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z/VSE VTAPE Update and Usage

zDG06

Ingo Franzki, IBM



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Agenda

§ Basics

- Remote vs. VSAM
- Formats (AWS, Zipped, PTF)
- Transferring tape images
- Actions

§ News

- VTAPE QUERY
- Simplified Use of DLBL Statements for VSAM Files
- Tivoli Storage Manager Support

§ Hints & Tips

- Performance



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

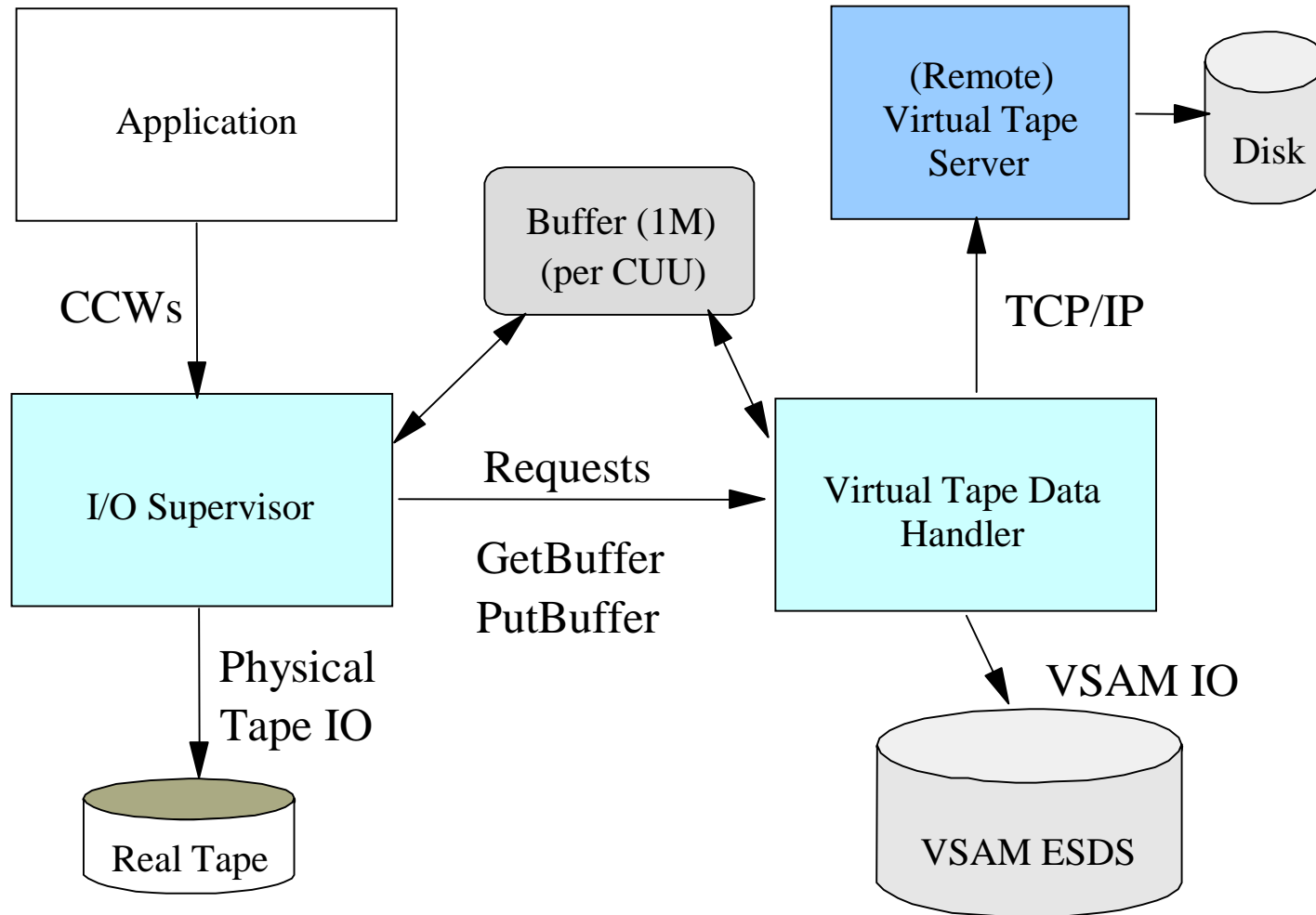
–Remote file (e.g. on a workstation)

§ 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

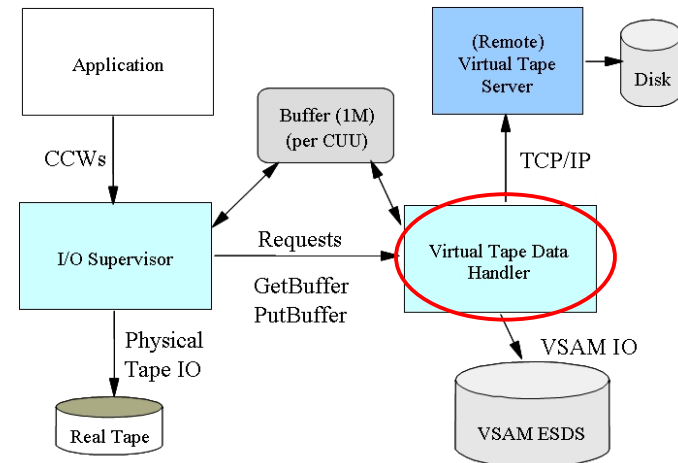
§ Tape image file is closed at VTAPE STOP

§ 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
  
```

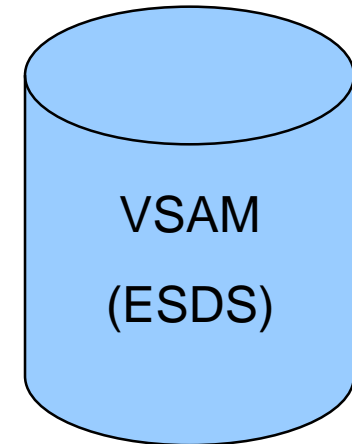
Since z/VSE 4.2, the job name can be changed.
Use JNM= 'jobname' at VTAPE START command

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/...)
 - Linux (on zSeries or Intel)
 - 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

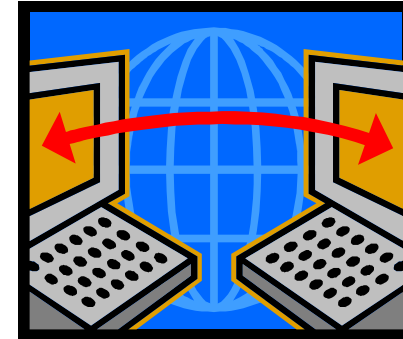
– From one workstation to another workstation

- 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 ShopzSeries

- 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	§ VTAPE functionality was introduced
VSE/ESA 2.7	§ Binary PTF data (for PTF install) § Zipped AWSTAPE and PTF data § Removed DVCDN/DVCUP requirements
z/VSE 3.1	§ FakeTape (FLEXES) and zipped FakeTape
z/VSE 4.1 & 4.2	§ AWSTAPE with ZLIB compressed records § Support for Tivoli Storage Manager (TSM) § QUERY command to query active VTAPES § Simplified Use of DLBL for VSAM VTAPES § Many Interactive Interface Dialogs have been adopted to allow use of VTAPE

Note: "FLEXES" and "FakeTape" are trademarks of Fundamental Software, Inc.

News – Supported formats (as of z/VSE 4.1 & 4.2)



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	No	Yes
Binary PTF data	No	Yes (read only)
Zipped binary PTF data	No	Yes (read only)

Note: "FLEXES" and "FakeTape" are trademarks of Fundamental Software, Inc.

Zipped AWSTAPE format

§ 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'
```

Example: AWSTAPE image prod1.aws resides in ZIP file d:\images\products.zip

```
VTAPE START,UNIT=cuu,LOC=ip-addr,FILE=d:\images\products.zip!prod1.aws'
```

Binary PTF data

§ Simulates a PTF tape (read only)

– can be directly installed with II 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

§ 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



§ 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 only supported for remote 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

- § 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
- § Instead, 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 (using IDCAMS DEFINE CLUSTER).
 - 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
 - The updating of the standard labels was only possible in the BG partition
 - This prevented you from being able to define a new VSAM cluster, and then use this cluster with VTAPE in the same job, *unless* the job ran in BG.

Simplified Use of DLBL Statements for VSAM Files

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

Tivoli Storage Manager - Functions



§ Backup and Restore

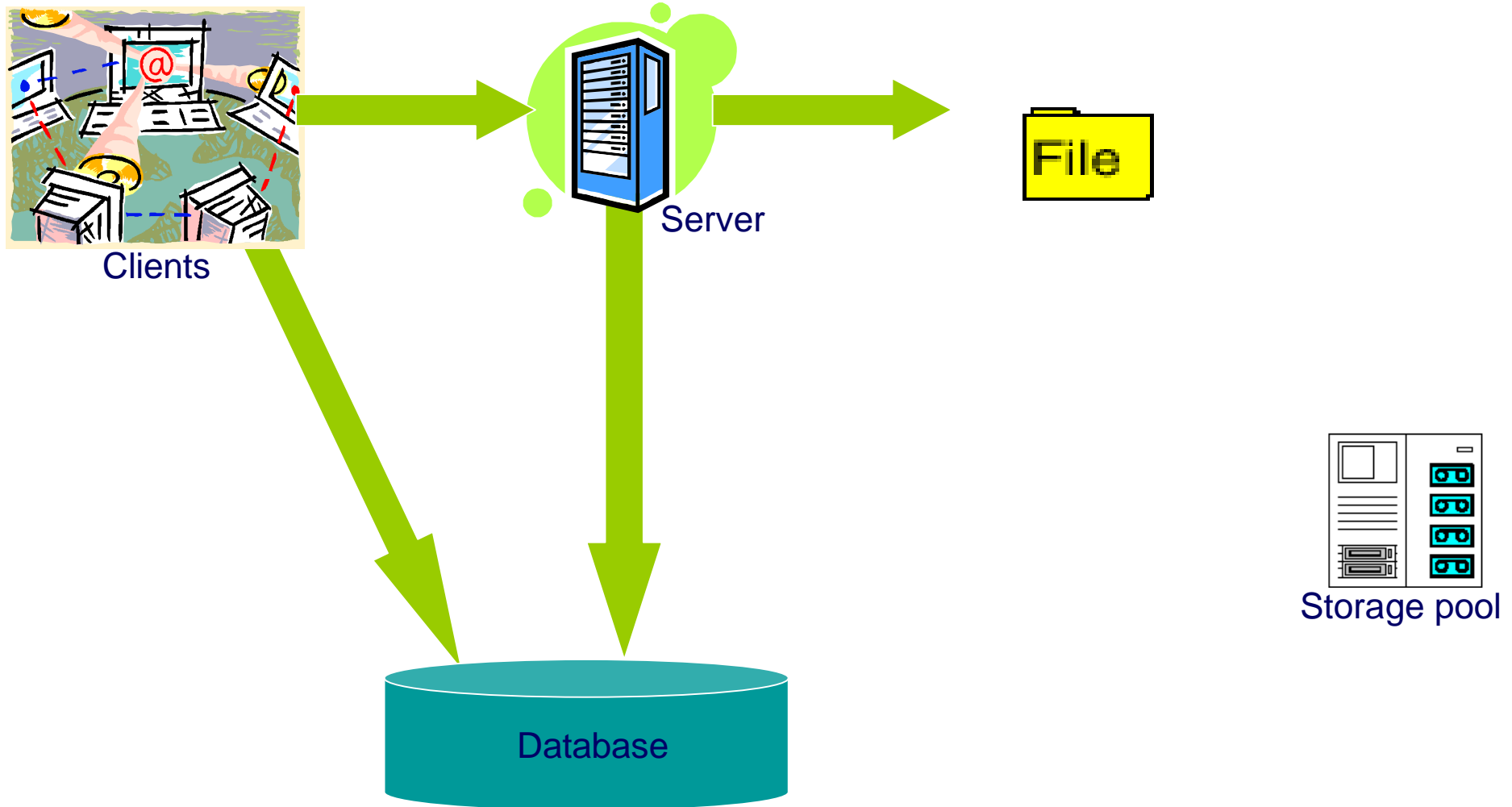
- Make a copy of a file or application data for backup purposes
- Backup can be started on a scheduled time or manually
- On restore the backup copy will be applied to the destination system

§ Archive & Retrieve

- Make a copy of a file or application data to archive it for a certain timeframe without being able to modify it (audit-save)
- Archive process can be started on a scheduled time or manually
- On retrieve the archived copy will be applied to the destination system

Tivoli Storage Manager - Architecture

Tivoli software



Tivoli Storage Managers – Backup VSE data



§ New 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

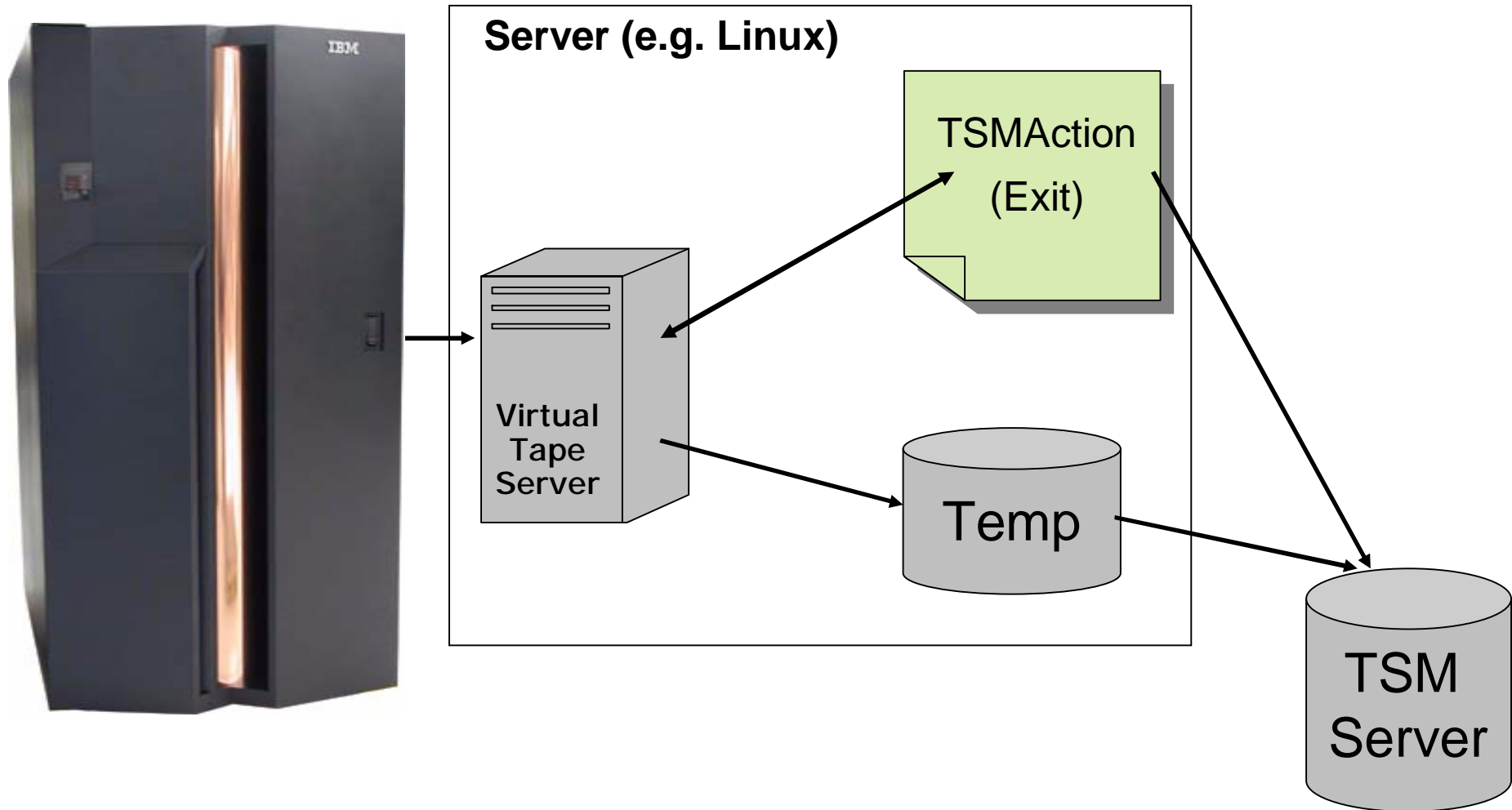
§ Based on the VTAPE Function of VSE

- 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

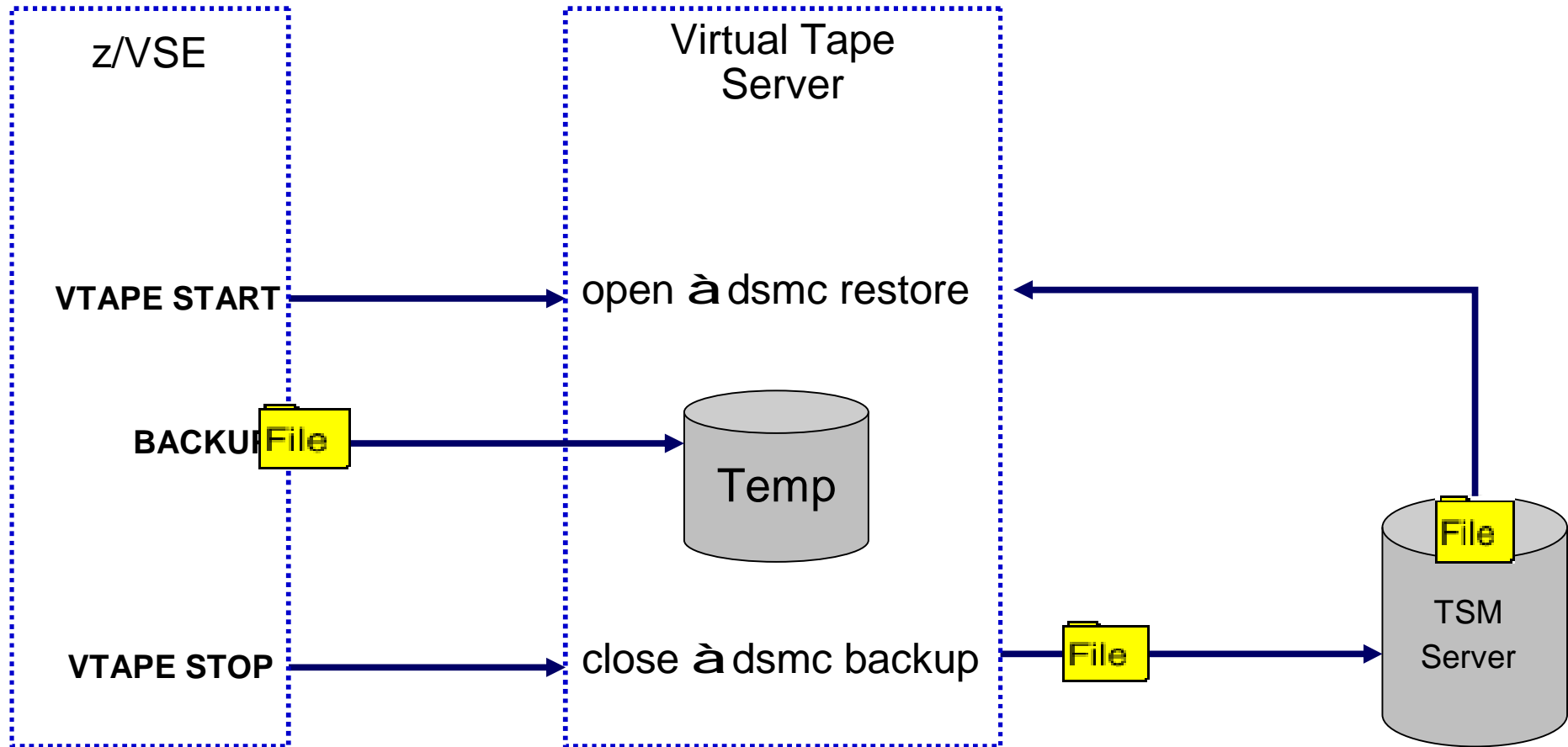
§ Existing Backup Jobs can be reused almost unchanged

Tivoli Storage Managers – Backup VSE data

Tivoli software



Tivoli Storage Managers – Backup VSE data



Hints & Tips for best performance

§ 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
 - Delayed-Ack Fix (\$SOCKOPT) – see next slides
 - 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 you should 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 also 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
```


VTAPE programming interfaces

§ Programming interface for tape image implementers

- Java interface `TapelImage`
- Allows to implement own tape images
- Tape image must be able to read/write tape records



§ Programming interface for Actions

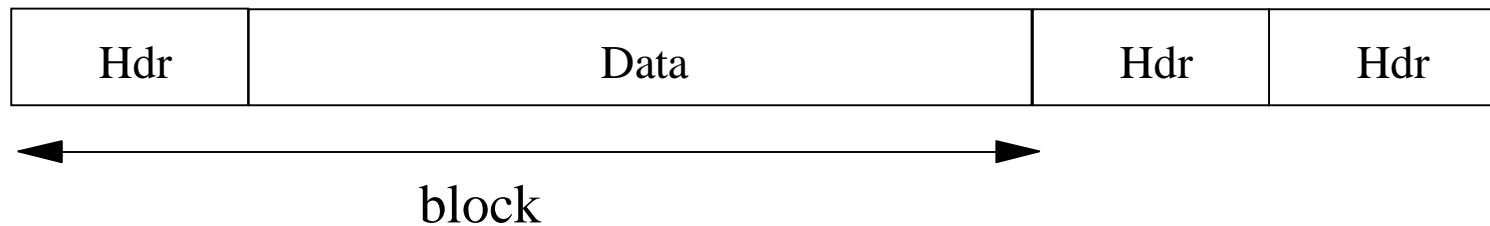
- Java interface `VirtualTapeAction`
- `beforeOpen(...)`
- `afterClose(...)`
- DefaultAction implementation is able to execute operating system commands

§ For more information please contact

- zvse@de.ibm.com

AWSTAPE Format

Known from P/390, R/390, Hercules, Flex-ES



Header (6 bytes)

Block Size (2 bytes, little endian)

Prev Size (2 bytes, little endian)

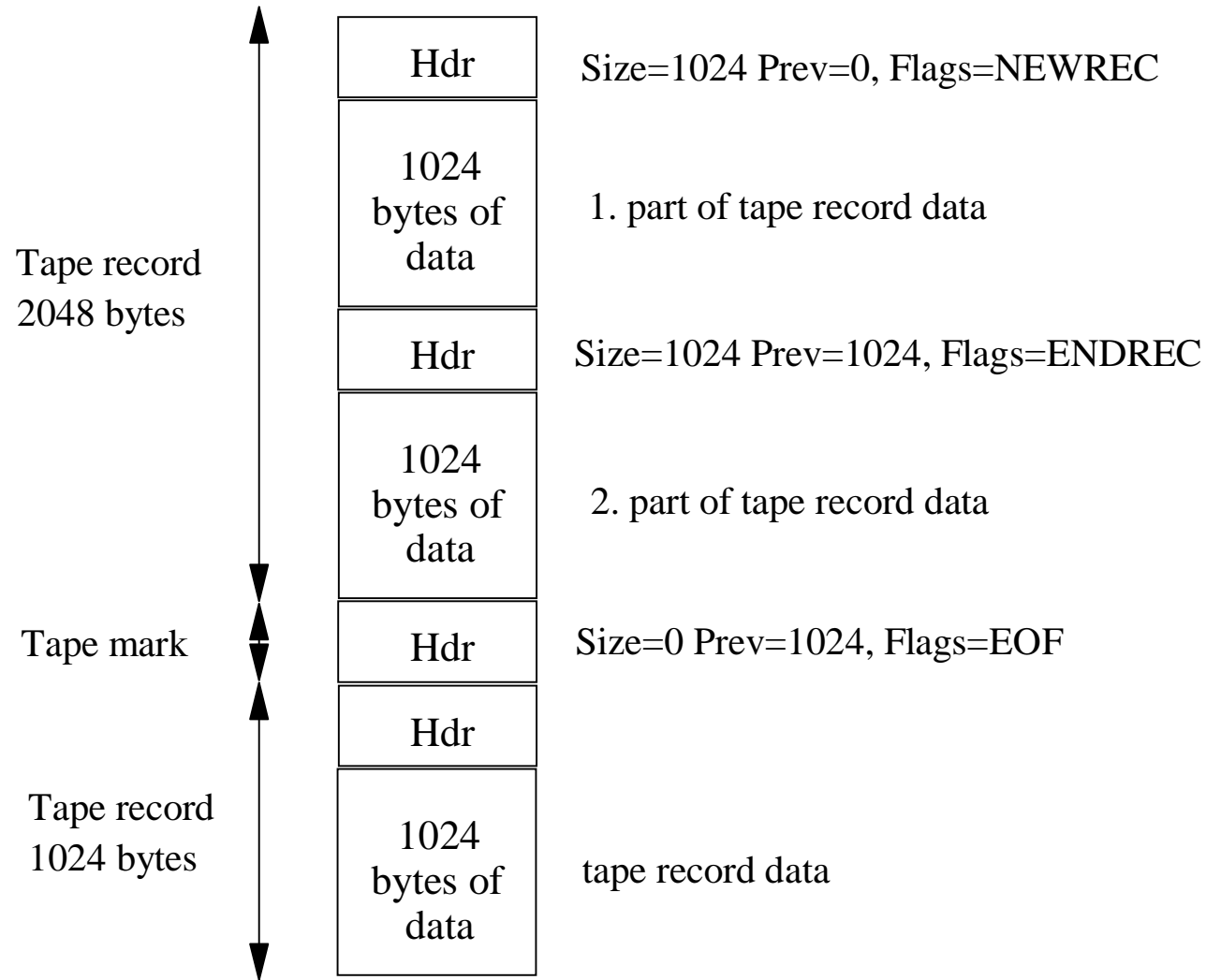
Flags (2 bytes)

X'2000' ENDREC Start of tape record in block

X'4000' EOF Block is a tape mark

X'8000' NEWREC End of tape record in block

AWSTAPE Format - continued



AWSTAPE Format – tools and resources

§ 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

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 list of files and blocks:

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

The right pane displays a hex dump of the selected block (Block 12). The hex data is shown in columns of 5 bytes each, with corresponding ASCII characters to the right. The ASCII characters include a license notice for IBM materials, dated 11/27/06, and copyright information for IBM Corporation, 1977-2005. The license text is partially obscured by asterisks and backslashes, likely due to control characters in the original data.

```

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..
    
```

The status bar at the bottom left of the window shows "Ready".

LISTVOL1 Utility – What is on my virtual tapes?

- § 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  PRODUCTION.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.

VSAM Considerations

Tape data is re-blocked into the VSAM records

Hdr	1. tape record		Hdr	2. tape record	
rest of 2. rec.		Hdr	3. tape record		Hdr 4. rec.
rest of 4. tape record			Hdr	Hdr	

Independent of VSAM record size

Chose as large as possible (32758 bytes)

Independent of tape record sizes

Up to 64K

VSAM Considerations - continued

§ No overwrite of existing data possible

§ Only append to file possible

§ But: rewrite from the beginning is possible

–Implicit reopen of the VSAM file with REUSE

§ Why?

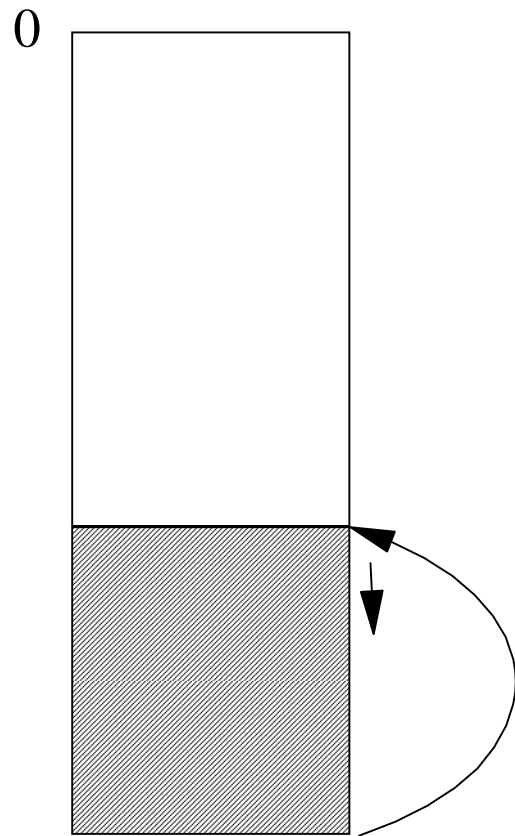
–ESDS can not delete records

–ESDS can update records

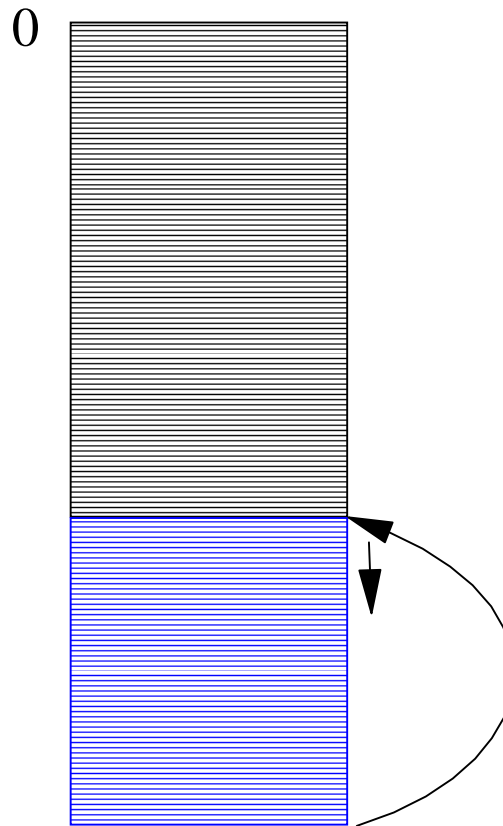
- But cannot change length of records
- This would be necessary to support AWSTAPE format

VSAM Considerations - continued

Real tape



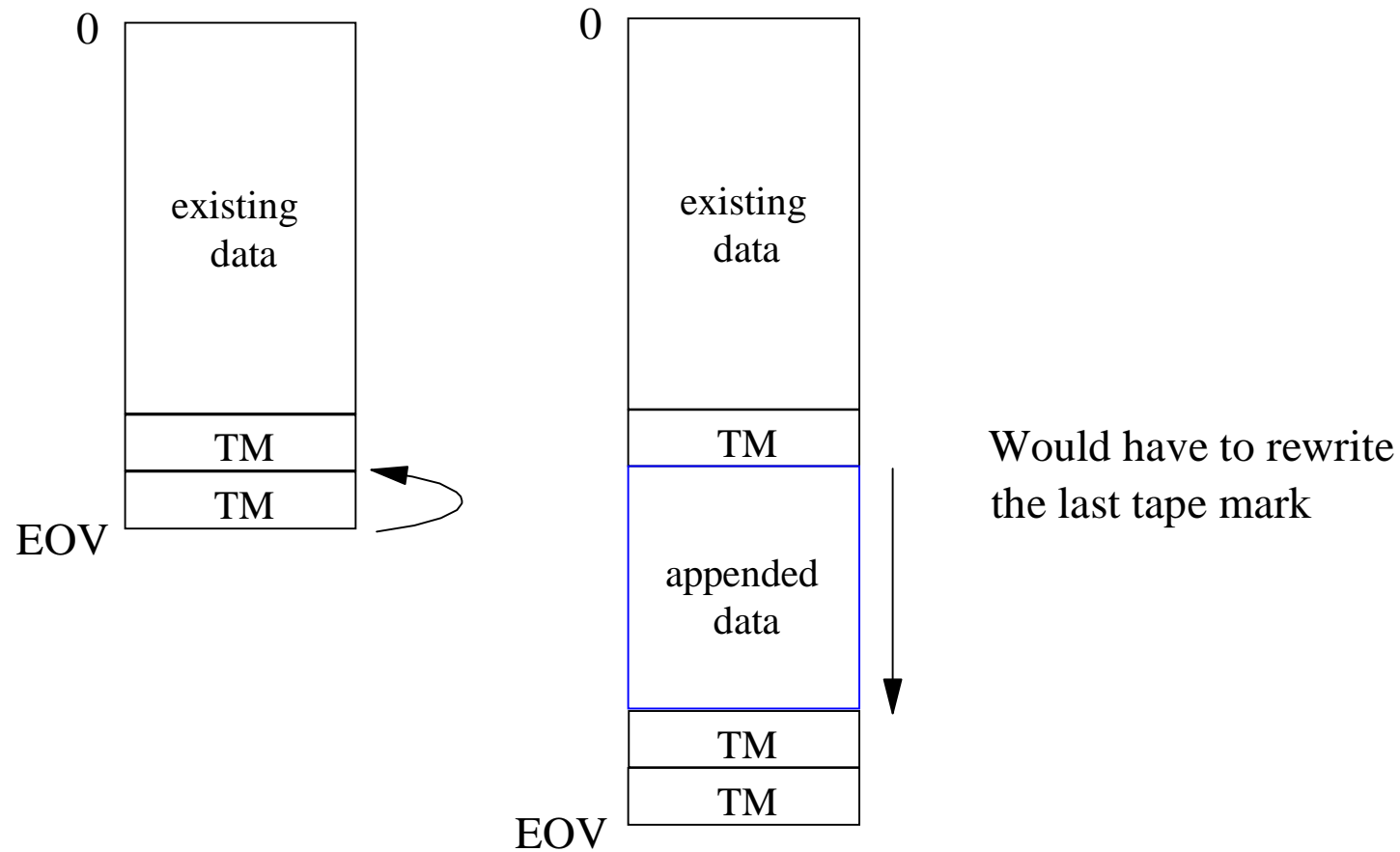
Virtual tape (ESDS file)



Would have to delete the records at the end of the tape image

VSAM Considerations - continued

Special case: Append of data to a tape



Note: The I/O supervisor will in most cases buffer the last Tape Mark, until VTAPE STOP, synchronization or repositioning. This allows BAM to append additional tape files.

Questions ?

