IBM Transformation:  
Enterprise Computing Model Update

Bill Reeder  
breeder@us.ibm.com  
Linux and Virtualization Architecture and Strategy  
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IBM Transformation – Enterprise Computing Model Update

- IBM Business Transformation and IT
- Enterprise Virtualization Progress
- IBM Optimization Services
- Lessons Learned Summary
IBM Strategy and Values

Focus on open technologies and high-value solutions

Deliver integration and innovation to clients

Become the premier Globally Integrated Enterprise

... Building a Smarter Planet

Our world is becoming INSTRUMENTED.

Our world is becoming INTERCONNECTED.

All things are becoming INTELLIGENT.

Smart traffic systems
Smart food systems
Smart energy grids
Smart supply chains
Smart retail
Smart healthcare

Dedication to every client’s success.
Innovation that matters—for our company and for the world.
Trust and personal responsibility in all relationships.
A single CIO organization supports IBM's business strategy

**Federated Model**

- Business Transformation Executives
- Business unit transformation and application portfolio management
- Client Facing Executives
- Technical Support
- Supply Chain
- Workforce Management
- Finance
- Development
- Global Integrating and Governance

**Single CIO Organization**

- CIO
  - RUN
  - Transform
  - Innovate
  - Enterprise Process Owners
  - Business Units
  - Geographies
  - Enterprise Integration and Governance

**CIO**
- Delivery of operational excellence and business value
- Implement enterprise strategy, architecture, standards & governance
- Development of global IT workforce
IBM’s own Transformation Experience

**IBM IT Transformation**

- IBM’s focus on IT enablement has allowed IBM to reduce IT spending by $1.5 Billion in the past 5 years

**Data Center Efficiencies Achieved**

- Consolidation of infrastructure, applications
- Optimize resources, Globally Integrated Enterprise

**Next Level of Infrastructure Challenge**

- Floor space, underutilized and outdated assets
- Continued infrastructure cost pressure
- Increase % IT spending to transformation initiatives

**Dynamic Infrastructure for a Smarter Planet**

- Simplified – rationalized and consolidated
- Standardized – service catalog
- Shared – virtualized and shared resources
- Dynamic – flexible/agile globally integrated enterprise, cloud computing

<table>
<thead>
<tr>
<th></th>
<th>1997</th>
<th>Today</th>
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<tbody>
<tr>
<td>CIOs</td>
<td>128</td>
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<tr>
<td>Host data centers</td>
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<td>Network</td>
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<td>Applications</td>
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IBM Strategic Delivery Model

- Global Resources
- Strategic IGA Location
- Strategic Web Location for IGA
- Ethernet & Power9 Networks
Project ‘Big Green’

IBM will consolidate and virtualize thousands of server images onto IBM System z™ mainframes

Substantial savings: energy, software and system support costs

80% less energy, 85% less floor space

Enabled by virtualization capability

Major proof point for Project Big Green

IBM’s Project Big Green spurs global shift to Linux on Mainframe

Armonk, NY, August 1, 2007

Think what we could do for you
### Enterprise Business Value

<table>
<thead>
<tr>
<th>Expectations</th>
<th>Benefits Realized</th>
<th>Challenges</th>
</tr>
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<tbody>
<tr>
<td>Business Case:</td>
<td>* Savings in energy, space, software and systems support costs</td>
<td>✧ Decision-Making: Business Unit versus Enterprise view</td>
</tr>
<tr>
<td>● Significant potential savings</td>
<td></td>
<td>✧ Detailed internal business case</td>
</tr>
<tr>
<td>● Virtualization as a cross-IBM</td>
<td></td>
<td>✧ Integrating project / program priorities</td>
</tr>
<tr>
<td>effort</td>
<td></td>
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<tr>
<td>Standardization and Simplification</td>
<td>* Inventory hygiene, mapping of applications</td>
<td>✧ Complex, customized environments</td>
</tr>
<tr>
<td>● Reduced complexity,</td>
<td></td>
<td>✧ Disparate release levels</td>
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<tr>
<td>centralized service</td>
<td></td>
<td>✧ Incomplete inventory records</td>
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<tr>
<td>● Dynamic allocation,</td>
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<td>✧ Inefficient processes impact cycle time and labor costs</td>
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<td>provisioning</td>
<td></td>
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<td>Migration and Service Quality -</td>
<td>* Improved security and resiliency</td>
<td>✧ Project management discipline</td>
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<tr>
<td>● Efficiency</td>
<td></td>
<td>✧ Workload selection and complexity</td>
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<tr>
<td>● Stability</td>
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<td>✧ Architecture for a shared environment</td>
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<tr>
<td>● Availability</td>
<td></td>
<td>✧ End to end resource balancing and skills management</td>
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<td>● Resiliency</td>
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IBM System z Linux Virtualization Progress

IBM implementing New Enterprise Data Center through achievements in
- Server and storage virtualization
- Energy efficiency and resiliency improvements

Benefits are on track with expectations
- Migration management key
- Business case is compelling
- Using System z10 technology, the number of machines could be cut by about half, with greater savings in energy, floor space, software and support costs

Lessons Learned, including:
- Enterprise strategy and sponsorship needed to drive business case and execution
- Compelling business imperative accelerates execution and drives support
- Enterprise view of migration managed by waves drives experience; savings for investment

IBM experience is driving Time to Value initiatives, integrated into IBM capabilities
- Dramatic reduction in labor through new processes supporting workload migrations
- Fall in/out analysis, working with business units, to close gaps in workload pipeline
- Piloting new testing strategy, processes & tools to automate
Business Case Leveraged RACE Tool, Iterative Approach

Utilized RACE commercial modeling tool
- Foundation for internal business case, constructed specific environmental variables
- Created financial plan for “known universe”
  - Identified relevant sample (5-10%) of most likely servers to be migrated and gathered financial profile information for each

Engaged SME’s within IBM
- Provided business case assumptions (i.e. depreciation/maintenance), modified as appropriate

Iterative Process
- Continuously engaged with core SME’s to ensure most current information

Project Metrics
- Weekly report of migrated servers and their disposition status (reuse or disposal using GARS*) and Energy Certificate status
- Working to incorporate actuals into the Business Case such that we can refresh our assumptions

*IBM Global Asset Recovery Services
TCO: A Range of IT Cost Factors – Often Not Considered

- **Availability**
  - High availability
  - Hours of operation

- **Backup / Restore / Site Recovery**
  - Backup
  - Disaster Scenario
  - Restore
  - Effort for Complete Site Recovery
  - SAN effort

- **Infrastructure Cost**
  - Space
  - Power
  - Network Infrastructure
  - Storage Infrastructure
  - Initial Hardware Costs
  - Software Costs
  - Maintenance Costs

- **Additional development/implementation**
  - Investment for one platform – reproduction for others

- **Controlling and Accounting**
  - Analyzing the systems
  - Cost

- **Operations Effort**
  - Monitoring, Operating
  - Problem Determination
  - Server Management Tools
  - Integrated Server Management – Enterprise Wide

- **Security**
  - Authentication / Authorization
  - User Administration
  - Data Security
  - Server and OS Security
  - RACF vs. other solutions

- **Deployment and Support**
  - System Programming
    - Keeping consistent OS and SW Level
  - Database Effort
  - Middleware
    - SW Maintenance
    - SW Distribution (across firewall)
  - Application
    - Technology Upgrade
    - System Release change without interrupts

- **Operating Concept**
  - Development of an operating procedure
  - Feasibility of the developed procedure
  - Automation

- **Resource Utilization and Performance**
  - Mixed Workload / Batch
  - Resource Sharing
    - shared nothing vs. shared everything
  - Parallel Sysplex vs. Other Concepts
  - Response Time
  - Performance Management
  - Peak handling / scalability

- **Integration**
  - Integrated Functionality vs. Functionality to be implemented (possibly with 3rd party tools)
  - Balanced System
  - Integration of / into Standards

- **Further Availability Aspects**
  - Planned outages
  - Unplanned outages
  - Automated Take Over
  - Uninterrupted Take Over (especially for DB)
  - Workload Management across physical borders
  - Business continuity
  - Availability effects for other applications / projects
  - End User Service
  - End User Productivity
  - Virtualization

- **Skills and Resources**
  - Personnel Education
  - Availability of Resources

**Routinely Assessed Cost Factors**
IBM System z Linux Virtualization Progress

- Established phased approach
- Comprehensive project plan and management system
- Benefits are on track with expectations
- Technical solution, education plan and operational plan
- IBM Time to Value initiatives, integrated into IBM capabilities
- Highest level of support from IBM senior executive team
- Increased focus on decommissioning to realize benefits

2009 Progress Update

- Refined workload segmentation
- Integrated workload selection approach
- Expansion to Europe / Japan
- Business case validation
- Process improvement and automation
- Global BT/IT CIO organization
- Broadened optimization focus
Workload Complexity is a Critical Variable Influencing Migration Costs

- **Very Complex Workloads**
  - C, C++ compilers
  - Custom code
  - Significant code upgrades required before migration

- **Complex Workloads**
  - Down level WAS
  - Partitioned DBs
  - DR Requirement
  - Many Korn, Perl scripts
  - Multiple Security Zones

- **Simple Workloads**
  - IHS
  - Domino
  - Small DBs
  - App Server – 1 Single JVM
  - Like to Like
  - Infra Workloads

**2009 Focus**
- Process simplification
- Data integration
- Automation
An Enterprise Workload Selection Process Enables Migration Success

**Location View**
Southbury GWA consolidation - sunset of first-generation Web Architecture

**Application View**
Portfolio analysis and “fit for purpose” selection - OnDemand Workplace, e-mail, Supply Chain

**Environment View**
Development and Test Environments allowing for iterative development and better application quality

**Technology View**
Bulk Moves – 35K Notes applications (GNA), IBM http servers, Domino

**2009 Focus**
- Location optimization
- Europe & Japan

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Client View of TCO Comparison for Similar Distributed Workload vs. System z Linux results in Potential 60-75% Gross Cost Savings / 5 yrs

Validation Results

- Updated
  - Space checker boarding
  - Redundant servers
  - HW age / mix
  - LEAN labor efficiencies
  - Network port mix

- Added
  - Space reuse cost avoidance

Results will vary based on several factors including # of servers and work load types

* HW Acquisition compares server/disk refresh of distributed environment to the cost of acquiring new mainframes/storage
IBM is Using a ‘Work in Process' Approach to Manage the Migration

Management Approach and Reporting

- 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
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™

Technical Attributes

- Software compatibility or platform dependency
- Workload characteristics
- Not fully virtualized / optimized
Process Automation will Enable Migration Productivity Improvements

- Application migration tools & services to replatform distributed applications to z Linux, and soon PowerVM
- Tooling will discover, map, migrate, and test applications moving to z Linux
- Improves time to value and accelerates ROI

Discover server inventory and application dependencies
Create migration request for target server using source server data
Provision OS and software, migrate source configuration, customize per request
Accelerate the test process for web applications
A Broadened Focus on IT Optimization will be Enabled by ECM
The IBM Optimization Factory simultaneously reduces one-time costs while maximizing steady-state benefits of virtualization.

Leverage innovation & integration to consistently produce optimal virtualization designs with the least TCO for a given level of investment.
The IBM Optimization Factory deploys this approach for System z Linux Consolidation and Migration Solution as two pre-packaged offerings.

2 Scope Packages / Engagement Phases

Design & Approach Services

- Logical Level
  - "As is" client environment
  - "To be" target architecture
  - High Level Solution Description
    - Logical Level Ops Model
    - Architecture Decisions Document
  - Business Case
  - High Level Transition Plan

Planning & Implementation Services

- Physical Level
  - Physical Design (Micro level)
  - Implementation Plan
  - Consolidated Environment
  - Application Migration

Deliverables:
- "As is" client environment
- "To be" target architecture
- High Level Solution Description
  - Logical Level Ops Model
  - Architecture Decisions Document
- Business Case
- High Level Transition Plan

Execute:
- Consolidated Environment
- Application Migration
IBM has a continuing tool development program to enhance data collection and reduce cycle times for migrations.

**Data Discovery**

- **Data Collector Appliance**
  - TADDM
  - DC Scheduling & Monitoring
  - System Administrator Interface
  - Data Parsing & Transfer
  - Specialized DC Scripts

**Comprehensive** - self contained appliance that scans the environment for comprehensive server, application and configuration information

**Non-Invasive** - agentless data collection tools run with optimized data collection schedule & monitoring to minimize impact to your infrastructure

**Secure** – the secure interface for entering credentials allows system administrators retain control over sensitive information

**Streamlined** - Fast and efficient packaging of collected data for uploading to IBM’s automated Analytics Engine

**Analysis**

- **Analytics Engine**
  - Target Platform Sizing Analysis
  - Application Affinity Analysis
  - Power & Cooling Analysis
  - SCOPEDB DB2
  - Engagement Status Reporting

**Integrated whitespace** - consolidation function that analyzes opportunity to further consolidate remaining distributed workload

**Integrated Power/Cooling** – calculates energy savings using advanced power management techniques

**Comprehensive** – View of overall engagement progress and status and that reduces time and effort for weekly project status reports

**Financials** - business case features enables architecture decisions to be made optimally using both technical and financial factors

**Workload Migration**

- **Migration Appliance**
  - IBM Migrator
  - Pre-Migration Scripts
  - OS–MW–DB Provisioning Manager
  - Application Configuration Manager
  - Testing Manager
  - IBM Recipes
  - Status Reporting

**Simplified** - specialized routines that simplify the collection of middleware, database, and application configuration data

**Controlled** - dynamic interface for controlling and directing application migrations

**Automated** - automated server, middleware, and database provisioning speed cycletime and ensure consistent results

**Proven** - fully tested and validated recipes for provisioning, configuring, and migrating a variety of middleware, database, and other software products
In addition to compelling savings, by virtualizing distributed workload onto System z Linux, ECM operational benefits are being realized.

**From application owner perspective …**

- Speed: Rapidly clone environment - hours vs. days vs. weeks
- On demand resources: Add system resources (memory, cpu) as needed
- Scalable growth: I/O intensive workloads and cyclical applications
- Enable new business models: Significantly reduced need for dedicated development and test servers

**From infrastructure owner perspective…**

- System stability: Server reboot/recycling greatly reduced
- Simplification: Less hardware and related features to manage
- Improved change management: Significantly less security patches to apply
- Increased agility: non-disruptive changes
**Energy Efficiency Certificates Deliver Savings**

*By formally decommissioning servers, IBM is able to demonstrate energy savings and receive energy efficiency credits (EECs)*

**Client requirements**
- Lower energy costs and achieve business benefit of Energy Efficiency
- Demonstrate Energy Efficiency Commitment

**Solution**
- Virtualized workloads onto System z platform and reduced energy consumption
- Hundreds of servers in pipeline to be redeployed, sent to GARS* and/or energy efficiency certificates issued
- IBM applied for EECs for eligible decommissioned servers to receive Energy Efficiency Credits
- GARS for asset reuse, recycling and/or reclamation

**Benefits**
- Quantifiable energy reductions, tradable certificates
- Demonstrated commitment to energy efficiency

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*IBM Global Asset Recovery Services*
Decommission Process Overview

Server available as a result of virtualization efforts

Check for technical viability and asset value to determine if h/w is a redeployment candidate

If redeployed
Request completed to coordinate shipping and update property control

If not redeployed
Complete Machine List Database and ship to GARS*
Apply to Neuring for energy efficiency certificates

Tracking tool is updated to reflect disposition of the assets in the project

Capture savings in business plan and business case
**Preparation**
- Motivate business units
- Build the business case
- Gather data

**Start-Up**
- Start small
- Run operations while transforming
- Manage complexity, monitor progress continually
- Define reference architecture

**Execution**
- Integrate view of waves, resources
- Communicate real-time lessons
- Create enterprise view of workload, server selection
- Address cultural and organizational transformation

**Critical Success Factors**
- Sponsor with an enterprise view
- Strategic investment for migration
- Clear goals with dedicated team
- Inclusive leadership for execution of migration
- Leverage talent and capability across all of IBM to drive results
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- Power Systems
- System I
- System p System x
- System z
- System z9
- System z10
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