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ON DEMAND BUSINESS™

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z/VM Product Update

Session ZT36

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Learning Objectives

- **At the conclusion of this material, you should be able to:**
  - Explain the improved pricing model for z/VM Version 5
  - Explain how z/VM V5.1 can help add more business value for customers looking to exploit zSeries virtualization technology
  - Accurately incorporate z/VM V5.1 functional content into your zSeries product proposals

Agenda

- **z/VM, the Mainframe Charter, and on demand Computing**
- **Recent VM Release History**
- **z/VM Version 5 Product Introduction**
- **z/VM V5.1 Content Overview**
- **Futures Discussion**

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z/VM, the Mainframe Charter, and on demand Computing

The Mainframe Charter - Providing a Strategic Framework

IBM is committed to delivering innovative solutions to meet our customers' on demand business requirements

It is our intention to continue to:

Innovation

- **Provide leadership in innovation to enhance the use of IBM eServer zSeries to support increasingly integrated and flexible business processes for the on demand business.**
- **Maintain zSeries' position as a benchmark for flexible, efficient, and responsive platforms for highly complex, integrated environments running a wide range of mission-critical workloads.**
- **Improve the autonomic and self-managing capabilities of the zSeries while working to simplify user processes and system administration tasks.**

Value

- **Enhance the value proposition and lower the cost of computing of zSeries solutions in a way that is compelling, clear, and consistent.**
- **Extend the on demand characteristics of zSeries servers, highlighting its strengths as an environment for usage-based computing.**
- **Increase the ability to account for allocation and use of zSeries resources in an on-demand environment.**

Community

- **Support programs designed to foster vitality in the zSeries community, helping to promote a strong application portfolio and world-class support services.**
- **Provide the skills and expertise to assist customers in designing, developing, and deploying on demand solutions built on a foundation whose cornerstone is zSeries.**
- **Leverage key open standards and common structures to enhance the use of zSeries in large, heterogeneous environments.**

These principles help guide IBM's investment priorities in zSeries systems today and far into the future and demonstrate IBM's commitment to provide value to its zSeries customers.

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

Mainframe Charter: Delivering New On Demand Capabilities

z/VM is a Key Component of the Mainframe Charter

Innovation

Proof Points

Provide leadership in innovation to enhance the use of IBM eServer zSeries to support increasingly integrated and flexible business processes for the on demand business.

- Integrated Facility for Linux (IFL)
- HiperSockets connectivity
- GDPS/PPRC multiplatform resiliency
- Linux Communications Server
- Enhanced z890 and z990 scalability

Improve the autonomic and self-managing capabilities of the zSeries while working to simplify user processes and system administration tasks.

- Virtual Machine Resource Manager
- IBM Director Multiplatform (future)
- New z/VM publication: "Getting Started with Linux on zSeries"

Value

Proof Points

Enhance the value proposition and lower the cost of computing of zSeries solutions in a way that is compelling, clear, and consistent.

- New z/VM V5 pricing model
- On/Off Capacity on Demand
- Share a single Crypto card among 256 Linux guest systems
- z890: lower entry point, improved granularity for zSeries (64-bit) solutions
- Enhanced server scalability with Linux exploitation of z/VM DCSS technology via execute-in-place file system

Increase the ability to account for allocation and use of zSeries resources in an on-demand environment.

- z/VM Monitor support (including support for On/Off Capacity on Demand)
- Performance Toolkit for VM: virtual server performance reporting and capacity planning

Community

Proof Points

Support programs designed to foster vitality in the zSeries community, helping to promote a strong application portfolio and world-class support services.

- z/VM-based Linux Community Development System (LCDS)
- z/VM training (IBM Learning Services, workshops, conferences)
- Support for University programs
- Active partnership with ISV community

Leverage key open standards and common structures to enhance the use of zSeries in large, heterogeneous environments.

- z/VM support for FCP/SCSI disks
- Virtual Server Management APIs
- z/VM support for virtual network switching (Layer 3 and Layer 2)

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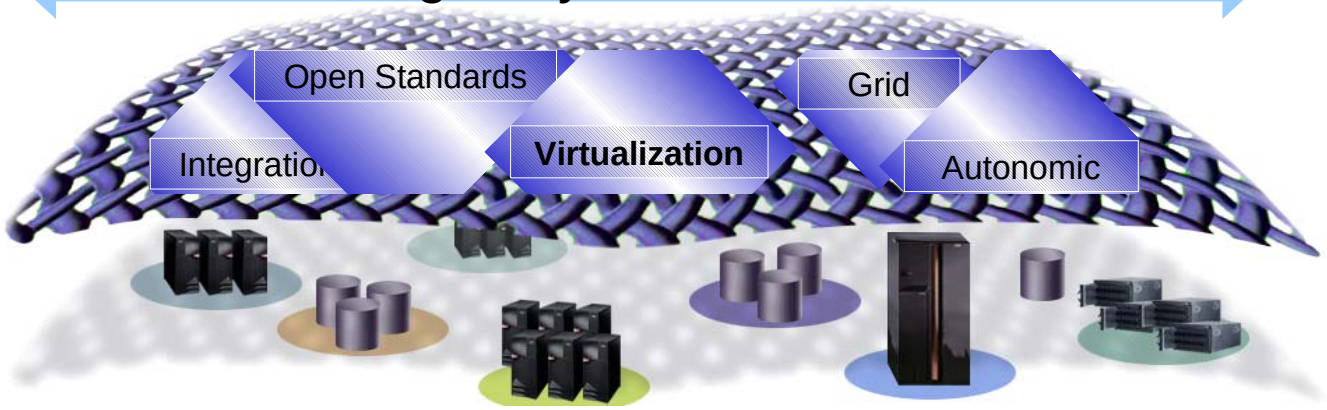
The On Demand Operating Environment

Think of it as a Global Fabric

Where everything enterprise wide becomes:

- Reusable, connected, and integrated…
- Resilient and highly secure…
- Scaleable and responsive..
- Simplified and optimized…
- Virtualized and cheaper to run…
- Unified and flexible to support the business model

All Managed by Business Priorities



Enhance Your Global Fabric

By Leveraging Your Most Capable Asset: Your Mainframe

As our customers understand the IT requirements for on demand business, they cite a strong synergy to zSeries capabilities

IBM's vision is to leverage zSeries leadership capabilities around:

- ★*Resource Virtualization*
- ★*Business Resiliency and Security*
- ★*Intelligent Workload Management*
- ★*Business Integration*

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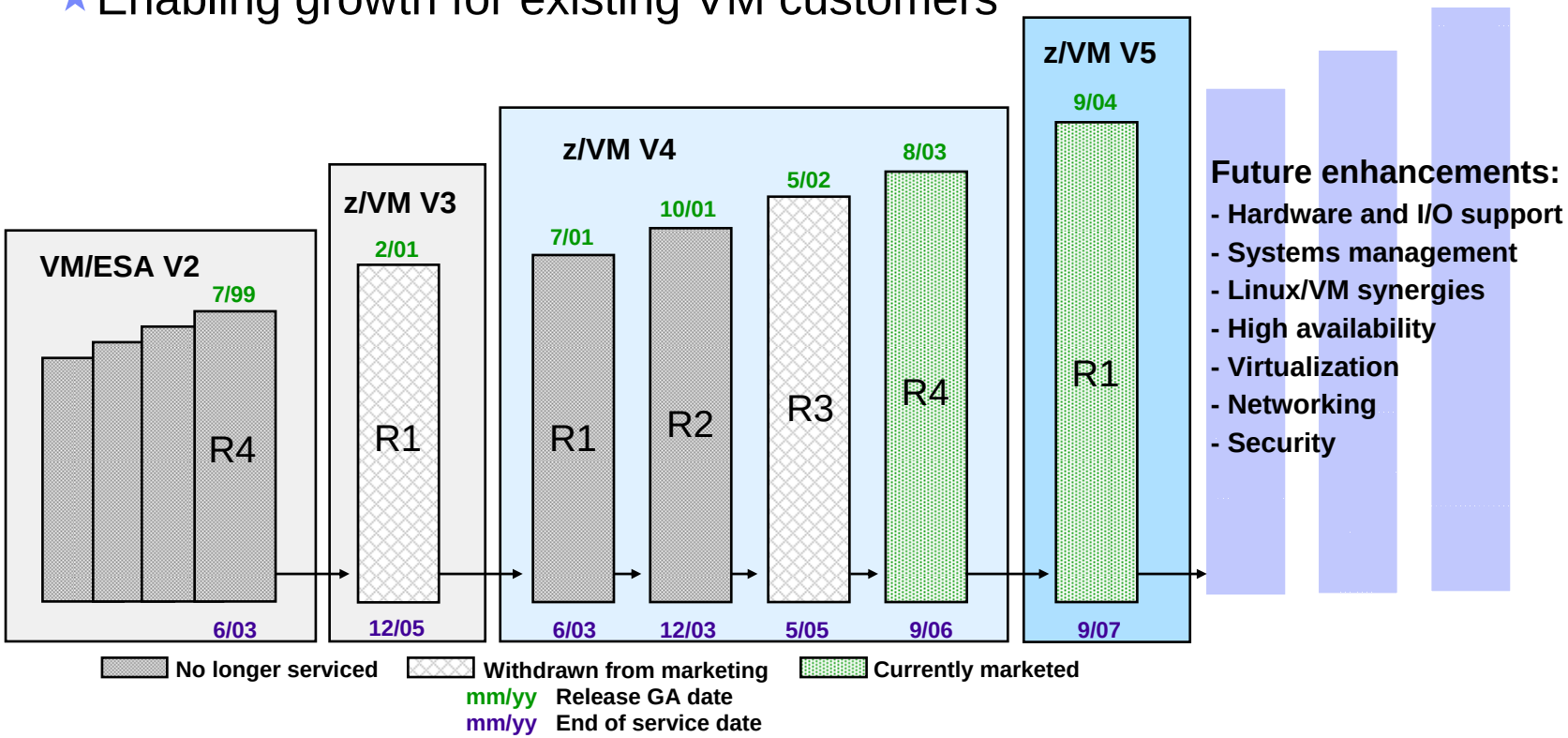
Recent VM Release History

VM Release Review

z/VM Version 5: High-Value Virtualization Technology

- ★Generating new business with Linux on zSeries
- ★Enabling growth for existing VM customers



z/VM Version 4 Release Highlights

- **z/VM V4.1**
  - New pricing Ts&Cs
  - Support for IFL engines
  - Linux performance support
  - Express Install (for new users)
- **z/VM V4.2**
  - Guest LAN support
  - HiperSockets support
  - PCICC / PCICA Crypto support
  - Linux performance support
  - Guest support for CF Duplexing
- **z/VM V4.3**
  - Guest FCP support
  - Virtual Machine Resource Manager
  - Guest LAN enhancements
- **z/VM V4.3 (continued)**
  - IP Wizard and “ifconfig” for z/VM
  - Virtual network accounting
  - Automated shutdown signal
  - RACF feature
- **z/VM V4.4**
  - z990 exploitation support
  - Integrated 3270 console support
  - Guest support for SCSI IPL
  - QDIO adapter interrupt passthru
  - Guest LAN IPv6 support
  - Virtual IP switch
  - IEEE VLAN support
  - System management APIs
  - Performance Toolkit feature
  - HCD and HCM support

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z/VM Version 5 Product Introduction

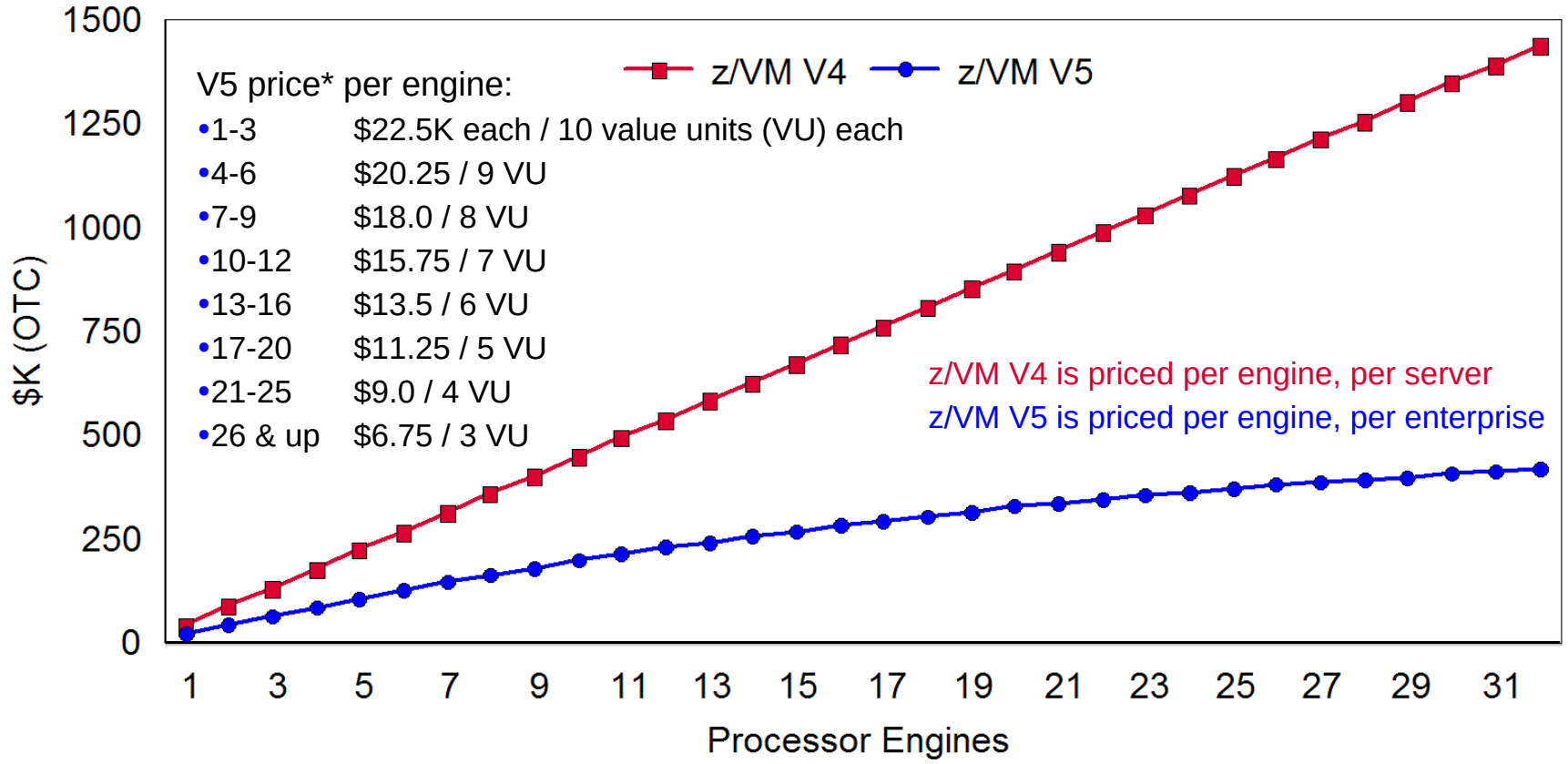
z/VM Version 5 Product Information

- **Runs on IBM @server zSeries processors (z800, z900, z890, z990) and other equivalent servers**
  - z/VM V5.1 Control Program requires 64-bit addressing (z/Architecture)
  - 64-bit and 31-bit (ESA/390) virtual machines are supported
- **Runs on Integrated Facility for Linux (IFL) processor engines as well as standard processor engines**
- **IPLA software product (5741-A05) with *new* pricing Ts&Cs**
  - One-time charge license fee, priced on a per-engine basis
  - Price/engine decreases (on a tiered basis) as more engines are licensed
  - Engines can be aggregated across an enterprise for licensing purposes
  - Ordered via the System Delivery Option (SDO) (5741-A06)
- **Optional Software Subscription & Support (S&S) product (5741-SNS)**
  - Required to receive IBM support center services
  - Entitles customers to future z/VM releases and versions
  - Annual, renewable license charge
- **Includes priced features**
  - DirMaint, RACF/VM, Performance Toolkit for VM
  - Pre-installed, but disabled (license required; same pricing model as base)

z/VM Version 5 Pricing – More Details

- **z/VM V5.1 uses a Value Unit pricing model**
  - z/VM V5 value units correspond to processor engines, not MIPS or MSUs
  - A single z/VM V5 value unit is priced at $2,250 (U.S. pricing as of 01/01/05)
  - Engines 1, 2, and 3 are priced at 10 value units each
  - Engines 4, 5, and 6 are priced at 9 value units each
  - Pricing continues on a tiered basis (see next chart)
- **z/VM Version 4 customers who have purchased Software Subscription and Support (S&S) are entitled to receive z/VM Version 5 at no charge**
  - No charge to run z/VM V5 on same number of V4-licensed engines
  - Subsequent S&S annual payments will be based on z/VM V5 pricing
  - Keep in mind z/VM Version 5 requires z/Architecture to operate
  - If the customer adds capacity (engines) after the migration, pricing for the added capacity will be based on the z/VM Version 5 pricing model
- **If z/VM V5 is licensed to run on an IFL engine, all IFLs must be counted to determine the z/VM V5 licensing fee**
- **If z/VM V5 is licensed to run on a standard engine, all standard engines must be counted to determine z/VM V5 licensing fee**

z/VM Version 5 Pricing



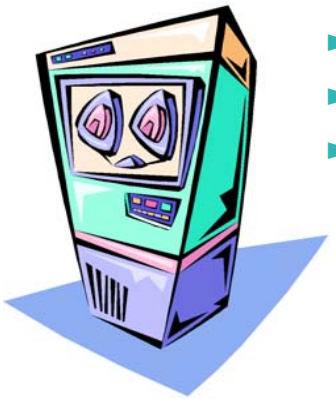
*U.S. prices as of January 1, 2005

z/VM Version 5 Product Packaging Changes

- **DFSMS/VM is no longer *automatically* shipped with the base product**
  - It is now a no-charge feature and must be ordered via the SDO
- **3270 PC File Transfer product (5664-281) is *included* with base product**
  - Delivered with z/VM V5 as a sample program (with no support)
- **Restricted source feature and PL/X source *no longer ship* with z/VM V5**
  - Restricted source is a no-charge feature of z/VM V4
  - PL/X source is provided with the z/VM V4 installation media
  - Both will be available as no-charge downloads from IBM Resource Link for z/VM V5 customers (who register with Resource Link)
- **Tivoli Storage Manager for VM is *no longer pre-installed* with z/VM V5**
  - Must be ordered as a standalone product (not orderable via the SDO)
  - TSM for VM is packaged with the z/VM V4 system DDRs
  - Consider TSM for Linux on zSeries for future TSM server support
- **National Language features for ISPF have been *removed* from the SDO**
  - Features can be ordered using the standalone ordering process

Functions Removed from z/VM Version 5

- **RTM and PRF features (replaced by Performance Toolkit for VM)**
- **SPTAPE (use SPXTAPE to backup Spool files)**
- **V=R and V=F virtual machine support**
- **CMS support for Java and NetRexx programs**
  - Consider using Linux for zSeries to host Java and NetRexx programs
  - More info at: **ibm.com**/zseries/zvm/java
- **Device support**
  - DASD/Controllers: 3370, 3375, 3380(1), Multiprise Internal Disk, 9332, 9335, 9336(2), 9340, 3830, 3880
  - Optical: 3995 Optical Dataserver
  - Tape/Controllers: 2440, 3420, 3422(3), 3424, 3430, 9348, 3803
  - Communications: all SDLC, BSC, and CETI ICAs
  - Refer to *z/VM: General Information* publication for a complete listing of devices supported by z/VM V5.1



Notes:
(1) RAMAC-emulated 3380 models J and K and 3390 DASD configured for 3380-track-compatibility are supported
(2) 9336 is a supported device geometry for Virtual Disks in Storage and emulated SCSI LUNs
(3) OMA/2 CD-ROM emulating a 3422 is supported

z/VM Version 5 Installation Support

- **z/VM V5.1 can be installed on:**
  - 3390-formatted DASD volumes
  - Enterprise Storage Server SCSI disks
- **Installation media options:**
  - DVD
    - Requires appropriate levels of the Hardware Management Console (HMC) and Support Element (SE)
    - Required for installation on SCSI disks (also supports 3390 volumes)
  - CD-ROM
    - Requires Optical Media Attach (OMA) software
  - 3590 and 3480 tape
- **System Residence (SYSRES) volume changes**
  - Spool and paging space removed from SYSRES
  - Located on separate installation volumes
- **Two installation methods available with z/VM V5**
  - Streamlined process ("Express Install") for new users
  - Traditional process for experienced systems programmers

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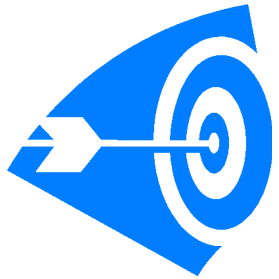
z/VM V5.1 Content Overview

z/VM Version 5 Release 1 Highlights

Announced 4/07/2004; Available since 9/24/2004

- **Processor and device support**
  - IBM eServer zSeries Model 990 enhancements
  - IBM eServer zSeries Model 890
  - PCIX Crypto support
  - Support for more than 16 CPUs
  - OSA-Express Integrated Console Controller support
  - CP/CMS use of FCP-attached SCSI disks
  - ESS Model 750 support
  - TotalStorage 3592 Tape support
- **Networking**
  - Enhanced Virtual IP Switch support
  - RACF authorization support for Guest LANs and Virtual Switches
  - VM TCP/IP support for IPv6
- **Server hosting support**
  - Dynamic virtual machine timeout
  - HyperSwap
- **Systems management**
  - Capacity on Demand enhancements
  - Additional Systems Management APIs
  - Performance Toolkit for VM enhancements
  - Service support enhancements
- **Ease-of-use**
  - New publication: *Getting Started with Linux on zSeries*



z/VM Version 5 Release 1 Post-GA Enhancements

Announced 10/07/2004; Available 4Q2004 and 1/28/2005

- **Processor and device support**
  - FCP LUN access control for SCSI devices used by z/VM and Linux guests
    - z/VM V4.4 and V5.1 support available coincident with hardware GA (date TBD)
    - IBM is interested in obtaining customers to participate in an Early Support Program
  - Crypto Express2 support for Linux and z/OS guests
    - z/VM V5.1 support available coincident with hardware GA (planned for 1/28/05)
  - New level of Coupling Facility Control Code (CFCC) (z/VM V3.1, V4.3, V4.4, V5.1)
- **Networking**
  - Support for new OSA-Express2 feature (z890 and z990)
    - 10 GbE Ethernet and enhanced connectivity
    - Support available for all supported z/VM releases (V3.1, V4.3, V4.4, V5.1) when hardware becomes generally available (planned for 1/28/05)
    - Refer to 2084/2086 PSP buckets for any required z/VM service
  - z/VM Virtual Switch exploitation of Layer 2 support
    - Support available with OSA-Express and OSA-Express2 on z890 and z990 servers
  - Enhanced OSA-Express connectivity support (z890 and z990 servers)
- **Systems Management**
  - Performance Toolkit for VM provides support for Monitor records created by the SUSE Linux 2.6 kernel
    - Available via PTF for APAR VM63580 on 12/03/04

IBM @server z990 Model 990

- **Four models (A08, B16, C24, D32); improved performance over the z900**
- **Up to 32 processors and 256 GB of central processor storage**
- **LPAR-mode-only server (no Basic mode); up to 30 LPARs**
- **Up to 4 Logical Channel Subsystems (LCSS)**
  - Each can be configured with up to 256 channel paths (1024 per CEC)
  - Up to 15 LPARs per LCSS, one LCSS per LPAR
- **Internal and external channels can span multiple LCSS**
  - Enables sharing channels among LPARs with different LCSS
  - Supported: Coupling Links (internal/external), HiperSockets, FICON, OSA
- **Support for cascaded FICON directors and IEEE VLAN (802.1q)**
- **Up to 120 FICON Express channels, up to 512 ESCON channels**
  - No parallel channels
- **Up to 16 HiperSockets for high-speed interconnect**
- **Up to 48 OSA-Express ports**
- **OSA-Integrated Console Controller (OSA-ICC)**
- **PCIX Cryptographic Coprocessor (PCIXCC)**
- ***Crypto Express2 and OSA-Express2 (January 28, 2005)***

IBM @server z890 Model 890

- **One model, 28 capacity settings; improved performance over the z800**
- **Up to 4 processors and 32 GB of central processor storage**
- **LPAR-mode-only server (no Basic mode); up to 30 LPARs**
- **Up to 2 Logical Channel Subsystems (LCSS)**
  - Each can be configured with up to 256 channel paths (512 per CEC)
  - Up to 15 LPARs per LCSS, one LCSS per LPAR
- **Internal and external channels can span multiple LCSS**
  - Enables sharing channels among LPARs with different LCSS
  - Supported: Coupling Links (internal/external), HiperSockets, FICON, OSA
- **Support for cascaded FICON directors and IEEE VLAN (802.1q)**
- **Up to 40 FICON Express channels, up to 420 ESCON channels**
  - No parallel channels
- **Up to 16 HiperSockets for high-speed interconnect**
- **Up to 40 OSA-Express ports**
- **OSA-Integrated Console Controller (OSA-ICC)**
- **PCIX Cryptographic Coprocessor (PCIXCC)**
- ***Crypto Express2 and OSA-Express2 (January 28, 2005)***

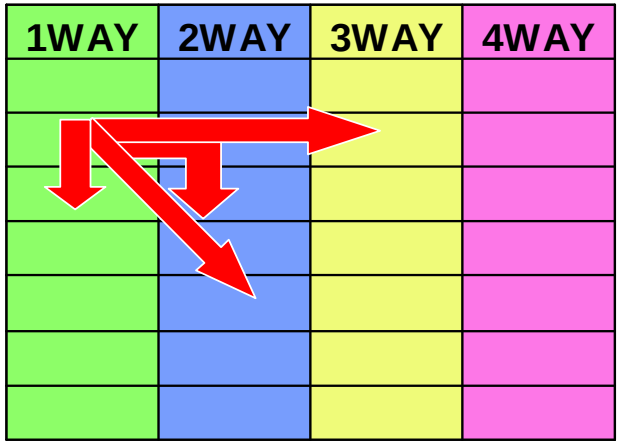
z890 Capacity Setting Feature Codes

1-WAY	2-WAY	3-WAY	4-WAY
110	210	310	410
120	220	320	420
130	230	330	430
140	240	340	440
150	250	350	450
160	260	360	460
170 – Full 1-way	270 – Full 2-way	370 – Full 3-way	470 – Full 4-way

Single Machine (2086), Single Model (A04)

z890 Capacity Setting Feature Codes

- **A dramatic new way to upgrade capacity**
- **One MCM per model with 5 Processor Units (PUs)**
  - Four PUs available for characterization
    - CPs, Integrated Facility for Linux (IFLs), Internal Coupling Facility (ICFs), or zSeries Application Assist Processor (zAAPs)
  - One PU standard as an SAP
- **Standard CPs**
  - Four full-capacity processors each with seven capacity settings
  - Upgrades can be horizontal, vertical, or diagonal to best fit your needs*
  - All upgrades are designed to be concurrent to hardware (no POR)
  - Horizontal upgrades designed to be concurrent to Operating System (no re-IPL)
  - Vertical and diagonal upgrades change CP speed
    - Formerly required re-IPL of OS
    - Designed to be concurrent with z/OS V1.4 or higher with PTF for APAR OA07510
    - Designed to be concurrent with z/VM V5.1 for Linux and z/OS (V1.4 or higher) guests



* Note: No mixing of standard CP capacity sizes in multi-engine machines; zAAPs cannot outnumber standard CPs in any machine.

z/VM Support for the z990 and z890

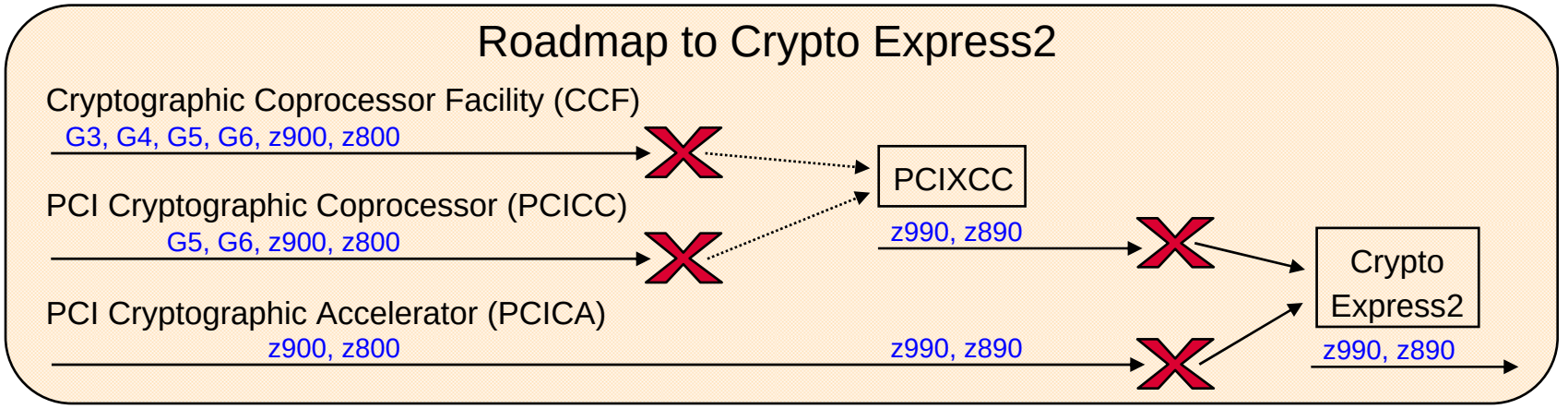
- **Multiple Logical Channel Subsystems (LCSS) support**
  - z/VM V5.1 and V4.4 support up to four (4) LCSS
  - Support available using HCD/HCM or CP dynamic I/O config commands
  - z/VM V3.1 and V4.3 provide limited support for 4 LCSS (dynamic I/O operations only supported within LCSS 0)
- **Spanned channel support**
  - z/VM V5.1, V4.4, V4.3, and V3.1 support internal (HiperSockets) and external (FICON and OSA) spanned channels
- **Extended Channel Measurement Data Support**
  - Support introduced in z/VM V4.4, included in z/VM V5.1
  - Enhances capacity planning and I/O performance measurement
- **Support for more than 15 LPARs**
  - Full support in z/VM V5.1 and V4.4
    - I/O configuration and dynamic reconfiguration support for up to 30 LPARs
    - CP Monitor provides performance data for servers with up to 30 LPARs
  - z/VM V4.3 and V3.1 can only run in first 15 LPARs
- **Compatibility support PTFs are available for z/VM V4.3 and V3.1**

PCIX Cryptographic Coprocessor (PCIXCC) Support

- **PCIXCC is only available on the z890 and z990**
- **PCICC (older technology) is not available on the z890 and z990**
- **PCIXCC offers improved performance for secure cryptographic functions (compared to PCICC operations)**
- **z/VM V5.1 support for PCIXCC, PCICC and PCICA features:**
  - z/OS guest support: dedicated-queue support for clear-key and *secure-key* functions
  - Linux guest support: dedicated-queue and *shared-queue* support for clear-key functions
- **Prior releases of z/VM offer no PCI crypto support for z/OS guests**

Crypto Express2 Support

- **A new cryptographic feature for z890 and z990 servers that replaces the PCIX Cryptographic Coprocessor (PCIXCC not available after 1/28/05)**
- **Combines the functions of both PCICA and PCIXCC in one feature, providing improved secure-key operations**
  - Dual integrated cryptographic coprocessors
  - Improved throughput compared to PCIXCC operations
- **z/VM V5.1 support for Crypto Express2 is planned for January 28, 2005**
  - Matches support for PCIXCC
  - Refer to 2084/2086 PSP buckets for any required z/VM service



Support for More than 16 CPUs

- **z/VM V5.1 can support up to 24 real processor engines in a single z/VM system image**
- **System workload will affect the efficiency of using a large number of processor engines**
  - z/VM overhead is expected to be lower with a configuration of fewer, more CPU-intensive guest images
  - Excessive overcommitment of storage could contribute to increased z/VM overhead
- **Future direction: support for more than 24 CPUs per z/VM image**

OSA-Express Integrated Console Controller Support

- **New Open Systems Adapter (OSA)-Express Integrated Console Controller supports TN3270E and non-SNA DFT 3270 emulation**
  - New Channel Path Identifier (CHPID): OSC
- **Enables 3270 emulation for console connections to operating systems running on z890 and z990 servers without requiring additional hardware (e.g., 3174, 2074)**
- **Can be used for console connections to LPARs and virtual machines**
- **Helps minimize costs associated with console controllers**
- **Likely a more attractive console option than the HMC-based Integrated 3270 Console support introduced in z/VM V4.4**
- **z/VM V4.4 will provide this support as well**
  - Available via PTF (APAR VM63405)

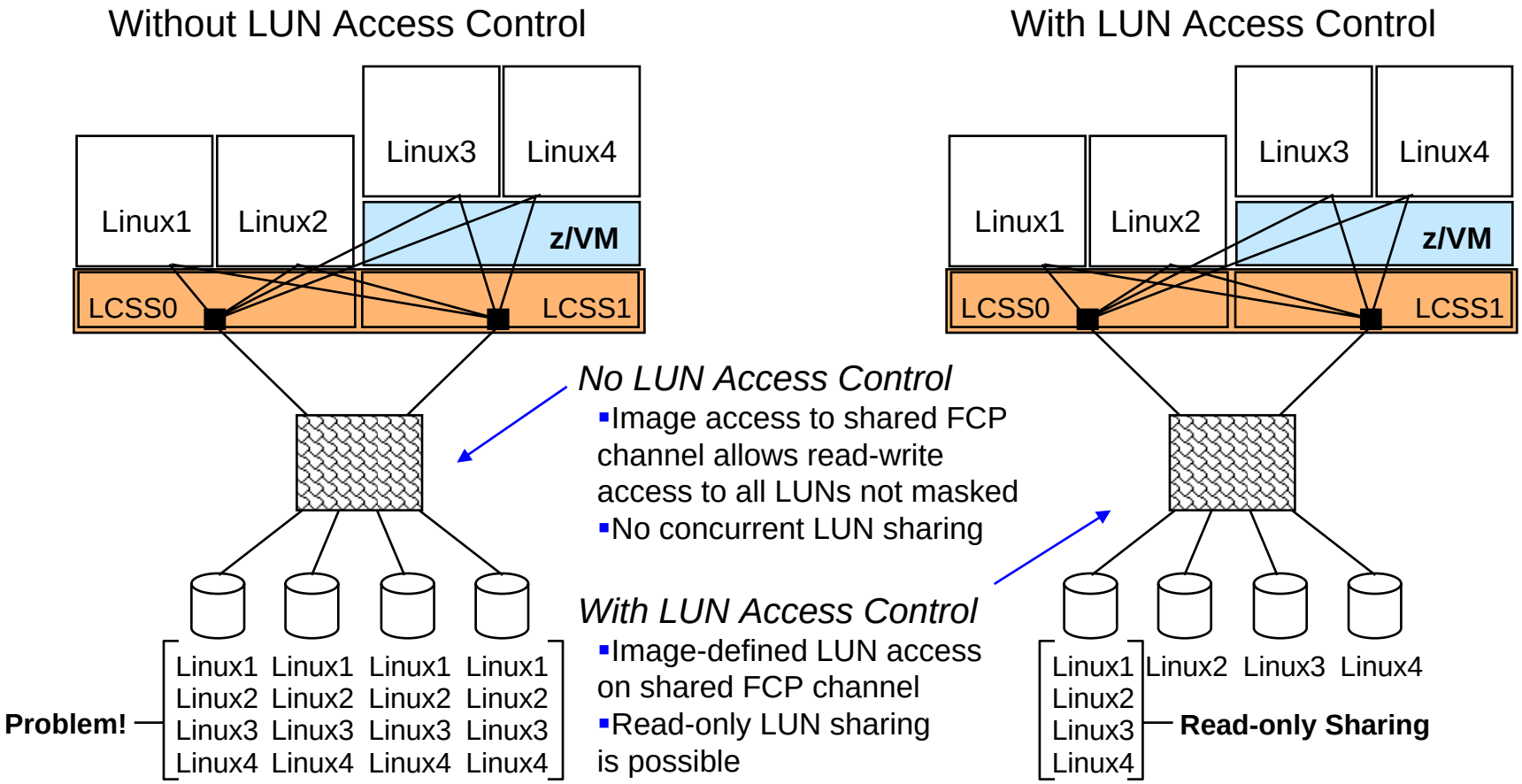
FCP-Attached SCSI Disk Support

- **z/VM V5.1 allows FCP-attached SCSI disks to be used for both system (CP/CMS) and guest use (e.g., Linux)**
- **SCSI disks are emulated as 9336 Model 20 FBA devices for system use**
  - Enables support for install, paging, spooling, directory services, minidisks
  - Guest systems supporting FBA (e.g., VSE) can use emulated SCSI disks
  - Emulation support currently limits usable disk space to 381GB
  - Paging, spooling, and directory space must reside in first 64GB
- **Non-emulated SCSI disks can still be attached to virtual machines**
  - For boot and/or data operations
  - Requires SCSI support in guest operating system
- **Currently supported SCSI disks are those within an Enterprise Storage Server connected to a fibre-channel fabric via zSeries FCP channels**
  - Generic SCSI driver available for other disks
- **SCSI-only disk configurations are now possible with z/VM V5.1 and Linux for zSeries**

FCP Logical Unit Numbers (LUN) Access Control

- **Provides added security for FCP-attached SCSI devices in a SAN fabric**
- **Enables multiple operating systems on the same zSeries server to share an FCP adapter and control access to the SCSI devices (LUNs) attached to the adapter**
  - Permissions can be established for z/VM itself (V5.1) as well as each Linux guest system
  - z/VM-on-z/VM environments are also supported
- **A configuration utility for FCP LUN access control will be available from IBM Resource Link (ibm.com/servers/resourcelink)**
- **FCP LUN access control will be supported by z/VM V5.1 and V4.4 when the function becomes available for z890 and z990 servers**
  - Requires PTF for APAR VM63328
  - z/VM V4.4 support: Linux guests only
  - z/VM V5.1 support: Linux guests and "system-owned" SCSI devices

FCP LUN Access Control



Understanding z/VM Support for SCSI Disks

- **Linux I/O to dedicated ECKD and dedicated SCSI disks can achieve roughly the same levels of performance**
- **z/VM ECKD I/O can achieve a higher level of performance than SCSI disk I/O**
  - Continue to use ECKD disks for CP/CMS I/O if it is an option
- **Increased pathlength of z/VM SCSI disk I/O can be offset**
  - Reduce over commitment of virtual-to-real memory (i.e., reduce paging)
  - Use minidisk cache for read-mostly I/O
  - FCP/SCSI channels are faster than ESCON/ECKD channels
  - Additional processor cycles will offset increased SCSI I/O pathlength
- **Sharing FBA-emulated SCSI disks among Linux images can offer disk and administrative savings**
  - Allows partitioning of SCSI disks using z/VM minidisk support (includes exploitation of minidisk cache support)
  - Allows use of tuning options like “Set Throttle” and “Set IOPriority”
  - Performance monitoring of emulated disks is functionally richer than dedicated SCSI disks
- **IBM TotalStorage DS 6000 offers a lower-cost ECKD option for z/VM data**

Enterprise Storage Server (ESS) Model 750 Support

- Member of the ESS product family; smaller than Model 800
- Up to 4.6 TB of storage with enclosures for up to 64 disk drives
- 8 GB of cache, 2-way processor, up to 6 Fibre Channel/FICON or ESCON adapters
- 72.8 GB and 145.6 GB 10000 RPM drives can be intermixed and configured as RAID 5 and 10, or a combination of both
- Peer-to-Peer Remote Copy (PPRC) and FlashCopy V1 and V2 support
- Parallel Access Volumes (PAV) support available for enhanced zSeries performance
- Upgradable to the ESS Model 800
- Supported by z/VM V5.1 as well as z/VM V3.1, V4.3, and V4.4

IBM TotalStorage DS6000 and DS8000

- **New data storage systems announced on October 12, 2004**
- **DS6000 series:**
  - Designed to provide exceptional price and performance in a modular package that redefines enterprise-class storage
    - 16 drives per 3U package; scalable from 4 to 224 drives; up to 67.2 TB
  - Shares advanced software features with ESS and DS8000
- **DS8000 series:**
  - Designed to deliver massive scalability using IBM POWER5 processors to help lower costs
    - Up to 6 times the performance of a base ESS 800 for increased response time and usable capacity (up to 192 TB of storage)
    - 20% smaller footprint than ESS 800
  - Storage system LPARs in select DS8300 allow two virtual storage systems within a single array (reducing price/megabyte)
- **z/VM support plans:**
  - z/VM V4.4 and V5.1 plan to support the DS6000 via PTF for APAR VM63534 (3/2005) and the DS8000 via PTF for APAR VM63535 (12/2004)

IBM TotalStorage Enterprise Tape Support

3592 Model J70 Controller and Model J1A Tape Drive

- **Advanced technology for greater performance and connectivity**
  - Supports up to four FICON attachments (double the number of attachments supported by the 3590 Model A60 controller)
  - Up to eight ESCON attachments supported
  - Up to 1.5 times the throughput of the 3590 Model A60 controller when using FICON attachment and 3592 Model J1A drives
- **3592 J70 Controller supports the attachment of 3590 tape drives or 3592 Model J1A drives**
- **z/VM support available with z/VM V5.1, V4.4, V4.3, and V3.1**
  - Configured to emulate either a 3490E or 3590B
  - 3592 Model J1A drives are supported when attached to the 3590 Model A60 controller or the 3592 Model J70 controller
- **PTFs required for z/VM releases prior to z/VM V5.1**
  - CP support in APAR VM63325
  - DFSMS/VM support in APAR VM63353

z/VM Virtual Networking
Enhanced Virtual IP Switch Support

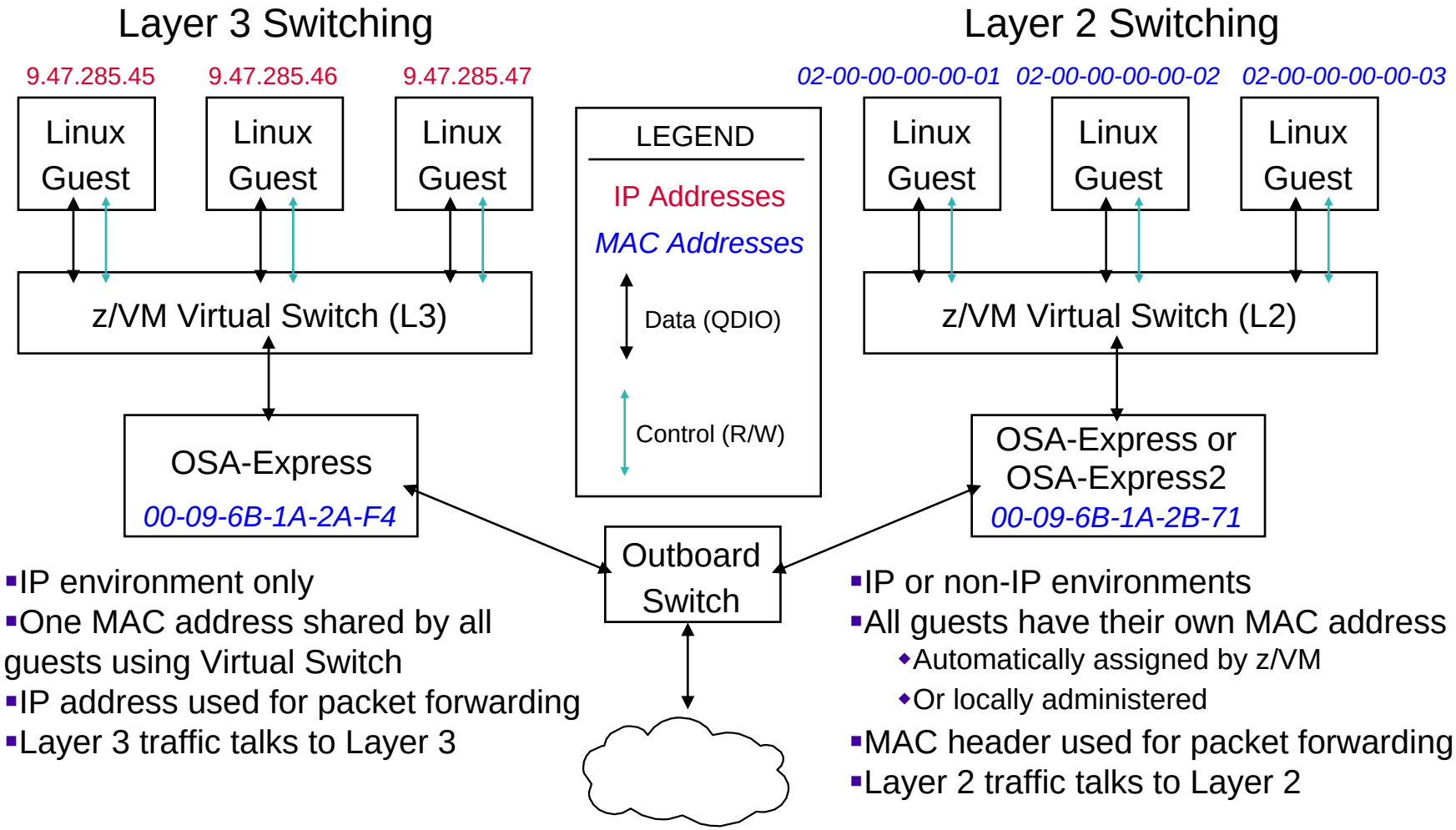
- **Virtual IP Switch first introduced in z/VM V4.4**
  - Allows virtual machines on a z/VM Guest LAN to be in the same subnet with the physical (OSA-Express) LAN segment
  - Eliminates the need for a router virtual machine on a Guest LAN
  - Lessens the time required to transport data onto the real LAN segment
  - Provides centalized network configuration and control
- **z/VM V5.1 improves virtual networking infrastructure reliability**
  - Faster failover to a backup OSA-Express device can be achieved when the primary device fails or stalls
  - z/VM V5.1 can detect a non-functioning TCP/IP controller and switch to a backup controller
  - SETIP requests from virtual machines are managed by z/VM to avoid overloading an OSA-Express device
- **New function minimizes potential network data loss and the corresponding need to re-transmit the data**

z/VM Virtual Networking
Virtual Switch Support for Layer 2 Mode

- **z/VM Virtual Switch support can operate in Layer 2 mode**
  - Works in conjunction with OSA-Express and OSA-Express2 support for Link Layer (Layer 2) transport mode (z890 and z990 servers only)
- **Allows destination and target nodes to be referenced by Media Access Control (MAC) addresses rather than IP addresses**
  - Supports IP and non-IP protocols (e.g., IPv4, IPv6, IPX, NetBIOS, SNA, AppleTalk, DECnet)
  - Deploying Layer 2 networks on z/VM can be less complex and more intuitive than deploying Layer 3 (IP) networks
- **z/VM Virtual Switch support will...**
  - Provide flexible and automatic MAC address generation and assignment enabling uniqueness within and across z/VM images, LPARs, and Servers
  - Perform protocol-independent Ethernet switching
  - Authorize/manage guest connections and IEEE 802.1q VLAN assignments
- **Support plans**
  - z/VM V5.1 support for OSA-Express: 12/03/04; OSA-Express2: 1/28/05
  - Linux for zSeries open source contributions: October 2004 (2.4 kernel); early 2005 (2.6 kernel)

z/VM Virtual Switch Support

Layer 3 Compared to Layer 2 Switching



- IP environment only
- One MAC address shared by all guests using Virtual Switch
- IP address used for packet forwarding
- Layer 3 traffic talks to Layer 3

- IP or non-IP environments
- All guests have their own MAC address
  - Automatically assigned by z/VM
  - Or locally administered
- MAC header used for packet forwarding
- Layer 2 traffic talks to Layer 2

z/VM Virtual Networking

External Security Manager Support for Guest LANs and Virtual Switches

- **z/VM V5.1 provides an ESM interface for controlling virtual machine access to Guest LANs and Virtual Switches**
  - The interface also enables a security manager to control Virtual LAN (VLAN) assignments for virtual machine connections to a Virtual Switch
- **The RACF feature of z/VM V5.1 supports this interface**
- **Non-ESM-controlled authorizations and assignments for z/VM virtual networks are still possible using directory entries and a command line interface**

Additional z/VM Support for IPv6

- **z/VM V4.4 added IPv6 support for z/VM Guest LANs**
  - Requires Guest LAN to be configured for OSA-Express simulation in QDIO mode
- **z/VM V5.1 offers additional IPv6 support**
  - The z/VM TCP/IP stack can now be configured for IPv6 networks connected via OSA-Express operating in QDIO mode
    - z/VM stack can be used as an IPv6 router
    - Provides static unicast routing of IPv6 packets and transmission of IPv6 Router Advertisements
    - TRACERTE and PING have been enhanced to support IPv6
  - CMS socket application programming support for IPv6 communications
    - IPv6 support provided in C-language sockets available in the Language Environment and the OpenExtensions Callable Service socket APIs
- **IPv6 offers several improvements over IPv4**
  - Addressing constraint relief (128-bit addressing)
  - Routing and network auto-configuration improvements

Additional Device Connections for z/VM TCP/IP

- **OSA-Express**
  - New support for z890 and z990 servers will allow up to 160 TCP/IP stacks to share an OSA-Express adapter (previous limit was 84)
  - Increased connectivity allows more virtual servers to connect directly to an external network
  - Hardware has been available since 10/29/04
  - z/VM support planned to be available 1/28/05 for V3.1, V4.3, V4.4, V5.1 via PTFs for APARs PQ91421 and VM63524
- **OSA-Express2**
  - New OSA-Express2 feature (z890 and z990 only) will support up to 640 TCP/IP stack connections
  - Helps reduce the number of OSA cards required to host multiple virtual server images
  - OSA-Express2 also provides support for 10 Gigabit Ethernet
  - Hardware availability is planned for 1/28/05
  - z/VM support is planned to be available 1/28/05 for z/VM V5.1 via PTFs for APARs PQ91421 and VM63524

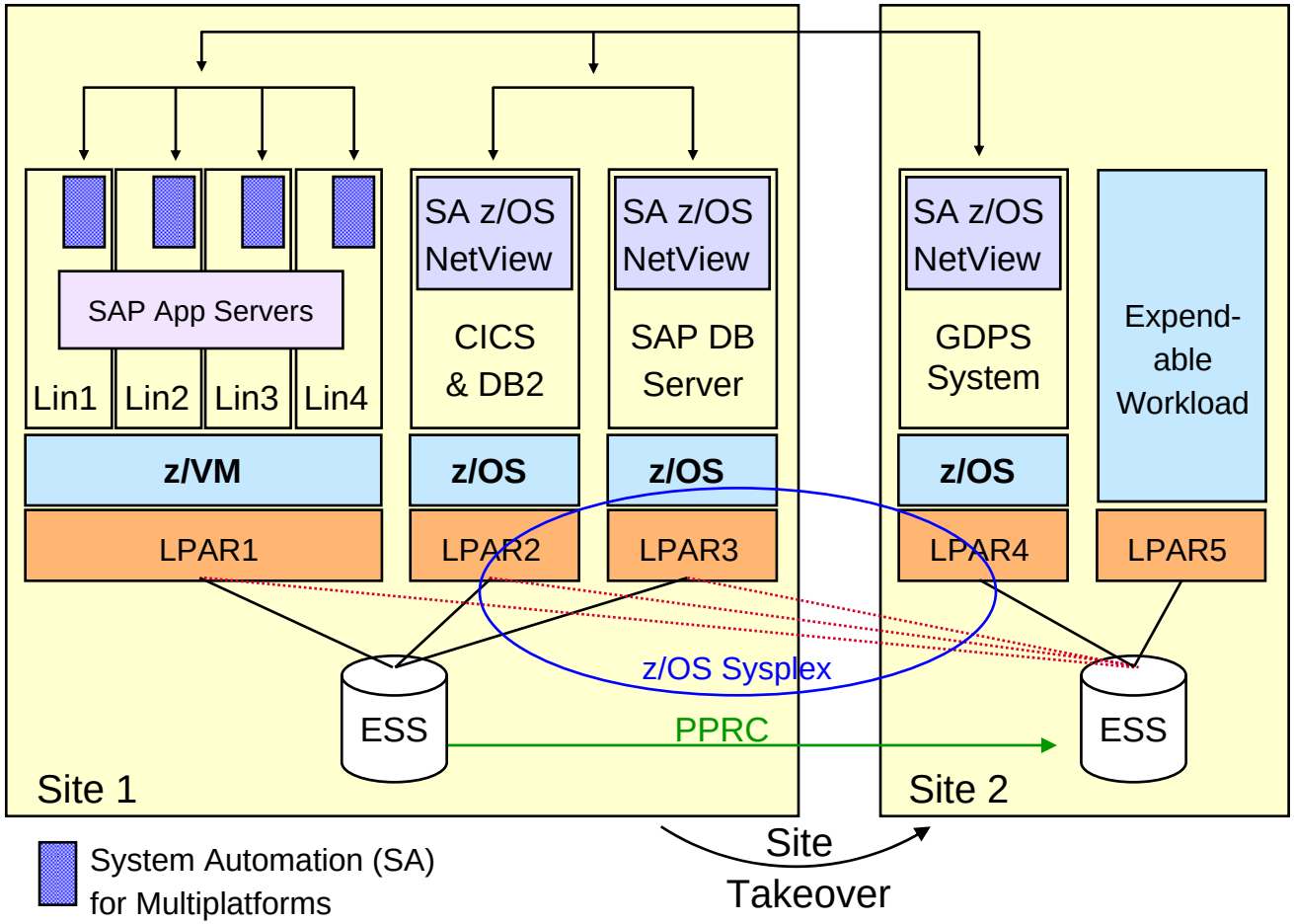
Dynamic Virtual Machine Timeout Support

- **Infrastructure support that facilitates deployment of virtual server failover solutions on z/VM V5.1**
- **Timeout support is a new programming service**
  - Uses an emulated Diagnose instruction (Diagnose X'0288')
  - Identifies an action or set of actions to be taken by the z/VM Control Program (CP) when a virtual machine becomes unresponsive
    - The duration of the time interval that defines "unresponsive" is under control of the guest system (specified via the Diagnose instruction)
    - The action(s) to be performed by CP are also specified by the guest system in the Diagnose instruction
  - The timeout actions will be performed by CP unless:
    - The virtual machine re-issues the Diagnose before the time interval elapses (which thereby establishes another time interval)
    - The guest system terminates or suspends the service
- **Potential uses:**
  - Activate a backup server when the primary server becomes unresponsive
  - Remove an unresponsive guest from a cluster
  - Relinquish shared resources

HyperSwap Support

- **New function that allows virtual machine devices associated with a real disk volume to be swapped transparently to another disk**
- **Can be used to switch a failing disk to a secondary disk that is part of a Peer-to-Peer Remote Copy (PPRC) pair**
- **Can also benefit data migration scenarios**
- **Geographically Dispersed Parallel Sysplex (GDPS) 3.1 exploits z/VM HyperSwap function for Linux and z/VM failover**
  - Requires GDPS, IBM Tivoli System Automation for Linux, Linux for zSeries, and z/VM V5.1
  - GDPS recovery actions:
    - In place re-IPL of failing operating system images
    - Site takeover/failover of complete production site
    - Coordinated planned and unplanned HyperSwap of storage subsystems
  - Ideally suited for disaster recovery of an application environment that spans Linux-on-z/VM images and z/OS system(s)

GDPS/PPRC Multiplatform Resiliency for zSeries



- Designed for customers with distributed apps
- SAP application server running on Linux for zSeries
- SAP DB server running on z/OS
- Coordinated near-continuous availability and DR solution for z/OS, Linux guests, and z/VM
- Uses z/VM HyperSwap function to switch to secondary disks
- Sysplex support allows for site recovery if needed

Capacity on Demand Enhancements

- **z/VM V5.1 supports On/Off Capacity on Demand (On/OffCoD) and Capacity Backup Upgrade (CBU) capabilities of zSeries servers**
  - Customers can turn on and off additional z/VM capacity and make payments for the added capacity on a daily basis
- **Functional enhancements in z/VM V5.1 include:**
  - Recognize processor configuration and capacity changes
  - Report configuration changes to the system operator and any guest system that supports configuration change notification
  - Report capacity changes to guests that support capacity measurements for billing purposes
  - Reflect capacity changes in z/VM monitor and accounting data

Additional Systems Management APIs

- **First introduced in z/VM V4.4**
- **Provides a set of callable functions to allocate and manage resources for guest systems running on z/VM**
- **The APIs enable:**
  - Allocation and management of virtual machine resources
  - Virtual machine configuration changes
  - Activation and deactivation of individual or lists of virtual images
- **Requires a directory manager (z/VM DirMaint feature supports the APIs)**
- **Back-end interface allows providers to insert their own solutions**
- **z/VM V5.1 enhancements:**
  - New RPC server (Version 2)
  - DASD volume management for virtual images
  - Virtual Machine Resource Manager support
    - VMRM configuration file management
    - Ability to query VMRM measurement data
  - Ability to query status of active images

Performance Toolkit for VM Enhancements

- **Performance Toolkit for VM was introduced in z/VM V4.4**
  - Priced z/VM feature; derivative of the FCON/ESA program (5788-LGA)
  - A performance reporting tool for the z/VM system and guest images
    - Realtime and historical reporting
    - Offers threshold monitoring and user loop detection
    - Can monitor remote z/VM systems
    - Results can be viewed graphically with a web browser
- **Replaces RTM and PRF**
  - z/VM V4 RTM and PRF customers with current S&S subscriptions are entitled to a no-charge upgrade to the Performance Toolkit for VM
- **z/VM V5.1 enhancements:**
  - Incorporates PRF function not available in the V4.4 level of the Toolkit
  - New high-level reports can be generated based on Application Monitor records from Linux
    - z/VM V5.1 support planned to be available 12/03/2004 via PTF (APAR VM63580)
    - Linux support available in 2.6 kernel from SUSE
  - New reports for SCSI disks

Service Support Enhancements

- The automated service process has been enhanced
- RSU levels and individual PTF levels for a component can be more easily queried
- Service memo files can be cataloged online and displayed using the VMFUPDAT command
- The local modification procedure can now be automated using LOCALMOD (a new command)

New z/VM Publication

"Getting Started with Linux on zSeries"

- **Intended for new z/VM users**
- **Provides an explanation of z/VM basics, including how to configure and use z/VM functions and facilities**
- **Focus is on creating and managing Linux virtual machines**
- **Subject material includes:**
  - Configuring, administering, and servicing a z/VM system
  - Configuring TCP/IP for z/VM
  - Creating and cloning Linux virtual machines
  - Setting up basic system automation
  - Monitoring performance and capacity
  - Diagnosing z/VM and Linux problems

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Futures Discussion

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Statements of Direction

- IBM intends to support more than 24 CPUs in a single z/VM image in the future on appropriate releases of z/VM in combination with designated zSeries server(s).
- z/VM V5.1, with the RACF for VM optional feature, is in evaluation for Common Criteria (ISO/IEC 15408) certification against the Labeled Security Protection Profile (LSPP) and the Controlled Access Protection Profile (CAPP), both at the EAL3+ assurance level.
- z/VM V5.1 is the last release of z/VM to support the use of IBM 2741 and TWX Terminal Model 33/35 (TTY), or their equivalents, as virtual consoles. This includes any ASCI device, such as the IBM 3101 or IBM 3163, that simulates one of these terminal types using the communication controller Emulator Program (EP).
- IBM intends to withdraw the System Administration Facility and the Server-Requester Programming Interface (SRPI) from a future release of z/VM.
- *IBM intends to expand the exploitation of 64-bit support in future z/VM releases to provide better utilization of main storage in configurations larger than 2GB to help ease constraints imposed by demands for main storage below 2GB.*
- *In the future, Linux guests running on z/VM may benefit from IBM Virtualization Engine support for Linux on zSeries, which is intended to include Enterprise Workload Manager support for zSeries, Linux for zSeries participation in IBM Director Multiplatform, and the IBM Dynamic Infrastructure for mySAP Business Suite, a solution using Virtualization Engine systems provisioning.*

Italicized statements were released on October 7, 2004

Note: All statements regarding IBM's plans, directions, and intent are subject to change or withdrawal without notice. Any reliance on this Statement of Direction is at the relying party's sole risk and will not create any liability or obligation for IBM.

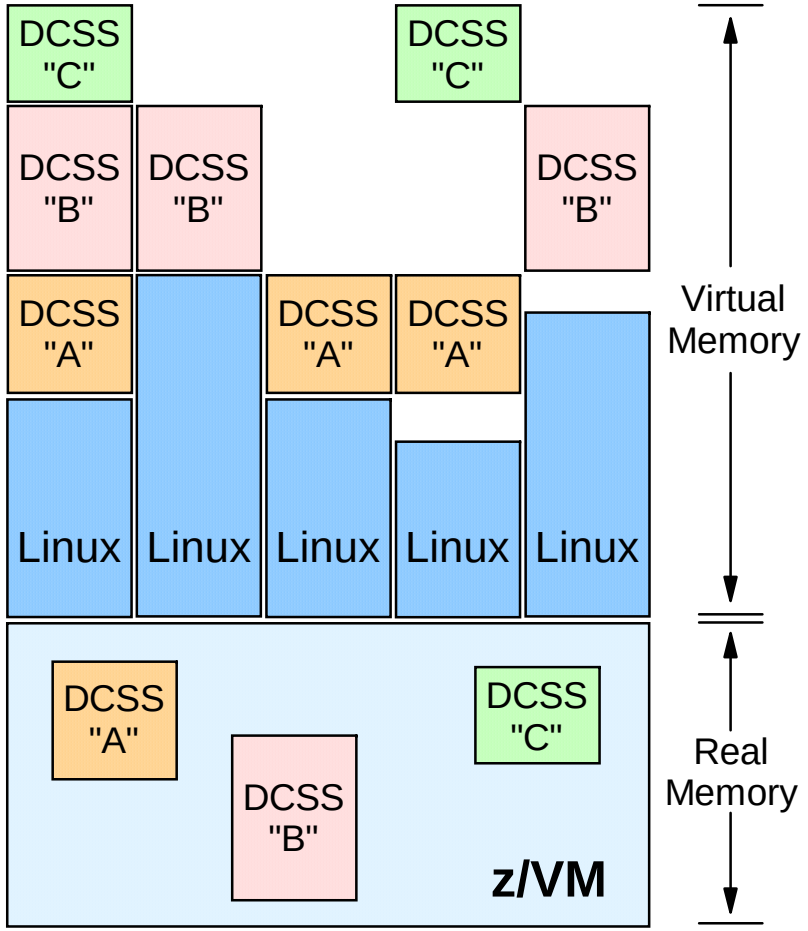
z/VM Future Support *Candidates*

- **Processor and I/O support**
  - New processor support
  - New storage systems support
  - SCSI disk support enhancements
  - More cryptographic support
- **Platform scalability**
  - Control Program exploitation of large real memory
  - z/VM and zSeries hardware synergy (e.g., QDIO passthru support)
- **Infrastructure simplification**
  - Guest LAN and Virtual Switch enhancements
  - Performance Toolkit enhancements
- **Systems management and provisioning**
  - Enhanced system and guest availability support
  - Collaborative memory management
  - Enhanced DCSS support
  - Security improvements

Linux and z/VM Technology Exploitation

Exploitation of z/VM Support for Discontiguous Shared Segments (DCSS)

- DCSS support is a z/VM exclusive
  - Share a single, real memory location among multiple virtual machines
  - High-performance data access
  - Can help reduce real memory utilization
- Linux exploitation support available today
  - Execute-in-place (xip2) file system
  - DCSS memory locations can reside outside the defined virtual machine configuration
  - Access to file system is at memory speeds; executables are invoked directly out of the file system (no data movement required)
  - Avoids duplication of virtual memory and data stored on disks
  - Enables throughput benefits for Linux guest images and enhances overall system performance and scalability



Linux and z/VM Future Technology Exploitation

Collaborative Memory Management

- **Problem**: virtual memory utilization far exceeds real memory availability
- z/VM Control Program paging operations become excessive
- Overall system performance and guest throughput suffers

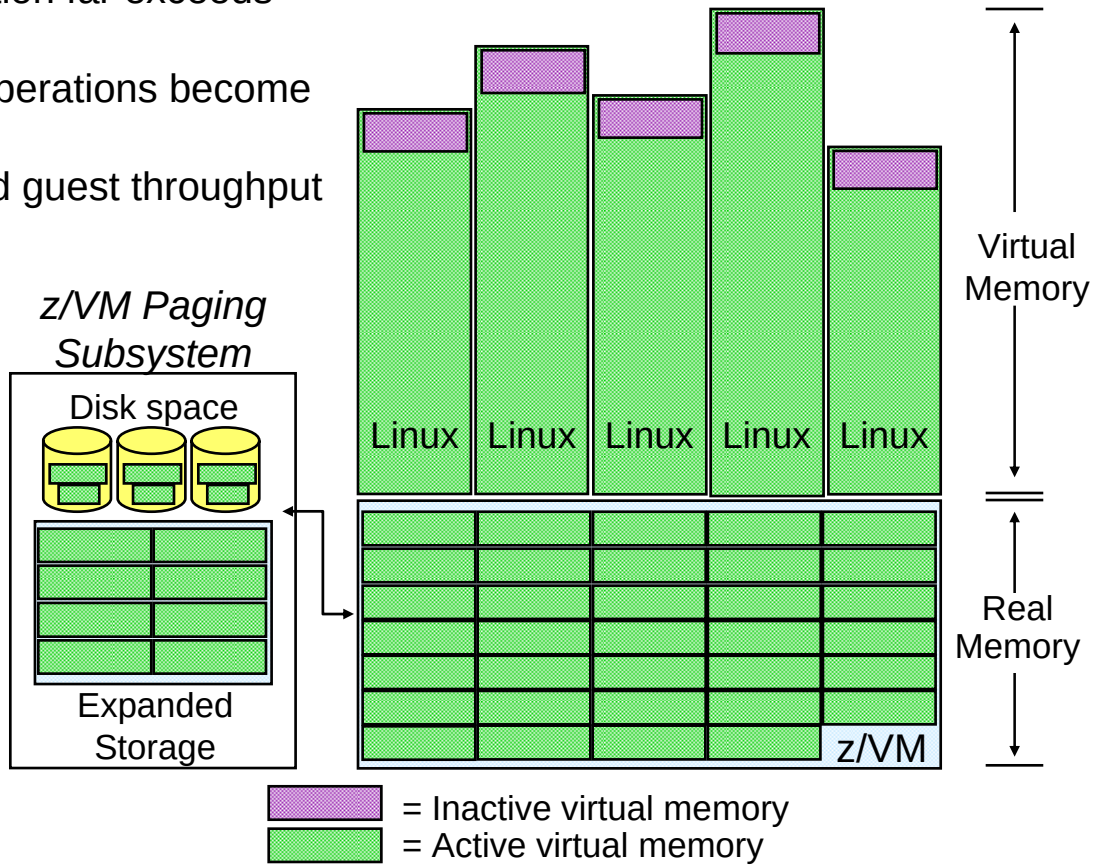


Chart 1 of 2

Linux and z/VM Future Technology Exploitation

Collaborative Memory Management

- **Solution**: real memory constraint detected and Linux images signaled to reduce virtual memory consumption
- Linux memory pages are released
- Demand on real memory and z/VM paging subsystem is reduced
- Overall system performance and guest image throughput improves

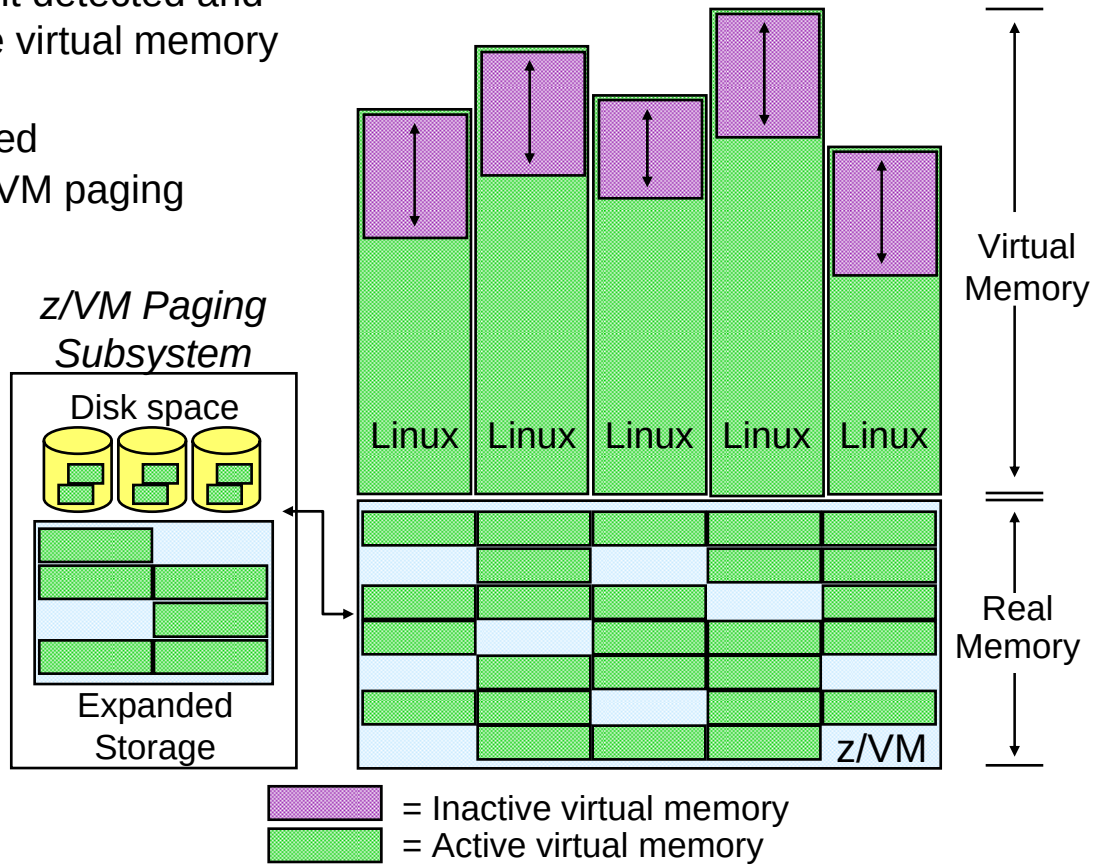


Chart 2 of 2

Additional Resources

- **The Campus for more education:**
  - BPs: http://www.ibm.com/partnerworld/sales/systems/education
    - Includes link to IBM PartnerWorld University (Web lectures for key topics)
    - http://www.ibmweblectureservices.ihost.com/pwu
  - IBMers: w3.ibm.com/sales/systems/education
    - Includes links to the Online Universities for Cross-Brand and each Brand (Web lectures for key topics)
  - Customers: www-1.ibm.com/servers/eserver/education

Linux and z/VM Resources

- **IBM Learning Services Classes**
  - Linux Basics - a zSeries and S/390 Perspective (HLX13)
  - Installing, Configuring, and Servicing z/VM for Linux Guests (ZV060)
  - z/VM and Linux Connectivity and Management (ZV100)
  - Linux Implementation for zSeries (ZL100)
  - Advanced Solutions for Linux on zSeries (ZL150)
  - Deploying WebSphere and Advanced e-business Applications on Linux for zSeries (LINX5)
  - Deploying WebSphere Centric Products on Linux for zSeries (LINX6)
  - Find more info at: **ibm.com**/servers/eserver/zseries/os/linux/ed.html
- **z/VM Security and Integrity whitepaper**
  - ibm.com/servers/eserver/zseries/library/techpapers/gm130145.html
- **Linux for zSeries and S/390 listserver**
  - www.marist.edu/htbin/wlvindex?linux-390
- **IBM Global Services**
  - techsupport.services.ibm.com/linux/support

Linux on IBM @Server zSeries and S/390 Redbooks

- **System Management**
  - publib-b.boulder.ibm.com/Redbooks.nsf/RedpieceAbstracts/sg246820.html
- **Server Consolidation with Linux for zSeries**
  - publib-b.boulder.ibm.com/Redbooks.nsf/RedpaperAbstracts/redp0222.html
- **High Availability for z/VM and Linux**
  - publib-b.boulder.ibm.com/Redbooks.nsf/RedpaperAbstracts/redp0220.html
- **Cloning Linux Images in z/VM**
  - publib-b.boulder.ibm.com/Redbooks.nsf/RedpaperAbstracts/redp0301.html
- **Performance Measurement and Tuning**
  - publib-b.boulder.ibm.com/Redbooks.nsf/RedpieceAbstracts/sg246926.html
- **Large Scale Linux Deployment**
  - publib-b.boulder.ibm.com/Redbooks.nsf/RedbookAbstracts/sg246824.html
- **Managing a Samba Server from z/VM**
  - publib-b.boulder.ibm.com/Redbooks.nsf/RedbookAbstracts/redp3604.html
- **TCP/IP Broadcast on z/VM Guest LAN**
  - publib-b.boulder.ibm.com/Redbooks.nsf/RedbookAbstracts/redp3596.html
- **Application Development**
  - publib-b.boulder.ibm.com/Redbooks.nsf/RedbookAbstracts/sg246807.html
- **ISP/ASP Solutions**
  - publib-b.boulder.ibm.com/Redbooks.nsf/RedbookAbstracts/sg246299.html

Linux on IBM @server zSeries and S/390 Redbooks

Continued...

- **Linux Systems Management Using Aduva Director**
  - publib-b.boulder.ibm.com/Redbooks.nsf/RedbookAbstracts/redp3599.html
- **Virtual Router Redundancy Protocol on VM Guest LANs**
  - publib-b.boulder.ibm.com/Redbooks.nsf/RedpaperAbstracts/redp3657.html
- **z/VM Configuration for WebSphere Deployments**
  - publib-b.boulder.ibm.com/Redbooks.nsf/RedpaperAbstracts/redp3661.html
- **VSWITCH and VLAN features of z/VM 4.4**
  - publib-b.boulder.ibm.com/Redbooks.nsf/RedpaperAbstracts/redp3719.html
- **Formatting and Labeling a DASD Volume for Linux Guests Running Under z/VM**
  - www.redbooks.ibm.com/abstracts/tips0275.html
- **Partitioning DASD for Linux Guests Running Under z/VM**
  - www.redbooks.ibm.com/abstracts/tips0277.html
- **Linux with zSeries and ESS: Essentials**
  - publib-b.boulder.ibm.com/Redbooks.nsf/RedbookAbstracts/sg247025.html
- **IBM Lotus Domino 6.5 for Linux on zSeries Implementation**
  - publib-b.boulder.ibm.com/Redbooks.nsf/RedpieceAbstracts/sg247021.html
- **Accounting and Monitoring for z/VM Linux Guest Machines**
  - publib-b.boulder.ibm.com/Redbooks.nsf/RedpaperAbstracts/redp3818.html
- **Best Security Practices**
  - publib-b.boulder.ibm.com/Redbooks.nsf/RedpieceAbstracts/sg247023.html

Linux on IBM @server zSeries and S/390 Redbooks

Continued...

- **Performance Toolkit for VM**
  - www.redbooks.ibm.com/redpieces/abstracts/sg246059.html
- **Advanced LDAP User Authentication: Limiting Access to Linux Systems Using the Host Attribute**
  - www.redbooks.ibm.com/redpieces/abstracts/redp3863.html
- **Printing with Linux on zSeries Using CUPS and Samba**
  - publib-b.boulder.ibm.com/Redbooks.nsf/RedbookAbstracts/redp3864.html
- **Running Linux Guest in less than CP Priviledge Class G**
  - publib-b.boulder.ibm.com/Redbooks.nsf/RedpaperAbstracts/redp3870.html
- **Linux on zSeries Fibre Channel Protocol Implementation Guide**
  - www.redbooks.ibm.com/redpieces/abstracts/sg246344.html
- **Implementing IBM Tape in Linux and Windows**
  - www.redbooks.ibm.com/redpieces/abstracts/sg246268.html
- **Networking Overview for Linux on zSeries**
  - www.redbooks.ibm.com/redpapers/abstracts/redp3901.html
- **OSA-Express Quick-Start Table for z/VM**
  - www.redbooks.ibm.com/abstracts/tips0104.html
- **Capacity Test of IFL vs. CP**
  - www.redbooks.ibm.com/abstracts/tips0479.html

Keep in Touch with z/VM Development

- **z/VM Web Site:**
  - **ibm.com**/eserver/zseries/zvm/
- **Feedback:**
  - **ibm.com**/eserver/zseries/zvm/forms

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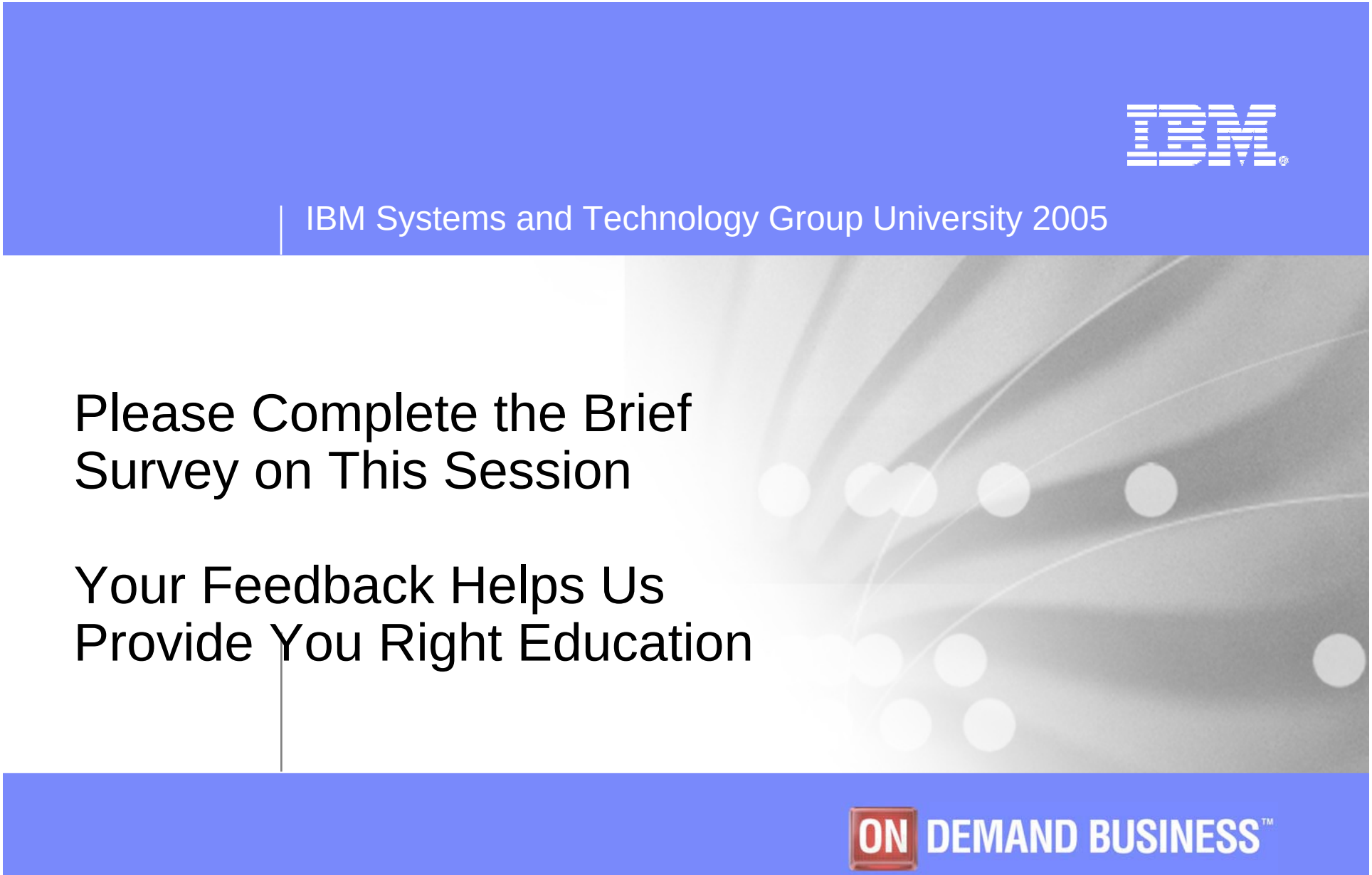

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