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z/VSE Project Manager



# Enterprise2014

## z/VSE VTAPE – All you need to know

zSN010

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# Agenda

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- **Basics**
  - Remote vs. VSAM
  - Formats (AWS, Zipped, PTF)
  - Transferring tape images
  - Actions
- **Enhancements**
  - VTAPE QUERY
  - Tivoli Storage Manager Support
  - **Stacking Tape Support**





## Overview

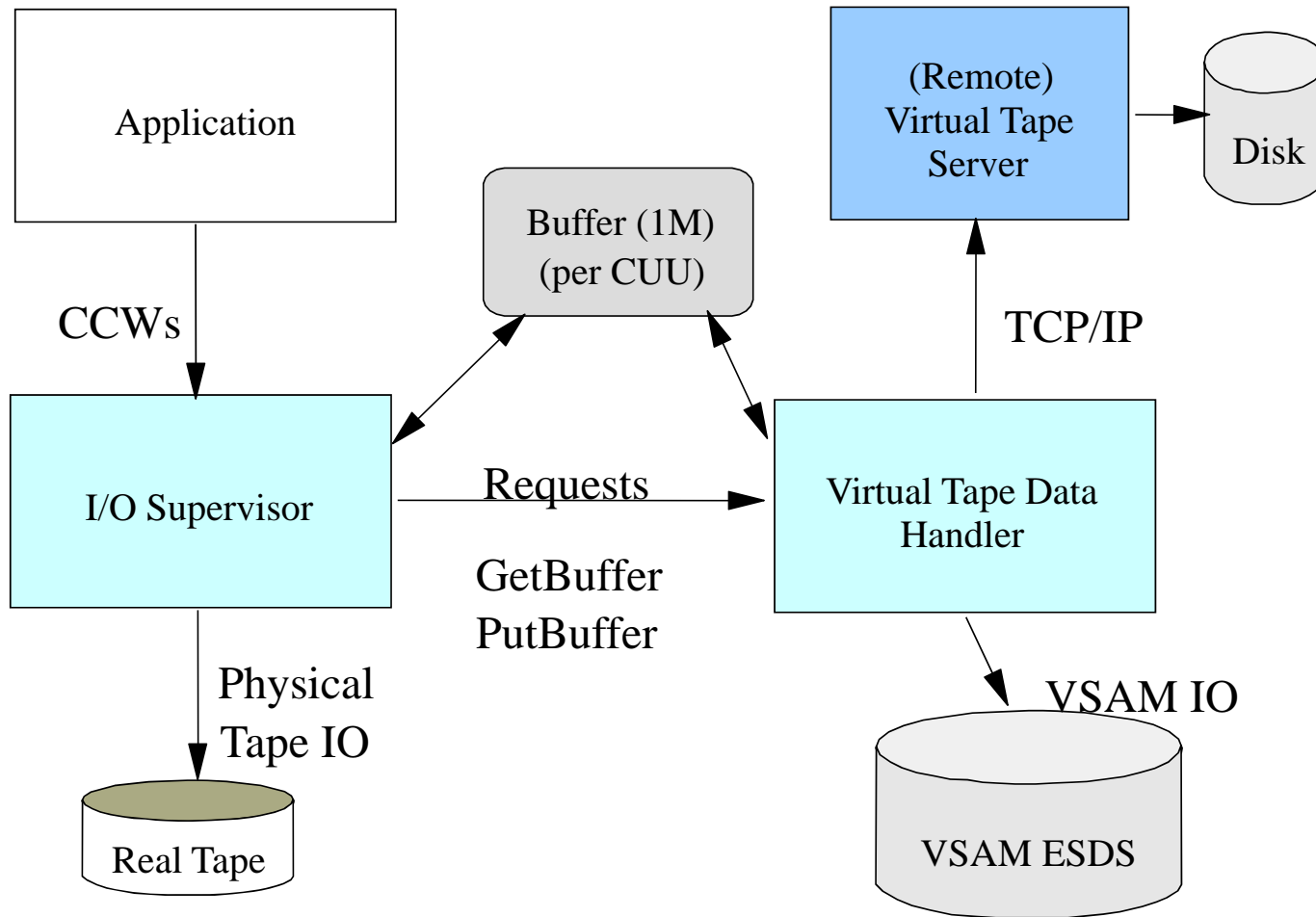
---

- VSE VTAPE support is part of z/VSE since VSE/ESA 2.6
- Emulates a complete tape
  - Can contain multiple tape files, not just one tape file
- Uses a tape image file instead of a physical tape
- Tape image file can reside in
  - VSAM ESDS
  - Remote file (e.g. on a workstation)
- Tape image file has AWSTAPE format
  - known from P/390, R/390, Hercules, Flex-ES





# Overview





## Overview - continued

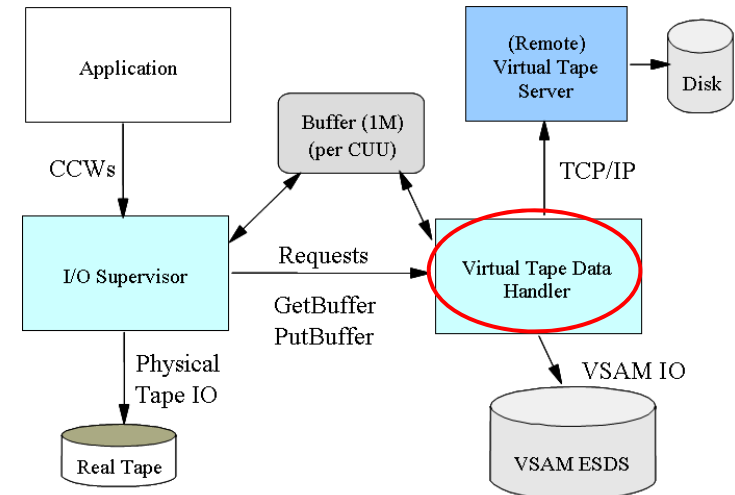
---

- VTAPE command
  - `VTAPE START,UNIT=<cuu>,LOC=<ip or VSAM>,FILE='filename'`
  - `VTAPE STOP,UNIT=<cuu>`
- Tape image file is opened at VTAPE START
- Tape image file is closed at VTAPE STOP
- Access to tape image can be
  - READ - read only
  - WRITE - read and write (existing content is kept)
  - SCRATCH - read and write (content is cleared)

# Virtual Tape Data Handler Partition



- Runs in a batch partition
  - Dynamic class R per default
- Accesses VSAM tape images
- Establishes TCP/IP connections to remote system
- Startup job TAPESRVR
  - Skeleton SKVTASTJ in ICCF lib 59



```

* $$ JOB JNM=TAPESRVR,DISP=L,CLASS=R
* $$ LST CLASS=A,DISP=D
// JOB TAPESRVR START UP VSE TAPE SERVER
// LIBDEF
*,SEARCH=(PRD2.CONFIG,PRD1.BASE,PRD2.SCEEBASE)
// ID USER=VCSRV
// EXEC $VTMAIN,SIZE=$VTMAIN
/*
/&
* $$ EOJ
  
```

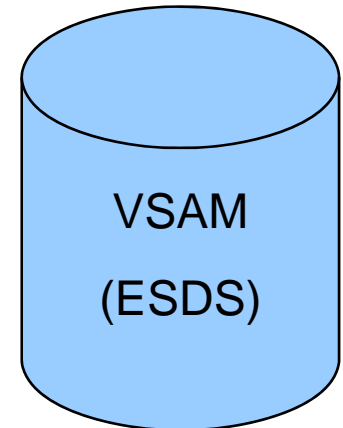
Since z/VSE 4.2, the job name can be changed.  
Use JNM= 'jobname' at VTAPE START command



## VSAM tape images

---

- A VSAM tape image resides in a VSAM ESDS Cluster
- Recommended file attributes
  - CI size = 32768
  - Record Size = 32758 (32768-10)
  - REUSE = YES
  - Shareoption = 1
  - Records/Cylinder/Tracks depends on amount of data
- Skeleton SKVTAPE in ICCF lib 59
- Size limit is 4GB (because VSAM ESDS size limit)







## Remote tape images

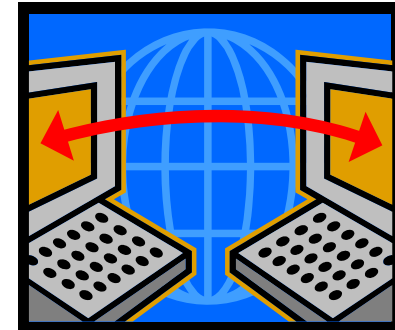
---

- A remote tape image resides in a file
  - on the remote workstation's file system
- The file is created automatically (if not existing)
- Filename (and path) are remote system dependent
  - Be careful with uppercase translation of filename
- Remote systems can be
  - Windows (95/98/NT/2000/ME/Vista/7/8/...)
  - Linux (on System z, Intel, p, ....)
  - Unix (Aix, Sun, HP, ...)
  - Any Java capable platform
- Size limit depends on file system (e.g. FAT, NTFS, ext, ...) of remote system





# Transferring tape images



- Transfer tape images in binary
  - From one workstation to another workstation
    - Network drive
    - File transfer
  - From a workstation to a VSAM ESDS cluster

```
ftp 9.164.186.20
bin
quote site lrecl 32758
quote site recfm v
put d:\backup.aws VSAM.TAPE.IMAGE
```

- initiate FTP session
- transfer in binary
- specify record size
- record format variable
- transfer the file

# Usage Example - Backup to CD-ROM



- **Step 1:** Do a backup to a virtual tape

```
// JOB BACKUP
VTAPE START,UNIT=480,LOC=9.164.186.20,FILE='d:\backup.aws,SCRATCH
MTC REW 480
MTC WTM,480
// EXEC LIBR
BACKUP LIB=PRD2 TAPE=480
/*
VTAPE STOP,UNIT=480
/ &
```



- **Step 2:** Copy (burn) d:\backup.aws to a CD-ROM
- **Step 3:** Archive the CD-ROM
- **Step 4:** Restore directly from CD-ROM

## Usage Example – Reduce offline time

---



- **Step 1:** Backup all your files, databases, libraries, ... onto separate VSAM VTAPES
  - During this time your CICS needs to be down (offline)
- **Step 2:** Backup all the VSAM VTAPE files to a real tape
  - This can be done while CICS is up (online)
  - Can even be done on a separate VSE system, if the DASDs are shared
- Reduces the backup time (offline time)
- Only one real tape needed for all backup steps



## Usage Example - Dump offload

---

- Create a (remote) virtual DUMP tape
  - DUMP Fx, cuu
  - DUMP SVA, cuu
  - DUMP SUF, cuu
  - Offload function in IUI Dialog (Fastpath 43)
- Send the tape image containing the DUMP to IBM for analysis
  - Attach it to a e-mail
  - Put in onto IBM's FTP server





## Usage Example - PTF install

---

- Order one or more PTFs via IBM Shopz
  - You will get a notification when the PTF is ready for download
  - Download the file containing the PTF(s)
    - e.g. eptf5375.bin
  - Unzip (if zipped) and rename it to eptf5375.ptf
- Apply the PTF(s) as usual
  - Use PTF Apply Dialog 1423
  - Use Virtual Tape pointing to the downloaded PTF data
  - Indirect apply is also possible



# News – by VSE release/version



z/VSE release	Function
VSE/ESA 2.6	<ul style="list-style-type: none"> <li>VTAPE functionality was introduced</li> </ul>
VSE/ESA 2.7	<ul style="list-style-type: none"> <li>Binary PTF data (for PTF install)</li> <li>Zipped AWSTAPE and PTF data</li> <li>Removed DVCDN/DVCUP requirements</li> </ul>
z/VSE 3.1	<ul style="list-style-type: none"> <li>FakeTape (FLEXES) and zipped FakeTape</li> </ul>
z/VSE 4.1 & 4.2	<ul style="list-style-type: none"> <li>AWSTAPE with ZLIB compressed records</li> <li>Support for Tivoli Storage Manager (TSM)</li> <li>QUERY command to query active VTAPES</li> <li>Simplified Use of DLBL for VSAM VTAPES</li> <li>Many Interactive Interface Dialogs have been adopted to allow use of VTAPE</li> </ul>
z/VSE 5.1	<ul style="list-style-type: none"> <li>SCOPE=JOB: Automatically stop VTAPE at EOJ</li> <li>RLE Compressed AWSTAPE format (used/created by TapeStream)</li> <li>Over time several Interactive Interface Dialogs have been adapted to support VTAPE</li> </ul>
z/VSE 5.2	<ul style="list-style-type: none"> <li><a href="#">Stacking Tape Support for VTAPE</a></li> </ul>

Note: "FLEXES" and "FakeTape" are trademarks of "Fundamental Software, Inc" and "TapeStream" is a trademarks of "Fischer International Systems Corporation".

# News – Supported formats



Format	VSAM	Remote
AWSTAPE	Yes	Yes
Zipped AWSTAPE	No	Yes (read only)
FakeTape (FLEXES)	No	Yes
Zipped FakeTape (FLEXES)	No	Yes (read only)
AWSTAPE with ZLIB compressed records	Yes (since z/VSE 4.3)	Yes
Binary PTF data	No	Yes (read only)
Zipped binary PTF data	No	Yes (read only)
RLE Compressed AWSTAPE (TapeStream)	No	Yes

Note: "FLEXES" and "FakeTape" are trademarks of "Fundamental Software, Inc" and "TapeStream" is a trademarks of "Fischer International Systems Corporation".





## Zipped AWSTAPE format

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- To save disk space a AWSTAPE image can be zipped (PKZIP)
  - one or more tape images in one ZIP file
- To save download time
  - Extended VTAPE START filename syntax
  - Allows to read directly from a zipped image
  - without unzipping it first

```
VTAPE START,UNIT=cuu,LOC=ip-addr,FILE='zip-file.zip!aws-file.aws'
```





## Binary PTF data

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- Simulates a PTF tape (read only)
  - can be directly installed with IUI Dialog 1423
- Input data is a binary PTF stream
  - PTF job stream with LRECL=80 (binary)
  - As downloadable from IBM ShopzSeries
  - PTF data can also reside in a ZIP file
- Extended VTAPE START filename syntax for ZIPed data
  - File must have extension '.PTF'



```
VTAPE START,UNIT=cuu,LOC=ip-addr,FILE='ptf-file.ptf'
```

```
VTAPE START,UNIT=cuu,LOC=ip-addr,FILE='zip-file.zip!ptf-file.ptf'
```



# FakeTape format

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- FakeTape format is known from FLEXES
  - Note: "FLEXES" and "FakeTape" are trademarks of Fundamental Software, Inc.
- Allows to work with FakeTape tape images
  - read FakeTape files
    - format is detected automatically
  - Create FakeTape files
    - File extension must be `.fkt` or `.faketape`
    - Otherwise AWSTAPE format is created
  - Also able to read zipped FakeTape files



# AWSTAPE with ZLIB compressed tape records

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- To save space, the tape records stored within a AWSTAPE file can be compressed using ZLIB 1.2.1.
  - Every single tape record is compressed separately
  - Compression ratio is not as good as zipped AWSTAPE files
- Per default uncompressed tape images are created
  - You can force compression by using a file extension of '.zaws'.
- ZLIB compression is supported for remote tapes
  - Since z/VSE 4.3, its also supported for VSAM virtual tapes





## VTAPE Exits

- Virtual Tape Server can call exits (also called actions)
  - VTAPE START (open of tape image)
  - VTAPE STOP (close of tape image)
- Can be used for tape management tools
  - start backup of tape image
  - notify operators
- The IBM provided default action can execute a command or shell script/batch script



### VirtualTapeServer.properties

...

```
action=com.ibm.vse.vtape.DefaultAction
```

```
actionparam=open:open.bat close:close.bat
```

...



# VTAPE QUERY command

- With **z/VSE 4.1** a new QUERY command has been added

```
>> | _// _ | _VTAPE QUERY_ | _ ,UNIT=cuu_ | _><
```

- If the UNIT operand is omitted, information about all virtual tapes will be displayed
- If the UNIT operand is specified, detailed information about the specified virtual tape cuu is displayed
- Example:

```
R2 0047 Display all virtual tapes
R2 0047 -----
R2 0047
R2 0047 182    9.152.2.70, 2386          TAPE.AWS          WRITE
R2 0047
R2 0047 181    VSAM                      VTAPE1            WRITE
R2 0047
R2 0047 -----
```

# Simplified Use of DLBLs for VSAM Files

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- From **z/VSE 4.1** onwards, you are no longer required to have the DLBL for VSAM files used with VSE VTAPE in the system standard label area
- You can specify the DLBL statements directly in the job that issues the VTAPE START command
  - The VTAPE START command will then transfer the label information to the tape server partition.
- With this support, you can (for example):
  - Define a new VSAM file and use this cluster in the same job with a virtual tape.
  - You are no longer required to add the DLBL statement to the system standard labels
- Prior to z/VSE 4.1, the DLBL of the VSAM file used with VSE VTAPE had to reside in the system standard labels

# Simplified Use of DLBL Statements for VSAM Files

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Job running in F4

```
// JOB BACKUP
// ON $CANCEL OR $ABEND GOTO VTAPSTOP
* FIRST DEFINE THE CLUSTER
// EXEC IDCAMS,SIZE=AUTO
  DEFINE CLUSTER ( -
    NAME (VTAPE.TEST.FILE) -
    ...
    CATALOG (MY.USER.CATALOG)
  IF LASTCC NE 0 THEN CANCEL JOB
/*
* NOW DO THE BACKUP INTO THE NEWLY CREATED CLUSTER
// DLBL MYVTAPE, 'VTAPE.TEST.FILE', ,VSAM, CAT=MYUCAT
// DLBL MYUCAT, 'MY.USER.CATALOG', ,VSAM
VTAPE START,UNIT=480,LOC=VSAM,FILE=MYVTAPE
// EXEC LIBR
  BACKUP LIB=PRD2 TAPE=480
/*
/. VTAPSTOP
VTAPE STOP,UNIT=480
/&
```

Running in R1

VTAPE  
Data Handler

Label Area of R1

→ IJVTcuu  
→ IJVCcuu

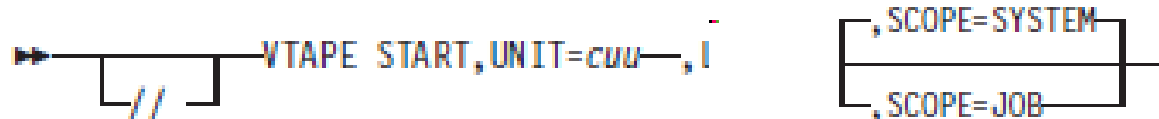
VSAM OPEN is performed  
using IJBVTcuu DLBL





## VTAPE SCOPE parameter

- With **z/VSE 5.1** a new SCOPE parameter has been added



- The SCOPE parameter defines the lifetime of the VTAPE definition:
  - **SYSTEM** (default) specifies that the association can only be released by an explicit VTAPE STOP request
  - **JOB** specifies that the association can be released either by an explicit VTAPE STOP request or automatically during end-of-job (/&) processing
    - In this case the VTAPE definition is limited to a single job

# Tivoli Storage Managers – Backup VSE data

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**Tivoli** software

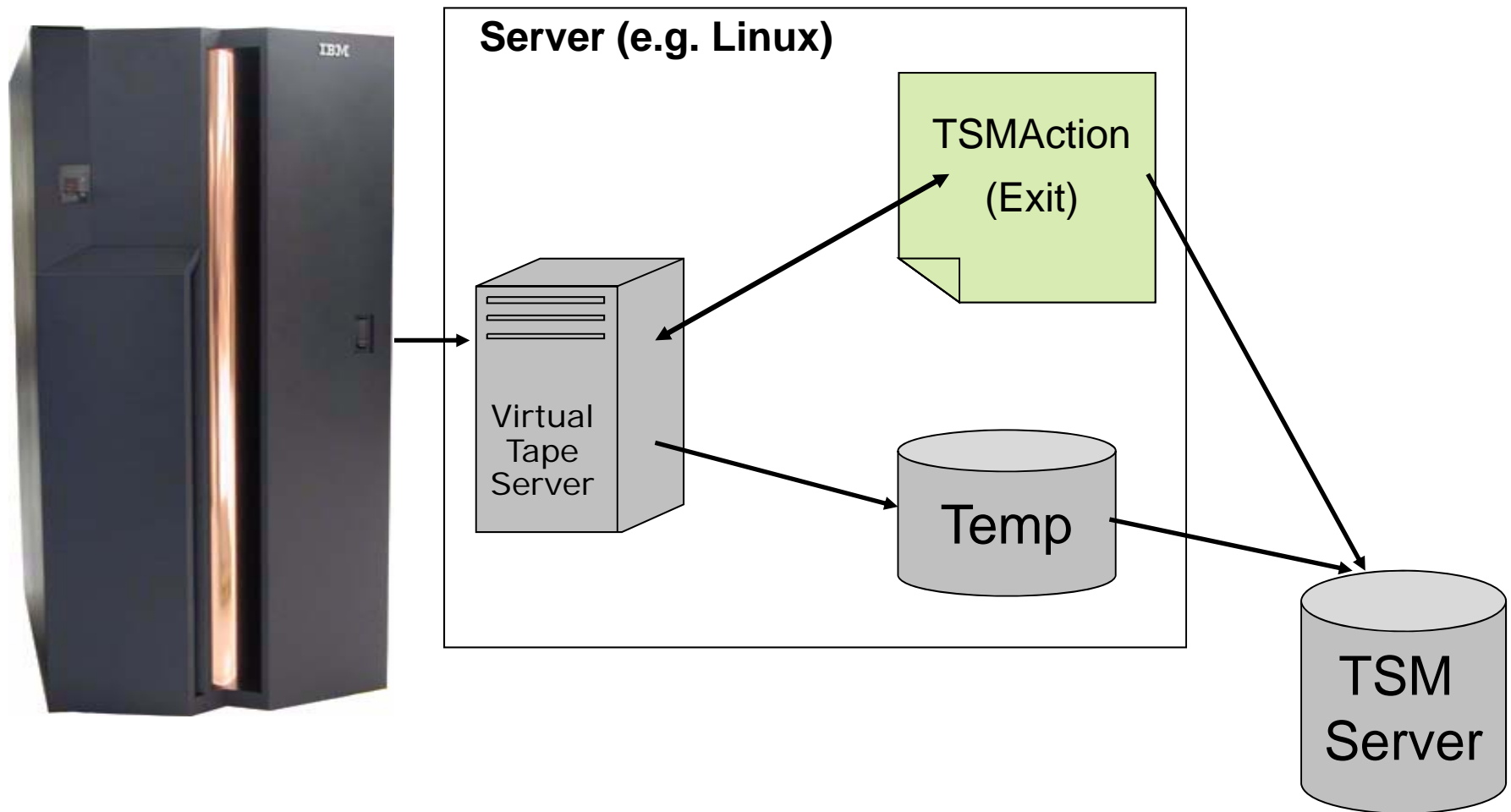
- **Starting with z/VSE 4.1**
  - Allows to integrate VSE backups into an existing TSM environment
- **Uses the TSM Command-Line interface (DSMC)**
  - Available on many different (middle tier) platforms, e.g. Linux on System z
- **Based on the VTAPE Function of VSE**
  - Complete tape images will be backed up via TSM
  - VTAPE OPEN/CLOSE Exit (so called Actions)
  - At OPEN time, the tape image will be restored via TSM
  - At CLOSE time, the tape image will be backed up via TSM
- **Existing Backup Jobs can be reused almost unchanged**

# Tivoli Storage Managers – Backup VSE data

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**Tivoli** software



# Tivoli Storage Managers – Backup VSE data

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**Tivoli** software

## Backup of a VSAM Clusters using TSM

```
* $$ JOB JNM=VSAMBKUP,DISP=L,CLASS=0
// JOB VSAMBKUP
// LIBDEF PHASE,SEARCH=IJSYSRS.SYSLIB
* THIS JOB BACKS UP VSAM DATASETS
// DLBL IJSYSUC,'VSESP.USER.CATALOG',,VSAM
*
* THIS FUNCTION USES A VTAPE FOR OUTPUT
VTAPE START,UNIT=181,LOC=9.152.216.105,FILE='TSM:VSAM.AWS(BACKUP)',SCRATCH
// ASSGN SYS005,181
// EXEC IDCAMS,SIZE=AUTO
    BACKUP ( -
            VSAM.CONN.SAMPLE.DATA -
            . . . -
            ) -
    REW -
    NOCOMPACT -
    BUFFERS(3)
/*
// ASSGN SYS005,UA
VTAPE STOP,UNIT=181
/&
* $$ EOJ
```

### Syntax:

TSM:<name>(<mode>,<optionset>,  
          <fromdate>,<fromtime>)

mode       - BACKUP or ARCHIVE  
optionset   - Name of the configuration  
fromdate   - Date (for Restore)  
fromtime   - Time (for Restore)

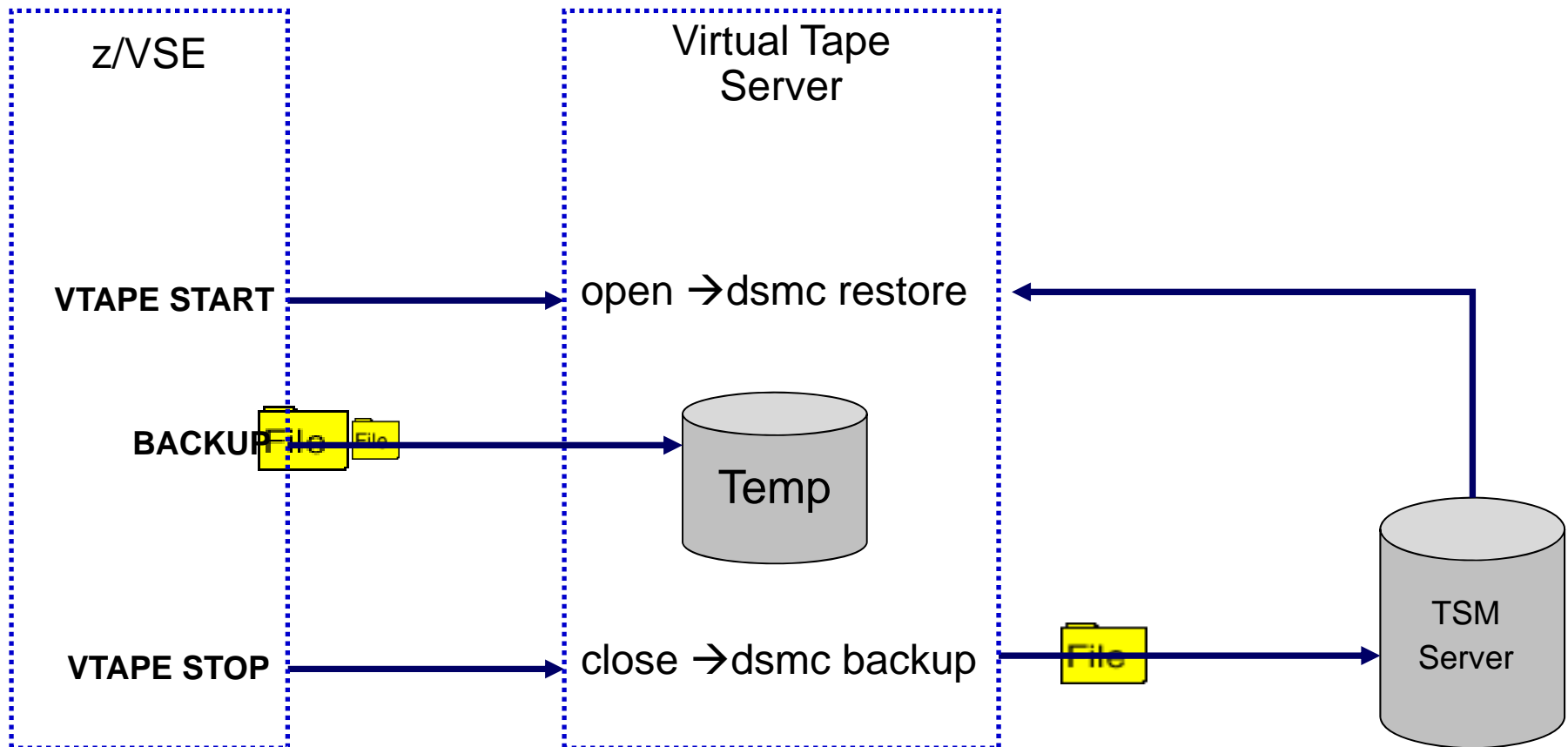
# Tivoli Storage Managers – Backup VSE data

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Tivoli software





# Hints & Tips for best performance

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- **VSAM virtual tapes**

- Traditional VSAM tuning helps to increase performance
  - Buffers
  - Optimization for sequential processing



- **Remote virtual Tapes**

- Performance tuning falls back to TCP/IP and network tuning
  - Make sure the TCP Receive Window Size is set to 32K
  - High network throughput requires increased CPU Power
  - Reduce the number of hops between VSE and the VTAPE server
- Make sure the partition priorities are right
  - ...,TCP/IP,VTAPE Server, ... , Job that uses VTAPE, ...



## Hints & Tips – Delayed Ack Problem

- For best performance, assemble your \$SOCKOPT phase with the following option set in the socket option flag:
  - This setting fixes a problem that is known as "Delayed ACK" problem.
  - \$OPTSNWT.
- Please make sure you have applied ZP15E101 for TCP/IP 1.5E or APAR PK38492

```
// EXEC ASMA90,SIZE=ASMA90,PARM='SZ(MAX-200K,ABOVE),
      PUNCH      ' PHASE $SOCKOPT,* ,
$SOCKOPT CSECT
*
* * This phase is used by the BSD-C interface to allow global options
* * that affect the operation of all sockets in a partition.
      SOCKOPT CSECT,          Generate a csect          X
      BSDCFG1=$OPTMECB+$OPTSNWT, Socket options flag      X
      CLST=-1,                Seconds to wait for close   X
      CSRT=59,                Seconds before socket reuse X
      SSLLIBN=KEYLIB,         SSL library name           X
      SSLSUBN=SSLKEYS,        SSL sublib name            X
      SSLMEMN=MYKEY512,       SSL member name for keys  X
      SSLDEBG=00,             SSL debugging flag         X
      SSLFLG1=00, 80=req_close_notify_alert             X
      SSLFLG2=80, 80=do not use HW-Crypto                X
      SSLSTOR=80,             SSL storage usage           X
      SYSID=00                Use this TCP/IP sysid
*
      END $SOCKOPT
```



## Latest PTFs and APARs

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- **Please check for latest PTFs on the following web page:**
  - <http://www.ibm.com/systems/z/os/zvse/support/vtape.html>
  
- **Additional Information about VTAPE can be found in the following document:**
  - <ftp://public.dhe.ibm.com/eserver/zseries/zos/vse/pdf3/VSEVirtualTapeSupport.pdf>





# AWSTAPE Format – tools and resources

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- **AWSTAPE format descriptions:**

- <http://www.bustech.com/support/techtips/mas/awstape.htm>
- <http://www.cbttape.org/awstape.htm>

- **Tools:**

- **AWSBROWS:** PC based browser for AWSTAPE files:  
<http://www.cbttape.org/ftp/adhoc/Awsbrows.zip>  
<http://www.cbttape.org/~fish/AWSBrowse-1.5.1.1805-bin.zip>
- **LISTVOL1 Tool:** Reads the first 2 tape records of tape image in AWSTAPE format residing in a VSAM ESDS cluster and prints the VOLSER and FILEID from the VOL1 and HDR1 labels on the tape.  
<http://ibm.com/vse> goto Downloads and then Tools
- **Data Extract Utility:** Extracts Tape files from a AWSTAPE image and stores each file in a separate file on your PC.  
Comes as part of VSE Virtual Tape Server



# AWSBROWS – Browser for AWSTAPE files

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The screenshot shows the AWSBrowse application window titled "vse41ga.aws - AWSBrowse". The window has a menu bar (File, Edit, View, Help) and a toolbar with various icons. The main area is divided into two panes. The left pane shows a file list with columns for File, Block, and Bytes. The right pane shows a hex dump of the selected file's content.

File	Block	Bytes
File: 1	Block: 1	80 bytes
File: 1	Block: 2	80 bytes
File: 1	Block: 3	80 bytes
File: 1	Block: 4	80 bytes
File: 1	Block: 5	80 bytes
File: 1	Block: 6	80 bytes
File: 1	Block: 7	80 bytes
File: 1	Block: 8	80 bytes
File: 1	Block: 9	80 bytes
File: 1	Block: 10	80 bytes
File: 1	Block: 11	512 bytes
File: 1	Block: 12	12,288 bytes
File: 1	Block: 13	22,428 bytes
File: 1	Block: 14	2,792 bytes
File: 1	Block: 15	31,744 bytes
File: 1	Block: 16	31,744 bytes
File: 1	Block: 17	31,744 bytes
File: 1	Block: 18	31,744 bytes
File: 1	Block: 19	31,744 bytes
File: 1	Block: 20	31,744 bytes
File: 1	Block: 21	31,744 bytes
File: 1	Block: 22	31,744 bytes
File: 1	Block: 23	31,744 bytes
File: 1	Block: 24	31,744 bytes
File: 1	Block: 25	31,744 bytes
File: 1	Block: 26	31,744 bytes

Hex	Hex	Hex	Hex	Hex	Text
0000	05A041AA	000018BA	4AB0A12E	58E0B0C2	.....[.^~..\^B
0010	47F0A130	5B5BC15B	D7D3C2E3	F8F1C3F0	.0~.\$\$\$PLBT81C0
0020	F1F161F2	F761F0F6	D3C9C3C5	D5E2C5C4	11/27/06LICENSED
0030	40D4C1E3	C5D9C9C1	D3E24060	40D7D9D6	MATERIALS - PRO
0040	D7C5D9E3	E840D6C6	40C9C2D4	40404040	PERTY OF IBM
0050	40404040	F5F6F8F6	60C3C6F8	404DC35D	5686-CF8 (C)
0060	40C3D6D7	E8D9C9C7	C8E340C9	C2D440C3	COPYRIGHT IBM C
0070	D6D9D74B	40F1F9F7	F76B40F2	F0F0F540	ORP. 1977, 2005
0080	C1D3D340	D9C9C7C8	E3E240D9	C5E2C5D9	ALL RIGHTS RESER
0090	E5C5C44B	40404040	40404040	40404040	VED.
00A0	40404040	40404040	40404040	E4E240C7	US G
00B0	D6E5C5D9	D5D4C5D5	E340E4E2	C5D9E240	OVERNMENT USERS
00C0	D9C5E2E3	D9C9C3E3	C5C440D9	C9C7C8E3	RESTRICTED RIGHT
00D0	E2406040	40404040	E4E2C56B	40C4E4D7	S - USE, DUP
00E0	D3C9C3C1	E3C9D6D5	40D6D940	C4C9E2C3	LICATION OR DISC
00F0	D3D6E2E4	D9C540D9	C5E2E3D9	C9C3E3C5	LOSURE RESTRICTE
0100	C440C2E8	C7E2C140	C1C4D740	E2C3C8C5	D BYGSA ADP SCHE
0110	C4E4D3C5	40C3D6D5	E3D9C1C3	E340E6C9	DULE CONTRACT WI
0120	E3C840C9	C2D440C3	D6D9D74B	40404040	TH IBM CORP.
0130	10004120	00024160	A0001B62	58E0B0C2	...?...-.....\^B
0140	1B5541F0	03D80EE4	58E0B0C2	4580AA3E	...0.Q.U.\^B...?
0150	D201E006	AF86D201	E004AF86	D201E390	K.\?.fK.\?.fK.T.
0160	AF86D201	E3A6AF86	9240E05C	D206E05D	.fK.Tw.fk \*K?\)
0170	E05CD503	0064B0CA	4770A1A6	91F00062	\*N...^...~wj0..

# LISTVOL1 Utility – What is on my virtual tapes?

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- This tool helps to manage VSE VTAPE images stored in VSAM files
- It can display the VOLSER and File-ID of the files stored on the virtual tape without mounting it as VTAPE.
- The ListVOL1 utility reads the first 2 tape records of tape image
  - You can specify multiple VTAPE files
- It prints the VOLSER and FILE-ID from the VOL1 and HDR1 labels on the tape:

```
LISTVOL1 UTILITY - LIST VOL1/HDR1 LABELS OF VTAPES

FILENAME: VOLSER  FILE-ID
-----
VTAPE1   : TAPE00  TAPE.DATASET.00
VTAPE2   : PRDDAT  PRODUCTON.DATA
VTAPE3   : BACKUP  MY.BACKUP.FILE
-----

LISTVOL1 UTILITY - FINISHED
```

# Extract Tool – Extract data from a AWSTAPE file



- Extracts Tape files from a AWSTAPE image
  - stores each file in a separate file on your PC
- Comes as part of VSE Virtual Tape Server
- To run it:
  - Extract.bat

```
set
classpath=.;VirtualTape.jar;vtapetools.jar;%classpath%
java com.ibm.vse.vtape.tools.ExtractFiles %1
```
  - Extract.bat <awstape-file>
  - Output is one or more PC files named <awstape-file>.0 ... <awstape-file>. n.



# Agenda

- Basics
- Enhancements
  - VTAPE QUERY
  - Tivoli Storage Manager Support
  - **Stacking Tape Support**



# Stacking Tape Support

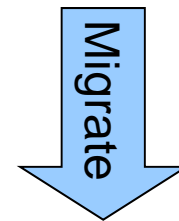
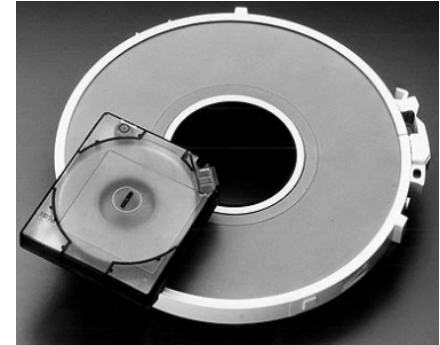


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- **Backups of vital business data must be kept for a long time** (e.g. 10 years)
- Customer often have to copy old-generation tapes to tapes of a newer HW generation when migrating to new tape hardware
- Today's tape capacity is high (e.g. 4 TB for a 3592)
  - Old 3480 tapes usually contain only very little data
  - Waste of space and money
    - if the copy is done on a 1 to 1 basis
- **Requirement:**
  - Allow to 'stack' several smaller tapes onto one larger tape
  - A modern 3592 cartridge has space for dozens/hundreds of old-generation tapes



# Stacking multiple smaller tapes onto one large tape

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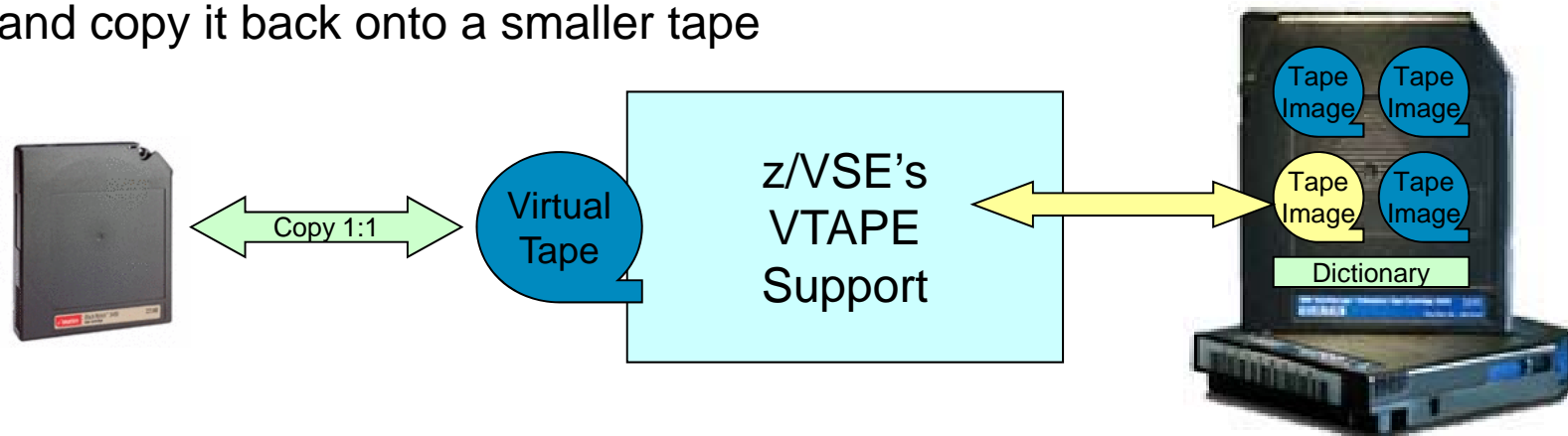


A 3592 cartridge has space for dozens/hundreds of old-generation tapes



## z/VSE's Stacking Tape Support

- **With z/VSE 5.2 z/VSE provides Stacking Tape support**
  - The VTAPE function provides tape-to-tape copy on a n:1 basis
    - by stacking multiple **tape images** on a single high-capacity tape cartridge (3592)
  - Basically its a VTAPE-on-Tape
    - Similar to VTAPE-on-VSAM ESDS or VTAPE-on-remote file
- **Allows you to stack multiple (old-generation) tapes onto a single high capacity tape**
  - You copy an **entire** old-generation tape onto the stacking tape
  - The stacking tape contains a **directory** of tape images contained
  - Later you can mount such a tape image, located on the stacking tape, and copy it back onto a smaller tape

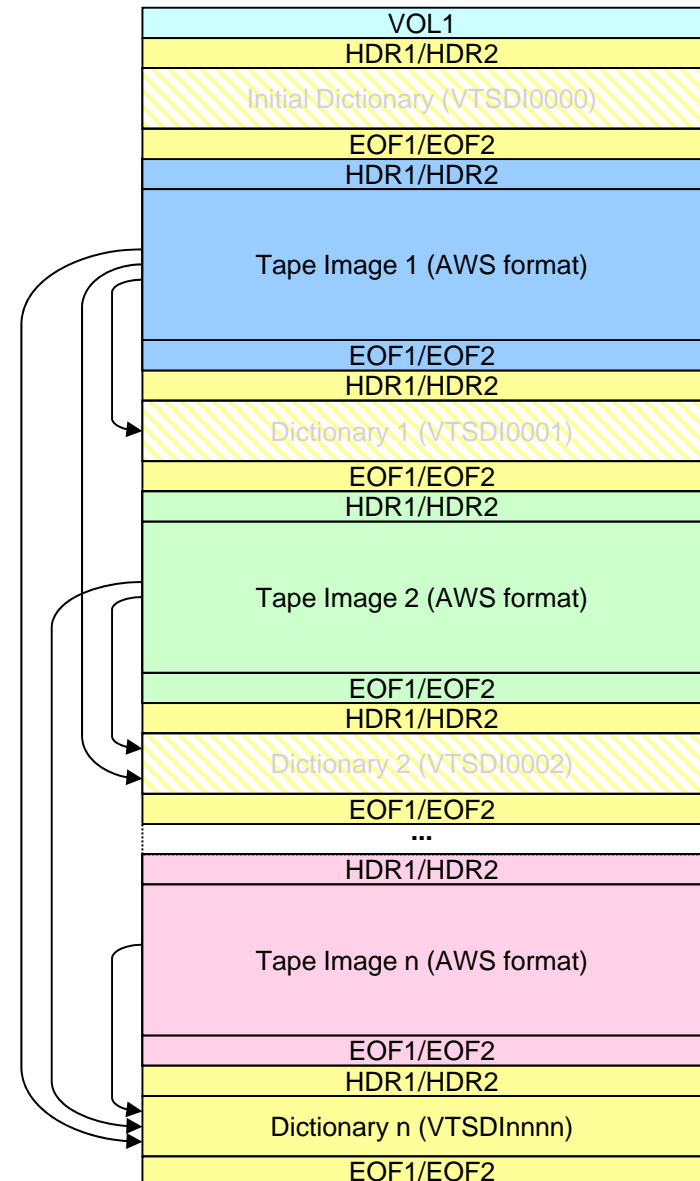






# Stacking Tape - Layout

- **Stacking Tapes** are **standard IBM labeled tapes**
- Each copied **tape image** is stored as **regular SAM tape-file**
  - AWSTAPE format
  - RECFM=U
  - BLKSIZE=65528
  - Filename: as specified on VTAPE command
- The **AWS tape image file** contains the **entire** copied tape, including
  - Data
  - Tapemarks
  - Volume/file headers
- **Dictionary files** contain a **dictionary of all tape images on the stacking tape**
  - Only the last dictionary file on the tape is valid
  - For each tape image written to the stacking tape, a new dictionary file is written
  - Format: RECFM=F, LRECL=80
  - File name: VTSDInnnn (nnnn is a counting number)
- **A dictionary entry** contains
  - Name of the tape image
  - Size in mega bytes
  - Creation date
  - VOLSER (if tape image contains labeled tape)





## Initializing a stacking tape

---

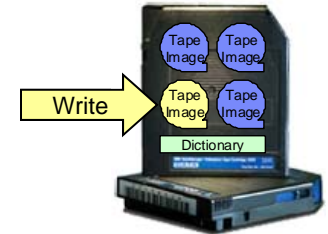
- Before you can add tape images onto a stacking tape, you need to initialize it
  - `// VTAPE INIT, STACKTAPE=cuu`
- Where `cuu` must be a
  - IBM standard label tape (must already contain a volume label)
  - An 3592 tape
- On **VTAPE INIT** the Virtual Tape Data Handler partition writes an initial directory as first file to the tape and issues a completion message on the console
- Once a stacking tape is initialized, it cannot be initialized again
  - Any subsequent **VTAPE INIT** function causes an error message
  - The **VTAPE LIST** and **VTAPE START** functions will fail, if the stacking tape has not been initialized
- **Note:** Do not mix up **VTAPE INIT** with DITTO INT or the INTTP utility
  - DITTO INT and the INTTP utility write new volume labels to the tape and the tape data is completely cleared
  - Once a stacking tape contains data it must not be initialized with DITTO INT or INTTP
    - unless the tape data is obsolete, and you really want to initialize the tape from scratch

# Copying data onto a stacking tape



- Mount the stacking tape to start writing (copying) a new tape image onto it:

```
// VTAPE START,UNIT=cuu1,LOC=TAPE,STACKTAPE=cuu2,
      FILE='MY-FIRST-FILE',WRITE
```

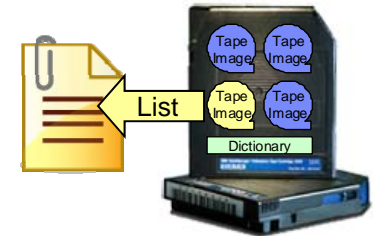


- A new (to be written) tape image is mounted as VTAPE on **cuu1**
- VTAPE START will first read the last directory on the stacking tape **cuu2**
  - To check if a tape image with the same name exists already
- The new tape image will be appended at the end of the stacking tape **cuu2**
- Use a tape copy tool to copy the entire content from the to-be-archived tape onto **cuu1**
  - e.g. **DITTO TT**
  - You can only use **pure sequential** processing on the mounted virtual tape
- **VTAPE STOP** closes the tape image
  - and writes an updated directory right behind this newly created tape image

# Listing the contents of a stacking tape



- The **VTAPE LIST** function displays information about the tape images that are listed in the last directory file on the stacking tape



```
// VTAPE LIST, STACKTAPE=cuu
```

- The contents is printed to SYSLOG (console)
- In addition the content is listed into library member <VOLSER>.LIST in PRD2.CONFIG
- A directory entry contains
  - The name of the tape image, as specified on the VTAPE START command for WRITE
  - The size in mega bytes
  - The creation date
  - The VOLSER (if tape image contains a labeled tape)

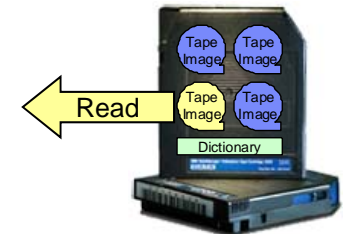
File-----	Date--	VOLSER	Size---
MY-FIRST-FILE	140120	BKUP47	432M
MY-SECOND-FILE	140205	DATA01	97M
-----			



## Reading from a stacking tape

- Mount a specific tape image on the stacking tape to start reading (copying) from it:

```
// VTAPE START,UNIT=cuu1,LOC=TAPE,STACKTAPE=cuu2,
      FILE='MY-FIRST-FILE',READ
```



- **VTAPE START** will read the last directory on the stacking tape **cuu2**
  - To determine, whether a tape image with the specified file name exists
- Then, it positions the tape to the beginning of the specified file
  - ... opens it and mounts it as VTAPE on **cuu1**
- Use a tape copy tool to copy the entire content from the virtual tape **cuu1** onto a physical tape (or onto another VSAM-VTAPE)
  - e.g. **DITTO TT**
  - You can only use **pure sequential** processing on the mounted virtual tape
- **VTAPE STOP** closes the tape image



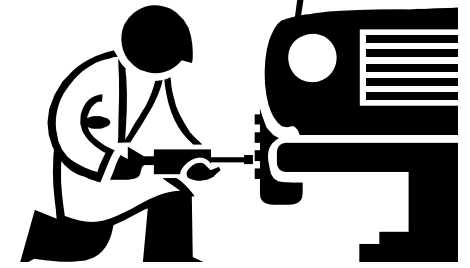
## Automatic repair

---

- In case of program abends, operator cancels or I/O problems with the stacking tape *CUU* can cause an abnormal termination of either the requester partition or the Virtual Tape Data Handler partition
  - In case of write access, the newly created virtual tape file on the stacking tape might be incomplete and therefore unusable
  - Also, the directory file might be missing or incomplete
- The next **VTAPE LIST** or **START** function detects this kind of tape corruption and performs an automatic repair
  - The tape is positioned to the last valid directory and writes two tape marks
    - thus indicating EOV (end of volume) and invalidating all data behind the last valid directory
  - If such a repair was processed, the Virtual Tape Data Handler partition writes the following message to SYSLOG:

```
R1 0047 STACKING TAPE nnnnnn PROCESSED AN AUTOMATIC REPAIR.
```

- **Note:** The stacking tape must not be write-protected in order to allow for automatic repair





# Restrictions & Considerations

- Existing virtual tape files on a stacking tape **cannot be individually deleted modified, or replaced**
- **VTAPE START** with **WRITE** access enabled **can never change existing tape files**
  - It can however add a new virtual tape file and a new directory to the stacking tape
- Stacking tapes can be accessed only with **WRITE** or **READ** access. **SCRATCH** access is not supported
  - If all data on a stacking tape has become obsolete, you can initialize the tape from scratch with **DITTO INT** or the **INTTP** utility
- Concurrent **VTAPE** access to files on one stacking tape is not supported
  - Even **VTAPE LIST** is rejected, if a virtual tape file is open for read or write via **VTAPE START**
- The Virtual Tape Data Handler partition **requires ownership** of the stacking tape *cuu* while processing **VTAPE** functions and I/O operations
  - No other partition can use this tape *cuu*, because tape ownership is exclusive
- There is **no alternate tape support** for stacking tapes.
  - All virtual tape files and their corresponding directory files must reside on one single tape volume
- If a virtual tape on a stacking tape is accessed with **VTAPE START**, it must not be positioned with the **MTC** command
- Only utilities, which **read or write strictly sequentially** without any repositioning are supported
- When running with a tape library, you must issue a **LIBSERV** command to mount stacking tape volumes and establish ownership for the Tape Data Handler partition



For more information,  
please see the z/VSE web site:

<http://www.ibm.com/zvse/>

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#### IBM z/VSE V5.2 is available

z/VSE V5.2 is the newest release of z/VSE and is intended to be the base for future z/VSE enhancements. This ongoing evolution of z/VSE, together with z/VSE's support of the newest IBM zEnterprise servers and IBM System Storage technology, is designed to help clients protect their investments in z/VSE, grow their workloads, or consolidate their systems. It demonstrates again IBM's commitment to z/VSE clients.

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**Replays available!**

**Dates and replays @**

**<http://www.ibm.com/zvse/education/>**

- **September 2014**
  - z/VSE Connectors Update
- **July 2014**
  - Introduction to tuning VSAM file performance under CICS TS in z/VSE
- **June 2014**
  - Tapeless Initial Installation
- **May 2014**
  - z/VSE Version 5 Update
- **March 2014**
  - TCP/IP for VSE Update
- **January 2014**
  - Update on Encryption and SSL
- **November 2013**
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  - Language Environment for z/VSE- News, Tips and Enhancements
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  - z/VSE CMT and SCRT Update
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