Capitalize On The Power Of An IBM Solution

Build A Dynamic Infrastructure On Power

We Need Smarter Data Centers Too

- TCO – Take Costs Out!
- More agility

Data Center Manager

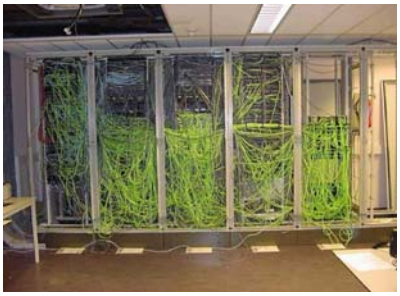
IBM can help you achieve a **Dynamic Infrastructure** that delivers all of these capabilities today!

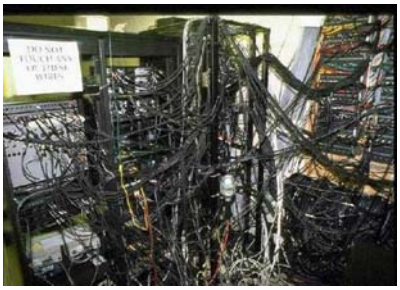
IBM

Server Sprawl Is Out Of Control And Has Consequences

- Low server resource utilization
- Excessive energy usage and heating problems
- Too many software licenses
- Additional staff required for platform management
- Unexplained outages
- Too much complexity
- Response to business requirements is too slow

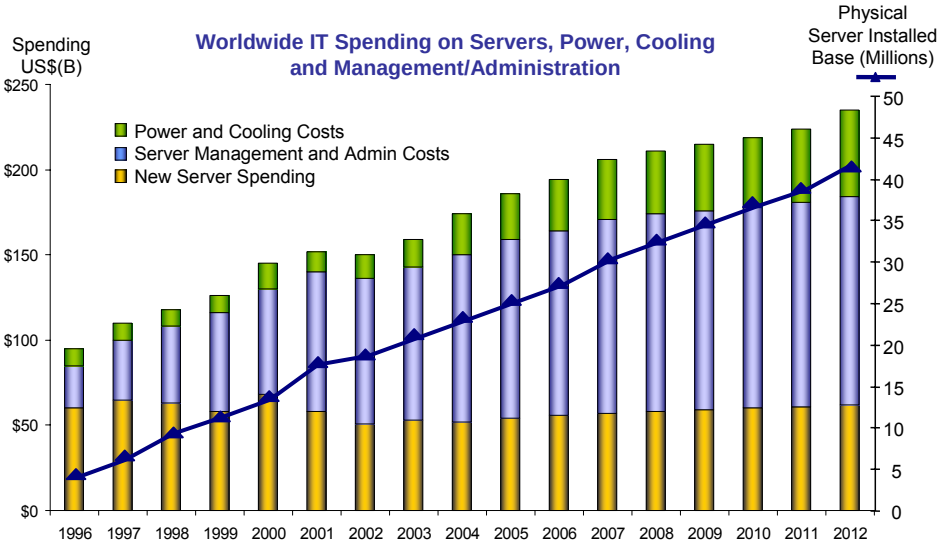
Complexity





- Complexity drives error rates
- Reduces responsiveness
- Increases unexplained outages
- Likely to impact security and performance

Server Sprawl Drives Increasing Annual Operating Costs



Source: IDC, 2008.

How Much Does It Cost You To Provide IT Services?

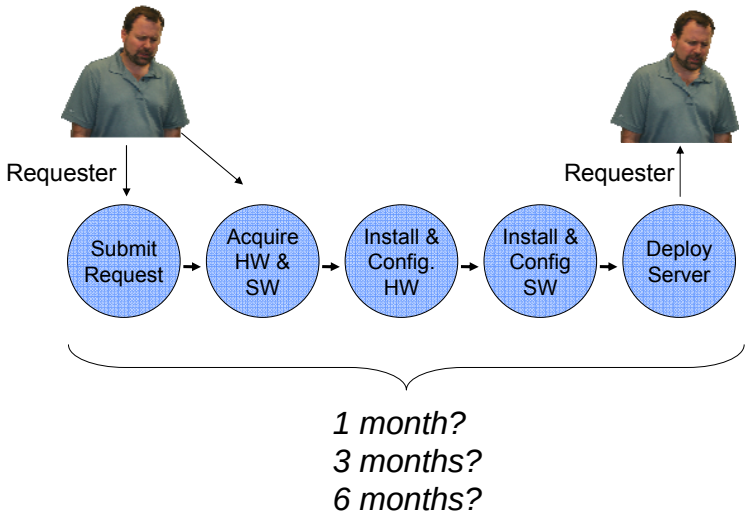
Annual Operations Cost Per Server
(Averaged over 3917 Distributed Servers)

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 System Administration	$20,359
Total Annual Costs	$34,447

The largest cost component was labor for administration
7.8 servers per headcount @ $159,800/yr/headcount

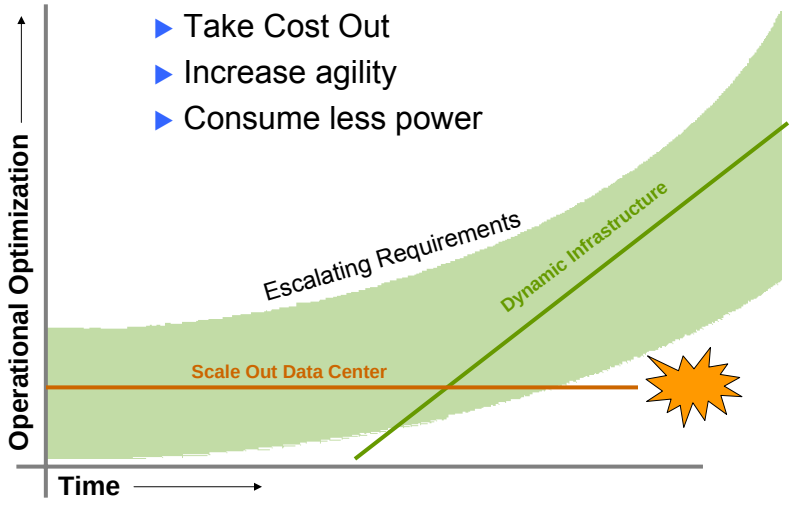
Source: IBM Internal Study

How Long Does It Take You To Provision A New Server?



Dynamic Infrastructure – Reinventing The Data Center To Meet Requirements

- Escalating Requirements
  - Take Cost Out
  - Increase agility
  - Consume less power



Dynamic Infrastructure

IBM

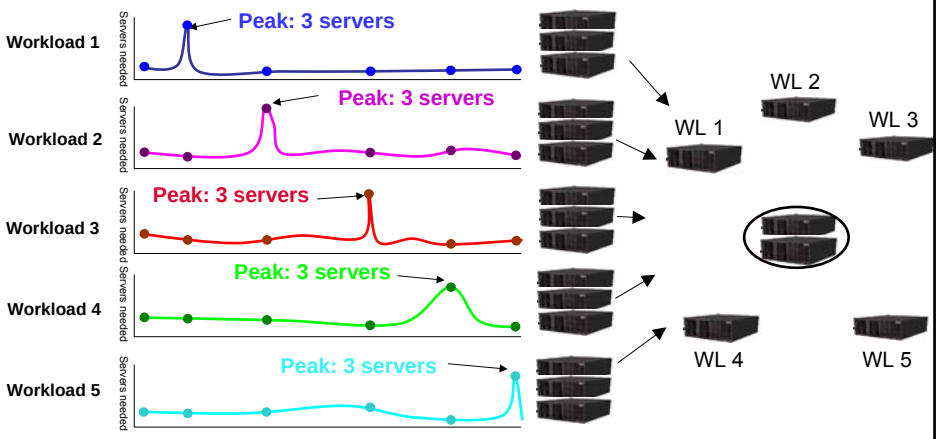
Take Costs Out

The biggest thing you can do to take costs out is . . .

Consolidate workloads on virtualized servers

- Achieves the lowest cost per unit of work
- Reduces hardware, software, labor and environmental costs

Here Is An Example

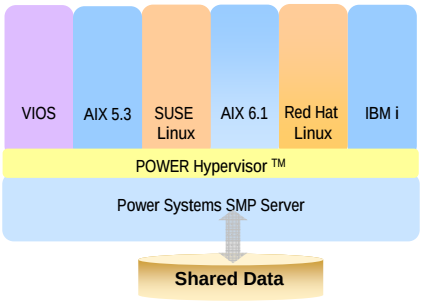


What is required: Virtualization and Intelligent Workload Management to accommodate shifting workloads.

This is automatic on Power Systems!

Power Systems Are Designed For Virtualization

- Power Systems server virtualization is a key enabler for the Dynamic Infrastructure
- Consolidate servers by running multiple operating system images on a single Power Systems server



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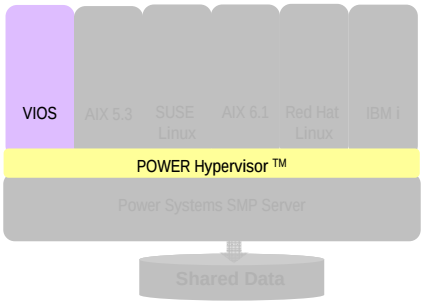


- PowerVM feature enables virtualization
  - Power Hypervisor
  - Virtual Input Output Server (VIOS) shares disk and network

Real World Examples Of Consolidation With IBM Software On Power Systems?

BOSE

- Any data center growth would have required multimillion dollar build out
- Consolidated **65** HP servers on **2** IBM Power Systems p5-595 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

VARIAN medical systems — A partner for life

- Production, development and test requirements meant significant underutilized capacity in the data center
- Using LPAR technology, consolidated **30** preexisting servers into **1** IBM Power 570 running AIX
- Additional capacity now available as well

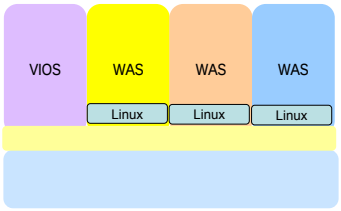
Case Study: Calculate The Savings

30 HP Itanium Servers Integrity rx3600

Consolidate

Power 570 Server (16 Cores)

30 LPARs Plus VIOS



WebSphere Application Servers on Red Hat Linux Average Utilization 24%

Average Utilization 70%

Case Study: Current Cost Of Running Each HP Server

- Example:
  - JEE application on WebSphere Application Server on Red Hat Linux
  - On HP Integrity rx3600

Annual Cost Per Unconsolidated Server*

Power and Cooling	$1,203
Floor Space	$113
Annual Server Maintenance	$924
Annual Connectivity Maintenance	$213
Annual Disk Maintenance	$203
Annual Software Support	$4,799
Annual Enterprise Network	$1,024
Annual System Administration	$20,359
Total Annual Costs	$28,838

* Source: Internal IBM Consolidation Project

For 30 unconsolidated servers, annual costs are ***$865,129***

Case Study: Consolidate Thirty HP Servers To One Power System

Price Sources and Calculations -- Power 570 and maintenance, Red Hat Linux and maintenance - IBM Technical Sales; WebSphere Application Server: IBM.com Passport Advantage Express Software Catalog; HP Integrity and maintenance: HP TPC-C benchmark report.

88% reduction in energy consumption

67% reduction in floor space costs

Power Systems One Time Acquisition Costs

Server Acquisition	$ 725,582
Connectivity Acquisition	$ 38,322
Disk Acquisition	$ 98,719
Software Licenses	$ 1,499
Migration Cost	$ 336,993
Total OTC (Cost of migration)	$ 1,201,114

Unconsolidated Annual Cost (for 30 old HP Integrity Servers)

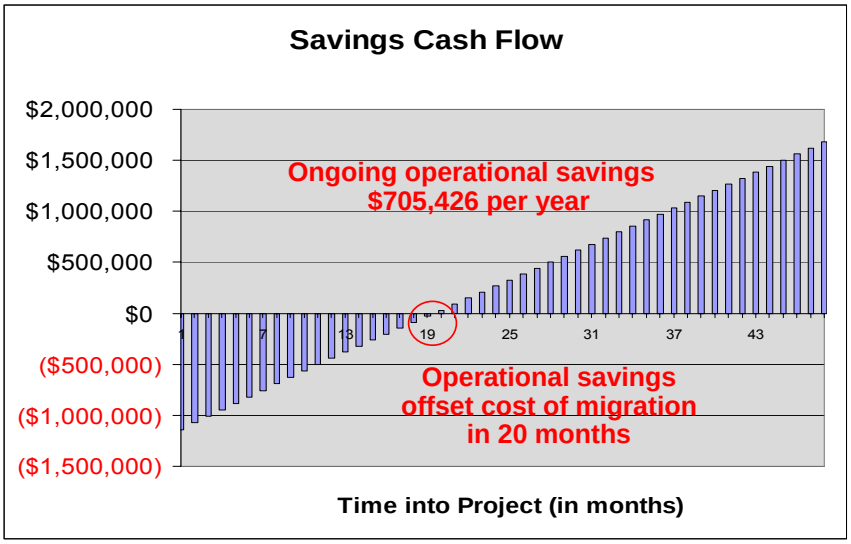
Power and Cooling	$ 36,094
Space	$ 3,375
Annual Server Maintenance	$ 27,720
Annual Connectivity Maintenance	$ 6,390
Annual Disk Storage Maintenance	$ 6,090
Annual SW Support	$ 143,970
Annual Enterprise Network	$ 30,720
Annual System Administration	$ 610,770
Total Annual Costs	$ 865,129

Power Systems Annual Costs

	Year 1	Years 2, 3
Power and Cooling	$ 4,214	$ 4,214
Space	$ 1,125	$ 1,125
Annual Server Maintenance	$ 2,070	$ 43,120
Annual Connectivity Maintenance	$ 1,533	$ 1,533
Annual Disk Storage Maintenance	$ 3,949	$ 3,949
Annual SW Support	$ 1,499	$ 17,339
Annual Enterprise Network	$ 13,824	$ 13,824
Annual System Administration	$ 74,600	$ 74,600
Total Annual Costs	$ 102,813	$ 159,703

Operational cost reduction = $762,316 in year 1 and $705,426 per year after that.

Case Study: Cash Flow



Another Thought On Taking Costs Out

1. Server Consolidation using Power Systems Virtualization
   - ✓ Eliminate older hardware
   - ✓ Fewer servers
   - ✓ Higher utilization

Typical Energy Consumption Savings

70-90%

2. Policy Based Energy Management
   - ✓ Power Systems and Active Energy Manager

10-20%

What It Takes To Implement Smarter Energy Management

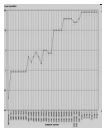
- Hardware enablement, capability
  - CEC-level
    - Fan, PCI, Rear-door Heat Exchanger
  - Component-level
    - CPU, RAM, fan, PCI …
- Sensors
  - To detect environmentals, changing conditions
- Policy-based energy management
  - Monitor
  - Control

Policy Based Energy Consumption With Power Systems And Active Energy Manager

Policy Settings

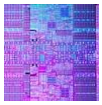
Power Systems

Monitor Utilization



Active Energy Manager

Control Clock Rate



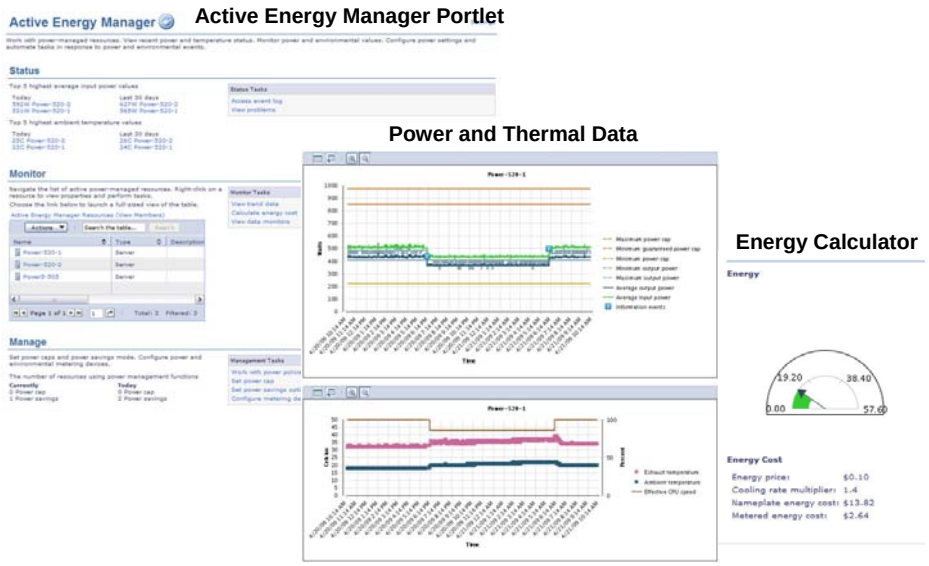
Control Fan Speed

Active Energy Manager – Policy Options

	Static High Performance	Static Low Power	Dynamic Power Savings	
			Favor Power	Favor Performance
CPU Clock Rate	100%	86%	86-95% as needed	86-100% as needed
Fans	100%	Variable as needed	Variable as needed	Variable as needed

- Energy consumption is automatically controlled via setting fan speed and clock rate
- Choose from four basic power management policies
- Power capping is also available

DEMO: Introduction To Active Energy Manager



A Dynamic Infrastructure On Power Systems Lowers Costs

IBM

Power Systems Agility

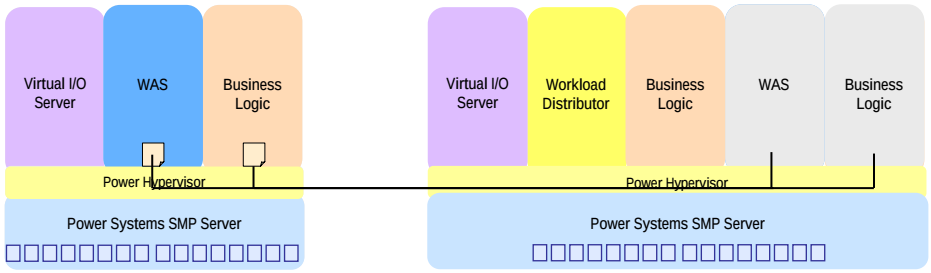
- Once the server has been virtualized, the running system is encapsulated
- Encapsulated systems can be managed in an agile fashion
  - Change resources assigned to a partition while running
  - Move running partitions to another physical server
  - Quickly deploy more virtual servers
- System reliability is a requirement

Power System Dynamic LPAR Support

- Change resources assigned to Virtual Servers while running
  - Rebalance CPU
  - Rebalance Memory
  - Add or remove I/O adapters
- HP Integrity Virtual Machine cannot add or remove I/O adapters to Virtual Servers
- Microsoft and VMware require the Virtual Servers to be shutdown

DEMO: Live Partition Mobility Moves Running LPARs Between Machines

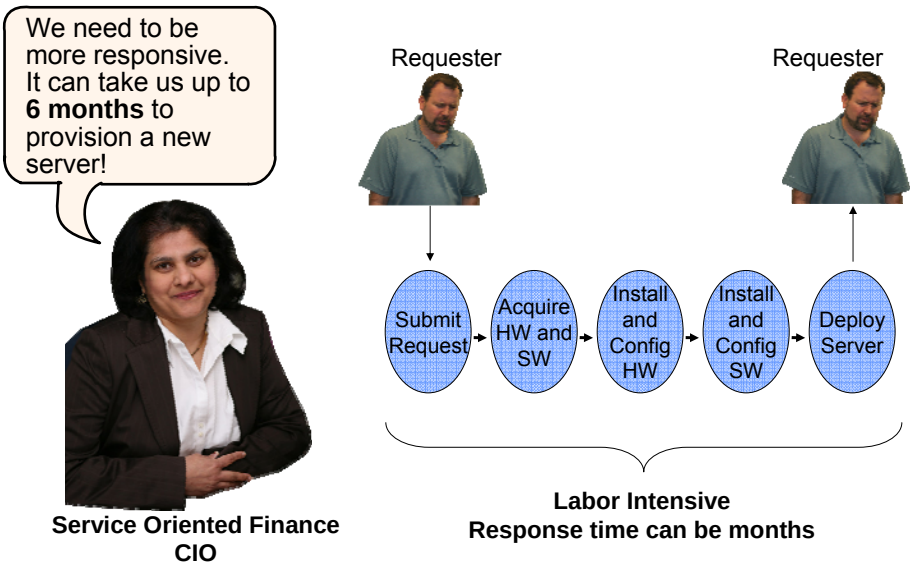
- Move WebSphere LPARs to a different physical server without downtime



Live Partition Mobility

- Move a running LPAR (Power System based Virtual Server) to a different physical server
  - Eliminate the impact of planned downtime
  - Simplify migration to new hardware
  - Rebalance server utilization
  - Turn machines off during the weekend to save power

Deploying New Servers Is Labor Intensive And Time-Consuming

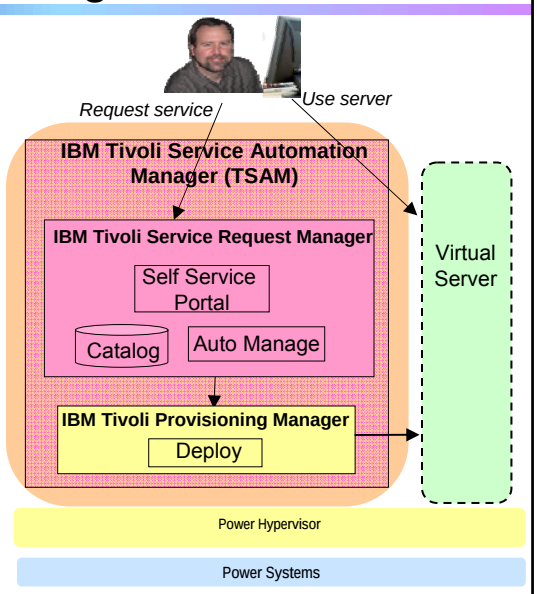


Tivoli Service Automation Manager (TSAM) Delivers Fast Self-Service Provisioning

- TSAM leverages two stable and mature Tivoli products to create a user friendly provisioning solution
  - Tivoli Service Request Manager (TSRM) provides the web-based interface with service desk and service catalog
  - Tivoli Provisioning Manager (TPM) provides the automation infrastructure required to deploy new virtual servers
- TSAM users can create, delete or modify a virtual server

Example – Workflow For New Virtual Server Based On Existing Image On Power

1. Use browser to create a new virtual server from the catalog
2. TSAM approves user request, reserves hostname
3. TSAM starts the deployment process via Tivoli Provisioning Manager workflow
4. TSAM notifies the user that the virtual server is ready

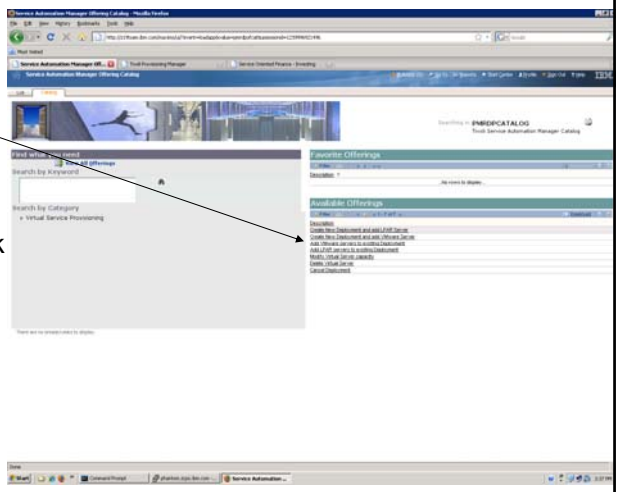


Respond Quickly By Provisioning With IBM Tivoli Provisioning Manager

- Automates the manual tasks of installing and configuring software environments
- Tasks automated through automation workflows
  - Pre-built workflows describe provisioning steps
  - Automation Package Developer allows customization for data center best practices and procedures
  - Automatic workflow execution with verification at each step
- Can be used to configure standalone dedicated servers as well as virtual servers

DEMO: Request-Driven Provisioning With Tivoli Service Automation Manager (TSAM)

- User submits a request to add an LPAR via the catalog
- LPAR is created with complete software stack (AIX, WebSphere, SOF application) installed

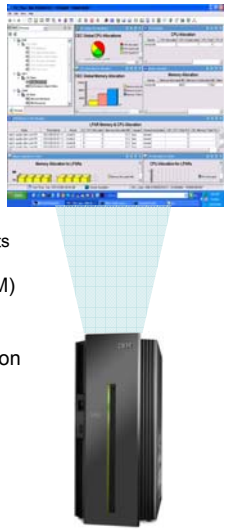


How Tivoli Provisioning Manager Compares To HP And VMware

- **HP Opsware** does not have workflow flexibility
  - Pre-defined tasks only
  - Any new task or change to existing tasks has to be done through a service engagement with EDS
- **VMware vCenter** can only install copied images
  - Images have to be created in advance, no ability to install a new system from media
- **VMware vCenter** cites a limitation on the number of managed servers
  - Hundreds (not thousands)

Dynamic Infrastructure Management Solutions For AIX On Power Systems

- Systems management solution that includes **discovery**, **monitoring**, **performance tracking** and **usage accounting** capabilities
  - Provides customers with the tools to effectively and efficiently manage their Dynamic Infrastructure
- Management Edition for AIX
  - Leverages mature, stable IBM Tivoli products and IBM DB2
    - IBM Tivoli Monitoring (ITM)
      - Visualizes actual virtual server utilization against historical trends
      - Automates a customers best practices in response to system events with configurable views, situations and workflows
    - IBM Tivoli Application Dependency Discovery Manager (TADDM)
      - Discovers, centralizes and visualizes data center components,
      - Discovers component relationships, discovers and tracks changes
    - IBM Usage and Accounting Manager (IUAM) Virtualization Edition
      - Provides usage and accounting for virtualized environments
    - IBM DB2
      - A common prerequisite for all the above products
- Enterprise Edition for AIX
  - Includes Management Edition for AIX, plus
    - Workload Partition Management



Key Benefits Of AIX On Power Dynamic Infrastructure Management Solutions

Reduce data center costs
- Optimize use of hardware to lower energy costs

Improve application availability
- Find problems before end users are impacted
- Up to a 50% reduction in incident problem isolation

Reduce labor costs
- Reduce mean time to repair

Customer: Healthcare benefits provider

Business Need: The customer implemented a virtualization project to reduce energy consumption. The customer needed to discover the physical environment to determine resources that should be virtualized and to monitor progress of the virtualization project

Solution: To assist in the decision making process, the customer integrated discovery information from TADDM with capacity and utilization information available via IBM Tivoli Monitoring. Virtualization progress is being measured using TADDM 'Frame' and 'Host' reports which depict physical to virtual ratios of servers in the data center.

Benefits: Reduction in power usage: Customer is able to see the progress of virtualization project and impact of virtualization on power and cooling profile of the data center and provides planning information to gauge the sustainability of their datacenters over the coming years.

Customer: Power company

Business Need: The customer needed to be alerted when there are problems with virtual resources and needed to quickly isolate and fix problems. The customer needed to understand the performance trends for virtual and physical servers to understand capacity limitations and balance workloads.

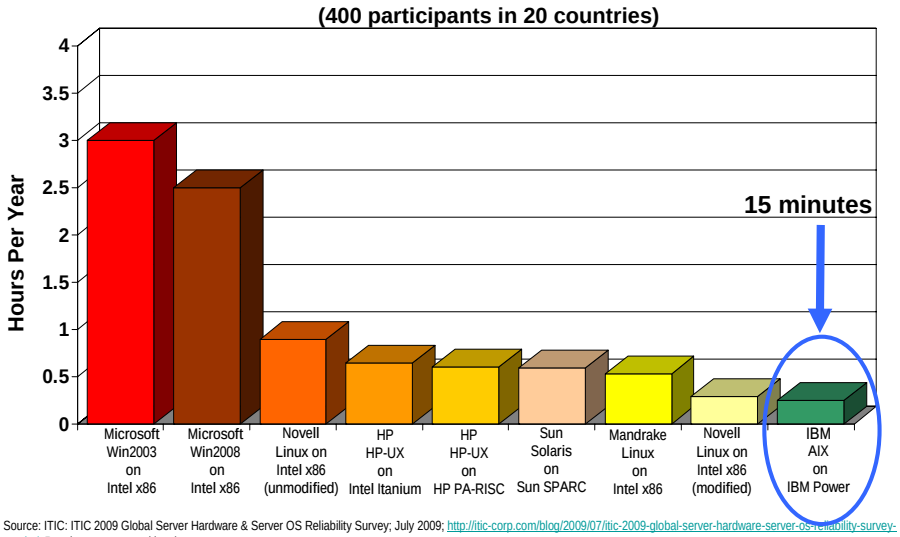
Solution: Real time and historical reporting on server LPAR utilization (memory, network, disk and CPU). Historical performance data is kept for 3 months for utilization/capacity reporting while disk and process information is retained for 3 days.

Benefits: Provides for easy monitoring of the performance of critical virtual resources, detect problems and balance workloads. Situations distributed to LPARs/VIOS servers alert teams to fix potential problems before end users are impacted.

Power Systems Provides The Availability Needed For The Dynamic Infrastructure

- Built-in redundancy
  - Redundant power supplies, fans, service processor, clock
  - Processor instruction retry
  - Transparent retry of soft errors on application fault
- Storage protection keys
  - Isolate data and protect against memory overlay that causes subtle and intermittent problems
- Error detection
  - Predictive failure analysis on processors, caches, memory, I/O and DASD
    - Sparing through the use of Inactive resources as replacement for failed components
  - First Failure Data Capture (FFDC)
    - Automatic capture of diagnostic information
    - No need to recreate the problem to collect data for a diagnostic

AIX On Power Is The Leader In Operating System Availability*



Source: ITIC: ITIC 2009 Global Server Hardware & Server OS Reliability Survey; July 2009; http://itic-corp.com/blog/2009/07/itic-2009-global-server-hardware-server-os-reliability-survey-results/; Results are measured in minutes per year.
*Note: All operating systems included in the survey are not included in this chart. Fifteen operating systems on various processor architectures were included in the survey.

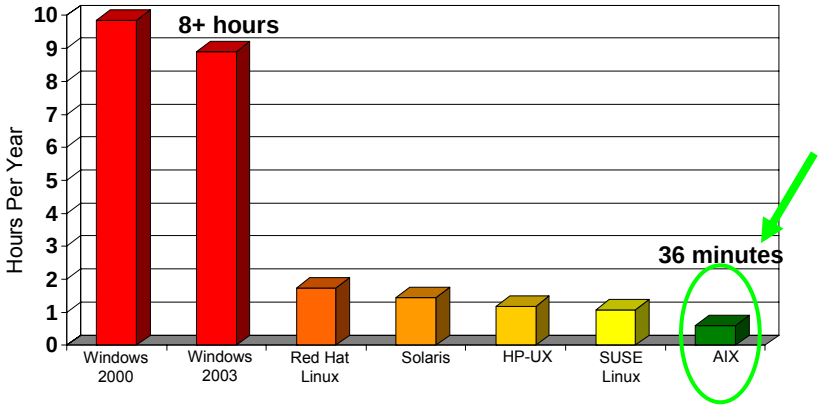
Comparing Dynamic Infrastructure Capability

Dynamic Infrastructure Capability	IBM Software Power Systems	ORACLE hp	Microsoft intel
Solution	**PowerVM**	**Integrity Virtual Machines**	**VMware vSphere 4.0**
Consolidate the Most Images	Most Computing Capacity	Less Capacity	Even Less Capacity
Change Partitions While Running	Yes - Dynamic LPARs	Cannot add/remove I/O adapters	Shut down virtual servers
Move Partitions While Running	Yes - Live Partition Mobility	Online VM Migration has Limited Function	Yes - VMotion
Policy Based Power Management	Yes	CPU On / Off Only	CPU On / Off Only
Platform Availability	The Best	Good	Worst

- Result: Dynamic Infrastructure built with IBM Software and Power Systems delivers
  - Lowest cost per unit of work
  - Most agile management

AIX Is The Leader In Operating System Availability

(400 participants in 27 countries)



Source: 2007-2008 Global Server Operating Systems Reliability Survey, Yankee Group, March 2008. As quoted in "Windows Server: The New King of Downtime" by Mark Joseph Edwards at www.windowsitpro.com/article/articleid/98475/windows-server-the-new-king-of-downtime.html, March 5, 2008 and in http://www.sunbeltsoftware.com/stu/Yankee-Group-2007-2008-Server-Reliability.pdf. Measured in hours per year.