z/VSE Exploitation of IBM z Systems and IBM Storage

Ingolf Salm - salm@de.ibm.com

z/VSE 6.1

http://www.ibm.com/zVSE

http://twitter.com/IBMzVSE

http://www.ibm.com/developerworks/mydeveloperworks/blogs/vse/

Trademarks

The following are trademarks of the International Business Machines Corporation in the United States, other countries, or both.

Not all common law marks used by IBM are listed on this page. Failure of a mark to appear does not mean that IBM does not use the mark nor does it mean that the product is not actively marketed or is not significant within its relevant market.

Those trademarks followed by ® are registered trademarks of IBM in the United States; all others are trademarks or common law marks of IBM in the United States.

For a complete list of IBM Trademarks, see www.ibm.com/legal/copytrade.shtml:

*, AS/400®, e business(logo)®, DBE, ESCO, eServer, FICON, IBM®, IBM (logo)®, iSeries®, MVS, OS/390®, pSeries®, RS/6000®, S/30, VM/ESA®, VSE/ESA, WebSphere®, xSeries®, z/OS®, zSeries®, z/VM®, System i, System i5, System p, System p5, System x, System z, System z9®, BladeCenter®

The following are trademarks or registered trademarks of other companies.

Adobe, the Adobe logo, PostScript, and the PostScript logo are either registered trademarks or trademarks of Adobe Systems Incorporated in the United States, and/or other countries.
Cell Broadband Engine is a trademark of Sony Computer Entertainment, Inc. in the United States, other countries, or both and is used under license therefrom.
Java and all Java-based trademarks are trademarks of Sun Microsystems, Inc. in the United States, other countries, or both.
Microsoft, Windows, Windows NT, and the Windows logo are trademarks of Microsoft Corporation in the United States, other countries, or both.
Intel, Intel logo, Intel Inside, Intel Inside logo, Intel Centrino, Intel Centrino logo, Celeron, Intel Xeon, Intel SpeedStep, Itanium, and Pentium are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries.
UNIX is a registered trademark of The Open Group in the United States and other countries.
Linux is a registered trademark of Linus Torvalds in the United States, other countries, or both.
ITIL is a registered trademark, and a registered community trademark of the Office of Government Commerce, and is registered in the U.S. Patent and Trademark Office.
IT Infrastructure Library is a registered trademark of the Central Computer and Telecommunications Agency, which is now part of the Office of Government Commerce.

* All other products may be trademarks or registered trademarks of their respective companies.

Notes:

Performance is in Internal Throughput Rate (ITR) ratio based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput improvements equivalent to the performance ratios stated here.

IBM hardware products are manufactured from new parts, or new and serviceable used parts. Regardless, our warranty terms apply.

All customer examples cited or described in this presentation are presented as illustrations of the manner in which some customers have used IBM products and the results they may have achieved. Actual environmental costs and performance characteristics will vary depending on individual customer configurations and conditions.

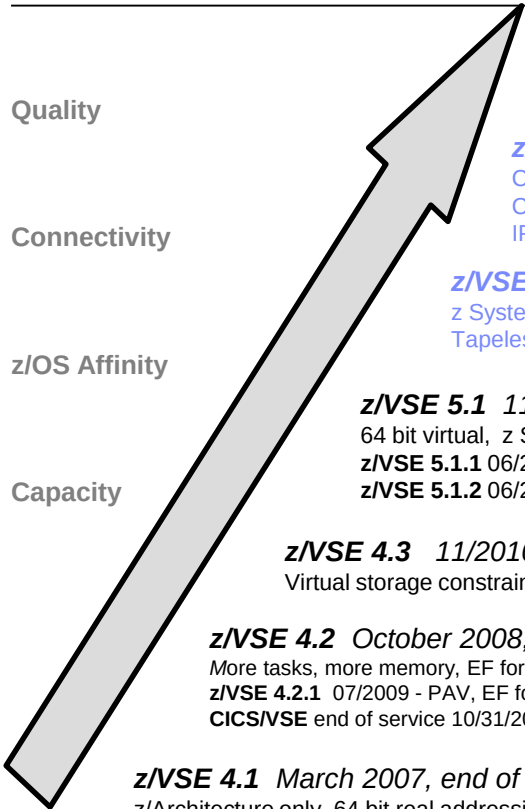
This publication was produced in the United States. IBM may not offer the products, services or features discussed in this document in other countries, and the information may be subject to change without notice. Consult your local IBM business contact for information on the product or services available in your area.

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

Information about non-IBM products is obtained from the manufacturers of those products or their published announcements. IBM has not tested those products and cannot confirm the performance, compatibility, or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

Prices subject to change without notice. Contact your IBM representative or Business Partner for the most current pricing in your geography.

z/VSE Roadmap



z/VSE announcement: 04/2016 & 07/2016
z13s support, z/VSE Network Appliance,
SODs: z114 / z196 or higher, CICS TS for z/VSE 2.2

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*
z Systems exploitation, z9 or higher, device support,
Tapeless installation, networking / security enhancements

z/VSE 5.1 *11/2011, end of service 06/30/2016*
64 bit virtual, z Systems 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 6.1 Overview

- Preview: May 11, 2015, GA ann.: 10/05/2015, GA 11/27/2015, RSL with cutoff June 30, 2016

- Hardware support
  - Architectural Level Set to IBM System z10 or later
  - IBM z13 / z13s support
    - Configurable Crypto Express5S
      - More than 16 cypto domain support
    - FICON Express16S for ECKD, channel to channel or FCP-attached SCSI
    - z/VSE Network Appliance, available since June 30, 2016
  - IBM System Storage options
    - (Virtual) tape solutions
      - IBM TS7700 Virtualization Engine Release 4.0
      - IBM TS7760
    - Disk solutions
      - IBM System Storage DS8870 Release 7.5, DS8880 (DS8884, DS8886, DS8888)
        - As ECKD and FCP-attached SCSI disks
      - IBM FlashSystem V9000 for use with FCP-attached SCSI disks.

z/VSE 6.1 Overview …

- New CICS version: CICS TS for z/VSE 2.1 - fullfills Statement of Direction (SOD)
- 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
- Statement 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/VSE Version 6 announcement – what will be next ?

- Announced April 12, 2016
- Support of IBM z13s
  - Configurable Crypto Express5S
  - FICON Express16S
  - z/VSE Network Appliance (available since June 30, 2016)
- Support of IBM System Storage DS8880 (ECKD and FCP-attached SCSI devices)
- Migration Pricing Option (MPO) for
  - z/VSE 6.1
  - CICS TS for z/VSE 2.1
  - IBM TCP/IP for z/VSE 2.1
  - See http://www-03.ibm.com/systems/z/os/zvse/howtobuy/mpo.html

z/VSE Version 6 announcement – Statement of general direction (SOD)

- High Performance FICON (zHPF)
- Install from DVD stage 2 (FBA / SCSI)
- CICS TS for z/VSE enhancements
  - CICS Explorer enhancements (define programs, files, etc.)
  - Channels & containers enhancements
- Enhancements related to CICS TS for z/VSE – web services
  - z/VSE SOAP engine to exploit Channels and Containers
  - new z/VSE Representational State Transfer (REST) engine with JSON support
- Security enhancements
  - Basic Security Manager (BSM) enhancement
    - IUI dialog for batch resources (DTSECTAB security)
- Product delivery of z/VSE on DVD and electronically only for future z/VSE
- More information is here:
  - https://www.ibm.com/developerworks/community/blogs/vse/entry/New_announcement_for_z_VSE_Version_6_What_will_be_next?lang=en

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

Latest z/VSE 6.1 announcement

- Announced July 19, 2016, available July 22, 2016
- General Print Server (GPS) feature for IBM TCP/IP for z/VSE 2.1
  - Requires license and license key to use it
  - Application Pak license required
- Availability of z/VSE Network Appliance for z13 and z13s servers
- IBM Storage options
  - IBM TS7700 R4.0
  - IBM TS7760
  - IBM TS8880 (TS8884, TS8886, TS8888)
- Statement of general direction (SOD)
  - Stabilization of z/VSE support for the IBM System z10® server family: z/VSE V6.1 is the last z/VSE release planned to support the IBM System z10 server family of servers.

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

z Systems server support

- z/VSE V5 supports IBM System z9 (z9 EC, z9 BC)
- z/VSE V5 and V6.1 support IBM z Systems servers:
  - IBM z13, IBM z13s
  - 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 / V6 can run in an LPAR or as a z/VM guest on all supported z/VM releases
  ... in uni- or multiprocessor mode

- IBM eServer zSeries z890 Server **end of service** October 31, 2016
  http://www-01.ibm.com/common/ssi/printableversion.wss?docURL=/common/ssi/rep_sm/1/897/ENUS2086-_h01/index.html
- zBC12 / zEC12 **end of marketing** announcement
  http://www-01.ibm.com/common/ssi/cgi-bin/ssialias?infotype=AN&subtype=CA&htmlfid=897/ENUS916-037&appname=USN

- Statement of general direction (SOD)
  - z/VSE 6.1 last release planned to support **z10 server** family of servers
  - z13 will be the last z Systems server to support running an operating system in **ESA/390 architecture mode**
    - all 24-bit and 31-bit problemstate application programs originally written to run on the ESA/390 architecture will be unaffected by this change. See z13 announcement January 2015: http://www-01.ibm.com/common/ssi/cgi-bin/ssialias?infotype=an&subtype=ca&appname=gpateam&supplier=897&letternum=ENUS115-001

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

z/VM support

- z/VM V5.4
  - z/VM 5.4 withdrawn from service December 31, 2017
    https://www-01.ibm.com/common/ssi/cgi-bin/ssialias?infotype=AN&subtype=CA&htmlfid=897/ENUS916-121&appname=USN
  - Operates on z800 / z900 or higher, up to zBC12 / zEC12, not supported on z13 / z13s

- z/VM 6.2 - End of service June 30, 2017
  - Supports z10 or higher

- z/VM 6.3 - End of service December 31, 2017
  - SOD: Last release planned to support z10 server family of servers

- z/VM 6.4 preview
  - GA planned for 4Q2016
  - Architectural Level Set (ALS) to z114 / z196
  - http://www-01.ibm.com/common/ssi/ShowDoc.wss?docURL=/common/ssi/rep_ca/9/897/ENUS216-009/index.html&lang=en&request_locale=en

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

z Systems support

VSE Release	z800 / z900 z890 / z990	z9	z10	z196 / z114 / zEC12 zBC12 / z13 / z13s	VSE EoM	VSE EoS
Future (SOD)	No	No	No	Yes	tbd	tbd
z/VSE V6.1	No	No	Yes	Yes	tbd	tbd
z/VSE V5.2	No	Yes	Yes	Yes	03/13/2017	tbd
z/VSE V5.1	No	Yes	Yes	Yes	05/23/2014	06/30/2016
z/VSE V4.3	Yes	Yes	Yes	Yes	06/25/2012	10/31/2014
z/VSE V4.2	Yes	Yes	Yes	Yes	10/26/2010	10/31/2012
z/VSE V4.1	Yes	Yes	Yes	Yes	10/17/2008	04/30/2011
z/VSE V3.1	Yes	Yes	Yes	Yes	05/31/2008	07/31/2009
VSE/ESA V2.7	Yes	Yes	Yes	Yes	09/30/2005	02/28/2007
VSE/ESA V2.6	Yes	Yes	Yes	Yes	03/14/2003	03/31/2006

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

z/VSE on IBM z13 & z13s

- IBM z13 & z13s Toleration / Exploitation:
  - At GA toleration PTFs for z/VSE 5.1, 5.2, 6.1 were delivered
    see z13 PSP: http://www-01.ibm.com/support/docview.wss?uid=isg1_2964DEVICE_2964-ZVSE
    see z13s PSP: http://www-01.ibm.com/support/docview.wss?uid=isg1_2965DEVICE_2965-ZVSE
  - z/VSE
    - can run in more LPARs (85)
    - supports new Crypto Express5S in coprocessor and accelerator mode
      - supports more than 16 domains with the new Crypto Express5S
    - supports new FICON Express16S
      - ECKD and FCP-attached SCSI disks
    - supports newest version of SCRT
    - exploits z Appliance Container Infrastructure (zACI)

z Systems exploitation (overview)

- 64 bit real addressing - up to 32 GB, 64 bit virtual addressing – up to 90 GB
- Large page support (z10 and higher)
- Dynamic add / remove of logical CPs (z10 and higher)
- Network: OSA-Express 3, OSA-Express 4, OSA-Express 5S support
- Crypto: 4096-bit RSA key support with configurable Crypto Express3 (z10, z196. z114)
  - … and Crypto Express4S (zEC12, zBC12), Crypto Express5S (z13, z13s)
- Exploitation with Linux Fast Path (LFP)
  - HiperSockets Completion Queue on z196, z114 and higher (LFP in LPAR)
  - in z/VM mode LPAR (z10 and higher)
  - z/VSE z/VM IP Assist (z196, z114 and higher)
  - z Appliance Container Infrastructure (zACI – z13, z13s)
    - z/VSE Network Appliance (zACI) – GAed on June 30, 2016
- z Systems and zEnterprise BladeCenter Extension (zBX) support
  - Intra Ensemble Data Network (IEDN) communication using the z/VM VSWITCH
  - Virtual LAN support, Layer 2 support
- Static power save mode supported for SCRT (z196, zEC12, z13)
- I/O: FICON Express8 / FICON Express16S (z13, z13s)
- zEC12 / zBC12 / z13 / z13s do not support ESCON channels

IBM z Systems exploitation

- Following functions are not supported in z/VM guests:
- **Large page** (1 megabyte page) support for data spaces (z10 and higher)
  - Better exploitation of large processor storage, may improve performance
  - No configuration options required
  - Transparent to applications
- **Dynamic add of logical CPs** (z10 and higher)
  - 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 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
  - IBM TCP/IP for z/VSE – licensed from CSI International
  - IBM IPv6/VSE – licensed from Barnard Software, Inc. (BSI)
  - Linux fast path (LFP)

- TCP/IP connectivity for IPv6 communication
  - IBM 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) …

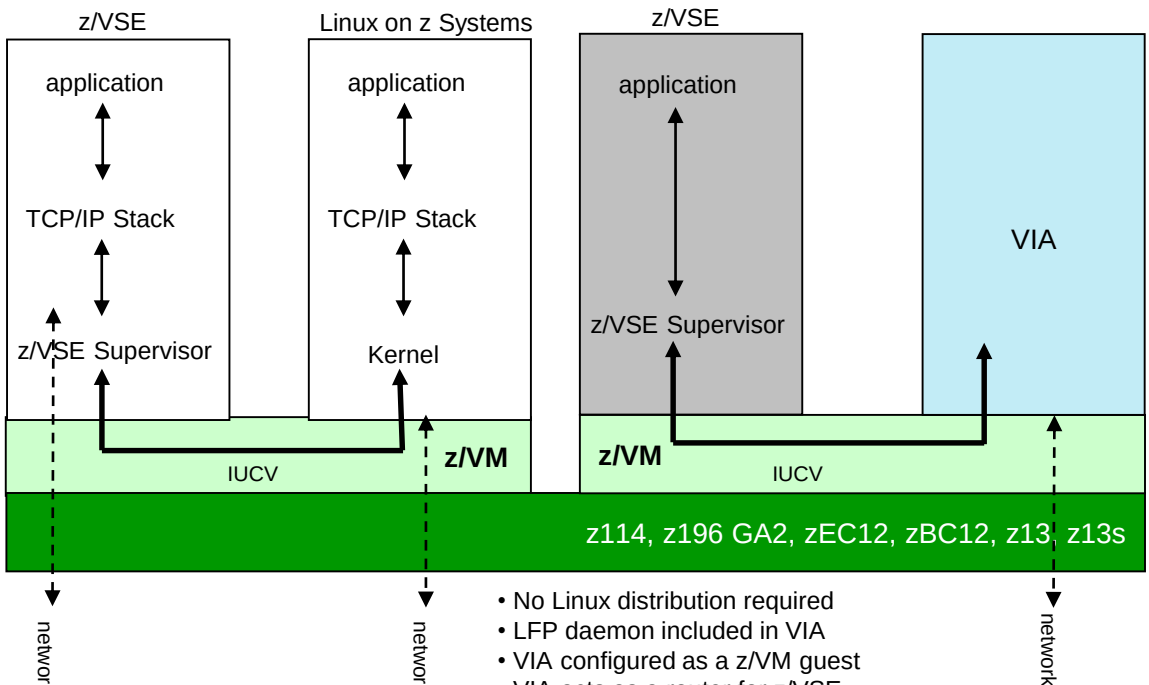
- LFP on z/VM
  - IUCV based communication between z/VSE and Linux on z Systems
  - Both – z/VSE and Linux – need to be z/VM guests of the same z/VM
  - Linux distribution provided by the customer

- LFP using z/VSE z/VM IP Assist (VIA)
  - IUCV based communication between z/VSE and VIA appliance
  - Both – z/VSE and the VIA appliance – need to be z/VM guests of the same z/VM
  - VIA appliance 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

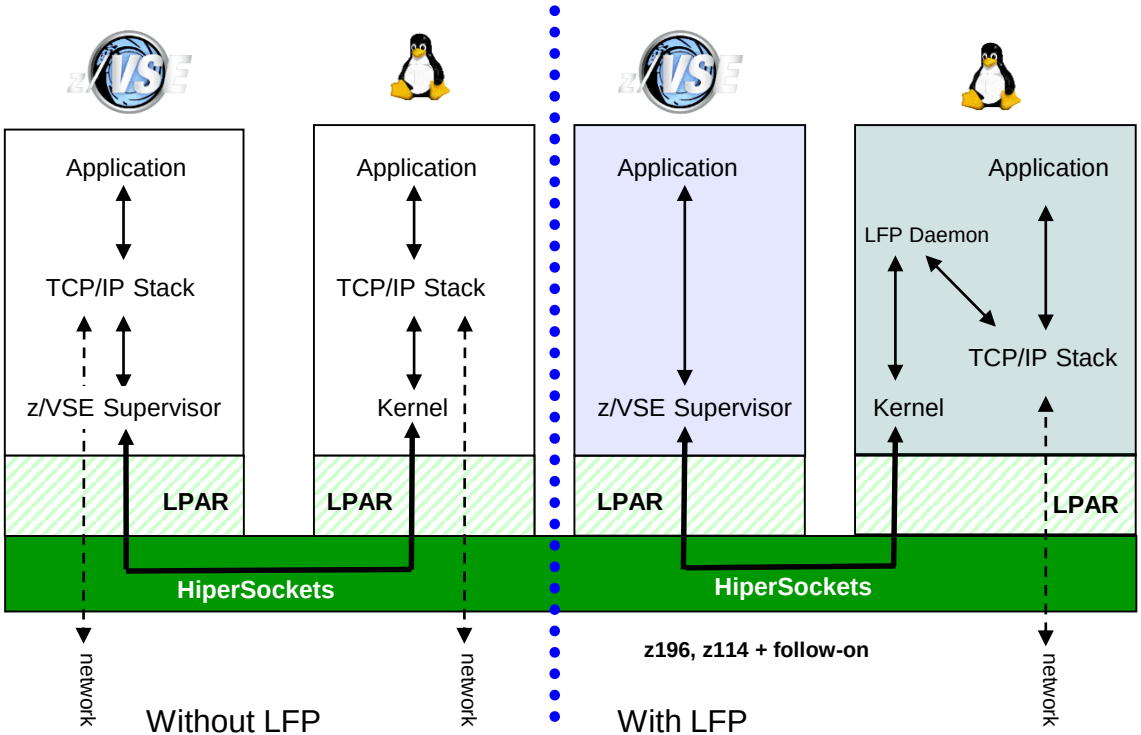
- LFP using z/VSE Network Appliance (VNA) – available since June 30, 2016
  - HiperSockets based communication between z/VSE and VNA
  - z/VSE and VNA in LPARs

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



Linux Fast Path in LPAR - z/VSE V5 and V6

Faster communication between z/VSE and Linux applications under z/VM



z/VSE Network Appliance (VNA)

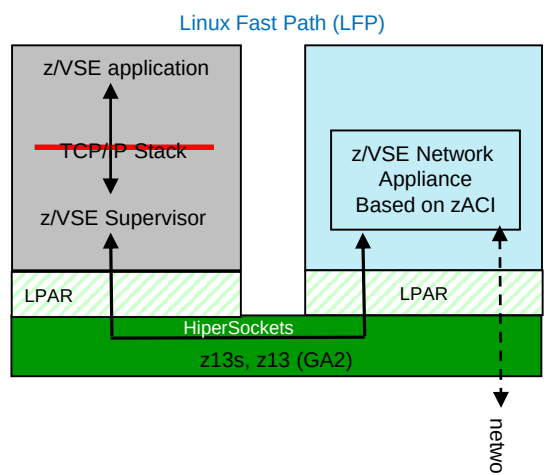
- New with z13 GA2 / z13s, available since June 30, 2016
- VNA acts as a router for z/VSE
- TCP/IP application uses Linux Fast Path (LFP) and connects through HiperSockets to VNA
- Based on z Appliance Container Infrastructure (zACI) delivered with z13s and z13 GA2
- z/VSE is first exploiter of zACI

- No Linux license,
  No TCP/IP stack required on z/VSE,
  No z/VM required to connect to the network

- Supported with z/VSE 6.1 and 5.2,
  works with z/VSE 5.1

- VNA for LPAR only

- zVSE - z/VM IP Assist (VIA) for z/VM guests



64 bit real addressing

- Processor storage support up to 32 GB
- 64 bit real addressing only, introduced with z/VSE 4.1
- 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

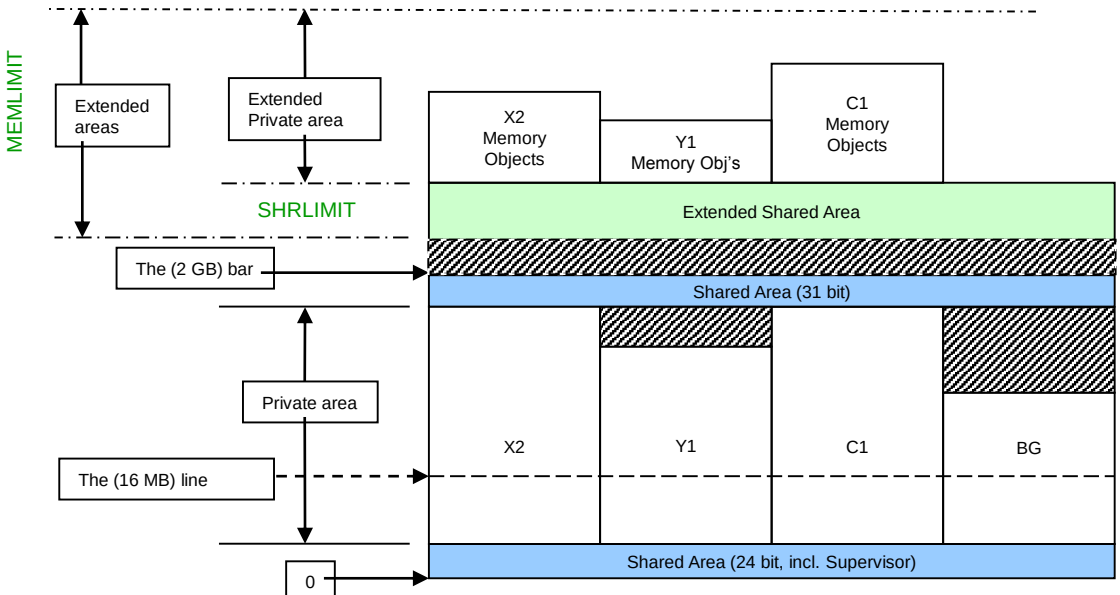
- Support 64 bit virtual addressing - Virtual address space > 2 GB
- 64 bit area can be used for **data only**
  - No instruction execution above the bar
- Data space size remains at max. 2 GB

- **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 data spaces
  - Reduces complexity of programs - data contained in primary address space
  - 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

- I/O buffers
  - Can be created above the bar (above 2 GB)
  - Supported in **private memory objects** only
- Supported for ECKD devices
  - Not supported for FBA / SCSI / tape devices, LIOCS
- 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

z Systems FICON / OSA-Express support

- FICON Express8 / FICON Express16S (z13, z13s) - Higher I/O bandwidth
- Adapter interruptions (may improve performance)
  - 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 z Systems
- 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, z13s
- OSA-Express for non-QDIO environments (CHPID type OSE)
  - SNA and passthru traffic require configuration via OSA/SF
    - OSA-Express4S / OSA-Express5S on HMC (zEC12, zBC12, z13, z13s)
- 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

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)

Configurable network buffers

- Configurable network buffers for HiperSockets and OSA Express devices
  - May improve TCP/IP performance
  - Up to 64 QDIO (Queued Direct I/O) buffers
  - To be configured in configuration file (IJBOCONF.PHASE)
  - Requires PFIXed partition 31 bit GETVIS space
  - For OSA-Express (CHPID OSD, OSX), HiperSockets (CHPID IQD)

- Configurable
  - input buffers for HiperSockets and OSA Express devices (since z/VSE 5.1)
  - output buffers for HiperSockets and OSA Express devices (z/VSE 6.1)

z Systems hardware cryptographic support

- Enhances Internet security
- Encryption support via crypto cards or on the processor itself (CPACF)
  CPACF = Central Processor Assist for Cryptographic Functions
- Cryptographic assists
  - Exploited by the SSL support of TCP/IP transparently
  - Encryption Facility for z/VSE
- 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
  - zEC12 / zBC12: Crypto Express4S support (z/VSE 5.1 + PTF, z/VSE 5.2, z/VSE 6.1)
  - z13 / z13s: Crypto Express5S support (z/VSE V5 + PTF, z/VSE 6.1)
    - 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 - 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 z Systems 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 TS1120 / TS1130 / TS1140 Tape Drive
- IBM System Storage TS7700 / TS7720 / TS7760 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

- IBM 3592 Tape Controller Model C07 **end of marketing** announcement, effective June 17, 2016
  http://www-01.ibm.com/common/ssi/cgi-bin/ssialias?subtype=ca&infotype=an&appname=iSource&supplier=897&letternum=ENUS916-074

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
    - Data will be encrypted and compressed, when specified
    - Default: encryption disabled
  - Data encryption is transparent to z/VSE applications
  - 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 cartridge.
  - You may download EKM from the internet

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

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

SOD: High Performance FICON support in z/VSE

- High Performance FICON (zHPF) for ECKD devices only
  - Channel programs are translated to zHPF commands
  - Transparent to applications

- z/VSE
  - Supports zHPF implementation phase 1
  - Translates a subset of CCW commands (define extent, locate record, TIC, …)

  - If transport mode I/O results in an I/O error, the request will be retried in command mode
  - z/VM APAR to support phase 1 for z/VM guests

- Benefits
  - May improve I/O performance
  - Highly dependent on workload characteristics

- Not yet available: Announced in April 2016 as Statement of general direction (SOD)

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

FlashCopy Support

- Available on IBM System Storage 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
- Multiple relationship FlashCopy
  - Up to 12 volumes from one source in a single FlashCopy operation

FlashCopy Support …

- Space Efficient Flashcopy (IBM System Storage DS8000 FlashCopy SE)
  - 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) – Metro Mirror
  - 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
- Transparent to all VSE applications and subsystems
  - Reasons for transparency:
    - z/VSE's SCSI implementation is based on FBA support
    - FBA to SCSI emulation on low level I/O interface
    - Applications can not exploit SCSI commands directly

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 / V3500 Entry Disk
  - IBM FlashSystem V840 / V9000

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
- Fast Service Upgrade (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 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

SOD: Enhancements for SCSI device support

- **Tapeless installation**
  - Available since z/VSE 5.2 for ECKD
  - Tools provided to create an installation disk (supported in LPAR and z/VM guest)
  - Installation disk contains a boot program and the z/VSE base tape in AWS file format

  - Tapeless installation to be enhanced for installation disk on **FCP-attached SCSI devices**
  - Installation on ECKD, FBA and FCP-attached SCSI disks supported

  - Supports initial installation only

- Not yet available: Announced in April 2016 as Statement of general direction (SOD)

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

Documentation related to z/VSE

- z/VSE documentation page - http://www-03.ibm.com/systems/z/os/zvse/documentation/

- z/VSE Collection Kit - November 2015
  - Available for download in IBM Publication Center
  - Electonic only, not on physical DVD

- Documentation of z/VSE releases - z/VSE Internet Library on http://www.ibm.com/systems/z/os/zos/bkserv/vse.html

- z/VSE Knowledge Center: http://www.ibm.com/support/knowledgecenter/SSB27H/zvse_welcome.html
- CICS TS for z/VSE Knowledge Center: http://www.ibm.com/support/knowledgecenter/SSECAB_2.1.0/welcome.html

- IBM Redbooks
  - Redbook page with new IBM System z mainframe Redbooks
    - zEC12 / zBC12 / z13 / z13s Technical Guides
    - IBM System z Connectivity Handbook, SG24-5444
  - More IBM Redbooks information on next page

- Technical articles: http://www-03.ibm.com/systems/z/os/zvse/documentation/documents.html#articles
  - z/VSE release & hardware upgrade
  - z/VSE SCSI Support and Migration Options
  - z/VSE z/VM IP assist
  - Parallel Access Volume (PAV) white paper

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 6.1:
  - http://www.ibm.com/systems/z/os/zvse/documentation/#hints

- 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
  - Enhanced Networking on IBM z/VSE
    http://www.redbooks.ibm.com/Redbooks.nsf/RedpieceAbstracts/sg248091.html?Open

- Requirements: https://www-03.ibm.com/systems/z/os/zvse/contact/requirement.html

Thank You

Please forward your questions or remarks to
zvse@de.ibm.com
salm@de.ibm.com

z/VSE Live Virtual Classes

z/VSE @ http://www.ibm.com/zvse/education/

LINUX + z/VM + z/VSE @ http://www.vm.ibm.com/education/lvc/

Read about upcoming LVCs on @ http://twitter.com/IBMzVSE

Join the LVC distribution list by sending a short mail to zvse@de.ibm.com