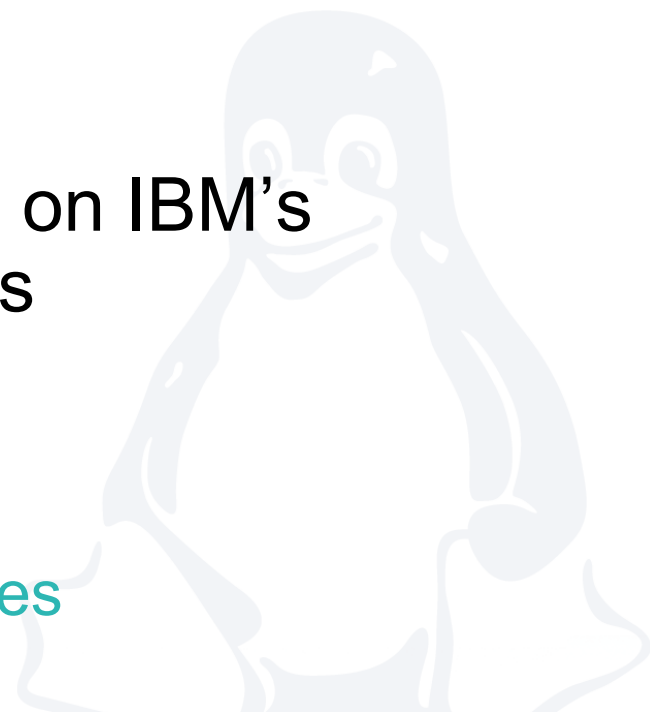




| Linux @ IBM

IBM, Linux and zSeries: An Update on IBM's Linux Strategy and Linux on zSeries

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

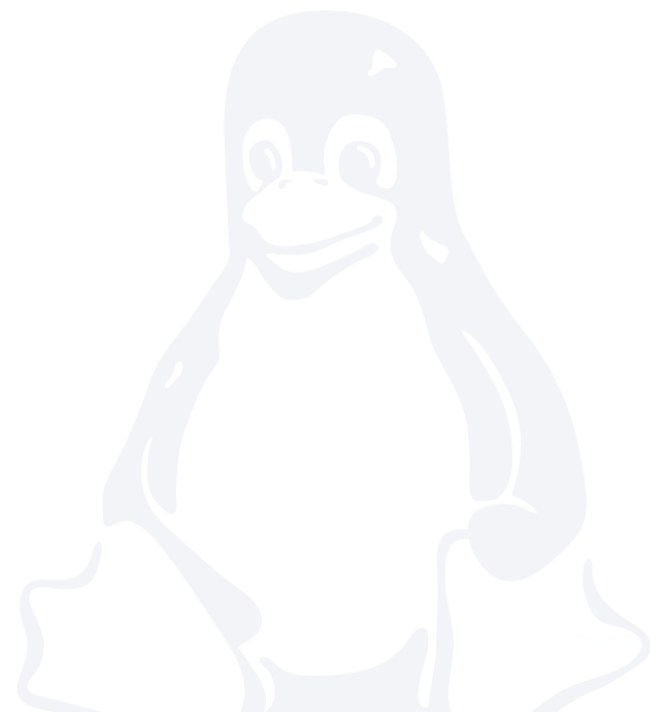




| Linux @ IBM

IBM's Linux Strategy

ibm.com/linux





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

“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





Open Source Software

www.opensource.org



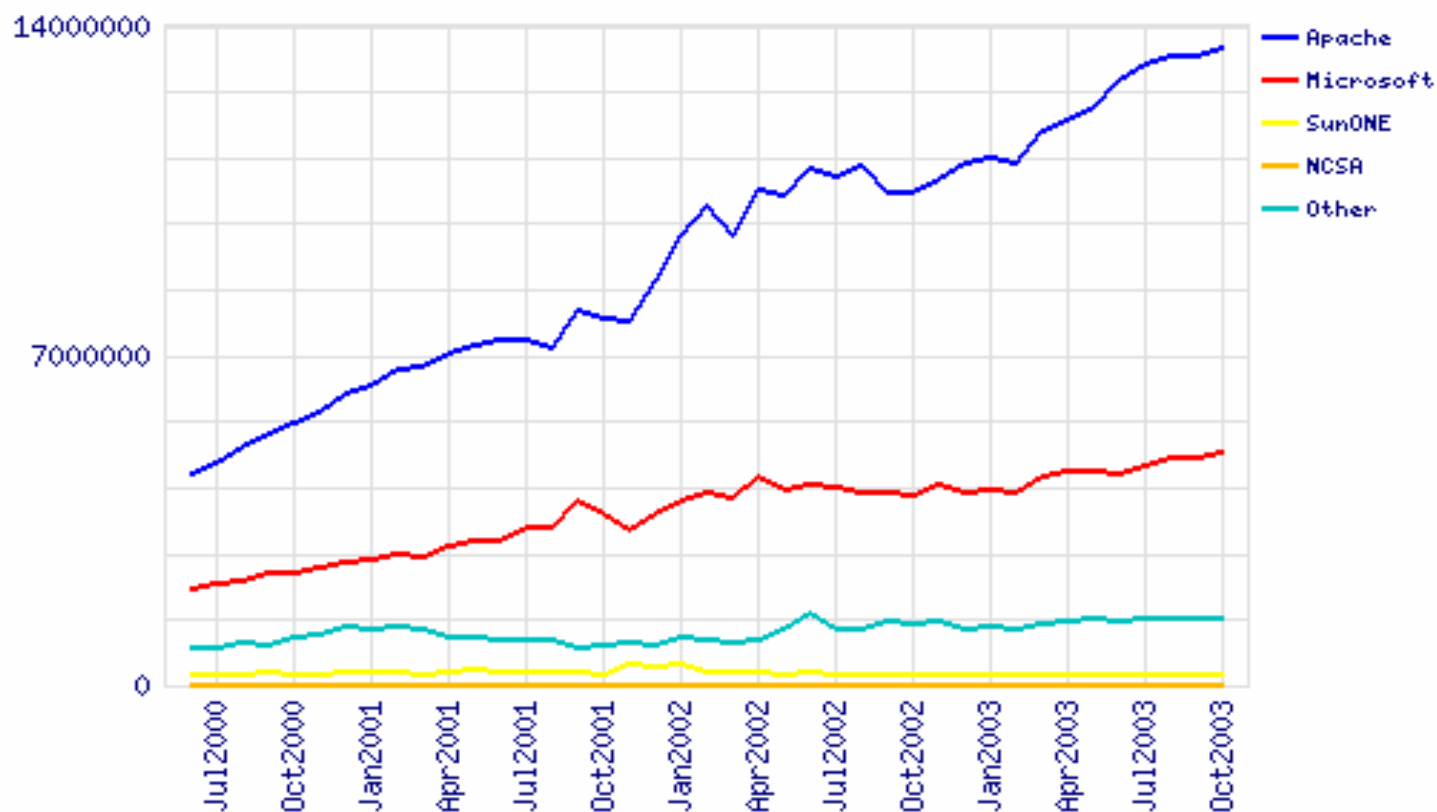
- **What is Open Source Software?**
 - Community develops, debugs, maintains
 - Generally high quality, high performance software
 - The "classic" licenses, GPL, LGPL, BSD, MIT, and Mozilla
 - Open Source Initiative now approves 46 licenses
 - Business models
- **Why does IBM consider it important?**
 - 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





Apache usage

Totals for active servers across all domains
June 2000 - October 2003

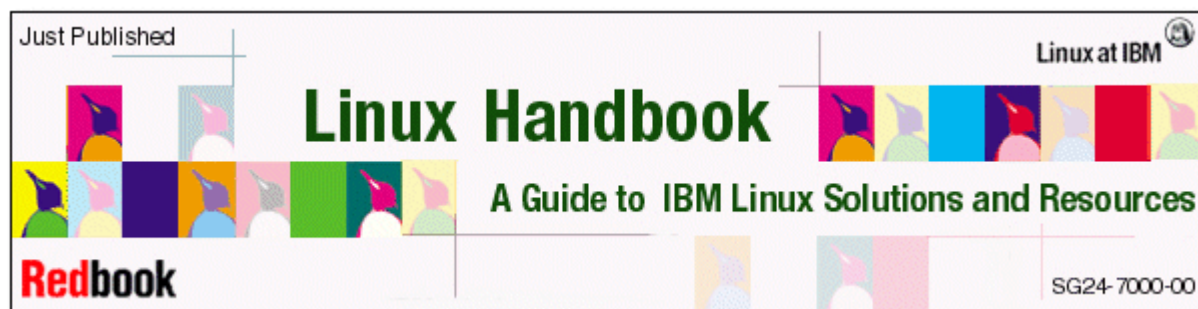


Source: news.netcraft.com



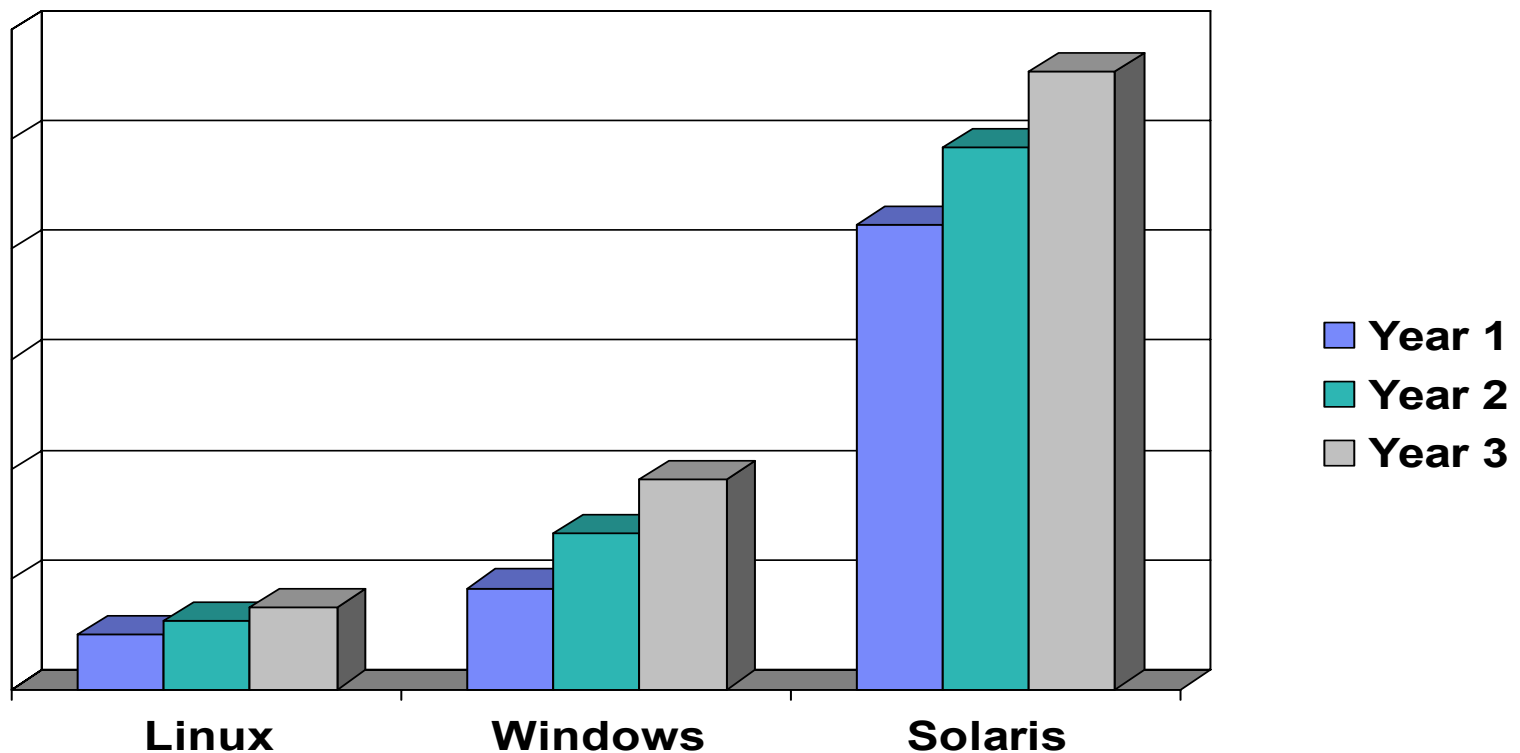
Sources of information

- IBM Redbooks Linux Portal – [*www.ibm.com/redbooks/portals/Linux*](http://www.ibm.com/redbooks/portals/Linux)
- Linux Online! - [*www.linux.org*](http://www.linux.org)
- Linux Magazine - [*www.linux-mag.com*](http://www.linux-mag.com)
- LinuxPlanet - [*www.linuxplanet.com*](http://www.linuxplanet.com)
- Linux Journal - [*www.linuxjournal.com*](http://www.linuxjournal.com)





Linux for business: It all started with cost benefits



Based on Web deployment experiences of 14 customers
Source - Robert Frances Group - July 2002
www.ibm.com/linux/RFG-LinuxTCO-vFINAL-Jul2002.pdf

but cost alone is not enough...



OSS/Linux strengths support key customer needs

■ Business needs

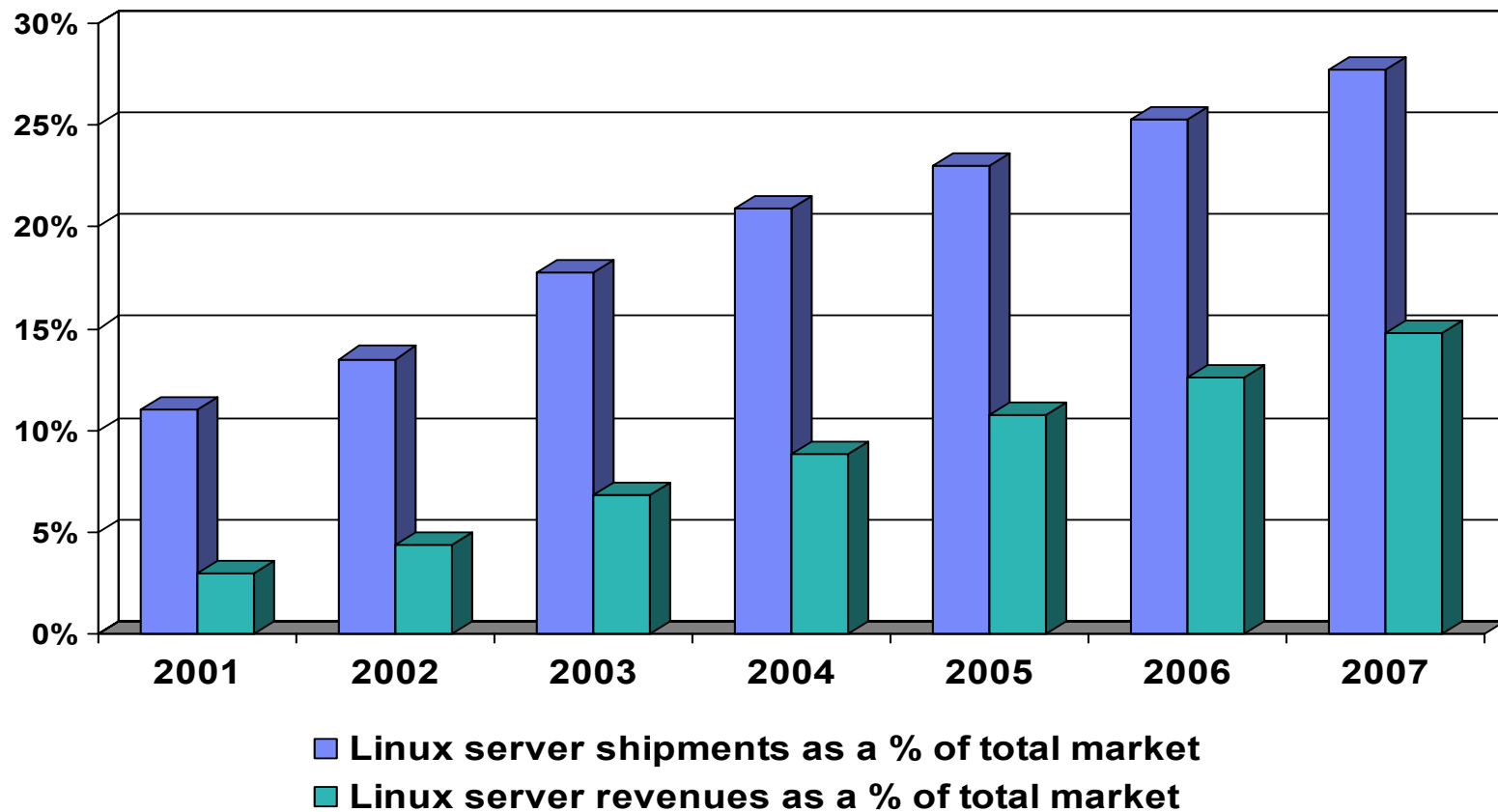
- Address current budget challenges
- Enhance security and privacy
- Improve collaboration of people and organizations
- Shorten cycle time of business and IT projects
- Prepare to address uncertain future needs
- Manage costs and reduce risks over time

■ OSS/Linux strengths

- Low acquisition and lifecycle costs
- Open source permits independent validation
- Open standards enable interoperation
- Application availability and scalability
- OSS model relies on user energy to direct evolution
- Platform stability and lack of “software monoculture”



Linux adoption rates around the world



Source: IDC Server Market Quarterly Forecast, April 2003

Note: Does not include servers running downloaded versions of Linux



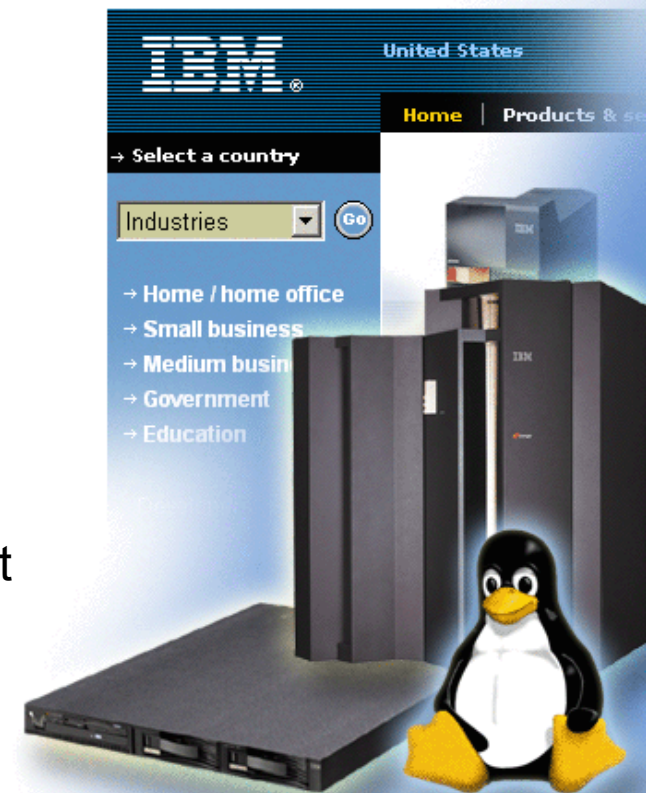
Linux is an industry-wide initiative





IBM uses Linux extensively

- **1800+ production servers world-wide**
 - excludes Research and Development !
- **A partial list of our internal Linux projects:**
 - Microelectronics EDGE Application
 - Intranet forums
 - IBM's On Demand Workplace development
 - Security assessments
 - e-mail anti-virus scanners
 - Operations: e-hosting and network management
 - IBM Standard Software Installer (ISSI)
 - Microelectronics 300mm wafer manufacturing
 - Manufacturing line Kiosks





IBM sports infrastructure

- **IBM hosts international sports events on Linux servers**
 - US PGA Tour
 - Tennis: US Open, Wimbledon, Roland Garros, Australian Open
- **Web serving on-demand**
 - Delivery hosted by IBM Global Services
- **Linux provides:**
 - Ability to handle very high traffic during live events; high availability; flexible, cost-efficient platform for hosted services





IBM 300mm wafer facility

■ Background :

- US\$2.9BN 140 000 sq foot facility
- Largest single investment in IBM's history
- Largest private investment in NY state's history

■ Challenge :

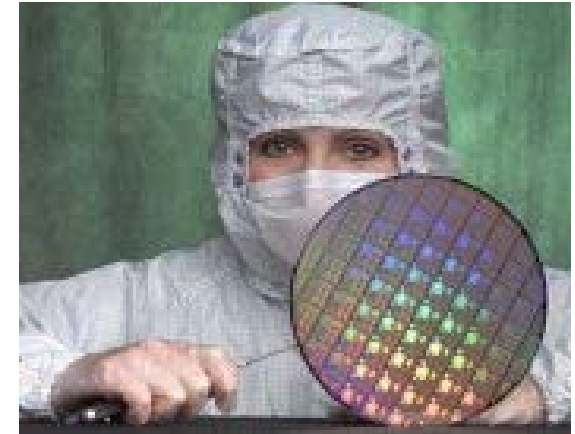
- 60 x 60 x 24 x 365 automation
- 300 machines in constant communication
- Ten fold more complex than normal manufacturing

■ The evaluation :

- 90 day test of 3 machines
 - Windows - degradation in 6-7 days + outages in 10
 - Linux - no issues left it running for 5 months

■ The proof :

- Not one single failure to date (18 months)



Perry Hartswick
IBM
Manager of
300mm
Systems

"... just for fun, we kept the Linux experiment running to see what would happen. We finally shut it off after 5 months, and it was still running like a clock."



IBM's On Demand Workplace

- w3.ibm.com
- Knowledge management
- Content collaboration
- e-Learning
- Employee self service

The screenshot shows the IBM w3 On Demand Workplace interface. At the top, a banner reads "Welcome to IBM's On Demand Workplace" with navigation links for BluePages, Search, HelpNow, and Feedback. Below this, a date and user greeting "14 Oct 2003, Hello Jim Elliott" are displayed, along with links for Edit Page Layout, Profile Settings, Sign Out, and Help. The main content area is divided into several sections. On the left, a sidebar contains a "w3 Home" menu with links to News, Sam's w3 Pages, About IBM, and About w3. Below this is an "ESSENTIAL LINKS" section with links to IBM Canada Intranet (OnICE), IBM Global Campus, IBM SiteServ, IBM Standard Software Installer, IBM Travel, Req/Cat, Team Central, and Solution Assurance. The main content area features a "NEWS" section with a large headline "all storage is local with IBM TotalStorage" and a "read" link. Below this, there are "Top Stories" and "News About IBM" sections. The "Top Stories" section includes two articles: "All-IBM solution ensures customer satisfaction throughout Hilton chain" and "IBM to report 2003 third-quarter results". The "News About IBM" section includes three articles: "Citrix, IBM cozy up on systems integration", "Judge blocks bid to use IBM data in cancer suit", and "IBM unveils data storage management system". On the right side of the main content area, there is a "On Demand THE NEW AGENDA" section with a "Webcast" and a "Whirlpool" link. Below this is a "SEARCH" section with a search bar and a "GO" button. At the bottom of the search section, there is an "Advanced Search" link and a "Search Experts and Expertise with Persona" link.

w3 Welcome to IBM's On Demand Workplace

BluePages Search HelpNow Feedback

14 Oct 2003, Hello Jim Elliott Edit Page Layout Profile Settings Sign Out Help

NEWS

all storage is local
with IBM TotalStorage
[read]

Top Stories

All-IBM solution ensures customer satisfaction throughout Hilton chain
The Hilton client team hammered out an Integrated Technology Services deal and added software, hardware, financing and services to it. [Selling for IBM] [read]

IBM to report 2003 third-quarter results
IBM senior vice president and chief financial officer John Joyce's address to financial analysts will be presented here [read]

Brazil agrees: Linux
Brazil joins growing number of countries adopting open standards [Americas]

News About IBM

Citrix, IBM cozy up on systems integration
Integration with WebSphere [CRN]

Judge blocks bid to use IBM data in cancer suit
Judge rules list "irrelevant" [The Wall Street Journal]

IBM unveils data storage management system
Storage Tank: IBM first, others soon [Forbes]

IBM looks within for security push

On Demand
THE NEW AGENDA

Webcast:
Making on demand real for customers

Whirlpool:
Productivity up 46%

→ RESOURCES

SEARCH

BluePages w3
Persona Forums
News ibm.com

GO

Advanced Search
Search Experts and Expertise with Persona



Three main types of Linux usage

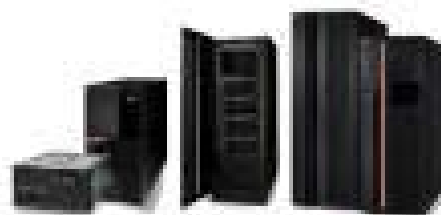
- **Desktop**



- **Embedded systems**

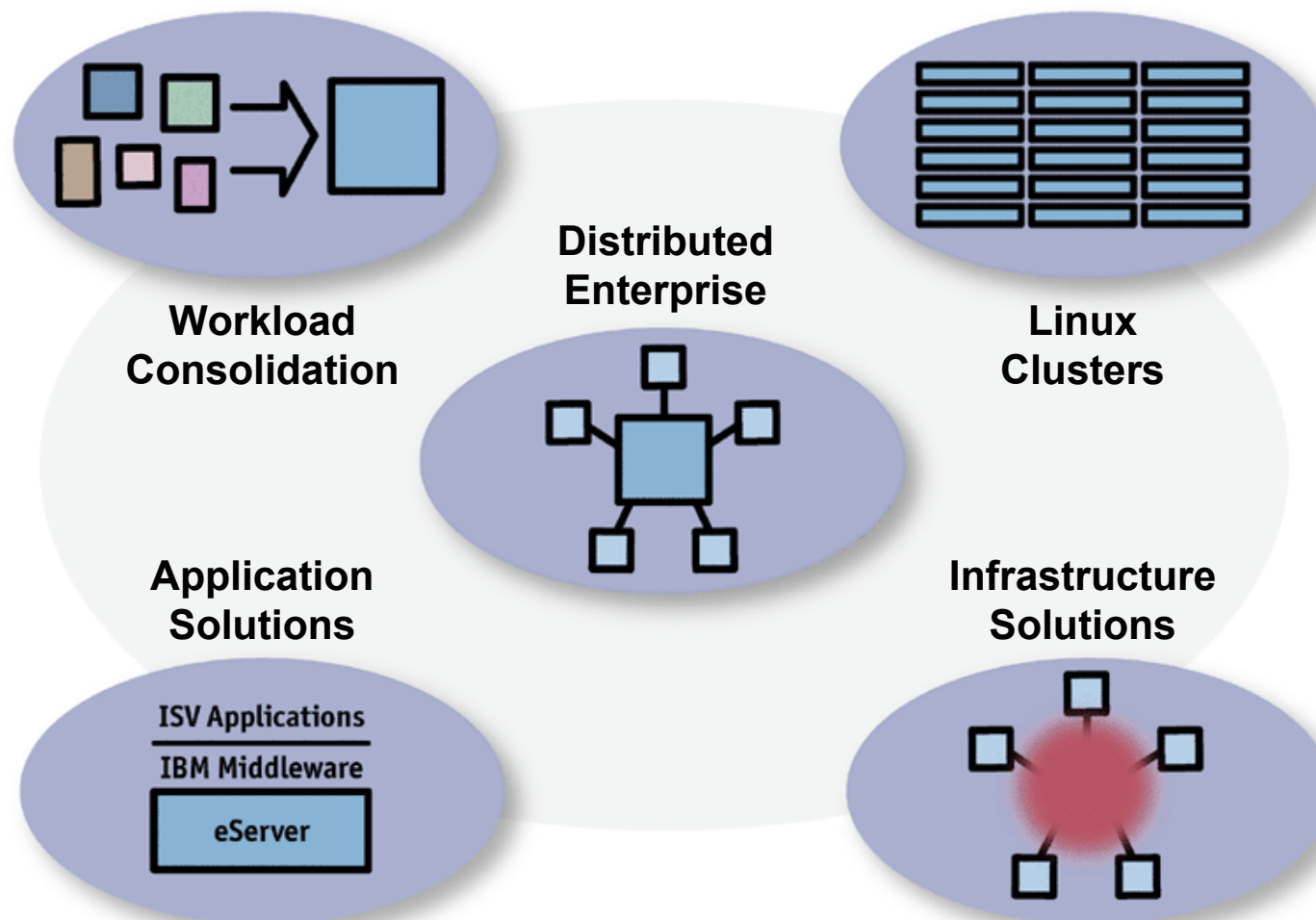


- **Servers**





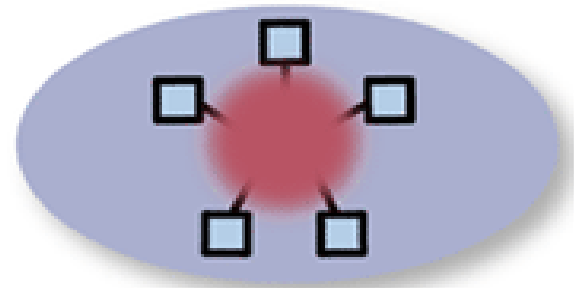
Linux deployment on servers





Infrastructure solutions

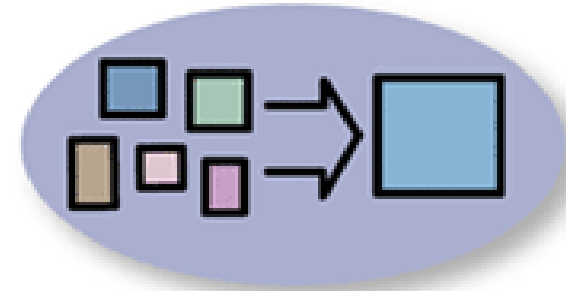
- **File and print**
- **Web and application**
- **Application development**
- **Content, caching, security**
- **Advantages:**
 - Low cost
 - Highly reliable
 - Turnkey
 - Rapid set-up





Workload consolidation

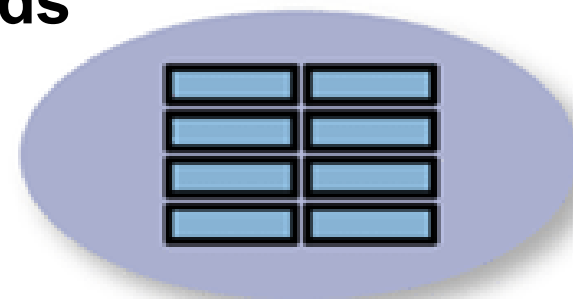
- **Replace many with few**
- **Optimize assets**
- **Advantages:**
 - Reduce costs
 - Virtualize servers
 - Share resources
 - Dynamically manage workloads





Linux clusters

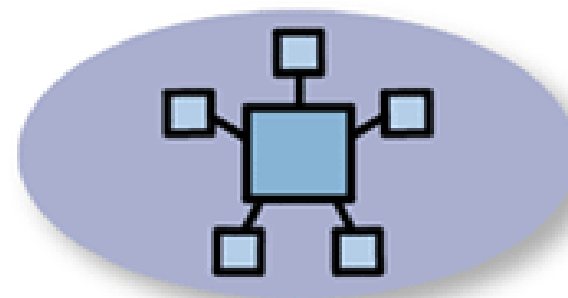
- **Computationally intensive workloads**
- **High performance computing**
- **Horizontal scalability**
- **Advantages:**
 - Supercomputing performance
 - Choice of architectures
 - Cluster software
 - Open Source - Beowulf
 - IBM Cluster Systems Manager
 - Many others





Distributed enterprise

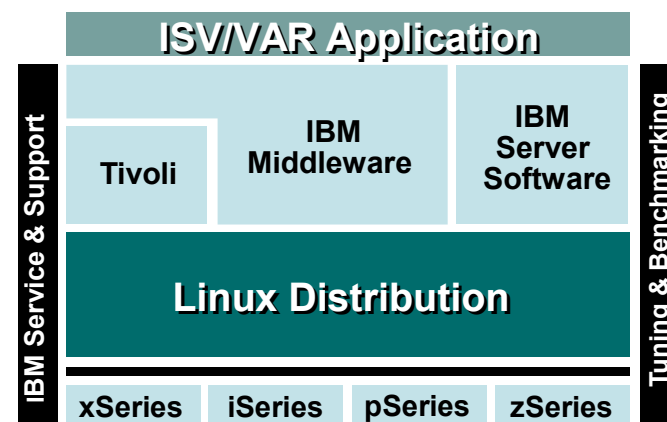
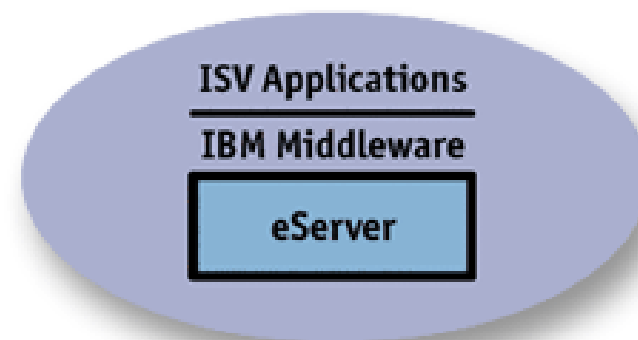
- **Point-of-sale**
- **Kiosk solutions**
- **Geographically dispersed**
- **Advantages:**
 - Low cost, small footprint
 - High reliability and stability
 - Secure
 - Easily replicated
 - Centrally managed





Application solutions

- **IBM and ISV solutions**
- **e-business initiatives**
- **Industry applications**
- **Leverage ISV expertise**
- **Advantages:**
 - Bundled @server / IBM middleware / ISV application
 - Optimized solutions
 - Reduced implementation time





Fact or fiction: Some myths about Linux

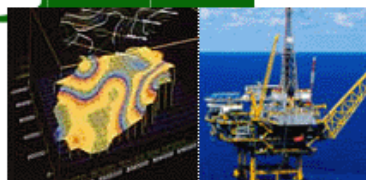
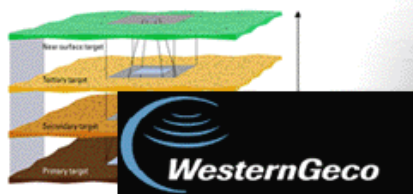
- **Linux does not scale**
- **Linux is not ready for the enterprise**
- **Linux skills are scarce**
- **Linux porting is difficult**
- **Linux lacks business applications**
- **Linux is not secure**



Fact: Linux sets records in horizontal scalability,
rapidly improving SMP ratios



Supercomputing
MHPCC
MAUI 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**



"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**



27





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**
 - www.nsa.gov/selinux
- **Linux security web site**
 - www.linuxsecurity.com
- **Common criteria certification**
 - SuSE Linux Enterprise Server 8 certified at the EAL2+ plus level
 - Red Hat Enterprise Linux 3 undergoing evaluation at EAL2

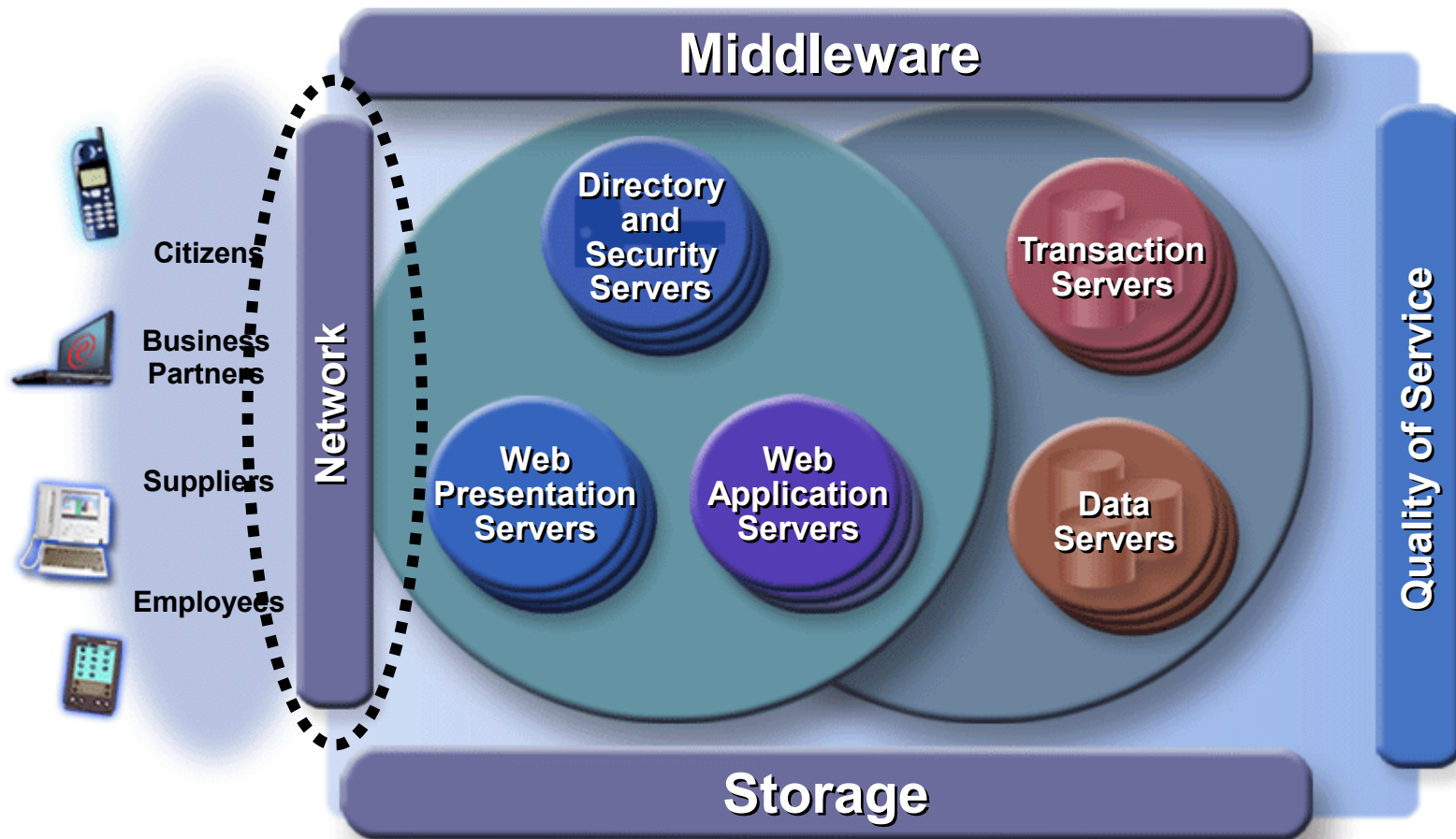


"Security through obscurity is the motto of yesterday, the slogan of today is security through transparency."

Margareta Wold,
German Minister of
Economy and
Technology

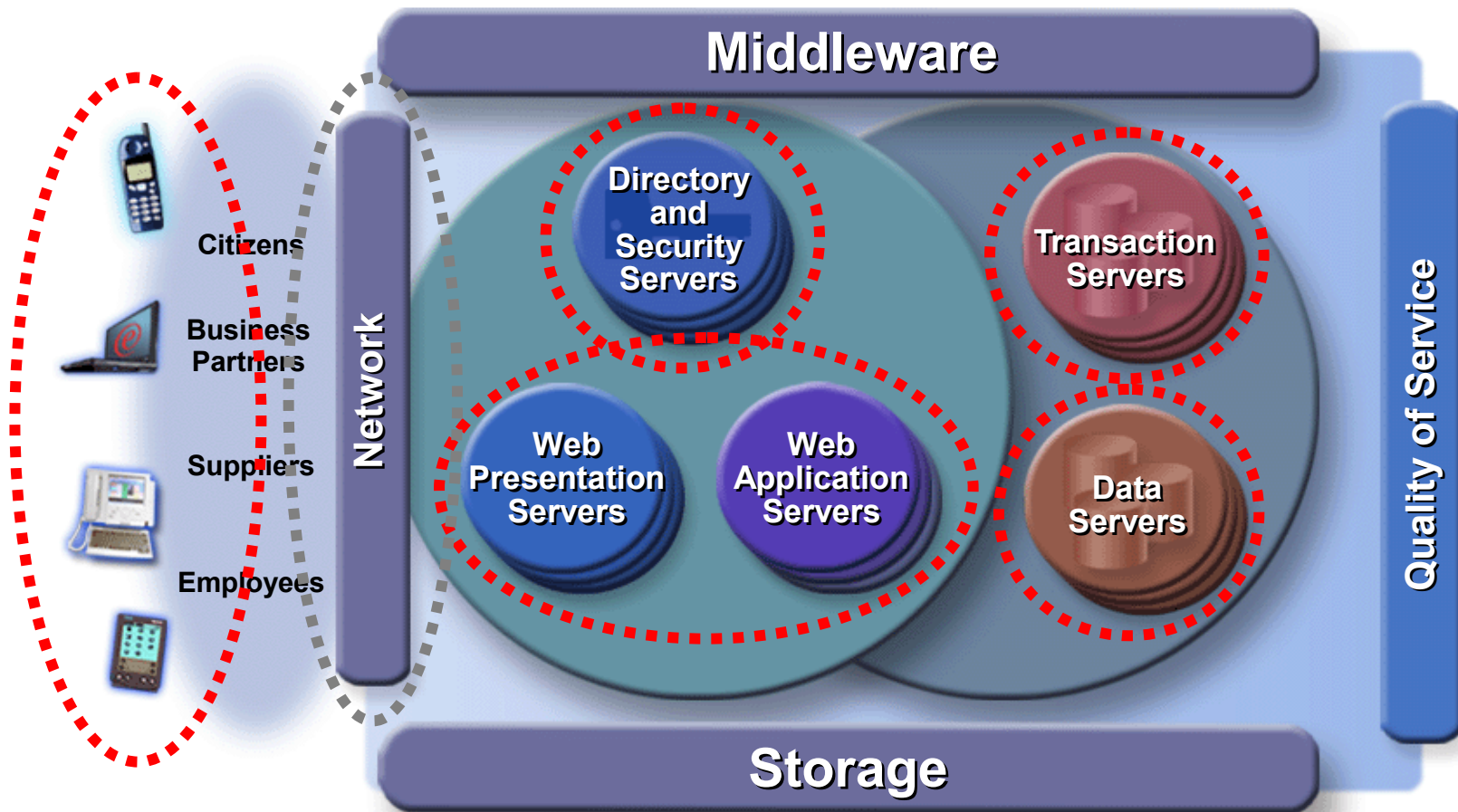


“Traditional” view of Linux fit





Linux fits everywhere!





Comprehensive IBM Linux investments





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 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

IBM

Home | Products & services | Support & downloads | My account

→ Select a country

Linux at IBM

Solutions
Industries
Medium business
Developers
Pervasive
PartnerWorld Linux Lens
Education
Geographies
Downloads
Events
Services
News
Case Studies
Linux links
Archive
What's New

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 PGA TOUR**
Linux Virtual services enables the PGA TOUR's TOURCast, a real-time online event service
- Lotus Linux desktop products emerge**
Lotus now provides collaboration on the Linux desktop
- USA TODAY cover story**
Linux took on Microsoft and won big in Munich

Linux Hardware

- [Linux on @server](#)
- [IBM Linux Clusters](#)
- [Storage products](#)
- [Personal Systems](#)

Software for Linux

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

Featured Event

- [Linux World Conference & Expo Frankfurt - October 27-29, 2003](#)

Linux resource partners

- [Database Trends and Applications](#)

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Build a router on Linux

Follow along with internetworking specialists Dominique Cimafranca and Rex Young as they [set up Zebra](#), software that emulates Cisco routers on Linux. (Articles)

- [Build grid apps with PEG](#): Take this free tutorial to learn about Python Extensions for the Grid (PEG), a suite of Python interfaces to existing grid support libraries and systems. (Education)
- [Crucial Linux details](#): Learn the ins and outs of using USB devices, setting up secure shell (ssh), and using and configuring NFS servers and clients in the latest LPI certification prep tutorial. (Education)
- [Build Python grid apps with Globus](#): Want to use Python as an interface to the grid? In this tutorial, learn how to build grid applications using the pyGlobus commodity kit with the Globus Toolkit. (Education)
- [Meet the new kernel](#): The new stable kernel promises faster, more scalable, and more reliable performance across more platforms. Look at some of the big and small changes to come in Linux 2.6. (Articles)
- [Boot faster](#): Learn how to start independent services in parallel to avoid the one-at-a-time sequence that typically bogs down the Linux boot process. (Articles)

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- [Tutorials](#)
- [Software Evaluation Kit](#)
- [CDs and downloads](#)
- [Submit content](#)
- [IBM Redbooks](#)
- [developerWorks journal](#)
- [IBM developers store \(U.S. only\)](#)

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IBM hardware for Linux

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 Store Solutions**
 - Point-of-sale
 - Kiosk solutions
- **IBM TotalStorage**
 - Enterprise Storage Server
 - FASTT Storage
 - LTO and Magstar tape



IBM software for Linux

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**
- **Linux editions of software products are available the same day as all other platforms**
- **Primary software solutions to be available on Linux**



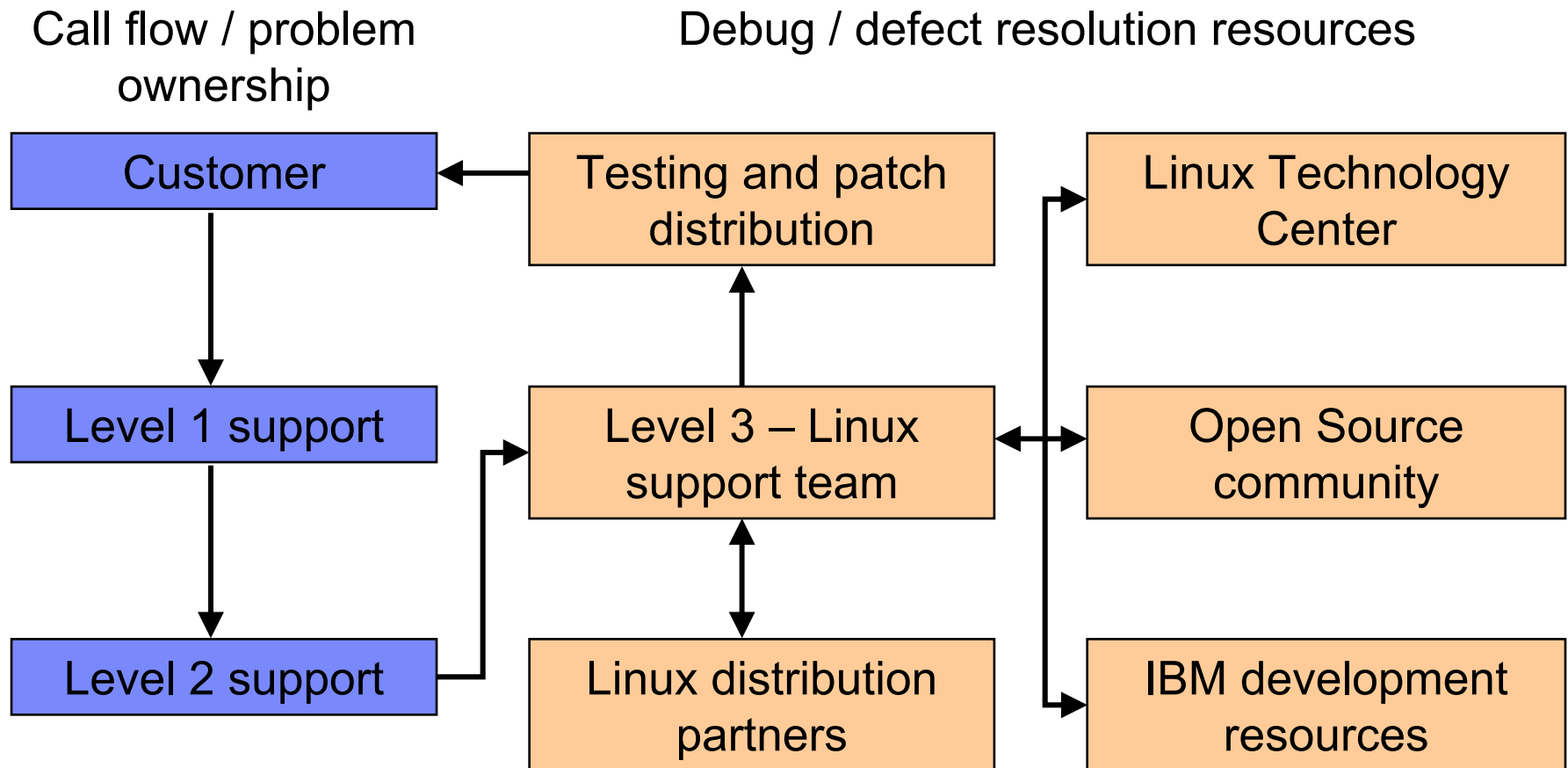
IBM Global Services for Linux

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**



IBM support structure for Linux





IBM alliances with Linux distribution partners

■ Red Hat

- Customers may purchase the full suite of Red Hat products from IGS
- Red Hat Enterprise Linux 3
www.redhat.com/software/rhel



■ SuSE

- Customers may purchase SLES from IGS
- SuSE Linux Enterprise Server 8
www.suse.com/us/business/products/server/sles



- **Cross-platform support of the IBM @server family for either Red Hat or SuSE distributions**
- **Customers can obtain remote technical support from IBM for Red Hat or SuSE**



| Linux @ IBM

Linux on IBM @server zSeries

ibm.com/zseries/linux





Linus Torvalds on Linux and IBM

San Jose Mercury News - July 4, 2004

- **Q: Did it surprise you that IBM, this big giant company, embraced Linux?**
- **A: I always thought IBM was interesting. Early on in 1998 and 1999, a lot of people were going through the motions of embracing Linux. They would mention it in a press release. But IBM always followed through. Because I was never interested in the commercial market, I never found fault with how people used Linux there. *I enjoyed that IBM started porting Linux to the S/390, found that hugely amusing. I thought, OK, somebody has done a few too many drugs. But it ended up being a master stroke.* The people who started it just did it because they found it interesting. It ended up working out really well.**



What is Linux on zSeries?

- **A native zSeries operating environment**
 - Pure Linux, an ASCII environment
 - Exploits IBM zSeries hardware
 - Linux for S/390 - 32-bit
 - Linux for zSeries - 64-bit
 - Not a unique version of Linux
- **zSeries application sourcing strategy**
 - The IBM commitment to z/OS is not affected by this Linux strategy
 - zSeries customers are offered additional opportunities to leverage their investments through Linux
 - New doors are opening for zSeries customers to bring Linux-centric workloads to the platform





Why Linux on zSeries?

1. **Increased solutions through Linux application portfolio**
2. **Large number of highly skilled programmers familiar with Linux**
3. **Integrated business solutions**
 - Data richness from zSeries
 - Wide range of Linux applications
4. **Industrial strength environment**
 - Flexibility and openness of Linux
 - Qualities of service of zSeries
5. **Unique ability to easily consolidate large number of servers**





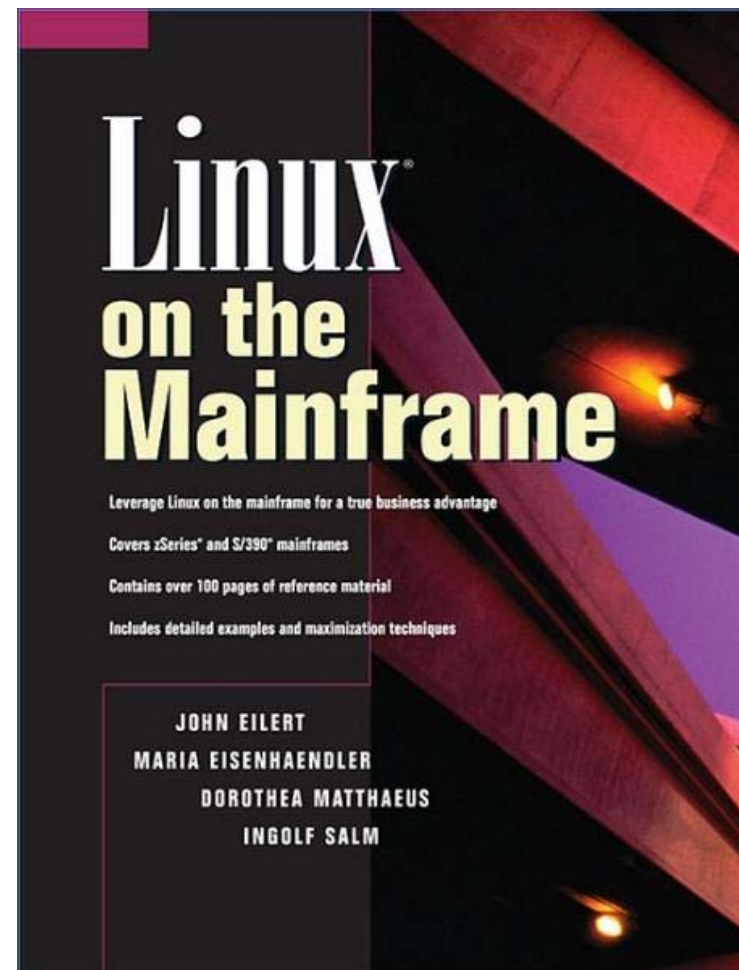
What is different about Linux on zSeries?

- **Access to zSeries specific hardware**
 - Crypto support – PCICA, CPA
 - Traditional and Open I/O subsystems
 - Disk – ECKD or SCSI (on a SAN)
 - Tape – Magstar or LTO
 - OSA-Express for very high speed communication between TPF, z/OS and Linux
 - HiperSockets for ultra-high speed communication between z/OS and Linux
- **z/VM aware**
 - Enhanced performance
 - System management tools



Suggested reading

- **Linux on the Mainframe**
 - Chapters
 - Linux on the Mainframe - an Introduction
 - Planning for Linux
 - Is Linux on the Mainframe for Me?
 - Making the Most of Linux on the Mainframe
 - Running Applications
 - Publisher: Prentice Hall
 - ISBN: 013101415
- **IBM Redbooks**
 - *ibm.com/redbooks*





Discrete vs. consolidated

Discrete servers	Consolidated solution
Larger support staffs are required to maintain servers and network gear	Smaller support staffs are required to maintain 1 or 2 servers
Disaster recovery very difficult for large / complex server farms	Disaster recovery very easy for virtual server farms
Lower hardware reliability	Higher hardware reliability
Software resource must be duplicated for each server	Software resource shared among virtual servers
Higher software application cost due to more hardware processors	Lower software application cost due to fewer hardware processors
Failover is provided by additional server hardware in "hot standby mode"	Failover is provided by virtual server in "hot standby mode"
Discrete servers may require significant amounts of power and floor space	Server and disk storage subsystem require minimal power and floor space



Operating environments for Linux on zSeries

■ **Basic mode**

- An entire processor complex devoted to Linux
 - Not practical in most cases, not available on z990

■ **Logical Partitions (LPAR)**

- Hardware partitioning enabling up to 30 “logical partitions” each of which runs a separate operating system – traditional operating systems and Linux

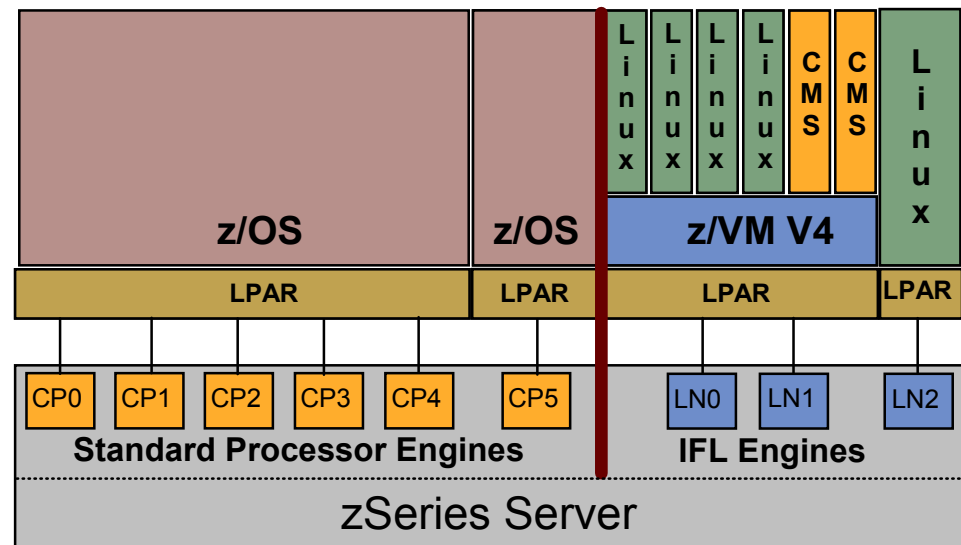
■ **Virtual Partitions (z/VM)**

- zSeries virtualization technology
- Support for large numbers of Linux images with rich system management capabilities
- Very flexible, great for server consolidation
- Best RAS characteristics



zSeries Integrated Facility for Linux

- **Additional engines dedicated to Linux workloads**
 - Supports z/VM V4, Linux for S/390 and Linux for zSeries
 - Available on 9672 G5/G6, Multiprise 3000 and zSeries
 - IFLs on "sub-uni" systems run at full speed!
- **Traditional zSeries software charges unaffected**
 - IBM zSeries and S/390 software
 - Independent Software Vendor products
- **Linux and z/VM charged only against the IFLs**





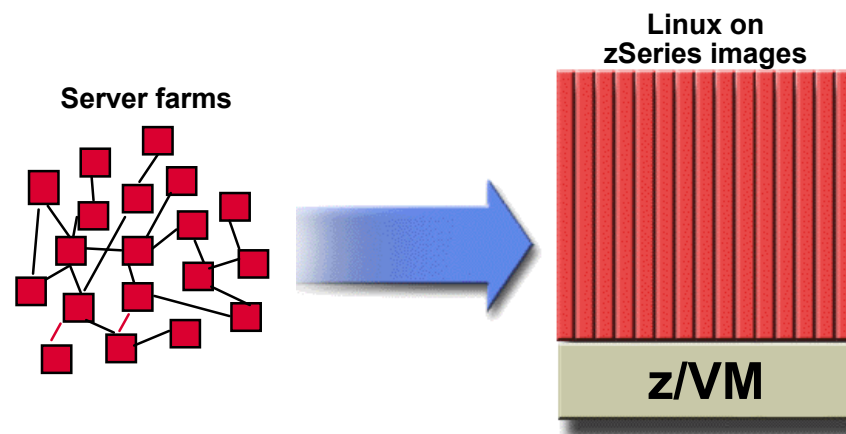
z/VM Version 4

- **Combination of hardware, firmware, and software**
 - Over 35 years of development experience
- **Supports ten to hundreds of images, depending on workload**
- **Supports Linux for S/390 guests on 9672 G5/G6 and Multiprise 3000**
- **Supports Linux for S/390 and Linux for zSeries guests concurrently on zSeries**
- **z/Architecture exploitation**
- **Extensive systems management software from IBM and ISVs**
 - Computer Associates
 - BMC
 - Linuxcare



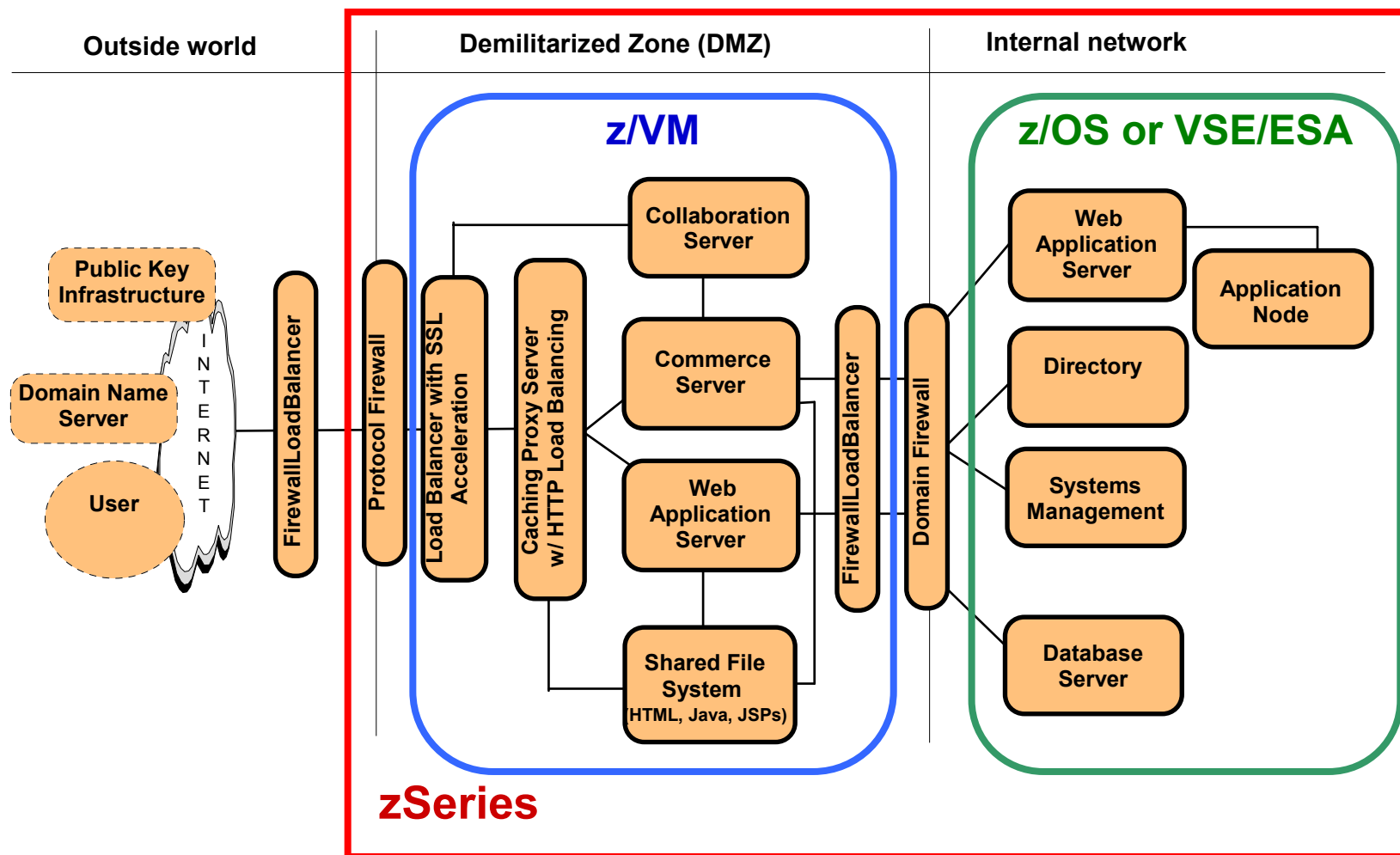
The value of z/VM for Linux

- **Enhanced performance, growth and scalability**
 - Server consolidation enables horizontal growth
 - N-tier architecture on two tiers of hardware
 - Extensive support for sharing resources
 - Virtual networking
 - Effective isolation of Linux images, if required
- **Increased productivity**
 - Development and testing
 - Production support
- **Improved operations**
 - Backup and recovery
 - Command and control





Application serving with Linux on zSeries





Linux on zSeries for developers

- **developerWorks**
 - Dedicated "Linux Zone"
 - ibm.com/developerworks/linux
- **Linux Application Tools**
 - ibm.com/zseries/os/linux/ldt/
- **zSeries Linux Community Development System**
 - ibm.com/zseries/os/linux/lcds
- **Speed-start your Linux application**
 - Linux Software Evaluation Kit
 - Full function, market-available products
 - ibm.com/developerworks/offers/linux-speed-start

Speed-start your Linux app 2003





ISVs for Linux on zSeries

ibm.com/zseries/solutions/s390da/linuxproduct.html

- **End of 2001 - 59 ISVs with 114 applications**
- **End of 2002 - 133 ISVs with 252 applications**
- **An increase of over 220% in ISVs and applications in 2002!**
- **Currently 171 ISVs with 353 applications**
- **Resources for ISVs**
 - Solution Network for Linux at ibm.com/servers/enable/linux
 - IBM Solution Partnership Centers at www.developer.ibm.com/spc
 - Linux on zSeries Developer Relations at www.developer.ibm.com/zseries/linux.html

Data current as of September 25, 2003



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

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LINUX. THE FUTURE IS OPEN.





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