

Session B14

What's Happening with Linux on the Mainframe?

Joe Kreitz



Miami Beach, FL

October 22-25, 2001

Agenda

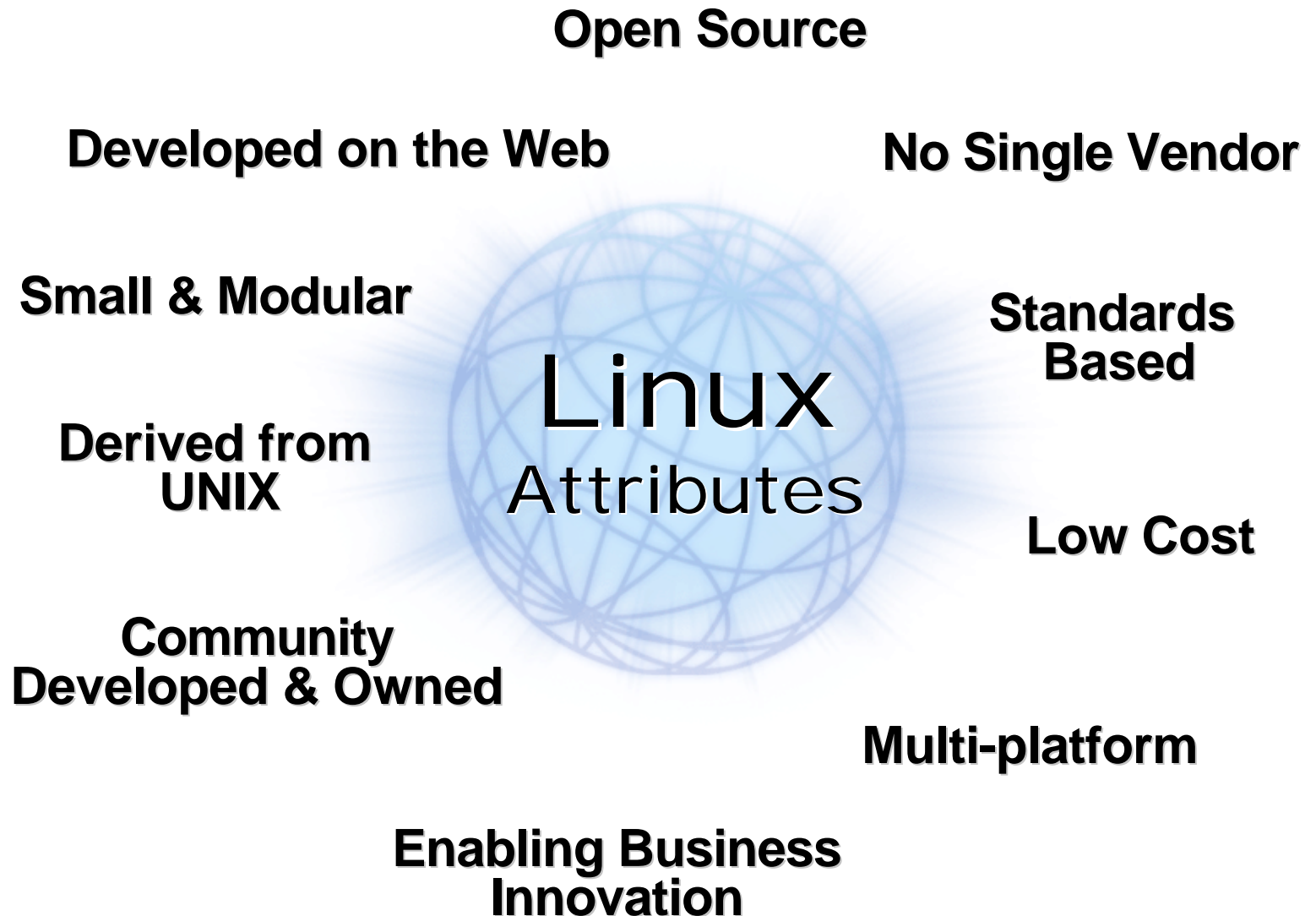
1. What is Linux & What is its value
2. What's happening in the Marketplace
 - a. Market trends
 - b. The Open Source Community
 - c. Linux Distribution Partnership
3. Some Linux Misconceptions
4. IBM's Linux Strategy
5. Linux for zSeries
6. Customer References
7. IBM Linux software and services Offerings
8. Linux Evolving or "watch this space"
 - a. Pervasive / Wireless/ Embedded Technology
 - b. Project eLiza
 - c. Grid Computing

What is Linux?

- **UNIX-like operating system developed by Linus Torvalds**
 - ▶ Version 2.4 available
- **Developed / tested by the Open Source community**
 - ▶ Highly Disciplined/Structured
 - ▶ High Quality
 - ▶ Secure
 - ▶ Stable
- **Packaged and shipped by distributors**
 - ▶ Red Hat
 - ▶ SuSE
 - ▶ Turbo Linux
 - ▶ Caldera
 - ▶ Other Regional Distributors (Red Flag, Connectiva, Mandrake, etc...)



What Makes Linux Different...



The Value of Linux as an Operating System

■ Growing Marketplace Acceptance

- The continual compound growth of Linux deployments and large skill pool attests to the market acceptance

■ Industry Wide Initiative

- Linux is the first operating system that the entire industry has rallied around. Not just select vendors

■ Multi-platform

- Linux runs on every platform. There is no other OS with this characteristic

■ Basis of Innovation

- Because of its open nature, Linux is the basis for new and innovative uses of technology

Open Source

No Single Vendor

Coexistence

Born-on-the-Web

Small & Modular

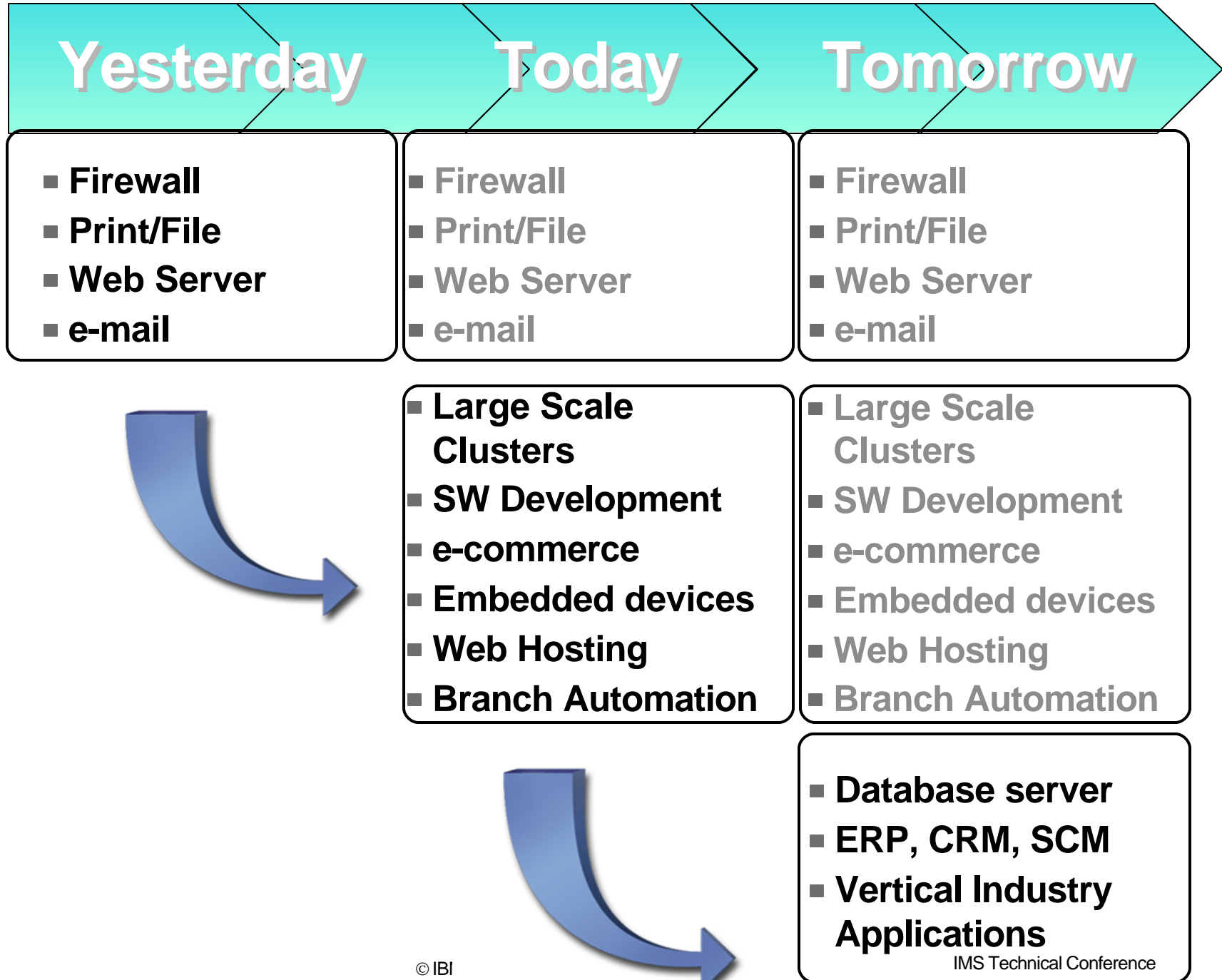
Community Developed
& Owned

UNIX Heritage

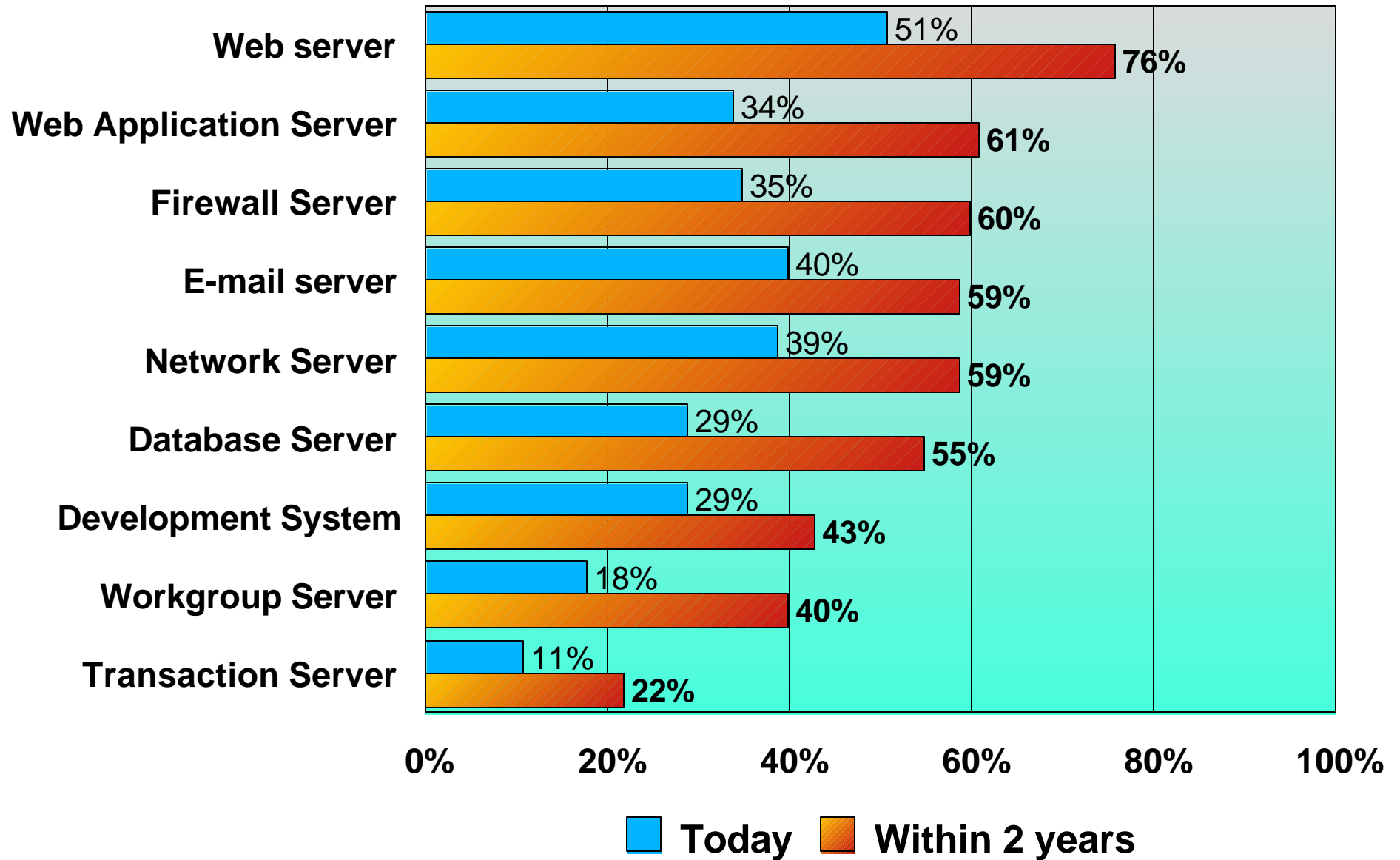
"It's out there... LINUX is already inside most companies in some form or another and will continue to spread - with or without the CIO's support" -CIO Magazine 12/15/2000



Linux Deployment



WW Linux Application Deployment

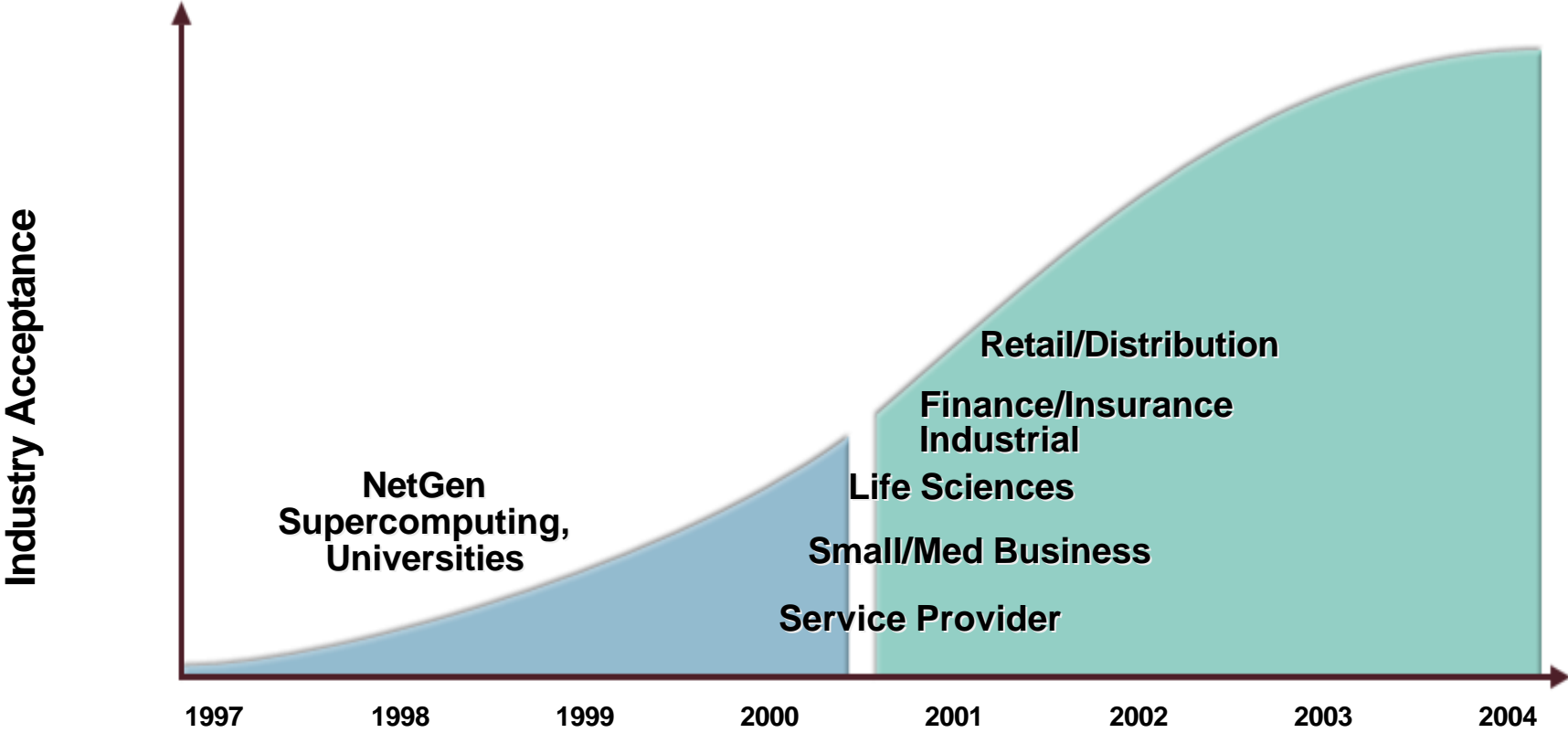


IBM Market Research
February 2001

© IBM Corporation 2001

IMS Technical Conference

Linux Market Evolution



Early Adopters

Technology Centric

Mainstream

*Business centric,
mainstream users*



Open Source Software Advantage

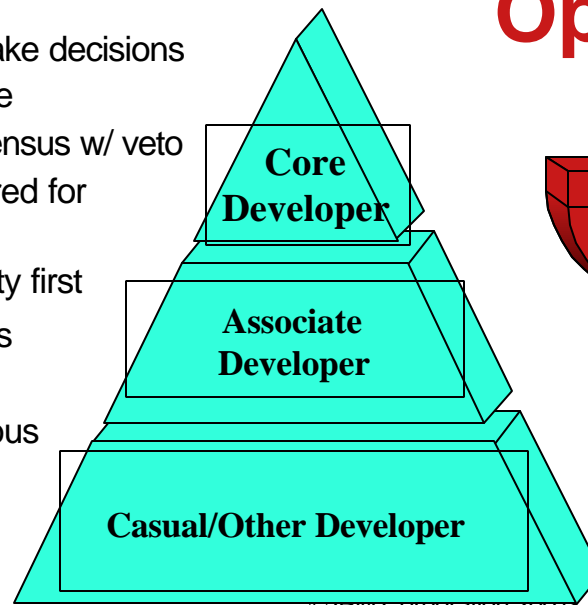
■ Open-Source software

- ▶ software -- with source code -- available on the Internet for unrestricted distribution under an open-source license
- ▶ participatory community debugs, enhances, and maintains the source code
- ▶ strong technical leadership
- ▶ high quality, secure code

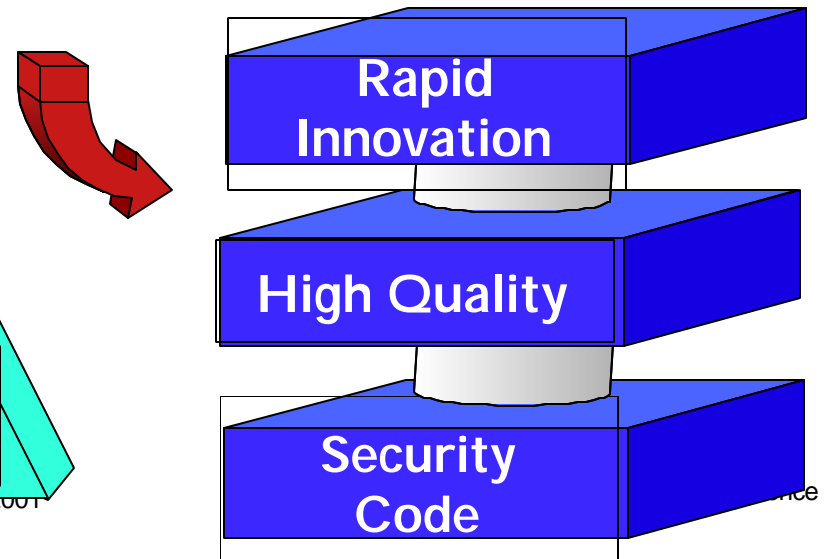
■ Linux

- ▶ Linux distributions are an "open source" based operating system, distributed freely, with it's underlining kernel source code openly published enabling low cost of entry.
- ▶ "Linux provides a common, stable scalable and inexpensive Unix [style] operating system across a multitude of platforms, hence lowering overall costs ... " (Giga, 1999)

- inner group who make decisions
- directly commit code
- team runs via consensus w/ veto
- shared vision required for progress/success
- conservative - quality first
 - active participants
 - design/coding
 - respect for previous contributions
- sheer numbers have impact



Open Source Approach



IBM as a member of the Linux Community

■ IBM Linux Technology Center (LTC)

Mission - Enterprise enable the Linux Operating System through the development and contribution of utilities, tools and code (ie - "make Linux better").

▶ Website

– <http://oss.software.ibm.com/developerworks/opensource/linux>

▶ Not just the Kernel

▶ 200+ Worldwide Developers

▶ **Industry Leadership supporting Linux/OSS**

– OSS projects

– Community access to enterprise HW/SW (e.g. OSDL)

– Support Open Source organizations and initiatives

– Linux support across IBM

– Distribution Partner alliances

Myth #1:Linux doesn't scale.

Fact: Linux Sets Records in Horizontal Scalability, Rapidly Improving SMP

- Linux sets records in horizontal scalability
 - ▶ Supercomputing
 - NCSA/US DOD Maui
 - next gen info. & compute infrastructure
 - high perf computing, visualization & desktop sw
 - develop more accurate weather reports
 - 256 IBM eServer X330 (two Pentium III processors)
 - ▶ Seismic Processing
 - Shell -- 1024-way xSeries cluster
 - Amerada Hess
 - CGG
- "Customer workloads that can easily be parallelized and which allow for horizontal scalability are capable of running today on 1 - 4 way Linux systems." Stacey Quandt, Giga
- 2.4 Kernel improves SMP scalability
 - ▶ 4-way > 8-way SMP
 - ▶ LTC Benchmark: significant perf. improvement 2.4 vs 2.2 (eg. in Red Hat 6.2)
- Transaction Processing Performance Council
 - ▶ Configuration running Linux and DB2 took top honors in the TPC-H database benchmark
 - ▶ 2,733 queries per hour vs. 1,699 per hour SQL server 2000



Myth #2: Linux isn't ready for the Enterprise.

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

- "Every major release...significant improvements to Linux's performance, scalability and reliability. Linux exploits multi-processor servers and fast I/O in a large and fast growing number of enterprises. Many of these...are telecommunications providers and financial institutions - that have a need for scalable, reliable operations and exemplary quality of service that is well above the norm." Jonathan Eunice, Illuminata
- Linux for mission-critical apps:
 - ▶ Internet Banking - Banco Mercantil
 - ▶ Seismic mapping - Royal Dutch Shell Oil; Amerada Hess
 - ▶ Internet Services - Telia; Deutsche Telecom
 - ▶ Retail/POS - Lawson ; Thrifty car rental
 - ▶ Agency Automation - Hill House Hammond
- Netcraft web server survey - 04/01
 - ▶ 63% Apache Web server (28.6M)
 - Apache - most popular Linux killer application
- In a Cluster Environment Peak Operation Downtime Per Year*
 - ▶ Microsoft.....30 hours
 - ▶ Linux.....14 hours

Myth #4: Linux isn't secure.

Fact: Linux Architected for Security, Open Source Development Enhances I

- "Compared to Windows that is running on majority of desktops today, Linux is more secure."
Rob LEMOS, ZDNet News senior writer
- The US National Security Agency embracing Linux
- The Open Source development process
 - ▶ Darwinian -- structured/disciplined
 - ▶ Exposed vs. hidden
 - ▶ Consider: Interbase example
 - ▶ Consider: Network Time Daemon remote root exploit fix in 5 days
- "In the hands of a capable Security Administrator Linux is as secure as UNIX."

Daniel Frye, Director IBM Linux Technology Center

www.ibm.com/ltc/whitepapers/linux



Myth #5: Linux skills are scarce.

Fact: Linux Skills are Easy to Learn, Widely Taught, Transferable from UNIX

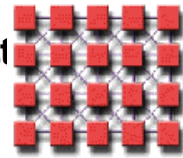
- "Linux is based on the UNIX heritage. Our experience...has shown how quickly UNIX programmers have developed into Linux programmers... weeks. UNIX skills are easily and quickly transferable to Linux." Helene Armitage, IBM VP Unix and Linux Development
- IBM Learning Services
 - ▶ 40 courses
 - ▶ www.ibm.com/training/spotlight/linux
- "A few people here know a little bit about UNIX, but nobody is a specialist on Linux. ...we don't even know we're running the database on a Linux server." Expert Invest AB, Andre Genkel, Expert Administrator
- Universities are embracing Linux -- MIT, UC at Berkley, Univ. of Texas, Loyola College, Univ. of Cincinnati, National Univ. of Korea, Beijing Univ., Osaka Univ. to name a few
- A large percentage of university students are graduating with Linux skills
- IDC: Linux users are more likely to be in technical industries, younger, innovators, in larger companies and locally focused

IBM Linux Strategy: Game Changing Applications

Workload Consolidation:

- Multiple workloads consolidated on ^ zSeries/iSeries
- Reduced cost
- Better resource use & performance
- Speed of deployment

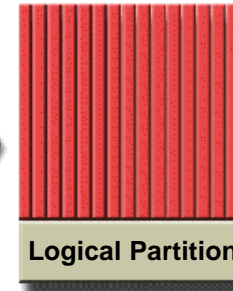
Server farms



Single purpose Internet-related servers



Linux for zSeries



Logical Partition

Telia Net

Replacing 70 Unix servers with a S/390 running Linux

Banco Mercantil

30 NT servers to Linux zSeries

Distributed Enterprise:

Centrally managed but geographically dispersed replicated servers which are low cost, robust, very reliable



Lawson

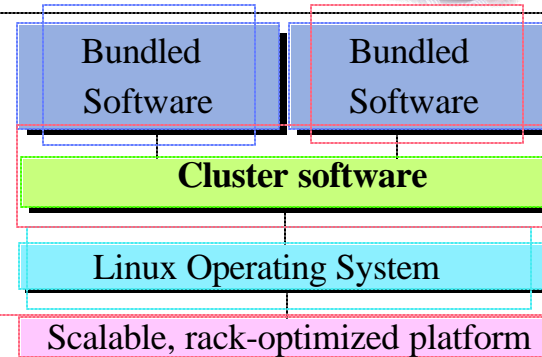
Linux based kiosks in 7600 stores

Hill House Hammond

Automation at 290 branch offices

Linux Clusters:

Pre-built / tested / integrated configurations providing scalability, high-availability, rapid setup and installation for parallel environments (web serving, engineering, scientific)



Royal Dutch Shell

Oil exploration 1024 IBM xSeries servers

NCSA - Faster creation of innovative applications in HPC

Appliances:

Stable, Reliable, Affordable servers preconfigured with Linux applications -- deployed in minutes



Intel Processor	800MHz
Form Factor/Height	Rack/ 1U

XSeries 100 -

Web server
NAS server



Workload Consolidation Opportunities

Reduced cost of ownership, enhanced resource utilization, performance and speed of deployment

Description

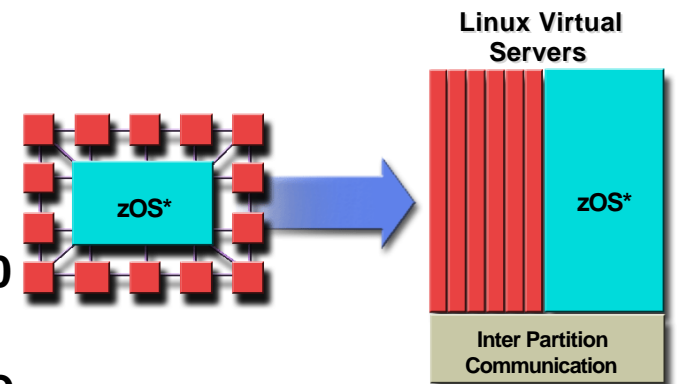
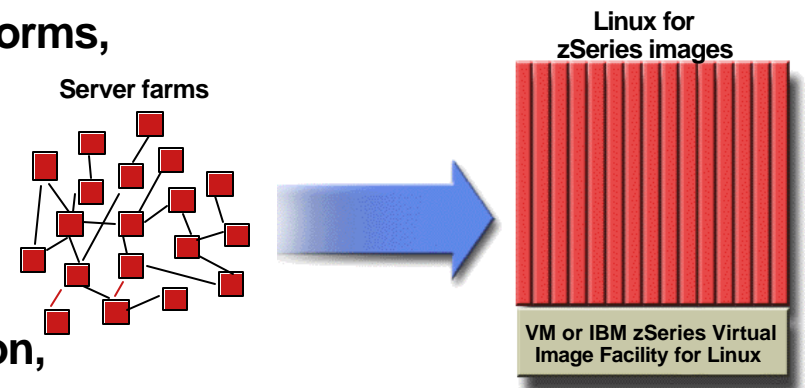
- Port Unix apps -> Linux
- Multiple, workloads on large, centrally platforms, such as ^ zSeries and ^ iSeries
- Consolidate many -> one

Benefits

- Cost reduction, Management, Administration, Power, Floor space
- Time to market
- Performance, Scalability
- Reliability

References

- Telia Net - Replacing 70 Unix servers with a S/390 running Linux under VM
- Banco Mercantil - Consolidate 30 NT servers onto Linux zSeries



Consultants evaluate IBM's Linux strategy

From Illuminata's "Big Blue Penguin" Report:

"IBM has emerged as Linux's most important, credible, and systematic proponent"

From Zona's "New Religion: Linux and Open Source:

"...[IBM] virtually legitimized Linux overnight as a serious option for enterprise IT managers"

From Illuminata's "Big Blue Penguin" Report:

"...IBM's attentions [to Linux] have been practical and single-minded in a way you will never see from Compaq, Dell, or Sun"

From Zona's "New Religion: Linux and Open Source:

"IBM's... placing Linux squarely on the radar screens of purchasing institutions"

Gartner Report

	Vision	Commitment	Viability
IBM	++	++	++
Compaq	+	+	+
Dell	+	+	+
HP	+	+	+
SGI	-	++	-
Sun	-	-	+
VA Linux	+	++	-

Linux for Competitive Advantage

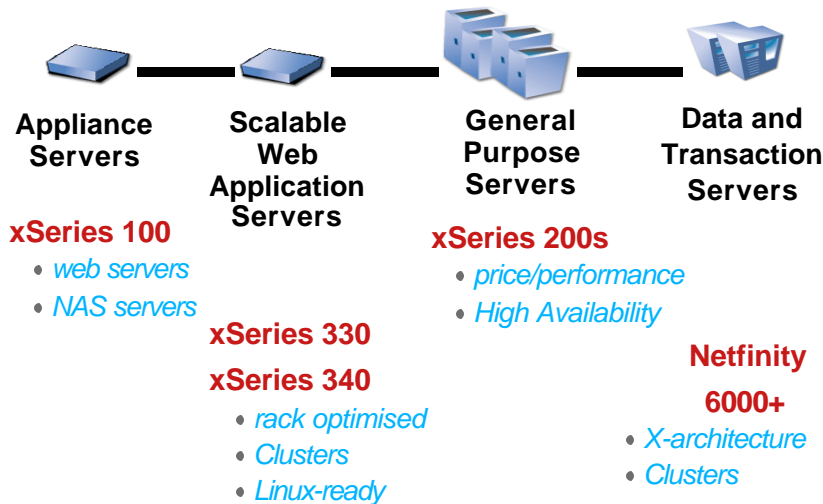
Who Will Get There First?

	Workload Consolidation	Distributed Enterprise	Commercial Cluster	File/Print	Server Appliance
Financial Services	<ul style="list-style-type: none"> • Webserving • Infrastructure • Trading Floor 	<ul style="list-style-type: none"> • Branch Automation 	<ul style="list-style-type: none"> • Ent Risk Mgmt • Derivative Pricing • Portfolio Mgmt • Mkt Data Distrib. • Data Warehouse 		
Distribution/Retail	<ul style="list-style-type: none"> • Webserving • Infrastructure • e-marketplace • ERP Appls 	<ul style="list-style-type: none"> • Stores/Outlets • Kiosk • Point of Sale 	<ul style="list-style-type: none"> • Data Mining • Web Clusters 		
Service Providers	<ul style="list-style-type: none"> • Shared Web hosting eComm • Operational Support Sys. • S/W Asset Mngt. 	<ul style="list-style-type: none"> • PoP • Appliances • Content Distribution/ Caching 	<ul style="list-style-type: none"> • Dedicated Web hosting, e-commerce • Softswitch 	All organizations	All organizations
NetGen	<ul style="list-style-type: none"> • Life Sciences SPs • Portal • Internet Datacenter 	<ul style="list-style-type: none"> • Content Distribution/ Caching 	<ul style="list-style-type: none"> • Internet Datacenter • Net-native apps. 		
HPC Life Sciences Petroleum Universities	<ul style="list-style-type: none"> • Student "Linux Machine" 	<ul style="list-style-type: none"> • Exploration • Data Gathering • Distance Learning 	<ul style="list-style-type: none"> • Pharma • Bioinformatics • Genomics • Geophysical Mapping • Supercomputing 		

Industry's Broadest Linux Server Line

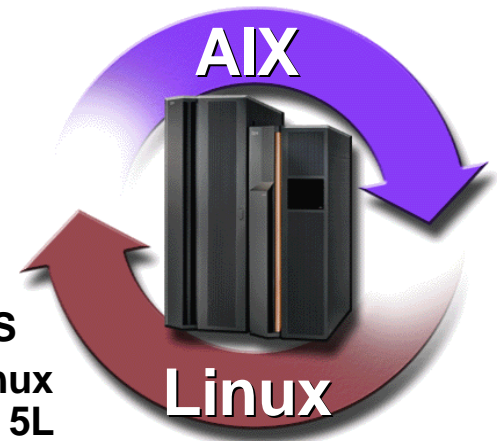
IBM ^

Linux for ^ xSeries and Netfinity
The Point of Entry - Where Industry Standards Meet Enterprise Capabilities

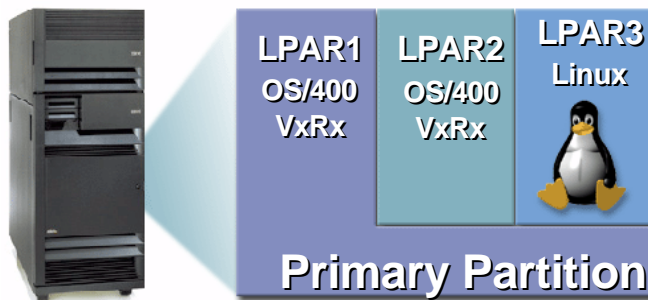


Linux for ^ pSeries & RS/6000
The Point of Integration - Where Linux Meets UNIX

- Native Linux for RS/6000 (32-bit)
- Native Linux for pSeries (64-bit)
- Exploit Power3 / Power4 Floating Point, 64-Bit Performance, I/O Bandwidth and RAS
- AIX Toolbox for Linux Applications in AIX 5L



Linux for ^ iSeries
The Point of Coexistence - Where Linux Complements Integrated e-business Solutions



- Linux in a partition
- Integrates new ebusiness applications

Linux for ^ zSeries and S/390
The point of consolidation - Linux Ascends to the Mainframe

- Pure Linux OS
- Exploits zSeries hardware
- Scalable, protected partitions
- Shared infrastructure
- Reduced cost of ownership



Linux for zSeries and S/390

The Point of Consolidation - Where Linux Ascends to the Mainframe

Flexible Design

- Linux runs native, in a Logical Partition (LPAR) or on a Virtual Partition (z/VM)
- z/VM supports hundreds of images
- New Integrated Facility dedicates incremental processing for Linux
- Linux for S/390 - 32 bit
- New Linux for zSeries - 64 bit



IBM Middleware

- DB2 UDB
- MQSeries Client
- WebSphere Advanced
- Connectors
- Tivoli Storage Manager Client

IBM Support & Services

- IGS defect and how-to support for SuSE and Turbolinux distributions of LINUX for S/390, zSeries
- Service offerings



Applications

- BMC
- Computer Associates
- CompuWare
- Software AG
- Many other vendors
- Hundreds of open source software applications

Commercial Distribution Partners

- SuSE - Internet download or CD-ROM
- Turbolinux - Internet download or CD-ROM
- Linux for S/390 - available now
- Linux for zSeries - available early 2001
- Red Hat Linux for zSeries - 2001

zSeries added value

■ Reliability

- ▶ The most reliable hardware platform available, MTBF over 60 years*

■ Availability

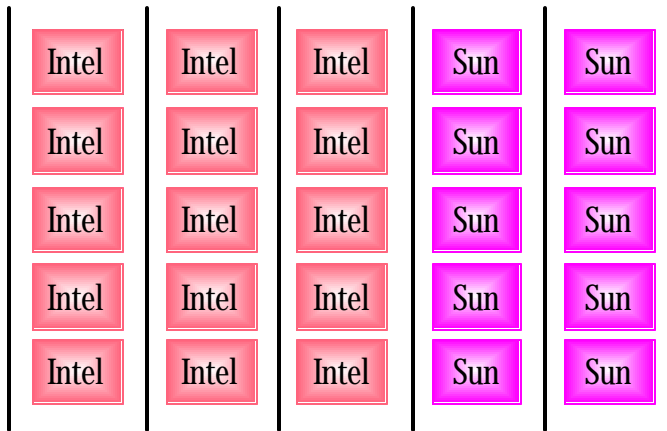
- ▶ Centralized Linux systems are easier to manage / duplicate
- ▶ Use of functions from S/390 operating systems for Linux (e.g. backup, autostart, etc.)

■ Scalability

- ▶ Physical very large processor configurations
- ▶ Logical & Virtual Linux partitions
- ▶ Nondisruptive scalability
- ▶ Capacity Upgrade on Demand

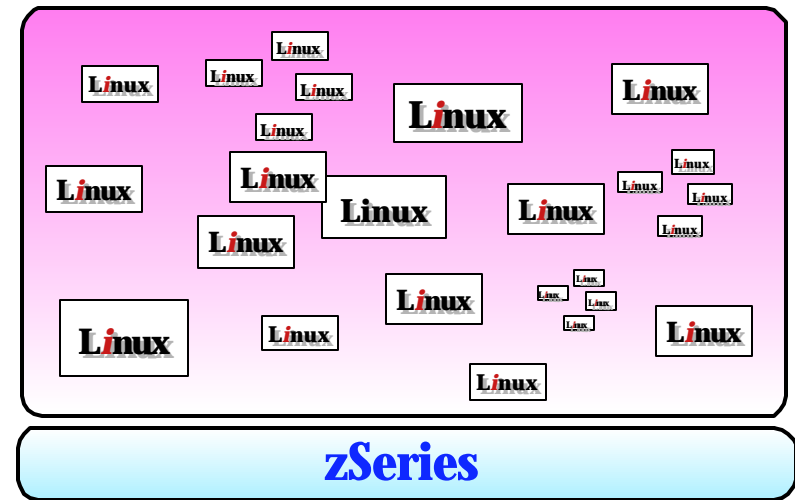
Linux on zSeries: a New Alternative

Traditional Server Farm



- **Discrete servers consume incremental expense**
 - Hardware price and maintenance
 - Power, cooling, floor space
 - People
- **Connectivity requires kilometers of cables**
- **Time to deploy new servers requires days at best**
- **High availability ensured by spares and re-boots**
- **Disaster recovery never successfully tested**

Server Farm in a Box



- **Reduce costs without sacrificing server autonomy**
- **Virtual, high-speed, inter-server connectivity**
- **Deploy new servers on-demand in minutes**
- **Architecture designed for high availability**
- **Mainframe infrastructure & practices, i.e. demonstrable disaster recovery**
- **Substantial TCO savings**

Linux IT Trends Survey data

zSeries customers interested in Linux on any platform

	All	< 400 MIPS	> 400 MIPS
- No interest	40.2%	42.8%	35.7%
- Considering	21.4%	20.1%	23.8%
- Evaluating	23.9%	23.5%	24.7%
- Implementing	3.9%	5.4%	1.3%
- In production	10.5%	8.2%	14.6%

On which architectures are you considering running Linux?

	All	< 400 MIPS	> 400 MIPS
- Intel	65.3%	67.5%	61.9%
- RISC	27.4%	27.1%	27.8%
- AS/400 & Midrange	8.0%	10.1%	4.9%
- Mainframe	48.3%	48.7%	47.7%

Source: IBM IT Trends Survey

zSeries Application Sourcing Strategy

- **z/OS is a key component of IBM's zSeries application sourcing strategy**
 - z/OS - Traditional
 - z/OS - UNIX System Services*
 - Java, Enterprise JavaBeans, WebSphere
 - Platform independent development and deployment
 - Deploy on zSeries with z/OS and Linux for zSeries
 - Linux for zSeries

- **The choice for a given application depends on its:**
 - Source
 - Required qualities of service
 - Time to market

* z/OS 1.2 enhancements: Unicode, C++ ANSI '98, new file system

Linux for zSeries - Awards

■ October 2000

zSeries Multiprise 3000 with Linux wins "Best of Show" at the Annual Linux Showcase in Atlanta, GA

■ February 2001

zSeries 900 with z/VM wins "Best Hardware" at LinuxWorld Conference and Expo in New York, NY

■ March 2001

zSeries 9672 and the Enterprise Storage Server win "Best of Show" at the Linux Business Expo in Sydney, Australia



"Creating New Web Sites in Minutes" at Telia Net

■ Challenge

- ▶ Improve competitive pricing in Internet services business
- ▶ Gain reliability and systems management capabilities while providing for workload growth

■ Solution

- ▶ IBM ^ zSeries G6 with 1500+ virtual Linux Internet servers
- ▶ Replace 70 Unix servers, consolidate workload into one manageable system



Banco Mercantil

Leading Bank in Venezuela

■ Challenge

- ▶ Growing infrastructure of NT Servers became costly and unmanageable
- ▶ Gain reliability and systems management capabilities while providing for workload growth

■ Solution

- ▶ Phase 1- Replaced 30 NT file, internet domain, and firewall servers with a G6 zSeries running Linux.
- ▶ Phase 2 - Moving applications from Unix systems to the z Series
- ▶ Reduced administrative support
- ▶ Higher availability
- ▶ Improved price/performance



CSK Network Systems Corporation

Expanding Capacity & Achieving Greater Reliability

■ Challenge

- ▶ Improve infrastructure scalability to meet increasing customer demand for ASP services
- ▶ Improve reliability of IT environment in cost effective manner

■ Solution

- ▶ Workload consolidation to Linux on ^ zSeries
- ▶ Co-resident S/390 and Linux applications

The image shows a screenshot of the CSK website. The header features the CSK logo and a 'TOP Page' link. A navigation menu on the left includes links for Top Message, Outline, Organization, Board of Directors, History, Location, IR info, News release, Corporate Community, Junior Summit, CSK Group, SEGA, ASCII, BELLSYSTEM24, and CSK ELECTRONICS. Below this are links for 'from webmaster', Copyright, TEXT-Site-Map, Japanese page, and E-mail. The main content area is divided into several sections: 'CSK Internet Solutions' with a link to 'Internet/Intranet Realtime Publishing on Internet, "Slingshot"™' and 'E-Bank'; 'IR Informations' with two entries: '(11/24) Financial Results-CSK CORPORATION CHUKAN KESSAN TANSHIN REPORT' and '(05/26) The provision of stock options through new share subscription rights and revisions to a portion of the Articles of Corporation for the retirement of stock'; 'News Releases' with two entries: '(05/26) Notification of Representative Director Personnel Changes' and '(04/26) CSK and Sunaga Bank Open SE Bank, a Web Portal for System Engineers'; and 'publications' with a link to 'Estimate World's No. 31 - CSK Technology Report'. An orange 'SLINGSHOT' logo is overlaid on the bottom right, with the text 'Real-Time Publishing on the Internet' below it. The background of the logo features a collage of financial data, including stock market tickers and charts.

Linux for zSeries Operating Environments

■ Native "on the metal" - single image

- Unlikely, as this means one Linux system on the whole processor

■ Logical Partitions (LPAR)

- Hardware partitioning enabling up to 15 "logical partitions" each of which runs a separate operating system, traditional OS and Linux

■ Virtual Partitions

- z/VM - support for large numbers of Linux images with rich system management capabilities
 - Very flexible, great for server consolidation
- Virtual Image Facility - basic support for Linux images
 - Easy to use

IBM Virtual Image Facility for Linux

- **Enables multiple Linux images to run on a single zSeries system**
 - Natively or in an LPAR
 - Does not require VM skills
 - Supports ten to hundreds of images, depending on workload
- **Complements the zSeries Integrated Facility for Linux**
 - Attractive pricing terms and conditions
- **Only supports the Linux for S/390 operating system**
 - SuSE and Turbolinux distributions for S/390 supported
 - On zSeries processors supports 32-bit mode
- **Easy-to-use, line-mode interface for controlling hypervisor services**
 - Accessed through a client application running in a Linux image
 - Used to create additional server environments for Linux images
- **Includes support for an internal network that enables high-speed communication among Linux images**

IBM z/VM

- **"Hypervisor" which provides virtual partitions**
 - Supports ten to thousands of images, depending on workload
 - Supports Linux for S/390 and Linux for zSeries guests
- **Complements the zSeries Integrated Facility for Linux**
 - Attractive pricing terms and conditions
- **z/Architecture exploitation**
 - 64-bit real storage support - real storage constraint relief
 - 64-bit virtual support - run 64-bit guest systems on zSeries
- **Extensive systems management software from IBM and ISVs**
 - Tivoli Storage Manager server pre-installed for high performance file level backup of Linux data

Run many Linux instances with powerful system management functions

The Value of z/VM for Linux

■ Increased performance, growth and scalability

- Server consolidation enables horizontal growth
- Three-tier architecture on two tiers of hardware
- Extensive support for sharing resources
- Virtual networking
- Complete isolation of Linux images if required

■ Increased productivity

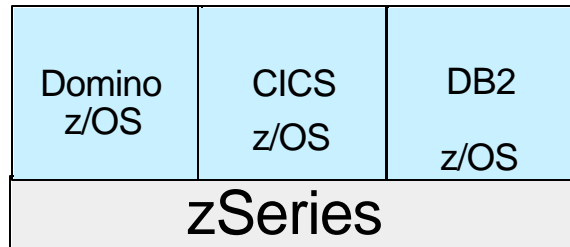
- Development and testing
- Production support

■ Improved operations

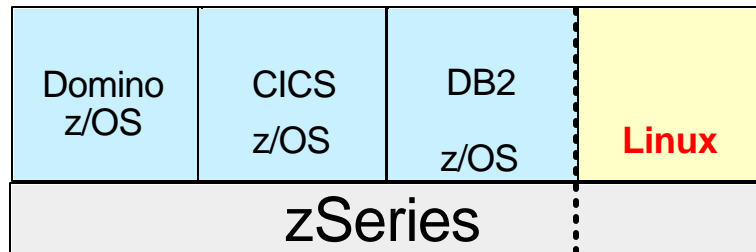
- Backup and recovery (Tivoli Storage Manager)
- Command and control

Run many Linux instances with powerful system management functions

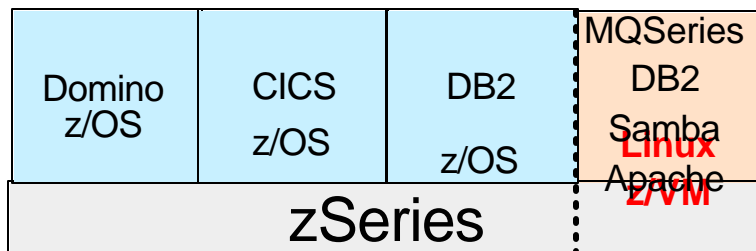
IBM zSeries Integrated Facility for Linux



Example 1



Example 2



Example 3

■ Business As Usual

- Typical z/OS environment on a 3-way processor

■ Add IBM zSeries Integrated Facility for Linux engines

- Traditional environment price remains the same
- Cost of IBM zSeries Integrated Facility for Linux and Linux distribution

■ Add IBM software for Linux on zSeries

- Traditional environment price remains the same
- Cost of IBM zSeries Integrated Facility for Linux, Linux distribution, z/VM, and IBM middleware (e.g. MQSeries and DB2 Connect)

IBM Global Services Support for Linux

■ Advanced Support

- Customized service solution
 - Focused support team
 - Accelerated response
 - Customized reporting
 - Proactive recommendations/support

■ Account Advocate

- Assigned technical specialist/team
 - Tracks, reviews & escalates
 - Problems as required
 - Available 9X5
 - Reviews support activity with customer monthly

■ Consulting & Education

- Open source consulting
- Linux infrastructure assessment
- Class room and Web-based courses
- Redbooks

■ Support Line

- Fee service for How To/Usage and Defect questions
 - 800# and electronic access
 - 9x5 or 24x7 coverage
 - Response time: 2 hours prime shift, 2-4 hours off shift

■ Implementation

- System installation and configuration
- e-business ^ solutions
- Cluster solutions
- Platform migrations

■ Application

- Installation services for WebSphere
- Installation services for MQSeries
- DB2 migration
- Server consolidation

Hardware support for Linux for S/390

- **Linux for S/390 is supported on the following processors**
 - Multiprise 3000
 - 9672 - Generation 5 and 6
 - z900 (also supports Linux for zSeries)
- **Additionally on 9672 G5 / G6 and z900:**
 - Integrated Facility for Linux
 - CPs that can only run Linux operating systems
 - "Special" terms and conditions apply to IFLs

Linux Distribution Alliances

- **Turbolinux Server 6 for zSeries and S/390**

- Turbolinux Web site is: *www.turbolinux.com*

- **SuSE 7.0 Enterprise Server for S/390**

- SuSE Web site is: *www.suse.de/en*

- **Red Hat**

- Red Hat Web site is: *www.redhat.com*

What the Press and Consultants are Saying

- **Swedish telco Telia has dealt a severe blow to Sun Microsystems by scrapping 70 Sun servers and replacing them with a single IBM S/390 mainframe running Linux.**
 - Silicon.com: Linux mainframe ousts Sun servers at Telia
- **80 percent of respondents found operating stability and reliability to be the most important attributes for customers choosing Linux. IBM is also providing customers with a cost-effective alternative for deployment as their business grows with support for both Intel-based servers and the ability to scale to multiple Linux images with Linux for zSeries and S/390 servers.**
 - Zona Research Study
- **Customers can now take advantage of the reliability of Linux on the highly scalable zSeries and S/390 platforms coupled with the scalability and reliability of DB2 and WebSphere software. Grede Foundries, an iron and steel castings manufacturer, is successfully using DB2 Connect for Linux on the mainframe to consolidate a large collection of servers into one, thereby decreasing administration costs and connectivity issues.**
 - Software Industry Report
- **Most significant is the introduction of a new generation of Web-optimized mainframes, which will run 64-bit Linux distributions expected from SuSE and Turbo. Dubbed the "zSeries," these 64-bit mission-critical servers can have up to 640 750 MHz copper processors, clustered with up to 2TB memory. With integrated cryptographic coprocessors, 96 fiber-optic channels, and an expected downtime of five minutes per year, the z900 can potentially run tens of thousands of Linux virtual machines simultaneously.**

IBM Storage Products Supports Linux

Capacity, Expansion, Protection, Reliability, Efficiency

- Enterprise Storage Server - Shark- for zSeries and S/390
 - ▶ Large Expansion Capacity
 - ▶ High Scalability and Availability
 - ▶ Heterogeneous platforms
- Modular Storage Server for xSeries
 - ▶ More price/performance
 - ▶ RAID & redundancy
- Fast T200, Fast T500 disk storage servers for xSeries
 - ▶ Workgroup & Department storage
 - ▶ RAID & redundancy
- Linear Tape Open (LTO)
 - ▶ Ultrium(tm) drives supporting Linux for tape back-up solutions.

■ Sw: Tivoli Storage Management



Middleware for Linux



*Development
Tools and
Components*

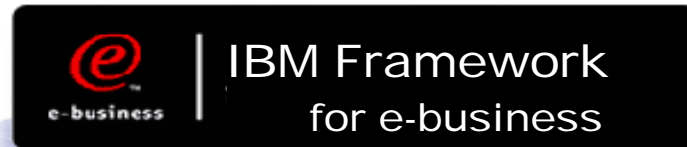
*Application
Server
Software*

*Secure
Network &
Management
Software*

- ★ *Java Development kit*
- ★ *VisualAge for Java*
- ★ *WebSphere Host On-Demand*
- ★ *WebSphere Homepage Builder*
- ★ *WebSphere Site Analyzer*
- ★ *Performance Pack Cache Manager for Multi-platform*
- ★ *ViaVoice Dictation*
- ★ *IBM MQSeries*
- ★ *Lotus Domino Application Server*
- ★ *WebSphere Application Server*
- ★ *WebSphere Commerce Suite*
- ★ *DB2 Universal DataBase (UDB)*
- ★ *Tivoli Storage Manager*
- ★ *SecureWay Wireless Software*
- ★ *Network Dispatcher*



IBM Framework for e-business - Product Portfolio



IBM MQSeries

- Connect applications on Linux to applications on other systems
- Speed application deployment and integration
- Manage and integrate business process flow across more

than 35 application environments



Lotus Domino

- Rapidly develop and deploy collaborative applications with base eMail, group calendaring and discussion DBs
- Advanced capabilities for managing work and information flow

- Integration with database, ERP and transaction systems



IBM WebSphere

Application Servers

- Speed transition from publishing to Web-based apps
- Add dynamic data, business logic transactions, and/or connections
- Runs on Apache Web Servers

Commerce Suite

- Develop, manage

e-commerce site & shopping/checkout experience



IBM DB2

- Best performing database for Linux, UNIX and NT/2000
- Handles multimedia as well as conventional data
- Optimized for Web applications
- Delivers enterprise class reliability and availability

- Attaches to Linux Apache Web servers

IMS Technical Conference

www.ibm.com/linux/software



IBM WebSphere Software Platform

Family of software products that enable business processes over the Web



Linux Enabled

WebSphere Homepage
Builder
VisualAge for Java

WebSphere Transcoding Publisher

WebSphere Site
Analyzer
WebSphere Personalization

WebSphere Application Servers

WebSphere Commerce
Suite
MQSeries

WebSphere Edge
Server



Customer and Partner e-business Applications

Application
Accelerators

e-commerce & e-markets
collaboration
workflow

Foundation
Extensions

development tools
support for pervasive clients,
personalization & portals
scalability & availability

Foundation

WebSphere Application Server
MQ Series Messaging

- Builds on Apache
- Complements Linux Horizontal Scale
- Seamlessly integrates with Linux
- Fully standards-based like Linux
- Extends Linux natural Internet affinity

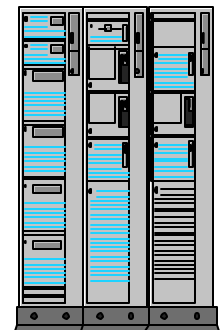
DB2 Spans the Spectrum on Linux

DB2 is the only *embedded-to-enterprise industrial strength Linux database solution.....*

Great performance!!!!

- Configuration running Linux and DB2 took top honors in the TPC-H database benchmark with 2,733 queries per hour vs. 1,699 per hour SQL server 2000

ZDNet: Take that! Linux beats MS in benchmark test
May 16, 2001 www.zdnet.com



***Enterprise Edition,
Enterprise-Extended
Edition.***



***Workgroup
Edition,
Developers
Edition,
Personal Edition***



Everyplace



© IBM Corporation 2001
43



IMS Technical Conference

DB2 Universal Database On Linux

- ▶ **DB2 Universal Database is the industry's first multimedia, Web-ready relational database management system.**
 - ✓ *Strong enough to meet the demands of large corporations*
 - ✓ *Flexible enough to serve medium-sized and small e-businesses*
 - ✓ *For business intelligence, content management, enterprise information portals and e-business*
 - ✓ *More than 40 million DB2 users from over 300,000 companies worldwide relying on IBM data management solutions.*
- ▶ **Robust Enterprise Database Server for Linux**
 - ✓ *Support for Personal, Workgroup and Enterprise Editions*
 - New EEE includes support for DB2 clusters on Linux
 - ✓ *Includes DB2 and IMS Connect for Linux for host connectivity*
 - ✓ *Full technical support available*
- ▶ **Includes full DB2 UDB Web Support**
 - ✓ *JDBC, SQLJ, Java Stored Procedures & User Defined Functions*
 - ✓ *DB2 PERL module & Web Control Center*
- ▶ **DB2 Version 7.1 for Linux available - Workgroup, EE, & EEE**
 - ✓ *Also included in the new IBM Small Business Suite for Linux*
- ▶ **Free DB2 UDB Personal Developer's Edition**

Lotus Domino for Linux

- Leading messaging and collaborative application platform available for Linux today
- Scalability, availability and manageability attributes complement Linux
- Domino R5 Server
 - ▶ Includes all Domino services
 - ▶ Choice of Mail Server, Application Server, or Enterprise Server International Language Support
 - ▶ The Domino R5 Application Server ships with the IBM Small Business Suite for Linux
- Fully functional Domino Solutions available now on Linux !
 - ▶ Sales Force Automation
 - ▶ Project Management
 - ▶ Customer Relationship Management
 - ▶ Interactive Web based forms
 - ▶ Resource Management



Lotus Domino for Linux

*MQSeries for Linux V5.2:
Enabling Application Integration*

▶ **Connects applications on Linux to applications on other platforms**

- ✓ *Heterogeneous any-to-any connectivity from desktop to mainframe (over 35 platforms supported)*
- ✓ *A comprehensive family of [APIs] designed to make coding for any messaging task straightforward.*
- ✓ *Allows business to integrate disparate islands of automation*
- ✓ *Time independent communication*
- ✓ *Assured one-time delivery*
- ✓ *MQSeries accounts for about three-quarters of the worldwide revenue for all embedded Message Oriented Middleware (MOM) according to Gartner Group.*
- ✓ *There are more than 2000 Certified MQSeries Specialists working for more than 650 different companies worldwide*



ibm.com/software/ts/mqseries/announeoct/mqseriesv52/MQLX4Q0052.pdf

Building services on strength of Linux

Integrated Technology Services

- e-business Infrastructure
- Performance Testing
- Business Recovery
- Technical Support
- IT Architecture
- Networking & Connectivity
- Storage & SAN Services

Business Innovation Services

- e-business Strategy
- Buy & Supply
- Sell & Support
- Enterprise Resources
- e-business Integration

Linux

Strategic Outsourcing

Learning Services

Why IBM for Linux Services ?

Dedicated World Wide Linux Practices Established in all Geographies of the world



12 Consulting, Installation, Migration and Support Offerings Available

Over 25 Education and Training modules developed for Linux that are available in 20 countries and 5 languages

Over 300 skilled Linux resources ready to be deployed on customer engagements

IBM Global Services with our partners extends our global reach by delivering industrial strength, mission critical services.

Can provide the same level of support that our customers are accustomed to for all other operating systems

IBM Linux Services

Appliance & File/Print

Clusters

Distributed Enterprise

Workload Consolidation

Strategy

IBM Service Offerings

- System Installation & Configuration
- e-business eServer Solutions
- Support Line
- Open Source SW Consulting
- Classroom & Web-based Courses
- Installation Services for WebSphere
- Installation Services for MQ Series

- High Performance Clusters
- Classroom Courses

- System Installation & Configuration
- e-business eServer Solutions
- Support Line
- Open Source SW Consulting
- DB2 Migration
- Installation Services for MQ Series
- Classroom & Web-based Courses

- Workload Consolidation
- Solaris -> Linux Migration
- Platform Migration
- Support Line
- Open Source SW Consulting
- Classroom Courses

- Open Source SW Consulting
- Classroom & Web-based Courses

Support Line for the Linux Operating System

24x7 coverage, Linux total systems management, supplements customer staff with IBM skilled specialists

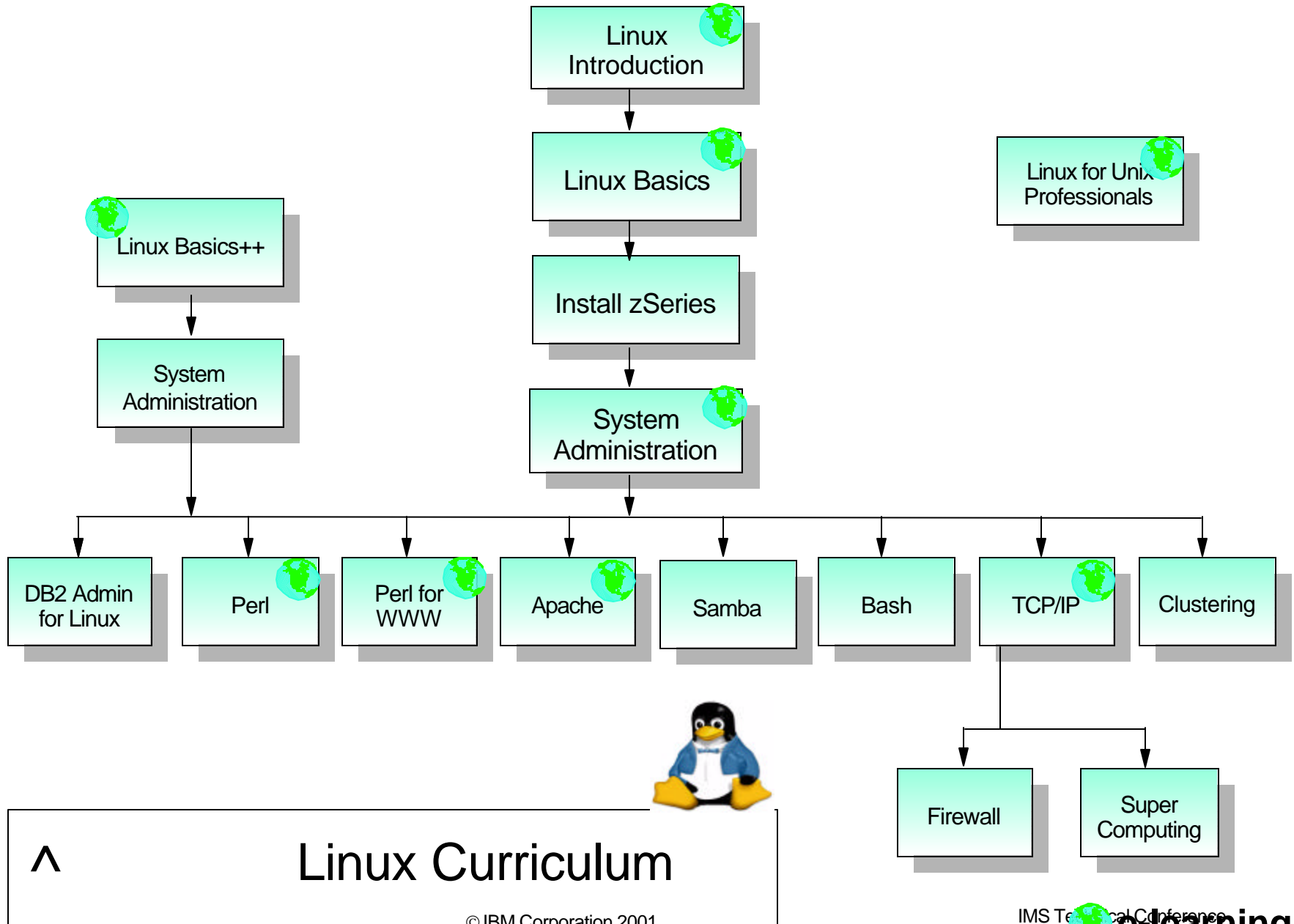
Description

- ▶ Defect support, how to's, problem definition and solution definition for supported distributions of Linux and Linux applications, through dial or electronic submission.

Benefits:

- ▶ Electronic support and problem submission saves customer time and allows tracking of open support issues
- ▶ Fast, accurate problem resolution
- ▶ 24x7 Enterprise level support available

Linux training from IBM Learning Services



Linux Enablement - Global Services

Service & Support

- One-stop prime shift or full shift (24 X 7) enterprise level support
- Support for major Linux distributions
- Toll-free Phone & electronic access
- How-to & defect-level support
- 90-day no-charge start-up support
- Account Advocate, Advanced Support and Consult Line service options

Professional Services

- Comprehensive services offerings
 - Server Consolidation
 - e-business Enablement
 - Open Source Consulting & Education
 - Application Migration
 - Clustering Offerings

Education & Training

- Full portfolio of courses:
 - Via classroom - 19,
 - Via web - 23,
 - Via satellite (US) - 6
- Available in 20 countries
- Available in 5 languages
- Linux server operators and end-users, including Linux basics, awareness for managers, system administration, and e-business
- How-to (Redbooks) for Linux
- Linux Professional Institute (LPI) sponsor for certification

Pre-Sales Technical Support

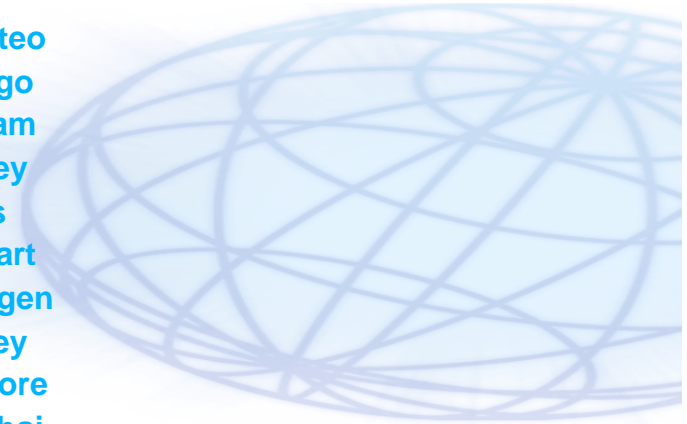
- Integrated into Techline Support Structure
- Local pre-sales technical support teams
 - Complex Situations
- Benchmark, testing & demo facilities
- Solution design, configuration sizing & solution assurance

Linux Support for Developers

11 WW Porting Centers

- Linux Workshops, Tech Support
- Linux testing on IBM ^
- Linux Performance Tools and MORE

San Mateo
Chicago
Waltham
Hursley
Paris
Stuttgart
Boeblingen
Sydney
Bangalore
Shanghai
Tokyo



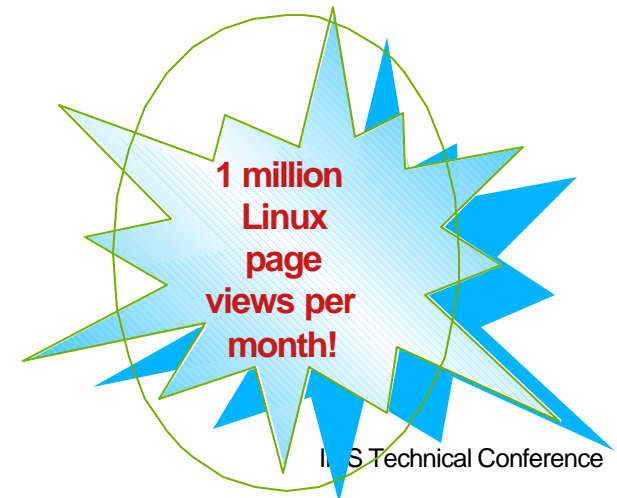
DeveloperWorks

Dedicated "Linux Zone"

Open Source Center

focus on open-industry standards
and cross-platform development

alphaWorks, available through
developerWorks



Global Solutions Directory Application

Global Solutions Directory - Search Results - Netscape

File Edit View Go Communicator Help

Back Forward Reload Home Search Netscape Print Security Shop Stop

Location: solutions/ism/Results.nsf/Results2/DF6815ACFCD423FF00256A22005FD4AE?D

IBM Shop IBM

Home Products Consulting Industries News About I

Search

Your search found **1919 matching solutions.** You limited the results, however, to only the first 250 .

Sort results by: relevance

Move list to entry number: []

List entry 1 to 25

Solution name	Company
Smart Internet and Linux Solutions	
XPlay	
Absoft Pro Fortran for Linux/Int	
Convolo	
VMware for Linux	
PATROL Preview for Linux for S	
Linux: Installation, Configuration	
LifeKeeper for Linux	SteelEye Technology
Phoenix Adaptive Firewall	Progressive Systems, Inc.
Systems/C	Dignus, LLC
VERITAS NetBackup BusinessServer for Linux	Veritas Software Corporation
Arriba for Embedded Linux	Viosoft Corporation
BRU(TM) Backup & Restore Utility	Enhanced Software Technologies, Inc.
Oracle8i on Linux on Netfinity	Oracle Corporation

- SAP
- Informix
- SAS
- Legato
- Veritas
- SendMail

Over 2000 Linux Applications available TODAY

- 1400+ ebusiness, Linux**
- 240+ e-commerce, Linux**
- 400+ web application servers, Linux**



Business Partner Directory - Domino on Linux

The screenshot shows a Microsoft Internet Explorer browser window displaying the IBM Business Partner Directory. The search criteria are: Geography: United States, Category: Lotus Domino, Operating System: Linux. The results show 241 companies. A table lists several companies, with a red circle highlighting the 'Premier Level' column header and a red arrow pointing to the 'Location' column header. A text box overlay states: 'Hundreds of Business Partners with thousands of Domino apps - the majority of which run on Linux'.

Search criteria: Geography: United States, Category: Lotus Domino, Operating System: Linux

There are **241 companies** matching your criteria.

Partnerworld for Software Premier Business Partners

Premier Level		Advanced Level	
Company	Location	Phone	Email
3X Corporation PartnerWorld for Software	760 Lakeview Plaza Blvd Worthington, Ohio 43085-4724 United States	614 433-9406	keith.justus@3x.com
411 Computers, Inc. PartnerWorld for Software	6432 Jolie Suite A Countryside States		
apisci consulting, inc. PartnerWorld for Software	201 W Ch Suite 110 Cary, North		
AAC Associates, Inc. PartnerWorld for Software	8470 Tyco Vienna, Virginia 22182 United States		
Advanced Systems Group PartnerWorld for Software	150 El Camino Real Suite 200 Tustin, California 92780-3668 United States	714 730-7899	tomorr@advancedsystems.com
Agility Partners PartnerWorld for Software	50 Kearney Rd Suite 21 Needham, Massachusetts 02494 United States	781 453-0501	info@agilitypartners.com

Linux Value for IBM Business Partners

- Linux is game-changer that creates new opportunities
- Only IBM provides:
 - ▶ e-business leadership
 - ▶ full range of Linux-enabled products
 - ▶ leadership role in open source movement
- PartnerWorld lets you leverage your investment in UNIX, Linux, IBM middleware and/or IBM server expertise
 - ▶ New "Linux Lens" on PartnerWorld Web Site
www.ibm.com/PartnerWorld/linux
 - ▶ **Ready, Set, Linux!**
 - ▶ Offset Your Investment
 - ▶ **"You Pass, We Pay"**: pass LPI Test 101 or Red Hat RHCE Test and get **reimbursed up to ~ US \$3,000**
 - ▶ **PartnerRewards**: achieve LPI or Red Hat certification and **claim up to ~ US \$3,000**

Linux Web Portal - www.ibm.com/Linux



Linux at IBM

In recognition of its growing, worldwide user-base, we're proud to introduce the home of Linux at IBM. We're here to share information and bring you news on all the latest developments in the ever-evolving world of Linux.

Linux provides a revolutionary open source platform offering superior dependability and open expandability to support software innovation. We're proud to be a part of the Linux movement, and we look forward to working with the larger community to nurture Linux and to see it thrive.

Hardware	Software	Services	Key alliances
→ Linux servers at IBM	→ e-business software for Linux	→ Service offerings	→ Caldera Systems
→ Intel-based servers xSeries	→ Developer Toolbox for Linux	→ Support Line e-Services	→ RedHat
→ Integrated application servers iSeries	→ DB2 for Linux	→ Linux Learning Services	→ SuSE
→ Enterprise servers zSeries	→ WebSphere for Linux		→ Turbolinux
→ Personal systems	→ Linux Technology Center Projects		
	→ Other Open Source Projects		

Features
Moving Linux into the Enterprise: An Interview with Rich Michos

IBM news
April 12, 2001

- Single entrypoint into all Linux Hardware, Software and Services offerings

- News updated daily:
 - ▶ Features
 - ▶ IBM News
 - ▶ Industry News

- **The Linux Line**
Linux e-newsletter for Customers, Business Partners, Open Source Developers and Linux Community

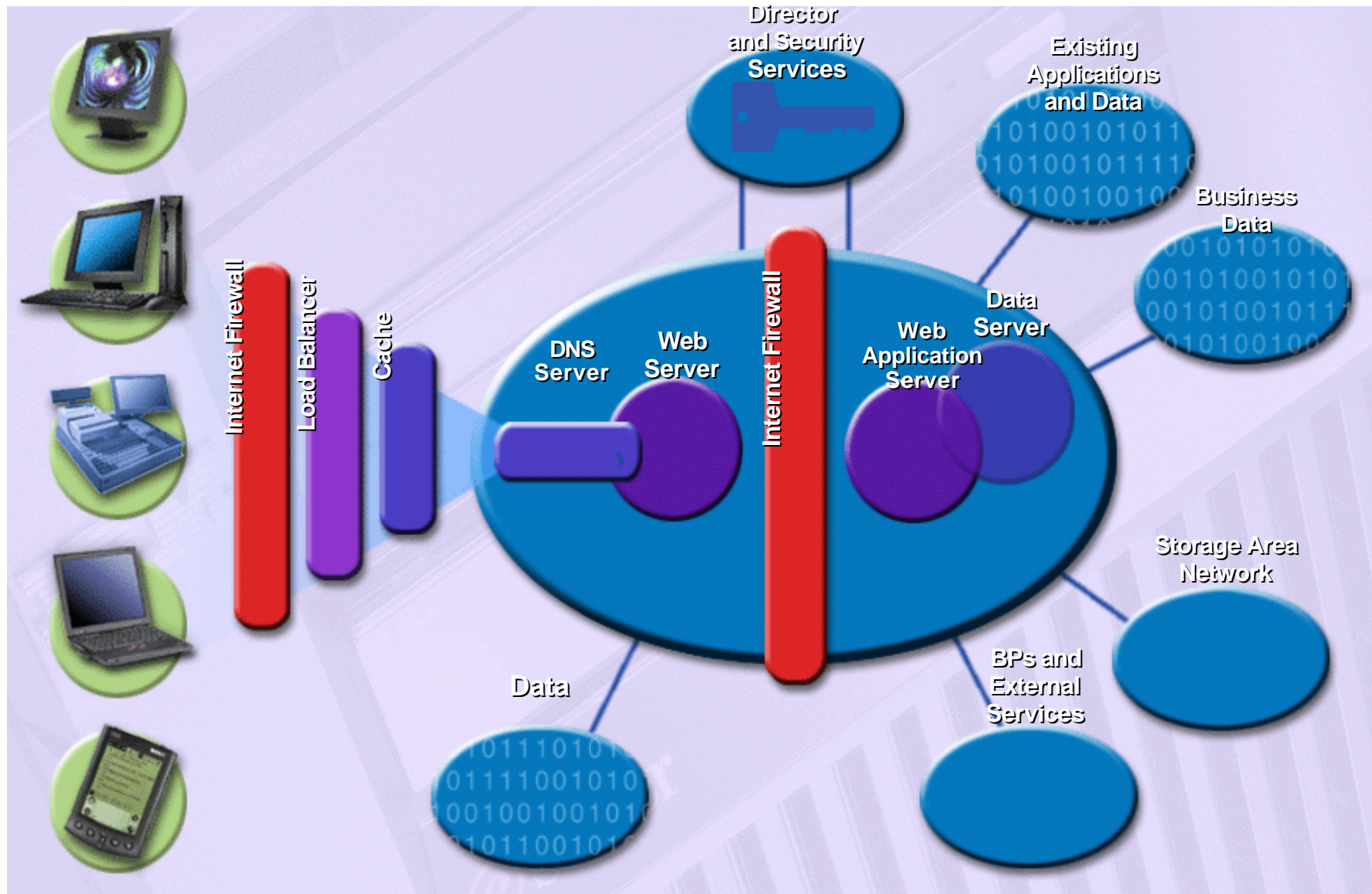


Embedded Linux is already happening

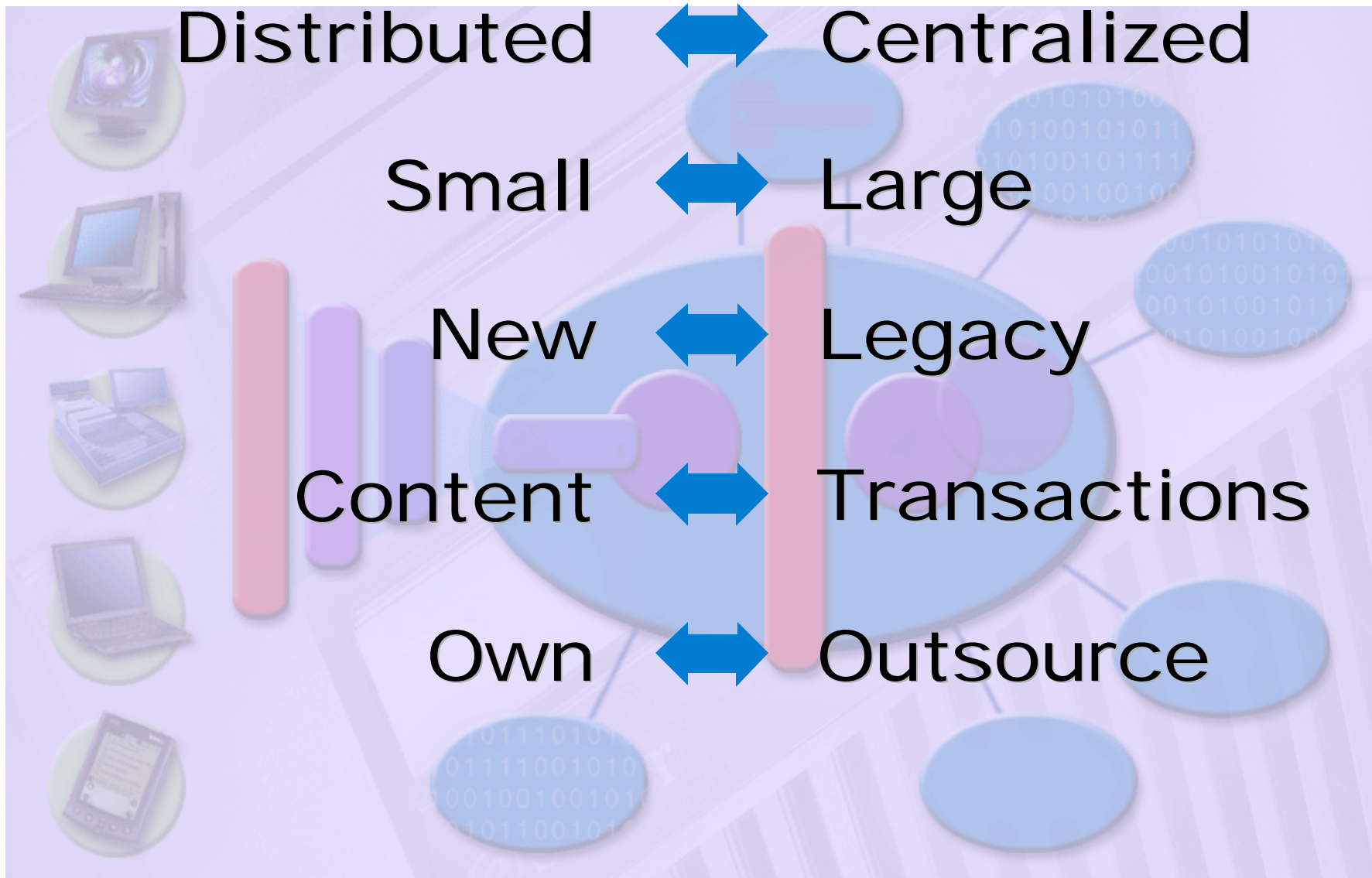
- Tivo Set-Top-Box
- Gateway Connected Touch Pad home Internet appliance
- Sony SNT-V304 Video Network Server
- PhatNoise PhatBox car mp3 player
- PalmPalm: Linux-based cellular phone and PDA
- Nokia Media Terminal, a powerful "infotainment center"
- Ericsson H610 Cordless Web Screen
- Filanet Internet gateway, VPN/firewall, email server, file sharing
- Yopy multimedia PDA based on Linux



Exploding e-business Infrastructure



Diverse e-business Infrastructure



Integration and Flexibility



Integration and Flexibility

IBM's Commitment to Linux

xSeries

ThinkPad

Network Station

NetVista

**Professional Services,
Education and Training,
Technical Support,
Service and Support**

**VisualAge
for Java Pro**

iSeries

pSeries

**Enterprise
Storage
Server**

zSeries

**Linux
Cluster**

MQSeries

DB2

**Lotus
Domino**

WebSphere

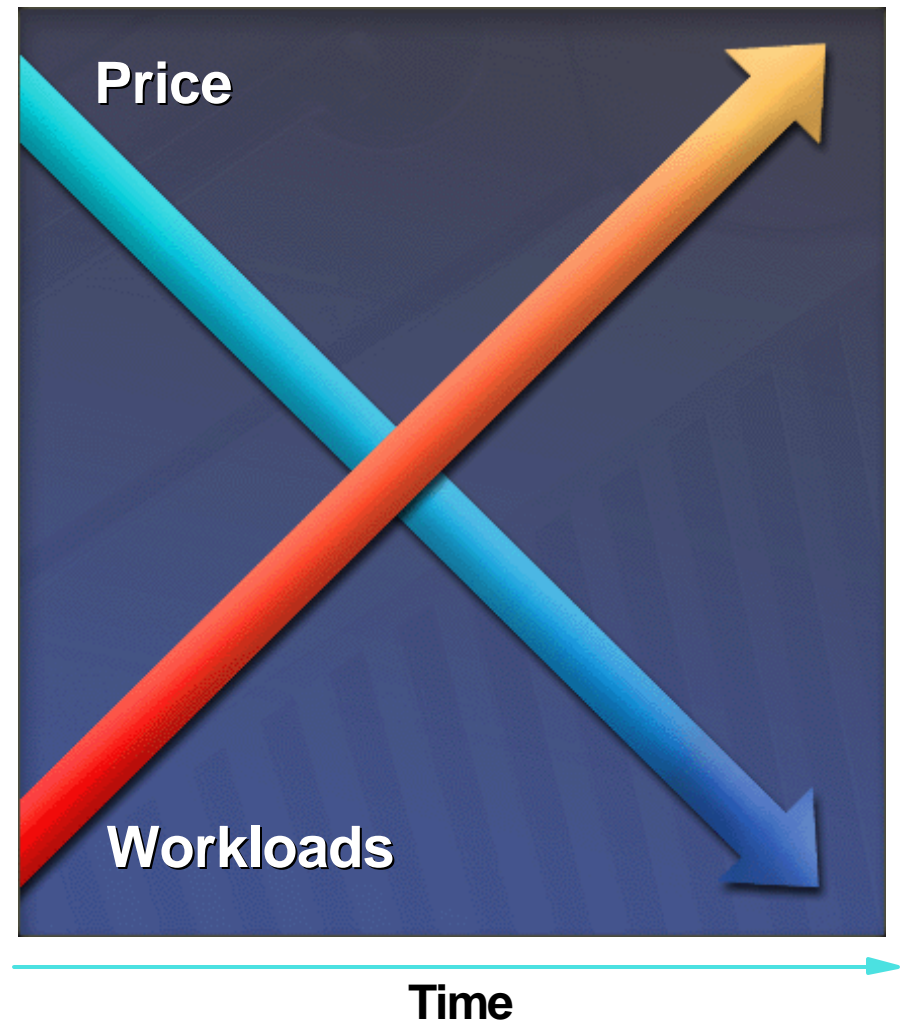
**Tivoli Storage
Management**

**Tivoli Management
Agent**

**Modular
Storage
Server**

Infrastructure Management at Reasonable Costs

- Proliferating technology drives:
 - ▶ Complexity
 - ▶ Software and services costs
 - ▶ Skills shortage
 - ▶ New kinds of workloads



Best of Breed Functions Within Individual Servers

PSSP
*AIX Parallel
System
Support
Programs*

IRD
*Intelligent
Resource
Director*

HACMP
*High Availability Cluster
Multi-Processing for AIX*

**Sysplex
Clustering**

IBM Director
*Lifecycle Tools:
Software
Rejuvenation*

TSDM
*Tivoli Service
Delivery Manager*

**Blue
Hammer**

CUoD
*Capacity Upgrade
on Demand*

LPAR
*Logical
PARTition
Mode*

TSM
*Tivoli
Storage
Manager*

ECC
*Error
Correction
Code*

xArchitecture
*Technology
Leadership in Intel
Standard Systems*

Self-managing Systems

Dynamic workload management

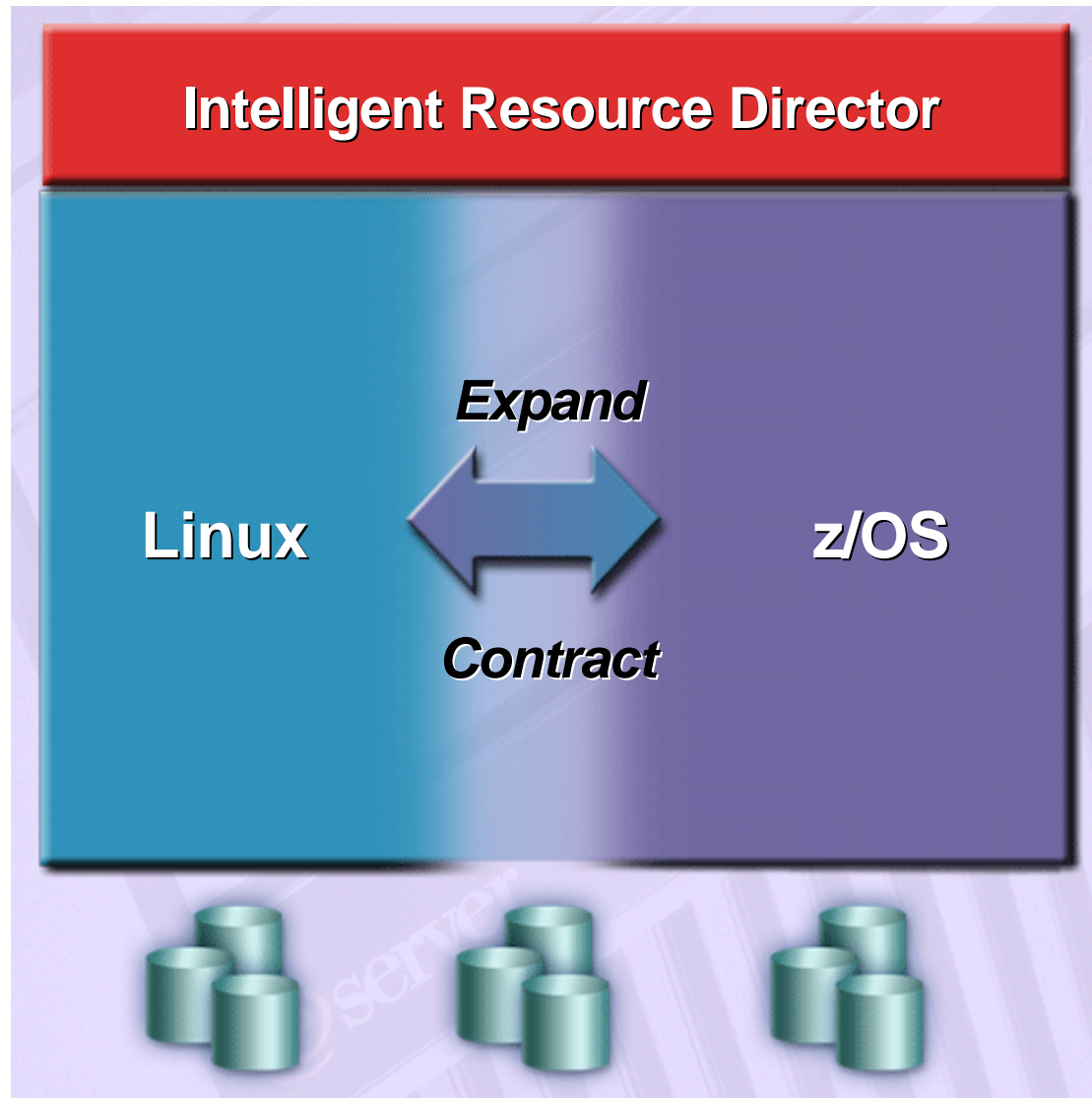
Scalable clusters

Distributed server management

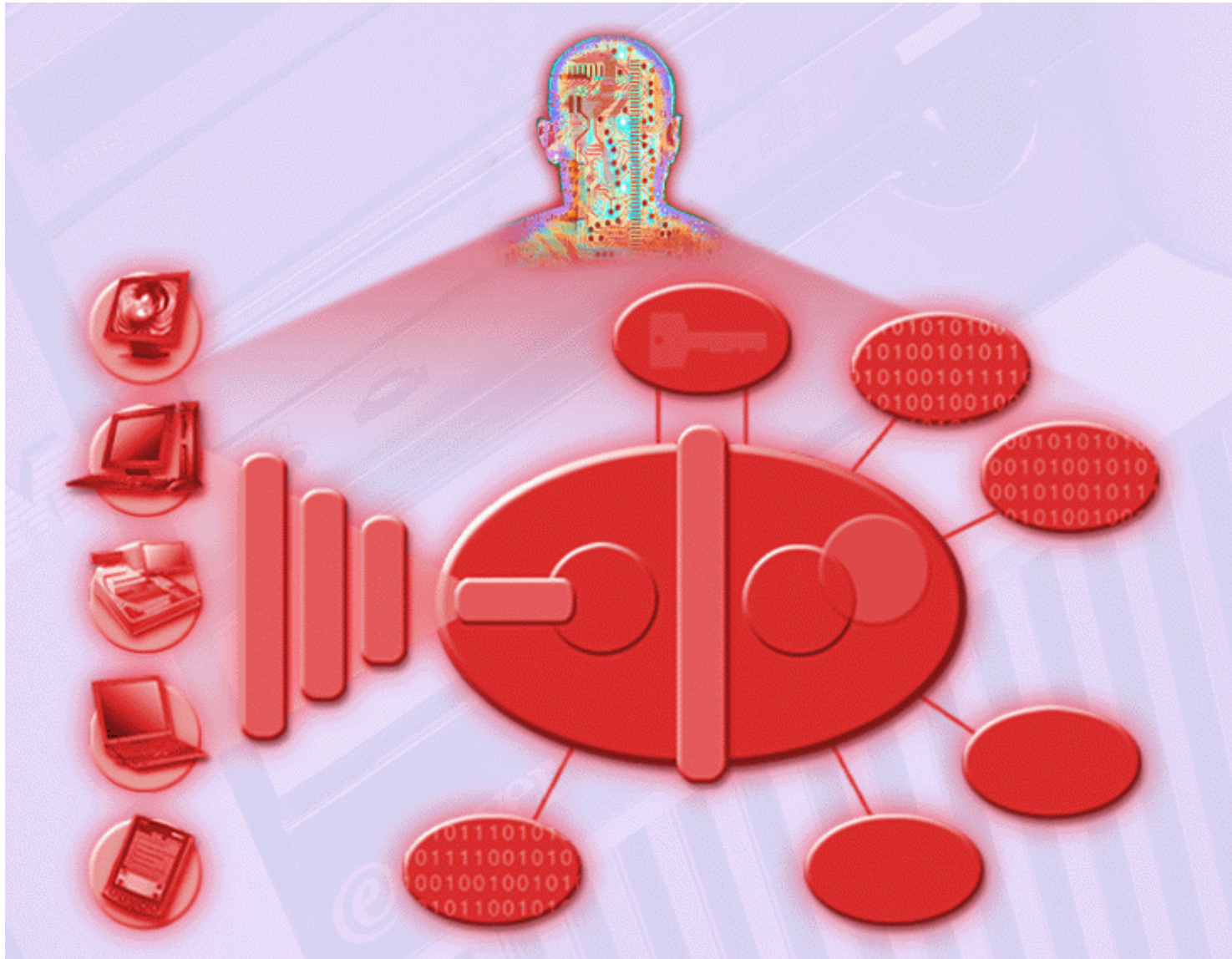
Self-healing systems

- . . .

Today: Dynamic Workload Management

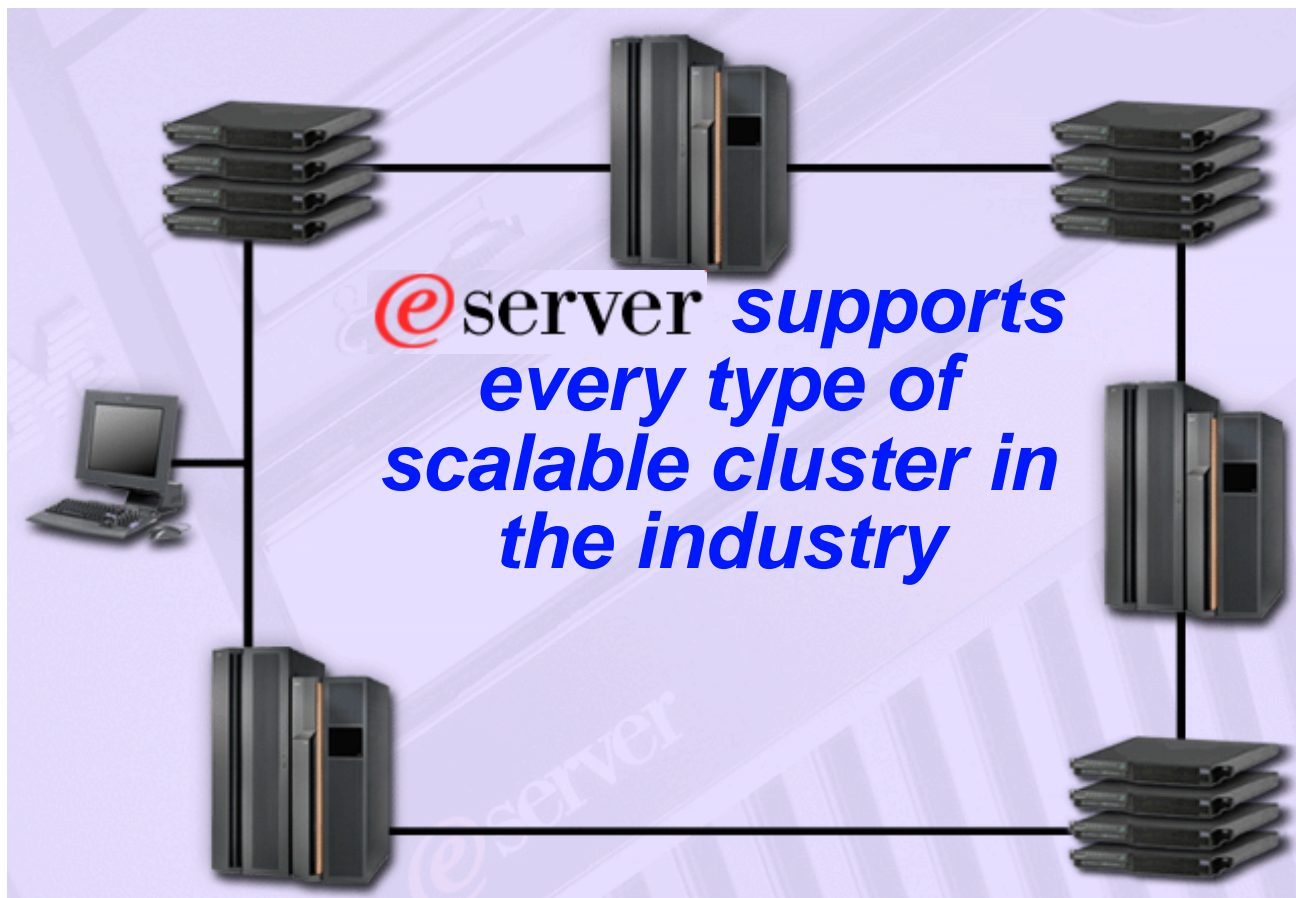


Future: Heterogeneous Workload Management



Today: Scalable Clusters

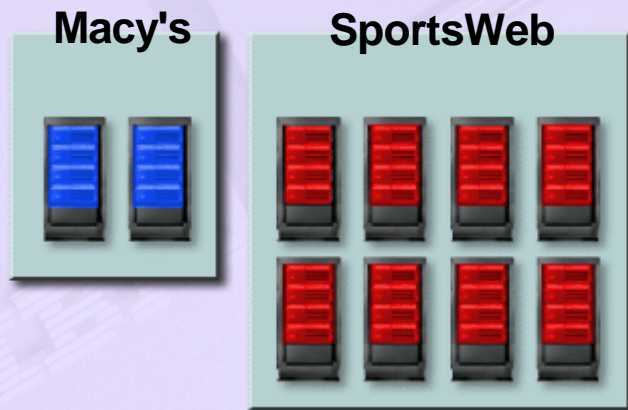
- PSSP: AIX Parallel System Support Programs
- Blue Hammer: UNIX/Linux
 - ▶ CSM: Clustered Systems Management
 - ▶ GPFS: Global Parallel File System



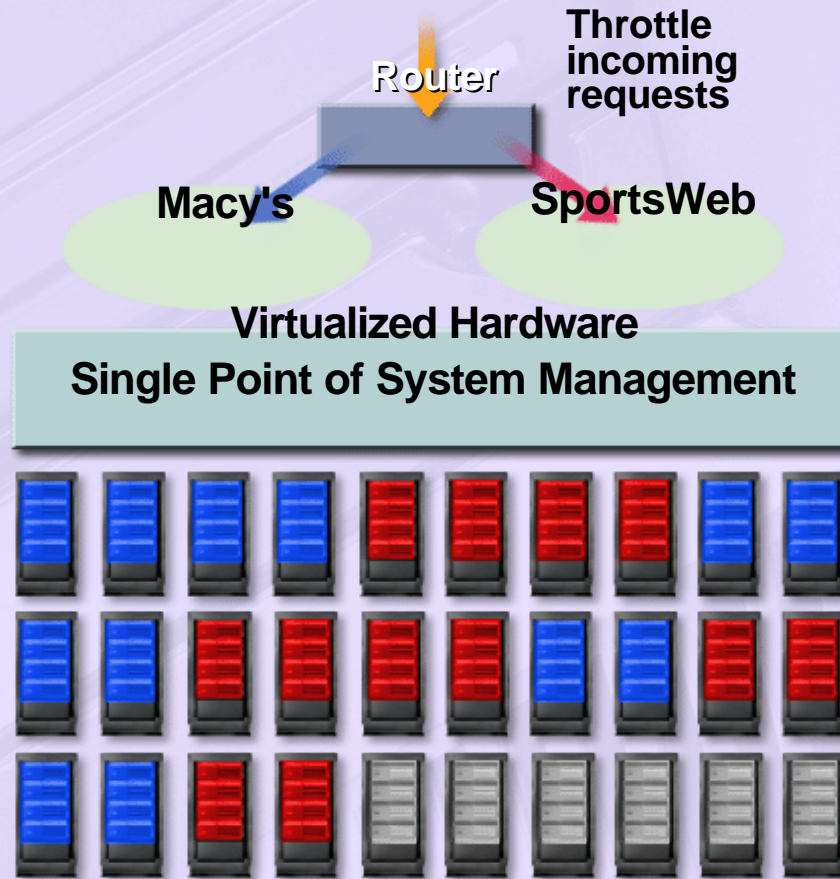
Future: Océano Project

OcéanoRequests

Today:



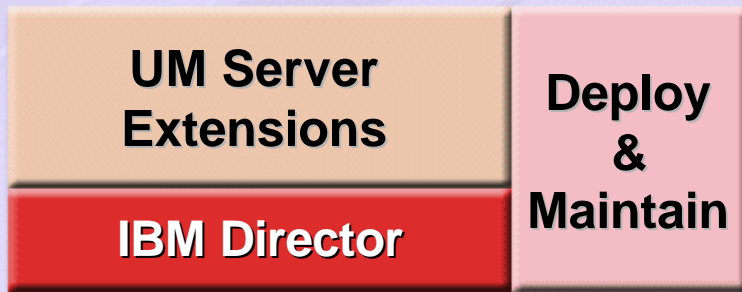
Fixed resource allocation
Separate management
Best effort basis, using own resources



Track performance metrics
Aggregate & correlate metrics
(end-to-end) to SLA violations
Orchestrate reconfiguration

Today: Distributed Server Management

@server *xSeries*



...1000s of nodes

Agent Layer



IBM Remote Supervisor Adapter (Falcon)



xArchitecture

Future: Distributed Server Management

@server *xSeries*

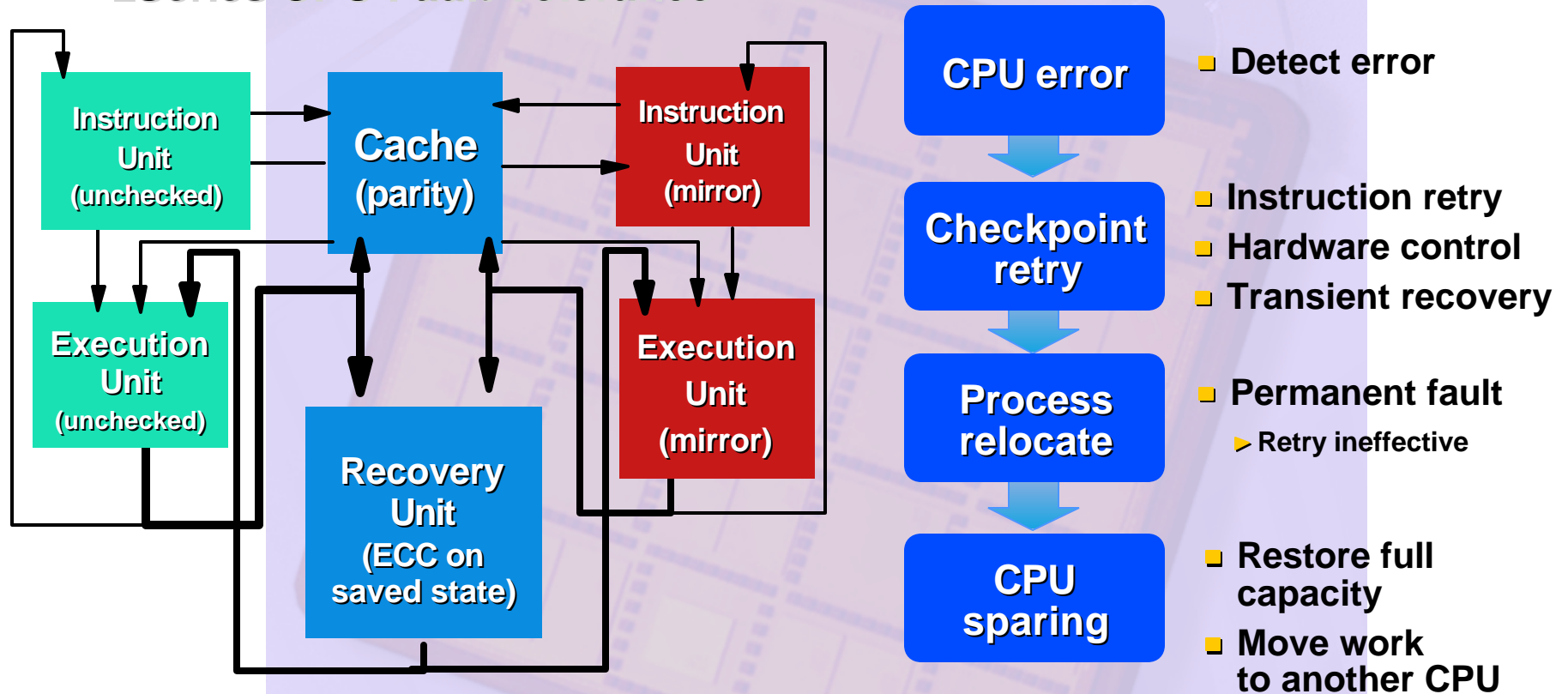
Raquarium



**Wireless Management
of anything from
anywhere**

Today: Self-Healing Systems

zSeries CPU Fault Tolerance



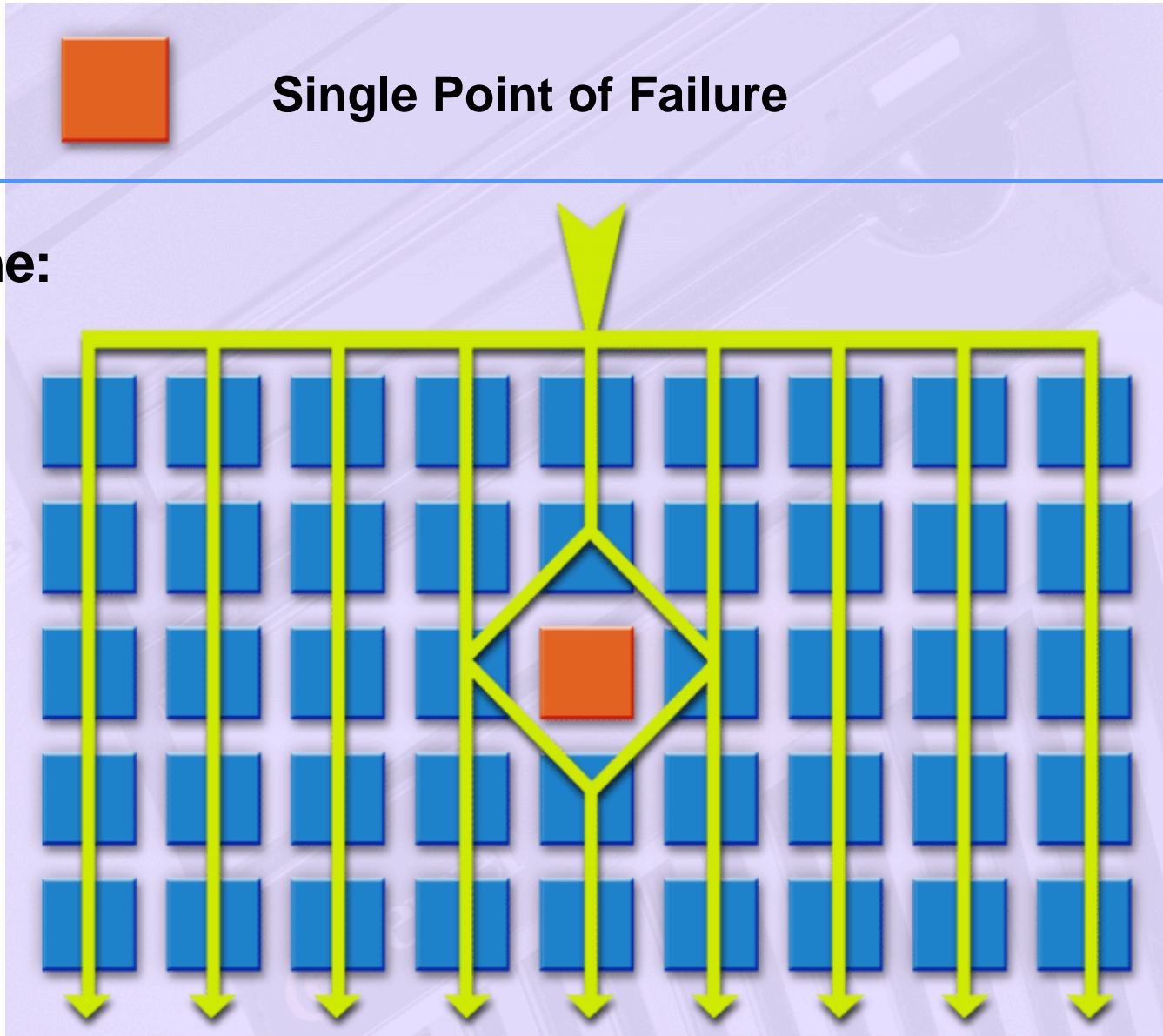
Future: Blue Gene

Today:



Single Point of Failure

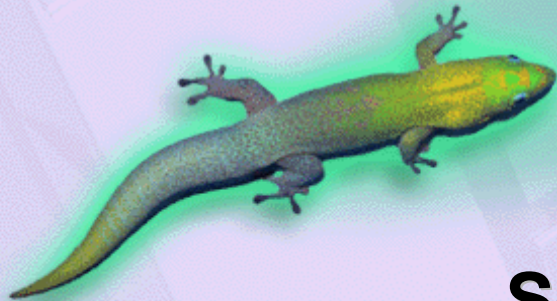
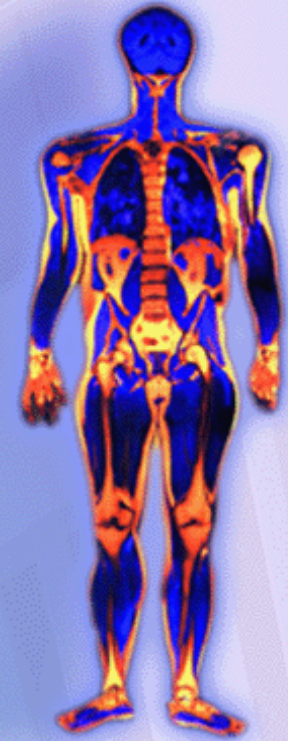
Blue Gene:



Towards Autonomic Computing

Self-optimizing

Self-configuring



Self-healing

Self-protecting

Some Questions About Grid Computing

- What is Grid Computing and why is it important?
- How does Grid differ from and relate to Peer to Peer and Web Services ?
- What is the technology and who are the key Players?
- What does IBM's offer to Grid computing?
- What type of applications lend themselves to Grid computing ?

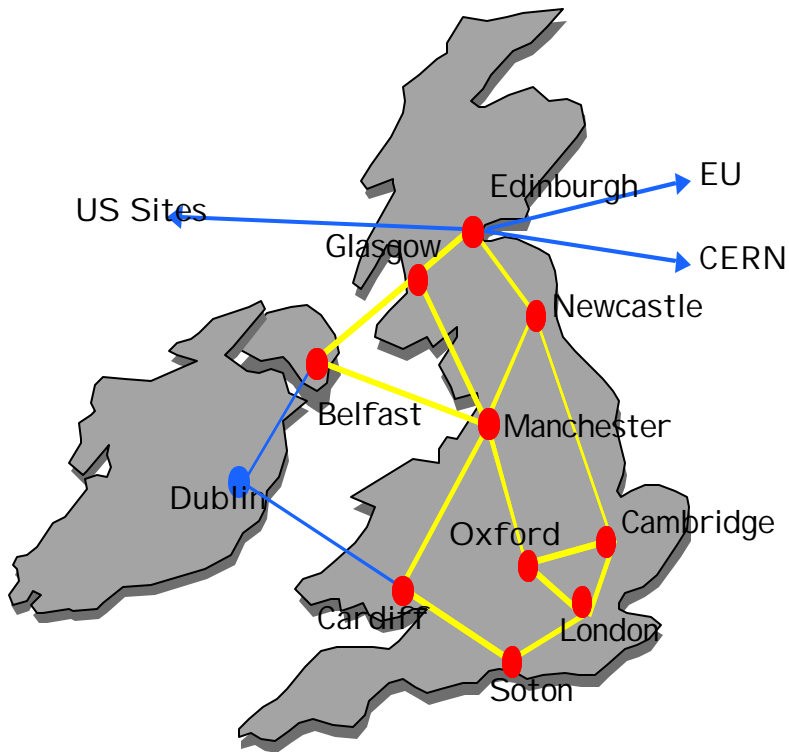
The Grid is an Approach to Distributed Computing

- Coordinate resource sharing and problem solving in or between physically dispersed virtual organizations (Foster and Kesselman)
 - Direct access to computers, data, software, storage, and other resources
 - Must be highly controlled with resource providers and consumers defining clearly:
 - who can share
 - what is shared
 - what conditions allow sharing
 - Institutions and Individuals defined by sharing rules constitute a virtual organization
- Made difficult due to: heterogeneity, WAN latency, scale, autonomy, dynamic nature, unpredictability, privacy and security
- Motivated by need for incremental compute resources, efficient utilization of existing compute resources, need for sharing compute resources

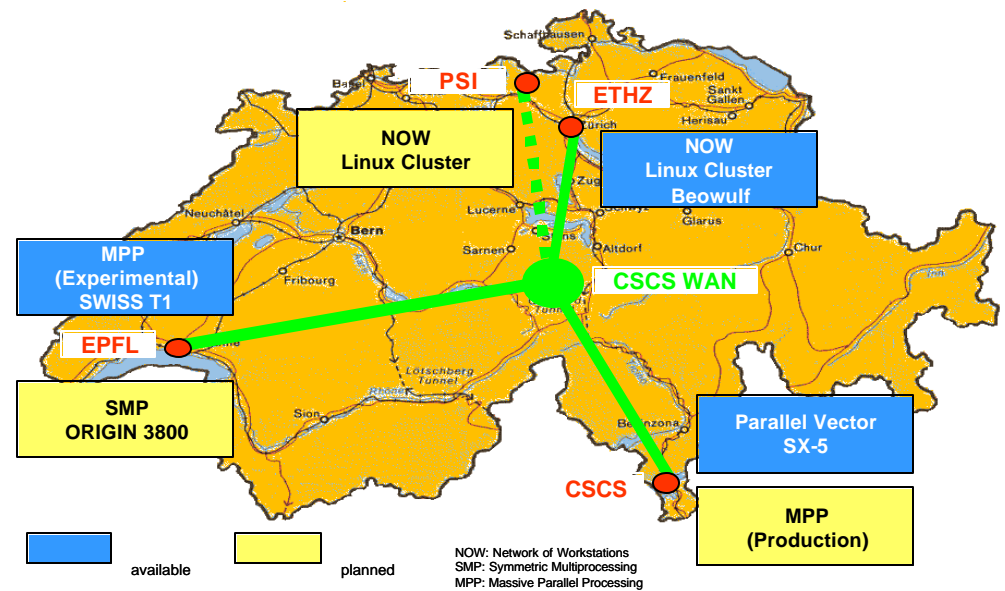
Anatomy of the Grid

- Grid approaches
 - ▶ Collaboration for design, business, gaming, communication
 - ▶ Sharing Data
 - ▶ Aggregating resources
 - ▶ Application submission
 - ▶ Scavenging unused compute cycles
- The vision is to create virtual dynamic organizations through secure, coordinated resource sharing among collections of individuals, institutions and resources
 - ▶ A means to create e-utilities and support e-business applications

Planned national Grid research networks



UK



Switzerland

Web Services, P2P, and Grid

	Web Services	P2P	Grid
Namespace	DNS	non-DNS directory	DNS+LDAP
IP addressing	static	static or dynamic	static or dynamic
Network connection	always connected	intermittent connection	always (today)
Representation	service is a proxy for an organization	peer is a proxy for an individual person	service is a proxy for a cluster resource
Function	different kinds of service work together	interchangeable peers work together	compute/storage resource management
Key issue to be solved	describing and finding services (UDDI, WSDL)	finding & addressing peers in real time ("presence" registry)	describing and finding resources (LDAP today)
Protocols & APIs	Open	Open or proprietary	Open
Virtual Organizations	Yes	Some do, some don't	Yes

Key Grid Software Technology- GLOBUS

- **GLOBUS** : Collection of **Open Source protocols** to enable grids involving sharing, scavenging, accessing applications, aggregating resources (exists on NT, Linux, AIX, etc.)
- **Small team collaboration**
 - Ian Foster and Carl Kesselman (a GRID equivalent to Torvalds on Linux)
 - Core Team: Argonne, UofC, USC, NCSA, NIU
 - License is GTPL and non-viral (courtesy of US government funding)
 - **Influenced through Global Grid Forum (GGF) today**
- **Technologically still immature; alternatives popping up**
 - Virtual computing projects (UVA; joint effort NYU & ASU)
 - Commercial solutions - JAVA (weakness in cross platform support on supercomputers, security, and local policy)
- **Attracting money**
 - IBM has been offered \$1.5 M (UK Govt. funding) to work on strengthening Globus Toolkit and SRB
 - IBM matching funds required ;Microsoft and SUN also engaged; other community issues abound.
 - NASA, DoD Modernization Program, DARPA, NPACI, DOE making investments

IBM assets relevant to Grid Computing

- ▶ Security
 - SecureWay, [Enhanced Linux Security](#), PCI-Crypto Hardware
- ▶ Resource Discovery and Publication
 - Private UDDI, WDSL, Open LDAP, MQSI
- ▶ Resource Reservation and QoS
 - xWLM, Network QoS, Loadleveler, Oceano, HA-Geo, MQ
- ▶ Data Movement and Management
 - Discovery Link, GPFS, HPSS, Federated NAS, Content Distribution Framework, Storage products
- ▶ Systems
 - [Linux Clusters](#), [z-, x-, and p-Series Linux](#), [Enterprise Linux](#)
- ▶ IBM Global Services
 - Human resources (skills and capabilities), service delivery center infrastructure assets

Summary: IBM's Commitment to Linux

Technical Support

ISV Porting Center

Linux
Technology Center



Linux Whitepapers



OSDL

Products



Linux Services



Linux -
Enabled BP's



www.ibm.com/linux



Close: Next Steps for Your Linux Implementation

- Determine where Linux fits in your IT strategy
- Identify a real business need that is best served by Linux as a pilot
- Ask your rep about Linux Installfest for a quick start
- Consider specially priced G5, G6, or Multiprise 3000 models for Linux with z/VM and a no-charge OSA-Express and specially priced upgrades from G3 and G4 to G5 with an IFL
- Ask your rep about the Integrated Facility for Linux and z/VM
- More information at the following Web sites:
 - Visit our Linux for zSeries site ibm.com/zseries/linux
 - Subscribe to The Linux Line ibm.com/linux/linuxline
 - Leverage The Design Center fore-Transaction Processing ibm.com/servers/design_center