Bob Moffat
Senior Vice President and Group Executive, Systems and Technology Group

Systems and Technology
Systems and Technology

2009 and 2010 Imperatives

- Improve competitiveness and enhance business execution
  - Leadership Cost / Expense Structure
  - Leadership Go to Market
  - Leadership Products

- Extend leadership in virtualization and consolidation

- Continue systems leadership to gain share and capture profit

Longer Term Model

- Position IBM to win the future computing infrastructure opportunity

- Drive additional growth and margin opportunity through:
  - System Design
  - Virtualization
  - Workload Management

- Capture emerging workloads for Smarter Planet

Long-Term Pre-Tax Income Growth Model: 7% - 9%
On Track to Deliver $1B Gross Profit from Virtualization by 2010
Tracking to 2010 Objectives

$250K+ Portion of Server Market (% of IBM Revenue Share)

Source: IDC Worldwide Quarterly Server Tracker 4Q08

Virtualization Track (Cumulative GP $M)

Through 2008, ahead of track to $1B GP from virtualization by 2010

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Evolution of the Data Center

- Virtualization allows clients to consolidate like platforms for higher utilization and lower costs
- Going forward, clients want to manage heterogeneous pools of servers, storage and network as a single system

Scale-Out Sprawl

Consolidation

Virtualization

Ensembles

- Windows Servers
- Unix Servers
- Linux Servers
- Firewalls, Routers
- Switches
- Management Servers
- Storage
- Windows Server
- Mainframe or Unix Server
- Linux Server
- Networks
- Storage
- Virtual Servers, Storage, Networks
- Multi-System Virtualization
- Ensembles

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Future Systems View of Infrastructure

- Highly-automated, virtualized computing services
- High performance converged network
- Virtualized storage services
- Surrounded by quality of service expectations for application resiliency, system security, improved economies of scale and efficiency
## Workloads Key to Addressing Client Needs

### 2008 Workload Size for Server / Storage and CAGR for 2010-2012

<table>
<thead>
<tr>
<th>Workload</th>
<th>IBM Position</th>
<th>Revenue (B)</th>
<th>CAGR (%)</th>
<th>Profit (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transaction Processing and Database</strong></td>
<td>#1</td>
<td>$21B</td>
<td>2%</td>
<td>$2.1B</td>
</tr>
<tr>
<td><strong>Analytics and High Performance Computing</strong></td>
<td>#1</td>
<td>$12B</td>
<td>2%</td>
<td>$0.8B</td>
</tr>
<tr>
<td><strong>Business Applications</strong></td>
<td>#1</td>
<td>$16B</td>
<td>2%</td>
<td>$1.1B</td>
</tr>
<tr>
<td><strong>Web, Collaboration and Infrastructure</strong></td>
<td>#2</td>
<td>$43B</td>
<td>3%</td>
<td>$1.6B</td>
</tr>
</tbody>
</table>

**Source:** IBM's ordinal positions from IDC's 2008 Server Workload Multiclient Study and IDC's 2008 Server Workload Multiclient study. IBM achieved those rankings in both the server MCS and the storage MCS, separately. Source of Market Revenue, CAGR and Profit: IBM Analysis.
Not all Workloads Are the Same

Transaction Processing and Database
- Scale
- High Transaction Rates
- High Quality of Service
- Handle Peak Workloads
- Resiliency and Security

Analytics and High Performance Computing
- Compute intensive
- High I/O Bandwidth
- High Memory Bandwidth
- Floating point

Business Applications
- Scale
- High Quality of Service
- Large Memory Footprint
- Responsive Infrastructure

Web, Collaboration and Infrastructure
- Highly Threaded
- Throughput-oriented
- Scale Out Capable
- Lower Quality of Service
Workloads Influence Platform Choices

Most Common Choices for Enterprises Greater Than 1000 Employees

Mainframe
- UNIX
  - Transaction Processing and Database
    - Scale
    - High Transaction Rates
    - High Quality of Service
    - Handle Peak Workloads
    - Resiliency and Security
  - UNIX

Business Applications
- UNIX
  - Scale
  - High Quality of Service
  - Large Memory Footprint
  - Responsive Infrastructure

Web, Collaboration and Infrastructure
- Windows
  - Highly Threaded
  - Throughput-oriented
  - Scale Out Capable
  - Lower Quality of Service

Analytics and High Performance Computing
- UNIX
  - Compute intensive
  - High I/O Bandwidth
  - High Memory Bandwidth
  - Floating point

Source: IDC WW Server Workloads 2008, IDC WW Storage Workloads 2008. UNIX = UNIX + Linux + i5OS
More than 8K Client Assessments Demonstrate Clients Use Multiple Platforms to Optimize IT

- Most clients run hundreds or thousands of different workloads.
- They leverage multiple types of servers, storage, and operating systems.
- Many factors impact the selection of the optimal platform, including:
  - Quality of service requirements
  - ISV support
  - Availability of platform skills and capacity
  - Adjacent workloads
  - Data

Industry breakdown of various client assessments conducted by IBM over the last 12 months
Emerging Workloads
The Next Era of Systems Innovation

- Frequency
- Performance
- Consolidation
- Multi-core / Virtualization
- Hybrid
- Fit for Purpose
- Simplified
- Dynamic

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Hybrid Systems Today – Fit for Purpose

Hybrid Supercomputing

Specialty Workload Engines
- zILP
- IFLs
- Crypto
- zAAP
- Coupling

Hybrid Gameframe

Floppy

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Innovation at All Levels of Systems Stack

- **Clouds**: Help improve Data Center efficiency
- **System Management**: Allow better asset utilization
- **Hybrid Systems**: Enhance emerging workload consolidation
- **Flash**: Increase system performance and efficiency
- **10G Ethernet**: Enable network fabric convergence
- **Multi-core Processors**: Change hardware system design
- **3D Integration**: Revolutionize chip packaging
- **Computational Lithography**: Extend CMOS density scaling
Emerging Workloads

A Smarter Planet will generate vast amounts of data that will be disseminated at networking speeds. Emerging class of applications require **real-time data analysis** and **prediction** with improved:

### Performance
- **Accelerators** – enable real-time analytics
- **Multi-thread chips** – need for concurrent operations

### Scaling
- **Modularity** – dynamically adjust and sustain performance at peak loads
- **Scale-out storage** – provide repository for archiving and retrieving massive amounts of data

### Efficiency
- **Energy management** – enable new levels of energy optimization
- **Advanced virtualization** – create single view for intelligent workload placement and mobility
- **Ensembles and Clouds** – manage pool of resources as single system
Smarter Traffic - Stockholm Congestion Management

Workload scale and complexity are increasing as cities aspire to implement “smarter” policies

Tariff calculation of 300K vehicles a day
Power System with multiple LPARs, DS4000 storage, WebSphere Application Server, DB2, AIX, SAP

Real time license plate recognition
System x BladeCenter, DS4500 storage, WebSphere Application Server, DB2, Message Broker, IBM OCR, Linux

Web/retail channels for payment processing
System x BladeCenter and DS4500 storage, WebSphere Application Server, DB2, Message Broker, Linux, SAP CRM

Analytics and Intelligence for metrics and incentives
Power System w/ multiple LPARs and DS4000, DB2, SAP, BI
Emerging Workloads: Hybrid Systems

**Real-Time Analytics**
- Financial Analytics
- Network Security and Threat Management
- Medical Imaging
- Video Surveillance
- 3D On-Line Infotainment
- Search

**General Purpose System**
- Throughput and Computational Accelerators
- Multi-workload consolidation and secured transactions
  - Mainframe
  - UNIX
  - x86
  - Storage

**Integrated Systems Management**
- Specialty engines for optimized workload characteristics
  - Image rendering
  - Database acceleration
  - Encryption
  - Compression
  - Computation intensive

**Throughput and Computational Accelerators**
Hybrid Systems Blueprint for a Smarter Planet

Enabling customers to more efficiently run both traditional and emerging workloads

**Integrated Accelerators**
- Performance optimization and emerging workload consolidation
- Integration of high value functions – encryption, compression, acceleration

**Integrated Software**
- Flexible operating environment – zOS, AIX, IBM i, Linux, Windows
- Systems software – virtualization, management, energy, security, availability
- Upward integration into IBM’s middleware stack for end-to-end optimization

**Integrated High Speed Fabric and Virtual I/O**
- Tight integration for improved virtualization across servers, storage and network
- Improved resiliency for higher availability across the datacenter

**Unified Infrastructure Management**
- Policy-based system management for intelligent placement and mobility of workloads
- Shared resource pooling – manage servers, storage and network as a single system
Summary

- The future infrastructure will be highly automated, virtualized compute services connected by a high speed data fabric.
- Workloads are critical to understanding both how clients choose platforms and will deploy the future infrastructure model.
- IBM will sustain its leadership and profitability in the data center.
- IBM innovation and leadership in system design, virtualization, and workload management provide additional growth and margin opportunity.
- IBM is best positioned to capture emerging workloads for Smarter Planet.
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