

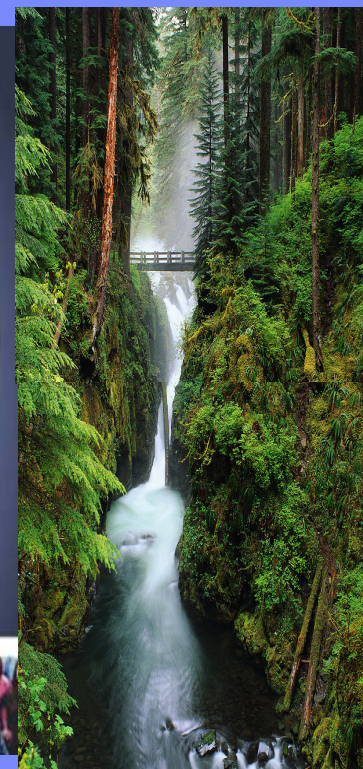


IBM System z: Lean and Green

Using IBM System z Technology to
Solve the Costly Challenges of IT
Complexity,

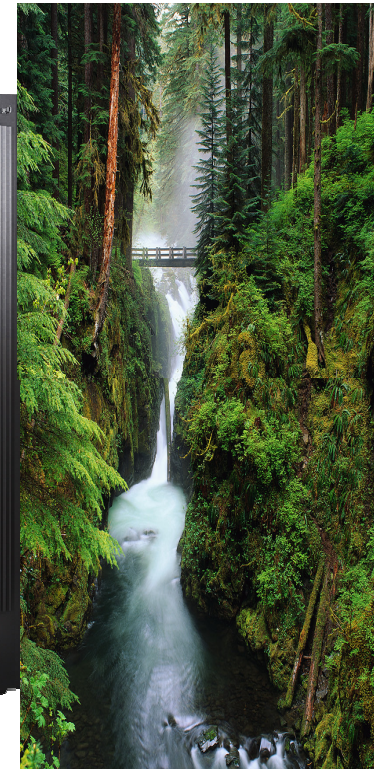
Power and **Cooling**
through Consolidation

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Agenda

- **Server Proliferation & Energy Cost Escalation**
- **Energy & Cooling Costs at a Tipping Point**
- **Lean & Green: The Green Data Center and IBM's Project Big Green**
- **Why System z for Virtualization & Server Consolidation Including IBM's Internal Consolidation Proof Point: Do More with Less**
- **Need for Energy Management & IBM Solutions**
- **Getting Started Towards a Green Data Center with System z & Linux**
- **Customer Proof Points & Next Steps**



Server proliferation – complexity and energy crisis

- **IT Complexity is driving business pain and cost to our clients**
 - People Cost has doubled as a % of Total IT Cost from 33% in 1996 to 66% in 2006 ¹
 - Software costs continue to grow linearly with distributed server growth ¹
- **Energy costs are rising and have become a high priority concern for customers**
 - Global climate and environmental concerns
- **Increased technology density brings with it additional energy requirements**
 - Projections on Power Use for 50k Sq. Ft. Data Centers: ²

Year	Avg. Watts Per Sq. Ft.	Total kWh	Annual Utility Cost (8.68 cents kWh)
2003	40	17,520,000	\$1,520,736
2005	80	35,040,000	\$3,041,472
2007	240	105,120,000	\$9,124,416
2010	500	219,000,000	\$19,009,200

- **Continued server proliferation is unsustainable due to energy requirements and cost, the cost of infrastructure complexity and the resulting inflexibility of the infrastructure**

¹ Source: IDC, On-Demand Enterprises and Utility Computing: A Current Market Assessment and Outlook, IDC #31513, July 2004.

² Source: AFCOM, "Trends in Data Center Design and Construction," California Data Center Design Group

Data centers have Doubled their power consumption in the last 5 years

According to IDC, by 2010 for every \$1 spent on hardware, 70 cents will be spent on power and cooling and by 2012 for every \$1 spent on hardware, \$1 will be spent on power and cooling.

- According to IDC, 46.8% of data center managers do not know how many watts per square foot their data centers can or do support. The other 50%+ of respondents were thought to be largely “guessing” when they said they did know.

Data centers typically consume 15 times more energy per square foot than a typical office building and, in some cases, may be 100 times more energy intensive.

Data Centers equal the CO2 produced by the entire airline industry

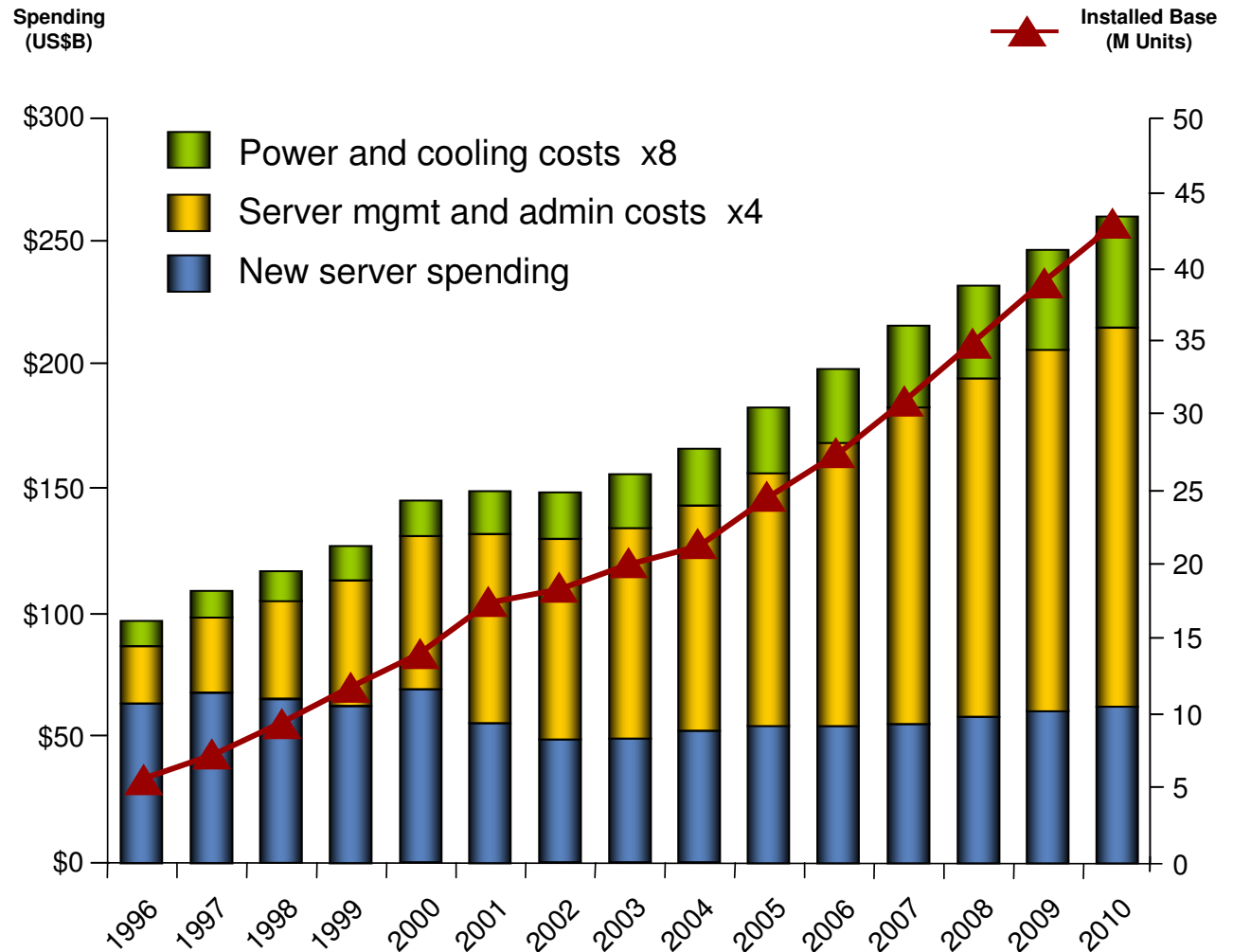
**Energy costs are predicted
to rise in the next 10 years**



Power and cool cost trends for IT installed base

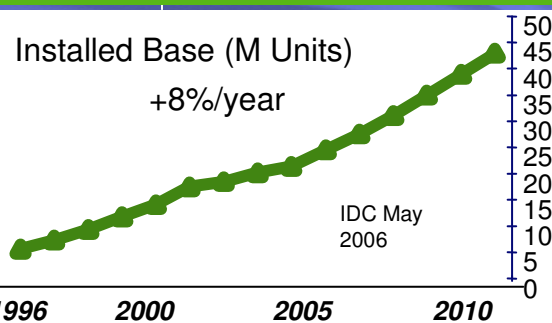
- Today, 50 cents is spent on energy for every dollar of hardware

- This is expected to increase by 54% over the next four years

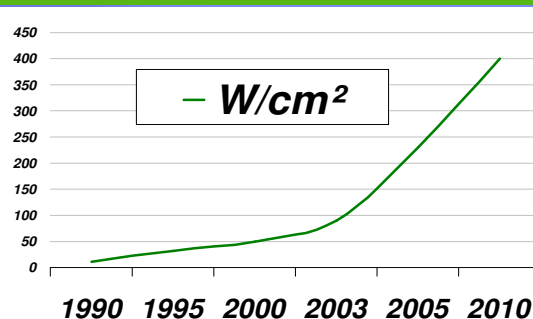


Source: IDC, Virtualization 2.0: The Next Phase in Customer Adoption, Doc #204904, Dec 2006

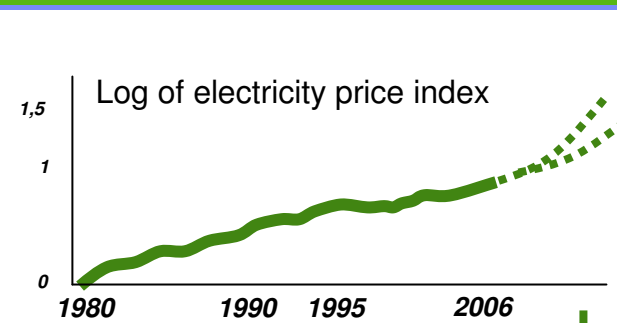
Increased number of servers



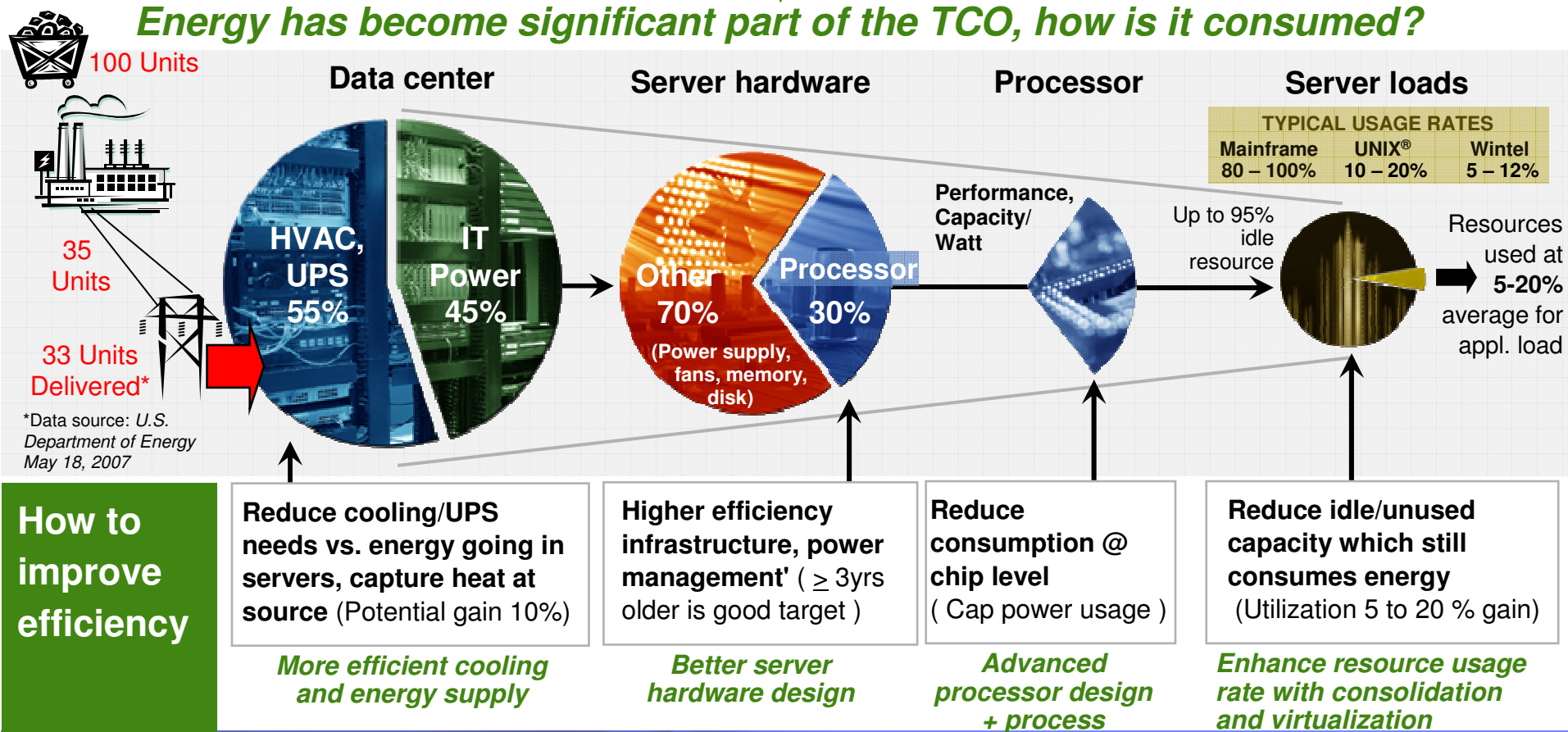
Increased processor consumption



Increased cost of electricity



Energy has become significant part of the TCO, how is it consumed?



Clients are focused on energy, cooling and cost savings

■ Energy and Cooling

- Gartner reports that 50% of poll respondents cited **Excessive Heat or Insufficient Power** as their key issue ¹
- Most Data Centers are experiencing some sort of power/cooling problem.
- Data center power density is increasing by approximately 15% annually ³
- Power draws per rack have grown 8x since 1996 ³
- Over 40% of Data Center customers report power demand outstripping supply ³

■ Cost Savings

- **35% of CIO's** report '**controlling IT costs**' as a top IT management priority⁷
- **50% of data centers** have server consolidation projects underway...
....to reduce costs and better control systems ²
- **One third of CIO's** have applied or plan to apply '**lean manufacturing principles**' to data centers, to reduce waste and improve labor productivity ⁸
- **56% of CEO's** cite **cost reduction** benefits as the top benefit of business model innovators

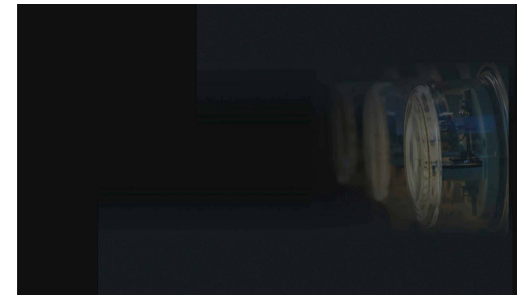
Source: 1. Gartner Data Center Conference, December 2005; 2. Gartner Data Center Conference, December 2006; 3. IDC, "The Impact of Power and Cooling on Data Center Infrastructure," 2007; 7. State of the CIO, CIO Magazine; 8. McKinsey Oct 20 2006: What's on CIO Agendas in 2007?; 9. The Global CEO Study, IBM 2006



Power-Hungry Computers Put Data Centers in Bind

November 14, 2005

- ***Today's distributed servers draw too much electricity and generate too much heat***
 - E.g. 3,800 watts per square foot in 2005 from 250 watts per square foot in 1992
 - Also the “tiniest new circuitry leaks current when switched off”
- **If planners miscalculate, servers overheat, damaging circuitry or causing shutdowns**
 - “Power-related problems in 2005 will cause 4 of the 20 major failures, up from 2 of 20 last year”
 - “The people who buy computers often aren't the people who have to manage them”
- **Outcomes:**
 - Major reconstructions – digging up parking lots, knocking down walls
 - 4 - 5 times increase in power utility bills
 - \$20,000 electrical-system upgrade (**Diesel generators cost: \$50K to \$200K**)
 - \$150,000 air-conditioning upgrade (**Cooling Units cost: \$25K to \$50K**)
 - Room temperatures averaging 92°F → erratic machine behavior
 - Reducing raised-floor occupancy
 - Building new facilities (**Floor space build out costs: \$250/Sq. Ft. to \$1,500/Sq. Ft. ,Design and deployment costs: \$30K to \$75K**)



**Pomona Valley
Medical Center**

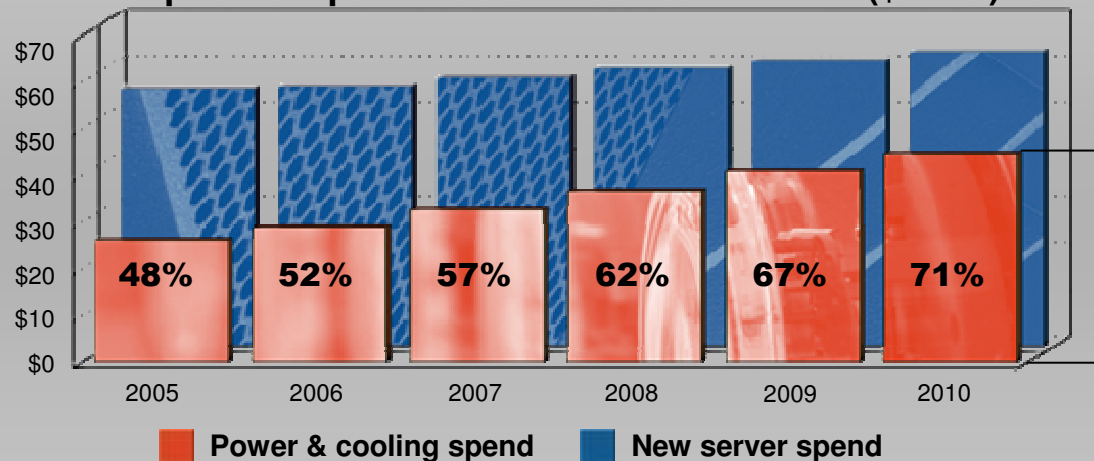
“Temporary shutdown of systems serving the hospital's laboratory, \$40,000 in damage to servers and hard drives, and prompted a \$500,000 retrofitting of the cooling system”

Data centers are at a tipping point



- ❑ Left unchecked, the cost to power and cool servers in the future may well equal the cost of acquisition.
- ❑ If IDC 2010 forecast holds, the cost to power and cool servers in the data center will increase 54%.
- ❑ IT executives now rank power and cooling in the top 5 among current concerns.

Expense to power and cool installed base (\$USB)



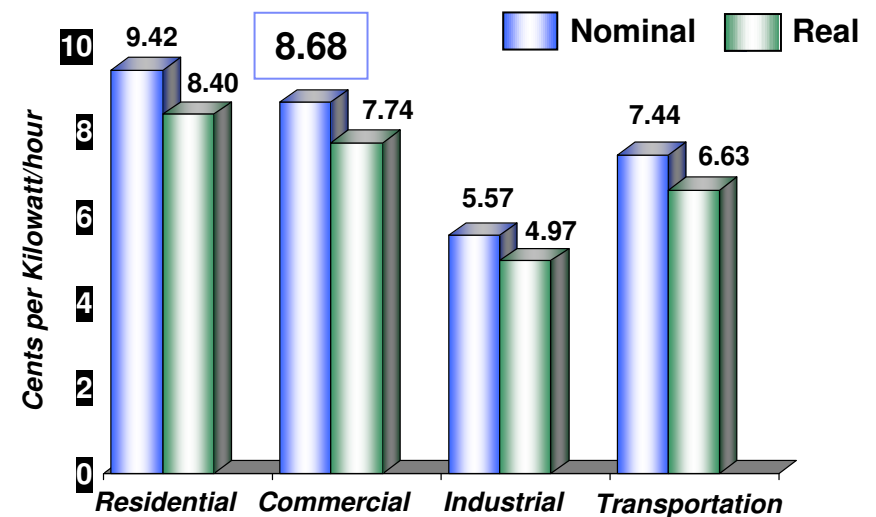
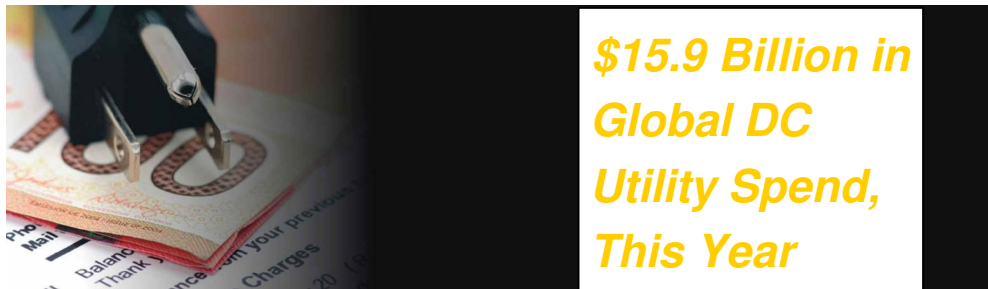
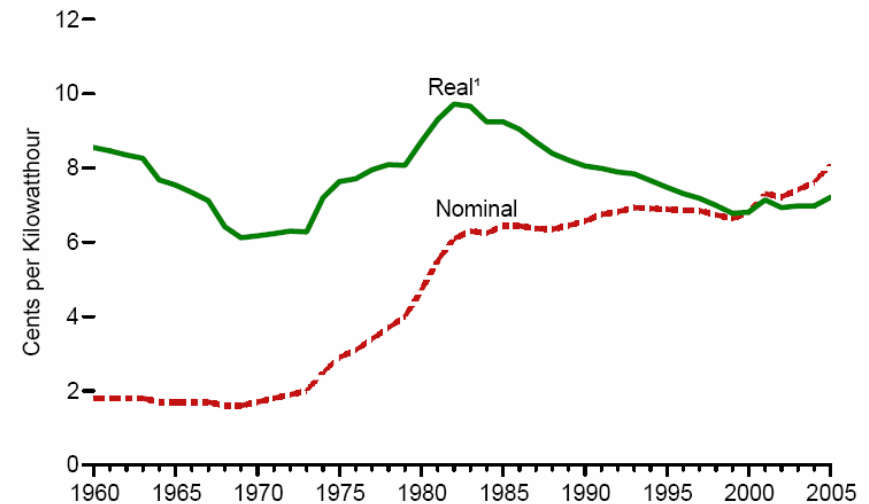
The expense to power and cool the installed base of servers is projected to grow four times compared with the growth rate for new server spending

Source: IDC, 'Worldwide Server Power and Cooling Expense 2006-2010,' Document #203598, Sept. 2006

Cost of electricity

In real terms the price of electricity was largely declining since the 1980s. However, regulation and supply shortages are reversing that trend

Total, 1960-2005



Source: Energy Information Administration / Annual Energy Review 2005

Cost of capital: **power/cooling** will force companies to invest

“Most data centers will struggle to accommodate the growth, as well as the power and cooling requirements, of new high-density servers, which will result in an inability to meet growing business needs”

Gartner 2006*

“77% of AFCOM members expect to relocate or make major physical improvements to their data center.”

AFCOM 2006

“Through 2009, 70 percent of data center facilities will fail to meet operational and capacity requirements without some level of renovation, expansion or relocation”

Gartner Group 2005

“Building costs for data center space can range from \$400 to \$4,000 per square foot, depending on facility specs”

Rick Sawyer, Director of Data Center Technology
for American Power Conversion

Source: * Gartner: A Message From Data Center Managers to CIOs: Floor Space, Power and Cooling Will Limit Our Growth, Rakesh Kumar, August 2006

Now is the time to be **Lean and Green!**

Meeting the demand for growing IT capacity – an alternative approach

–**LESS IS MORE** – Focus on highly efficient
use of **FEWER** servers

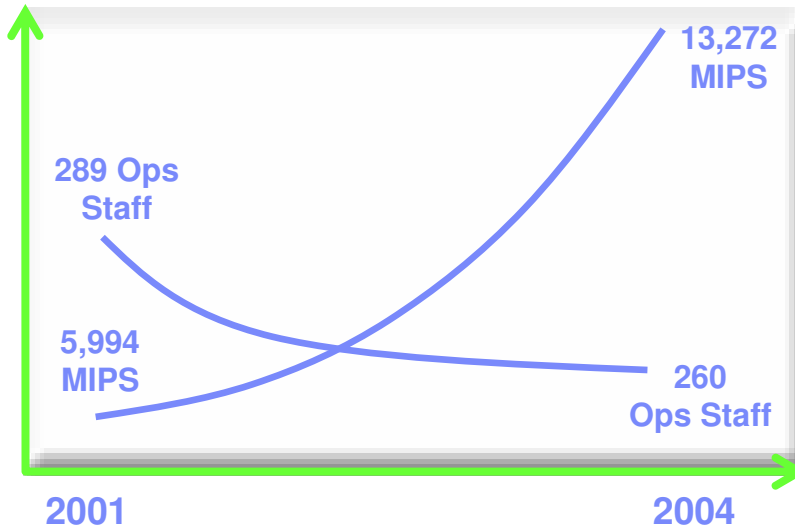
- 100s of workloads on a single server
- Deploy advanced management and automation capabilities
- Deploy highly secure and resilient technologies

–**Start with highly energy efficient technologies**



IBM System z9™ can help solve excess growth and complexity

Volume of workloads processed has never been larger



“Since we published our last high-level perspective of the ratio between MIPS and head count in 2001, the largest z/OS installations have more than doubled their ‘MIPS to head count’ ratio.”

L. Mieritz, M. Willis-Fleming – Gartner, 2004

Gartner

Mainframe data center staffing levels have not significantly changed despite large increases in workload volumes.

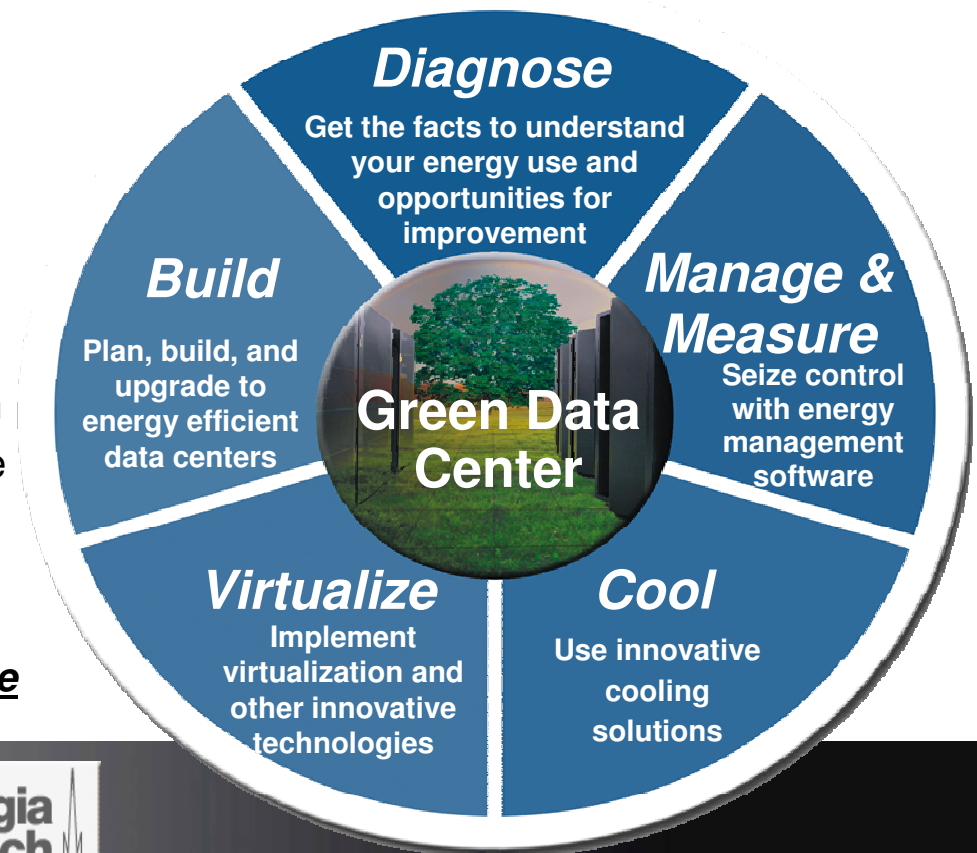
**First
National
Bank of
Omaha**

“Their disparate computing environment was becoming extremely expensive, requiring FNBO to hire more people as more boxes were brought online. “I looked at our infrastructure in 2002 and saw we were growing servers at a rate of 30 percent per year. For every application I had, I needed another one to five servers behind that, for things like development and application and Web serving. And every 20 servers translates to another body to administer them.”

Ken Kucera, senior vice president and division head of FNBO Enterprise Technology Services

What is a green data center?

- Green data centers are efficient and environmentally responsible in five strategic business aspects
- IBM client are seeing results:
 - 45% reduction in power and cooling
 - 20% increase in server/storage utilization
 - Up to 80% reduction in data center space
- Large Centralized Servers provide significant advantages for achieving energy efficiencies today and in the future



Why do I need a green data center ?

Business value: Move from current state → to Green Data Center

Financial



Rising global energy prices

Squeeze on IT budgets

Constraints on IT growth

- Ability to accurately view baseline energy cost
- Cost savings from more efficient energy use
- Relax budgetary pressures to allow growth

Operational



High density server systems

Aging data center technology

Systems availability risks

- More computing performance per kilowatt
- Flexibility to adopt more efficient technology
- Extend the life of IT equipment

Environmental



Corporate social responsibility

Lack public image

Improve employee morale

- Meaningful energy conservation
- Improved public image
- Positive contribution to the Green movement creates a good place to work

“Project Big Green” is a major IBM initiative to help our clients achieve greater energy efficiency

<http://www-03.ibm.com/press/us/en/presskit/21440.wss>

■ IBM to reallocate \$1 billion each year:

- To accelerate “green” technologies and services
- To offer a roadmap for clients to address the IT energy crisis while leveraging IBM hardware, software, services, research, and financing teams
- To create a global “green” team of energy efficiency specialists
- To offer IBM green solutions that include the strength of IBM’s hardware, software, services, research and financing teams

• Mainframe Gas Gauge

http://www-03.ibm.com/systems/z/energy_efficiency/

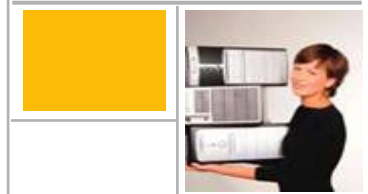
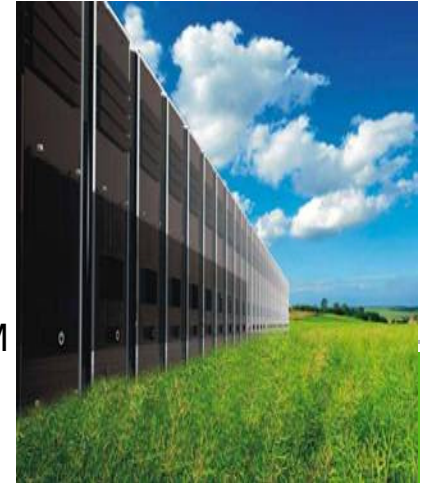
• Energy Efficiency Certificate Program

■ Re-affirming a long standing commitment at IBM:

- Energy conservation efforts from 1990 – 2005 have resulted in a 40% reduction in CO2 emissions and a quarter billion dollars of energy savings
- Annually invest \$100M in infrastructure to support remanufacturing and recycling best practices
- ***Will double compute capacity by 2010 without increasing power consumption or carbon footprint saving 5 billion kilowatt hours per year . . . equals energy consumed by Paris - “the City of Lights”***

■ What “green” solutions can mean for clients:

- For the typical 25,000 square foot data center that spends \$2.6 million in power annually, energy costs can be cut in half
- Equals the reduction of emissions from taking 1,300 cars off of the road...or a 3.5 million-pound reduction in coal burned for energy generation



IBM Consolidation Announcement Highlights

- **IBM will consolidate thousands of servers onto approximately 30 System z mainframes**
- **We expect substantial savings in multiple dimensions: energy, software and system support costs**
- **Major proof point of IBM's 'Project Big Green' initiative**
- **The consolidated environment will use 80% less energy**
- **This transformation is enabled by the System z's sophisticated virtualization capability**



Think what we could do for you

IBM'S PROJECT BIG GREEN SPURS GLOBAL SHIFT TO LINUX ON MAINFRAME



Plan to shrink 3,900 computer servers to about 30 mainframes targets 80 percent energy reduction over five years

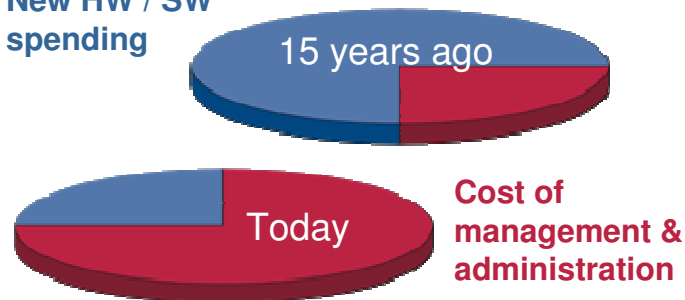
Optimized environment to increase business flexibility

ARMONK, NY, August 1, 2007 – In one of the most significant transformations of its worldwide data centers in a generation, IBM (NYSE: IBM) today announced that it will consolidate about 3,900 computer servers onto about 30 System z mainframes running the Linux operating system. The company anticipates that the new server environment will consume approximately 80 percent less energy than the current set up and expects significant savings over five years in energy, software and system support costs.

At the same time, the transformation will make IBM's IT infrastructure more flexible to evolving business needs. The initiative is part of Project Big Green, a broad commitment that IBM announced in May to sharply reduce data center energy consumption for IBM and its clients.

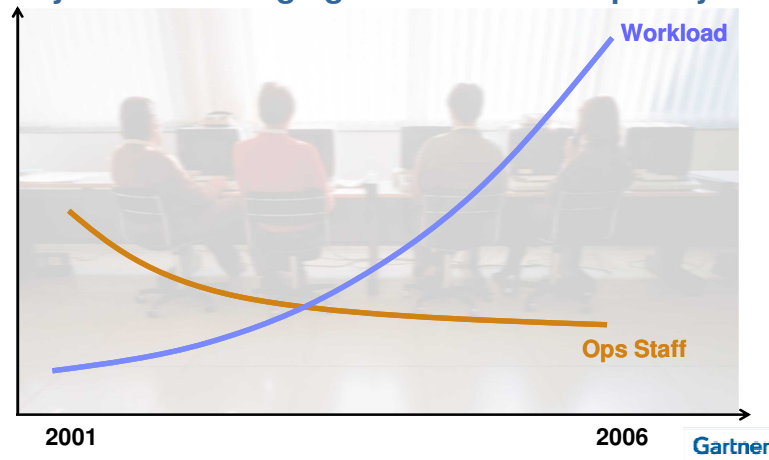
Why System z Now?

New HW / SW
spending



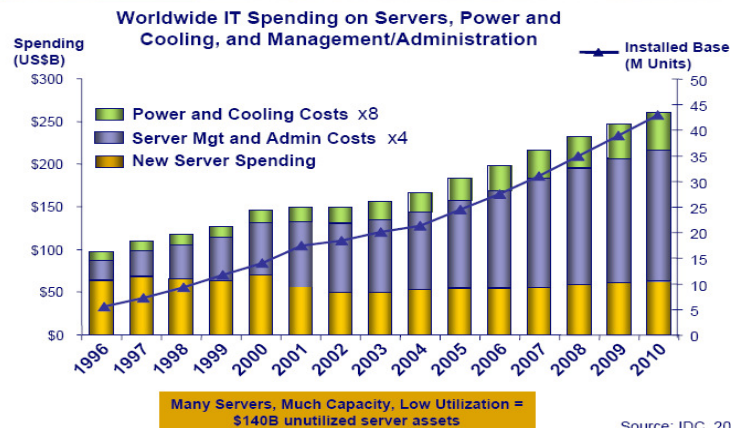
Source: Tony Picardi, IDC
Economist.com: Make it simple. October 28th, 2004
From The Economist print edition

System z9 Managing Growth and Complexity



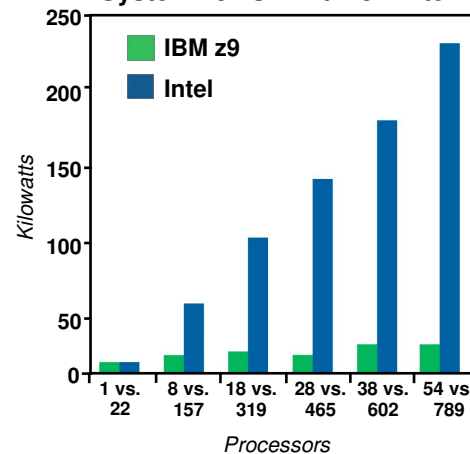
Worldwide Server Market:

Cost of Management Ramps Dramatically



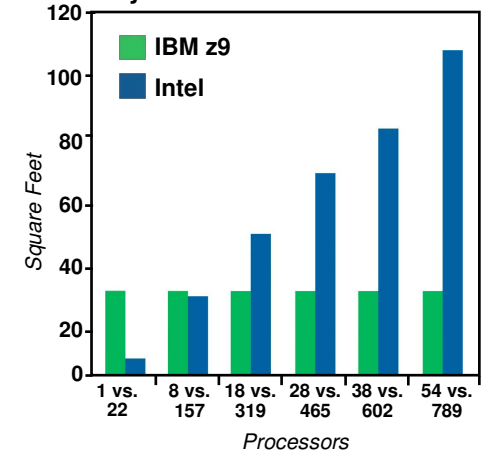
POWER:

System z9 vs. Linux on Intel



SPACE:

System z9 vs. Linux on Intel



The Linux on Intel servers selected in this example are functionally eligible servers considered for consolidation to a System z running at low utilization such that the composite utilization is approximately 5%. The utilization rate assumed for System z EC is 90%. This is for illustration only actual power and space reductions, if any, will vary according to the actual servers selected for consolidation.

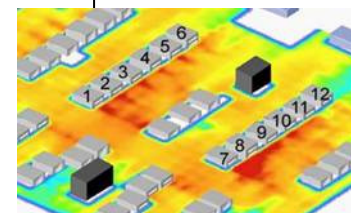
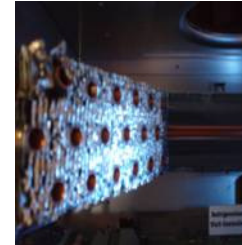
Consolidate data centers for large savings (IBM)

Your IT Cost may vary:

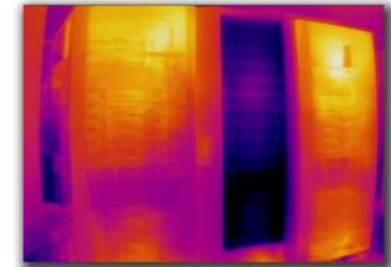
- **92% less hardware**
 - Move to IFL's
 - +80% energy reduction
 - +85% space reduction
- **180% greater utilization**
 - 30% average utilization going to over 85%
- **Reduced People cost through virtualization**
 - Freeing up resources for growth opportunities
- **Potential for dramatic reductions in software expense for processor based licenses**
 - Elimination of 23,000 SW licenses and related on-going S&S costs
- **Significant reductions in power and cooling costs are possible**
 - Less Stress on Data Center Infrastructure
- **Significant reductions in IT Data Center square footage are likely**
 - Enables growth and better utilization of facilities

Workload consolidation using Linux on a mainframe may result in over 40% IT Cost savings

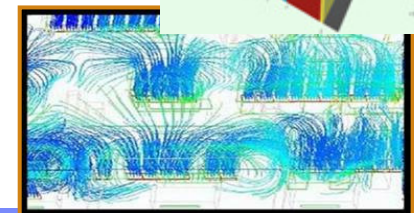
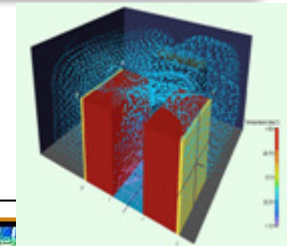
5-Year IT Expenses (K\$)



IBM innovations in cooling technology



Cool



System z – industry-leading virtualization + RAS

Do More with Less

Helping customers reduce costs:

✓ *Virtualization*

✓ *Data Center consolidation*

✓ *Automation*

System z designed for large scale consolidation

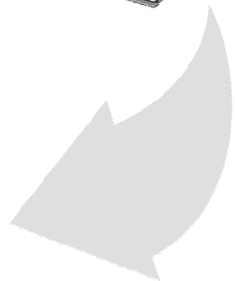
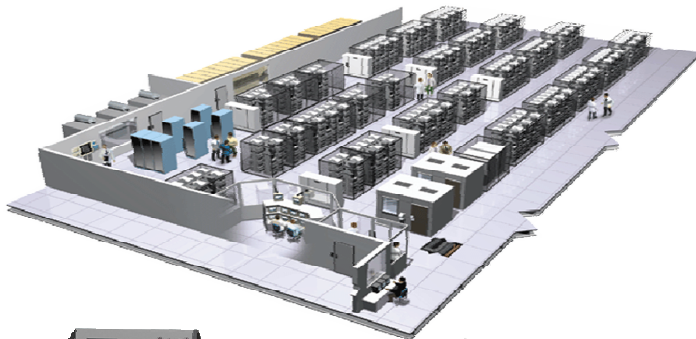
- 100s of virtual servers in a single footprint
- Hardware utilization rates of 85%+, compared to 15%-30% for distributed server
- Servers provisioned in seconds rather than days
- Processors, memory and channels shared across multiple virtual servers
- Advanced workload management and automation

**The power
of many . . .**



**. . . the simplicity
of ONE**

IT **Leanness** starts with a data center in a box . . . not a server farm



**Virtualization &
scale up
consolidation
hit server units**

Advantages of Linux on System z

- **Central point of management**
- **High resource utilization**
- **Low cost of operations**
 - Fewer Servers
 - **Less energy, cooling and space**
 - **Less environmental impact**
 - Fewer SW Licenses
 - Fewer resources to manage
- **Fewer intrusion Points**
 - Tighter Security
- **Fewer points of Failure**
 - Greater Availability

“Low end ‘volume’ server units were flat in 4Q06 versus a year ago; a low level not seen since 2Q02. We attribute this sudden decline in unit growth to a shift to mid and high-end systems as companies embrace virtualization and adopt server consolidation projects favoring scale up over scale out.”

Richard Farmer of Merrill Lynch

Why energy management?

- **Power needs continue to grow**
 - Each generation of servers provides faster, denser transistors with increasing leakage currents
 - Storage needs are growing faster than servers
- **The heat load of server systems is growing rapidly**
 - Current and future systems projected to be 25-35+ kilowatts per rack
- **Realization that:**
 - The power/thermal problem in Data Centers is growing
 - Most Data Centers are experiencing some sort of power/cooling problem.
 - The degree of the problem varies widely, it is worse in older, smaller, and cramped Data Centers
 - At some point performance and capacity may be limited by the power/cooling capabilities of the Data Center
 - Not addressing the problem is also a RAS concern
 - For every 18 degree F temperature above spec, the rate of decay for electronics systems doubles (Arrhenius equation)

On-site energy efficiency consultation for your IT systems

Perform a Server and Storage Power/Cooling Trends and Data Center Best Practice assessment to determine the potential cost/energy savings

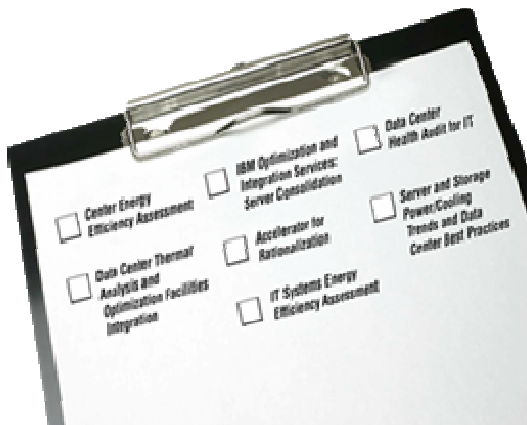


What IBM can do for your Green Data Center IT

- Educate you on the Best Practices for Energy Efficient use in your data center
- Provide insight into the future direction of computing as it relates to Energy
- Review the results and discuss roadmaps to “green data center”
- Requires only a 4-hour interview for IBM consultant to gather high level data

Your benefit

- ✓ Identify simple to implement, low or no cost, energy saving ideas
- ✓ Customized “Green Blueprint”
- ✓ Know your potential IT savings
- ✓ Ability to implement more solutions and technologies

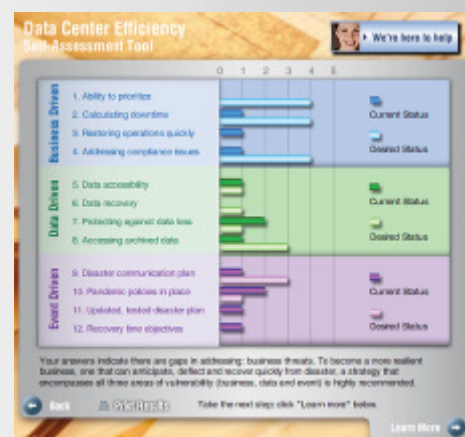
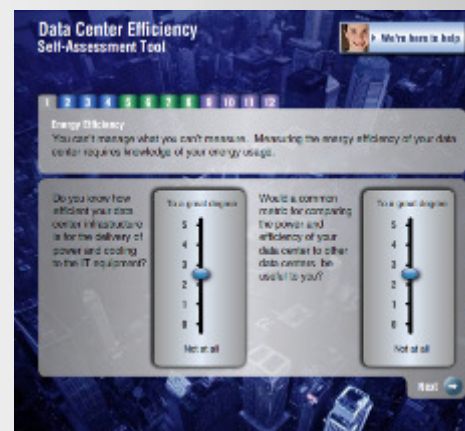


Web-based tool provides an energy efficiency self-assessment

A free self-assessment is available on the Web that can highlight opportunities for energy efficiency improvement

Assessment process

- Twelve questions on energy usage
- Three main categories
 - Awareness of power-related issues
 - Deployment of tactical quick hitters
 - Extent of the strategy for data center planning
- Report on improvement areas
- IBM service recommendations



ibm.com/itsolutions/optimizeit/cost_efficiency//energy_efficiency/services.html

Managing energy consumption within the infrastructure

- **ResourceLink™** provides tools to calculate server energy requirements before you purchase a new system or an upgrade
- **IBM System z10** to offer a 14% improvement in performance per KWh over z9 EC
- **Has energy efficiency monitoring tool: Mainframe Gas Gauge**
 - Introduced on IBM System z9 platform in April 2007
 - Power and thermal information displayed via the System Activity Display (SAD)
- **New IBM Systems Director Active Energy Manager (AEM) for Linux on System z V3.1**
 - Offers a single view of actual energy usage across multiple heterogeneous IBM platforms within the infrastructure
 - AEM V3.1 energy management data can be exploited by Tivoli® enterprise solutions such as IBM Tivoli Monitoring, IBM Tivoli Usage and Accounting Manager, and IBM Tivoli OMEGAMON® XE on z/OS
 - AEM V3.1 is a key component of IBM's Cool Blue™ portfolio within Project Big Green

IBM PowerExecutive



The Mainframe “Gas Gauge” Manual

http://www-03.ibm.com/systems/z/energy_efficiency/

- **Mainframe power and temperature monitoring information is available using the System Activity Display (SAD) produced by the Hardware Management Console (HMC).**
- **In order to use this, the mainframe must be an IBM® System z9™ and must be running Driver 67 level licensed internal code.**
 - Driver 67 is on all machines shipped after May 11, 2007
 - It can normally be applied non-disruptively to machines shipped prior to May 11, 2007
 - Driver 67 delivered new functions to IBM System z9 Enterprise Class (z9™ EC) (GA3) and IBM System z9 Business Class (z9 BC) (GA2)
 - Contact your IBM Service Rep if you need a driver upgrade

How do I get started towards a Green Data Center?



Adopt best practices in data center energy efficiency to deliver financial benefits

- *Reduce operational costs from energy use in your physical infrastructure*
- *Establish your energy efficiency metric – to others in your industry and for year-to-year improvement in your own operation*
- *Provide savings to fuel business growth versus physical infrastructure*



Take advantage of innovative technologies

- *More computing performance per kilowatt*
- *Aggressively exploit Virtualization capabilities in servers and storage*
- *Include Energy Management in your Service Level Agreements*



Consider ways to reduce environmental impact

- *Meaningful energy conservation*
- *Improved public image*
- *Positive contribution to the Green movement creates a good place to work*

The System z: Triple **Lean and Green** bottom line

Economic



- Maximum performance/watt
- Improve IT cost today and future
- Data center infrastructure efficiencies

Environmental



- Improve Green Grid EEI Score
- Space efficient Recyclable product

Social



- Help reduce carbon footprints
- Corporate commitment to cut IBM energy use by \$1B
- Double IT capacity by 2010 without adding watts

❑ Client Profitability

- Cool Blue portfolio across STG- SWG-IGS, **energy savings System z**
- Asset and infrastructure investment protection

❑ System z is leading edge Green Technology

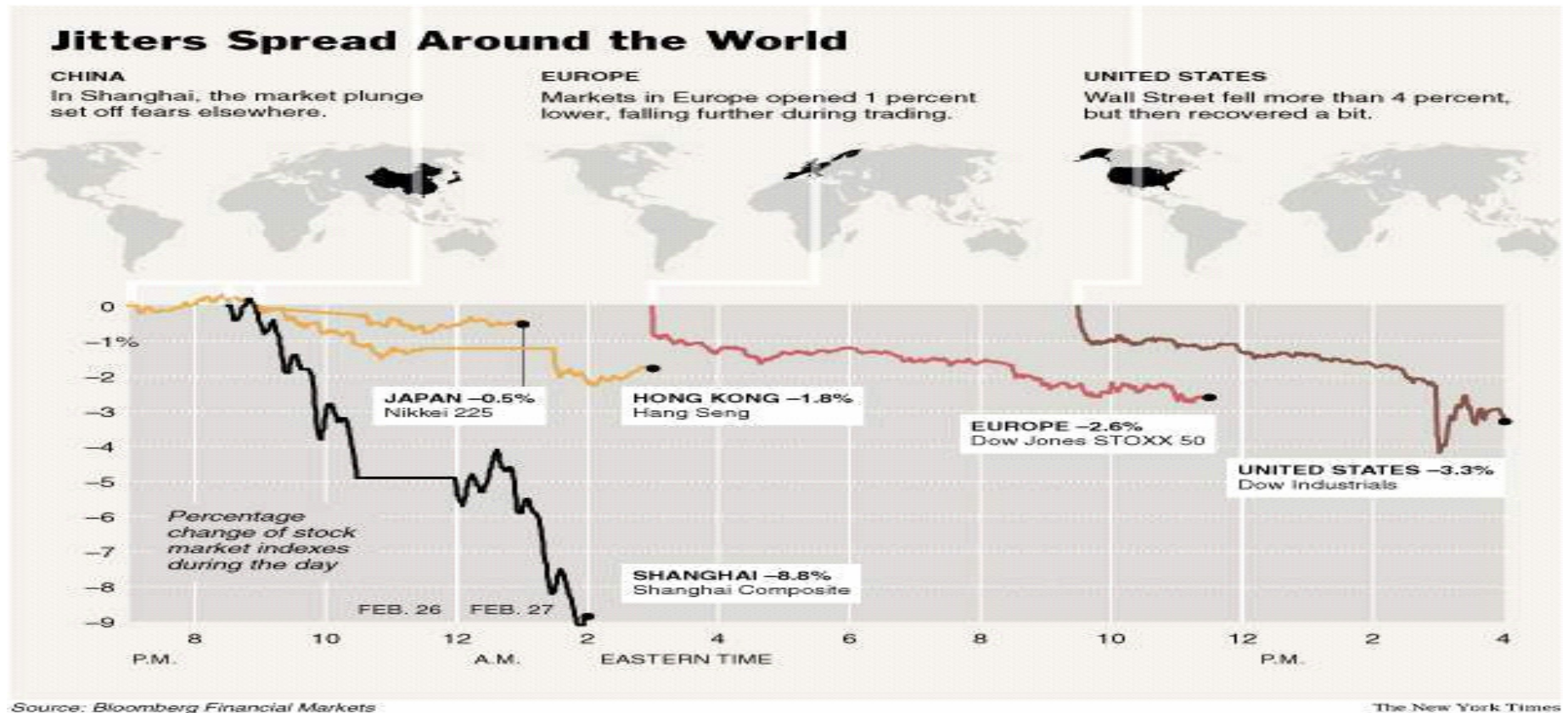
- High efficiency power supplies and blowers
- Advanced Virtualization drives Energy efficiency
- Liquid cooling reduces current leakage

❑ Sustainable and Enduring Client Value

- Investment in new IBM data centers over next 4 yrs
- IBM to cut our own energy use by ~\$1 billion by 2010 while doubling compute capacity



Sometimes markets roar



Bloomberg.com

When the Financial Markets got the jitters on Feb 26/27, 2007 and the DJI fell about 400 points for the day, and when the Equity Firms had to drive their System z9 machines at 100% CPU Utilization, their machines worked as designed, flawlessly.

Many of those questioned commented, "What on Earth would I have done with this unplanned peak load capacity demand if these systems were running on UNIX® or Intel®?"

Compelling Economics

Leverage the ability of Linux on System z to run many distributed workloads and to often consolidate x86 core processors at a 20:1 ratio to deliver significant IT Cost savings to customers.

- People Cost
- Software Cost
- Maintenance
- Energy Cost
- Facilities Cost



Power and Space Consumption

Consolidation of low utilization x86 servers to Linux on System z9 EC may provide up to

4 times the work in the same space

and may provide up to

12 times the work for the same power consumption

The Linux on x86 servers selected in this example are functionally eligible servers running at low utilization such that the composite utilization is approximately 5%. The utilization rate assumed for System z9 EC is 90%. This is for illustration only, actual power and space reductions, if any, will vary according to the actual servers selected for consolidation.

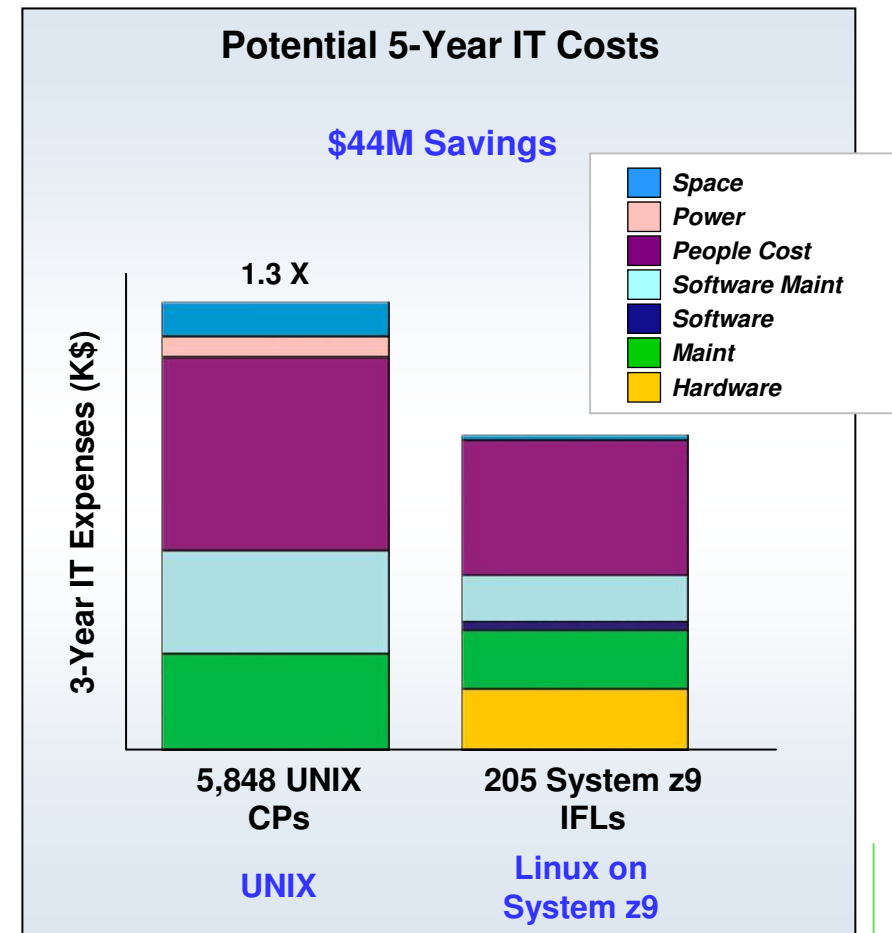
Potential IT Cost impact of mainframe consolidations

Your IT Cost may vary:

- **Potential for dramatic reductions in software expense for processor based licenses**
 - Software savings driven by eliminating 5,848 S+S charges for all consolidated SW applications
- **Significant reductions in power and cooling costs are possible**
 - 97% Savings in KWatts and Energy Costs in this scenario
- **Significant one-time Facilities Cost Avoidance**
 - Reducing the number of racks saves an additional \$28.8M USD in New Data Center build costs
- **People savings from virtualization**
- **Increased processor utilization**

Workload consolidation using Linux on a mainframe can result in significant IT Cost savings

Telecom Company IT Costs
Varied UNIX Workloads
5-Year TCO (Scorpion Study Results)



Clients are focused on server consolidation and cost savings

■ Consolidation

- **50% of data centers** have server consolidation projects underway...
-to reduce costs and better control systems ¹
- **29% of clients** see datacenter consolidation as a high priority for the next year ²
- **35% of large enterprises** see consolidating servers onto fewer platforms a high priority ³
- **52% of System z clients** plan server consolidations; **45%** plan to simplify their IT infrastructure ⁴
- The '**consolidation effect**' is exerting downward pressure on server unit shipments ⁵
- Virtualization is and will likely continue to have a negative impact on server unit growth, as virtualization often results in **consolidation rates of up to 10:1**⁶

■ Cost Savings

- **35% of CIO's** report '**controlling IT costs**' as a top IT management priority⁷
- **One third of CIO's** have applied or plan to apply '**lean manufacturing principles**' to data centers, to reduce waste and improve labor productivity ⁸
- **56% of CEO's** cite **cost reduction** benefits as the top benefit of business model innovators

Source: 1. Gartner Data Center Conference, December 2006; 2. Goldman Sachs' IT Spending Survey, Jan 30 2007; 3. STG Needs Research 2006; 4. System z Systems Directions survey; 5. IDC: Server Workloads 2006: Understanding Workload Deployments; 6. Bernstein, 3/12/2007: IT Hardware: What's Eating Server Growth?; 7. State of the CIO, CIO Magazine; 8. McKinsey Oct 20 2006: What's on CIO Agendas in 2007?; 9. The Global CEO Study, IBM 2006

Nationwide

Key Benefits (Value Proposition)

Expect to save over \$16M over the next 3 years.

Initial phase consolidated 250+ Production, Development & Test servers to 6 IFLs

Savings will be in cooling, maintenance, software and equipment costs, said Guru Vasudeva, a Nationwide computer expert who is overseeing the technology's implementation

Lower middleware and application costs, 50% reduction in monthly charges for Web infrastructure 80% reduction in data center floor space utilization, optimized CPU utilization

Greater operational and managerial efficiencies and lower cost per virtual server

Building better capacity management processes and workload modeling to better assess which applications and workloads most appropriate to migrate to the z platform for additional cost savings

Leveraged IBM services, server and software expertise for best practices in tuning and capacity management, better management and resource optimization to drive down costs



Solution:

GTS Capacity Planning and Capacity Management Services

IBM eServer™ zSeries® 990 IFLs with 136 GB memory and associated systems software licenses

Novell SUSE Enterprise Linux 9

IBM WebSphere®

IBM DB2 Universal Database™ (UDB)

IBM WebSphere MQ

z/VM-Linux and Support Line Linux support

Nexxar

Business Need:

An architecture for IT infrastructure to provide very high (24x7) availability and the ability to sustain significant anticipated business growth

Advance virtualization capabilities to quickly create a secure, custom-tailored computing environment for each "private label" relationship

Key Benefits (Value Proposition):

- ✓ An architecture that suits requirements for security, manageability, reliability, availability, scalability, extensibility and flexibility
- ✓ The ability to grow Nexxar's growth by acquisition business while staying within the same platform
- ✓ **Consolidation of more than 80 x86 servers onto an IBM System z9 Business Class (BC)**
- ✓ **A 75% reduction of headcount required to maintain the operating environment in comparison with the x86 systems previously on the floor**



Solution:

Hardware

- IBM System z9
- IBM System Storage™ (DS8100, 3590)

Software

- z/OS® -DB2®
- **z/VM-Linux**
- WebSphere Application Server
- Tivoli® OMEGAMON®
- Rational®

Services

- GTS Infrastructure
- Systems Management Services

Next steps. . .

- **Let IBM help you get the facts on energy efficiency**
 - Take the Energy Efficiency Web Self-Assessment
ibm.com/itsolutions/optimizeit/cost_efficiency/energy_efficiency
 - Contact your IBM representative to schedule an assessment.
- **Google “Green Data Center” for more information about IBM.**
- **Leverage IBM experience in energy efficiency and resiliency**
 - Apply it to the tactical problems your data center faces
 - Address your physical infrastructure, IT technology or both
 - Use it across your enterprise including data center consolidation and new data center building plans

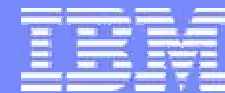


A large, dark-colored IBM mainframe computer system is shown from a low angle, looking up at its massive structure. The IBM logo is visible on the upper left side of the machine. The background is a deep blue sky.

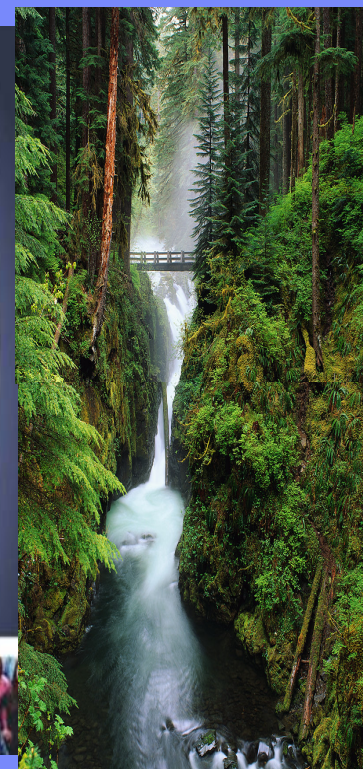
THANK
YOU

wgjones@us.ibm.com

IBM



Backup Charts



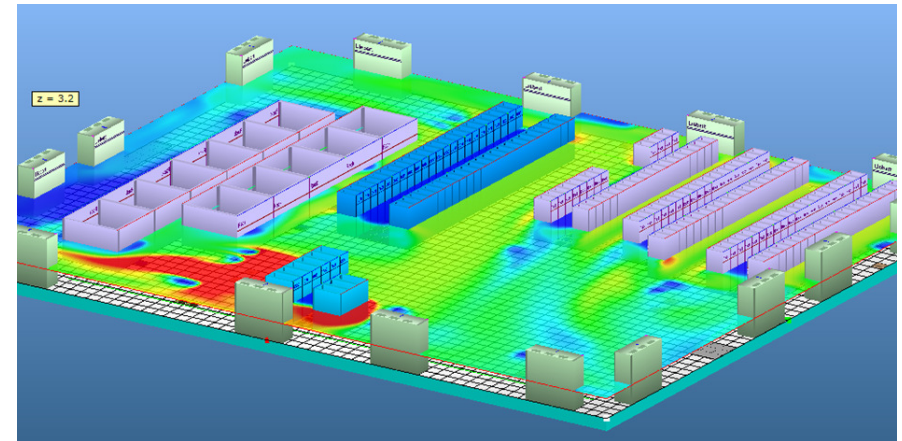
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IBM Systems & Technology Group
IBM Software Group

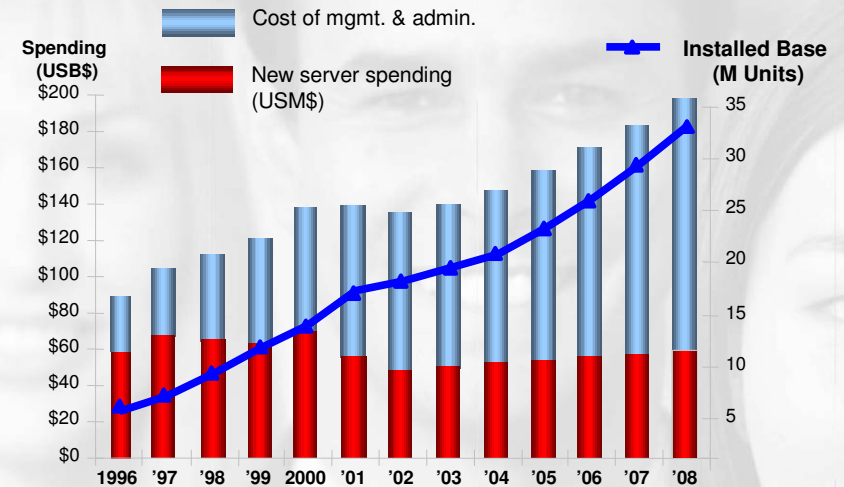
Today's IT **complexity** has driven many hidden costs

*Customers' desire for **a solution to complexity-driven pain** has never been higher*

- **Managing today's mixed IT platform environments can be complex and costly**
 - Thousands of servers and growing
 - Hundreds of applications
 - More data
 - Thousands of software licenses
 - Thousands of distributed control points
 - Ineffective costing methodologies
- **The Result**
 - Massive complexity
 - Strains on electricity, cooling, and space
 - Underutilized IT assets
 - Spiraling people costs
 - Increased downtime and security costs
 - Potentially - poor IT platform choices



Cost of People vs. Spending on New Systems



Source: IDC, On-Demand Enterprises and Utility Computing: A Current Market Assessment and Outlook, IDC #31513, July 2004.

Best practices, services, and innovation portfolio Enabling Greener and more reliable servers

Energy Solutions

- **Use energy efficient servers**
- Data Center Stored Cooling Solution
- Optimized Airflow Assessment for Cabling
- Scalable Modular Data Center
- Data Center Relocation and Consolidation, Data Center Facilities Design

Energy Assessments

- **Data Center Thermal Analysis and Optimization Facilities Integration**
- Optimization and Integration Services: Server Consolidation
- Data Center Health Audit for IT
- Accelerator for Rationalization
- Data Center Energy Efficiency Assessment
- IT Systems Energy Efficiency Assessment
- **Server and Storage Power/Cooling Trends and Data Center Best Practices**

Energy Management

- **PowerExecutive™**
For trending and capping
- **Tivoli Monitoring**
Aligning power use with workload goals
- **Tivoli Provisioning**
Actively moving workloads and power up/down resources
- **Power Configurator**
To plan your power usage
- **Virtualization on IBM Systems and IBM System Storage**
Drives utilization up and annual power cost down

PowerExecutive



Virtualization



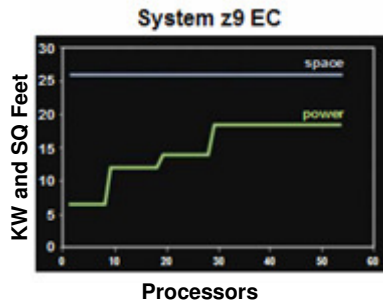
Energy Technology

- **BladeCenter®**
Open, Easy, Green
- **IBM System Storage™**
Increases utilization reduce energy use
- **X-Architecture™**
Designed from the ground up for efficiency
- **IBM Power Supplies**
Measurement built in
- **Rear Door Heat Exchanger**
Thermal management innovation



- **IBM System z™**
Energy efficiency tools
- **Power Architecture™**
Processor efficiency management
- **IBM Blue Gene**
#1 efficient system in Green 500

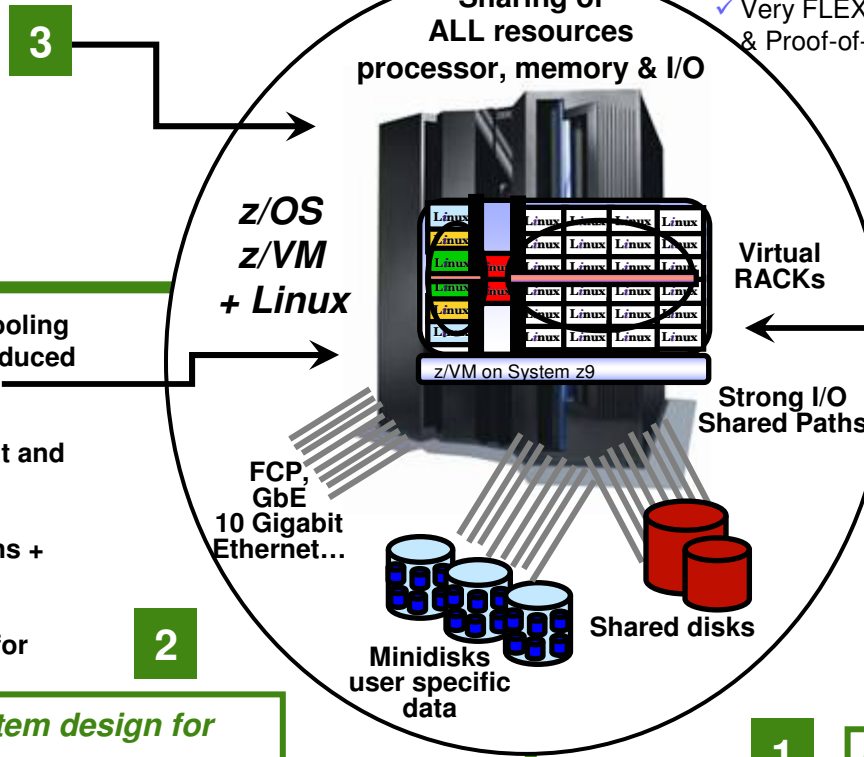
Virtualization on the System z9 EC may provide up to 4 X the same work in the same space and may provide up to 12 X the work for the same power consumption:



Highest usage rate (80- 100%) and resource usability, extensive consolidation of servers and their ecosystem

- ✓ Virtual Machine – Software Hypervisor “integrated” with the Hardware Architecture. z/VM is Proven technology.
- ✓ 10's, 100's, up to 1000's of “virtual servers” with z/VM
- ✓ New servers installed in “minutes” – CLONING
- ✓ Sharing of CPU, Memory & I/O resources
- ✓ Virtual Network – HiperSockets, Virtual Switches/Routers
- ✓ Virtual I/O (mini-disks, temporary disks, Multiple Image Facility, virtual cache . . .)
- ✓ Virtual Appliances (SNA/NCP, etc.)
- ✓ Most advanced and secure LPARs

- ✓ System z has improved the performance / watt of every new release of the processor CMOS. 9 times.
- ✓ Autonomic Workload Management (IRD) across LPARs for QoS according to a goal-Business Policy – PRIORITIES, capping, monitoring, reporting, charge back . . .
- ✓ Automation & System Management facilities
- ✓ System z9 BC and EC Power Estimator + Power and cooling actuals with System Activity Display. Can automate capture of actual watts and BTUs/hr.
- ✓ Interface to Power Executive (1Q08)
- ✓ Low “cpu-cost” via Hardware & ucode support
- ✓ Very FLEXIBLE “NO COST” solution for Test, Development & Proof-of-Concept



IBM System z Enterprise hub at lowest energy level consumed

90% efficiency, Refrigeration cooling in System z has significantly reduced (leakage) power.

Low temperature processor unit and L2 cache for high efficiency

Shared redundant regulated fans + Efficient Bulk Power supplies.

Flexible use of parts designed for energy efficiency

Efficient system design for energy savings

Built-in distributed hardware architecture + Centralization:

- ✓ Made of multiple dedicated sub-systems for low overhead and optimized usage rate (compute, I/O multiple sub-systems)
- ✓ Dedicated specialty engines for high efficiency: IFL (Linux), zAAP (Java, WebSphere), zIIP (Data access) and embedded processors (cryptographic, compression)

Energy saver system architecture

4

Information Lifecycle Management:

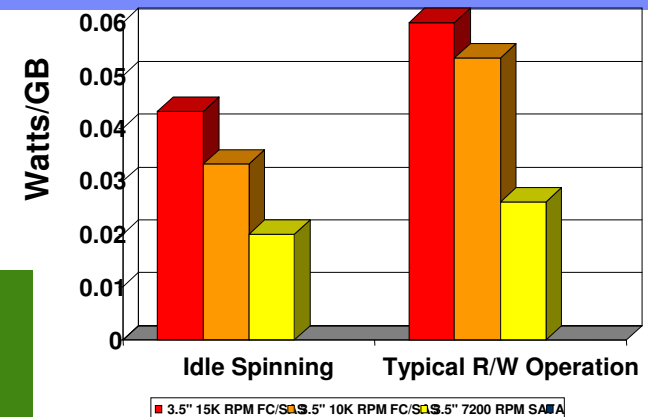
Determine policies, processes, practices to aligns business value of information with the most cost effective, energy efficient IT infrastructure through the management of service levels

- Use IBM TotalStorage Productivity Center to help identify stale, orphan or unused files

5

Use slower drives: ATA drives run at only 7200 RPM and consume less energy than 10K or 15K RPM FC/SAS drives. Available on DS8000, DS6000, DS4000, N series and DR550

IBM System Storage solutions for a green data center



Tape Virtualization:

Virtualization allows disk arrays to front end tape workloads, to leverage the speed of the disk with the cost benefits of tape, eliminating the need to manage the movement of the data from the disk to tape. Example: TS7740 and TS7520 Virtualization Engine

3



6

Rear Door Heat Exchanger:

Capture efficiently heat generated, back of the rack, 55% less heat blown in the room

Capture heat @ source

Combine Disk and Tape:

You can combine disk and tape to meet application access and performance requirements, and still benefit by low energy consumption of tape. This can use 4x less energy for typical combinations. Example: DR550 and DR550 Express

2

1

Tape is Green:

Tape uses 20x less energy expense than disk. Consider the TS1120 or LTO-4 technologies

7

Increase Storage Utilization:

Increase storage utilization to decrease your Watts per Usable TB

- Consider RAID-5 or RAID-DP instead of RAID-10 for disk configuration
- Use SAN Volume Controller with dynamic volume expansion to increase disk utilization
- Use N series A-SIS de-duplication and FlexVol features

Environmental responsibility is a core IBM value

New Goal Announced!

Further extend IBM's early accomplishments by reducing CO₂ emissions associated with IBM's energy use 12% from 2005 to 2012 via energy conservation, use of renewable energy, and/or funding CO₂ 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



2005



2005



The Climate Group
2005

USEPA
Climate
Protection
Award
1998 and 2006



**Green Power
Purchaser
Award 2006**

Environmental Efforts at Big Blue



Computer
Program
Charter
Member
1992



Charter
Member
2000



Chicago Climate Exchange

Charter
member
2003



1605(b) voluntary
emissions reporting
since 1995



Business Environmental
Leadership Council



U.S. Environmental Protection Agency
Charter Member 2002



WRI Green Power Market
Development Group
Charter member 2000

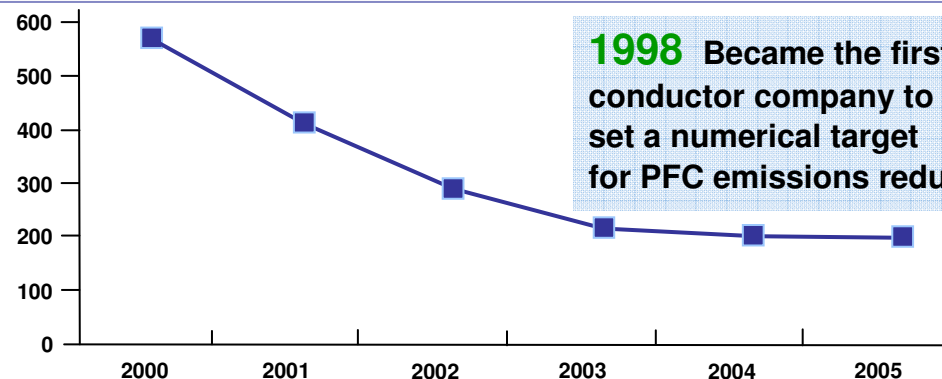
CARBON DISCLOSURE PROJECT

Since inception

Early Results



Between 1990 and 2005, IBM's global energy conservation actions reduced or avoided CO₂ 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%

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DB2*	GDPS*	Notes*	System z
DB2 Connect	Geographically Dispersed Parallel Sysplex	OMEGAMON*	System z9
DB2 Universal Database	HiperSockets	On demand business logo	SystemPac*
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