Building a Better Infrastructure With IBM Middleware on System p

Consolidation Thru Virtualization Saves Space, Energy and Costs

Underutilization Drives Consolidation

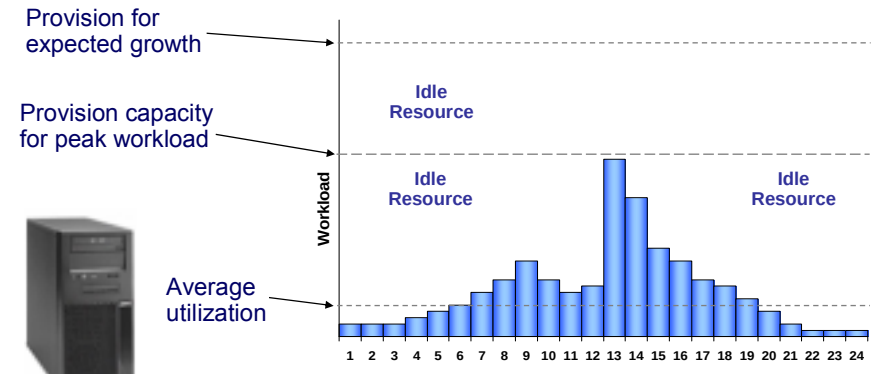
What is your average server utilization?

Service Oriented Finance CIO

Well,
My Windows servers average 5-10%, and my Unix servers average about 27% utilization

Data Center Manager

Utilization of Distributed Servers



Server dedicated to one application or functional role

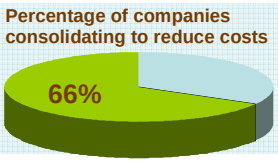
- Typical utilization of Windows Servers <5%
- Typical utilization of distributed UNIX Servers 15 – 20%
- Typical utilization of System p Servers 70 – 100%

What's a CIO To Do?

Service Oriented Finance CIO

Data Center Manager

Many Businesses Today See Server Consolidation as the Answer

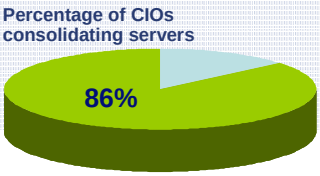


Two-thirds of the companies surveyed prefer to run multiple applications per server *in order to minimize costs and labor and to increase flexibility and system utilization.*

- IBM Market Intelligence Research, High End UNIX Buyers, November 2005

*"Most companies have already begun consolidating their servers — **86 percent of the CIOs** we asked cited progress in this area. Virtualization is the next natural move."*

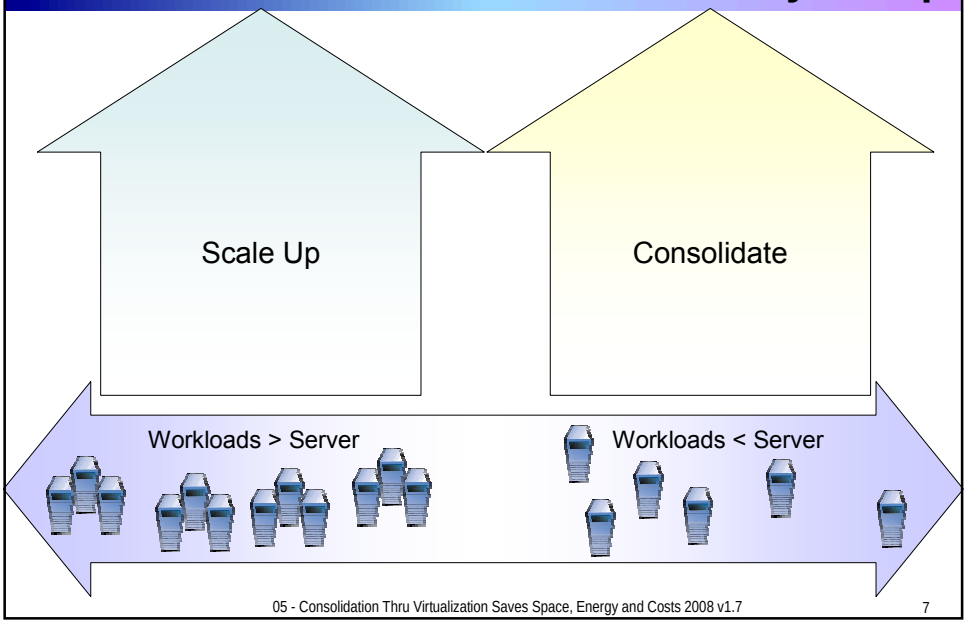
- McKinsey Quarterly, May 2006



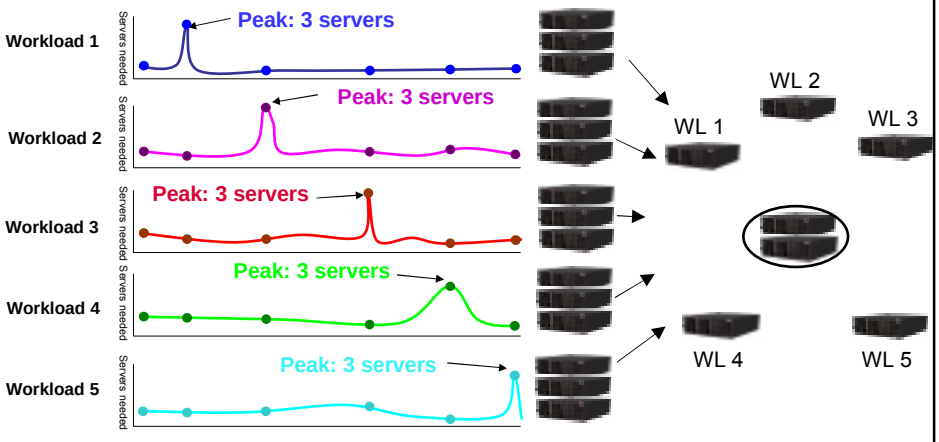
Economics of Consolidation

- Consolidating workloads means running multiple workloads on a single system at the same time
- Consolidation achieves greater utilization of assets which minimizes cost per unit of work
- Same principal was applied by Henry Ford at the dawn of the industrial era
  - It still applies today

Let's Focus on Consolidation With System p



Theoretically Run the Same Workloads with Less Resources

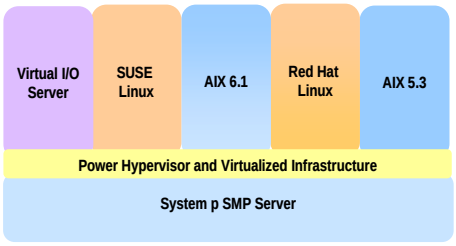


What's Required: Virtualization and Intelligent Workload Management to Accommodate Shifting Workloads – automatic on System p

Virtualization – How It Works in System p

Power Hypervisor™ manages processing resources among logical partitions

Logical Partitions (LPARs) provide operating system and application isolation



Virtual I/O server provides virtual devices to enable shared I/O operations

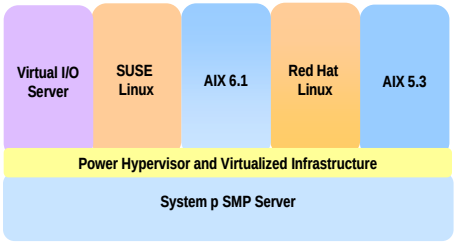
AIX 6 allocates resources to workload partitions

Integrated virtual ethernet enables high speed memory to memory networking between partitions

Up to 128 dispatchable threads on 64 processors

Logical Partitions (LPARs)

- Create Logical Partitions to run different workloads
- Install operating system and applications into each LPAR
- Power Hypervisor and Virtual I/O Server dynamically allocate and manage resources among LPARs
  - Logical Processors – shared or dedicated
  - Memory
  - Storage
  - Networking



Processors Are Virtualized And Shared

- Physical processors are either dedicated to a specific LPAR or assigned to the shared pool
  - LPARs utilize available processing units in shared pool as needed
- The Power Hypervisor applies processing power where and when it is needed
  - Always makes sure an LPAR gets its entitled processing units
    - Min – how much the LPAR must get to be able to start
    - Max – the maximum amount the LPAR can ever get (a cap)
    - Entitled – how much the LPAR is always guaranteed when needed
- Core processing capacity is allocated to LPARs in one one-hundredth (0.01) increments
  - MicroPartitioning
- Dedicated processors can lend available processing units to the shared pool

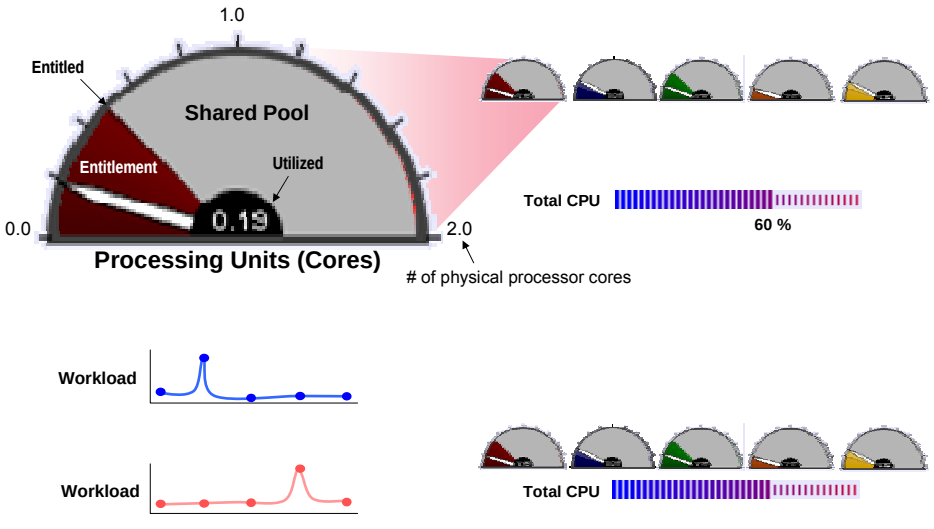
Virtual I/O Server (VIOS)

- A special purpose LPAR that:
  - Runs in a logical partition itself
    - Based on AIX, but not a general purpose partition
    - No additional licenses needed – included in PowerVM
  - Shares I/O resources among the Logical Partitions
  - Provides the user interface for the Power Hypervisor to dynamically allocate resources
    - Hardware management functions
      - Integrated Virtualization Manager (IVM) user interface
  - Provides the Power Hypervisor with resource usage data
    - To facilitate physical resource management and utilization

DEMO:
Prepare to Consolidate by Creating a New LPAR

- Create a new LPAR for a new file server
  - Configure min, max and entitled values for processors and memory
  - Define virtual devices

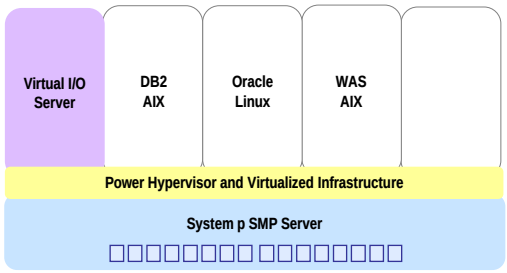
DEMO: Maximize Processor Utilization with Shared Processors



Candidates for Easy Workload Consolidation on System p

Workload	How
Workloads from smaller p systems	Deploy
Middleware workloads ▸ Infrastructure (Web, file servers, DNS, DHCP…) ▸ Database (DB2, Oracle, Informix …) ▸ Java and J2EE Web Application Servers ▸ Collaboration (Domino, SameTime …) ▸ Systems Management (Tivoli …)	Deploy
Other Linux Workloads ▸ C/C++ Applications ▸ Intel-specific Linux applications	Recompile PowerVM Lx86 Emulator
SOA and Emerging Applications ▸ Web 2.0 ▸ ESB and SOA stack infrastructure ▸ New Media ▸ Enterprise Search and Analytics	Deploy

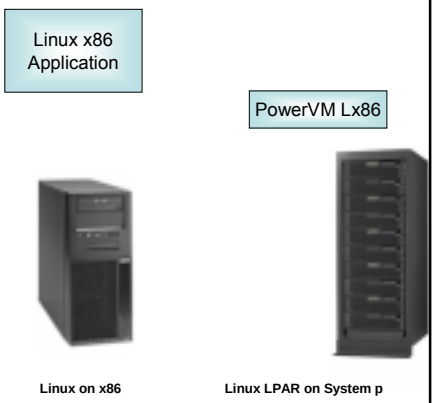
Consolidating Workloads on System p



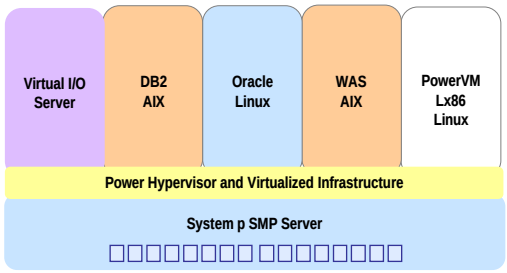
Workloads less than server capacity

PowerVM Lx86 Runs Your x86 Linux Applications

- Run your 32-bit x86 Linux applications without any modifications – not even recompilation
  - Full 32-bit Intel x86 ISA, including MMX, Floating-point, IA-32 instruction set
  - Support for Red Hat AS 4 U4 and newer and Novell SLES 9 and 10
  - Interoperability between applications running on PowerVM Lx86 and native POWER
- **Useful when the source code is not available**
- Performance
  - Targeted application performance 80%+ of native Linux on POWER



Consolidating Workloads on System p

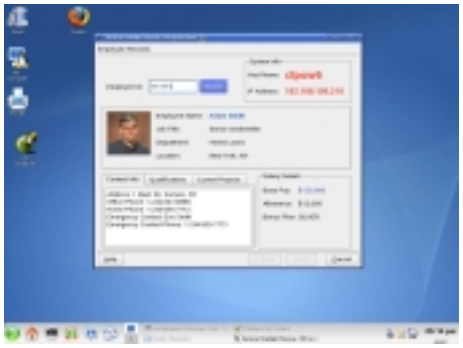


Workloads less than server capacity

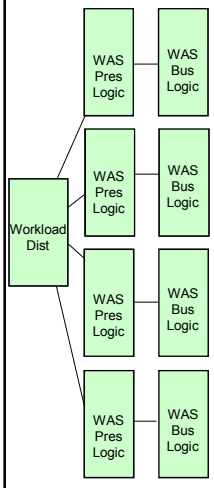
DEMO: Consolidating an Application onto PowerVM Lx86 on System p

- Human Resource application
- Running on x86 Linux with X Windows
- Source code is not available
- Consolidate on PowerVM Lx86 with no recompilation

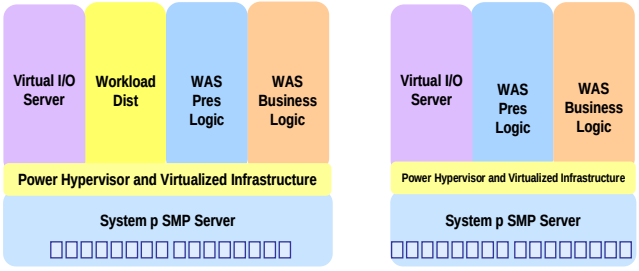
HR Application on PowerVM Lx86



Clusters Can Also Be Consolidated

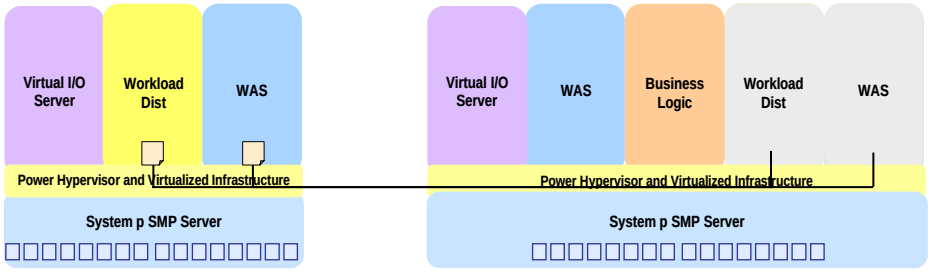


Typical Multitier WebSphere Deployment cluster on Intel



PowerVM Live Partition Mobility Moves Running LPARs Between Machines

- No LPAR downtime
- Move LPAR within the same or different physical servers
  - Both LPARs must share access to the same storage
- Manual or automatically initiated (e.g load usage, cron tasks …)
- Useful for workload balancing, maintenance and weekend shutdowns
- Live application mobility is a similar concept for PowerVM AIX 6 Workload Partitions



The Competitors Can't Match System p Virtualization Capabilities

	IBM System p PowerVM	Sun Logical Domains	HP Integrity IVM	VMware ESX Server
Bare metal hypervisor	**Built into hardware**	Software only-few models	No	Implemented in Software
Hardware assists	OS-Hypervisor interoperation	HW supervisor attention needed	HW supervisor attention needed	HW supervisor attention needed
Maximum number of cores per partition	64	8	4	4
Secure virtualization	EAL4+	Not Certified	Not Certified	EAL2
Live Partition Mobility	PowerVM integrated	No	No	Add-on feature
Workload Partitions	AIX6	Solaris 10	No	No
Live Application Mobility	Auto or Manual	Manual (requires stop)	No	No

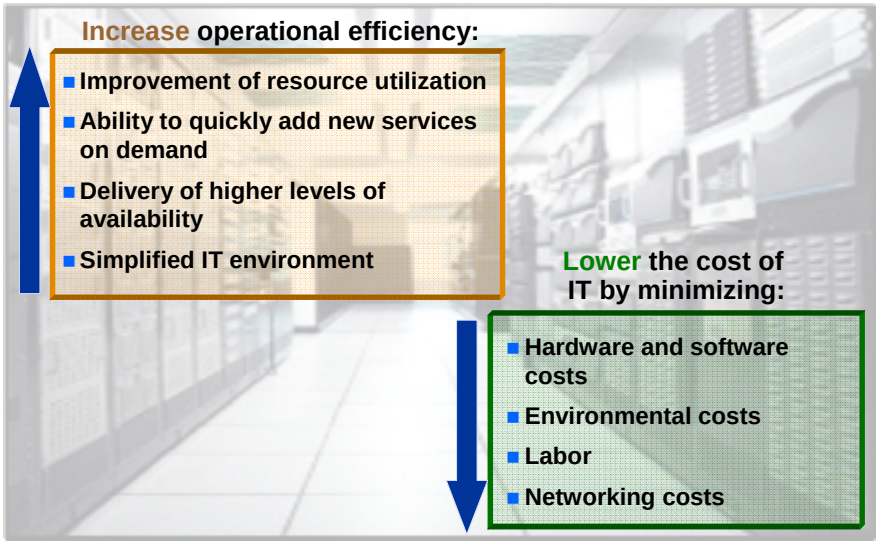
What's Possible with IBM Software on System p™?

- Any data center growth would have required multimillion dollar build out
- Consolidated **65** HP servers on **2** IBM System p595 servers (one primary and one backup)
  - Leveraged LPAR technology to manage capacity and plan for growth while lowering existing data center costs and eliminating build out requirement.

30 to 1

- Production, development and test requirements meant significant underutilized capacity in the data center
- Using LPAR technology, consolidated **30** preexisting servers into **1** IBM System p570 running AIX
- Additional capacity now available as well

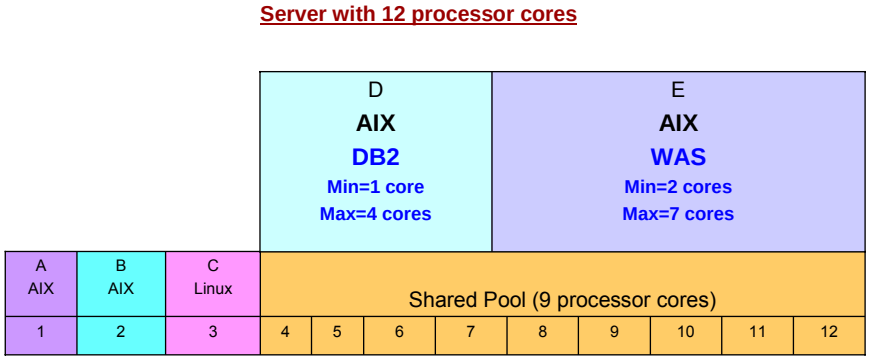
System p Consolidation Optimizes IT



IBM's Sub-Capacity Pricing For Software

- Flexible payment options for IBM software according to logical partition (LPAR) usage on System p
  - Dedicated and Shared Cores
- *You* decide how many processors to license per software application
- *You* decide how to assign processor partition workloads
- *You* can revise processor assignments to meet requirements

License Counting: Shared Pool with Multiple Partitions



DB2 cores to license:
- 4 for partition D

WAS cores to license:
- 7 for partition E

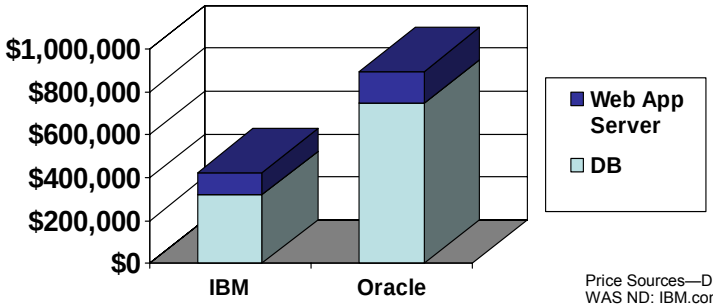
Oracle Has No Sub-Capacity Pricing

"Oracle does not offer special licensing terms for server usage models where the number of CPUs can be scaled down or their usage varied – the "Pay Per Use" or "Pay Per Forecast" models."

Source: Oracle Corporation, Jan 15, 2008 - http://www.oracle.com/corporate/pricing/partitioning.pdf

Middleware on System p: IBM vs. Oracle Pricing

Price of DB & Web App Server on 4 Cores of 12-Core System p6 570

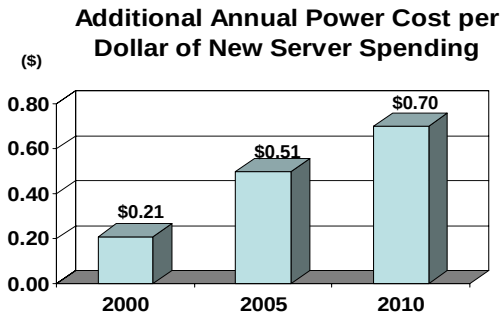


Price Sources—DB2, Partitioning, WAS ND: IBM.com Passport Advantage Express Software Catalog; Oracle Database EE, Partitioning, Server SE: Oracle Technology Global Price List, September 4, 2007.

Cost of Power and Cooling

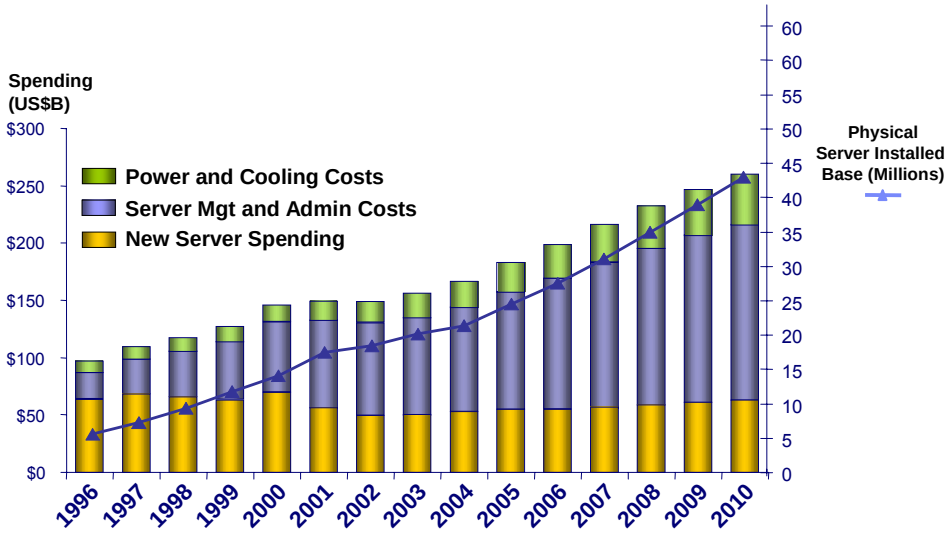
Data Center Power Crisis

- **Half of the data centers in the world are going to be unable to support server power requirements by the end of 2008.**
- **Energy costs will become the second largest operating cost in 70% of data centers by 2009.**
  —Gartner Group, 25th Annual Data Center Conference, December 2006.



Source: IDC, "Enabling Technologies for Power and Cooling," September 2006

When Budgets Are Fixed, More Money for Labor Means Less for New Projects



Source: IDC, May 2006

Total Cost of Ownership is More Than Just Purchase and Installation

TCO =

- Cost of Hardware Acquisition +
- Cost of Software Acquisition +
- Annual HW & SW Maintenance Costs +
- Cost of Storage Acquisition +
- Cost of Power +
- Cost of Administration +
- Cost of Floor Space +
- Cost of Network Connectivity

Annual Cost Per Unconsolidated Server

	Annual Cost*
Power	$731
Floor Space	$987
Annual Server Maintenance	$777
Annual connectivity Maintenance	$213
Annual Disk Maintenance	$203
Annual Software support	$10,153
Annual Enterprise Network	$1,024
Annual Sysadmin	$20,359
Total Annual Costs	$34,447

For 30 unconsolidated servers, annual costs are $1,033,410

* Source: IBM internal consolidation project

Consolidation Cost Summary and Comparison – 30 Servers to 1 System p570

System p One Time Charge

Server Acquisition	$ 725,582
Connectivity Acquisition	$ 38,321
Disk Acquisition	$ 98,718
Software Licenses	$ 488,678
Migration Cost	$ 505,488
Total OTC (Cost of migration)	$ 1,856,787

75% reduction in annual operations cost

80+% reduction in power consumption

(Includes cost of migration!)

System p Annual Cost

	Year 1	Years 2+
Power	$ 4,214	$ 4,214
Space	$ 375	$ 375
Annual Server Mt	$ 33,564	$ 33,564
Annual Connectivity Mt	$ 1,532	$ 1,532
Annual Disk Storage Mt	$ 3,948	$ 3,948
Annual SW Support	$ 1,499	$ 97,469
Annual Ent. Network	$ 13,824	$ 13,824
Annual Sys Admin	$ 82,888	$ 82,888
Total Annual Costs	$141,844	$ 237,814

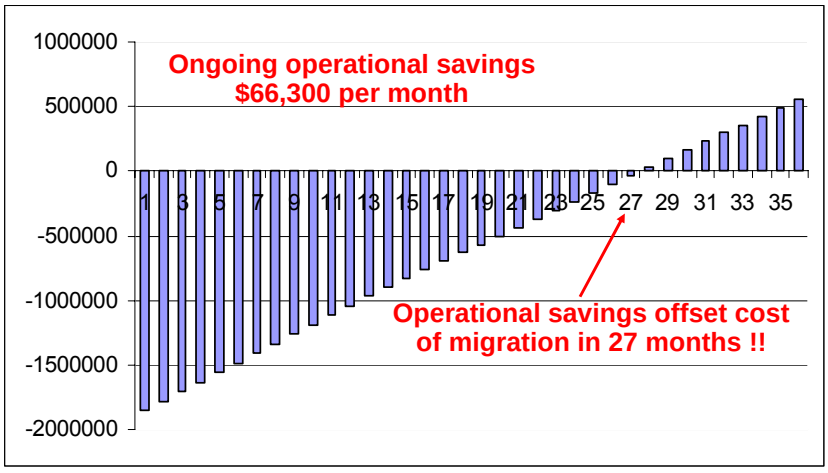
Unconsolidated Annual Cost

	Per Year
Power	$ 21,930
Space	$ 29,610
Annual Server Mt	$ 23,310
Annual Connectivity Mt	$ 6,390
Annual Disk Storage Mt	$ 6,090
Annual SW Support	$ 304,590
Annual Ent. Network	$ 30,720
Annual Sys Admin	$ 610,770
Total Annual Costs	$ 1,033,410

Operational cost savings = $ 891,566 yr 1, $795,596 yrs 2+, Break even in 27 months!

Cash Flow Analysis

Savings Cash Flow When Consolidating 30 Servers to 1 System p570



Time Into Project (in months)

What Else Can Consolidation Do For You?

Hourly Downtime Cost by Industry

Industry	Hourly Business Cost	Per Employee
Energy	$2,817,846	$569
Telecommunications	$2,066,245	$187
Manufacturing	$1,610,654	$134
Finance/Brokerage	$1,495,134	$1,080
Information Technology	$1,344,461	$184
Insurance	$1,202,444	$371
Retail	$1,107,274	$244
Pharmaceuticals	$1,082,252	$168
Banking	$996,802	$131
Food Processing	$804,192	$153
Consumer	$785,719	$128
Chemicals	$704,101	$195
Average	***$1,010,536***	***$206***

Source: Meta Group, IT Performance Engineering & Measurement Strategies: Quantifying Performance Loss, October 2000

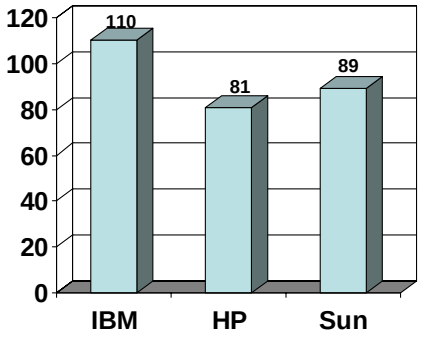
System p Built for High Availability

System p Reliability, Availability, Serviceability Features

- Fault Prediction and Avoidance
- Failure Diagnostics
- Intermittent Fault Resolution
- System Redundancies
- Dynamic Deallocation
- Hot-Swap Parts Replacement

Customers Say System p Availability Is Highest

Observed Availability



Scoring: Gabriel Consulting's Vendor Preference Index (VPI)

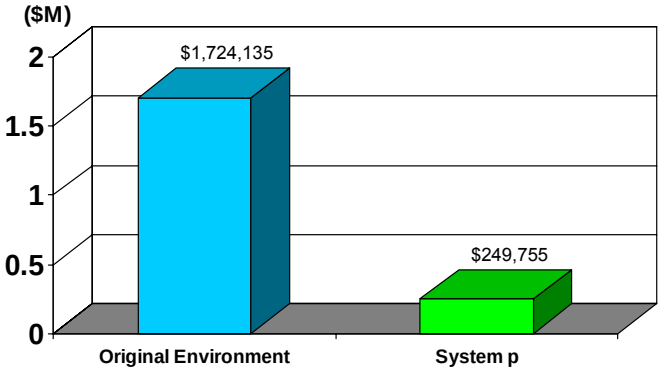
Scores > 100 are great
Scores = 100 are par
Scores < 100 are not so good

Based on survey of 277 enterprise Unix customers in 4Q '06; one-third standardized on IBM, HP, Sun; 75% have two or more Unix variants.

Source: Gabriel Consulting Group, "Unix Vendor Preference Survey 4Q'06," December 2006.

Alinean Inc. Consolidation on System p Reduced Annual Downtime Cost by $1.47M

Alinean Inc. Downtime Costs, Before and After Consolidation



Source: "IBM System p5: Lower TCO Through Server Consolidation," Alinean Inc., September 2006

IBM Factories Get You Started on the Road To Consolidation

- Free Proof of Concept and cost/benefit analysis
- Includes high level architecture
- Consolidation Discovery and Analysis Tool (CDAT) now available as a free download for IBM Sales and Business Partners

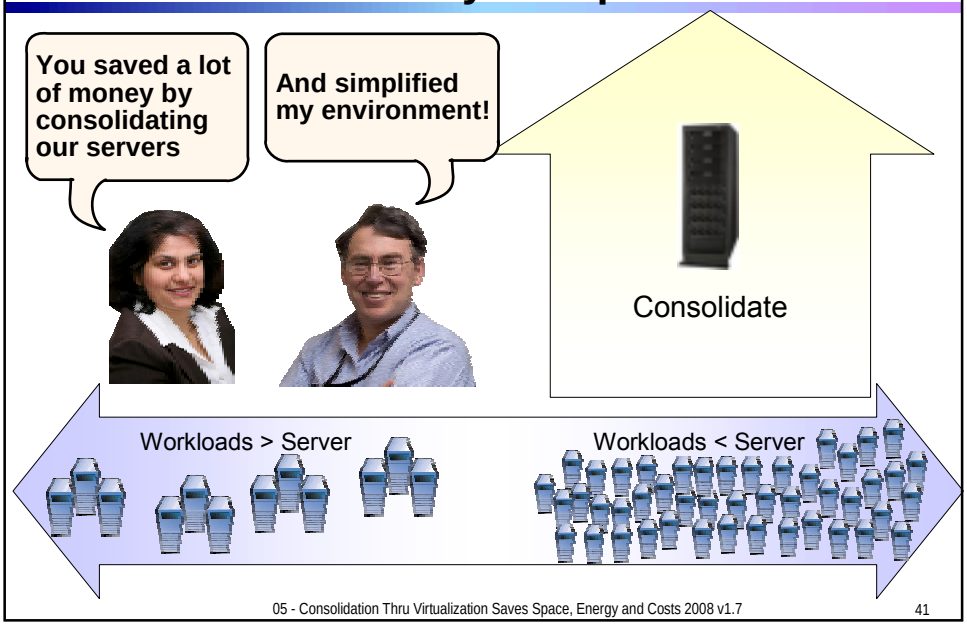
Our teams conduct data center interviews and run analysis tools to assess current efficiency and make consolidation recommendations

IBM

- **Migration Factory**
- **Server Consolidation Factory**
- **Availability Factory**
- **X86 Server Consolidation Factory on POWER Systems**

IBM: http://w3-1.ibm.com/sales/systems/portal/_s.155/254?navID=f220s380&geoID=All&prodID=IBM%20Systems&docID=spshcdattool
BPs: PartnerWorld

Service Oriented Finance Consolidated Their Servers onto System p



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URLs and References

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  - http://www-03.ibm.com/systems/p/hardware/annc_0213/index.html?ca=p5&met=annc_0213&me=W&P_Site=p5hero
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