z/VSE VTAPE Update and Usage

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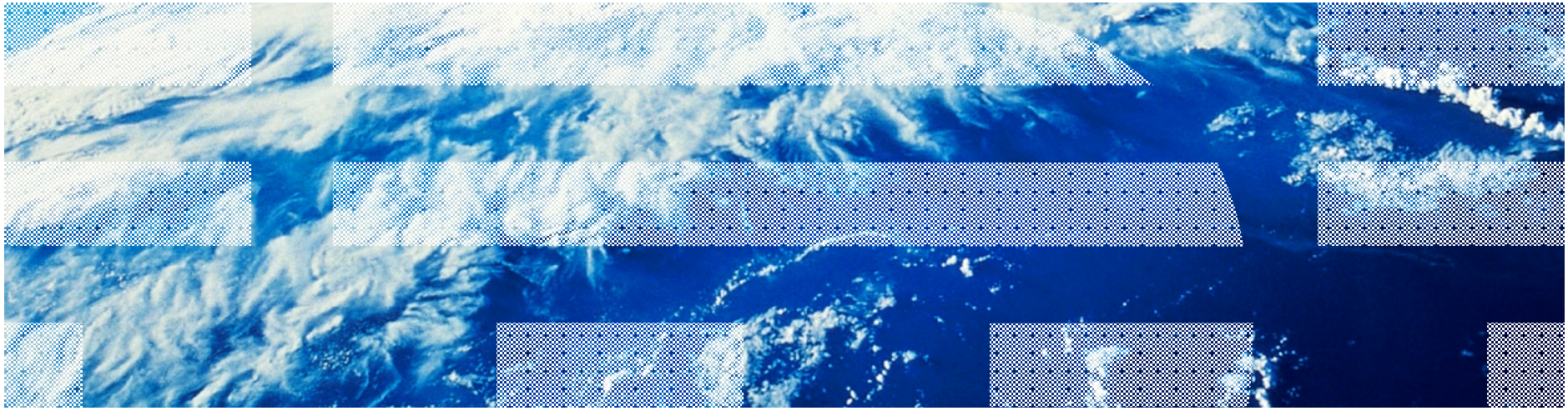

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Notes:
Performance is in Internal Throughput Rate (ITR) ratio based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput that any user will experience will vary depending upon considerations 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.
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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

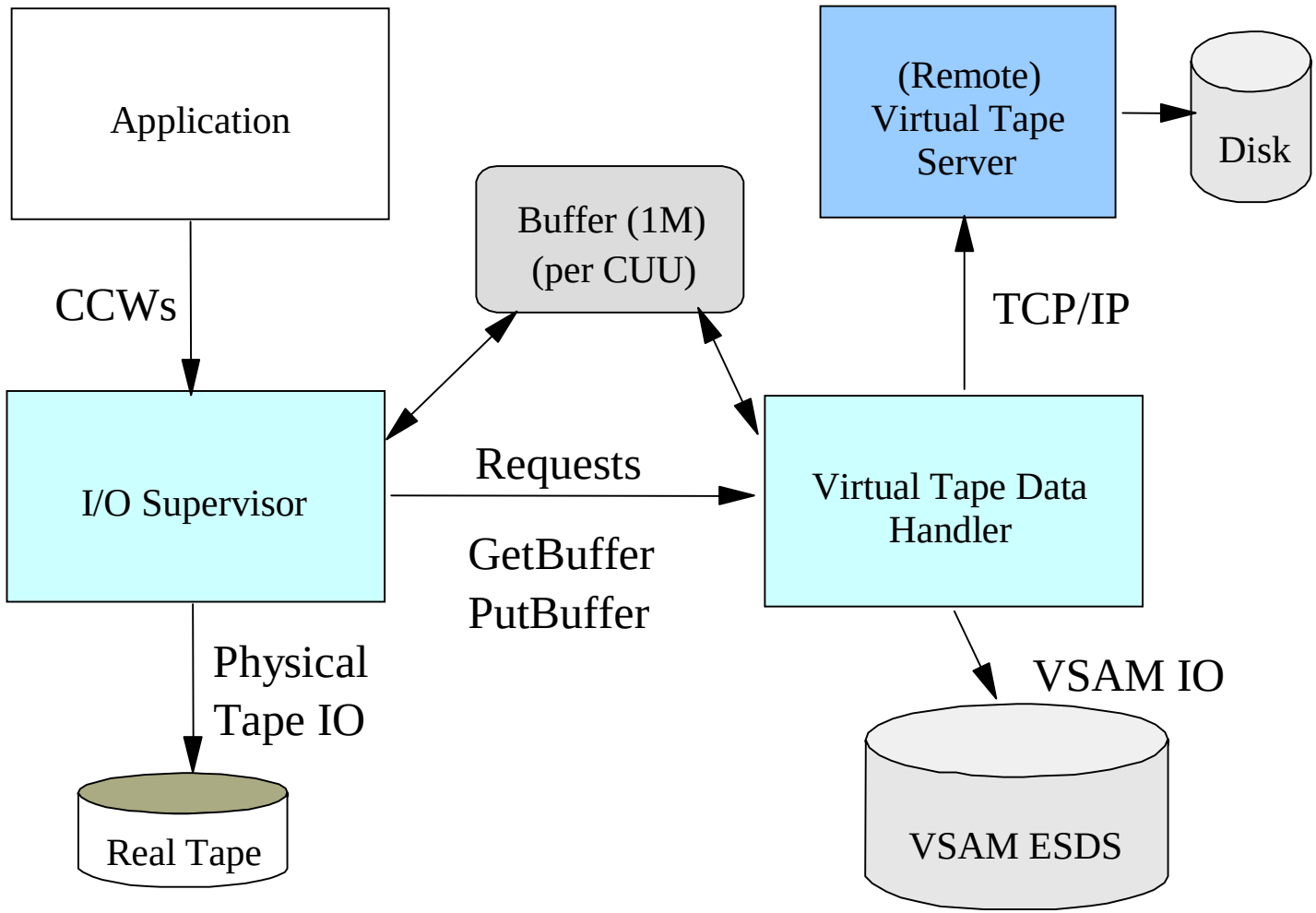
§ Emulates a complete tape
  – Can contain multiple tape files, not just one tape file

§ 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

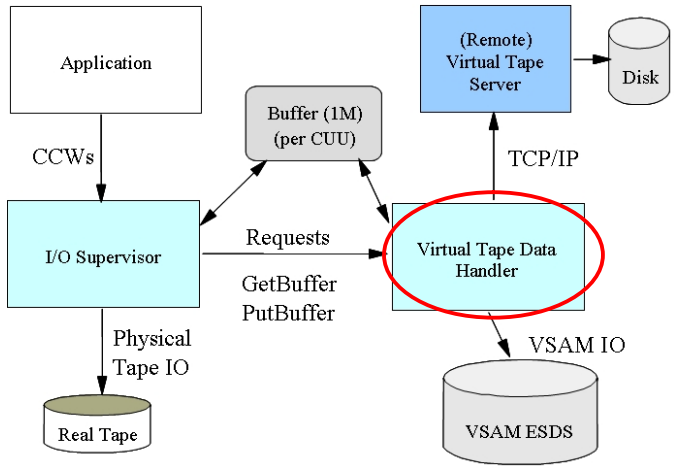


Overview - continued

- 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



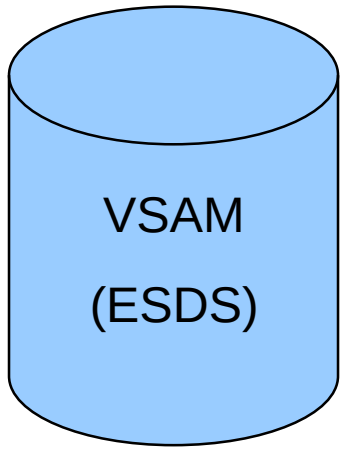

```
* $$ JOB JNM=TAPESRVR,DISP=L,CLASS=R
* $$ LST CLASS=A,DISP=D
// JOB TAPESRVR START UP VSE TAPE SERVER
// LIBDEF
*,SEARCH=(PRD2.CONFIG,PRD1.BASE,PRD2.SCEEBASE)
// ID USER=VCSRV
// EXEC $VTMAIN,SIZE=$VTMAIN
/*
/&
* $$ EOJ
```

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



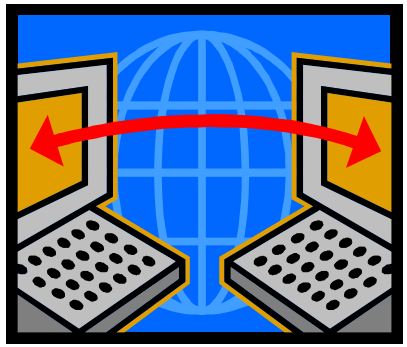
§ Skeleton SKVTAPE in ICCF lib 59

§ 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                        - initiate FTP session
bin                                     - transfer in binary
quote site lrecl 32758                  - specify record size
quote site recfm v                      - record format variable
put d:\backup.aws VSAM.TAPE.IMAGE       - 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 ore 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	Yes (since z/VSE 4.3)	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 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

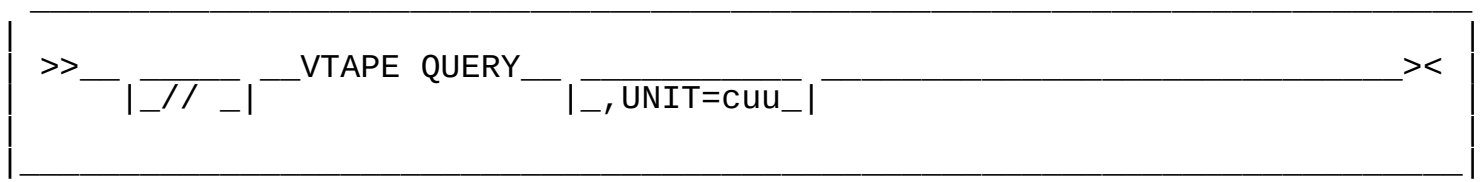
§ The IBM provided default action can execute a command or shell script/batch script

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



§ 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

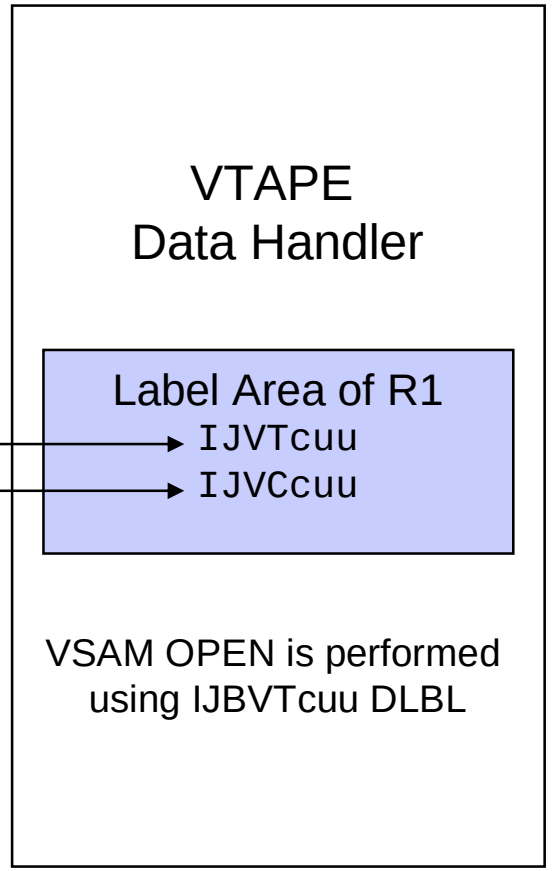
- From z/VSE 4.1 onwards, you are no longer required to have the DLBL for VSAM files used with VSE VTAPE in the system standard label area
- Instead, you can specify the DLBL statements directly in the job that issues the VTAPE START command
  - The VTAPE START command will then transfer the label information 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



Tivoli Storage Manager - Functions

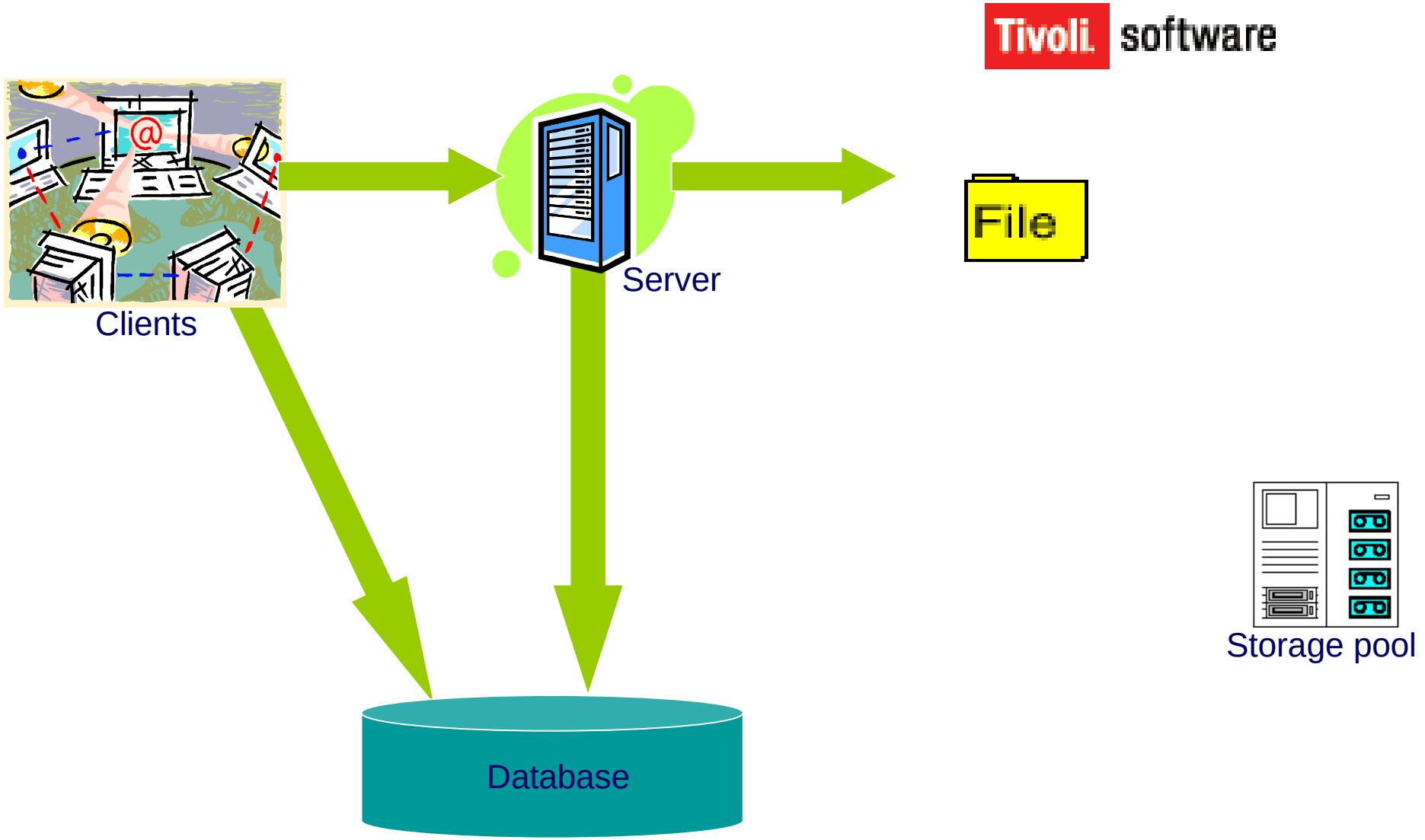
§ Backup and Restore

- 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

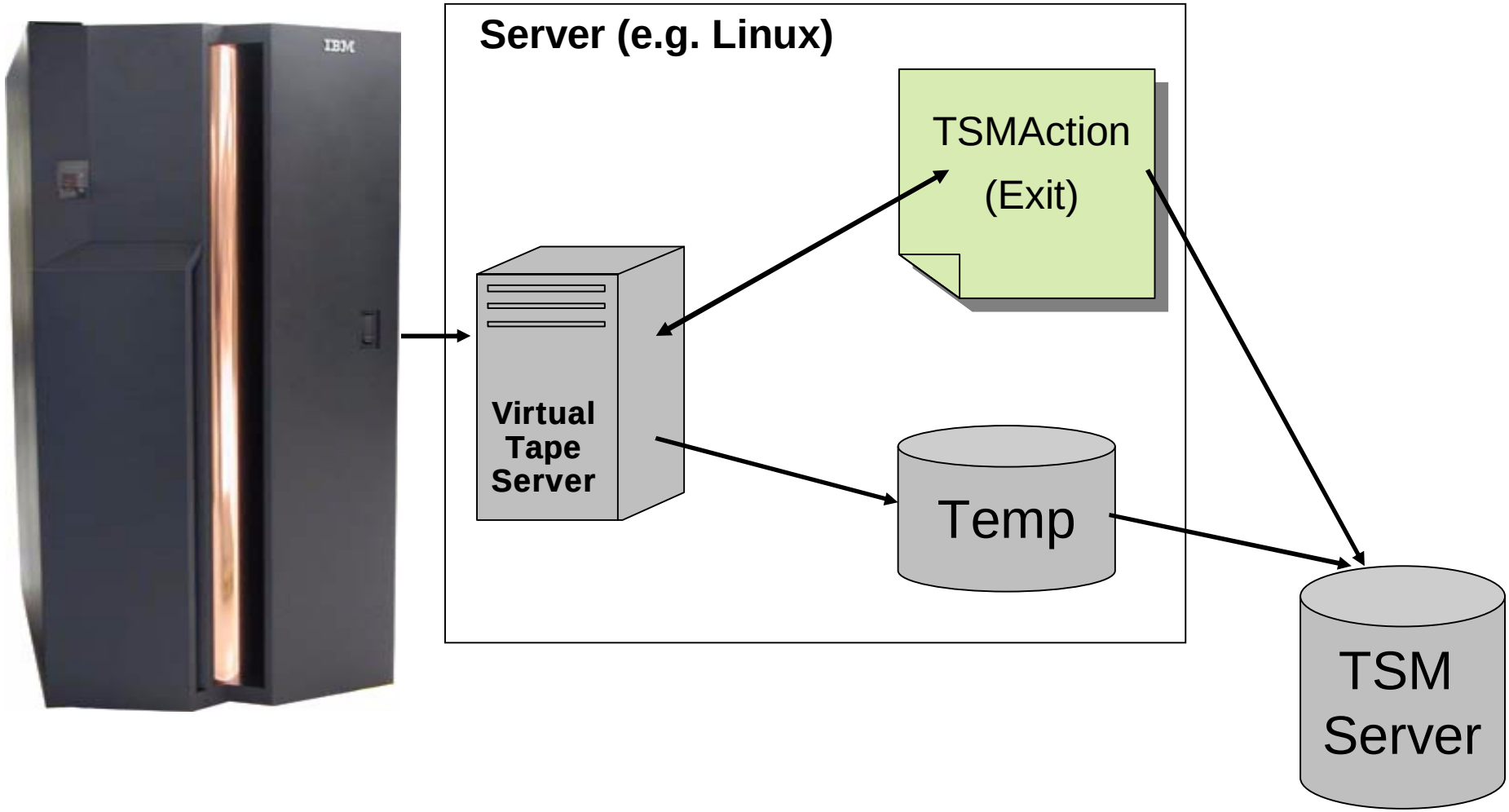
Tivoli Storage Manager - Architecture



Tivoli 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 Storage Managers – Backup VSE data

Tivoli software

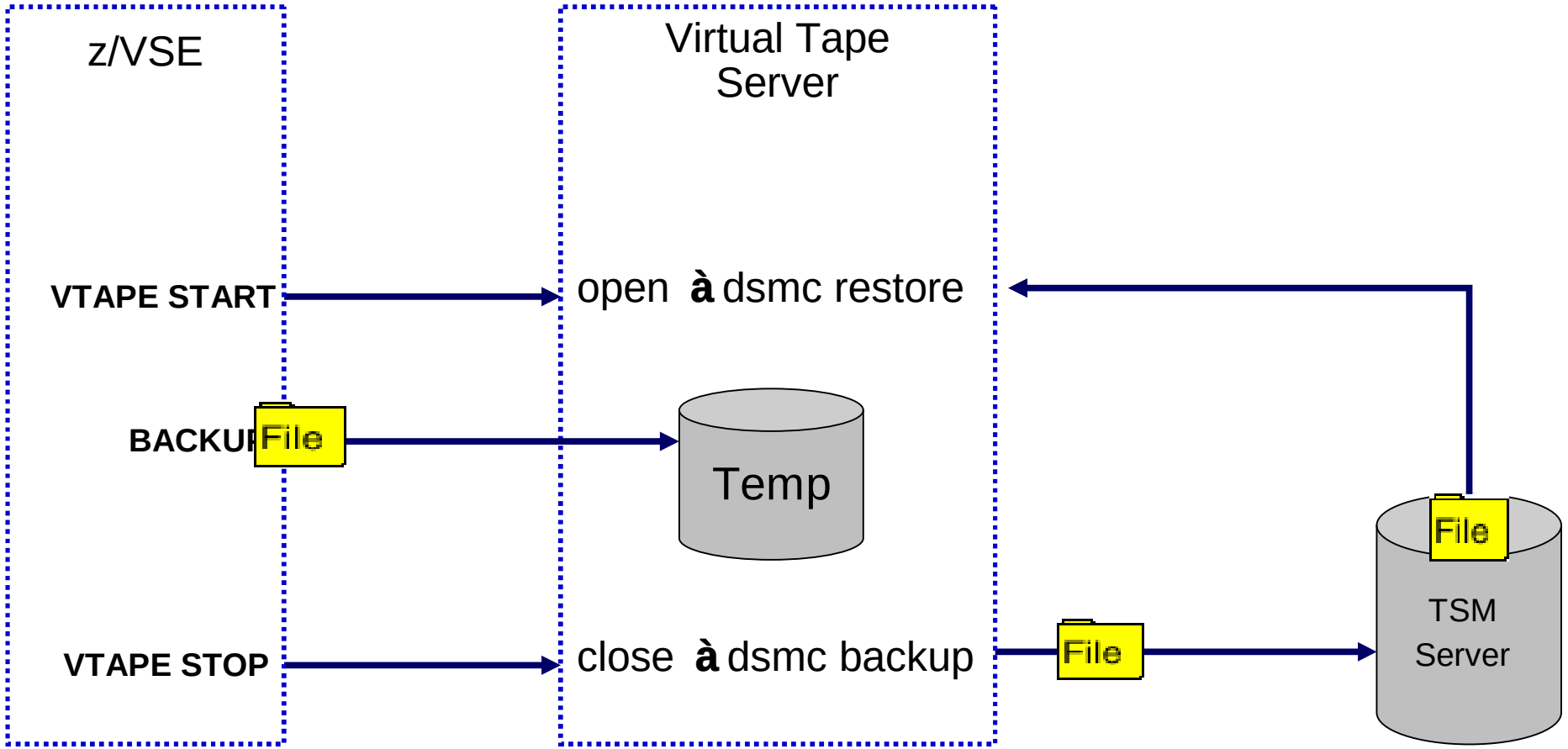
Backup of a VSAM Clusters using TSM

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



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 useage          X
               SYSID=00                     Use this TCP/IP sysid
*
         END   $SOCKOPT
```

VTAPE programming interfaces

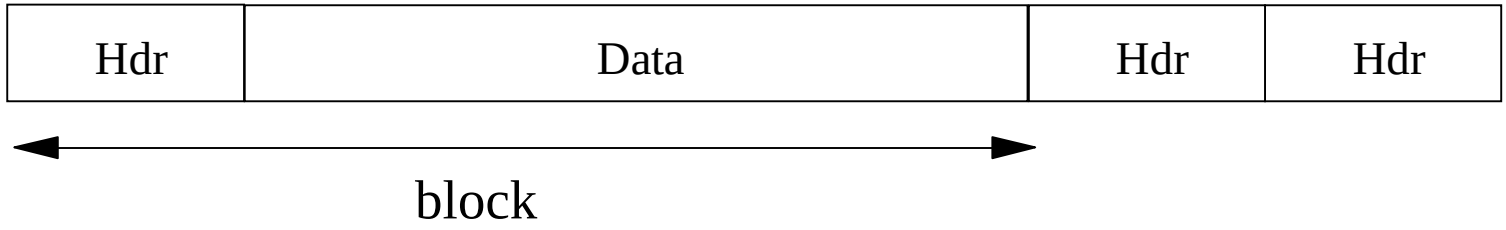
§ Programming interface for tape image implementers
- Java interface TapeImage
- Allows to implement own tape images
- Tape image must be able to read/write tape records

§ 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)

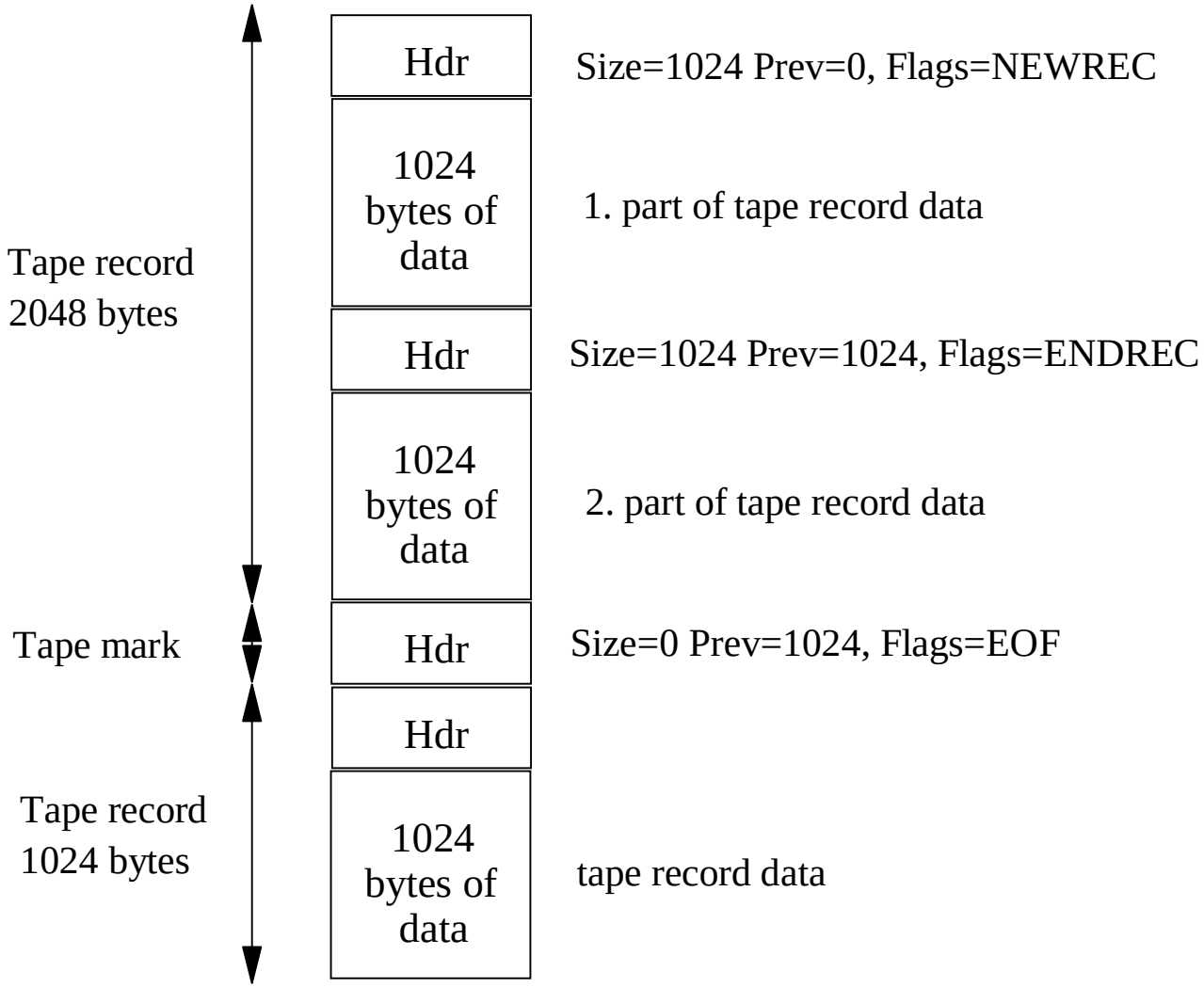
Block Size (2 bytes, little endian)

Prev Size (2 bytes, little endian)

Flags (2 bytes)

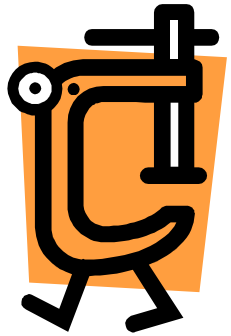
X'2000'	ENDREC	Start of tape record in block
X'4000'	EOF	Block is a tape mark
X'8000'	NEWREC	End of tape record in block

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

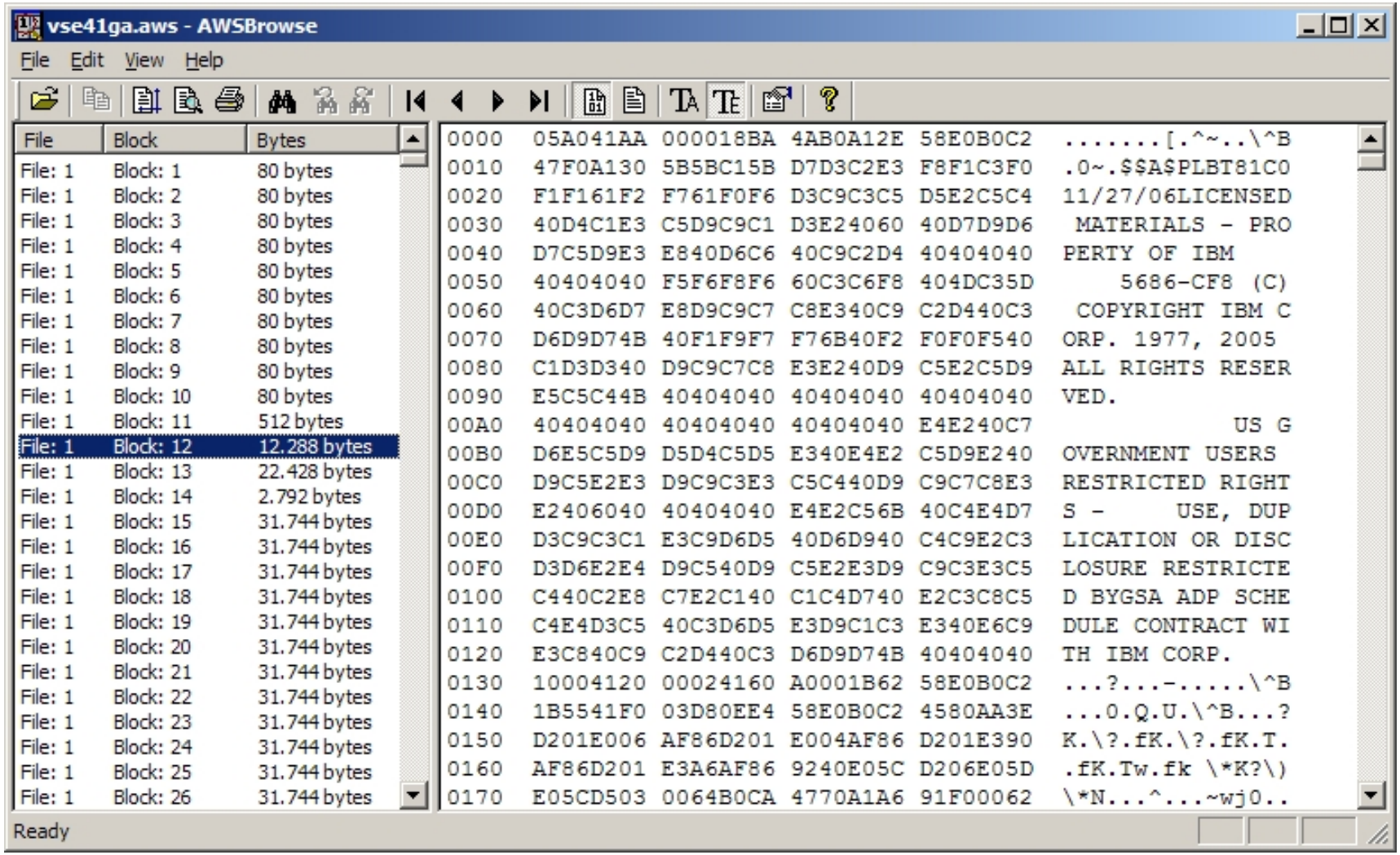


§ **Tools:**
- **AWSBROWS:** PC based browser for AWSTAPE files:
  http://www.cbttape.org/ftp/adhoc/Awsbrows.zip
  http://www.cbttape.org/~fish/AWSBrowse-1.5.1.1805-bin.zip

- **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



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  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

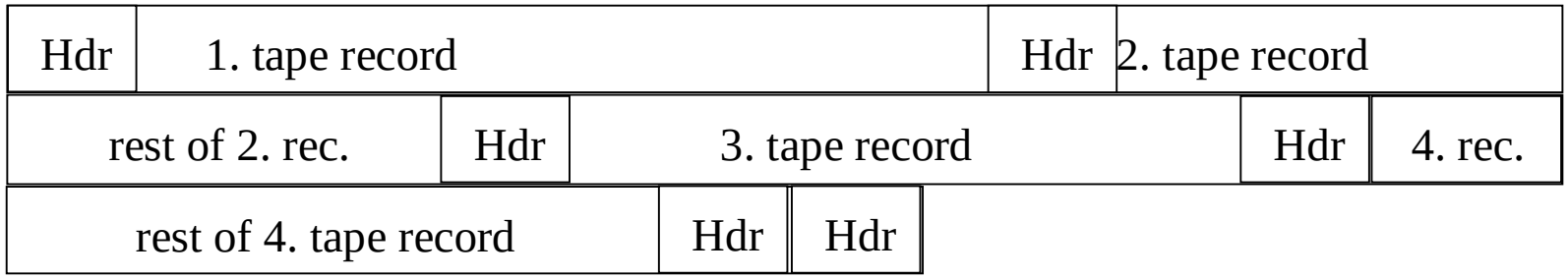
```
set
classpath=.;VirtualTape.jar;vtapetools.jar;%classpath%
java com.ibm.vse.vtape.tools.ExtractFiles %1
```

  - `Extract.bat <awstape-file>`

  - Output is one or more PC files named <awstape-file>.0 ... <awstape-file>. n.

VSAM Considerations

Tape data is re-blocked into the VSAM records



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

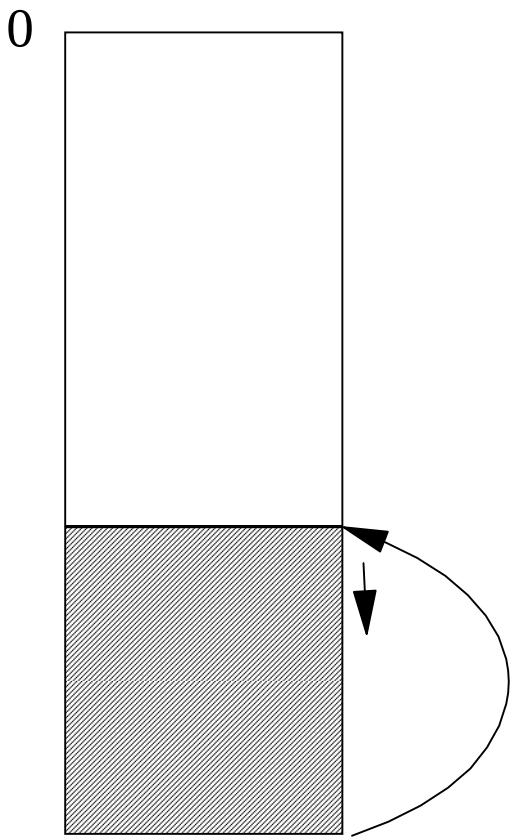
§ Only append to file possible

§ But: rewrite from the beginning is possible
  – Implicit reopen of the VSAM file with REUSE

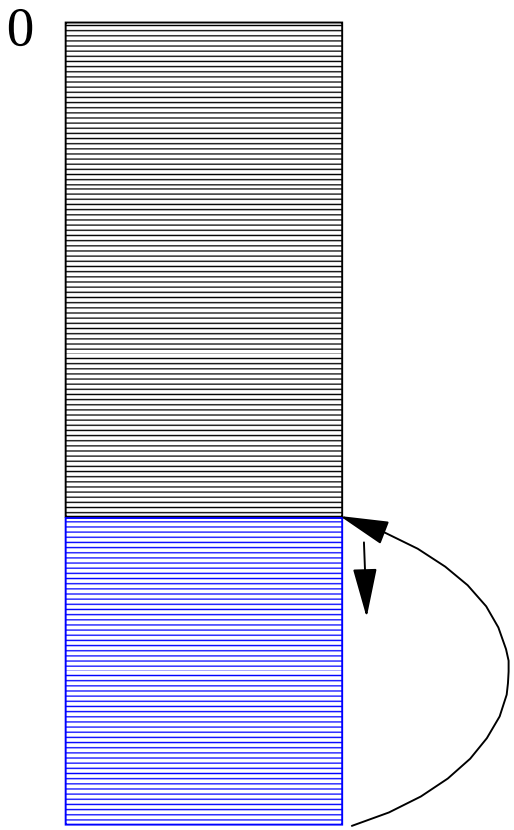
§ Why?
  – ESDS can not delete records
  – ESDS can update records
    • But cannot change length of records
    • This would be necessary to support AWSTAPE format

VSAM Considerations - continued

Real tape



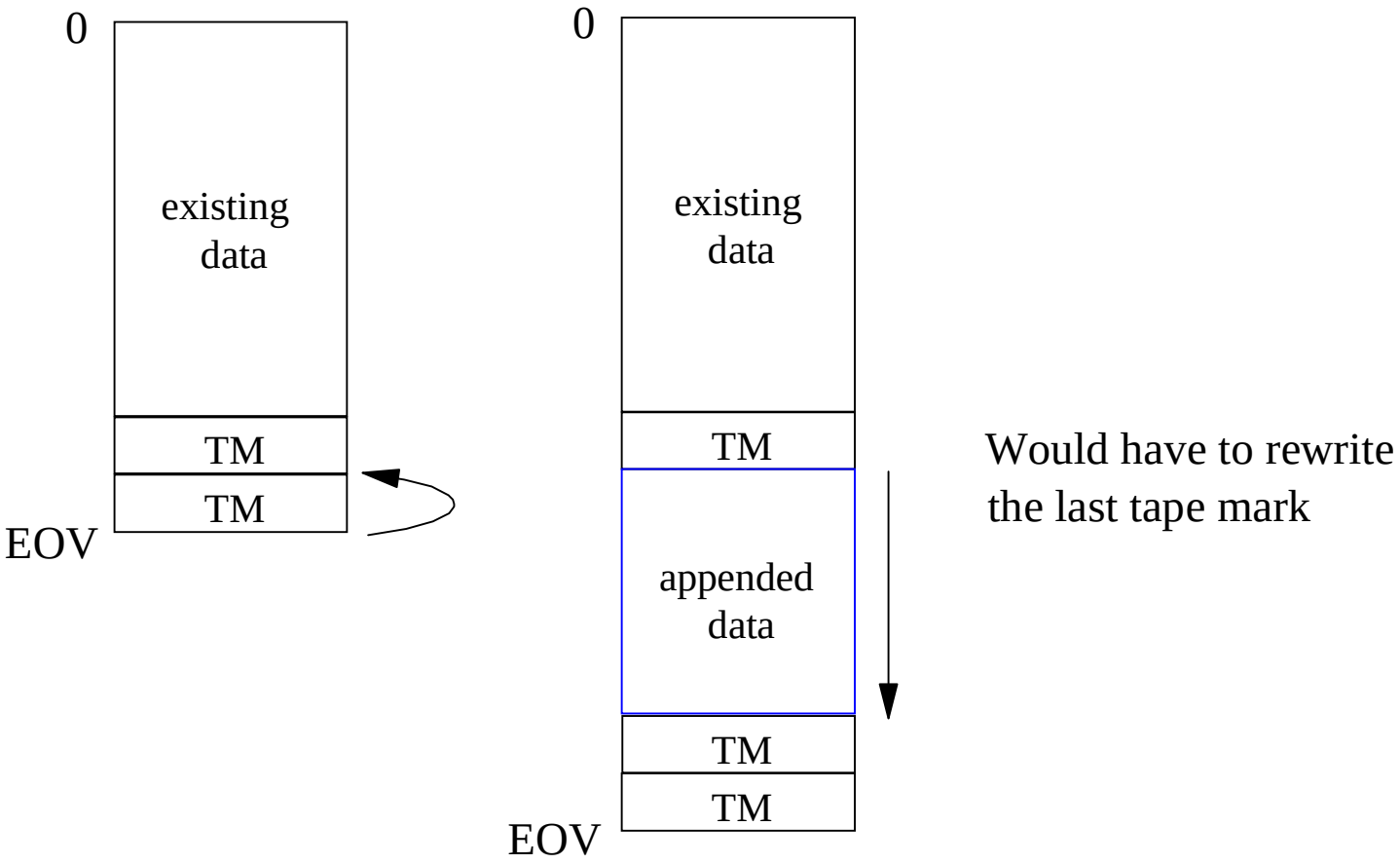
Virtual tape (ESDS file)



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 ?