



IBM eServer™

# pSeries Software Directions



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# AIX & Linux for POWER- Operating System



- ▶ Industrial strength UNIX product
- ▶ IBM optimization for POWER hardware
- ▶ High-end Scalability, Reliability, Availability
- ▶ Roadmap for Future

## Linux Affinity

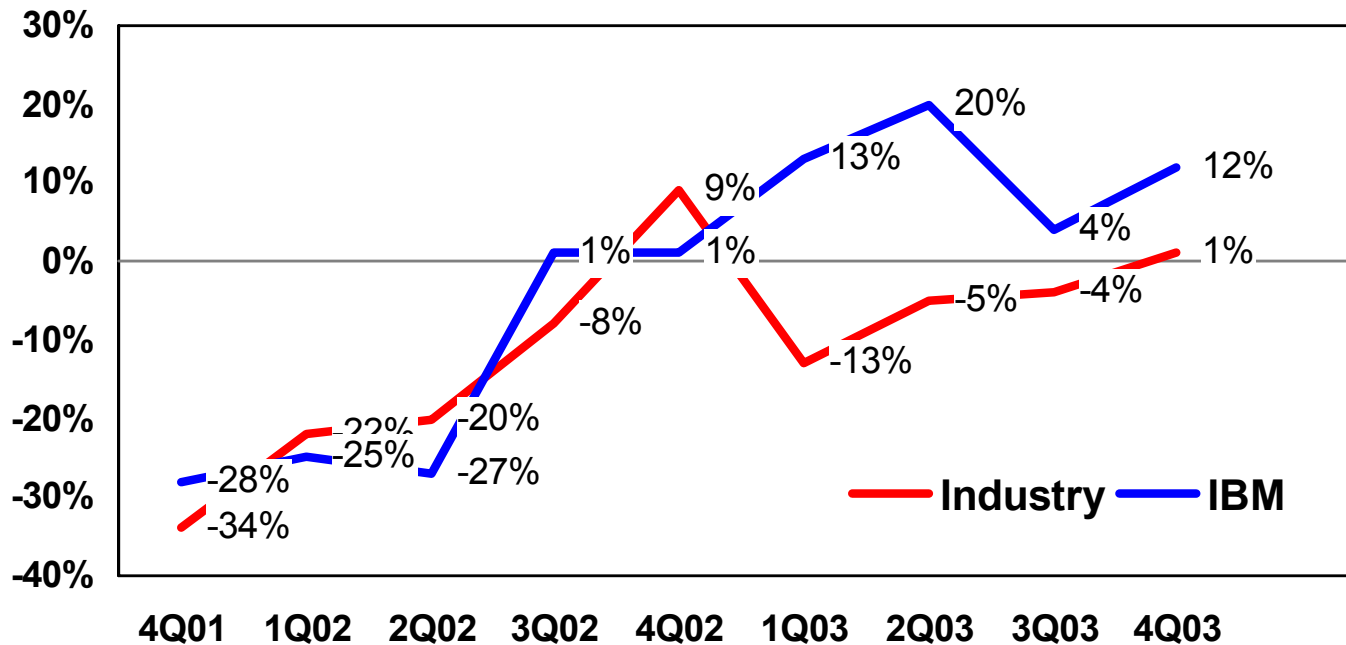
- ▶ "compile and go" applications
- ▶ Leverage Linux skill base

- ▶ Standard Community-developed Linux
- ▶ Open source code
- ▶ Strategic application development platform
- ▶ Improving scalability and commercial qualities
- ▶ Growing market



# pSeries/AIX UNIX Revenue Growth

## Worldwide UNIX Year to Year Revenue Growth



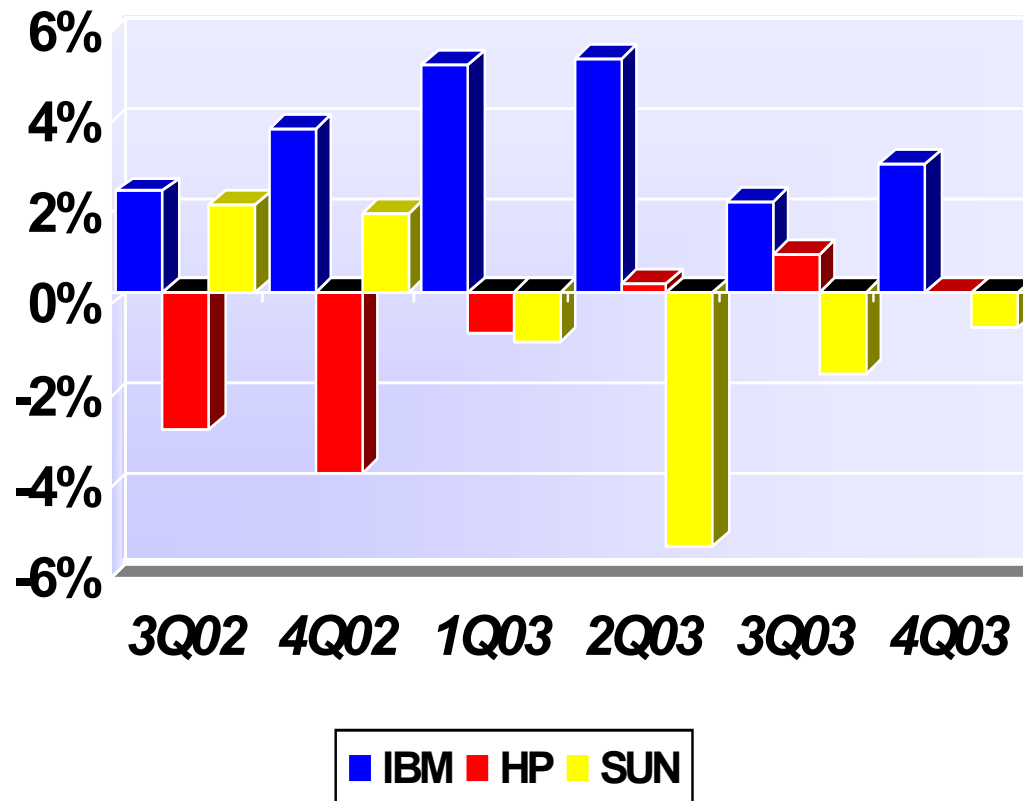
Source: IDC Worldwide Quarterly Server Tracker

**".. There will be only three growth server operating systems (Windows, Linux, AIX) through 2008 (0.8 probability), ..."**

*Gartner Cannes Symposium November 2003*

# pSeries/AIX Market Share

## Change in UNIX Market Share



Source: IDC Worldwide Quarterly Server Tracker

## Benefits

- Independent Software Vendors are moving to pSeries w/AIX&Linux  
*IBM tracked a 2x increase in application availability from 3Q02 to 3Q03*
- Business Partners are moving to pSeries
- Increased skill pool for customer admin support
- Industry analysts are positive about AIX future growth

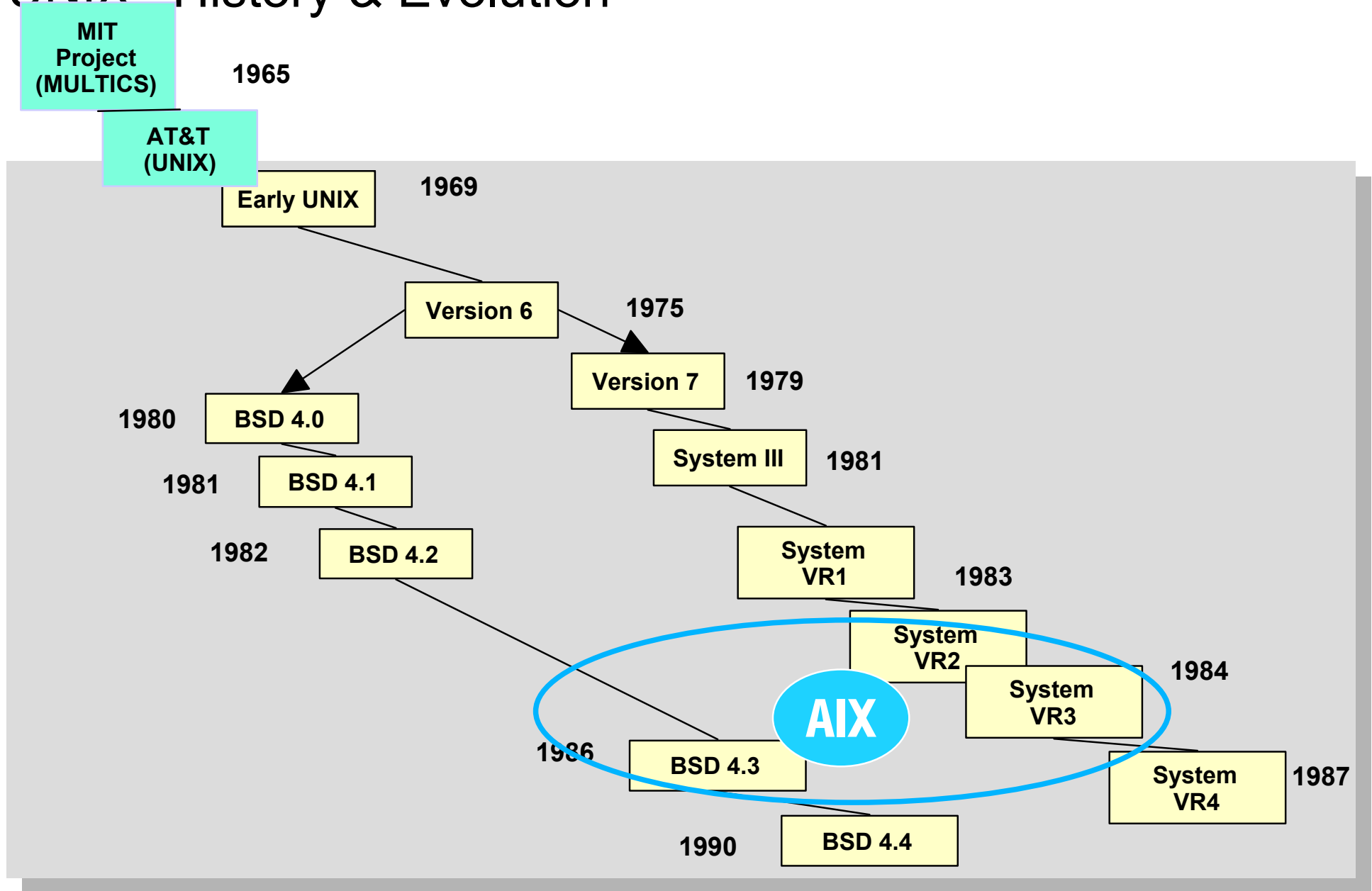
**".. By YE08, AIX will grow market share approaching or passing Solaris as No. 1 Unix operating system (0.8 probability), ..."**

*Gartner Cannes Symposium November 2003*



# AIX for pSeries

# UNIX® History & Evolution





# UNIX® History & Evolution

1965 - MULTICS

- ▶ MIT, GE, AT&T 1969 - UNIX Born (UNICS)
  - ▶ Ken Thompson & Dennis Ritchie (AT&T)

## IBM UNIX OS Development History

- ▶ **PCs to Mainframe**
- ▶ **UNIX Environments: AIX on RISC (RT PC, RS/6000, pSeries), AIX/PS2, AIX/ESA (OSF-1), AIX/Itanium(pre-production)**

1975 - IBM Invents RISC Technology

1978 - Berkeley Software Distribution (BSD)

1

1983 - UNIX System V



1986 - IBM RT PC w/ AIX Versions 1 & 2

1988 - Open Software Foundation



1990 IBM RS/6000 & AIX Version 3

- ▶ **AIX V3: Integration of AT&T System V3.2 & BSD 4.3**

AIX/6000

1991 - Linux Introduced



1993 - UNIX Trademark transferred to X/Open

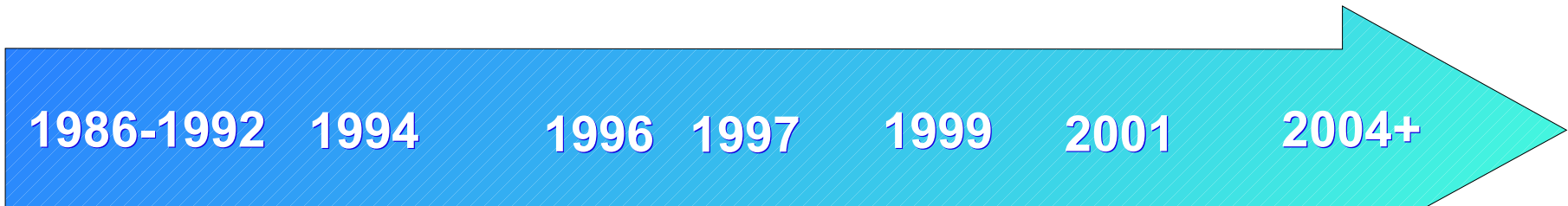
1994 - AIX Version 4



2000 - AIX 5L

- ▶ **Project Monterey (AIX/POWER&Itanium)**
- ▶ **AIX 5L Version 5.1 & 5.2 w/POWER4**

# AIX Roadmap Evolution



**AIX/6000**



**AIX V2 & V3**  
 Establishment in the market  
 UNIX credibility  
 Open systems stds

**AIX V3.2.5**  
 Maturity:  
 - Stability  
 - Quality

**AIX V4.1**  
 Scalability:  
 - POWERPC spt  
 - **4-way SMP**  
 - Client/Server pkg  
 New Standards compliance  
 Simplicity:  
 - Graphical, fast installation  
 - Common Desktop Environment  
 HACMP Clustering

**AIX V4.2**  
 High-end scalability  
 - 8-way SMP  
 - >2GB memory  
 Standards:  
 - **UNIX95 brand**  
 RAS Enhancements  
 NFS V3

**AIX V4.3**  
 Scalability, Function, Performance:  
 - POWER3 Support  
 - 24-way SMP  
 - 96 GB memory  
**32/64-bit API spt**  
 UNIX98 Branding  
 Networking/Security:  
 - **TCP/IP V6**  
 - **IPsec**  
 Web Sys Mgt  
 AIX Workload Mgr  
**Java JDT/JIT**  
 Exp/Bonus CDs

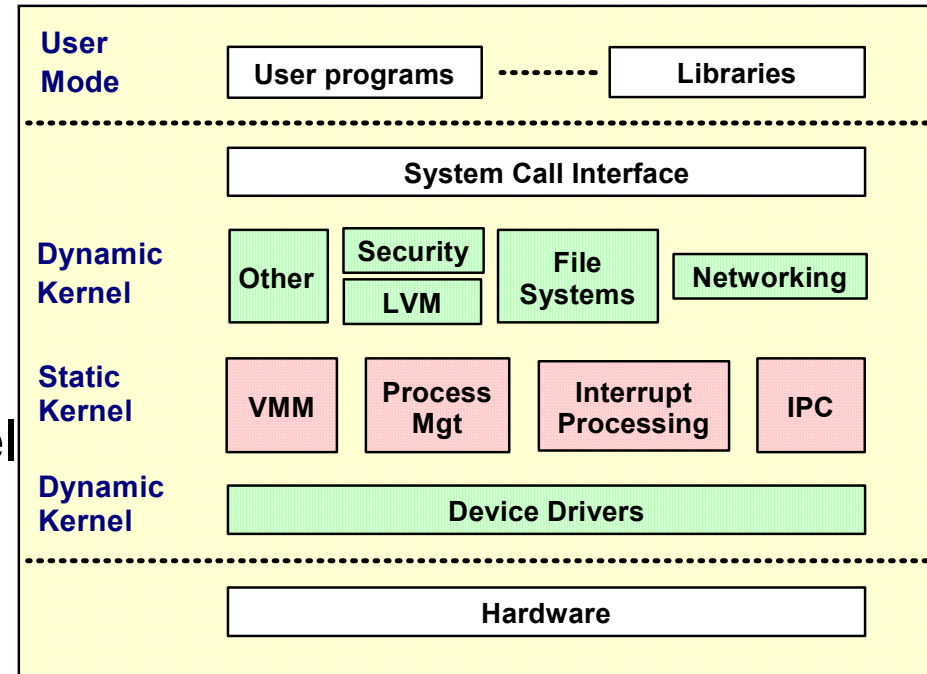
**AIX V5.1/5.2**  
 Scalability, Function, Performance:  
 - POWER4 Support  
 - 32-way SMP  
 - 256/512GB mem  
 - 16 TB filesystems  
 - **64bit kernel/drivers**  
 - **Logical Partitioning**  
 - eLiza RAS  
 - Networking Enh  
 - Java 2 support  
 - Linux App Support  
 Cluster Mgt (CSM)  
 Grid Toolkit

**AIX V5.3**  
 TBA



# AIX 5L Design Overview

- Based on UNIX System 5.2.2
  - ▶ Substantial integration of BSD4.3/4.4
- ▶ Optimized for POWER processor-based systems
- Fully pageable, pre-emptible kernel design
- Dynamic device drivers and kernel extension interface
- 32 and 64-bit application environments on 64-bit system
- Large number of integrated system features:
  - ▶ Journalling Filesystems (JFS, JFS2) , Logical Volume Manager (LVM), Object Data Manager (ODM), full ILS-enabling
  - ▶ TCP/IPv6, NFS/NIS, 2D & 3D graphic subsystems
  - ▶ Web-based System Manager, SMIT Panels-based System Manager, AIX Workload Manager, and more....

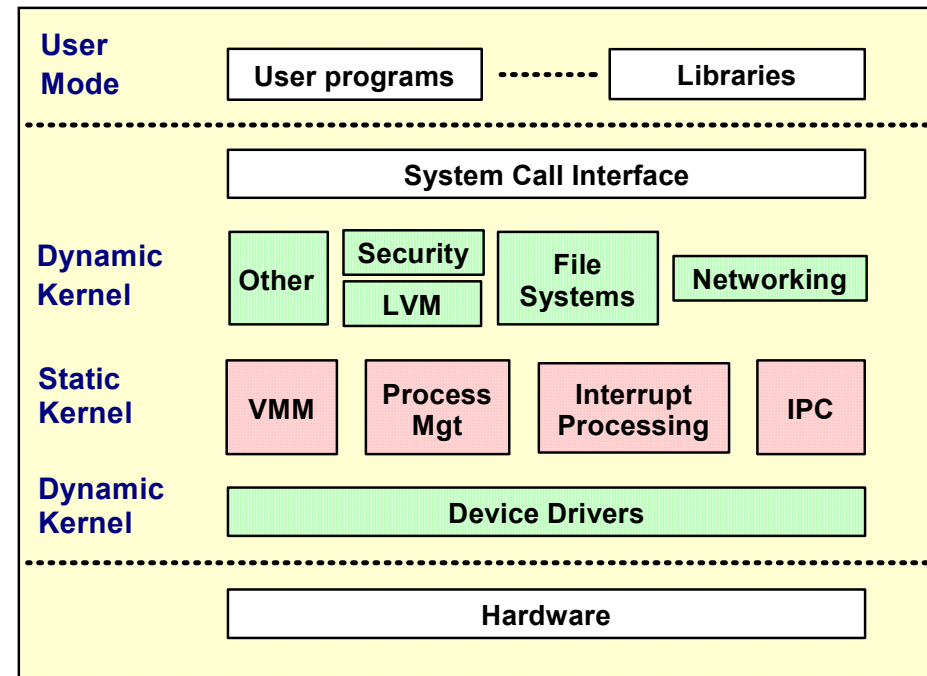


## Designed for Enterprise Computing

- ▶ Reliability, Availability
- ▶ Serviceability
- ▶ Scalability
- ▶ Manageability
- ▶ Security

# AIX 5L Kernel Overview

- Dynamic fully preemptible kernel design
  - No kernel compiles required
  - Many changes can be made without a system reboot.
- "Plug and Play" Device support
  - Eliminates complex device configuration
  - New devices can be added on the fly
- 32/64-bit coexistence on 64-bit system
  - Open files / process: 32,767
  - Open files / system: 1,048,576
  - Threads / process: 32,767
  - Networking Buffer Pool: 1GB
  - Message queues, semaphores, and shared memory regions: 131,072
- 32-bit or 64-bit kernel can be selected at boot time for performance



32-bit or 64-bit kernel can be selected at boot time for performance

AIX 5L Binary compatibility maintained for all well-behaved 32-bit or 64-bit applications

# AIX RAS

## ■ **Hardware error handling enablement**

- Dynamic CPU deallocation
- UE-Gard - uncorrectable hardware errors that formerly would result in a system checkstop handled by terminating the affected thread
- Concurrent diagnostics and error log analysis
- Enhanced Error Handling - adapter first failure data capture (FFDC)

## ■ **System hang and "Lost I/O" detection/recovery**

- SMIT-configurable, provides data capture, optional automatic reboot

## ■ **Automatic Dump Analysis tool**

- Scripting support with samples, improved dump size estimation

## ■ **Error Logging**

- "Error Storm" log handling by count versus data logging
- Error Log Retrieval API for diagnostics use
- Scalability enhancements

## ■ **Graphical trace log viewer**

- Applications allowed to generate corefiles without reboot

## ■ **Inventory scout** - for system microcode level checks

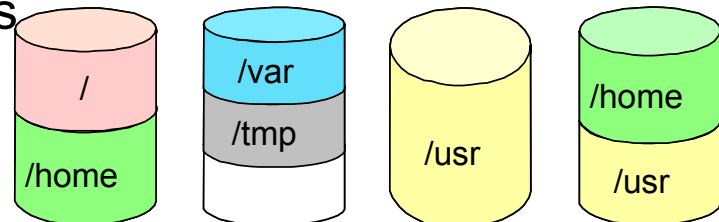
# AIX Storage Management

## ■ AIX Logical Volume Manager

- ▶ Integrated with and included with AIX
- ▶ Dynamically manage logical volumes and file systems.
- ▶ Mirroring and striping support included (RAID 0+1)
- ▶ LVM Mirror Write Consistency, Split mirror backup support
- ▶ Snapshot copy, hot spare, concurrent HA support
- ▶ Hot spot mgt (High IO rate partition)
  - ✓ Support to detect and move physical partitions to other disk within volume group
- ▶ Dynamic LUN size – automatically adapts to changing SAN infrastructure

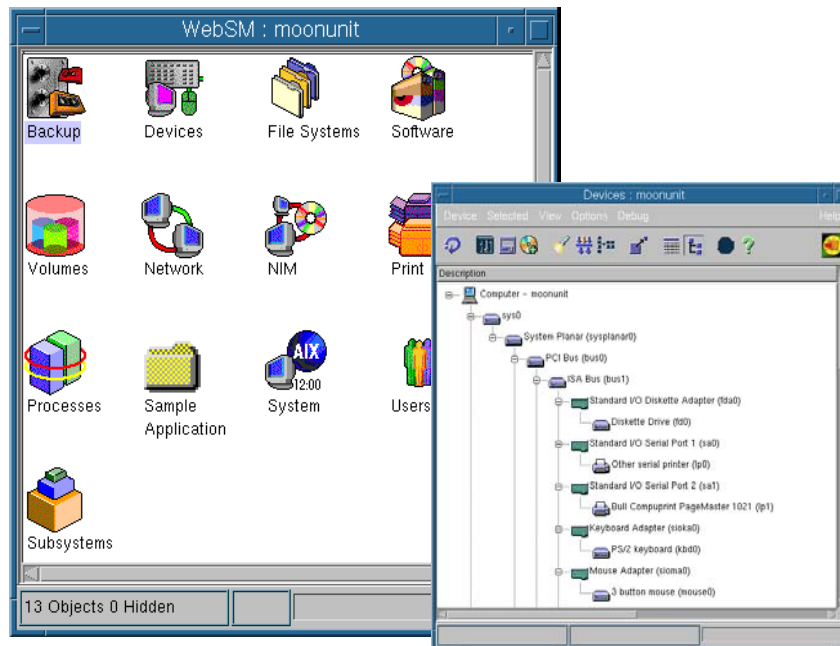
## ■ AIX Journaled File System, JFS & JFS2

- ▶ Integrated and included with AIX
- ▶ J2 High capacity – 16 Terabyte supported, 4 Petabyte architectural limit
- ▶ Protects file systems from inconsistencies
- ▶ Provides rapid recovery from outages
- ▶ High performance
- ▶ Cached, Direct, Concurrent



# AIX 5L System Management

*Manage multiple AIX systems via Internet on Java-enabled browsers*



## Comprehensive Web System Manager Applications:

- ▶ Backup/Restore
- ▶ Custom Tools plug-in
- ▶ Devices - config & status
- ▶ Filesystems
- ▶ Network
- ▶ Network Install Manager
- ▶ PC Services- FastConnect
- ▶ Printers
- ▶ Processes
- ▶ Software - installed sw
- ▶ User/Groups/admin roles
- ▶ Logical Volumes
- ▶ Workload Manager
- ▶ Event Monitoring

## System Management tools:

- ▶ **SMIT panels-based interface**
- ▶ **Network Installation Manager (NIM)**
- ▶ **Resource Monitoring and Control**
- ▶ Alternate Disk installation migration spt
- ▶ compare\_report, lppmgr - tools for centralized install and updates

# AIX 5L Web-based System Manager GUI

*Manage AIX via Internet "from anywhere" on Java1.1-enabled browsers*

Web-based System Manager - /WebSM.pref: /Management Environment/bigbend

Console Host Selected View Window Help

Navigation Area

- Management Environment
  - kruemcke
  - bigbend**
  - sapdb
  - sapapp01
  - sapapp02
  - websphere1
  - websphere2
  - oradb
  - webserve1
  - webserve2
  - webserve3
  - webserve4

bigbend

- Backup and Restore
- Custom Tools
- Devices
- File Systems
- Monitoring
- Network
- Network Installation Management
- Overview
- Printers
- Processes
- Software
- Subsystems
- System Environment
- Users
- Volumes
- Workload Manager

Ready | 16 Objects shown 0 Hidden. | 0 Objects selected. | root - bigbend



# AIX 5L WebSM - VPN Task Guides

**Networking plug-in**

Allows configuring and management of TCP/IP, PPP, NIS, NIS+, and VPNs

Additional SNMP plug-in enables SNMP monitoring and managing capabilities

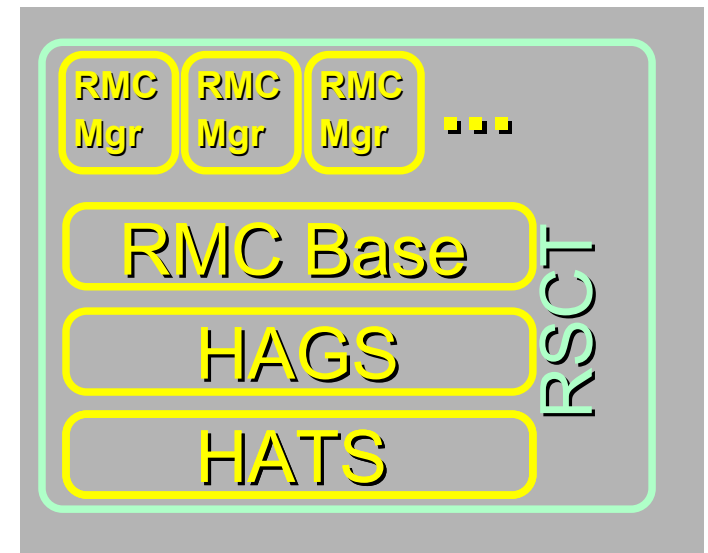
# AIX 5L System Management

*"Built-in" system monitoring infrastructure*

## Resource Management and Control (RMC)

- **Common way to start, stop, and collect status information on processes and subsystems**
- **Monitors status of all processes in a group and informs members upon failure**
  - ▶ Harvesting eliminates registering new resources
- **Group Services (HAGS)**
  - ▶ Distributed coordination and synchronization service
- **Topology Services (HATS) provides**
  - ▶ Adapter status and node connectivity info using heartbeat
  - ▶ Reliable Messaging Service

**RMC used by CSM, HACMP, GPFS and other LPPs for high availability services**



# AIX 5L System Management

*"Built-in" system monitoring infrastructure*

## ■ RMC controls

- ▶ 84 predefined conditions
- ▶ 8 predefined responses
- ▶ Site-defined conditions and responses

## ■ Resource Monitors

- ▶ Network adapters
- ▶ Disk, paging and file systems
- ▶ Processor statistics
- ▶ System wide status
- ▶ Program statistics

## ■ Responses

- ▶ Run a command
- ▶ Send an e-mail
- ▶ Broadcast a message
- ▶ Log an entry

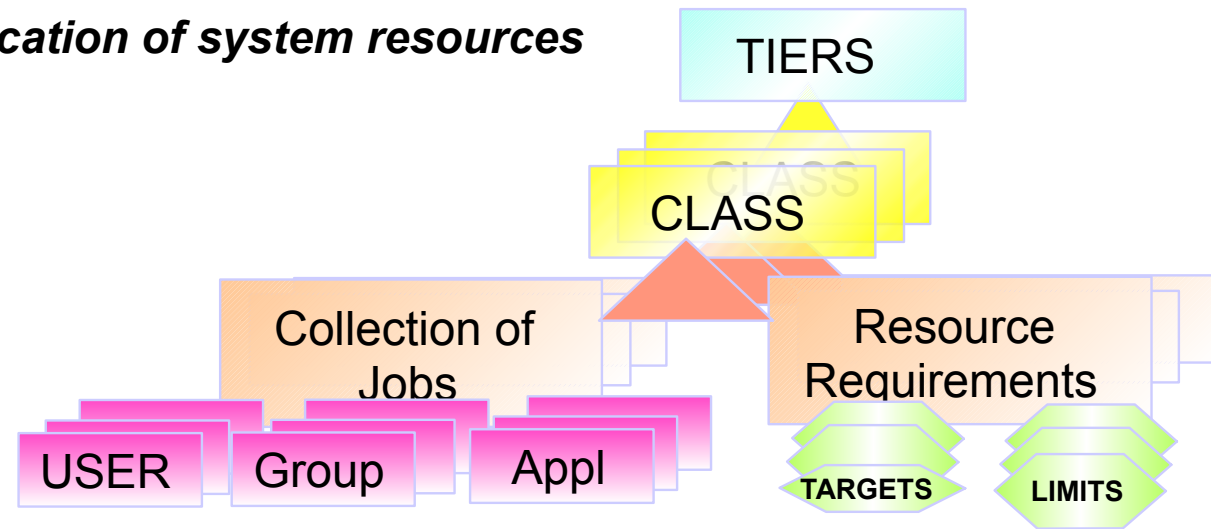
The screenshot displays the configuration window for a Resource Monitor. The window has two tabs: "General" and "Monitored Resource". The "Monitored Resource" tab is active. The configuration is as follows:

- Name:** /tmp space used
- Resource Class:** Journaled File System
- Monitored Property:** PercentTotUsed
- Event Expression:** PercentTotUsed > 90
- Event Description:** An event will be generated when more than 90% of the total space in the /tmp directory is in use.
- Rearm Expression:** PercentTotUsed < 85
- Rearm Description:** An event will be rearmed when more than 90% of the total space in the /tmp directory is in use.
- Severity:** Informational
- Responses to the condition...:** (Empty field)

Buttons: Details..., Use Defaults, OK, Cancel, Help

# Planned AIX 5L Workload Management

*Allows the efficient allocation of system resources*



## Features

- Assigns priorities and controls to system resource
  - ▶ Overrides systems scheduler, fully dynamic operation with passive mode support
  - ▶ CPU, Memory and Disk I/O resource mgt independently
  - ▶ Launched/managed from command line or GUI
- Resource priorities:
  - ▶ 10 tiers, 27 classes, subclasses w/admin roles
  - ▶ Application Tag APIs, wildcard pathname spt
- Resource controls:
  - ▶ Provides target and limit support
  - ▶ Example: amount of connect time, # processeds, # logins, real memory limits per process, etc

# AIX Networking

## ■ Robust IPv4, IPv6, Mobile IP support

- ▶ 128-bit IP addressing, Dynamic auto-configuration, Redundant routing/Multihoming
- ▶ Tunnel support, Secure r cmds/Kerberos 5 support, CIDR

## ■ Virtual IP Address (VIPA)

- ▶ Virtual I/P address for system and app usage; provides session preservation

## ■ Virtual Lan Support (VLAN)

## ■ IP Multipath routing, gated multicast routing

- ▶ Load balance between two gateways or two interfaces on the same network
- ▶ Round-robin equal cost routes, Dead gateway detection

## ■ Network Interface Backup

- ▶ Automatic failover between network adapters

## ■ Etherchannel/trunking support

## ■ Dynamic Feedback Protocol Support (DFP)

- ▶ Provide load statistics to a Cisco LocalDirector

## ■ TCP Explicit Congestion Notification

- ▶ Active “pacing” for network traffic

## ■ IPsec security - options for IPv4 and IPv5

- ▶ Secure tunnelling, strong encryption, dynamic loading of crypto extensions, etc



# pSeries - AIX 5L Security

## ICSA Certified Virtual Private Network (VPN)

- ✓ IPv6 / IPv4
- ✓ Authenticated Headers / Encapsulated Security Payload support
- ✓ IKE support
- ✓ MD5/ SHA-1, DES, TDES Crypto Algorithms

## Security and Directory

- ✓ Integrated Kerberos V5
- ✓ Pluggable Auth Mechanism (PAM)
- ✓ GSSAPI library
- ✓ LDAP V3 Server & Client
- ✓ Open SSH (Bonus Pack)
- ✓ User/Group security
- ✓ Admin roles support
- ✓ QoS, IKE, DNS, sendmail
- ✓ Integrated security auditing
- ✓ Fine-grained access controls
- ✓ Strong, per-user configurable identification & Authentication
- ✓ Account / Password management

## PCI H/W Crypto Adapter(s)

- ✓ DES, Triple DES, RSA and more
- ✓ FIPS 140-1 Level 4 certified
- ✓ PKCS-11 support



## pSeries Hardware Security

- ✓ Address Spaces
- ✓ Data Spaces
- ✓ LPAR

## Evaluated Security

- ✓ ICSA VPN / IPsec certification
- ✓ Common Criteria (CAPP/EAL4+) AIX5.2

## JAVA Support

- ✓ Java Crypto Architecture (JCA)
- ✓ Java Crypto Enablement (JCE)
- ✓ Java Authentication/Authorization Services (JAAS)

## WEB/ HTTP Security

- ✓ SSL v3
- ✓ Digital Certificates
- ✓ PKCS-11 consumption

## Tivoli Ready

- ✓ TMA out-of-box support
- ✓ Risk Manager IDS 'adapter'
- ✓ User Administration
- ✓ Security Management

# AIX 5L Performance Tools

*Native AIX tools to monitor and tune system performance in distributed environments*

## ■ Native performance tools

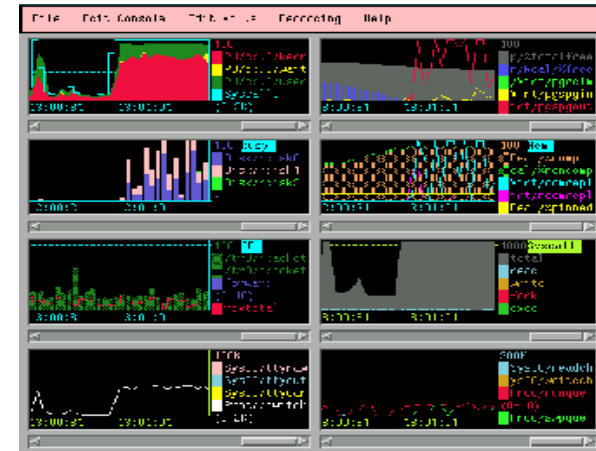
- ✓ **truss** - debugging and trace of all system calls
- ✓ **/proc** - debug filesystem
- ✓ **curt** and **splat** - thread and lock analysis tools
- ✓ **topas** - enhanced for NFS and SMP stats and wlm support
- ✓ **tprof** - enhanced for Java profiling
- ✓ **vmstat** - virtual memory acnew I/O activity view
- ✓ **PM (Performance Management) APIs** - for custom analysis

## ■ Template-based AIX performance tuning via a stanza based file: **/etc/tunables**

- Supports *no*, *nfso*, *schedo* (*schedtune*), and *vmo* (*vmtune*)
- Supports persistent values for *no* and *nfso* across reboot
- File can be exported and imported to multiple servers

## ■ Performance Toolbox LPP

- ✓ **xmtrend** - longterm recording (24x7) of performance statistics
- ✓ **jazizo** - post-processing GUI for viewing or analyzing PTX recording files. Allows customizing statistics, time period, view
- ✓ **wlmpert** - workload mgt trend analysis tool
- ✓ **Top viewer** - Integrated GUI version of topas tool for monitoring or viewing overall system status



# AIX 5L Java Technology

*Java™ 2 compliant environment enabling to "Write Once Run Anywhere"*

## AIX 5L Java environment spt: v1.3, v1.3.1, v1.4, v1.4.1

### ■ IBM AIX Developer Kit, Java 2 Technology Edition

#### Version 1.3.1 - 32 bit & 64 bit

- ▶ Appletviewer, Opt. Java Interpreter, Java class compiler
- ▶ Source-level debugger, Java Runtime Interpreter
- ▶ Java Classes (JDBC, Java IDL, RMI, JNDI)
- ▶ Tools for automatic generation of html docs for applets, Runtime libs for Java Multimedia links, Java AWT (draw/fill perf, colormap init.)
- ▶ Tools to Build Secure Java Applications
- ▶ XML for Java Version 2.1.1 (XML parser)
- Java 3D Version 1.2.1





# AIX 5L Version 5.2 Overview

## Integrated 32-bit/64-bit application and system support

- ✓ 32-bit Binary compatibility for all AIX Versions 4 and 5L releases
- ✓ 64-bit Binary compatibility for all AIX 5L releases

## Enhanced scalability, ease-of-use, security, performance

- ✓ 32-way SMP, **1TB memory, Dynamic LPAR/CUoD**
- ✓ **Autonomic computing support, self-managing features**
- ✓ High perf. Journaling Filesystem (**JFS2 - 16TB capacity**), **Native MPIO**
- ✓ AIX Workload Mgr, IBM LDAP Directory, Kerberos Authentication server
- ✓ **Linux interoperability and AIX Toolbox for Linux Applications**
- ✓ **Integrated SVR4 Affinity services**
- ✓ **Formal security certification (Common Criteria CAPP/EAL4+)**

## Value-Add layered software

- ✓ **HACMP Version 5.1** for system and application failover
- ✓ **Cluster Systems Manager (CSM)** for AIX and Linux
- ✓ Grid Toolkit, and more....

# AIX 5L 5.2 Linux and SVR4 Services

*Increased productivity for pSeries administrators and developers  
facilitating migration and co-existence*

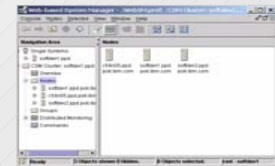
## Quick Reference Material

- ▶ AIX, Solaris and Linux cross-reference data sheet



## Linux Affinity

- **AIX Toolbox for Linux Applications**
  - ▶ Now over 380 applications, tools, and utilities
- **Linux-AIX distributed cluster systems management (CSM)**
  - ▶ Common management for up to 128 AIX and Linux on pSeries and Linux on xSeries systems/LPARs/nodes from single interface



## SVR4 Affinity

- **AIX-Solaris Interoperability features**
  - ▶ LDAP client support for RFC2307 based schema
  - ▶ Run level scripts options for both Solaris and Linux compatibility
- **UNIX System VR4 commands**
  - ▶ Native SVR4 admin tools: print, pkgadd, truss/proc, >30 new cmds

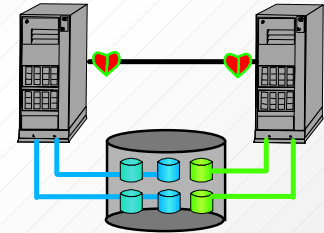


# pSeries Layered Software Products

*Add value to pSeries environments above the OS*

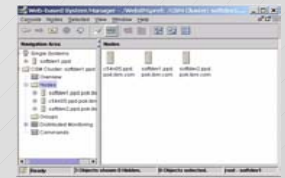
## *Support for AIX environments:*

- **HACMP Version 5.1 (07/03)**
  - **Fast Disk Takeover and Improved security**
  - **XD (Extended Distance) features:**
    - ▶ PPRC support, unlimited distance IP data mirroring



## *Support for AIX and Linux for POWER environments:*

- **Cluster System Management (CSM) Version 1.3.2**
  - ▶ Common cluster management on AIX and Linux on xSeries; CSM support for Linux on pSeries added in 9/03
  - ▶ Supports managing heterogeneous clusters of up to 128 pSeries and xSeries servers/nodes
- **Global Parallel File System (GPFS) Version 2.2 (12/2003)**
  - ▶ AIX, Linux on xSeries, and new Linux on pSeries support
- **GRID Toolkit Version 3**



# AIX 5.2 Summary

## ✓ **PERFORMANCE and new system support!**

- ▶ Optimized performance and scalability enhancements for POWER4 systems
- ▶ **Seamless support for future POWER5 systems and Blades with added performance**

## ✓ **New Functional enhancements**

- ▶ **Dynamic Logical Partitions**
- ▶ **Dynamic Capacity Upgrade on Demand flexibility**
- ▶ **CUoD Hot sparing**
- ▶ **16 TB JFS2 large files/filesystem capacity and scaling**
- ▶ **Linux and UNIX SVR4 compatibility features for administrators**
- ▶ ....and many more enhancements in all technology areas

## **Cluster Management flexibility with CSM**

- ▶ Common management for AIX and Linux on pSeries and Linux and xSeries

For a whitepaper overview of AIX 5.2 features-

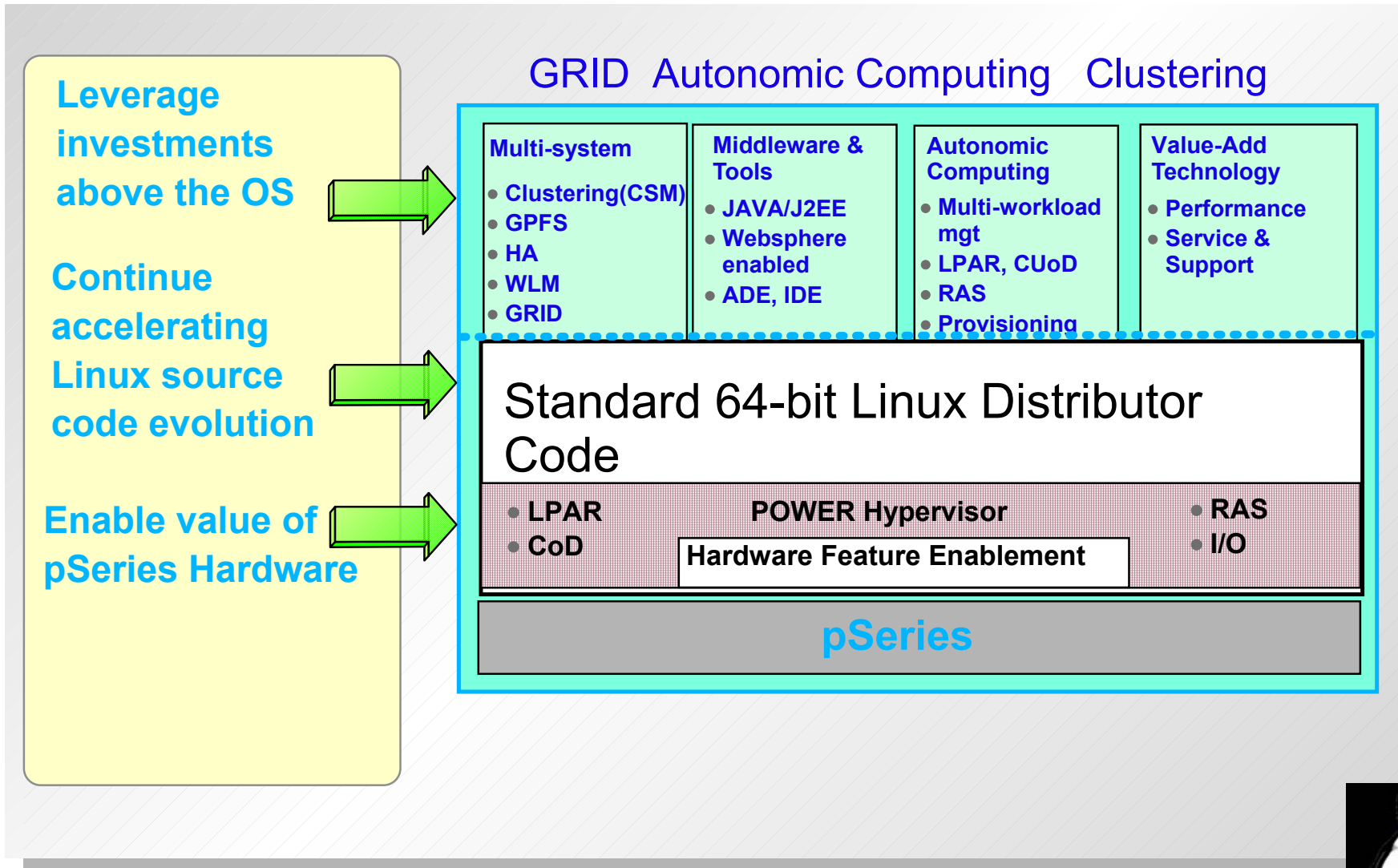
[http://www.ibm.com/servers/aix/whitepapers/aix\\_ondemand.html](http://www.ibm.com/servers/aix/whitepapers/aix_ondemand.html)



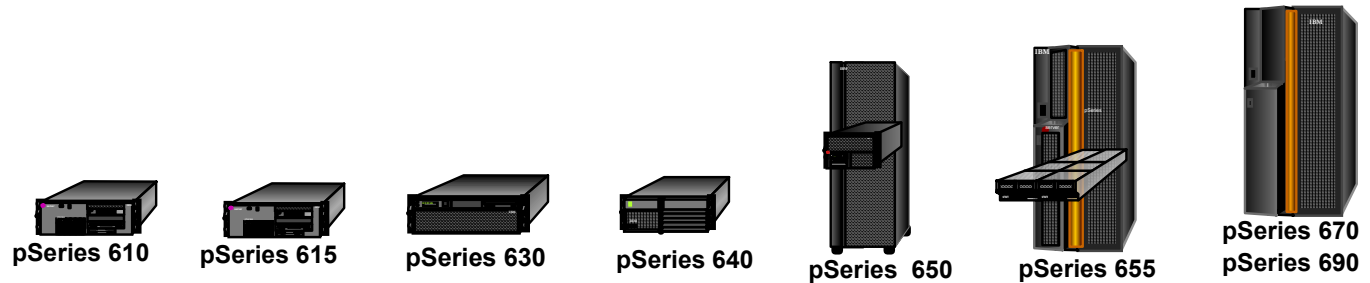
# LINUX for pSeries

# Linux for pSeries - Strategy

*Add IBM Value Above and Below the OS*



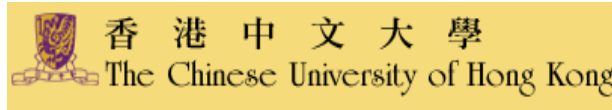
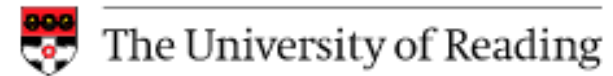
# Linux on pSeries - System Support 2003



| Mode                     | SMP | SMP | SMP LPAR | SMP | SMP LPAR | SMP LPAR | LPAR |
|--------------------------|-----|-----|----------|-----|----------|----------|------|
| <b>Red Hat RHEL 3</b>    |     |     |          |     |          |          |      |
| <b>SuSE SLES 8</b>       |     |     |          |     |          |          |      |
| <b>Turbolinux TLES 8</b> |     |     |          |     |          |          |      |
| <b>Conectiva 8</b>       |     |     |          |     |          |          |      |



# Linux on pSeries - Growing Customer Base



Linux in an LPAR



INTERMOUNTAIN HEALTH CARE

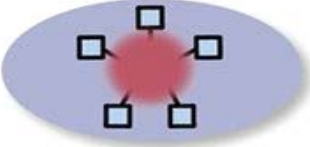

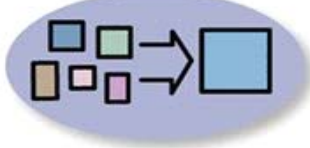



LINUX SCALE OUT - LINUX SCALE UP - LINUX in an LPAR

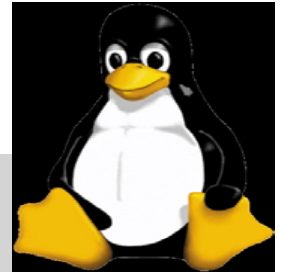




# How Customers are Deploying Linux on pSeries

|  | Recent Customers  | Value   |
|--|---|---|
| <b>Infrastructure Solutions</b><br> | <ul style="list-style-type: none"> <li>▪ <b>Library of Congress and University of Washington, Rutgers &amp; Georgia Tech</b></li> <li>▪ LexCom GmbH</li> <li>▪ Saturn (Italian retailer)</li> </ul>                         | <ul style="list-style-type: none"> <li>▪ Lower cost</li> <li>▪ Easy to maintain</li> <li>▪ Open</li> <li>▪ Scalable</li> <li>▪ Reliable</li> </ul>  |
| <b>Distributed Enterprise</b><br>   | <ul style="list-style-type: none"> <li>▪ <b>China Ministry of Railways</b></li> <li>▪ HeNan Government</li> <li>▪ National Assembly Library</li> </ul>  | <ul style="list-style-type: none"> <li>▪ Highly reliable and secure</li> <li>▪ Lower cost</li> <li>▪ Range of small footprint servers</li> <li>▪ Easily replicated</li> </ul>   |
| <b>Linux Clusters</b><br>           | <ul style="list-style-type: none"> <li>▪ <b>Munich University</b></li> <li>▪ <b>Russia Joint Supercomp. Ctr.</b></li> <li>▪ National Institute of Health</li> <li>▪ Center for Development of Advanced Computing</li> </ul> | <ul style="list-style-type: none"> <li>▪ Proven roadmap</li> <li>▪ Price/performance</li> <li>▪ Scale out or scale up</li> <li>▪ Efficient cluster management</li> </ul>  |
| <b>Workload Consolidation</b><br> | <ul style="list-style-type: none"> <li>▪ China Unicom</li> <li>▪ Lotto.com</li> <li>▪ Standard Life</li> <li>▪ Deutsche Bank</li> </ul>   | <ul style="list-style-type: none"> <li>▪ Reduce cost of ongoing operations</li> <li>▪ Dramatically improve TCO</li> <li>▪ Increase flexibility &amp; speed of deployment</li> <li>▪ Increase reliability, availability</li> </ul> |
| <b>Application Solutions</b><br>  | <ul style="list-style-type: none"> <li>▪ <b>IBM eServer Integrated Platform for e-business</b></li> <li>▪ <b>IBM SWG products</b></li> <li>▪ Selectica</li> <li>▪ Foedero</li> <li>▪ DataSynapse</li> </ul>                 | <ul style="list-style-type: none"> <li>▪ Integrated, tested, proven</li> <li>▪ Optimized for Java applications</li> <li>▪ Reduced implementation time</li> <li>▪ Base platform for ISV applications</li> </ul>                    |

# Gartner on Linux Vendors..



## Gartner's Evaluation of Linux Vendors

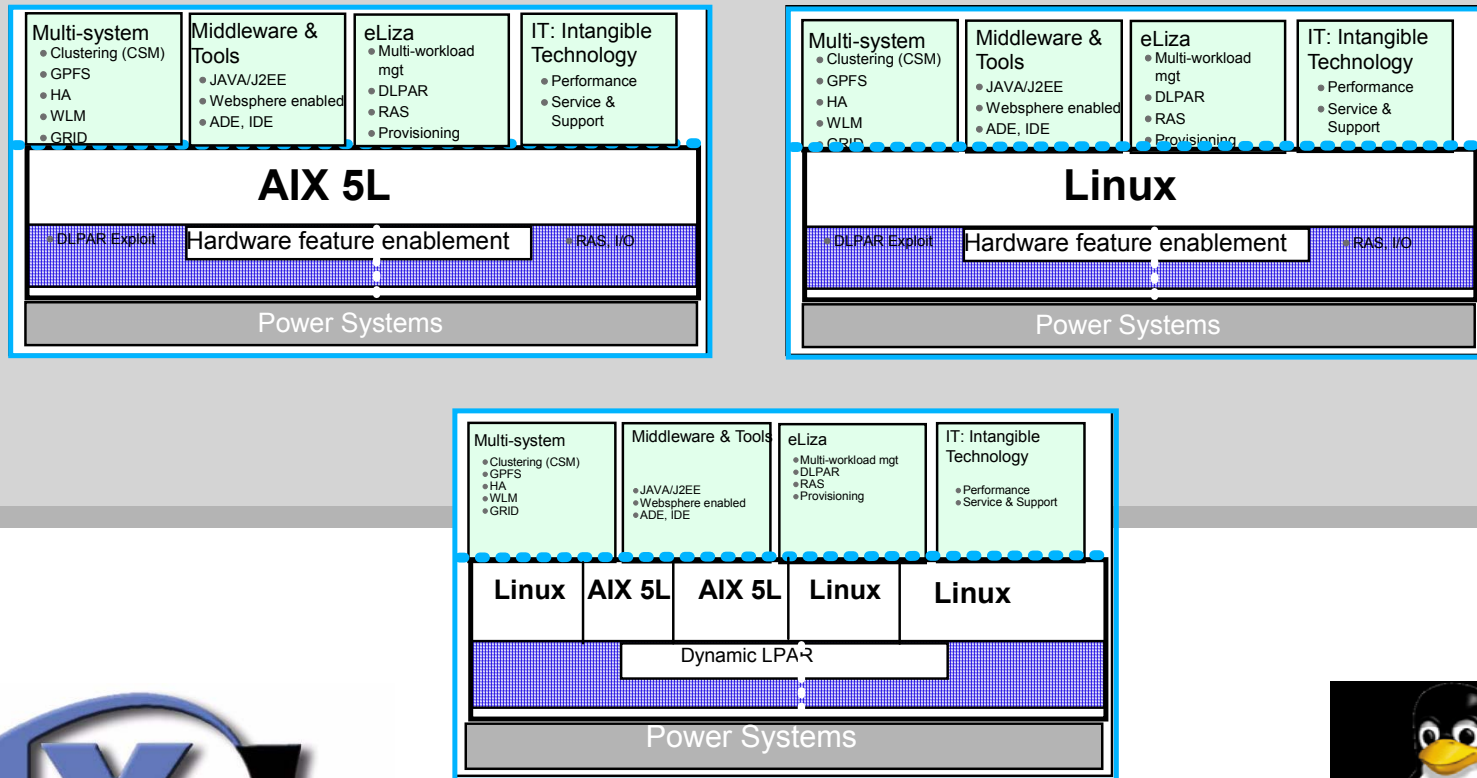
|                         | Platforms | Partnering | Stack | Open Source<br>Software<br>Collaboration | Services/<br>Support | Programs/<br>Markets | Weighted<br>Total | Weighted<br>Average |
|-------------------------|-----------|------------|-------|--|----------------------|----------------------|-------------------|---------------------|
| <b>IBM</b>              | 8         | 8          | 9     | 8  | 8                    | 7                    | 184               | 8.0                 |
| <b>Hewlett-Packard</b>  | 8         | 8          | 6     | 8  | 8                    | 7                    | 169               | 7.3                 |
| <b>Novell/SUSE</b>      | 8         | 5          | 4     | 7  | 5                    | 2                    | 113               | 4.9                 |
| <b>Sun Microsystems</b> | 4         | 1          | 5     | 6  | 4                    | 1                    | 82                | 3.6                 |
| <b>Dell</b>             | 5         | 3          | 1     | 1  | 4                    | 3                    | 65                | 2.8                 |

Source: Gartner Research (February 2004)

10 = best  
1 = worst

# pSeries Software Offerings

## Flexibility and Choice: AIX 5L and/or Linux



✓ And LPARs allow mix and match.....

