



# Virtualization

(with Robustness, Performance & Security)

*AIX6.1: The Next Step in  
the Evolution of UNIX*

**Joefon Jann,**  
*Distinguished Engineer  
IBM T.J.Watson Research Center  
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## Agenda

### AIX Virtualization Features & the Values they bring to Customers:

1. (LPAR) Dedicated Static LPARs
2. (DLPAR) Dedicated Dynamic LPARs
3. (SPLPAR) Shared Processor LPARs
4. (SMT) Simultaneous MultiThreads
5. (WPAR) Workload Partitions – a) System WPAR, b) Application WPAR
6. Partition Mobility -- a) WPAR Mobility, b) LPAR Mobility
7. Latest Virtualization Features
  - VIOS Virtual Tape Support
  - (NPIV) N\_Port ID Virtualization for SAN
  - (AMS) Active Memory Sharing
- Industry-Leading UNIX Virtualization, Performance, Robustness, plus Security & a rich set of Systems Management Tools
  - AIX Enterprise Edition for Manageability (includes WPAR Mgr, TADDM, ITM, TUAM )
  - Migration Factory
- Highlights of AIX Leadership – *Virtualization, Robustness & Performance*
- Some handy AIX URLs

# IBM's History of Virtualization Leadership



*40 years of Virtualization tradition culminates with PowerVM*



IBM developed <b>CP67-OS</b> that later became <b>VM/370</b> on the z-mainframe	IBM announced 1st machines with <b>physical partitioning</b>	IBM announced <b>LPAR on the z-mainframe</b>	IBM announced <b>LPAR on POWER4™</b>	IBM announced <b>DLPAR</b> with AIX5.2 on POWER4™	IBM announced <b>SPLPAR, SMT &amp; VIOS</b> with AIX5.3 on POWER5™	IBM announced AIX6 on POWER6™, the 1st UNIX® with Live <b>Partition Mobility WPARs</b> avail.	IBM announced <b>PowerVM</b>	IBM announced <b>AMS, NPIV, Virtual Tape</b>
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“In our opinion, the System p platform offers exceptionally high performance and availability in a very flexible package. We can quickly adapt to changing business conditions by activating additional processors or moving system resources from one partition to another – all without the delay and complexity of installing new hardware.”

*-- Clive Taylor, Head of Operations, Metavante Technologies Ltd  
March 2008*

Client quote source: Metavante Technologies Ltd case study published at [http://www-01.ibm.com/software/success/cssdb.nsf/CS/STRD-7CAKTE?OpenDocument&Site=eserverpseries&cty=en\\_us](http://www-01.ibm.com/software/success/cssdb.nsf/CS/STRD-7CAKTE?OpenDocument&Site=eserverpseries&cty=en_us)

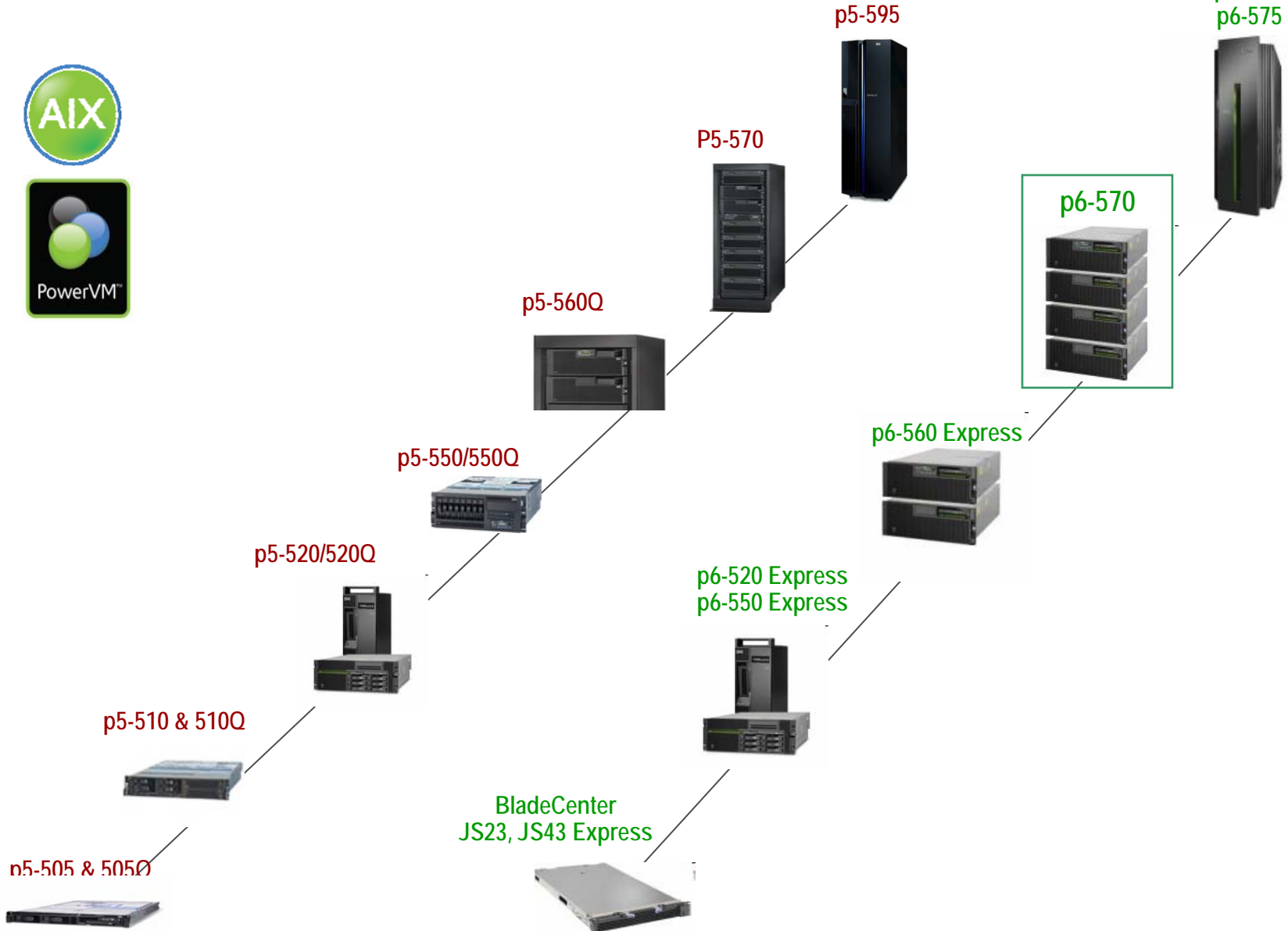
# Scale up, scale out, scale within

--- Run Much, Pay Little & Save Energy

## POWER5+

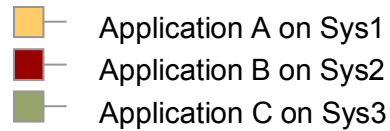
## POWER6

Future  
POWER7...



About a decade ago,  
many organizations run 1 application on 1 or more servers,  
*buying more servers than they needed:*

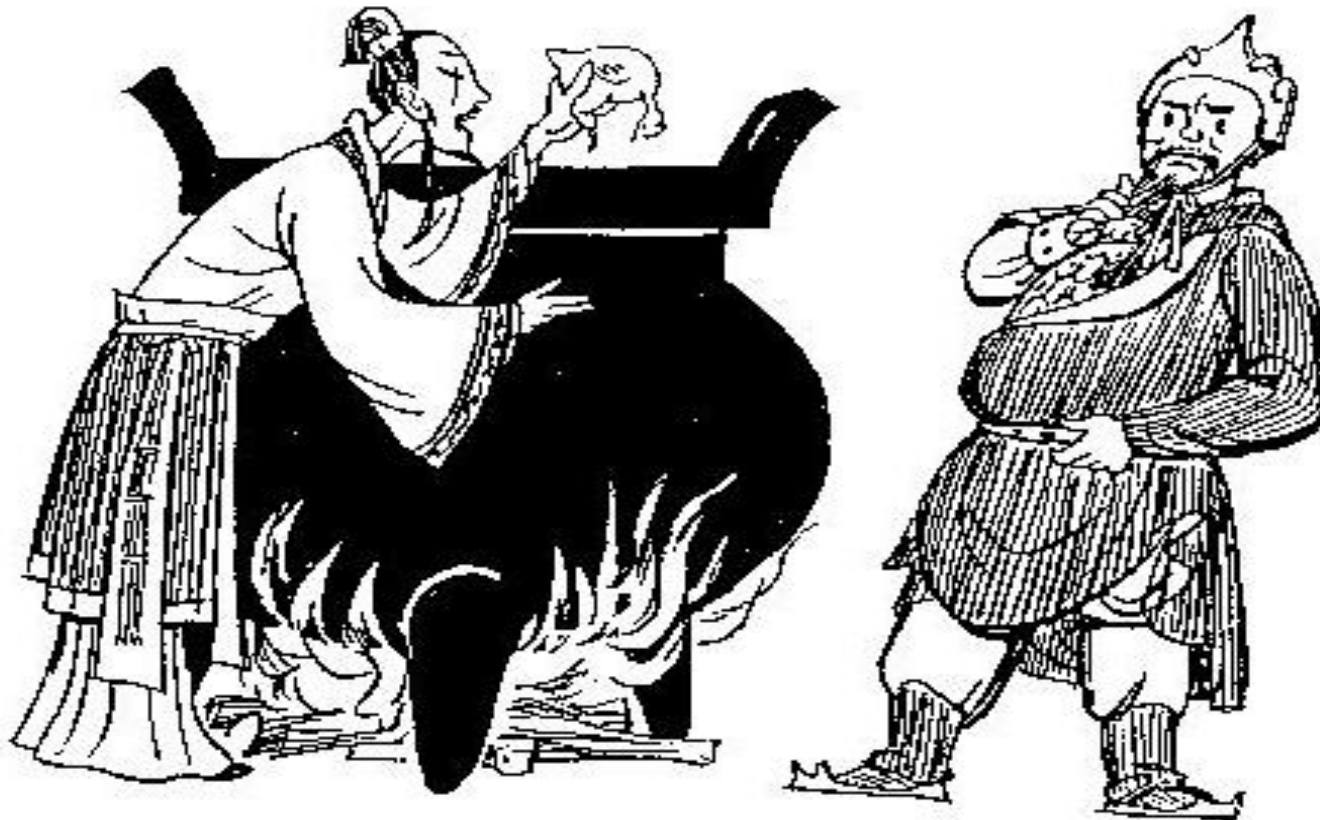
1. Wastes energy
2. Big footprint
3. Hard to manage



# Like Cooking a Chicken in a Pot meant for Stewing an OX

-- "History of Later Han Dynasty" by Fan Ye (398 – 445 AD)

牛鼎烹雞



1. Wastes fuel
2. Big footprint
3. Hard to manage

## *Then comes AIX pSeries Partitioning Innovations -- giving you more for your money*

In 2001 IBM introduced static LPAR on P4 systems, enabling:

### ■ Servers Consolidation

-- the workloads of several smaller servers can simply be placed into separate LPARs of an SMP, hence unifying and reducing system administration tasks.

### ■ Workloads Separation

-- Development, Testing, & Production Workloads can each run in its own Logical Partition.

### ■ running an Application at its optimal performance with the right amount of resources

-- without assigning excessive amounts of h/w resources e.g. the whole machine.

In 2002, IBM introduced DLPAR on P4 systems, enabling the following Autonomic features:

### *Self Protecting feature:*

**Dynamic CPU Guard** = graceful CPU de-configuration, for CPUs with intermittent errors.

### *Self Healing feature:*

**Dynamic CPU Sparing:** This is "Dynamic CPU Guard" feature enhanced with automatic enablement of a spare CPU to replace a defective CPU.

**Future hot-repair:** hot-plug MCM -- when the HW supports it in the future.

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## Benefits of DLPAR *cont'd*

### *Self Configuring feature:*

#### ■ DCUoD ( Dynamic Capacity Upgrade on Demand )

-- which allows shipped spare resources to be enabled after notifying IBM.

### *Self Optimizing feature:*

#### ■ DCOD ( Dynamic Capacity on Demand )

-- which enables us to mitigate peak-to-average workload differentials of the

LPARs, by dynamically moving real resources among a selected subset of LPARs, either

a) **manually** using HMC line-commands or using the HMC GUI

b) **dynamically** across LPARs by a Cross-LPAR Resource-Manager

(e.g. the "DLPAR Toolset for IBM pSeries" on Alphaworks, & later, the PLM Manager)

which triggers movements across LPARs, of appropriate amounts of resources,

based on user-specified time-schedule,

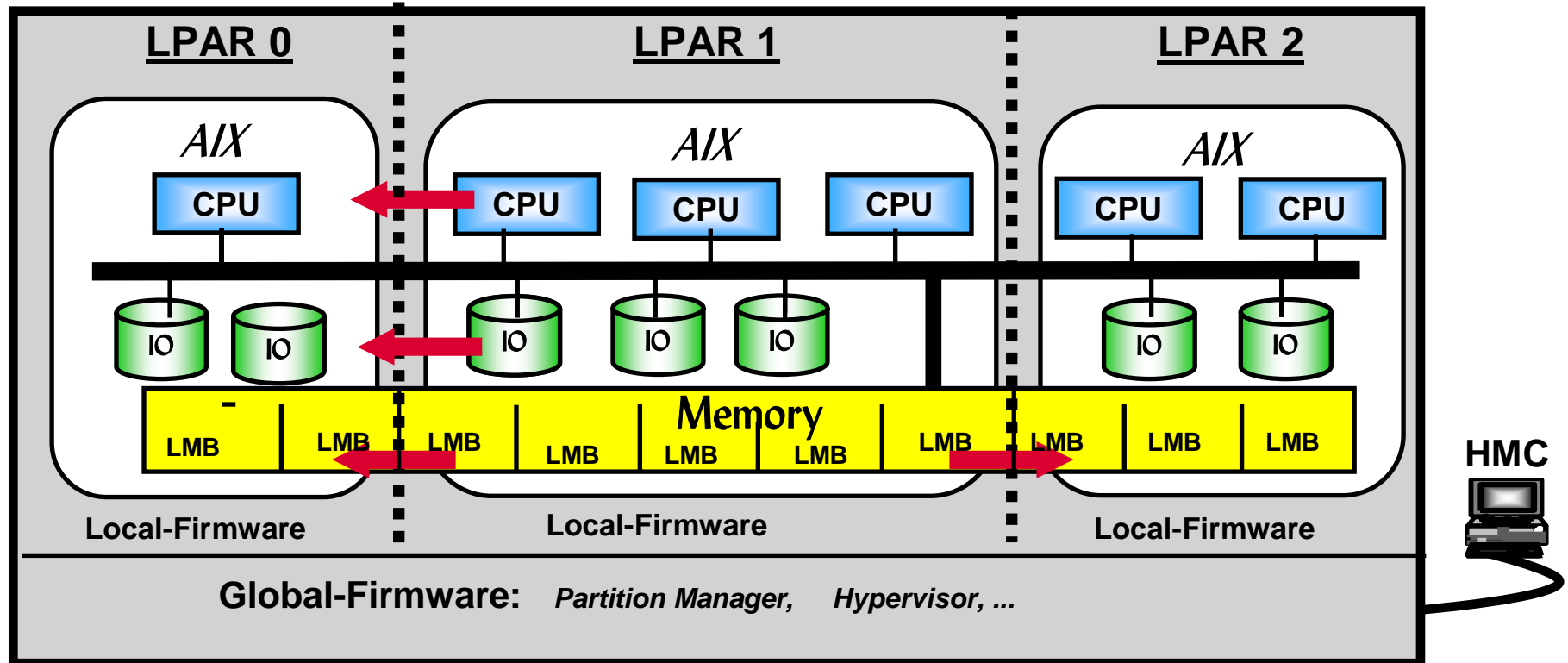
or

based on loads on the OSs in the LPARs.

Optionally, the user could specify weights to indicate the relative importance of the LPARs.

# Dynamic LPAR (DLPAR) Provides Instantaneous Resource Flexibility

SMP:



DLPAR is the system technology that allows you to move selected HW resources

from 1 OS instance to another, on a pSeries SMP, without requiring reboots.

The Granularity of resource movements are:

P4 and AIX 5.2 (GAed in 10/2002)

- ▶ Processor: 1 CPU
- ▶ Memory: 256MB-sized LMB (Logical Memory Block).
- ▶ IO: One IO-slot (PCI-slot)

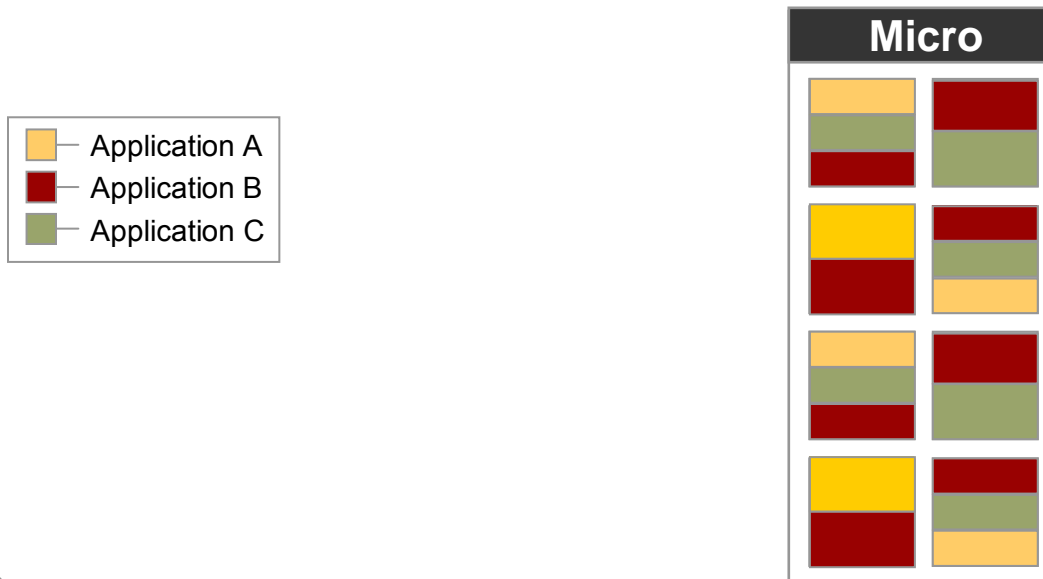
P5 and AIX 5.3 (GA in 8/2004)

- .1 CPU on P5 Systems (with the Adv. Power Virtualizatrtn feature).
- LMB size as small as 16 MB
- One IO-slot (PCI-slot) PLUS Virtual IO (ntwk & disks)

# SPLPARs or Micro-Partitioning *available since AIX 5.3 on P5*

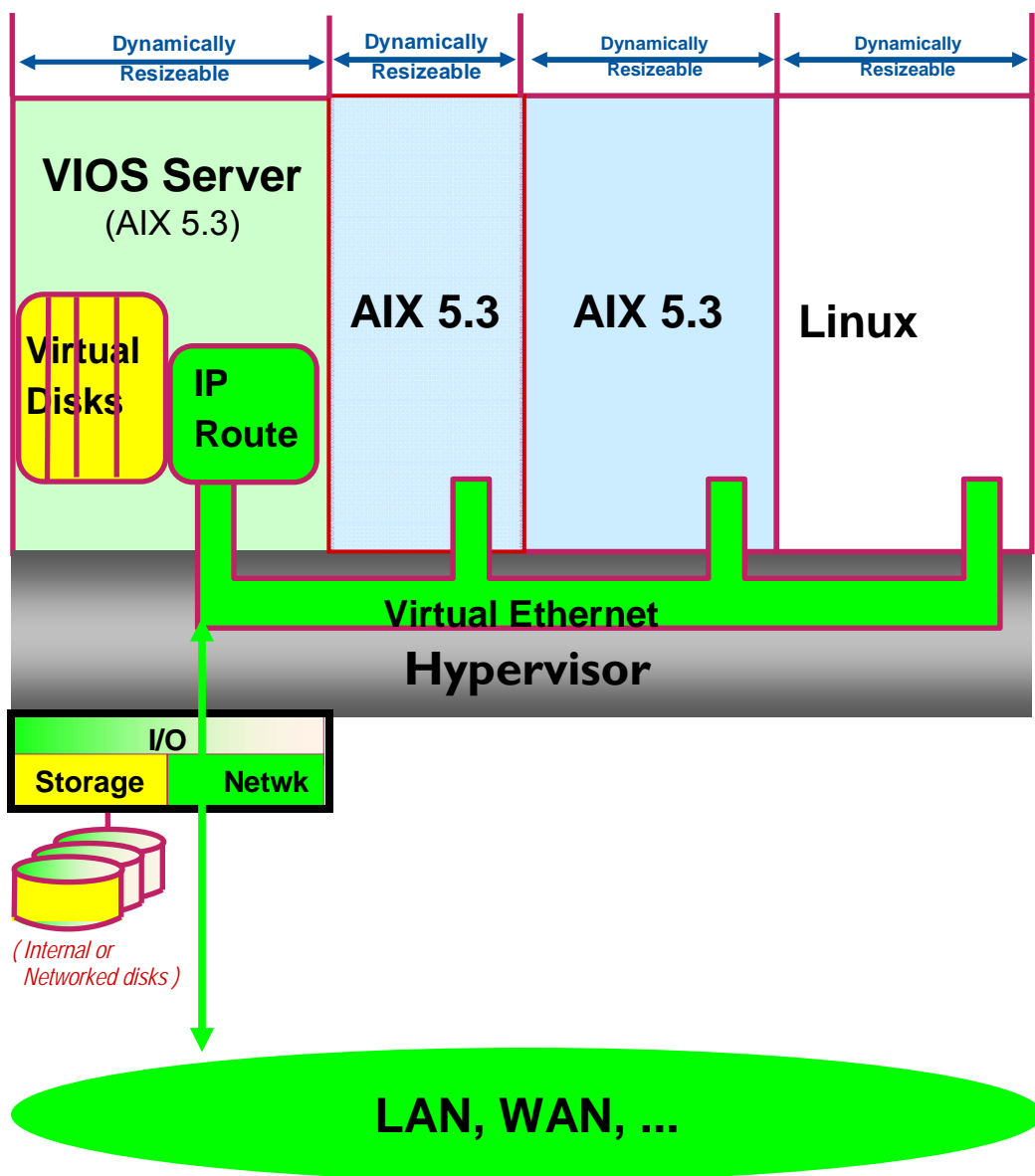
*-- enables you to run more work with a single server than ever before.*

- SPLPARs enables higher server utilization => **less cost**
- SPLPARs automatically & rapidly responds to changing needs => **less headaches**



## AIX on P5 Systems Increases Server Utilization & Reduces Cost

--- *with DLPAR plus SPLPAR, Virt-Ethernet, VIO & SMT*



### AIX 5.3 or 5.2H on P5 onward support:

#### -- DLPAR granularities:

- > Can Move as little as 1/10 of a CPU.
- > Can Move as small as 16 MB of Real memory (i.e. LMB size can be as small as 16 MB).
- > Can Move 1 IO-slot at a time

#### -- Virtual Ethernet

- > No real adapter needed between LPARs.
- > VIOS not required to use Veth.

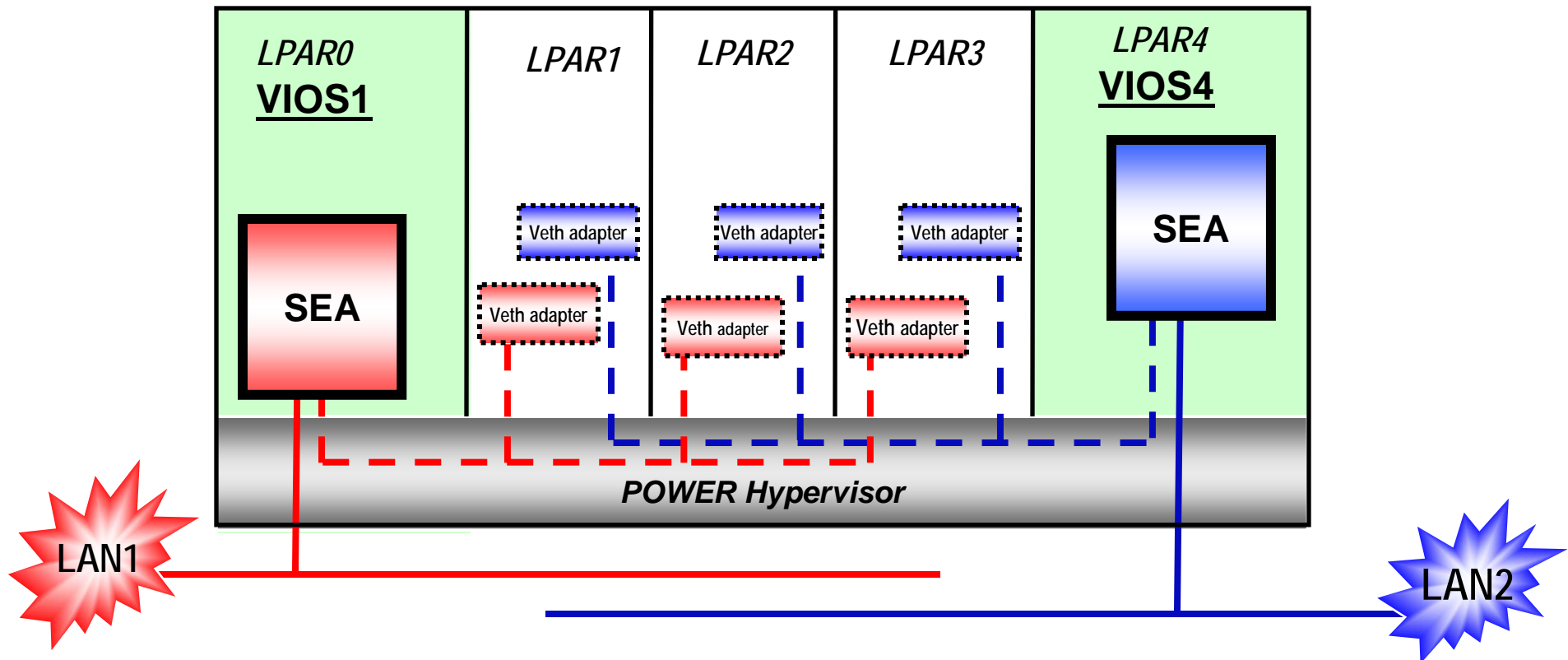
#### -- VIOS (Virtual I/O Server) LPAR provides support for

- > Shared disk via SCSI and Fiber Channel.
- > Shared ethernet to connect to other subnets.

#### -- SMT (Simultaneous MultiThreading) on P5 & P6 systems gives you 2 hw threads (Logical CPUs) with 1 physical-CPU enabling MOST applications to run much faster.

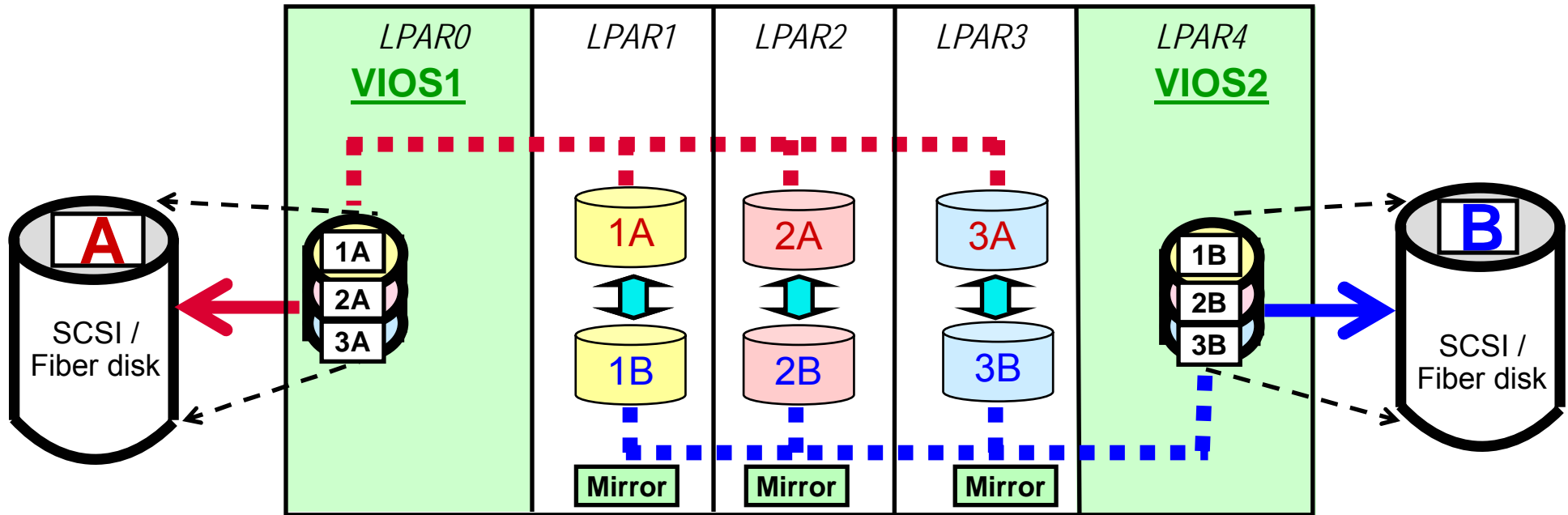
#### -- Max. 254 LPARs per CEC (Central Electronic Complex)

# Veths (Virtual Ethernet) & SEA (Shared Ethernet Adapter)



- Veth. performs like a standard Ethernet.
- Reduces # physical adapters needed, hence **saves you MONEY & headaches.**
- Can have multiple Vethernets per LPAR.
- IP forwarding / bridging is provided by VIOS LPAR.
- Each real adapter can support up to 16 virtual Ethernet LANs
- **The Second VIOS is OPTIONAL**, and provides connectivity even when the VIOS is down.
- Supported since AIX 5.3 on P5 onward.

## How Virtual I/O Disks Saves Money & Provides High Availability



### VIO Saves You Money

One VIOS real disk can appear as **multiple logical disks** to the client LPARs

### How VIO Provides High Availability:


1. Use **Redundant VIOS LPARs** to provide the logical disks.
2. Use **LVM mirroring** in a Client LPAR to replicate disks
3. **Result:** Client LPARs remain available when a disk, or even when one VIOS goes down.

## Counting Processors with SMT and (*DPLPAR* vs. *SPLPAR*) – an example



### Dedicated-Processor LPAR (*DPLPAR*)

**SMT on**




**# Logical Processors (8)**

- **SMT on:** 2 to 1 ratio with \ Virtual processors

or

**SMT off**




**# Logical Processors (4)**

- **SMT off:** 1 to 1 ratio with \ Virtual processors



**# Virtual Processors (4)**

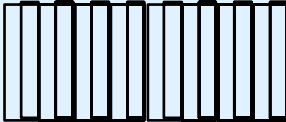
1 to 1 ratio with physical processors



**# Physical Processors (4)**

### Shared-Processor LPAR (*SPLPAR*)

**SMT on**




**# Logical Processors (80)**

- **SMT on:** 2 to 1 ratio with \ Virtual processors

or

**SMT off**




**# Logical Processors (40)**

- **SMT off:** 1 to 1 ratio with \ Virtual processors



**# Virtual Processors (40)**

Up to 10 to 1 ratio with physical processors



**# Physical Processors (4)**

AIX's view

PHYP's view

# AIX Evolution

1986-1992

1994-1996

1997-1999

2001-2002

2004-2005

2007-2009

AIX/6000



## AIX 2 & 3

Establishment in the market:

- RISC Support
- UNIX credibility
- Open Sys. Stds..
- Dynamic Kernel
- JFS and LVM
- SMIT

## AIX 3.2.5

Maturity:

- Stability
- Quality

## AIX 4.1/4.2

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

## AIX 4.3

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

## AIX 5L 5.1/5.2

Flexible Resource Management:

- POWER4+ spt.
- **Dynamic LPAR**
- **DCUoD, CPU Sparing**
- New 64bit kernel
- 512GB mem
- JFS2
- 16 TB filesystems
- UNIX03 branded
- Concurrent I/O
- MultiPath I/O
- Flex LDAP Client
- XSSO PAM spt

## AIX 5L 5.3

Advanced Virtualization:

- POWER5 support
- 64-way SMP
- SMT
- **MicroPartitions™**
- VIOS
- **Partition Load Mgr**
- NFS Version 4
- Adv. Accounting
- Scaleable VG
- JFS2 Dyn.Shrink
- SUMA
- SW RAS features
- POSIX Realtime

## AIX 6.1

- POWER6 support
- **WPAR Mobility**
- **LPAR Mobility**
- **AMS, NPIV, Virt Tape**
- **Enterprise RAS / Continuous Availab.**
  - Storage Keys
  - Dynamic tracing
  - Software FFDC
  - Recovery Rtns
  - Concur.kern.Update
- RBAC
- Encrypting JFS2
- AIX Security Expert
- Director Console

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

64/128-way SMT

Dynamic InfraStructures

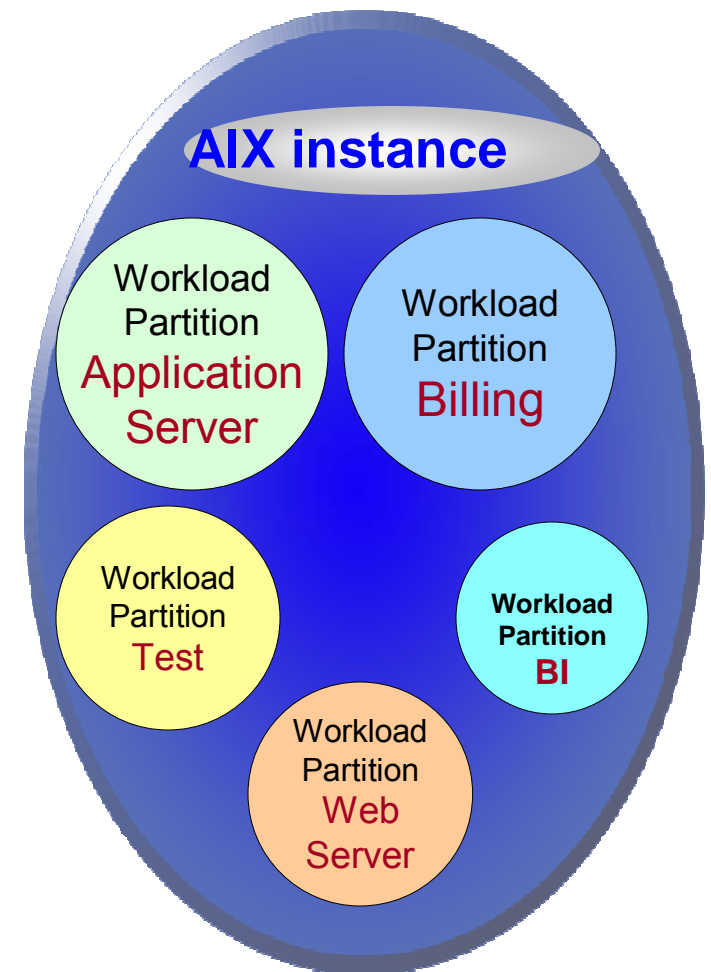
# WPARs (AIX Workload Partitions)

improve administrative efficiency by reducing the # of AIX images to maintain

- An AIX instance can be software-partitioned into WPARs, *unlike the hardware-partitioning of a CEC into LPARs.*
  - WPARs share the system resources within the AIX instance, *e.g. System directories, CPUs, Memory, I/O.*
  - Each WPAR obtains a regulated share of system resources.
- There are 2 types of WPARs:
  - System Partitions (sysWPAR)
  - Application Partitions (appWPAR)

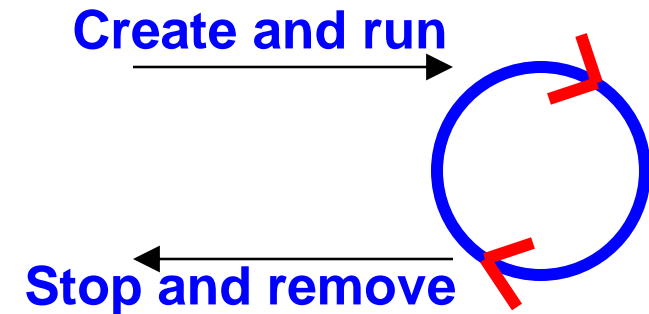
Each sysWPAR is a separate administrative domain:

- Each sysWPAR can have its unique network, fileSystems, & security (*i.e. loginids, groups, etc.*)



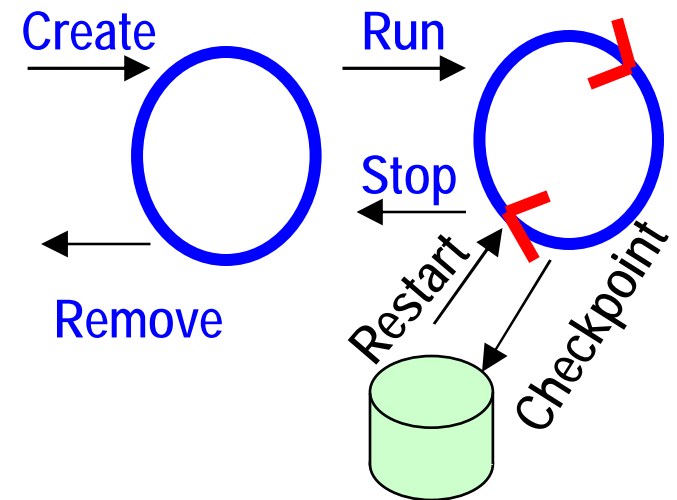
# Application WPARs provide Lightweight Isolation

- An appWPAR isolates an individual application.
- An appWPAR is Light-weight:
  - one process plus the Application itself
  - The Application can start further processes
- An appWPAR can be created & started *in seconds*
- The Application starts when appWPAR is created
  - and the appWPAR is dismantled when the Application stops.
- appWPARs share the global AIX's file systems.
- appWPARs are good candidates for HPC applications:
  - For long-running HPC Applications that run for days
  - Checkpoint/restart capability could be very useful.



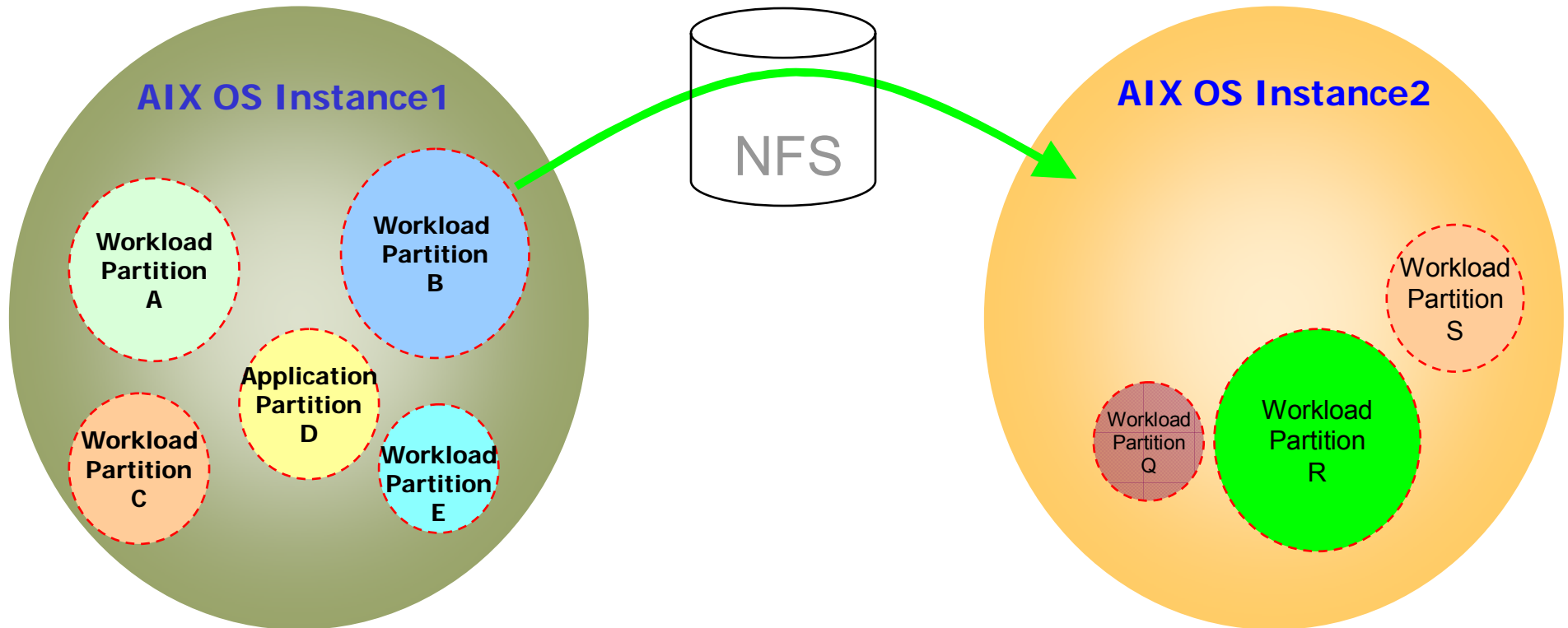
# System WPARs are easier to setup than LPARs

- Has a more complete OS environment than an appWPAR
  - Can runs multiple services & applications.
- It takes longer to create a sysWPAR than an appWPAR, because it builds its own fileSystems.
  - sysWPARs are removed only when requested.
- User logins are like another AIX system
  - Has its own root user, users, and groups.
- sysWPARs can be stopped and restarted w/o AIX reboot.
- Has its Own system services *e.g. inetd, cron, syslog*
- Does not share writable fileSystems with other sysWPARs or the global AIX.
- Is Integrated with Role-Based Access Control (RBAC)
  - granular privilege & security controls within WPAR



## Live WPAR-Mobility

- Enables you to Move non-disruptively a WPAR from 1 AIX Instance to another (even in a different CEC).
- Application State (Memory and I/O) is fully Preserved



### Key scenarios:

**Server Repair/Upgrade** - needs to be shut down for service or upgrade

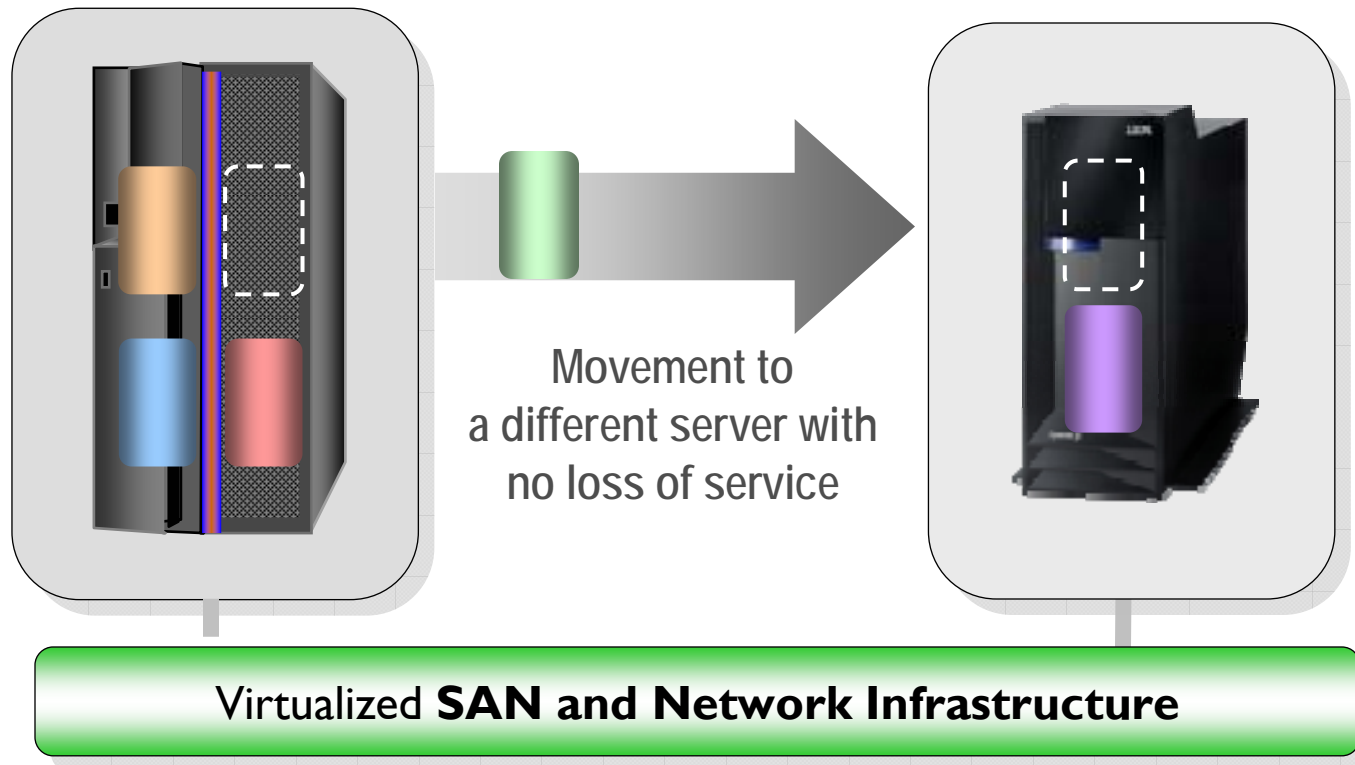
**Workload Balancing** - Need to redistribute workloads to optimize resources

**Workload Growth** - Growing SMP server workload to a more powerful SMP server

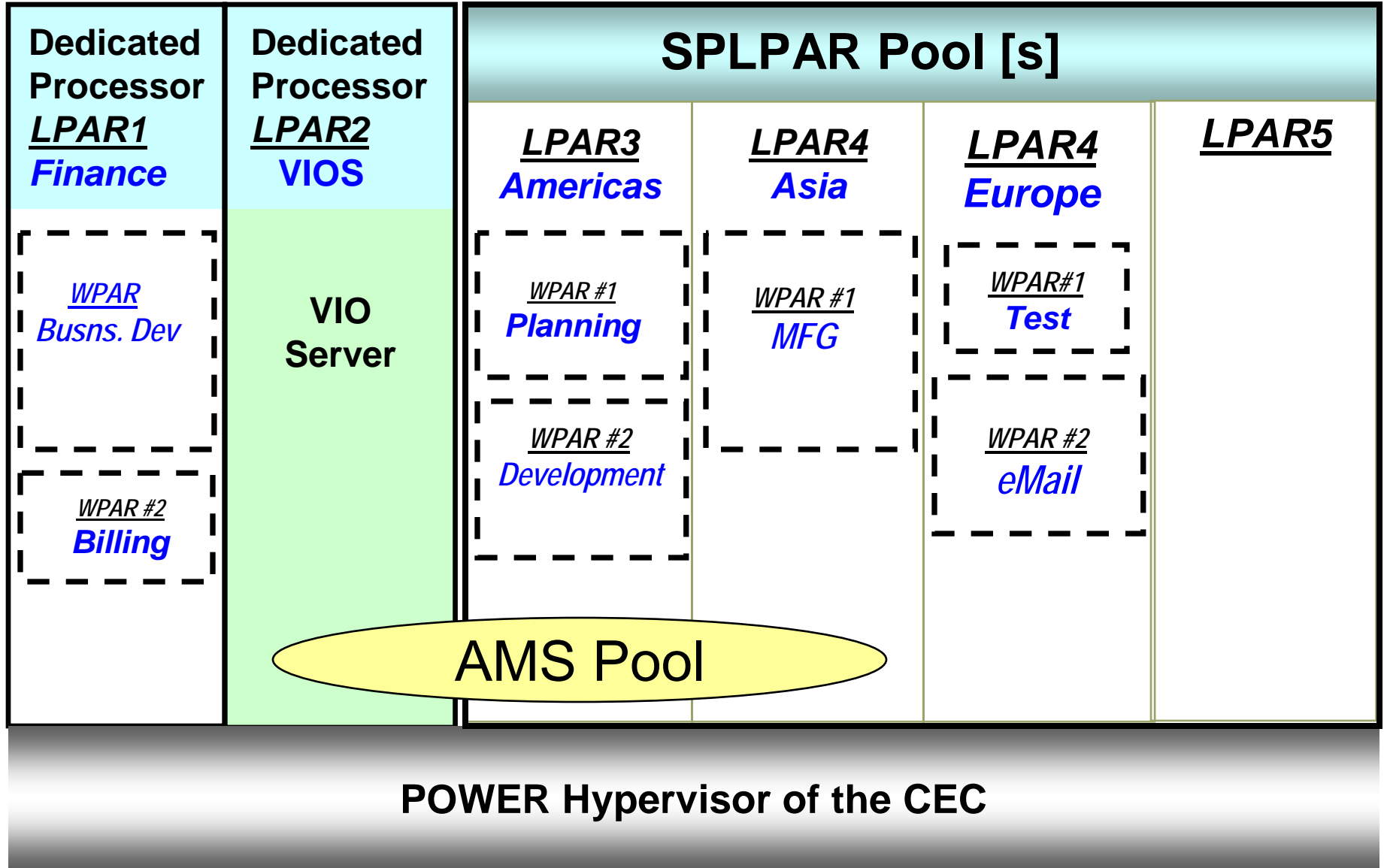
# Live LPAR-Mobility with POWER6

Allows migration of a running LPAR to another physical server

- ✓ Reduces impact of planned outages
- ✓ Relocates workloads to enable growth
- ✓ Provisions new technology with no disruption to service
- ✓ Saves energy by moving workloads off underutilized servers

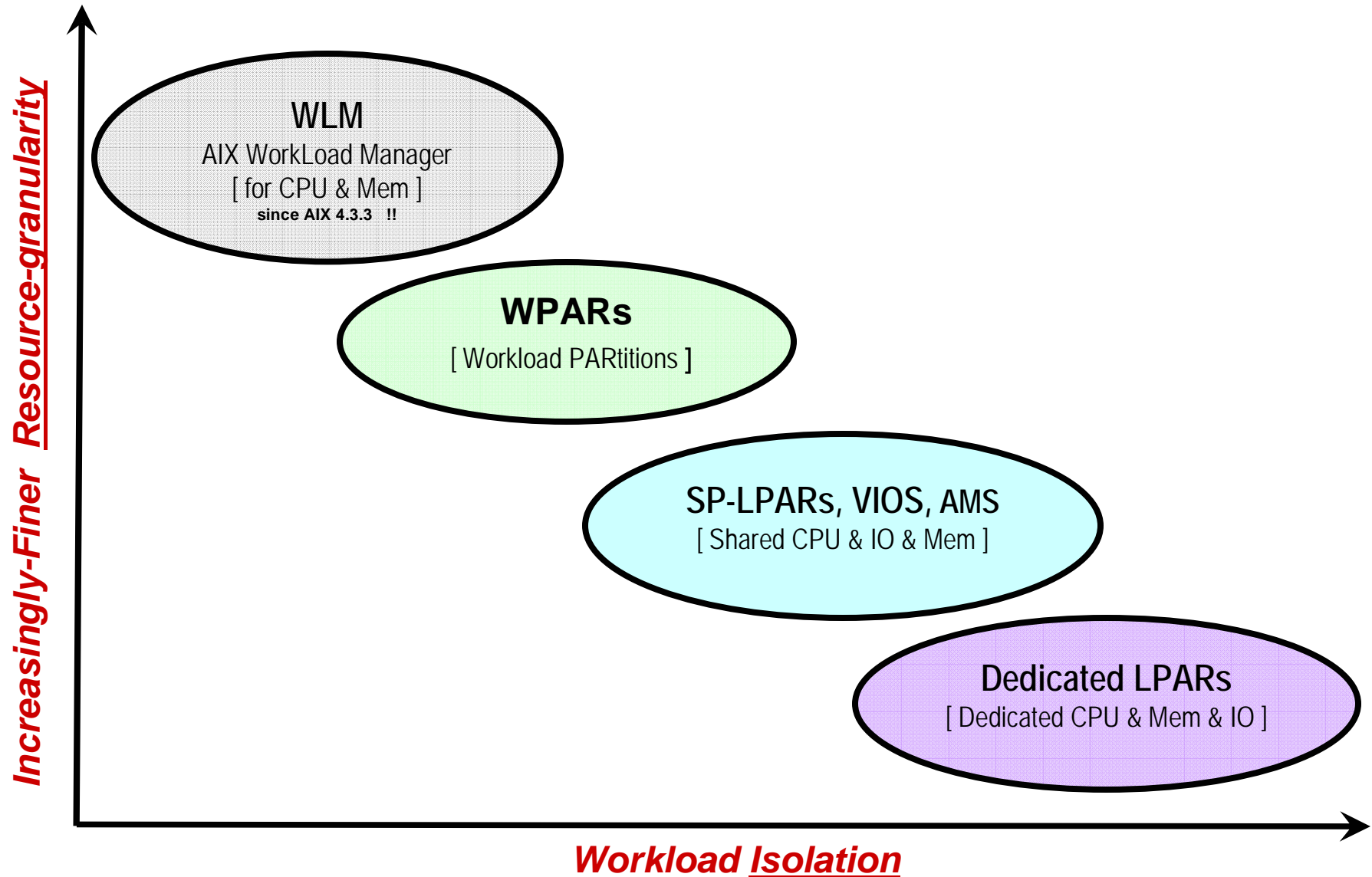


# All types of PARtitions in a pSeries CEC



# AIX Virtualization Leadership:

*-- Its Rich set of options spans the 2-D space of workload-Isolation & Resource-Granularity*

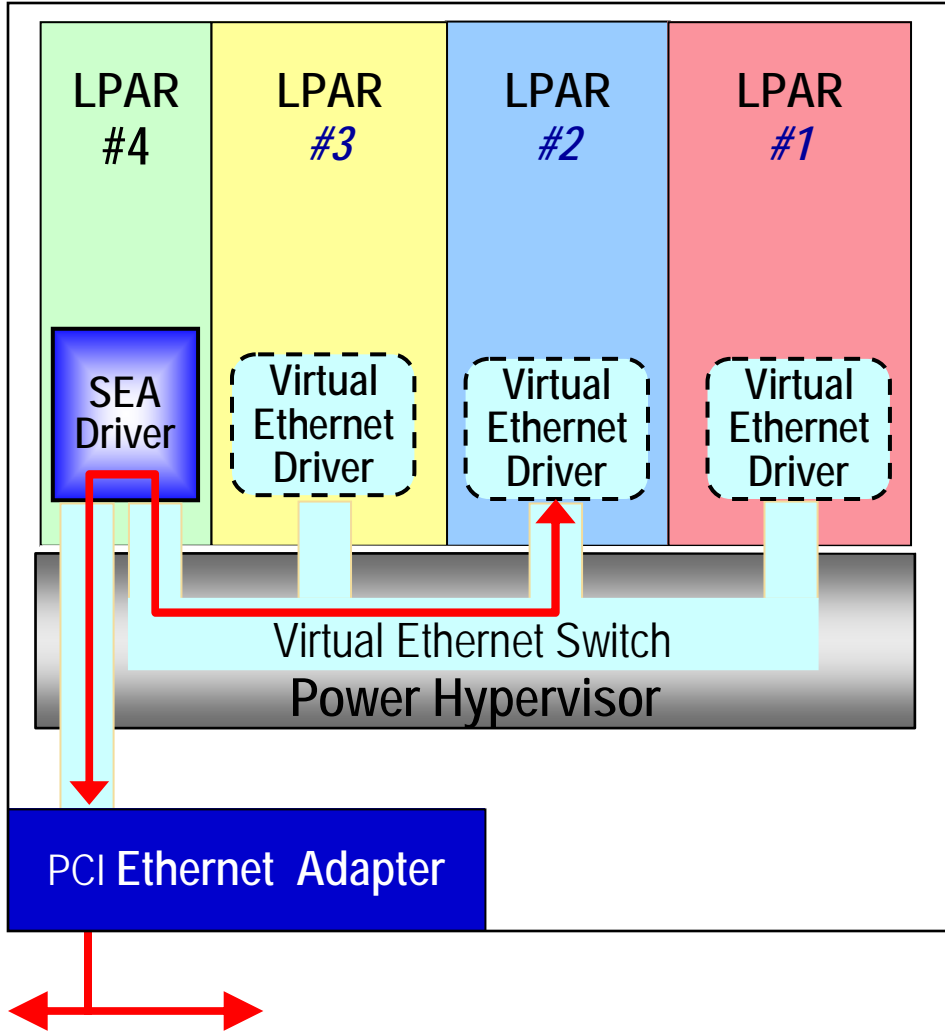


## Advanced Virtualization Support Matrix

<u>Advanced Functionality</u>	<u>AIX 5.3 TLs</u>	<u>AIX 6</u>	<u>P5</u>	<u>P6</u>
Live LPAR Mobility	Yes	Yes		Yes
<b>Multiple Shared-Processor Pools</b>	<b>Yes</b>	<b>Yes</b>		<b>Yes</b>
Workload Partitions (WPARs)		<b>Yes</b>	<b>Yes</b>	<b>Yes</b>
Live WPAR Mobility		Yes	Yes	Yes

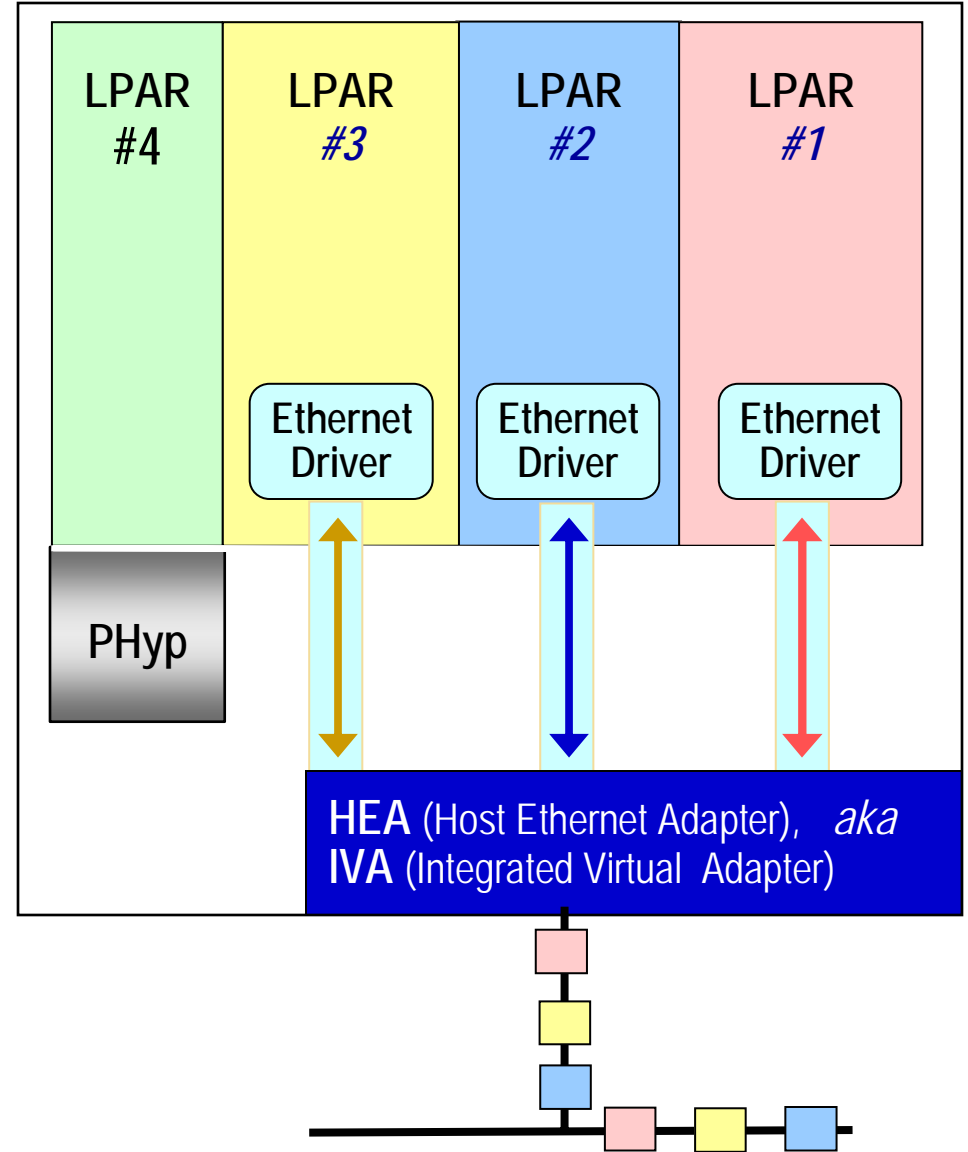
# Network: SEA or HEA / IVA

*Option 1: SEA*



SEA (Shared Ethernet Adapter)

*Option 2: HEA (in P6 systems)*

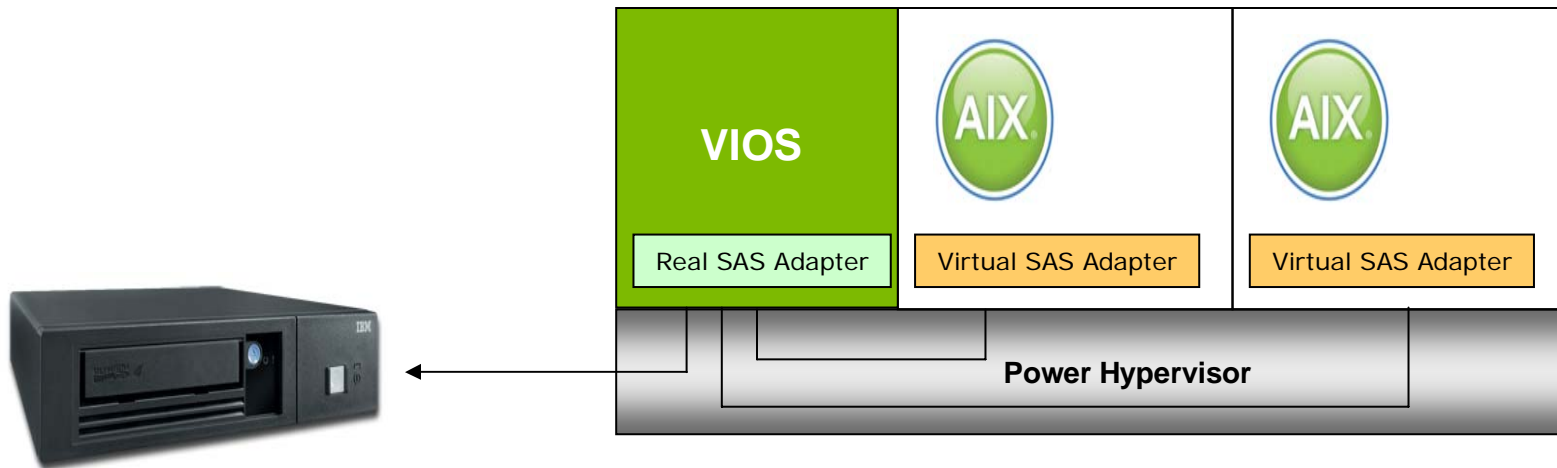




# Tape Drive: VIOS Virtual Tape Support for Client LPARs

Enables client LPARs to directly access SAS tape resources, **reducing the # of real tape drives to order, and the headache to physically re-attach a tape drive to another LPAR.**

- Real SAS Tape adapter is owned by VIOS partition
- SAS Tape Drives Supported: **DAT72, DAT160, LTO3, and LTO4**
- Support is included with PowerVM Express, Standard, or Enterprise Edition
- Supports AIX 5.3 & 6.1 LPARs on P6 systems



## Statement of Direction

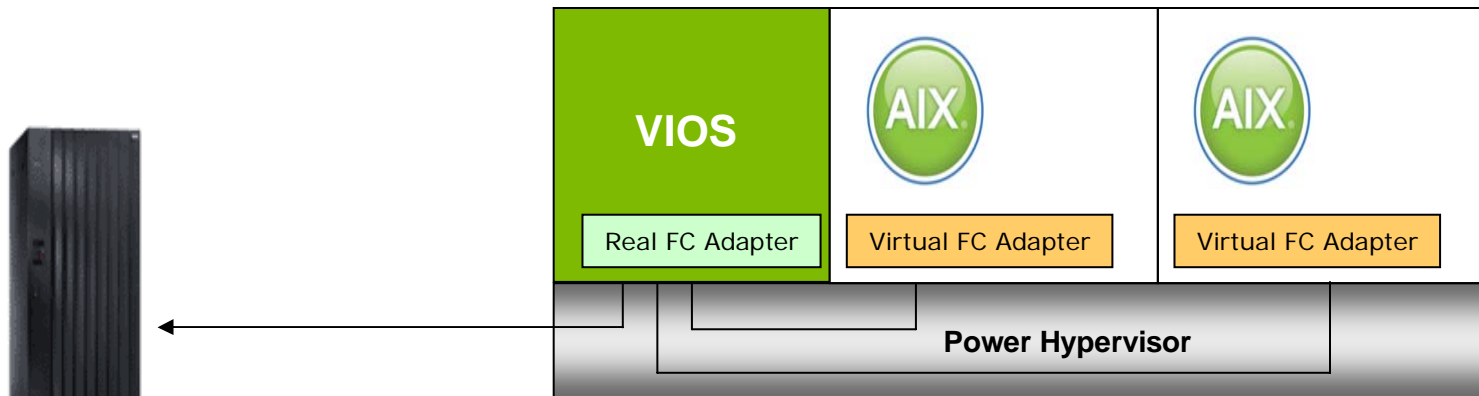
- *IBM intends to support VIOS virtual tape capabilities with IBM i and Linux environments in 2009.*

All statements regarding IBM's future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.



## NPIV (N\_Port ID Virtualization)

- NPIV provides direct access to Fiber Channel Adapter from multiple client LPARs, simplifying the management of Fibre Channel SAN storage environments.
  - Fibre Channel adapter is owned by the VIOS LPAR
  - Power 520, 550, 560, and 570, with an 8 GB PCIe Fibre Channel Adapter
  - Supported with PowerVM Express, Standard, and Enterprise Edition
  - Supports AIX V5.3 and AIX V6.1 LPARs



- ✓ Enables use of existing storage management tools
- ✓ Simplifies storage provisioning
- ✓ Enables access to SAN devices including tape libraries

### Statement of Direction

- IBM intends to support N\_Port ID Virtualization (NPIV) on the POWER6 processor-based Power 595, BladeCenter JS12, and BladeCenter JS22 in 2009.

All statements regarding IBM's future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.

## Statement Of Direction:

# AMS (Active Memory Sharing) feature in PowerVM



Active Memory Sharing will **transparently** flow memory resource from 1 LPAR to another in the same CEC for **increased utilization & flexibility** of available physical memory in the CEC.

- **Memory virtualization enhancement for Power Systems**
  - Supports over-commitment of physical memory
  - Overflow-memory goes to a paging device on the VIOS.
  - Shifts memory dynamically from idle LPARs to active LPARs
  - Improves physical memory utilization, implies **reduces memory costs**.
- **Extends Power Systems **Virtualization Leadership****
  - Similar Capability is not provided by HP nor SUN virtualization offerings
- **Designed for partitions with variable memory requirements**
  - Low average memory requirements
  - Active/inactive environments
- **Planned to be available with PowerVM Enterprise Edition**
  - Supports AIX 6.1, Linux, and i 6.1 LPARs .
  - p6 Systems only

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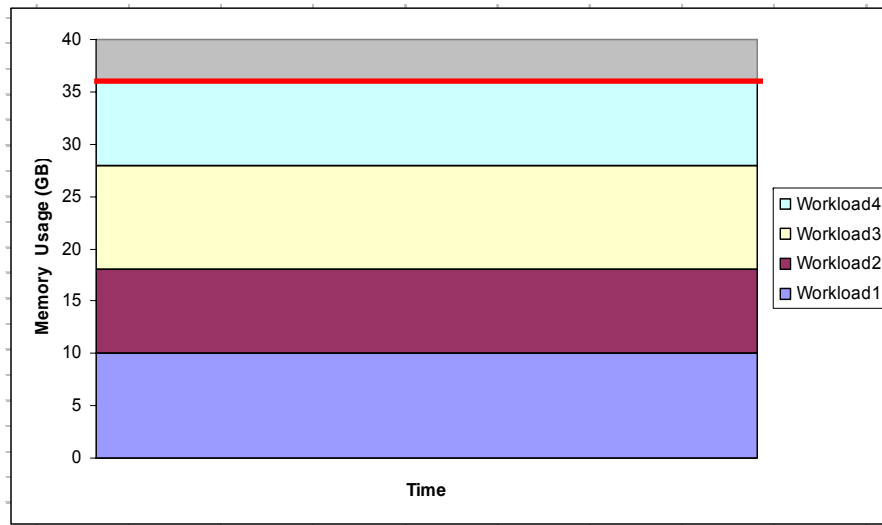
# AMS Reduces Your Memory Costs – an example

- Intelligently flows memory among LPARs with variable workloads demands
- Hence reduces memory requirements

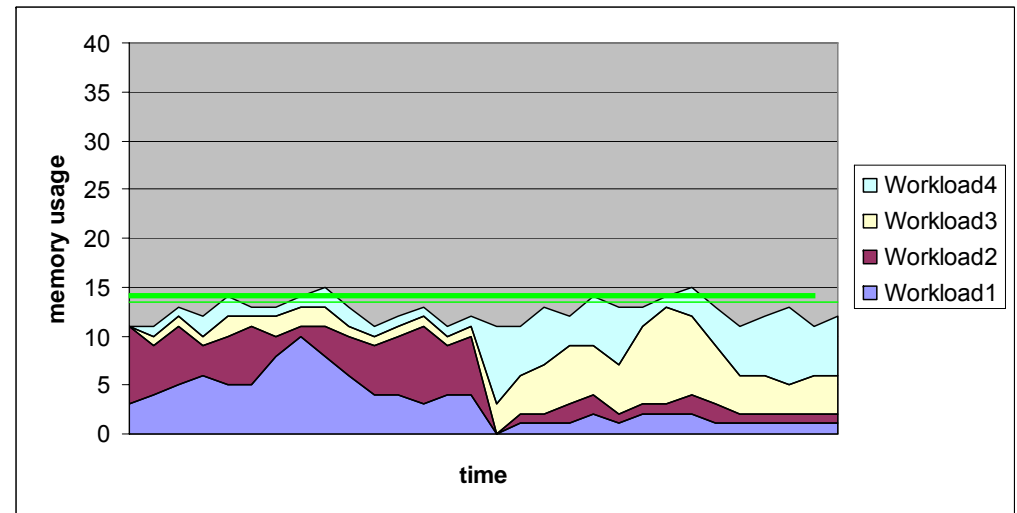
<u>Active / Inactive LPARs</u>	<u>Required Physical Memory</u>
Dedicated Memory <span style="color: red;">—</span>	36 GB
Shared Memory <span style="color: green;">—</span>	14 GB
Dedicated Memory Cost*	40GBx\$16K/8GB = \$80K
Shared Memory Cost*	16GBx\$16K/8GB = \$32K
<b>Shared Memory Savings*</b>	<b>24GBx\$16K/8GB = \$48K</b>

\* Based on cost of 8GB Memory Dimms

4 LPARs with Dedicated Memory



4 LPARs with AMS (Shared Memory)



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# PowerVM Editions

*Delivering industrial-strength virtualization for AIX, Linux & i customers*



## PowerVM Editions

- o Unified virtualization branding & technology for AIX, i and Linux
- o Exploiting 40 years of IBM virtualization leadership
- o One approach for ordering and deployment across Power™ servers

	Express	Standard	Enterprise
Maximum LPARs	1+2 / Server	10 / Core	10 / Core
Management	IVM	IVM, HMC	IVM, HMC
Virtual I/O Server	✓	✓	✓
Lx86	✓	✓	✓
Shared Dedicated Capacity*	✓	✓	✓
Multiple Shared Processor Pools*		✓	✓
Live Partition MobilityP			✓

Selected PowerVM technologies are not available on all models of Power systems

# AIX® Enterprise Edition

*AIX Enterprise Edition is a single offering that brings together AIX 6 with key service management capabilities that are designed to:*

- *Improve availability through access to relevant real-time information*
- *Enhance operational efficiency through visualization of resources and centralized management of virtualized AIX environments*
- *Provide accurate assessment of system resource usage*

**AIX Enterprise Edition includes:** 

1. AIX V6.1
2. wparMgr: PowerVM Workload Partitions Manager for AIX™
3. ITM: IBM Tivoli Monitoring
4. TUAM: Tivoli Usage & Accounting Mgr *Virtualization Edition for pSystems*
5. TADDM: Tivoli® Application Dependency Discovery Manager

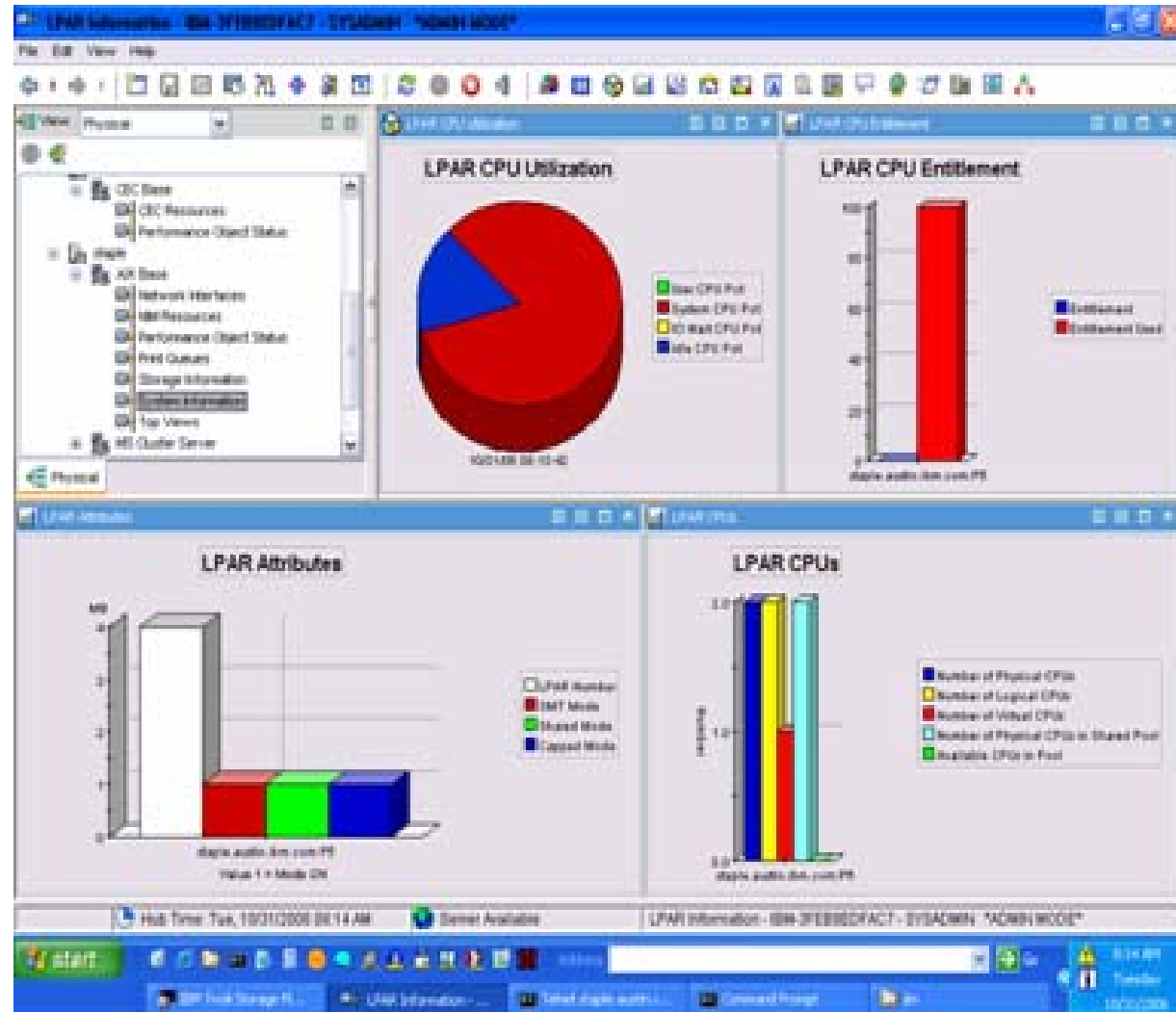
**ITM** (*IBM Tivoli Monitoring*)

Clients get business-level views and management of service availability



### Consolidated monitoring of physical and virtual resources

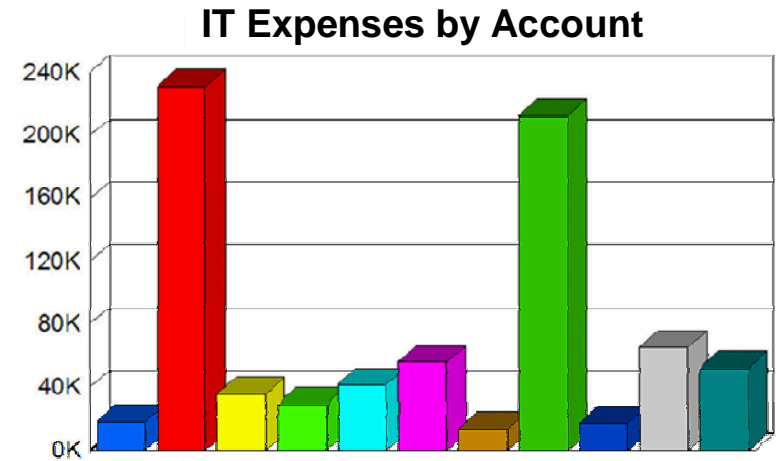
- Designed to improve mean-time-to-recovery by relating virtual to physical resources.
- Data warehouse provides side-by-side real-time & historical data to assist problem determination & planning.
- Out-of-the-box reporting allows clients to quickly provide executive-level reports & identify resource bottlenecks.



**TUAM:** (IBM Tivoli Usage and Accounting Manager Virtualization Edition)



- Track usage by account, department or organization
  - Accountability and usage tracking
  - Help forecast growth by department
- Single hardware system metrics and reports
- Data collectors
  - AIX, Linux® and AIX Advanced Accounting
    - Processor, server, LPAR, I/O, and VIO
  - File System – allocated and used



- Reporting
  - Business Intelligence Reporting Tool
  - Reports will be provided, with aggregation by userid within a given server
  - Pre-Defined Accounting Schema
  - [Export to spreadsheet](#), comma delimited, & CSB

Account Code	CPU Usage	Disk Kilobytes Read	Disk Kilobytes Written	Memory Kilobytes Active
ATM - ATM Transactions	54,825.00	40,185.00	2,015	44,464,061
CCX - Credit Card	28,839.00	12,920.00	4,718	27,081,652
COM - Commercial Loans	159,016.00	85,347.00	1,014	49,588,067
DAC - Drafts and Collections	20,160.00	12,778.00	868	15,779,025
DEP - Electronic Deposits	201,584.00	59,357.00	2,918	72,375,663



# AIX6.1: The Next Step in the Evolution of UNIX

## 1. Virtualization Leadership

- DLPAR, SPLPAR, SMT, VIOS
- WPAR Mobility, LPAR Mobility
- Virtual Tape, NPIV, AMS

## 2. Near-Continuous Availability

- Concurrent AIX Kernel Updates
- Memory Protection Keys Domains
- Dynamic Tracing with ProbeVue
- HACMP[/XD] (Hi Availability Cluster Management)

## 3. Security

- RBAC (Role Based Access Control)
- AIXpert -- choose lo, med, hi security
- Encrypting Filesystem
- EAL4+

## 4. Manageability

- smitty, pConsole, NIM
- HMC / IVM mgt
- AIX Enterprise Edition
- TSM & mksysb for backups

## 5. Leadership Performance

- Scientific Workloads
- Commercial Workloads (*TPCC, SAP, ..*)

# AIX on POWER offers you these Advantages & More

## Leadership Performance

- Number 1 in TPCC with AIX & DB2 for over a decade
- Concurrently pageable page sizes (4KB & 64KB page-sizes)
- Excellent SAP performance with P6 DFP (Decimal Floating Point) unit.
- Many time top performance in HPC applications – *Deep Blue, ASCI/Blue, ASCI White, ASCI Purple, ...*

## Leadership Continuous Availability in the UNIX Marketplace

- Concurrent kernel Update (*hotpatch*), Memory Protection Keys, ProbeView (*Dynamic Trace*), etc., and more are coming.

## Leadership Virtualization & Scalability – to save you money

- Leadership Virtualization with DLPAR, SPLPAR, SMT, Virtual ethernet, disk, tape, WPAR, WPAR migration, LPAR migration, AMS, etc.
- AIX is the forerunner UNIX to support Mutli-core since POWER4.
- **Scale-up, scale-out, scale within** with a full range of small to huge servers. **AIX has over 15 yrs. of advanced clustering technologies.**
- Maxima: 8K WPARs per LPAR, 254 LPARs per CEC => **over 2 million** WPARs per CEC,  
64 cores/CEC. Soon: **4-SMTs per P7-core** => 256 Logical CPUs per AIX instance (*AIX architecture can support even more*).

## Security & Virus Resistance

- Very easy-to-use AIXpert (set security level to low/medium/high) that comes with AIX.
- NFS4 ACL – the First-to-market complete NFS4 Server & Client OS, *since AIX5.3.0; offering fine grain industry-standard security.*
- Security -- RBAC (Role Based Access Control) *since AIX 5300-005.*
- Achieved EAL4+ level, and more features are upcoming, e.g. AHAFS.

## Manageability

- smitty, mksysb, NIM & NIM tools, IVM, Systems Director, Tivoli, dynamically shrinkable JFS2 filesystem (IBM invented JFS).
- migration tools (*mig2p5, Unix Configuration Migration tool, ...*), IBM Migration Factory, etc.

## Very good documentation, Developerworks, User Groups

- Good online Docs (manuals, Red Books)
- Free tools on Developerworks
- User Groups (*e.g. powerAix.org, power.org, IBM Power Systems Technical University, User Blue, etc*), classes.

## Linux Affinity

- “**AIX Toolbox for Linux**” comes with AIX distribution: (a) Run Linux tools on AIX, and/or (b) Use gcc on AIX to compile, then run in AIX.
- Related offering: Use Lx86 to run x86 executables directly on pLinux.

# Useful AIX URLs for Easy Access & More Details

- **AIX Info Center** – good online Docs (manuals, manpages, Red books, etc. ):  
<http://publib.boulder.ibm.com/infocenter/systems/scope/aix/index.jsp>
- **PowerVM Virtualization on IBM System P: Intro & Config, 4ed** (Red Book):  
<http://www.redbooks.ibm.com/redbooks/pdfs/sg247940.pdf>
- **AIX 6.1 Difference Guide** (Red book):  
<http://www.redbooks.ibm.com/redbooks/SG247559/wwhelp/wwhimpl/js/html/wwhelp.htm>
- **IBM AIX Continuous Availability Features** (Red paper):  
<http://www.redbooks.ibm.com/abstracts/redp4367.html?Open>
- **IBM Systems Magazine – Open Systems edition**  
<http://ibmsystemsmag.com/opensystems/>
- **AIX6 Advanced Security** (Red book):  
<http://www.redbooks.ibm.com/redpieces/abstracts/sg247430.html?Open>
- **IBM PowerHA/XD (High Availability / eXtended Distance) for AIX ( HACMP/XD )**  
<http://www-03.ibm.com/systems/power/software/availability/xd/index.html>
- **IBM DeveloperWorks Wikis – AIX Home**  
<http://www.ibm.com/developerworks/wikis/display/WikiPtype/Home>
- **Introduction to WPAR** (Red book)  
<http://www.redbooks.ibm.com/redpieces/abstracts/SG247431.html>
- **User Groups – AIX, POWER**  
<http://www.ibm.com/developerworks/wikis/pages/viewpage.action?pagelid=104533263>  
<http://www.poweraix.org>  
<http://www.power.org>

## *RAS is the "Number 1" Customer Requirement* **AIX is the UNIX Industry Leader in Continuous Availability**

**AIX6 offers a Rich Set of Robustness Features** & more are in the pipeline:

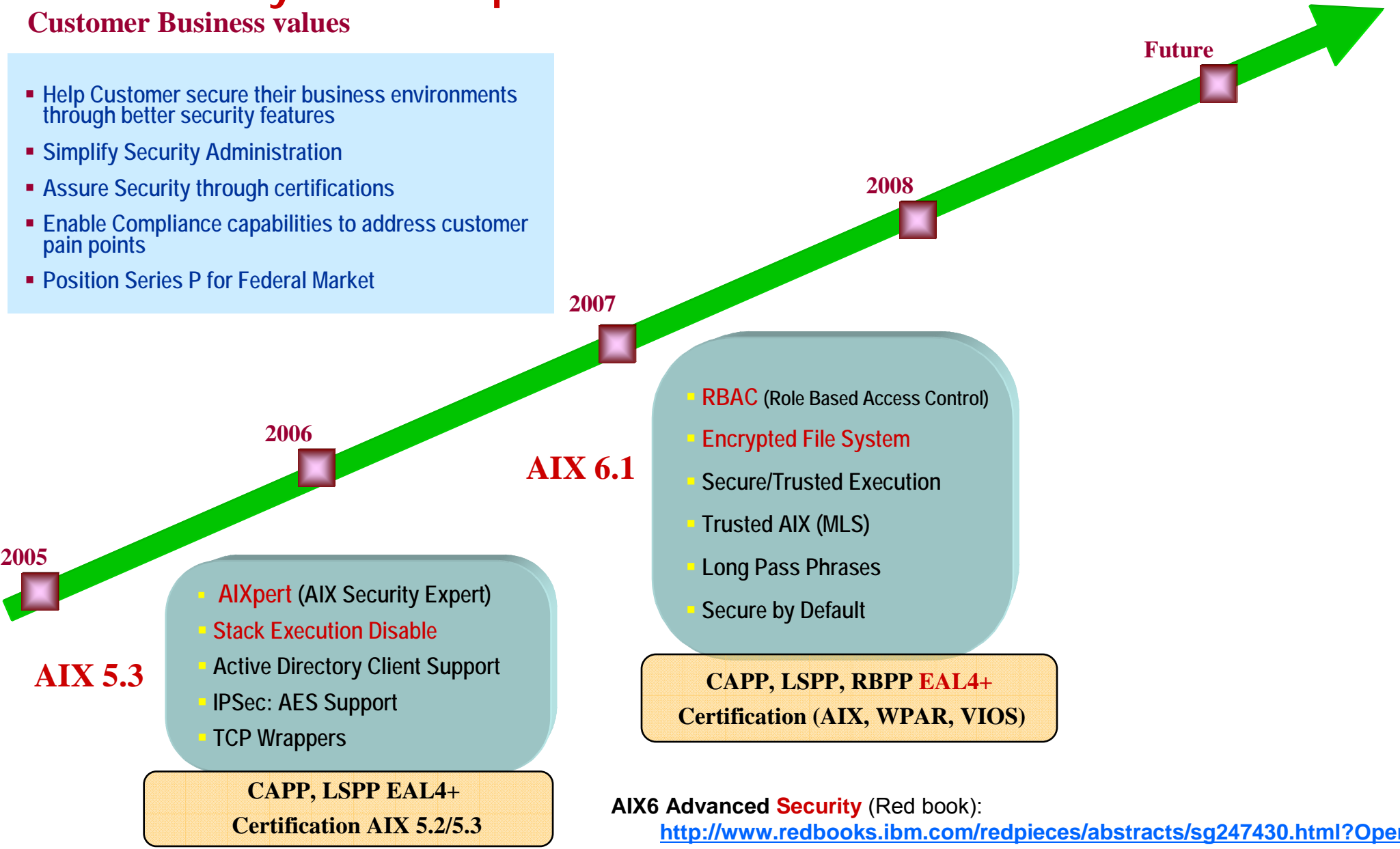
1. *Memory Protection Key Domains*
2. *Concurrent AIX kernel updates*
3. *Cross Server WPAR Mobility & LPAR Mobility*
4. *Dynamic Tracing with ProbeVue*
5. *Functional Recovery Routines*
  
6. *Component Trace*
7. *Memory Overlay Protection*
8. *Parallel Dump*
9. *Lightweight Malloc debug*
  
10. *Lightweight Memory Trace*
11. *Consistency Checkers*
12. *Component RAS infrastructure*
13. *AIX error log*
14. *AHAFS (Autonomic Health Advisor FileSystem)*

Red Paper "IBM AIX Continuous Availability": <http://www.redbooks.ibm.com/abstracts/redp4367.html?Open>

# AIX Security Roadmap

## Customer Business values

- Help Customer secure their business environments through better security features
- Simplify Security Administration
- Assure Security through certifications
- Enable Compliance capabilities to address customer pain points
- Position Series P for Federal Market



AIX6 Advanced Security (Red book):

<http://www.redbooks.ibm.com/redpieces/abstracts/sg247430.html?Open>

\* All statements regarding IBM's future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.

# IBM Research Worldwide





**Thank you !**

