

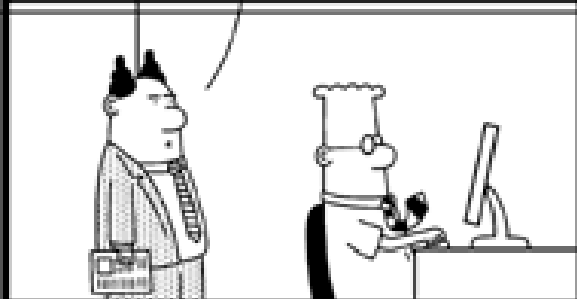


IBM Transformation: Major IT Consolidation Initiative

February 25, 2008



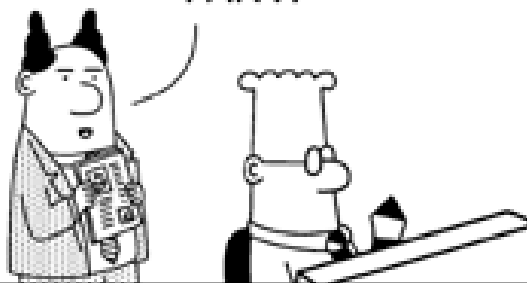
OUR SERVERS ARE USING TOO MUCH ELECTRICITY. WE NEED TO VIRTUALIZE.



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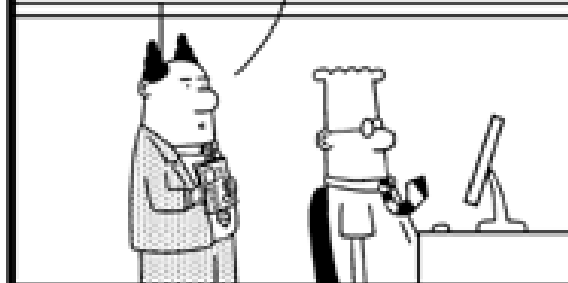
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I DID MY PART BY READING ABOUT VIRTUALIZATION IN A TRADE JOURNAL. NOW YOU DO THE SOFTWARE PART.



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WHY IS YOUR PART TAKING SO LONG?



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Enterprise Computing Model Update

Agenda

- **IBM Announcement Highlights**
 - IBM Transformation and “Big Green”
 - IBM Global Account Infrastructure Challenge and Approach
- **IBM Virtualization Update**
 - Virtualization Progress
 - Application and Workload Selection
 - Technical and Operational Solution
 - Successful Techniques and Lessons Learned





IBM Consolidation Announcement Highlights

- *IBM will consolidate thousands of servers onto approximately 30 IBM 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 sophisticated virtualization capability*



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.

Project 'Big Green'

**Double compute capacity
with no increase in
consumption or impact**



- **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 almost 1,000 energy efficiency specialists from across IBM
- **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

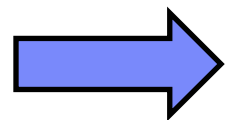
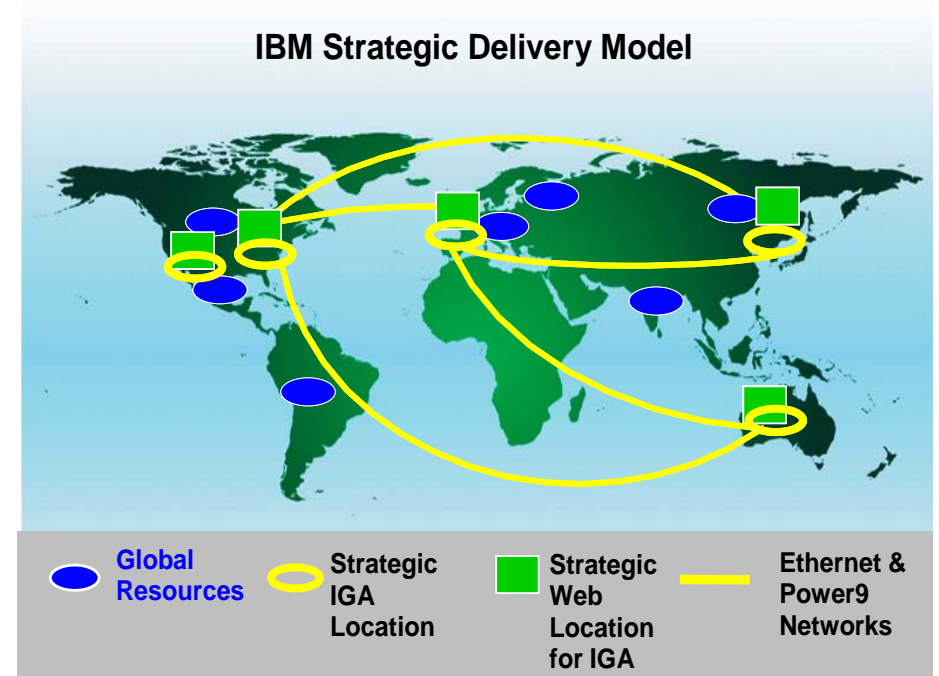


IBM's Transformation: An Ongoing Journey

Data Center Efficiencies Achieved

- Consolidation of infrastructure
- Application consolidation/reduction
- Enterprise architecture optimization
- Global resource deployment

	IBM Metrics	1997	Today
TECHNOLOGY	CIOs	128	1
	Host data centers	155	7
	Web hosting centers	80	5
	Network	31	1
	Applications	15,000	4,700

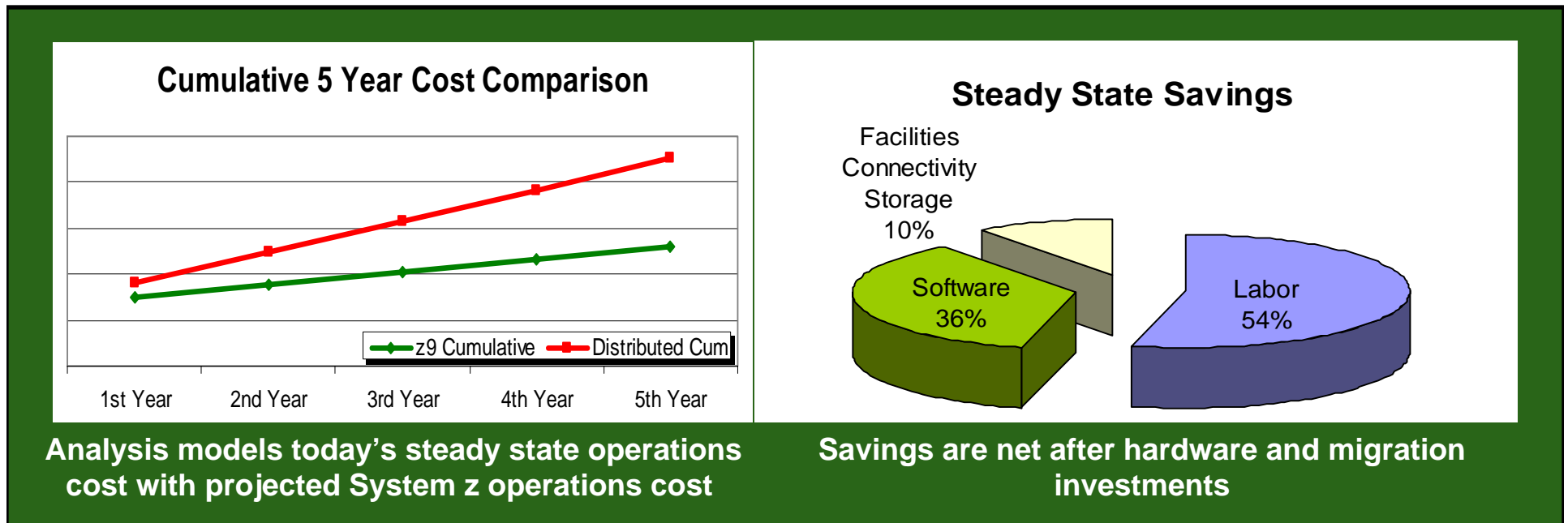


Next Level of Infrastructure Challenge

- Floor space challenges in key facilities
- Underutilized assets in outdated Web infrastructure
- Continued infrastructure cost pressure

Early modeling identified significant potential for savings through virtualization on System z

- **Performed TCO and virtualization assessment on IBM portfolio**
 - Cross-IBM effort: System z, SW Migration Services, STG Lab Services, TCO Academy, Migration Factory



- **Identified substantial savings opportunity**
 - Annual Energy Usage to be reduced by 80%
 - Total floor space to be reduced by 85%

The anticipated facilities savings are substantial and contribute to IBM's green initiative

- 80% Savings in Annual Energy Usage

Comparison of Annual Energy Usage for Workloads				
	Distributed solution		System z Solution	
	Kilowatts (K)	Cost* (\$K)	Kilowatts (K)	Cost* (\$K)
Power	24,000	\$2,400	4,796	\$479
Cooling**	14,400	\$1,440	2,877	\$287
Tot Energy	38,400	\$3,840	7,673	\$767

* Electrical cost calculated at rate of .10 per kW

** Cooling is 60% of power cost

- 85% Savings in total floor space
 - 11,045 square feet for distributed solution
 - 1,643 square feet for System z solution



This is a cornerstone initiative in the IBM quality of service imperative

- Leverages maturity of System z stack products for robust high availability
- Reduces complexity and increases stability
- Centralizes service level process management
- Potential for faster provisioning speed (months → days)
- Provides dynamic allocation of compute power
 - Capacity on demand; increase/reduce compute power
- Provides world class security



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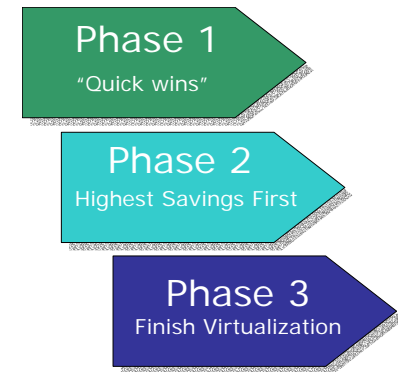
➤ IBM Virtualization Update

- Virtualization Progress
- Application and Workload Selection
- Technical and Operational Solution
- Successful Techniques and Lessons Learned



IBM Virtualization Progress

- **Established phased approach for quick wins**
- **Migrated initial servers from ‘early adopter’ teams**
 - Inventoried more than 4000 servers
 - Over 500 images deployed (migrated and new)
- **Comprehensive project plan and management system in place**
 - Integrated business priorities with transformational objectives
 - ‘Work in progress’ approach to maximize server migrations
 - Pipeline, process, technical, finance and communications support
- **Developed internal business case and cash flow analysis using specific server costs, detailed labor analysis, migration expense**
- **Technical solution, education plan and operational plan developed**
- **Highest level of support from IBM senior executive team**



IBM is using a 'work in process' approach to manage the migration

Weekly Pipeline Summary - Server Metrics

IBM ECM End to End Process

Project Phase		Total Servers In Pipeline
Ph 1: US	Management Approach and Reporting <ul style="list-style-type: none"> • Process approach borrowed from factory line management • Metrics for each process and sub-process • Quality measured with process fallout – tracked by cause • Daily status calls for issue resolution • Weekly status reporting for CIO and management team 	
Ph 2: US		
Ph 3: Americas		
Ph 4: Europe		
Ph 5: AP/Japan		
	Pipeline Management Finance Comms Process Technical Solution	

Several factors are used in the analysis to determine which workloads to move



▪ Servers delivering large saving

- Old technology: servers, storage, network
- Servers with low utilization
- Servers that free up contiguous space
- Locations with high cost of energy and space



▪ Lower cost migrations

- New deployments
- Servers/applications with planned change
- Associated servers
- Lower complexity, fewer dependencies



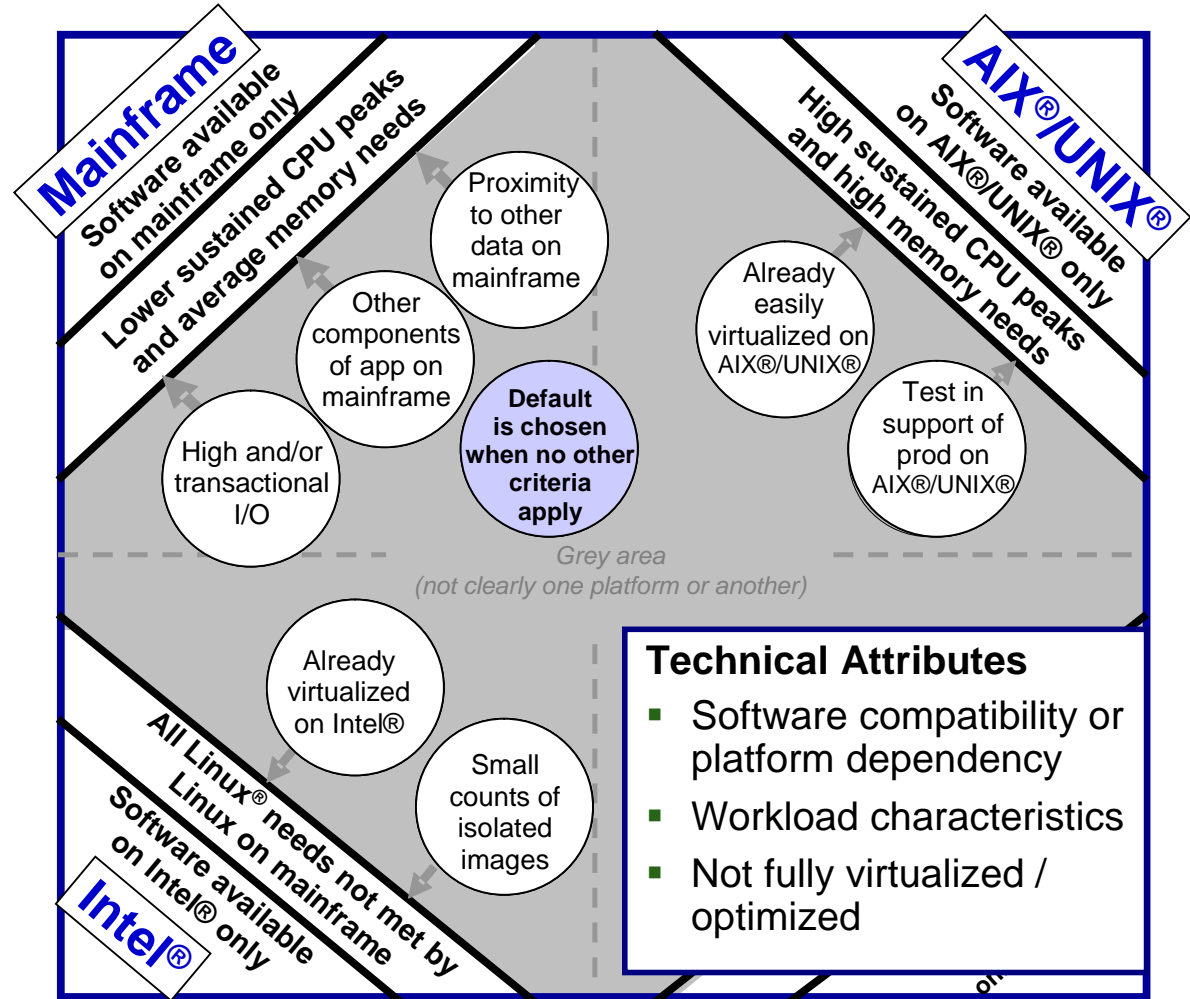
▪ Business aspects

- Criticality and Impact to the business
- Business cycles
- SLA

Each workload is evaluated for suitability based on technical attributes

Priority Workloads for Consolidation:

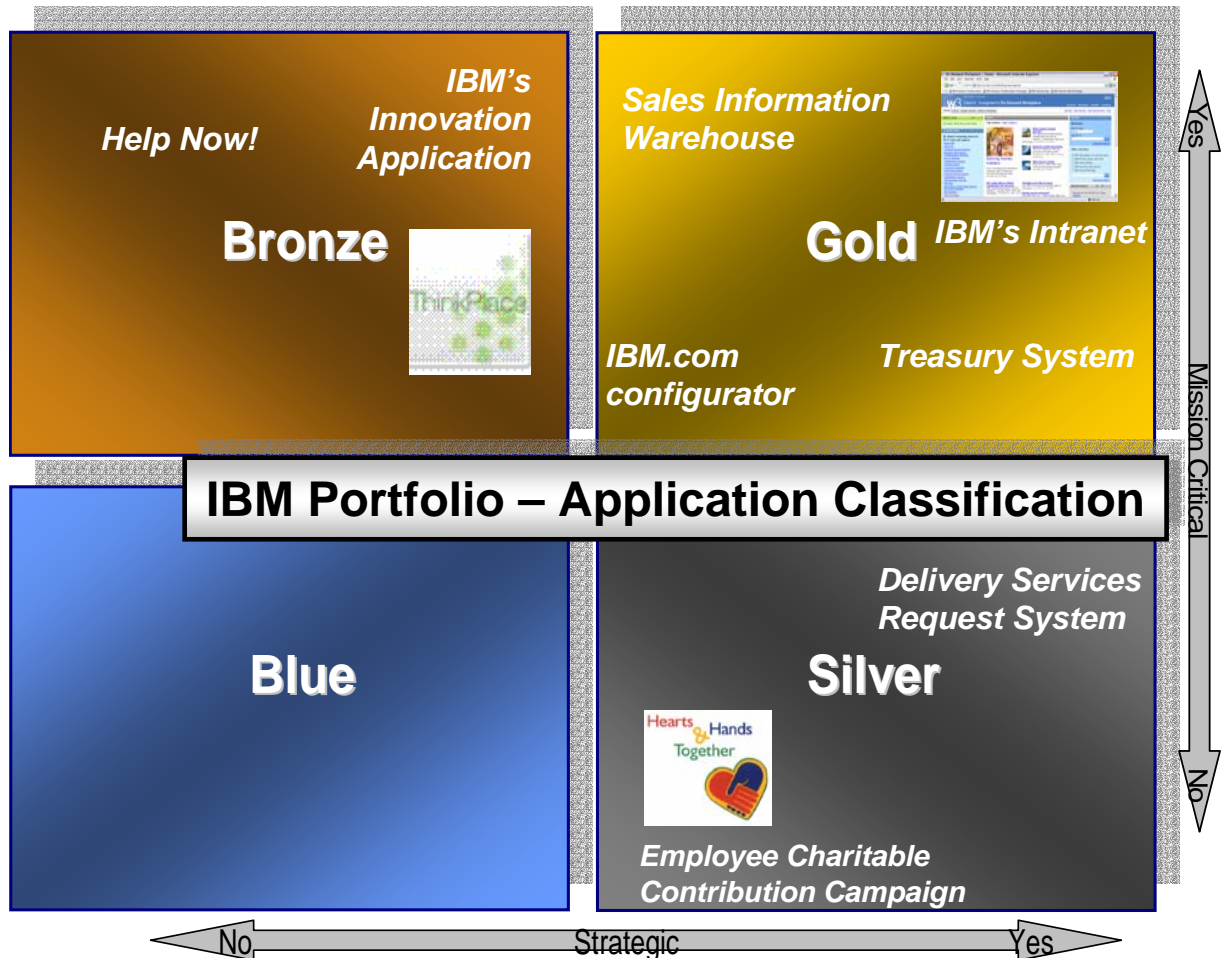
- WebSphere® applications
- Domino® Applications
- Selected tools: Tivoli®, WebSphere® and internally developed
- WebSphere MQ
- DB2® Universal Database™



Applications moving to System z tend to be strategic and mission critical

Application View

- Includes all business units, a cross-section of business functions
- Most are internally developed Web and Domino-based
- Tend to be complex with multiple servers and interfaces
- Almost 50% of initial applications are classified as "Gold"



Virtualization will leverage existing IBM System z boxes, increasing workloads with a measured approach

- Leveraging System z machines with Linux currently running in IBM's five major data centers worldwide
- Initially, machines are loaded to 50% utilization to allow for experience with the workloads
- A mix of high availability and non-high availability work ultimately enables capacity for automatic load spreading at 75% utilization, going to 90% on failover
- New capacity is being added together with backup for redundancy and high availability as needed





Operationally, the goal is to minimize change while leveraging the capability of System z

The distributed and mainframe support teams collaborated with IBM's Design Center to develop the operational approach and the basis for the reference architecture

Approach:

- Adapt existing Unix team processes
- Engage z team to operate System z and z/OS®
- Broaden the VM/mainframe knowledge of the mid-range team through training, to assist in support of VM Hypervisor (z/VM®) and Linux
- Use existing monitoring and operational tools, i.e.
 - Tivoli Monitoring and Enterprise Portal
 - VM Resource Manager
 - Monitor and Performance Toolkit
 - Administer Capacity, OS Provisioning and Software Distribution Tools

Training needs and classes for personnel involved in System z virtualization have been identified

- **IT Architects**

- Broad based knowledge of Linux on System z solutions, VM and the underlying System z platform

- **Project Managers**

- Sufficient knowledge of Linux on System z, VM, mainframe attributes, and migration scenarios to manage an ECM project

- **Server Build Personnel**

- Understand the Linux on System z operating system; High level understanding of VM

- **Systems Administrators/Systems Operations Personnel**

- Understand the unique attributes of Linux on System z and the VM/mainframe environment; Include Linux in base SA and systems operations education



A half day of general virtualization education for application owners and delivery personnel provides a high level view of virtualization, migration and Linux on System z



Successful Techniques - Preparing for Virtualization

Motivate business units

Enlist a Senior Executive Sponsor

Sr. VP Linda Sanford, who manages Transformation for IBM is providing enterprise leadership, working with Business Unit Sr. VPs

Build an “incentive” rate

Financial benefit provides good incentive for support and teaming in project execution. Reductions are being phased in during the project with differentiated rates.

Build the business case

Start with a high level planning estimate

Initial estimates from zRACE model were validated by the CFO through a detailed analysis of a sample subset of 325 servers

Gather data

Augment inventories with network tools

Local and central Configuration Management DB needed augmentation with network scans to gather configurations and application mapping



Successful Techniques - Project Start-up

Start Small

Migrate a small set of servers for a fast start

An initial Phase to immediately migrate a small number of servers worked well to build early experience.

Run operations while transforming

Use a dedicated team

IBM's commercial migration practice is implementing most of the management and migration, minimizing the operational team's responsibility to Final Test, Environment Build and Cutover.

Manage complexity

Engage strong project management

A structured management approach and broad, sustained sponsorship from the business units are critical.

Monitor progress and continuously improve

Use an end-to-end process approach

A streamlined end-to-end process approach has been established with clear interfaces and handoffs. It will be monitored and improved with process flow metrics, yield metrics and automation.

Successful Techniques – Business Unit Communication

The CIO Office is providing leadership and communication with the Business Units:

- Initial CIO communication shared business objectives and commitment
- Exceptions scrutinized by CIO
- Regular meetings and communication with business unit application owners during migration
- Common concerns from business units and application owners being mitigated

Top 5 Concerns	Mitigation
Will my bill go up? How much will it be?	Implementing tiered rates: base cost plus variable usage. Rates will accurately reflect cost to the corporation
Have there been any successful pilots?	Accepting volunteer applications initially. CIO migrating most visible internal application: IBM's Intranet
Will my application run?	Focus on common middleware for initial migrations, communicating results to application teams
Will this impact my business priorities?	Migration process leverages planned changes and takes other business priorities into consideration
What about technical training?	Training to be delivered to application owners and development teams



Going forward, the IBM Virtualization team focus is:

- **Process efficiency** – increase throughput and reduce cycle time, leveraging process improvements and IBM Research innovations
- **Operational metrics** – manage the pipeline with key metrics
- **Server / application selection criteria** – validate effectiveness of screening and early decision making
- **Savings tracking and analysis** – validate transformation model and capture actual savings

Critical Success Factors

- **Sponsor with an enterprise view**
- **Strategic investment for migration**
- **Clear goals, dedicated team, inclusive leadership for execution of migration**
- **Leveraging talent and capability across all of IBM to drive rapid results**





Tell us Your Virtualization Story!





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