

## Linux and Virtualization for System z

Next Generation  
e-business

# Marketplace Innovation

Integration

Interoperability

**Linux** Application  
Portability

Technology  
Innovation

Dennis Wunder  
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## Things to think about

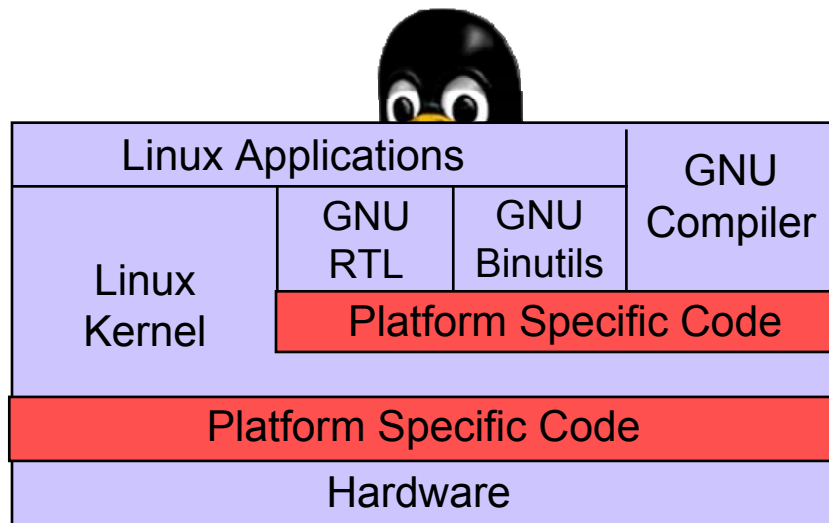
- Observation: Businesses are solving today's problems with yesterday's answers.
- Many of today's problems come from yesterday's solutions... Peter M. Senge
- Chinese Proverb: If we do not change our direction, we are likely to end up where we are headed.
- It's time to revisit or think about System z.

# What is Linux?

- **A fully-networked 32/64-bit UNIX-like operating system developed by Linus Torvalds**
- **Multi-user, multitask, multiprocessor**
- **Compilers like C, C++, Fortran, Smalltalk, Ada, java**
- **GNU development tools, runtime, and utilities**
- **apache- web server, samba- file and print server, nfs file server, ldap, database**
- **X Windows Graphical User Interface - gnome, kde**
- **Coexists with other operating systems**
- **Runs on multiple platforms**
- **Includes the source code**



# Linux + System z9 or zSeries = SYNERGY



## Linux

- Reliable, stable, secure
- Large selection of applications middleware and tooling from IBM, ISV's and Open Source
- Available from multiple distributors
- Evolves rapidly to meet business challenges
- Plentiful availability of skilled administrators and developers



## System z10 and zSeries

- Legendary dependability
- Designed for multiple diverse workloads executing concurrently
- Highly scalable – up or out
- Rich security features
- Proven high volume data acquisition and management
- Advanced virtualization capabilities

# Open Standards for Deployment/Development

**Common  
Application  
Development**



```
if (i < IOTABLE_SIZE; i++)  
if (iotable[i].num == 0)  
break;  
i == IOTABLE_SIZE)  
printf("warning: ioport table is full\n");  
else {  
p = find_gap(&iolist, from, num);  
if (p == NULL)  
return;  
iotable[i].name = name;  
iotable[i].from = from;  
iotable[i].num = num;  
iotable[i].next = p->next;
```



**zSeries**



**risc**



**x86**

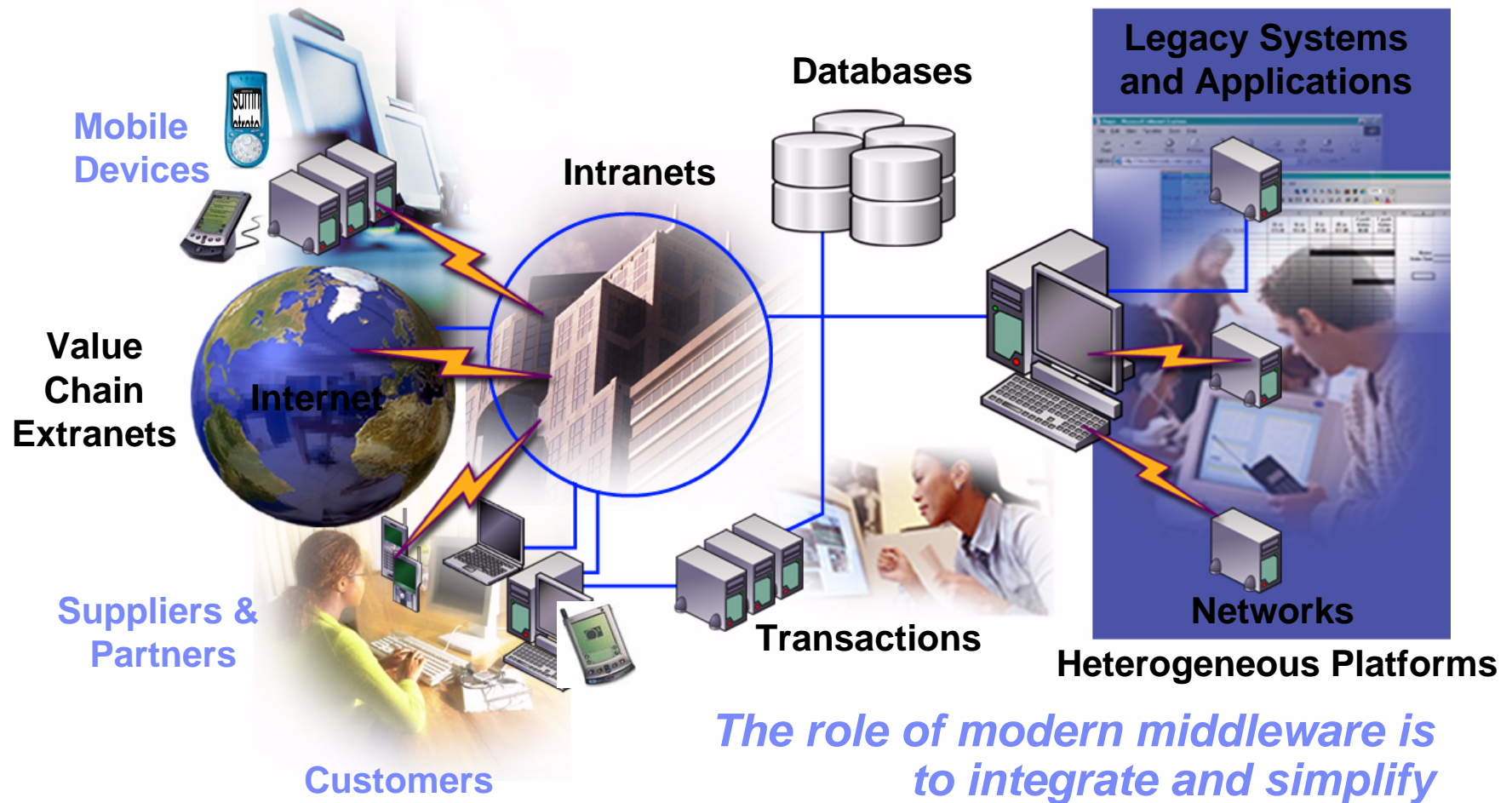


**Embedded  
Appliances**



# Today's IT Environment

*IT environments are increasingly heterogeneous and complex*

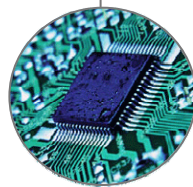


# Business Design Breakthrough Enabled by Technology

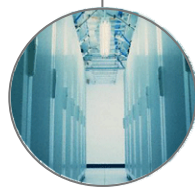
**New business designs** are emerging to enable companies and institutions to be **more productive and responsive** to whatever the world throws at them.



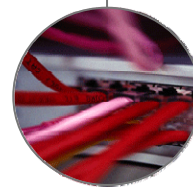
↑ **Adoption of open standards**



↑ **Processor speed**



↑ **Storage**



↑ **Bandwidth**



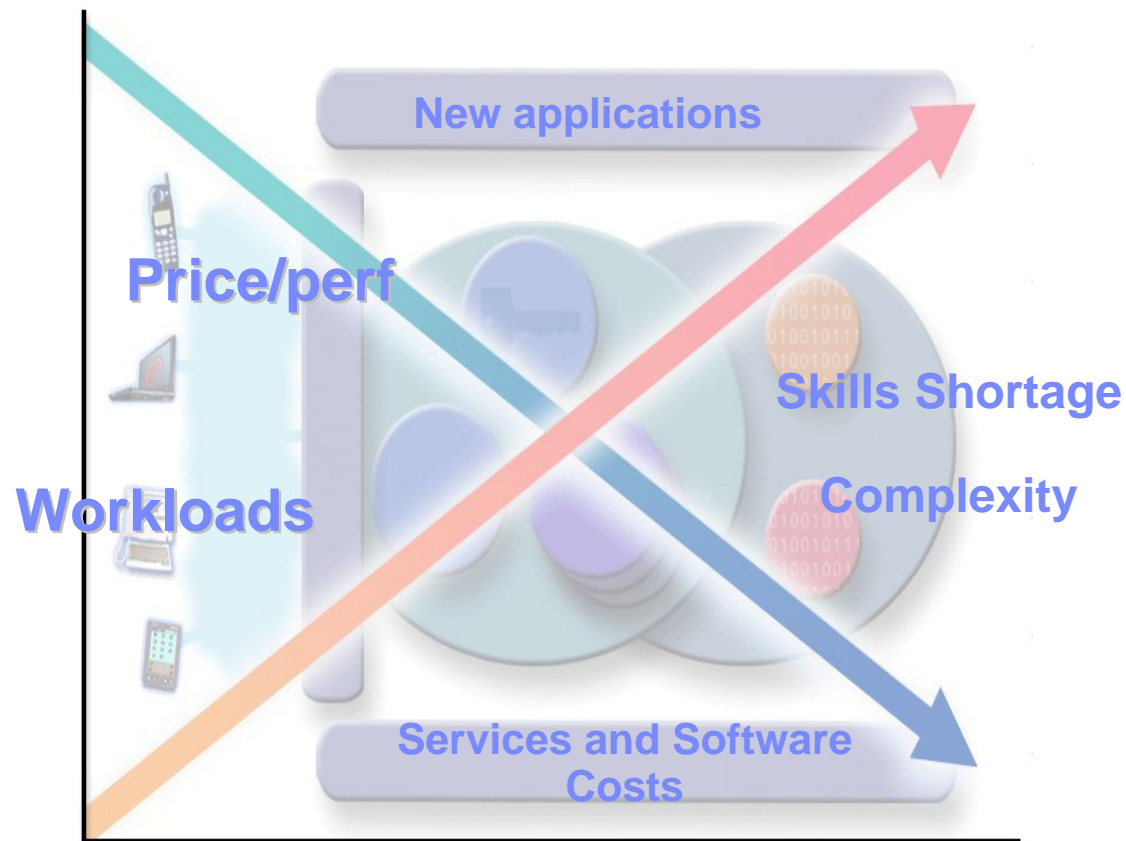
↑ **Number of networked devices**



↓ **Interaction costs**

# Key Concerns for IT Executives

price/performance gains in technology  
are more than offset  
by complexity and increasing costs



## ► Escalating Cost of IT Infrastructure

- desktop, network, servers, storage
- increasing complexity, higher service costs, more demanding SLAs
- multi-tier applications requiring dozens of servers

## ► Difficult to link IT to business plans

- need for integrated IT 'vision' (Nice to have...most don't.)
- need incremental and full TCO analysis

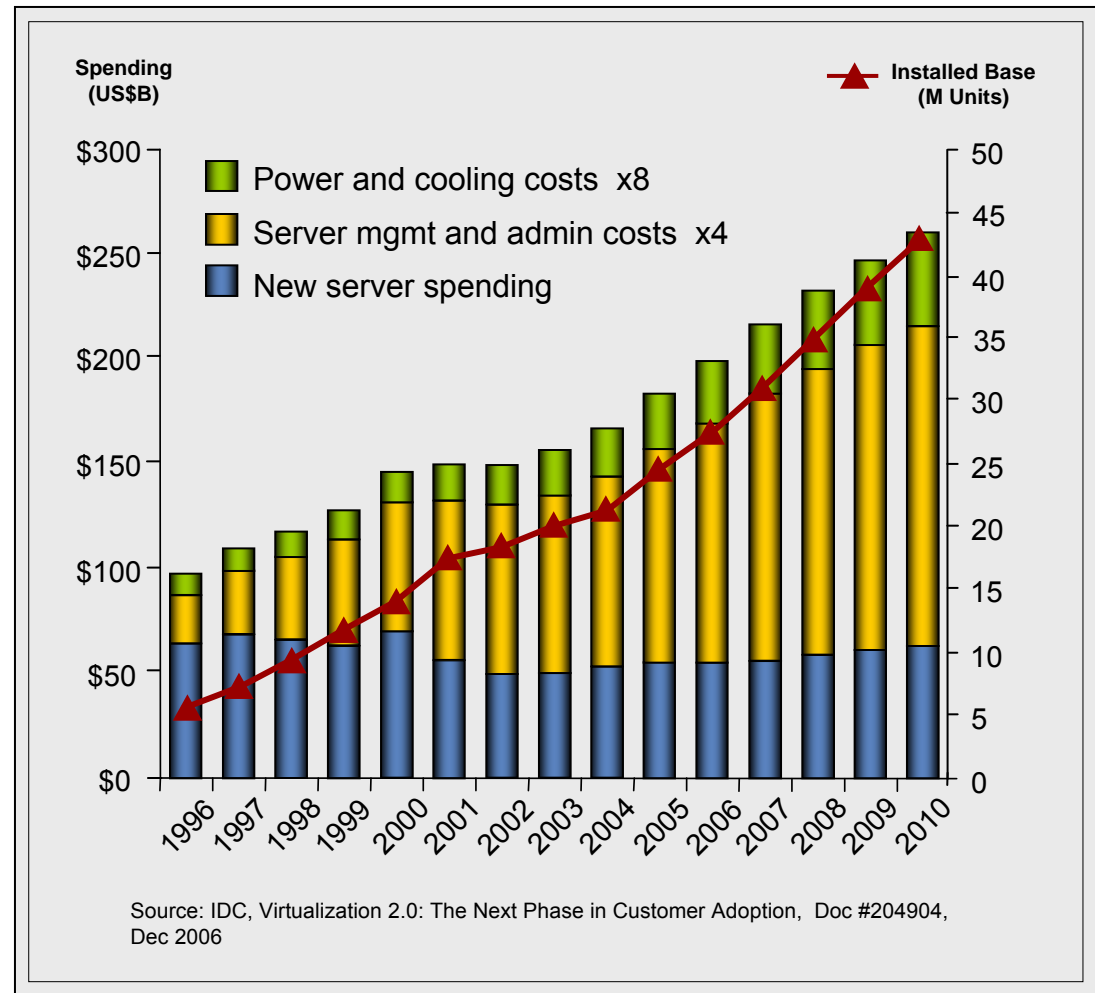
## ► Difficult for IT infrastructure to respond quickly to change in business directions

- need a simpler IT infrastructure that is highly flexible
- need for rapid implementation without the long-term cost and risk



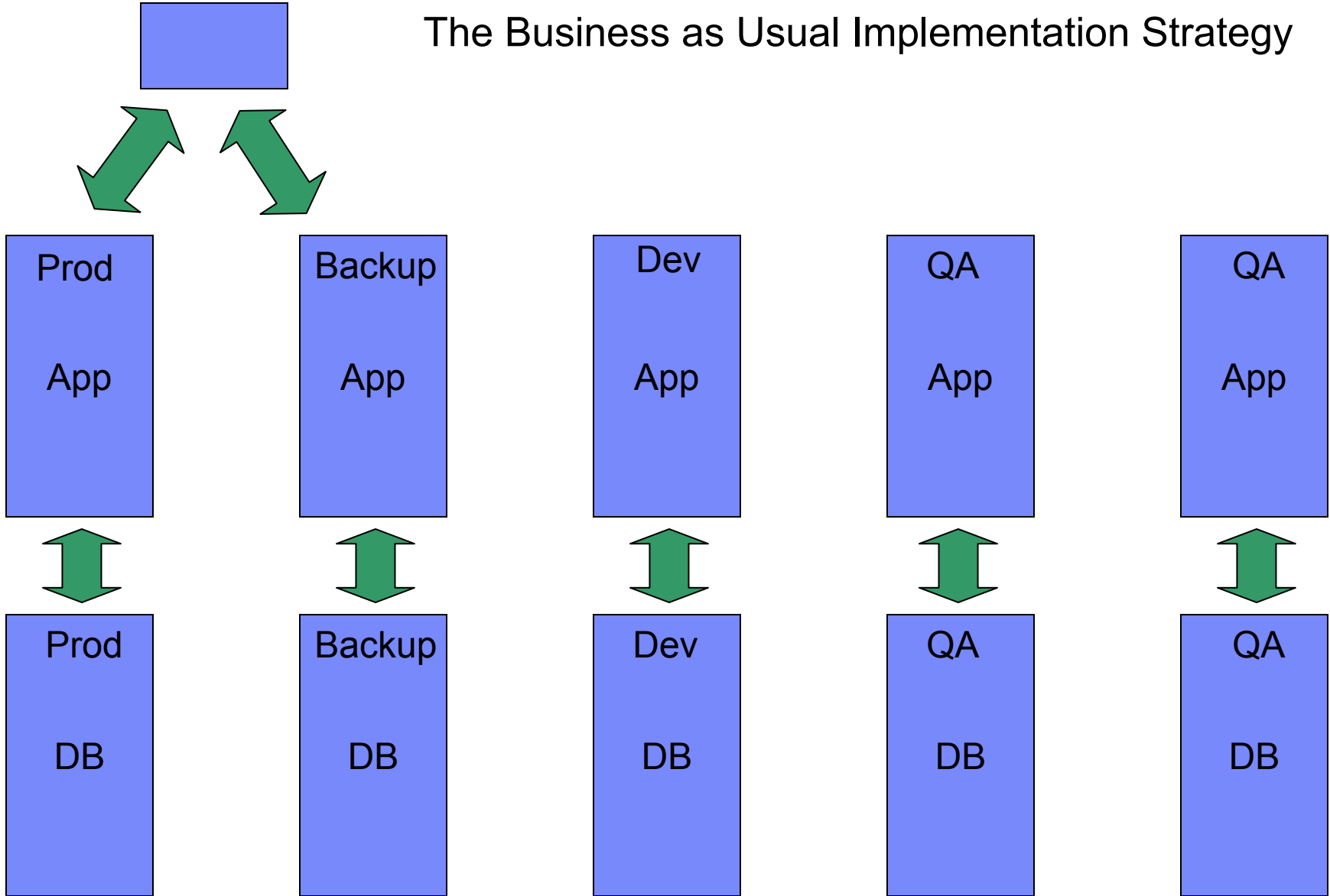
## Today's reality . . .

- IDC reports that IT operational labor spend is growing at 10% CAGR 2003 – 2008
- 70% of IT budget goes toward operational overhead
- 85-95% of server capacity is excess – nearly \$140B in over expenditure
- Typical company IT energy costs have been rising 15% per year over the last 5 years
- Today, each dollar of new servers cost \$0.52 to power and cool and is forecast to increase to \$0.71 in the next four years

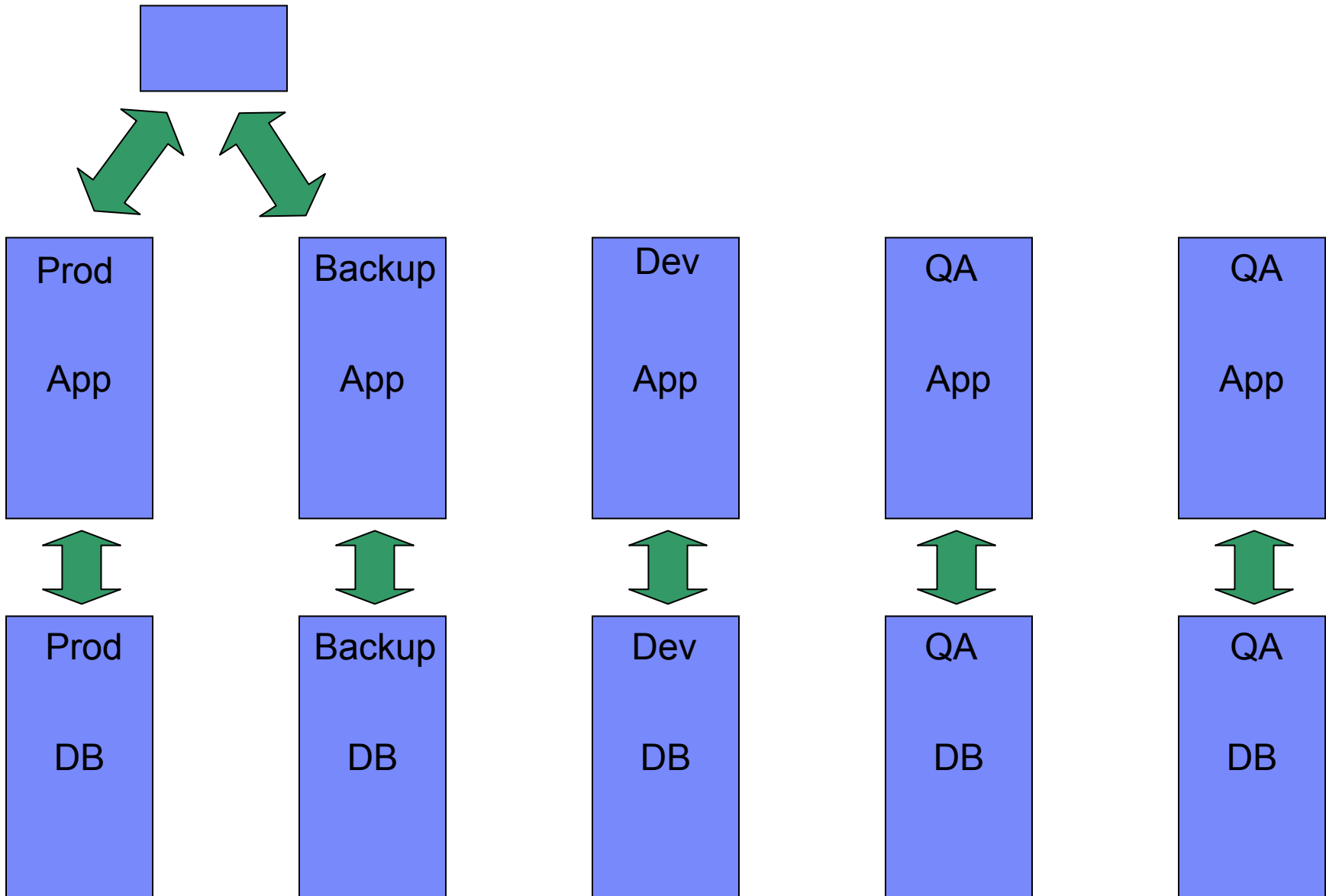


Load Balancer

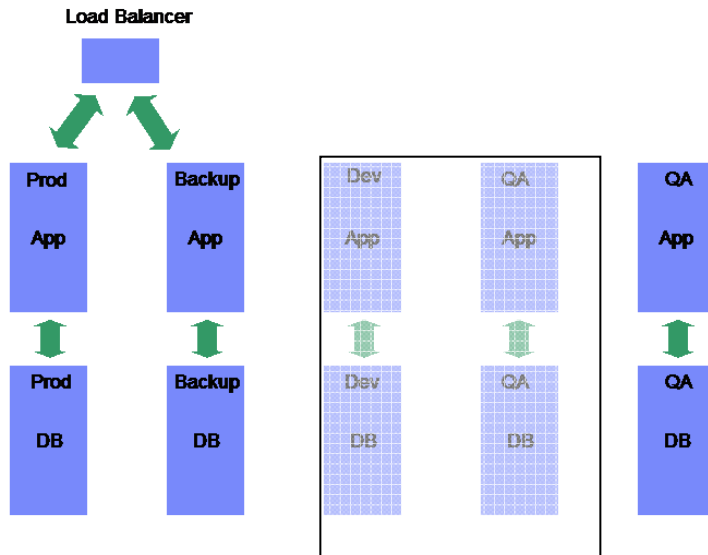
# The Business as Usual Implementation Strategy



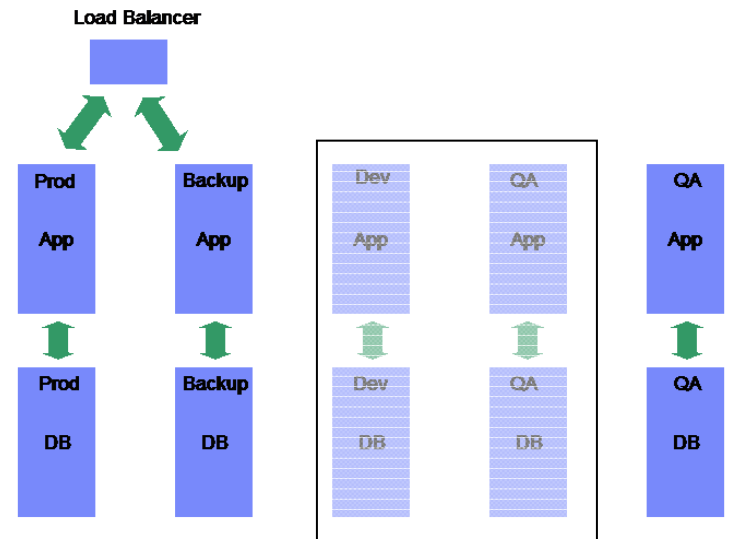
# Load Balancer



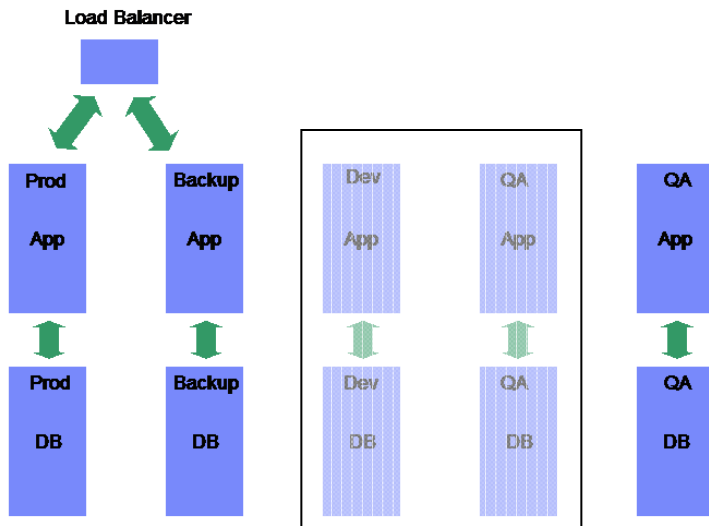
### ERP



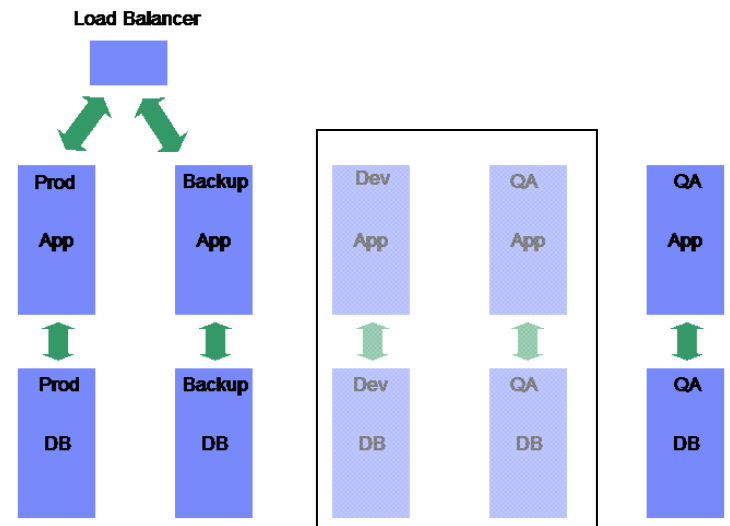
### CRM



### SCM

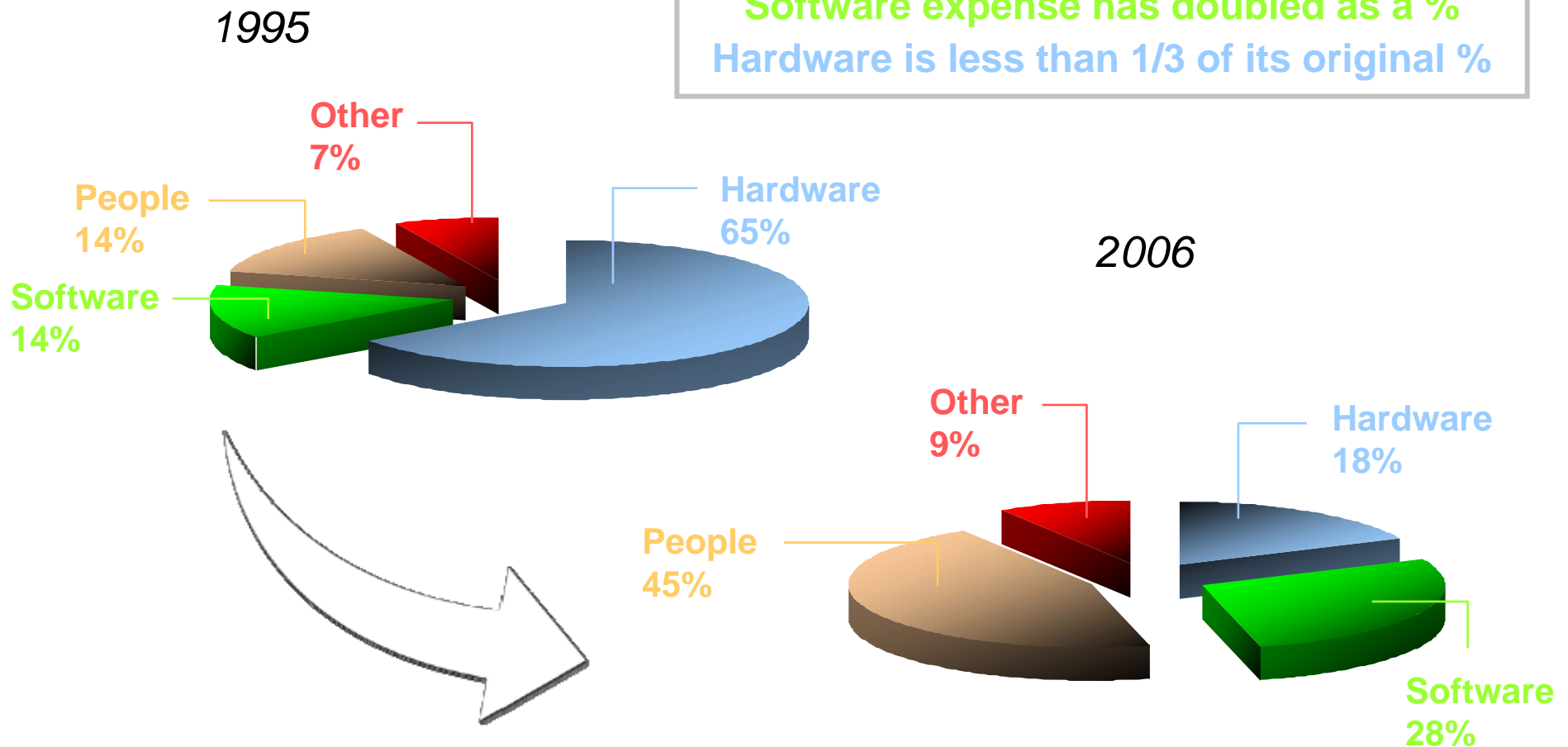


### WebApps



Throughout the past 10 years the cost dynamics of supporting corporate IT infrastructures has changed significantly as has the landscape.

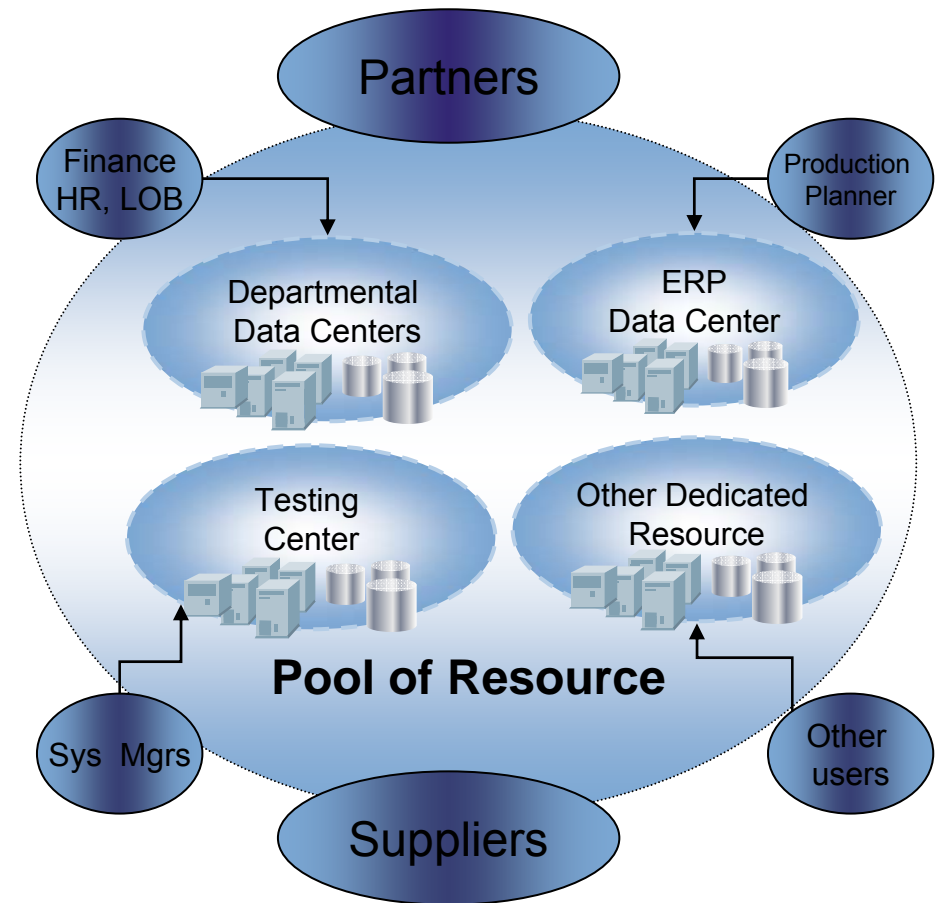
People expense has tripled as a %  
Software expense has doubled as a %  
Hardware is less than 1/3 of its original %





## Virtualization Definition

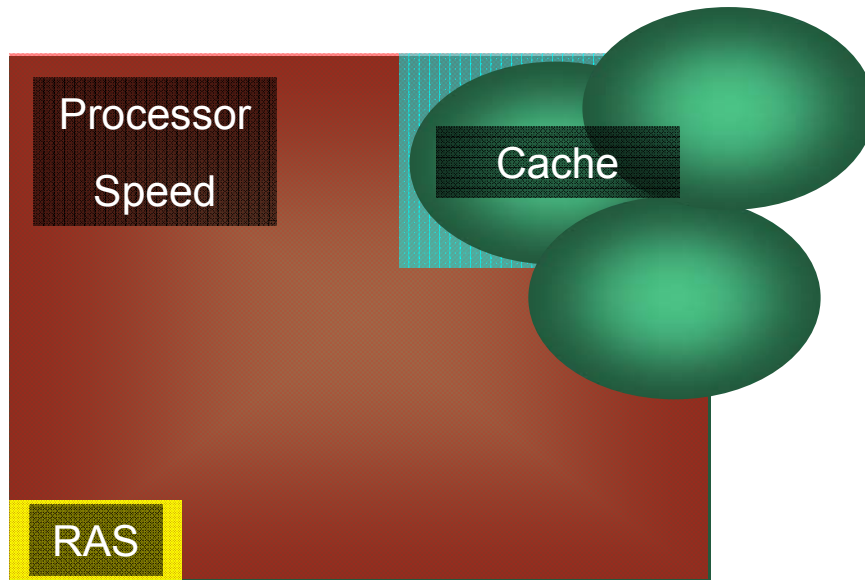
Virtualization is the process of presenting computing resources in ways that users and applications can easily get value out of them, rather than presenting them in a way dictated by their implementation, geographic location, or physical packaging. In other words, it provides a logical rather than physical view of data, computing power, storage capacity, and other resources



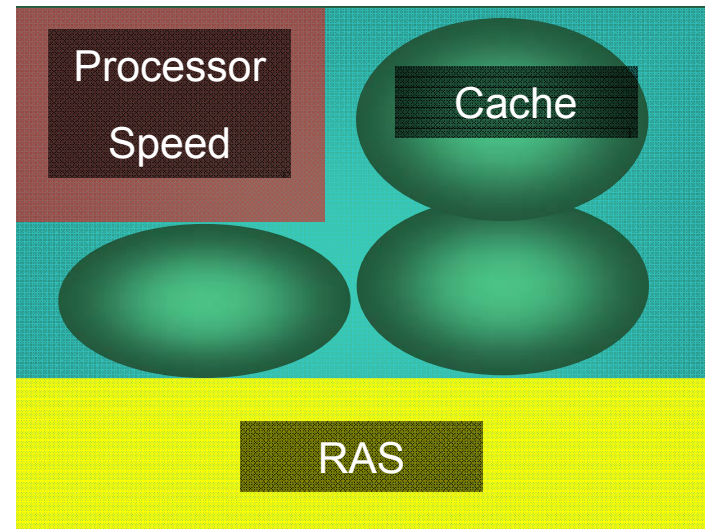
*Jonathan Eunice, Illuminata Inc*

# Design choices affect “benchmark” performance

## Mixed/WLM/Virtualization



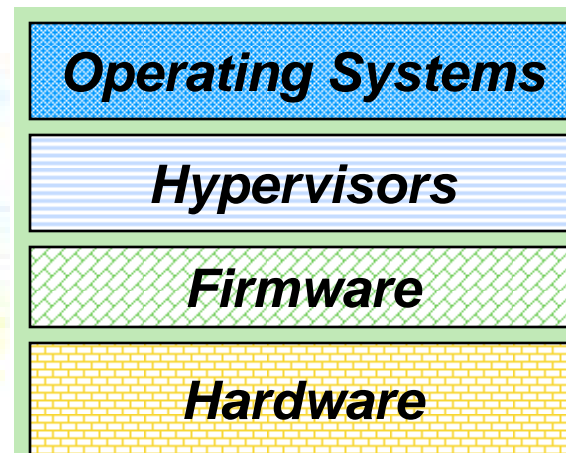
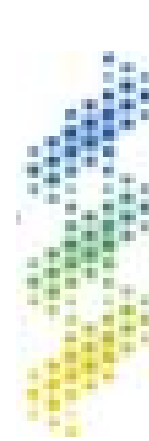
- Working set(s) too large for cache
  - Maximized Processor speed penalized
  - RAS is valued in mixed workloads
  - Minimized RAS is “penalized”
  - “Fast” processor is under-utilized
- Replicated**



- Cache contains multiple working sets
  - Processor speed optimized by cache
  - RAS Space is “valued”
  - All of “slow” processor is used
- Consolidated**

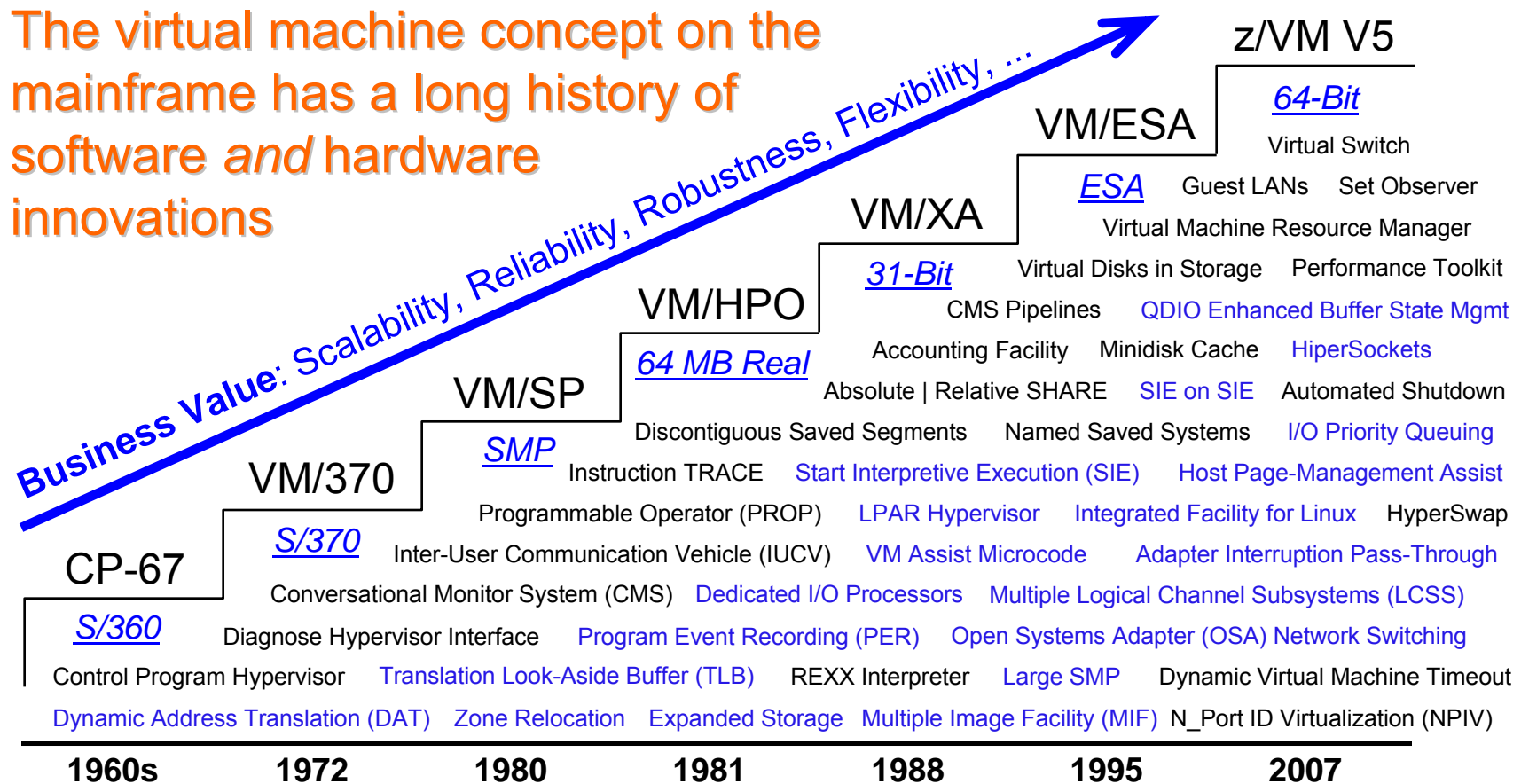
## IBM System z Virtualization Genetics

- **System z is thoroughly architected to host applications in a virtualized environment**
- **This is accomplished with a coordinated set of investments that permeate the technology stack of hardware, firmware, hypervisors, and operating systems**
- **This means clients can maximize the utilization, scalability, and security of all system assets, including:**
  - *CPU*
  - *Memory*
  - *I/O*
  - *Networking*
  - *Cryptography*
- **All with exceptional levels of operational ease and cost efficiencies**



# IBM System z Virtualization Genetics

The virtual machine concept on the mainframe has a long history of software *and* hardware innovations



System z virtualization starts on the chip; an integration of hardware, firmware, and software functionality

## System z channel subsystem improves I/O performance

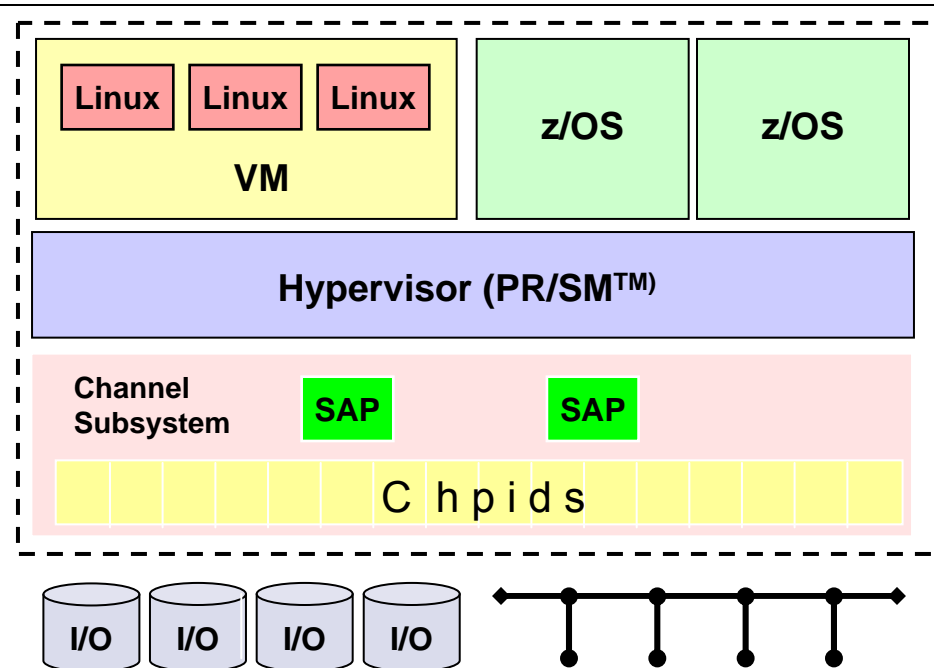
### Channel Subsystem

- System Assist Processors (SAP)
- I/O Channels (RISC Processors)
- Shared I/O capability

### Significant I/O Offload

- Address limit checking
- Channel path management
- I/O busy conditions
- Manage Interrupts
- Dynamic path reconnect
- Transfer data
- Receive CU sense information
- Channel subsystem monitoring

### This benefits all logical partitions including z/OS and Linux

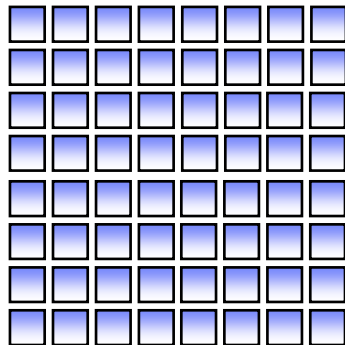




# System Design Affects Virtualization Capabilities

System z packs a lot of compute power into a single box

## Up to 64-way SMP

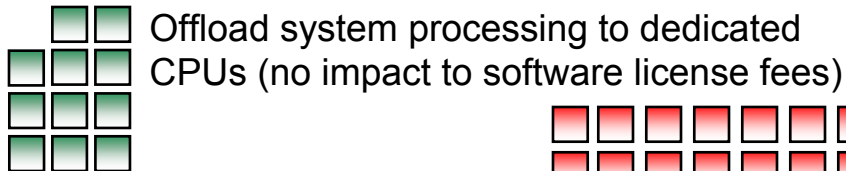


Share up to 64 processors with up to 60 LPARs  
 Configure these processors as CPs, IFLs, zAAPs\*, zIIPs\*, or ICFs\*

\* No software license fees

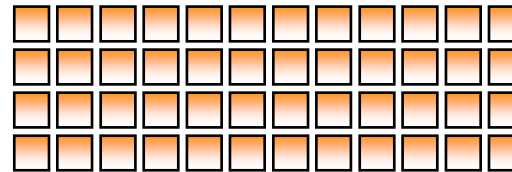
## 2 Standard Spare PUs

## Up to 11 System Assist Processors

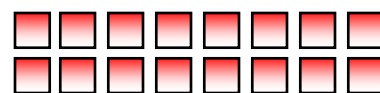
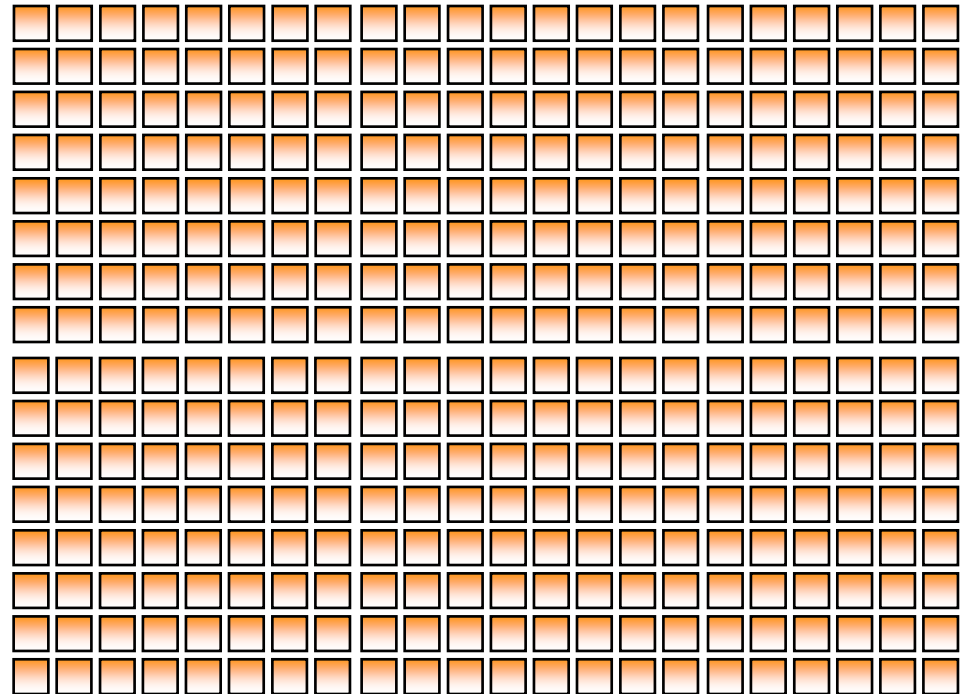


Offload system processing to dedicated CPUs (no impact to software license fees)

## Up to 336 I/O Processors



No additional charge for these processors



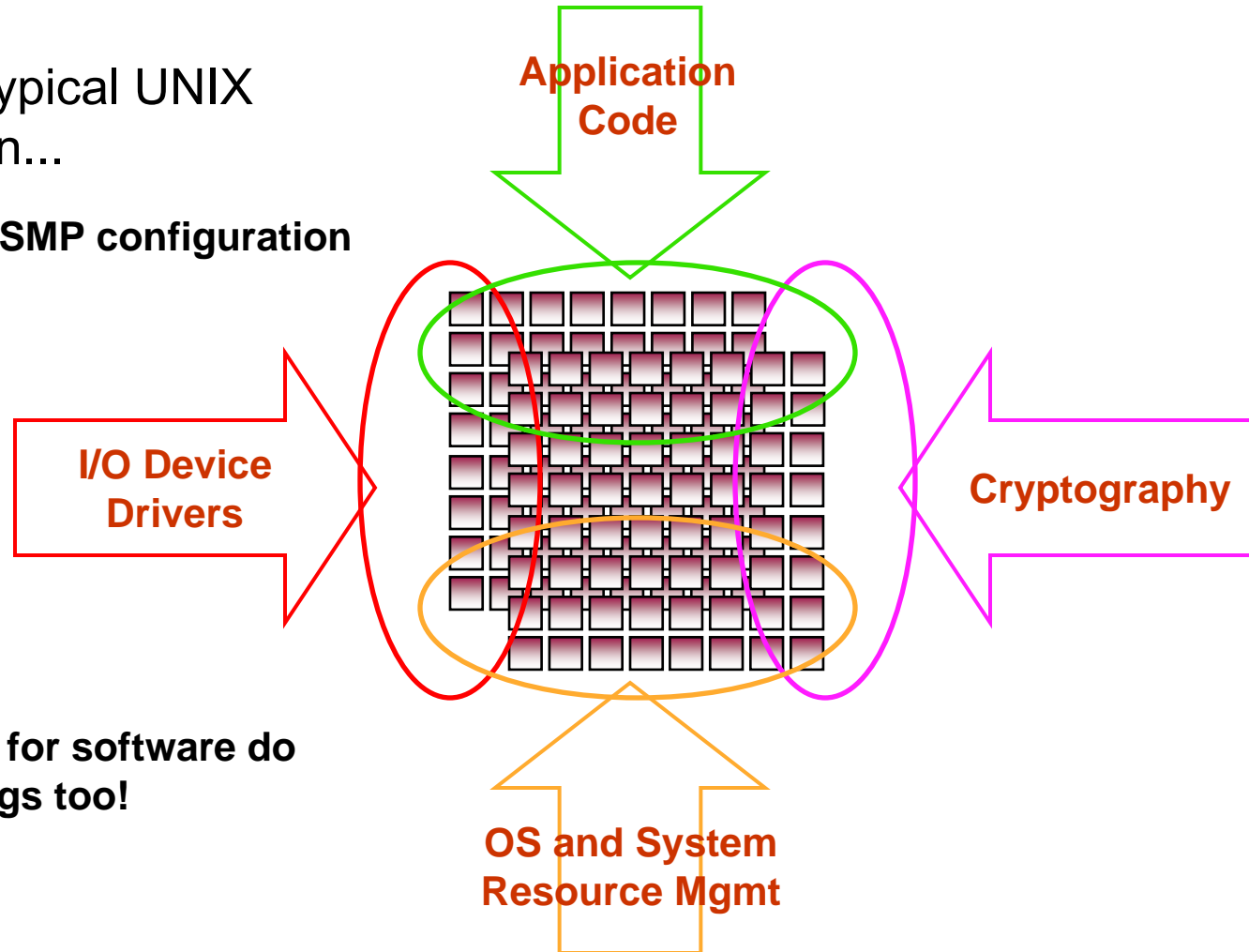
## Up to 16 Crypto Express2 CPUs

High scale performance for SSL transactions

# System Design Affects Virtualization Capabilities

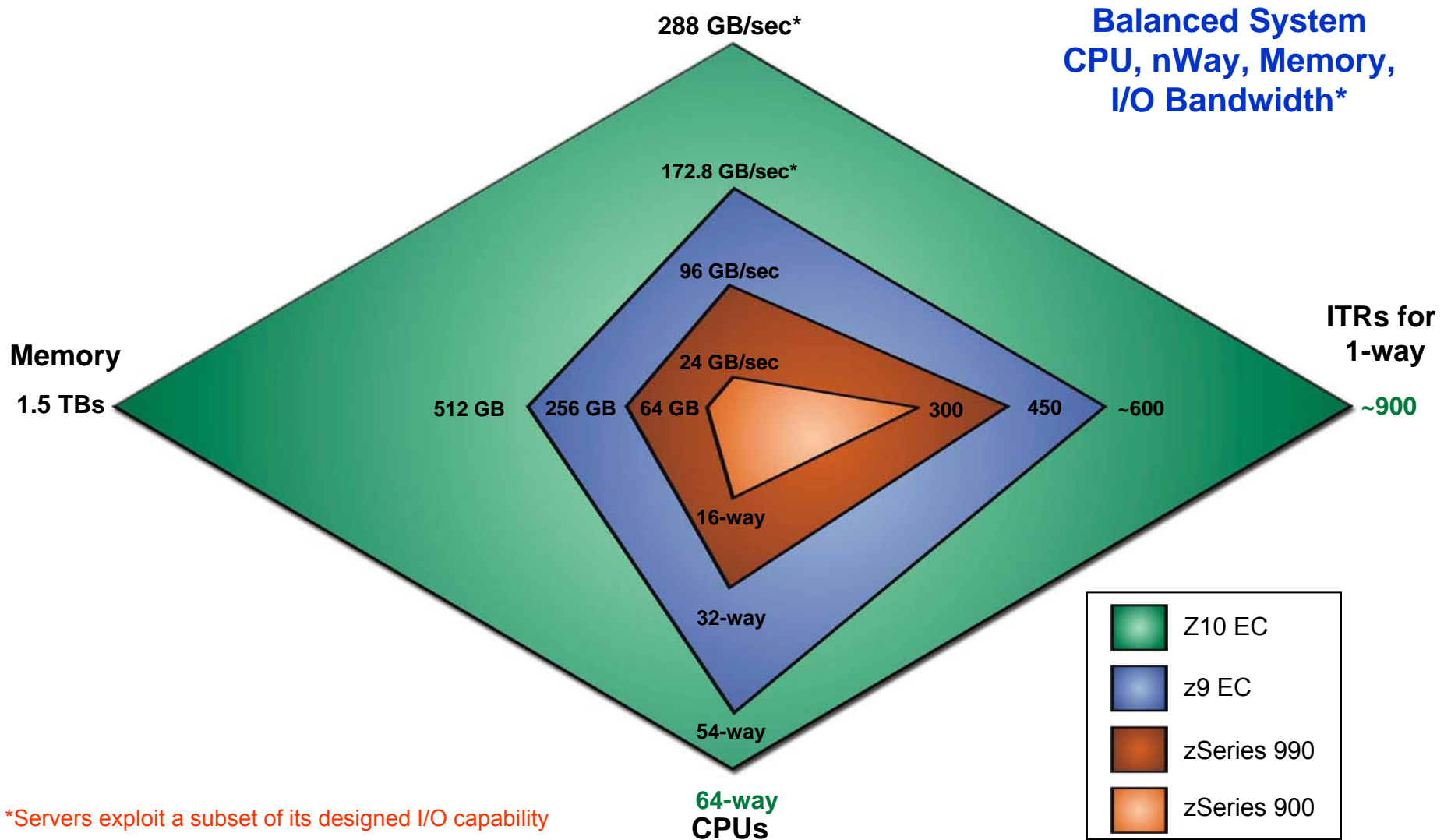
Compare to typical UNIX system design...

Up to 128-way SMP configuration



**CPUs licensed for software do a lot other things too!**

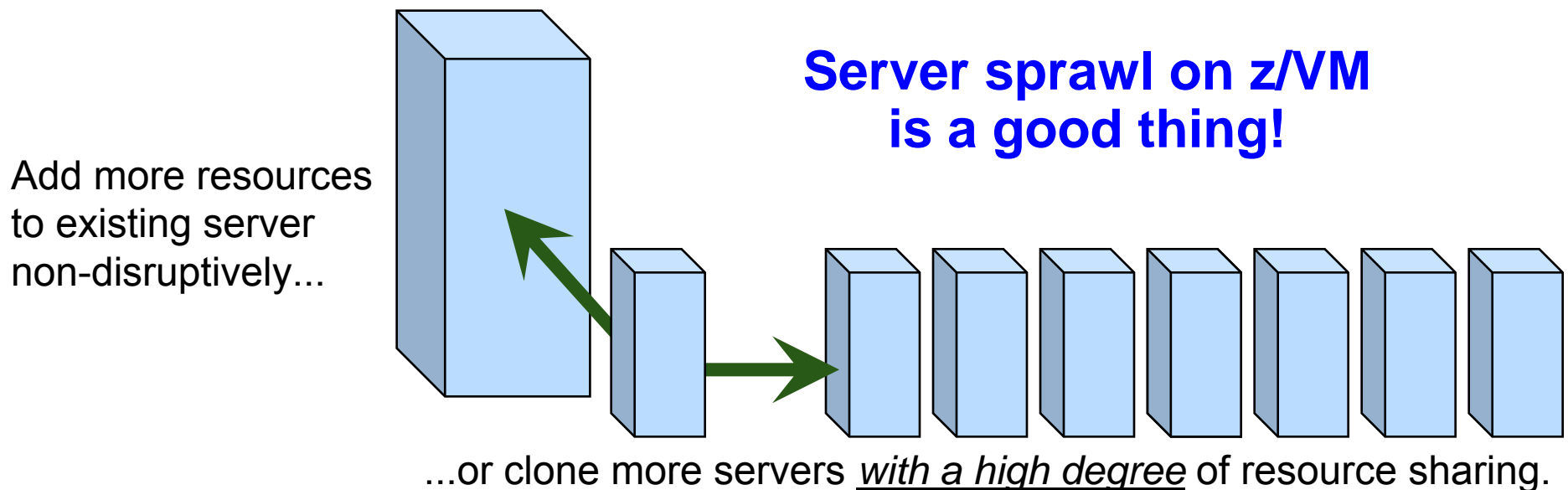
# IBM System z: System Design Comparison



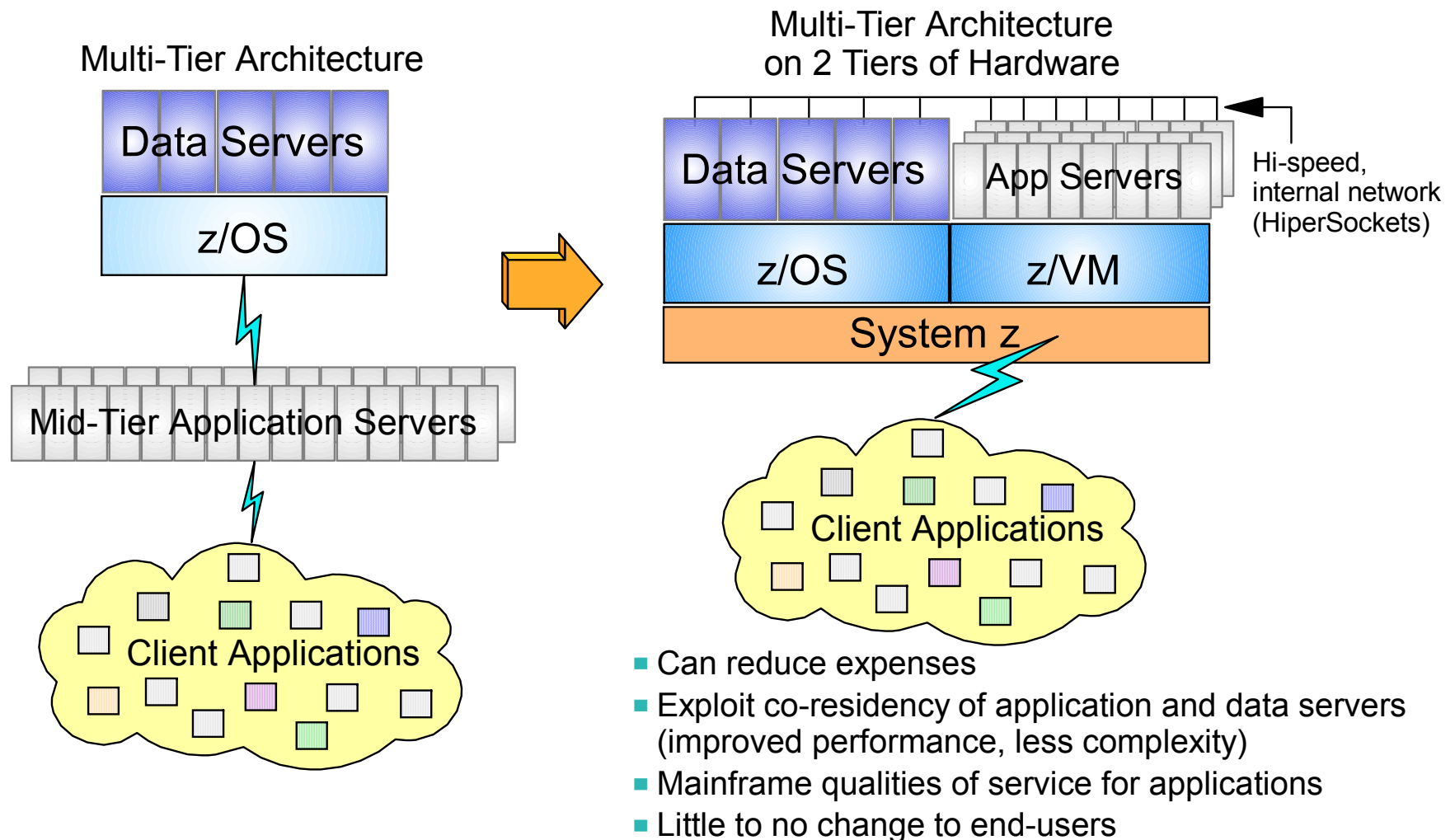
# z/VM Resource Sharing and Scalability

## Scale Up and Out with Linux

- With z/VM you can grow horizontally and vertically on the same System z server...dynamically
- Provision a virtual machine for peak utilization and allocate its resources to other servers during off-peak hours... Automatically

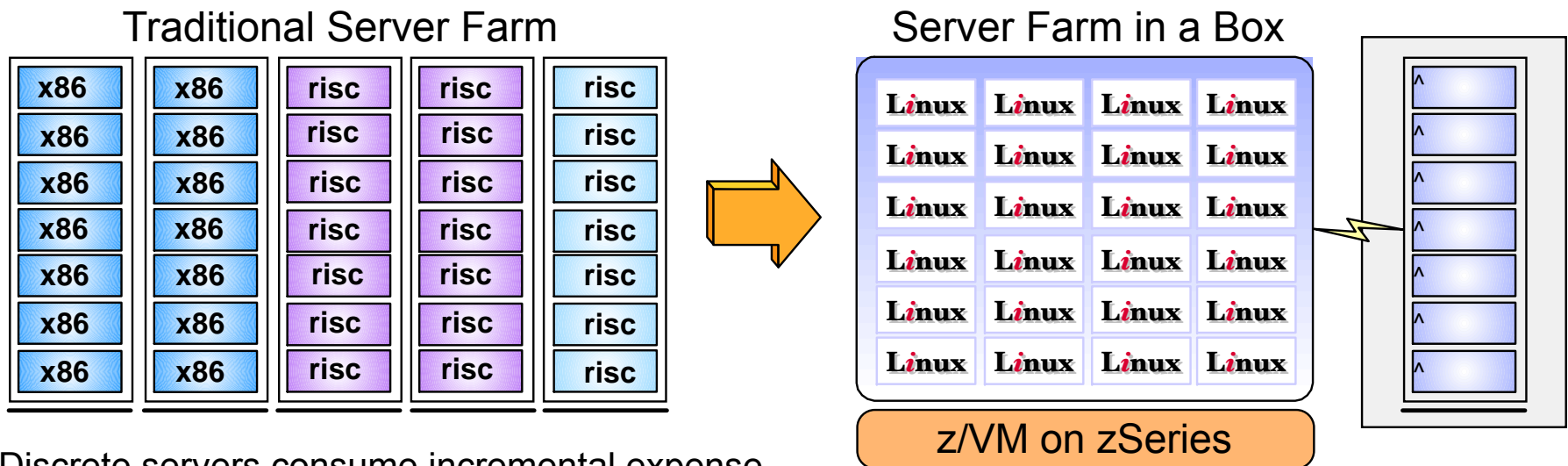


## Co-locate Application Servers with Transactions and Data Infrastructure Simplification – Application Integration





# Infrastructure Simplification with Linux on z/VM



- Discrete servers consume incremental expense
    - ▶ Hardware price and maintenance
    - ▶ Floor space, power, cooling
    - ▶ Additional support staff
    - ▶ Per server (engine) software fees
  - Connectivity requires kilometers of cables
  - High availability ensured by spares / re-boots
  - Disaster recovery difficult to test
- Can reduce costs without sacrificing server autonomy (one server per application)
  - Virtual, high-speed, inter-server connectivity
  - Exploit an architecture designed for high availability
  - Mainframe qualities of service
  - Tested disaster recovery services
  - Connect to discrete servers as required

## Candidate Software Technology Opportunities

- WebSphere and WebLogic Application Servers
- UDB, Informix, Oracle Databases
- WebSphere MQ Series
- DB2 Connect
- CICS Transaction Gateway
- IMS Connect for Java
- Communications Controller for Linux
- LDAP security services
- IBI Web Focus

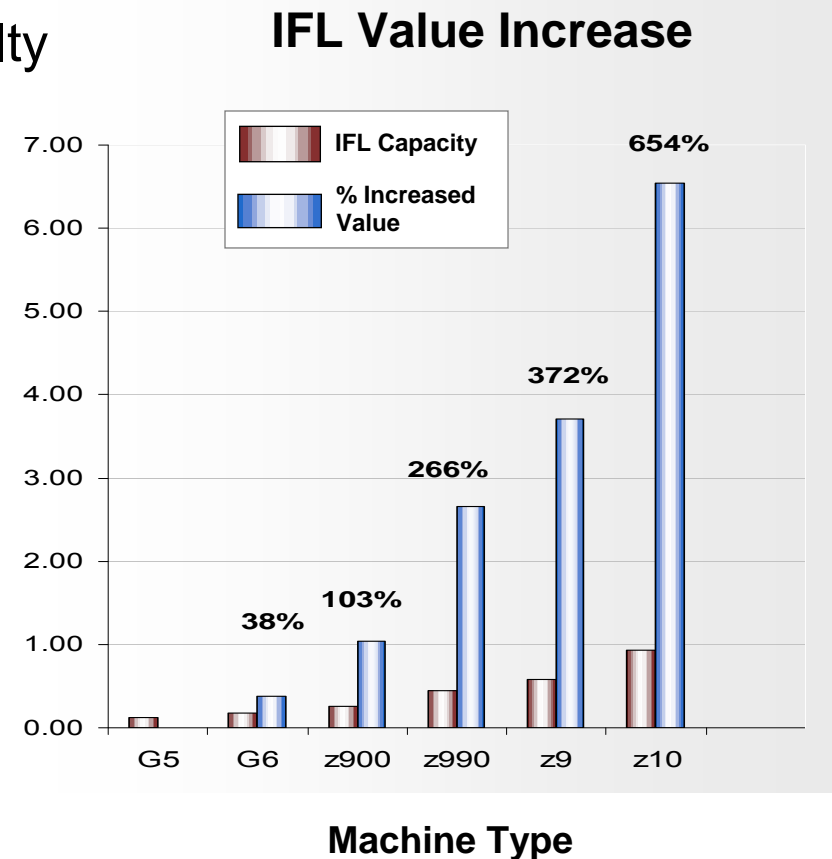
**IFL capacity increases "just happen"**

*when you do a mainframe hardware upgrade*

**"ZAAP's too"**

## Harness the Unique Value of Specialty Engines

- Integrated Facility for Linux (IFL) specialty engine Prices have remained constant
- IFLs typically move with upgrades at \$0 price
- Over 50% more capacity from z9 EC!!!
- Distributed model over same time:
  - 3 Technology Refreshes (New Hardware)
  - 3 System migrations



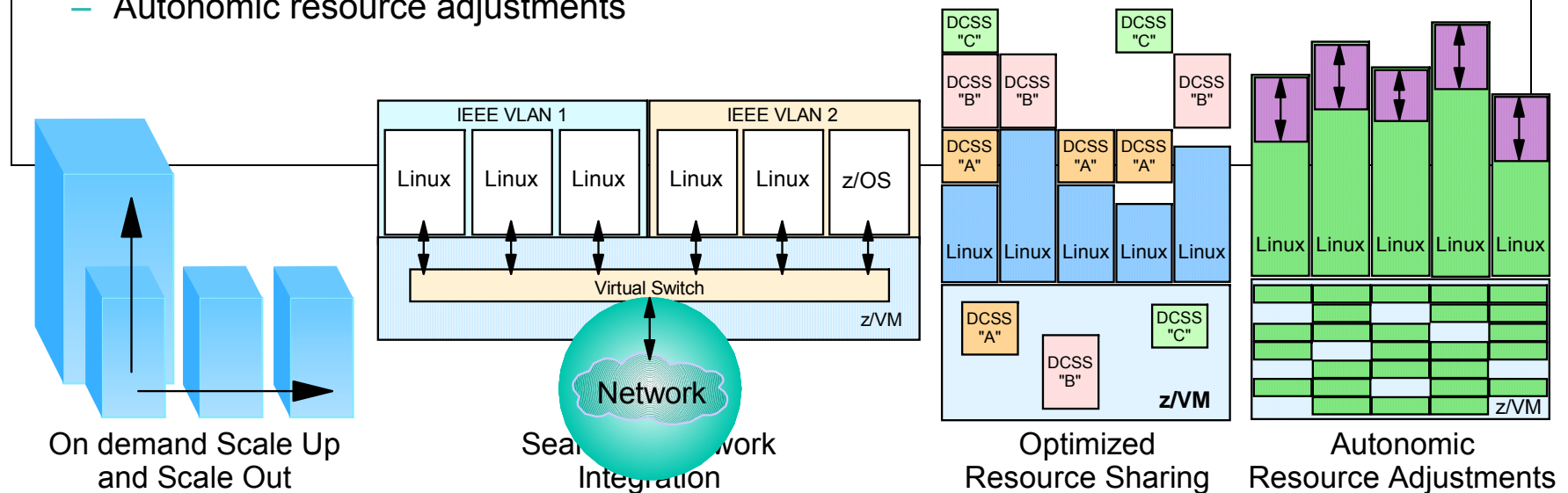
### *Specialty Engines:*

*The investments that keep paying dividends generation to generation*



# z/VM Vision and Investment Strategy

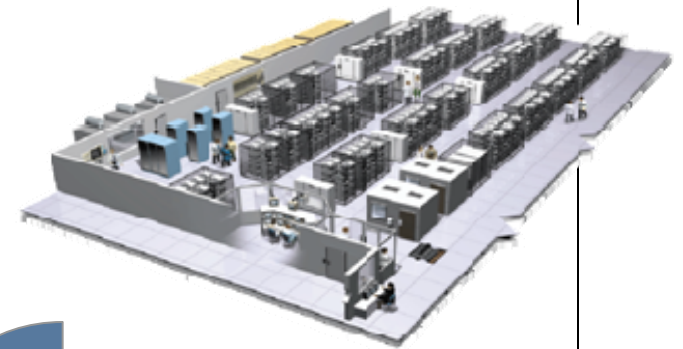
- **Make z/VM virtualization technology pervasive on System z9**
  - Improved performance, scalability, operational ease of use
  - Complementary investments in LPAR (PR/SM) and z/VM
- **Deliver platform solutions that exploit Linux and z/VM synergies**
  - On demand scale up and scale out
  - Seamless network integration
  - Optimize resource sharing
  - Autonomic resource adjustments



# Take back control of your IT infrastructure

## *A data center in a box – not a server farm*

- **Central point of management**
- **Increased resource utilization**
- **Potentially lower cost of operations**
  - Less servers
  - Fewer software licenses
  - Fewer resources to manage
  - Less energy, cooling and space
- **Fewer intrusion points**
  - Tighter security
- **Fewer points of failure**
  - Greater availability



# Nationwide



## Key Benefits (Value Proposition)

Expect to save over \$15M over the next 3 years

- ✓ Savings will be in cooling, maintenance, software and equipment costs, said Guru Vasudeva, a Nationwide computer expert who is overseeing the technology's implementation.
- ✓ Lower middleware and application costs, 50% reduction in monthly charges for Web infrastructure  
80% reduction in data center floor space utilization, optimized CPU utilization
- ✓ Greater operational and managerial efficiencies and lower cost per virtual server
- ✓ Building better capacity management processes and workload modeling to better assess which applications and workloads most appropriate to migrate to the z platform for additional cost savings
- ✓ Leveraged IBM services, server and software expertise for best practices in tuning and capacity management, better management and resource optimization to drive down costs



**Nationwide\***  
*On Your Side™*

Investments Retirement Insurance

## Solution

- ▶ GTS Capacity Planning and Capacity Management Services
- ▶ IBM zSeries 990 IFLs with 136 GB memory and associated systems software licenses
- ▶ Novell SUSE Enterprise Linux 9
- ▶ IBM WebSphere®
- ▶ IBM DB2 Universal Database™ (UDB)
- ▶ IBM WebSphere MQ
- ▶ SupportLine Linux support



## Hannaford, a US supermarket chain, moved to a System z9



### Business Challenges

- Differentiate in highly competitive marketplace with world-class supply chain
- Reduce cost of hundreds of servers, improve availability and security

### Solution

- Introduce CAO system, consolidate to IBM System z9 and Linux

### Results

- Reduced cost of goods
- Improved sales, service & customer satisfaction
- Increased BP sat
- Significant IT cost reduction

*“Thousands of employees ... now have access to the same, up-to-date data, giving us a competitive advantage.”* Bill Homa, CIO

*“We are saving hundreds of thousands of dollars by not having computer operators running systems from the z9 down to Microsoft server... we actually have a smaller IT staff now than we did 5 years ago, ... managing probably 10 times the processing power.”*

## Dramatic cost savings achieved through server consolidation



### Telmex

#### Challenge

- Reduce the costs and complexity of maintaining a UNIX server farm
- Improve WebSphere Application Server performance

#### Solution

- Consolidated 65 HP UNIX servers onto a single zSeries server
- Migrated all 13 UNIX applications to Linux

#### Value

- IT cost savings of US\$2M per year through reductions in administration overhead
- WebSphere Application Server speed increase of 300%
- Single mainframe point of control simplifies systems management
- Dramatically smaller server footprint



# A Tale of Two Companies: Baldor & Welch's



## Companies take divergent paths with mainframe

One IT department embraces it; another decides to abandon it

[Patrick Thibodeau Today's Top Stories >](#) or [Other Hardware Stories >](#)

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**August 15, 2005 (Computerworld)** -- Baldor Electric Co. and Welch Foods Inc. have much in common. Both are growing, midsize companies with similar-size IT departments. Each uses packaged ERP applications and is run by IT managers who want complete alignment with the business. But when it comes to the hardware running these systems, the companies are polar opposites.

Fort Smith, Ark.-based Baldor has consolidated its hardware to an IBM z990 running Linux that hosts its SAP ERP applications. The company, which makes electric motors, moved off IBM pSeries servers running AIX and is planning to switch applications on its Intel servers to applications that run on the mainframe, including moving a Windows-based mail server to Lotus Domino.

## The Difference is in the Bottom Line

	BALDOR	WELCH'S
Supplier	IBM	Dell
Moved From...	3 MF & 8 Unix	S/390 & AS/400
Moved To...	1 z990 System z	100 Intel Servers
Virtualization	z/VM	VMWare
Decision Completion Time	Approx. 6 months	Started before June 2005—will run til 2007
IT Staff	Down to 38	50
IT Spend	1.2% of Sales (declining to .8%)	2.5% of Sales

Computerworld did a story comparing two "growing midsize companies":

- **Baldor** implemented SAP using zLinux, z/VM, and DB2 on z/OS and is spending less than 1% of sales on I/T.
- **Welch's** implemented Oracle ERP on DELL using VMware, Oracle DB, Linux and is spending 2.5% of sales on I/T.



- **Leading exploiter of latest SAP functions**
  - SAP Business Suite, NetWeaver, CRM, SRM, Enterprise Portal
  - Sales and distribution, manufacturing, payroll, finance
  - For total of 3,800 employees
- **Saw 40% improved performance consolidating everything on one IBM ~ zSeries 990 (z990)**
  - DB: z/OS, Application Servers: Linux for System z
  - 24 secure partitions, HiperSockets
  - IBM TotalStorage® DS8000 with 14 TB
  - All managed by less than 40 professionals
- **Unmatched availability and reliability with zSeries HW & SW**
  - Projected costs of outage: \$100,000 / hour

# First National Bank of Omaha

## Challenge

- Large complex IT infrastructure was difficult to monitor, manage and scale
- With 600 servers, maintenance costs skyrocketed
- Staff growth 30% each year
- Average 12% server and 14% storage utilization rates
- Peak transaction volumes in certain applications forced bank to continually add capacity

## Solution

- IBM System z with z/VM and Linux virtual servers
- 70 IBM BladeCenter™ servers
- IBM SAN Volume Controller
- IBM System p 695 runs the bank's data warehouse

## Benefits:

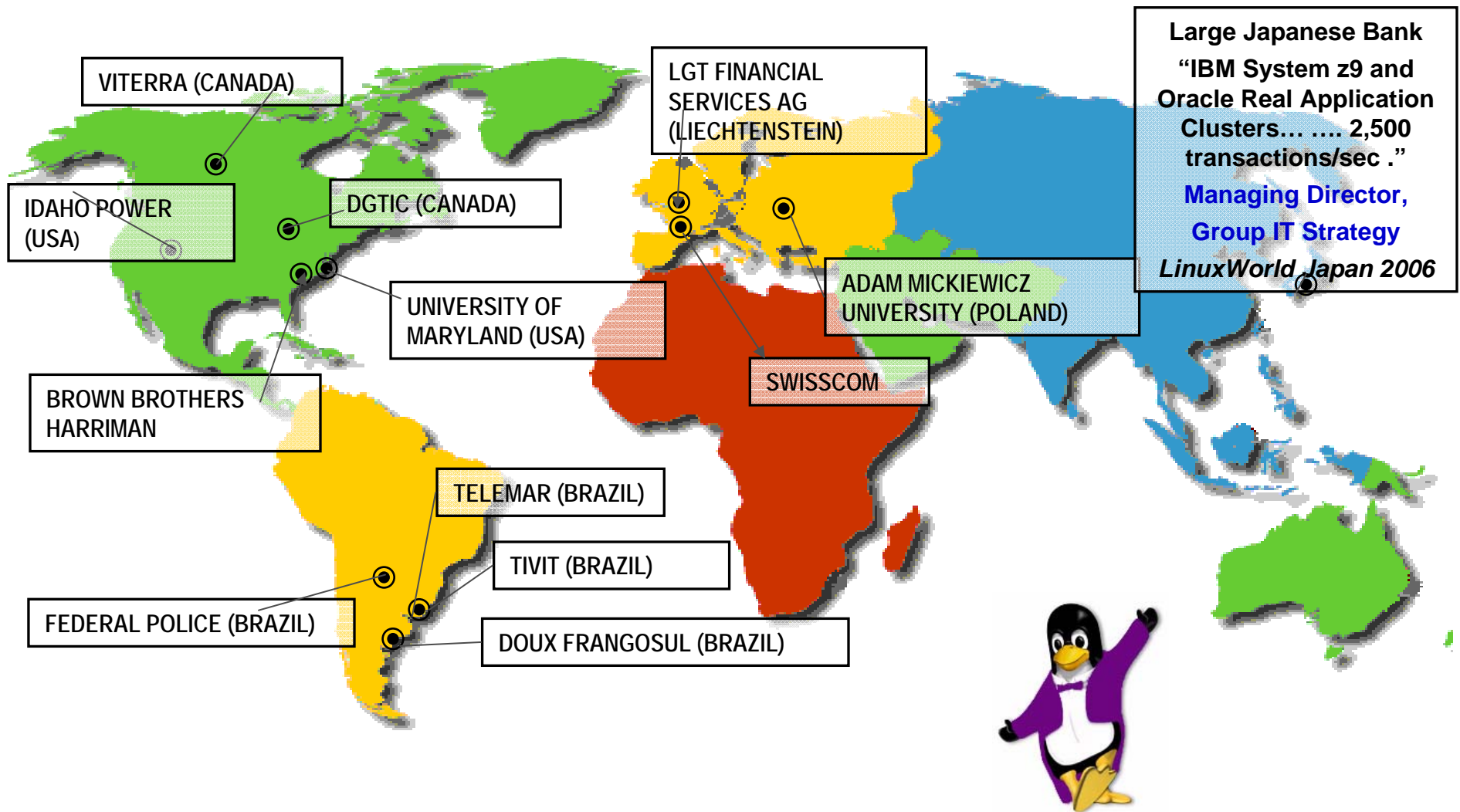
- Realized ratio of 18 : 1 on physical server consolidation by using virtualization
  - Ported 30 SUN based WebSphere server applications to Linux on System z
  - Consolidated 560 Intel-based servers to 70 BladeCenter servers
- Decreased systems staff from 30 to 8 to manage entire infrastructure
- Capacity Upgrade On demand to provide additional mainframe computing resources when extra capacity required
- Storage consolidation helped bank reduce number of devices to manage

“As a result of consolidation, we only have to maintain a handful of servers instead of nearly 600 – making the task much less complex and expensive”

*Kenneth J. Kucera, senior vice president, division head of Enterprise Technology Services*



# Sample of Customers Who Have Chosen *IBM System z running Linux with Oracle Database*





# World's largest Linux migration gets extra boost

## Linux for System z and Domino at Deutsche Bahn



### Computer

#### •COMPUTERWORLD press release 2/4/2005

- Uses z990 servers
- z/VM virtualization technology
- Support for 55,000 Lotus Notes users
- System z solution chosen for
  - Continuous cost savings
  - Greater flexibility
  - Integration benefits

*“Our mission is to develop and deliver an efficient and economical IT service for German railways. Linux is a key element in our strategy, and the smooth process of migrating our mainframe-based Lotus Notes system is a clear sign that this major project will be successful” – Detlef Exner - director of production at Deutsche Bahn’s IT service provider DB Systems*

Details available at:

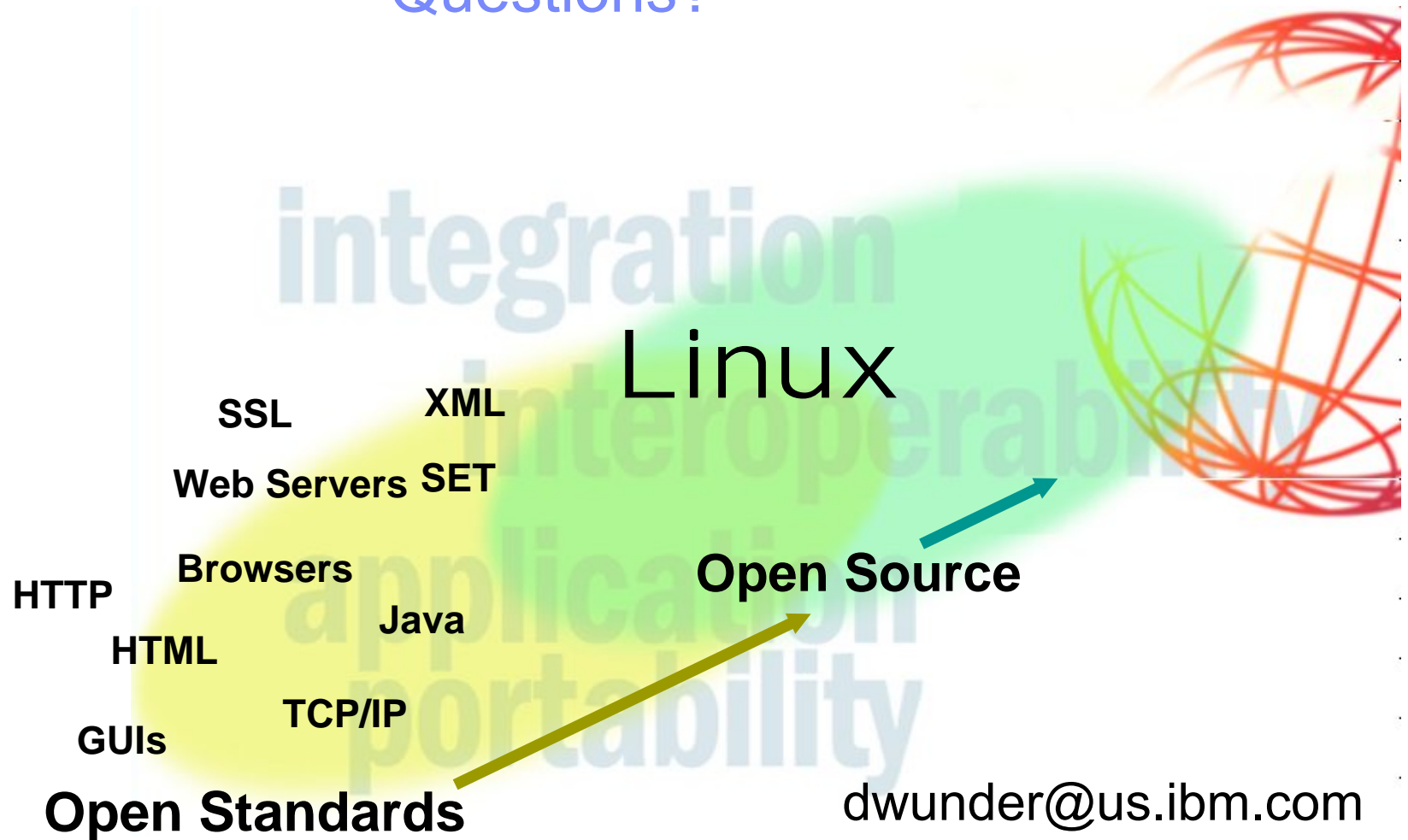
<http://www.computerworld.com/newsletter/0,4902,99522,00.html?nliid=AM>

The screenshot shows a web browser displaying a ComputerWorld article. The article title is "World's largest Linux migration gets major boost". The text discusses Deutsche Bahn's migration of its Lotus Notes system to Linux on System z servers. Key points from the article include:
 

- The migration is the world's largest, involving 55,000 Lotus Notes users.
- Deutsche Bahn chose Linux for System z due to its continuous cost savings, greater flexibility, and integration benefits.
- The migration is a clear sign that the project will be successful.
- Detlef Exner, director of production at Deutsche Bahn's IT service provider, DB Systems, is quoted as saying: "Our mission is to develop and deliver an efficient and economical IT service for German railways. Linux is a key element in our strategy, and the smooth process of migrating our mainframe-based Lotus Notes system is a clear sign that this major project will be successful."

 The screenshot also shows a sidebar with navigation links, a Microsoft advertisement for Windows Server System, and a "FREE GUIDE TO SSI encryption" offer.

# Questions?



[dwunder@us.ibm.com](mailto:dwunder@us.ibm.com)

Attribute	z/VM V5.3	VMware ESX 3.5	System z Value
Supported operating systems	Linux, z/OS, z/VSE, z/TPF, z/VM itself	Linux, Windows, Netware, Solaris 10	z/VM-on-z/VM = added flexibility
<b>Scalability and Performance</b>			
Hypervisor scalability	Up to 32 CPUs, 256 GB of memory, More than 1 TB of active virtual memory	Up to 32 CPUs, 256 GB of memory	Cost-saving, extreme scalability of virtual server environment
Virtual Machine (VM) scalability	Up to 64 CPUs, 1 TB of memory, extensive I/O bandwidth	Up to 4 CPUs, 64 GB of memory, modest I/O bandwidth	Virtualizes servers on z/VM that cannot run on VMware
CPU sharing	No limit	Up to 8 VMs per CPU	Add servers without adding HW
Architected (practical) VM limit	Thousands (hundreds) per copy of z/VM	128 (singles) per copy of VMware	Avoid real server sprawl
CPU capacity on demand	Yes, non-disruptively	No	Fast, easy capacity growth
In-memory support	Minidisk cache; Virtual Disks in Storage; DCSS (shared program executables)	Shared virtual memory pages (detected via background operation)	Enhanced resource utilization
Logical Partition (LPAR) support	Yes	No	Secure Linux access to z/OS
<b>Flexible Operations</b>			
Resource over-commitment support (memory, CPU, network, I/O)	Extensive	Modest	Absorb workload spikes; add more servers to a "full" system
Reconfiguration of Virtual Machines	Non-disruptive re-config for CPU, I/O, networking; VM re-boot for memory	VM reboot required for re-config of CPU, memory, ethernet, disk	Higher server and application availability; staff productivity
Command and control, monitoring, automation infrastructure	Extensive, robust, time-tested	Modest, yet easy to use	Cost-optimized systems management support
Virtual Machine mobility support	No; single-image scalability of z/VM does not require mobility for mgmt	Yes; essential for workload mgmt across multiple copies of VMware	Can dynamically add or remove resources to meet demand
<b>Integrity and Security</b>			
Fault isolation / hypervisor security	Hardware-assisted isolation*; CAPP/EAL 3+	No I/O virtualization separation; CAPP/EAL 2	Helps to avoid security breaches; data security and integrity
Run multiple copies of hypervisor on single server	Yes; share CPU, I/O, and networking resources among z/VM systems	No	Workload isolation; lower-cost failover (using same hardware)

\* z/VM runs in System z LPARs, which have achieved EAL 5 certification; System z HiperSockets provide high-speed, secure connectivity among LPARs.

# IBM Server Family Supports Linux

## ■ System z™

- ▶ Legendary quality of service, security and scalability
- ▶ Self management capabilities
- ▶ Industry leading virtual partitioning for z/OS and Linux

## ■ System i™

- ▶ Renowned customer loyalty
- ▶ Simultaneous multi environment workloads for Windows, Linux , Java, Websphere

## ■ BladeCenter™

- ▶ Highly manageable, modular infrastructure
- ▶ Shared resources for business continuity
- ▶ Performance density



## ■ Clusters

- ▶ Price and performance leadership in both Unix and Linux environments

## ■ System x™

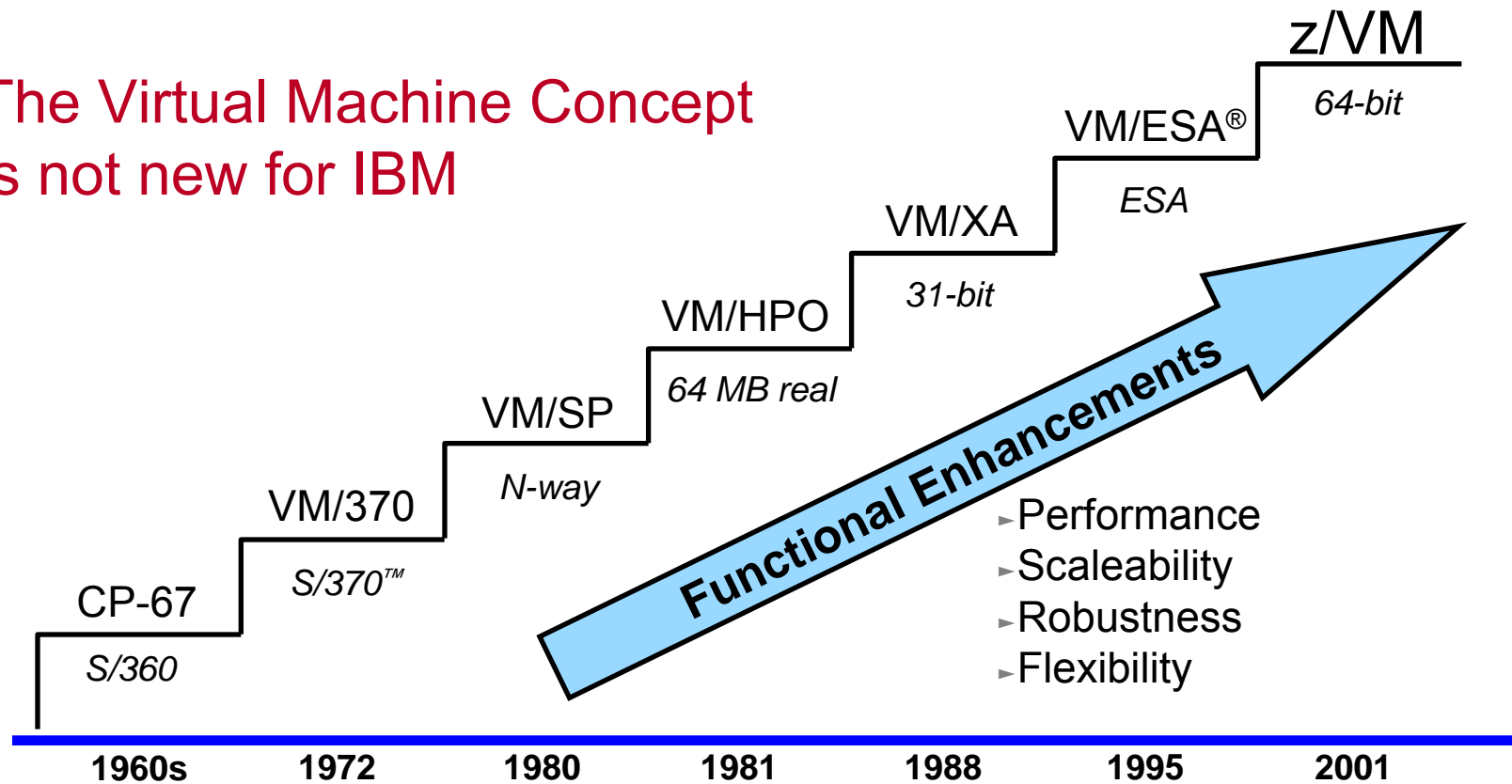
- ▶ Revolutionary Enterprise X-Architecture™ technology for Intel
- ▶ Linux grassroots partnership
- ▶ End-to-end product portfolio for Intel

## ■ System p™

- ▶ Unparalleled performance and reliability
- ▶ Leading edge autonomic computing
- ▶ Uncompromising Unix and Linux servers

# IBM Mainframe Virtualization Technology Evolution

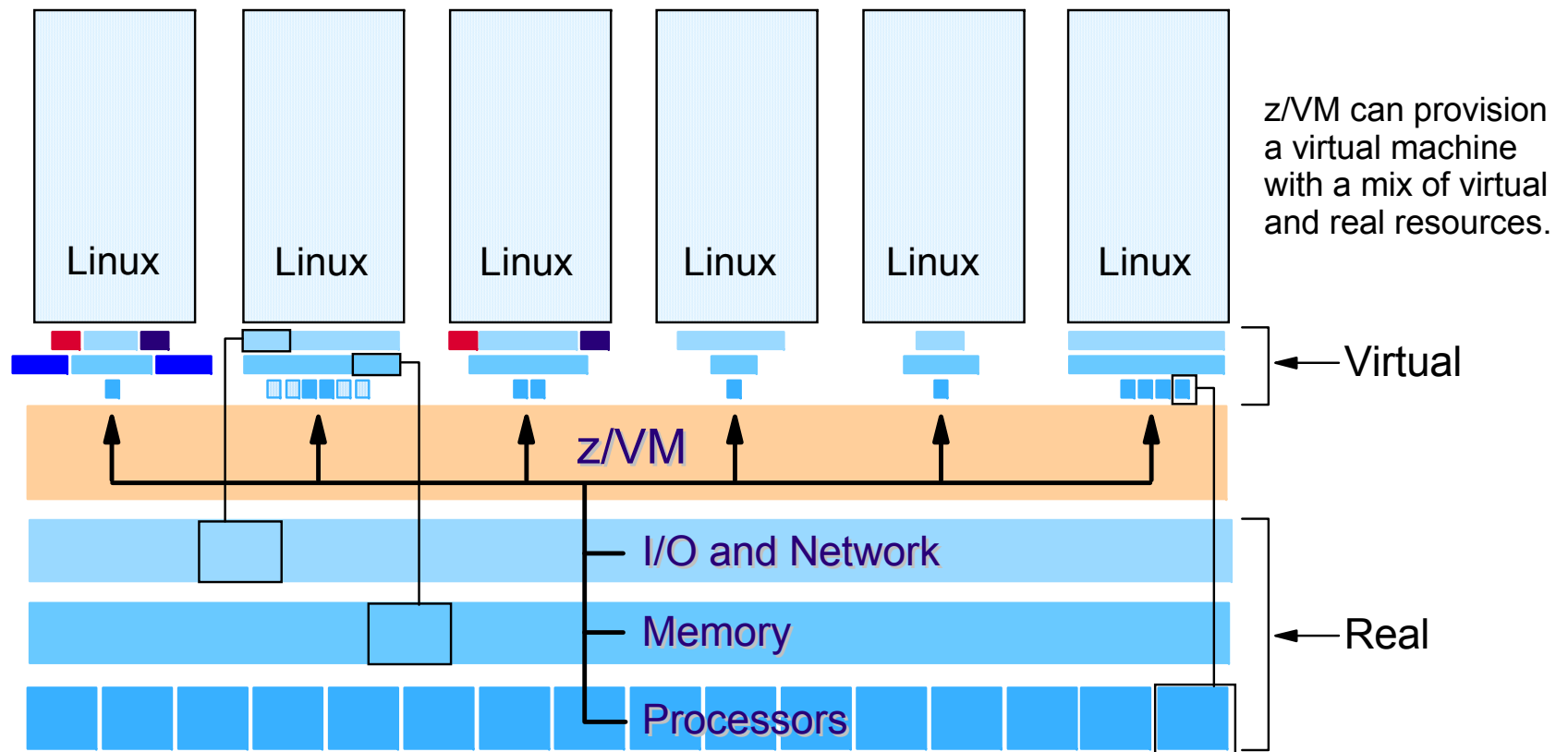
The Virtual Machine Concept  
is not new for IBM



zSeries virtualization starts on the chip...a combination of hardware, architecture, firmware, and software functionality

## z/VM Technology: More than Partitioning

A Virtual Machine simulates the existence of a dedicated real machine, including processor functions, storage, and input/output resources.

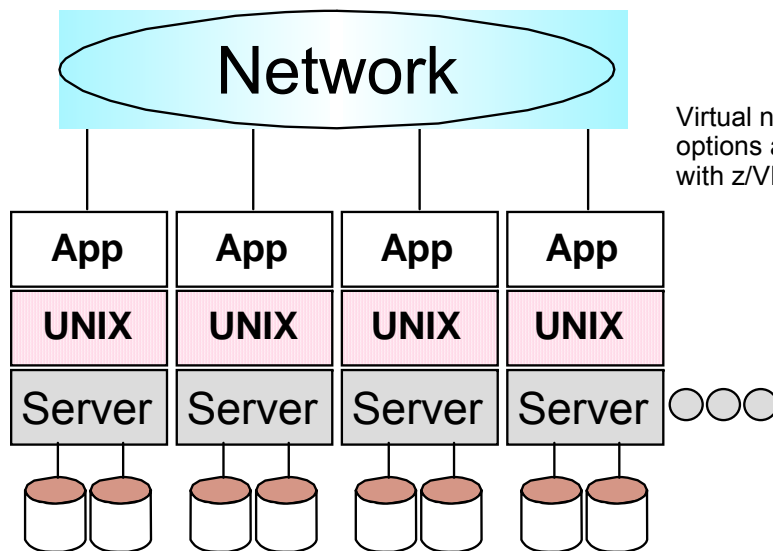


Linux on z/VM is the industry's most advanced *virtual* blade solution



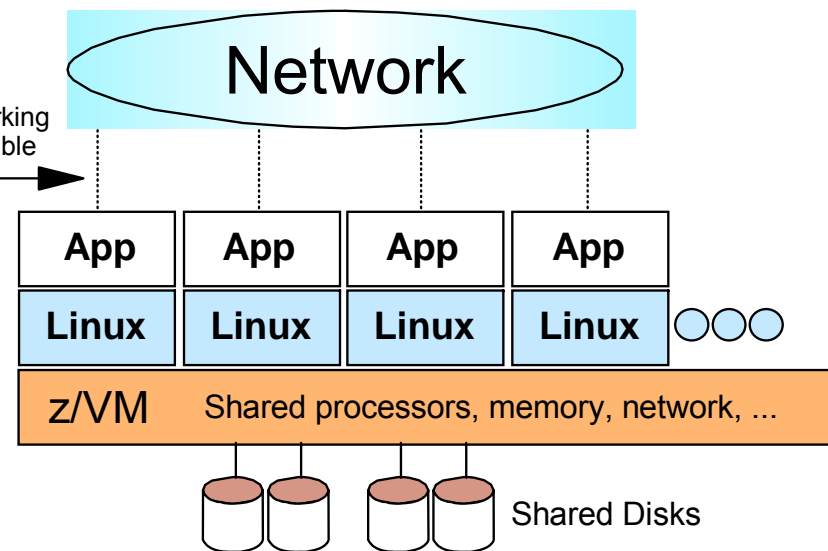
# Achieve Rapid Horizontal Growth with Linux on z/VM

Typical UNIX® environment



- Dedicated processors, disks, adapters, ...
  - Resources wasted when idle
- Complex system management
  - Networking and software products required for command and control
- New servers available in hours / days

Linux on z/VM



- Shared resources
  - Idle capacity given to servers that need it
- Simplified system management
  - Everything in one box
  - Automation tools included in z/VM
- New servers online in minutes / seconds
- On/Off Capacity on Demand available



# Nexxar



## Business Need

A architecture for IT infrastructure to provide very high (24x7) availability and the ability to sustain significant anticipated business growth

## Key Benefits (Value Proposition)

- ✓ An architecture that suits requirements for security, manageability, reliability, availability, scalability, extensibility and flexibility
- ✓ The ability to grow Nexxar 's growth by acquisition business while staying within the same platform
- ✓ Consolidation of more than 80 x86 servers onto an IBM System z9 Business Class (BC)
- ✓ A 75% reduction of headcount required to maintain the operating environment in comparison with the x86 systems previously on the floor.



## Solution

- **Hardware**
  - IBM System z9
  - Storage (DS8100, 3590)
- **Software**
  - zOS-DB2, zVM-Linux
  - WebSphere Application Server
  - Tivoli OMEGAMON
  - Rational
- **Services**
  - GTS Infrastructure & Systems Management Services

# Hoplon



## Business Need

To offer a robust, streamlined, open standards-based deployment platform for a new online game.

## Key Benefits (Value Proposition)

- ✓ IBM DB2 delivered a 30% performance increase over previous DB solution
- ✓ Meets their extreme security requirements
- ✓ Extreme flexibility for massive multi-user on line game (MMOG) environment
- ✓ Hoplon's innovative game design leverages the attributes of service-oriented architecture to enable streamlined, organic growth of the game environment.
- ✓ IBM Managed Hosting Services optimize IT investment by delivering the benefits of IBM zSeries technology on-demand
- ✓ IBM Rational Purify helped speed time to market for Hoplon's new game by enabling a single programmer to quickly solve critical memory issues.



## Solution

- ▶ **Hardware**
  - IBM eServer z900
- ▶ **Software**
  - IBM Rational® Purify®
  - IBM WebSphere and IBM DB2
  - Linux
- ▶ **Services**
  - IBM Managed Hosting Services and IBM Migration

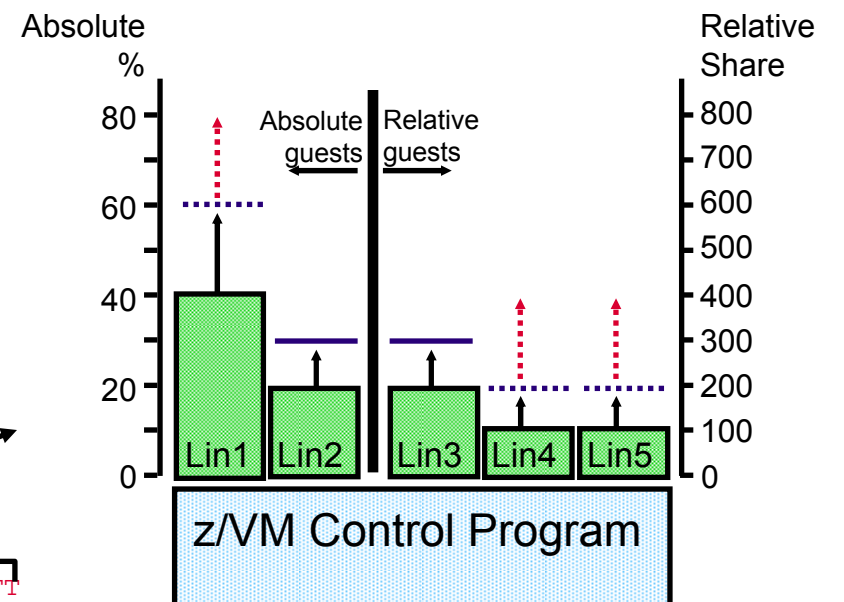
## z/VM Technology - CPU Resource Controls

Allocate system resources on a per-Linux-image basis using SET SHARE command

- This is a highly flexible and self-managed function of the z/VM Control Program
- Reserve CPU capacity for peak usage
  - Use it when needed
  - Relinquish the processor cycles for other servers when not needed
- "Absolute guests" receive top priority
- The Virtual Machine Resource Manager can be used to monitor and adjust remaining capacity allocated to "Relative guests"

### VM Directory Entries

```
SET SHARE Lin1 ABSOLUTE 40% ABSOLUTE 60% LIMITSOFT
SET SHARE Lin2 ABSOLUTE 20% ABSOLUTE 30% LIMITHARD
SET SHARE Lin3 RELATIVE 200 RELATIVE 300 LIMITHARD
SET SHARE Lin4 RELATIVE 100 RELATIVE 200 LIMITSOFT
SET SHARE Lin5 RELATIVE 100 RELATIVE 200 LIMITSOFT
```



### Notes:

- ..... = limit can be exceeded if unused capacity is available (**limitsoft**)
- = limit will not be exceeded (**limithard**)