IBM

E33

Modern z/VSE Solutions that exploit DB2 UDB on Linux

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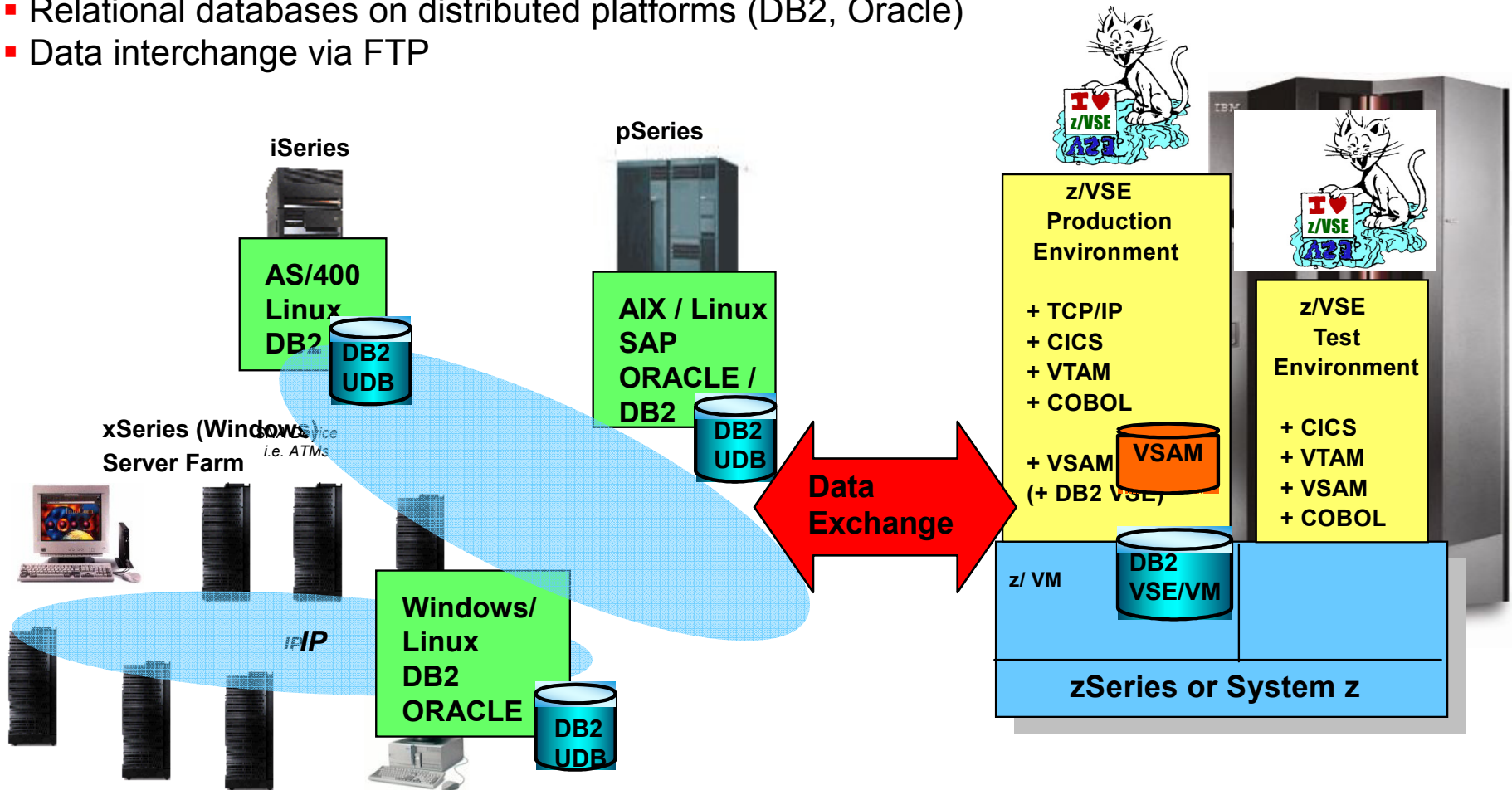Intel is a registered trademark of Intel Corporation.

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DB2 possible solution scenarios

- **DB2 Scenarios with VSE**
  - DB2 Server and 'DB2 Client' to access DB2 UDB

- **VSE Applications access DB2 UDB**
  - SQL access to DB2 UDB on Linux on zSeries

- **VSE/VSAM Access to DB2 UDB**
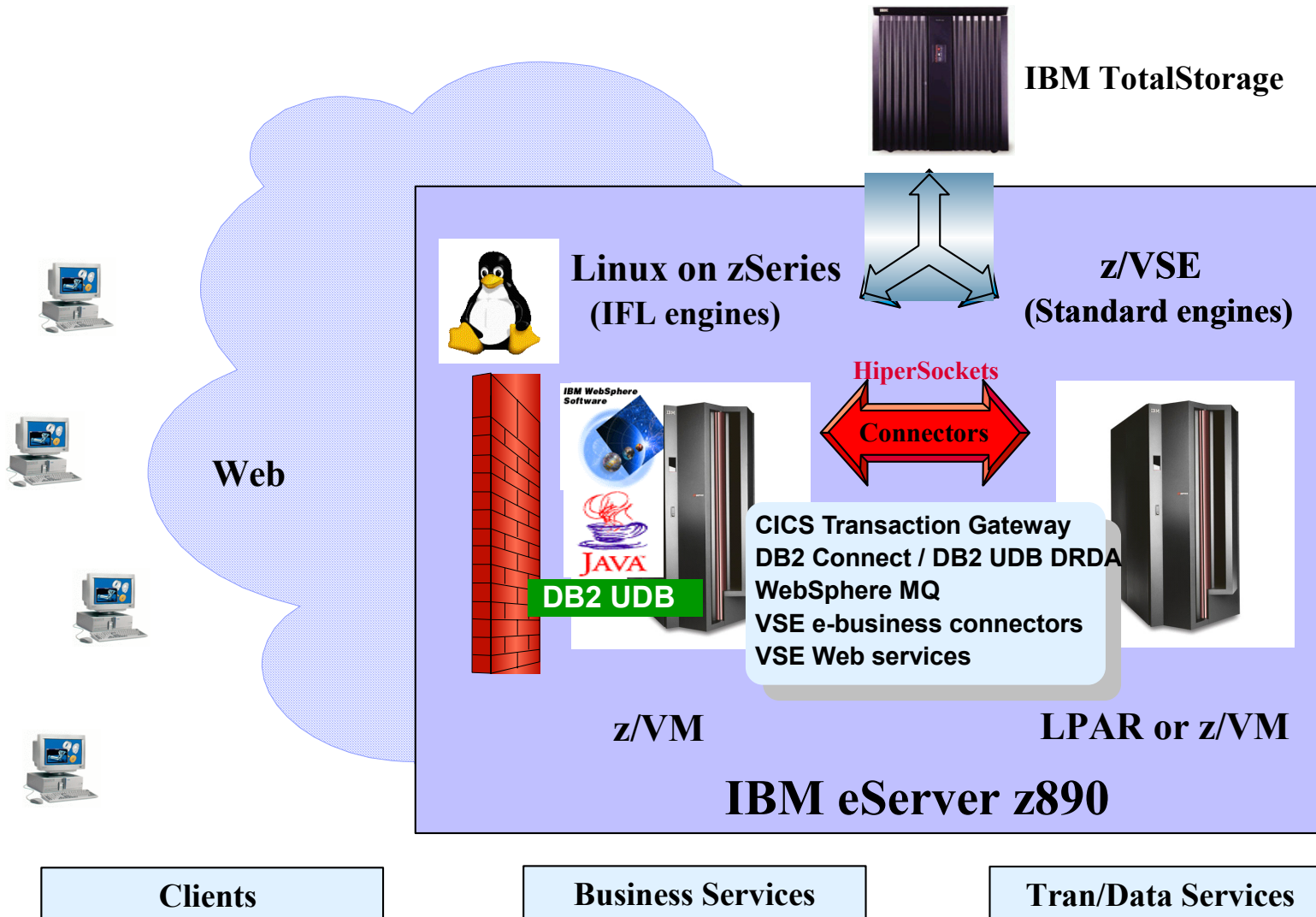 - VSAM applications, to access DB2 UDB

Typical VSE Customer Environment

- Various different servers (zSeries, pSeries, iSeries, xSeries, and competitive)
- VSAM data on VSE (few DB2 environments)
- Relational databases on distributed platforms (DB2, Oracle)
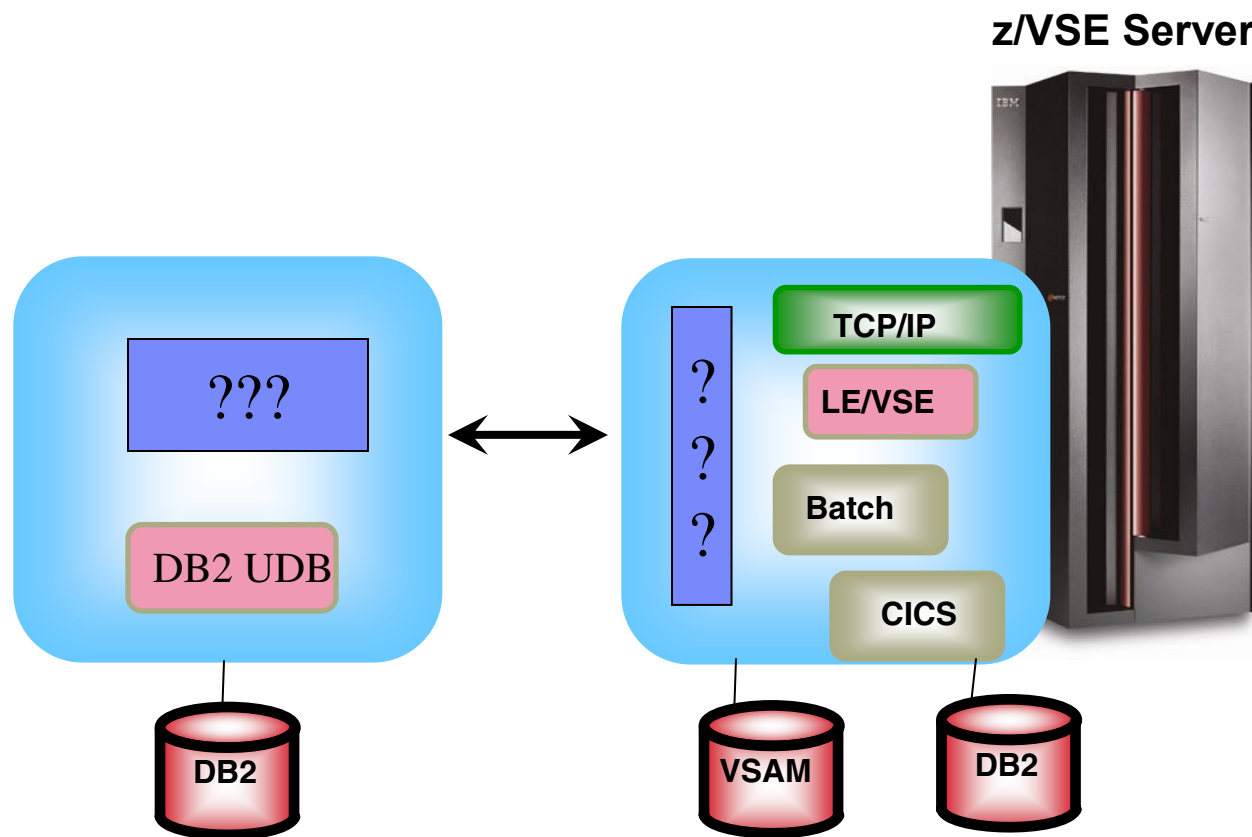- Data interchange via FTP
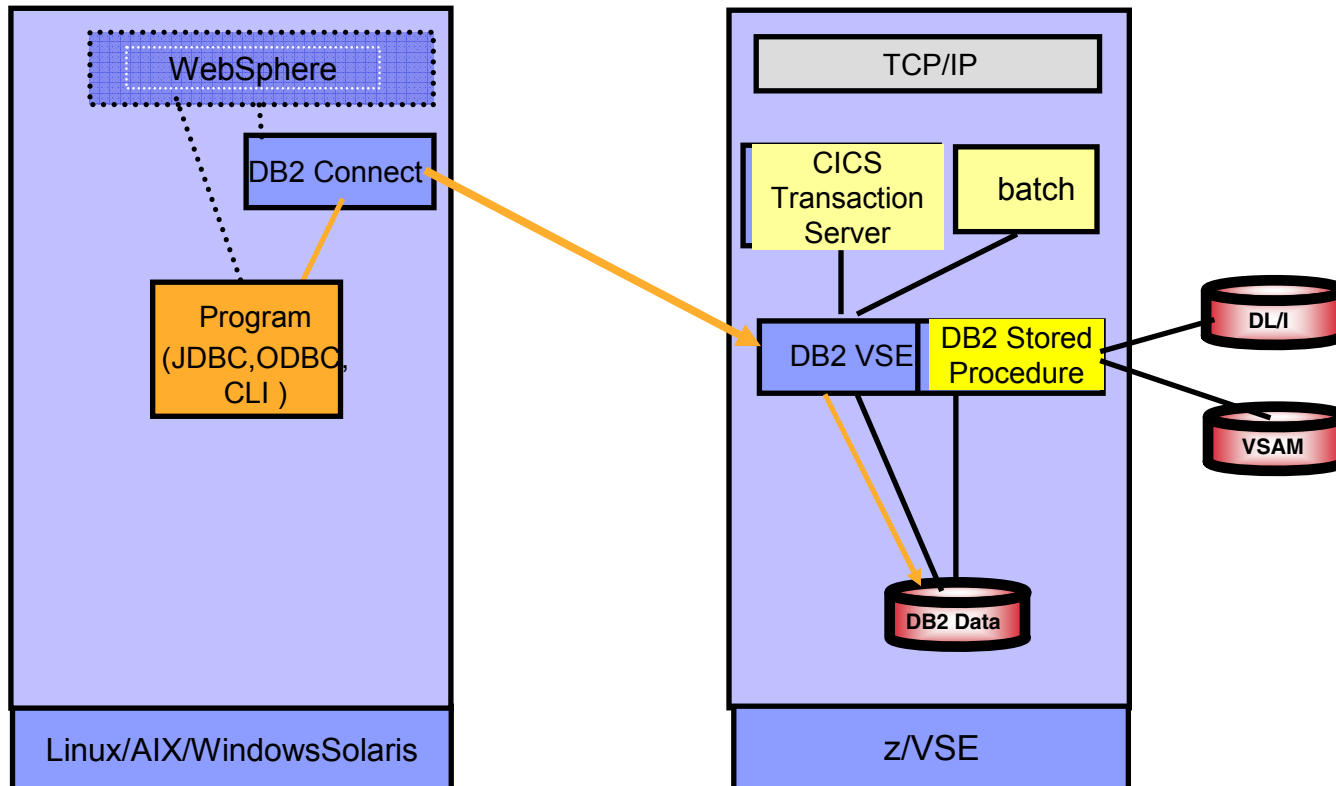
z/VSE with Linux on zSeries
The most prominent setup

IBM TotalStorage

Linux on zSeries
(IFL engines)

z/VSE
(Standard engines)

HiperSockets

IBM WebSphere
Software

JAVA

DB2 UDB

Connectors

CICS Transaction Gateway
DB2 Connect / DB2 UDB DRDA
WebSphere MQ
VSE e-business connectors
VSE Web services

Web

z/VM

LPAR or z/VM

IBM eServer z890

| **Clients** | **Business Services** | **Tran/Data Services** |

VSE applications and DB2 UDB on Linux on zSeries

z/VSE Server

???

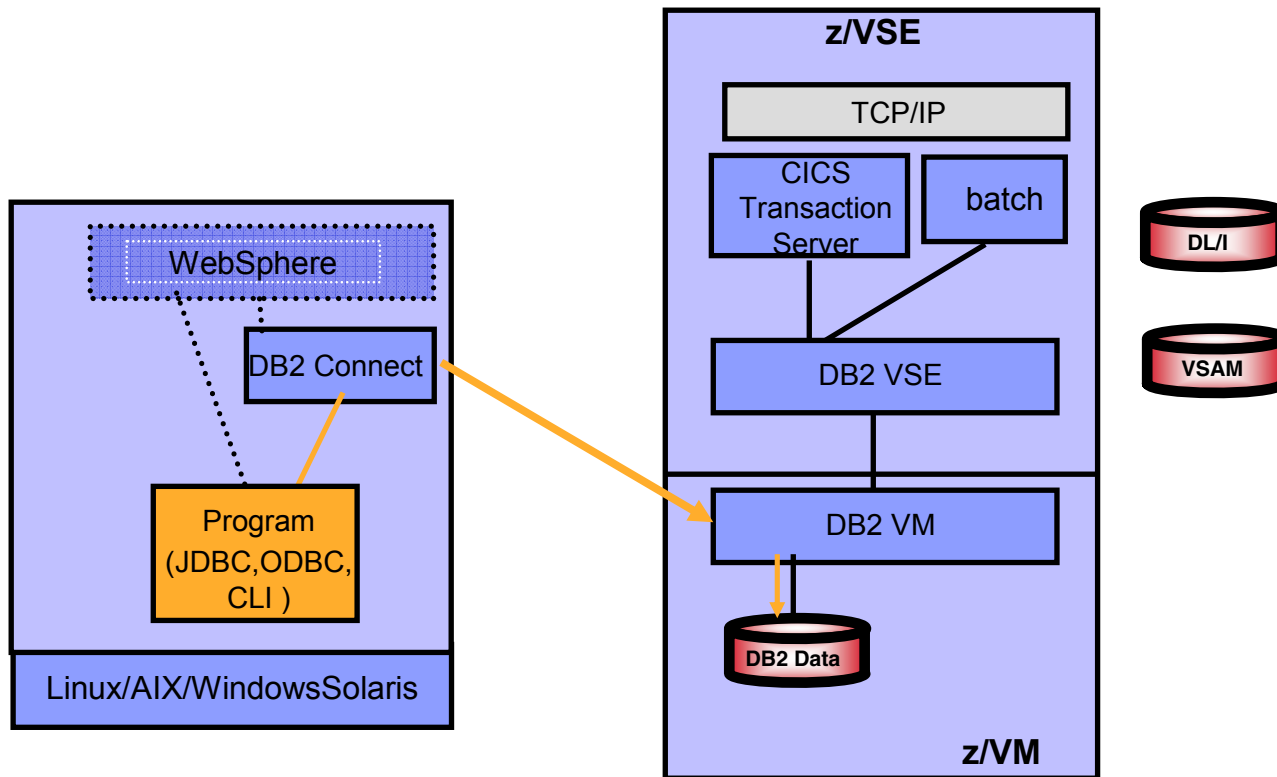DB2 UDB

DB2

? ? ?

TCP/IP

LE/VSE

Batch

CICS

VSAM

DB2

Relational Access to DB2 VSE

► Remote access of DB2 VSE via DB2 Connect

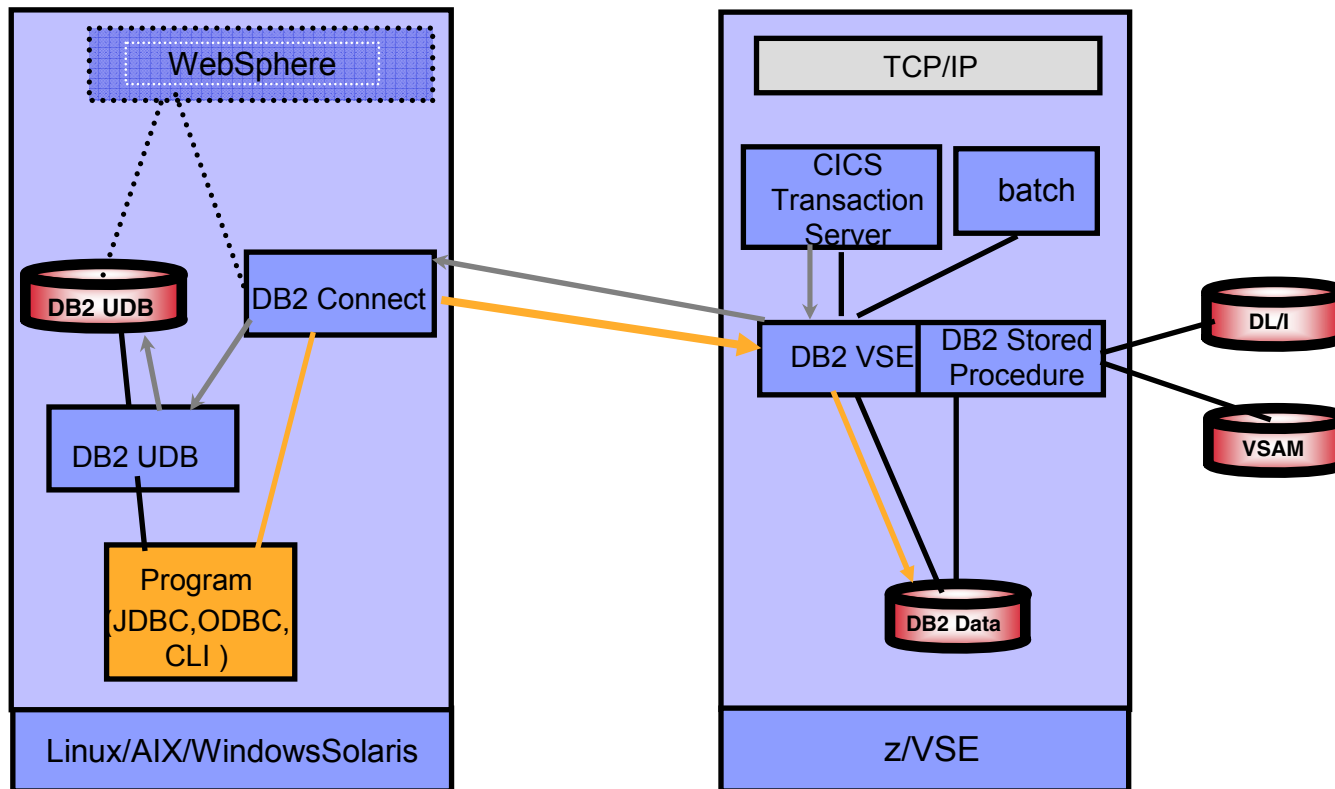► Integration of non relational VSE data (i.e. VSAM, DL/I) with remote DB2 logic via Stored Procedures

DB2 VSE/VM Guest sharing scenario, access to DB2 VM from Remote applications

- ►VSE applications access DB2 VM via Guest sharing
  - ►DB2 server for VM/VSE must be installed on both platforms
  - ►DB2 Databases (data) on VM only
- ►Remote access of DB2 VM via DB2 Connect
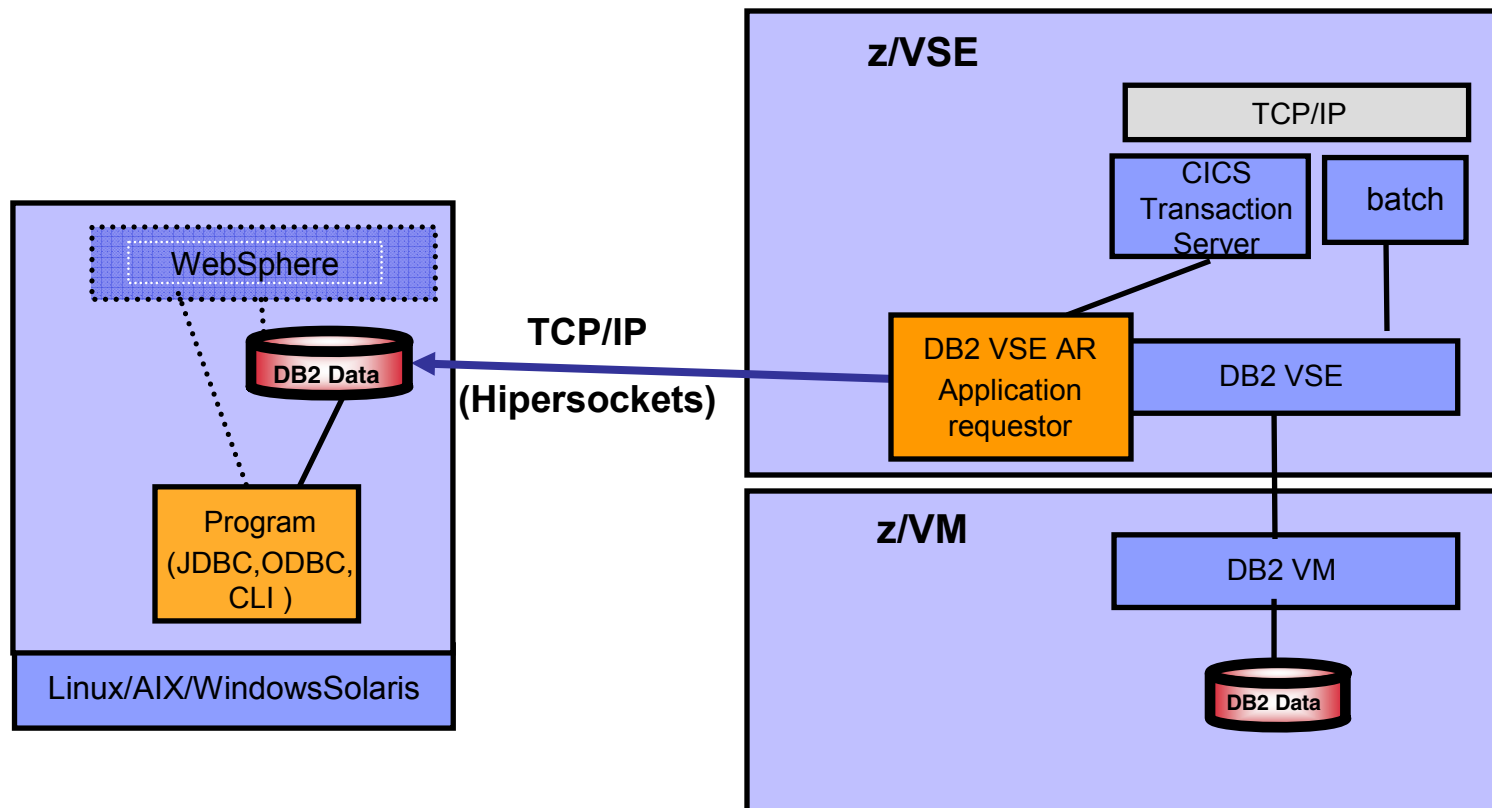- ►No Stored procedure access to VSE data possible

# Integration of DB2 UDB with DB2 VSE in Remote applications

► Remote access of DB2 VSE via DB2 Connect

► Integration of non relational VSE data with DB2 logic via Stored Procedures

► Remote programs can access DB2 UDB and DB2 VSE at the same time.

DB2 VSE applications to access, remote DB2 UDB on Linux
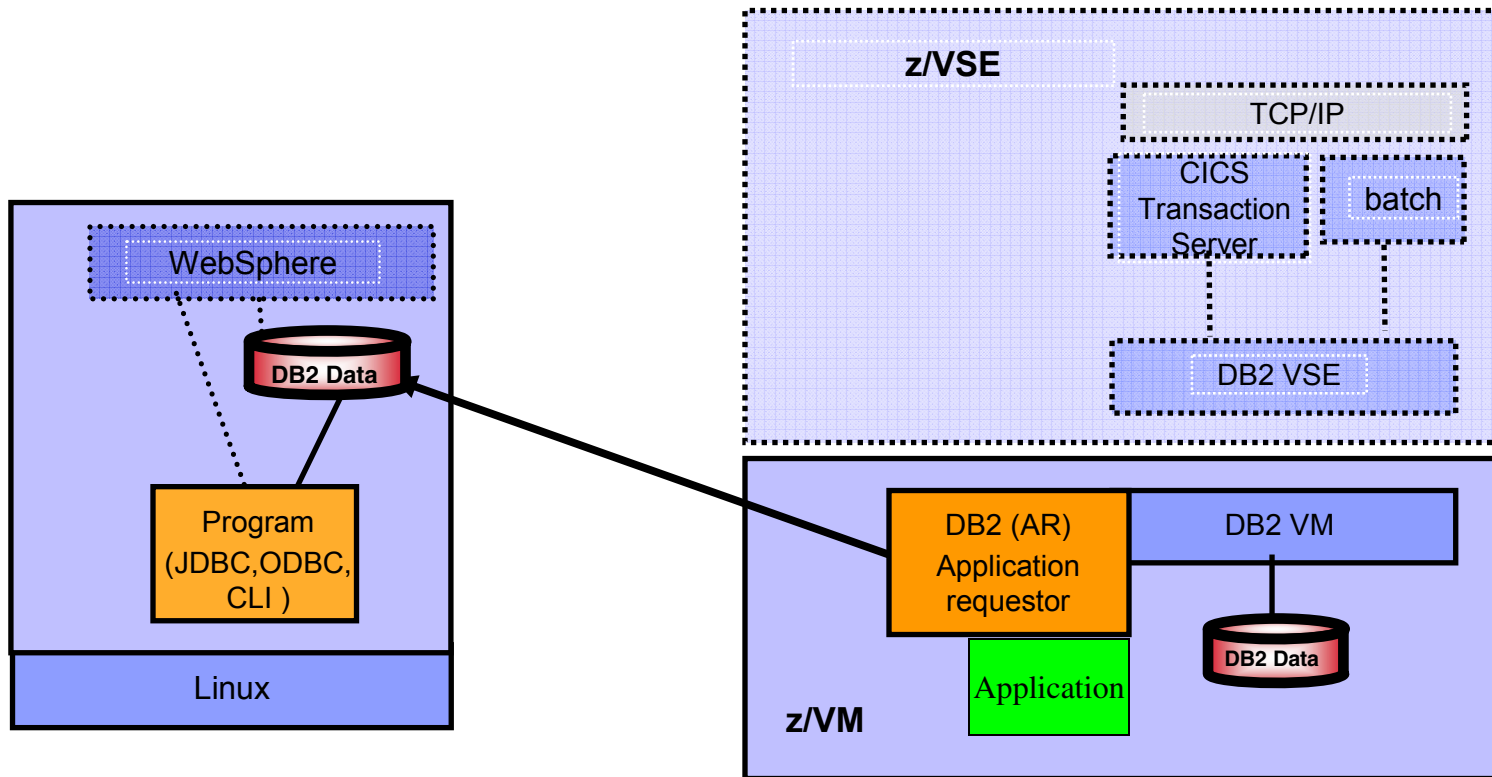

► VSE applications access remote DB2 UDB data via DB2 Application requestor in VSE

► VSE applications access DB2 VM via Guest sharing

   ► DB2 must be installed on both platforms

   ► DB2 Databases on VM only (no data on DB2 VSE)

DB2 VSE applications to access, remote DB2 UDB on Linux (NOT possible via DB2 AR in VM)
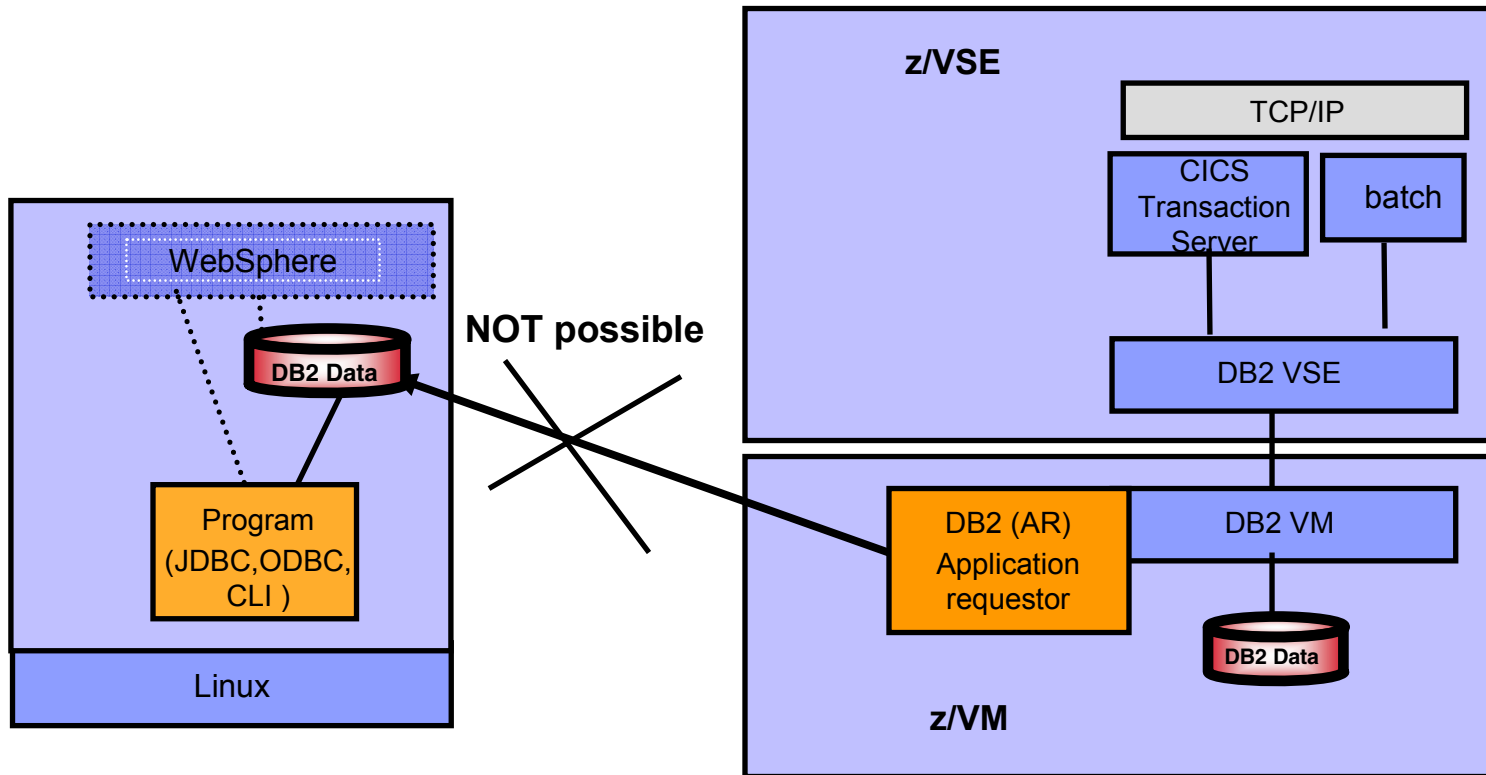
- ►VSE application access DB2 VM via Guest sharing
    - ►DB2 must be installed on both platforms
    - ►DB2 Databases on VM only
- ► **From VSE applications NO remote access via VM Application requestor possible**
    - ►**DB2 VM Applicatin Requestor (AR) can not be a gateway to DB2 UDB on Linux**

DB2 VM applications to access, remote DB2 UDB on Linux

► VM application accesses DB2 UDB on Linux

DB2 VSE applications to access, remote DB2 UDB on Linux on zSeries - Special OFFERING
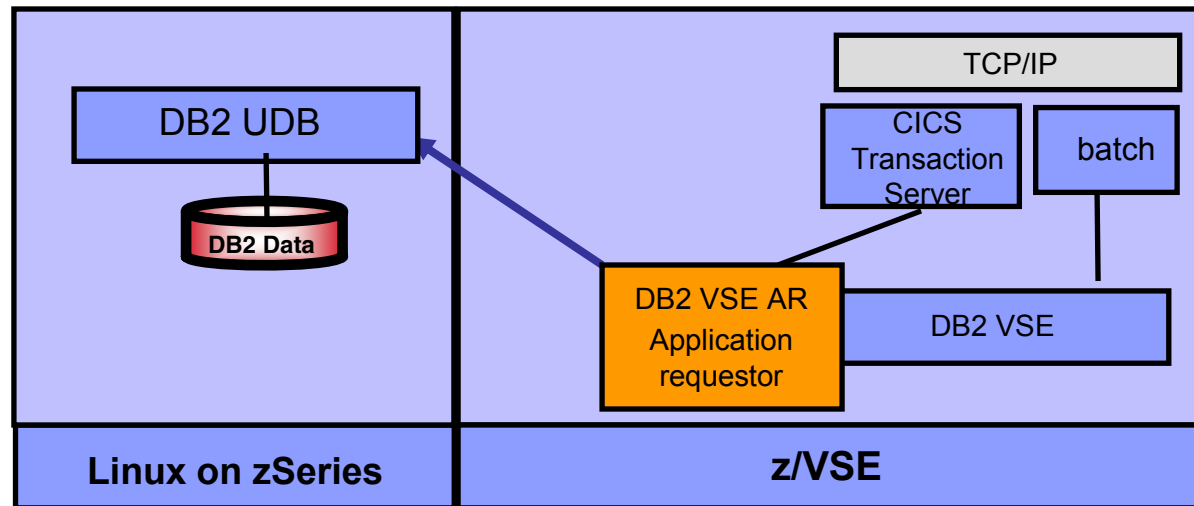
- ►Original Price Model: License for DB2 VM/VSE **AND** DB2 UDB for Linux
- ►**PRPQ: P10154 (Ordering Nr: 5799-HAQ)**
    - ►**Reduced License for DB2 VSE Client only - if NO data on VSE**
        - ►**Full Price for DB2 UDB on Linux on zSeries**

- ►**Special Price for DB2 UDB for Linux on zSeries**

- ►*Note:*
    - ►*Both Products are needed because of the Programing interface and precompiler*
    - ►*On VSE the SQL language that can be used is the DB2 VSE SQL Language – because of precompiler*

Federated Database design
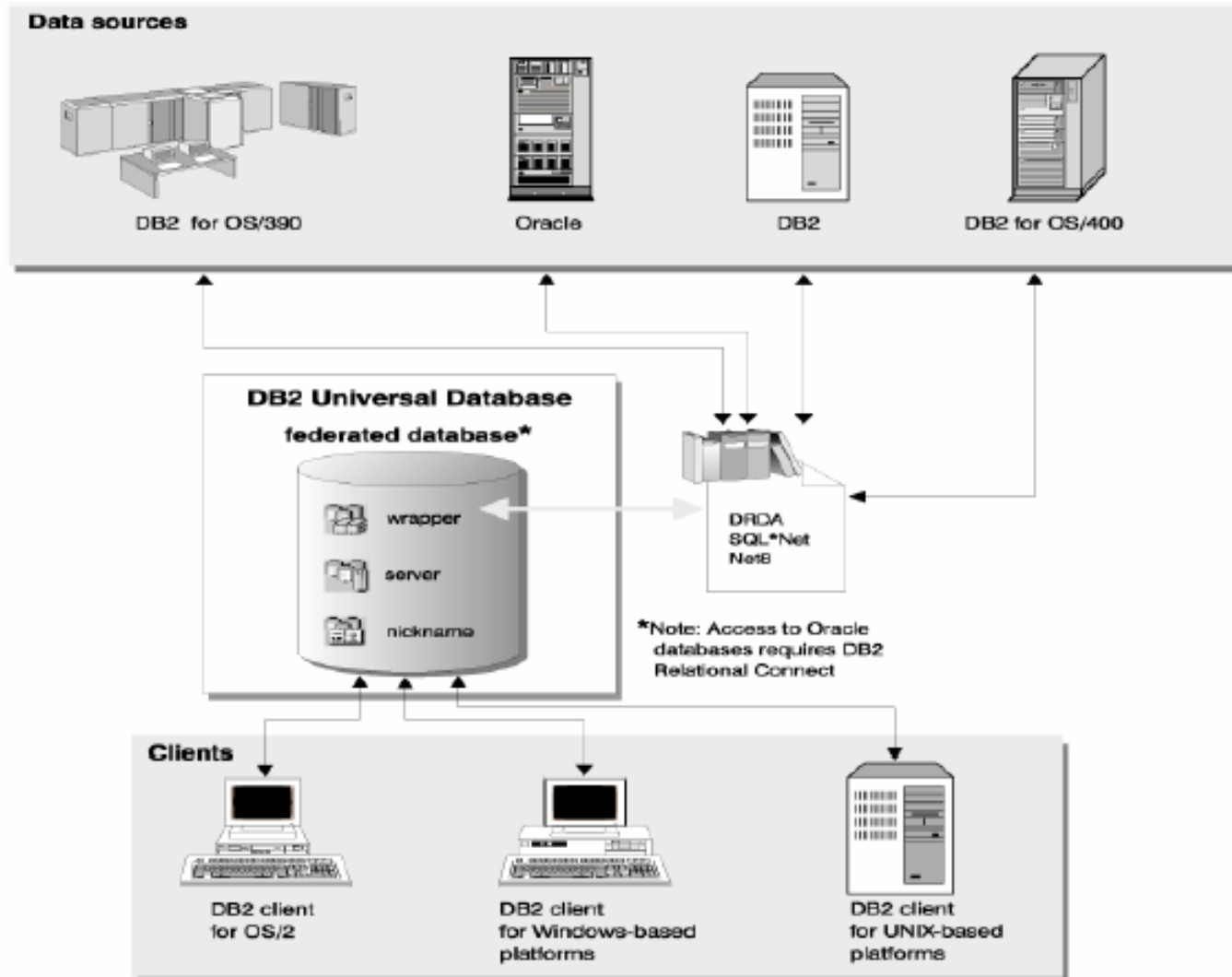
DB2 UDB on Linux on System z logical integrate DB2 VSE via Federated option in DB2 UDB
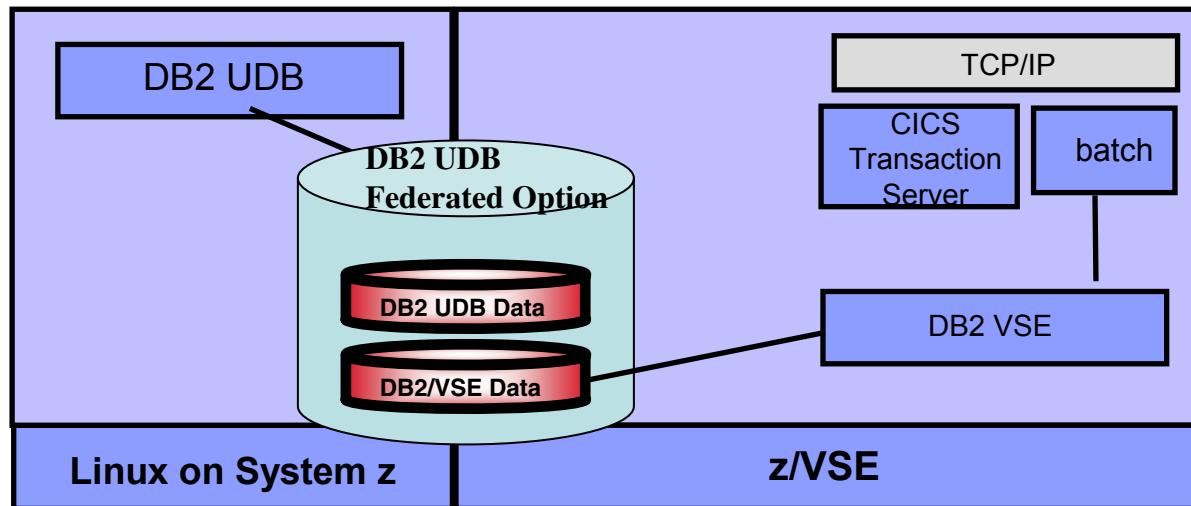
- ►Minimum changes – maximum combination
    - ►DB2 UDB for Linux on System z with Federated Option – includes DB2 VSE logically
    - ►DB2 UDB Applications have transparent access to DB2/VSE

DB2 Scenarios – with DB2 UDB on Linux

pSeries

AIX / Linux
SAP
ORACLE /
DB2

DB2
UDB

iSeries

AS/400
Linux
DB2

DB2
UDB

Linux on zSeries

Software
IBM WebSphere

DB2
UDB

DB2
VSE

Connection
via
HiperSockets

z/VSE V3.1
Production
Environment

+ CICS
+ VSAM
+ COBOL

+ DB2 VSE
Client*

z/VSE V3.1
Test
Environment

+ CICS
+ VSAM
+ COBOL

I ♥ z/VSE

I ♥ z/VSE

z/VM V5	z/VM V5	z/VSE Test System LPAR
IFL Engine	**Standard Engine**	

IBM eServer zSeries
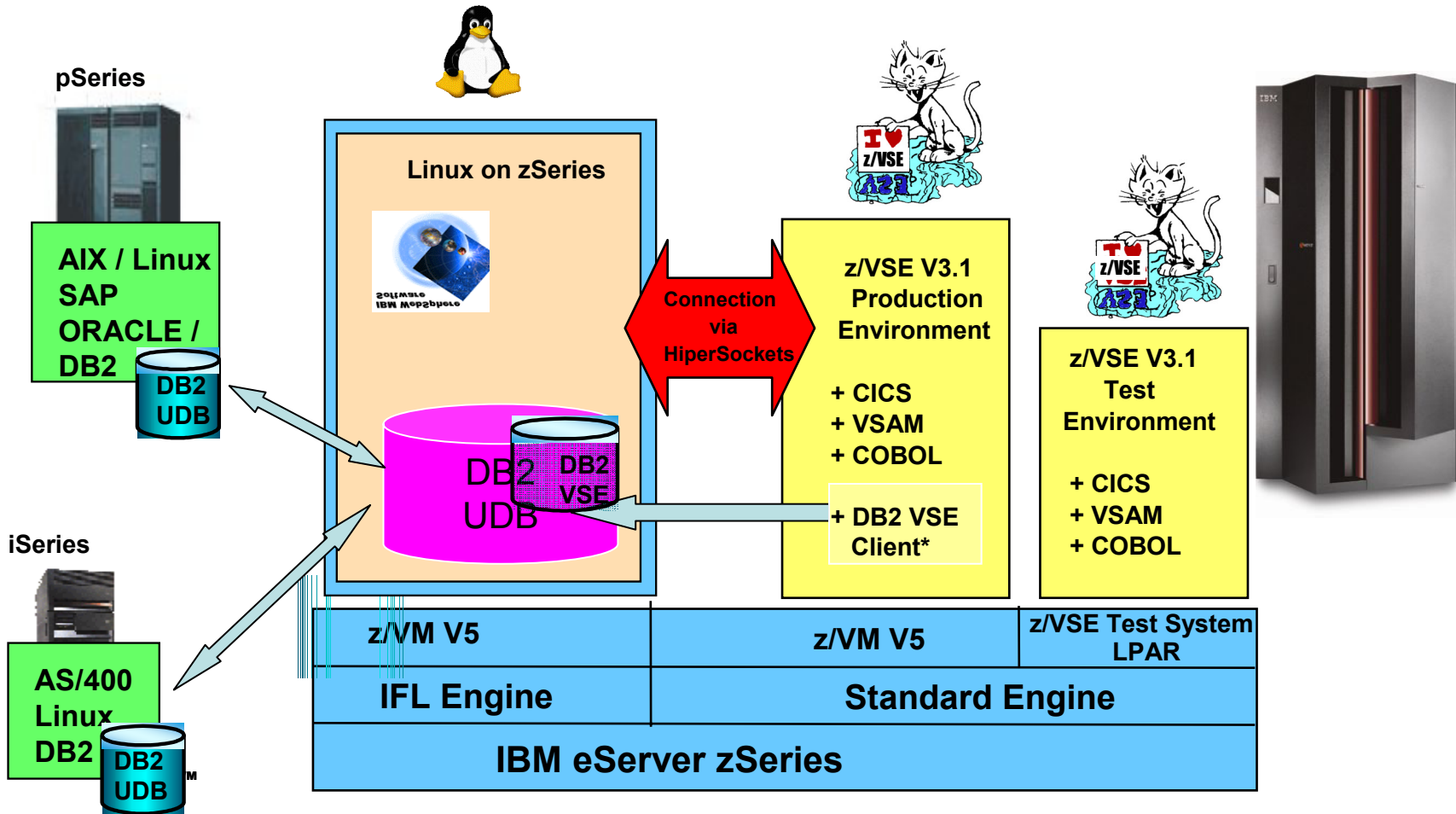
(*) DB2 VSE Client – the client functionality only, can be obtained
with <u>PRPQ P10154</u>

Q Replication Architecture between DB2 UDBs

Admin

Source **Control**

Capture

Log based

WebSphere MQ

Control

Apply

Target
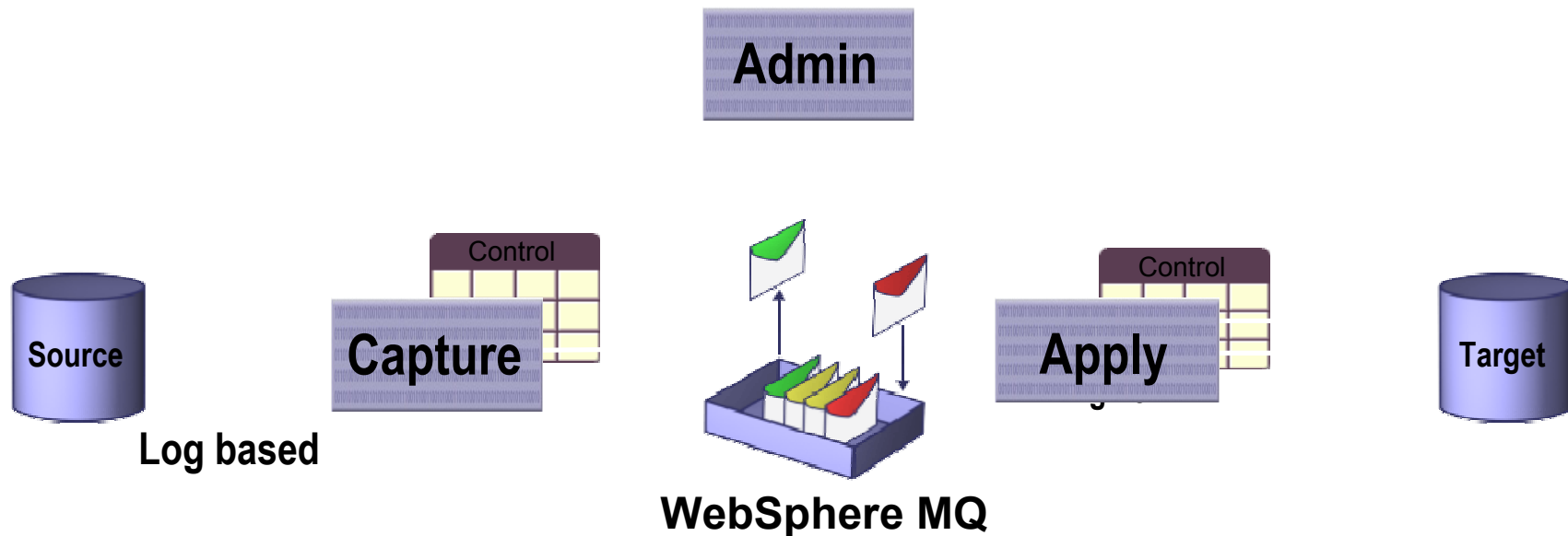
- Each message represents a transaction
- Highly parallel apply process
- Differentiated conflict detection and resolution
- Integrated infrastructure for replication and publishing
- Staged availability of heterogeneous support

DB2 VSE and DB2 UDB on Linux on zSeries

Why use DB2 UDB on Linux on zSeries with VSE Core applications

- Modern environment in DB2 UDB on Linux on zSeries

- Existence of lots of tools for:
  - database management
  - Optimization and Tuning
  - Data analysis (Warehouse, Mining, OLAP)

- ASCII environment – easy integration with distributed DB2 UDBs
- Consolidation of DB2 UDB databases from distributed platforms

- **Note: DB2 CONNECT is not needed on Linux on zSeries**

DB2 VSE and DB2 UDB on Linux on zSeries

Why use DB2 UDB on Linux on zSeries with VSE Core applications

- VSE applications access to DB2 UDB on Linux via HiperSockets
  - reliable network – no wires
  - fast network (memory copy speed)
  - transparent

- Core applications on VSE (CICS and batch):
  - can be used unchanged with considerations of EBCDIC – ASCII code pages (i.e. sorts with low values)
  - can show performance degradations if mass single row processing is done – these applications might need adaptions

- **Note: DB2 CONNECT is not needed on Linux on zSeries**

Environment and Database design

Configuration for CICS applications and remote DB2 UDB database

- VSE environment
  - configure DB2 VSE database directory
    - configure ARISDIRD (IP, port, DBname of remote database)
  - enable DRDA code (batch and online)
    - configure ARIS74LD (batch), ARIS745D (AR)
    - new transaction in CICS to bind packages (CBND) to remote AS (done during program preparation)

- zLinux environment
  - configure database manager on DB2 UDB zLinux
    - change some DBM parameters to allow implicit connect from within CICS
  - configure VSE batch and ISQL options (create remote packages)
    - ARIISQL for ISQL and ARIDSQL for Batch

- Note: DB2 CONNECT is not needed on Linux on zSeries
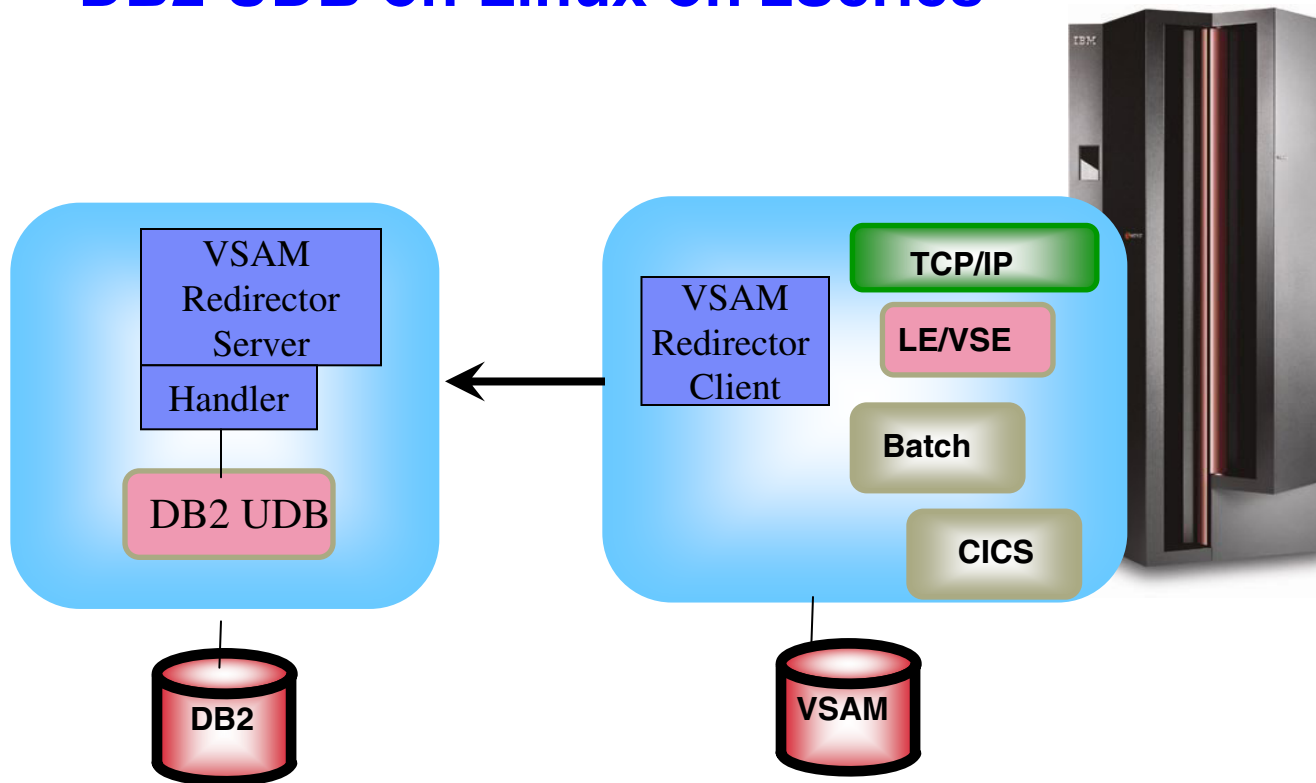
Environment and Database design

Configuration for CICS applications and remote DB2 UDB database

Application considerations:

- migrate tables from DB2 VSE to DB2 UDB zLinux
    - UDB export/import options
    - use of federated DB2 UDB options and a cursor application

- existing CICS/DB2 VSE applications
    - no changes to the source code required (except Code page issues)
    - the SQL precompile creates new packages on the remote DB2 UDB)

- existing VSE batch DB2 VSE applications
    - no changes to source code required
    - adapt CONNECT statements to access remote DB2 UDB

VSE/VSAM applications
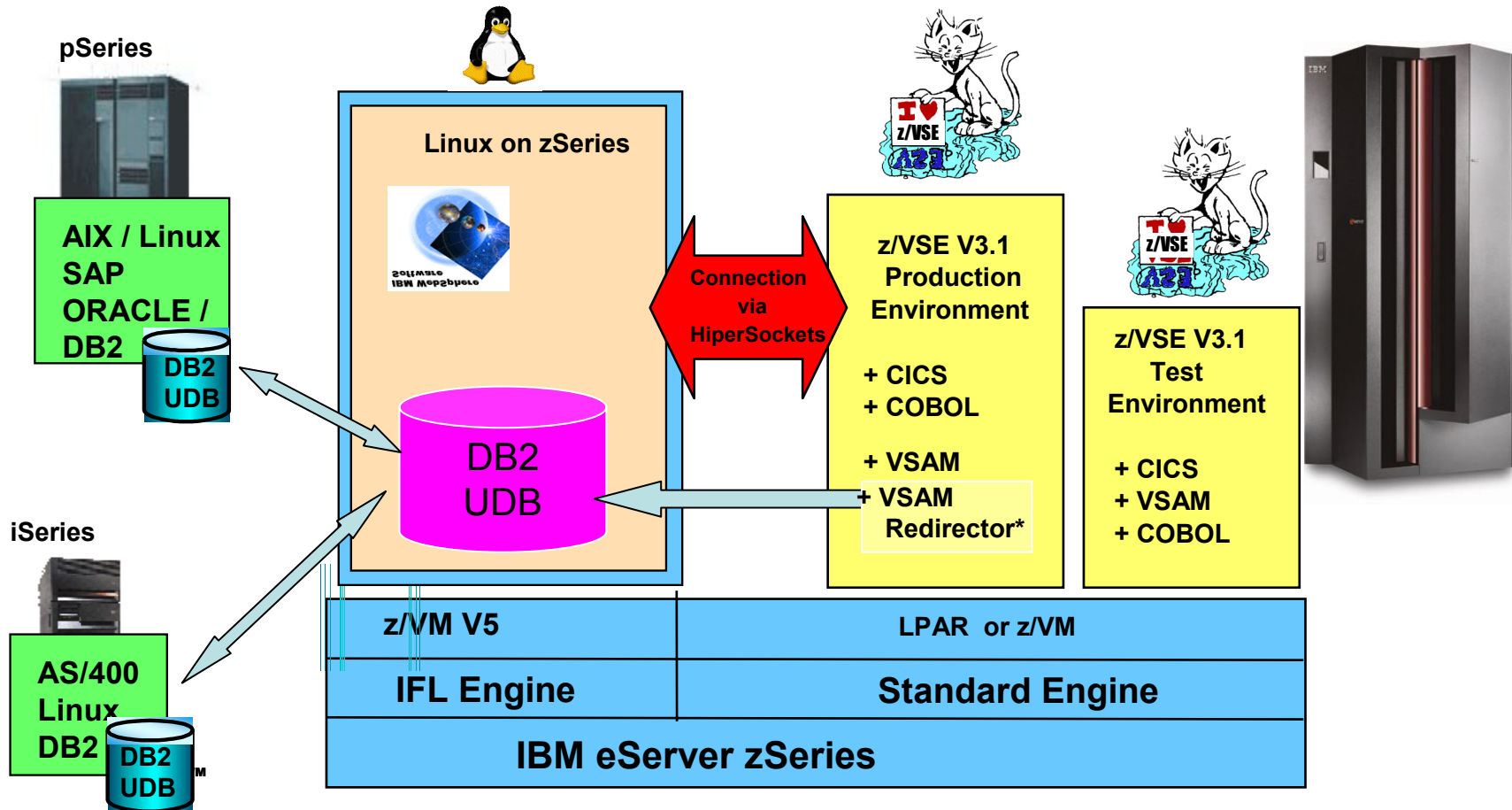# access to
DB2 UDB on Linux on zSeries

z/VSE Server

VSAM Redirector Server	
Handler	
DB2 UDB	

DB2

VSAM Redirector Client	TCP/IP
	LE/VSE
	Batch
	CICS

VSAM

Common Data Store – Transparent Work of VSAM Programs with DB2 UDB on Linux on zSeries

pSeries

AIX / Linux SAP ORACLE / DB2

DB2 UDB

Linux on zSeries

Software IBM WebSphere

DB2 UDB

Connection via HiperSockets

z/VSE V3.1 Production Environment

+ CICS
+ COBOL

+ VSAM
+ VSAM Redirector*

z/VSE V3.1 Test Environment

+ CICS
+ VSAM
+ COBOL

iSeries

AS/400 Linux DB2

DB2 UDB

z/VM V5	LPAR or z/VM
IFL Engine	Standard Engine
IBM eServer zSeries	

(*) VSAM Redirector – Common data store solution – with DB2 on Linux on zSeries Solutions without changes to VSAM programs

VSE/VSAM Redirector

■ Benefits

➤ no changes to existing applications

➤ access remote data from VSE applications

➤ synchronization of VSAM data and remote data (database)

➤ transparent for batch and CICS

➤ offers new options for incremental

  ➤ processing

  ➤ FTP

  ➤ journaling

VSAM Redirector types of operation

(1) Real time access VSAM to DB2

    a)   synchronization (two phase commit of VSAM and DB2)
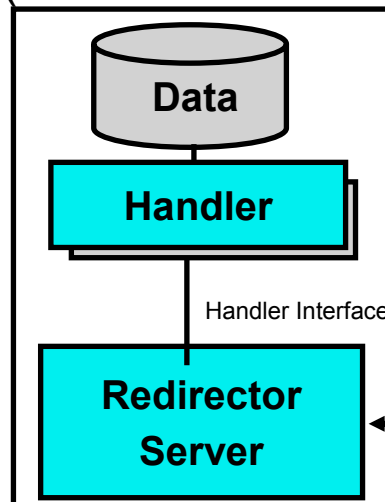
    b)   Real time access to DB2 (no VSAM access anymore)

(2) VSE local data collection for VSAM

    a)   Capture Exit and Incremental FTP, processing

    b)   MQ Exit and MQ Series solutions

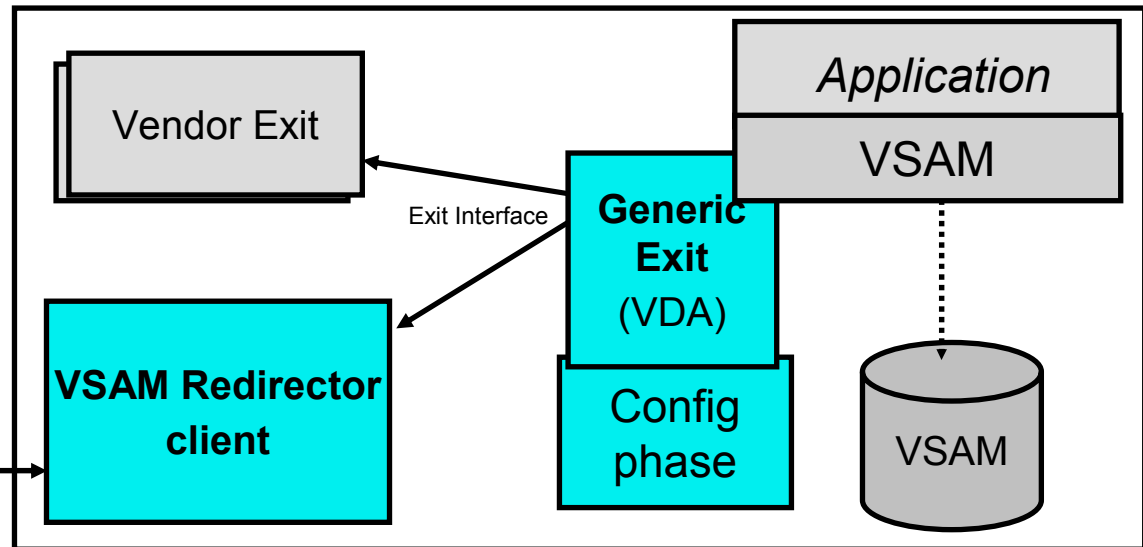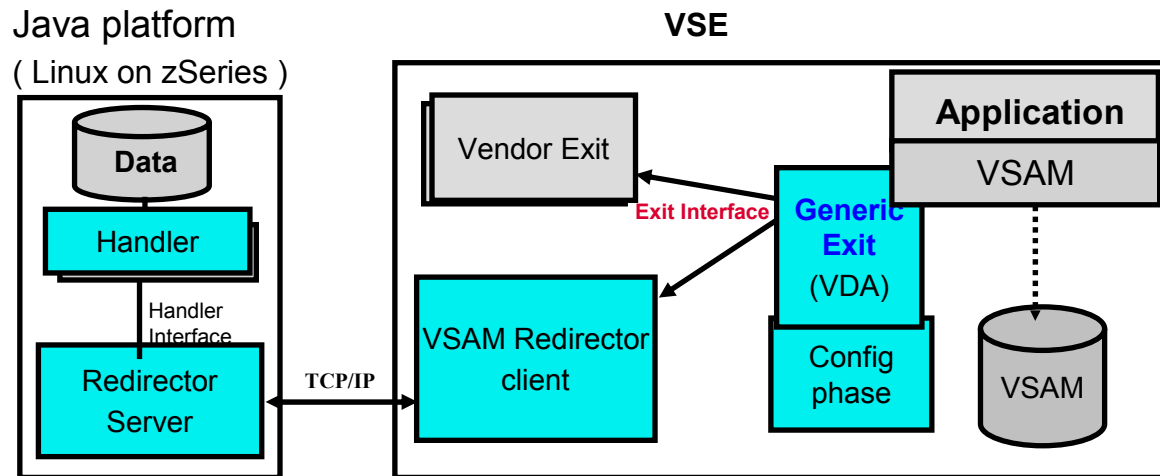# VSE/VSAM Redirector - functional view

► Redirector Components:

► Generic Exit is based on VSAM Data Access Exit (VDA)

► Config phase - redirection properties

► Redirector client

► Redirector server

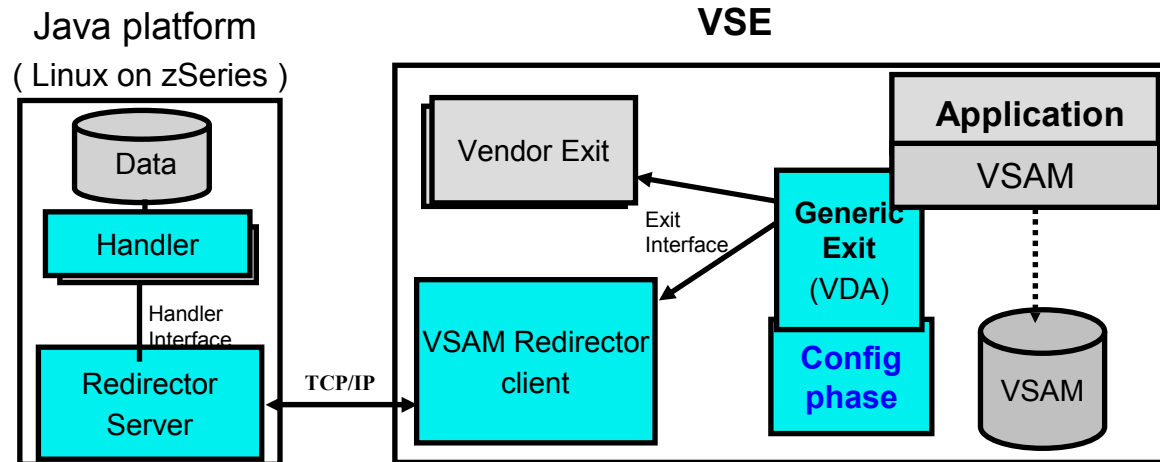► Handler

VSE/VSAM Redirector - Components
Generic Exit

Java platform
(Linux on zSeries)

VSE

Data

Handler

Handler
Interface

Redirector
Server

TCP/IP

Vendor Exit

Exit Interface

Generic
Exit
(VDA)

Config
phase

Application

VSAM

VSAM Redirector
client

VSAM

► **Generic Exit**
- ► **based on VSAM Data Access Exit (VDA) IKQVEX01**
- ► **VSAM requests will be intercepted (i.e. OPEN,CLOSE,GET,PUT,POINT...)**
► **The exit is called twice for each VSAM request.**
- ► **before request execution**
- ► **after request finished**
► **RC=0 from exit, normal VSAM processing continues**
► **RC=4 from exit, skip all physical VSAM access, return to caller with RC=0**
► **Config phase is used for decisions of further processing**
► **Open (documented) Exit interface**
► **To use Generic Exit, no changes to VSAM programs are required.**

VSE/VSAM Redirector - Components
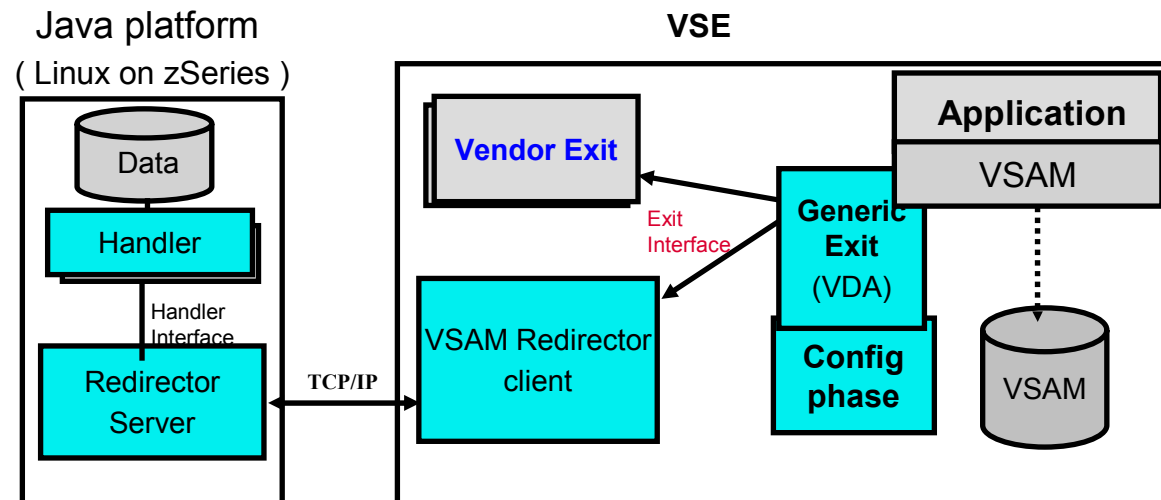## Configuration phase

Java platform
(Linux on zSeries)

VSE

Data	
Handler	Vendor Exit
	Exit Interface
Handler Interface	**Generic Exit** (VDA)
Redirector Server	VSAM Redirector client
	Config phase

TCP/IP

Application

VSAM

VSAM

► **Config phase**

► contains parameters for the processing decision

  ► cluster and catalog name

  ► whether VSAM file should or not be redirected

  ► destination specification like IP address, PORT, handler,

  ► option string containing i.e. database name, userid, password

► skeleton in ICCF Library 59 (SKRDCFG) is provided

► allows integration of existing VDA Exit phases

Information in Configuration phase

► **CATALOG**= VSAM catalog name for the file to be redirected. (wildcard allowed) (CLUSTER=* - required)
　　NOTE: If the master catalog is redirected, you might not be able to startup your VSE/ESA system!

► **CLUSTER**= VSAM cluster name.(wildcard allowed).

► **EXIT**= Name of the exit phase or 'IESREDIR'.
　► EXIT=phasename　-　the phase with this name will be invoked (integration of VDA exit)
　► EXIT='IESREDIR'　-　the redirector client will be invoked with additional parameters

► **OWNER**= Name of the primary VSAM data owner (VSAM or REDIRECTOR)
　► OWNER = REDIRECTOR　-　No VSAM access is done for this VSAM cluster, all requests will be redirected
　► OWNER = VSAM:　Dual processing occurs (both VSAM processing and redirecting requests are done)

► Options *for both OWNER modes*:
► **IP**= IP address VSAM Redirector Server to handle the requests
► **PORT**= (optional, default is 2387) Port number the VSAM Redirector Server
　　Standard port is 2387 is assigned by the Internet Assigned Numbers Authority (IANA).
► **HANDLER**= Name of the Java class to be started, which represents the request handler
► **OPTIONS**= A string with arbitrary, options.

► Options *for OWNER=VSAM:*
► **IGNOREERROR**= NO|YES (opt, default NO) If set to YES, no error is set if redirector server is unreachable.
► **PUTREQONLY**= NO|YES (opt, default is NO). If set to YES , only INSERT, UPDATE and DELETE requests are redirected. (useful for synchronisation purposes, excluding the requests POINT and GET).
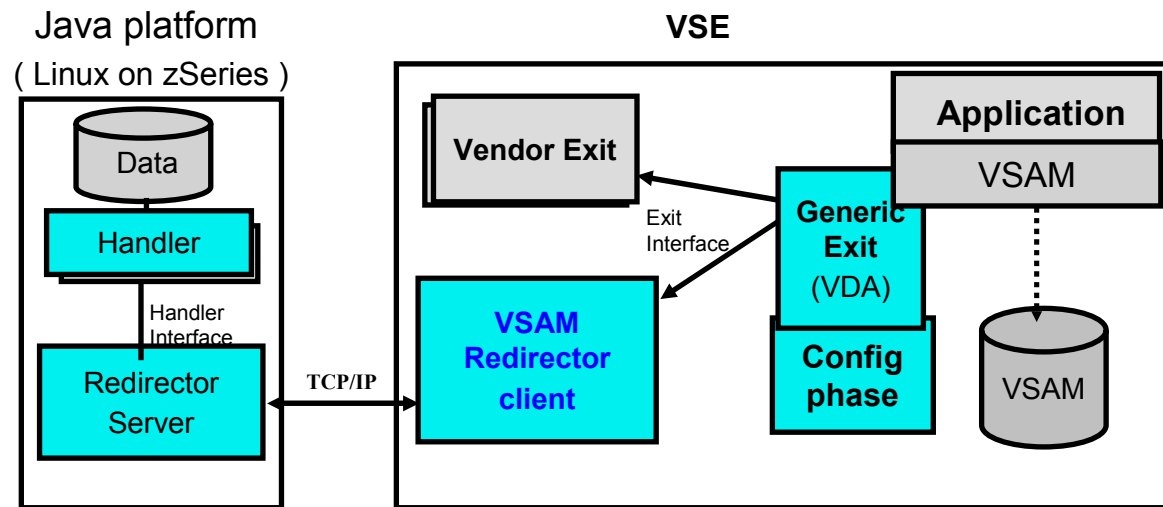
VSE/VSAM Redirector - Components
Vendor Exit

Java platform
(Linux on zSeries)

VSE

Data

Handler

Handler
Interface

Redirector
Server

TCP/IP

Vendor Exit

Exit
Interface

VSAM Redirector
client

Generic
Exit
(VDA)

Config
phase

Application

VSAM

VSAM

► Vendor Exit

   ► user (or vendor) written phase for data collection/transformation

   ► has to comply with the documented Exit Interface

Note: No chaining of Vendor Exit with VSAM Redirector client supported

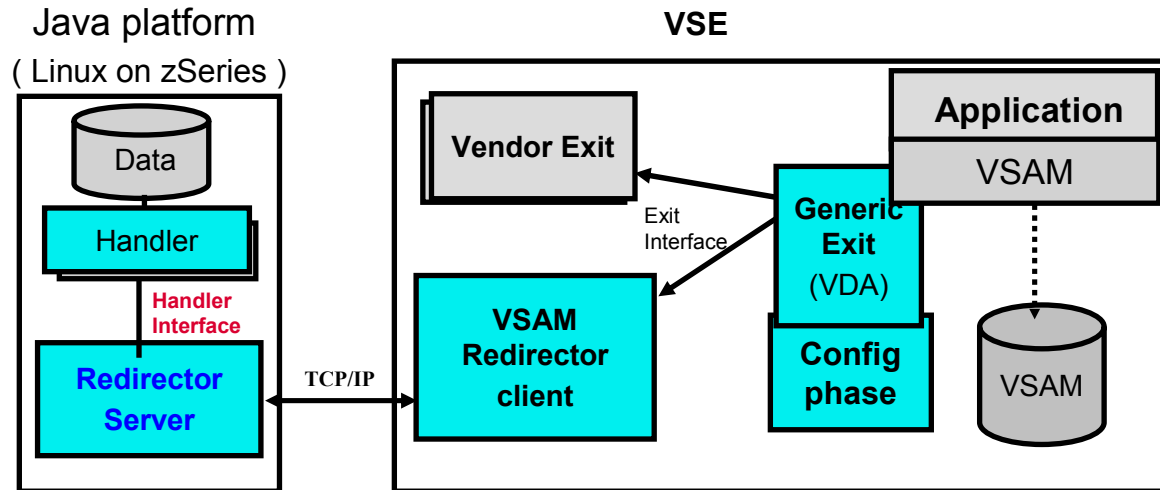# VSE/VSAM Redirector - Components

VSAM Redirector client

► VSAM Redirector client

    ► running on VSE in user's program partition

    ► component implemented as reentrant SVA phase

    ► responsible for TCP/IP connection/session handling with Redirector server

VSE/VSAM Redirector - Components

Redirector server

Java platform
(Linux on zSeries)

VSE

Data

Handler

Handler Interface

Redirector Server

TCP/IP

Vendor Exit

Exit Interface

VSAM Redirector client

Generic Exit (VDA)

Config phase

Application

VSAM

VSAM

► VSAM Redirector server
  - ► implementation: 100% Java
  - ► command line interface to interact with server (start/stop/status)
  - ► Open Handler Interface
  - ► responsible for TCP/IP connection with Redirector client
  - ► responsible for data translations (EBCDIC - specified Code Page)
  - ► configured via VSAMRedirectorServer.properties file
  - ► calls the handler for data processing (OPEN,...,CLOSE method)
  - ► generates (translates) error messages for VSAM

VSE/VSAM Redirector - Components

Redirector server (configuration)

- ► VSAMRedirectorServer.properties file used to configure Redirector server
  - ► messages = on|off
    - ►on: print server messages
    - ►off: quite mode, messages will not be shown

  - ► listenport = portnumber
    - ►TCP/IP portnumber on which the server listens

  - ► maxconnections = number
    - ► number of maximum parallel connections allowed, from clients

  - ► codepagetranslator = com.ibm.vse.server.DefaultTranslator
    - ► the codepage translater class to be used to convert Strings from EBCDIC into ASCII and back (get method from VSAMRequestInfo.class)

  - ► tracelevel = number (currently 0 - 2)

Note: Individual translators can be written and implemented via VSAM Redirector properties file (codepagetranslator).
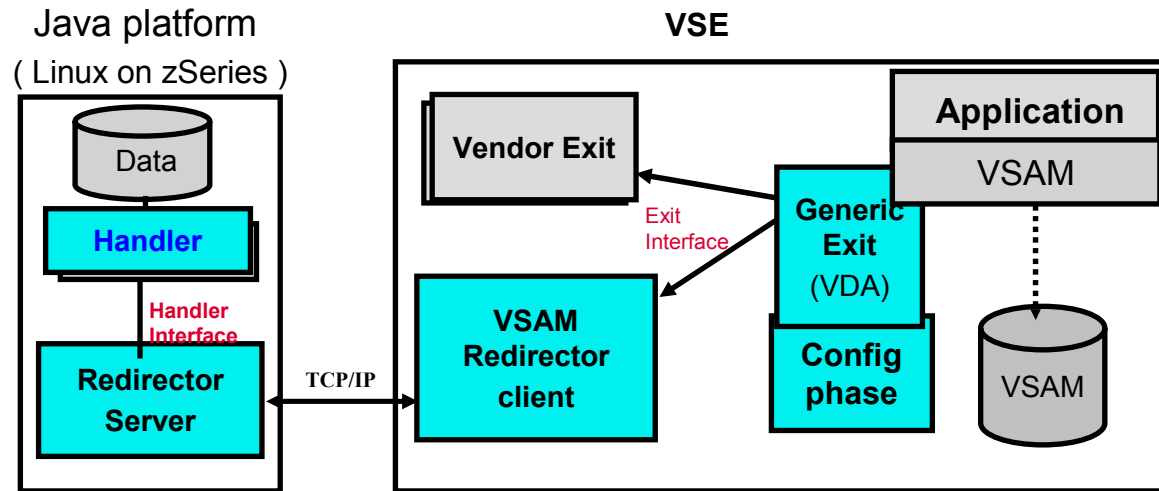
VSE/VSAM Redirector - Components

Redirector server (translator)

► Redirector server has 'data translation' functions inplemented in the
VSAMRequestInfo.class

► VSAMRequestInfo.class contains methods to get and set data areas

in the communication area. 'offset' plus 'length' of the record area and these
methods are used to transform the data into:

  ► String

  ► Number (Signed/Unsigned)

  ► Packed Decimal

  ► Binary bytes

These methods (see Javadoc) are called from handler if necessary.

VSE/VSAM Redirector - Components
Handler

Java platform

(Linux on zSeries)

VSE

Data

Handler

Handler Interface

Redirector Server

TCP/IP

Vendor Exit

Exit Interface

Generic Exit

(VDA)

Application

VSAM

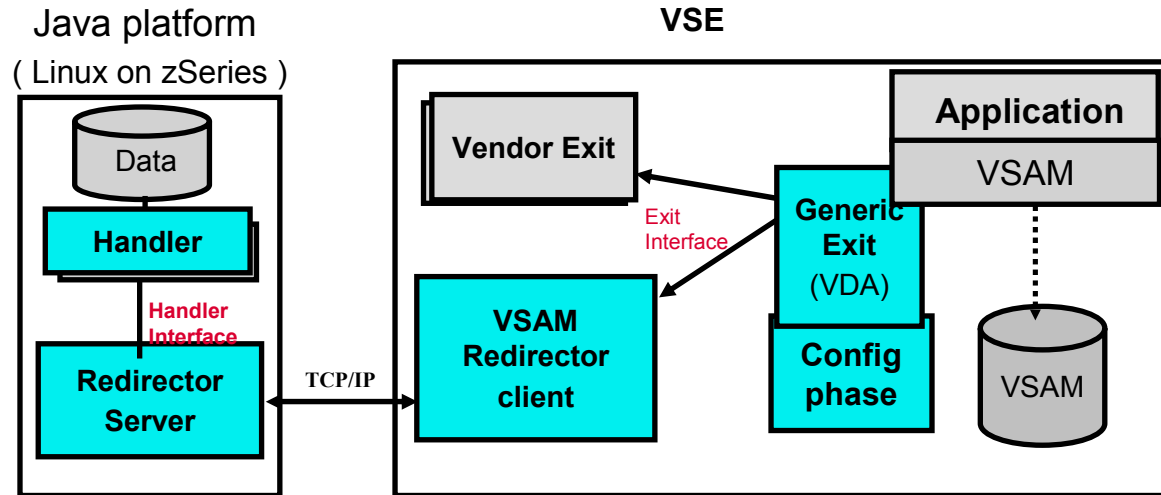**VSAM Redirector client**

Config phase

VSAM

► Handler

- ► file system specific

- ► must reside in the directory of Redirector server

- ► sample implementations: 100% Java

- ► multiple handlers per system possible

- ► Handler interface allows individual handler for proprietary/standard file systems and platforms

- ► VSE contains a sample implemenatation for a relational handler (DB2) and an HTML handler

VSE/VSAM Redirector

Working with remote data

Java platform
(Linux on zSeries)

VSE

Working with data residing on another platform OWNER=REDIRECTOR

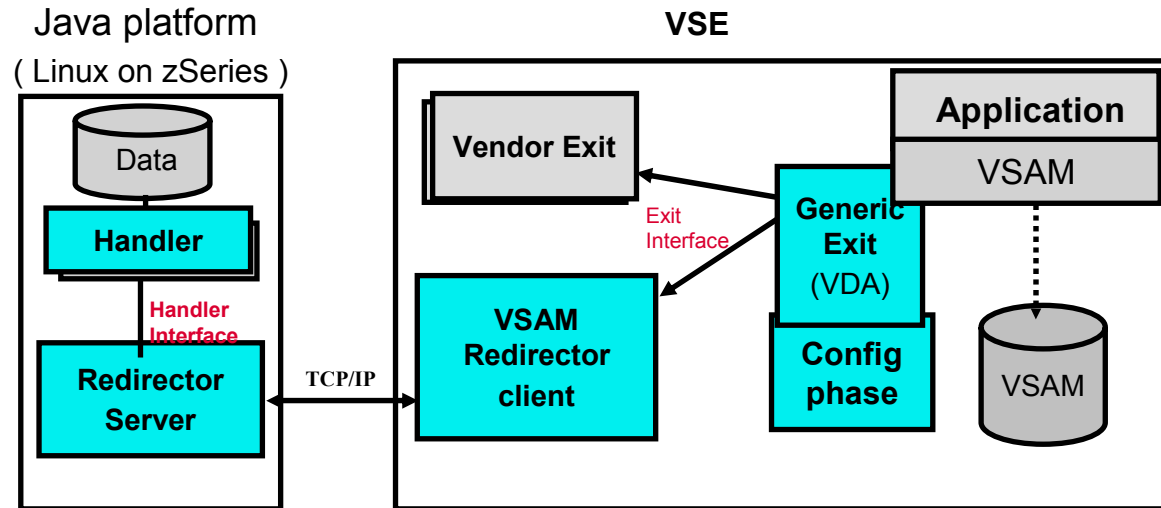No VSAM access any more (after OPEN).

All requests are redirected to VSAM Redirector client, which connects to the VSAM Redirector server. VSAM Redirector server performs the request via the proper handler.

Note:

1.The redirected VSAM file must exist and have at least one dummy record.

2.You cannot chain exits if any one of these exits has OWNER set to REDIRECTOR.

VSE/VSAM Redirector
Synchronisation

Java platform

(Linux on zSeries)

VSE

Data

Handler

Handler Interface

Redirector Server

TCP/IP

Vendor Exit

Exit Interface

Generic Exit (VDA)

VSAM Redirector client

Config phase

Application

VSAM

VSAM

Synchronizing existing VSAM data with a remote file system (OWNER=VSAM)

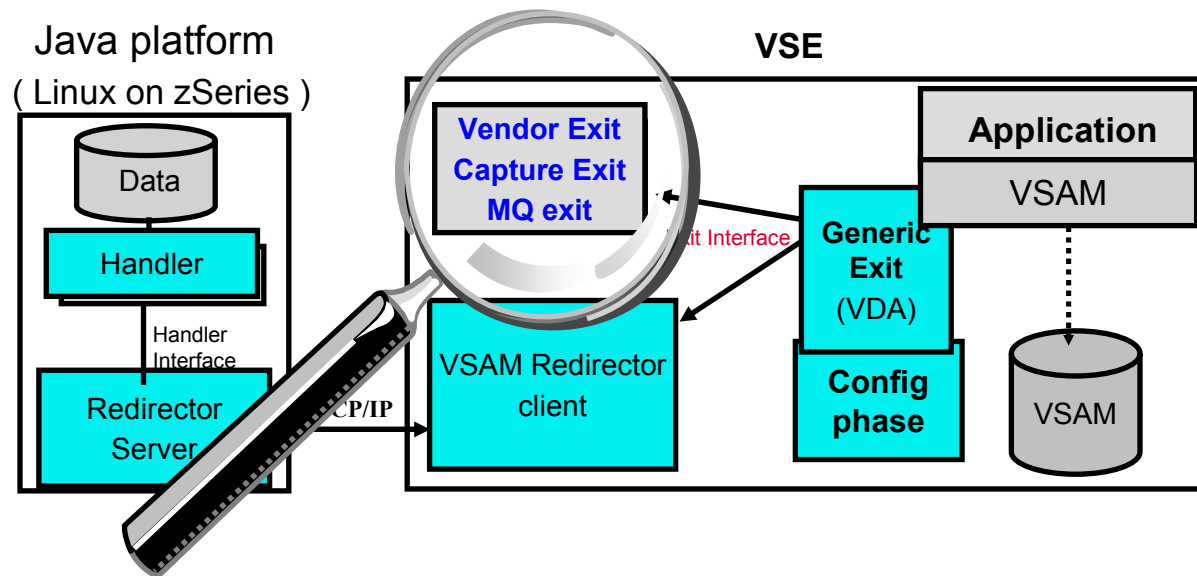**The programs perform a VSAM access and redirected access.**

Each VSAM request causes two invocations of VSAM Redirector Client, giving the chance to commit or rollback depending on VSAM request completion.

Note:

PUTREQONLY=YES allows to make changes only simultaneously on 2 sides, READs are done from VSAM.

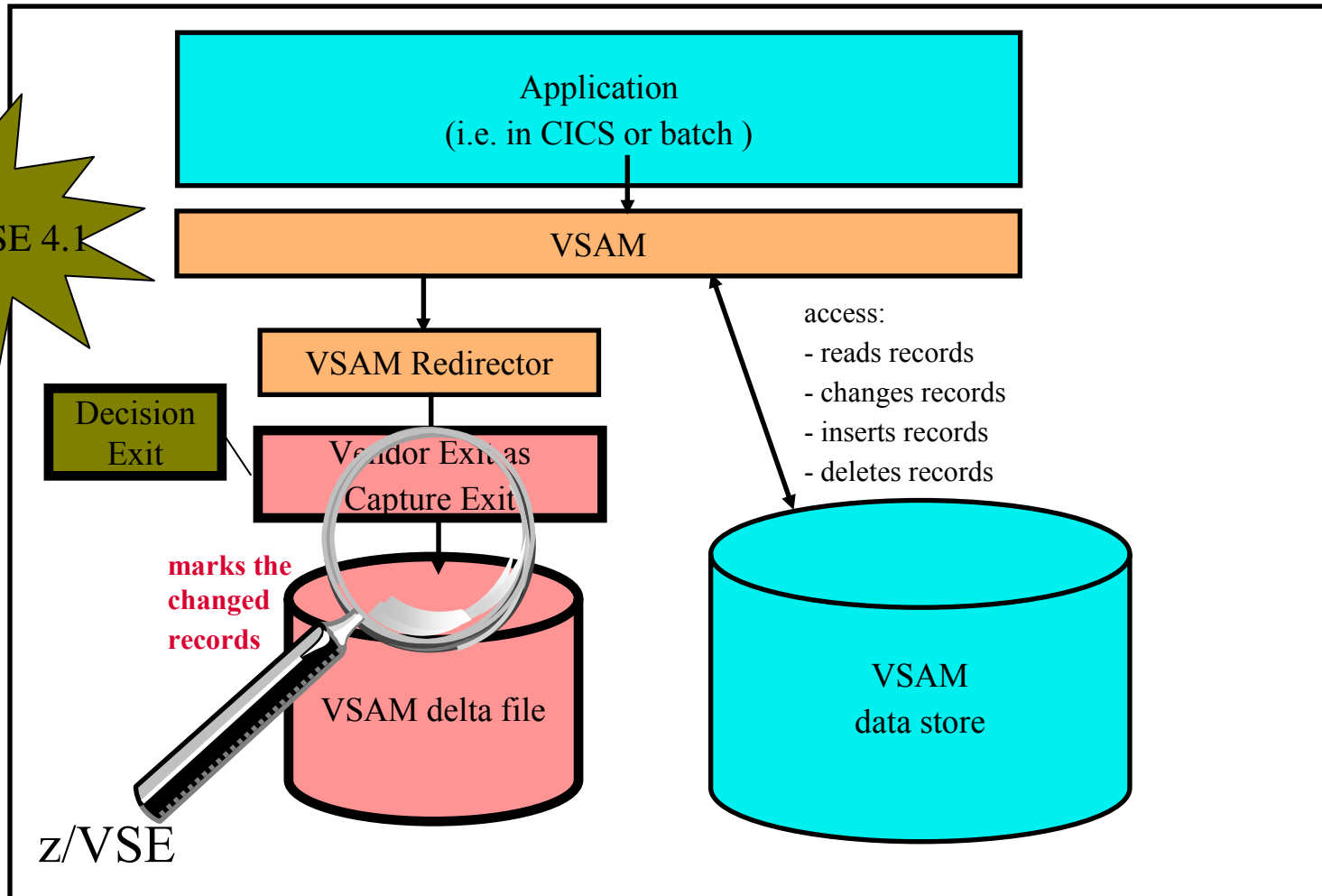# VSAM Data collection / transformation / journaling on VSE

Vendor Exit

Java platform
(Linux on zSeries)

VSE

Data

Handler

Handler
Interface

Redirector
Server

TCP/IP

**Vendor Exit
Capture Exit
MQ exit**

Exit Interface

VSAM Redirector
client

**Generic
Exit**
(VDA)

**Config
phase**

Application

VSAM

VSAM

► Vendor Exit

  ► user (vendor) written phase for data collection/transformation
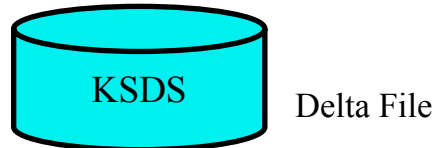
  ► has to comply with the documented Exit Interface

Note: No chaining of Vendor Exit with VSAM Redirector client
supported

Architectural View

Application
(i.e. in CICS or batch)

VSAM

New in z/VSE 4.1

VSAM Redirector

Decision
Exit

Vendor Exit as
Capture Exit

**marks the
changed
records**

VSAM delta file

access:
- reads records
- changes records
- inserts records
- deletes records

VSAM
data store

z/VSE

Journaling   or   cumulative

KSDS   Delta File

Delta File   KSDS

key

Journaling Delta File
Rekord 1   inserted
Rekord 2   inserted
Rekord 3   inserted
Rekord 2   updated
Rekord 1   deleted
Rekord 3   updated
Rekord 4   inserted
Rekord 1   inserted
Rekord 2   updated
Rekord 4   updated
Rekord 4   deleted
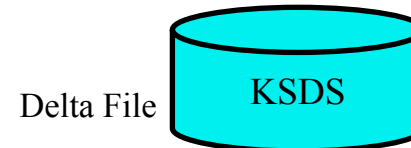
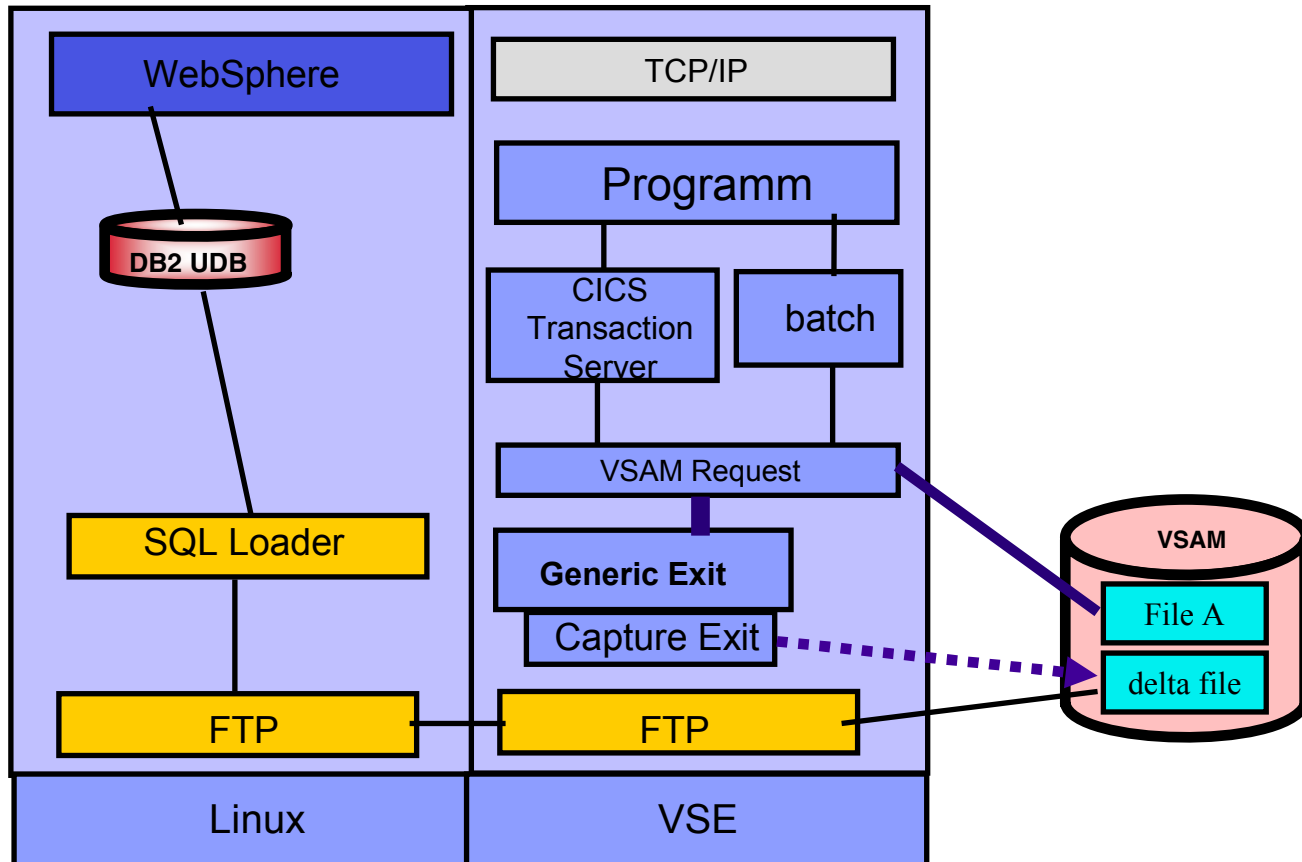| cumulative Delta File |
|---|
| Rekord 1   inserted |
| Rekord 2   updated |
| Rekord 3   updated |
| Rekord 4   deleted |

☞ The last version only of a changed VSAM record is stored into the delta file

Capture Exit

## Reduce network traffic, save time

►Collect the changed records in a separate VSAM file

    ►Possibility of cleansing

►FTP – as before, with a much smaller file

Capture Exit and Java-Based Connector

Asynchronous data pull from remote
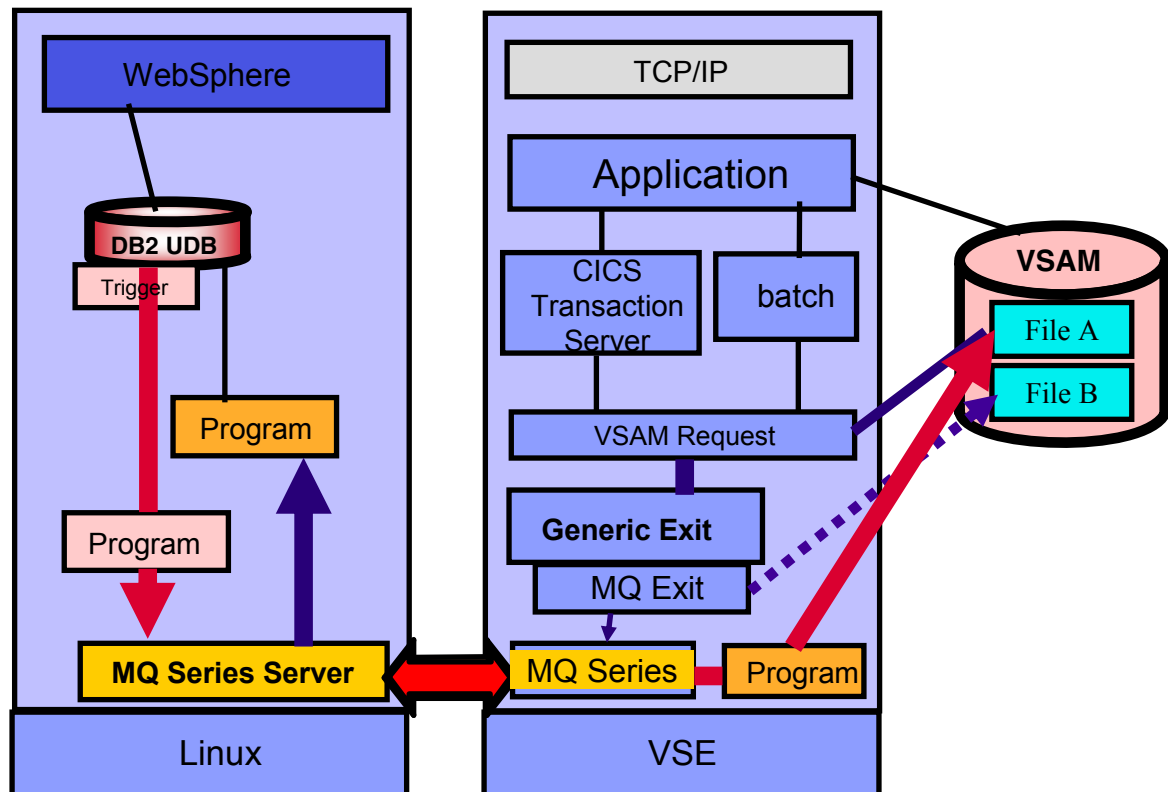
Reduce network traffic, save time

►Collect the changed records in a separate VSAM file

►Possibility of cleansing

►Connector Client reads the delta file and inserts them into a database

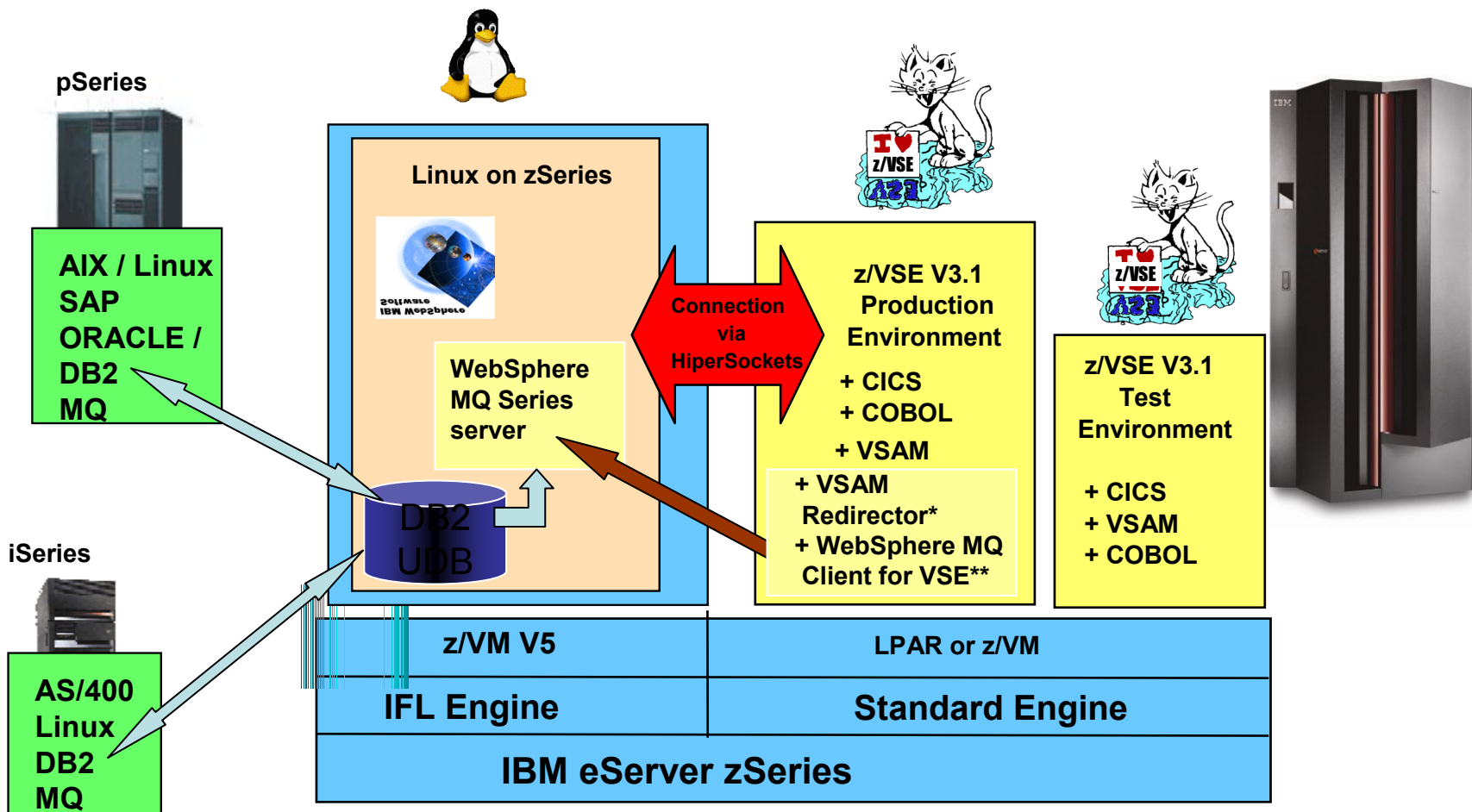►Transparent Journaling of data changes if wanted
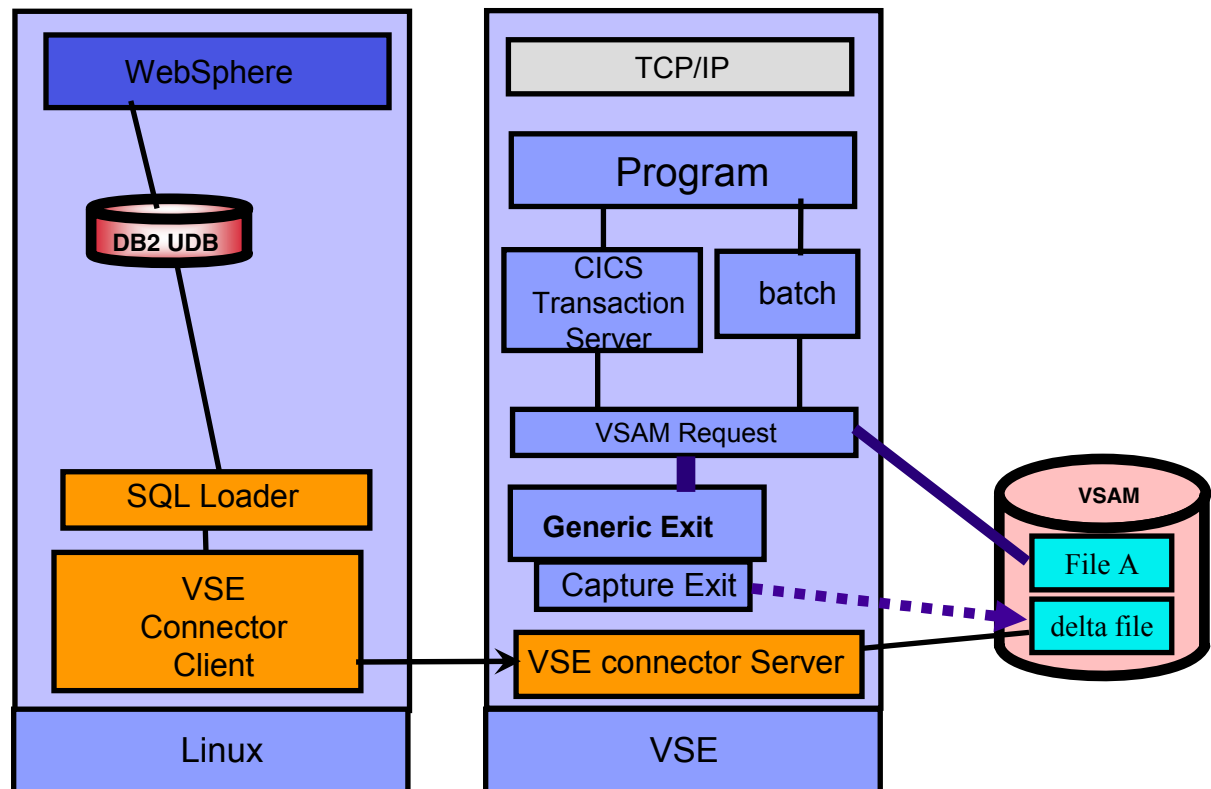
MQ Exit

Integration of VSE Application with MQ Series

► enablement for MQ Series w/o changing existing applications.

WebSphere MQ Series Solutions with z/VSE and DB2

pSeries

AIX / Linux SAP ORACLE / DB2 MQ

Linux on zSeries

Software IBM WebSphere

WebSphere MQ Series server

DB2 UDB

Connection via HiperSockets

z/VSE V3.1 Production Environment

+ CICS
+ COBOL
+ VSAM

+ VSAM Redirector*
+ WebSphere MQ Client for VSE**

z/VSE V3.1 Test Environment

+ CICS
+ VSAM
+ COBOL

iSeries

AS/400 Linux DB2 MQ

z/VM V5	LPAR or z/VM
IFL Engine	**Standard Engine**
IBM eServer zSeries	

(*) **VSAM Redirector + Redirector MQ Exit** allows MQ Solutions without changes to VSAM programs
(**) **WebSphere MQ Client for VSE** is brand-new and free of charge

More information about DB2 UDB and DB2/VSE

➢ Summary of DB2 Planning and Customization Tasks (VSE)
  http://publibz.boulder.ibm.com/cgi-bin/bookmgr_OS390/BOOKS/iespie41/10.4.5

➢ Enabling the DB2 Server for VSE
  http://publibz.boulder.ibm.com/cgi-bin/bookmgr_OS390/BOOKS/iespie41/10.4.4

➢ Customizing Tasks for DB2 Server for VSE (DB2-Based Connector)
  http://publibz.boulder.ibm.com/cgi-bin/bookmgr_OS390/BOOKS/IESWUE41/HDRINDB2BC

➢ DB2 - Resolve Frequent Problems

  http://publib.boulder.ibm.com/infocenter/db2help/index.jsp?topic=/com.ibm.db2.udb.doc/conn/c0005607.htm

➢ DB2 Universal Database (UDB)
  http://www.ibm.com/software/data/db2/udb/

➢ Moving Data from DB2/VSE&VM to DB2 UDB
  http://www-306.ibm.com/software/data/db2/vse-vm/support.html

Additional Information

- z/VSE Home Page

  http://www.ibm.com/servers/eserver/zseries/zvse/

- z/VSE Solutions and Utilities

  http://www-1.ibm.com/servers/eserver/zseries/zvse/solutions/

Redbooks

- e-business Solutions for VSE/ESA   SG24-5662

- e-business Connectivity for VSE/ESA   SG24-5950

- CICS Transaction Server for VSE/ESA
  CICS Web Support   *SG24-5997-00*

- *Handbook For WebSphere 5*   *SG24-7042*
  (Connectors to z/OS and VSE)

  We appreciate your comments on z/VSE: zvse@de.ibm.com