

## z/VSE Hardware Support

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Ingolf's z/VSE Blog: <https://www.ibm.com/developerworks/mydeveloperworks/blogs/vse>

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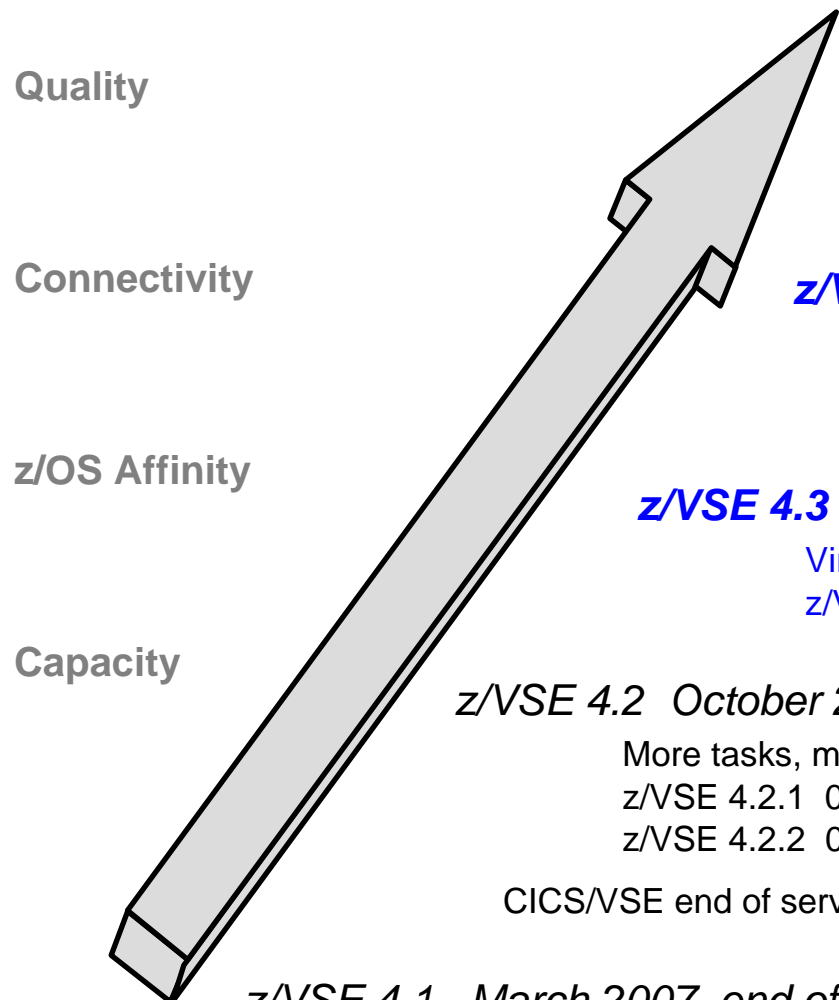
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## Agenda



- Roadmap
- VSE strategy
- z/VSE 5.1
- Processor support
- Device support

# VSE Roadmap



Quality

Connectivity

z/OS Affinity

Capacity

## z/VSE Statement of Direction (SOD)

Install from DVD  
CICS Explorer update

### z/VSE 5.1.1 (+ Enhancements) GA 06/14/2013

TS1140, 64 bit I/O, openSSL and  
database connector enhancements

### z/VSE 5.1 GA 11/25/2011

64 bit virtual, zEnterprise exploitation, z9 or higher  
z/VSE 5.1.1 06/2012: CICS Explorer, LFP in LPAR,  
database connector

### z/VSE 4.3 11/2010

Virtual storage constraint relief, 4 digit cuus  
z/VSE 4.3.1 08/2011, *end of support 05/31/2014*

### z/VSE 4.2 October 2008, end of service 10/31/2012

More tasks, more memory, EF for z/VSE 1.1, CPU balancing, SCRT on z/VSE  
z/VSE 4.2.1 07/2009 - PAV, EF for z/VSE 1.2  
z/VSE 4.2.2 04/2010 - IPv6/VSE 05/2010

CICS/VSE end of service 10/31/2012

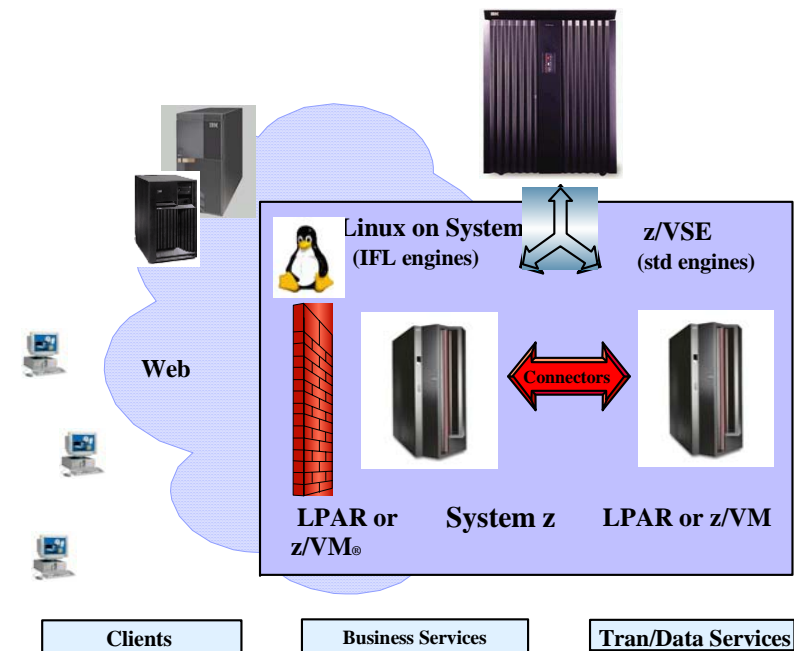
### z/VSE 4.1 March 2007, end of service 04/30/2011

z/Architecture only, 64 bit real addressing, MWLC – full and sub-capacity pricing

## VSE Strategy

- Helps **Protect** your existing investments in core VSE programs, data, equipment, IT skills, *plus* business processes, end user training, etc.
  - modernize, i.e. extend VSE resources to Web
  - **exploit IBM servers, storage, and software**
- **Integrate** VSE with the rest of your IT based on open and industry standards
  - (IBM) middleware
  - VSE connectors and web services
- **Extend** with Linux on System z
  - infrastructure consolidation/simplification
  - add new infrastructure and/or line-of-business applications

## Why Not Think Inside the Box?



## z/VSE V5.1

- z/VSE 5.1: GA 11/25/2011, z/VSE 5.1.1: GA 06/15/2012
- 64-bit virtual addressing
- Introduces Architectural Level Set (ALS) that requires System z9 or later
- IBM zEnterprise 196 (z196), IBM zEnterprise 114 (z114), IBM zEnterprise EC12 (zEC12)
  - Support Static Power Save Mode for MWLC clients with subcapacity option (z196 and zEC12 only)
  - 4096-bit RSA keys with Crypto Express3 for enhanced security
  - Support of OSA-Express for zBX (CHPID OSX) to participate in an Intra Ensemble Data Network (IEDN) in z/VM guest or LPAR
- Exploitation of IBM System Storage options
  - Copy Export function of TS7700 Virtualization Engine for disaster recovery
  - Multi-Cluster Grid support of the TS7700 Virtualization Engine Series (TS7700)
  - IBM Storwize V7000 Midrange Disk System (z/VSE 4.2 and later)
  - IBM XIV (z/VSE 4.2 and later)
- Fast Service Upgrade (FSU) from z/VSE 4.2 and z/VSE 4.3
- Pricing
  - Midrange Workload License Charge (MWLC) pricing with sub-capacity option
  - z114: Advanced Entry Workload License Charge (AEWLC) pricing with sub-capacity option

## z/VSE V5.1 ...

- Networking enhancements
  - IPv6 support for Linux Fast Path
  - z/VSE z/VM IP Assist (VIA) exploitation
  - TCP/IP communication using Layer 2 (Data Link Layer)
  - Virtual Local Area Network (VLAN) support for OSA Express and Hipersockets
    - Global VLAN supported by TCP/IP for VSE/ESA and IPv6/VSE
    - General VLAN supported by IPv6/VSE
- IPv6/VSE
  - Large TCP window support, can increase throughput
  - 64 bit virtual exploitation, large TCP window storage allocated above the bar
  - Layer 2 support (OSA Express, IPv6 only)
  - VLAN support
- System management enhancements
  - SNMP Trap Client Extension monitoring – API
- High availability and disaster recovery enhancements
  - Copy Export function of TS7700 Virtualization Engine for disaster recovery
  - Multi-Cluster Grid support of the TS7700 Virtualization Engine Series (TS7700)
  - GDPS (Geographically Dispersed Parallel Sysplex) client (in a z/VM guest)
    - z/VSE supports heartbeat only
    - GDPS K-system can only monitor z/VSE
    - GDPS K-system can manage z/VM and therefore can manage z/VSE indirectly

## z/VSE 5.1 Additional Enhancements

- GA 06/15/2012 – contained in z/VSE 5.1.1:
  - CICS Explorer for z/VSE
  - Linux Fast Path in LPAR
  - Linux Fast Path via z/VSE z/VM IP Assist (z/VSE VIA)
  - IBM System Storage Tape Controller 3592 Model C07
  - z/VSE database connector
  - VSE/POWER enhancement to ease job output handling
  - New symbolic parameter IJBVMID containing the z/VM userid if running on z/VM
  
- New functionality in 4Q/2012 via PTFs:
  - 64-bit input/output (I/O) processing for applications
  - IPv6/VSE V1.1 enhancements (encryption support)
    - o Secure Sockets Layer (SSL) for secure data transmission
    - o Layer 2 support for OSA Express devices for IPv4 links



## z/VSE 5.1 Announcement (04/02/2013)

- IBM z/VSE V5.1 - Additional enhancements - GA planned for June 14, 2013
  - Announcement content:
    - Support of zEC12
      - Configurable Crypto Express4S
      - OSA Express4S 1000BASE-T
    - Support of IBM System Storage
      - IBM System Storage TS1140 (3592 E07)
      - IBM System Storage TS7700 Virtualization Engine Release 3.0
      - IBM System Storage DS8870
      - IBM System Storage Storwize V7000 Release 6.4
    - 64-bit input/output (I/O) processing for applications
    - HiperSockets configurable input buffers

## z/VSE 5.1 Announcement (04/02/2013) ...

- Announcement content ....
  - System dump support for memory objects
  - z/VSE Database connector enhancements
  
  - OpenSSL update
  - IPv6/VSE V1.1 enhancements
    - o Secure Sockets Layer (SSL) for secure data transmission
    - o Layer 2 support for OSA Express devices for IPv4 links
  
- Statement of general direction (SOD):
  - IBM intends
    - o in the future to enhance IBM CICS Explorer for IBM CICS Transaction Server for VSE/ESA to provide updates to CICS resources.
    - o to add functionality that allows initial installation of z/VSE without requiring a physical tape.
  
  - It is planned to reduce the AEWLC and MWLC list price of IPv6/VSE V1.1.

All statements regarding IBM's plans, directions, and intent are subject to change or withdrawal without notice.

## Supported System z Environments

- z/VSE 4.3 support
    - IBM e-server zSeries processors (z800, z900, z890, z990)
    - IBM System z9 (z9 BC, z9 EC)
    - IBM System z10 (z10 BC, z10 EC)
    - IBM System zEnterprise (z114, z196, zEC12)
  
  - z/VSE 5.1 supports
    - IBM System z9 (z9 BC, z9 EC)
    - IBM System z10 (z10 BC, z10 EC)
    - IBM System zEnterprise (z114, z196, zEC12)
- ... and can run on
- uni- and multiprocessors
  - In basic mode (z800, z900 only), in LPAR mode or in z/VM guest
  - z/VSE 4.3 and 5.1 run under all supported z/VM releases.



## VSE Support for System z

VSE Release	z800 / z900	z890 / z990	System z9 / z10 / z196 / z114 / zEC12	VSE EoS
z/VSE V5.1	No	No	Yes	tbd
z/VSE V4.3	Yes	Yes	Yes	05/31/2014
z/VSE V4.2	Yes	Yes	Yes	10/31/2012
z/VSE V4.1	Yes	Yes	Yes	04/30/2011
z/VSE V3.1	Yes	Yes	Yes	07/31/2009
VSE/ESA V2.7	Yes	Yes	Yes	02/28/2007
VSE/ESA V2.6	Yes	Yes	Yes	03/2006
VSE/ESA V2.5	Yes	No	No	12/2003
VSE/ESA V2.4	Yes	No	No	06/2002
VSE/ESA V2.3	No	No	No	12/2001

## *64 bit real addressing*

- Processor storage support up to 32 GB
- 64 bit real addressing only, introduced with z/VSE 4.1
- z/VSE 5.1
  - Virtual address space > 2 GB
  - 64 bit virtual addressing
- Data space size remains at max. 2 GB
- Implementation transparent to user applications
- Performance: 64 bit real can reduce / avoid paging
- Many z/VSE environments can run without a page dataset (NOPDS option)

## IBM zEnterprise exploitation

- Following functions are not supported in z/VM guests:
- Large page (1 megabyte page) support for data spaces (z10, zEnterprise)
  - Better exploitation of large processor storage, may improve performance
  - No configuration options required
  - Transparent to applications
- Dynamic add of logical CPUs (z10, zEnterprise)
  - Ability to dynamically add logical central processors (CPs) without preplanning
  - Logical processor add from HMC/SE
  - Allows adding CPs to LPAR without re-IPL of the z/VSE system
  - Capacity of the z/VSE V4.3 system may be in-/decreased dependent on workload needs
  - New SYSDEF TD parameters (STARTSBY / STOPSBY) to manage the additional CPs

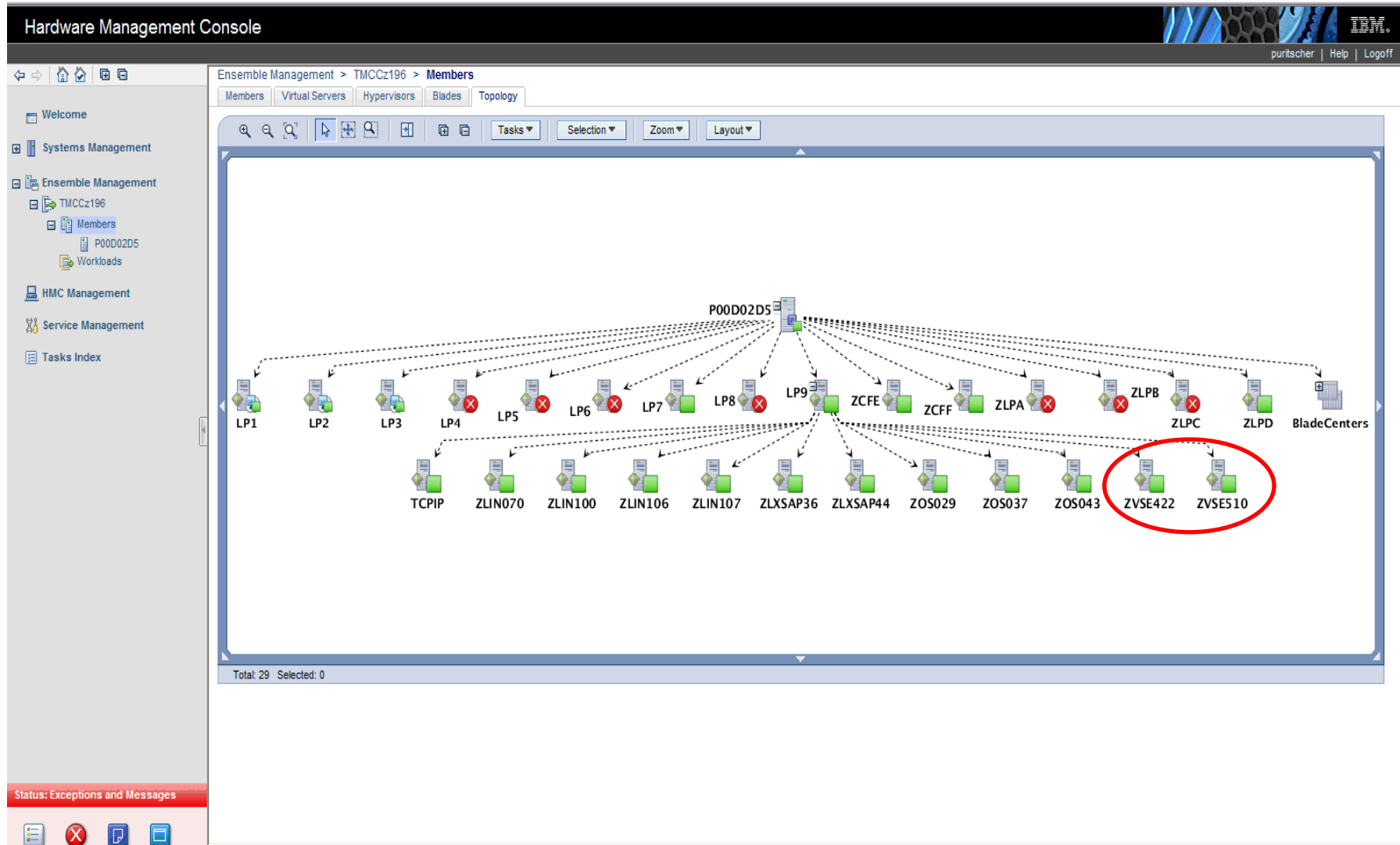
```

query td
AR 0015 CPU STATUS SPIN_TIME NP_TIME TOTAL_TIME NP/TOT
AR 0015 00 ACTIVE 0 16367 26978 0.606
AR 0015 01 INACTIVE
AR 0015 02 INACTIVE
AR 0015 03 STANDBY
AR 0015
AR 0015 TOTAL -----
AR 0015 0 16367 26978 0.606
AR 0015 NP/TOT: 0.606 SPIN/(SPIN+TOT): 0.000
AR 0015 OVERALL UTILIZATION: 0% NP UTILIZATION: 0%
AR 0015
AR 0015 CPU BALANCING: NOT ACTIVATED
AR 0015
AR 0015 ELAPSED TIME SINCE LAST RESET: 4026069
AR 0015 1I40I READY
  
```

## IBM zEnterprise exploitation ...

- 4096-bit RSA key support with configurable Crypto Express3 (z10, zEnterprise)
- Crypto Express4S support (z/VSE 5.1 + PTF)
- Linux Fast Path (LFP) in z/VM mode LPAR (z10, zEnterprise)
- Hipersockets Completion Queue (zEnterprise) -> Linux Fast Path in LPAR
- Linux Fast Path via z/VSE z/VM IP Assist (z/VSE VIA)
- zEnterprise and zEnterprise BladeCenter Extension (zBX) support
  - “native” Intra Ensemble Data Network (IEDN) – z/VSE 5.1
  - IEDN communication using the z/VM VSWITCH – z/VSE V4 and 5.1
- Static power save mode supported for SCRT (z196, zEC 12 only)

# zEnterprise zManager (HMC) and z/VSE





## zEnterprise zManager (HMC) and z/VSE

Hardware Management Console
purtscher | Help | Logoff

Ensemble Management > TMCCz196 > Members

Members Virtual Servers Hypervisors Blades Topology

Filter: [ ] Tasks Views

Select	Name	Member	Status	Processors	Memory (MB)	Type	Auto Start	Shutdown Timeout
<input type="checkbox"/>	P00D02D5		Operating			PR/SM		
<input type="checkbox"/>	LP9	P00D02D5	Operating			z/VM	--	300
<input type="checkbox"/>	TCP/IP	P00D02D5	Operating	1	128	z/VM		
<input type="checkbox"/>	ZLIN070	P00D02D5	Operating	2	3,072	z/VM		
<input type="checkbox"/>	ZLIN100	P00D02D5	Operating	2	1,024	z/VM		
<input type="checkbox"/>	ZLIN106	P00D02D5	Operating	4	6,144	z/VM		
<input type="checkbox"/>	ZLIN107	P00D02D5	Operating	1	1,024	z/VM		
<input type="checkbox"/>	ZLXSAP36	P00D02D5	Operating	2	6,144	z/VM		
<input type="checkbox"/>	ZLXSAP44	P00D02D5	Operating	2	6,144	z/VM		
<input type="checkbox"/>	ZOS029	P00D02D5	Operating	4	2,048	z/VM		
<input type="checkbox"/>	ZOS037	P00D02D5	Operating	4	16,384	z/VM		
<input type="checkbox"/>	ZOS043	P00D02D5	Operating	4	16,384	z/VM		
<input checked="" type="checkbox"/>	ZVSE422	P00D02D5	Operating	2	1,024	z/VM		
<input type="checkbox"/>	ZVSE510	P00D02D5	Operating	3	2,048	z/VM		
<input type="checkbox"/>	ZLPA	P00D02D5	Operating			z/VM	--	300

Page Size: 500 Total: 19 Filtered: 19 Selected: 1

Tasks: ZVSE422

Virtual Server Details

Toggle Lock

Daily

- Activate
- Deactivate
- Grouping

Monitor

- Monitor System Events

Configuration

- Delete Virtual Server
- New Virtual Server Based On

Status: Exceptions and Messages

## zEnterprise zManager (HMC) and z/VSE

**Virtual Server Details - ZVSE422 [P00D02D5:LP9:TMCC40]**

Processors

Initial virtual processors: \* 2

Maximum virtual processors: \* 2

Share limit: None

Initial share mode: Relative

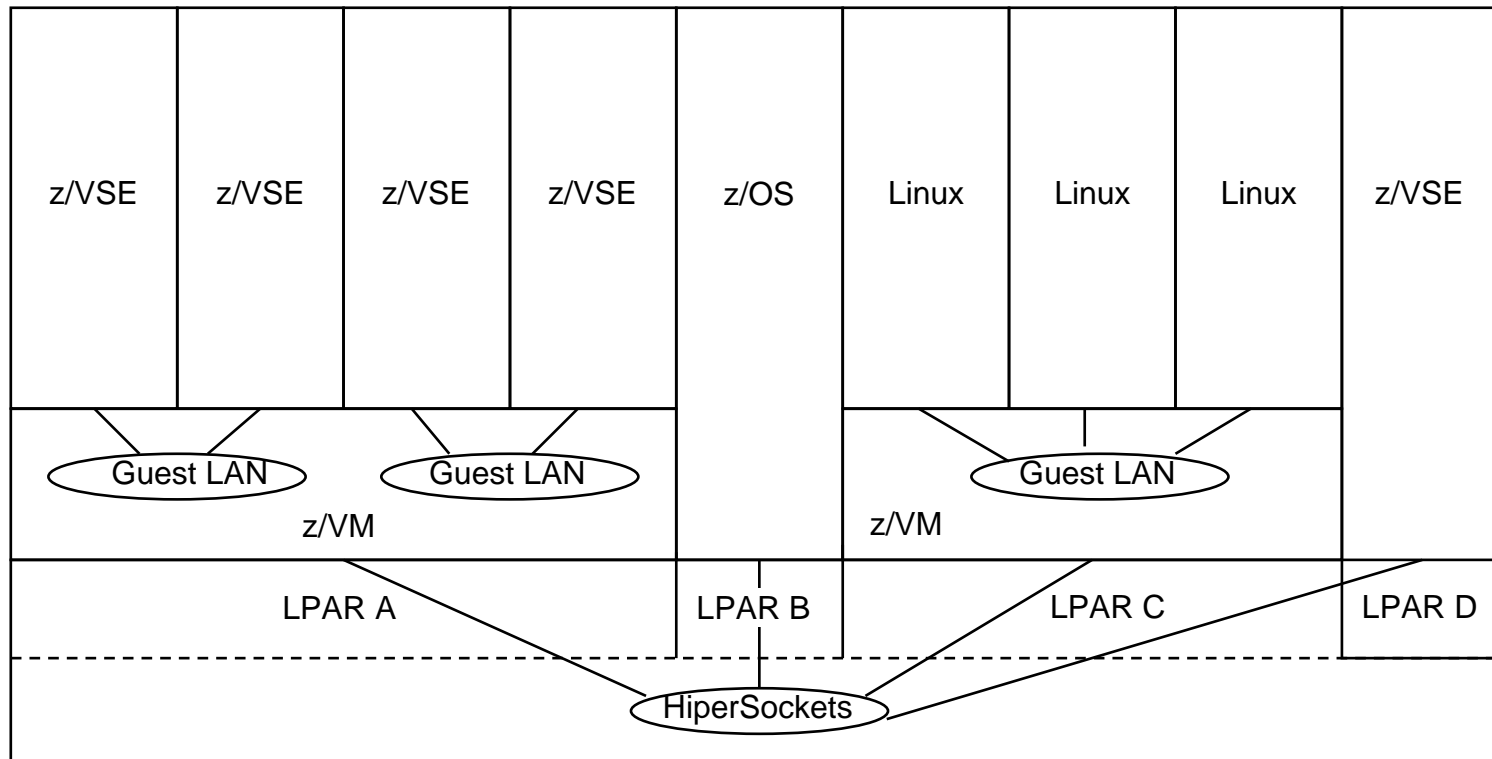
Initial relative shares: \* 2000

OK Apply Cancel Help

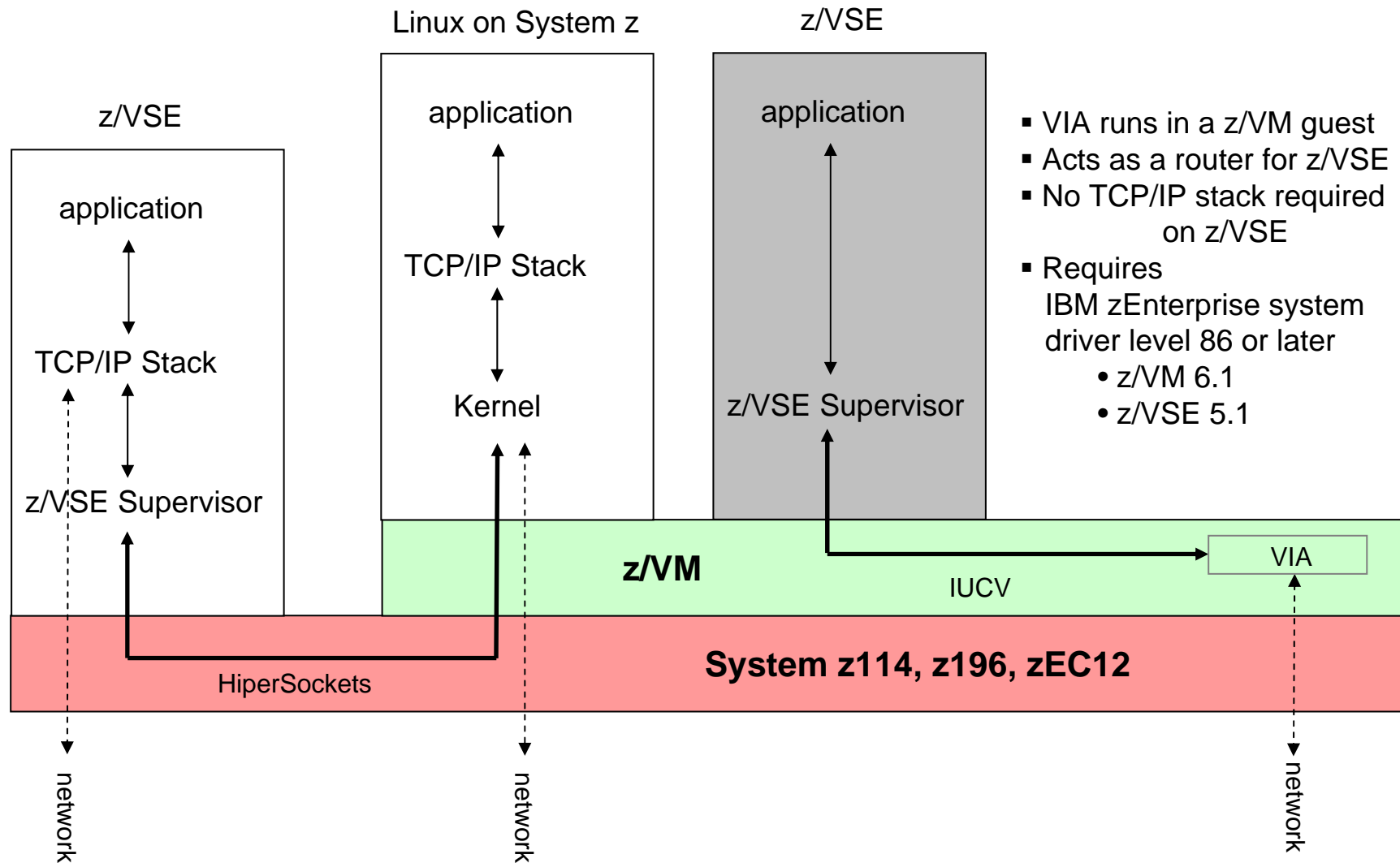
## System z HiperSockets

- “network in the box”,
  - TCP/IP based communication at near memory speed within one system
    - System z Logical Partitions (LPARs)
    - z/VM guests (via virtual guest LAN)
    - z/VM guests and LPARs
  
- z/VSE may communicate with
  - Linux on System z
  - z/OS
  - z/VM
  - z/VSE V4 or z/VSE 5.1
  
- Virtual HiperSockets via z/VM Guest LAN support
  
- HiperSockets Completion Queue

## HiperSockets Example



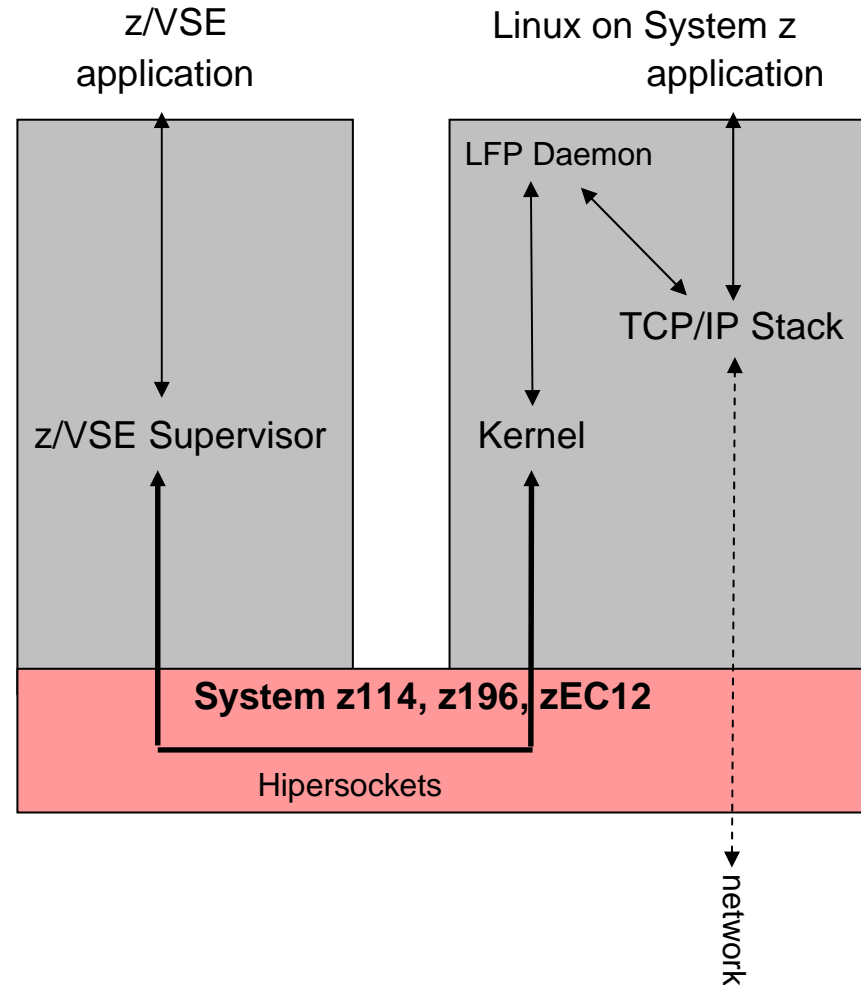
## LFP - z/VSE z/VM IP Assist (VIA)



- VIA runs in a z/VM guest
- Acts as a router for z/VSE
- No TCP/IP stack required on z/VSE
- Requires IBM zEnterprise system driver level 86 or later
  - z/VM 6.1
  - z/VSE 5.1

## Linux Fast Path (LFP) – Linux Fast Path in LPAR

- No TCP/IP stack required on z/VSE
- System requirements
  - Supported on zEnterprise
    - Exploits HiperSockets completion queue
  - Linux on System z distribution (RHEL, SLES)
  - z/VSE 5.1.1 (z/VSE 5.1 + PTF)



## System z Exploitation

- FICON Express8 - Higher I/O bandwidth
- Adapter interruptions (performance improvements)
  - OSA-Express3 / OSA-Express4S (QDIO mode), FICON Express8 (FCP)
- OSA-Express features
  - 10 Gigabit Ethernet, Gigabit Ethernet
  - 1000BASE-T Ethernet (4 modes of operation)
    - ICC (Integrated Console Controller)
    - QDIO (Queued Direct I/O) for TCP/IP traffic
    - Non-QDIO for TCP/IP and SNA traffic
    - OSN (Open System Adapter for NCP) works with IBM Communication Controller for Linux on System z
- z/VM queued-I/O assist for real networking devices
  - OSA Express adapters (CHIPID type OSD)
  - Hipersockets (CHIPID type IQD)

## OSA Express Support

- OSA-Express for high-speed communication
  - OSA-Express3 on z10, z196, z114, zEC12
  - OSA-Express4S on z114, z196 and zEC12
- OSA-Express for non-QDIO environments (CHPID type OSE)
  - SNA and passthru traffic require configuration via OSA/SF
- z/VSE supports the Gigabit Ethernet (GbE) and 10 Gigabit Ethernet (10 GbE) features
  - To be configured in IOCDs as CHPID type OSD (other CHPID types not supported)
  - Exploited by TCP/IP via DEFINE LINK,TYPE=OSAX command
  - OSA-Express 10 GbE (2 ports), GbE (4 ports)
- Port specification for TCP/IP
  - OSA-Express 10 GbE features: one port per CHPID to connect to the network
  - OSA-Express GbE: two ports per CHPID – port 0 and port 1
    - To use port 0, no port specification is necessary
    - To use port 1, the port needs to be specified, e.g.:
      - DEFINE LINK,TYPE=OSAX,DEV=D00,DATAPATH=D02,OSAPORT=1



## System z hardware cryptographic support

- Enhances Internet security
- Encryption support via crypto cards or on the processor itself (CPACF)
- Cryptographic assists
  - Exploited by the SSL support of TCP/IP transparently
  - Encryption Facility for z/VSE (CPACF)
- Transparent for “TCP/IP” applications
  - VSE connector server, CICS Web Support, VSE/Power PNET
- No definition necessary

## System z hardware cryptographic support ...

- CPACF – for symmetric encryption
  - AES for 128-bit keys (z9 EC, z9 BC), AES for 256 keys (z10 EC or higher)
- Crypto Express2 / Express3 / Express4S – for asymmetric encryption
  - Encryption hardware assist for increased SSL throughput
    - Supports SSL handshaking only for applications that use the SSL crypto API
  - Crypto Express4S support (z/VSE 5.1 + PTF)
  - 2048-bit RSA key with Crypto Express2
  - 4096-bit RSA key support with configurable Crypto Express3 / Crypto Express 4S (z/VSE 4.3 or higher)
  - Configurable Crypto Express
    - Dynamically configurable in coprocessor or accelerator mode
  - Dynamic change of cryptographic processors
    - Add/remove cryptographic processor of z10 LPAR or higher
  - AP (adjunct processor)-queue adapter-interruption facility
    - May accelerate the SSL throughput

## Signal Quiesce (Signal Shutdown) Support

- If e.g. an IML or IPL is performed via the HMC / SE or z/VM SIGNAL SHUTDOWN , a signal-quiesce event is generated.
- Need to be enabled via IPL SYS QUIESCE=YES | NO

- If QUIESCE=YES a message is generated:

```
0W01D DO YOU WANT TO CONTINUE SYSTEM SHUTDOWN (WILL BE FORCED AFTER TIMEOUT)?  
REPLY 'YES' TO ENTER HARD WAIT STATE OR 'NO'
```

- If the operator reply is **yes**,
  - The system will enter the disabled wait state
- If the operator reply is **no** or does not reply, the system will wait for a predefined time interval
  - Console automation can initiate a controlled system shutdown
- z/VSE does not provide controlled shutdown processing

## 4 digit CUUs

- Ease of use and infrastructure simplification
  - In mixed environments running z/VSE together with z/VM, Linux on system z or z/OS
  - Removes the requirement for a z/VSE specific IOCDs configuration
  - Provides more flexibility
  
- 4 digit CUUs transparent to applications and most system programs
  - Implemented via mapping to 3 digit CUUs during IPL
  - z/VSE will only use 3 digit CUUs after IPL complete

## Exploitation of IBM System Storage Products

- IBM System Storage TS1130 / TS1120 Tape Drive
- [June 14, 2013: TS1140 Tape Drive](#)
- IBM System Storage TS7700 / TS7720 Virtualization Engine
  - Copy Export function of TS7700 Virtualization Engine for disaster recovery (z/VSE 5.1)
  - Multi-Cluster Grid support of the TS7700 Virtualization Engine Series (z/VSE 5.1)
- IBM System Storage TS3400 autoloader Tape Library
- IBM System Storage TS3500 Tape Library
- IBM TS7680 ProtecTIER Deduplication Gateway for System z
  - Disk-only virtual tape solution
- zVSE supports the S/390 channel command interface via
  - Perform Subsystem Function (PSF)
  - Perform Library Function (PLF) commands

## Tape Data Encryption

- IBM TS1120 / TS1130 / **TS1140** Tape Drive with encryption feature
  - Supports data encryption within the drive itself
  - Using Systems Managed Encryption with the TS1120 / TS1130
  - z/VSE support will require the **Encryption Key Manager** component running on another operating system other than z/VSE using an out-of-band connection.
    - Generation and communication of encryption keys for tape drive
    - TCP/IP connection between EKM and the tape controller
  - Data encryption is transparent to z/VSE applications
  - Data encryption
    - Data will be encrypted and compressed, when specified
    - Default: encryption disabled
  - Encryption re-keying support to encrypt data key of encrypted tape cartridge

## Data Encryption ...

- Encryption Key Manager (EKM)
  - EKM is a Java application, used to generate and protect AES keys
  - On request EKM generates AES (256 bit) data keys and protects those keys
  - Key encryption key label (KEKL) identifies the encryption keys
  - The KEKL or the hash value of the public key can be stored on the cartridge.
  - You may download EKM from the internet
  
- In z/VSE jobs must have an ASSGN statement and KEKL statement to access or write encrypted data
  
- ASSGN statement
  - ASSGN SYSnnn, cuu, mode
    - cuu = device address
    - mode =
      - o 03 encryption write mode
      - o 0B encryption and IDRC write mode
      - o 23 encryption and unbuffered (compression) write mode
      - o 2B encryption and IDRC and unbuffered write mode
  
- KEKL statement
  - // KEKL UNIT=cuu, KEKL1=key\_label\_1, KEM={L|H}
    - KEM = key encoding mechanism
      - o L = label, H = public key hash

## Exploitation of IBM System Storage Products ...

- IBM System Storage DS8000/DS6000 64K cylinder support:
- Allows consolidation of smaller disks volumes
- Supported by BAM and VSE/VSAM
  
- VSAM supports more than 1,500 clusters per catalog
- VSAM FAT-BIG DASD support
  - **Small DASD** (normal): smaller than 64k tracks per volume
    - 3390 in LISTCAT
  - Large DASD with two subtypes:
    - **Big DASD**: more than 64k tracks per volume
      - o BIG-3390 in LISTCAT
      - o Support of up to 10017 cylinders
    - **Fat DASD**: up to 64k cylinders
      - o FAT-3390 in LISTCAT
      - o New type of volume



## Parallel Access Volume (PAV)

- Optional licensed feature of DS8000, DS6000, ESS series
- Enables z/VSE to simultaneous process multiple I/O operations to the same volume
  - Can provide enhanced throughput
  - Can help to consolidate small volumes to large volumes
- Multiple logical addresses to the same physical device  
= Base and alias volumes for concurrent processing of I/O operations
  - Configuration in DASD, IOCDS and z/VSE
  - Base device: physical device to be added during IPL
  - Alias device(s) are associated to the base device.
  - z/VSE supports up to 7 alias devices
- Multiple z/VSE jobs can transfer data to or from the same physical volume in parallel
- All z/VSE references to I/O devices (e.g. in JCL) relate to the base device
- In z/VSE PAV processing can be dynamically activated or deactivated via the AR/JCL command `SYSDEF PAV=START` or `STOP`
- Max. 1023 I/O devices can be added, if PAV to be activated

## FlashCopy Support

- Available on DS8000, DS6000 and ESS
- Source and copied data almost available immediately
- NOCOPY option
  - Direct copy to backup device
- Dataset copy
  - Source and target volumes may have different sizes
  - Should not be used for VSAM files
- Elimination of Logical Subsystems
  - Source and target volume can span LSS
- Multiple relationship FlashCopy
  - Up to 12 volumes from one source in a single FlashCopy operation

## FlashCopy Support ...

- IBM System Storage DS8000 FlashCopy SE (Space Efficient)
  - Allocates storage on target volume only “as-needed”, if copied tracks from source volume
- FlashCopy Consistency Group
  - Allows to create a consistent point-in-time copy across multiple volumes
- Supported by ICKDSF only
  - DS8000 Remote Mirror and Copy (RMC)
  - Peer-to Peer Remote Copy (PPRC)
    - Allows remote data replication
- z/VSE does not support:
  - Incremental FlashCopy
  - Persistent FlashCopy relationship
  - Inband Commands over Remote Mirror link

## SCSI Support in z/VSE

- SCSI disks as emulated FBA disks on z/VM
  - z/VSE supports a max. size of 2 GB
- Direct attached SCSI disks
  - z/VSE supports up to 24 GB (VSAM: 16 GB)
  - z/VSE supports SCSI disk devices only
  - Impact on applications
    - Transparent to all VSE applications and subsystems,
    - Reasons for transparency:
      - z/VSE's SCSI implementation is based on FBA support
      - applications can not exploit SCSI commands directly
      - FBA to SCSI emulation on low level I/O interface
- SAN Volume Controller (SVC)
  - To access FCP-SCSI disks in DS8000, DS6000, DS4000 and ESS series as well as disk subsystems from other manufacturers supported by SVC
- IBM XIV Storage System
- IBM Storwize V7000 Midrange Disk System

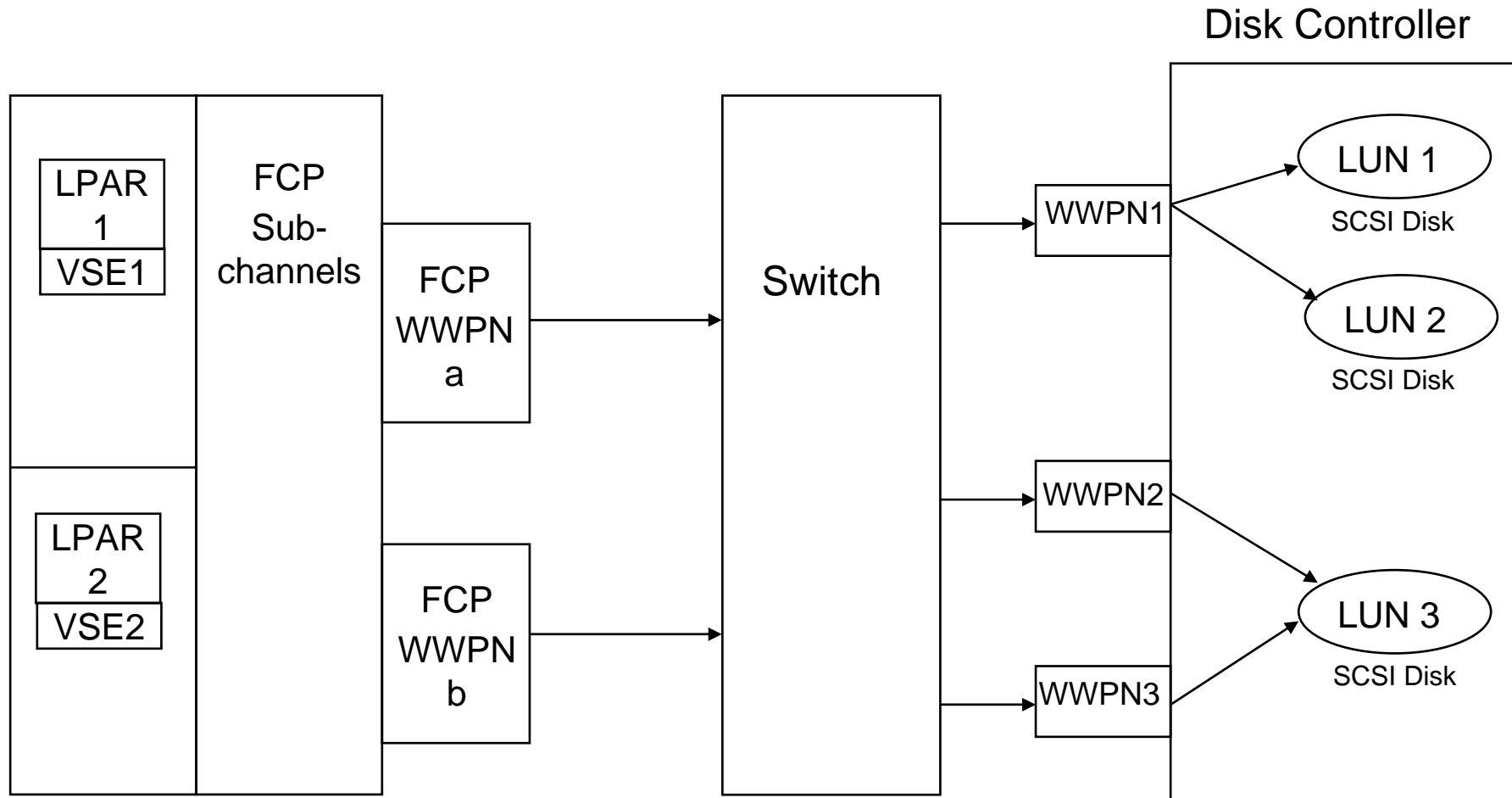
## SCSI Support in z/VSE

- Access SCSI devices through Fibre Channel Protocol (FCP)
- z/VSE's SCSI support includes:
  - SCSI for system and data device (SCSI only system)
  - Multipathing for fail-over
- SCSI support transparent to existing (I/O) APIs
- SCSI disk devices utilize fixed block sectors
  - Block size restricted to 512 bytes,  
even if the SCSI device can be configured with larger block sizes
- FSU from SCSI to SCSI device only

## SCSI Support - Configuration

- IPL / JCL commands and dialog to define and query a SCSI device
  
- Required steps to get a SCSI device known to z/VSE
  - Device configuration
  
  - Switch configuration
    - In case of point to point connections (System z9 or higher) not necessary
  
  - FCP Adapter to be configured in IOCDs (CHIPID type FCP)
  
  - FCP adapter and SCSI disk to be defined in VSE via
    - IPL ADD commands to define FCP and FBA device
    - IPL DEF or JCL SYSDEF command to define connection to LUN

## SCSI Support – Disk Controller Configuration



Point to point connection possible (z9 or higher possible)

## More Information

... on VSE home page: <http://ibm.com/vse>

- Ingolf's z/VSE blog: <https://www.ibm.com/developerworks/mydeveloperworks/blogs/vse>
- z/VSE Planning
- **Hints and Tips for z/VSE 5.1:**
  - <http://www.ibm.com/systems/z/os/zvse/documentation/#hints>
- 64 bit virtual information:
  - IBM z/VSE Extended Addressability, Version 5 Release 1
  - IBM z/VSE System Macro Reference, Version 5 Release 1
- CICS Explorer: <http://www.ibm.com/software/htp/cics/explorer/>
- IBM Redbooks:
  - Introduction to the New Mainframe: z/VSE Basics  
<http://www.redbooks.ibm.com/abstracts/sg247436.html?Open>
  - Security on IBM z/VSE – updated  
<http://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/sg247691.html?Open>
  - z/VSE Using DB2 on Linux for System z  
<http://www.redbooks.ibm.com/abstracts/sg247690.html?Open>