zPL3033 - zVSE Hardware Exploitation

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IBM z Systems • IBM Power Systems • IBM Storage

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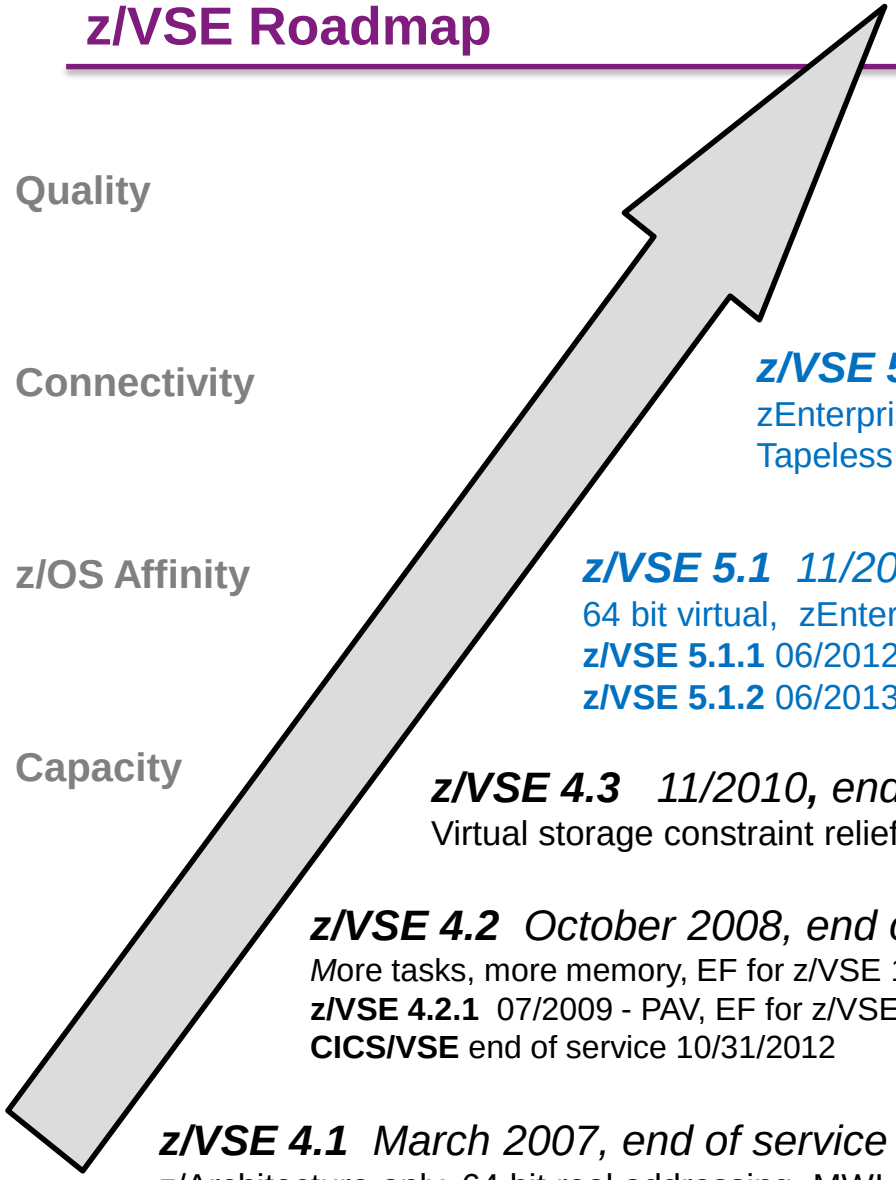
z/VSE Roadmap



z/VSE 6.1 *Ann 10/ 05/2015, GA 11/27/2015*
CICS TS for z/VSE 2.1: CICS Explorer update, Channels & Containers; TCP/IP for z/VSE 2.1, IPv6/VSE 1.2, **z10 or higher**; z Systems exploitation

z/VSE 5.2 *Ann: 04/07/2014, GA 04/25/2014*
zEnterprise exploitation, device support
Tapeless installation, networking / security enhancements

z/VSE 5.1 *11/2011, end of service 06/30/2016*
64 bit virtual, zEnterprise exploitation, z9 or higher
z/VSE 5.1.1 06/2012: CICS Explorer, LFP in LPAR, database connector
z/VSE 5.1.2 06/2013: TS1140, 64 bit I/O, openSSL, db connector enhancements

z/VSE 4.3 *11/2010, end of service 10/31/2014*
Virtual storage constraint relief, 4 digit cuus, z/VSE 4.3.1 08/2011

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

z/VSE 5.2 – Quick Overview

- Announcement: 04/07/2014, GA: 04/25/2014
  Latest Recommended Service Level (RSL): April 2015

- Hardware support
  - IBM zSystems support (including z13)
  - Device support
    - Tape, ECKD and FCP-attached SCSI disks

- 64 bit virtual exploitation
  - Virtual disk in memory objects

- Networking enhacements
  - IPv6 support for selected z/VSE functions

z/VSE 5.2 – Quick Overview …

- Security enhancements
  - Basic Security manager (BSM) and VSE/POWER audit enhancements
- Ease of use
  - Tapeless installation from ECKD devices
  - Stacking tape support
- Fast Service Upgrade (FSU) from z/VSE 4.3 and z/VSE 5.1
- Pricing
  - z9, z10, z196, zEC12, z13: Midrange Workload License Charge (MWLC) pricing with sub-capacity option
  - z114, zBC12: Advanced Entry Workload License Charge (AEWLC) pricing with sub-capacity option

z/VSE 5.2 – Quick Overview ...

- Support for IBM zEnterprise EC12, IBM zEnterprise BC12
  - Configurable Crypto Express4S feature
  - OSA-Express5S features
  - HMC based configuration for OSA-Express4 and OSA-Express5S (OSA/SF)

- Support for IBM z13
  - More LPARs (up to 85)
  - Configurable Crypto Express5S (via PTF)
    - More than 16 domains
  - OSA-Express5S
  - PSP bucket describes requirements (PTFs) for z/VSE
    http://www-01.ibm.com/support/docview.wss?uid=isg1_2964DEVICE_2964-ZVSE

z/VSE 5.2 – Quick Overview ...

- Support for IBM System Storage
  - Tape support
    - Systems Managed Encryption with IBM System Storage TS1140
    - IBM System Storage TS7700 Virtualization Engine Release 3.3
  - ECKD / FCP-attached SCSI disk support
    - IBM System Storage DS8870 Release 7.5
    - Upgrade of the z/VSE support for the Parallel Access Volume (PAV) feature (ECKD)
  - FCP-attached SCSI disk support
    - IBM Storwize V7000
    - IBM Storwize V5000 Midrange Disk
    - IBM Storwize V3700 Entry Disk

z/VSE 6.1 GA Announcement

- Preview: May 11, 2015, GA ann.: 10/05/2015, planned GA 11/27/2015

- Hardware support
  - Architectural Level Set to IBM System z10 or later
  - IBM z13 support
    - Configurable Crypto Express5S
      - More than 16 cypto domain support
    - FICON Express16S for ECKD, channel to channel or FCP-attached SCSI
  - IBM System Storage options
    - IBM System Storage TS7700 Virtualization Engine Release 3.3
    - IBM System Storage DS8870 Release 7.5 (ECKD and FCP-attached SCSI disks)
    - IBM FlashSystem V9000 for use with FCP-attached SCSI disks.

- New CICS version: CICS TS for z/VSE 2.1 - fullfills Statement of Direction (SOD)

z/VSE 6.1 GA Announcement …

- Networking enhacements
  - IPv6/VSE 1.2 – new release
  - TCP/IP for z/VSE 2.1 – new version

- Connectors
  - MQ Client Trigger Monitor

- z/VSE 6.1 requires an initial installation,
  Fast Service Upgrade (FSU) from z/VSE V5 not supported

- z/VSE 6.1 will be delivered in English only

- z/VSE Central Functions renamed to z/VSE

- Statemant of direction:
  IBM plans to deliver future upgrades of z/VSE on DVD or electronically only.

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

z Systems / z/VM support

- z/VSE V5 and V6 support IBM z Systems servers:
  - IBM z13
  - IBM zEnterprise EC12 (zEC12)
  - IBM zEnterprise BC12 (zBC12)
  - IBM zEnterprise 196 (z196)
  - IBM zEnterprise 114 (z114)
  - IBM System z10 (z10 EC, z10 BC)
- z/VSE V5 supports IBM z Systems servers:
  - IBM System z9 (z9 EC, z9 BC)

... and z/VSE V5 and V6 can run in an LPAR or as a z/VM guest on all supported z/VM releases

... in uni- or multiprocessor mode

- VM V5.4 support:
  - z/VM 5.4 withdrawn from service December 31, 2016 or until z9 processors are withdrawn from support, whichever is later. Replacement product: z/VM V6 (August 5, 2014 announcement).
  - z/VM 5.4 not supported on z13.

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z Systems support

VSE Release	z800 / z900	z890 / z990	z9	z10 / z196 / z114 / zEC12 / zBC12 / z13	VSE EoS
z/VSE 6.1 (GA 11/27//2015)	No	No	No	Yes	tbd
z/VSE V5.2	No	No	Yes	Yes	tbd
z/VSE V5.1	No	No	Yes	Yes	06/30/2016
z/VSE V4.3	Yes	Yes	Yes	Yes	10/31/2014
z/VSE V4.2	Yes	Yes	Yes	Yes	10/31/2012
z/VSE V4.1	Yes	Yes	Yes	Yes	04/30/2011
z/VSE V3.1	Yes	Yes	Yes	Yes	07/31/2009
VSE/ESA V2.7	Yes	Yes	Yes	Yes	02/28/2007
VSE/ESA V2.6	Yes	Yes	Yes	Yes	03/2006
VSE/ESA V2.5	Yes	No	No	No	12/2003
VSE/ESA V2.4	Yes	No	No	No	06/2002
VSE/ESA V2.3	No	No	No	No	12/2001

z/VSE release / Hardware status: http://www-03.ibm.com/systems/z/os/zvse/about/status.html

z Systems exploitation (overview)

- 64 bit real addressing - up to 32 GB (System z), 64 bit virtual addressing – up to 90 GB

- Large page support (z10 and higher)
- Dynamic add / remove of logical CPs (z10 and higher)
- OSA-Express 3, OSA-Express 4, OSA-Express 5S support
- HiperSockets Completion Queue on z196, z114, zEC12, zBC12, z13 (z/VSE 5.1.1 and higher)
- Linux Fast Path (LFP) in z/VM mode LPAR (z10 and higher)
- Exploitation of the z/VSE z/VM IP Assist (zEnterprise, z13)
- zEnterprise and zEnterprise BladeCenter Extension (zBX) support
  - Intra Ensemble Data Network (IEDN)
  - Virtual LAN support, Layer 2 support
  - IEDN communication using the z/VM VSWITCH
- 4096-bit RSA key support with configurable Crypto Express3 (z10, zEnterprise)
  …. and Crypto Express4S (zEC12, zBC12), Crypto Express5S (z13)
- Static power save mode supported for SCRT (z196, zEC12, z13)

- zEC12 / zBC12 / z13 do not support ESCON channels

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 CPs (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                        0       16367       26978   0.606
AR 0015
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
```

TCP/IP Connectivity for z/VSE

- TCP/IP stacks are provided by ISVs

- TCP/IP connectivity for IPv4 communication
  - TCP/IP for VSE – licensed from CSI International
  - IPv6/VSE – licensed from Barnard Software, Inc. (BSI)
  - Linux fast path (LFP)

- TCP/IP connectivity for IPv6 communication
  - IPv6/VSE
  - Linux Fast Path

- All TCP/IP stacks can run concurrently within one z/VSE system

Linux Fast Path (LFP)

- Does not require a TCP/IP stack on z/VSE

- Routes IPv4 or IPv6 socket request from z/VSE applications to Linux on z Systems
- LFP daemon (small program) on Linux forwards the socket request to the Linux TCP/IP stack

- LFP belongs to the z/VSE base product – no additional charge
  - No standard TCP/IP applications (Telnet, FTP, …) provided

- Customer has to provide
  - System resources (IFL, disk space, …)
  - Linux distribution (non-firmware solution)

- Benefits
  - z/VSE customers may
    - save a TCP/IP license
    - better balance system resources (offload CPU cycles to Linux)
    - improve performance for some applications

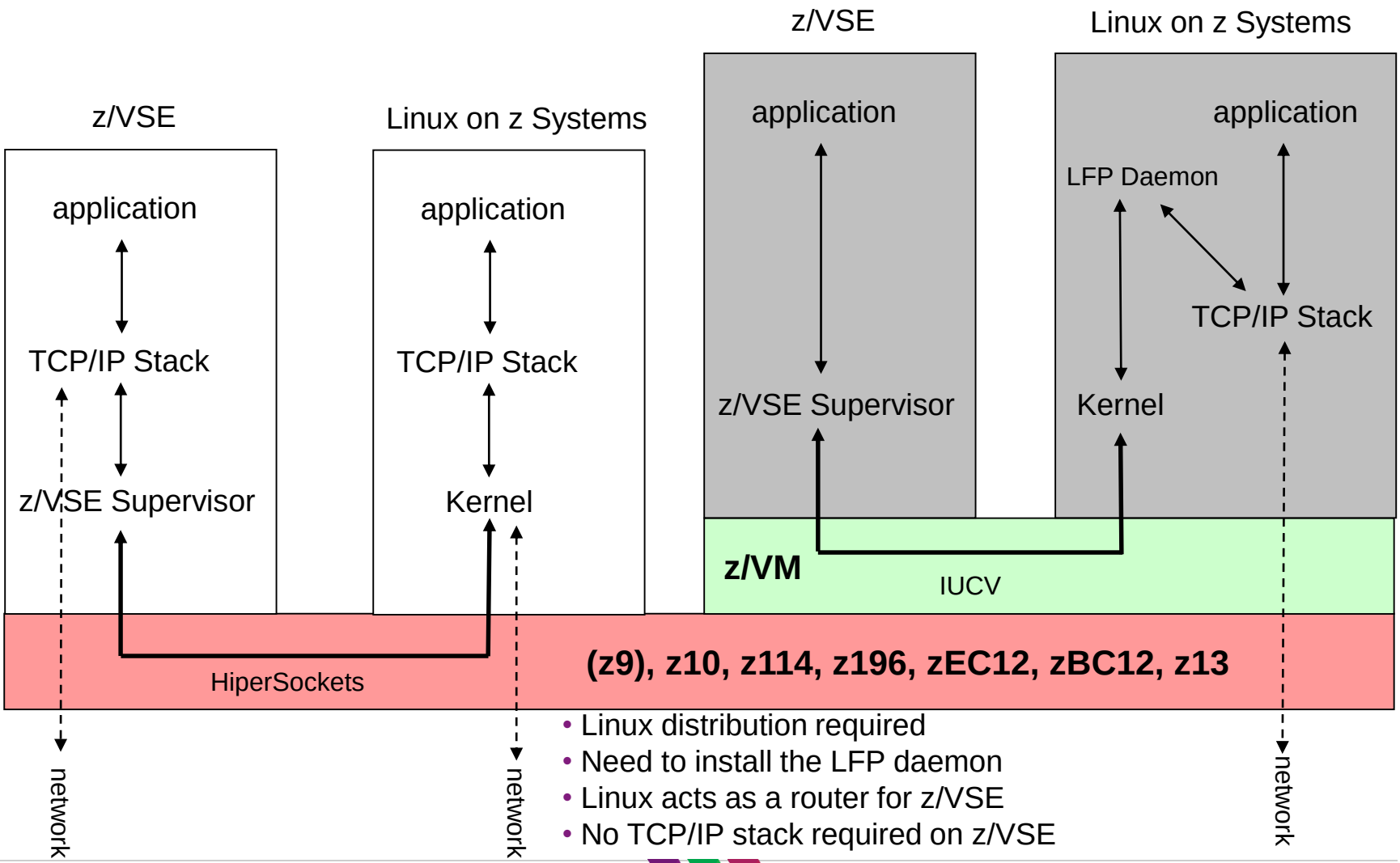
Linux Fast Path (LFP) …

- LFP on z/VM
  - IUCV based communication between z/VSE and Linux on z Systems
  - Both – z/VSE and Linux – need to be z/VM guests of the same z/VM
  - Linux distribution provided by the customer

- LFP using z/VSE z/VM IP Assist (VIA)
  - IUCV based communication between z/VSE and VIA (Linux on z Systems)
  - Both – z/VSE and Linux – need to be z/VM guests of the same z/VM
  - Linux and LFP daemon provided by firmware

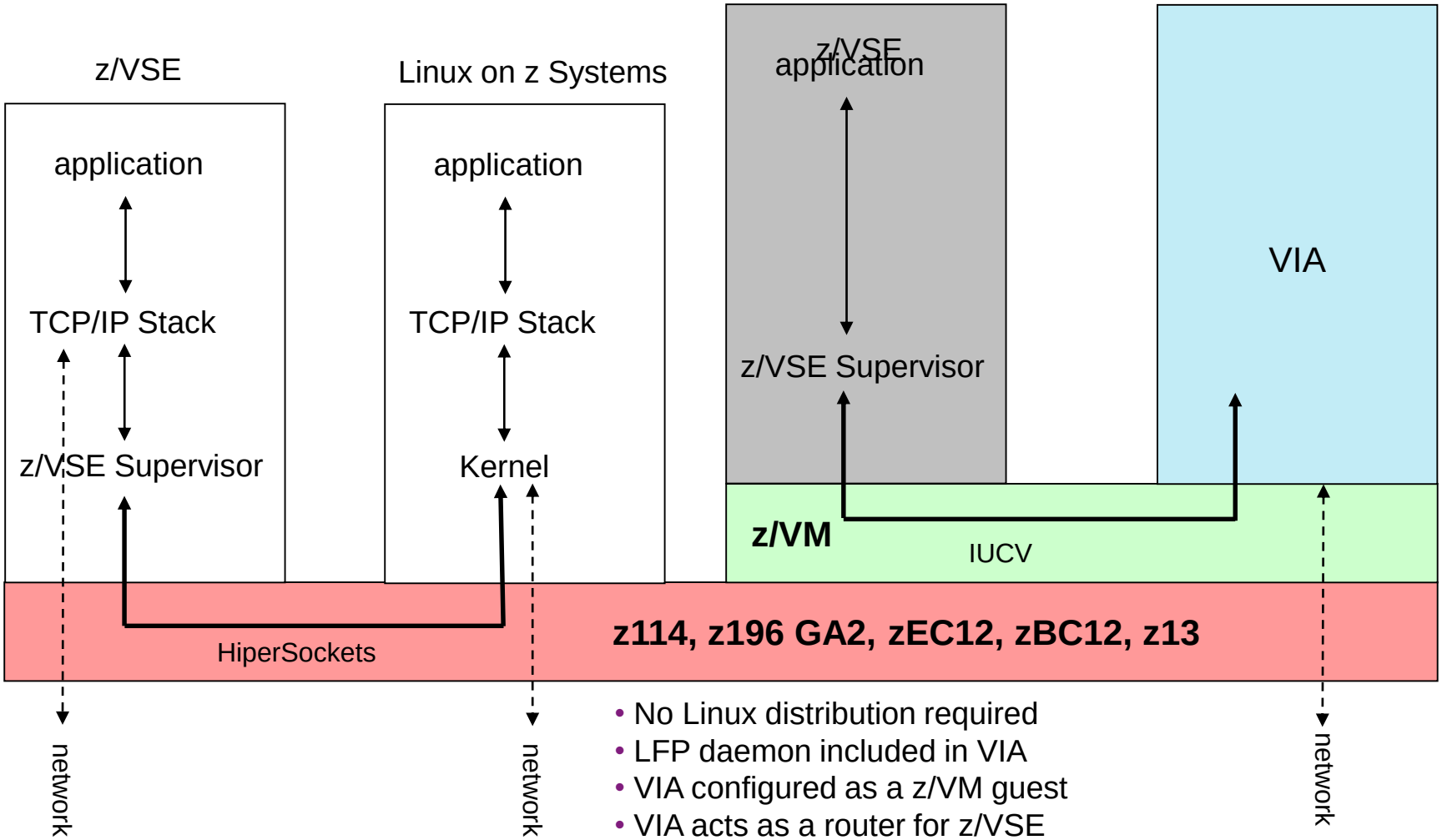
- LFP in LPAR
  - HiperSockets based communication between z/VSE and Linux on z Systems
  - z/VSE and Linux in LPARs
  - Linux distribution provided by the customer

Linux Fast Path (LFP) - Linux Fast Path on z/VM



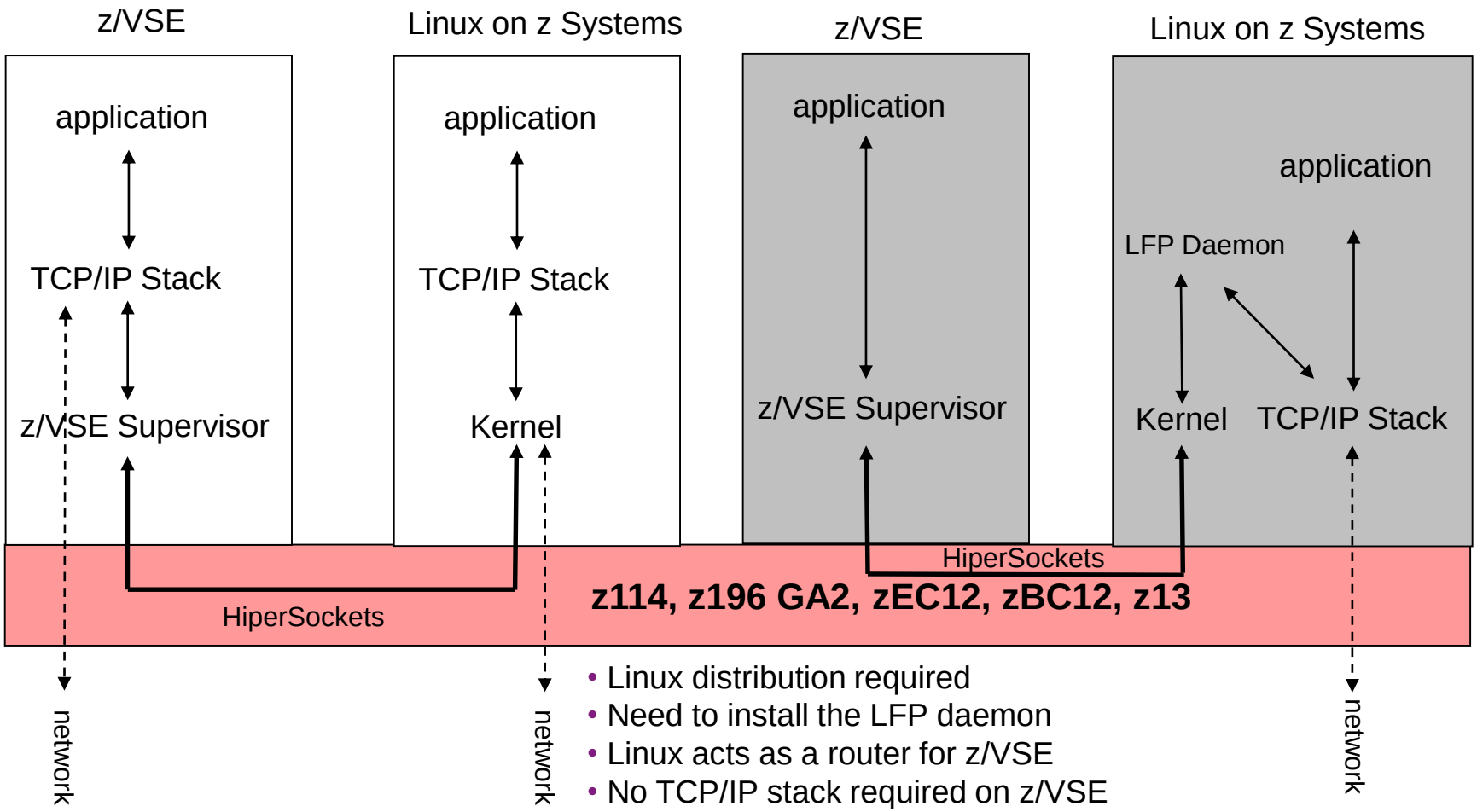
- Linux distribution required
- Need to install the LFP daemon
- Linux acts as a router for z/VSE
- No TCP/IP stack required on z/VSE

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



- No Linux distribution required
- LFP daemon included in VIA
- VIA configured as a z/VM guest
- VIA acts as a router for z/VSE
- No TCP/IP stack required on z/VSE

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



- Linux distribution required
- Need to install the LFP daemon
- Linux acts as a router for z/VSE
- No TCP/IP stack required on z/VSE
- Requires HiperSockets completion queues

64 bit real addressing

- Processor storage support up to 32 GB
- 64 bit real addressing only, introduced with z/VSE 4.1
- z/VSE Version 5
  - Virtual address space > 2 GB
  - 64 bit virtual addressing
- 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)

64 bit virtual

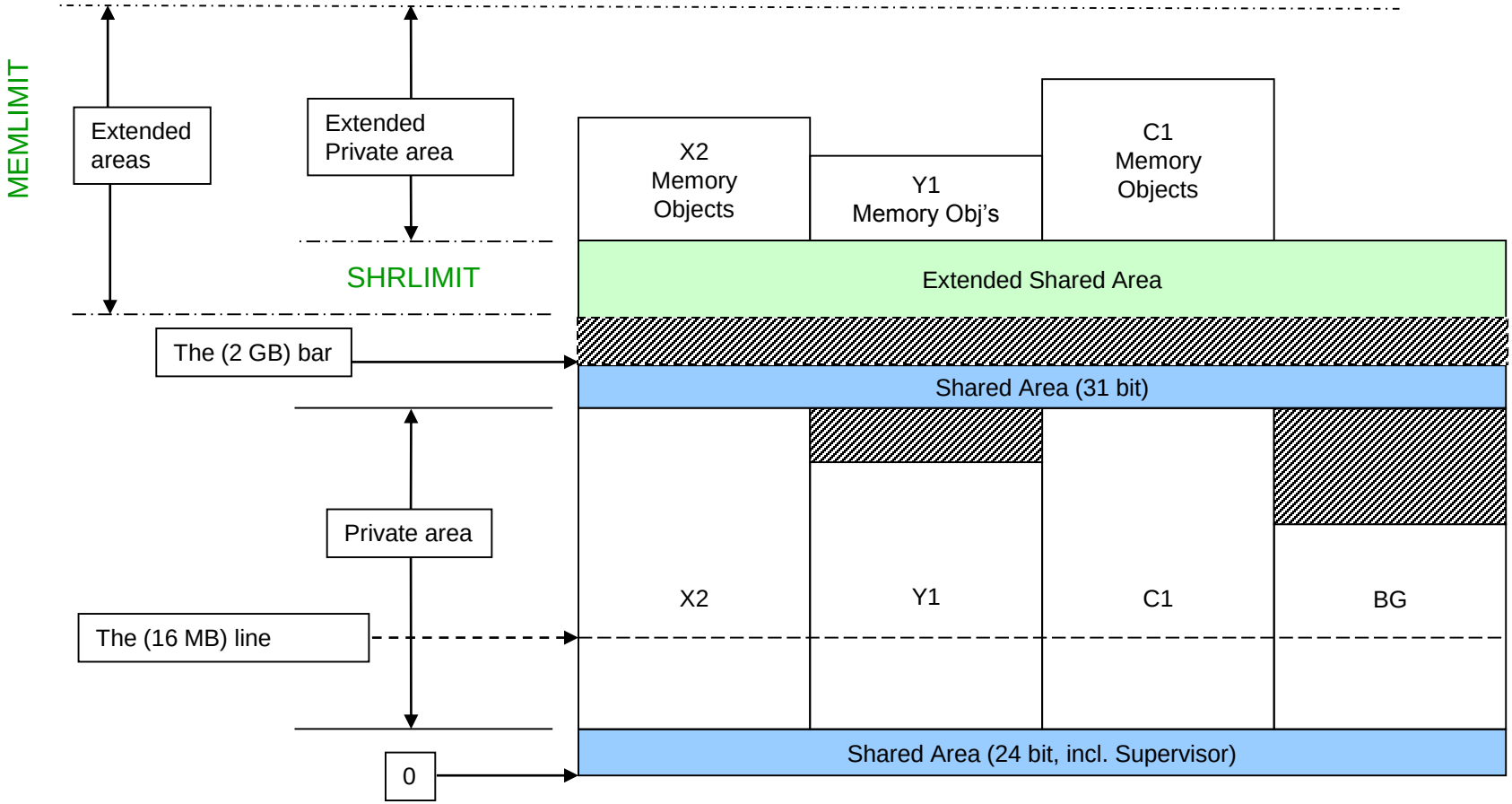
- Support 64 bit virtual addressing
- 64 bit area can be used for **data only**
  - No instruction execution above the bar
- Data space size remains at max. 2 GB

- **z/OS affinity:** APIs (IARV64 services) - to manage memory objects – compatible with z/OS
  - Private memory objects for use in one address space
  - Shared memory objects to be shared among multiple address spaces

- Maximum VSIZE still limited to 90 GB

- Advantages:
  - Eases the access of large amounts of data,
    e.g. instead of using and managing data spaces
  - Reduces complexity of programs
    - Data contained in primary address space
  - Chosen design has no dependencies to existing APIs, minor impact on existing system code

64 bit virtual - address space layout



64 bit virtual I/O for applications

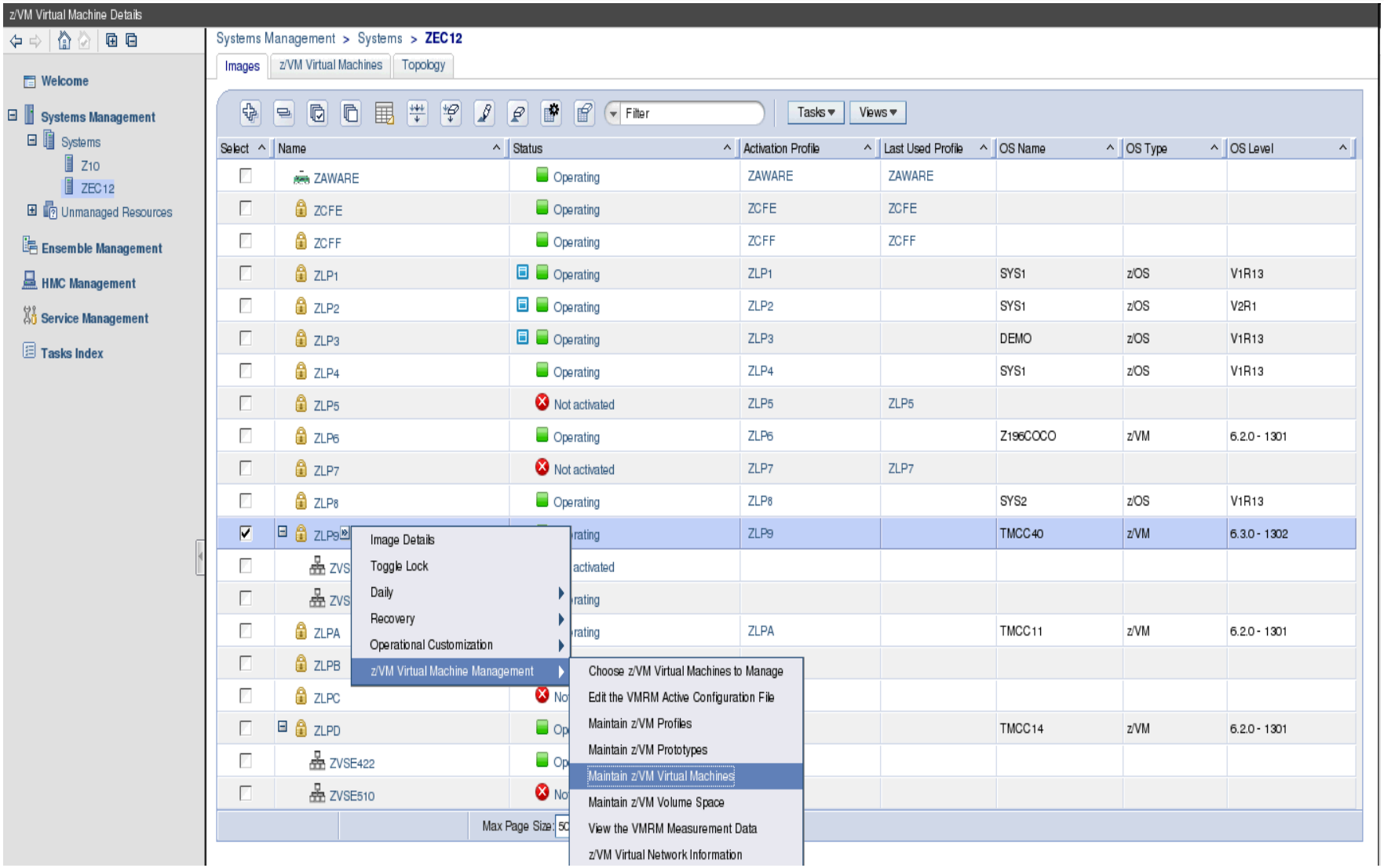
- Available with z/VSE 5.1.2, z/VSE 5.2 and z/VSE 6.1

- I/O buffers
  - Can now be created above the bar (above 2 GB)
  - Supported in **private memory objects** supported only

- Interfaces
  - SYSCOM bit IJBIO64E in IJBIOFL1, if 64 bit virtual I/O support available
  - CCB macro with a new parameter: IDAW=FORMAT2
  - CCB points to a Format-0 or Format-1 CCW
  - CCW with IDA-flag and data address point to a single Format-2 IDAW containing a 64 bit virtual address.
  - I/O control blocks to be allocated below the bar (in 31 bit storage)
  - I/O buffer will be TFIXed by I/O Supervisor, not necessary to PFIX the I/O buffer

- Supported for ECKD devices only
  - Not supported for FBA / SCSI / tape devices, LIOCS

zEnterprise zEC12 / zBC12 zManager (HMC)



zEnterprise zManager zEC12 / zBC12 (HMC)

Virtual Machine Details for ZVSE510 - ZVSE510 [ZEC12:ZLP9:TMCC40]

General | Acceptable Status | **Configuration** | Virtual Network

Memory Size: 2 GB
Share Type: Relative
Share Value: 2000
Number of CPUs: 2

CPU Information

ID	Number	Status
FF11111128278000	0	Base
FF22222228278000	1	Stopped

Device Information

Address	Type
0191	DASD
019D	DASD
019E	DASD
9005	DASD
9006	DASD

Apply | Cancel | Help

View an Existing z/VM Virtual Machine - ZEC12:ZLP9

The virtual machine's directory statements are displayed below.
Click "View Profile" to view a profile.

Virtual Machine Name: ZVSE510

Directory Statements:

```
USER ZVSE510          3G 4G G
  ACCOUNT 3300
  CPU 0 CPUID 111111
  CPU 1 CPUID 222222
  IPL CMS PARM AUTOCR
  LOGONBY PURIT
  MACH ESA 2
  OPTION MAINTCCW CPUID 222222 QUICKDSP MAXCONN 25 TODENABLE
  POSIXINFO UID 12813
*-------------------------------------------
* VSE MACHINE
*-------------------------------------------
```

Add a New z/VM Virtual Machine - ZEC12:ZLP9

Specify the virtual machine name and either select a prototype to add it with or specify the directory statements below.
If you select a prototype, any directory statement data will be ignored.
If you specify directory statements, then the initial password and initial account number may not be specified.
Click "OK" to add the virtual machine.
Click "View Prototype..." to view the selected prototype.
Click "View Profile..." to view a profile.

Virtual Machine Name: test
Virtual Machine Prototype Name: Select a prototype below
Initial Password:
Initial Password (verify):
Initial Account Number:

Select a prototype below
CMS
LINUX
ZVSE

ectory Statements:

```
USER ZVSETEST
```

Change an Existing z/VM Virtual Machine - ZEC12:ZLP9

Change the existing virtual machine's directory statements below.
Click "OK" to change the virtual machine.
Click "View Profile..." to view a profile.

Virtual Machine Name: ZVSE510

Directory Statements:

```
USER ZVSE510          3G 4G G
  ACCOUNT 3300
  CPU 0 CPUID 1
  CPU 1 CPUID 222222
  IPL CMS PARM AUTOCR
  LOGONBY PURIT
  MACH ESA 2
  OPTION MAINTCCW CPUID 222222 QUICKDSP MAXCONN 25 TODENABLE
  POSIXINFO UID 12813
*-------------------------------------------
* VSE MACHINE change comment for test!!
*-------------------------------------------
```

z Systems FICON / OSA-Express support

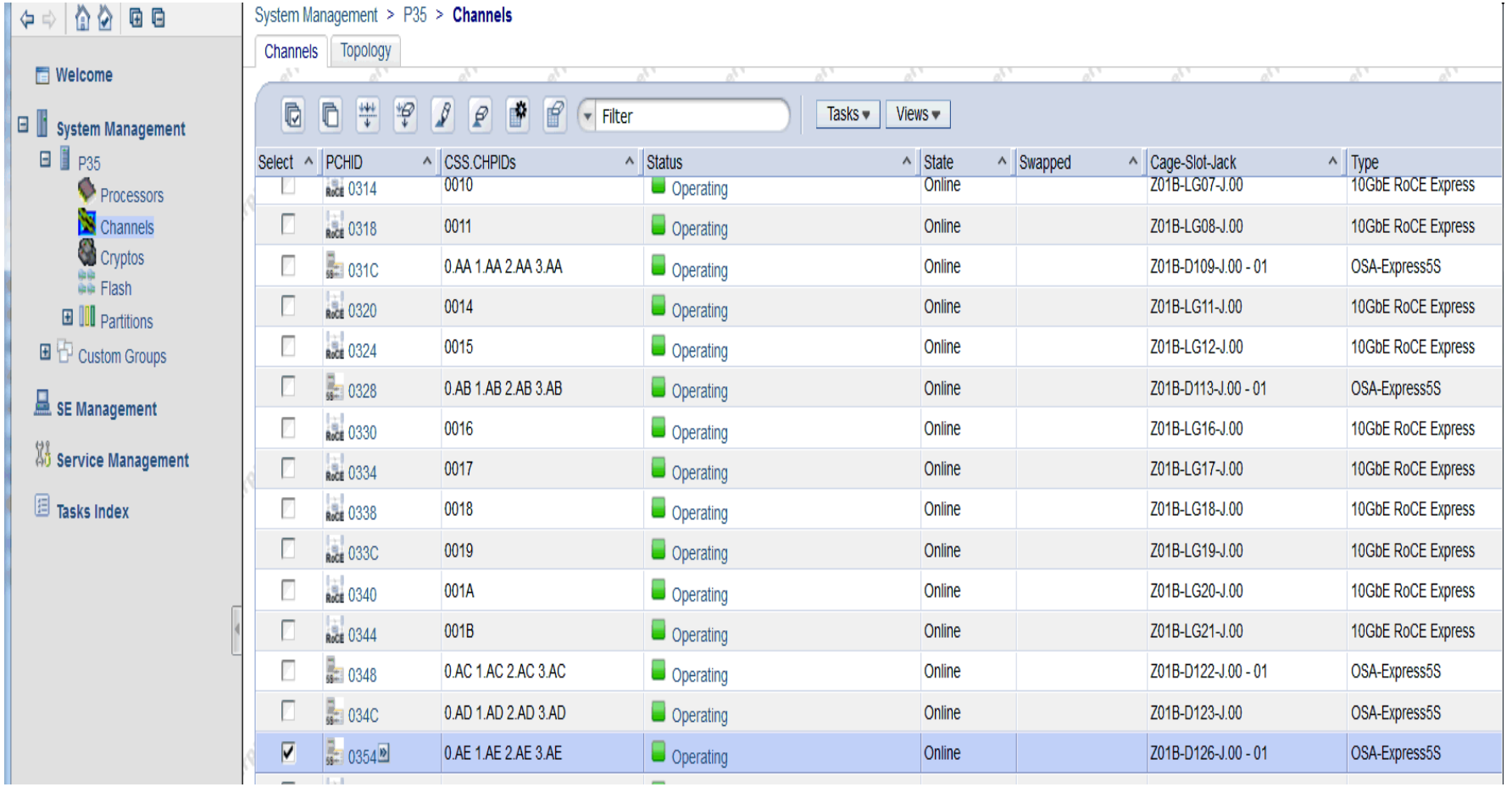
- FICON Express8 / FICON Express16S (z13) - Higher I/O bandwidth
- Adapter interruptions (performance improvements)
  - OSA-Express3 / OSA-Express4S / OSA-Express5S (QDIO mode)
  - FICON Express8 / FICON Express8S / FICON Express16S (FCP)

- 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, zBC12
  - OSA-Express4S on z114, z196 and zEC12, zBC12
  - OSA-Express5S on zEC12, zBC12, z13
- OSA-Express for non-QDIO environments (CHPID type OSE)
  - SNA and passthru traffic require configuration via OSA/SF
    - OSA-Express4S / OSA-Express5S on HMC
- 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
- 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

OSA-Express Support on zEC12 / zBC12 HMC



Select	PCHID	CSS.CHPIDs	Status	State	Swapped	Cage-Slot-Jack	Type
	0314	0010	Operating	Online		Z01B-LG07-J.00	10GbE RoCE Express
	0318	0011	Operating	Online		Z01B-LG08-J.00	10GbE RoCE Express
	031C	0.AA 1.AA 2.AA 3.AA	Operating	Online		Z01B-D109-J.00 - 01	OSA-Express5S
	0320	0014	Operating	Online		Z01B-LG11-J.00	10GbE RoCE Express
	0324	0015	Operating	Online		Z01B-LG12-J.00	10GbE RoCE Express
	0328	0.AB 1.AB 2.AB 3.AB	Operating	Online		Z01B-D113-J.00 - 01	OSA-Express5S
	0330	0016	Operating	Online		Z01B-LG16-J.00	10GbE RoCE Express
	0334	0017	Operating	Online		Z01B-LG17-J.00	10GbE RoCE Express
	0338	0018	Operating	Online		Z01B-LG18-J.00	10GbE RoCE Express
	033C	0019	Operating	Online		Z01B-LG19-J.00	10GbE RoCE Express
	0340	001A	Operating	Online		Z01B-LG20-J.00	10GbE RoCE Express
	0344	001B	Operating	Online		Z01B-LG21-J.00	10GbE RoCE Express
	0348	0.AC 1.AC 2.AC 3.AC	Operating	Online		Z01B-D122-J.00 - 01	OSA-Express5S
	034C	0.AD 1.AD 2.AD 3.AD	Operating	Online		Z01B-D123-J.00	OSA-Express5S
✓	0354	0.AE 1.AE 2.AE 3.AE	Operating	Online		Z01B-D126-J.00 - 01	OSA-Express5S

OSA/SF Support on zEC12 / zBC12 HMC

Advanced Facilities - PCHID0354

Channel ID: 0354
Channel type: OSE for non-QDIO
Card description: OSA-Express5S 1000BASE-T Ethernet
Select a function and click "OK".

- View code level
- Card trace/log/dump facilities...
- Card specific advanced facilities...
- Reset to defaults...

OK Cancel

Advanced Facilities - PCHID0354

Channel ID: 0354
LAN port type: 1000Base-T Ethernet
Select a function and click "OK".

- Query port status...
- View port parameters...
- Display or alter MAC address...
- Enable or disable ports...
- Run port diagnostics
- Set card mode...
- Panel configuration options...
- Manual configuration options...
- Activate configuration
- Display activate configuration errors...
- Display OAT entries...

OK Cancel

Edit OSA Address Table (OAT) Entries - PCHID0354

Channel ID:0354 LAN port type:OSE

--- Select Action --- Filter

Select	CSS	IID	Unit Address	Device Number	LPAR Name	Port Number	Session Type	IP Address	Router Indicator
◉	00	01	00, 01	0580, 0581	R35LP01	0	TCPIP	NONE	NONE
○	00	01	02, 03	0582, 0583	R35LP01	1	TCPIP	NONE	NONE
○	00	02	00, 01	0580, 0581	R35LP02	0	TCPIP	NONE	NONE
○	00	02	02, 03	0582, 0583	R35LP02	1	TCPIP	NONE	NONE
○	00	03	00, 01	0580, 0581	R35LP03	0	TCPIP	NONE	NONE
○	00	03	02, 03	0582, 0583	R35LP03	1	TCPIP	NONE	NONE
○	00	04	00, 01	0580, 0581	R35LP04	0	TCPIP	NONE	NONE
○	00	04	02, 03	0582, 0583	R35LP04	1	TCPIP	NONE	NONE
○	00	05	00, 01	0580, 0581	R35LP05	0	TCPIP	NONE	NONE
○	00	05	02, 03	0582, 0583	R35LP05	1	TCPIP	NONE	NONE
○	00	06	00, 01	0580, 0581	R35LP06	0	TCPIP	NONE	NONE
○	00	06	02, 03	0582, 0583	R35LP06	1	TCPIP	NONE	NONE

z Systems 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 z Systems
  - z/OS
  - z/VM
  - z/VSE V4 and higher
- Virtual HiperSockets via z/VM Guest LAN support
- HiperSockets Completion Queue (z/VSE V5, z/VSE 6.1)

HiperSockets configurable input buffers

- Available as APAR DY47394 (z/VSE 5.1)
- QDIO input queue buffers were set to 8 before
- More QDIO input buffers can improve performance
- In z/VSE you may increase the number of buffers to up to 64
- With a new configuration option you may select 8 (default), 16, 32 or 64 in the configuration file (IJBOCONF.PHASE)
- QDIO input buffers are allocated in 31 bit partition GETVIS space
- The buffers are to be PFIXed.
  - The limit for PFIX storage has to be defined with the JCL SETPFIX command
- QDIO input buffers are available for HiperSockets and OSA Express (CHPID OSD)

z Systems 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 / Express5S – 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)
  - z13: Crypto Express5S support (z/VSE V5 + PTF)
    - More than 16 domain support: APAR DY47586
  - 2048-bit RSA key with Crypto Express2
  - 4096-bit RSA key support with configurable Crypto Express3 / Crypto Express4S / 5S
  - 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 / TS1140 Tape Drive
- IBM System Storage TS7700 / TS7720 Virtualization Engine
  - Copy Export function of TS7700 Virtualization Engine for disaster recovery
  - Multi-Cluster Grid support of the TS7700 Virtualization Engine Series
- IBM System Storage TS3400 autoloader Tape Library
- IBM System Storage TS3500 Tape Library

- zVSE supports the 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 / TS1140
  - z/VSE support requires a 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 the encryption key manager 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) for TS1120 and TS1130
  - 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 cardridge.
  - You may download EKM from the internet

- Encryption Key manager for TS1140
  - Requires the product IBM Security Key Lifecycle Manager (SKLM) V2.5

Data Encryption …

- 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 =
      - 03 encryption wirte mode
      - 0B encryption and IDRC write mode
      - 23 encryption and unbuffered (compression) write mode
      - 2B encryption and IDRC and unbuffered write mode

- KEKL statement
  - // KEKL UNIT=cuu,KEKL1=key_label_1,KEM={L|H}
    - KEM = key encoding mechanism
      - 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
      - BIG-3390 in LISTCAT
      - Support of up to 10017 cylinders
    - **Fat DASD**: up to 64k cylinders
      - FAT-3390 in LISTCAT
      - 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 series
- 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

SCSI Support in z/VSE

- FCP-attached SCSI disk support (IBM System Storage)
  - DS8000, DS6000 and ESS series
  - 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
  - IBM Storwize V5000 Midrange Disk
  - IBM Storwize V3700 Entry Disk
  - IBM FlashSystem V900 for use with FCP-attached SCSI disks.

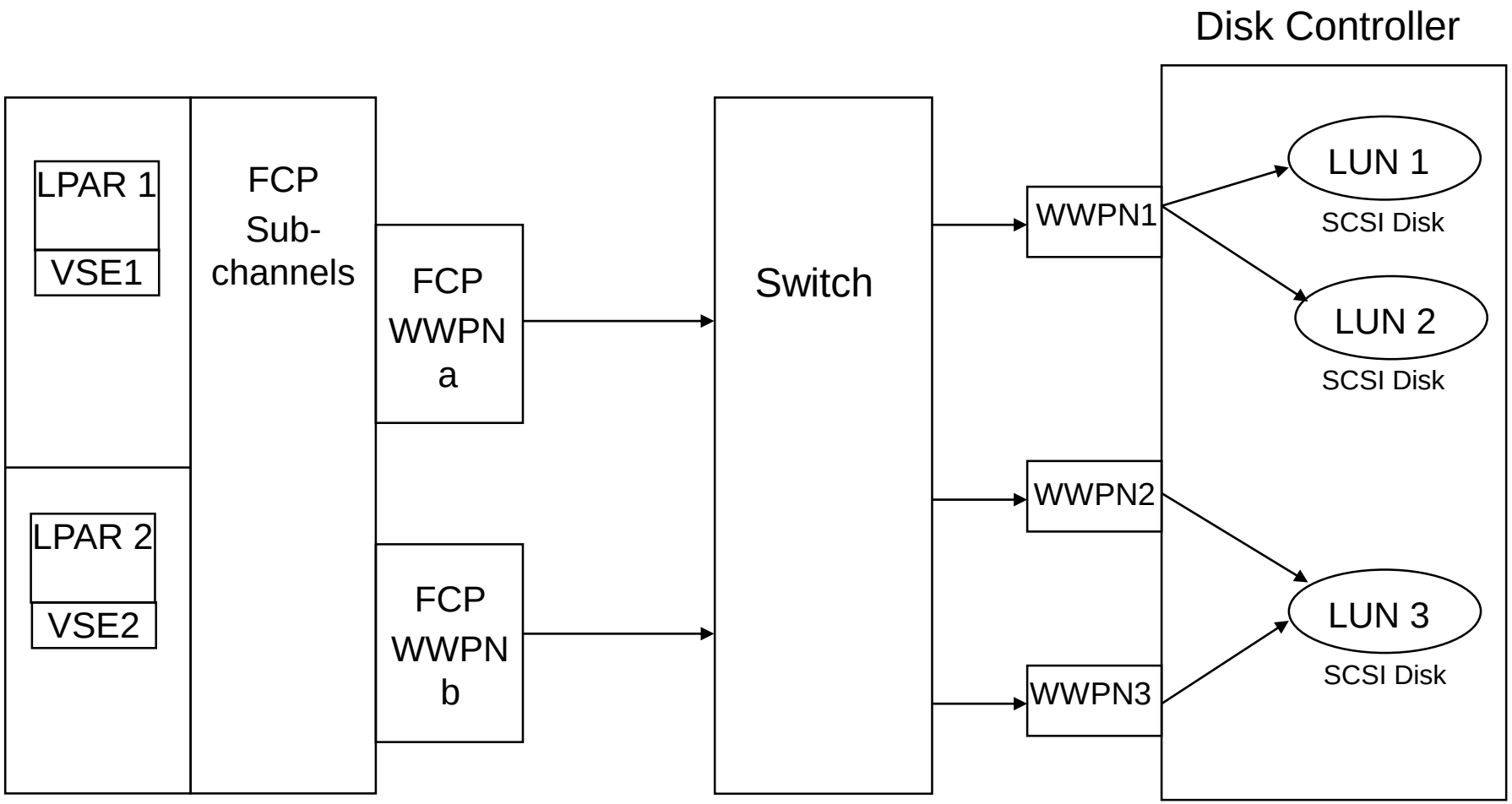
SCSI Support in z/VSE

- 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

- Hints and Tips for z/VSE V5:
  - http://www.ibm.com/systems/z/os/zvse/documentation/#hints

- 64 bit virtual information:
  - IBM z/VSE Extended Addressability, IBM z/VSE System Macro Reference

- CICS Explorer: http://www.ibm.com/software/htp/cics/explorer/

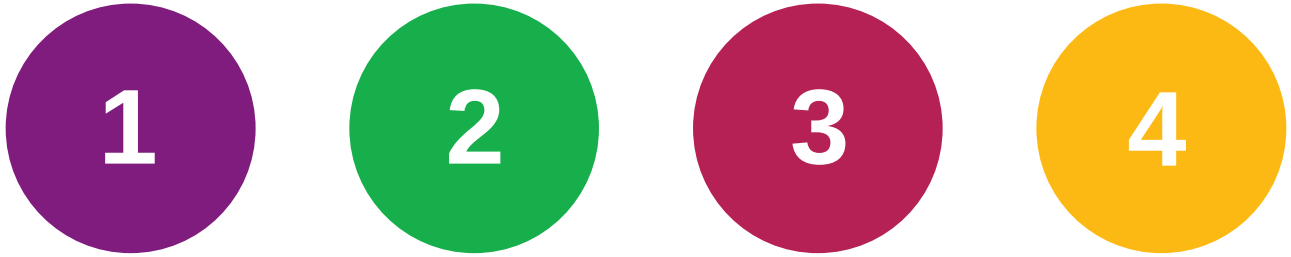
- IBM Redbooks:
  - Introduction to the New Mainframe: z/VSE Basics
    http://www.redbooks.ibm.com/abstracts/sg247436.html?Open
  - Security on IBM z/VSE – updated
    http://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/sg247691.html?Open
  - z/VSE Using DB2 on Linux for System z
    http://www.redbooks.ibm.com/abstracts/sg247690.html?Open
  - New: Enhanced Networking on IBM z/VSE
    http://www.redbooks.ibm.com/Redbooks.nsf/RedpieceAbstracts/sg248091.html?Open

- Please contact z/VSE: https://www-03.ibm.com/systems/z/os/zvse/contact/contact.html
  or me – Ingolf Salm – salm@de.ibm.com – for any questions

Questions ?

Session Evaluations

YOUR OPINION MATTERS!



Submit four or more session evaluations by 5:30pm Wednesday to be eligible for drawings!

*Winners will be notified Thursday morning. Prizes must be picked up at registration desk, during operating hours, by the conclusion of the event.

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