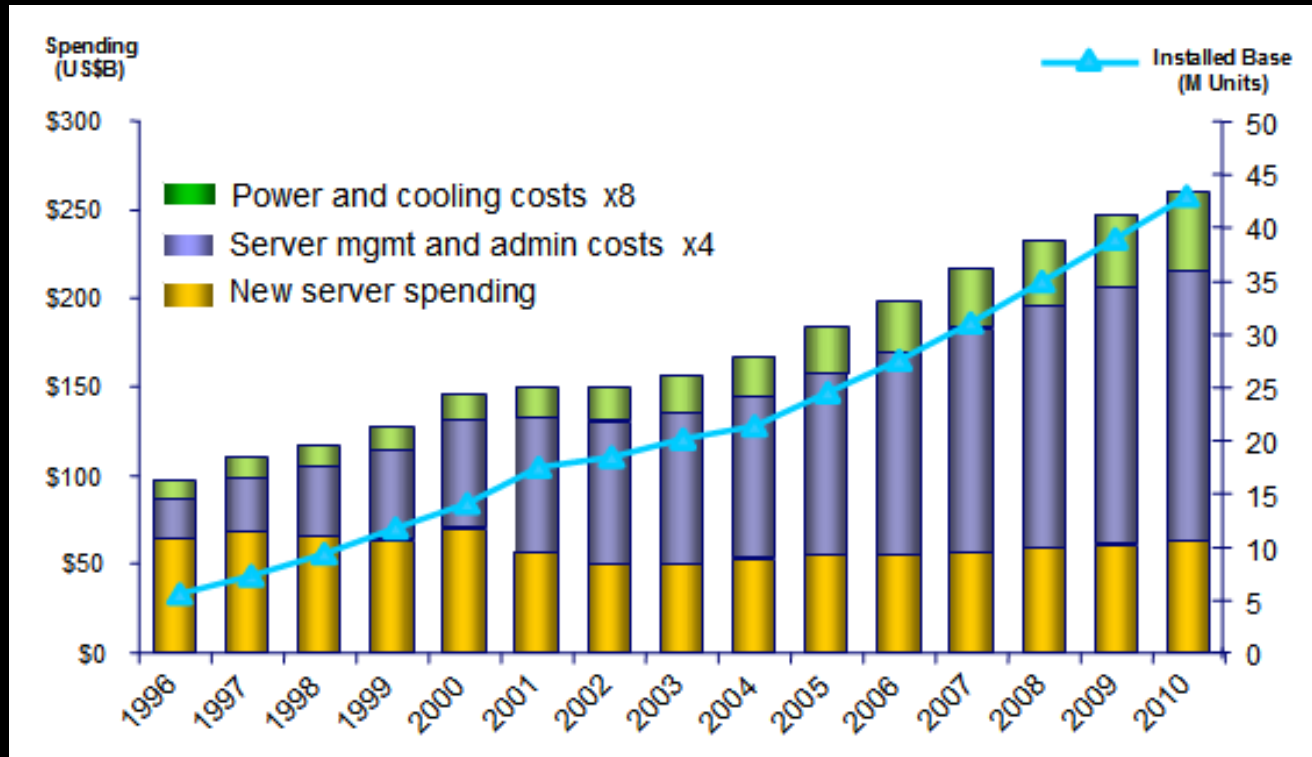Zorislav Sic, Power Systems SME, IBM CEE
May 2009

IBM

IBM Dynamic Infrastructure FORUM
Virtualized Power Infrastructure

Clients are shifting focus to reducing energy, cooling, and management costs

Over 40% of data center clients report power demand outstripping supply.*

*The Impact of Power and Cooling on Data Center Infrastructure, IDC available at
http://www-03.ibm.com/systems/z/pdf/IDC_Impactof

Customer challenges with large-scale server deployments

Multiple servers are outgrowing the **available space**

Dedicated servers with average **low utilization** rates

Service level agreements are broken at an unacceptable rate

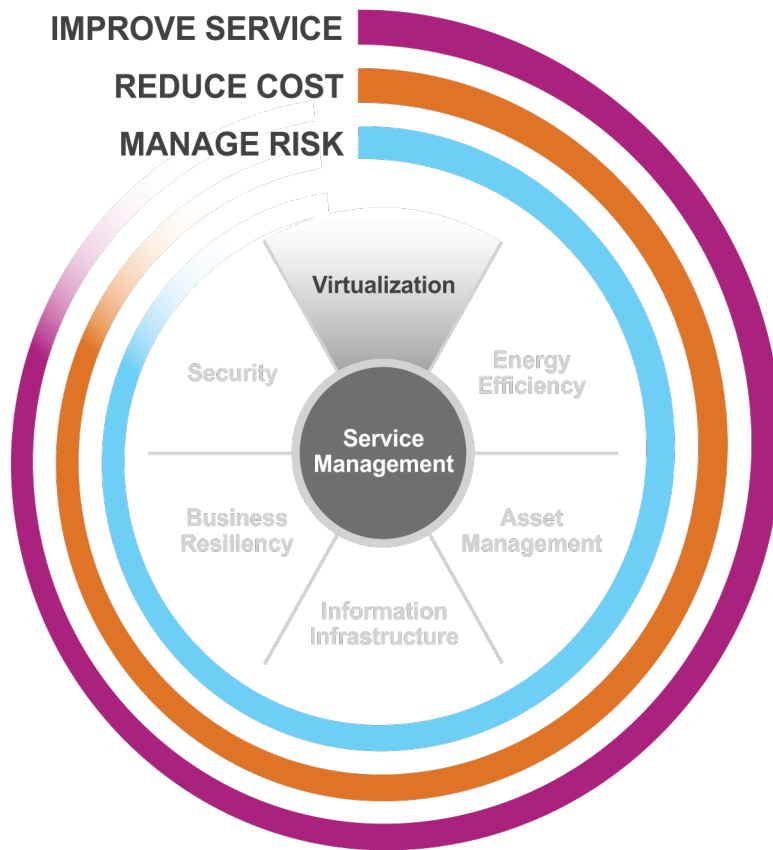**Electric utility bills** are becoming a monthly focus item

The **cost of managing** servers exceeds the cost of developing new software

Sprawling servers leads to skyrocketing software **licensing costs**

Typical Server Farm

Web

Application

Database
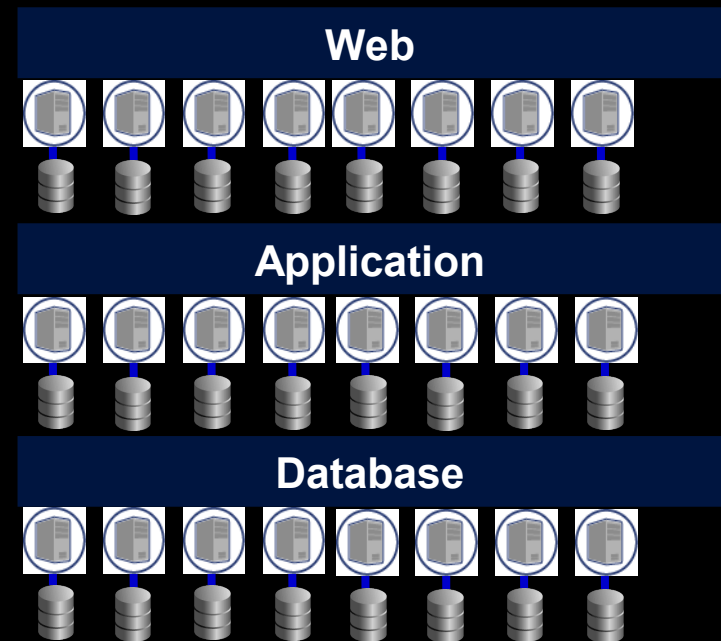
Virtualization is a key enabler for a dynamic infrastructure that can address today's challenges and tomorrow's opportunities.

IMPROVE SERVICE
REDUCE COST
MANAGE RISK

Virtualization

Security

Energy Efficiency

Service Management

Business Resiliency

Asset Management

Information Infrastructure

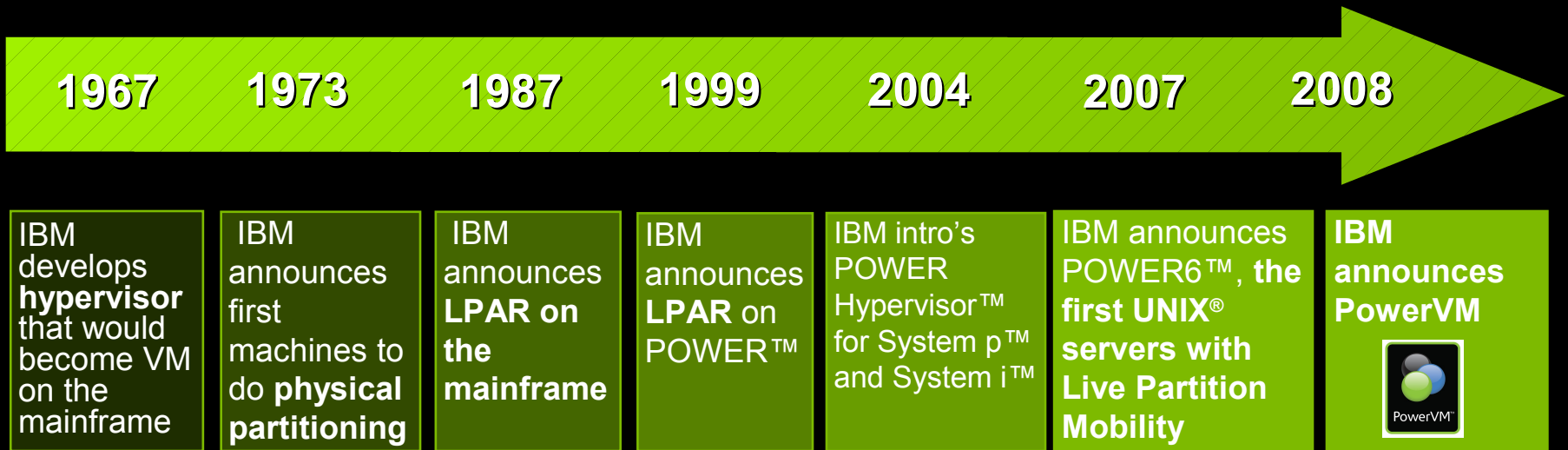….delivers superior business and IT services with agility and speed

Automates business and IT assets

Delivers higher value services

Achieves more with less

Addresses the information challenge

Exploits flexible sourcing

Manages and mitigates risks

IBM

IBM's History of Virtualization Leadership

A 40 year tradition continues with PowerVM™

1967   **1973**   **1987**   **1999**   **2004**   **2007**   **2008**

IBM develops **hypervisor** that would become VM on the mainframe	IBM announces first machines to do **physical partitioning**	IBM announces **LPAR on the mainframe**	IBM announces **LPAR** on POWER™	IBM intro's POWER Hypervisor™ for System p™ and System i™	IBM announces POWER6™, **the first UNIX® servers with Live Partition Mobility**	**IBM announces PowerVM** PowerVM™

PowerVM is the leading virtualization platform for UNIX, IBM i and Linux® clients

✓ Unify virtualization branding & technology for AIX®, i and Linux

✓ Exploit 40 years of IBM virtualization leadership

IBM

Optimizing IT with Industrial Strength Virtualization

Introduced in 1999

100,000s of partitions

65% of Power servers

PowerVM Provides a Shared Infrastructure

AIX

i for Business

Linux

Multi-OS support:
UNIX, i and Linux

Over 15,000 applications

Share processor, memory and I/O
across operating environments

Management

Energy

Security

Availability

OS and Integration

Virtualization

Power™
Systems Software

PowerVM Technologies

The leading virtualization platform for UNIX, i and Linux enables a more agile and responsive infrastructure

Hypervisor

Support for multiple operating environments

Dynamic Logical Partitioning

Micro-partitioning, resource movement

Multiple Shared Processor Pools

Cap processor resources for a group of partitions

Virtual I/O Server

Virtualizes resources for client partitions

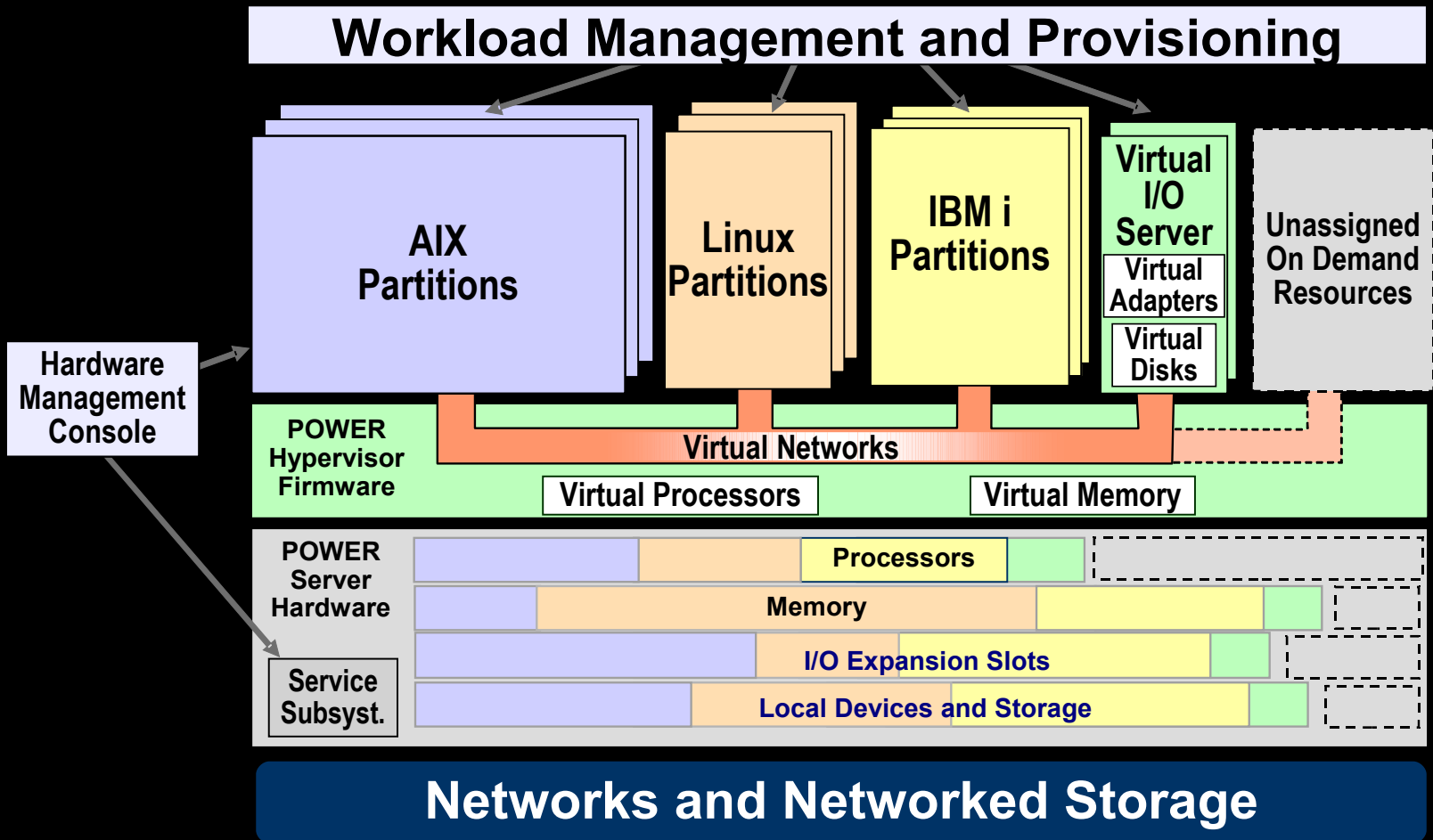Integrated Virtualization Manager

Simplifies partition management for entry systems

Lx86
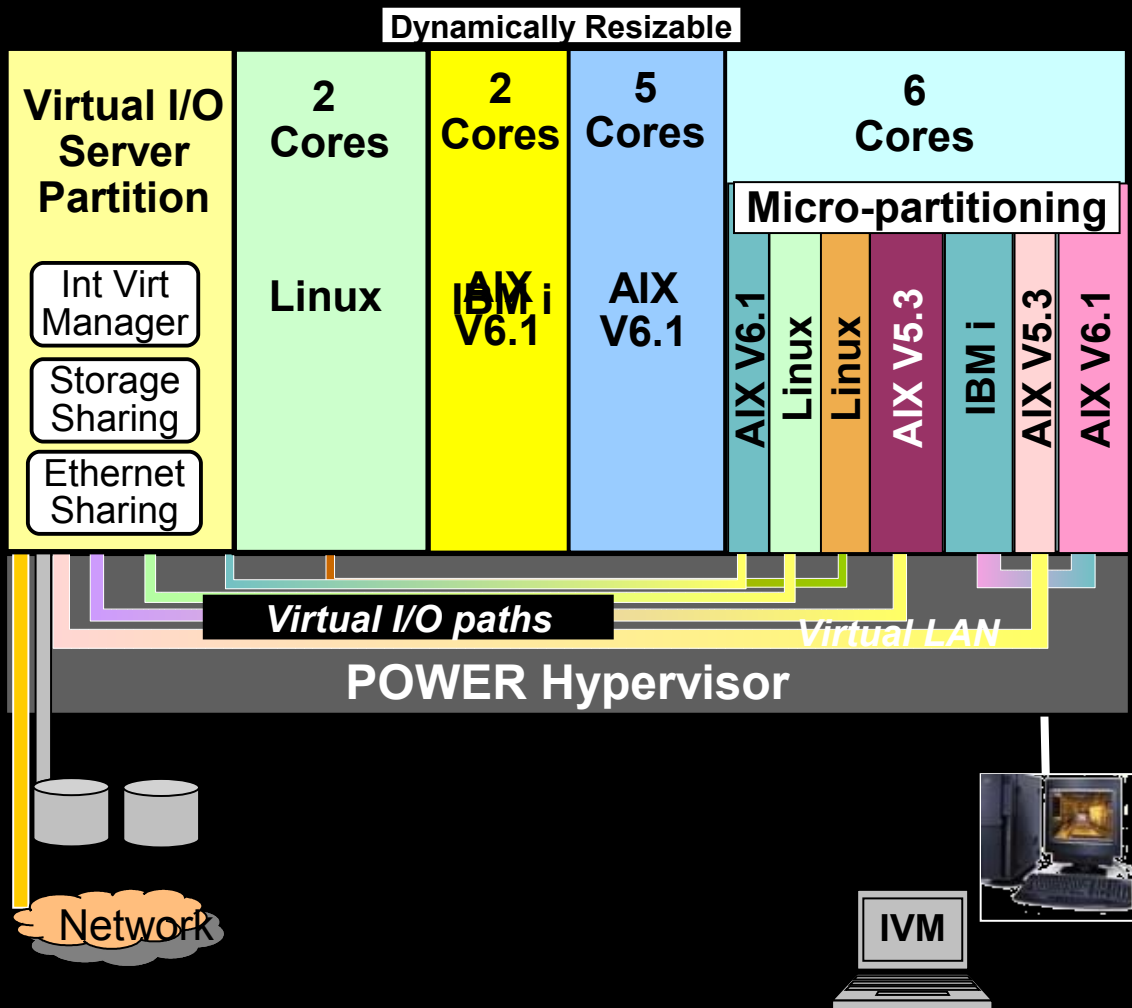
Supports x86 Linux applications

VIOS AIX i for Business Linux

Power Hypervisor

PowerVM™

PowerVM Virtualization Architecture

☒**Virtualization of P5 & P6 servers is accomplished using two layers of firmware:**
A thin core hypervisor that virtualizes processors, memory, and local networks
One or more Virtual I/O Server partitions that virtualize I/O adapters and devices

Power Systems Virtualization with PowerVM

Dynamically Resizable

Virtual I/O Server Partition	2 Cores	2 Cores	5 Cores	6 Cores
Int Virt Manager	Linux	AIX/IBM i V6.1	AIX V6.1	**Micro-partitioning**
Storage Sharing				AIX V6.1 · Linux · Linux · AIX V5.3 · IBM i · AIX V5.3 · AIX V6.1
Ethernet Sharing				

Virtual I/O paths

Virtual LAN

POWER Hypervisor

Network

IVM

Micro-Partitioning Feature
- Share processors across multiple partitions
- Minimum partition $1/10^{th}$ core
- 254 partition maximum
- AIX V5.3/6.1, Linux, & IBM i

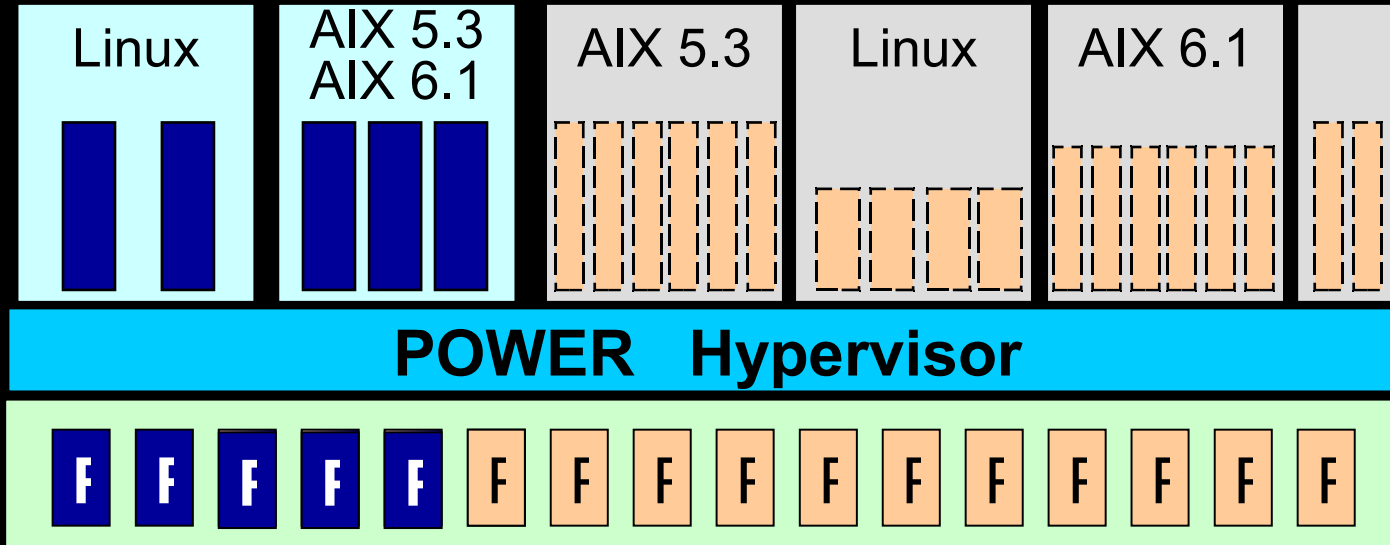## Managed via HMC or IVM

Virtual I/O server
- Shared Ethernet
- Shared SCSI & Fibre Channel attached disk subsystems

Benefits
- Fewer Processors & Adapters
- Reduced Environmental Cost
- Rapid Service provisioning

AIX®   i for Business   Linux®

Shared Dedicated Processors

Linux	AIX 5.3 AIX 6.1	AIX 5.3	Linux	AIX 6.1	

POWER Hypervisor

F F F F F F F F F F F F F F F F

Dedicated Processors	**Shared (Non-Dedicated) Processors**

Excess Dedicated Capacity Utilization

- Unused capacity in dedicated processor partitions can be "Donated" to shared processor pool
- Excess cycles will only be utilized by uncapped partitions that have consumed all of their entitled capacity.
- POWER6 Servers

IBM

PowerVM Active Memory Sharing

Dynamically optimize memory utilization across virtual images

PowerVM™

Dynamically adjusts memory available on a physical system for multiple virtual images based on their workload activity levels:

- Different workload peaks due to time zones
- Mixed workloads with different time of day peaks (e.g. CRM by day, batch at night)
- Ideal for highly-consolidated workloads with low or sporadic memory requirements

Available with PowerVM Enterprise Edition

- Supports AIX, IBM i and Linux workloads

Blends Power Systems hardware, firmware and software enhancements to optimize resources

- Supports over-commitment of logical memory
- Overflow managed by VIOS paging device
- Two VIOS partitions can be used for redundancy
- Compatible with Live Partition Mobility

Memory Usage (GB) vs Time

- Asia
- Americas
- Europe

Memory Usage (GB) vs Time

- Night
- Day
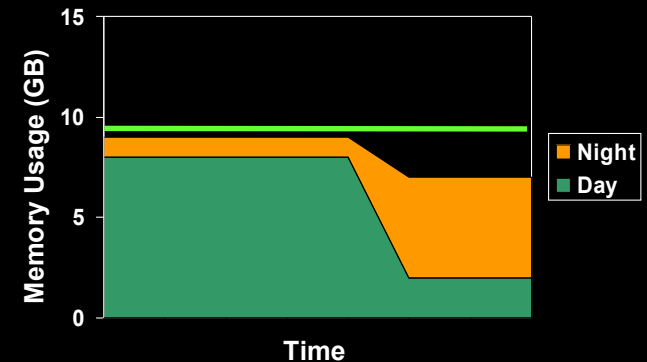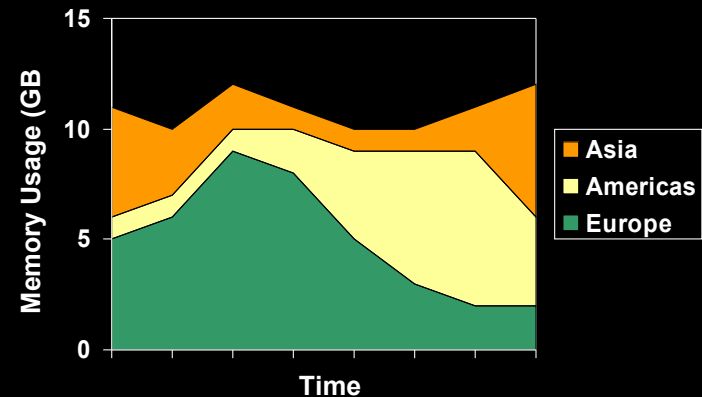
Integrated Host Ethernet Adapter

Integrated, Flexible 1Gb / 10Gb Ethernet Adapter

    High Performance Adapter

    Connected directly to system GX+ bus

    Can be shared between partitions

    Provides Virtual Ethernet (without VIO Server)

    Provides an internal logical Layer2 Switch

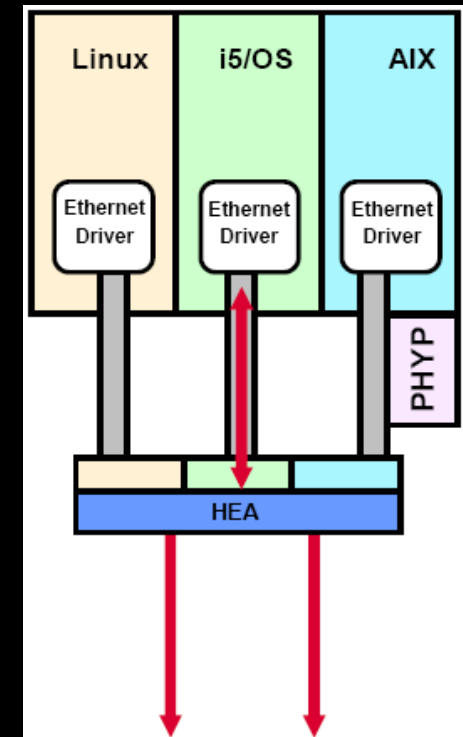Improved latency for short packets

    e.g. Synchronization used in Messaging and Database

Multi Core Scaling

    Multiple default queues per logical port

    Received packets processed by the same processor

   Option for higher performance / fewer logical ports

NPIV

N_Port ID Virtualization (NPIV) provides direct Fibre Channel connections from client partitions to SAN resources , simplifying SAN management

Fibre Channel Host Bus Adapter is owned by VIOS partition

Supported with PowerVM Express, Standard, and Enterprise Edition

Supports AIX 5.3 and AIX 6.1 partitions

Power 520, 550, 560, and 570, with an 8 GB PCIe Fibre Channel Adapter

VIOS

AIX

AIX

FC Adapter

Virtual FC Adapter

Virtual FC Adapter

Power Hypervisor
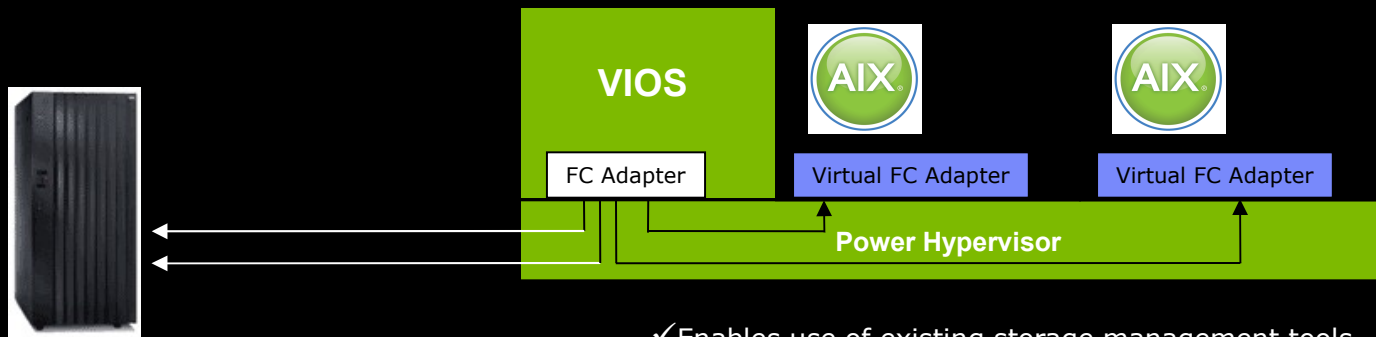
✓Enables use of existing storage management tools
✓Simplifies storage provisioning (i.e. zoning, LUN masking)
✓Enables access to SAN devices including tape libraries

PowerVM™

AIX Workload Partitions

Separate regions of application space within a single AIX image

Improved administrative efficiency by reducing the number of AIX images to maintain

Software partitioned system capacity

Each Workload Partition obtains a regulated share of system resources

Each Workload Partition can have unique network, filesystems and security

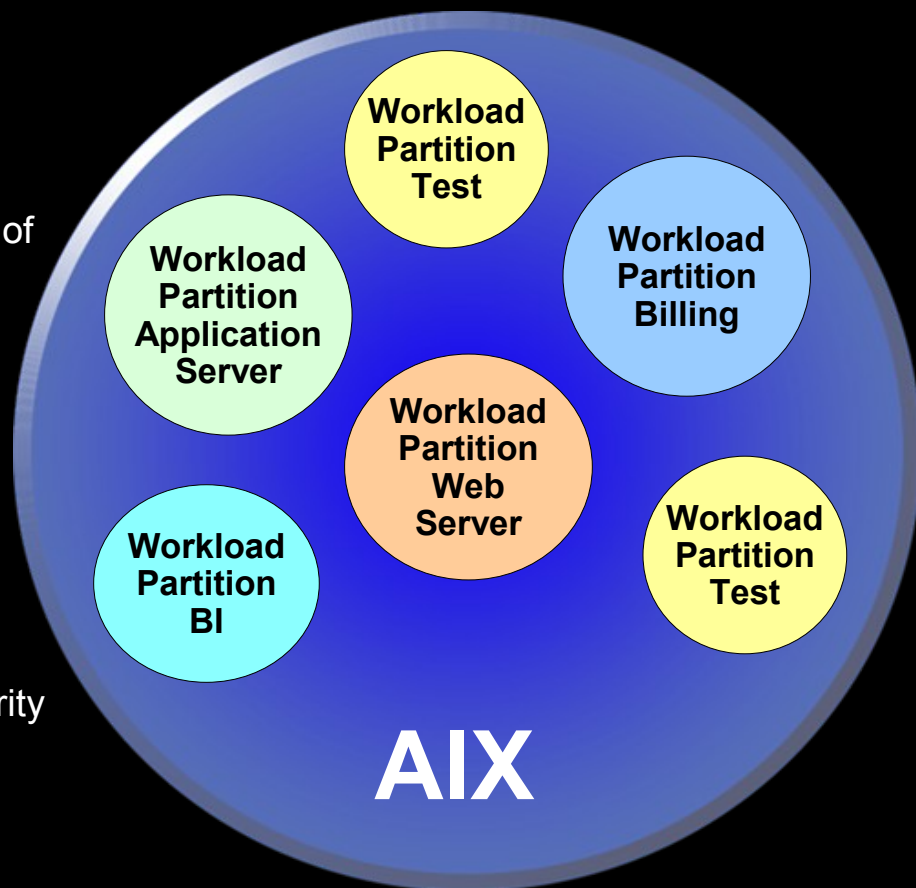**Two types of Workload Partitions**

System Partitions

Application Partitions

Separate administrative control

Each System Workload partition is a separate administrative and security domain
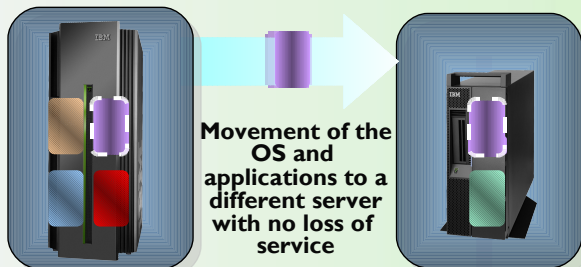
Shared system resources

Operating System, I/O, Processor, Memory

Workload Partition Test

Workload Partition Billing

Workload Partition Application Server

Workload Partition Web Server

Workload Partition BI

Workload Partition Test

AIX

Mobility on Power Systems

PowerVM

Live Partition Mobility

Movement of the OS and applications to a different server with no loss of service
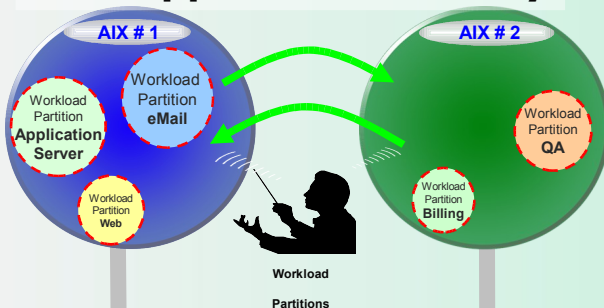
Virtualized SAN and Network Infrastructure

PowerVM Live <u>Partition </u>Mobility

- *Move an entire Logical Partition from one system to anothe it is running with almost no impact to end users*
- *Moves the entire LPAR including the operating system*
- *Requires POWER6, PowerVM Enterprise Edition, and all I/ be through the Virtual I/O Server*
- *Works with partitions running AIX V5.3, AIX 6 and Linux*

AIX

Live Application Mobility

AIX # 1

Workload Partition **Application Server**

Workload Partition **eMail**

Workload Partition **Web**

AIX # 2

Workload Partition **QA**

Workload Partition **Billing**

Workload

Partitions

NFS and virtualized network infrastructure

AIX Live <u>Application </u>Mobility

- *Move a Workload Partition from one AIX system to anothe system while running with almost no impact to end users*
- *Moves only the WPAR, the AIX operating system is not m*
- *Requires AIX 6, Workload Partitions Manager, and all WP filesystems must be NFS*
- *Works on POWER4™, POWER5™, and POWER6*

IBM

PowerVM Lx86

Run unmodified Linux/x86 applications on Power alongside AIX, IBM i and Linux on Power applications

Simplifies migration of Linux on x86 applications, enabling customers to realize the cost reduction benefits of multi-platform workload consolidation

Runs most existing 32-bit x86 Linux applications with no application changes

Included with the purchase of all PowerVM Editions
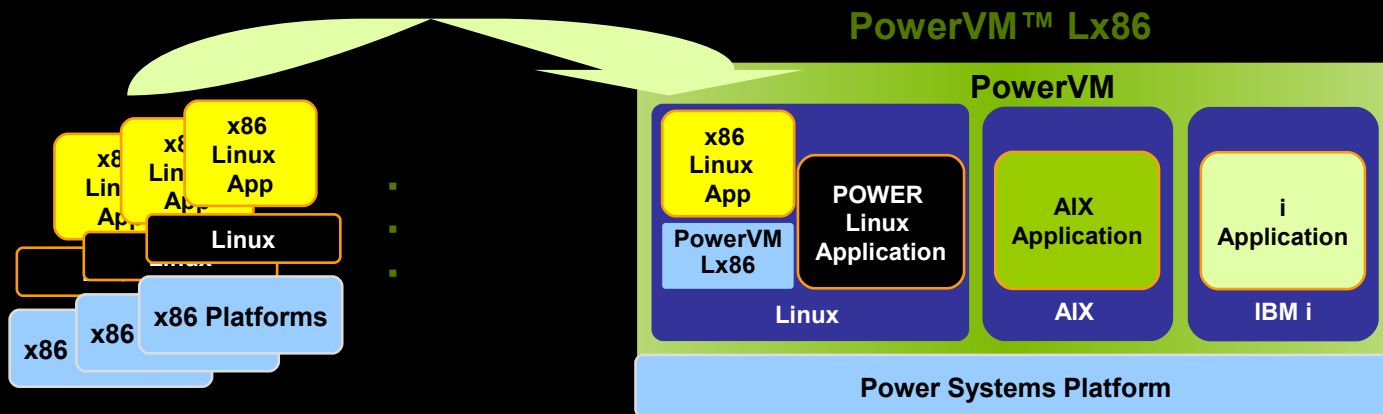
PowerVM Editions let customers select the optimal virtualization solution

PowerVM Editions
offer a unified virtualization solution for any Power workloads:

PowerVM Editions	Express	Standard	Enterprise
Maximum LPARs	1+2 / Server	10 / Core	10 / Core
Management	IVM	IVM, HMC	IVM, HMC
Virtual I/O Server	✓	✓	✓
PowerVM Lx86	✓	✓	✓
Multiple Shared Processor Pools		✓	✓
Live Partition Mobility			✓
Active Memory Sharing			✓

Why virtualize workloads with PowerVM?

The process of creating a virtualized workload with PowerVM is simple:

  Create a new PowerVM logical partition (LPAR) or virtual machine (VM)

  Install the operating system (AIX, IBM i or Linux) in the LPAR

  Install the application in the LPAR

  Configure the operating system and application as required

At this point, the completed virtualized workload can be stored like any other file

The benefits of virtualizing workloads with PowerVM in this way include:

  Rapid provisioning – deploying the ready-to-run workload is a quick and easy process

  Scalability – deploying multiple copies of the same workload type is simplified

  Recoverability – bringing a workload back online after an outage is fast and reliable

  Consolidation – many diverse workloads can be hosted on the same server

All of these benefits save system administrator time and resources

  In addition, workload consolidation offers significant IT infrastructure cost reductions

Workload consolidation with PowerVM virtualization reduces costs

PowerVM enables unrivaled **consolidation** of multiple AIX, IBM i and Linux workloads, allowing clients to:

Reduce infrastructure costs: less datacenter and rack space, less cabling

Reduce utility costs: less energy and cooling

*Reduce operational costs:* faster provisioning, simpler scaling and easier recoverability

PowerVM delivers these benefits through innovative technology that optimizes physical resources:

Micro-partitioning enables most efficient use of available cores, with 1/100th of a core granularity

Multiple shared processor pools

Dynamic movement of virtualized processor and I/O resources (in VIOS) based on workload activity

Latest innovation: PowerVM extends resource optimization to memory, with Active Memory Sharing

IBM
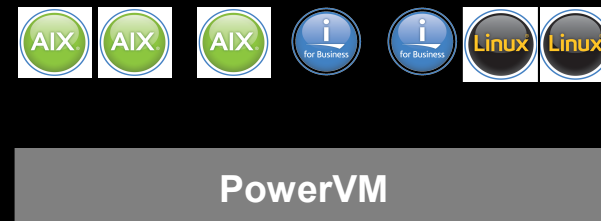
Dynamic resource allocation can improve service levels

To respond to opportunities and challenges with agility and speed an organization must have business-driven service management that scales dynamically

Power Systems support dynamic resource movement
- Processors
- Memory
- I/O devices

Power Hypervisor
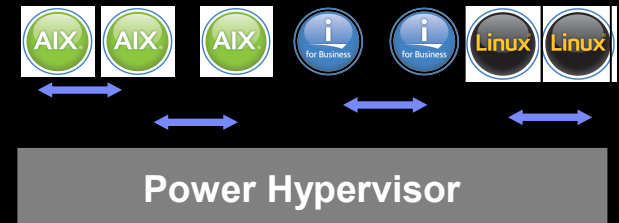
PowerVM adds automatic movement
- Dynamic movement of 1/100th of processor
- Processor resources are moved among partitions
- Active Memory Sharing will move memory

Quickly and easily respond to changing workload demands

IBM

PowerVM virtualization can also help manage risk

Business and IT security and resiliency are as critical as ever, and must be dynamic and intelligent in order to match the speed of business change

PowerVM Live Partition Mobility

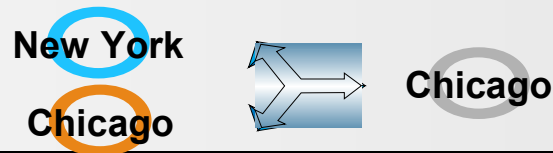Move running AIX and Linux partitions between systems

Virtualized SAN and Network Infrastructure
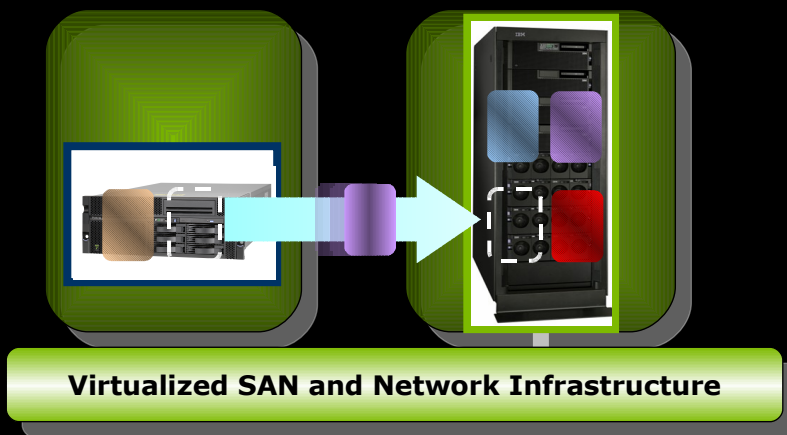
Eliminate planned outages and balance workloads across systems

Optimization often begins with physical consolidation
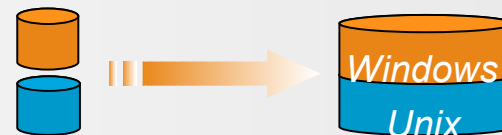
Consolidation and Virtualization
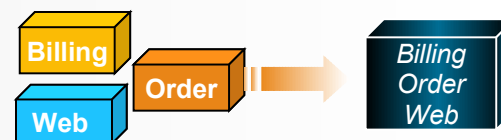
Reducing the number of sites

New York

Chicago

Chicago

Reducing the number of servers

Centralize data from different sources

Windows

Unix

Migrate several applications into fewer applications

Billing

Order

Web

Billing
Order
Web

The role of virtualization is expanding

*A Dynamic Infrastructure can also provide a great foundation to construct a more efficient platform
for delivering cloud based services*

Physical Consolidation

- Improve utilization
- Reduce costs
- Lower power usage

Advanced Virtual Resource Pools

- Decouple complexity from scale
- Share resources optimally
- Automate workload management
- Simplify HA & DR

Service Management

- Discover, monitor, meter, secure and automate deployment of virtualized resources
- Assure SLA achievement
- Optimize service placement
- Integrated virtualization management with IT processes

Cloud

- Always available
- Elastic scaling
- Pay for use
- Automated provisioning
- Simplified user interface

Managing IBM Platforms
See and manage physical and virtual resources across multiple systems

IBM Systems Director: Simplify platform management across server and storage infrastructure.

Unifies Platform Management with a consistent look-and-feel for IBM server systems.

Allow many systems to be easily managed together.

Leverage IBM best-of-breed virtualization capabilities to simplify systems management.

IBM Systems Director

IBM TotalStorage Productivity Center.

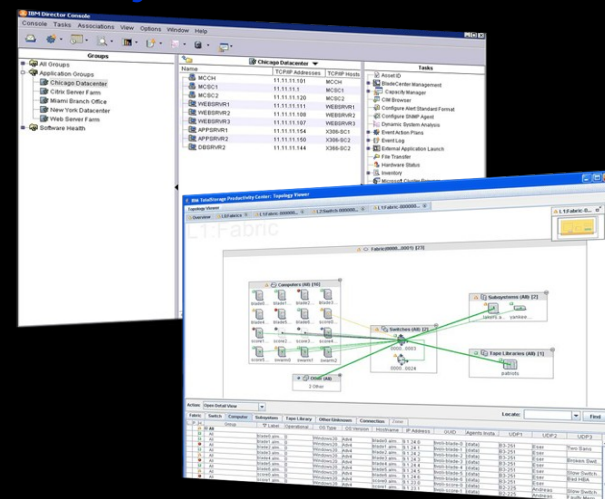Management of physical & virtual resources.

Centralize single point of management & control for storage infrastructure.

Simplify management of complex multi-vendor heterogeneous environments.

Improve administrator efficiency and storage utilization.

End-to-end topology views of virtualized environments.

TotalStorage Productivity Center

IBM

Tivoli and Platform Management

Systems Director =
Platform Management

*Detailed "care and feeding"
of IBM hardware*

*Tell me what I have
Let me install & configure it
Tell me if it's working
Let me update it*

Tivoli =
Service Management

**Integrated visibility, control
& automation across
heterogeneous business and
technology assets**

See the business
Govern and control the
business
Optimize the business

**TotalStorage
Productivity Center =
Storage
Management**

*Detailed "care and feeding"
of storage systems*

IMPROVE SERVICE
REDUCE COST
MANAGE RISK

Virtualization
Security
Energy Efficiency
Service Management
Business Resiliency
Asset Management
Information Infrastructure

Thank You!