U08   DB2 for Linux
Bill Wong, Program Director, DB2 for Linux and Life Sciences, IBM

IBM is an industry leader and supporter of the Linux movement. This presentation gives an overview of Linux and an overview of IBM's strategy surrounding Linux. Various customer scenarios using DB2 and DB2 Connect on Linux will be examined (both on Intel and zSeries). Finally, a brief overview on some of the latest features relevant in an Linux environment will be discussed.

U08

DB2 for Linux Update

DB2 Technical Conference - 2002

IBM Data Management Technical Conference

Anaheim, CA   **Sept 9 - 13, 2002**

Agenda

- Introduction to Linux and DB2

- DB2 Technology Overview

- Scalability and Performance

- zSeries and DB2 Connect

- DB2 Application Development

- DB2 Infrastructure Support and Solutions

- DB2 vs. Competition

- Why DB2 for Linux

What is Linux?

- UNIX®-like operating system developed by Linus Torvalds
  - ▶ Version 2.4 available
    - – 4-way SMP, 64-bit, Partitions, 1TB file size, Journaling...

- 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
  - ▶ Others (Red Flag, Conectiva, Mandrake, etc...)

Linux is open and ready for business.

- Linux has become the fastest growing server operating system in the world

- Linux adoption moving into the next phase

- IBM is committed to Linux

Fact: IBM has already invested over $1 billion in Linux.

Linux Momentum

Customer demand is very high and growing fastest

- Linux will definitely have the <u>fastest growth</u> in 2002, at almost 50% over 2001
  Gartner Group, December 2001

- Linux will have a "<u>breakout year</u>" in 2002. Now it seems clear that Linux has become a viable <u>alternative for enterprise use</u>.
  IDC, January 2002

- Exploring Linux - especially on the server side - <u>should be part of an organization's IT investment</u> portfolio. ...viewed as an insurance policy to <u>hedge against future Microsoft incursions into your wallet</u>.
  META Group, August 2001

WW New Server OS Share (units)

Windows

Linux

All UNIX

Other
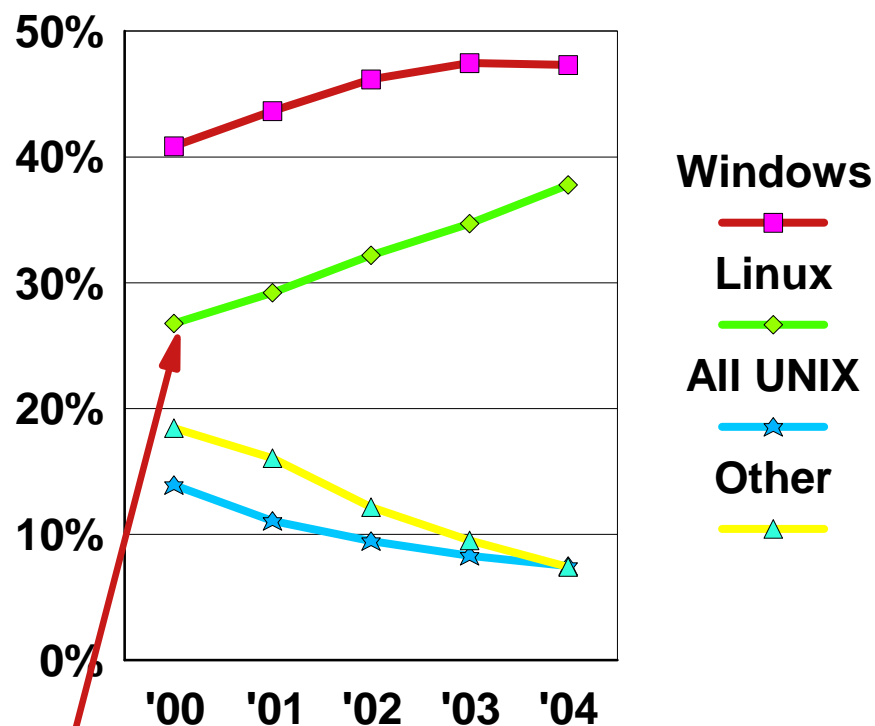
IDC, July 2001

Linux 23.6% Growth

Linux Distributors

Red Hat

- **Strength - Mindshare & Marketshare Leader**
- **Relationship- Worldwide & IBMwide**
  - ► IBM Software bundles agreement
  - ► IBM *@server* agreement
  - ► IBM products in Red Hat MarketPlace
- **IBM Platforms:**
  - ► Complete

TurboLinux

- **Strength - Japan, China**
- **Relationship - Worldwide & IBMwide**
  - ► IBM Software bundles agreement
  - ► IBM *@server* agreement
- **IBM Platforms:**
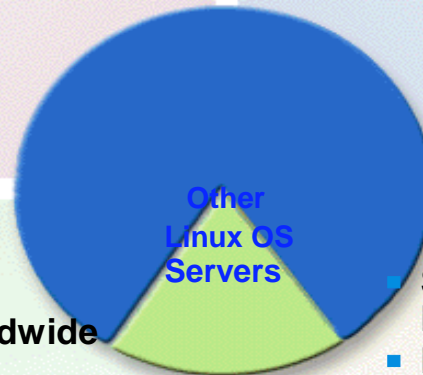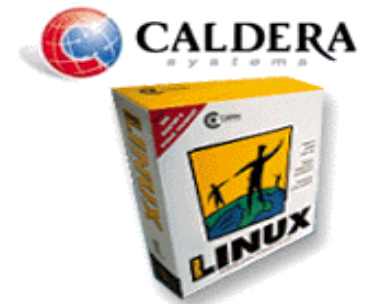 - ► Complete

SuSE

- **Strength - Europe**
- **Relationship - Worldwide & IBMwide**
  - ► IBM Software bundles agreement
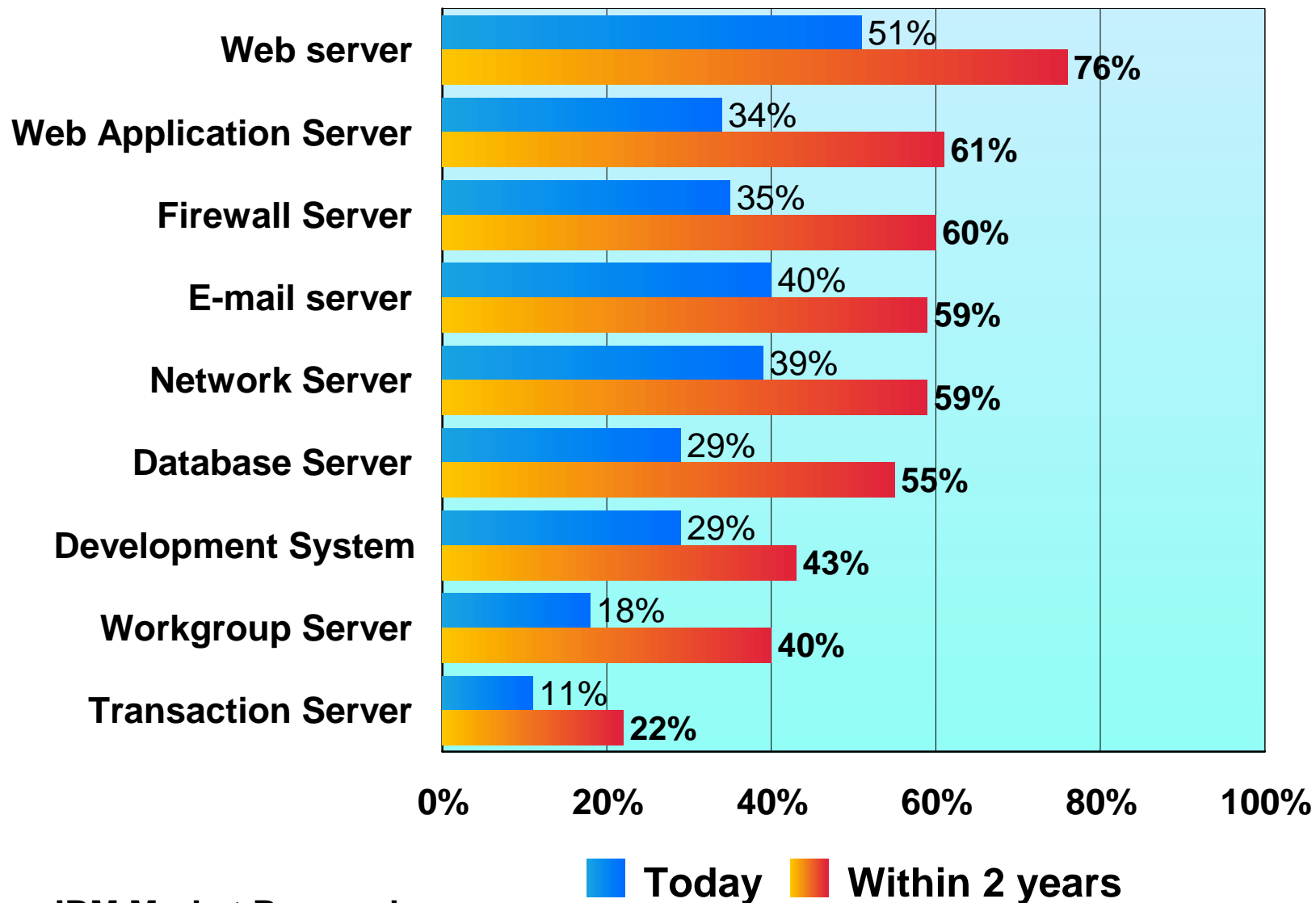 - ► IBM *@server* agreement
- **IBM Platforms:**
  - ► Complete

Caldera

- **Strength - WW Channel Partner infrastructure**
- **Relationship - Worldwide**
- **IBM Platforms:**
  - ► xSeries

Other Linux OS Servers

Linux Application Deployment

	Today	Within 2 years
Web server	51%	76%
Web Application Server	34%	61%
Firewall Server	35%	60%
E-mail server	40%	59%
Network Server	39%	59%
Database Server	29%	55%
Development System	29%	43%
Workgroup Server	18%	40%
Transaction Server	11%	22%

Today **Within 2 years**

IBM Market Research
February 2001

IBM Data Management Technical Conference

Linux and DB2 - a powerful combination

- DB2 for Linux - proven database technology
- A unique advantage: pure power at a low cost
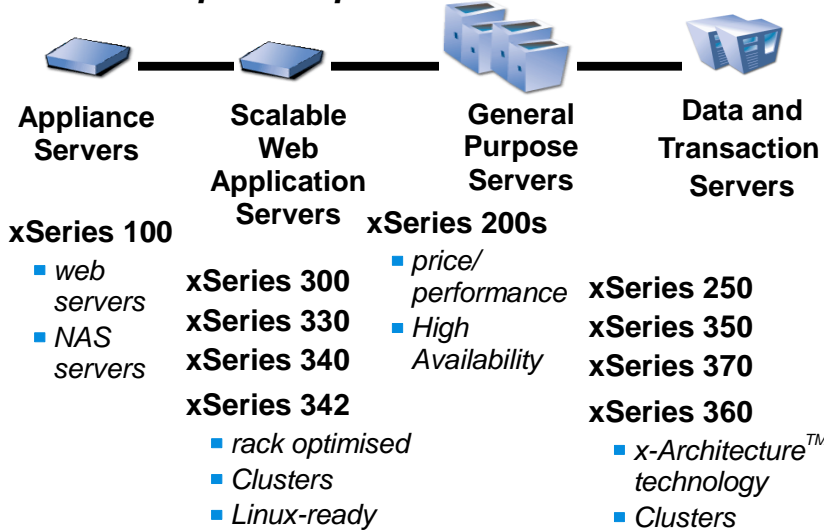- Plus, rock-solid stability, flexibility and manageability

DB2 puts penguins on steroids.

Industry's Broadest Linux Server Line

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

Appliance Servers

Scalable Web Application Servers

General Purpose Servers

Data and Transaction Servers

xSeries 100
- *web servers*
- *NAS servers*

xSeries 300
xSeries 330
xSeries 340
xSeries 342
- *rack optimised*
- *Clusters*
- *Linux-ready*

xSeries 200s
- *price/ performance*
- *High Availability*

xSeries 250
xSeries 350
xSeries 370
xSeries 360
- *x-Architecture™ technology*
- *Clusters*

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**

AIX
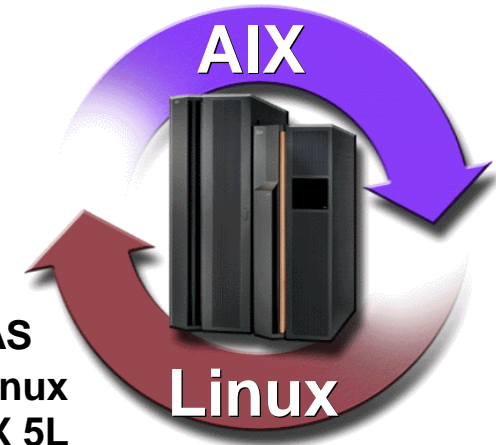
Linux

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

LPAR1 OS/400® VxRx
LPAR2 OS/400 VxRx
LPAR3 Linux

Primary Partition
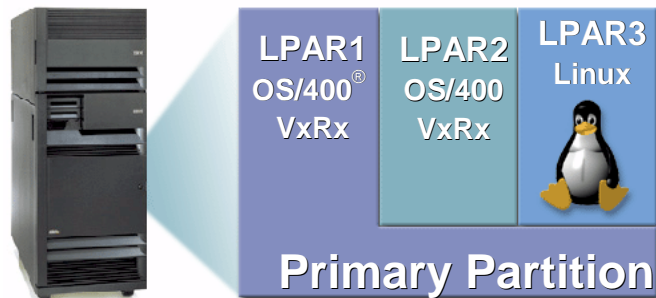
- **Linux in a partition**
- **Integrates new ebusiness applications**

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

- **True Linux**
- **Exploits zSeries HW**
- **Scalable, protected partitions**
- **Shared infrastructure**
- **Reduced cost of ownership**

LiNuX For S/390...

...it's COOL.

DB2 for Linux: From Palmtop to Teraflop

Embedded-to-enterprise industrial strength database solution.

Hosts
- DB2 Linux/390
- DB2 zOS
- DB2 VM/VSE
- DB2 OS/400

Enterprise & Extended
- Linux
- Linux 64-bit for IPF
- AIX
- Windows
- HP-UX
- Solaris
- Windows 64-bit for IPF

DB2 Connect
- Linux
- AIX
- Windows
- HP-UX
- Solaris

Workgroup
- Linux
- Windows
- AIX
- Solaris
- HP-UX

Personal
- Linux
- Windows

Everyplace
- Linux
- Windows
- PalmOS
- EPOC-32
- Neutrino

DB2 for Linux Availability:
- Intel and AMD 32-bit chips
- 64-bit Itanium Processor Family (SDK)
- IBM iSeries Linux (Technology Preview)
- IBM Linux/390 and zSeries Linux

Packaging Options

Individual

Central

PDAs, Handhelds

Local Admin Power User

Departmental

Non-clustered, enterprise management

Clustered

Satellite Edition

Personal Edition

Workgroup Edition

Enterprise Edition

Enterprise-Extended Edition

Personal Developer's Edition

Universal Developer's Edition

IBM.
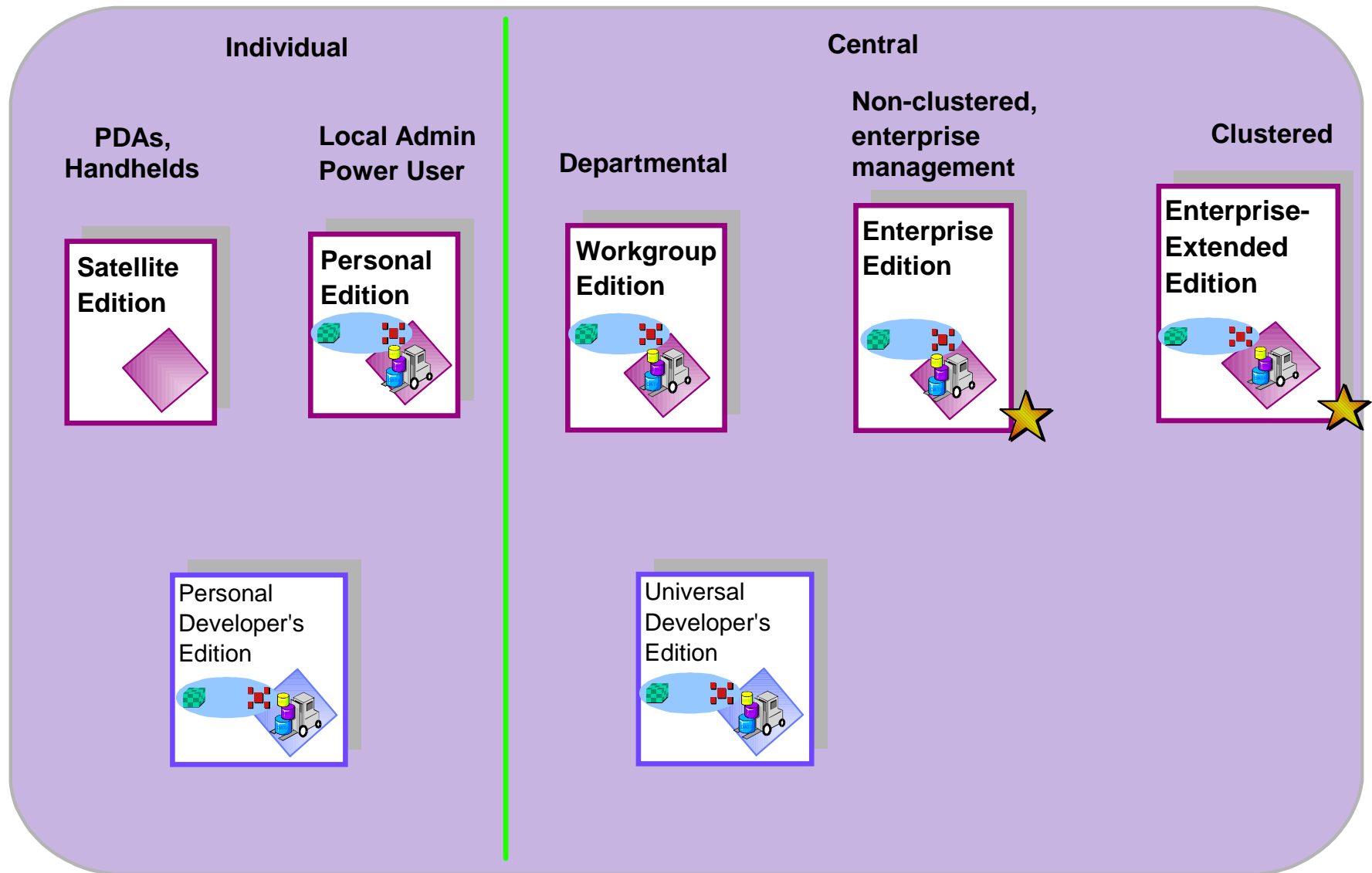
Technical Highlights

- SMP/MPP support, OLAP functions, Support for Binary Large Objects

- Leader in query optimization technology and performance

- Stored procedures, data encryption and globalization

- Heterogenous Federated supporting distributed joins between Oracle, DB2 Host Data, and DB2 Distributed DataDB2 Replication

- HA Failover support

- Backing for the InfiniBand I/O industry specification and DAT file format

- Exploits Linux 2.4 Kernel capabilities
  - ▶ Raw I/O Device support
  - ▶ Greater than 2GB tablespace containers and log file support

Technical Highlights

- Supports Java (J2EE, JDBC, SQLJ)

- Fully web enabled including support for PHP, Python and Perl

- XML Extender allows the storage and retrieval of XML documents using SQL APIs

- Net.Search Extenders enable in memory text search semantics for high speed text searching

- Web based and GUI interfaces to all DBA tasks

- Productivity tools for visual development and migration
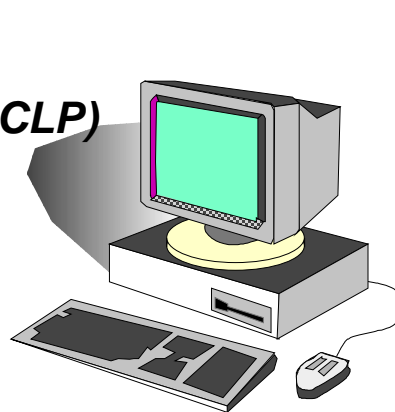
Integrated Tools

Administrator

- ✓ *Web Control Center (Navigator) and Utilities*
- ✓ *Performance Monitor*
- ✓ *Performance Configuraton Wizard*
- ✓ *Network Configuration Wizard*
- ✓ *Parallel Load*
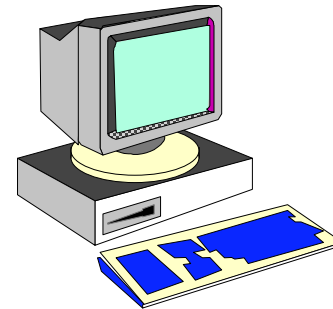- ✓ *Job Scheduler*
- ✓ *Governor*
- ✓ *Data Reorg*

DB2 Server

✓ **Data Replication**
- ✓ **Capture**
- ✓ **Apply**

DB2 Server

DB2 Connect Gateway
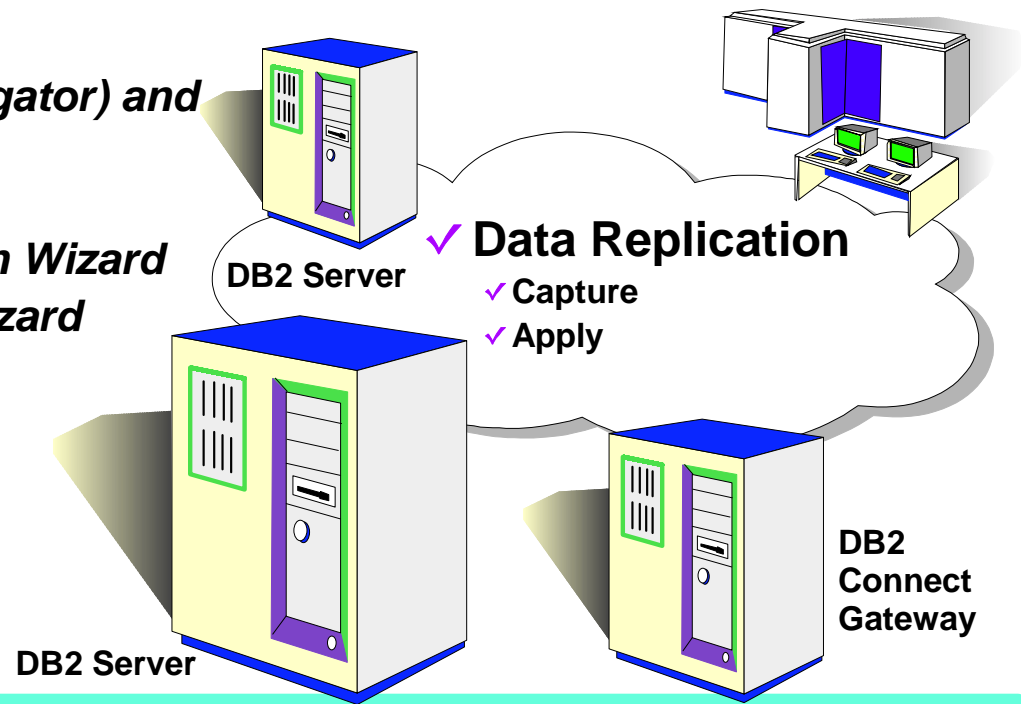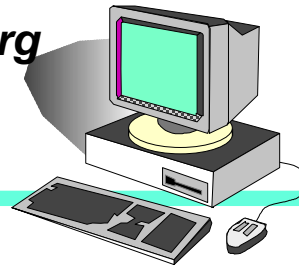
Developers

- ✓ *Command Center (GUI CLP)*
- ✓ *Visual Explain*
- ✓ *DB2 Extenders*

Users

- ✓ *Client Configuration Assistant*
- ✓ *DB2 Discovery*

IBM.

DB2 UDB Clustering

IBM delivered the industry's first database support of Linux Clusters

► Start small & grow ... add extra capacity as needed
► Easy to add nodes to the cluster
► Investment in skill set maintained
► High-end clustering for web and data warehouse apps for low TCO
  – Commodity hardware
  – Not locked into a proprietary OS
► Leading benchmarks
► Terabyte Club
► Shared nothing architecture
  – Scale & performance
  – High availability
  – Management tools

LINUX

DB2 EEE
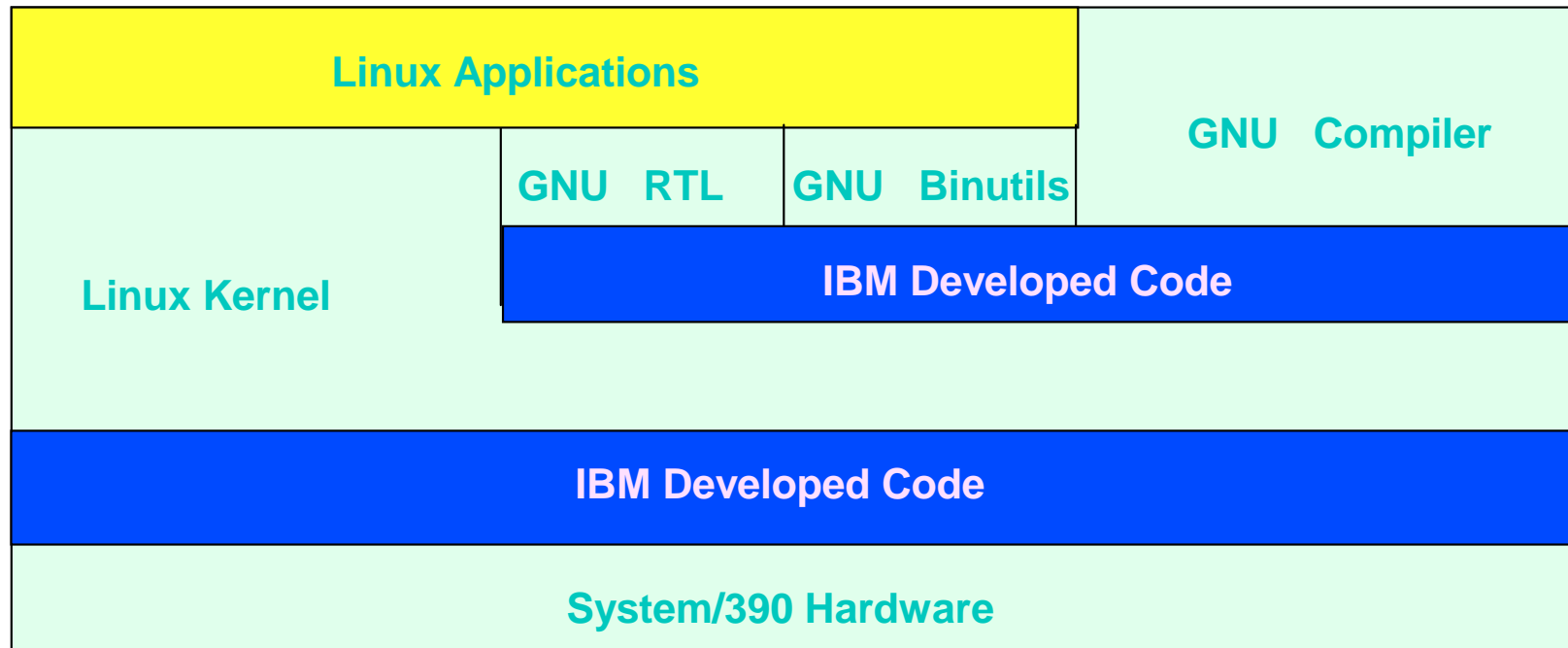
LINUX

DB2 EEE

LINUX

DB2 EEE
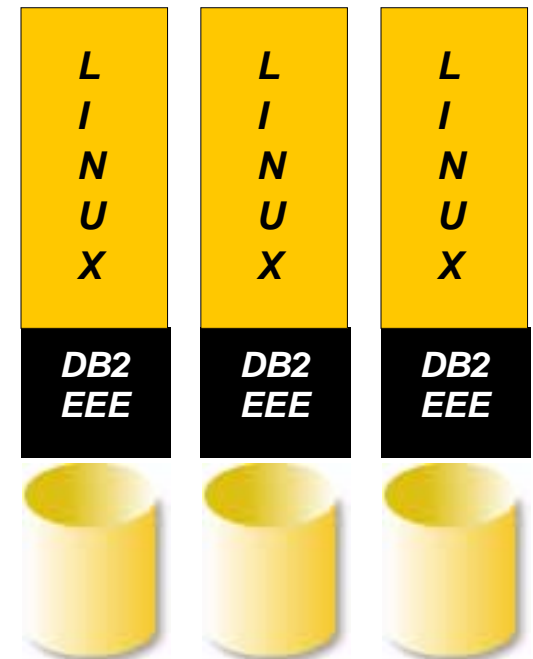
Single database image

Near linear scaling

What is Linux for S/390 and zSeries?

Linux Applications

- Pure Linux, ASCII Environment.
- Not a unique version of Linux.
- Distributions available from SuSE, Redhat, TurboLinux
  - 2.2 and 2.4 kernels
  - 31 and 64 bit
- Exploits IBM S/390 Hardware, including IEEE floating point.

- No intention to replace z/OS or other S/390 operating systems.
- Runs native, in an LPAR, or on z/VM
  - Up to 15 LINUX instances run directly on the server (one or more engines); or many more with z/VM
- Integrated Facility for LINUX engine(s) isolates traditional z/OS Software costs

Linux Applications		GNU Compiler
Linux Kernel	GNU RTL / GNU Binutils	
	IBM Developed Code	
IBM Developed Code		
System/390 Hardware		

Linux for S/390 IT Trends Survey Data

S/390 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%

Linux Deployment on S/390 IT Trends Survey
Data

Percentage of customers planning to consolidate Linux workload on a mainframe in the next 12 months?

All	< 400 Mips	> 400 Mips
17.3%	9.2%	29.7%

What applications are you considering running on Linux on a mainframe?

	All	< 400 Mips	> 400 Mips
ERP	9.4%	9.3%	9.6%
SCM	21.9%	19.5%	25.7%
CRM	30.4%	28.0%	34.3%
E-MAIL AND COLLAB	39.4%	36.5%	43.9%
BI	25.1%	33.4%	11.2%
S/T/E	26.2%	27.2%	24.7%
E-COMM	61.2%	53.1%	73.2%
WEB SERVING	59.2%	58.3%	60.5%
OLTP	31.4%	34.4%	26.9%
OTHER	14.0%	13.4%	15.0%

DB2 for Linux on zSeries or S/390

IBM delivered the industry's first database support of the mainframe running Linux

zSeries customers can extend and leverage their current investment in hardware

- 100s-1000s of Linux operating systems can coexist with other operating systems on a single zSeries under VM
- With VM, a customer can offer a complete Linux server environment to each of their application developers and host production systems all on the same zSeries machine
- The zSeries can be logically partitioned into 15 LPARs so a single zSeries could host zOS, VM and VSE, and Linux applications

Consolidation of Linux servers on zSeries reduces cost, improves reliability and manageability

- Hardware savings, skill leverage
- "5-9s" zSeries reliability

Customers can take advantage of the features specific to UNIX environments on DB2 UDB on Linux
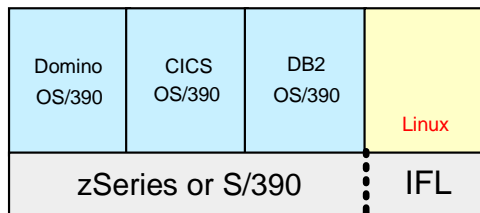
- With DB2 UDB and DB2 Connect available on Linux for zSeries it is possible for vendor applications that are currently available for UNIX customers (that are not yet ported to zOS) to leverage the zSeries platform
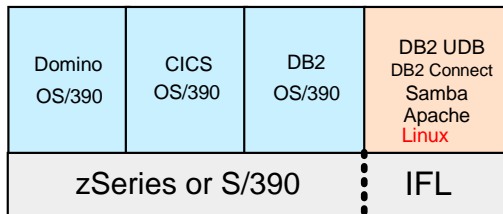
Integrated Facility for Linux engines

Domino OS/390	CICS OS/390	DB2 OS/390
zSeries or S/390		

Stage 1

Domino OS/390	CICS OS/390	DB2 OS/390	Linux
zSeries or S/390			IFL

Stage 2

Domino OS/390	CICS OS/390	DB2 OS/390	DB2 UDB DB2 Connect Samba Apache Linux
zSeries or S/390			IFL
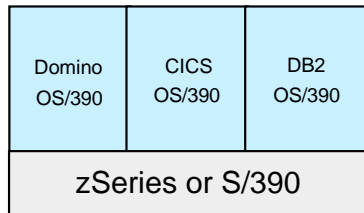
Stage 3

- Business As Usual
  - ► Typical z/OS or OS/390 environment on a 3 way processor

- Same as above with one IBM Integrated Facility for Linux engine added
  - ► Traditional environment price remains the same

- Same configuration as above with IBM middleware for Linux for zSeries added
  - ► Traditional environment price remains the same
  - ► Add cost of IBM middleware (i.e DB2 UDB and DB2 Connect)

- Add compute power for Linux workloads without increasing charges for traditional zSeries software from IBM and ISVs
- Available as a feature on Multiprise 3000, 9672 G5/G6 and zSeries systems
- Adding IFL processors has NO effect on existing software prices running on zSeries

DB2 Query Scalability
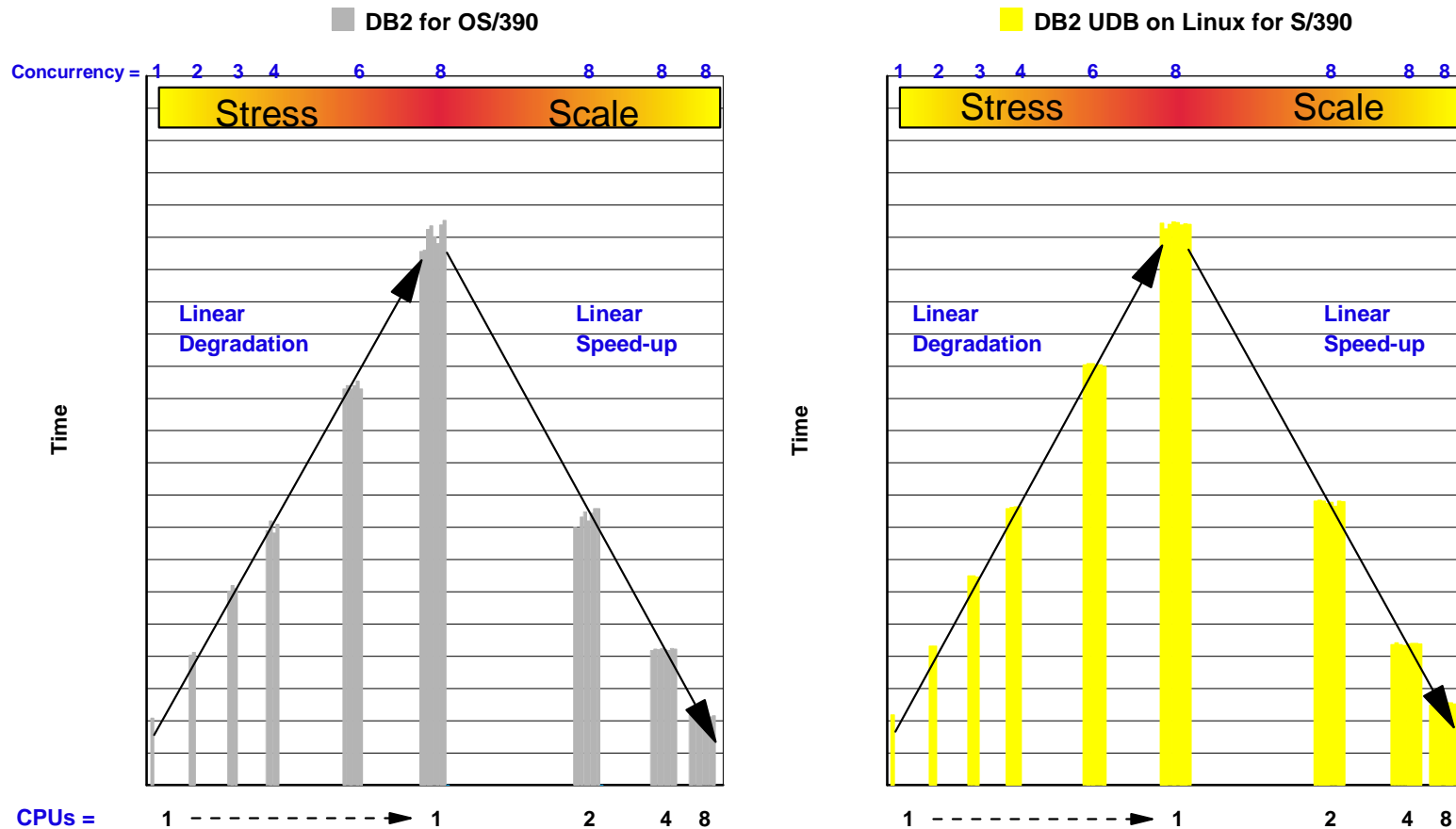
Source: e-Business Intelligence: Leveraging DB2 for Linux on S/390 - July, 2001
http://www.redbooks.ibm.com/pubs/pdfs/redbooks/sg245687.pdf

- Workload targets data mart applications
- Not applicable for data warehousing or OLTP applications

DB2 Connect -- Enterprise Integration with Linux

Middle tier of gateway servers was needed

Clients

DB2 Connect for
UNIX, Windows, OS/2

DB2 for
OS/390, VM, VSE

Before
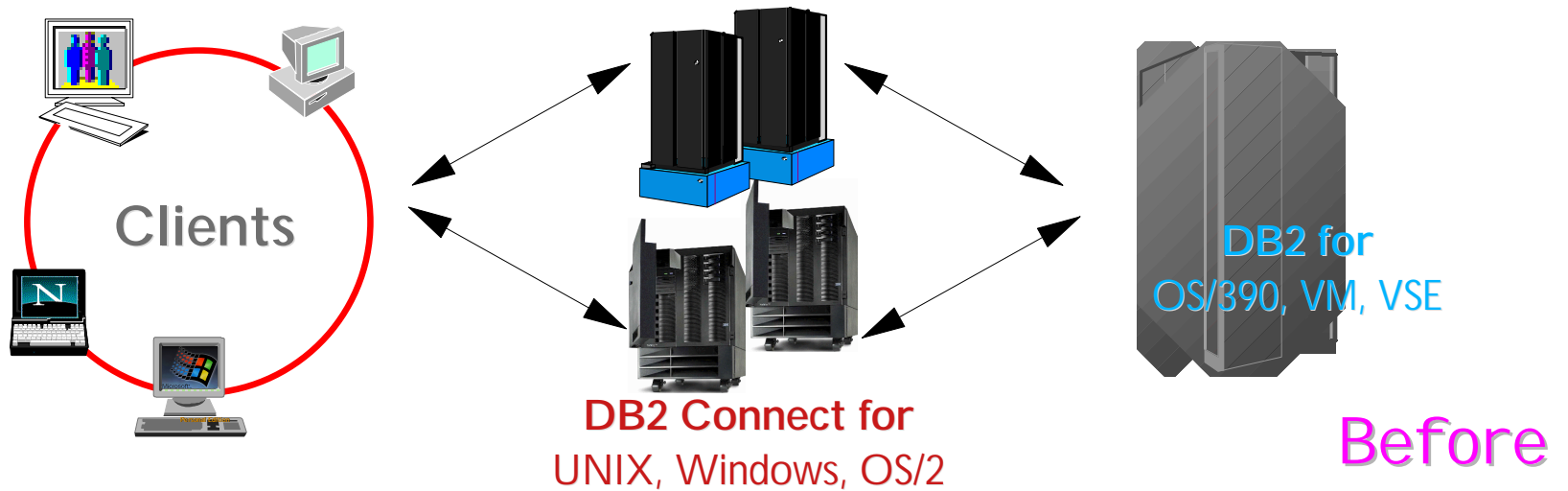
Eliminate middle tier with DB2 Connect on zSeries

Clients

DB2 Connect for
Linux - S/390

DB2 for
z/OS, VM, VSE

After
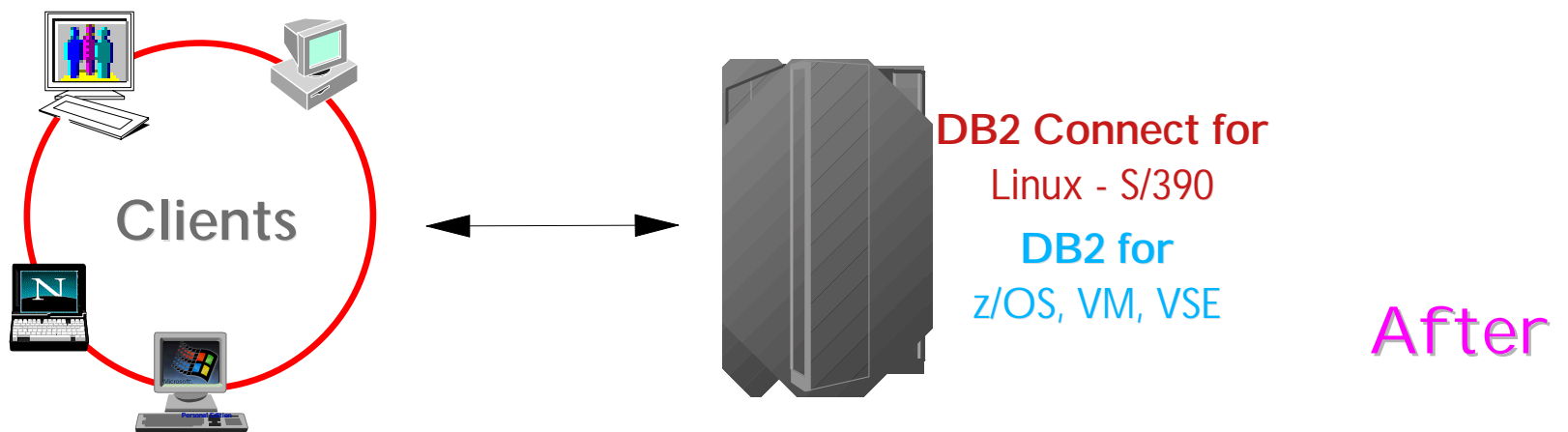
Web Development with DB2 for Linux

- DB2 Integrates seamlessly with Java and IBM Websphere family
- Net.Data provides quick access to DB2 data from web servers
- Integrates with Popular Open Souce Apps and Apache
  - Perl
    - DB2 interface is available for download provide by IBM
    - http://www.ibm.com/software/data/db2/perl
  - PHP
    - Works directly with CLI layer through something called unified-odbc in PHP
    - http://www.php.net
  - Python
    - DB2 driver available in open-source
    - http://www.python.org

Learn how to jumpstart your e-business application development for DB2 and Apache
- Install and configure DB2 for Linux, Apache, PHP, Perl and Python
- Identify and include DB2 specific drivers for each language database interface
- Connect to the DB2 database
- Create and execute SQL statements

www7b.boulder.ibm.com/dmdd/library/tutorials/db2linux/db2linux.html

DB2 UDB For Developers

- **Personal Developers Edition can be downloaded for free**

- **Try and Buy for 90 Days**
  - ►EE (Intel and zSeries), EEE (Intel)
    http://www.ibm.com/software/data/db2/udb/downloads.html

- **No-charge Linux Software Evalution Kit**
  - ►Contains IBM key middleware for Linux including the Universal Developer's Edition (UDE) for DB2 on Linux
    http://www.ibm.com/linux
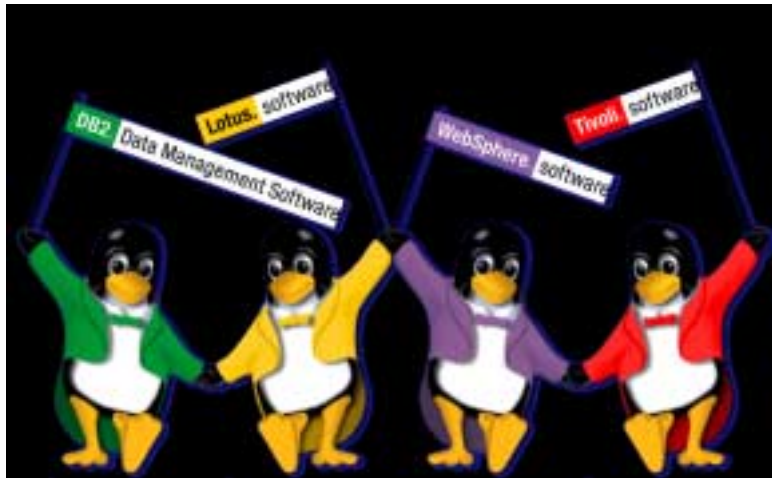
Partners and Solutions

- **Business Solutions**
  - ► ERP - SAP
  - ► Accounting - Accpac, Sage
  - ► Retail - Apropos, Marcole
  - ► Finance - Axiom, Eontec, Sanchez

- **Business Intelligence**
  - ► SAS
  - ► Dimensional Insight
  - ► MicroStrategy
  - ► Brio
  - ► Business Objects, Informatica

Infrastructure Partners

Partners on DB2 EE and EEE on Intel-based and mainframe servers

WITH

Borland®

- ► RAD Development Environment
- ► Kylix & Delphi

LEGATO®

- ► HA/BAR
- ► LAAM and Networker

SteelEye

- ► HA
- ► LifeKeeper

QUEST SOFTWARE

- ► Systems Mgmt
- ► Quest Central for DB2

PUSH

✓ *Develop once with DB2 & Borland and deploy in multiple Linux/Windows environments*

✓ *Used by a major ERP vendor for their own Backup-and-Recovery*

✓ *DB2 and Steeleye advantages with Linux IA-32 clusters*

✓ *Wide range of monitors/tools to support DB2 in a variety of environments*

High Availability Fail-over Solutions

Be confident that your mission critical data is always accessible with high availability solutions for DB2!

- Similar functionality as HACMP on AIX, MSCS on Windows etc.
- Administration GUI Interface provided by all vendors
- All required scripts provided by vendors
- Available for Linux IA-32 today

Our Partners Include:

- ► LifeKeeper from SteelEye Technologies
  - – Supports all clustering configurations
  - – http://www.steeleye.com
- ► Legato Automated Availability Manager
  - – Supports all clustering configurations
  - – http://www.legato.com

DB2 Database: Payroll

Cluster

DB2 → Failover → Hot Standby

OR

DB2 Database: Payroll

Cluster

DB2 Instance A → Failover ← DB2 Instance B

Active-Passive or Hot Standby

Active-Active or Mutual Takeover
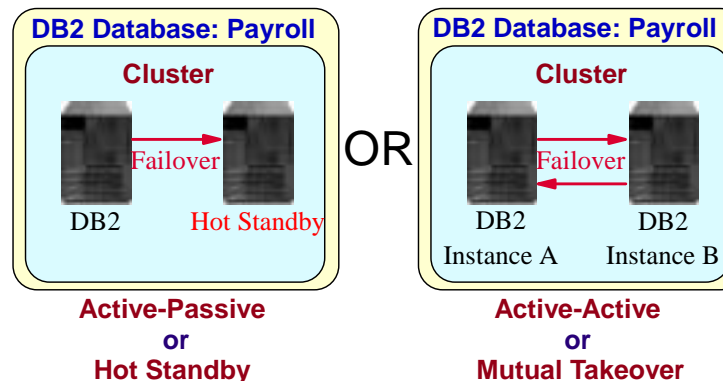
DB2 for Linux vs. Other Databases: Open-Source

- ► is not ACID compliant
- ► lacks many of the business-required features such as triggers, stored procedures, views, or full support for transactions
- ► is great as a small data store but doesn't scale well as workloads and transactions increase

---

- ► Comparison of DB2 and open-source databases on Linux
- ► "DB2 UDB for Linux provides ... lowest long-term total cost of ownership."
- ► None of the open-source databases grow beyond entry-level business needs
- ► Download from: http://www6.software.ibm.com/dl/db2_01/techguide-p

---

- ► lacks major management utilities and features
- ► unable to control degree of transaction rollback
- ► does not allow online backups while letting applications to remain connected and active

DB2 for Linux vs. Other Databases: Commercial

Oracle9i Database

- Oracle claims it embraces Linux - where are the references?
- IBM leads in database performance; Oracle has published no Linux benchmarks
- Total cost of ownership: IBM is the low-cost database leader
- Market growth: IBM continues to grow faster than the industry

Microsoft
SQL Server

- Does not run on Linux today
- Still can't scale as well as DB2
- Lags behind DB2 in benchmarks (TPC-H 100GB category)
- DB2 for Linux embraces more open standards than Microsoft and interfaces with a variety of platforms
- Microsoft states no future support for Java

Migrating from other DBMS on Linux

- Commercial Databases
  - ► Today Sybase and Oracle on Linux
  - ► MTK for Sybase and MTK for Oracle available on Linux today internally

- Most popular Open-source Databases
  - ► MySQL
    - Aiming for a migration tool for database and data by mid-year

  - ► PostgreSQL
    - Migration tool migrating database developed
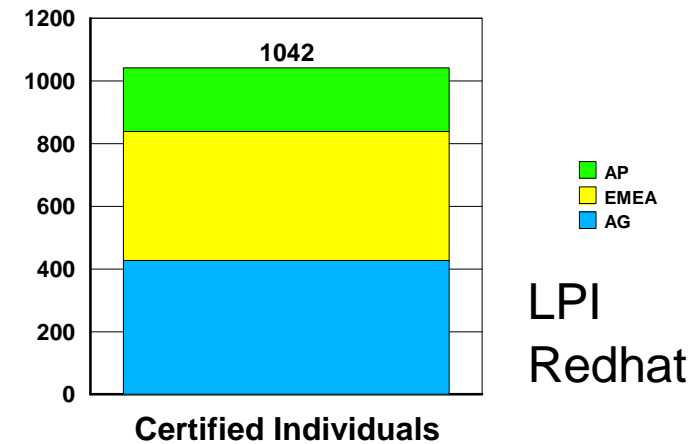   - Likely to be made available through open-source externally in the near future

- IBM Migration Team
  - ► Americas, AP, EMEA

IBM Business Partner Linux Skills and Applications Growth in 2001

IBM Business Partner Linux Skills Growth

- AP
- EMEA
- AG
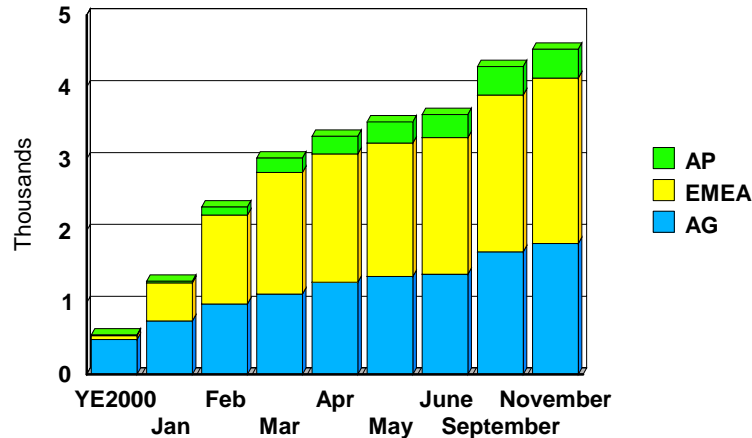
IBM Data as of
12/6/2001

IBM Business Partner Certified Skills

1042

- AP
- EMEA
- AG

LPI
Redhat

Certified Individuals

**Linux Applications
Global Solutions Directory**

Feb	Mar	Apr	June	Dec
1702	1919	2178	2290	2800

IBM.

™!IBM Corporation 2002

IBM Data Management Technical Conference
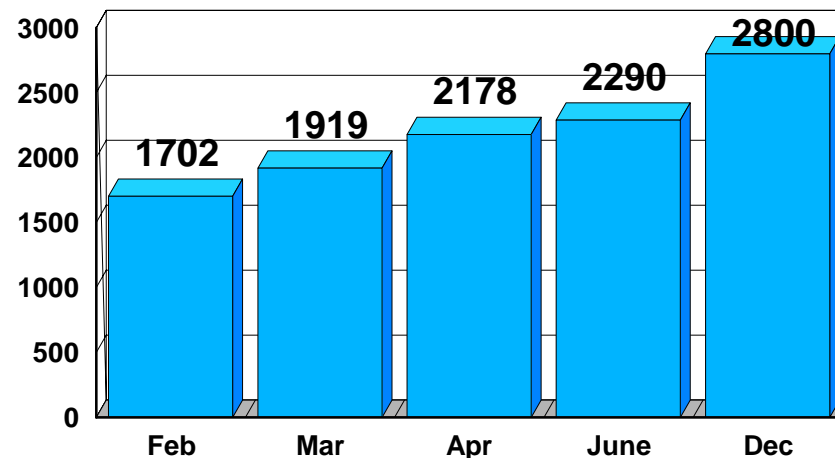
IBM Solutions Guide for Linux

Highlighted **Customer References**

- ✓ **Korean Air using**
  - DB2 for Linux for zSeries
  - WebSphere App Server, Linux for zSeries
  - IBM eServer zSeries
- ✓ **GREDE Foundries**
  - DB2 for Linux for S/390
  - DB2 Connect to VSE/ESA
  - IBM S/390 (zSeries)
- ✓ **Kvick.com**
  - DB2 for Linux
  - IBM Netfinity (xSeries)
  - IBM Business Partner Netmill
- ✓ **Future Cellular**
  - ACCPAC with DB2 for Linux
  - AGS Software
  - ACCLink
  - IBM Point of Sale Terminals
  - IBM eServer xSeries

IBM Linux Support

Technical Support

ISV Porting Center

Linux Technology Center

Linux Sales Specialists

Linux Whitepapers

Products

OSDL

www.ibm.com/linux

Linux - Enabled BP's

Linux Services

Why DB2 UDB for Linux

Delivers Value

Less

- **Lowest Total Cost of Ownership**
  - TCO consultant reports are available for viewing at: http://www-4.ibm.com/software/data/pubs/tech-consult.html
  - New pricing for DB2 for Linux on Intel: up to 1/2 off when purchased through Passport Advantage (Announcement Letter 202-004) -- TCO gets even better!!

- **Broad Platform Support**
  - DB2 runs most popular UNIX and Intel Server platforms and the mainframe as well!
  - DB2 supports all major industry standards relevant to distributed data
  - DB2 can grow as your business needs grow but investment in skill set is maintained from entry to enterprise across platforms

- **Seamless Connectivity to Other Data**
  - DB2 delivers the industries most advanced heterogeneous environment support
  - Seamlessly access relational and non-relational data from a variety of data sources

Why DB2 UDB for Linux

Peace of Mind

- **World Wide 24x7 Service and Support**
  - Best of Breed in industry

- **IBM and ISV Application and Tool Enablement**
  - ERP, CRM, BI, Tools and other solutions are available from ISVs for DB2 on Linux
  - Extensive technical enablement and co-marketing programs to support business partner success with IBM technologies

- **24x7 Reliability, Scalability, Availability and High Performance**
  - Leader in query optimization technology and performance
  - DB2 is the performance leader on Linux .. see the recent TPC-H benchmark results (www.tpc.org)

Why DB2 UDB for Linux

Easy to Manage

- **GUI based central control point for Managing DB2 Servers**
  - Control Center presents a single GUI interface to all DBA tasks

- **DB2's Self Managing and Smart Database Technology Reduces the Complexity of Administration**
  - DB2 has the industries best SQL optimizer, eliminating the need for hand tuned queries, simplifying the job of the DBA and the application developer

Summary

Flexibility & Choice of Deployment

Ability to Consolidate on Platform of Choice

Vendor Independence

Major system vendors are adopting Linux on their platforms

Lower Total Cost of Ownership

Emerging SW vendors developing on Linux

Established ISV's porting to Linux

Application availability & new business innovation

Skills growing in Universities, development organizations and research labs

Unix Skills Transferable

Larger pool of skills available

Linux Adoption   Effects   Benefits

™!IBM Corporation 2002   IBM Data Management Technical Conference

Appendix

Useful Links

- IBM Mart homepage
  - www.ibm.com/servers/eserver/zseries/zmart/
- DB2 UDB EE Download site
  - www.ibm.com/software/data/db2/udb/downloads.html
- QMF homepage and download site
  - www.rocketsoftware.com/qmf/index.html
- IBM Mart Installation Assistance
  - www.ibm.com/servers/eserver/zseries/zmart/contact_us.html
- Download sites for Linux on zSeries Distributors
  - www.ibm.com/servers/eserver/zseries/os/linux/dist.html
- IBM Linux homepage
  - www.ibm.com/linux/
- Linux Online
  - linux.org/
- Dimensional Insight
  - www.dimins.com
- IBM Teraplex Integration Centers
  www.ibm.com/software/data/bi/teraplex/
- IBM Linux Home Page
  www.ibm.com/linux/

Linux for zSeries homepage

www.ibm.com/servers/eserver/zseries/os/linux/

More Information

www.ibm.com/linux

> ►**Links to IBM Linux & open source sites**
>> ○ IBM Hardware for Linux
>> ○ IBM Software for Linux
>> ○ IBM Service and Support for Linux
>> ○ IBM Alliances / Linux distribution partner's sites
>> ○ IBM Open source contributions

www.ibm.com/developerWorks

> ►**Comprehensive online resource for the developer community**
>> ○ Linux zone
>> ○ Open source zone
>> ○ plus .... Java, XML, Security, Web architecture zones

learn.ibm.be/linux

> ►**Introduction to Linux (no-charge)**

IBM Wall Street Journal Ad

"Ultimately, Linux will do for applications what the Internet did for networks."

1991. Helsinki.

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