IBM Deep Computing

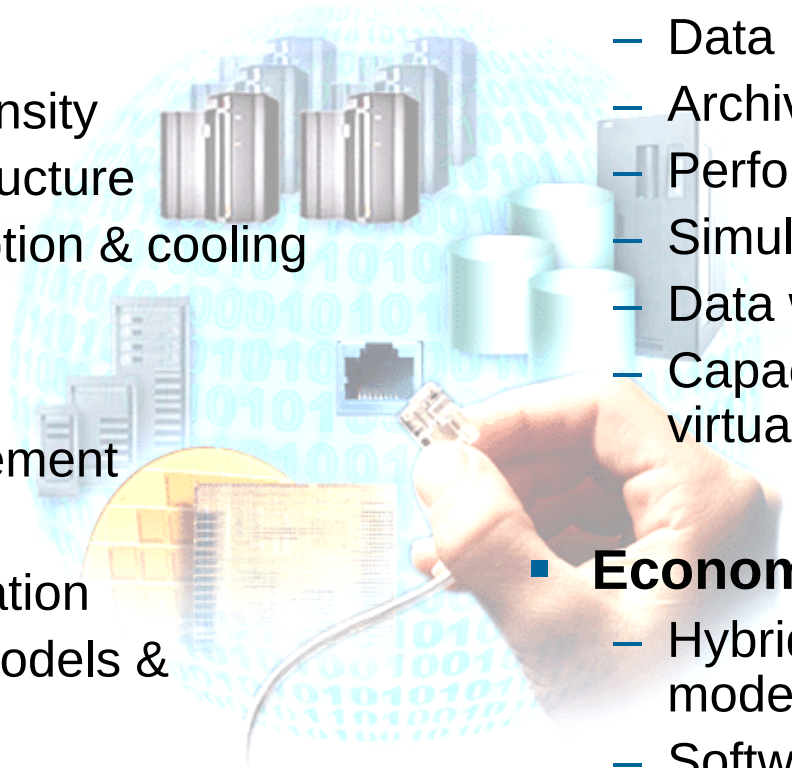
Rebecca Austen

Director, Deep Computing Marketing

Deep Computing Innovation

Addressing Challenges Beyond Computation

- **System Design**
  - Scalability
  - Packaging & density
  - Network infrastructure
  - Power consumption & cooling
- **Software**
  - System management
  - Security
  - Software integration
  - Programming models & productivity

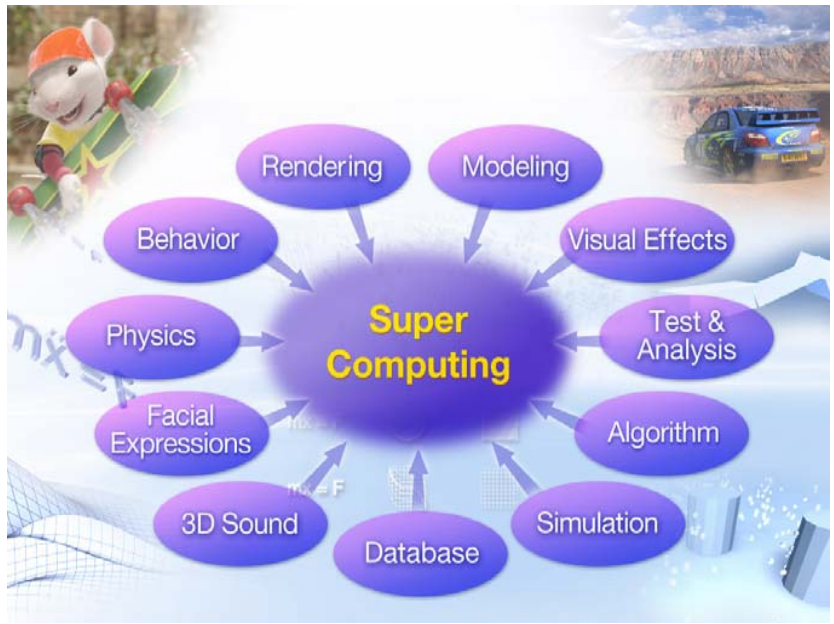


- **Data**
  - Data management
  - Archival & compliance
  - Performance & reliability
  - Simulation & modeling
  - Data warehousing & mining
  - Capacity management & virtualization
- **Economics**
  - Hybrid financial & delivery models
  - Software licensing

Deep Computing Collaboration

Innovation Through Client and Industry Partnerships

- **System, Application & User Requirements, Best Practices**
  - SPXXL, ScicomP
  - BG Consortium
- **Infrastructure**
  - DEISA, TeraGrid, MareNostrum
- **Software & Open Standards**
  - GPFS evolution
  - Linux, Grid
- **Research & Development**
  - Technology/systems – Blue Gene, Cell
  - Collaborative projects – Genographic, WCG



Deep Computing Embraces a Broad Spectrum of Markets

Digital Media

Digital content creation, management and distribution

Life Sciences

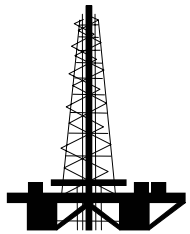
Research, drug discovery, diagnostics, information-based medicine

Business Intelligence

Data warehousing and data mining

Petroleum

Oil and gas exploration and production

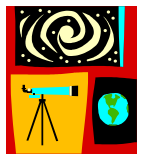


Financial Services

Optimizing IT infrastructure, risk management and compliance, analytics

Industrial/Product Lifecycle Management

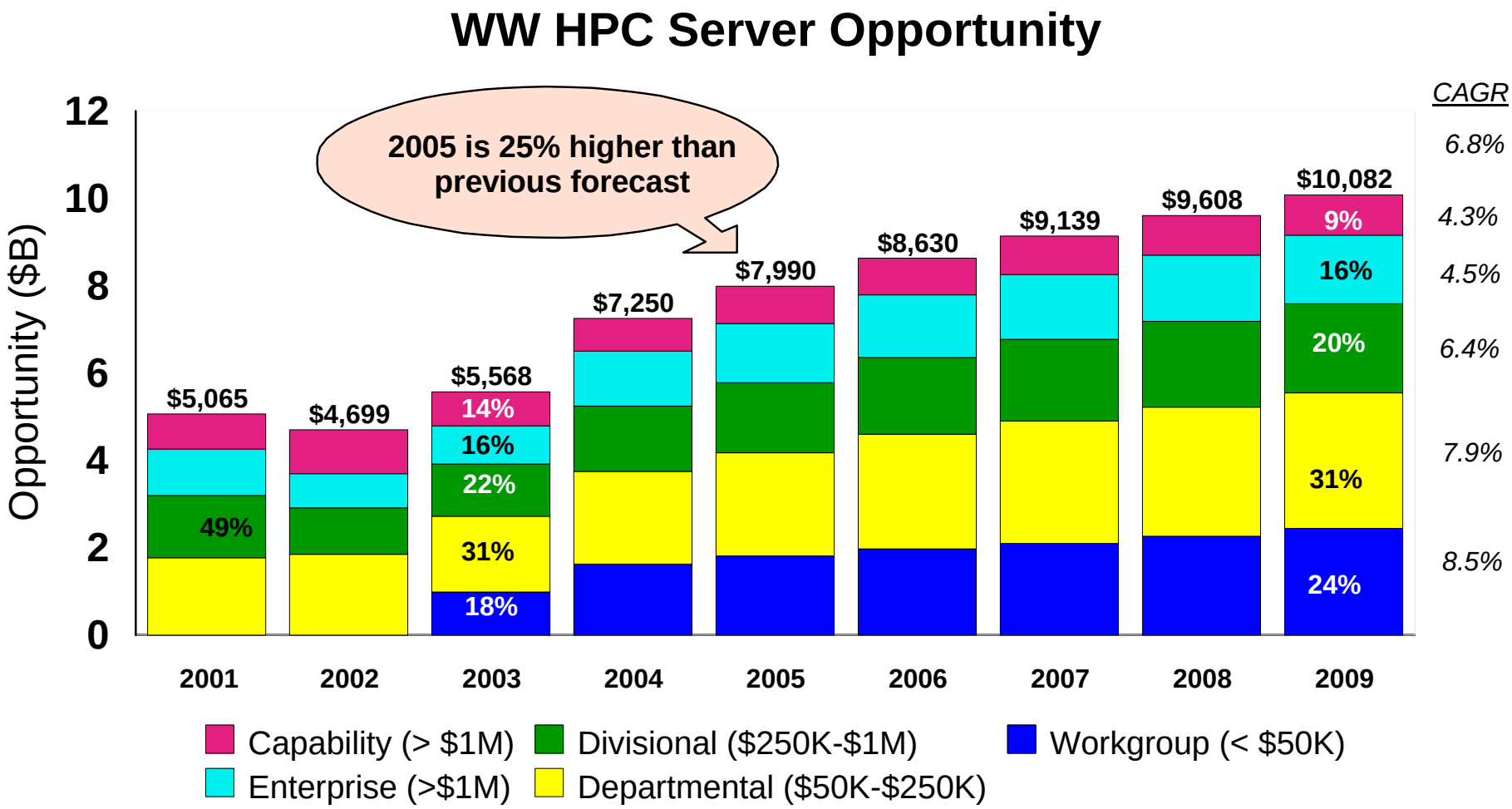
CAE, EDA, CAD/PDM for electronics, automotive, and aerospace



Government & Higher Education

Scientific research, classified/defense, weather/environmental sciences

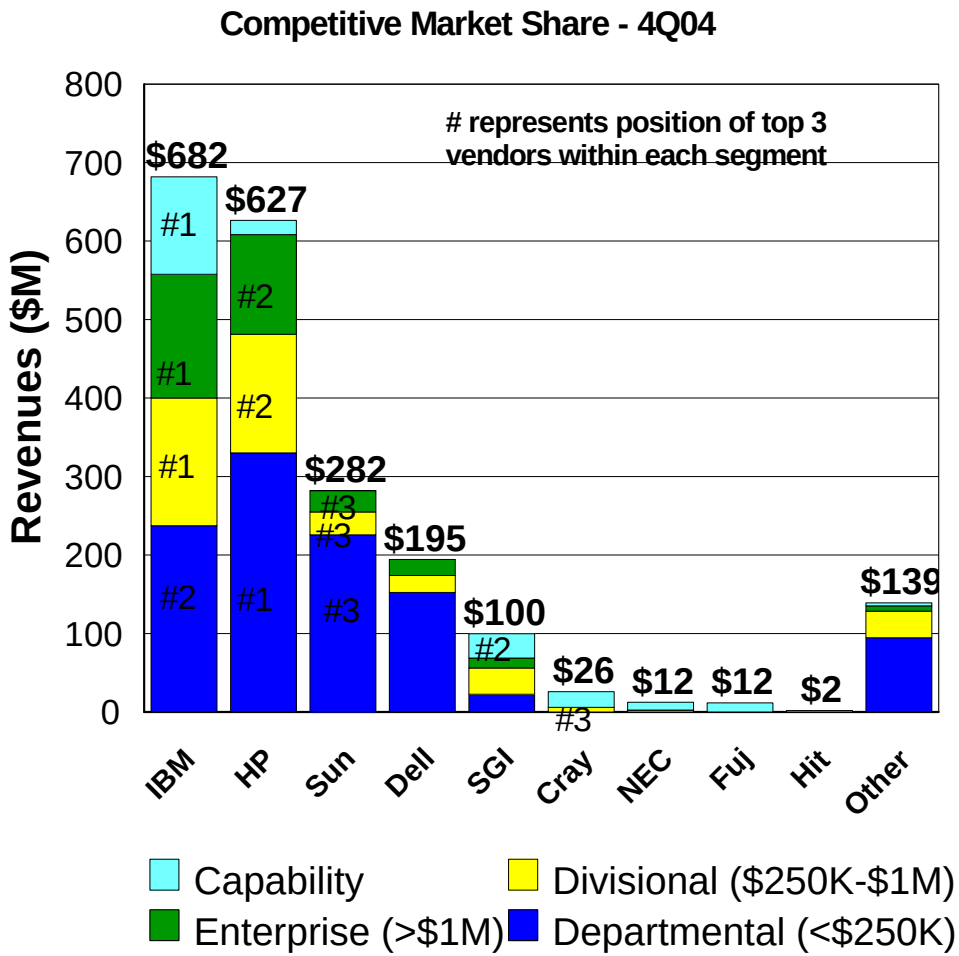
Market Opportunity & Growth



Source: IDC 05/2005

Market Opportunity & Growth

- Total HPC market opportunity (server, storage, workstation, software, etc.) estimated by IBM at $32B to $40B
- Strong growth in emerging business areas (e.g., life sciences, digital media, financial analytics), complementing traditional HPC markets (scientific research, defense, academia, industrial)
- Highest revenue and growth in lower price band segments
- Significant expansion in Linux clusters and blades (IBM #1); Opteron momentum
- Shifting competitive dynamics



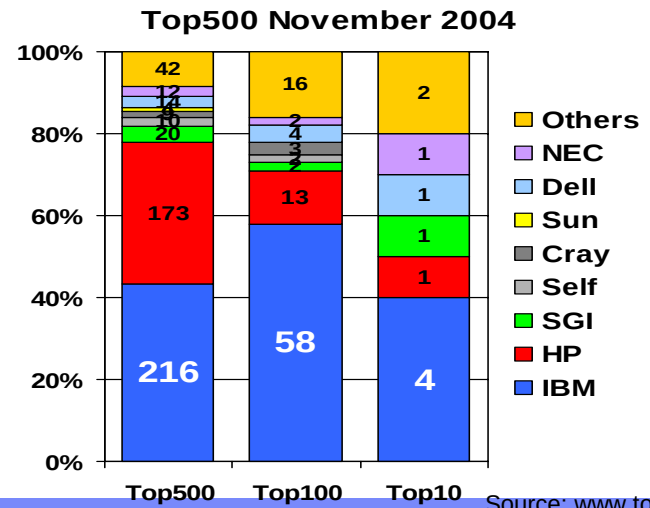
Source: IDC 03/2005

Supercomputing Leadership

	Ten years ago	*Five years ago*	*Today*
Largest system	143 Gflops	2.1 Tflops	70.7 Tflops
Teraflop systems	0	2	398
Research/Academic	60%	48%	41%
Industry	24%	46%	55%
Linux clusters	0	6	294

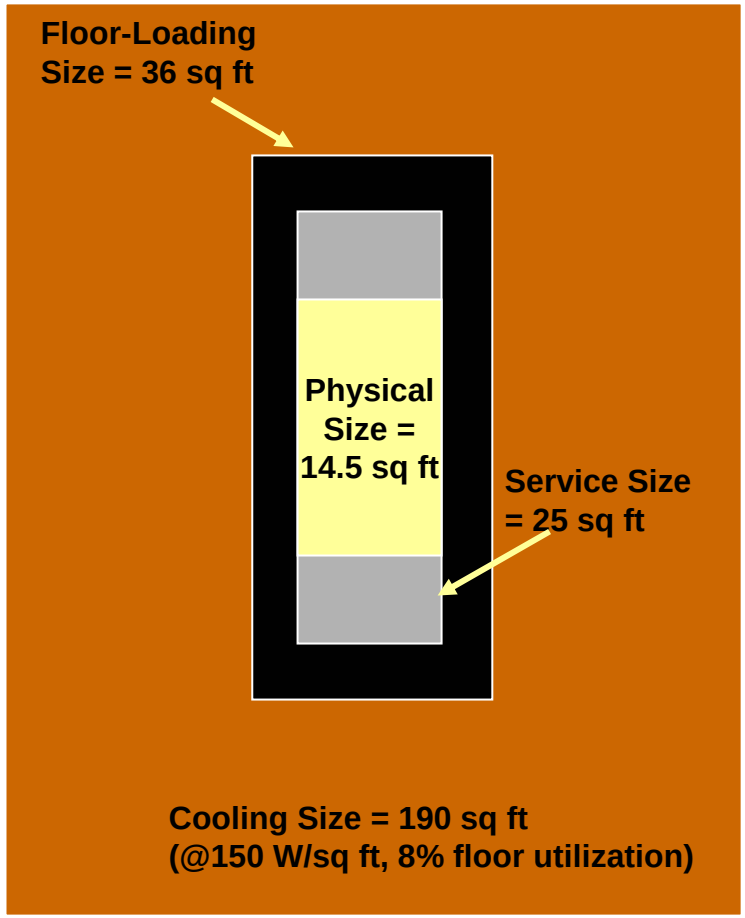
IBM Leadership (Nov 2004)

- ☑ **#1 system - DOE - BlueGene/L (70.7 TF)**
- ☑ **Most systems on list with 216 (43.2%)**
- ☑ **Most aggregate throughput 556.9 TF (49.4%)**
- ☑ **Most in Top10 (4), Top20 (8), Top100 (58)**
- ☑ **Most Linux Clusters with 161 of 294 (54.7%)**
- ☑ **Largest system in Europe (MareNostrum)**



Source: www.top500.org

Power Affects System Size



"What matters most to the computer designers at Google is not speed, but power -- low power, because data centers can consume as much electricity as a city."

Eric Schmidt, CEO Google (Quoted in NY Times, 9/29/02)

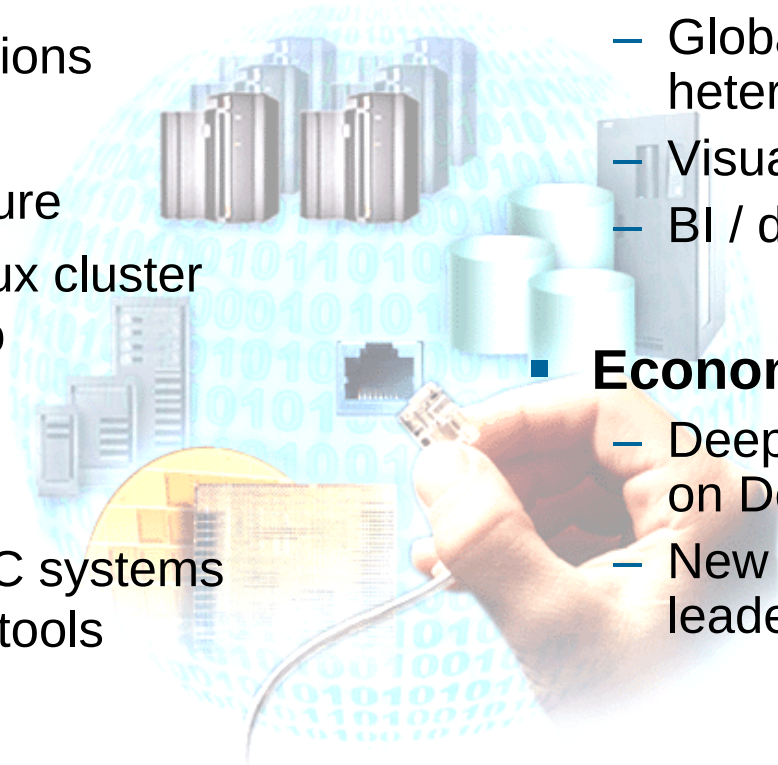
Space and Power as Key Requirements

- What does it take to build a 360 TFlop System?
  - Space
    - BG/L ~100 SqM
    - Linux Cluster ~1000 SqM (extrapolation)
  - Power
    - BG/L ~1.5 MW
    - Linux Cluster ~15 MW (extrapolation)
  - Implications:
    - 1 MW/yr = $1M
- How do we get to a PFlop?
  - Plan for BG/P
    - ~ 100 SqM
    - ~ 2.0 MW

View from the Computer Room

Deep Computing Innovation & Collaboration

- **System Design**
  - Blue Gene solutions
  - Cell technology
  - Power architecture
  - Evolution of Linux cluster & blade portfolio
- **Software**
  - Evolution of HPC systems management & tools
  - DARPA PERCS



- **Data**
  - Global, shared heterogeneous file systems
  - Visualization solution
  - BI / data warehousing
- **Economics**
  - Deep Computing Capacity on Demand
  - New metrics for HPC leadership …

Special Notices

This document was developed for IBM offerings in the United States as of the date of publication. IBM may not make these offerings available in other countries, and the information is subject to change without notice. Consult your local IBM business contact for information on the IBM offerings available in your area.

Information in this document concerning non-IBM products was obtained from the suppliers of these products or other public sources. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

IBM may have patents or pending patent applications covering subject matter in this document. The furnishing of this document does not give you any license to these patents. Send license inquires, in writing, to IBM Director of Licensing, IBM Corporation, New Castle Drive, Armonk, NY 10504-1785 USA.

All statements regarding IBM future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.

The information contained in this document has not been submitted to any formal IBM test and is provided "AS IS" with no warranties or guarantees either expressed or implied.

All examples cited or described in this document are presented as illustrations of the manner in which some IBM products can be used and the results that may be achieved. Actual environmental costs and performance characteristics will vary depending on individual client configurations and conditions.

IBM Global Financing offerings are provided through IBM Credit Corporation in the United States and other IBM subsidiaries and divisions worldwide to qualified commercial and government clients. Rates are based on a client's credit rating, financing terms, offering type, equipment type and options, and may vary by country. Other restrictions may apply. Rates and offerings are subject to change, extension or withdrawal without notice.

IBM is not responsible for printing errors in this document that result in pricing or information inaccuracies.

All prices shown are IBM's United States suggested list prices and are subject to change without notice; reseller prices may vary.

IBM hardware products are manufactured from new parts, or new and serviceable used parts. Regardless, our warranty terms apply.

Many of the pSeries features described in this document are operating system dependent and may not be available on Linux. For more information, please check: http://www.ibm.com/servers/eserver/pseries/linux/whitepapers/linux_pseries.html

Any performance data contained in this document was determined in a controlled environment. Actual results may vary significantly and are dependent on many factors including system hardware configuration and software design and configuration. Some measurements quoted in this document may have been made on development-level systems. There is no guarantee these measurements will be the same on generally-available systems. Some measurements quoted in this document may have been estimated through extrapolation. Users of this document should verify the applicable data for their specific environment.

Revised February 6, 2004

Special Notices (Cont.)

The following terms are registered trademarks of International Business Machines Corporation in the United States and/or other countries: AIX, AIX/L, AIX/L(logo), alphaWorks, AS/400, Blue Gene, Blue Lightning, C Set++, CICS, CICS/6000, CT/2, DataHub, DataJoiner, DB2, DEEP BLUE, developerWorks, DFDSM, DirectTalk, DYNIX, DYNIX/ptx, e business(logo), e(logo)business, e(logo)server, Enterprise Storage Server, ESCON, FlashCopy, GDDM, IBM, IBM(logo), ibm.com, IBM TotalStorage Proven, IntelliStation, IQ-Link, LANStreamer, LoadLeveler, Lotus, Lotus Notes, Lotusphere, Magstar, MediaStreamer, Micro Channel, MQSeries, Net.Data, Netfinity, NetView, Network Station, Notes, NUMA-Q, Operating System/2, Operating System/400, OS/2, OS/390, OS/400, Parallel Sysplex, PartnerLink, PartnerWorld, POWERparallel, PowerPC, PowerPC(logo), Predictive Failure Analysis, pSeries, PTX, ptx/ADMIN, RISC System/6000, RS/6000, S/390, Scalable POWERparallel Systems, SecureWay, Sequent, ServerProven, SP1, SP2, SpaceBall, System/390, The Engines of e-business, THINK, ThinkPad, Tivoli, Tivoli(logo), Tivoli Management Environment, Tivoli Ready(logo), TME, TotalStorage, TURBOWAYS, VisualAge, WebSphere, xSeries, z/OS, zSeries.

The following terms are trademarks of International Business Machines Corporation in the United States and/or other countries: Advanced Micro-Partitioning, AIX/L(logo), AIX 5L, AIX PVMe, AS/400e, BladeCenter, Chipkill, Cloudscape, DB2 OLAP Server, DB2 Universal Database, DFDSM, DFSORT, Domino, e-business(logo), e-business on demand, eServer, GigaProcessor, HACMP, HACMP/6000, Hypervisor, i5/OS, IBMLink, IBM Virtualization Engine, IMS, Intelligent Miner, Micro-Partitioning, iSeries, NUMACenter, OpenPower, POWER, Power Architecture, Power Everywhere, PowerPC Architecture, PowerPC 603, PowerPC 603e, PowerPC 604, PowerPC 750, POWER2, POWER2 Architecture, POWER3, POWER4, POWER4+, POWER5, POWER5+, POWER6, Redbooks, Sequent (logo), SequentLINK, Server Advantage, ServeRAID, Service Director, SmoothStart, SP, S/390 Parallel Enterprise Server, ThinkVision, Tivoli Enterprise, TME 10, TotalStorage Proven, Ultramedia, VideoCharger, Visualization Data Explorer, X-Architecture, z/Architecture.

A full list of U.S. trademarks owned by IBM may be found at: http://www.**ibm.com**/legal/copytrade.shtml.

UNIX is a registered trademark in the United States, other countries or both.

Linux is a registered trademark of Linus Torvalds in the United States, other countries or both.

Microsoft, Windows, Windows NT and the Windows logo are registered trademarks of Microsoft Corporation in the United States and/or other countries.

Intel, Itanium and Pentium are registered trademarks and Intel Xeon and MMX are trademarks of Intel Corporation in the United States and/or other countries

AMD Opteron is a trademark of Advanced Micro Devices, Inc.

Java and all Java-based trademarks and logos are trademarks of Sun Microsystems, Inc. in the United States and/or other countries.

TPC-C and TPC-H are trademarks of the Transaction Performance Processing Council (TPPC).

SPECint, SPECfp, SPECjbb, SPECweb, SPECjAppServer, SPEC OMP, SPECviewperf, SPECapc, SPEChpc, SPECjvm, SPECmail, SPECimap and SPECsfs are trademarks of the Standard Performance Evaluation Corp (SPEC).

NetBench is a registered trademark of Ziff Davis Media in the United States, other countries or both.

Other company, product and service names may be trademarks or service marks of others.

Revised August 23, 2004