Linux on POWER

# IBM @server® OpenPower™
## "New" systems tuned for Linux®

**Tomaž Vincek**
**IT arhitekt**
**IBM Slovenija**

ON DEMAND BUSINESS™

# Companies look to IT providers to support their growth and reduce costs – at minimal risk and on demand

## Line of business organizations need

- Accelerated Return On Investment (ROI) on IT investments, lower costs
- Reduced business risk
- Higher productivity from workforce
- Flexible and secure IT infrastructure that enables on demand business
- Minimal downtime of business applications

## IT departments seek

- Simplified deployment and management of IT infrastructure
- Higher performance at lower cost
- Better utilization of IT assets
- Integrated and tested solutions with minimal risk
- Open, flexible and reliable platform

# ROI and IT simplification objectives drive specific requirements for the next generation Linux server

## Key adoption drivers

- Rapid adoption and maturing of Linux Operating System (OS)
- 32- to 64-bit transition
- Increasing popularity of scale-out deployment
- Consolidation of infrastructure, application workloads
- Adoption of commercial clusters
- Price-focused purchases of “good enough” entry servers (2-way and 4-way)

## Linux server selection criteria

- A low cost, reliable, secure way to simplify IT infrastructure, and run business-critical applications
- A solution designed and tuned for Linux OS that fits easily into existing environments
- A balance of performance / reliability and Linux OS freedom / low cost
- Strong and vibrant ecosystem
- A committed partner to provide the support and “a security blanket”

Source: ZMET customer research, March 2004

# Introducing the IBM @server OpenPower

*Family of entry IBM POWER5™ systems tuned for the Linux OS*


- **Tuned for Linux**
- **Optional Virtualization designed to lower operational costs**
- **Enterprise-class RAS**
- **Leading-edge performance**

# What the Market is saying

**Sept. 13, 2004:** ***William Claybrook, Harvard Research Group, US***
**"No Contest: IBM OpenPower is Easily the Price/Performance Leader."**

**Sept. 13, 2004:** ***CNET, Asia***
**"IBM clearly sees that Linux is the vehicle that makes it easier for customers to move to the Power platform."**

**Sept. 14, 2004:** ***CXOToday, India***
**"As [OpenPower] runs on IBM's Power5 monster chip, the server has managed to edge out HP and Sun on crucial industry benchmarks."**

**Sept. 14, 2004:** ***Dan Olds, Gabriel Consulting Group, US***
**"OpenPower has a fast, fast processor at an affordable price. It opens up a whole new market for IBM."**

**Sept. 13, 2004:** ***By Lee Kroon, Andrews Consulting, US***
**"OpenPower puts a stake in the ground that proves that IBM is serious about competing for the lower-end market."**

**Sept. 13, 2004:** ***InfoWorld Magazine, US***
**"We consider [the OpenPower servers initiative] to be a significant step in advancing the Linux ecosystem. This will make it more possible to deliver some of the advantages of the security and affordability Linux can offer"**

# With IBM commitment to and industry momentum for Linux, OpenPower delivers exceptional business value

Linux

## Client
Delivering business value

### Linux
- Growth
- Maturing
- Cross platform
- Empowering

### Leadership offerings
- Performance
- Price/performance
- Enterprise features
  - RAS
  - Virtualization
  - Tuned for Linux

### Community
- Developers
- ISVs
- Applications
- University programs
- Access to systems and tools

### Solutions
- Go to Market
- Plug-and-play solutions
- Available through IBM and IBM Business Partners
- Migration tools and programs

Linux
Systems
IBM Middleware

## IBM commitment
IBM POWER™ Architecture™

Service and Support
on demand Solutions
Leadership Tools

# What is the Linux operating environment?

Linux

**Created as an open standards-based, UNIX® OS operating environment**

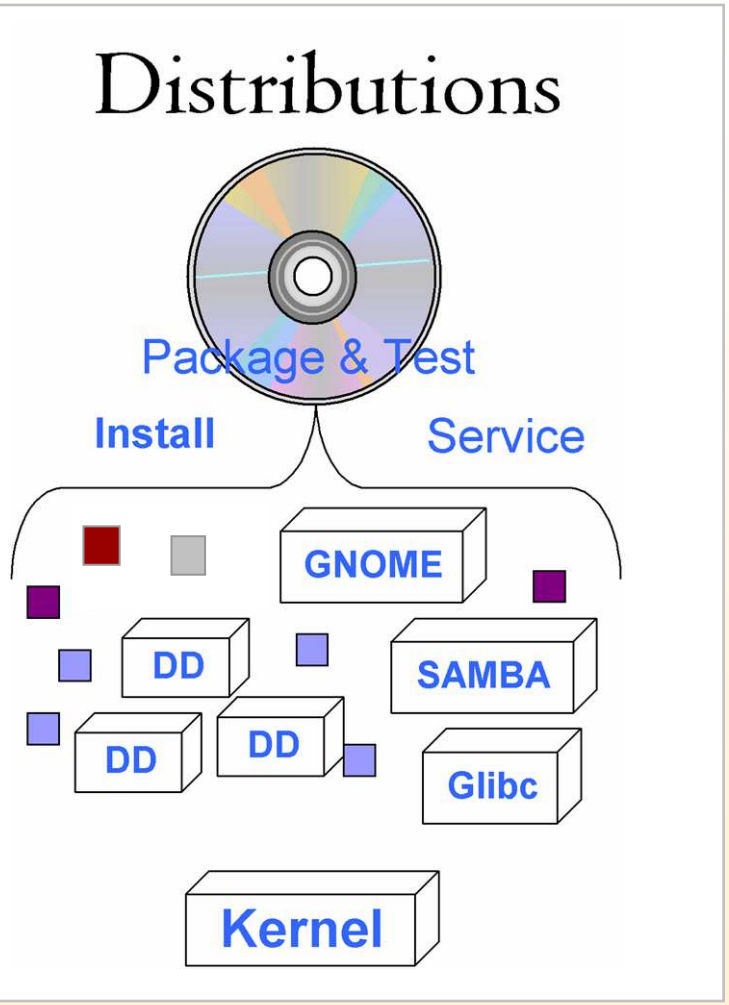
**Packaged and shipped by many distributors, including Red Hat and SUSE LINUX**

**Provides a cost-effective operating environment**

**Delivers the power you need to run your business-critical applications**

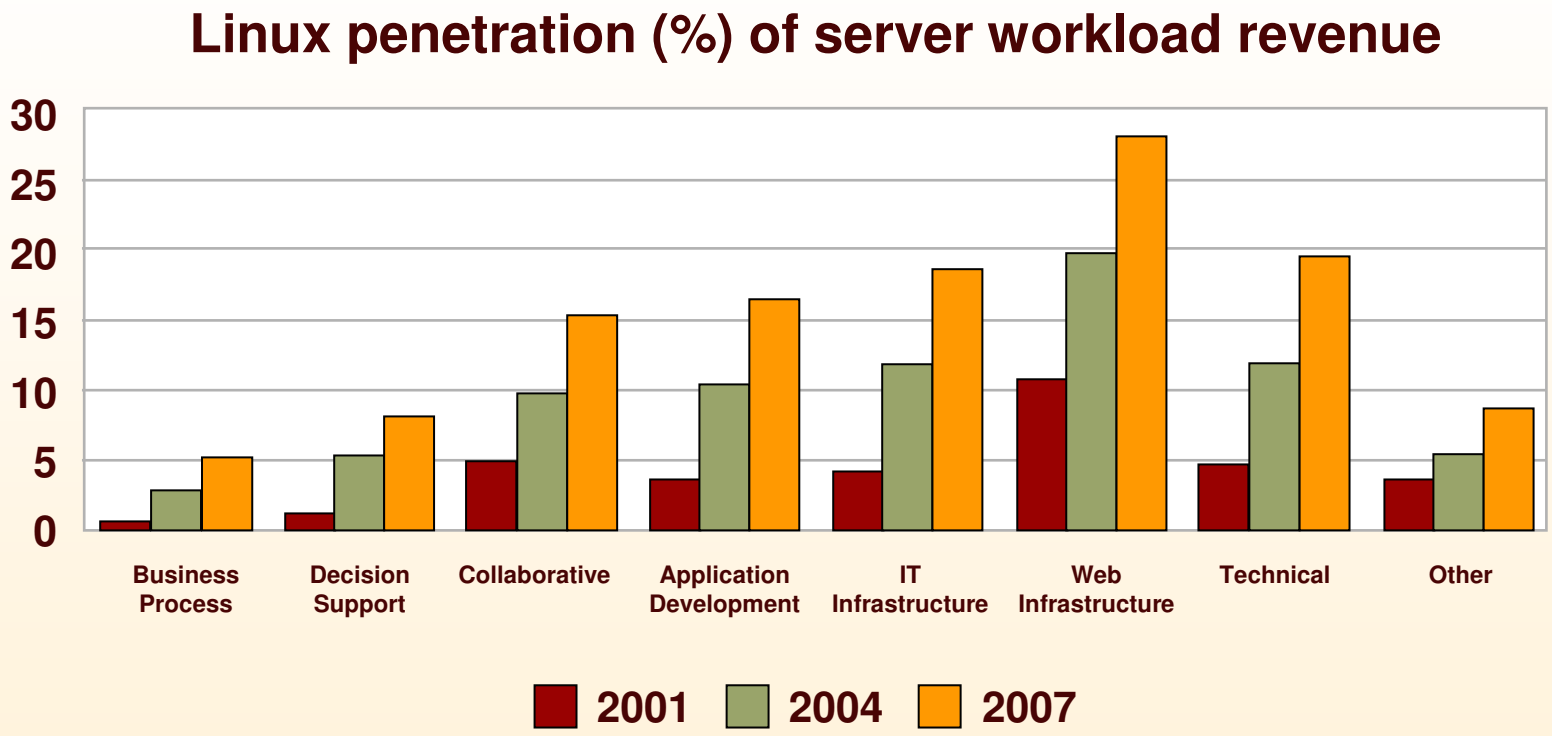
**Provides a stable, security-rich operating environment**

**Developed and continuously tested by the open source community**



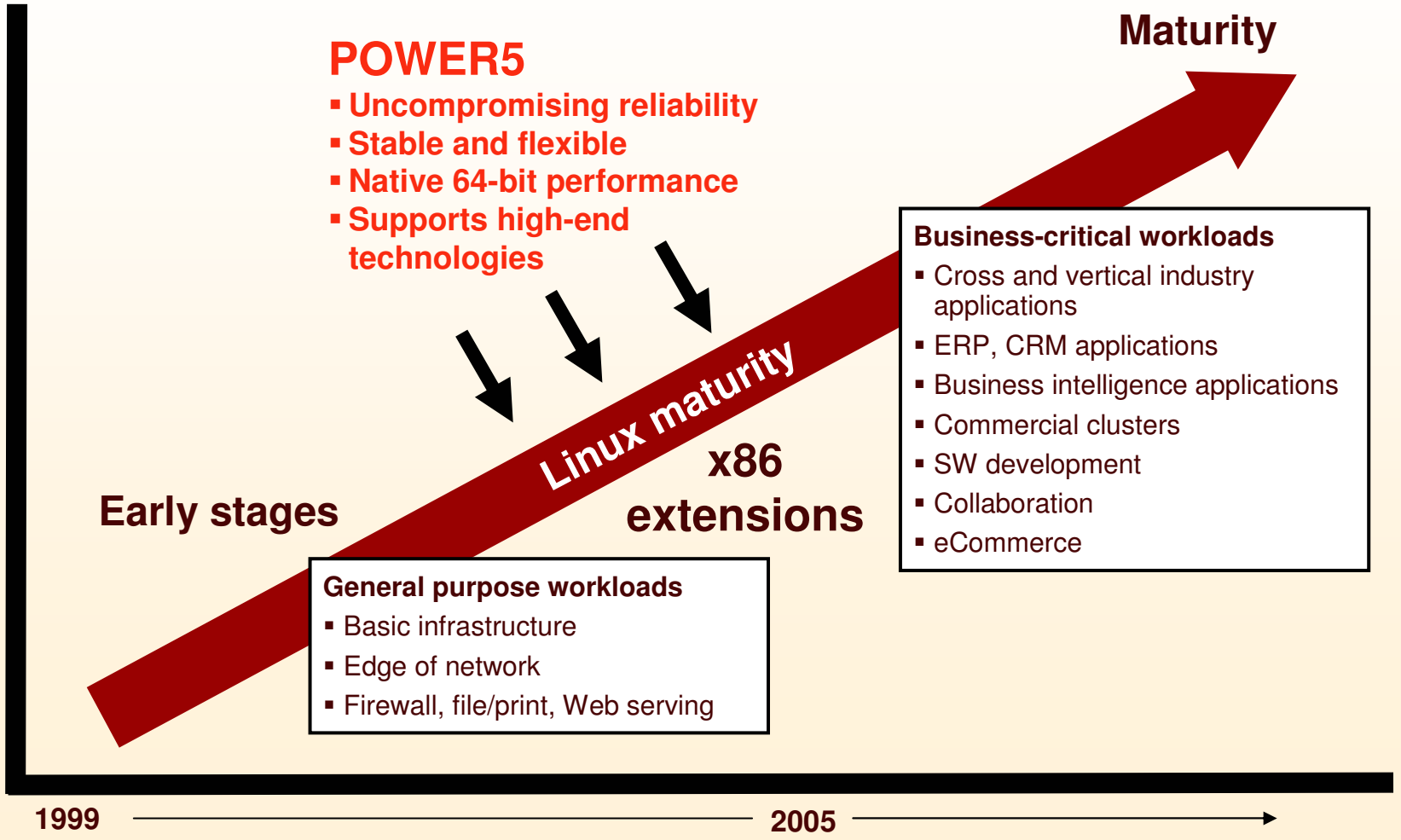
Linux

# Clients expanding Linux to new workloads




Source: IDC Workload Study 2004

# POWER5™ technology is accelerating Linux acceptance for business-critical workloads



# IBM @server Linux OS offering umbrella

Linux

@server
Linux OS Offerings

**Linux on POWER™**

SuSE redhat

IBM @server
xSeries®

IBM @server
BladeCenter™
HS20 / JS20

IBM @server
OpenPower

IBM @server
i5 / iSeries™

IBM @server
p5 / pSeries®

IBM @server
zSeries®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- Go to Market
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- Available through IBM and IBM Business Partners
- Migration tools and programs

Linux
Systems
IBM Middleware

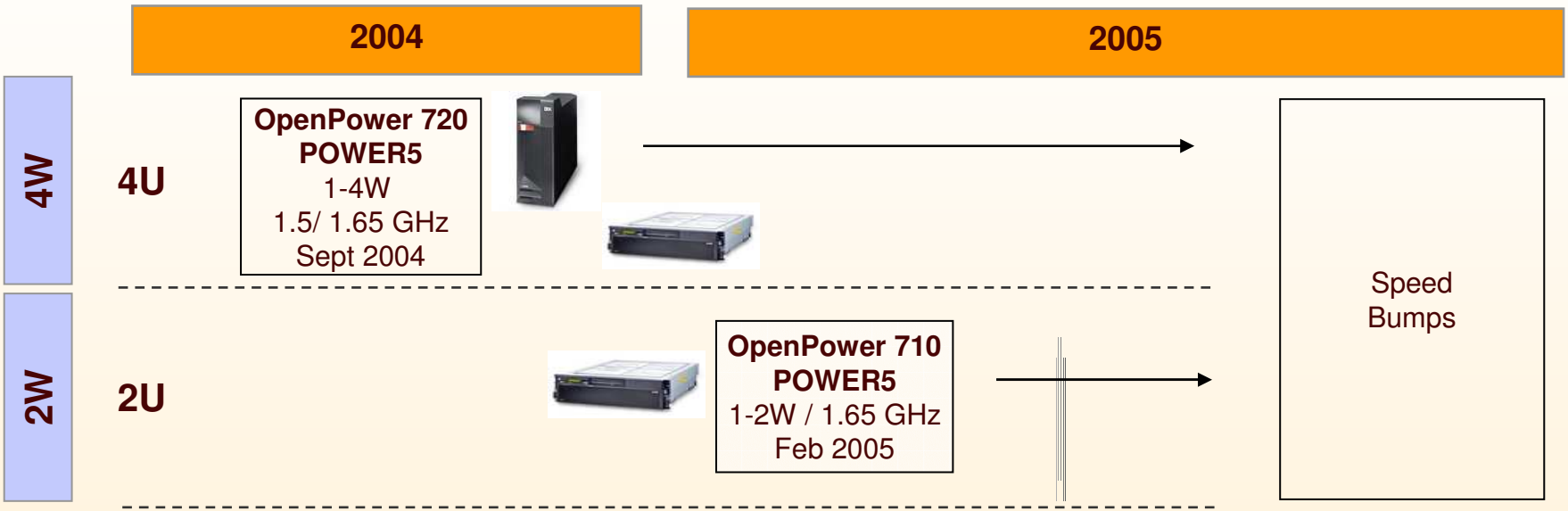
## IBM commitment

IBM Power Architecture

Service and Support
on demand Solutions
Leadership Tools

# Continuing market momentum for OpenPower offerings

Leadership Offerings

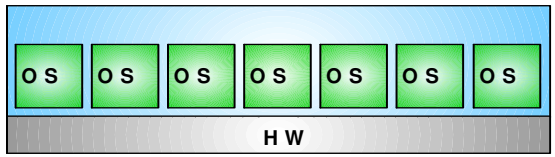


# An integrated set of OpenPower offerings delivers the passion of Linux enriched by the POWER of IBM

Leadership Offerings

**OpenPower 720 (4U 4W)**
**OpenPower 710 (2U 2W)**

**Optional virtualization**




**Workload/industry solutions**

**Linux OS on OpenPower**

suse

redhat

**OpenPower Support/Installation Services**

# OpenPower systems keep business-critical applications up and running

Leadership Offerings

## OpenPower provides improved performance, reliability and stability features

### Tuned for Linux means improved performance

- Linux supports and takes advantage of unique POWER5 features (simultaneous multithreading, First Failure Data Capture, hardware-based virtualization)
- New features introduced in POWER5 to run better on Linux (instruction/data cache coherency, faster data lock acquisitions)

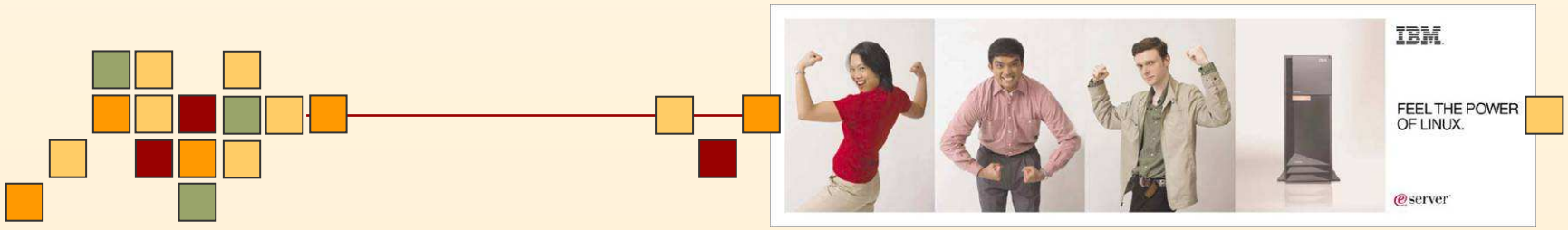
### POWER5 platform provides flexibility and stability

- Evolutionary roadmap
- Decade of experience
- Runs 32- and 64-bit applications

### Robust reliability, availability and serviceability (RAS) features unique to Linux on POWER5

- First Failure Data Capture
- Dynamic Processor Deallocation[1]
- Logical Partitioning (LPAR) error containment
- Service processor
- DDR and IBM Chipkill™ memory
- Error-correcting code (ECC) memory

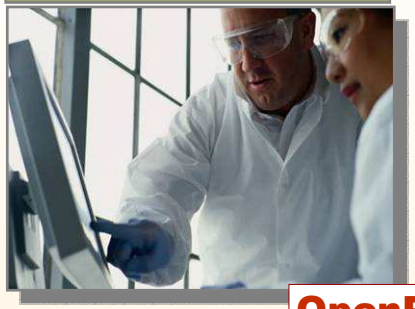
1 OpenPower with SUSE LINUX Enterprise Server for POWER (SLES 9).



# OpenPower 710 and 720 are well positioned to cover your key workloads

Leadership Offerings

Technical



Web Infrastructure

Business Processes

Collaboration

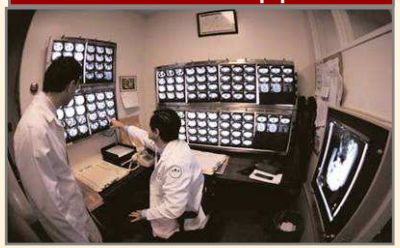
OpenPower 720

OpenPower 710

Application Development

IT Infrastructure

Decision Support



# New IBM @server OpenPower 710 is ideal for infrastructure, Web serving and HPC applications

Leadership Offerings

## OpenPower 710

## Specifications:

- 2U 1-way up to 2-way, rack-mount
- 1.65 GHz processor frequency
- Up to 32GB memory
- 4 bays for Ultra320 SCSI drives
- 3 PCI-X slots, USB: 2, HMC: 2
- DVD-ROM in base
- Redundant cooling and optional redundant power
- 3 year parts and labor NBD warranty and support
- Software support
  - SUSE LINUX Enterprise Server 9 for POWER (SLES 9)
  - Red Hat Enterprise Linux AS 3 for POWER (RHEL AS 3)
- IGS Service Offerings
- Optional POWER Hypervisor™ and Virtual I/O Server
- Entry 1W $3,449[1], 2W $3,999[1]

1 Entry - 1GB memory, 1x73 GB 10K Drive. US List Prices as of April 12, 2005. Prices are subject to change without notice. Reseller prices may vary.

# IBM @server OpenPower 720 designed for business critical applications like ERP and SCM

Leadership Offerings

**OpenPower 720**

## Specifications:

- 4U up to 4-way, rack-mount or deskside
- Two processor speeds (1.65 GHz and 1.5 GHz)
- Maximum memory 64GB
- 8 bays for Ultra320 SCSI drives
- 5 PCI-X slots
- Optional onboard RAID
- 3 year parts and labor NBD warranty and support
- Software support
  - SLES 9
  - RHEL AS 3
- IGS Service Offerings
- Optional POWER Hypervisor and Virtual I/O Server
- Entry $5,000[1], Configured $20,600[1]

1 Entry: 1 1.5 GHz processor, 512 MB mem, 1 73.4GB 10K rpm SCSI drive; configured: 4 1.65 processors, 8GB mem, 1 73.4GB 10K rpm SCSI drive. US List Prices as of April 12, 2005. Prices are subject to change without notice. Reseller prices may vary.

# IBM virtualization technologies are designed to provide more business value than server consolidation alone

Leadership Offerings

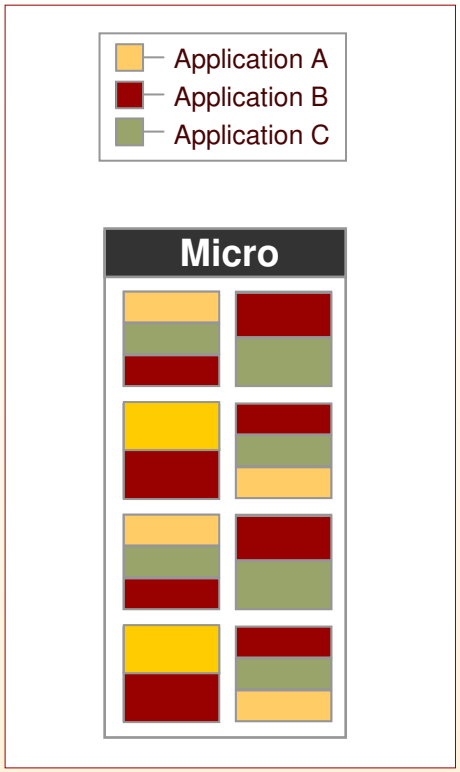
"Enterprises should change their thinking about consolidation and pursue a server virtualization strategy rather than a server consolidation project.

Server virtualization technologies pool and connect server resources in a way that masks the physical nature and boundaries of those resources from resource users."

*— T. Bittman, Gartner Research Note, SP-21-5502 November 14, 2003*

# Optional virtualization feature* helps improve system utilization – on demand

Leadership Offerings




- Create multiple, secure, discrete server partitions on a single system
  - A component of IBM Virtualization Engine™ system technologies, built on years of mainframe experience.
  - Lower costs, improve flexibility, improve manageability, safeguard data, and be prepared for what tomorrow brings through a more simplified infrastructure.
- Leadership virtualization capabilities
  - IBM Micro-Partitioning™
  - LPAR / Dynamic LPAR[1]
  - Virtual I/O Server (storage, LAN adaptors)
- $590** per processor plus software maintenance

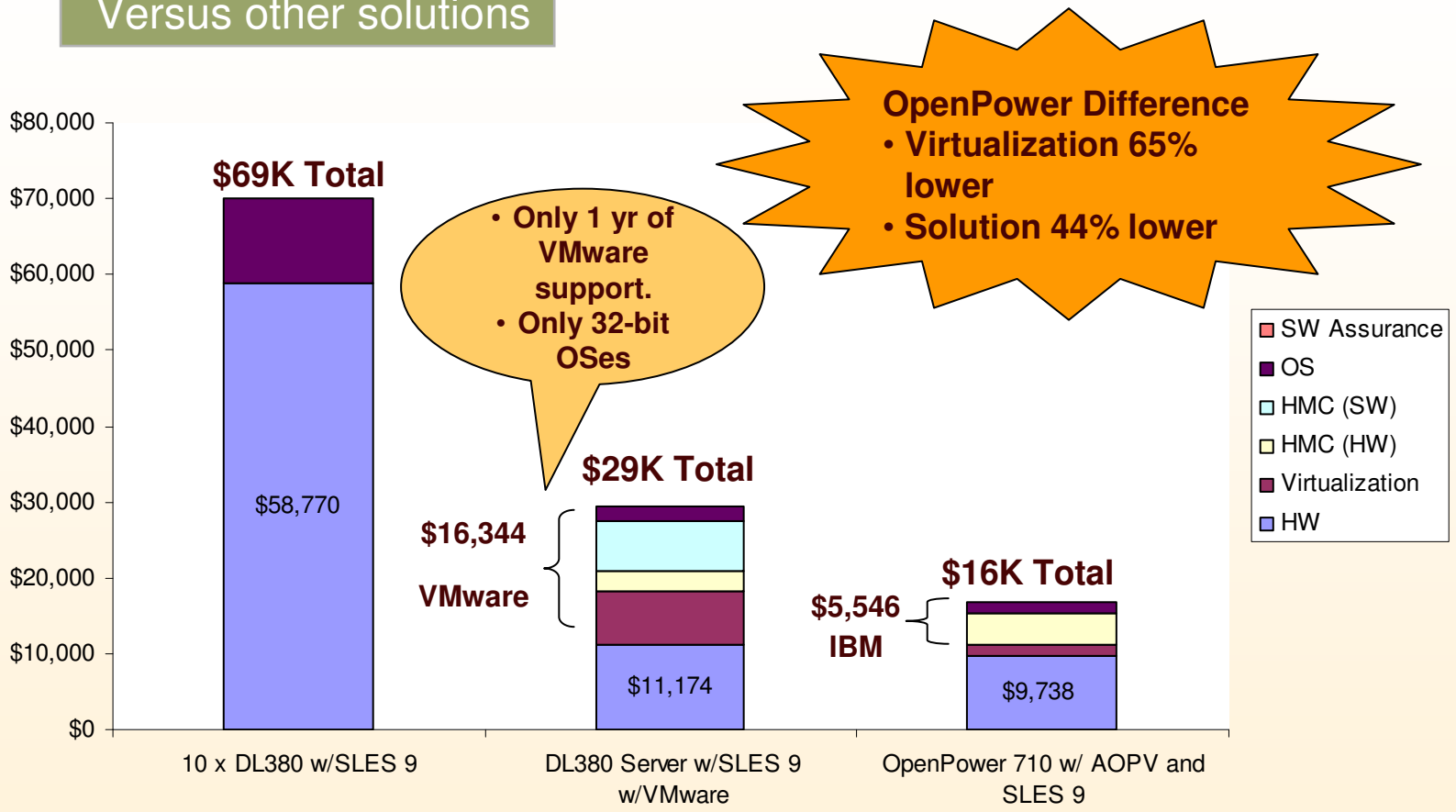
1 - Support varies by distribution.

* POWER Hypervisor™ and Virtual I/O Server
** US List Prices as of April 12, 2005. Prices are subject to change without notice. Reseller prices may vary.

# Advanced OpenPower Virtualization options help significantly reduce acquisition costs

Leadership Offerings

## Versus other solutions




- Base is 10 x 1-way DL380 servers, with only 15% utilization replaced by 1 x 2-way HP DL380 with VMware or 1 x 2-way OpenPower 710 with the Advanced OpenPower Virtualization
- Current prices for VMware off HP's Web site (1-4-05) for DL380 model with Virtual Infrastructure Node. VMware Web site indicates DL380 is supported in 32-bit mode only.
- HP/VMware HMC estimates based of HP DL140 Web site price (1-4-05) and VirtualCenter price from the DL380 (1-4-05)


## Client

Delivering business value

### Linux

- Growth
- Maturing
- Cross platform
- Empowering

### Leadership offerings

- Performance
- Price/performance
- Enterprise features
  - RAS
  - Virtualization
  - Tuned for Linux

### Community

- Developers
- ISVs
- Applications
- University programs
- Access to systems and tools

### Solutions

- Go to Market
- Plug-and-play solutions
- Available through IBM and its IBM Business Partners
- Migration tools and programs

Linux
Systems
IBM Middleware

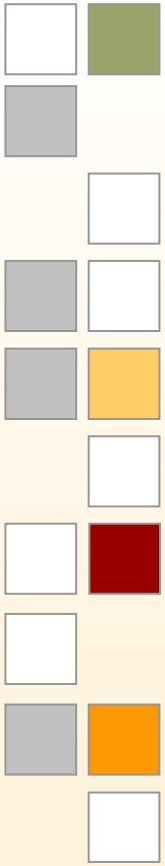
## IBM commitment

IBM POWER Architecture

Service and Support
on demand Solutions
Leadership Tools

# The IBM long-term investment in POWER delivers today

*An innovative architecture that helps simplify your environment and maximizes business flexibility*



## Collaborative Power.org

- Allows device designers, chip manufacturers and other members of the community to work together on new and innovative applications

## Technology leadership

- IBM Virtualization Engine systems technologies
- Mainframe-inspired, enterprise-class reliability, availability, scalability (RAS) features

## Over a decade of experience

- Evolutionary approach with a roadmap to the future
- Systems architecture expertise

## 64-bit performance

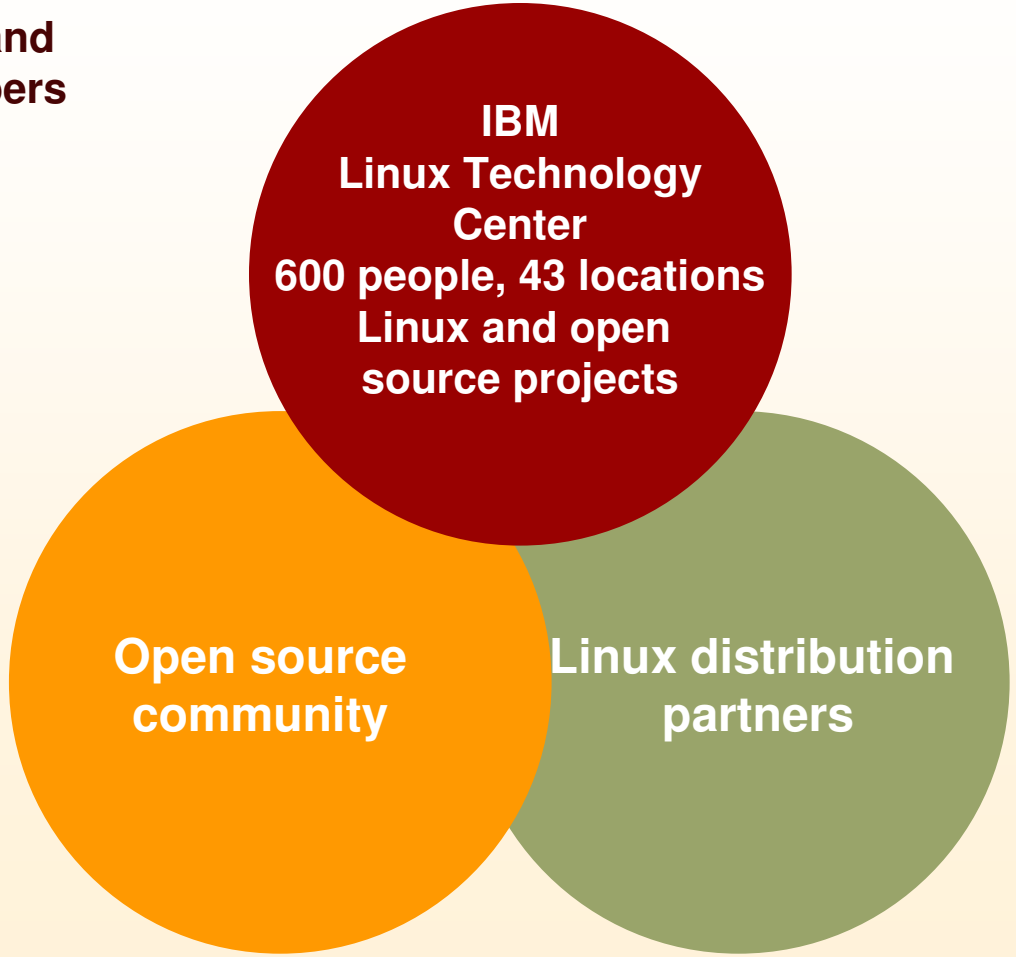
- Allows enterprise-class applications to run on Linux OS systems

# IBM is investing to help drive Linux mainstream

Community

## Key maintainers and community members

- Free Standards Group
- SAMBA
- OpenLDAP
- IPv6
- SCTP
- Various device drivers
- EVMS
- JFS
- SBLIM, Pegasus
- LSM, Bastille
- PCI hot-plug
- USB
- APM
- OMNI Print
- PPC32, PPC64
- Linux-HA, Heartbeat
- Linux Test Project
- .....and growing




## Development areas to tune Linux on POWER

- Scalability
- RAS
- Networking
- Systems Mgmt
- Security
- Performance
- Standards
- Test
- Quality
- Performance

# IBM makes it easy to simplify and expedite the porting of applications

Community

**ISV and developer portals**
- Comprehensive Web site for access to HW, technical support, education, toolkits and unique marketing on demand programs

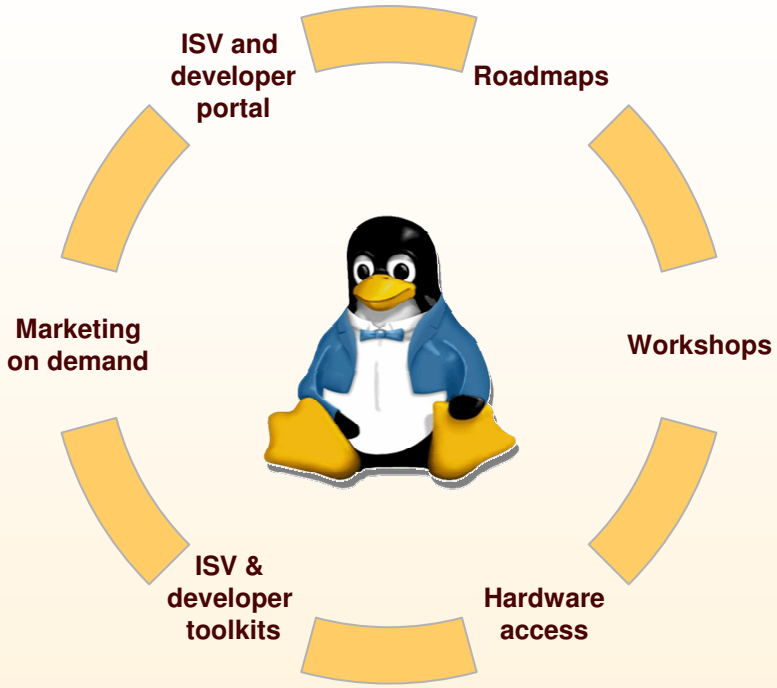
**Porting white papers**
- Microsoft® Windows® to Linux
- IBM POWER4™ to POWER5
- How to achieve compatibility between distributions
- Java™ on Intel® to Java on POWER

**Workshops**
- Access to 100s of free seminars and workshops (hands-on labs, technical white papers, how to guides)

**Hardware access (free, on demand access)**
- Access to 25 WW Innovation Centers
- Virtual Loaner Program to handle 1000s of ISVs
- Remote test drive for ISVs to test applications
- Remote access for developers through Univ of Portland
- Developer access to 100s of technical support personnel

**ISV and developer toolkits**
- IBM and open source toolkits for ISVs and developers

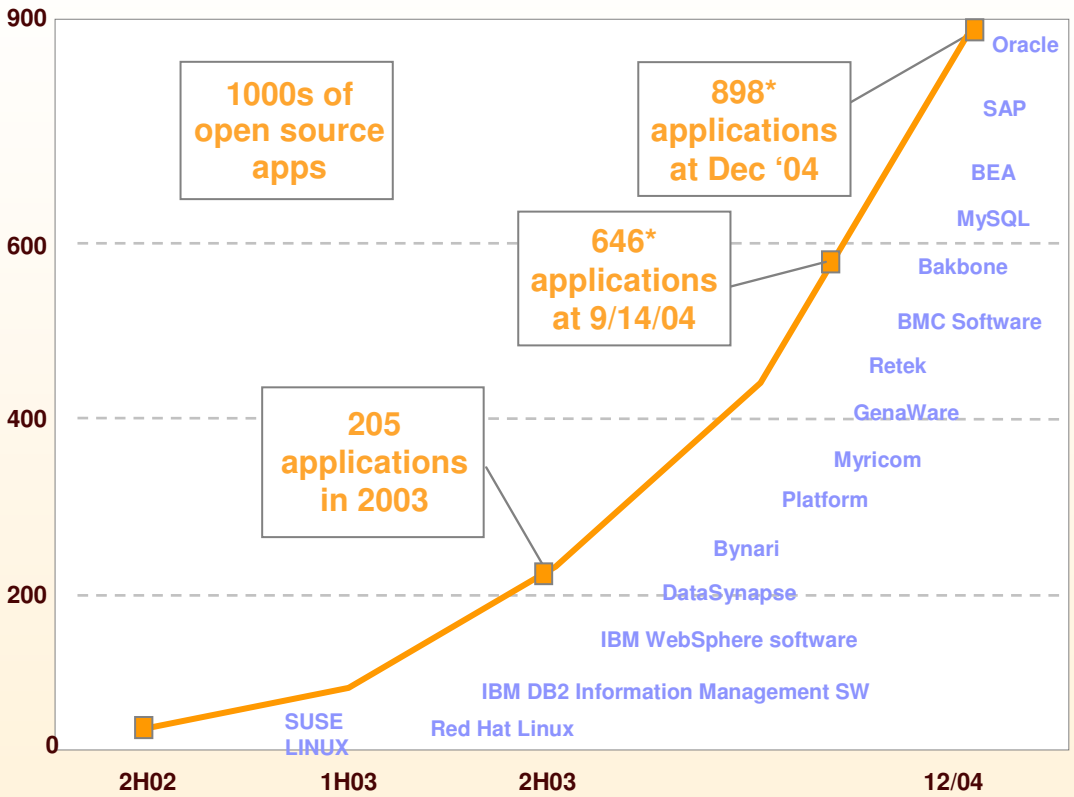
**Marketing on demand**
- Global Solutions Directory and @server Solution Connection @server Proven
- Online sizing tools, templates for sales collateral and GTM




http://www.ibm.com/developerworks/linux/power

# Infrastructure and industry applications have increased by 40% in the three months since OpenPower launched

Community




* http://www-1.ibm.com/servers/eserver/linux/power/apps/all.html

**IBM Middleware applications**
- Full complement of core software from IBM WebSphere®, IBM DB2®, Tivoli®, IBM Informix®
- IBM Compilers, Cluster Management

**ISV infrastructure and tools**
- Cognos, BEA Weblogic Server, MySQL DB, Bakbone, NetVault, BMC Patrol Agent & KMs, Novell, Acucorp, Absoft, Myricom, Storix, Platform Computing, Oracle 10g client & others

**Open source infrastructure and tools**
- Apache, Samba, Sendmail, others
- Distributed with Red Hat & Novell SUSE LINUX

**Workload applications**
- Deep computing – growing portfolio of Life Sciences, Petroleum & open source apps
- SAP now available for Linux on POWER

**Industry and regional applications**
- Temenos, Fair Isaac, Genaware, Hansa, Tecsys, Evant, eOne, Triversity & others

*Number of applications depends on distribution level.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## IBM commitment

IBM POWER Architecture

Service and Support
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Leadership Tools

# OpenPower Consolidation Express Solution

*Virtualization of infrastructure workloads simplified*

Solutions

## Reference architecture thoroughly tested by IBM Engineers to accelerate time-to-value

**Challenges addressed**

- Servers underutilized
- Servers undersized based on forecasted demand
- Server sprawl complicating management
- IT not easily adaptable to changing requirements

**Business value**

- Simplified infrastructure – less servers, more performance, easier to manage
- Flexibility – resources assigned as/when needed
- Utilized – get more from your servers
- Scalable – grow IT with your business
- Robust – improve customer satisfaction
- Easy to implement – optimize your staffing

**Deploy with Confidence**

- Recommended configs tuned for performance
- Install, set-up and configuration scripts
- Sizing guide and tuning instructions
- Key challenges addressed
- IBM and partner support

http://www-1.ibm.com/servers/eserver/linux/power/solutions.html

### Tested Solution Stack

| | |
|---|---|
| Apps | Directory/Authentication: OpenLDAP<br>Firewall: SUSEfirewall2, Red Hat Firewall*<br>File and Print: Samba 3<br>Web Serving: IBM HTTP Server, Apache*<br>Mail: Bynari Insight Server |
| OS | SUSE Linux Enterprise Server 9 for POWER<br>Red Hat Enterprise Linux AS 3 for POWER |
| HW | @server OpenPower 720, OpenPower 710<br>POWER Hypervisor and Virtual I/O Server |

*Available in second release in Q105

### Fast Start Kit

- Workloads stress tested
- Tuned, pre-tested “Solution Starter Points”
- Sizing popular combinations of stack components*
- Single sign-on through OpenLDAP
- Highly secure with optional firewalls included
- Tailored installation and configuration scripts, including automated POWER Hypervisor and Virtual I/O Server set-up
- Manual with tailored install, configure, integrate and tune instructions
- Available at no charge on download page

# OpenPower Network Email Security Integration Architecture

## Challenges addressed

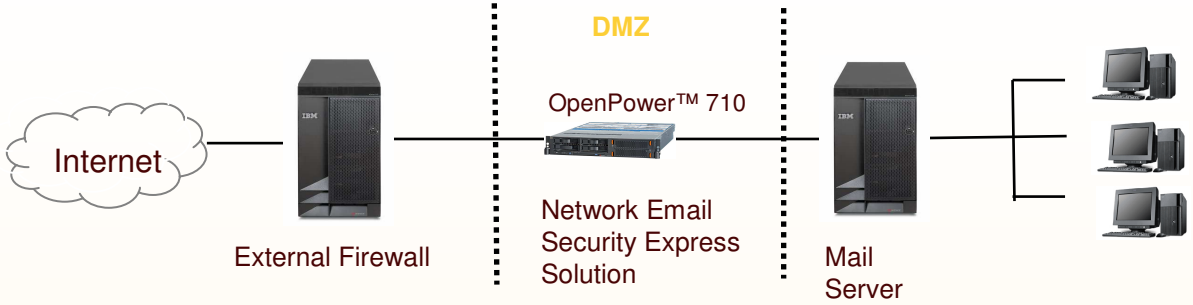
- Fills a critical gap in network e-mail security
- Adaptable, flexible and scalable appliance
- Multiple scanning engines
- Policy Driven – supports compliance to corporate security policy
- Archival features help address the legislated compliance requirements

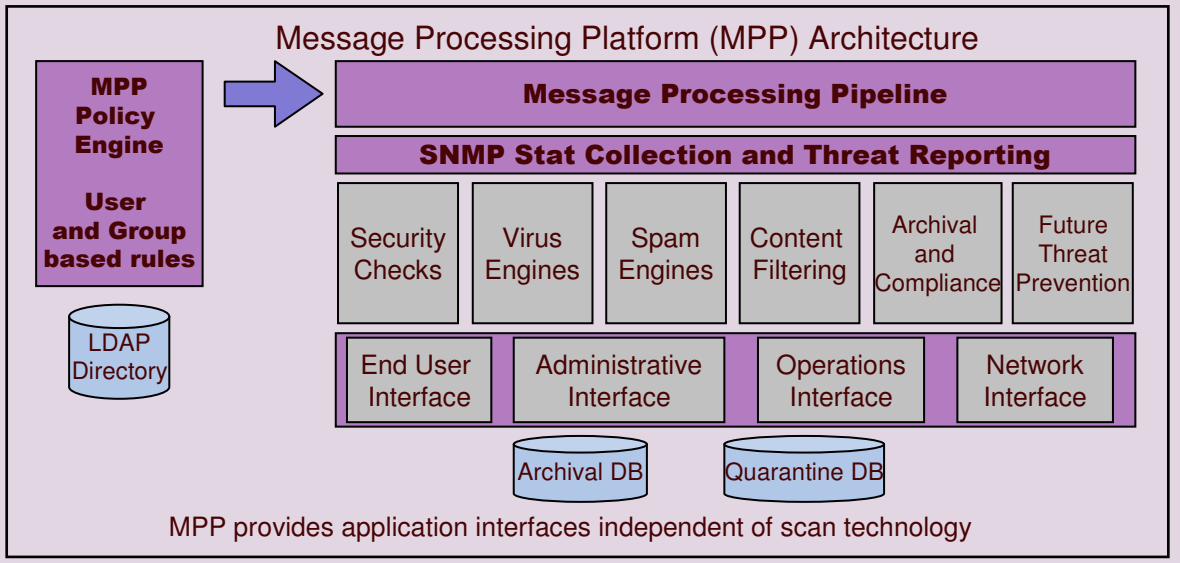
## Business Value

- Augments current server topology
- Multiple spam, virus and content filter scanning engines are provided
- Can add Spam and AV engines as needed without changing the user interface
- Enterprise performance at SMB prices
- High reliability of OpenPower server
- Outstanding ROI

## Deploy with confidence

- Comprehensive solution deliverables
  - Easy to purchase
  - Easy to install
  - Easy to use
  - Easy to manage/update



# IBM @server OpenPower and DB2 for SAP® solution

*Choice, Flexibility, Performance and low TCO with Linux on POWER*

## Summary

### Market Objectives

- Expand share in high growth SMB space
- Provide differentiated solution for SMB
- Leverage Linux momentum to grow IBM share
- Drive demand for solution through SAP VARs
- Enable IBM HW BP who have SAP infrastructure skills

### Target – Medium sized companies

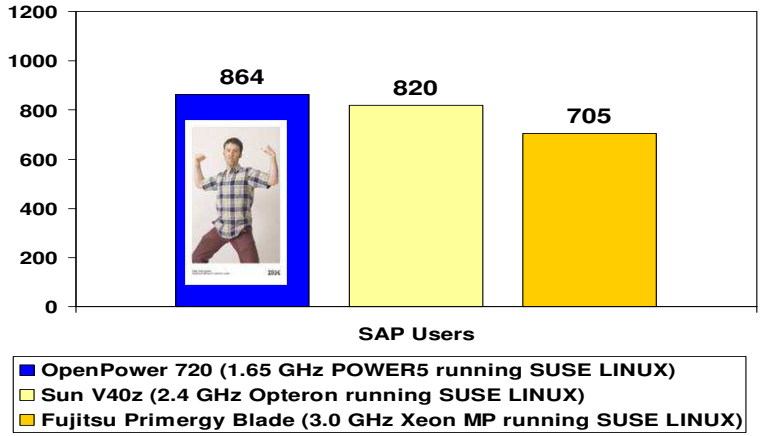
- Looking to reduce SAP infrastructure costs
- Want open solution but need UNIX capabilities
- Looking to replace home grown ERP applications
- Planning upgrades to PeopleSoft Enterprise One infrastructure

### Value Statement

- The combination of Linux, DB2®, and OpenPower provides a robust infrastructure to help SMB customers deploy SAP solutions cost-effectively with leading price/performance to help them accelerate their ROI

## Proof-Point: S & D B/M 2-Tier 4-Way

### OpenPower 720 vs. 4-way Linux Systems




Source: http://www.sap.com/benchmark/ Current as of 03/31/05[1]

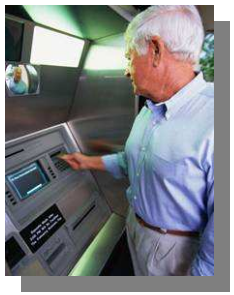
## Solution Stack

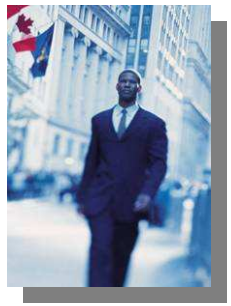
| | |
|---|---|
| SAP | All-In-One, mySAP ERP, & Core R/3 |
| DB | IBM DB2 UDB Enterprise Edition |
| OS | SUSE SLES 9 (Red Hat 4 in V2) |
| Server | OpenPower 720 and 710 |
| Other SW | Tivoli® System Automation (HA) |
| Storage | Basic SCSI, DS4000, Tape Options |

# OpenPower industry solutions help meet unique IT challenges

Solutions

## Industry Solution Portfolio





| Solution | Application |
|---|---|
| ERP[1] | - SAP |
| Proteomics* | - Waters / Micromass |
| Computational Chemistry* | - GAMESS, CPMD, Amber |
| Banking Payments* | - eFunds IST/Switch |

**Others in future...**

[1]Application server now
* Planned availabity in 2Q05

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

# SAP on @server OpenPower Solution

Solutions

**Superior price/performance helping customers drive down the total cost of ownership**

**Challenges addressed**

- High SAP infrastructure costs
- Poor efficiency and productivity
- Downtime impacting QoS
- Scalability and flexibility

**Business Value**

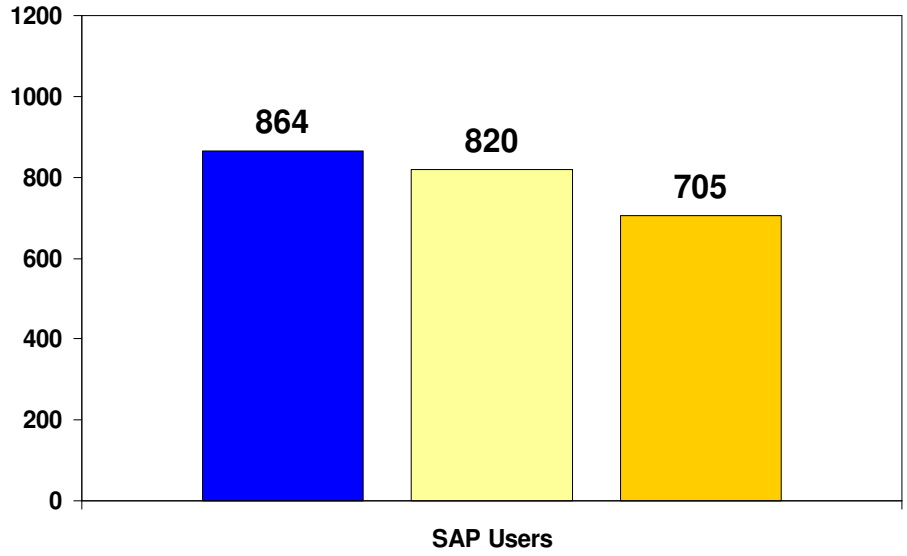
- Reduced total cost of ownership
- Improved application performance
- Accelerated ROI
- Infrastructure flexibility
- Improved ability to respond to changing business needs

**Deploy with confidence**

- Proven and stable 64-bit technology
- Scalable and reliable Linux infrastructure
- High quality of service they demand from an optimized Linux environment
- A business solution that can grow as their needs grow.

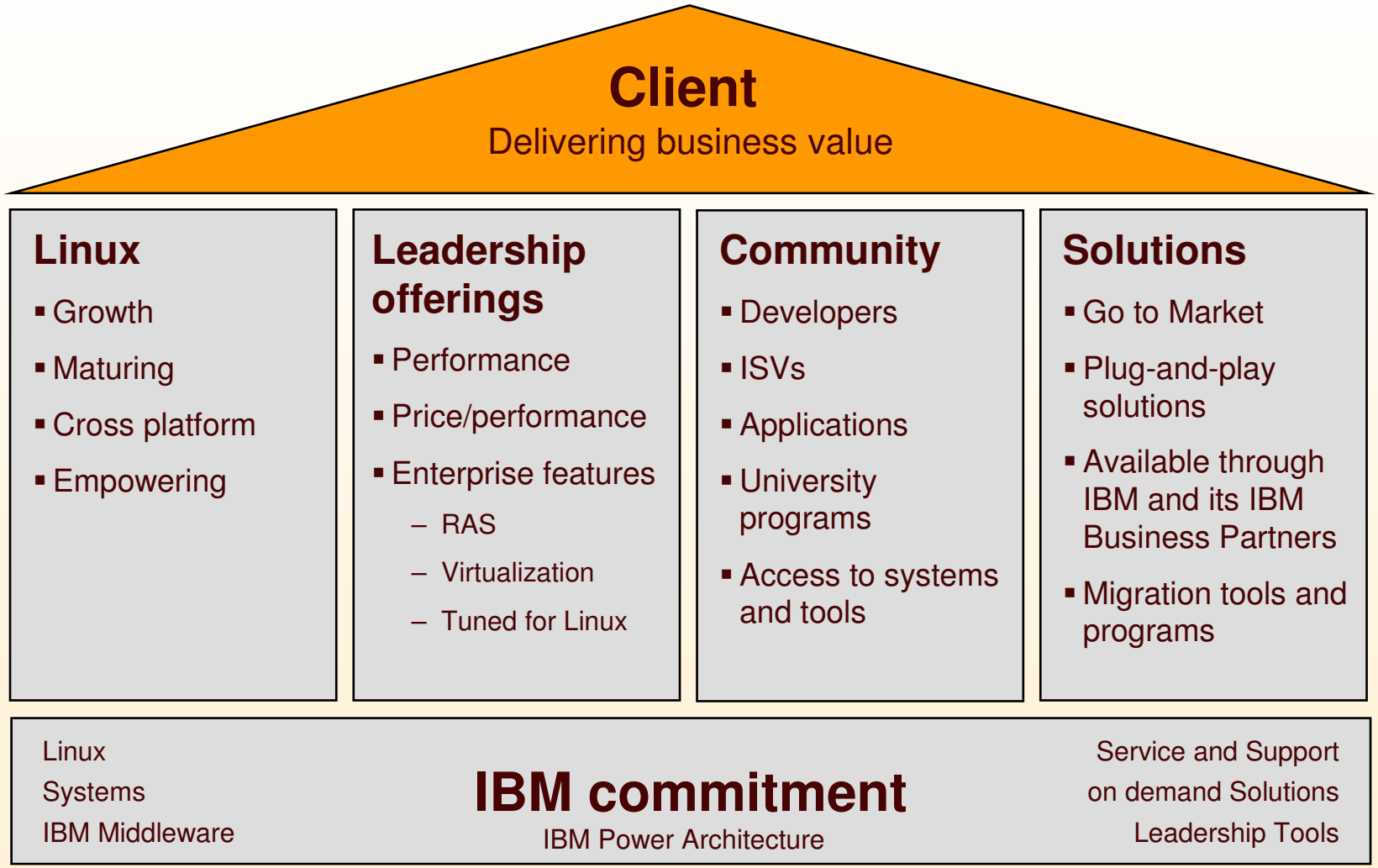
http://www-1.ibm.com/servers/eserver/linux/power/solutions.html

## OpenPower 720 vs. 4-way Linux Systems




http://www.sap.com/benchmark

OpenPower 720 result of 864 users, 1.95 second average response time, 86,670 fully processed line items per hour, certification number 2004057; Sun V40z result of 820 users, 1.95 second average response time, 82330 fully processed line items per hour, certification number 2004044; Fujitsu Siemens Blade Server RX600 result of 705, 1.98 second average response time, 70670 fully processed line items per hour, certification number 2004055. Results current as of April 1, 2005.


Client
Delivering business value
Linux
Growth
Maturing
Cross platform
Empowering
Leadership offerings
Performance
Price/performance
Enterprise features
– RAS
– Virtualization
– Tuned for Linux
Community
Developers
ISVs
Applications
University programs
Access to systems and tools
Solutions
Go to Market
Plug-and-play solutions
Available through IBM and its IBM Business Partners
Migration tools and programs
Linux
Systems
IBM Middleware
IBM commitment
IBM Power Architecture
Service and Support
on demand Solutions
Leadership Tools

# OpenPower will deliver exceptional business value

Client

## IT needs:

- Reduce cost of initial and ongoing IT operations
- Reduce business risk
- Improve productivity of workforce
- Deploy infrastructure that is flexible, reliable and secure

## OpenPower features:

- High utilization and simplified management with virtualization
- Vibrant Linux OS community
- IBM commitment to POWER platform
- High availability with dependable, and stable systems
- Openness and freedom of Linux

## OpenPower benefits:

- Lower costs
- Peace of mind
- More performance for lower price
- Build and pay as you grow

# OpenPower systems are available through any authorized IBM Representative


- Clients can learn more about IBM @server OpenPower solutions through an IBM salesperson, through an IBM Business Partner or via **ibm.com**
- IBM Business Partners worldwide are trained to help you determine your needs and discuss all of your IBM @server options.
- Information and orders may be handled via an IBM Business Partner, ibm.com / IBM TeleSales or your IBM sales representative.

**Sales teaming with independent software vendors**

**IBM TeleSales**

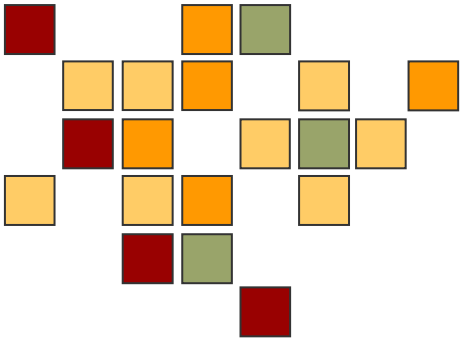
**IBM Business Partner sales**

# IBM @server OpenPower: tuned for Linux


- **Breakthrough price and performance**
- **Optional virtualization designed to lower operational costs**
- **Enterprise-class RAS features**
- **IBM service and support**

For more information about OpenPower, visit:
**ibm.com**/eserver/openpower

For more information about POWER Architecture, visit:
**ibm.com**/power



# Backup

# OpenPower 720 – Flex your muscles performance

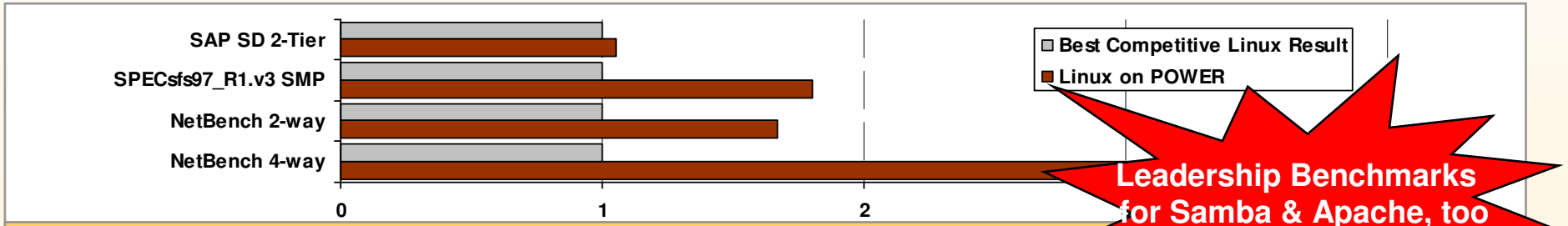
**The performance of the OpenPower 720 beats all competitive systems in**

- **Non-clustered TPC-H 100GB**
- **8 CPU TPC-H 300GB**

**It is also the top 4-way Linux system in**

- **SAP SD 2-Tier**
- **SPECsfs_R1.v3**

## Comparing the OpenPower 720 vs. Competitive Linux Results




## Relative Performance

| Benchmark | # CPU's | GHz | IBM System | Result | Competitive Result | OpenPower Faster by | Competitive System running Linux |
|---|---|---|---|---|---|---|---|
| SAP SD 2-Tier | 4w | 1.65 | OP720 | 864 | 820 | 5.4% | Sun V40z |
| NetBench 2-way | 2w | 1.65 | OP720 | 1,563 | 936 | 67.0% | HP ProLiant DL380 G3 |
| NetBench 4-way | 4w | 1.65 | OP720 | 2,911 | 901 | 223.1% | HP ProLiant DL760 |
| SPECsfs97_R1.v3 SMP | 4w | 1.65 | OP720 | 73,092 | 40,579 | 80.1% | HP AlphaServer 1280 running Tru64 UNIX** |

| SAP SD 2-Tier | # Users | Avg. Resp. Time | Line Items/Hr | Certification Number |
|---|---|---|---|---|
| OpenPower 720 | 16w | 1.95 | 86,670 | 2004057 |
| Sun V40z | 8w | 1.90 | 82,330 | 2004044 |

All results are as of 4/01/05
** No 4-way competitive Linux results available.

Source:
http://www.spec.org and http://www.sap.com/benchmark/ and http://www.veritest.com/clients/reports

# Additional RAS Backup from Slide 16

Leadership Offerings

- Dependable systems with robust RAS
- Flexibility – once you settle on POWER architecture as your strategic platform, you can deploy a scale out model using OpenPower systems. If you want to scale up to 8W and above, then you can use the pSeries servers (also on POWER architecture). You don't have to deploy/train on multiple HW architectures
- Stability – 10 years of research and support of the 64 bit POWER technology. It is as stable as it gets.

| Reliability/Availability Features | OpenPower | Wintel | Lintel | Comments |
|---|---|---|---|---|
| • Automatic First-Failure Data Capture and diagnostic fault isolation capabilities | Yes | No | No | Used by Error Log Analysis Tool |
| • Self-healing internal POWER5™ processor array redundancy | Yes | No | No | ECC, bit steering, memory scrubbing, etc |
| • Industry-first PCI bus parity error recovery | Limited | No | No | EEH detection: partition down vs system |
| • Scrubbing and redundant bit-steering for self-healing in main storage | Yes | Limited | Limited | Wintel/Lintel not as robust |
| • ECC and Chipkill™ correction in main storage | Yes | Yes | Yes | |
| • Fault tolerance with N+1 redundancy, dual line cords, and concurrent maintenance for power and cooling | Yes | Yes | Yes | |
| • Predictive failure analysis on processors, caches, memory, I/O and DASD | Yes | Limited | Limited | Wintel /Liintel do not have predictive analysis of I/O |
| • Processor run-time and boot-time deallocation based on run-time errors (Dynamic Processor Deallocation and Persistent Processor Deallocation) | Yes | No | No | FFDC adventage |
| • Fault avoidance through highly reliable component selection, component minimization and error mitigation technology internal to chips | Yes | No | No | |
| • Concurrent run-time diagnostics based on First-Failure Data Capture for power, cooling, and I/O subsystems | No | No | No | pLinux concurrent diag targeted for 2Q'05 |
| • Service Processor is a separate, independent processor that provides hardware initialization during system IPL, operation monitoring of environmental and error events | Yes | Limited | Limited | Wintel /Lintel SP is not as robust |