

Security on z/VSE

More details in IBM Redbook “Security on IBM z/VSE”

<http://www.redbooks.ibm.com/abstracts/sq247691.html?Open>

2018 VM Workshop

Greensboro, NC

June 28 – 30, 2018

<http://www.vmworkshop.org/2018.shtml>

Ingolf Salm - salm@de.ibm.com
IBM Germany

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

z/VSE security

- Provides protection of
 - z/VSE system, data and resources
 - Prevent unauthorized access to z/VSE and data
 - Data modification by unauthorized users
 - z/VSE in a network
 - Prevent unauthorized remote access to z/VSE
 - Systems in the network could try to
 - connect to z/VSE and
 - access data (VSAM files, POWER queues,)

z/VSE security features

- Batch security
- Online security
- Basic Security Manager (BSM)
 - May be replaced by External Security Manager (ESM)
- Single sign-on support with LDAP
- Cryptography (provided by IBM Z, openssl, ...)
- CICS Web Support (CWS)
- Connector security
- TCP/IP security (firewall, SSL / TLS, ...)
- Security for FTP
- Auditing, logging and reporting
- Intrusion detection
- Policy compliance

z/VSE Basic Security Manager (BSM)

- BSM covers
 - Batch security
 - Defined during IPL via SYS SEC=YES
 - Protects resources such as libraries, files
 - Online (signon) security
 - Defined during CICS startup in SIT SEC=YES
 - Protects access to CICS environment
 - CICS transaction security
 - Defined via IUI dialogs or batch utility
 - Protects the usage of CICS transactions (applications)
 - CICS resource security
 - Defined via resource classes in IUI dialogs or batch
 - Protects access to CICS files, WebShere MQ, FACILITY resources, ...

z/VSE security status

- SIR Attention Routine command shows the security status

SIR SYS

.....

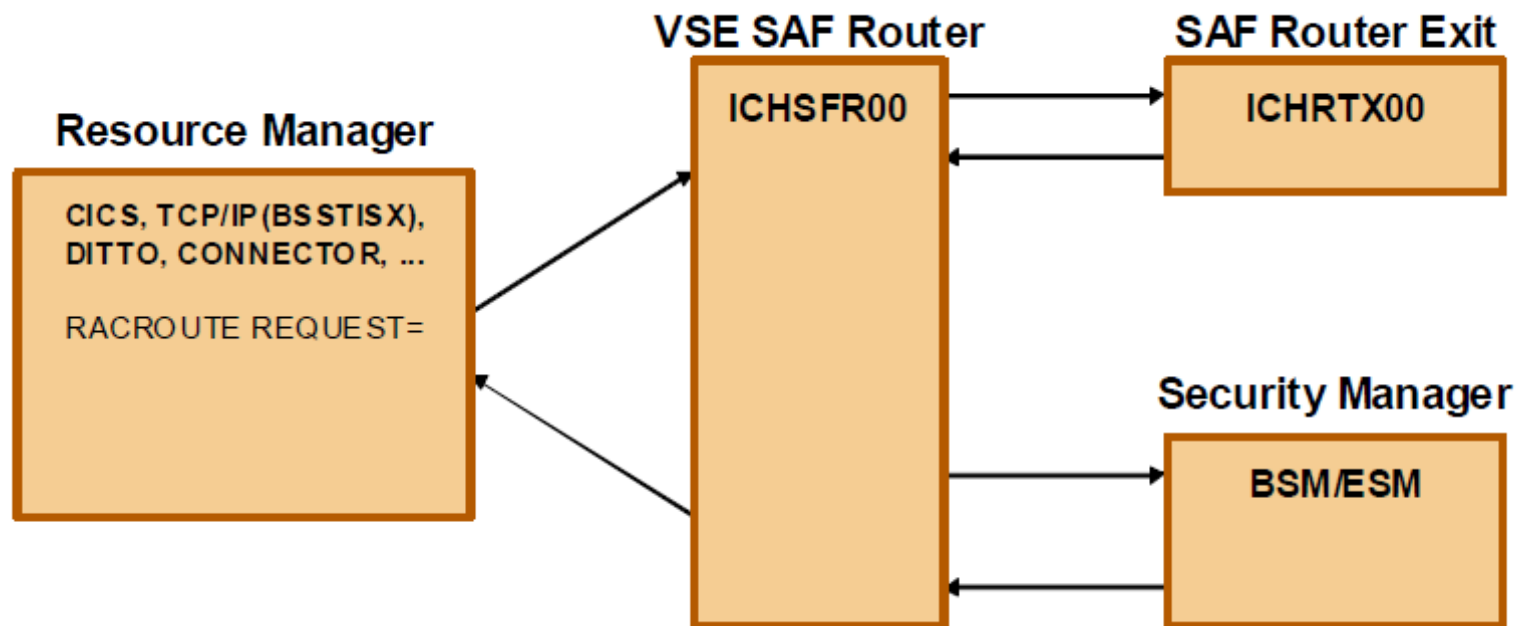
```
AR 0015 IPL-PROC   = $IPLESA          JCL-PROC   = $$JCL
AR 0015 SUPVR      = $$A$$SUPI        TURBO-DISPATCHER (B2) ACTIVE
AR 0015                                     HARDWARE COMPRESSION ENABLED
AR 0015 SEC. MGR.  = BASIC             SECURITY   = ONLINE and BATCH
AR 0015 1I40I     READY
```

- BSTADMIN utility lists the security settings (BSTADMIN STATUS command)

```
0 exec BSTadmin
BG 0000 1S54I  PHASE BSTADMIN IS TO BE FETCHED FROM IJSYSRS.SYSLIB
BG-0000 BST901A ENTER COMMAND OR END
0 status
BG 0000 CLASS      ACTIVE      CMDAUDIT
BG 0000 -----
BG 0000 USER       YES         NO
BG 0000 GROUP      YES         NO
BG 0000 DATASET    YES         NO
BG 0000 VSELIB     YES         NO
BG 0000 VSESLIB    YES         NO
BG 0000 VSEMEM     YES         NO
```

z/VSE security concept

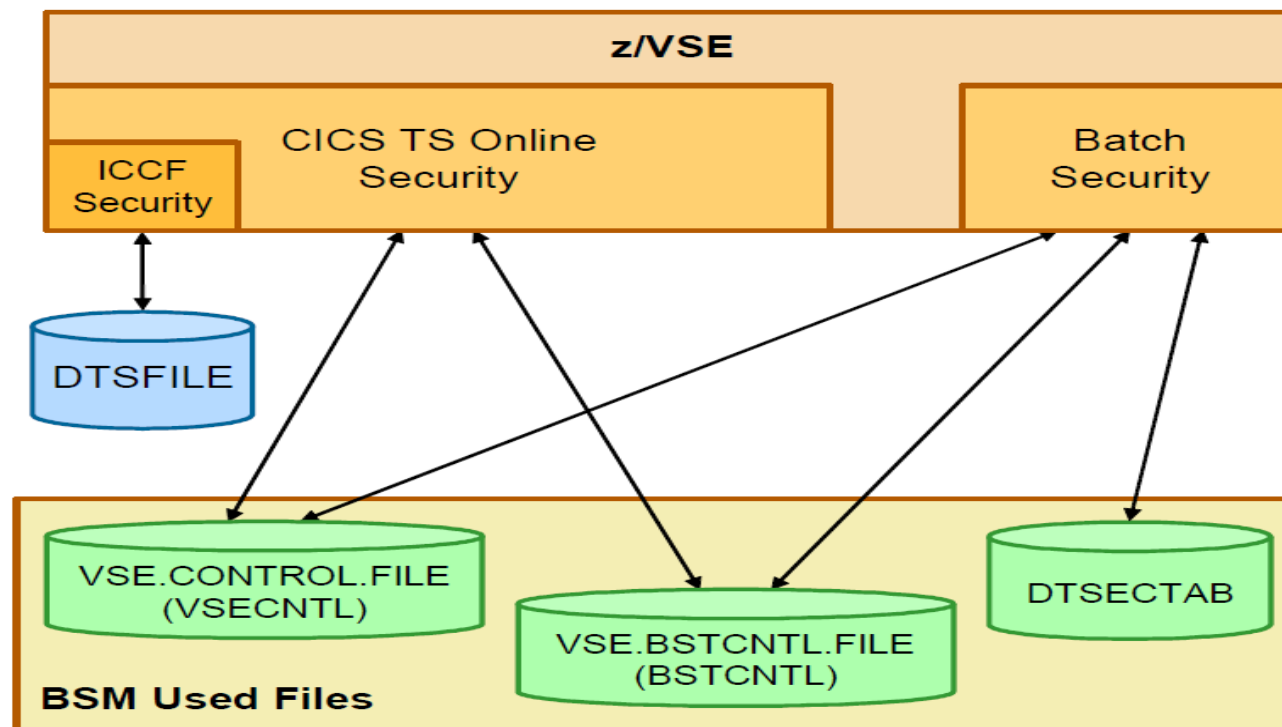
- CICS Transaction Server requires a security manager
 - z/VSE provides the Basic Security Manager (BSM)
 - BSM can be replaced with an External Security Manager (ESM)
 - “Application” (Resource Manager) uses RACROUTE services
 - SAF = System Authorization Facility



IBM Redbook “Security on IBM z/VSE” <http://www.redbooks.ibm.com/abstracts/sg247691.html?Open>

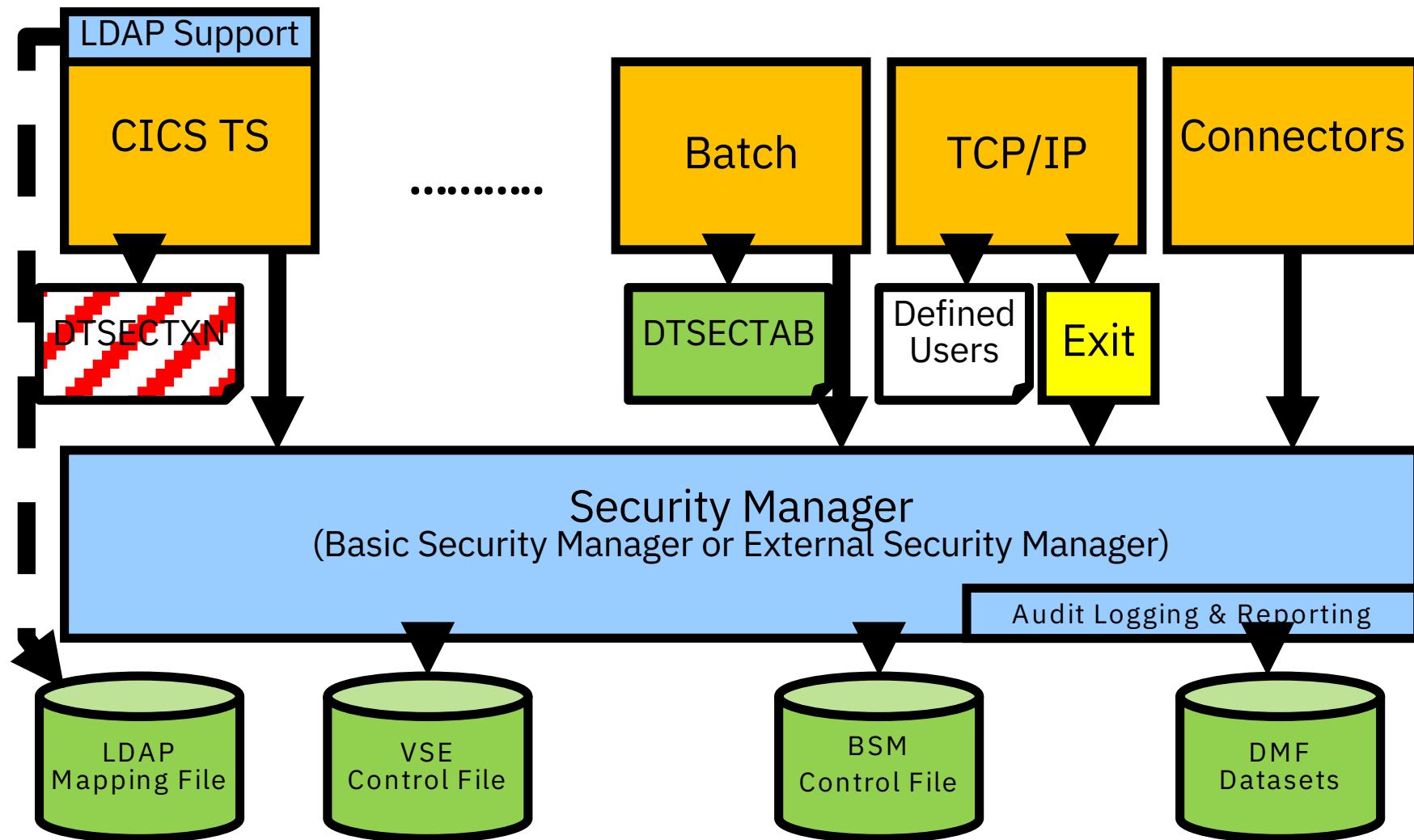
z/VSE security files

- BSM uses the following files to store security related information
 - VSE Control File – central repository for user profiles (e.g. userid)
 - BSM Control File – profiles for resource classes
 - CICS resources: transactions, programs, files, journals, temp. storage queue, transient data queue, ...



IBM Redbook "Security on IBM z/VSE" <http://www.redbooks.ibm.com/abstracts/sg247691.html?Open>

z/VSE security components



Security server partition

- CICS TS requires an external security manager
 - z/VSE users may choose
 - BSM (Basic Security Manager) provided with z/VSE
 - ISV security manger
 - To be selected at IPL (SYS ESM, SYS SERVPART)
- Default is to start the BSM security server in partition FB
- BSM security server partition
 - Controls access to VSE and BSM control file, e.g. for RACROUTE requests
 - Contains functions to support cryptography features
 - Contains functions for BSM logging with DMF (Data Management Facility)
 - Provides a MSG command interface

Maintain User Profiles

- **IUI dialogs** or BSTADMIN utility can be used to maintain user profiles / groups
- Maintain User Profiles (2-1-1)
 - To define / change / delete userids
 - To connect a new user id to a group
 - To add a new user to the LDAP mapping file
- Security Group Maintenance (2-8-2)
 - To connect user-IDs to groups or define new groups
- To refresh security information
 - Perform a BSM Security Rebuild (2-8-3)
- In case of LDAP authentication,
you need to add a new user-ID to the LDAP mapping file (2-1-7),
the Maintain User Profiles dialog or via IESLDUMA utility
- Don't forget "PF5" to process requests

Maintain User Profiles ...

- BSM Group Maintenance (2-8-2)
 - To define / change / delete a group
 - To connect a user id to a group
 - To display user ids of a group
- Default groups: GROUP01 to GROUP64
 - corresponding to the 64 CICS transaction security keys
- BSM rejects the definition of a new group named the same as a user id
- Perform a BSM Security Rebuild to activate the changes (2-8-3)
- BSM Cross Reference Report (2-8-5)
 - To get information about a user, group, etc.

BSM Resource Profiles

- Repository for resource profiles:
 - DTSECTAB contains the entries for z/VSE files, libraries, sublibraries and members
 - Skeleton DTSECTRC in ICCF library 59 to maintain the table
 - BSM Control File keeps the profiles for all other resource classes supported by BSM
- BSM Resource Profile Maintenance (2-8-1)
 - Define / change / delete profiles to control access
- Unified BSM Resource Profile Maintenance (2-8-6)
 - To browse the list of BSM resource classes to maintain class profiles
- Resource profiles for
 - Transactions, PCT, PPT FCT, APPL, FACILITY, MQ classes, and more
 - VSELIB, VSEMEM, VSESLIB to define batch classes (z/VSE 6.2)
 - To submit batch job, that assembles, catalogs and links the DTSECTAB

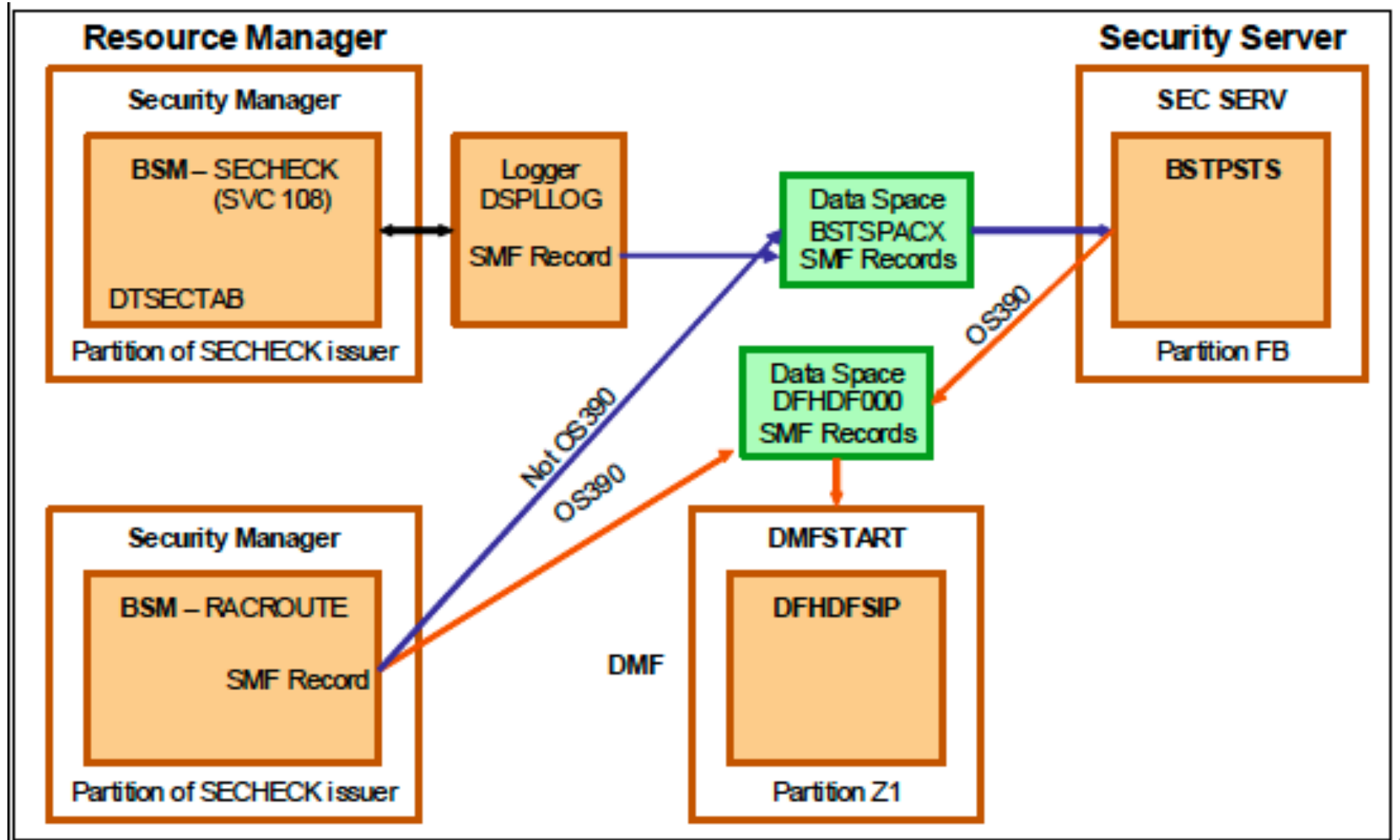
Audit - Logging and Reporting

- All access attempts to protected resources can be logged
 - Allowed access as well as disallowed access
- Possible attacks can be detected
 - E.g. multiple logon attempts with invalid password
- Analysis can be done using a reporting tool
 - Summary report. Detailed report of all access attempts
- Separation of auditor function from administrator function
 - Definition of a user id with type AUDITOR

Audit - Logging and Reporting ...

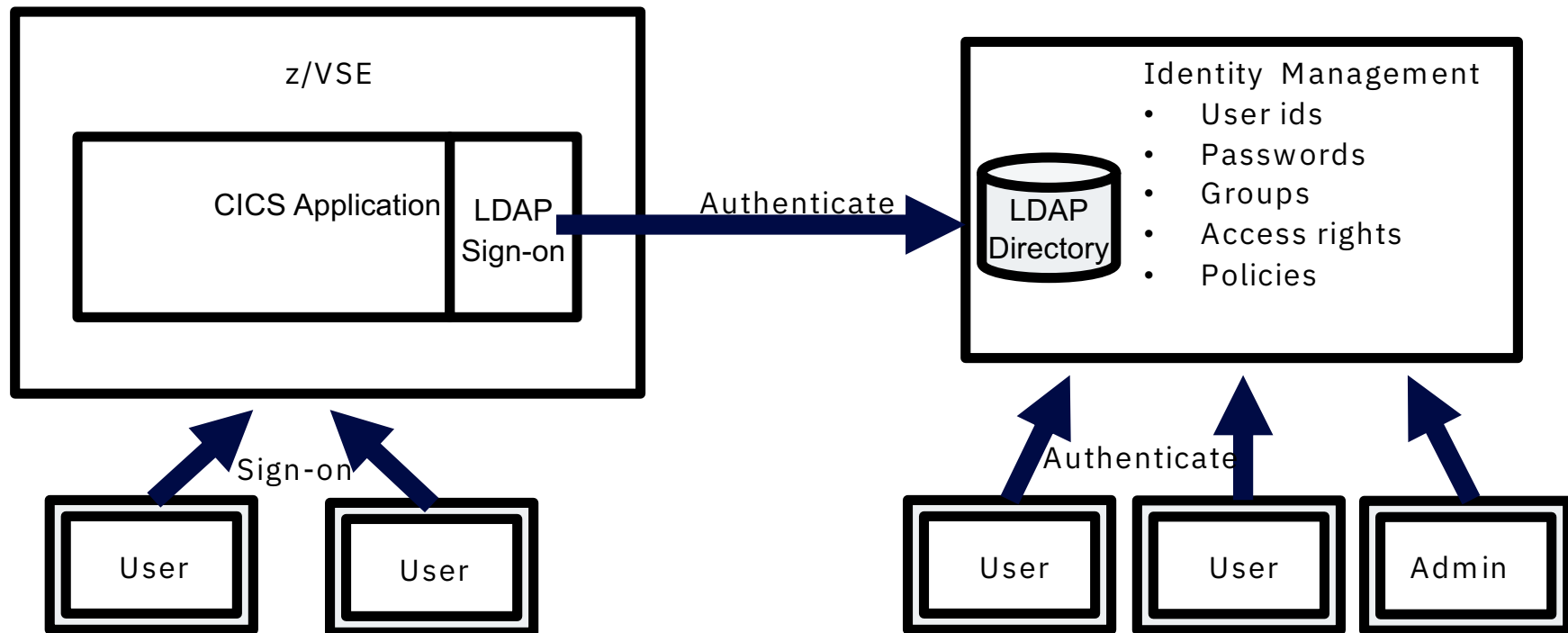
- Past: ACLR (Access Control Logging and Reporting) was used for auditing of batch (DTSECTAB) resources
- DMF (Data Management Facility) can replace ACLR
 - DMF a component of CICS TS for z/VSE / CICS TS for VSE/ESA
 - BSM sends SMF (System Management Facility) type 80 records to DMF
 - DMF to be started in a (dynamic) partition, otherwise no logging
 - DMF can be used for batch and online logging
- Report writer (BSTRPWTR) generates reports
 - Extract SMF records into new dataset
 - Generate reports from that dataset

Audit - Logging and Reporting (Transfer SMF records to DMF)



IBM Redbook "Security on IBM z/VSE" <http://www.redbooks.ibm.com/abstracts/sg247691.html?Open>

LDAP signon support



- LDAP = Lightweight Directory Access Protocol
- Enables users to sign on to z/VSE using a single, corporate-wide 'Identity Management' systems (i.e. IBM Security Identity Manager (ISIM), former IBM Tivoli Identity Manager, etc.)

IBM Redbook "Security on IBM z/VSE": <http://www.redbooks.ibm.com/abstracts/sg247691.html?Open>

LDAP signon support

- LDAP user-IDs and passwords can be up to 64 characters.
- To overcome VSE internal limits:
 - 4 character VSE/ICCF user-IDs, 4 and 8 character CICS user-IDs
 - up to 8 character Passwords
- LDAP sign on sits on top of existing z/VSE security manager (i.e. BSM, ESM, etc.)
- z/VSE LDAP client can work with common LDAP servers
 - IBM Security Directory Server, z/VM LDAP server
 - OpenLDAP, Apache Directory server, Microsoft Active Directory, Apache Directory, ...
- Benefits
 - Improved protection, consistent access rules, enterprise-wide repository
- z/VSE 6.2: LDAP sign-on enhancements provide
 - RESET option for LDAP user mapping tool to clear cached user password hash
 - Forces full LDAP sign-on at next user sign-on
 - Wildcard support for CHANGE and DELETE commands of user mapping tool

Migrating from older BSM versions

- Since z/VSE 3.1.1, BSM uses the BSM Control File instead of DTSECTXN
 - Please migrate transaction security definitions from DTSECTXN to BSM Control file
 - IUI dialog for DTSECTXN removed in z/VSE 6.1
 - DTSECTXN not supported in z/VSE 6.2
- The steps depends on:
 - VSE system level from which you installed z/VSE
 - Whether you performed an FSU (Fast Service Upgrade) or an initial installation.
 - Whether you wish to retain the use of your previous security definitions.
- Please see z/VSE 6.2 Administration Chapter 31 for details
 - See table describing steps to perform before and after migration of VSE

Batch security

- If batch security is active (SYS SEC=YES), all jobs need to specify a user-ID and password
 - Either using the // ID statement within the job: // ID USER=user, PWD=password
 - or in the * \$\$ JOB card: * \$\$ JOB JNM=MYJOB, . . . , SEC=(user,password)
- User id and password are verified against
 - DTSECTAB (using the SECHECK - SVC 108 – interface)
 - Security Manager (RACROUTE)
- Components (LIBR, VSAM, ...) use this user id to verify access rights against DTSECTAB
- If you submit jobs from the ICCF library
 - Submitted job automatically inherits the user-ID and password from the submitting user
 - No need to specify a // ID statement or user-ID in the * \$\$ JOB card
- Inheritance only works if batch security is active at the time you do the submit
 - Jobs that were submitted prior to activating batch security do not have any inherited security information, you may have to re-submit those jobs
- z/VSE 6.2 provides a common interface for online and batch resources via IUI dialogs
 - New dialogs generate the DTSECTAB

Protect JCL operands

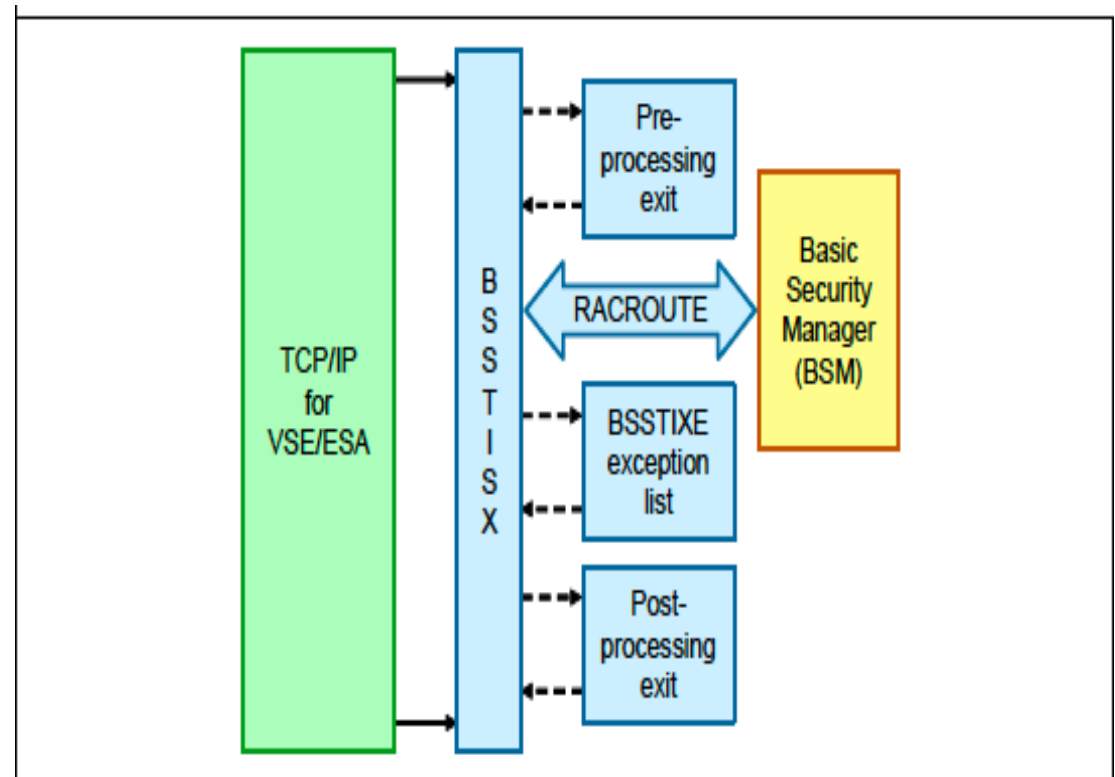
- You can use BSM security to protect operands of specific JCL statements
 - For example, you can protect the PERM operand of the ASSGN and LIBDEF statements.
- Profiles of class FACILITY provided for JCL statement checking:
 - IBMVSE.JCL.ASSGN.PERM
 - IBMVSE.JCL.LIBDEF.PERM
 - IBMVSE.JCL.LIBDROP.PERM
 - IBMVSE.JCL.OPTION.PARSTD
 - IBMVSE.JCL.OPTION.STDLABEL
- To perform JCL statement checking:
 - JCL security must be enabled (IPL SYS SEC=YES,JCL)
 - The minimum access right for Universal Access or user-IDs/groups must be READ

IDCAMS command security

- VSE/VSAM IDCAMS provides a number of cluster management and catalog maintenance commands which can be destructive to data
 - The usage of IDCAMS commands can be restricted
- The administrator can control access to IDCAMS commands by using the 'IDCAMS.GENERAL' BSM resource profile of the resource class FACILITY
 - IDCAMS commands access control is designed for batch processing only
 - If batch security is not active (SYS SEC=NO) or IDCAMS function is executed in ICCF pseudo partition, then no security checks are performed

TCP/IP Security

- In general TCP/IP stacks use their own user id definitions
- Security Exit available from IBM to check user ids / resource access via Security Manager
 - Issues RACROUTE calls for
 - User identification and verification
 - Resource access control
 - z/VSE files, libraries, members
 - POWER entries
 - SITE commands



Firewall: IBM TCP/IP for z/VSE V2

- A new version of CSI's TCP/IP stack – only supported on z/VSE Version 6
- New white-list firewall
 - Access denied unless an IP address is specifically allowed to communicate with the VSE system.
 - Firewall shield loaded during TCP/IP startup (in fail or warn mode - for logging only)
 - Configuration phase contains a list of IP addresses
 - Firewall configuration phase can be reloaded
 - To each IP address range you may specify VSE ports (TCP or UDP) and if ICMP (Ping) is allowed
 - Example:
FIREWALL
ALLOW,IPV4BEG=039.101.062.131,IPV4END=039.101.062.131,
TCPPTS=PORTGRPA,UDPPPTS=NONE,ICMP=YES
 - FIREWALL commands for administration
 - ON, OFF, LOAD PHASE=<phase name>
 - WARN, FAIL, DEBUGON | DEBUGOFF, MSGON | MSGOFF, REPORT

Firewall: IBM IPv6/VSE 1.2 / 1.3

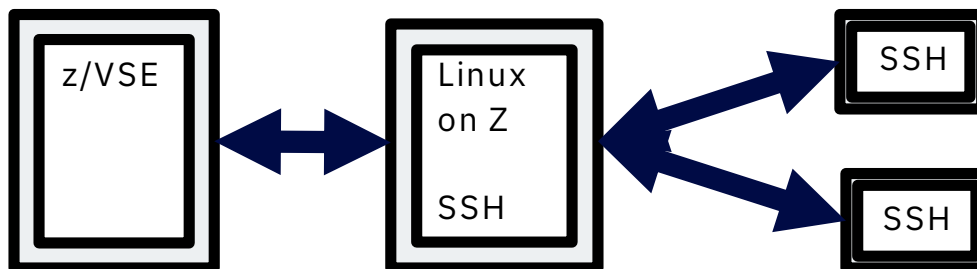
- New releases of BSI's TCP/IP stack
 - IBM IPv6/VSE 1.2 only supported on z/VSE 6.1
 - IBM IPv6/VSE 1.3 only supported on z/VSE 6.2
- New (basic) firewall
 - Examines IPv4 packets and IPv6 Ethernet frames
 - Enabled by default
 - VSE Librarian member contains the firewall rules table
 - To disable the firewall, just delete / rename the VSE Librarian member
 - Source IP address, packet protocol, TCP or UDP port, ICMP can be accepted / denied
 - Example: IN IP ALLOW IP 192.168.1.0 255.255.255.0
 - If a packet is denied, it is dropped. A message will be written to SYSLSST
 - Default firewall rules allow all packets to be processed by the stack
 - Only Inbound (IN) rules are processed
 - Firewall commands via MSG <syslog id>
 - MSG <syslog id>,D=FIREWALL,RELOAD
 - MSG <syslog id>,D=FIREWALL,LIST
 - MSG <syslog id>,D=FIREWALL,LOGLEVEL n (0=no logging, 4=message to SYSLSST)

IBM Z Pervasive Encryption with z/VSE

- Exploitation of IBM z14 / z14 ZR1
 - CPACF instructions as provided by z/Architecture
 - CryptoExpress cards
- Encryption at rest
 - Encryption Facility for z/VSE
 - Tape encryption (TS1120 – TS1140)
 - Disk encryption (DS8000)
- Encryption in flight, exploited by
 - openssl
 - All EZA API users
 - EZA Multiplexer
 - Connector server
 - TCP/IP for z/VSE
 - IPv6/VSE
 - ...

IBM IPv6/VSE 1.3: SSH copy facility

- Uses a Linux pass-through image for a SSL connection to a remote host
- Secure file transfer via SSH to and from z/VSE
- Compatible with IBM TCP/IP for z/VSE, LFP, z/VM IP Assist (VIA)
- See IBM IPv6/VSE 1.3 documentation for details



IBM TCP/IP for VSE: SecureFTP

- FTP protocol provides protocol for transferring files between systems on different platforms
 - Installation may transfer sensitive information such as customer names, credit card account numbers, social security numbers, ...
 - FTP protocol transmits data without any authentication, privacy or integrity
- **SecureFTP** provides user authentication, privacy and integrity
 - SecureFTP is integrated into TCP/IP for VSE/ESA and TCP/IP for z/VSE

How to setup Secure FTP with VSE:

<https://www-03.ibm.com/systems/z/os/zvse/documentation/security.html#howto>

OpenSSL Support

- OpenSSL on z/VSE
 - OpenSSL runtime library
 - New component: z/VSE cryptographic services, 5686-CF9-17-51S
 - Available since z/VSE 5.1 plus PTFs
 - Software implementations for algorithms with key lengths
 - Hardware Crypto Support (Crypto Express cards and CPACF)
 - z/VSE supports the GSK (z/OS SSL API) and openssl API
- OpenSSL exploited by z/VSE components and IPv6/VSE
 - IPv6/VSE product exploits OpenSSL via SSL Proxy Server (BSTTPRXY)
 - Proxies a clear text connection into an SSL/TLS connection and vice versa
 - Automatic TLS Facility (BSTTATLS)
Automatically converts any application into SSL/TLS application

z/VSE 6.2 Security enhancements

- OpenSSL enhancements
 - Upgraded to openssl 1.0.2h (newer SSL/TLS functions)
 - Elliptic Curve Cryptography (ECC) hardware acceleration with CryptoExpress5S / 6S
 - If hardware not available, ECC software implementation will be used
- CICS Web Support : SSL/TLS support of openssl or SSL of TCP/IP for z/VSE stack
 - Does not need LE environment
- EZA Multiplexer and EZA openssl support
 - EZA multiplexer can be configured to use interface phase for given TCP/IP stack
 - OpenSSL may be used independent of the TCP/IP stack
 - Similar to the LE/C TCP/IP socket API multiplexer

z/VSE 6.2 Security enhancements ...

- SSL/TLS connection to secure remote VTAPE network transfer
- Operator interface for crypto device driver when BSM is not used
- IBM IPv6/VSE 1.3
 - New FTP server security interface
 - FTP access to z/VSE file system may be protected by
 - Basic Security Manager (BSM) or
 - External Security Manager (ESM)
 - using the resource class FACILITY
- IBM TCP/IP for z/VSE 2.2: TLS 1.1 and TLS 1.2 support

IBM Z cryptographic support

- 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
- Displaying Hardware Crypto Status Information
 - General crypto configuration: MSG FB,DATA="STATUS=CR"
 - CPACF status: MSG FB,DATA="STATUS=CPACF"
 - Adjunct processor (crypto card) status: MSG FB,DATA="APSTAT AP=n"
- z/VSE 6.2: Operator interface for crypto device driver when BSM is not used

IBM Z cryptographic support - configuration

- No z/VSE configuration necessary for crypto hardware (no ADD statement)
 - You may define the devices in the HMC (LPAR) or z/VM directory
 - Crypto hardware detected during z/VSE IPL process
- Crypto hardware is transparent to end users and TCP/IP applications
 - Use of crypto hardware can be disabled via TCP/IP SOCKOPT phase
- How to setup cryptographic hardware for VSE:
 - <http://www.ibm.com/systems/z/os/zvse/documentation/security.html#howto>

IBM Z cryptographic support ...

- CPACF – for symmetric encryption
 - AES for 128-bit keys (z9 EC, z9 BC), AES for 256 keys (z10 EC or higher)
- Crypto Express cards – for asymmetric encryption
 - z13 / z13s: CryptoExpress5S, z14 / z14 ZR1: Crypto Express6S
 - More than 16 domain support
 - Encryption hardware assist for increased SSL throughput
 - Supports SSL handshaking only for applications that use the SSL crypto API
 - Configurable Crypto Express
 - 4096-bit RSA key support
 - Dynamically configurable in coprocessor or accelerator mode
 - Dynamic change of cryptographic processors
 - Add/remove cryptographic processor - z10 LPAR or higher

IBM Z cryptographic support - AP queue interrupt support

- Support for Crypto Express AP-interrupts (z10 and higher)
- A hardware interrupt is issued when a response is ready for de-queuing from a card.
 - Removes the need for the formerly used polling mechanism
 - User can switch between polling and interrupts (default: polling)
 - Using interrupts increase throughput for certain workloads without increasing CPU load
- Supported cards are:
 - Crypto Express2, Crypto Express3, Crypto Express4S / Crypto Express5S / 6S
- The VSE crypto device driver provides commands:
 - APEAI, enable AP interrupts for all APs
 - APDAI, disable AP interrupts for all APs

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 requires **encryption key manager** (EKM) component on non-z/VSE platform
 - Generation and communication of encryption keys for tape drive
 - TCP/IP connection between the encryption key manager and the tape controller
 - EKM for TS1120 / TS1130
 - Java application, used to generate and protect AES keys
 - generates AES (256 bit) data keys and protects those keys
 - Key encryption key label (KEKL) identifies the encryption keys
 - KEKL or the hash value of the public key can be stored on the cartridge.
 - download from the internet
 - EKM for TS1140
 - Requires the product IBM Security Key Lifecycle Manager (SKLM)

Tape 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 write 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)

Encryption Facility for z/VSE 1.2

- Optional priced feature
- Supports the use of SAM files, VSE/VSAM files, VSE library members, tapes, virtual tapes as input or output
- Requires CP Assist for Cryptographic Function (CPACF)
 - no charge feature, only z Systems servers
- Extends affinity between z/VSE and z/OS
 - Function roughly equivalent to EF for z/OS
 - Compatible with EF for z/OS V1.1 (Encryption Facility z System format)
 - o EF for z/VSE tapes can be read by EF for z/VSE, EF for z/OS, EF for z/OS Java Client, and Decryption Client for z/OS,
 - o EF for z/OS V1.1 and EF for z/OS Java client tapes can be read by EF for z/VSE
 - Supports openPGP standard
 - OpenPGP exploits 4096-bit RSA keys (z10 and above)

z/VSE security portal (lists latest security APARs)

<http://www-01.ibm.com/support/docview.wss?uid=isg3T1027465#security>

— Security and system integrity

IBM strongly recommends that users of the z/VSE Operating System validate the currency of security and system integrity service and take action to promptly install all security and integrity PTFs.

Security and system integrity related APARs/PTFs:

Last update: January 22, 2018

APAR Date	PTF	Contents
DY47721 2017/07/26	UD54251- 61S	z/VSE V5.2: zlib upgrade to V1.2.11 (CVE-2016-9840, CVE-2016-9841, CVE-2016-9842)

Technical Security Articles in IBM Knowledge Center

https://www.ibm.com/support/knowledgecenter/SSB27H_6.2.0/technical_articles_and_whitepapers.html

How to setup hardware crypto and TLS/SSL with z/VSE

- [How to setup SSL with the VSE Script Connector](#)
- [How to setup WebSphere MQ for z/VSE V3.0 and WebSphere MQ for Windows V7.0 with secured connections using SSL](#)
- [How to use Encryption Facility for z/VSE](#)
- [How to setup SSL with CICS Web Support](#)
- [How to setup Secure Telnet with VSE](#)
- [How to setup Secure FTP with VSE](#)
- [How to setup SSL with VSE](#)
- [How to setup and use Keyman/VSE](#)
- [How to setup cryptographic hardware for VSE](#)

z/VSE Security Documentation

IBM Redbooks:

- Security on IBM z/VSE
<http://www.redbooks.ibm.com/abstracts/sg247691.html?Open>
- Enhanced Networking on IBM z/VSE
<http://www.redbooks.ibm.com/abstracts/sg248091.html?Open>

z/VSE security page

<http://www.ibm.com/systems/z/os/zvse/documentation/security.html>

z/VSE security and integrity – service & support


<http://www-03.ibm.com/systems/z/os/zvse/support/preventive.html#security>


z/VSE 6.2 documentation in IBM Knowledge Center

https://www.ibm.com/support/knowledgecenter/en/SSB27H_6.2.0/zvse_welcome_6.2.0.html

- z/VSE Planning
- z/VSE Administration
- z/VSE e-business Connectors, User's Guide
- CICS TS Enhancements Guide

z/VSE Security Documentation ...

[Marketplace](#)


 IT Infrastructure ▾ Software ▾ Storage ▾ Training ▾ About Redbooks ▾

IBM Redbooks > z Systems >

Security on IBM z/VSE

An IBM Redbooks publication


Published 14 Juni 2018




ISBN-10: 0738456918
ISBN-13: 9780738456911
IBM Form #: SG24-7691-03
(440 pages)


View online


PDF [Download PDF](#) (21,3 MB)

 [Download EPUB](#) (12,4 MB)
for e-book readers

 [Tips for viewing](#)

More options

 [Discuss this book](#) (0 comments)

 [Permanent link](#)

Rating

[→ Rate this book](#)

<http://www.redbooks.ibm.com/abstracts/sg247691.html?Open>

Session reference links

- z/VSE Homepage: www.ibm.com/vse
- Ingolf's z/VSE blog: www.ibm.com/developerworks/mydeveloperworks/blogs/vse/
 - Use „Tags“ to search for topics
- VSE-L discussion list: <https://groups.google.com/forum/?fromgroups#!forum/bit.listserv.vse-l>
- Hints and Tips for z/VSE in IBM Knowledge Center
https://www.ibm.com/support/knowledgecenter/SSB27H_6.2.0/technical_articles_and_whitepapers.html

Thank You

Ingolf Salm

z/VSE Lead Architect

salm@de.ibm.com

Questions ?

Trademarks

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

BigInsights	DFSMSdss	FICON*	IMS	RACF*	System z10*	zEnterprise*
BlueMix	DFSMSHsm	GDPS*	Language Environment*	Rational*	Tivoli*	z/OS*
CICS*	DESORT	HyperSwap	MQSeries*	Redbooks*	UrbanCode	zSecure
COGNOS*	DS6000*	IBM*	Parallel Sysplex*	REXX	WebSphere*	z Systems
DB2*	DS8000*	IBM (logo)*	PartnerWorld*	SmartCloud*	z13	z/VM*
DFSMSdftp						

* Registered trademarks of IBM Corporation

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.

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.

IT Infrastructure Library is a registered trademark of the Central Computer and Telecommunications Agency which is now part of the Office of Government Commerce.

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.

Java and all Java based trademarks and logos are trademarks or registered trademarks of Oracle and/or its affiliates.

Linear Tape-Open, LTO, the LTO Logo, Ultrium, and the Ultrium logo are trademarks of HP, IBM Corp. and Quantum in the U.S. and

Linux is a registered trademark of Linus Torvalds 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.

OpenStack is a trademark of OpenStack LLC. The OpenStack trademark policy is available on the [OpenStack website](#).

TEALEAF is a registered trademark of Tealeaf, an IBM Company.

Windows Server and the Windows logo are trademarks of the Microsoft group of countries.

Worklight is a trademark or registered trademark of Worklight, an IBM Company.

UNIX is a registered trademark of The Open Group in the United States and other countries.

* Other product and service names might be trademarks of IBM or other 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.

This information provides only general descriptions of the types and portions of workloads that are eligible for execution on Specialty Engines (e.g. zIIPs, zAAPs, and IFLs) ("SEs"). IBM authorizes customers to use IBM SE only to execute the processing of Eligible Workloads of specific Programs expressly authorized by IBM as specified in the "Authorized Use Table for IBM Machines" provided at www.ibm.com/systems/support/machine_warranties/machine_code/aut.html ("AUT"). No other workload processing is authorized for execution on an SE. IBM offers SE at a lower price than General Processors/Central Processors because customers are authorized to use SEs only to process certain types and/or amounts of workloads as specified by IBM in the AUT.