



# Data Centre Evolution

Managing an efficient data centre for the future

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Tomorrow's Data Centre June 2008

# Innovation drives competitive advantage

**Innovation** is the process of delivering new products, services, processes and business models to create unique competitive advantage and accelerate growth.

## Business Objectives



*'Many inhibitors make innovation more challenging....'*

# Multiple new factors are driving Organizations

## Costs



Oil reaches \$135 a barrel  
May 2008

## Regulatory Mandates

Increased regulatory scrutiny, with government regulations around water usage, carbon emissions etc



“Going Green”

## Workload Growth



Growth in Application and Business workloads doubles every 2 years driving the need new servers, DASD, power and cooling

## Operational

Capacity shortages for data centre power and cooling are limiting ability to expand



## Social & People



Customers have started evaluating the green credentials of suppliers and products

## Cultural Shifts

Demographics changes and global teams require collaboration across cultural, generational and geographic boundaries



# Environmental responsibility is a core IBM value

## New Goal Extension

Further extend IBM's early accomplishments by reducing CO<sub>2</sub> emissions associated with IBM's energy use 12% from 2005 to 2012 via energy conservation, use of renewable energy, and/or funding CO<sub>2</sub> emissions reductions with Renewable Energy Certificates or comparable instruments.

## Awards & Recognition

**BEST Workplaces for Commuters™**

FORTUNE 500 Top 20  
2004, 2005, 2006



1998, 1999, 2001



**The Climate Group**  
2005

**USEPA Climate Protection Award**  
1998 and 2006



**Green Power Purchaser Award**  
2006

**CLIMATE LEADERS**  
U.S. Environmental Protection Agency

2005



2005



**Green IT Supplier of the Year 2008**  
**Green Infrastructure Project 2008 IBM & DEFRA**

## Environmental Efforts

Computer Program Charter Member  
1992



Charter Member  
2000



Charter member  
2003



Chicago Climate Exchange



Business Environmental Leadership Council

**CLIMATE LEADERS**  
U.S. Environmental Protection Agency

Charter Member 2002



WRI Green Power Market Development Group  
Charter member 2000



1605(b) voluntary emissions reporting since 1995

**CARBON DISCLOSURE PROJECT**

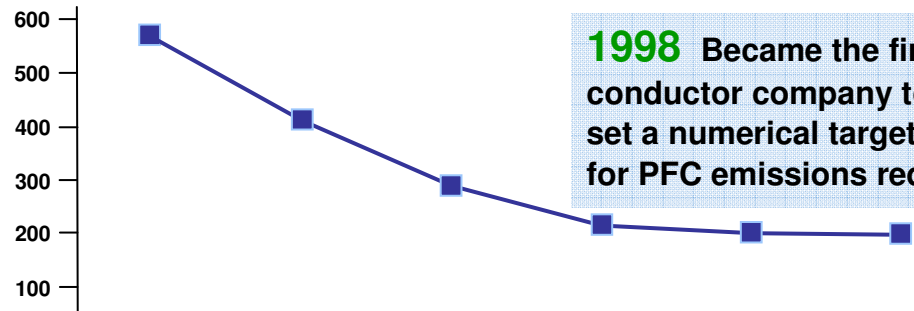
Since inception

## Long History

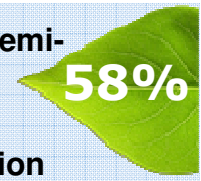


Between 1990 and 2005, IBM's global energy conservation actions reduced or avoided CO<sub>2</sub> emissions by an amount equal to **40%** of its 1990

emissions.



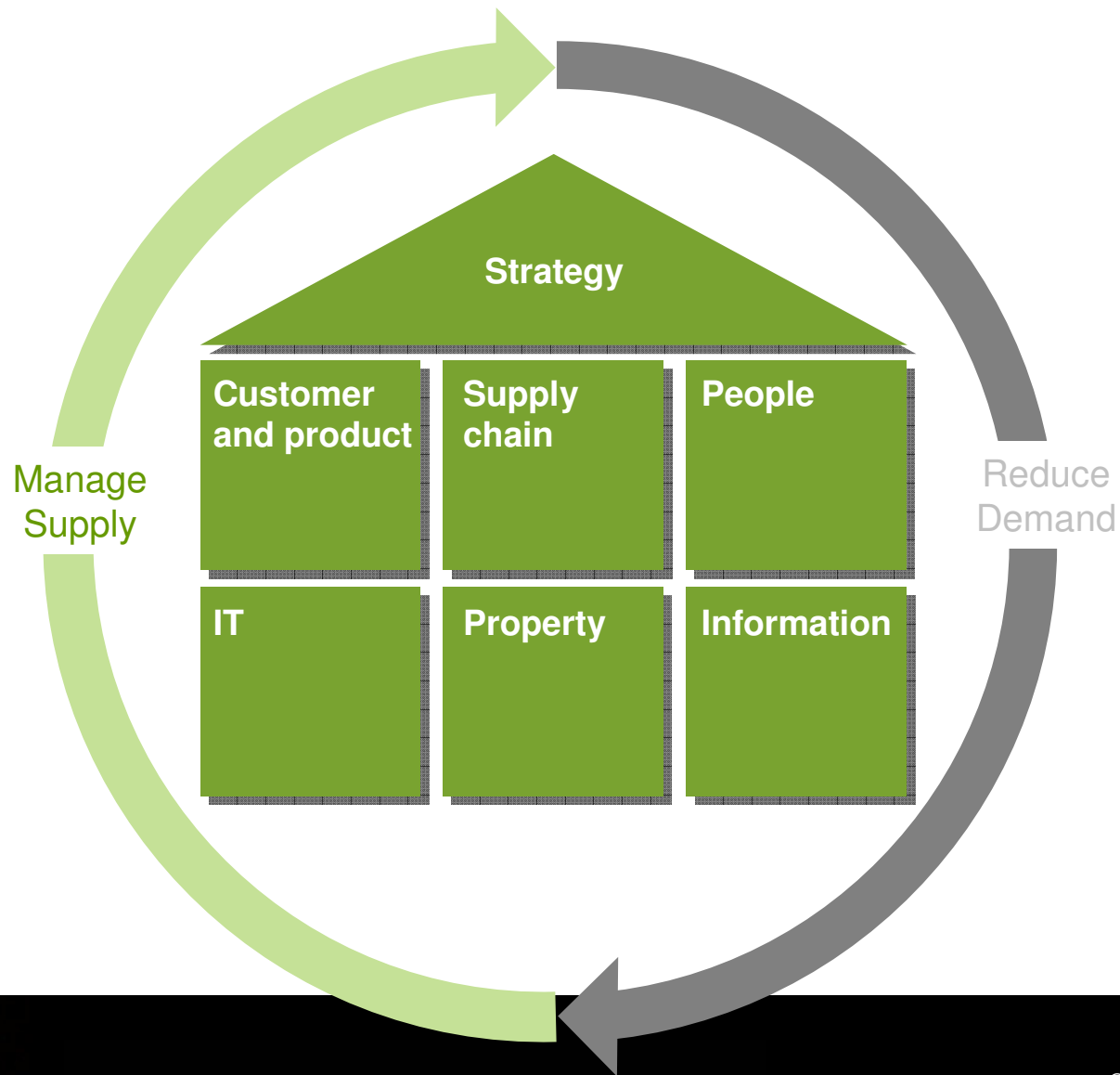
**1998** Became the first semiconductor company to set a numerical target for PFC emissions reduction



**58%**



# Introducing the IBM Carbon Management Model



# Challenge Areas

## Strategy

- Where should we focus our carbon reduction efforts?
- How integrated is our carbon strategy with our business strategy?
- Do we have an integrated programme of action?
- How do we finance our carbon programme?

## Customer and product

- How do we communicate our green credentials to our customers?
- What are the new green market opportunities and how do we exploit them?
- How can we design our products to be more carbon-friendly?
- How do we optimise these benefits throughout the full product lifecycle?

## Supply chain

- How can we make our end-to-end operations more carbon-friendly:
  - Manufacturing?
  - Logistics?
  - Procurement?

## People

- How do we establish and implement effective green HR policies:
  - Strategy?
  - Travel?
  - Home working?
- How do we engage with our employees on the green agenda?
- How do we enable and sustain behaviour change across our organisation?

## IT

- How do we integrate carbon management into our IT Strategy?
- How do we identify which areas of IT provide the greatest opportunities for carbon reduction?
- How do we reduce and minimise carbon in each area of IT – both now and in the future?
- How do we optimise to get more IT capacity for less carbon?
- How do we address immediate capacity/power issues?

## Property

- How do we reduce carbon in our:
  - Buildings and offices?
  - Production plant?
  - Distribution centres?
- How does the property portfolio contribute to our carbon footprint and how can we improve it?
- How do we work towards a more sustainable property portfolio?

## Information

- How do we measure and monitor information on carbon consistently and efficiently?
- How can we best visualise information to allow carbon management by LoB?
- How do we demonstrate regulatory and policy compliance?
- Do we have a carbon scorecard and key performance measures?

# Extended Attributes of a Greener Organization



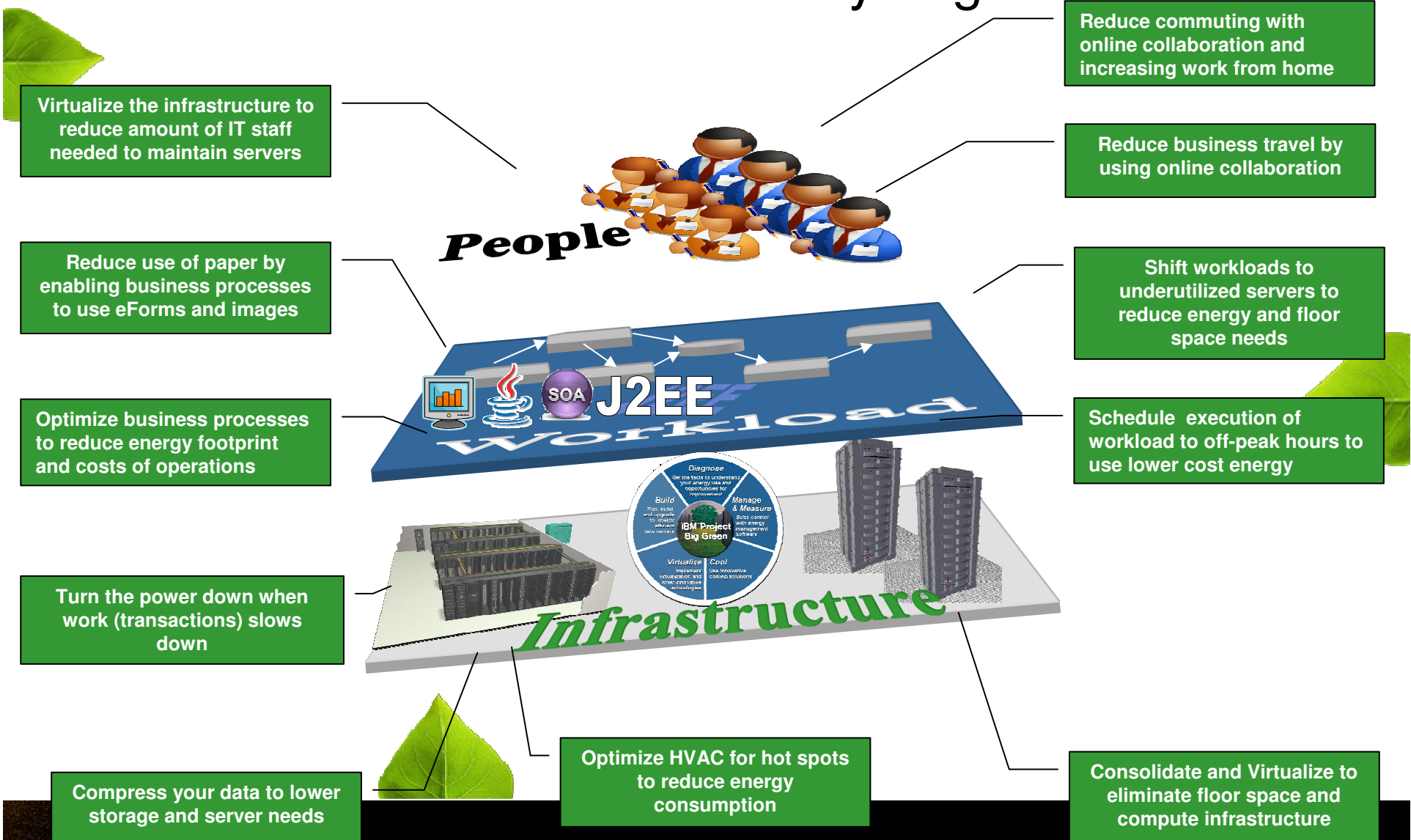
Optimized **People** resources and collaboration beyond boundaries to drive business growth while reducing travel and physical real estate costs



Efficient execution of business **Workloads** with processes and applications designed to maximize energy efficiency while meeting business needs.

Visualization, control and automation of **Infrastructure** to deliver a power efficient organization. Leverage consolidation, virtualization, and optimization.

# So . . . How can Software make you greener?





# What does 'Green' data centre mean?

Not everyone thinks '**Green**'

More likely '*Virtualisation*'

*'Optimisation'*

*'Energy efficiency'*

*'Out of Power or Space'*

*'Reduce operational cost'*

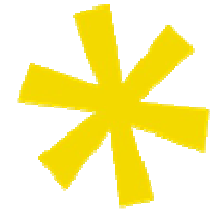
Evolving to "Tomorrow's Data Centre"

- ➔ Data centre optimisation and utilisation
- ➔ Energy efficiency (measuring, collecting, analyzing, visualisation)
- ➔ Data Centre Virtualisation
- ➔ Effective management of the facility and IT as a holistic entity
- ➔ Increased agility to meet business priorities and demands

*"We've only ever been told to perform ... but never efficiently"*

# The New Enterprise Data Center

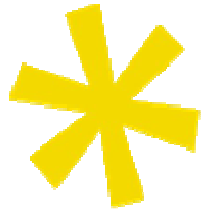
*An evolutionary new model for efficient IT delivery . . .*



***New economics:*** Virtualization with optimized systems and networks to break the lock between IT resources and business services

***Rapid service delivery:*** Service management enables visibility, control and automation to deliver quality service at any scale

***Aligned with business goals:*** Real-time integration of transactions, information and analytics - and delivery of IT as a service



Enabling The New Enterprise Data Center

# A holistic, integrated approach



*Enterprise Information  
Architecture*

*Highly Virtualized  
Resources*

*Security and Business  
Resilience*

*Efficient, Green and  
Optimized Infrastructure  
and Facilities*

*Business-Driven  
Service Management*



## *Simplified* – Drives IT efficiency

Physical consolidation and optimization

Virtualization of individual systems

Systems, network and energy management

## ***Simplified***



# UPMC

**IT Service  
Transformation  
Program**

*Consolidation and virtualization of servers and storage reducing complexity, energy and labor for \$40M est. cost reduction*

© 2007 IBM Corporation

# *Shared* – Rapid deployment of new infrastructure and services

Highly virtualized resource pools  
Integrated IT service management  
Green by design

*Simplified*

***Shared***



*Virtualized multi-vendor storage environment with faster creation of testing environments and over 50% performance improvement*

*Dynamic* – Highly responsive and business goal driven

Virtualization of IT service

Business-driven service management

Service oriented delivery of IT

*Shared*

*Simplified*

***Dynamic***

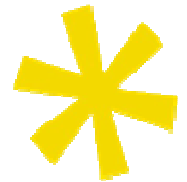


*New IT service requests provisioned for researchers –  
in minutes, not hours or days – with 95% less  
power and footprint expected*

**IBM**

© 2007 IBM Corporation

# This transformation spans across people, process and technology...



## **People**

- Skills shift from operations (break / fix) to IT Business Analysts
- Break down silos and organize around IT service delivery
- Paradigm shift toward shared environment

## **Process**

- Standardization
- Disciplined
- Repeatable and documented processes
  - Change and configuration management
  - Process automation

## **Technology**

- Open standards
  - Open management across servers, storage, networking
  - Open networking standards
- Role of systems and networking in recentralization
- Intelligent automation of IT & Facilities

# Software innovation - changing the game



- Better **Visibility** of data centre assets and change is critical
- Improve **Utilisation** and footprint through server consolidation and **Virtualisation** with capacity management & provisioning
- Extend systems **Monitoring** to include **Power and environmentals** with **Spatial capability** and integrated **Asset Management**
- Manage **Data Storage impact** on power consumption dynamically
- Extend Service Management to encompass critical Services and **Active Energy Management**
- Integrating **People, Process** and **Technology** with **Workflow Automation**
- **Charging** internal and external customers for these new utility resources



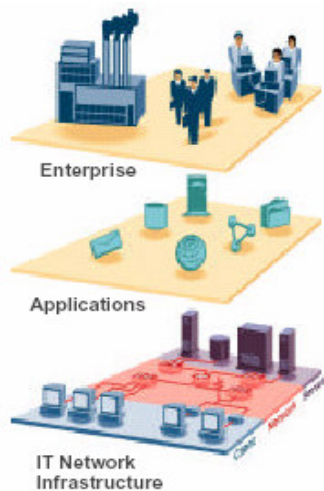
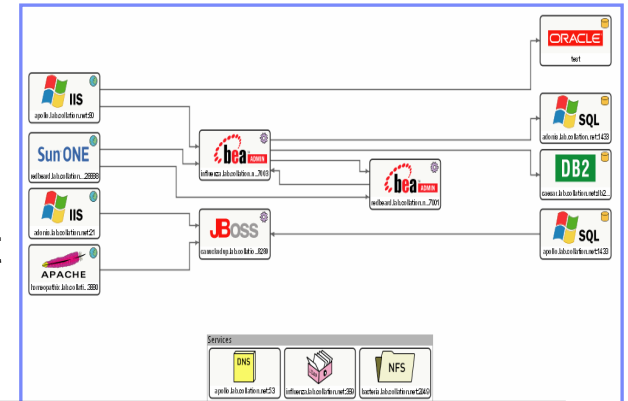
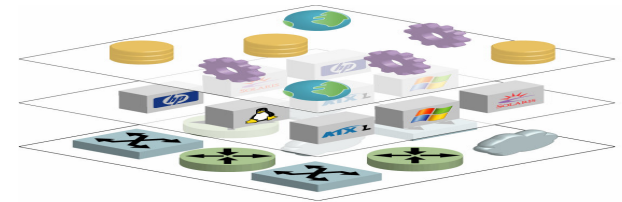
***Visibility. Control. Automation.***

© 2007 IBM Corporation



# Visibility – Discovery and Mapping

- Understand what assets are actually in the Data Centre
- How they are configured, changes applied and service impact
- Understand inter-dependencies and business service linkage
- How they are being used – what is critical and what is redundant
- The drift from standards and what to ‘course correct’



## Tivoli Application Dependency Discovery Manager (TADDM)

**Agent-less Discovery automates application mapping and device discovery**

**Records change for compliance and audit control**

**Populates CCMDB and integrates with IT Service Management processes**

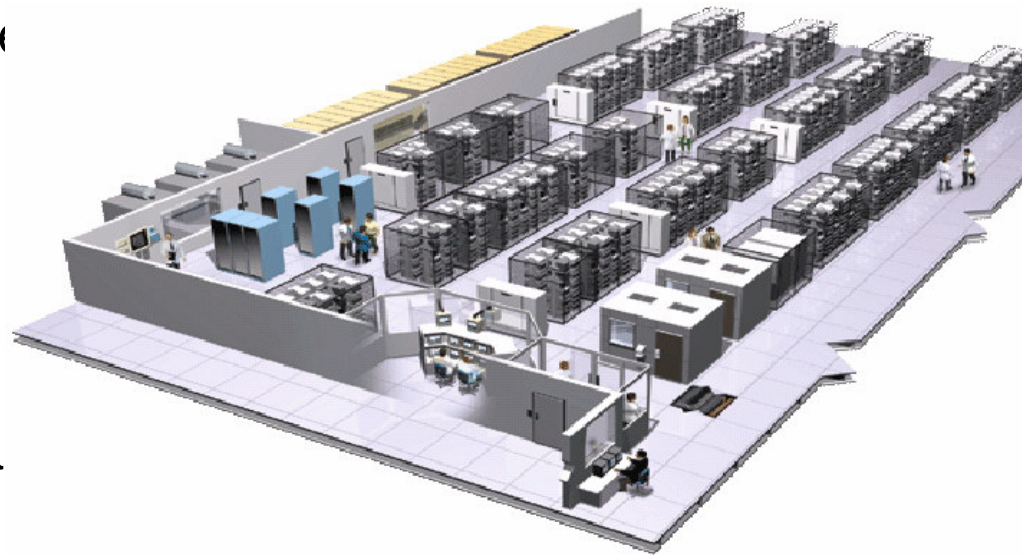


# Consolidate, Virtualize, and Optimize by Provisioning with Energy Intelligence

Provision new servers as needed instead of keeping servers active standby mode via **Tivoli Provisioning Manager**

Utilize virtualization to increase utilization of individual servers and eliminate unneeded servers.

Move workload to alternative data centers where energy is less

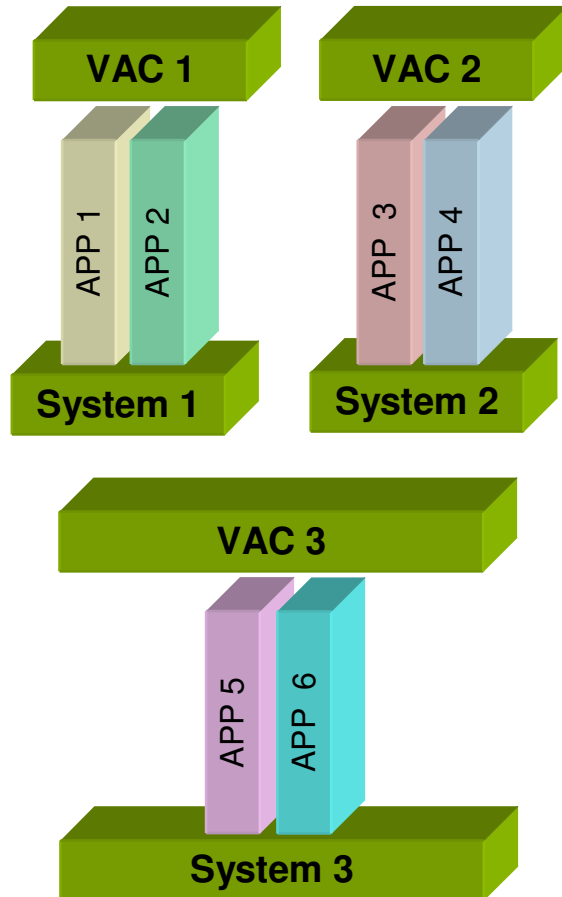


Support for mainframe, VMWare, MS Virtual Server, LPAR, DLPAR. Provisioning of servers, storage and network infrastructure.



# Energy Management Example

## *Dynamic server consolidation & integrated facilities*



Use of hibernation, powering off servers, and other low power states in combination with other workload balancing and provisioning tools can provide a valuable tool in management of Power and Thermal issues.

### **Automate Energy Control**

Policy based automation

### **Control Energy Consumption**

Consolidate workloads to reduce

### **Integrated Facilities Control**

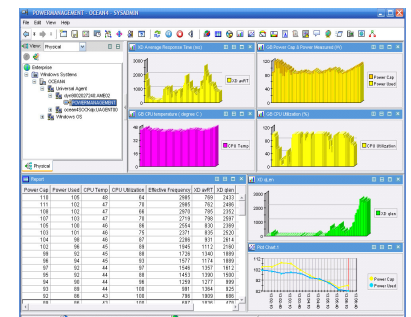
Match cooling & heat loads

# Monitoring for active energy management

*Tivoli Monitoring family provides the ideal platform for gathering IT and enterprise events for effective operations*

Critical resources can be monitored for availability and running data, including events relating to power, temperature and system stability from many sources including:

- IT Infrastructure – Systems, software, applications
- Facilities – Generators, Air Conditioning



Event management has traditionally been limited to IT assets only, however intelligent facilities equipment can now be integrated e.g.

- HVAC (Heating, Ventilation, Air Conditioning)
- Intelligent power supplies and generators



# Power efficiency in Information Risk Management

## Tivoli Storage management

### ***Virtualise the storage***

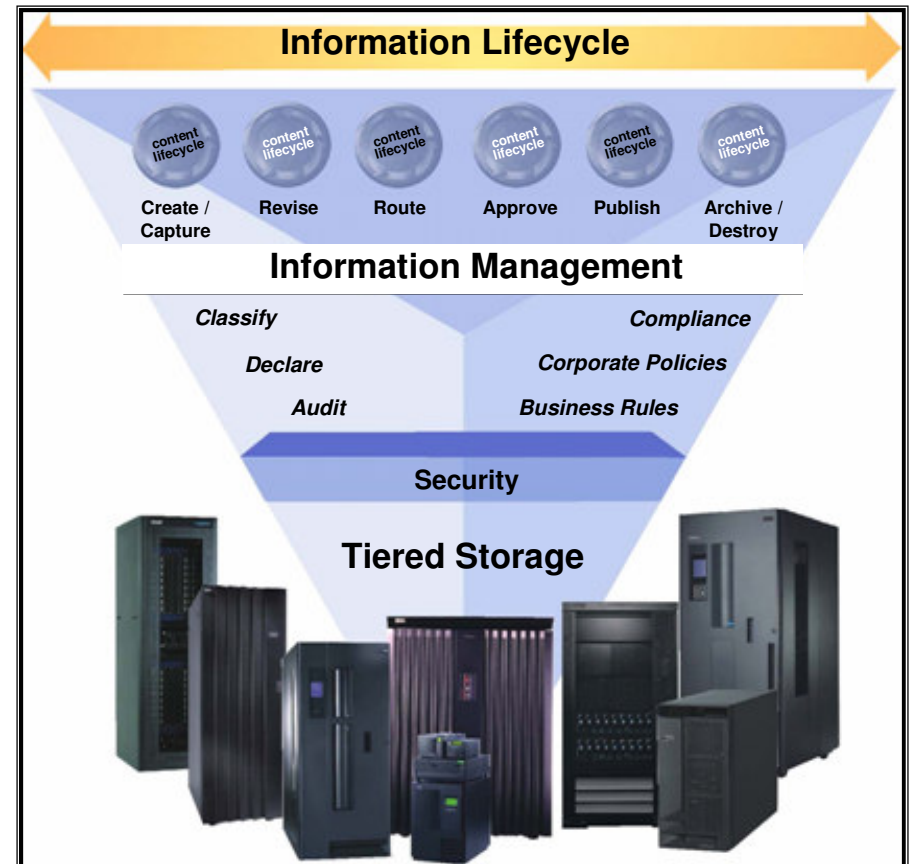
All storage can appear as a cohesive platform to increase utilisation

### ***ILM traditionally was to . . .***

Move data to the most cost effective storage for its current use

### ***In the future it will . . .***

Move data to the most power efficient storage that satisfies usage requirements



# Data Centre Security and Entitlement

*Tivoli security solutions provide a seamless operational and enterprise approach to Security, Risk & Compliance.*



Manage enterprise threats and vulnerabilities

Deliver continuous and reliable access to information and services

Manage identity to enable secure, seamless collaboration

Increase compliance & reduce reputation risks and audit deficiencies

Virtualised management of enterprise entitlement and access

*Maintaining a securely managed data centre provides business resiliency and effectiveness in managing highly virtualised, dynamic and efficient data centres.*

# Managing the converged asset lifecycle

Discover & manage the lifecycle of assets, from procurement to decommissioning

Understand the energy efficiency of assets, from servers to HVAC units

Efficiently manage the maintenance and pro active swap out procedures

Contract management with suppliers

Asset inventories, geo spatial detail and ownership information for compliance reporting

Manage incidents, problems, changes and configurations from a single platform

**Production Assets**

**Facility Assets**

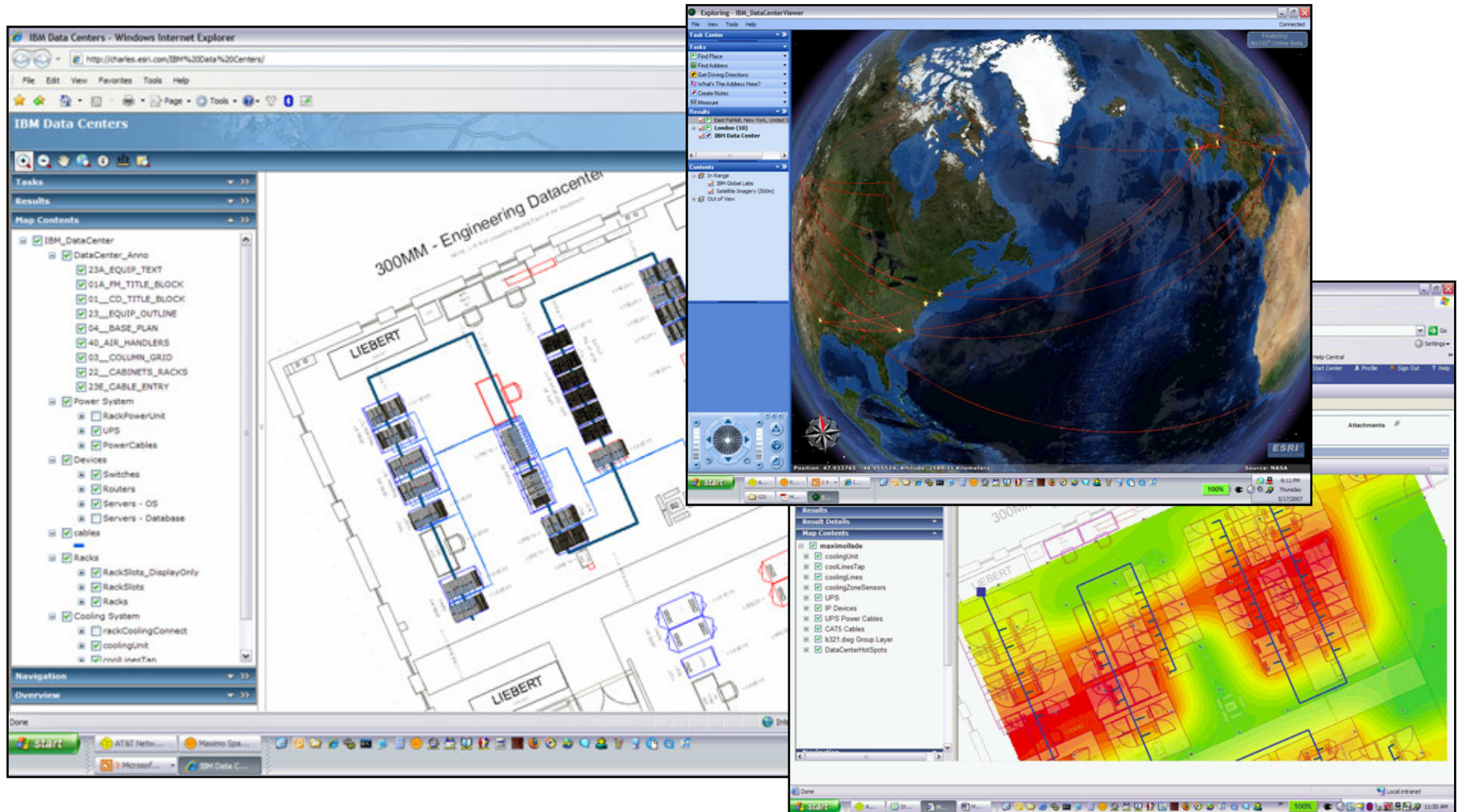
**Transportation Assets**

**IT Assets**

**Asset Management**



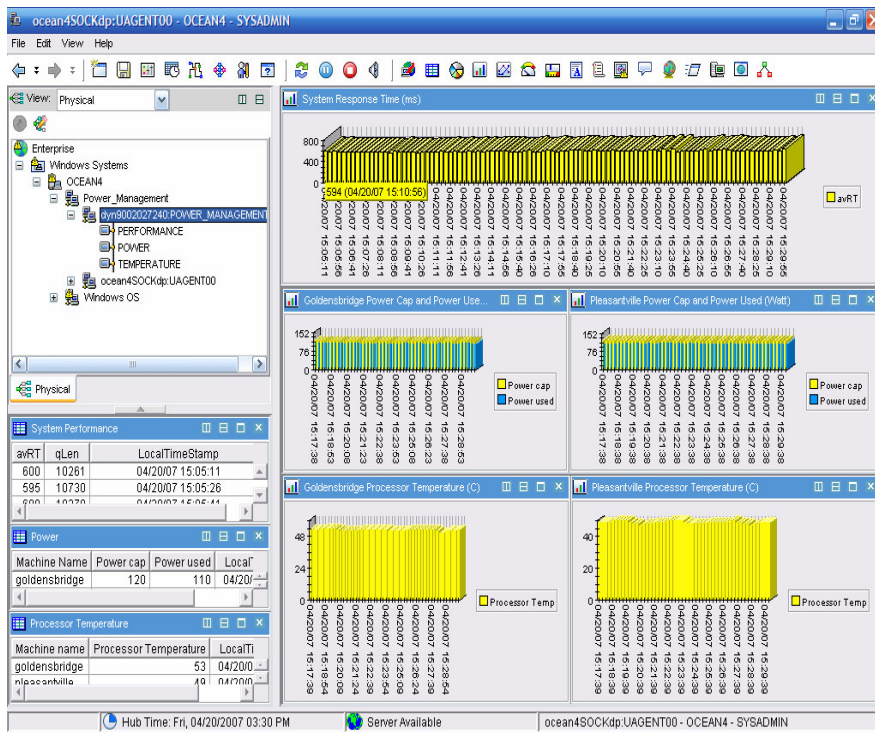
# Geospatial integration for assets and data centres





# Tivoli Monitoring for Green Energy

Now all your IT compute data plus all your facilities metrics in one spot !!



Visualize the power consumption and thermal signatures of data center resources

Alert operators and facility managers before servers reach critical energy and temperature thresholds

Automate and control server's energy usage to optimal levels including triggers to 3<sup>rd</sup> party partners

New Partner Ecosystem Announced May 08:



# Energy Service Management Capabilities

**Optimize your enterprise  
for energy efficiency**



How much power am I using?

How much money can I save by  
reducing power?

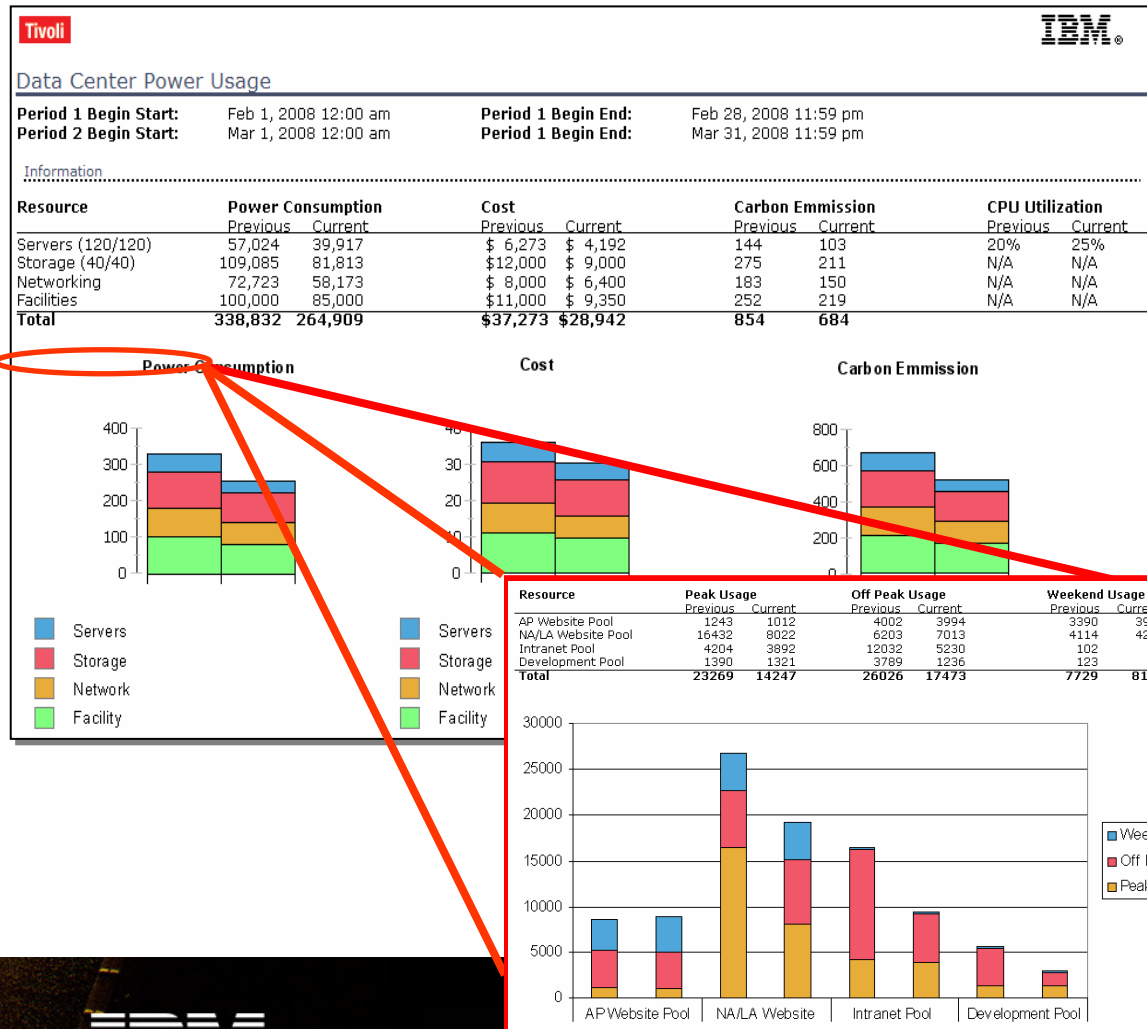
What services are costing me the  
most in power consumption?

Can I change and still meet my  
service level agreements?

What should I do first?

# Gain Visibility to Energy Usage

New energy Optimization reports included in ITM Tivoli Monitoring



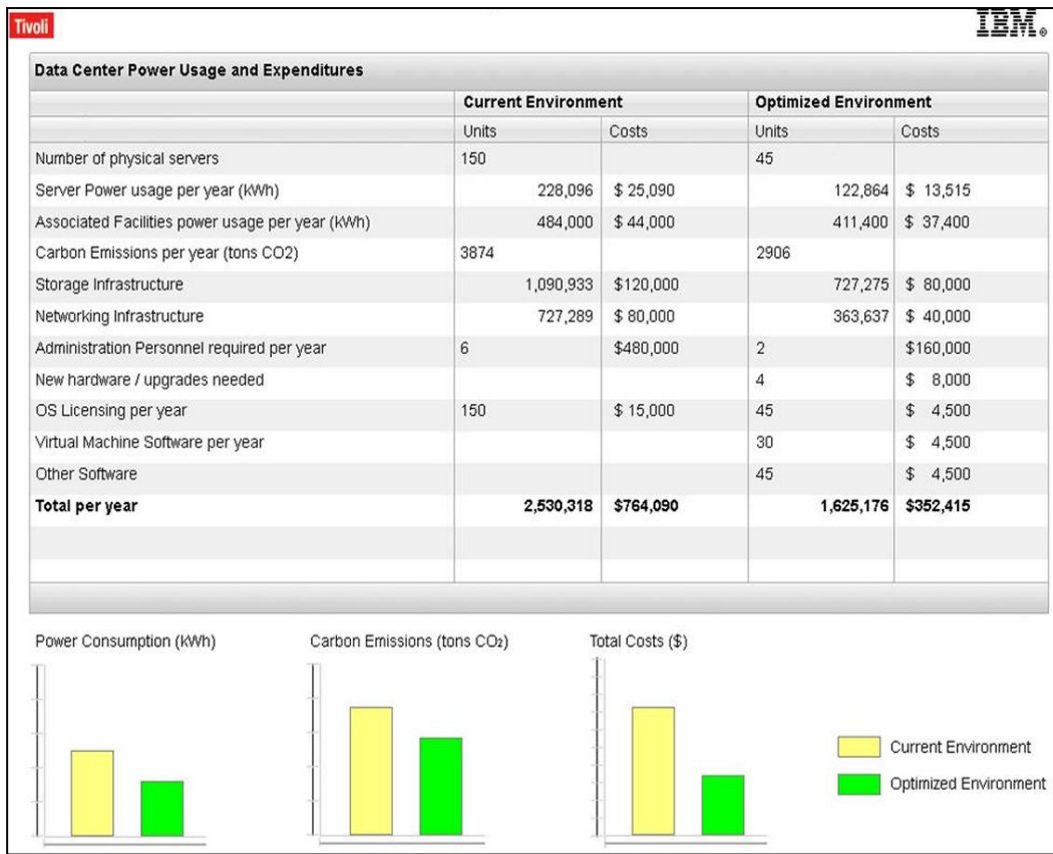
Track and trend changes in energy usage over time

Combine different data types and energy usage into a single report.

Obtain information needed to qualify for power company or government rebates and incentives



# Advanced Control and Automation of the Data Center's Energy Usage



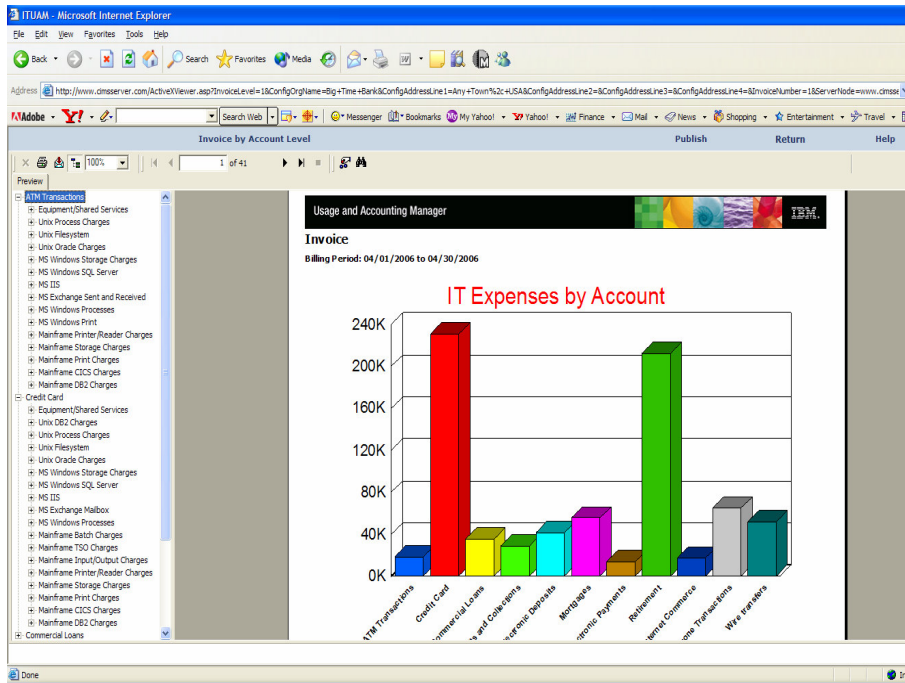
Compare current power utilization and costs to the optimal configurations

Model incremental changes to analyze how the data center environment will change

New energy Optimization reports included in ITM Tivoli Monitoring



# Chargeback of resources including energy used, plus power and thermal trends.



**Who used what?**  
**How much did it cost?**  
**Usage based accounting & chargeback**

Aggregate power consumption data and determine cost of power via **Tivoli Usage and Accounting Manager**

Set a benchmark for energy usage to better track improvements

Report on the amount of power consumed, when it was consumed, and which services consumed it

Introduce power utilization accountability



# Integrated Role-Based Dashboards

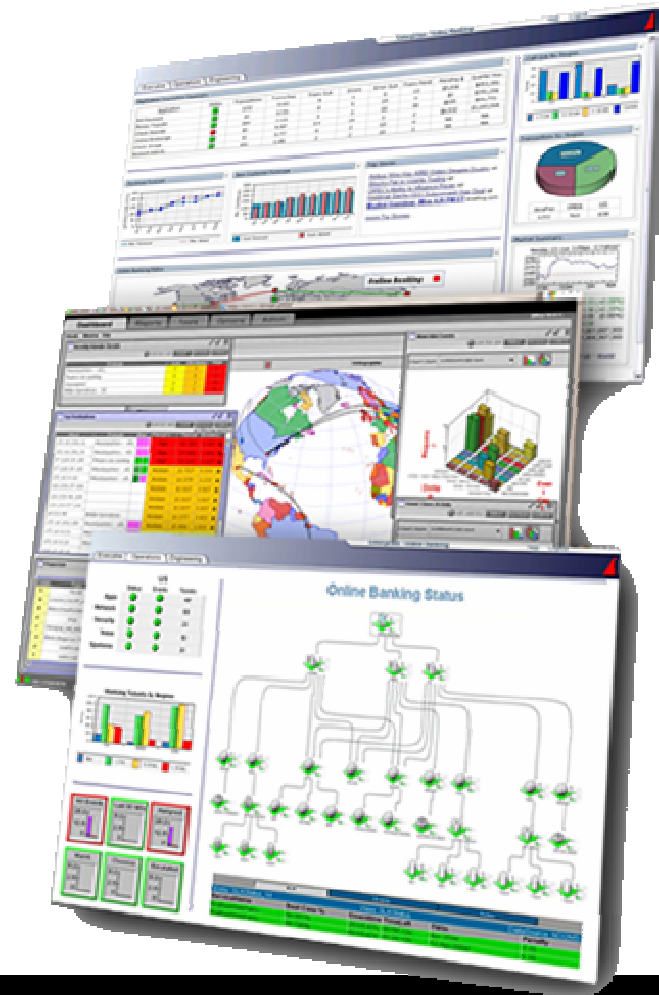
*Enabling better & faster decisions across all operational areas of the Data Centre*

Different roles have different informational and operational requirements.

UI integration strategy focused on dashboard and portal requirements of common operational organizations:

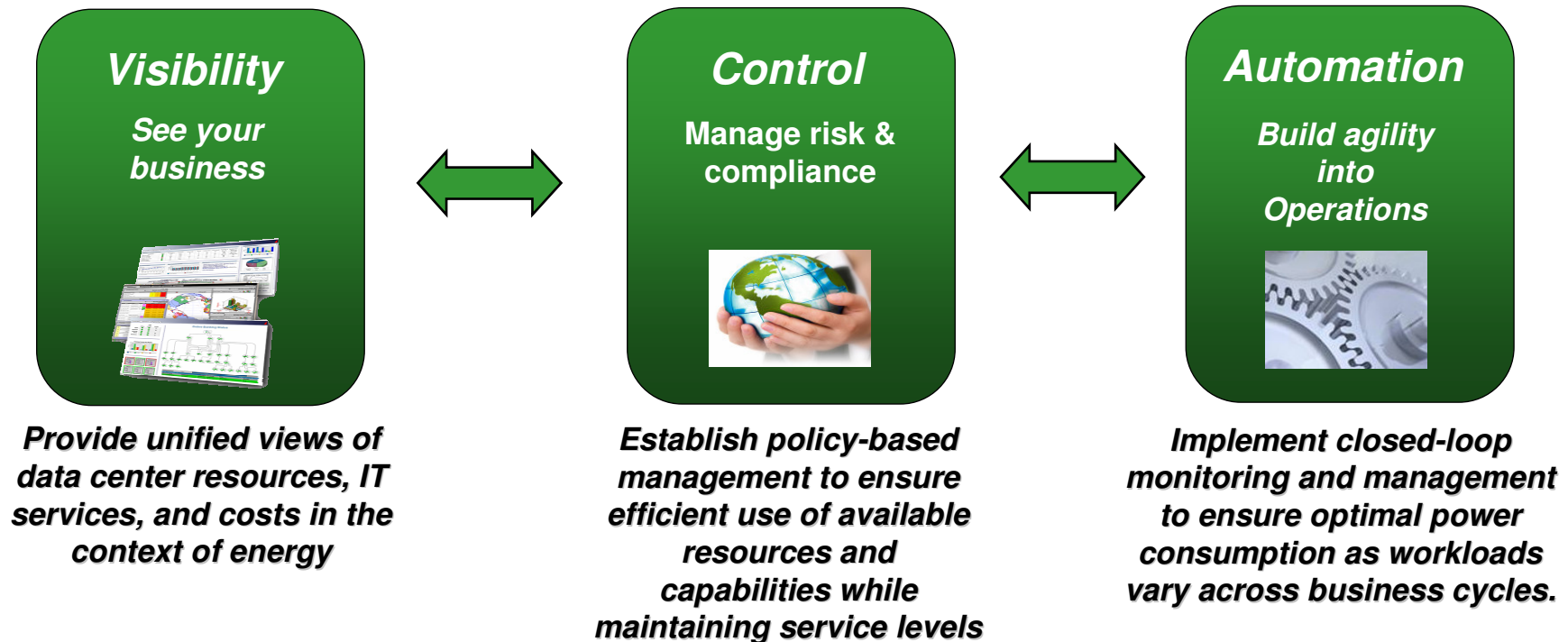
- IT Operations
- Service Provider
- Business Operations
- Storage Management
- Security Operations
- Energy & carbon dashboards
- Common reporting

Delivers appropriate data and capability to different operational and business audiences.



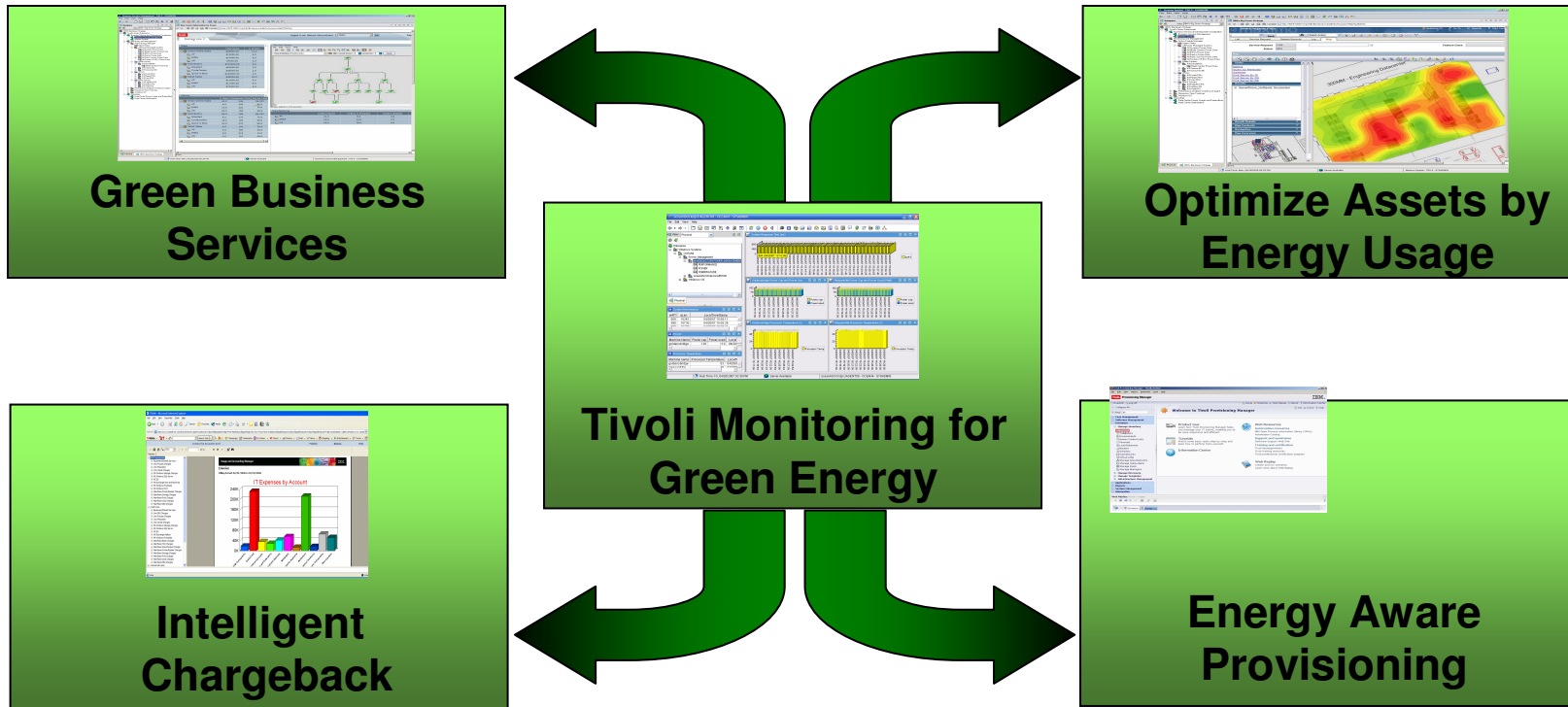
# Tivoli 'Green' Service Management

*An Integrated Approach to controlling energy costs*



# IBM Service Management's Green Data Center

Using Green Data to accent Tivoli's existing event architecture and data model





# Tivoli Energy Efficient Data Centre Value

## Visibility

- Visualisation, reporting, trending, dashboards
- Discovery, mapping, configuration management
- Integration between IT and Facilities
- Usage, accounting and chargeback

## Control

- Performance and availability monitoring and optimisation
- Virtualisation provisioning and management
- Enterprise asset lifecycle management
- Security management and governance

## Automation

- Dynamic workload management
- Active energy management
- Information lifecycle management
- Application lifecycle management



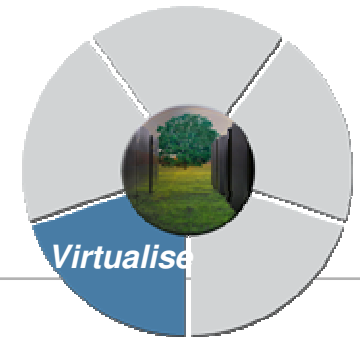
Some examples ...

saving money, space, energy, carbon



# Virtualise - IBM Global Infrastructure

*Improve operational efficiency and risk management while reducing energy usage by 80%*



## Client requirements

- Needed to reduce systems management complexity
- Needed to increase stability, availability, and provide world-class security
- Improve operational costs and energy efficiency

## Solution

- Consolidate 3,900 servers to 33 System z mainframes
- Migrate servers delivering largest savings first
- Eliminate assets with lowest utilisation first
- Aggregate by customer work portfolio to leverage strong customer buy-in
- Focus on freeing up raised floor space (30xoffice cost)
- Provision new applications to the mainframe

## Benefits

- Annual energy usage reduced by 80%
- Total floor space reduced by 85%

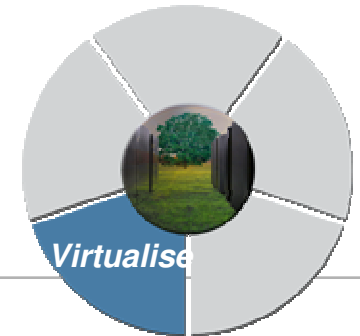


Initial priority for consolidation to Linux on System z



# Virtualise – Rationalization at UPMC

**Maximize service level and mitigate costs by saving \$18-22M over 3 years with Wintel, Unix and storage virtualization**



## **Client requirements**

Server growth 4x in 5 years – data center chaos  
Centralize IT services and consolidate data centers  
Free up space to produce revenue – more hospital beds

## **Solution**

Wintel and Unix virtualization  
Reducing from 40 storage databases to two centralized SAN arrays  
Consolidating 1,000 physical servers to 300 IBM servers (multiple platforms)

## **Benefits: \$18-22M savings over 3 years**

Virtualization saved \$9.8M in first five months  
Utilization rates increasing from 3% to 80% per server  
Server capacity increase by 150%  
Maintained flat infrastructure support staff  
Create hospital space



**UPMC** | University of Pittsburgh  
Medical Center

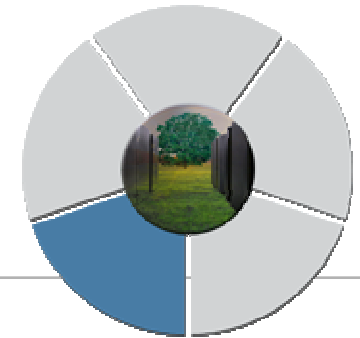
*“These accomplishments help position UPMC as a leader in the adoption of server virtualization technology among health care provider organizations...will fundamentally alter how IT is deployed and managed in the industry”*

*- Health Industry Insights, IDC, January 2007*



# Virtualize - IBM Data Center

*Improved operational costs up to 70% with aggressive distributed platform virtualization*



## Client requirements

- Improve IT equipment utilization
- Reduce IT hardware requirements

## Solution

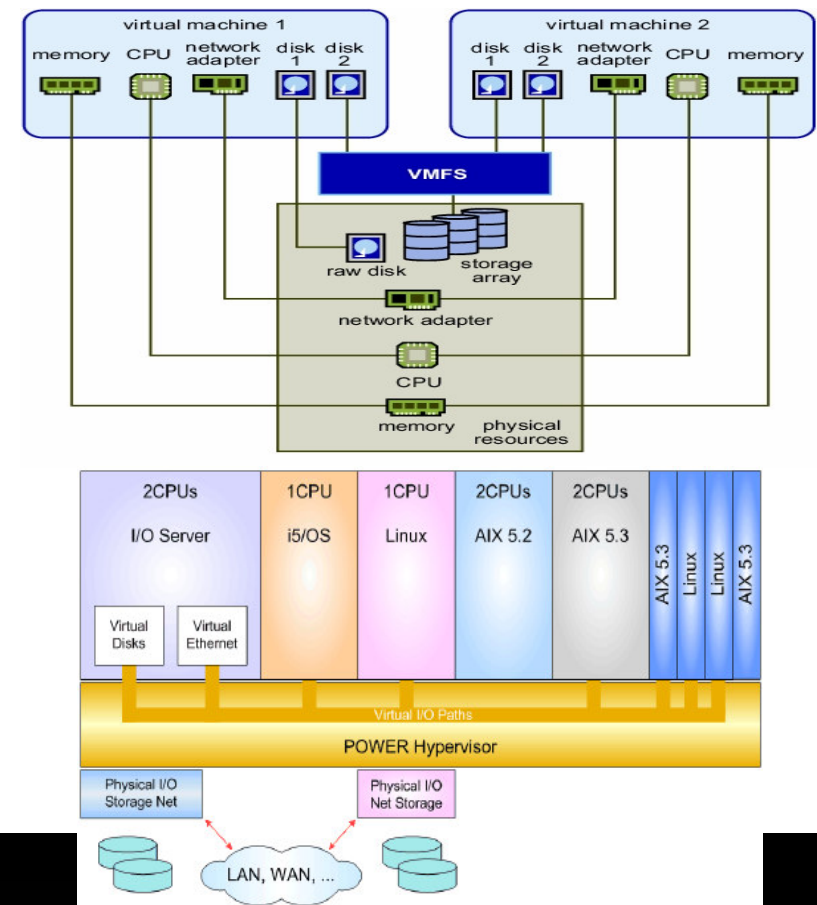
Advanced POWER Virtualization (APV) and VMWare  
Reduced number of physical servers

- Wintel from 11,000 to 1,500
- Unix from 8,500 to 1,500

Three times improvement in server utilization  
Formed a Virtualization Center of Excellence to  
implement best practices across geographies

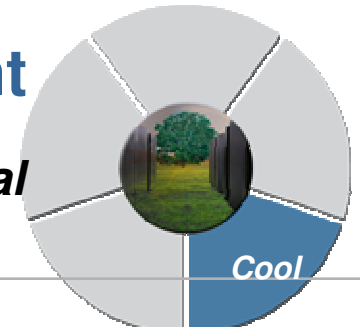
## Benefits

- Operational savings of up to 70%
  - Space, power and cooling, maintenance, software support and personnel costs



# Cool - Data Center Stored Cooling - IBM Bromont

*Implement innovative cooling technology to reduce operational costs from the largest data center energy user by 45%*



## Client requirements

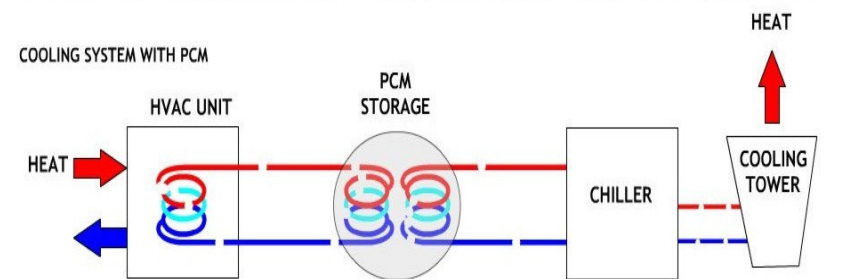
- Identify and attach the largest areas of energy consumption
- Reduce energy consumption and operating costs of chiller plant supporting Bromont (Quebec, Canada) site

## Solution

- Install “Cool Battery”
- Increase chiller utilisation by storing cold for use throughout the day
- Leverage environment - free cooling

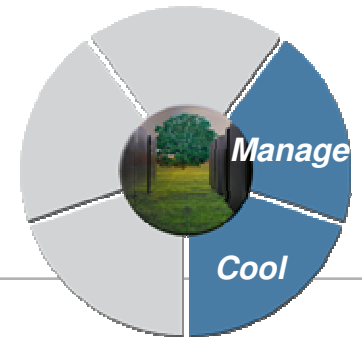
## Benefits

- Reduced chiller plant energy cost by 45%
  - Over 5.3 million kwhr per year
  - Demand reduction of approximately 1 MW
- Avoided need to install additional chiller
- Environmentally-friendly, non-toxic, no-maintenance



# Manage, Measure & Cool - IBM Southbury

**Implement IBM Energy Management Solution and IBM Rear Door Heat eXchanger for 10-30% energy savings**



## Client requirements

- Improve how to meter, control, and cap power usage
- Actively moving workloads and power up/down resources

## Solution

- Power density of 200 watts per square foot
- Use of 2-3 “Thermal Zones” for targeted power and cooling
- Power and thermal meters to measure baseline and changes
- Rack based thermal cooling

## Expected Benefits

- Integrated Facilities and IT solution
- Rack Level Cooling Improves Efficiency 20-30%
- Match Cooling Load to Heat Load: 10-30% Savings
- Combined Air and Water or Refrigerant Cooling
- Reduces Equipment Costs/More Flexible Facility



**IBM PowerExecutive**



# Energy Efficient Data Centre Summary

**Measurement** - Holistic integration of IT and Facilities assets and energy

**Visibility** – Real-time, integrated, role-based operational and business dashboards

**Control** - Active energy management within business service context

**Automation** - Dynamically adapting environment based on optimised service, energy and demand

**Exploit** - Innovate with technology across the business to reduce [the other 98%] carbon emissions







# Data Centre Evolution

Managing an efficient data centre for the future

Nicholas Drabble

Green Computing Programme Manager

IBM Software Group – UK, Ireland

Tomorrow's Data Centre June 2008

# Agenda

<b>10:00</b>	<b>Viola Dytko</b>	<b>Introduction &amp; Logistics</b>
	<b>Gary Barnett</b>	<b>Evolution</b>
	<b>Nick Drabble</b>	<b>Managing Tomorrow's Data Centre</b>
<b>11:25</b>		<b>Coffee</b>
	<b>Jonathan Humphries</b>	<b>Energy Efficiency in the Data Centre</b>
	<b>Tikiri Wanduragala</b>	<b>Optimising Data Centre Performance</b>
<b>12:45</b>		<b>Lunch</b>

