



IBM Software Group  
Enterprise Networking and Transformation Solutions (ENTS)

# Linux on System z A Short Introduction

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## A few terms that may be new to you

- **IFL**
  - ▶ Integrated Facility for Linux –a zSeries processor that supports Linux workloads exclusively
- **RPM**
  - ▶ Red Hat Package Manager
- **Code drop**
  - ▶ Making code available to the Open Source community (and Linux distributors) by placing it on DeveloperWorks
- **Linux Kernel**
  - ▶ The "kernel" of the Linux operating system. There are two main levels today - 2.4 and 2.6
- **LTC**
  - ▶ Linux Technology Center
- **SLES**
  - ▶ SuSE Linux Enterprise Server
- **RHEL**
  - ▶ Red Hat Enterprise Linux
- **GNU**
  - ▶ GNU's Not Unix (recursive acronym)

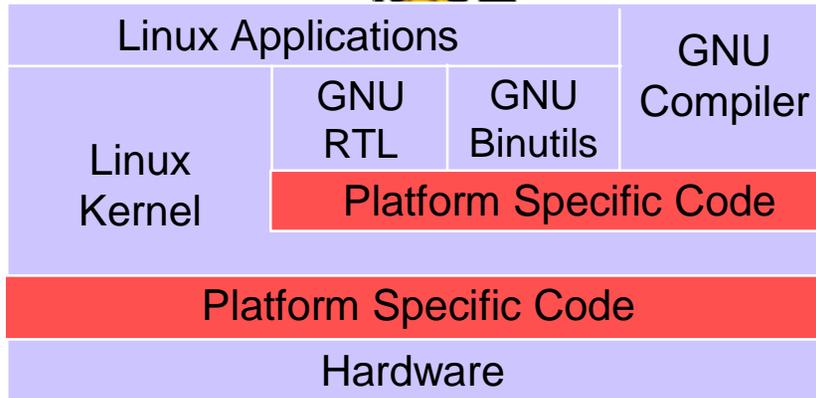
# What is Linux?

## ➤ Linux is an operating system like any other modern operating system

- ▶ It is a multi-tasking operating system
- ▶ It is a multi-user operating system
- ▶ It uses a virtual memory model
- ▶ It operates on both uni-processor (UP) and Symmetrical Multi-Processor (SMP) hardware
- ▶ It is UNIX-like (it was written from scratch - there is no original AT&T UNIX code in Linux)
- ▶ It is (almost) POSIX compliant
  - User interface - the shell environment
  - System calls
- ▶ It operates on both 32 (31) and 64-bit hardware platforms including Intel, Power, and System z
- ▶ It is ASCII - also when running on System z
- ▶ It is open source
  - Kernel code is subject to a strict review process for quality and adherence to coding standards

**In fact, if you are familiar with how the z/OS operating system base operates on the System z hardware, you know much more about Linux on System z than you might think you do.**

# Linux + System z = Synergy



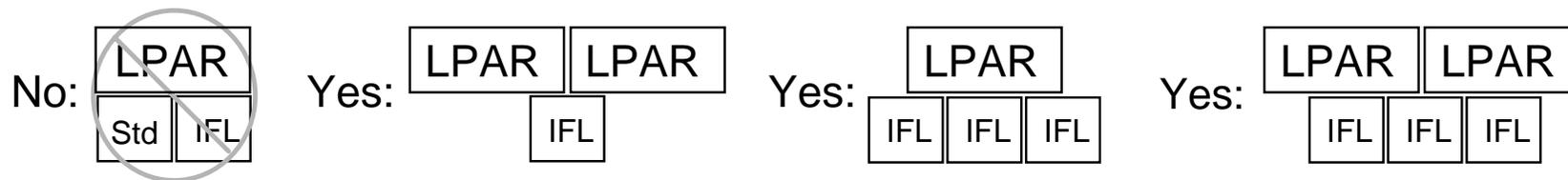
- Reliable, stable, secure
- Large selection of applications middleware and tooling from IBM, ISV's and Open Source
- Available from multiple distributors
- Evolves rapidly to meet business challenges
- Plentiful availability of skilled administrators and developers

- 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

## System z Integrated Facility for Linux (IFL) engines

### ➤ IFLs are processors dedicated to Linux-only workloads

- ▶ Less expensive than standard processors
- ▶ Will not support traditional mainframe operating systems
  - z/VM running Linux guests is OK using IFL engines, but not z/OS
- ▶ Only usable in LPAR mode; cannot be mixed with standard processors



### ➤ Available with z9 and zSeries servers, 9672 G5/G6, Multiprise 3000

- ▶ One standard engine must exist before IFLs can be added
  - Exceptions: z800-0LF, z990, z890, and System z servers
- ▶ Some servers don't have spare processors available for IFLs

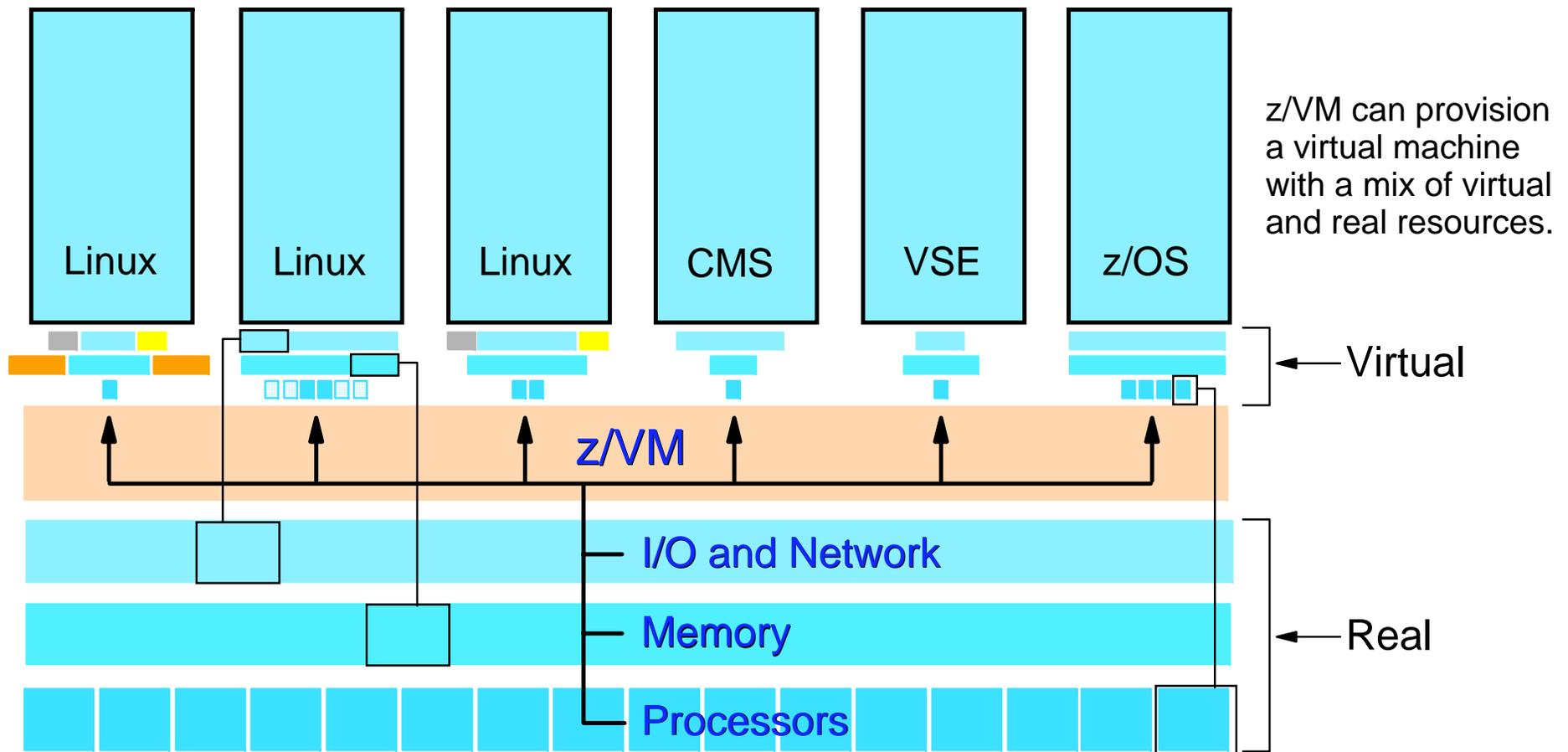
### ➤ Adding IFLs does not change a server's model designation

- ▶ No increase in fees for IBM or vendor software installed on standard processors

### ➤ Both CS Linux and Communication Controller for Linux can use IFL engines

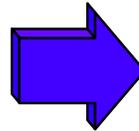
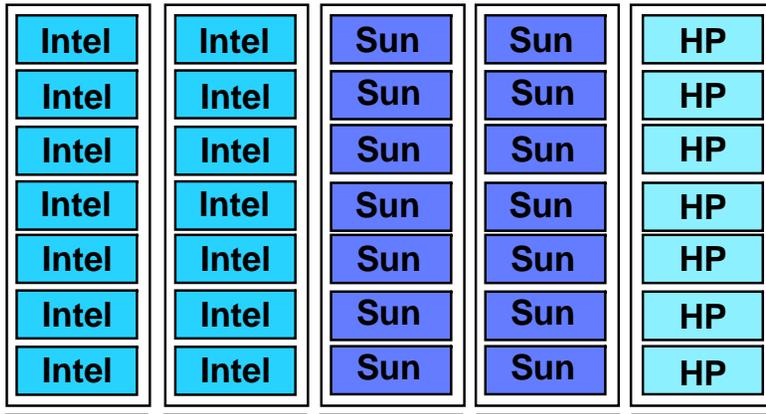
## z/VM and Linux on System z

- **Linux can run in a normal LPAR - one Linux operating system per LPAR**
- **If you need multiple Linux operating system instances, you should use z/VM**
  - ▶ A Virtual Machine simulates the existence of a dedicated real machine, including processor functions, storage, and input/output resources.

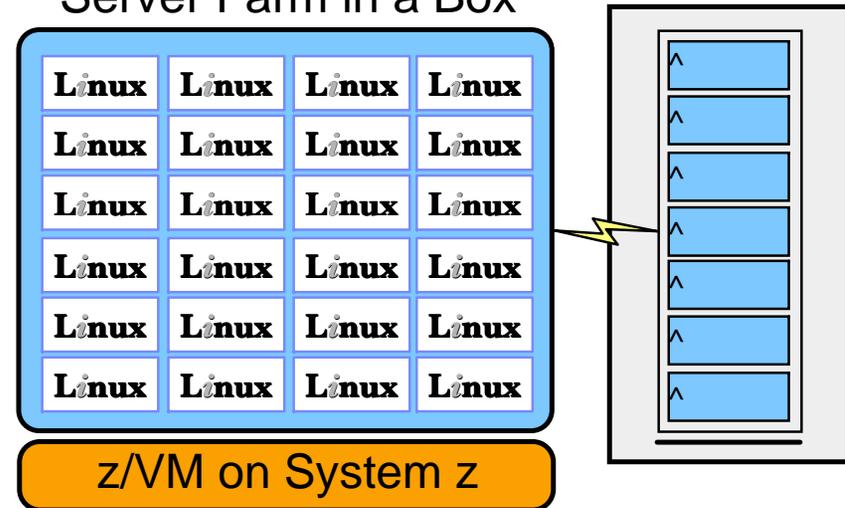


# Server Infrastructure Simplification with Linux on z/VM

## Traditional Server Farm



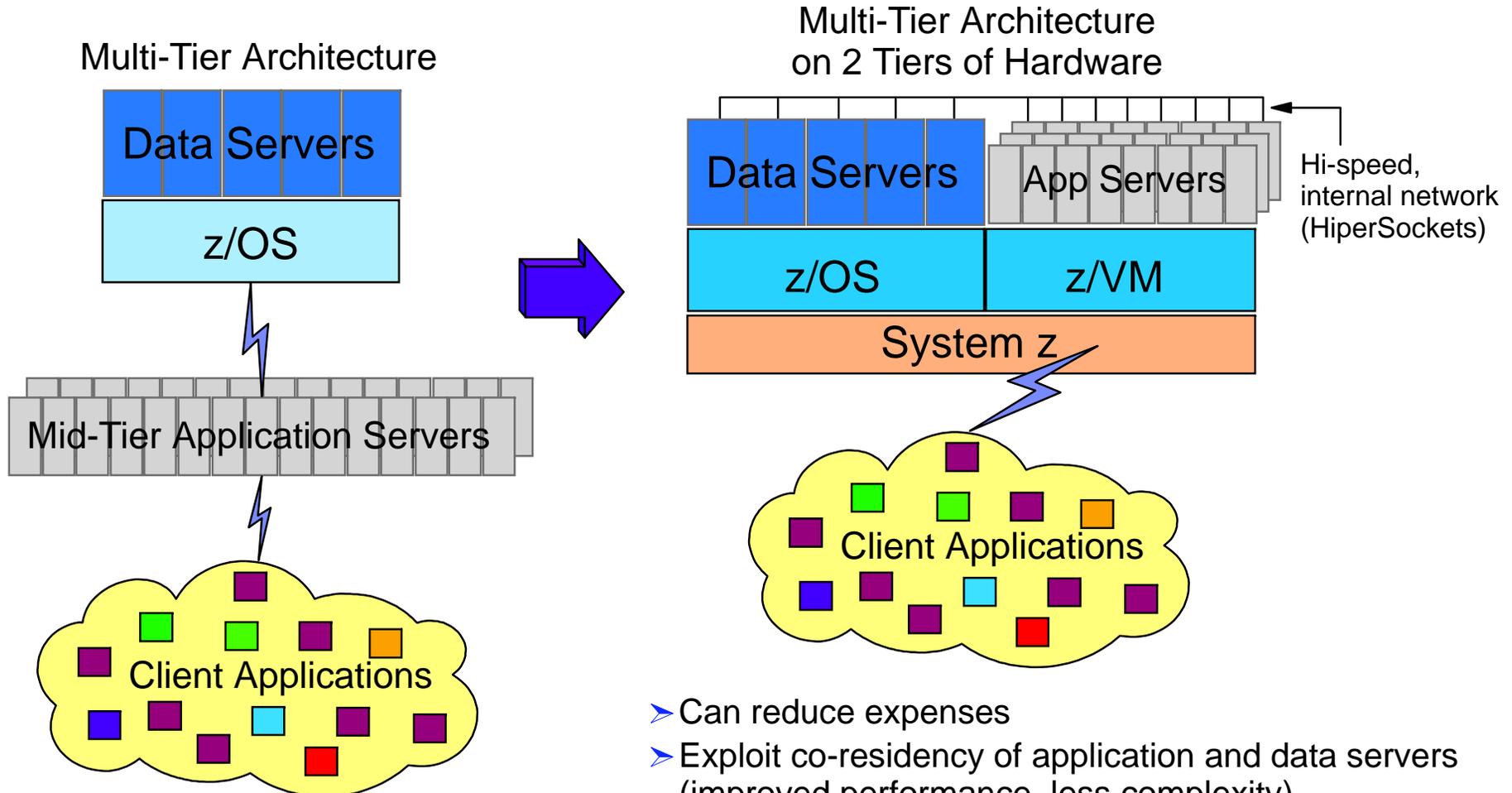
## Server Farm in a Box



- 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
  - ▶ Network adapters
  - ▶ Switch ports
- High availability ensured by spares / re-boots
- Disaster recovery difficult to test

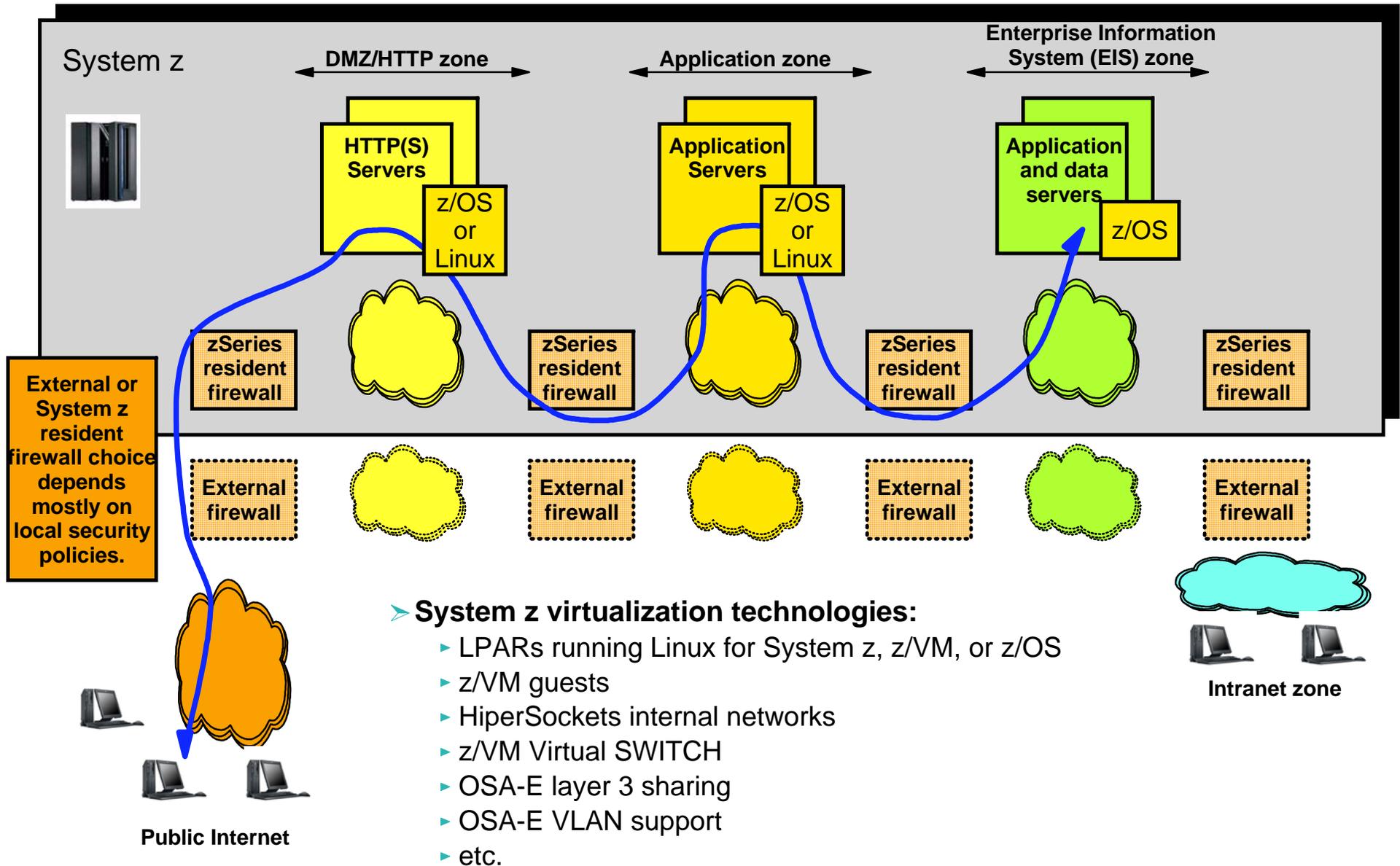
- Can reduce costs without sacrificing server autonomy (one server per application)
- Virtual, high-speed, inter-server connectivity
- Deploy new server within a few minutes without requiring HW changes
- Remove server and free virtual resources when a server no longer is needed
- Exploit an architecture designed for high availability
- Mainframe qualities of service
- Tested disaster recovery services
- Connect to discrete servers as required

# Server Infrastructure Simplification – Application Integration

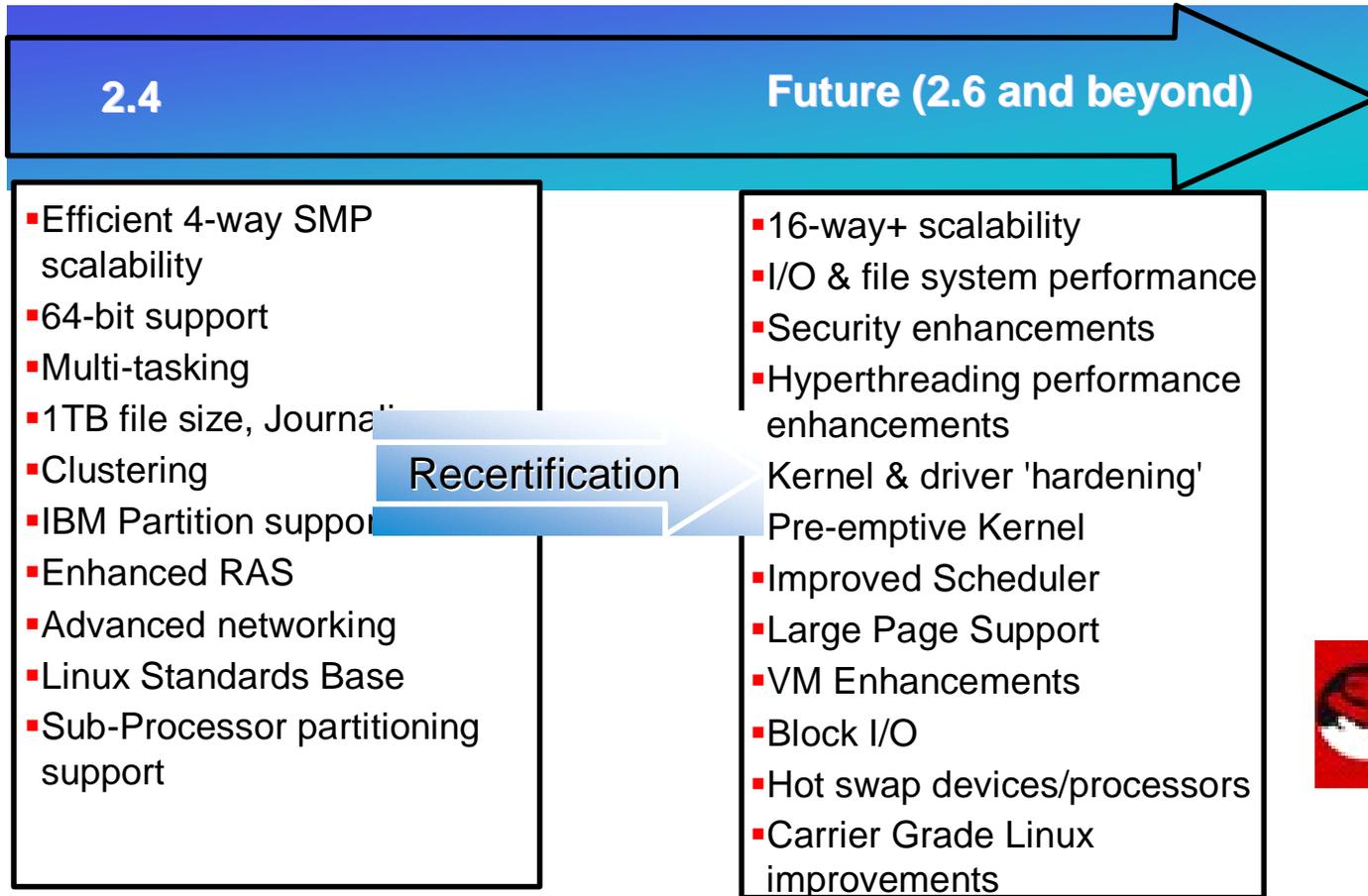


- Can reduce expenses
- Exploit co-residency of application and data servers (improved performance, less complexity)
- Mainframe qualities of service for applications
- Little to no change to end-users

# Generalized multi-tier Internet access applied to System z



# Linux technology evolution



**This represents a combination of current open source community priorities and IBM LTC project plans. Open source communities do not publish schedules or commit to specific dates or functions.**

# Open Source Code Drop October 2005 and March 2006

## Kernel

Kernel machine check handling

HAL support stage I

## Virtual Server

Adjustment of CPU accounting

xip2fs integration into ext2

Linux usage of CPU timer

User space access to CP commands (1)

## Networking

Linux NCP CDLC support

## Storage - ESCON/FICON

DASD tool harmonization

## Storage - FCP

N\_Port ID Virtualization (NPIV)

FCP re-IPL/reboot support

zfc Performance Statistics

SCSI IPL: Export SCSI IPL Parameter List

## RAS

Support for new 64bit Vmdump format

Update SCSI System dumper

## Security

CEX2A (PCIXCC fast path) DD support

## Kernel

ADTools Oprofile Call Graph patch

In-kernel Crypto API access to Hardware Crypto

## Virtual Server

Collaborative memory management stage 2

## Networking

Support for GuestLAN Sniffer

V=V QDIO Pass-thru stage 2

Deprecate the following Linux networking device drivers

- CTC (IP only)
- IUCV (for AF\_INET traffic, IUCV base infrastructure is kept)
- CLAW (IP only)

## Common I/O

Multiple Subchannel Set (MSS) Support

## Storage - ESCON/FICON

DIAG250 for 64 bit guests

HyperSwap support in DASD driver and common I/O layer

DASD fast fail support

Open source 3590 tape device driver

(1) ... Pre-req for IBM Director and XDR

## Linux Distribution Partners: Novell



Distribution	GA	EoService	Comments
SUSE SLES 8 31/64bit, K 2.4.19	11/18/2002	General support until 11/30/2007	UnitedLinux (SUSE, Turbolinux, Conectiva), 6/2003 code drop, z990 exploitation
SP3: K 2.4.21	11/14/2003	Self support until 11/19/2012	SP3 includes latest IBM fixes
SP3 Upd: K 2.4.21	04/30/2004		1/2004 code drop: z890 support, z990 GA3 support
SP3+SecUpd: K 2.4.21	08/03/2004		SP3+Sec Upd: CAPP/EAL3+ certified
SP4: K 2.4.21	03/14/2005		SP4: 10/2004 code drop incl. OSA Layer2 Switch, Crypto Express2
SUSE SLES 9 31/64bit, K 2.6.5	08/03/2004	General support until 07/30/2009	4/2004 code drop: 2.6 exploitation items, incl. glibc 2.3.3, gcc 3.3, binutils 2.15.90.0.1, strace 4.5.2, gdb 6.1, ltrace not supported, CAPP/EAL4 certified
SP1: K 2.6.5	01/27/2005	Extended support until 07/30/2011	SP1: Selected items from 3/2005 code drop
SP2: K 2.6.5	07/07/2005	Self support until 07/30/2014	SP2: Bug fixes and more items from 3/2005 code drop
SP2+SecUpd: K 2.6.5	11/14/2005		SP2+SecUpd: Selected items
SP3: K 2.6.5	12/22/2005		SP3: 10/2005 code drop

SLES 8 is based on a Linux 2.4 kernel

SLES 9 is based on a Linux 2.6 kernel

# Linux Distribution Partners: Red Hat



Distribution	GA	EoService	Comments
Red Hat RHEL 3 31/64bit, K 2.4.21	10/23/2003	Full support until 04/30/2006	Selected parts of 6/2003 code drop
U1: K 2.4.21	01/15/2004	Deployment support until 10/31/2006  Maintenance support until 10/31/2010	U1: SCSI multipathing, zFCP, HW crypto
U2: K 2.4.21	04/30/2004		U2: Sev 1 fixes, CAPP/EAL3+ certified
U3: K 2.4.21	09/03/2004		U3: Support for Power5 + selected fixes
U4: K 2.4.21	12/20/2004		U4: Driver and package updates
U5: K 2.4.21	05/18/2005		U5: Bug fixes only
U6: K 2.4.21	09/28/2005		U6: Bug fixes only
U7: K 2.4.21	03/10/2006		U7: Bug fixes only
Red Hat RHEL 4 31/64bit, K 2.6.9	02/15/2005	Full support until 08/31/2007	04/2004 code drop with kernel 2.6 exploitation items
U1: K 2.6.9	06/09/2005	Deployment support until 02/29/2008	U1: Bug fixes, support for IBM CCL R1, selected parts of 11/2004 code drop, significant performance improvements versus RHEL 3
U2: K 2.6.9	10/06/2005	Maintenance support until 02/29/2012	U2: Bug fixes and selected parts of 03/2005 code drop
U3: K 2.6.9	03/07/2006		U3: Selected parts of 10/2005 code drop

RHEL 3 is based on a Linux 2.4 kernel

RHEL 4 is based on a Linux 2.6 kernel

## System z Linux security

- **Novell's SUSE LINUX Enterprise Server 8 with Service Pack 3 on IBM eServers (including zSeries) as well as Red Hat's Enterprise Linux 3 with Update 2 has achieved Controlled Access Protection Profile compliance under The Common Criteria for Information Security Evaluation (CC), commonly referred to as CAPP/EAL3+.**
- **Statement of Direction - IBM has applied for Common Criteria (ISO/IEC 15408) certification of z/VM V5.1 with the RACF for z/VM optional feature against the Labeled Security Protection Profile (LSPP) and the Controlled Access Protection Profile (CAPP), both at the EAL3+ assurance level.**
- **Linux on IBM zSeries and S/390: Best Security Practices, SG24-7023**
- **Linux on zSeries Security Whitepaper, GM13-0488-00**
- **Support for zSeries PCICA and PCIXCC adapters**
- **Exploring Open Source Security for a Linux Server Environment,**
  - <ftp://ftp.software.ibm.com/eserver/zseries/misc/literature/pdf/whitepapers/gm130636.pdf>
- **All statements regarding IBM future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.**



## Linux support options



### ➤ IGS Linux Maintenance

- ▶ Pro-active
- ▶ Linux refresh on a quarterly basis
- ▶ Available for SUSE only

### ➤ IGS Linux Support Line

- ▶ Re-active
- ▶ Problem resolution
- ▶ "How to" support
- ▶ Integration into IBM's support structures
- ▶ Available for SUSE, Red Hat, Turbolinux

### ➤ Wide variety of support options

- ▶ Prime shift support
- ▶ 24x7 support
- ▶ Voice contact or electronic contact
- ▶ Inclusion of z/VM, CP, TCP/IP, etc.

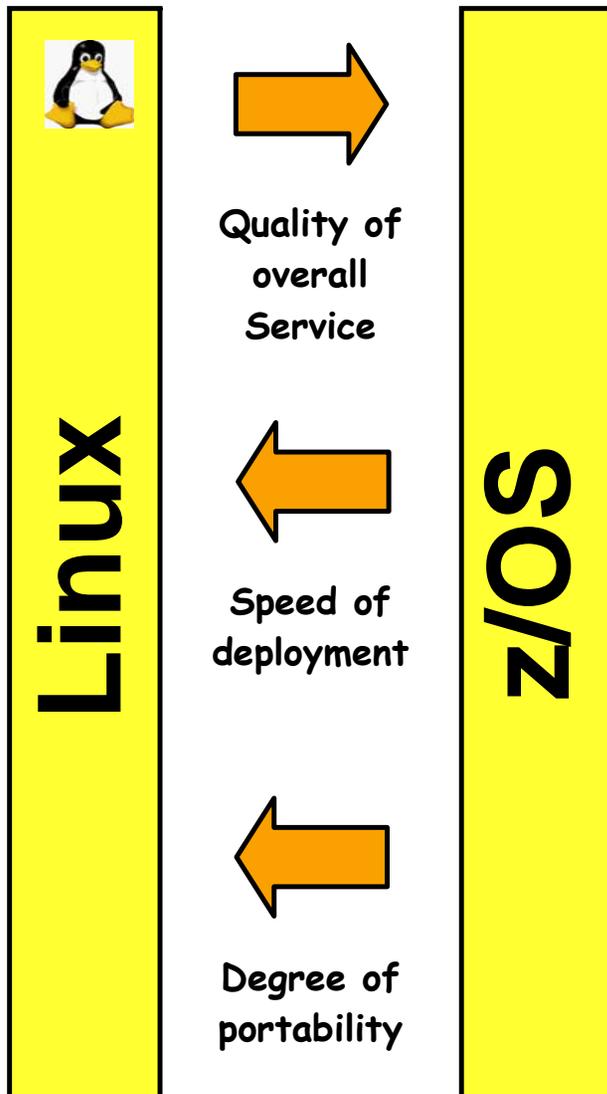
### ➤ Novell SUSE Support

- ▶ Need to distinguish between 'Professional Edition' and SLES
- ▶ With SLES 7/8/9, SUSE Upgrade Protection (= maintenance) is included in the package
- ▶ Maintenance is good for base CDs only, not for add-on packages
- ▶ Pricing for support contracts depends on # of processors and # of Linux images

### ➤ Red Hat Support

- ▶ RHEL 3 is supported for a full 5 years from product release date, to be extended to 7 years
- ▶ There are 3 phases of support:
  - Maintenance: includes security and selected bug fixes
  - Deployment: includes security and bug fixes
  - Full Support: includes security, bug fixes, and hardware updates

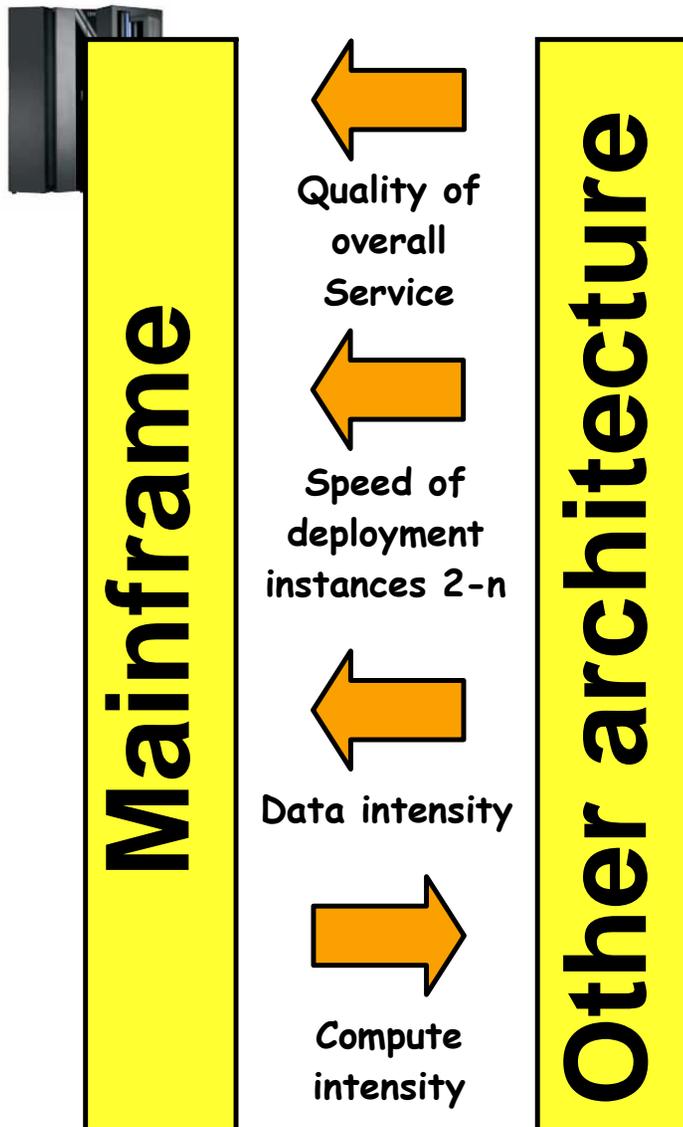
## Where to deploy - z/OS or Linux on System z?



### ➤ Other considerations

- ▶ Application availability
- ▶ Workload management function and granularity
- ▶ Data sharing across a Sysplex
- ▶ Manageability and scaling characteristics
- ▶ Availability of skills

# Hardware platform selection for Linux applications



## ➤ Other considerations

- ▶ Application availability
  - Is the solution certified on the hardware/software platform?
- ▶ Workload management
- ▶ Manageability and scaling characteristics
  - Especially DB2 on z/OS
  - Proximity of data to application
  - The best network is an internal network!

# Key points about Linux on the System z platform

(If you don't remember anything else, remember these things)

## ➤ **Linux is attractive to System z users because**

- ▶ It offers widely portable applications and skills
- ▶ There is a wide variety of applications/tools/enablers to choose from
  - IBM, ISV's and Open Source
- ▶ There are many programmers and sysadmins who know Linux
  - They graduate from college every year

## ➤ **System z servers are attractive to Linux users because**

- ▶ Legendary mainframe qualities of service
- ▶ A rich, very powerful suite of virtualization function
  - The mainframe has been in the virtualization game the last 35 years
- ▶ Very secure operating environment
- ▶ The ability to scale up or out on demand

## ➤ **System z Linux strategy**

- ▶ Is derived from customer requirements
- ▶ Participates in the Mainframe Charter - delivering on-demand capabilities on the System z platform

## ➤ **As Linux evolves, it becomes even more suitable for mission critical applications, especially when deployed on System z servers**

## ➤ **Virtualization is a key differentiator for Linux on System z**

- ▶ System z virtualization is UNIQUELY multi-dimensional

# Get started!

## ➤ Pick a problem to solve

- ▶ Avoid “sandbox” or “playpen” projects
- ▶ You don't need to start big or expensive
  - Infrastructure application like file/print, DNS, DHCP - or a networking "utility" based on CS Linux and/or CCL
  - Mail or collaboration consolidation
  - Open Source application
  - ISV application
  - Existing Linux/Unix application (hint – Unix applications that are closest to the Posix standard are easiest to implement in Linux)

**Important Web site: [www.linuxvm.org](http://www.linuxvm.org)**

## ➤ Pick a Linux distribution

- ▶ They're not all the same so it's important that you understand the differences
- ▶ Read the requirements of the specific solution you're planning to deploy

## ➤ Evaluate middleware and tooling requirements

- ▶ There is a wide selection from IBM and other vendors

## ➤ Evaluate hardware requirements

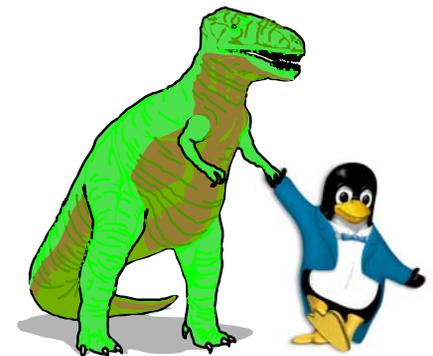
- ▶ Ask your IBM rep – offers and promotions occur throughout the year

## ➤ Evaluate skills

- ▶ IBM offers a selection of courses on System z, z/VM, and Linux

## ➤ Get to work

- ▶ And it's OK to have some fun while you're doing it!



## For more information....



URL	Content
<a href="http://www.ibm.com/servers/eserver/zseries">http://www.ibm.com/servers/eserver/zseries</a>	IBM eServer zSeries Mainframe Servers
<a href="http://www.ibm.com/servers/eserver/zseries/networking">http://www.ibm.com/servers/eserver/zseries/networking</a>	Networking: IBM zSeries Servers
<a href="http://www.ibm.com/servers/eserver/zseries/networking/technology.html">http://www.ibm.com/servers/eserver/zseries/networking/technology.html</a>	IBM Enterprise Servers: Networking Technologies
<a href="http://www.ibm.com/software/network/commserver">http://www.ibm.com/software/network/commserver</a>	Communications Server product overview
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<a href="http://www.ibm.com/software/network/ccl">http://www.ibm.com/software/network/ccl</a>	Communication Controller for Linux on zSeries
<a href="http://www.ibm.com/software/network/commserver/library">http://www.ibm.com/software/network/commserver/library</a>	Communications Server products - white papers, product documentation, etc.
<a href="http://www.redbooks.ibm.com">http://www.redbooks.ibm.com</a>	ITSO Redbooks
<a href="http://www.ibm.com/software/network/commserver/support">http://www.ibm.com/software/network/commserver/support</a>	Communications Server technical Support
<a href="http://www.ibm.com/support/techdocs/">http://www.ibm.com/support/techdocs/</a>	Technical support documentation (techdocs, flashes, presentations, white papers, etc.)
<a href="http://www.rfc-editor.org/rfcsearch.html">http://www.rfc-editor.org/rfcsearch.html</a>	Request For Comments (RFC)