



Linux @ IBM

Linux Implementation in the Public Sector

Fact or Fiction?

Jim Elliott
Advocate, @server Strategic Initiatives
IBM Canada Ltd.





What is Linux?

- **UNIX-like operating system**
 - Supported by a global community
 - Unprecedented flexibility
- **Why Linux?**
 - Single operating system; desktop to mainframe
 - Attracting the best technical talent
 - Basis for innovation
- **Packaged and shipped by distributors**
 - Red Hat, SuSE, other regional distributors
- **UnitedLinux - an open industry consortium**
 - Binary-compatible Linux distribution
 - Supported by all IBM @server platforms, key middleware
 - World-wide language support, standards based

“Hello everybody... I’m doing a (free) operating system (just a hobby, won’t be big and professional...)”

Linus Torvalds, creator of Linux, from the first Internet announcement on August 25, 1991



UNITEDLINUX



Open Source Software

www.opensource.org



- **What is Open Source Software?**
 - Community develops, debugs, maintains
 - Generally high quality, high performance software
 - The "classic" licenses, GPL, LGPL, BSD, MIT, and Moz
 - Open Source Initiative now approves 46 licenses
 - Business models
 - Package with commercial software
 - Package with hardware
 - Services
- **Why does IBM consider it important?**
 - Customers are asking for it
 - OSS is a good approach to developing open standards
 - OSS can be a source of innovation
 - Decision to use OSS is just another business decision

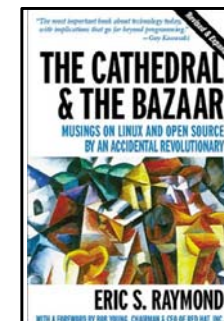




Sources of Information

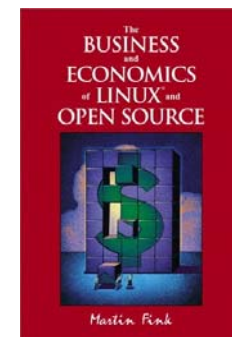
■ Suggested reading

- The Cathedral and the Bazaar
 - Eric Raymond, catb.org/~esr/writings/cathedral-bazaar
- Free as in Speech and Beer
 - Darren Wershler-Henry, freeasinspeechandbeer.com
- The Business and Economics of Linux and Open Source
 - Martin Fink



■ Linux publications and web sites

- Linux Online! - www.linux.org
- Linux Magazine - www.linux-mag.com
- LinuxPlanet - www.linuxplanet.com
- Linux Journal - www.linuxjournal.com





Linux is an Industry-wide Initiative





Comprehensive IBM Linux Investments

- **Application development**
 - Eclipse
 - WebSphere Studio
 - developerWorks
 - Speedstart
- **Enterprise Linux**
 - Linux Technology Center
 - Linux for Service Providers Lab
 - Global e-business Solutions Center
- **Porting and prototyping**
 - Linux Integration Center
 - Linux Application Center
 - Linux Centers of Competence
- **Comprehensive product enablement**
 - IBM @server platforms
 - IBM middleware
 - IGS services
 - On demand Linux services



Member of the Linux Community

ibm.com/linux/ltc

- **IBM well accepted by the Linux community**
 - 300+ developers world-wide
 - 70+ active Open Source projects
 - 80% of IBM's contributions are accepted
- **IBM engineers leading enterprise Linux focus**
 - Deeply involved in V2.5 of Linux kernel development
 - Motivated community to focus on addressing scalability and threading issues
 - Defect support for a set of core Linux packages
 - Led formation of Linux Test Project to validate reliability, robustness, and stability of Linux
 - Key participant and contributor to the "Carrier Grade Linux" project at the OSDL





OSDL Carrier Grade/Data Center Linux Project

www.osdl.org

- **Objectives:**
 - Provide value of Linux - speed, cost, flexibility
- **Roadmap to make Linux "carrier grade"**
 - "Harden" Linux to meet the stringent requirements for telecom network infrastructure solutions
 - High availability (zero downtime)
 - Rapid failover (switch in milliseconds)
 - Real-time performance (fast, predictable)
 - Online/concurrent service/update (no network disruption)
 - Robustness, scalability and performance validation
- **Working with partners to deliver complete solutions**
 - Open Source community
 - Linux distributors
 - Middleware and network application software vendors
 - Network equipment providers





IBM Linux Portal

ibm.com/linux

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Linux at IBM

Stable, secure, scalable and powerful, Linux is one of the cornerstones of the on demand operating environment. IBM is a recognized leader in the Linux community and the premier provider of [end-to-end Linux solutions](#): Linux-ready hardware, software and support. All in one place. On demand.

→ [Stay informed of all the latest developments with The Linux Line.](#)

Featured topics and solutions

- Linux and US Open**
Service winner! DB2 for Linux aces availability for US Open.
- Linux and PGA TOUR**
Linux Virtual services enables the PGA TOUR's TOURCast, a real-time online event service.
- Scott Hopkins On Linux**
Linux Clusters and grid mean options for industry.
- USA TODAY cover story**

Linux Hardware

- [Linux on @server](#)
- [IBM Linux Clusters](#)
- [Storage products](#)
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Software for Linux

- [IBM software](#)
- [Partner software](#)

Business Partners

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Featured Event

- [Linux Bootcamp at TECHXNY, NYC Sept 15 -18 2003](#)

Linux resource partners

- [Database Trends and Applications](#)
- [ePromag.com](#)

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Linux

- Tools and products
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More technologies

- Grid computing
- Java™ technology
- Open source projects
- Security
- Web architecture
- Web services

Write GnomeVFS modules

Learn how to use the GnomeVFS library to [extend GNOME](#), enabling drag-and-drop and other features across multiple protocols and file systems. (Articles)

- ➔ [Access USB using Java](#): Although interacting with hardware is not Java's main strength, two USB APIs for Linux -- jUSB and JSR-80 -- make it possible. (Articles)
- ➔ [Metaclass programming in Python, Part 2](#): Think inheritance is messy now? Try stirring metaclasses, metatypes, and magic methods into the mix. Despite the pitfalls, the benefits make it worthwhile. (Articles)
- ➔ [Roll your own graphs with Perl/Tk](#): Standard tools like gnuplot are fine for simple x-y graphs, but for more complicated data plotting needs, consider the unexpectedly chart-friendly Perl/Tk GUI toolkit. (Articles)
- ➔ [Manageability Services for Linux](#): [Download](#) this proof of concept demonstration technology from alphaWorks, and then learn how to use it to build grid services to manage Linux system resources. (Articles)
- ➔ [Compile Linux applications from source](#): Learn about shared libraries and get a handle on package management in this newest tutorial in the LPI certification prep series. (Education)

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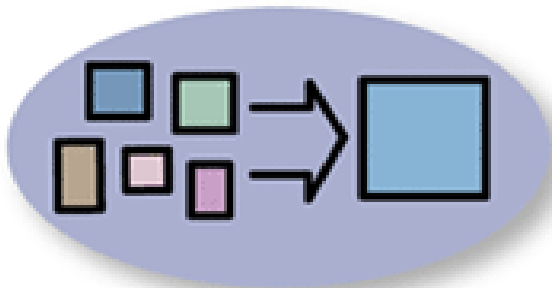
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your Linux App
NEW 4-CD set for 2003

Toolbox subscription
NEW CUSTOM CD OPTION

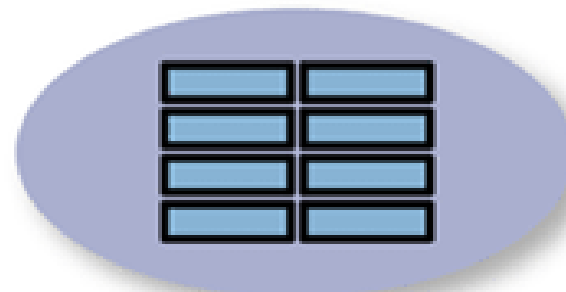


Linux Deployment on Servers

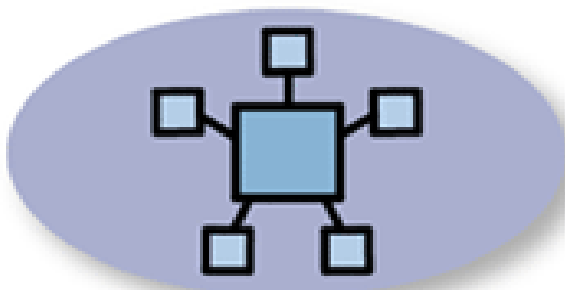
- **Workload Consolidation**



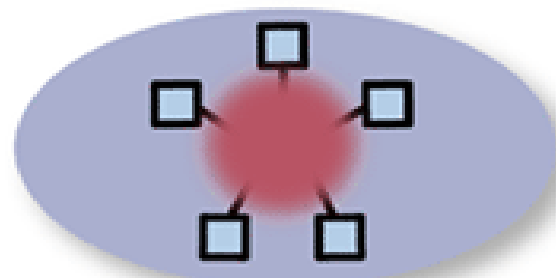
- **Linux Clusters**



- **Distributed Enterprise**



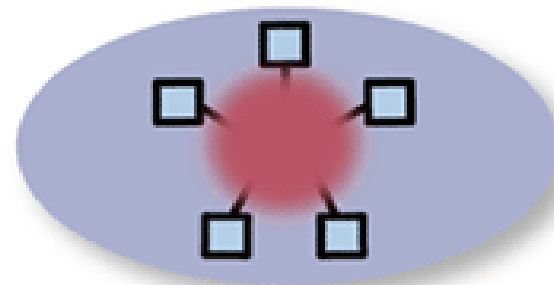
- **Infrastructure Solutions**





Infrastructure Solutions

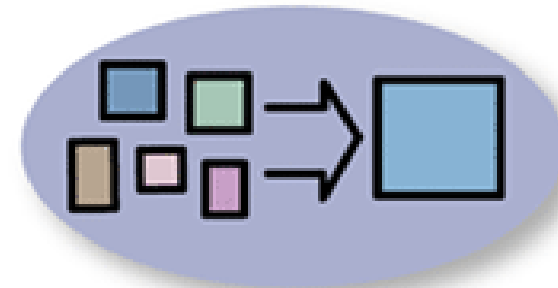
- **File and Print**
- **Web and Application**
- **Application development**
- **Content, Caching, Security**
- **Advantages:**
 - Low cost
 - Highly reliable
 - Turnkey
 - Rapid set-up





Workload Consolidation

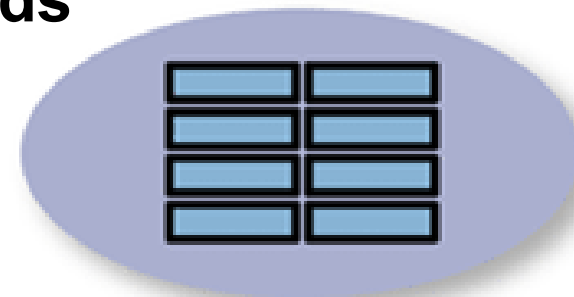
- **Replace many with few**
- **Optimize assets**
- **Advantages:**
 - Reduce costs
 - Virtualize servers
 - Share resources
 - Dynamically manage workloads





Linux Clusters

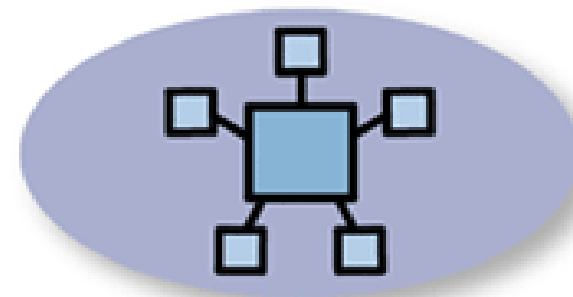
- **Computationally intensive workloads**
- **High performance computing**
- **Horizontal scalability**
- **Advantages:**
 - Supercomputing performance
 - Choice of architectures
 - Cluster software
 - Open Source - Beowulf
 - IBM Cluster Systems Manager
 - Many others





Distributed Enterprise

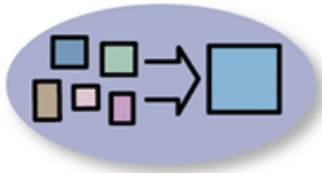
- **Point-of-sale**
- **Kiosk solutions**
- **Geographically dispersed**
- **Advantages:**
 - Low cost, small footprint
 - High reliability and stability
 - Secure
 - Easily replicated
 - Centrally managed





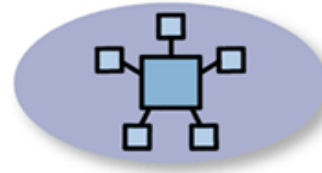
Government Customers are Deploying Linux Servers

Workload Consolidation



- **Regione Lazio - Italy**
- **US Department of Agriculture**
- **Union des Classes Moyennes, Belgium**
- **Fed. des Mutualités Socialistes**

Distributed Enterprise



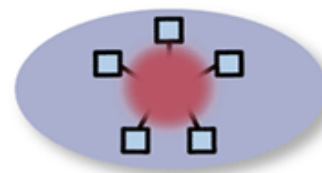
- **Instituto Electoral Federal - Mexico**
- **Thai Department of Education**
- **China Post**
- **Northern Territory Dept. of Education**

Linux Clusters



- **US NASA - Jet Propulsion Lab**
- **US Department of Energy**
- **BC Genome Sciences Center - Canada**
- **University of Pennsylvania**

Infrastructure Solutions



- **City of St. Louis, USA**
- **KDZV Hellweg, Sauerland - Germany**
- **City of Seattle, USA**
- **City of Orem, Utah, USA**
- **Dept. of Health and Human Services**



Linux in the Canadian Public Sector

- **Federal**
 - Department of National Defense
 - Herzberg Institute of Astrophysics
- **Alberta**
 - WCB Alberta
 - University of Calgary
- **BC**
 - BC Genome Sciences Center
- **Ontario**
 - Humber College
- **Saskatchewan**
 - University of Saskatchewan





Department of National Defense



- **Business Need:**
 - In order to decrease costs and improve time to market, DND sought a new platform and new tools for developing its training applications
 - DND needed a solution that would automate support for both Windows and Linux applications, eliminating the need to test manually for memory leaks and performance bottlenecks
- **Solution:**
 - Red Hat Linux on an IBM server as its development platform
 - Rational PurifyPlus for Windows and for Linux, which automatically scans code for memory leaks and possible performance bottlenecks
- **Benefits of the Solution:**
 - Rational PurifyPlus effectively cleans code and frees up the development staff to do other work
 - Checking new code for bugs now takes 30 percent less time



Herzberg Institute of Astrophysics Canadian Astronomy Data Centre

- **Business Need:**

- CADAC planned to develop the Canadian Virtual Observatory (CVO)
- The database is expected to start with a billion objects and grow by a billion objects per year for five years

- **Solution:**

- DB2 UDB Enterprise Edition Version 8 running on 10 IBM eServer xSeries 345 servers in a RedHat Linux 8.0 operating environment
- There are 300 astronomers from around the world that will use the system

- **Benefits of the Solution:**

- CAEC users can run queries on the more than one billion row database in less than a minute
- The xSeries servers provide a robust infrastructure to support the high capacity database





Workers Compensation Board of Alberta



■ **Business Need:**

- WCB needed to either increase the capacity of its IBM DB2 data warehouse solution
- Microsoft SQL Server considered as an alternative to DB2 on Linux, but determined that DB2 was more scalable and offered a lower-risk investment compared to SQL Server

■ **Solution:**

- Data warehouse solution moved to IBM DB2 Universal Database Workgroup Edition Red Hat Linux on a two-way Xeon 2.8 Ghz server
- DB2 is storing 400 MB and is serving 100 users
- Query Patroller used to manage track and manage queries against the DB2 data warehouse

■ **Benefits of the Solution:**

- Realized return on investment in just seven months
- DB2's "Shared Nothing Architecture" offers linear scalability as additional servers are added to the cluster
- The open-standards-based Linux operating system effectively positions it for the future



University of Calgary



■ **Business Need:**

- The university received a grant to research cryptography which requires highly complex calculations
- The infrastructure needed to offer high capacity on an open standards platform to support a large number of calculations, but also needed to be easy to manage and inexpensive to install

■ **Solution Implementation:**

- Computing infrastructure solution with the IBM eServer BladeCenter at its core
- Solution consists of an IBM eServer xSeries 345 server head node powering a 137 node BladeCenter cluster running Red Hat Linux

■ **Benefits of the Solution:**

- The IBM BladeCenter solution offers more computing processors, one-third less rack space, 20 percent less power and generating 30 percent less heat
- The IBM BladeCenter offers high quality systems management and deployment tools and works well with Linux



BC Genome Sciences Centre



- **Business Need:**
 - Needed a cost-effective and well-managed solution for Linux clustering
 - Due to very limited space for computing resources, GSC required a rack-optimized solution that was highly manageable at a rock bottom price
- **Solution:**
 - 100+ IBM xSeries servers in a cluster running Linux
 - Linux is a good solution for genome sequencing researchers, as most of the computational tools they use are available for Linux and the price and performance of the Linux clusters is terrific
 - Having access to a larger cluster with more computing power allows the researchers to tackle larger problems and advance their research
- **Benefits of the Solution:**
 - On April 12th, scientists at the Michael Smith Genome Sciences Centre completed the world's first genetic sequence of the coronavirus believed to be responsible for Severe Acute Respiratory Syndrome (SARS)
 - The GSC is now able to access and integrate the massive amounts of genomic data required for sequencing research



Humber College



- **Business Need:**

- Humber wanted to build a Web-based student registration program to better serve its students, and reduce the time and cost of student registration
- Core requirements included platform flexibility and scalability at a reasonable cost

- **Solution Implementation:**

- Developed using IBM WebSphere Studio Application Developer
- WebSphere Application Server for Windows is the portal to the registration system
- DB2 Linux is the database that contains all registration data
- DB2 for Linux, WebSphere Application Server and WebSphere Studio Application Developer are all running on Intel servers

- **Benefits of the Solution:**

- Humber College is now able to provide better service for its students and has reduced costs associated with the face-to-face and call center registration processes
- The use of the Red Hat Linux operating environment will reduce costs



University of Saskatchewan



- **Business Need:**
 - Research primarily in the area of bioinformatics, including both the development of parallelized software addressing biologically significant issues
 - Efficient queuing of hundreds to thousands of independent bioinformatics jobs varying in only input parameterization
- **Solution:**
 - Beowulf cluster
 - IBM xSeries 330 nodes
 - IBM xSeries 340 file and database servers using DB2
 - Ethernet communications network
- **Benefits of the Solution:**
 - Highly available clustering solution for research and student computing



Linux in the Canadian Private Sector

- **Mark's Work Warehouse**
- **GHY International**
- **Shell Canada**
- **MDS Proteomics**
- **Ritchie Brothers Auctioneers**
- **SITA**





Mark's Work Warehouse



- **Business Need:**
 - Mark's needed to update their point-of-sale environment to provide for new business applications and to remove an aging store server infrastructure
- **Solution:**
 - IBM SurePos 500 point-of-sale running Linux with a Java-based POS application from RETEK
 - Consolidated retail operations servers into the Calgary head office on Linux on xSeries integrated with the back-end iSeries system
- **Benefits of the Solution:**
 - Improved service levels significantly and reduced management costs
 - Allows for new applications in the stores and better data for management



GHY International



- **Business Need:**

- GHY had seven servers running a combination of Linux, Microsoft Windows, SCO Unix and OS/400
- GHY worked with IBM to identify requirements for a consolidated environment

- **Solution:**

- GHY leveraged the Linux, Windows and OS/400 virtualization capabilities of the IBM iSeries server to consolidate onto just three servers
- An iSeries 270 server supports the company's ERP application, the new Lotus Domino platform, and two Windows 2000 application servers
- An iSeries 820 server supports nine virtual Red Hat Linux 7.1 servers

- **Benefits of the Solution:**

- Improved service levels significantly and reduced management costs
- Security exposures have been eliminated and performance under the new implementation is estimated to be double that of the old environment
- GHY has achieved significant cost savings by adding seven Linux servers without the need for physical machines or associated administration efforts



Shell Canada



- **Business Need:**

- Recent activity on the eastern seaboard resulted in a requirement for additional compute capacity
- This led Shell Canada to consider alternate solutions for its Sun environment to ensure it achieves the optimal price/performance ratio

- **Solution:**

- The Linux operating system runs on the xSeries cluster and Shell Canada's internal Seismic Processing application runs on top of Linux
- Linux provides a robust, low cost operating system environment to Shell Canada to enable it to more cost effectively run its Seismic Processing

- **Benefits of the Solution:**

- This xSeries and Linux Red Hat solution provides Shell Canada with the same computing power for Seismic Processing as a comparable Sun Solaris solution at one third the price
- As requirements for capacity grow, Shell Canada is now positioned to grow this new, proven Linux environment



MDS Proteomics



■ Business Need:

- MDS Proteomics required greater analytical computing capability to determine the function of hundreds of genes and thousands of proteins monthly
- The company wanted to add these capabilities as a complement to established research facilities and systems

■ Solution:

- The MDS Proteomics supercomputing cluster ranks among the top nonmilitary systems in the world with the ability to perform more than 600 million calculations per second
 - Three 100-server clusters of IBM xSeries 330 systems running Linux
 - A network of IBM UNIX-based servers, including an IBM SP supercomputer and IBM pSeries servers
 - IBM DB2 Universal Database which provides a scalable relational data management system
 - An IBM Enterprise Storage Server (ESS)

■ Benefits of the Solution:

- Partnering with IBM Life Sciences, MDS Proteomics has created an integrated functional proteomics and drug discovery platform to reveal cellular pathways, identify novel targets and discover and advance the development of new therapeutic drugs and diagnostic products
- The IBM infrastructure solution has provided MDS Proteomics with a technology base that will meet the company's needs today and for the future.



Ritchie Brothers Auctioneers



- **Business Need:**

- Required an enterprise resource planning (ERP) solution that would capture the financial and operational data from each auction site around the world and transmit the data to the home office

- **Solution Implementation:**

- IBM DB2 UDB Workgroup Edition on IBM eServer xSeries 235 servers running Red Hat Linux
- Installed 31 xSeries servers - one server for each branch location

- **Benefits of the Solution:**

- The DB2 solution was 20 percent less expensive from a total cost of ownership standpoint
- Value in being able to standardize on one database to easily manage both its workgroup and enterprise applications
- Transmit extensive financial information from its operations in a more timely manner
- Greater stability and scalability attributes of the xSeries servers



SITA

SITA

Global information and communication solutions

- **Business Need:**

- SITA lacked a standard operating system, faced complex server management and had performance problems
- Standardize and consolidate its operating environment to improve performance, reduce costs and simplify management

- **Solution Implementation:**

- Four xSeries 335 servers are clustered with Linux Advanced Server Cluster to run SITA's Oracle database, functioning as the network interface to the company's IP network
- Twelve xSeries 345 servers house SITA's internal software application that monitors traffic control between airplanes and the control tower
- Conversations are recorded and stored on the Oracle database
- Four xSeries 360 servers provide the development and test environment.

- **Benefits of the Solution:**

- SITA was able to reduce the number of machines it managed by 50 percent - down to only 25 servers
- The smaller number of servers effected a savings of 40 percent in hardware maintenance efforts



Fact or Fiction: Some Myths About Linux

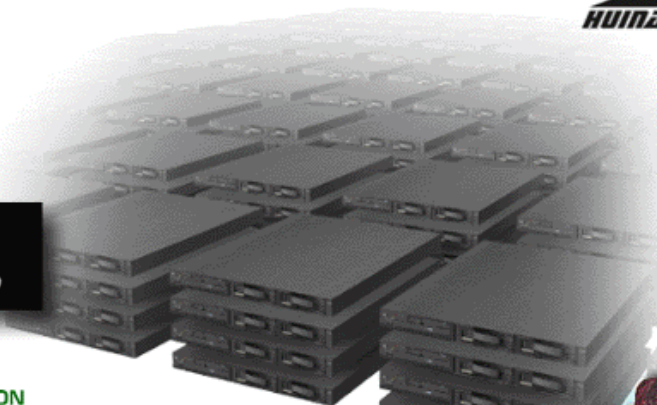
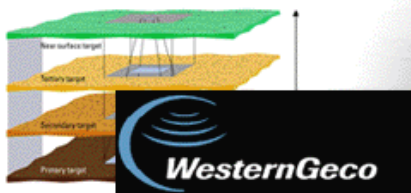
- **Linux does not scale**
- **Linux is not ready for the enterprise**
- **Linux skills are scarce**
- **Linux porting is difficult**
- **Linux lacks business applications**
- **Linux is not secure**



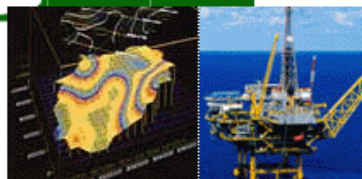
Fact: Linux sets Records in Horizontal Scalability, Rapidly Improving SMP ratios



Supercomputing
MHPCC
MALI HIGH PERFORMANCE
COMPUTING CENTER



Improving SMP
Scalability



Seismic Processing



Fact: Linux is Rock Solid in Many Mission-critical Applications

Retail / POS



Electronic
Commerce



The World's Online Marketplace™



Internet Service
Applications



Research



Fact: Linux skills are readily available

- **If your programmers know UNIX, they know Linux**
- **Linux is very popular in higher education**
- **Linux certification programs are available**
 - Linux Professional Institute
 - Red Hat
- **Linux education is widely available**
 - IBM Technical Training Services
- **IBM Linux Centres**
- **Many users groups provide Linux support - OCLUG**



"If your IT organization supports UNIX today, you are well positioned to support Linux. UNIX skilled programmers can easily and quickly develop into Linux programmers." Harry Roberts - SVP and CIO, Boscov's, Inc.



Fact: Porting to Linux is Easy

- **"Several large projects of moving UNIX-based applications from 100 kloc to 600 kloc have been completed. Most were completed in about 2 months and only required a small percentage (1% or so) of the code to be modified in any way."**
 - SoundView Technology Group, "Linux Momentum in Europe Appears to be Strong", June 2002
- **"Migrating UNIX web servers to Linux is one of the easiest migration scenarios in the industry."**
 - D.H. Brown, "Migrating Mail and Web Servers to Linux", August 2002
- **Porting tools available at ibm.com/developerWorks**





Fact: ISVs Adopting Linux





Fact: Linux is Architected for Security, Open Source Development Enhances It

- **The Open Source development process**
 - Darwinian -- structured/disciplined
 - Exposed vs. hidden
- **The US National Security Agency embracing Linux**
 - www.nsa.gov/selinux
- **IBM Linux security white papers**
 - ibm.com/linux/ltc/pubs
- **Linux security web site**
 - www.linuxsecurity.com



"I'm not proud, we really haven't done everything we could to protect our customers. Our products just aren't engineered for security."

Brian Valentine, Senior VP, Microsoft

"Security through obscurity is the motto of yesterday, the slogan of today is security through transparency."

Margareta Wold,
German Minister of
Economy and
Technology



IBM Hardware, Software, and Services

■ Hardware

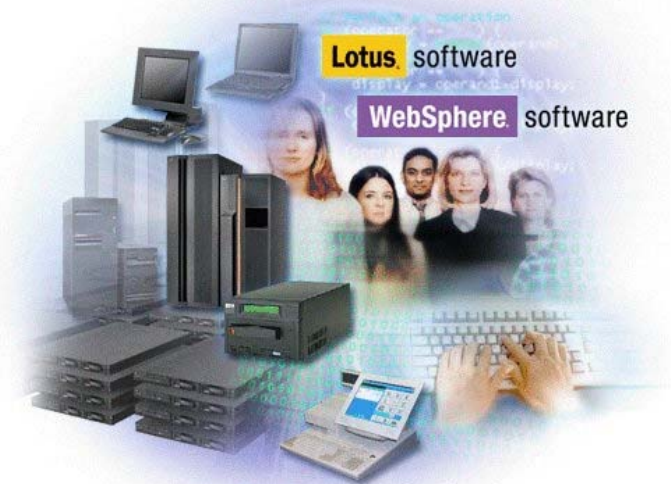
- All IBM @server platforms
- IBM TotalStorage solutions
- POS/Kiosk solutions

■ Software

- Over 200 software products available

■ Services

- Total solution approach
- Single point of contact
- Hardware, software and services
- Defect and usage support for Linux





IBM @server and TotalStorage Products

ibm.com/eserver/linux ibm.com/storage/linux

- **IBM @server zSeries**
 - Hundreds of Linux servers
 - Simplified management
 - Reduced cost of ownership
- **IBM @server iSeries**
 - Up to 31 Linux partitions
 - Integration with OS/400
 - Resource sharing and management
- **IBM @server pSeries**
 - Linux LPARs on Power4
 - Linux affinity in AIX 5L
 - Multi-platform flexibility
- **IBM @server xSeries**
 - X-architecture innovation
 - Operating system freedom of choice
 - Affordable, scalable, reliable
- **IBM @server Clusters**
 - Component integration
 - Speed to market
 - xSeries rack optimized servers
- **IBM @server Blades**
 - High density servers
 - Integrated shared components
- **IBM Intellistation**
 - High-end Linux workstations
- **IBM Retail Storage Solutions**
 - Point-of-sale
 - Kiosk solutions
- **IBM TotalStorage**
 - Enterprise Storage Server
 - FAST Storage
 - LTO and Magstar tape



IBM Software Products

ibm.com/software/linux

- **Solutions available across all product lines**
 - WebSphere - middleware, application server, e-business, and infrastructure software
 - DB2 - database software
 - Lotus - collaboration and messaging software
 - Tivoli - system and storage management software
 - Rational - software development tools
- **Over 200 IBM software products available today on Linux**
- **Scalable / modular / flexible / standards based / reliable**
- **eclipse.org: open is the world's new direction**
 - An open tool platform contributed by IBM to an independent open source organization





IBM Global Services for Linux

ibm.com/linux/services

- **High performance cluster integration services**
- **Enhance your e-business with Linux solutions**
- **SupportLine for Linux - unmatched 24x7 remote support**
 - Fast and accurate problem resolution
 - Helpful, skilled IBM services specialists to supplement your internal staff
 - Electronic support and problem submission that saves you time and allows you to track open support issues
- **Middleware enablement services for Linux**
- **IBM e-business Hosting**
- **IBM Technical Training Services**



Linux: Ready for the Enterprise

- **Reduces customer costs**
- **Increases freedom of choice**
- **Fosters innovation**
- **Promotes a culture of open standards**
- **Rewrites the rules for operating systems**

Jim Elliott, Advocate

IBM @server Strategic Initiatives

IBM Canada Ltd.

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