Connecting VSE to the World

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Agenda

- Connectors Concepts
- VSE Connectors
- VSE Redirector
- ECI
- SOAP

Connectors Concepts

- connect: to join or fasten together usually by something intervening[1]
- An eBusiness connector is a way to join different operating systems and architectures
- The VSE eBusiness connectors support the IBM Application Framework for e-business

[1] Webster's Ninth New Collegiate Dictionary

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Connectors Concepts

- The Application Framework for e-business
  - Assists in protecting your investment in zSeries technology
  - Allows exploitation of new technology for modernization
  - Extends core business applications to internet based technologies
  - Defines three logical layers or tiers
    - Client, Server, Connector

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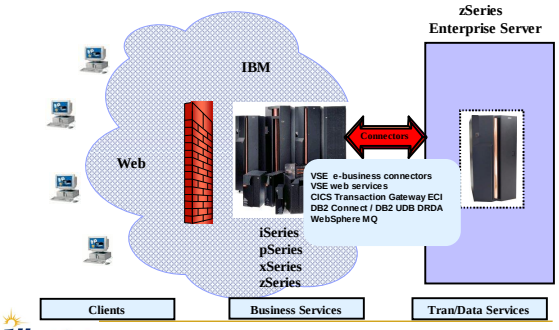
Connectors Concepts



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VSE Connector Components

- VSE Connector client
  - Java beans and classes that communicate with the connector server
  - Programmatic access to all VSE Connector Server components
  - Required component for some other pieces
  - One jar file used for execution

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VSE Connector Components

- VSE Connector server
  - Installed on the VSE/ESA host system
  - A long running job (default CLASS=R)
  - Listens on TCP/IP port 2893
  - Accessible libraries, plug-ins and allowed users are configurable
  - Features can be extended by writing additional plug-ins
  - Provides access to POWER, VSAM, DL/1, ICCF, Librarian and the System Console

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VSE Connector Components

- DB2 Based Connectors
  - Accessed via JDBC, ODBC and CLI
  - VSE side invoked as DB2 stored procedures
    - Available on DB2 for VSE & VM since Version 6
  - VSAM, DB2 and DL/1 are accessible
  - DB2 Connect is required

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VSE Connector Components

- VSAM Redirector
  - Allows access to remote resources from VSE
  - VSAM data can be migrated to a relational database
  - Access to the data is transparent to VSE
    - Remote resource looks like a VSAM file
    - COBOL, PL/1, Assembler, Batch or CICS

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VSE Connector Components

- VSAM Redirector
  - VSAM requests re-directed to another platform
    - Linux, Windows, etc
  - DB2 and Oracle handler delivered with VSE
  - VSAM Redirector client – on VSE
  - VSAM Redirector server – on java platform

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VSE Connector Components

- VSE Script
  - Allows access to VSE resources from non-Java environments
    - Visual Basic, Spreadsheets, Word Processors, C, COBOL, CGI
  - Install Script client on non-Java platform
  - Install Script server
    - Uses VSE Java Beans
  - Script language implemented as DLLs
    - For VB and Office apps

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VSE Connector Components

- SOAP Connector
  - XML based protocol that allows information exchange over the internet
  - XML provides structured documents
  - HTTP provides the transportation
  - Web Services are based on SOAP
  - VSE supports SOAP Services
    - SOAP Client
    - SOAP Server

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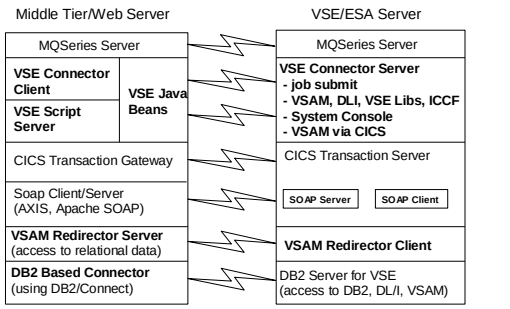
VSE Connectors



Boldfaced items are included with VSE/ESA

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Mapping VSAM records

- VSAM data
  - Field formats defined by programmer
  - Relationship between files maintained by programmer
  - Rules easy to break by writing 'invalid' data
- DB2 data
  - Field formats defined in database
  - Relationship between files maintained by the database software
  - Rules hard to break due to constraints in database

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Mapping VSAM records

- Mapping VSAM data structures
  - To allow Java programs access to VSAM data
  - Used by the VSE Connector Server
  - Stored on a VSAM file:
    VSE.VSAM.RECORD.MAPPING.DEFS (IESMAPD)
- Mapping DB2 data structures
  - To allow Mainframe programs access to DB2 data
  - Used by the VSAM Redirector Server
  - Stored on a DB2 table

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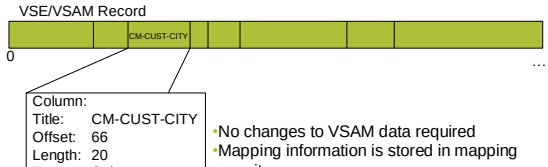
Mapping VSAM Records



Column:
Title: CM-CUST-CITY
Offset: 66
Length: 20
Type: String
Desc: Customer Location

- No changes to VSAM data required
- Mapping information is stored in mapping repository (VSE.VSAM.RECORD.MAPPING.DEFS)
- Data Types: string, binary, signed and unsigned number, packed
- Multiple maps per VSAM file allowed
- Views also supported, which can be any subset of VSAM fields

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Mapping VSAM records

- Creating a map
  - IDCAMS
  - Maptool
  - Java Beans
  - Import from copybook
- Maps are ultimately stored in the same place

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Mapping VSAM records

- IDCAMS method
  - Uses new RECMAP command
  - Map is 'automatically' stored in IESMAPD
- Maptool method
  - Spreadsheet-like GUI interface
  - Map can be stored on or retrieved from IESMAPD
- Java Beans
  - Create a map using a Java program
- Import from copybook
  - A COBOL copybook can be read by the Maptool to create a map

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Java access to VSE resources

- Java classes and methods are included with the VSE Connector client
- A number of objects are available and needed in your code
  - VSEConnectionSpec
  - VSESystem
  - VSEVsamCluster
  - VSEVsamRecord
  - VSEVsamMap

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VSAM-via-CICS

- Files accessed via Connector Server and another partition would run into a conflict if updates were involved from two or more jobs
- Before VSE/ESA 2.6 the only way to solve this was to use SHAREOPTION 4 or close the file(s) to CICS
- VSAM-via-CICS was introduced to address this problem

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VSAM-via-CICS

- Introduced with VSE/ESA 2.6
- Access to VSAM files are routed through CICS
- Minor file naming changes required in Java applications
- Possible performance advantage due to the use of LSR by CICS
  - Although the manual says to use the Connector Server for reading data

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VSAM-via-CICS Functionality

- Connector Client sends a VSAM request to the Connector Server
- If the request is for VSAM-via-CICS, it is passed to CICS via XPCC
- CICS processes the request
- Returns the result to the Connector Server, which passes it back to the client

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VSAM-via-CICS changes

- Java Program
  - Catalog name - #VSAM.#CICS.applid
  - File name – As defined to CICS

```
/*    String catName  = "SYSTEMS.USER.CATALOG"; */
      String catName  = "#VSAM.#CICS.V2CICS1";
/*    String fileName = "CONN.CUSTOMER.MASTER"; */
      String fileName = "CUSTMST";
```

- VSAM Map
  - Load old Map into Maptool
  - Export the Map
  - Change the Catalog and Cluster
    - Exactly the same as in the Java program

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VSAM Redirector concepts

- First made available on VSE/ESA 2.6
- Introduces the idea of VSE as a client
- Redirector server executes on a java platform
- Client code on VSE communicates with the server
- Client and Server are delivered with VSE/ESA

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VSAM Redirector concepts

- The client code on VSE implements a VSAM Data Access (VDA) exit
- The exit gets control at various points during VSAM file processing (OPEN, GET, POINT, PUT, CLOSE, etc)
- A program issues a VSAM file request
- The request is sent over a TCP/IP socket to the redirector server

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VSAM Redirector concepts

- The redirector server issues a database request
- When the database request is done, the result (or error) is returned to VSE
- The result is reformatted as a VSAM record (or error code) and returned to the requesting program
- Much more information about VDA exits:

http://www-1.ibm.com/servers/eserver/zseries/os/vse/support/vsam/vdaexits.htm

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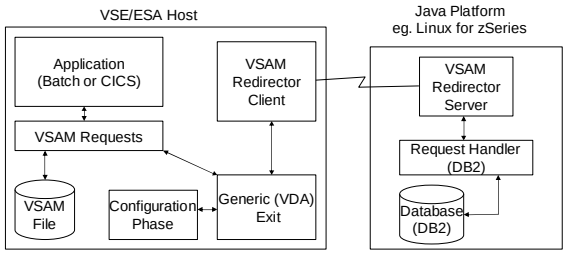
If you prefer a picture…



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Access to redirected files

- Redirected files look and act like standard VSAM files
- Utilities and programs that use standard VSAM access methods should be able to access a redirected file
  - COBOL, PL/1, Assembler, REXX
  - DITTO, Sort, IDCAMS

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An Introduction to Service-Oriented Architecture

- An approach to application design
- Delivers a service to an application or allows building of additional services
- Build loosely-coupled systems
- App to app conversations are typically stateless
- Can be based on Web Services

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An Introduction to Service-Oriented Architecture

- Requestor/Consumer: Person or process that uses the service
- Provider: Houses the service and allows access to it
  - Consumer and Provider are typically software
- Service: Application code available to a consumer for use in a business process
- The service may be a simple application or may involve many steps and called processes

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An Introduction to Service-Oriented Architecture

- Loosely-Coupled Systems
  - Minimizes artificial dependencies between consumer and provider
  - Consumer doesn't know or care about the service implementation
  - Consumer will invoke the service by way of a message sent to the system providing the service
  - The provider is similarly unconcerned about the implementation of the consumer

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An Introduction to Service-Oriented Architecture

- Stateless conversations
  - Each request should be a self contained message
  - All data related to the request is sent each time
- Stateful conversations
  - Adds complexity for provider and consumer
  - A token or session certificate must be exchanged

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CICS External Call Interface

- Make CICS program resources available to non-mainframe programs
- Provides a callable interface to CICS programs
  - C, C++, COBOL and Java
- Function is provided by the 'CICS Transaction Gateway'
- Fits in to the Service Oriented Architecture model definition

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CICS External Call Interface

- CICS Transaction Gateway (CTG) is available on the following platforms
  - Linux for zSeries
  - z/OS
  - AIX
  - HP/UX
  - Windows
  - Solaris

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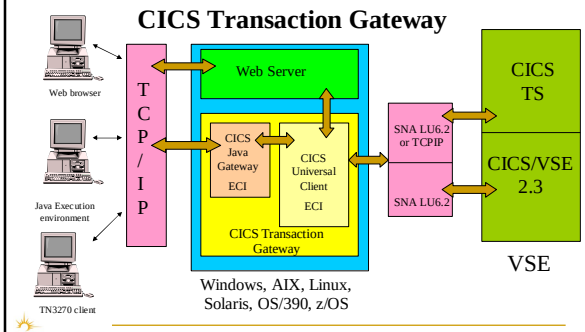
CICS External Call Interface



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CICS External Call Interface

- Programs outside of the zSeries environment can call a program running under CICS
- The CICS program can not perform any terminal I/O
- This will require a logical or physical separation of presentation logic and business logic
  - After they are separated, a new presentation layer can be introduced which uses the existing business logic

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An Introduction to Web Services

- Industry-wide attempt to integrate applications across disparate computing systems
- Not the first attempt (haven't we heard this before?)
  - RMI, COM, CORBA
    - RMI is based on Java
    - COM is MS centric
    - CORBA has it's roots in UNIX
    - Not compatible with each other

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An Introduction to Web Services

- Allows application-to-application communications
  - No concern of caller, called, parameter or response positioning
- Platform and language independent
- Based on four emerging standards
  - XML
  - SOAP
  - WSDL
  - UDDI

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An Introduction to XML

- eXtensible Markup Language
  - A World-Wide Web Consortium (W3C) standard definition of a structured document
- Released in 1998 for the exchange of structured documents over the web
  - Tasks that HTML and SGML were not designed to do

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An Introduction to XML

- HTML…
  - displays data
  - Tags are predefined and rigidly tied to the implementation (browser)
- XML…
  - describes data
  - Tags are free form and can be written by the author to suit the needs of the application
  - Complements, does not replace HTML

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An Introduction to SOAP

- Simple Object Access Protocol
  - Services Oriented Architecture Protocol
- Used to provide or access Web Services
- Conforms to conceptual intent of SOA
  - Platform independent
  - Language independent
  - Transport independent
  - Provides application to application communications
- Provides a way to extend business logic to other platforms and ensure data integrity

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An Introduction to SOAP

- Additionally SOAP is…
  - designed for internet communications
  - firewall friendly
  - extensible
  - an emerging W3C standard
  - based on XML
- SOAP uses XML messages transmitted between the consumer and provider
  - Typically over HTTP
  - SMTP, FTP, MQ are also used

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An Introduction to SOAP

- SOAP Message
  - Uses an XML element that identifies it as a SOAP message – the envelope
  - Must contain an encoding declaration for parameter value conversion
  - Optionally uses a header
  - Must use a body that contains call and response information
  - Optionally contains an element for fault information

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Companion SOAP components

- WSDL – Web Services Descriptor Language
  - An XML document, accessed via SOAP calls, whose elements describe a web service
  - Defines the service name, the input and output parameters and their data types
  - Is not concerned with protocol, operating system or programming language

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Companion SOAP components

- UDDI – Universal Description, Discovery and Integration
  - A service, accessed via SOAP calls, that contains a directory of other SOAP services
  - Allows the searching for a business that provides a service you require
  - When the discovery is made, provides the definition of how to do commerce
  - Is not concerned with protocol, operating system or programming language

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Soap Server on VSE/ESA

- Available on VSE/ESA 2.7
  - also 2.6 with PTFs (APAR UQ88864)
  - make sure current service is applied
- Since SOAP is primarily based on HTTP, fits very nicely with CICS Web Support
- Due to the transactional nature of SOAP, fully functional client support is only available in CICS Transaction Server
- SOAP for VSE/ESA does not use or require WSDL or UDDI

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SOAP Server on VSE/ESA

- Requires TCP/IP
  - Barnard Software – TCP/IP Tools
  - CSI – TCP/IP for VSE/ESA
- Requires CICS Transaction Server for VSE/ESA
- Requires a TCP/IP listener to be configured in CICS

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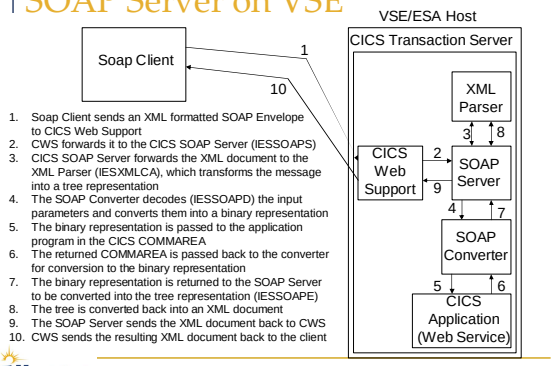
SOAP Server on VSE



1. Soap Client sends an XML formatted SOAP Envelope to CICS Web Support
2. CWS forwards it to the CICS SOAP Server (IESSOAPS)
3. CICS SOAP Server forwards the XML document to the XML Parser (IESXMLCA), which transforms the message into a tree representation
4. The SOAP Converter decodes (IESSOAPD) the input parameters and converts them into a binary representation
5. The binary representation is passed to the application program in the CICS COMMAREA
6. The returned COMMAREA is passed back to the converter for conversion to the binary representation
7. The binary representation is returned to the SOAP Server to be converted into the tree representation (IESSOAPE)
8. The tree is converted back into an XML document
9. The SOAP Server sends the XML document back to CWS
10. CWS sends the resulting XML document back to the client

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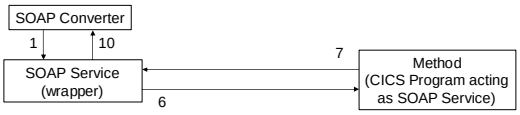
SOAP Server on VSE



2. Retrieves COMMAREA
3. Checks method name
4. Reads input queue until EOF
5. Formats each queue entry into COMMAREA
6. Calls program identified in method name
7. Control returns
8. Parses out returned COMMAREA
9. Writes each field into output TS queue
10. Returns control to converter

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Accessing the SOAP Server

- Many different ways to access a SOAP server
- Most modern programming languages
  - Java, C, C++, C#, Visual Basic, PHP
- Development frameworks
  - WebSphere, Tomcat, .net

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Soap Client on VSE/ESA

- Available on VSE/ESA 2.7
  - also 2.6 with PTFs (APAR UQ88864)
  - make sure current service is applied
- Web Services can be called by CICS programs
- Fully functional client support is only available in CICS Transaction Server
  - A Batch HTTP client is available, but not an XML encoder/decoder

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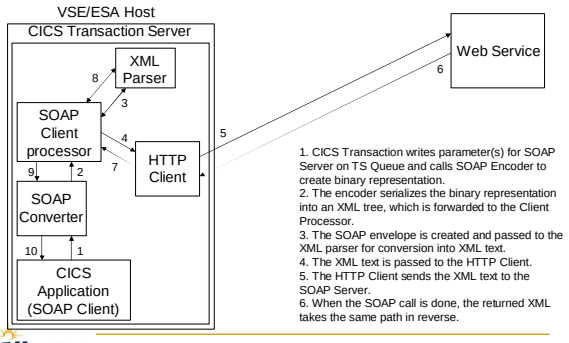
SOAP Client on VSE



1. CICS Transaction writes parameter(s) for SOAP Server on TS Queue and calls SOAP Encoder to create binary representation.
2. The encoder serializes the binary representation into an XML tree, which is forwarded to the Client Processor.
3. The SOAP envelope is created and passed to the XML parser for conversion into XML text.
4. The XML text is passed to the HTTP Client.
5. The HTTP Client sends the XML text to the SOAP Server.
6. When the SOAP call is done, the returned XML takes the same path in reverse.

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Summary

- VSE knows e-business
- Many connectivity options for data and application access between VSE and other platforms
  - VSE Java-based Connectors
  - DB2 Connectors
  - VSE Redirector Connector
  - ECI and SOAP
  - CICS Transaction Gateway
  - VSE and CICS Web Services
  - And a lot more

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References

- IBM Application Framework for e-business
  http://www.software.ibm.com/ebusiness/library.html
- IBM VSE Website
  http://www-1.ibm.com/servers/eserver/zseries/os/vse/support/vseconn/
  - Contains all connector based downloads
  - Installation information and documentation
  - Books in PDF format
    - VSE/ESA e-business Connectors User's Guide

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References and more information

- IBM Developerworks:
  'New to SOA and Web services'
  http://www-106.ibm.com/developerworks/webservices/newto/
- O'Reilly: 'Web Services primer'
  http://webservices.xml.com/pub/a/ws/2001/04/04/webservices
- Introduction to SOAP
  http://www.w3schools.com/soap
- Current and past WAVV presentations on XML, SOAP, VSE Web support, CICS Web support
  http://www-1.ibm.com/servers/eserver/zseries/zvse/

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