VSE/VSAM
Inside and
Advanced Features

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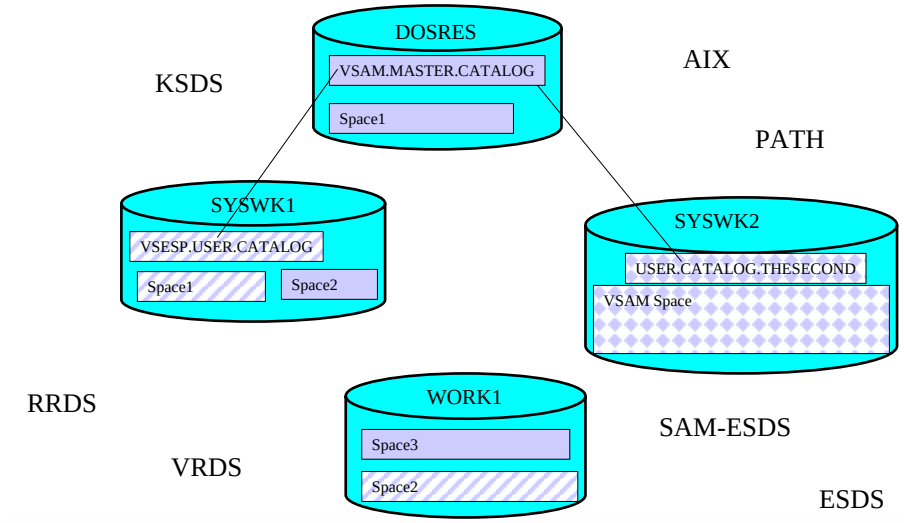
VSAM - Virtual Storage Access Method data organization



VSAM - Virtual Storage Access Method

All subsystems and Software Packages in VSE uses VSAM

VSE e-business Connectors

DB2 | MQ Series | CICS

DL/I | VTAM

VSAM Access Method (indexed, numbered, addressed, sequential)

- Dynamic space allocation
- Dynamic DASD allocations
- Access Optimizer (index)
- Organization optimizer (CI,CA)

VSAM - most important Recommendations

Do not define all VSAM clusters with a volume list with the same order

Control Interval (CI) and Control Area (CA)

- Do not specify CI free space.
- Define CA free space (at least 20%) for on-line files. freespace(0,20)
- Do not reorganize after a certain number of CI and/or CA splits.
- Reorganize files based on increased index levels
- Use clusters with random key access. Avoid: Add at end, delete from beginning
- Do not use IMBED or REPLICATE (was designed for small, slow older DASD)

Share options

- To access files for multiple concurrent writes with SHR(2) use
  - Dataset Name Sharing (DSN)
    - First OPEN (Input/output) determines access mode
  - DSN with Local shared resources (LSR) – separate Pools for index, data
    - Large Buffer Pools CIs are retained in memory once reference

Models

- Each VSAM cluster can be used as Model
- Implicit defined clusters (SAM) require a default model in catalog

VSAM - most used IDCAMS tools

IDCAMS Recovery tools

- **IDCAMS Backup/Restore:**
  Fairly quick. Allows restoration of individual clusters. No data reorganization

- **IDCAMS SNAP:**
  Extremely Fast, Allows restoration of individual clusters, by backing them up first with IDCAMS Backup, then restoring them. No data reorganization.

- **IDCAMS REPRO:**
  Slow. Use for compressed files. Reorganizes data.

- **IDCAMS EXPORT / DISCONNECT:**
  Slow. Compatible with MVS | OS/390 | z/OS.

- **FASTCOPY**
  Fast. Cannot restore individual clusters. No data reorganization. Must backup all volumes for catalog.

NOTE: Do not copy catalogs using FASTCOPY, unless old and new volume absolutely identical

VSAM - most used IDCAMS tools

IDCAMS maintenance tools

- **IKQVDU:**
  VTOC maintenance, VSAM ownership bit, volume scratch
- **IKQVEDA:**
  Trace facility for VSAM
- **IKQVCHK:**
  Catalog Consistency Checker
- **RECMAP**
  IDCAMS tool to define the structure of a VSAM record for e-business connectors

VSAM interface tools

- **IKQCPRED**
  Compression prediction tool before the use of compressed VSAM cluster
- **IDCONS**
  Interactive console interface to IDCAMS
- **VSAMIO**
  REXX / VSE Interface for VSAM data manipulation

VSAM advanced functions for a modern IT

- Hardware Compression
- Extralarge KSDS files (XXL)
- Buffer hashing
- VSAM redirector
- FTP alternatives
- VSAM 24X7 availability
- Snapshot/Flashcopy
- Virtual tape in VSAM Space
- VSAM access via JAVA and the VSE e-business connectors

Hardware Compression

Characteristics:

- transparent for all applications
- using dynamic Compression Dictionary
  (build at load mode time - Sampling)
  - max 64 KB uncompressed data
  - each record is sampled separately and can be stored at disc compressed or uncompressed
- compression dictionary unique per VSAM cluster - CAR (Compression Attribute Record)
  - stored in CCDS (Compression Control Data Set)
  - Catalog defined in IUI will define CCDS (one per catalog)
- LISTCAT shows CAR and compression status
- IKQCPRED -Compression prediction tool

VSAM Compressed cluster

- **Fully transparent for applications**
- **Hardware or Software emulation**
- **Dictionary:** build dynamically during initial load
- **Compression Control Dataset (CCDS) – contains compression attribute record (CAR) which describes the compression dictionary**
- **Cluster defined using "compressed" Attribute.**
- **Advantages:**
  - More data stored on dasd extent. Avoid 4 Giga-byte limit.
  - For sequential access, more records per buffer (CI), so fewer I/Os.
  - Some customers report substantial reductions in batch window.

Flag	Prior to Key	Key	Available for Compression

- At least 40 bytes per record must be available for compression.
- Requires up to 1Meg additional 31-bit GETVIS per file for compression services.

Extralarge KSDS

Characteristics:

- avoids 4 GB limitation
- file size up to Terra Bytes
  - 4.2 billions Control intervals = 140 TB
  - depends on physical disk architecture
    - 3390-9 approx 1.2 TB for a VSAM data set
- for KSDS with keyed access only
  (no RBA and CNV access)
- transparent for all applications
- easy switch from traditional to XXL KSDS using redefine of KSDS and REPRO for data
- LISTCAT shows XXL KSDS type

Buffer Hashing

►Characteristics:

►new technique, to replace the current buffer management for applications using the *LSR (Local Shared Resource)* option.

►No more sequential search through the buffer pool.

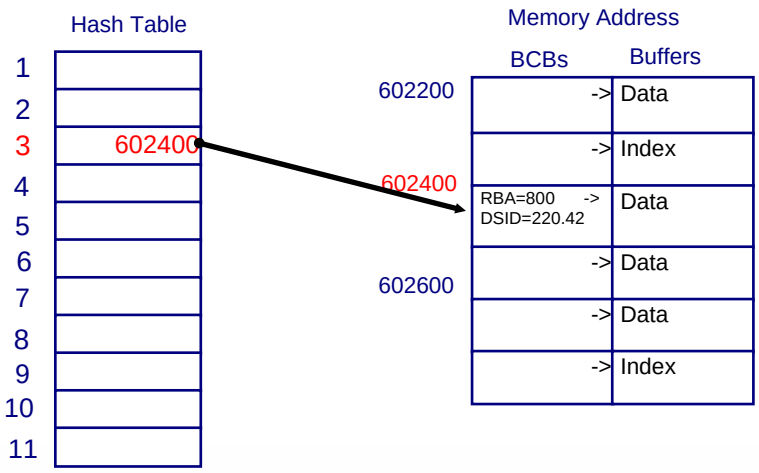
►Hash table maintained by VSAM with the VSAM LSR pool allocation

►The dimension of the hash table is calculated from the number of buffers.

►The new technique means:
direct buffer access using a hashing algorithm.

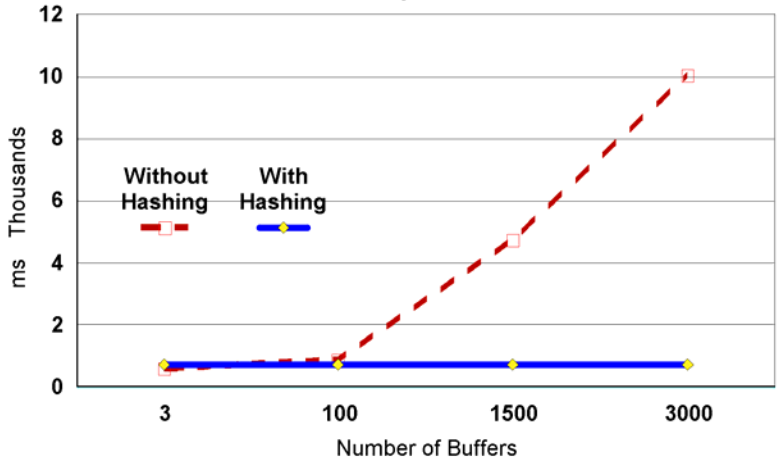
Example

Third entry in the hash table points to the requested Buffer Control Block



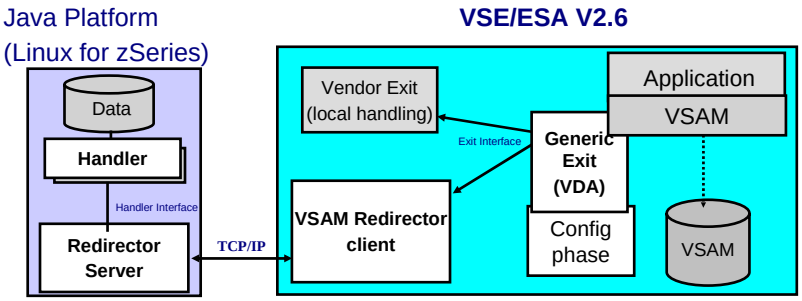
Simplified Performance Measurement

Runtime when Executing 10,000 Reads *



* Data in Memory

VSAM Redirector - synchronous VSAM data manipulation (local and with a remote site)



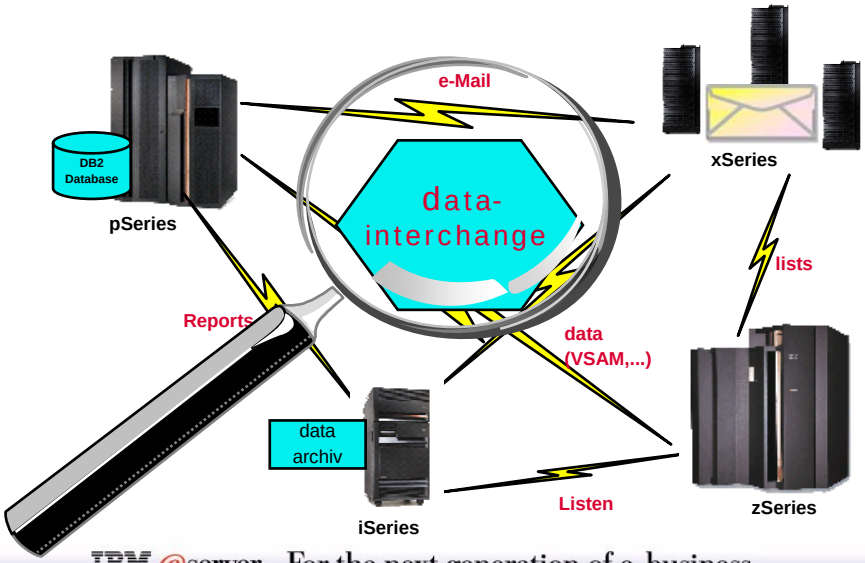
Catalog	Cluster	Exit	Owner	IP	Port	handler-name	option-string
MY.USER.CAT	MY.VSAM.FILE	IESREDIR	VSAM	10.0.0.1	4711	DB2Handler	user=xxx,pw=xxx,...
MY.USER.CAT	MY.RD.FILE	IESREDIR	REDIR	9.164.155.2	4711	DB2Handlernam	user=xxx,pw=xxx,...
VSESP.U.CAT	TEST.CLUST2	VENDOREX	n/a	n/a	n/a	n/a	n/a

- **Redirection of VSAM Requests to any remote system without changes to VSE applications**
- **Synchronization, migration or remote operation with data on remote systems**
- **transparent for Batch or CICS**

Customer - Benefits

- **VSE access to** various remote file systems without changing the programs
  - OWNER = REDIRECTOR
- **migration** of VSAM data to another file system
  - OWNER = REDIRECTOR and REPRO to redirected cluster
- **synchronization** of VSAM data with data on another platform (independent of file organizations)
  - OWNER = VSAM
- **transparent** for CICS or Batch

FTP - Today's data interchange method



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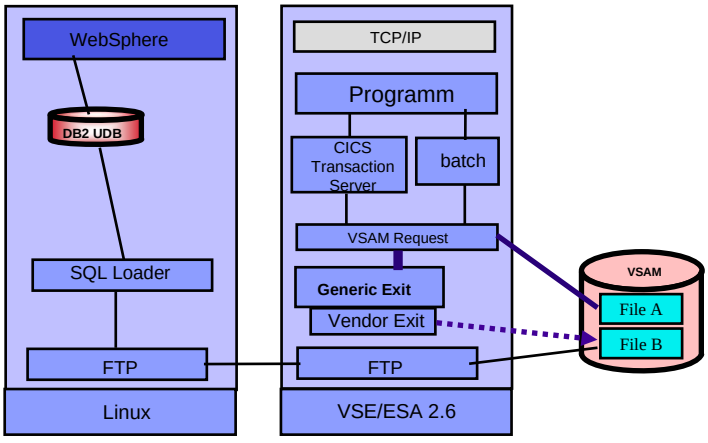
Incremental FTP for VSAM data



- Collect the changed records in a separate VSAM file
  - Possibility of cleansing
- FTP – as before, with a much smaller file
  - (The VSAM Redirector is part of VSE/ESA 2.6)

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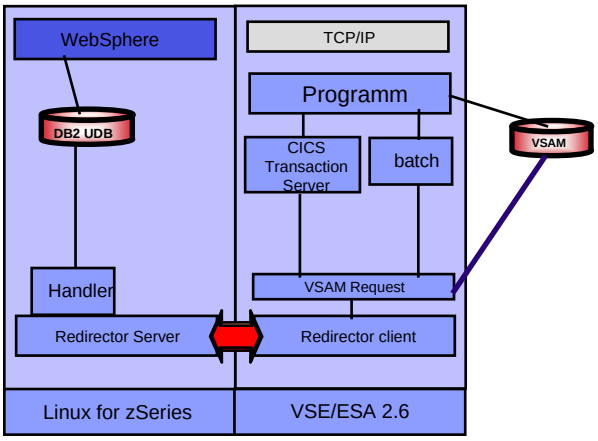
FTP – the daily mass data transfer

(1)Avoid the transfer of the whole file –Incremental FTP

Additional possibilities:

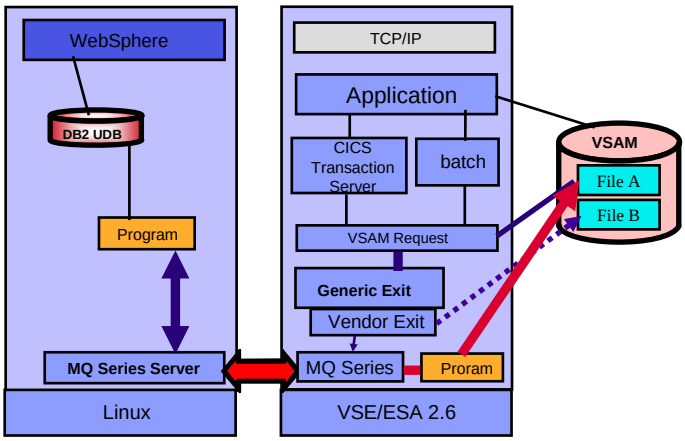
- ►Change/add information (i.e. timestamp) before storing the data
- ►Possibility of journaling
- ►Possibility of incremental Backup
- ►This process is similar to the capture function for relational data and data can be stored separately without touching the original (‘base’) data
- ►In some cases it would be very helpful to save in this mode the index part only – to know very fast which record did change in a certain time.

Real time synchronization of data



►Synchronization of DB2 UDB in Linux with VSAM, using VSAM Redirector.
(The VSAM Redirector is part of VSE/ESA 2.6)

Asynchronous VSAM data distribution



✓Eliminate the Backup-window

VSAM backup using
FlashCopy (ESS)
SnapShot (RVA)

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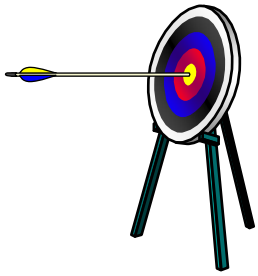
What is "FlashCopy" and "SnapShot"?

- The DASD architectures *RAMAC Virtual Array Storage (RVA)* and *Shark (ESS)* allow copy of DASD's with the utilities *"SnapShot"* respectively *"FlashCopy"* .
- The COPY process takes few seconds instead of hours !
- From OP system view the copy is a real copy of data.
- From the DASD controller view it is a virtual copy of data.

VSAM-Restrictions in a VSE system

- Duplicate VOLIDs (DASD names) not allowed on a VSE System !
- Duplicate VSAM Catalog names not allowed on a VSE System !

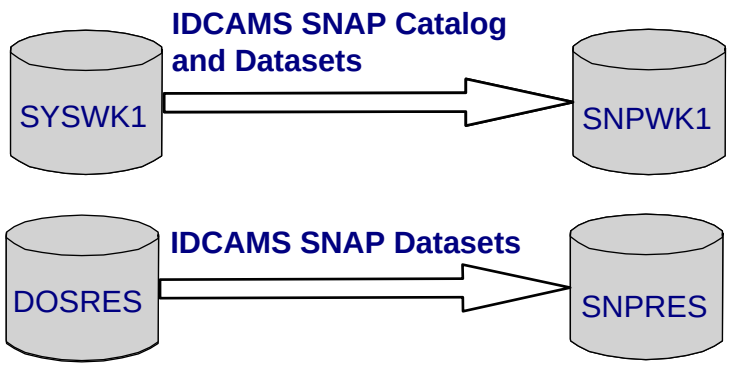
Support for FlashCopy / SnapShot for VSAM Datasets



1. IDCAMS SNAP Utility

2. IDCAMS "Synonym" BACKUP

Step 1: IDCAMS SNAP - copy all DASD's and give new Volid's



After Step 1, the DASD's and catalogs copied are identical, but cannot be used.

VSAM-Restrictions in a VSE system

- Duplicate VOLIDs (DASD names) not allowed on a VSE System !
  - SNAP changed the VOLID'S

- Duplicate VSAM Catalog names not allowed on a VSE System !

Step 2: IMPORT CONNECT a new catalog name

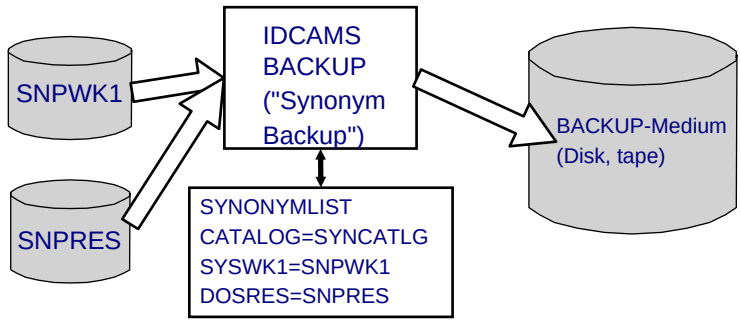
The catalog on the snapped volume needs a new name.

→ **we simulate a new catalog name with IDCAMS IMPORT CONNECT ,**

→ ***a synonym catalog name*.**

Step 3: Backup VSAM datasets from snapped volumes (the VSE system is online)

only "Synonym Backup" can read VSAM data from SNPWK1 and SNPRES !



After Step3: a "normal Backup medium" was created

What is "Synonym Backup"? (2)

- **With the exception of using the new synonym list, the backup process is unchanged.**
- **That means, all functions of IDCAMS BACKUP can be used**
- **IDCAMS BACKUP produces a normal Backup-Medium for IDCAMS RESTORE.**

Sample job: SNAP AND VSAM BACKUP

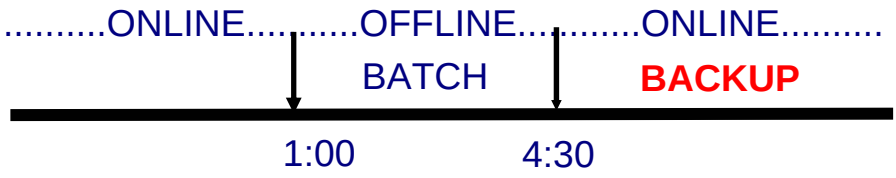
```
// JOB SNAP AND BACKUP FROM SNAPPED VOLUMES
// ASSGN SYS005,180
// DLBL IJSYSUC,'VSESP.SNAP.CATALOG',,VSAM
// EXEC IDCAMS,SIZE=AUTO
 /* STEP 1: DO THE SNAPSHOT */                    -
  SNAP                                            -
    SOURCEVOLUMES(SYSWK1,DOSRES)                  -
        TARGETVOLUMES(SNPWK1,SNPRES)
 /* AFTER STEP 1 THE ONLINE SYSTEM MAY BE STARTED */
 /* STEP 2: SYNONYM NAME FOR THE SNAPPED CATALOG  */-
  IMPORT CONNECT OBJECTS((VSESP.SNAP.CATALOG      -
        VOLUMES(SNPWK1) DEVT(3390)))                  -
        CATALOG(VSAM.MASTER.CATALOG)
 /* STEP 3: BACKUP FROM SNAPPED VOLUMES */        -
  BACKUP (*)                                      -
     SYNONYMLIST(                                 -
        SOURCEVOLUMES(SYSWK1,DOSRES)                  -
        TARGETVOLUMES(SNPWK1,SNPRES)                    -
        CATALOG(VSESP.USER.CATALOG)                   -
        SYNONYMCATALOG(VSESP.SNAP.CATALOG) )
/*
/&
```


Conclusion FlashCopy/Snapshot

Steps for online VSAM Backup using FlashCopy/Snapshot

- **Close online applications (shutdown CICS)**
- **FlashCopy the DASD's (datasets/databases, catalogs**
  - eventually run batch job streams
- **restart CICS and the online applications**
- **Backup your VSAM data during Production**

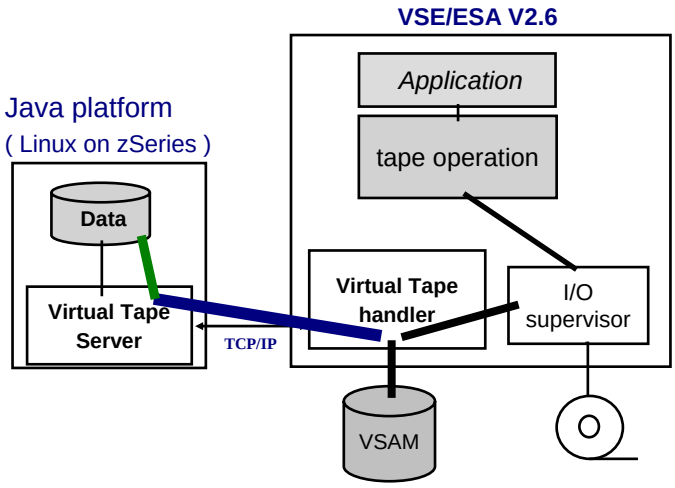
VSAM Backup and Online system in paralel



✓ Integrate VSE Backups in standard processes

Use of VSE/ESA 2.6 Virtual tape support to integrate VSE Backup media into general, automatic Backup processes

Virtual Tape support



- simulates a real tape (tape operation supported)
- transparent for applications

Virtual tape in VSAM Space

Characteristics

- VSE Virtual Tape support is part of VSE/ESA 2.6
- NOT: Virtual Tape Server (VTS) Hardware
- Emulates a tape with multiple tape files
- 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, Flex-ES

- A tape CUU can be switched to virtual with:

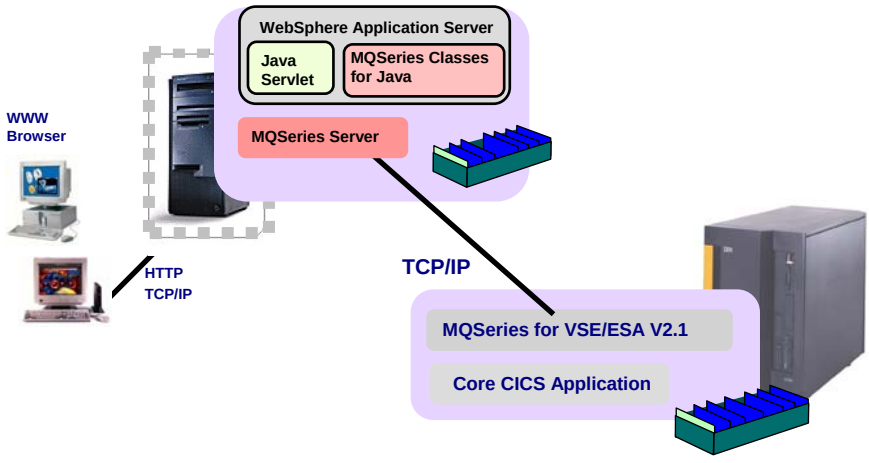
  VTAPE START,UNIT=cuu ...

  VTAPE STOP,UNIT=cuu

✓ Batch-window solutions

Use of MQ Series and
the new e-business connectors
to avoid Production downtime

For Ordering processes MQSeries increases productivity



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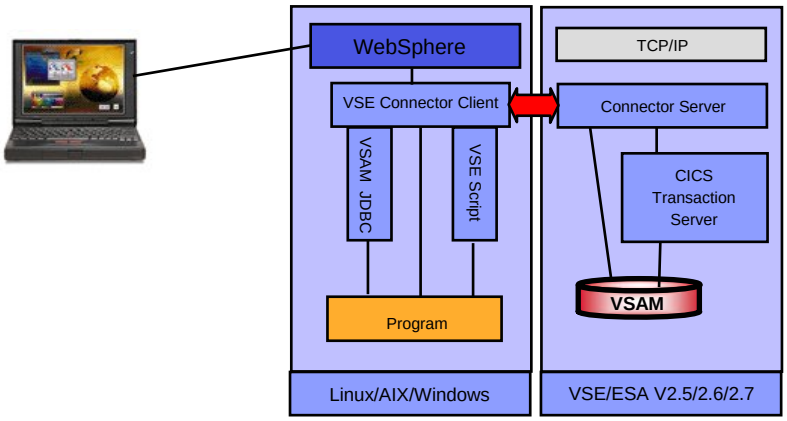
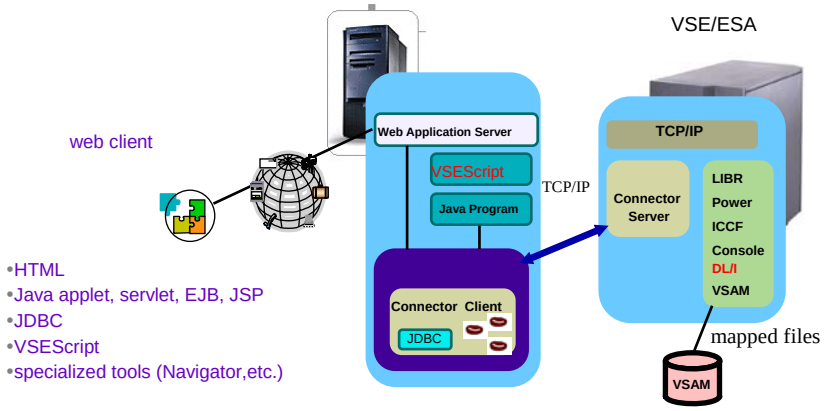
Accessing VSAM data from remote systems



- real time access to mapped VSE/VSAM data from remote systems
  - i.e. READ in batch Mode and UPDATE via CICS
- VSAM access is done in batch - no impact if CICS down

Java-Based Connector – VSE/ESA V2.5 and later



- HTML
- Java applet, servlet, EJB, JSP
- JDBC
- VSEScript
- specialized tools (Navigator,etc.)

- real time access to VSE resources from remote systems
- new possibilities for leveraging VSE/ESA investment

Konnektoren ermöglichen Business Intelligence Lösungen mit VSE Daten und die Einbindung in Websphere Lösungen

Integration verschiedenster Daten mit oder ohne Zwischenverarbeitung, und deren Verarbeitung mit relationelen Funktionen