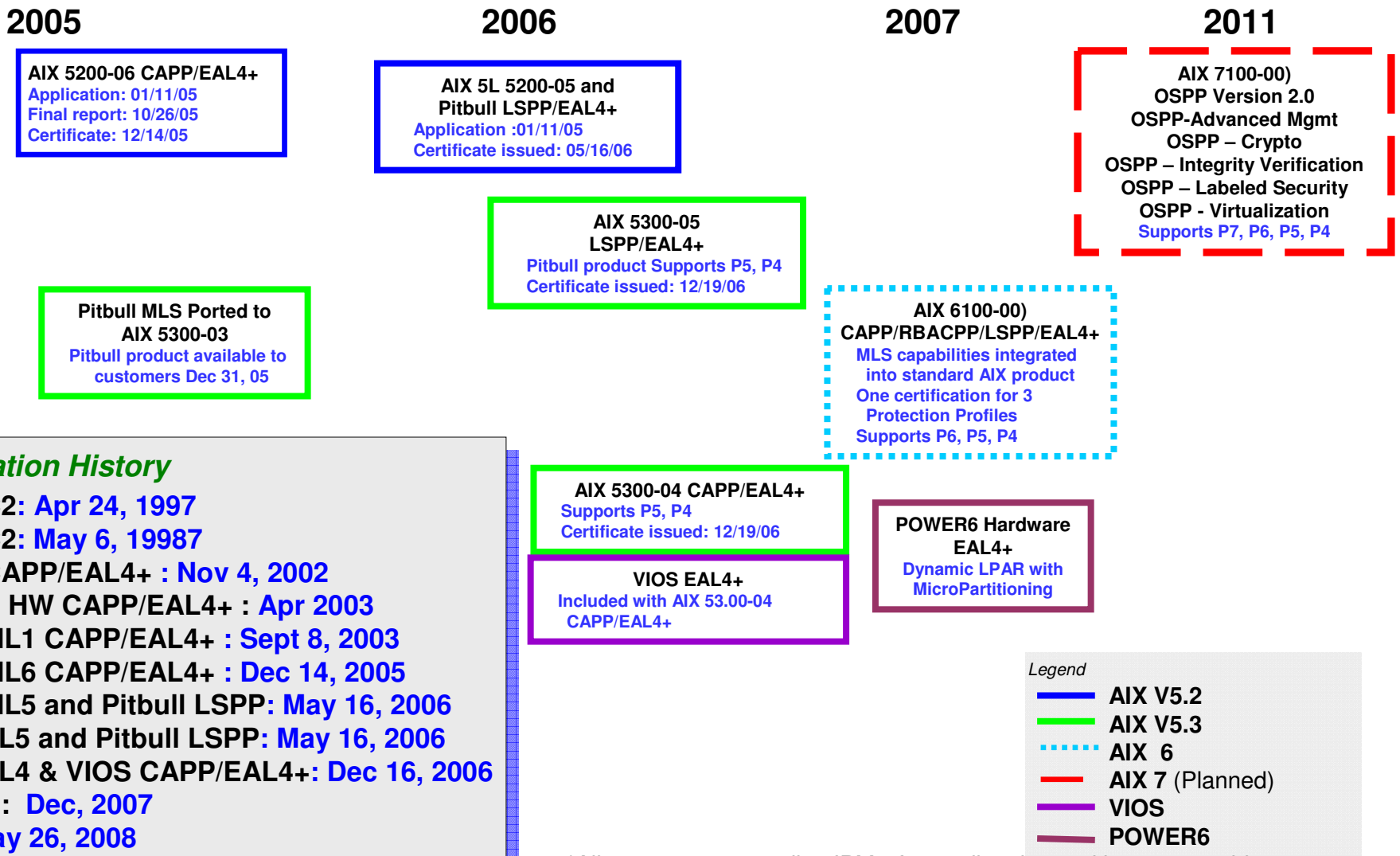
Table 9: Operating systems with the most critical and high vulnerability disclosures, 2010 H1.



AIX Dropped off the list due to low vulnerabilities!

**X-Force report – Mid-year 2010 http://www-935.ibm.com/services/us/iss/xforce/trendreports/*

AIX & Power Systems Security Certifications



Certification History

AIX 4.2 C2: Apr 24, 1997
AIX 4.3 C2: May 6, 19987
AIX 5.2 CAPP/EAL4+ : Nov 4, 2002
POWER4 HW CAPP/EAL4+ : Apr 2003
AIX 5.2 ML1 CAPP/EAL4+ : Sept 8, 2003
AIX 5.2 ML6 CAPP/EAL4+ : Dec 14, 2005
AIX 5.2 ML5 and Pitbull LSPP: May 16, 2006
AIX 5.3 TL5 and Pitbull LSPP: May 16, 2006
AIX 5.2 TL4 & VIOS CAPP/EAL4+: Dec 16, 2006
POWER6: Dec, 2007
AIX 6: May 26, 2008

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AIX Evolution – Over Twenty years of Progress

AIX/6000

AIX V2 & V3	AIX V4.1/4.2	AIX V4.3	AIX 5L V5.1/5.2	AIX 5L V5.3	AIX 6	AIX 7
Establishment in the market: - RISC Support - UNIX credibility - Open Sys. Stds.. - Dynamic Kernel - JFS and LVM - SMIT	**SMP Scalability:** - POWERPC spt. - 4-8 way SMP - Kernel Threads - Client/Server pkg - NFS V3 - CDE - UNIX95 branded - NIM - > 2GB filesystems -HACMP Clustering - POSIX 1003.1, 1003.2, XPG4 - Runtime Linking - Java 1.1.2	**Higher levels of scalability:** - 24-way SMP - 64-bit HW support - 96 GB memory - UNIX98 branded - TCP/IP V6 - IPsec - Web Sys. Mgr. - LDAP Dir. Server. - Workload Mgr - Java JDT/JIT - Direct I/O - Alt. Disk Install - Exp/Bonus CDs	**Flexible Resource Management:** - POWER4+ spt. - Dynamic LPAR - Dynamic CUoD - New 64bit kernel - 512GB mem - JFS2 - 16 TB filesystems - UNIX03 branded - Concurrent I/O - MultiPath I/O - Flex LDAP Client - XSSO PAM spt	**Advanced Virtualization:** - POWER5 support - 64-way SMP - SMT - MicroPartitions™ - Virt I/O Server - Partition Load Mgr - NFS Version 4 - Adv. Accounting - Scaleable VG - JFS2 Shrink - SUMA - SW RAS features - POSIX Realtime	**Enterprise RAS:** -POWER6 support -Workload Partitions -Application Mobility -Continuous Avail. -Storage Keys -Dynamic tracing -Software FFDC -Recovery Rtns -Concurrent MX -Trusted AIX -RBAC -Encrypting JFS2 -AIX Security Expert -Director Console	**Future of UNIX:** -256 core/1024 tread scalability -POWER7 Exploitation -Domain based RBAC - AIX Profile Manager -WPAR enhancements -AIX 5.2 in a WPAR -PowerVM virtualized storage -LVM SSD support -Terabyte segment
AIX V3.2.5 **Maturity:** - Stability - Quality						

Open Systems Workstations — Uni-processor

Distributed Client-Server — 4-8 way SMP

Network Centric Computing — 24-way SMP

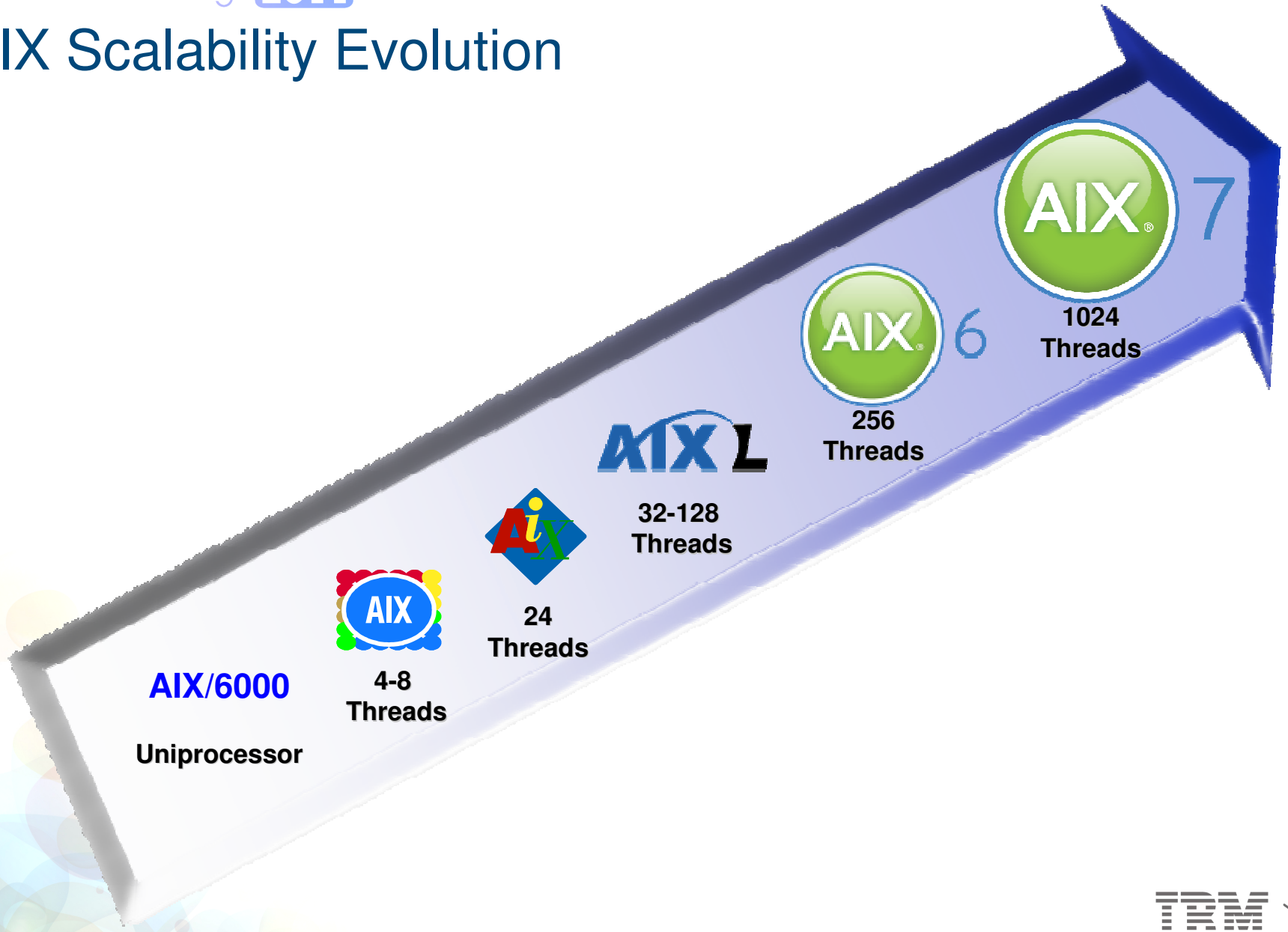
e-Business Computing — 32-way SMP

On Demand Business / *New Enterprise Data Center* — 64/256-way SMT

Smarter Planet — 1024-way SMT4

Power is performance redefined

AIX Scalability Evolution



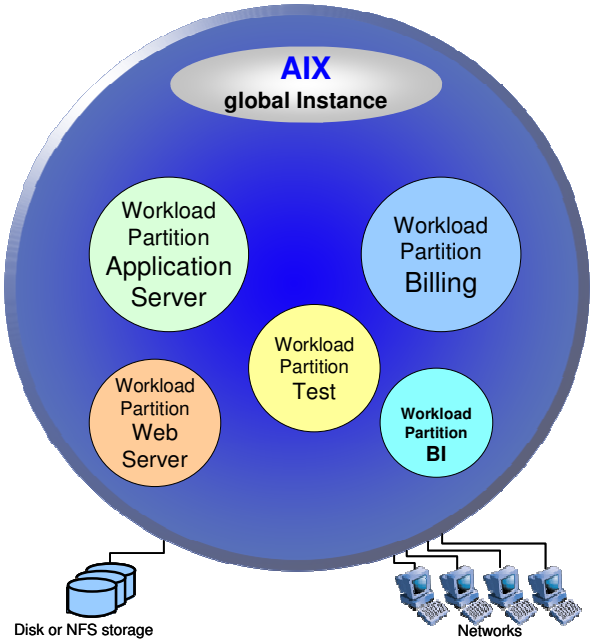
AIX 7 Hardware Enablement and Support

- Terabyte Segment support
  - *Designed to improve performance for workloads that use large amounts of memory*
- AIX kernel memory pinning
  - *AIX 7 memory pinned by default to enhance performance*
- Hardware acceleration for Encrypting Filesystems, IPSec and Trusted Execution
  - *Reduce processor workload for encryption*
- LVM Solid State Disk Support
  - *SSD only VGs,* filemon –o hot *to identify SSD candidates*

AIX Workload Partitions (WPAR)

What is it?

- Virtualized AIX operating system environments within a single AIX image
- Each WPAR shares the single AIX operating system
- Applications and users inside a WPAR cannot affect resources outside the WPAR
- Each WPAR can have a regulated share of processor, memory and other resources
- Two types of WPAR
  - System WPARs have separate security and appear like a completely separate OS
  - Application WPARs are manageability wrappers around a single application



Top reasons to use WPARs

- WPARs can save administrator work by reducing the number of AIX instances to patch
- WPARs have much lower memory resource requirements: 68 MB vs 1GB for an LPAR
- WPAR takes seconds to create and LPARs minutes
- Application mobility much simpler to organize than LPM
- Lots of WPARs on one AIX is simpler to monitor and control than monitoring across many LPARs.
- Rapid cloning is easy and lets you use "disposable images" - simple to create, experiment and throw away

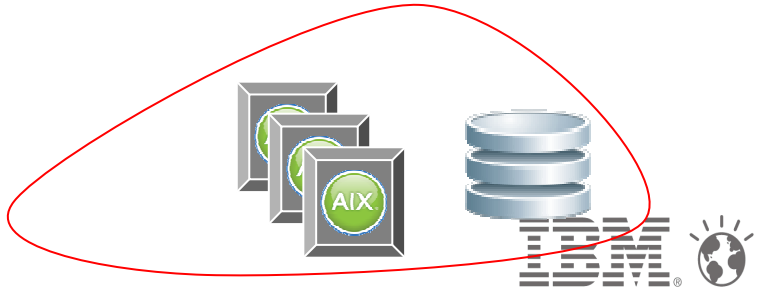
WPAR Enhancements

- Export of Fibre channel adapters to WPARs
  - *NPIV-like, but can work on any Fibre Channel adapter*
  - *Adds support for Fibre Channel tape*
- Kernel Extensions for WPARs
  - *Trusted kernel extensions may be loaded by the WPAR administrator*
  - *Extensions can be only for one WPAR or for entire system*
- Support for VIOS disks in WPARs (also in AIX 6.1 TL6)
  - *Long requested feature*

Cluster Aware AIX

Designed to simplify construction and management of clusters of AIX systems for scale-out computing and high availability

- Easily create clusters of AIX instances for scale-out computing or high availability
- Designed to:
  - *Significantly simplify cluster configuration, construction, and maintenance*
  - *Designed to improve availability by reducing the time to discover failures*
  - *Capabilities such as common device naming help simplify administration*
  - *Built in event management and monitoring*
- A foundation for future AIX capabilities and PowerHA SystemMirror V7



PowerHA SystemMirror (formerly HACMP)

PowerHA SystemMirror 7.1 Standard Edition represents the next generation of solutions for High Availability.

- ✓ **Based on Cluster Aware AIX** for kernel based HA technology
- ✓ **Systems Director based management** for simple, centralized cluster administration
- ✓ **Smart Assists** for out the box HA deployment of SAP and other popular applications
- ✓ **Multiple redundant heartbeat** with SAN communications for robust cluster integrity
- ✓ **Advanced resource group policies** for automated recovery sequencing
- ✓ **Available for AIX 7.1 and AIX 6.1 Technology Level 6**

PowerHA SystemMirror 6.1 Enterprise Edition expands storage options for multi-site HA/DR

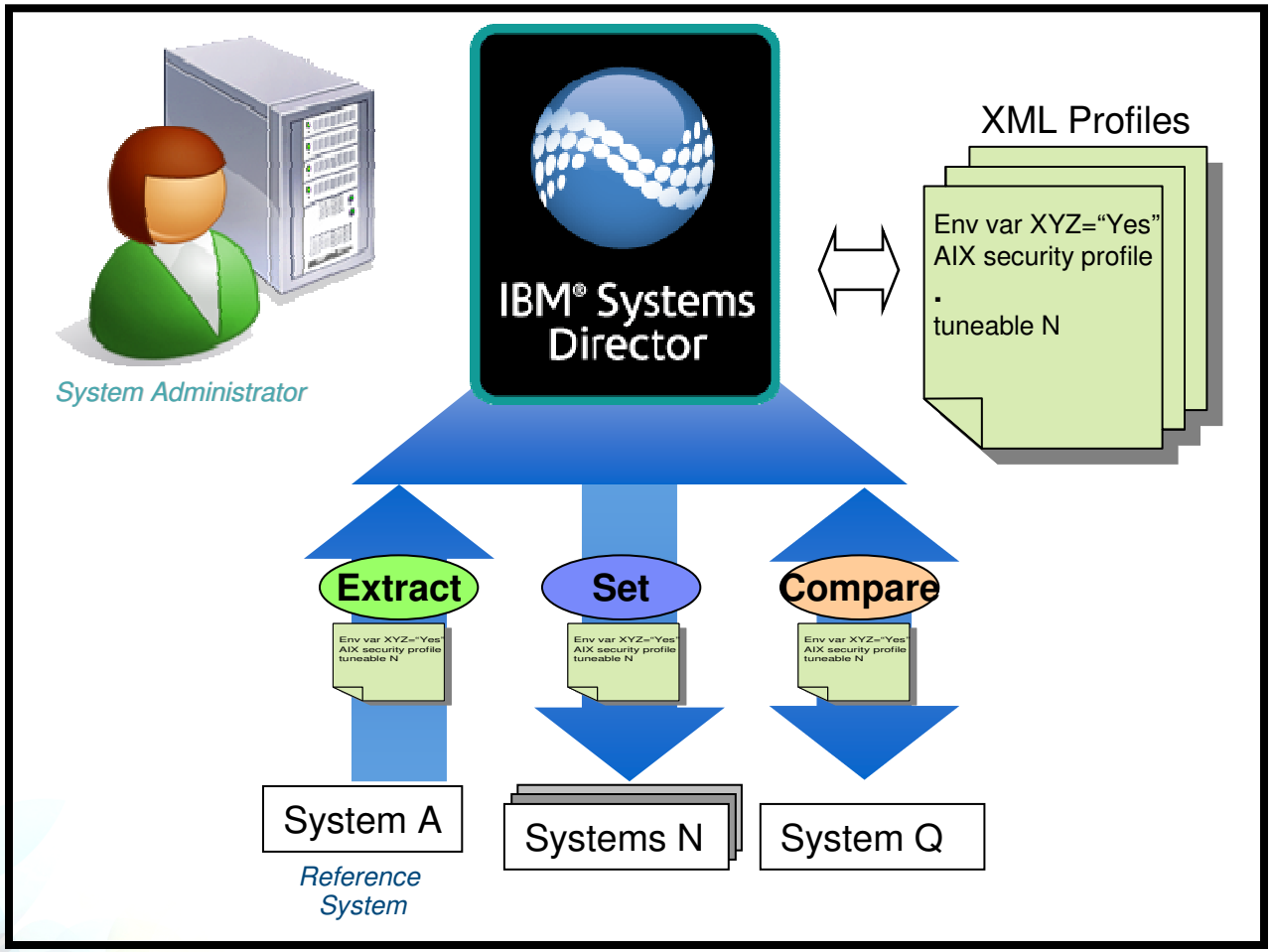
- ✓ IBM DS8000® Metro Mirror, SVC Metro Mirror & Global Mirror
- ✓ IBM DS8700® Global Mirror
- ✓ EMC SRDF
- ✓ Hitachi Truecopy

IBM

AIX 7 Profile Manager

Systems Director plug-in that is designed to simplify consistent AIX configuration across multiple systems

Simplified configuration using the AIX Profile Manager



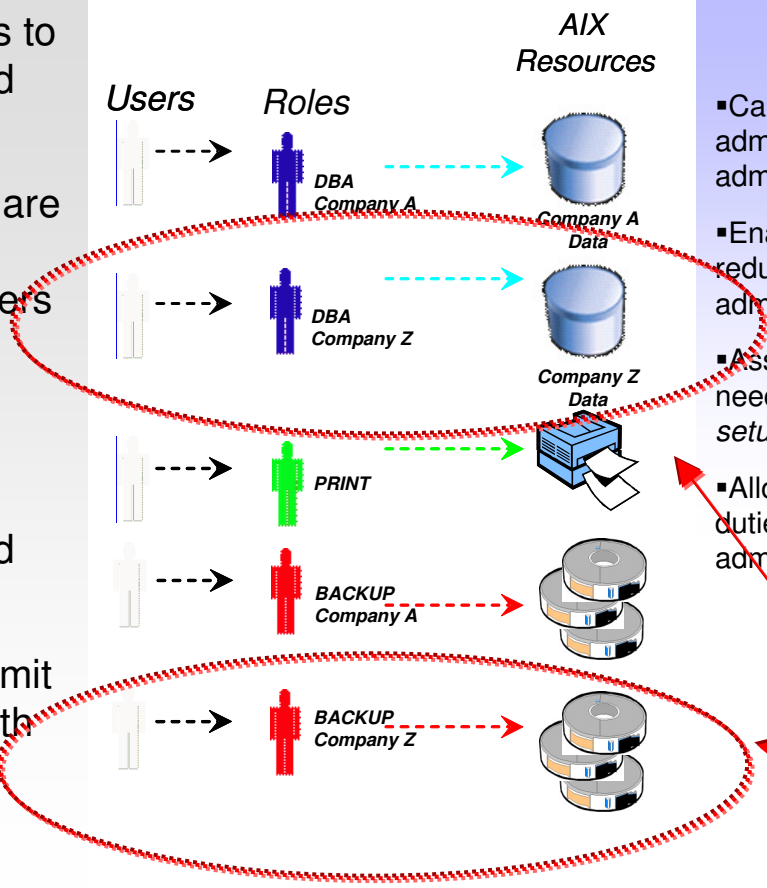
Configuration Elements managed by AIX Profile Manager

acctctl	dumpctrl	nis	namerslv	tsd
alog	errdaemon	probevue	nfs	trustchk
authzcfg	ewlm	tcp_nw	shconf	vmo
authent	ffdc	udp_nw	schedo	aix.secexpert
chcons	filter	ip_nw	privcmd	mkuser.defuser
Chdev.sys0	ioo	arp_nw	privdev	chuser
chlicense	krecovery	stream	privfile	login
chservices	lvmo	raso	smtctl	chsubserver
chsys	nfso	role	syscorepath	gen.param
class	mktcpip	ruser	traces	etc.env
sysdumpdev	file.data	trcctl	restricted	misc.other

AIX Role Based Access Control (RBAC) with Domains

What is it?

- A capability of AIX that allows privileged administration tasks to be delegated to non-privileged users
- Access to system resources are associated with roles that are assigned to non-privileged users
- Many roles are predefined which can reduce the effort of implementing RBAC
- Roles can also be associated with programs
- Domain access can further limit administrators to only work with resources for a particular organization (AIX 7)



How it can help?

- Can reduce the cost and complexity of security administration by allowing secure delegation of administrative tasks to non-privileged users
- Enables a more secure IT infrastructure by reducing the need for so many privileged administrators
- Assigning roles to programs can reduce the need for security exposures such as the use of *setuid* for programs
- Allows for new ways to delegate administration duties between system administrators and non-administrative users

Domain support Provides more granularity for multi-tenant IT shops

Introducing:

AIX 5.2 Workload Partitions for AIX 7

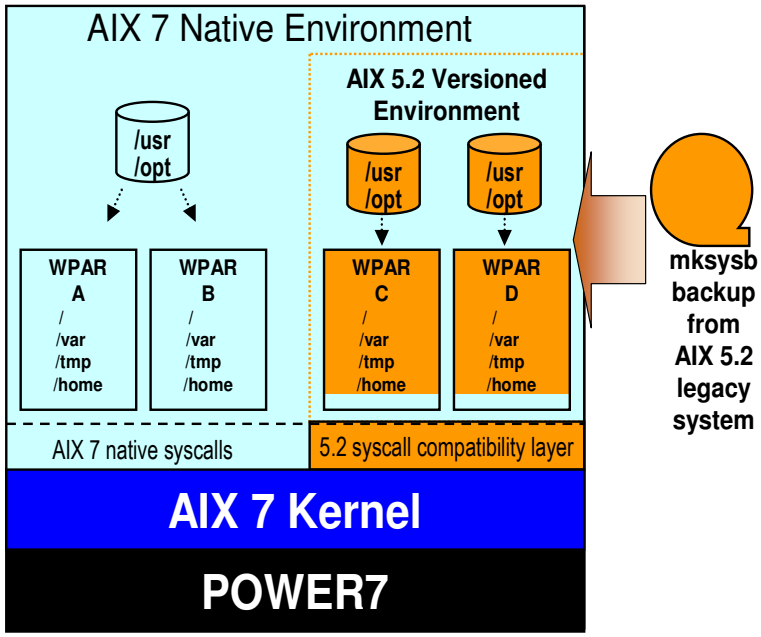
- A new licensed program product offering that allows customers to simplify migrating their old, AIX 5.2 workloads to POWER7
  - *Runs on top of AIX 7 and POWER7 processor-based servers*

- Customer value
  - *Simplify consolidation of old workloads on new hardware*
  - *Reclaim floor space and eliminate hardware support for obsolete servers*
  - *Protects customer investment in application stacks*
  - *Offering includes phone and fix support for AIX 5.2*
  - *Enables advanced capabilities such as SMT4, Live Application Mobility and Live Partition Mobility.*

AIX 5.2 Workload Partitions for AIX 7

How does it work?

- *Client simply backs up existing legacy AIX 5.2 environment and restores into an AIX 7 WPAR*
- *The AIX 5.2 environment including rootvg filesystems are preserved and restored*
- *Client applications continue to run in AIX 5.2 environment with AIX 5.2 libraries*
- *The kernel environment will be AIX 7*
  - SMT4, MicroPartitioning and VIOS are supported!
- *The SWMA for this offering will also provide how-to and limited defect support for the AIX 5.2 operating system*
- Managed via IBM Systems Director Workload Partitions Manager or command line



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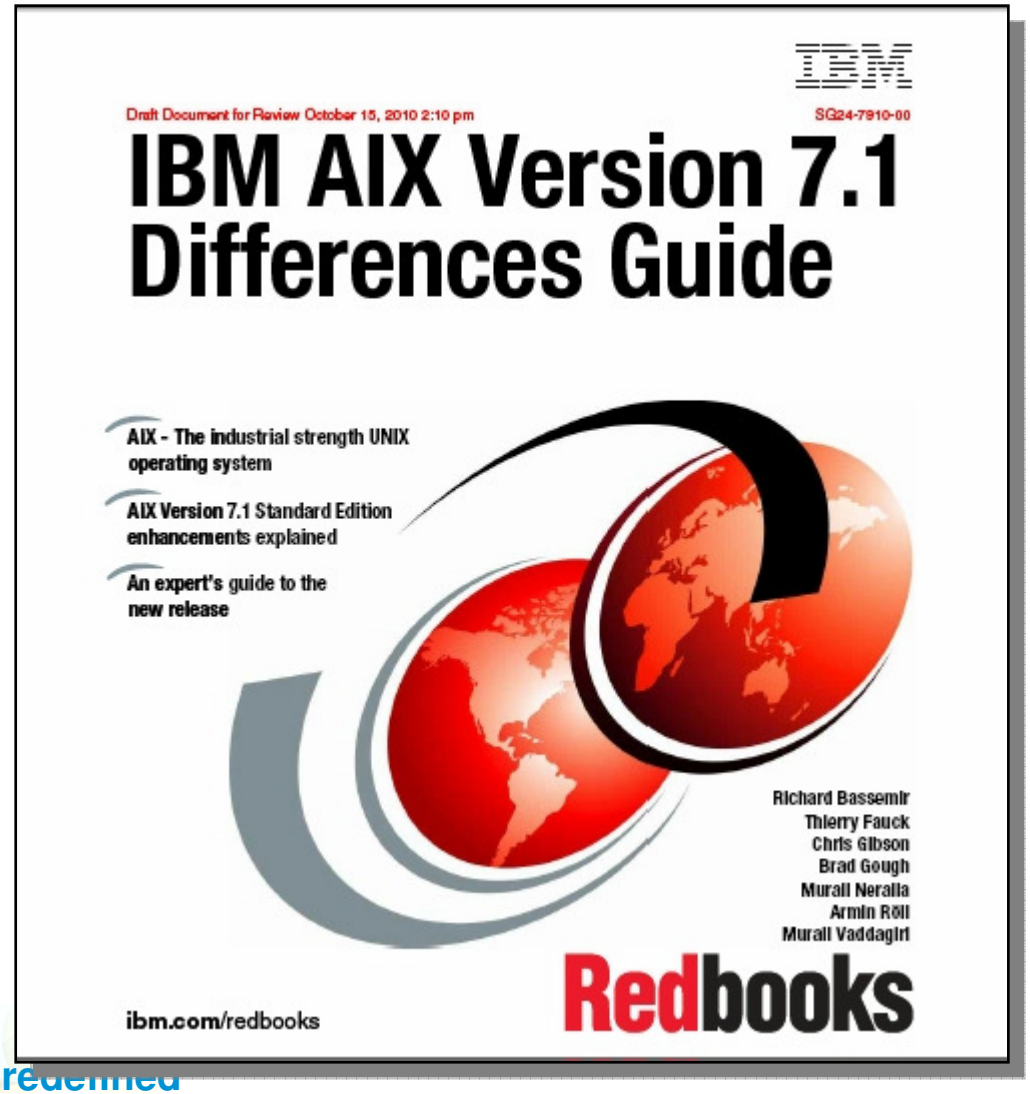
AIX 5.2 WPARs for AIX 7 will be a separately charged product built on AIX 7

AIX 7.1 Differences Redbook

Publication now available: Publication # SG24-7910



Why should clients move up to AIX 7 or AIX 6

- More performance on POWER7
  - *AIX 7 and AIX 6 can provide substantially more performance on POWER7 than AIX V5.3*
  - *AIX 7 supports massive workloads with up to 256 cores / 1024 threads*
- AIX V5.3 is nearing End of Life
  - *End of Marketing announced effective April 2011*
- Access to new features
  - *Capabilities like WPARs, Role Based Access Control, AIX Profile Manager are designed to improve security and administrative efficiency*
- AIX 7 will support running AIX 5.2 in a WPAR
  - *Excellent way to consolidate old workloads running on less efficient hardware*
- It's FREE!
  - *Customers with software maintenance agreements (SWMA) can upgrade for no additional charge within an Edition:* AIX 5.3 to AIX 7 Standard edition, *AIX 6 Express Edition to AIX 7 Express Edition, etc,*

Release strategy changes & future directions

2011 AIX release strategy changes

IBM significantly enhanced the AIX® Release and Service Delivery strategy in February 2011 for AIX 6 and AIX 7

The principal changes are:*

- ***Three years of support for each Technology Level (TL)*****
- ***A single Technology Level per AIX version, per year***
- ***Service Packs will be released approximately 4 times per year per Technology Level***

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****Due to variations in the release dates of Technology Levels from year to year, some Technology Levels will be supported for slightly more than three years and some will be supported for slightly less than three years. A three year service life for each Technology Level is an objective, not an absolute limit. The service life of Technology Levels will also be limited by the end of service life for the underlying AIX release**

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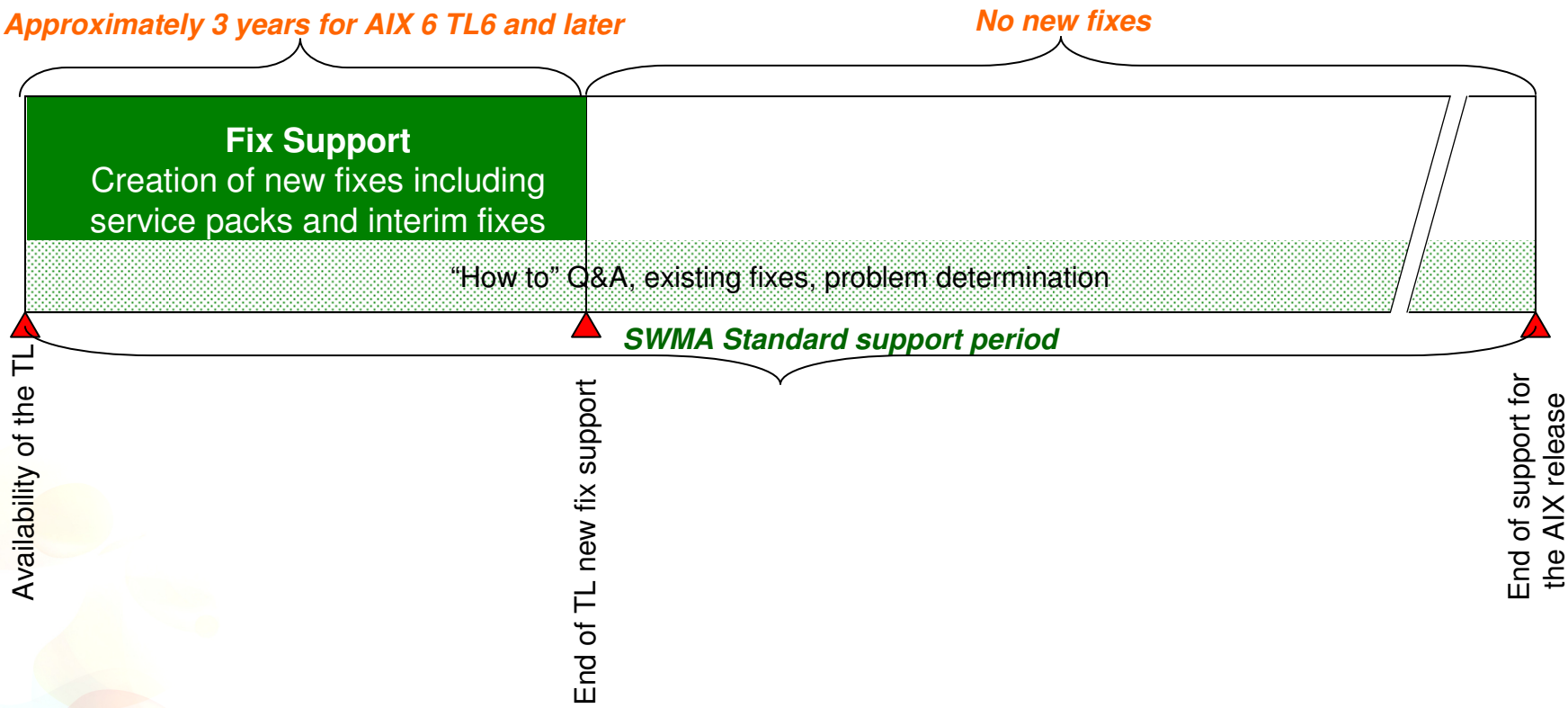
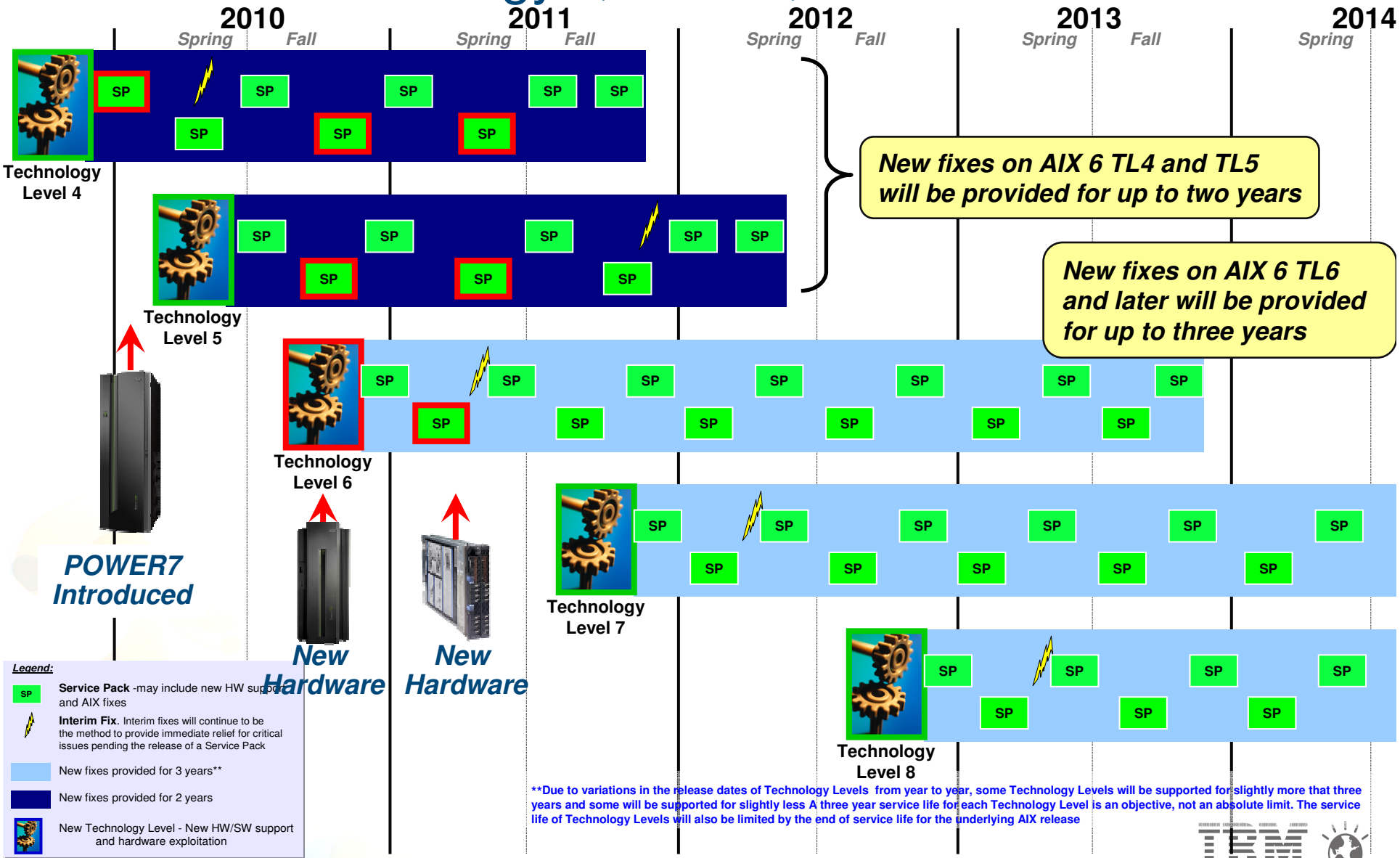
AIX Technology Level Lifecycle



AIX Release Strategy* (AIX 6 shown)



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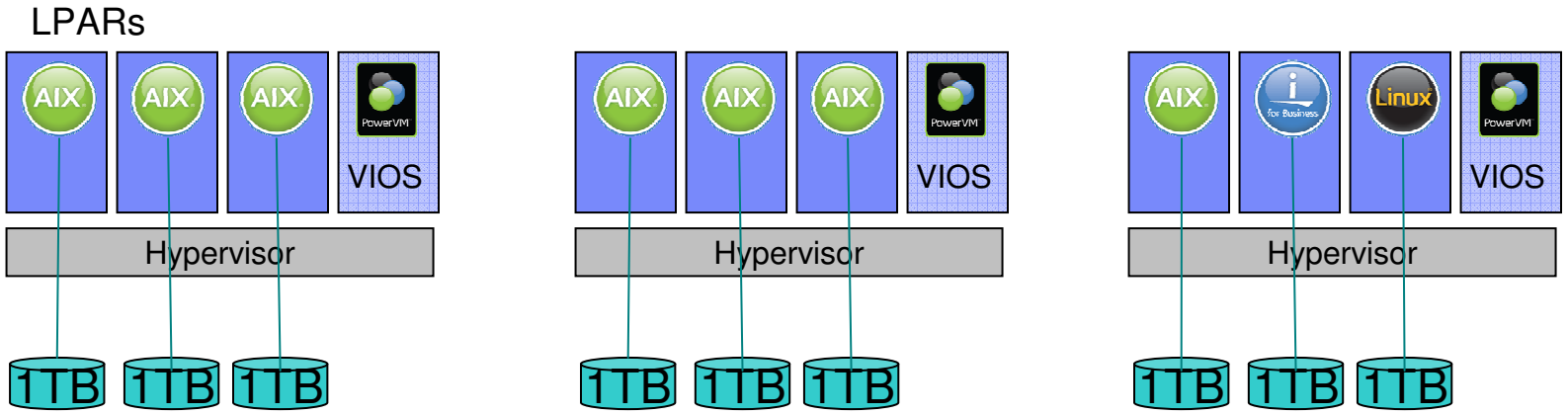
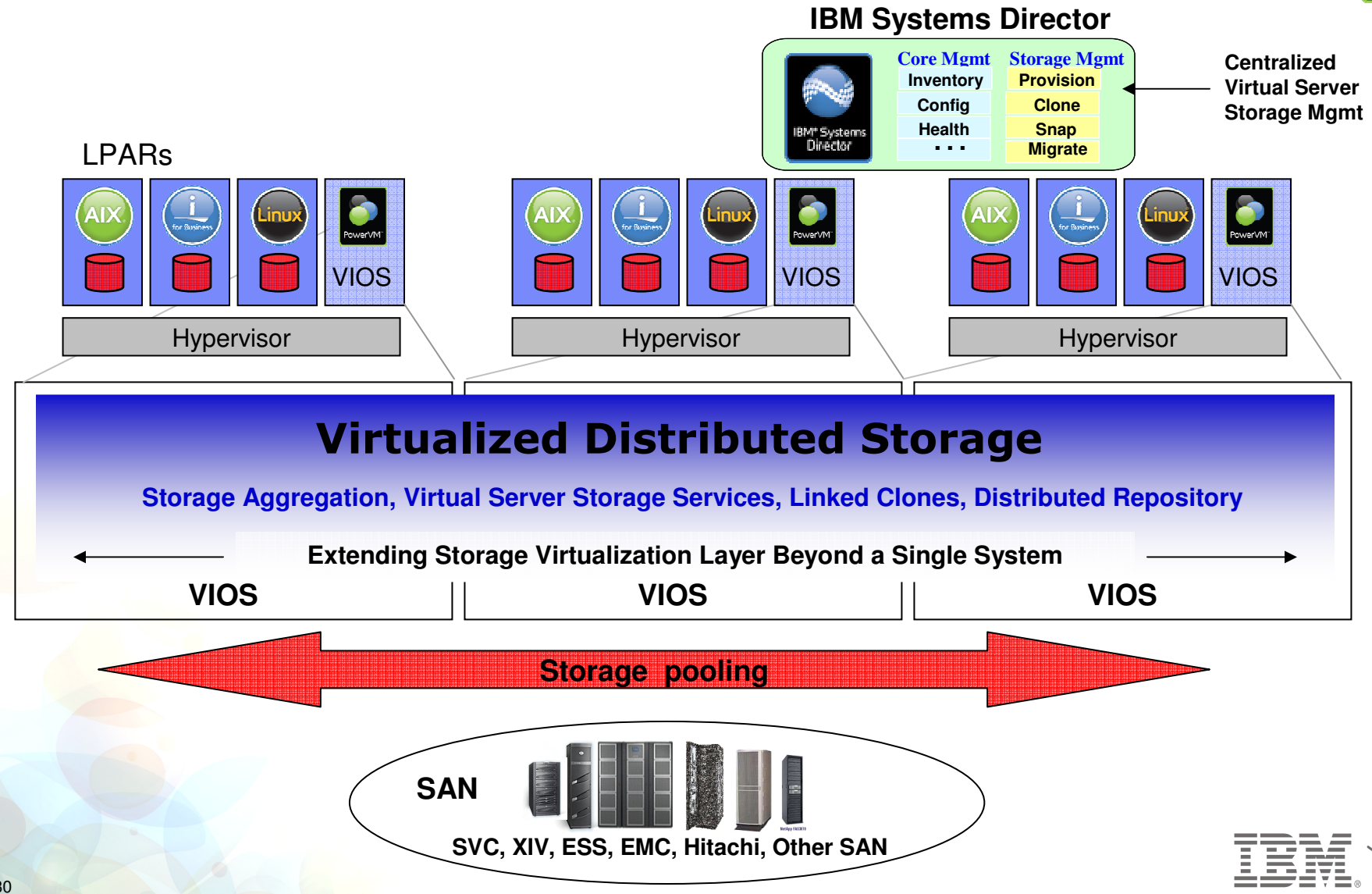
Standard storage provisioning for Power LPARs



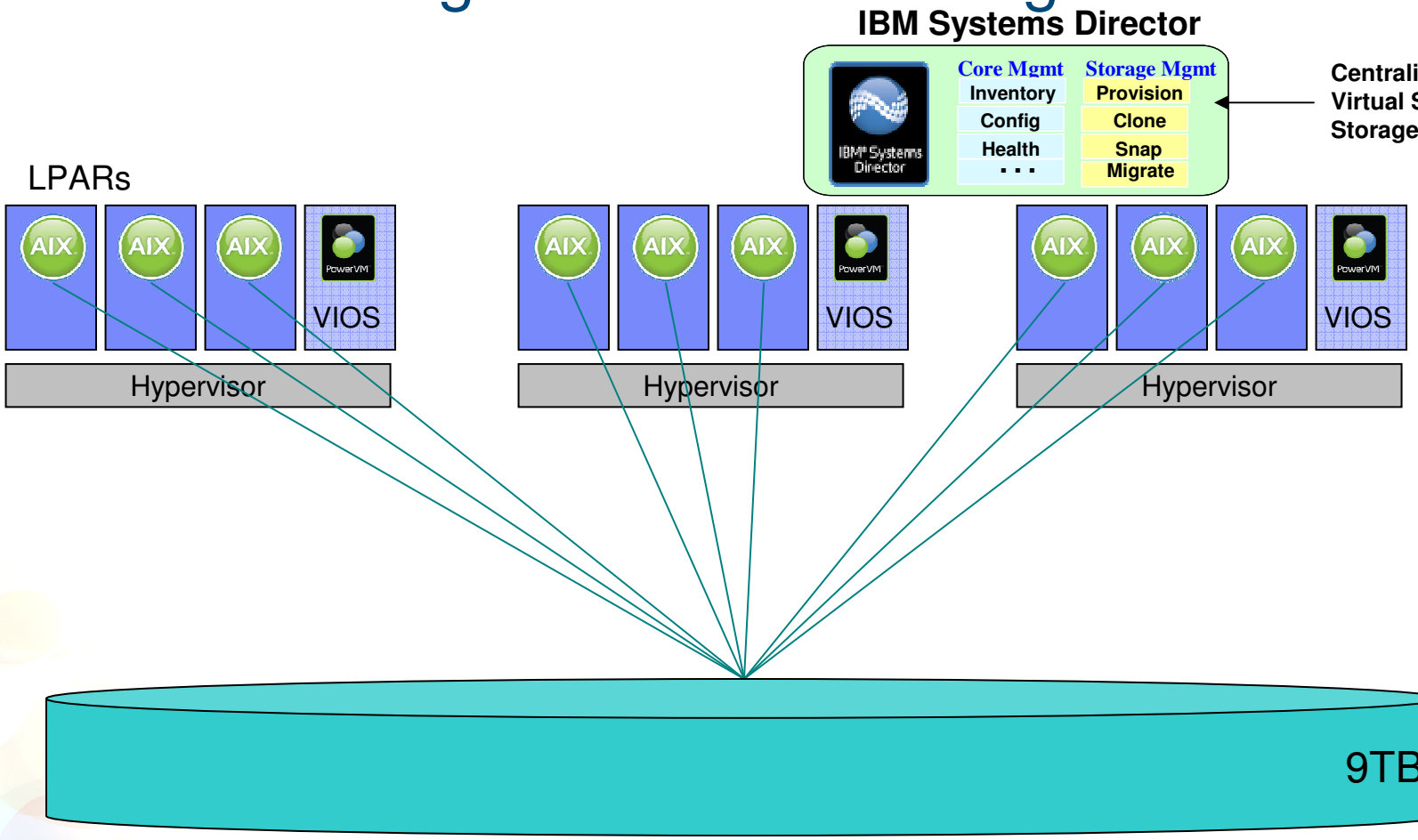
Steps to provision a new LPAR

1. System Admin configure LPAR with HMC/SDMC
2. SAN admin allocates SAN lun
3. Network admin allocates network addresses
4. System Admin configures VIOS for SAN and network for client
5. System Admin provisions AIX image
6. Application Admin provisions application on top of new LPAR

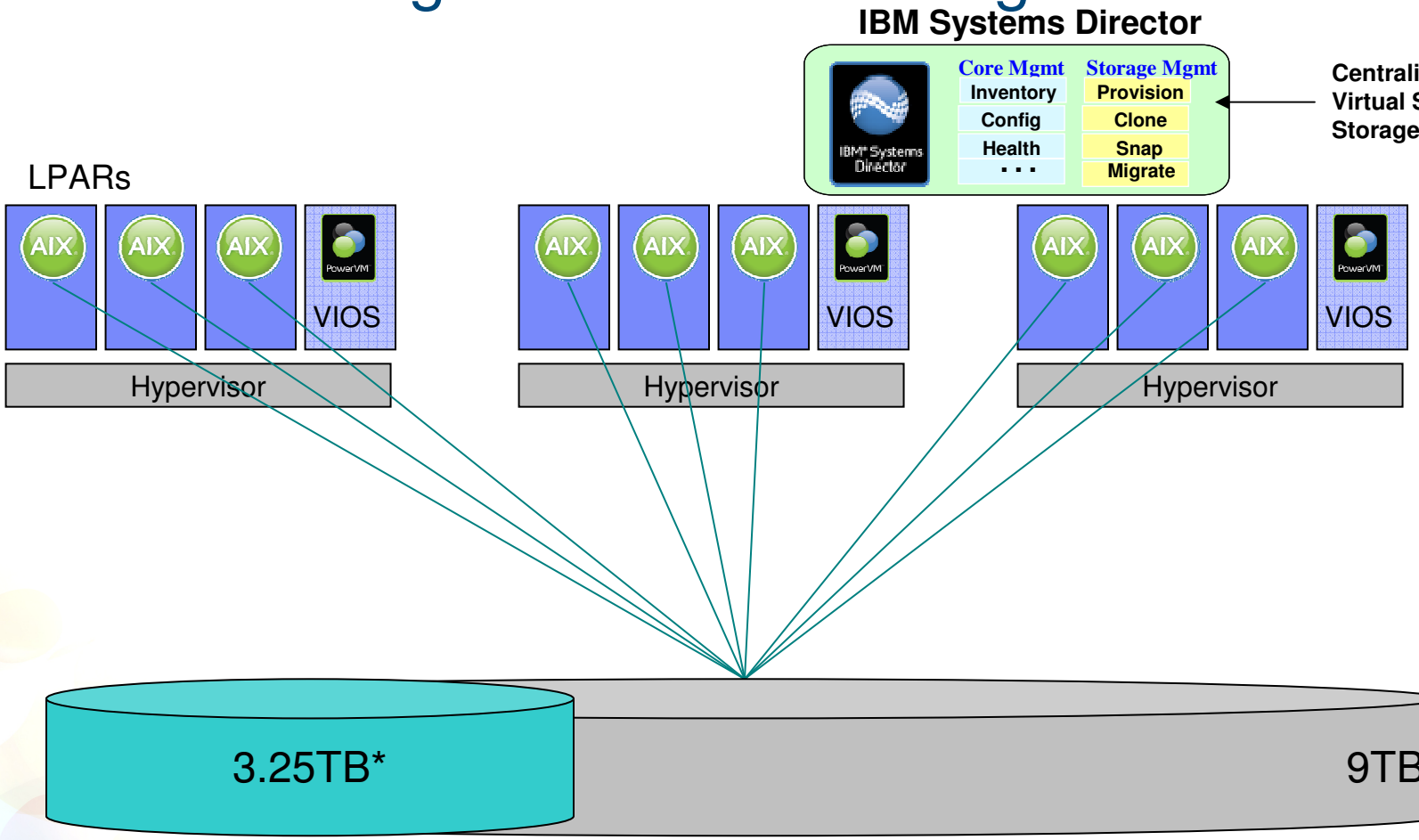
VIOS Shared Storage Pools (4Q 2011)



Thick Provisioning with Shared Storage Pools

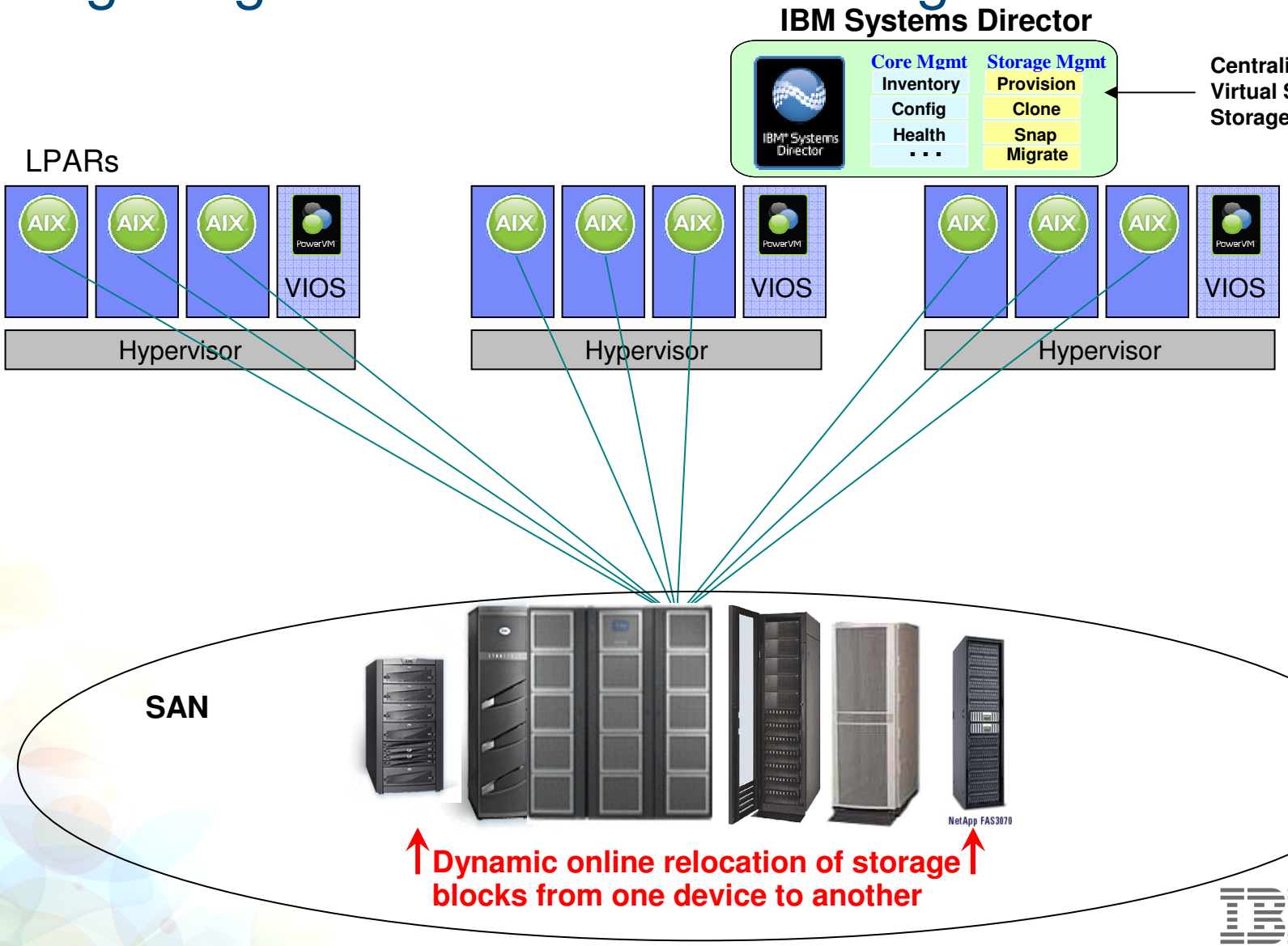


Thin Provisioning with Shared Storage Pools



* Actual amount of storage savings will vary widely

Storage migration with Shared Storage Pools



PowerSC Standard Edition

PowerSC provides a security and compliance solution to protect datacenters virtualized with PowerVM enabling higher quality services

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 (PowerSC Express)
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

PowerSC Express Edition

PowerSC Express Edition is designed to simplify IT compliance

- Features:
  - *Easily set dozens of AIX security configuration settings to match compliance standards*
  - *Provides pre-configured security profiles with recommended system settings for:*
    - The **Payment Card Industry Data Security Standard Version 2 (PCI DSS)**
    - The **US Department of Defense Security Technical Implementation Guide for UNIX (DODSTIG)**
    - The **Control Objectives for In-formation and related Technology (COBIT™)**
  - *Integrated with AIX Profile Manager to distribute profiles*
  - *Reports that show whether the system configuration matches the compliance standard*
  - *Support for AIX 7, AIX 6 and AIX V5.3*

- Potential Benefits:
  - *Designed to simplify the effort of maintaining system configuration for compliance*
  - *Preconfigured profiles facilitate standardization and easy implementation and potentially reduce the amount of administrative effort to interpret standards*
  - *Compliance reports may be used to provide a basis for audit activity*

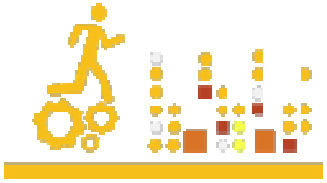
Note: *Almost all compliance standards include procedural elements that are outside the scope of system configuration settings. The IBM Compliance Expert Express Edition can potentially simplify compliance efforts, but it cannot, by itself, enforce compliance.*

PowerSC PCI profile - example content

Payment Card Industry Data Security Standard V2

Rule	Description	PCI Guide
Crontab permissions	Verifies that root cron jobs are owned and writeable only by root.	Section 2.2.4
Disable fingerd in /etc/inetd.conf	Comments out the entry for fingerd daemon from /etc/inetd.conf	Section 1.1.5
Disable unsecure commands	rlogin, tftp, rcp, rsh	Section 1.1.5b, Section 2.3
Disable X-Server access	Not useful. Runs xhost – to (temporarily) disable X-Server access for root	Secttion 2.2.4
Enable uucpd in /etc/inetd.conf	Comments out the entry for uucpd daemon in /etc/inetd.conf	Section 1.1.5
Guard host against port scans	shuns vulnerable ports for 5 mins to guard the host against port scans	Section 1.1.5(a,b) and Section 1.2.1(a,b)
Network Allowed Ports	Allows inbound/outbound traffic for only a range or set of ports, and denies all other port traffic	Section 1.2.1
Network option clean_partial_conns	Avoid SYN attacks clean_partial_conns=1	Section 1.3.6
Remove dot from non-root path	Remove current directory from $PATH for non-root users in the files: ~/.profile, ~/.kshrc, ~/.cshrc, ~/.login	Section 2.2.4
Remove guest account	Remove guest account & files (/home/guest)	Section 2.2.4
Root Password Integrity Check	Check roots password against english dictionary	Section 8 Requirements
security.login.disable	Defines the number of unsuccessful login attempts allowed before the port is locked.	8.5.13 Limit repeated access attempts by locking out the user ID after not more than six attempts.
security.login.retries	Sets the number of failed login attempts to a non-root account before it is locked.	8.5.13 Limit repeated access attempts by locking out the user ID after not more than six attempts.
security.password.histsize	Specifies the number of previous passwords that user cannot reuse	Section 8.5.12 Do not allow an individual to submit a new password that is the same as any of the last 4 passwods he or she has used.
security.password.maxage	Specifies the maximum number of weeks before a password can be changed	Section 8.5.9 Change user passwords at least every 90 days.
security.validate.grpck	Verifies the correctness of group definitions. (grpck -y ALL; grpck -n ALL)	Section 8.2.In addition to assigning a unique ID, employ atleast one of the following menthods to authenticate all users. Password or passphrase , Two-factor authentication
System Idle time in minutes	If the system has been idle for some time, require the user to re-enter the password to reactivate the terminal.	Section 8.5.15 If a session has been idle for more than 15 minutes, require the user to reenter the password to reactivate the terminal

PowerHA SystemMirror Enhancements



Deliver new services faster

SAP LiveCache hot standby

– Fast failover for SAP

Deliver higher quality services

Federated Security

– Centralized cluster wide security management

Deliver services with superior economics

Editions grow in value with each product release

– XIV and v7000 support with PowerHA 6.1 EE on AIX

– SVC and v7000 support with PowerHA 7.1 EE on IBM i

– 5 year life cycle for PowerHA System Mirror 7.1 on AIX

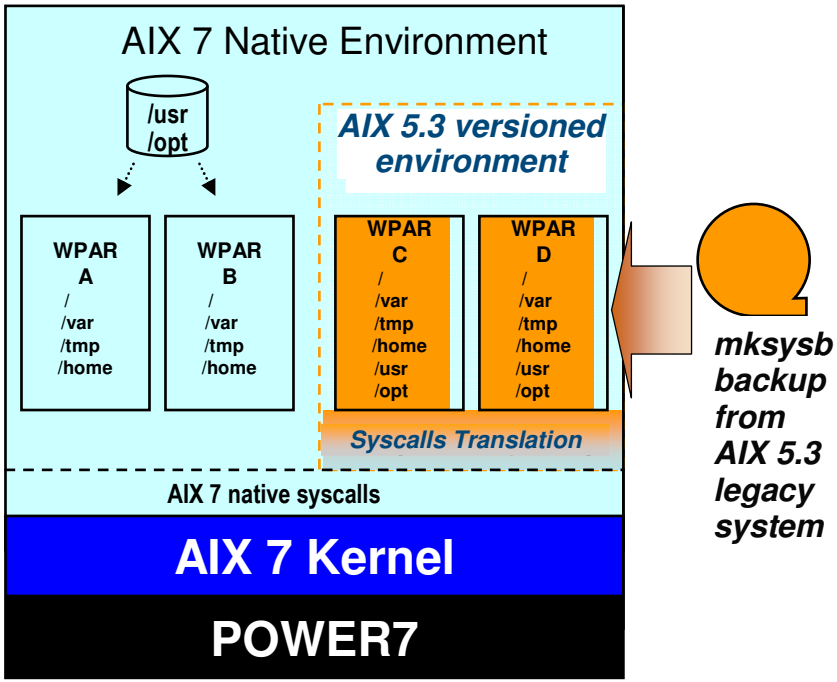
AIX 5.3 WPARs for AIX 7

New offering designed to simplify consolidation of AIX 5.3 environments

✓ *Minimize effort to consolidate old environments on new, more efficient hardware*

✓ *Allows clients who must stay on AIX V5.3 to better advantage of POWER7*

- *Allows a legacy AIX 5.3 environment to be run inside a WPAR on POWER7 processor-based systems with AIX 7*
  - Simply back up existing environment and restore inside of an AIX 7 WPAR
- *Processes run at full speed – no instruction translation is involved*
- *Includes how-to and limited defect support for the AIX 5.3 operating system running in the WPAR*
  - Does not require legacy extended support
- Mobility is supported
- Can be managed via IBM Systems Director Workload Partitions Manager



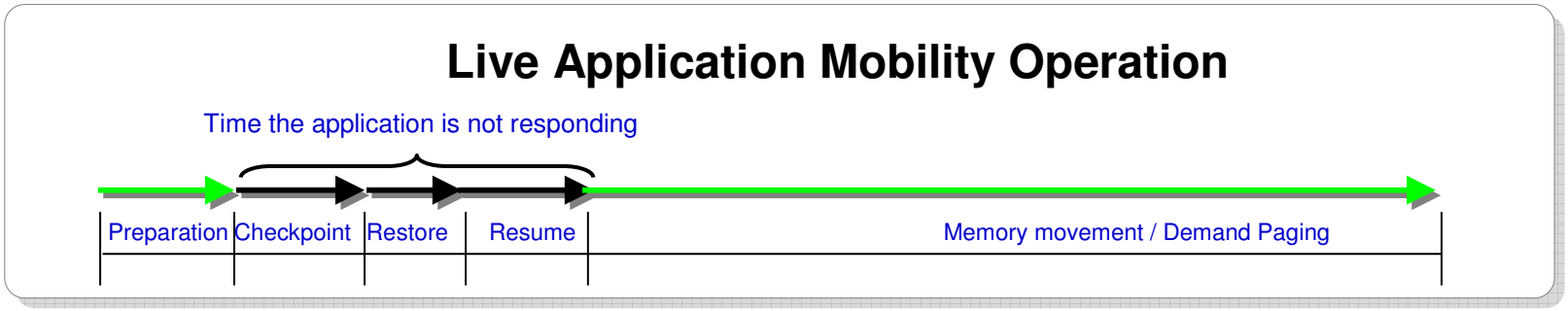
AIX 5.3 WPARs for AIX 7 will be a separately charged product built on AIX 7

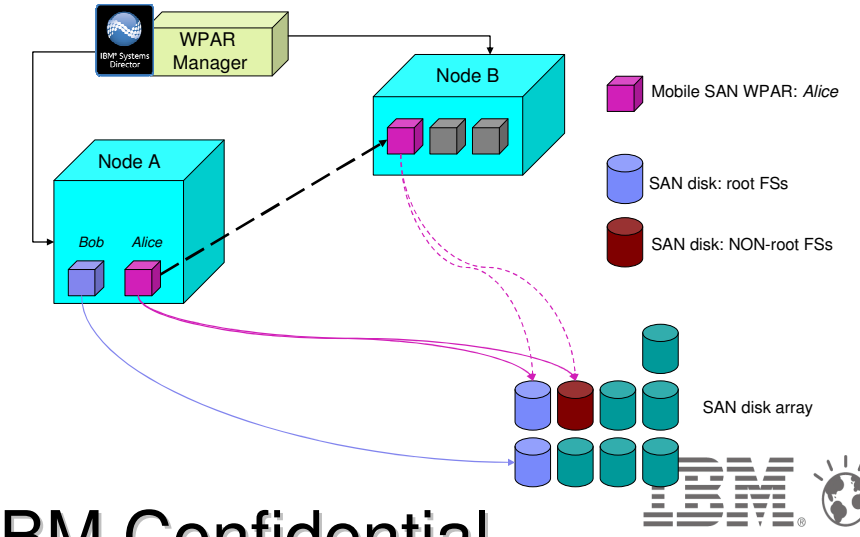
2011 AIX Enhancement Areas

- **Performance and Scalability**
  - *50% less JFS2 memory footprint for metadata (7.1.1 only)*
  - *JFS2 non-disruptive remount for the rbr and rbw mount options for improved sequential read or write performance*
  - *Improvements in loopback communications between processes in the same AIX instance*
- **Security**
  - *LDAP hosted per user authentication policy - the module to use for authenticating a user can be placed in a remote user repository like LDAP*
  - *LDAP hosted RBAC Domain policy*
- **System Tools**
  - *AIX Profile Manager support for customer developed controls*
  - *AIX Profile Manager support for PowerSC Express compliance profiles*
  - *mksysb restore performance*
  - *ProbeView enhancements*
- **Open Standards and Open Source**
  - *Designed to Single Unix Specification version 4 support (AIX 7.1.1 only)*
  - *Enhancements for beyond year 2038 support (system date can be set beyond 2038)*
  - *USGv6 IPv6 Certification*
    - AIX 6 TL5 and beyond
    - AIX 7 TL0 and beyond
- **Availability**
  - *LVM resiliency with failing I/O (chvg –O)*
- **Workload Partitions**
  - *SAN-based Live Application Mobility Performance*

WPAR Live Application Mobility Performance Enhanced

- Significant reduction in the length of time application is not responding during Live Application Mobility with SAN devices

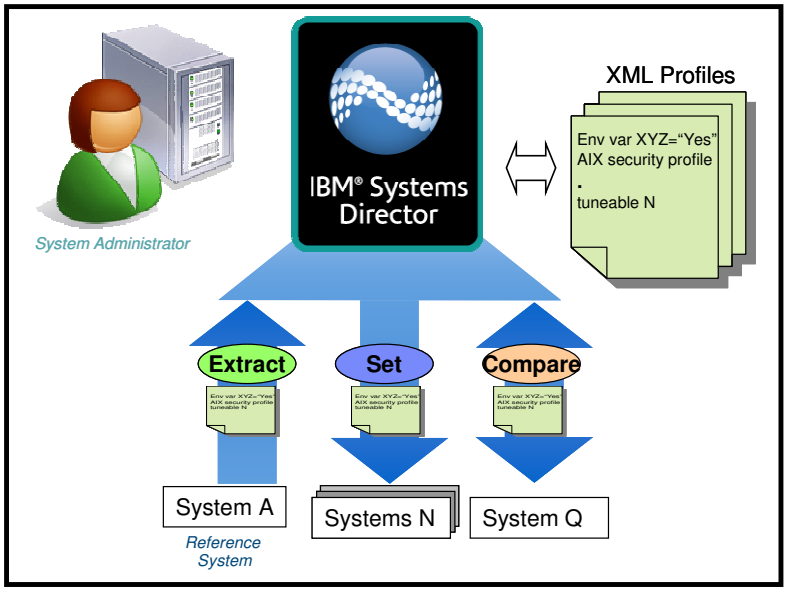




AIX 7 Profile Manager Enhancements

Systems Director plug-in that is designed to simplify consistent AIX configuration across multiple systems

- APIs documented to allow you to control settings outside of AIX
- Profile Manager now used for PowerSC Express Edition



mksysb enhancements

- Performance enhancement
  - *Automatically disables JFS logging during restore*
  - *Significant performance improvement seen*
  - *First delivered in AIX 6.1 TL6 and AIX 7 TL0*
  - *Added to alt_disk_install in AIX 6.1 TL7 and AIX 7 TL1*

- mksysb “-P” flag to automatically exclude files from compression
  - *Files to be excluded are in /etc/exclude_packing.<vgname>*

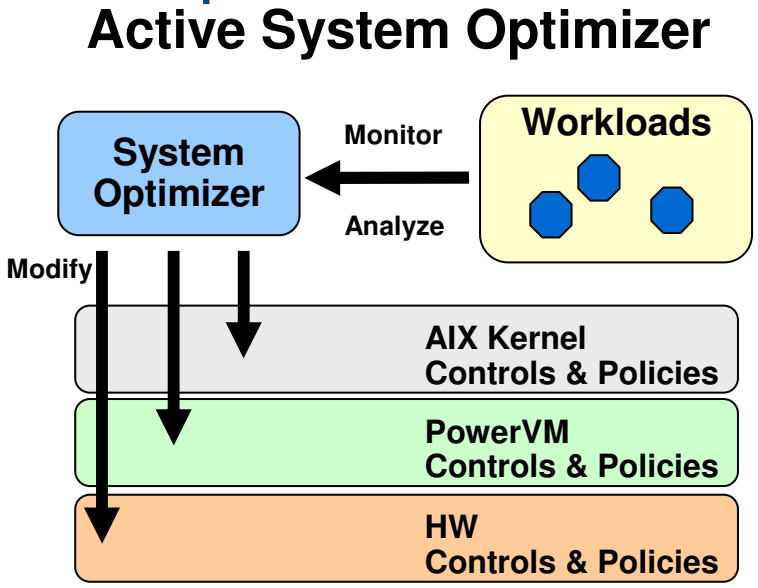
Today's System Performance Challenges

- Workloads are becoming more complex
  - *Mix of single threaded and multithreaded applications*
  - *Workload consolidation*
  - *Workload interdependencies*
- Servers are becoming more complex
  - *Larger numbers of cores*
  - *Larger number of threads*
  - *NUMA effects can dramatically affect performanc*
  - *Mobility can fragment server resources*

- System Administrators
  - *Very deep technology knowledge needed to manage these issues*
  - *Expectations are that systems should just "work"*

New approaches to system performance are needed that address both operating system and server optimization

AIX Active System Optimizer



Active System Optimizer profiles and analyses running workloads to dynamically tune system capabilities on a per workload basis

- Runtime workload monitoring and analysis
- Optimization via dynamic adjustment of system policies
- Autonomic and transparent

AIX 7 – *The Future of UNIX*

GRACIAS

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Any performance data contained in this document was determined in a controlled environment. Actual results may vary significantly and are dependent on many factors including system hardware configuration and software design and configuration. Some measurements quoted in this document may have been made on development-level systems. There is no guarantee these measurements will be the same on generally-available systems. Some measurements quoted in this document may have been estimated through extrapolation. Users of this document should verify the applicable data for their specific environment.

Revised September 26, 2006

Special notices (cont.)

Revised February 9, 2010

Notes on benchmarks and values

The IBM benchmarks results shown herein were derived using particular, well configured, development-level and generally-available computer systems. Buyers should consult other sources of information to evaluate the performance of systems they are considering buying and should consider conducting application oriented testing. For additional information about the benchmarks, values and systems tested, contact your local IBM office or IBM authorized reseller or access the Web site of the benchmark consortium or benchmark vendor.

IBM benchmark results can be found in the IBM Power Systems Performance Report at http://www.ibm.com/systems/p/hardware/system_perf.html .

All performance measurements were made with AIX or AIX 5L operating systems unless otherwise indicated to have used Linux. For new and upgraded systems, AIX Version 4.3, AIX 5L or AIX 6 were used. All other systems used previous versions of AIX. The SPEC CPU2006, SPEC2000, LINPACK, and Technical Computing benchmarks were compiled using IBM's high performance C, C++, and FORTRAN compilers for AIX 5L and Linux. For new and upgraded systems, the latest versions of these compilers were used: XL C Enterprise Edition V7.0 for AIX, XL C/C++ Enterprise Edition V7.0 for AIX, XL FORTRAN Enterprise Edition V9.1 for AIX, XL C/C++ Advanced Edition V7.0 for Linux, and XL FORTRAN Advanced Edition V9.1 for Linux. The SPEC CPU95 (retired in 2000) tests used preprocessors, KAP 3.2 for FORTRAN and KAP/C 1.4.2 from Kuck & Associates and VAST-2 v4.01X8 from Pacific-Sierra Research. The preprocessors were purchased separately from these vendors. Other software packages like IBM ESSL for AIX, MASS for AIX and Kazushige Goto's BLAS Library for Linux were also used in some benchmarks.

For a definition/explanation of each benchmark and the full list of detailed results, visit the Web site of the benchmark consortium or benchmark vendor.

TPC	http://www.tpc.org
SPEC	http://www.spec.org
LINPACK	http://www.netlib.org/benchmark/performance.pdf
Pro/E	http://www.proe.com
GPC	http://www.spec.org/gpc
VolanoMark	http://www.volano.com
STREAM	http://www.cs.virginia.edu/stream/
SAP	http://www.sap.com/benchmark/
Oracle Applications	http://www.oracle.com/apps_benchmark/
PeopleSoft - To get information on PeopleSoft benchmarks, contact PeopleSoft directly	
Siebel	http://www.siebel.com/crm/performance_benchmark/index.shtm
Baan	http://www.ssaglobal.com
Fluent	http://www.fluent.com/software/fluent/index.htm
TOP500 Supercomputers	http://www.top500.org/
Ideas International	http://www.ideasinternational.com/benchmark/bench.html
Storage Performance Council	http://www.storageperformance.org/results

Revised March 12, 2009

Notes on HPC benchmarks and values

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SPEC	http://www.spec.org
LINPACK	http://www.netlib.org/benchmark/performance.pdf
Pro/E	http://www.proe.com
GPC	http://www.spec.org/gpc
STREAM	http://www.cs.virginia.edu/stream/
Fluent	http://www.fluent.com/software/fluent/index.htm
TOP500 Supercomputers	http://www.top500.org/
AMBER	http://amber.scripps.edu/
FLUENT	http://www.fluent.com/software/fluent/fl5bench/index.htm
GAMESS	http://www.msg.chem.iastate.edu/gamess
GAUSSIAN	http://www.gaussian.com
ANSYS	http://www.ansys.com/services/hardware-support-db.htm Click on the "Benchmarks" icon on the left hand side frame to expand. Click on "Benchmark Results in a Table" icon for benchmark results.
ABAQUS	http://www.simulia.com/support/v68/v68_performance.php
ECLIPSE	http://www.sis.slb.com/content/software/simulation/index.asp?seg=geoquest&
MM5	http://www.mmm.ucar.edu/mm5/
MSC.NASTRAN	http://www.mscsoftware.com/support/prod%5Fsupport/nastran/performance/v04_sngl.cfm
STAR-CD	www.cd-adapco.com/products/STAR-CD/performance/320/index/html
NAMD	http://www.ks.uiuc.edu/Research/namd
HMMER	**http://hmmer.janelia.org/** http://powerdev.osuosl.org/project/hmmerAltivecGen2mod

Revised March 12, 2009

Notes on performance estimates

rPerf for AIX

rPerf (Relative Performance) is an estimate of commercial processing performance relative to other IBM UNIX systems. It is derived from an IBM analytical model which uses characteristics from IBM internal workloads, TPC and SPEC benchmarks. The rPerf model is not intended to represent any specific public benchmark results and should not be reasonably used in that way. The model simulates some of the system operations such as CPU, cache and memory. However, the model does not simulate disk or network I/O operations.

- rPerf estimates are calculated based on systems with the latest levels of AIX and other pertinent software at the time of system announcement. Actual performance will vary based on application and configuration specifics. The IBM eServer pSeries 640 is the baseline reference system and has a value of 1.0. Although rPerf may be used to approximate relative IBM UNIX commercial processing performance, actual system performance may vary and is dependent upon many factors including system hardware configuration and software design and configuration. Note that the rPerf methodology used for the POWER6 systems is identical to that used for the POWER5 systems. Variations in incremental system performance may be observed in commercial workloads due to changes in the underlying system architecture.

All performance estimates are provided "AS IS" and no warranties or guarantees are expressed or implied by IBM. Buyers should consult other sources of information, including system benchmarks, and application sizing guides to evaluate the performance of a system they are considering buying. For additional information about rPerf, contact your local IBM office or IBM authorized reseller.

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CPW for IBM i

Commercial Processing Workload (CPW) is a relative measure of performance of processors running the IBM i operating system. Performance in customer environments may vary. The value is based on maximum configurations. More performance information is available in the Performance Capabilities Reference at: www.ibm.com/systems/i/solutions/perfmgmt/resource.html

Revised April 2, 2007