E36

IMS Connect: The Hows, Whys and Wherefores

Suzie Wendler

Las Vegas, NV **September 15 - September 18, 2003**

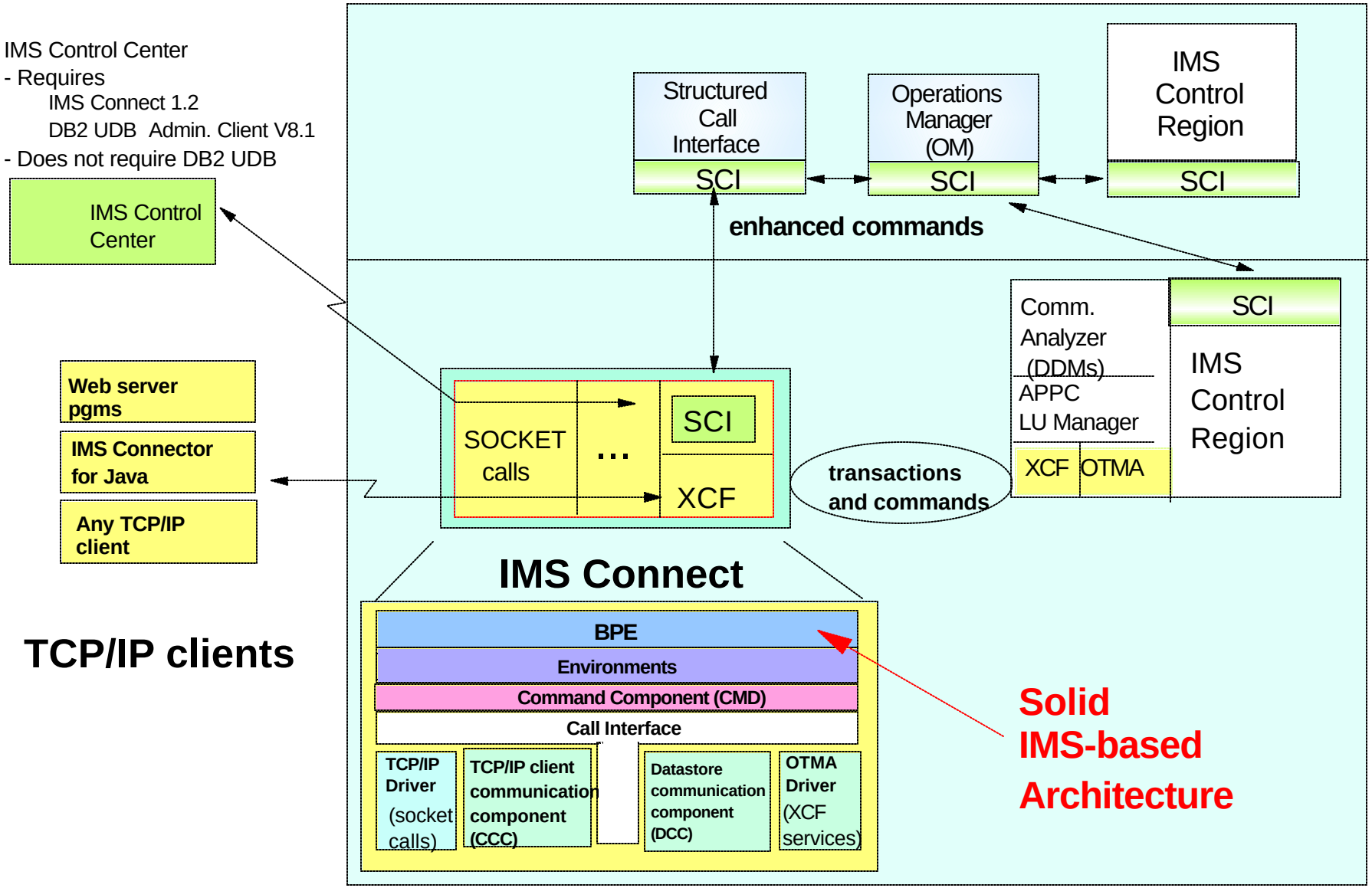
What is IMS Connect?

- **A product (5655-K52) that provides connectivity support between TCP/IP applications and IMS/TM**
  - Configured on an OS/390 or z/OS server
    - SMP installed and maintained
- **Benefits and Value**
  - Supports TCP/IP sockets access to IMS transactions and commands
    - No requirement to modify existing IMS transactions
  - Provides a general purpose and structured interface
    - For the IMS Connectors
    - For user-written clients
  - Provides a strategic base for new connection technologies
    - IMSPLEX

IMS Connect Architecture

- **Executes in a separate MVS Address Space than IMS**
- **Functions as a TCP/IP server for communication with external clients**
  - Uses MVS XCF Services to access IMS OTMA
    - Transactions and commands
  - Configuration supports
    - Multiple IMS Connects accessing the same IMS system
    - A Single IMS Connect accessing multiple IMS systems
- **Provides IMSPLEX support for enhanced commands**
  - Requires IMS V8 - Operations Manager (OM)
  - Interfaces between an IMS Control Center client and OM
    - Uses the Structure Call Interface (SCI)

IMS Connect Architecture ...



Background

- **IMS Connect V1.1**
  - Improved Performance with Persistent Sockets
  - EnhancedDump formatting capability
  - Enhanced manageability with SMP/E Install/Maintenance
  - Asynch output capability with IMS V7
  - Send only capability: Connect, Send (sendonly) , Disconnect
- **IMS Connect V1.1 enhancements**
  - Local/390 support
  - Unicode
  - ACK/NAK required notification support

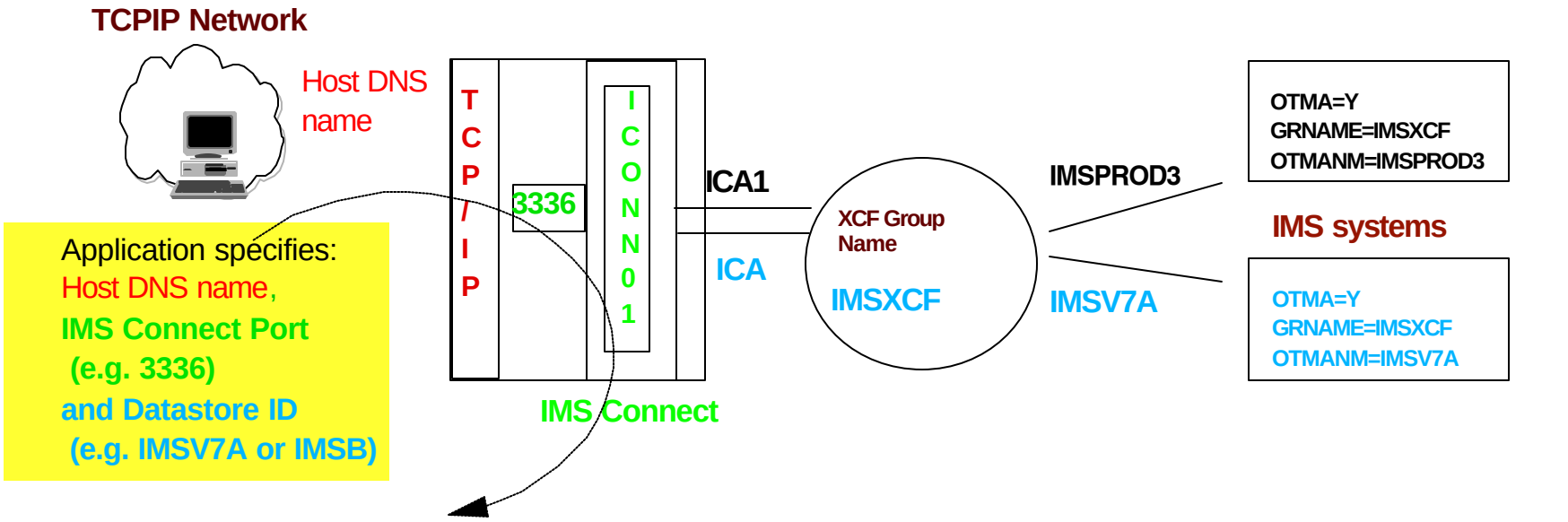
Background ...

- **IMS Connect V1.2**
  - IMS Connector for Java J2EE Runtime support for WebSphere access
    - Used with VAJava/WSAD IE - IMS Connector for Java
  - Two-phase Commit Support in Local 390 environments
  - Security enhancements
    - Passticket support
    - Trusted User support
  - More Granular timeout (eg. by transaction)
  - User message exit limitation relief
  - Auto reconnect to a recycled IMS system
  - IPV6 support
  - IMS V8 support - Operations Manager distributed interface

Background...

- **IMS Connect V2.1**
  - PING support
    - Determines IMS Connect availability
  - J2EE XA Two-phase Commit Support
    - Distributed environments
    - z/OS environments across TCP/IP
  - SSL support
    - Enhanced security control

Configuration

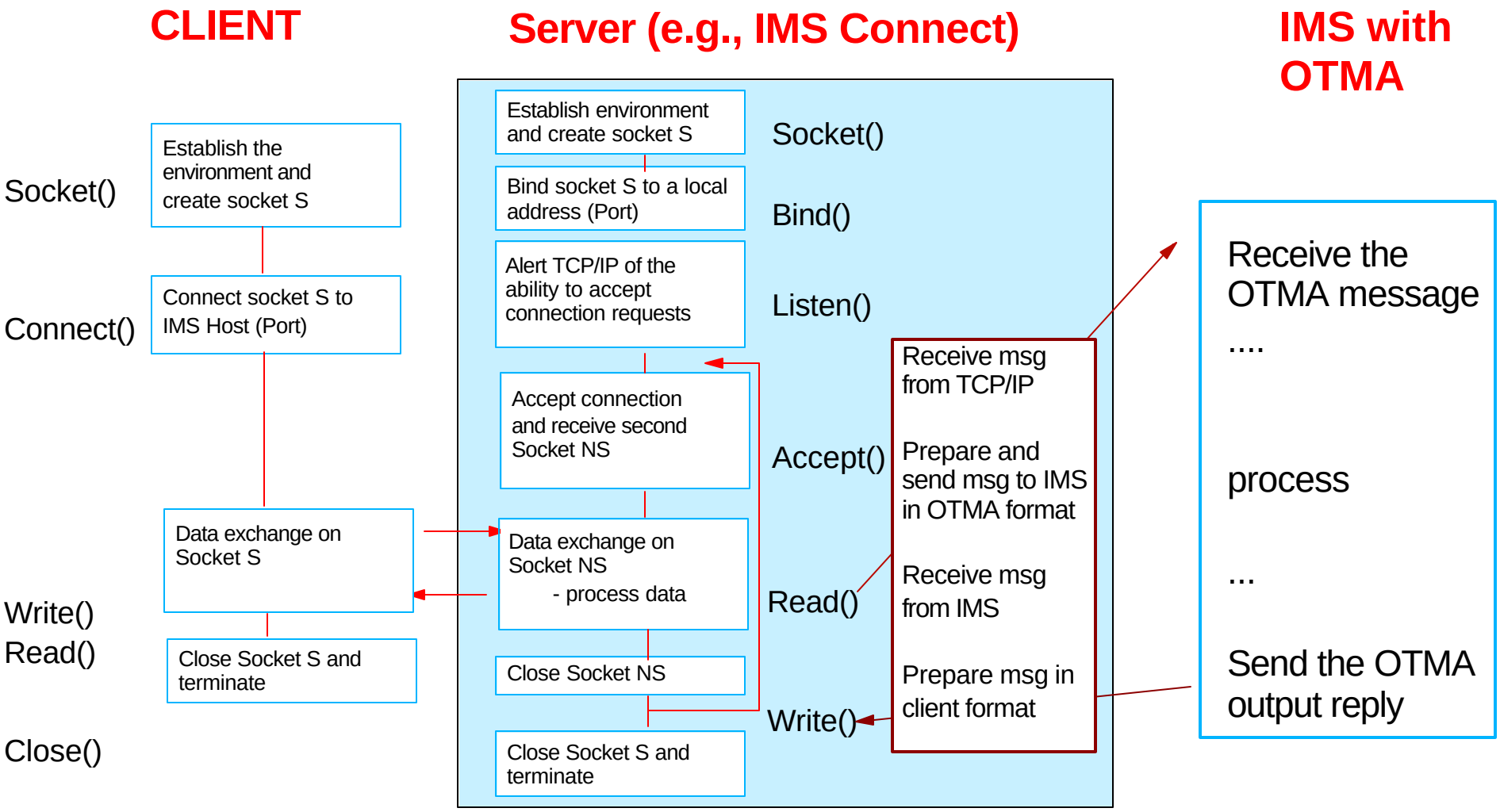


IMS Connect configuration (HWSCFGnn) member resides in IMS.PROCLIB

HWSCFGxx - New Parameters

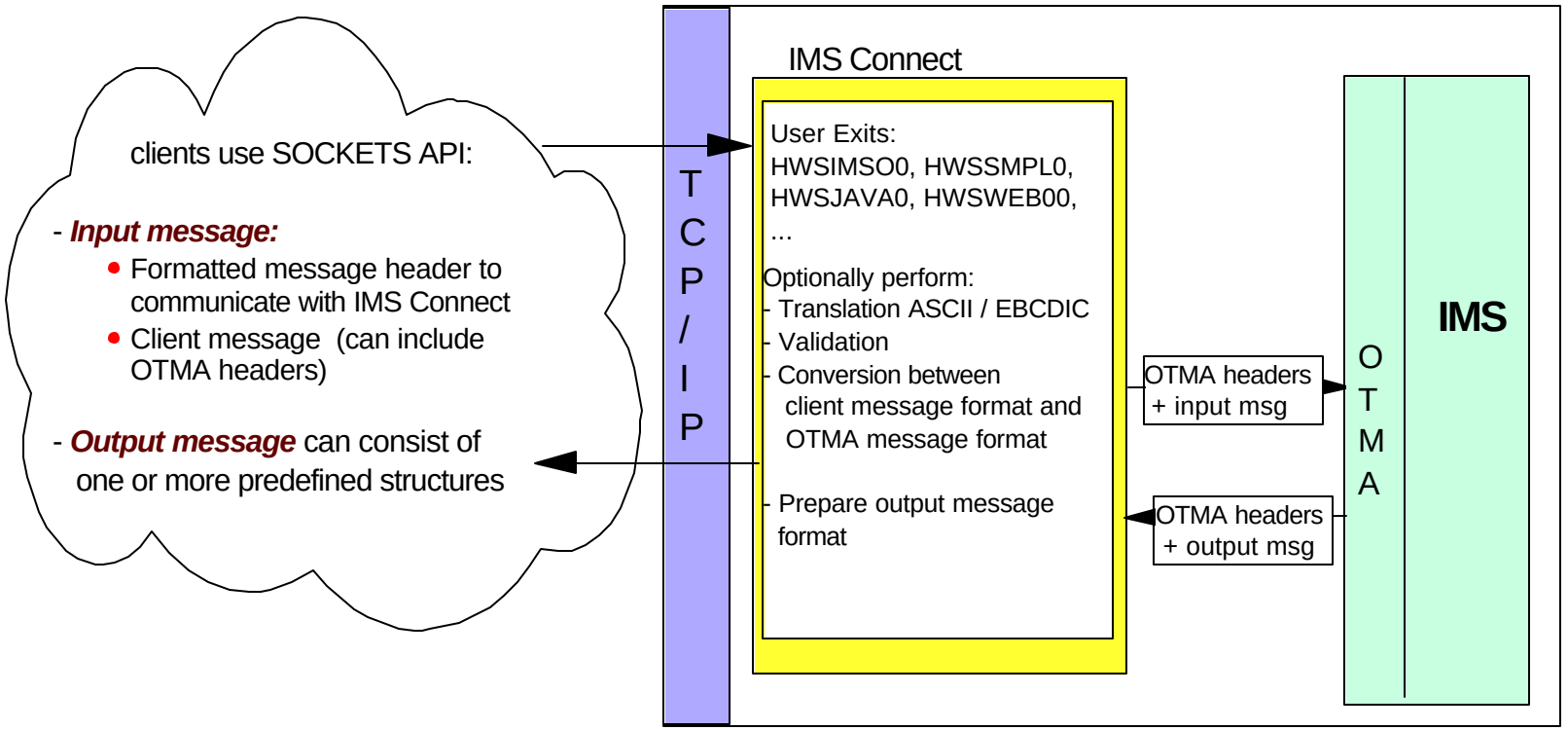
- **HWS**
  - RRS = Y | N (needed for two phase commit)
    - Specifies whether or not to enable RRS communication
- **TCPIP**
  - IPV6= Y | N
    - Specifies whether the environment is IPV6 or IPV4
  - SSLENVAR = , and SSLPORT = (needed for SSL support)
    - Member name of the SSL file and SSL Port numbers
  - TIMEOUT
    - Timeout value to disconnect client
- **DATASTORE**
  - APPL= (used for PassTicket support, optional)
    - Specifies APPL name to be used for interpretation
  - IMSPLEX: MEMBER=, TMEMBER= (Used with IMS V8)
    - Defines Operations Manager interface

Socket Application Basic Design



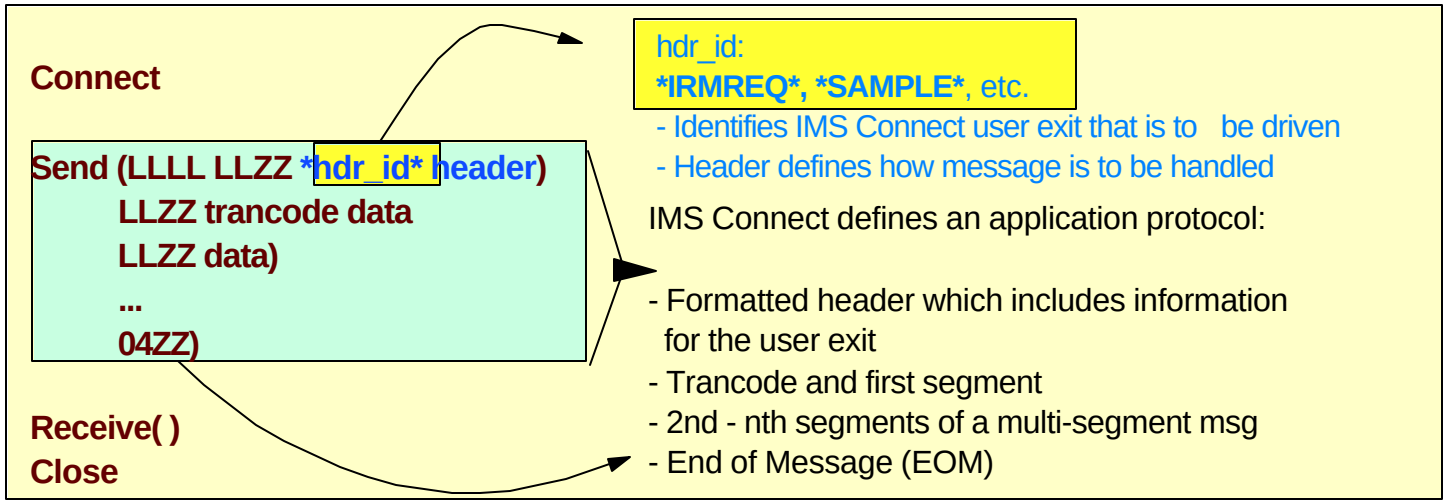
Message Flow

- **IMS Connect application protocol**
  - defines layout of input/output messages

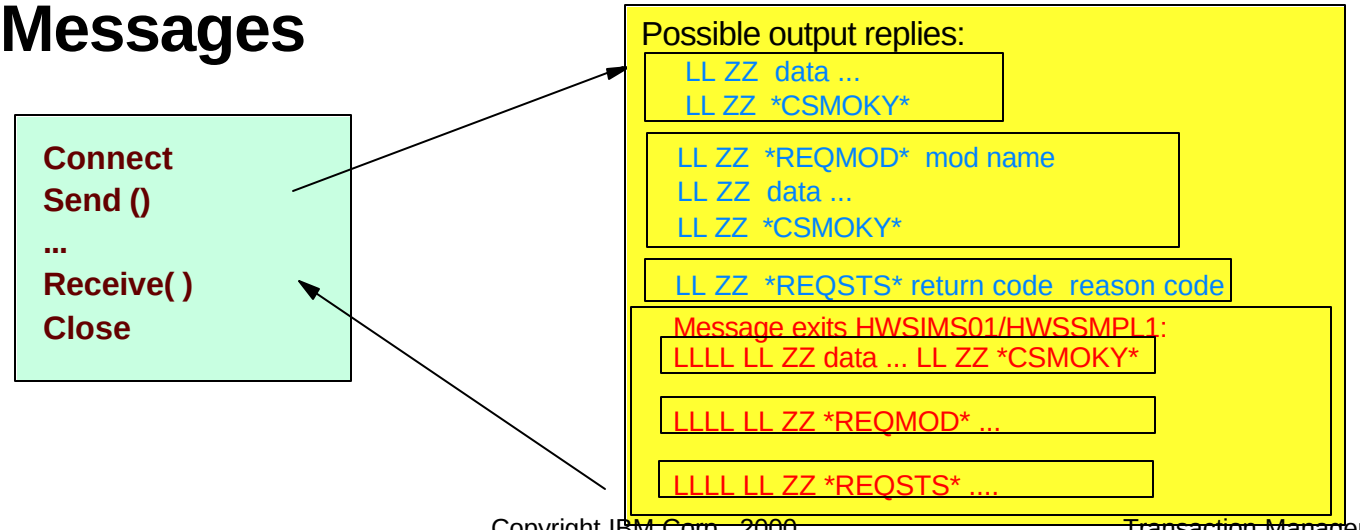


IMS Connect Application Protocol

- **Input Messages**
  - LLLL = length of entire msg including all data segments and the EOM
  - LL = length of the header data



- **Output Messages**



Application Protocols

- **Synchronization level (Sync_level)**
  - NONE
  - CONFIRM
  - SYNCPOINT - two phase commit
    - Websphere/390 and Websphere Distributed
- **Commit modes**
  - *Commit_then_send (Commit mode 0)*
    - Output is sent as a result of syncpoint
    - Always uses sync_level of CONFIRM
    - Output is queued until client sends an ACK
  - *Send_then_commit (Commit mode 1)*
    - IOPCB output is sent before syncpoint
    - Sync_level can be either NONE or CONFIRM

Asynchronous Output

- **Asynchronous output support**
  - Alternate TP PCBs (ALTPCB) messages
  - Queued commit-then-send reply messages (IOPCB) that could not be sent back on the original connection
- **IMS environment - IMS V7/V8**
  - IMS application ALTPCB destinations
    - Specify a destination = tpipe name = client id
  - IMS OTMA Exits needed for ALTPCB output
    - Prerouting Exit Routine (DFSYPRX0)
    - Destination Resolution Exit Routine (HWSYDRU0)
- **Remote client environment**
  - Retrieve messages

RESUME TPIPE - specify client id
- specify request type (single, noauto, auto)
RECEIVE - receive first output msg
ACK - acknowledge receipt of first msg
RECEIVE - receive second output message
ACK ...

Enhanced Timer Granularity

- **Provides a greater level of granularity for timeout settings**
  - IRM_TIMER value in IRM header
  - Time values:
    - no wait, wait indefinitely, .01-95 sec, 1-60 sec, 1-60 min
  - Specified by the client program and affects
    - RESUME TPIPE
    - SEND ACK/NAK
    - SEND of data
  - Also affects:
    - HWSIMSO0, HWSIMSO1, HWSJAVA0, HWSSMPL0, HWSSMPL1

Enhanced Timer Granularity ...

- **When setting value, consider appropriate wait time for IMS to return data to IMS Connect**
  - Defaults
    - RESUME TPIPE and associated ACK: 0.25 seconds
    - All other SENDs: HWSCFGxx TIMEOUT value
- **Each client SEND can specify a different value**
  - Guidelines
    - SEND of trancode+data or data only, or SEND of ACK associated with RESUME TPIPE
      - Set value to reflect the wait time in IMS
        - Do not use X'E9' - no wait
    - SEND of ACK/NAK associated with last output message
      - Set value to X'E9' - no need to wait
    - SEND of RESUME TPIPE
      - Value depends on AUTO, NOAUTO or SINGLE option

Local Option

- **Non-TCP/IP connectivity**
  - MVS Program Call (PC) interface to IMS Connect
    - Avoids TCP/IP Firewall issues
    - Provides compatible performance to TCP/IP connectivity
  - Defined in the CONFIG file as PORT=(9999,LOCAL,...)
    - Only 1 local PORT per IMS Connect
  - Supports commit mode 1 (send-then-commit)
    - 10 TPIPEs per IMS
- **Only supports IMS Connector for Java on S/390, z/OS**
  - IMS Connect and Websphere must be in the same LPAR

UNICODE

- **A standardized character coding system that provides a unique number for every character regardless of platform, program or language. (Used by XML and Java)**
- **IMS Connect supports**
  - Language groups 1,2,3
  - UTF-8, UTF-16, UTF-32 and UCS-2 encoding schema
- **Note:**
  - Data portion of a UNICODE message is NOT translated
    - IMS application must be able to deal with UNICODE

New fields/flags in the IRM for UNICODE support:

IRM_ES - Encoding schema (UTF-8, UTF-16,...)

IRM_F1 (new flags)

IRM_F1_UC - Unicode message text

IRM_F1_UCTC - Unicode transaction code

UNICODE ...

- **Input Messages**
  - Trancode can be sent in as ASCII, EBCDIC, UNICODE
    - Must be left-justified, 8 bytes, and padded with blanks
    - Message exit translates trancode to EBCDIC if needed
  - Any IRM or OTMA headers must be sent as ASCII or EBCDIC
  - Data portion of message in UNICODE is untranslated
- **Output messages**
  - IMS error messages (DFS....) are sent as ASCII or EBCDIC based on the code type in the IRM
  - Data portion of message in UNICODE is untranslated

Automatic Reconnect to IMS

- **Support to automatically reconnect to an IMS that rejoins the XCF group**
  - Relieves the existing manual method of issuing "OPENDS"

- **New "DISCONNECT" status**

  - VIEWHWS
  - VIEW DS

IP V6 Support

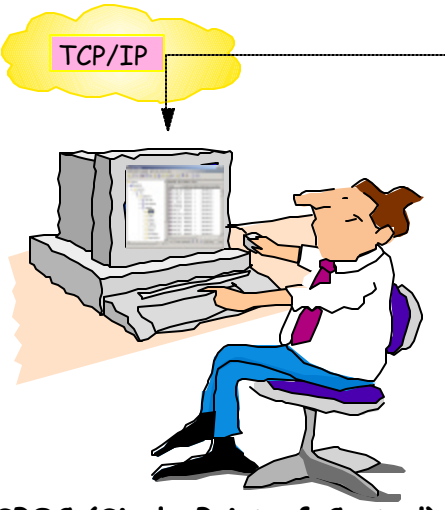
- **Support for IPV6 - larger addressing scheme**
  - Requires z/OS V1R4
  - IMS Connect
    - Configuration: TCPIP statement IPV6 = N | Y
    - User message exits - READ subroutine is affected
  - UNIX Systems Services Parameters
    - Customize BPXPRMxx member in parmlib and recycle TCP/IP

```
FILESYSTYPE Type(INET) Entrypoint(EZBPFINI)
        NETWORK DOMAINNAME(AF_INET)
        DOMAINNUMBER(2)
          MAXSOCKETS(2000)
         TYPE(INET)

       NETWORK DOMAINNAME(AF_INET6)
       DOMAINNUMBER(19)
        MAXSOCKETS(3000)
        TYPE(INET)
```

IMSPLEX Support

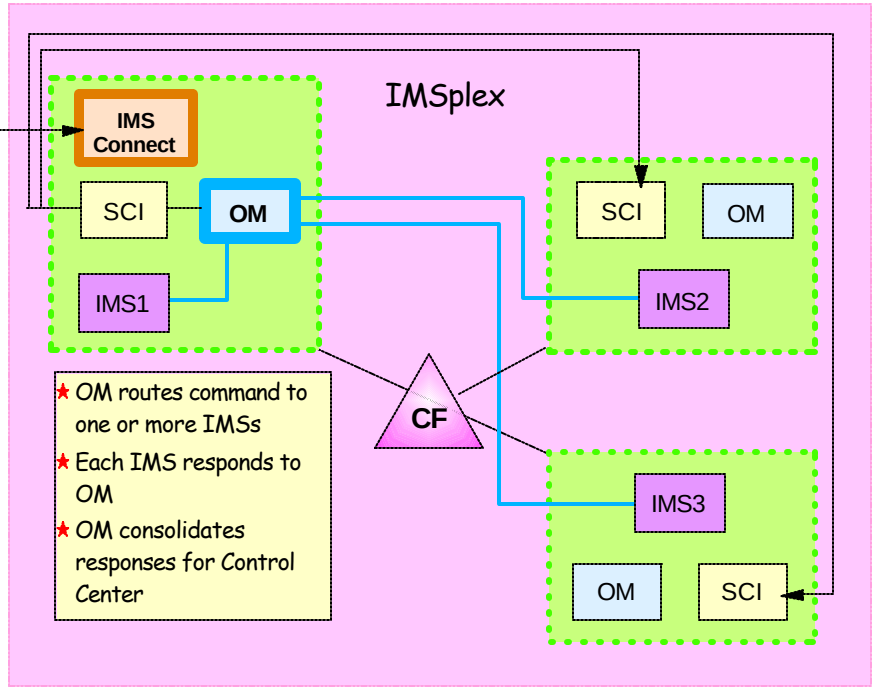
- **Allows IMS Control Center (TCP/IP SPOC) to issue IMS V8 enhanced commands**
  - Access to Operations Manager (OM) is through the Structured Call Interface (SCI)



SPOC (Single Point of Control)

IMS Control Center
- Requires IMS Connect
- Requires DB2 UDB Administration Client V8.1
  - Does not require DB2 UDB

For more information:
www-3.ibm.com/software/data/ims/imscc/index.html



IMS1,2,3 & 4 could be TM/DB or DBCTL Configurations

IMSPLEX Support ...

- **Implementation**
  - HWSCFGxx

HWS (ID=HWS, RACF=Y)
TCPIP (HOSTNAME=TCPIP,RACFID=RACFID,PORTID=9999,MAXSOC=500,
EXIT=(**HWSCSL00,HWSCSL01**,HWSSMPL0, HWSSMPL1)
DATASTORE (ID=IMS,GROUP=XCFGRP,MEMBER=HWSMEM,TMEMBER=IMSMEM)
IMSPLEX (MEMBER=IHWSPLEX1,TMEMBER=PLEX1)

Two new message exits: HWSCLS00, HWSCLS01 (OCO)
MEMBER = name passes to SCI as the name of IMS Connect
TMEMBER = 1-5 bytes - name specified in the SCI initialization proclib member

  - IMS Connect STEPLIB - include IMS V8 SDFSRESL

  - IMS Control Center
    - Specify IMS Connect HWS ID= value
    - Specify IMS Connect IMSPLEX tmember= value

  - New IMS Connect commands
    - STOPIP, OPENIP, VIEWIP

  - Start order: SCI, OM, RM, IMS
    - IMS Connect can be brought up at any time
      - Waits 30 minutes for SCI, otherwise requires OPENIP

PING Support

- **Mechanism to determine availability of IMS Connect**
  - Client Application:
    - Connect
    - Send PING IMS_CONNECT (must be uppercase0
    - Receive PING RESPONSE
    - Disconnect
  - User message exit support for PING
    - HWSSMPL0, HWSSMPL1, HWSJAVA, user written exit
    - Not supported by:
      - HWSIMSO0, HWSIMSO1, HWSCSLO0, HWSCSLO1

Two-Phase Commit

- **Capability that allows IMS transactions to participate as a resource in two-phase commit external transactions**
  - Requires
    - A syncpoint coordinator
      - RRS on MVS and/or an external coordinator, e.g.,IBM WAS (Websphere Application Server)
        - Uses an ID generated at the beginning of the transaction/process to monitor and modify the state of the transaction
    - Client code that uses IMS Connector for Java
      - Resource adapter
- **Environments**
  - LOCAL
  - DISTRIBUTED
    - Global XA transaction

Two-Phase Commit ...

Websphere Application Server platform with the IMS Resource Adapter	Communication Protocol	Global Transaction Two-Phase Commit Support
AIX	**TCP/IP**	**YES ***
Linux for z/Series and System 390	**TCP/IP**	**YES ***
Solaris	**TCP/IP**	**YES ***
Windows	**TCP/IP**	**YES ***
z/OS, OS/390	**TCP/IP** **Local option**	**YES *** **YES ****

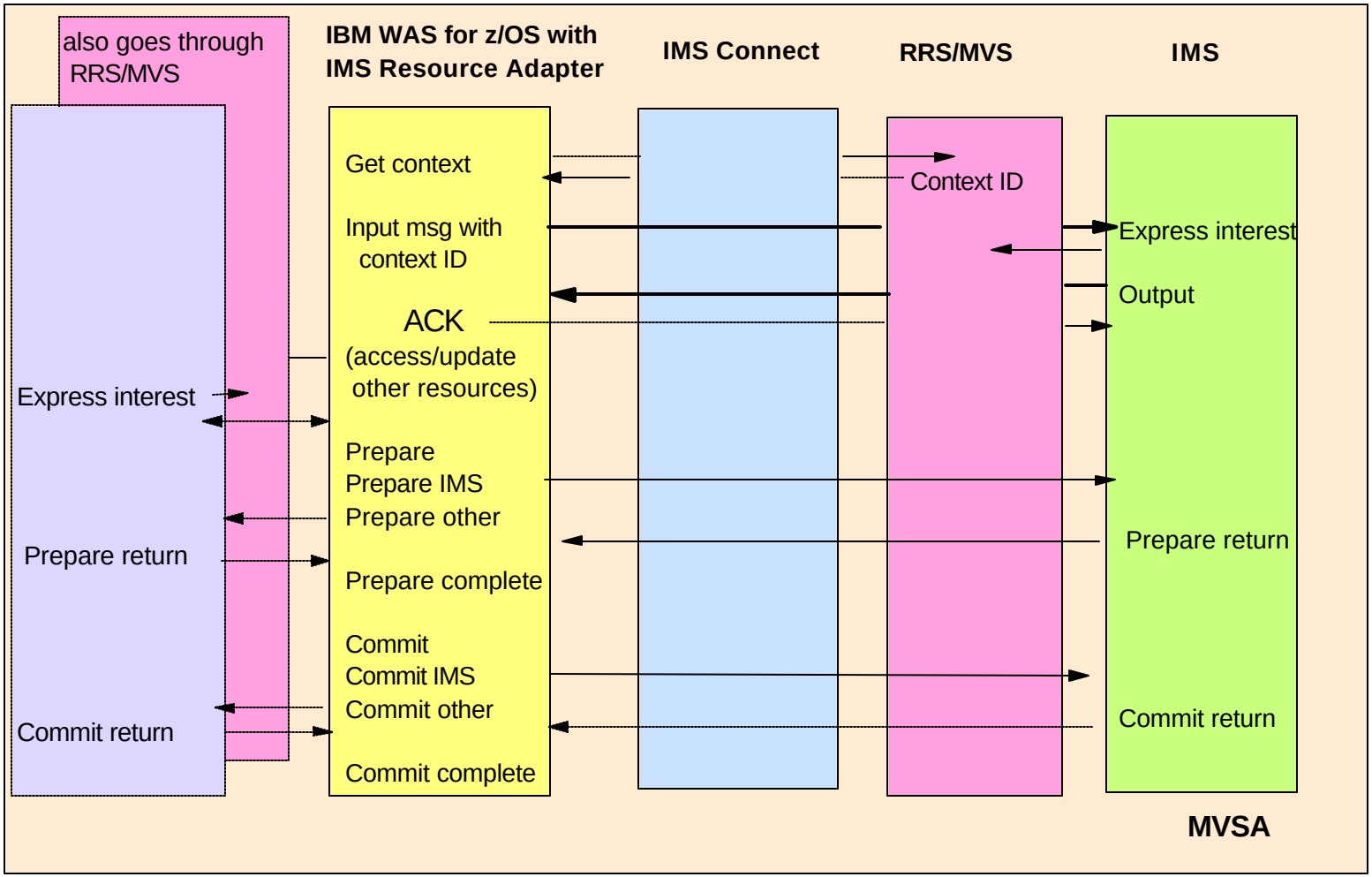
* IMS Connect, IMS, and RRS must be in the same MVS image

** WebSphere Application Server, IMS Connect, RRS and IMS must all exist in the same MVS image

- Software Requirements
  - Local Two-Phase Commit
    - IMS Connector for Java 1.2.5.2 with WSAD IE 4.1.1
    - WAS 4.0.1 for z/OS (+ APAR PQ65206)
    - IMS Connect 1.2 (+ APAR PQ65982)
  - Global Transaction (XA) support
    - IMS Connector for Java 2.1.0 with WSAD IE 5.0.1
    - WAS 5.0.1 for distributed platforms or WAS V5.0 for z/OS
    - IMS Connect 2.1

Two-Phase Commit ...

- **Local**
  - All components reside on the same MVS image
    - IBM WAS for z/OS, IMS Connect, RRS and IMS
  - Syncpoint coordination is managed by RRS

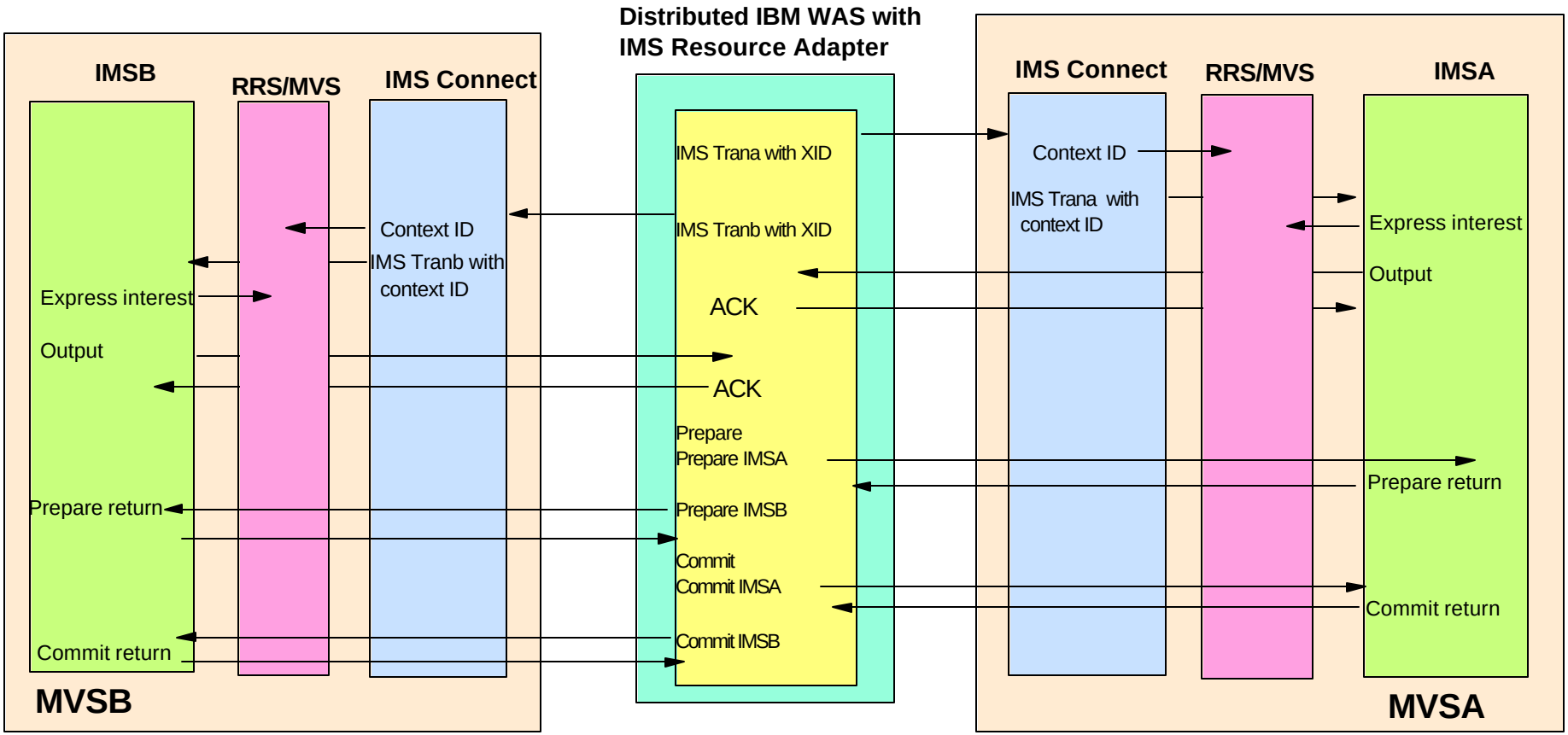


Two-Phase Commit ...

- **Distributed capability (Global XA Transaction)**
  - IMS only supports RRS (not XA X/Open protocol)
  - Remote environments use XA
    - IMS Connector for Java is the required Resource Adapter
  - IMS Connect
    - Acts as an extension to RRS and is the SDRM (Server Distributed Syncpoint Manager)
      - Assists RRS in communicating with other syncpoint coordinators
    - Acts as the CRM (Communications Resource Manager)

Two-Phase Commit ...

- **Distributed**
  - IBM WAS runs outside the MVS image
    - Remote platform, another MVS image
  - Host components reside on the same MVS image
    - IMS Connect, RRS and IMS



Security

- **Accessing IMS transactions from a TCP/IP Client**
  - TCP/IP Client
    - Provides Userid, Password, Groupid in message header
  - IMS Connect
    - Issues RACROUTE calls to authenticate user
    - Message exits can also call a user-written routine
    - Configuration values for IMS Connect (HWSCFGxx)
      - RACF = Y | N and RACFID = userid (default)
  - IMS Security
    - Validates userid access to transaction or command
    - Userid: from message header or RACFID
    - /SECURE OTMA None | Check | Full | Profile
- **Enhancements**
  - Passticket support
  - Trusted User support
  - SSL support

Security ...

- **PassTicket support**
  - Provides an encrypted alternative to sending a password
    - Generated/interpreted by an algorithm using:
      - Userid,Application identifier (APPLID), Timestamp, Secured signon key for encryption
  - **Implementation:**
    - The **client environment** generates the PassTicket
    - **IMS Connect** calls RACF to interpret/validate the PassTicket
      - HWSIMSO0/HWSIMS01
        - Use APPLID value coded on DATASTORE statement
      - HWSSMPL0/HWSSMPL1
        - Additionally, support passing of the APPLID in IRM
    - **RACF** uses PTKTDATA profile definition
      - Profile name matches APPLID name
      - PassTicket replay protection (default)

Security ...

- **Trusted User Support**
  - Bypasses security check for messages from 'trusted' users even with RACF=Y
  - Provided by HWSSMPL0/HWSSMPL1 user msg exits
    - Sample logic

Look for these lines in HWSSMPL0 and HWSSMPL1

```
************************************************************
**************TRUSTED USER SUPPORT**************
************************************************************
```

- **To implement trusted user support**
  - Define and provide logic in both:
    - **Client code**
      - Indicator in the IRM that the message is from a trusted user
    - **HWSSMPL0/HWSSMPL1** or your own user message exit
      - Detects the indicator in the IRM and bypasses security check

Security ...

- **SSL - TCP/IP encryption and authentication protocol**
  - Secure transfer of sensitive information
    - Provides a private channel between client and server that ensures:
      - Privacy of data
      - Authentication of partners
      - Message integrity
  - SSL Standard
    - **Handshake protocol** for initial authentication/transfer of encryption keys
      - Agreement on how to encrypt/decrypt data and the format to transmit the encrypted data
      - Authentication of each side using assymetric public/private key mechanism with digital certificates
    - **SSL Record protocol**
      - protocol for transferring data using agreed upon encryption / decryption
      - Symmetric key encryption uses the negotiated session keys

Security ...

- **SSL ...**
  - **SSL for z/OS key management** (z/OS V1R4)
    - Provides callable application services from the sockets api
    - Supports PKI (Public Key Infrastructure) keys and certificates in either:
      - HFS "key database", managed by the Unix shell *gskkyman* utility
      - RACF key rings (groups of private keys and certificates) in a RACF database, managed by the RACF command *RACDCERT*
        - preferred method
  - **IMS Connect**
    - Based on SSL for z/OS key management
      - Supports SSL V2.0, SSL V3.0, TLS V1.0
    - STEPLIB must include:
      - CEE.SCEERUN, SYS1.CSSLIB, GSK.SGSKLOAD
    - HWSCFGxx:
      - SSLENVAR - Specifies the IMS Connect proclib member name that contains the SSL initialization info (default exists)
      - SSLPORT(s) - ports to be used for SSL communication
        - up to 50 numbered from 1-65535 and unique from PORTID

Security ...

- **SSL ...**
  - Performance Considerations
    - Use cryptographic hardware where available
      - Full SSL handshake (both server and client side authentication) has heavy CPU requirements without cryptographic hardware
    - Use client side authentication only when necessary
      - In the SSL initialization file set GSK_CLIENT_AUTH_TYPE=GSK_CLIENT_AUTH_PASSTHRU_TYPE
        - Default is full handshake
    - Use 512 bit server key
      - Reduces cost of the SSL handshake if the added security of 1024 bit key is not required

IMS Connect Tips

- **IMS Connect client TCP/IP environment**
  - SO_Linger=Y,VALUE=10
    - Ensures no loss of data, blocks close() until ACK is received or 10 sec
  - TCPNODELAY=DISABLE
    - Optimizes transmission - Waits until buffer is full (multiple writes)
- **IMS Connect mainframe - PROFILE.TCPIP configuration**
  - PORT - NODELAYACKS
    - Allows any required ACKs to be sent immediately
  - SOMAXCONN
    - Max sockets queued on a listener (default of 10)
    - Should be large enough to support the max concurrent requests
- **IMS Connect configuration - TCPIP parameters**
  - ECB=Y, posts an ECB when there is work to do
  - MAXSOC = xxxx (default of 50)
    - Should be large enough to support concurrent throughput requirement
  - IPV6=Y (requires z/OS V1R4)
    - Better performance even if the network itself is not at IPV6 level

IMS Connect Tips...

- **XCF tuning**
  - MAXMSG
    - XCF signalling buffers
      - XCF buffer shortage can be seen as an IMS Connect hang condition
    - How big should they be?
      - Depends on requirements for message traffic, size and frequency of the messages, as well as the performance of the signaling paths and systems involved in the message transfer
  - z/OS V1R4.0 MVS Setting Up a Sysplex (SA22-7625)

IMS Connect Summary

- **IMS Connect continues opening up IMS to TCP/IP Clients**
  - Standard interface
  - Defined application protocol
  - Comprehensive set of capabilities
- **Accessed by the IMS Connectors**
  - IMS Client for Java, IMS Connector for Java, ...
- **Accessed by user-written programs**
  - Documented and well-defined interfaces