



IBM Software Group
Enterprise Networking and Transformation Solutions (ENTS)

Linux on System z A Short Introduction

Alfred B Christensen, Raleigh,
North Carolina, USA
alfredch@us.ibm.com

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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)

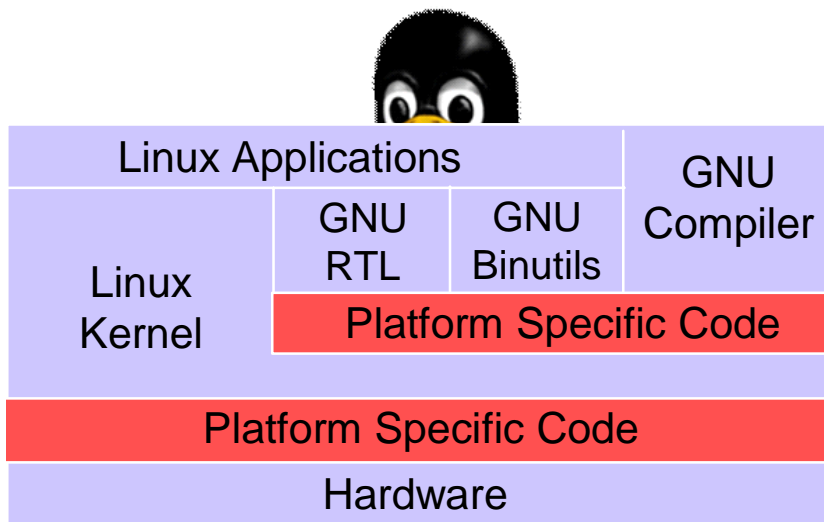
What is Linux?

➤ 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



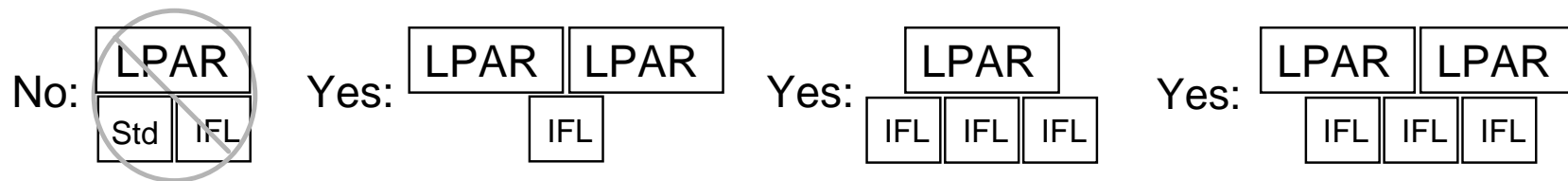
- Reliable, stable, secure
- Large selection of applications middleware and tooling from IBM, ISV's and Open Source
- Available from multiple distributors
- Evolves rapidly to meet business challenges
- Plentiful availability of skilled administrators and developers

- 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-OLF, z990, z890, and System z servers
- ▶ Some servers don't have spare processors available for IFLs

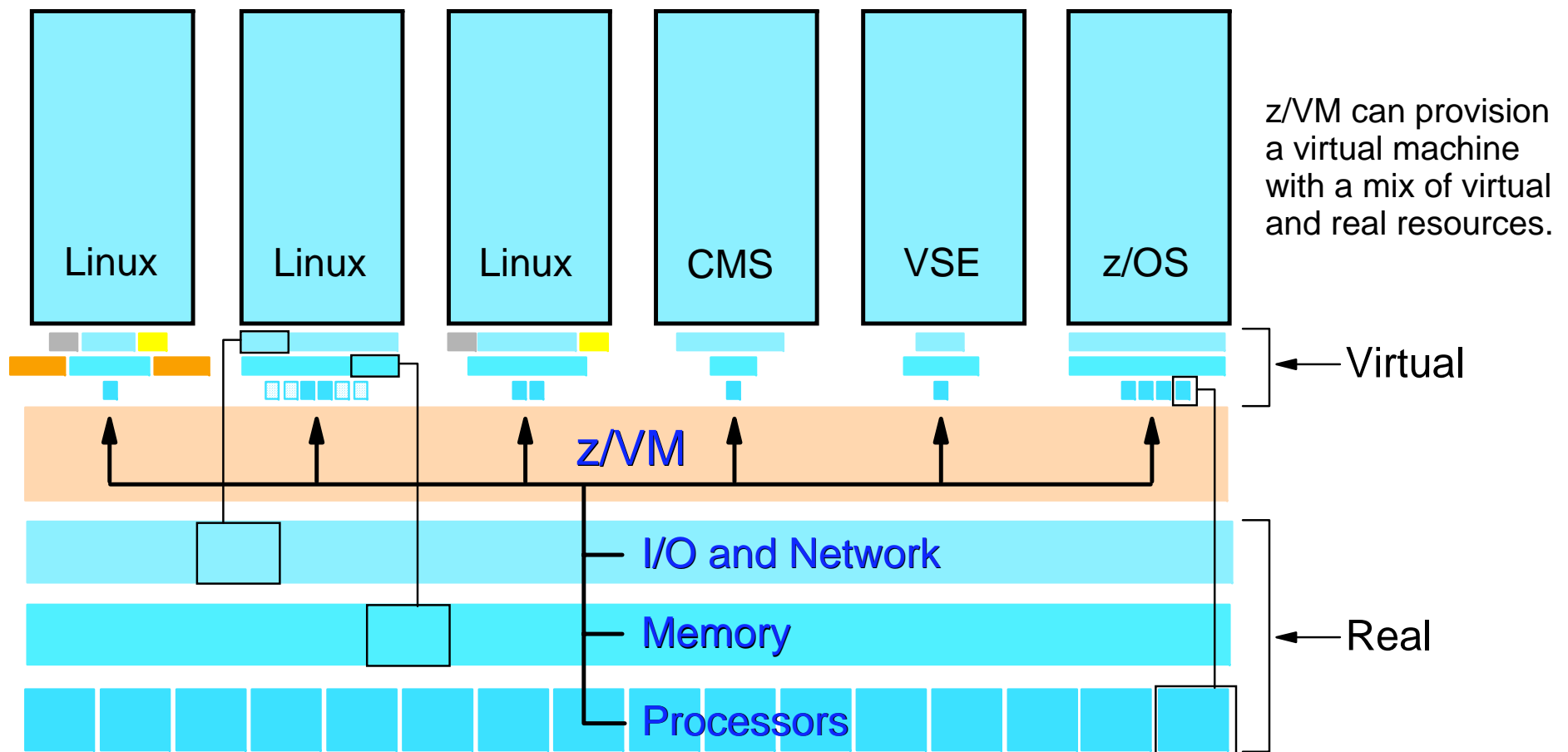
➤ Adding IFLs does not change a server's model designation

- ▶ 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

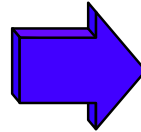
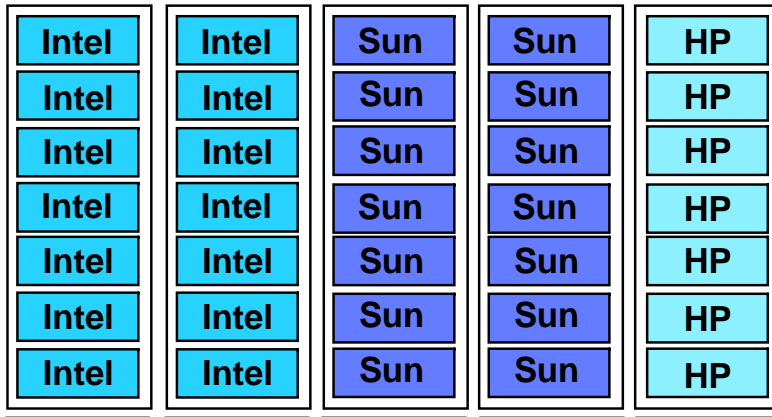
z/VM and Linux on System z

- **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.

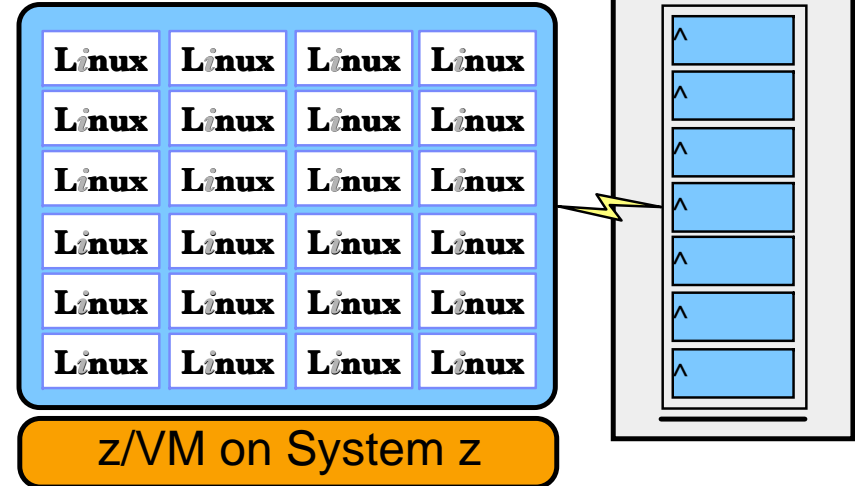


Server Infrastructure Simplification with Linux on z/VM

Traditional Server Farm



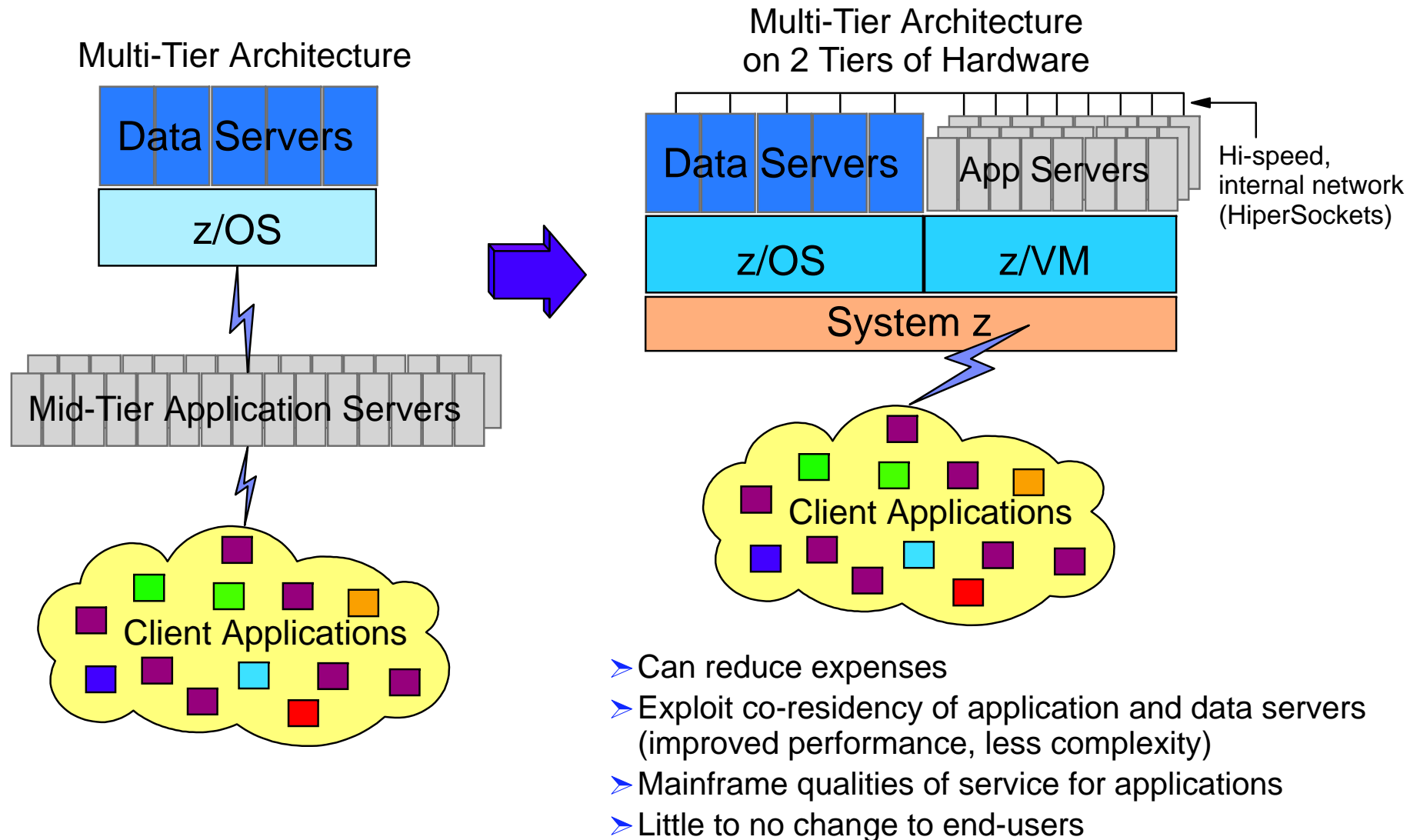
Server Farm in a Box



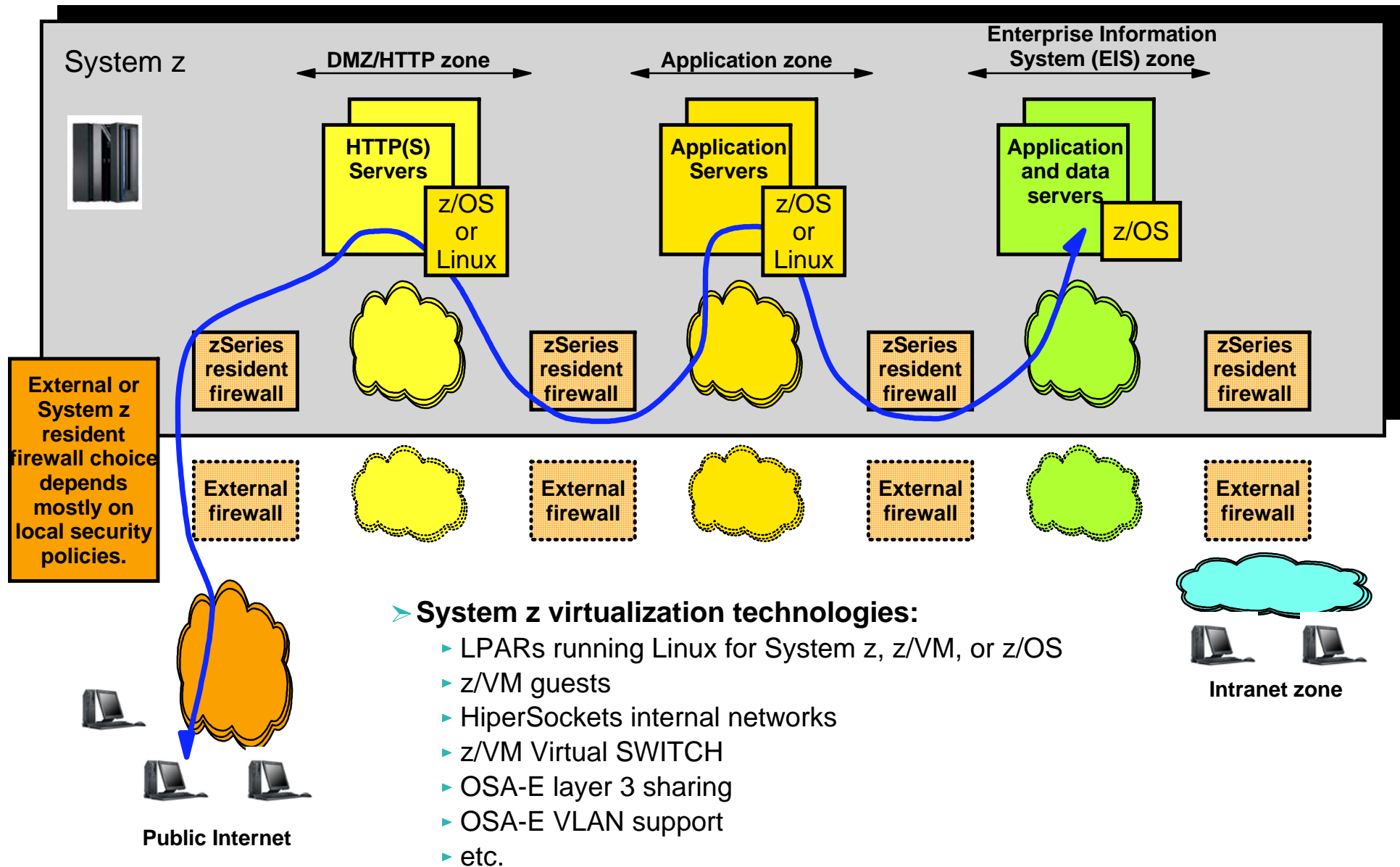
- Discrete servers consume incremental expense
 - ▶ Hardware price and maintenance
 - ▶ Floor space, power, cooling
 - ▶ Additional support staff
 - ▶ Per server (engine) software fees
- Connectivity requires kilometers of cables
 - ▶ Network adapters
 - ▶ Switch ports
- High availability ensured by 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

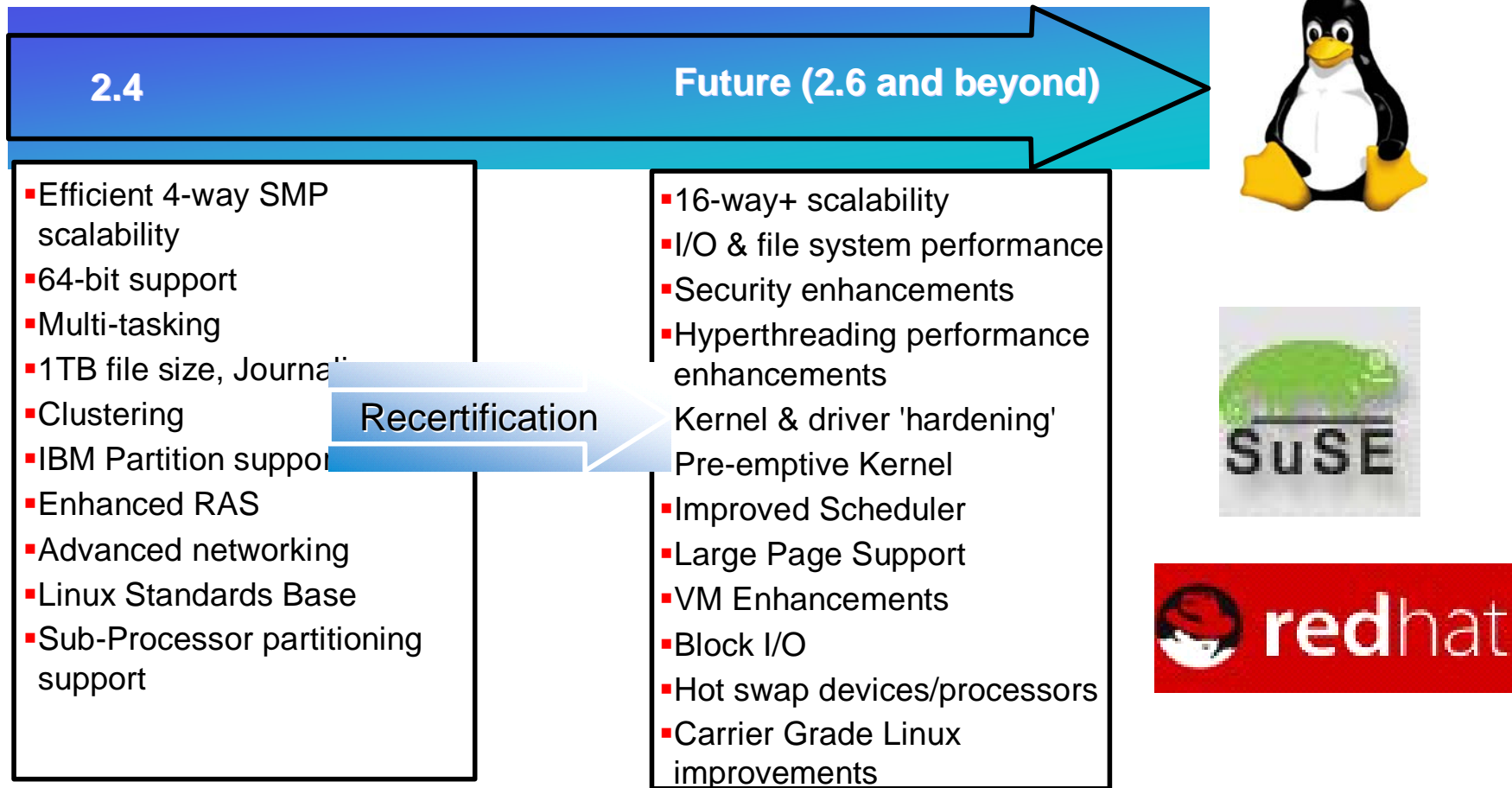
Server Infrastructure Simplification – Application Integration



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 1

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.

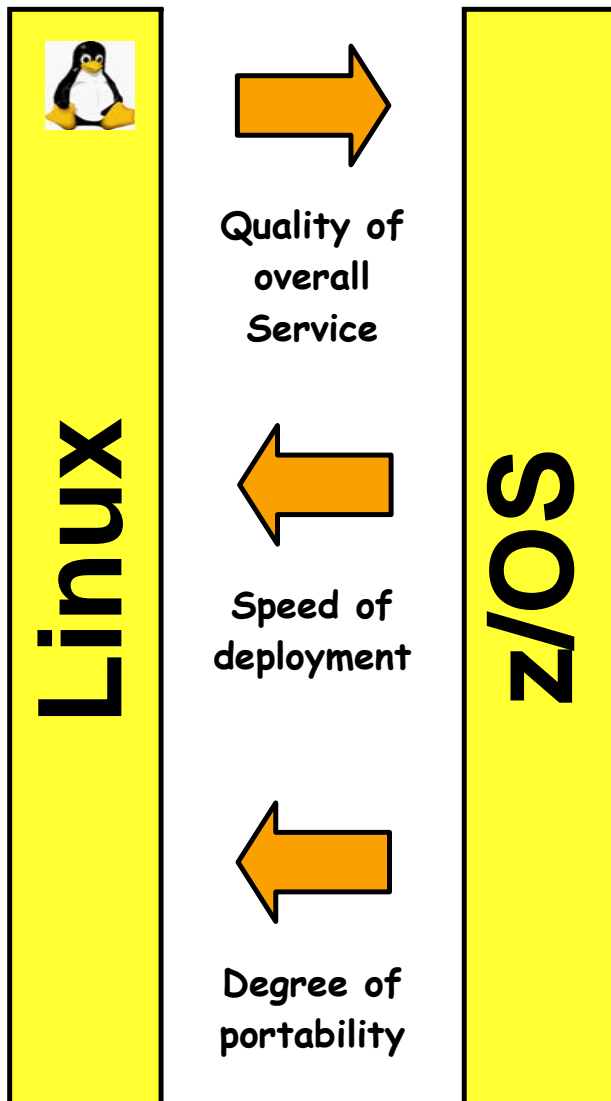
➤ Novell SUSE Support

- ▶ 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

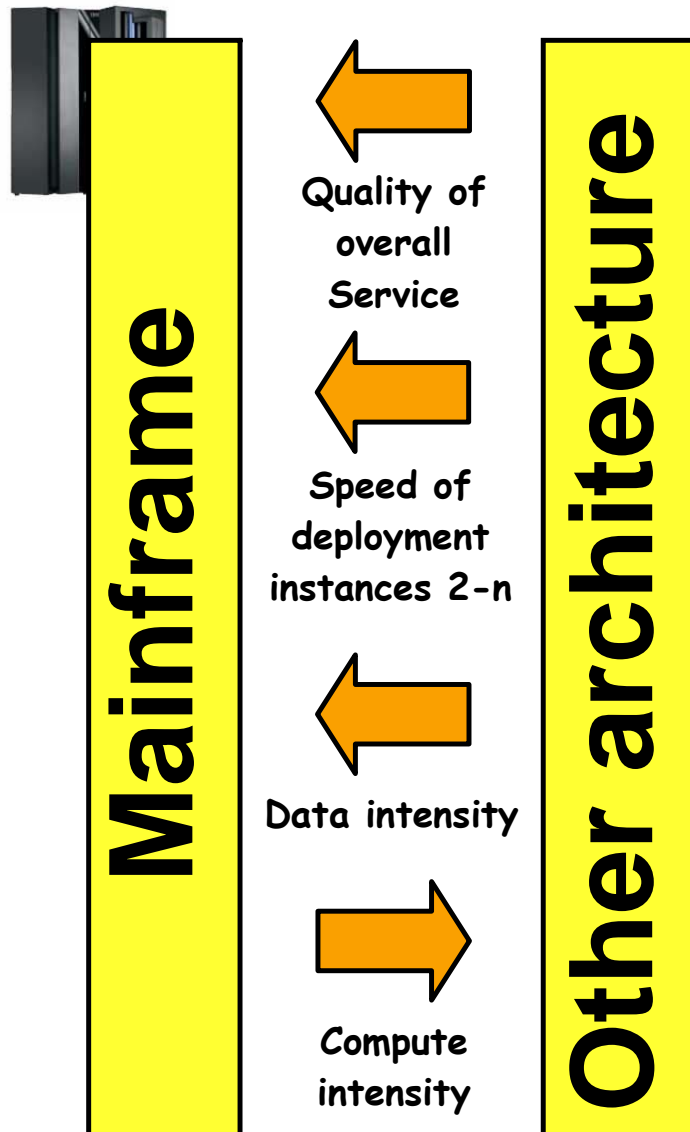
Where to deploy - z/OS or Linux on System z?



➤ 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

➤ 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

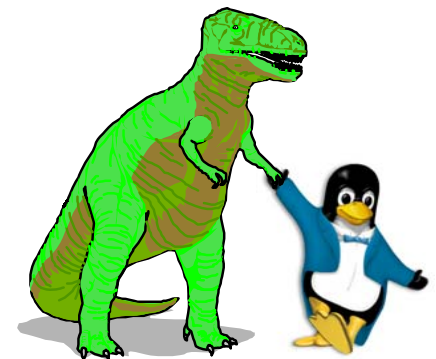
- ▶ Ask your IBM rep – offers and promotions occur throughout the year

➤ 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....



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http://www.ibm.com/servers/eserver/zseries	IBM eServer zSeries Mainframe Servers
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http://www.ibm.com/software/network/commserver	Communications Server product overview
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http://www.ibm.com/support/techdocs/	Technical support documentation (techdocs, flashes, presentations, white papers, etc.)
http://www.rfc-editor.org/rfcsearch.html	Request For Comments (RFC)