Innovation and Collaboration

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Innovation

Leadership

Execution
Innovation
Innovation heritage

- **5 Nobel Laureates**
- **8 National Medals of Technology**
- **5 National Medals of Science**
- **4 Turing Awards**
- **20 in National Academy of Sciences**
- **Over 330 Professional Society Fellows**
- **61 in National Academy of Engineering**
- **9 inductees in National Inventors Hall of Fame**
For over **four decades** of innovation in semiconductor technology, including the development and introduction of multicore-microprocessor integration, the DRAM cell, chemically-amplified photoresist, copper on-chip wiring, silicon on insulator (SOI) technology, and high speed silicon germanium devices.
Processor design evolution

**Bipolar Architecture**
Performance Lever:
Frequency

Multi-Chip Module (MCM)
1980’s

**CMOS Microprocessor**
Performance Levers:
Frequency & density

POWER4/5
Dual Core
1990’s – 2000’s

**CMOS SoC**
Performance Levers:
Integration & density

Blue Gene & Cell
Multi-core, quad-chip module (QCM), ASIC library, design tools
Beyond
User Interaction Drives Innovation in Computing

- Punch Cards
- Mainframe
- Batch
- Green Screen/Teletype
- Mainframe Multitasking
- Mini Computer
- WYSIWYG
- Stand Alone PC
- Windows
- SpreadSheet
- Word Processing
- Client/Server
- Internet
- Multimedia
- Natural Interaction
- Gaming
- WWW

User Interaction Drives Innovation in Computing
The next era of innovation
Innovation breakthroughs

...STG Today

Power4/5  Engineering & Technology Services  Virtualization Engine™  Innovative Networks

BladeCenter  Blue Gene®  power.org  Cell
Innovation breakthroughs

...STG Beyond

IBM Systems Agenda

Blades

Disk/Tape Encryption

Storage Application LPARs

65/45/32 nm Technology

Power6

Quasar
Leadership
Innovation leads to leadership

IBM eServer Launch

Source: IDC FY2005-Q3 Quarterly Server Tracker & STG MI

Share Gains

- Servers: +10 pts
- UNIX: +13 pts
- Intel: +6 pts
- Storage: +5 pts

Source: IDC FY2005-Q3 Quarterly Server Tracker & STG MI
Innovation leadership

People
- 35,000 employees worldwide

Products
- Leading systems vendor*
  - zSeries
  - Supercomputing
  - Tape
  - BladeCenter
  - UNIX servers
- One of the fastest growing*
  - Intel-based servers
- 100+ industry-leading benchmarks

Patents
- IBM patent leader for 12 consecutive years
- STG has more than half of IBM patents
  - 2004: 1,650 of 3,248

*Source: IDC & STG MI
Execution
Strategy

- Grow systems leadership
- Capture adjacent market growth
- Accelerate technology transformation
System design points

Mainframe

Modular

Blade
Systems direction

- Augment Moore’s Law
  - Improve integration
  - Enhance network scaling
  - Add more CPUs & threads per system

- Support evolving workloads driven by Web services/XML, enterprise search & analysis, security & privacy, IP convergence (VoIP, SIP) and high performance computing

- Exploit systems of all types
  - Large scale-up SMPs
  - Clusters
  - Geographically-distributed grids
  - Massively parallel
  - Application specific

- Offer low-power processing, silicon carrier, advanced chip module and rack cooling
IBM Systems

- z9
- p5
- i5
- X
- BladeCenter
- Disk
- Tape
Committing to High Value

*The Pillars of our Company*

- **Systems**
- **Software**
- **Services**
Product Innovation

*Power Technology*

- First System on a Chip (SoC)

- **Power4™ System**
  - 2x performance for 1/2 price
  - First multi-core three years ahead of industry
  - First dynamic logical partitioning in UNIX space

- **Power5™ System**
  - 3x performance of Power4 Systems
  - First micro-partitioning implementation in UNIX space

- Industry and application workload benchmark leadership

- Foundation established UNIX system leadership in June 2005
Step 1
Consolidate Servers
**Business Transformation Innovation**

*BladeCenter*

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**Step 2**
Integrate First Layer of the Network (L2)
Business Transformation Innovation

*BladeCenter*

**Step 3**
Integrate Storage Fabric
Business Transformation Innovation

*BladeCenter*

**Step 4**
Integrate Second Layer of the Network (L4-7)
Step 5
Consolidate Applications
Business Transformation Innovation

*BladeCenter*

Step 6
Consolidate Clients
Business Transformation Innovation
BladeCenter

Results

- BladeCenter Collapses Complexity
  - Reduce costs 1/4
  - Reduce power 1/3
  - Reduce floor space
  - Integrate into 1
Business Transformation Innovation

Engineering & Technology Services

- Drive innovation and make our product design technology available to others

- Optimize and customize solutions for new applications
  - Aerospace & defense
  - Medical
  - Consumer electronics

- Continue to expand Blue Gene and extend POWER/Cell into new applications
Product Innovation

Blue Gene®

- World’s most powerful supercomputer
  - #1 with 280 TeraFLOPs/sec

- Delivering unparalleled supercomputing innovation
  - Advancing scientific discovery
  - Commercial viability enabling breakthroughs in business applications

- Maintain unmatched systems attributes
  - Scale to 65,536 processors
  - Scale to 64 racks
  - 5.7 peak/rack
  - 8x FLOPs/watt
  - 10x FLOPs/sq. ft.
Business Transformation Innovation

Virtualization Engine™

- Deliver functions that enable customers to simplify & optimize their IT environment
- Enable use of common skills by unifying administrative tasks
- Enable goal-based scheduling across heterogeneous environments with workload manager (eWLM)
- Deliver advanced management of Virtual environments
Industry Ecosystem Innovation

*power.org*

- Establish a community to provide a pervasive, flexible, proven 32- to 64-bit architecture ideal for open innovation

- Work with 10,000+ community members

- Enable virtual collaboration & share best practices for adoption

- Support operational standards committees
  - High volume server reference platform
  - Bus architecture
  - Platform architecture
  - SoC design hierarchy
  - Storage SMB reference platform
Industry Ecosystem Innovation

*I創新 Networks*

- Formed to defray technology development costs and pool intellectual capital

- Centralized basic research to jointly operated government and/or industrial laboratories, enabling an era of pre-competitive cooperation

- Supports emergence of open standards and an expanded IBM ecosystem
Product Innovation

Cell Broadband Engine™

- Four-year collaboration to revolutionize the digital experience
  - Building-block technologies for next IBM family of computing
  - Technical specifications to open source and development communities
  - Delivers nine on-chip cores
    - 64-bit POWER processor
    - Eight synergetic processors

- Creates new possibilities in natural human interaction
  - Photo-realistic effects
  - Predictable, real-time response
  - Virtualizes for concurrent activities

- Delivers disruptive performance
The IBM Systems Agenda

**Virtualize Everything**
- Automate
- Optimize
- Simplify

**Commit to Open**
- Support open standards
- Advance open standards
- Provide choice

**Collaborate to Innovate**
- Enable information on demand
- Team with Business Partners, ISVs & clients
- Drive industry collaboration
Virtualize Everything

IBM Virtualization Engine

Look Like Little Things Look Like Big Things
Commit to Open

**Linux:**
5000+ developers

**power.org:**
36 companies & 10,000+ developers

**Blade:**
700 community members & blade.org formed

**Innovative Networks:**
Six partners for process technology

**Intellectual Property:**
500 accessible patents

**Open Spec**

**Aperi:** Open source storage community

**Linux:**
5000+ developers

**power.org:**
36 companies & 10,000+ developers

**Blade:**
700 community members & blade.org formed

**Innovative Networks:**
Six partners for process technology

**Intellectual Property:**
500 accessible patents

**Aperi:** Open source storage community
Collaborate to Innovate

Internal

Industry
SONY
TOSHIBA
AMD

Open Communities
Power.org
eclipse

Clients
BOEING
UPMC
NORTEL NETWORKS
Raytheon
NYSE
Business Transformation Innovation

**Blades**

- Cell Blade provides technical innovation for many applications
  - Streaming media
  - Medical imaging
  - Video surveillance
  - 3D and real time rendering
  - Collaborative engineering design

- Storage Blade allows servers and storage to exist in one chassis that are managed commonly
  - Ideal for remote offices, stores, bank branches

- Hosted-client Blade provides data centralization
  - Manage clients easier and more securely
  - Duplicate client experience
  - Optimizes compute power
Business Transformation Innovation

*Storage Application LPARs*

- World’s first programmable storage controller
  - Easily extend storage controller functionality using LPAR capability in DS8000 to run targeted applications
  - Leverage leadership LPAR features like dynamic LPARs, micropartitioning, LPAR isolation and Virtual I/O

- Deliver unmatched price/performance by offloading I/O and CPU intensive middleware (such as database predicate evaluation) to storage box

- Enable next level of intelligent storage which goes beyond storing data, to finding and locating data

- Enhanced security because data between application and storage need not traverse external network

- Attract ISV vendors to create an ecosystem for LPAR-based storage controllers
Product Innovation

Disk and Tape Encryption

- Enable customers to comply with new security laws and new cardholder information security procedures (CISP) and to minimize business impact of data exposure
- Support encryption directly in enterprise and LTO tape drives and directly in storage controllers (DS8000 initially)
  - Avoid expensive separate encryption appliances
  - Allow selective encryption of data
- Create industry-leading unified disk and tape key management software to support encryption
  - Secure business partner data exchange
  - Encrypted archival tape storage
  - Encrypted disk storage
- Provide support across enterprise and all platforms
Product Innovation
*65nm / 45nm / 32nm Technology*

- Led the industry in recognizing and proactively addressing the end of classical scaling

- Innovation now drives performance, not device dimensions

- Ultra Large Scale Integration proven at 65nm via fully functional processors

- Ongoing innovations enable advanced geometries
  - First microprocessor employing immersion lithography
  - Hybrid Orientation Technology
  - High-K Dielectrics for gate replacement
  - FinFet technology for ultimate scaling
  - Computational Technology
  - Advanced DFM, TCAD, and design tools
Product Innovation

*Power6*

- Next generation IBM scale-up systems based on POWER technology*
- Testing already underway

* Plans and directions
Product Innovation

**Quasar**

- Traditional Scaling Discontinuity: CMOS Power Crisis
  - Effects on core performance levers (Frequency, Pipeline depth)

- System Integration Techniques: Performance Management
  - Homogeneous and heterogeneous multi-core systems
  - Modular/SoC for flexible integration

- System Application Benefits: Throughput Improvements
  - Accelerators, appliances, specialized processors
  - Evolving and ecosystem/integrated system solution
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