E80

IMS Web Enablement - Picking the Right Solution

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Abstract

△ **Web enabling your IMS system can be done in a variety of ways using one of any number of solutions. This presentation is geared at providing a roadmap through the different choices to better define which solutions are best suited for a particular environment. It also details the decision points based upon the network used as well as the different application, capacity and security requirements.**

Where Do We Start?

⚠ **Know what is available**

- Technology

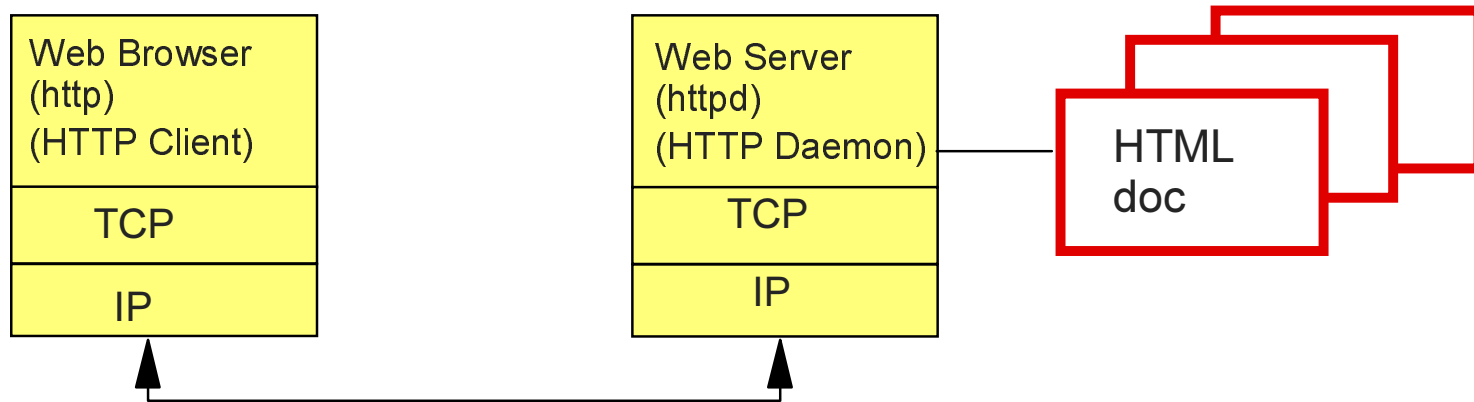- Products

- Solutions

⚠ **Define your requirements**

- Network

- Architecture

- Applications
  - ▶ Data sensitivity

A Little Bit of Background and History

⚖ In the Beginning ...

http://www.company.com/menu.html

Web Browser (http) (HTTP Client)
TCP
IP

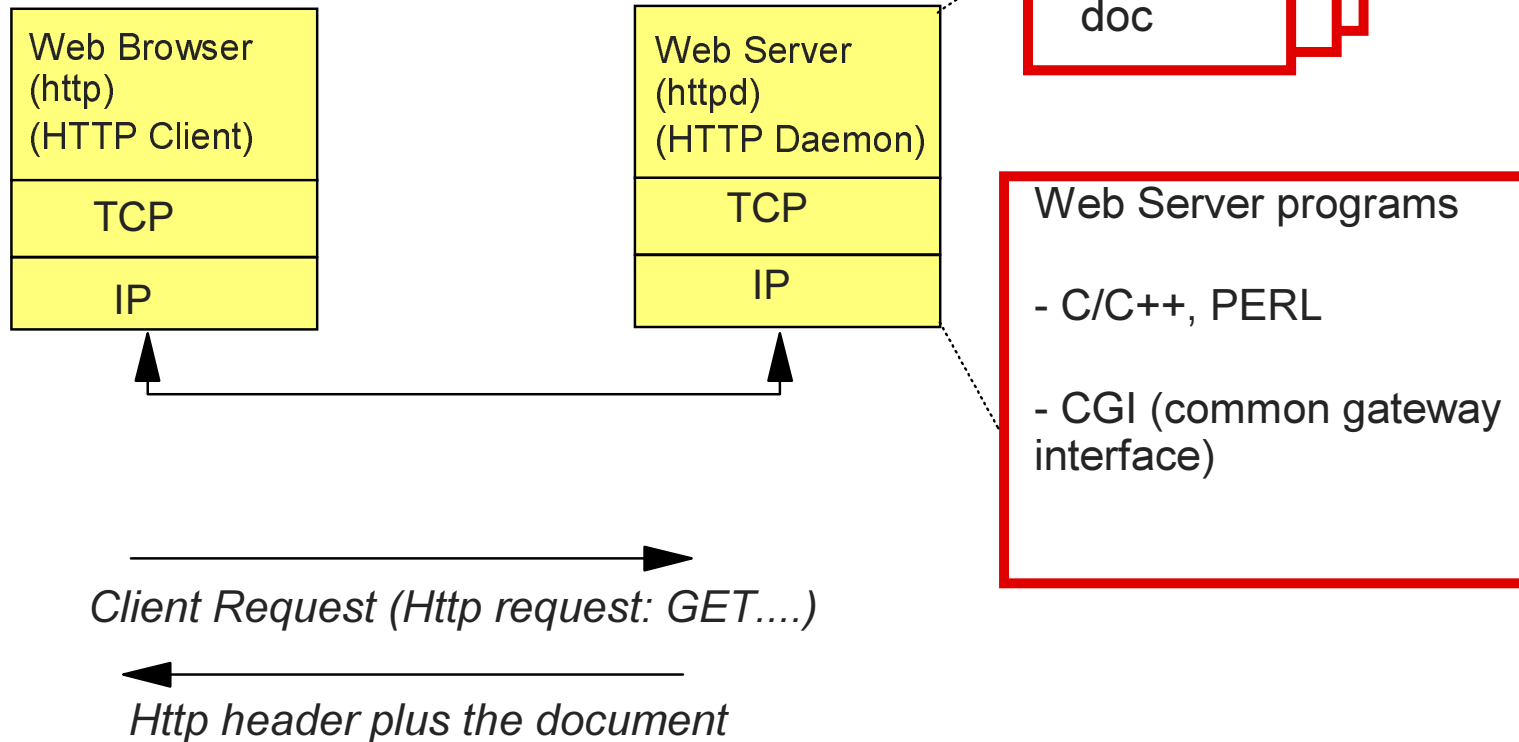| Web Server (httpd) (HTTP Daemon) |
|---|
| TCP |
| IP |

HTML doc

The HTTP (HyperText Transfer Protocol) application was created to allow users to access interlinked documents
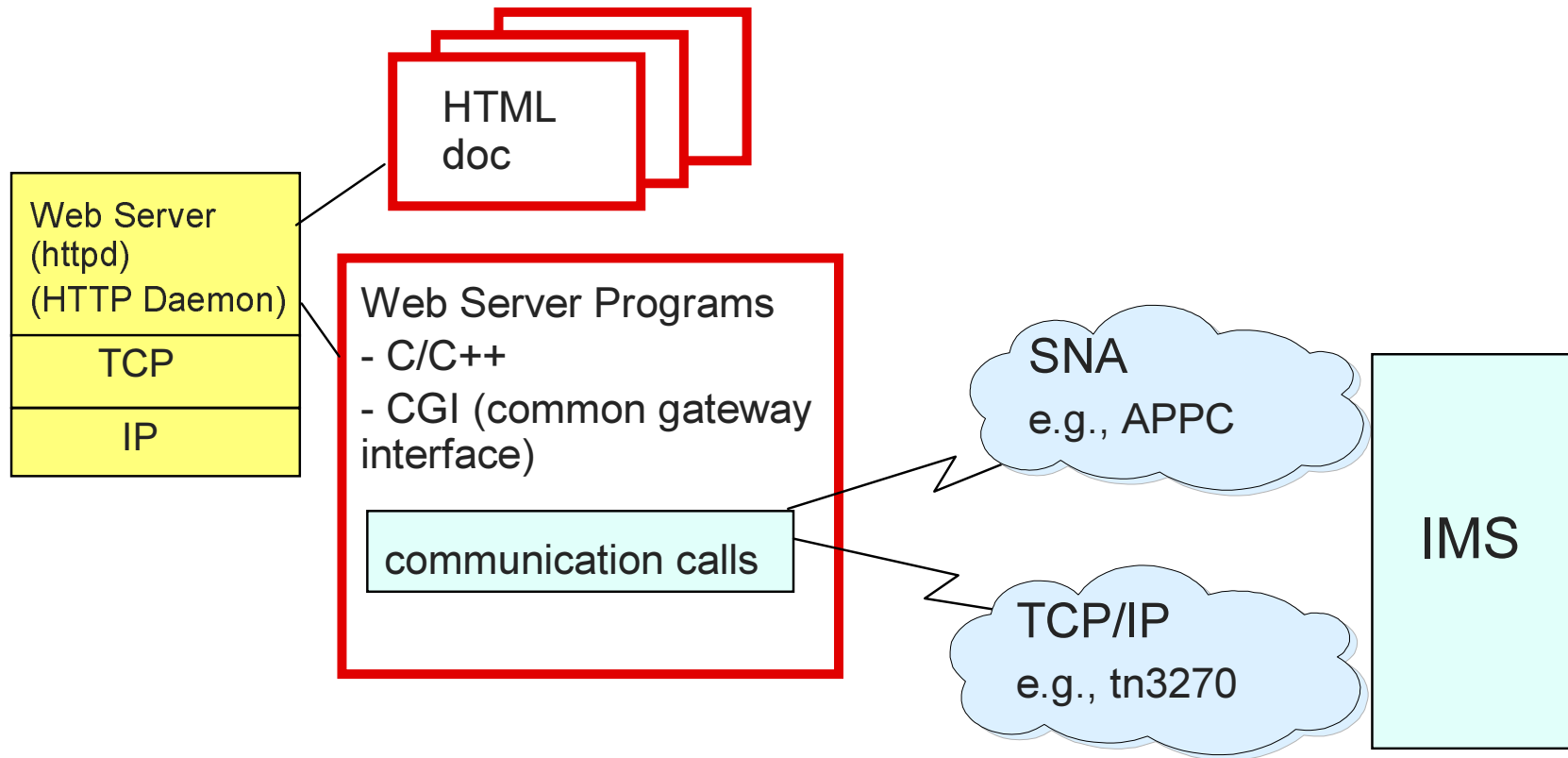
4

A Little Bit of Background and History

⚜ **Then there came a need to process data**

`http://www.company.com/menu.html`

Web Browser (http) (HTTP Client)
TCP
IP

Web Server (httpd) (HTTP Daemon)
TCP
IP

HTML
doc

Web Server programs

- C/C++, PERL

- CGI (common gateway interface)

Client Request (Http request: GET....)

Http header plus the document

5

A Little Bit of Background and History ...

⚠ **Then came access to enterprise systems**

HTML
doc

Web Server
(httpd)
(HTTP Daemon)

TCP

IP

Web Server Programs
- C/C++
- CGI (common gateway interface)

communication calls

SNA
e.g., APPC

TCP/IP
e.g., tn3270

IMS

Followed by The Evolution.... and The Confusion

Web Server programs

- CGI, vendor server APIs, Java applets and servlets, etc...

Web Server environments

- Multiple Vendors
- Different platforms
- A variety of ways to access the enterprise

Programming Languages

- C, C++, Visual Basic, Java, etc...

Solutions and Toolkits

- IMS Web, Net.data, VAJava, etc...

Web Server Program Evolution

⚠ **The support and evolution of web server programs included:**

- The programming interface

  - ► How to support input and output messages
  - ► How to schedule the programs

- The programming languages that could be used

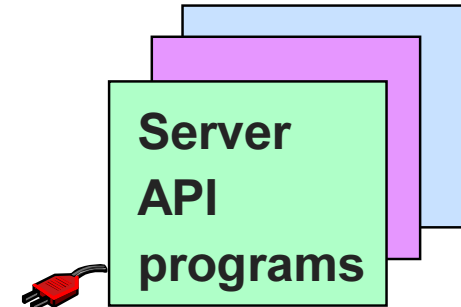# Web Server Program Evolution ...

△ **The programming interface**

CGI programs

Fast CGI programs

Server API programs

Server plug-ins (code that extends an http server)

- **Standard interface** supported by Web server vendors
  * Simple coding interface

- Different programming languages

- Straightforward implementation on different web server vendors

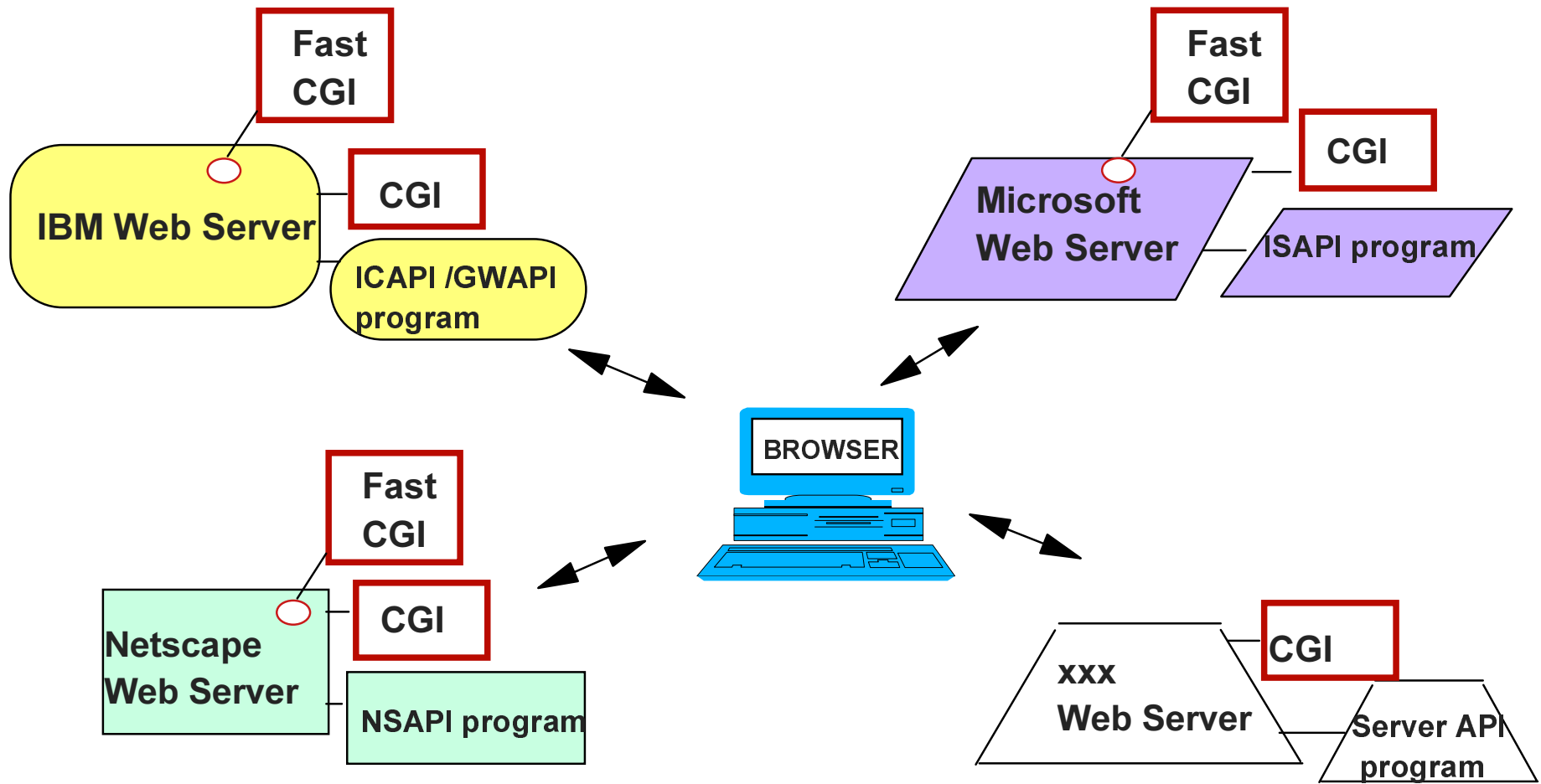- Supports lower volumes (thread   management per invocation)

- **Standard interface** supported by Web servers that have been extended for this capability

- CGIs must be written in C and linked with the fastcgi C routines (www.fastcgi.com)

- Supports higher volumes (thread management across invocations)

- **Unique interface by vendor** e.g., ISAPI, NSAPI, ICAPI, GWAPI ...

- Programming languages supported are based on the vendor

- Migration from vendor to vendor involves rewrites

- Supports high volumes

Web Server Program Evolution...

Fast CGI

CGI

IBM Web Server

ICAPI /GWAPI program

Fast CGI

CGI

Microsoft Web Server

ISAPI program

BROWSER

Fast CGI

CGI

Netscape Web Server

NSAPI program

CGI

xxx Web Server

Server API program

Web Server Program Evolution...

⚜ **The programming languages**

- C, C++, Visual Basic, Perl, ActiveX, Java ...

- Web servers (vendors) defined which they supported

  - ▸ Oftentimes based on the platform (UNIX, Windows, OS/390, etc.)
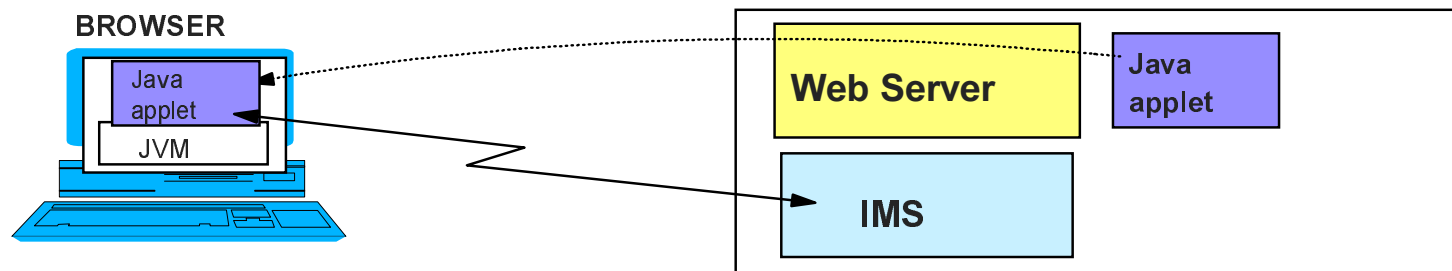
Web Server Program Evolution...

⚠ Java - the evolving standard

- OO Programming Language

  - ▶ Popular in the web environment
  - ▶ Specification created by Sun
  - ▶ Standard and portable

- Write and compile once -- run anywhere

  - ▶ Uses Java Development Kit (JDK) for developing and compiling
    - Source is compiled into machine-neutral bytecode

  - ▶ Requires Java Virtual Machine(JVM) to run
    - During execution the bytecode is interpreted and converted into native machine code

Web Server Program Evolution...

⚠ Java execution environments

- **Applications**
  - ▶ Require a Java Virtual Machine (JVM) to execute
  - ▶ Can run as stand-along programs
  - ▶ Can run in a web server (CGI, servlet)

- **Applets - little applications that are <u>stored</u> in a web server**
  - ▶ To execute, they are downloaded to and run in Browsers
    - ● Most browsers have a JVM
  - ▶ Can issue communication calls
    - ● Can only access the same platform as the Web Server

BROWSER

Java applet

JVM

Web Server

Java applet

IMS

Web Server Program Evolution...

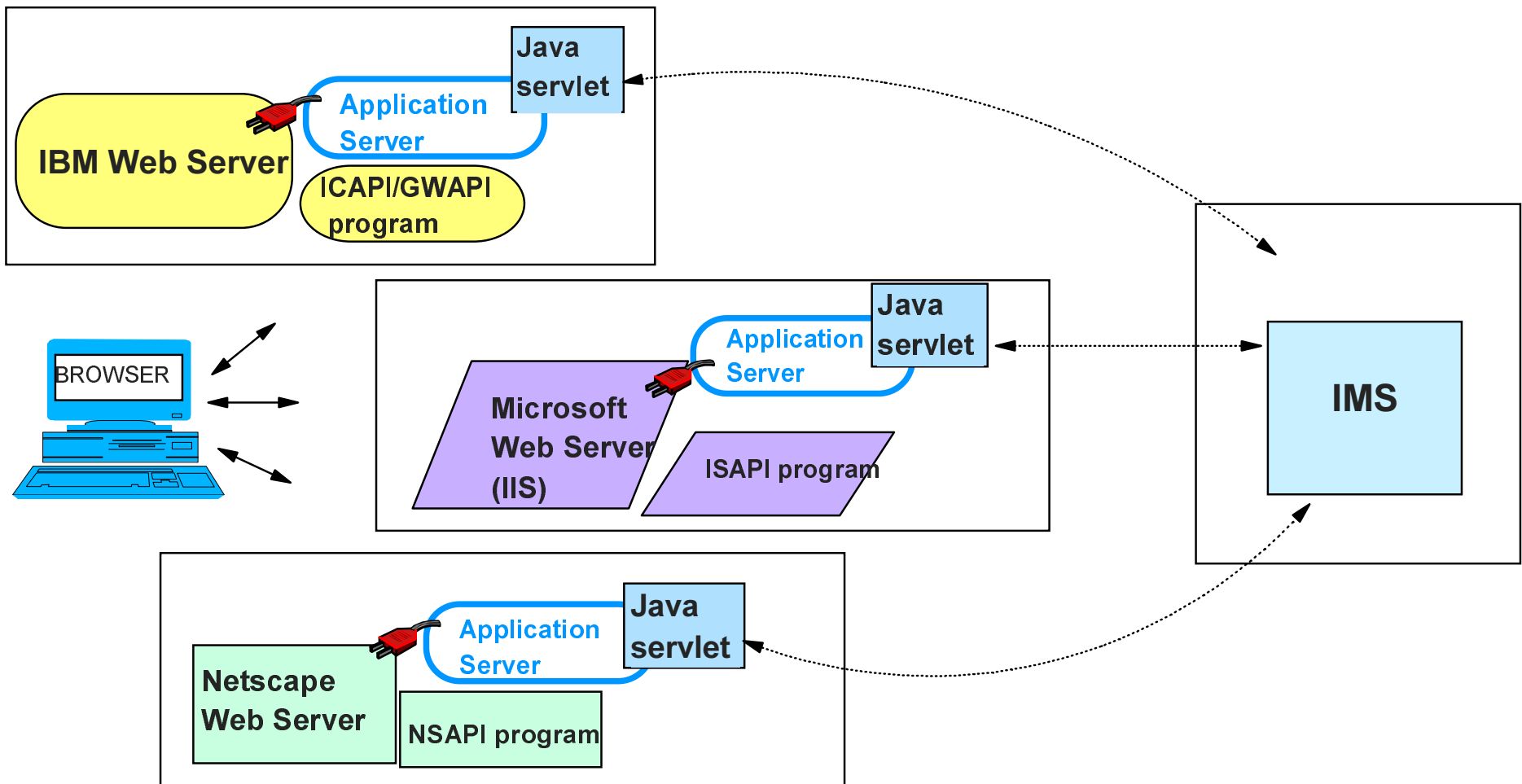⚠ **Java servlets - server-side programs**

- Java replacement for CGI programs
  - ▸ Much faster
  - ▸ Can stay alive across HTTP requests

- Java replacement for server plugins (NSAPI, ISAPI, ICAPI, ...)
  - ▸ Will be the same on all platforms
  - ▸ Safe - cannot crash the web server

- Run on Application Servers ⭐
  - ▸ Application servers are plug-ins
    - ● Provide the high-performing Java web server API

⭐ IBM's application server is called the Websphere Application Server
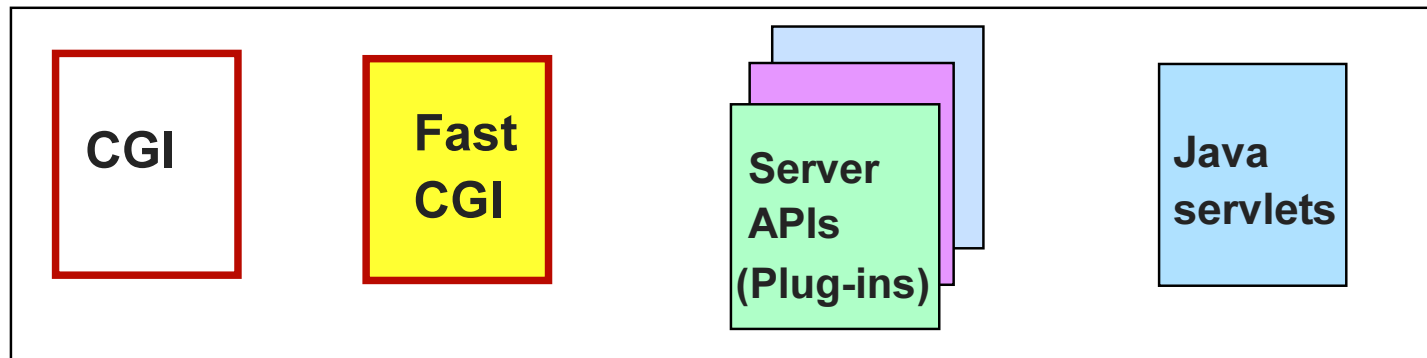
Web Server Program Evolution...

⚠ **Java servlets are written and compiled once then they are "published" to an Application Server that is "plugged into" a standard web server**

- The same servlet can be deployed on application servers that support different web servers

IBM Web Server

Application Server

Java servlet

ICAPI/GWAPI program

BROWSER

Microsoft Web Server (IIS)

Application Server

Java servlet

ISAPI program

Netscape Web Server

Application Server

Java servlet

NSAPI program

IMS

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Web Server Program Evolution ...

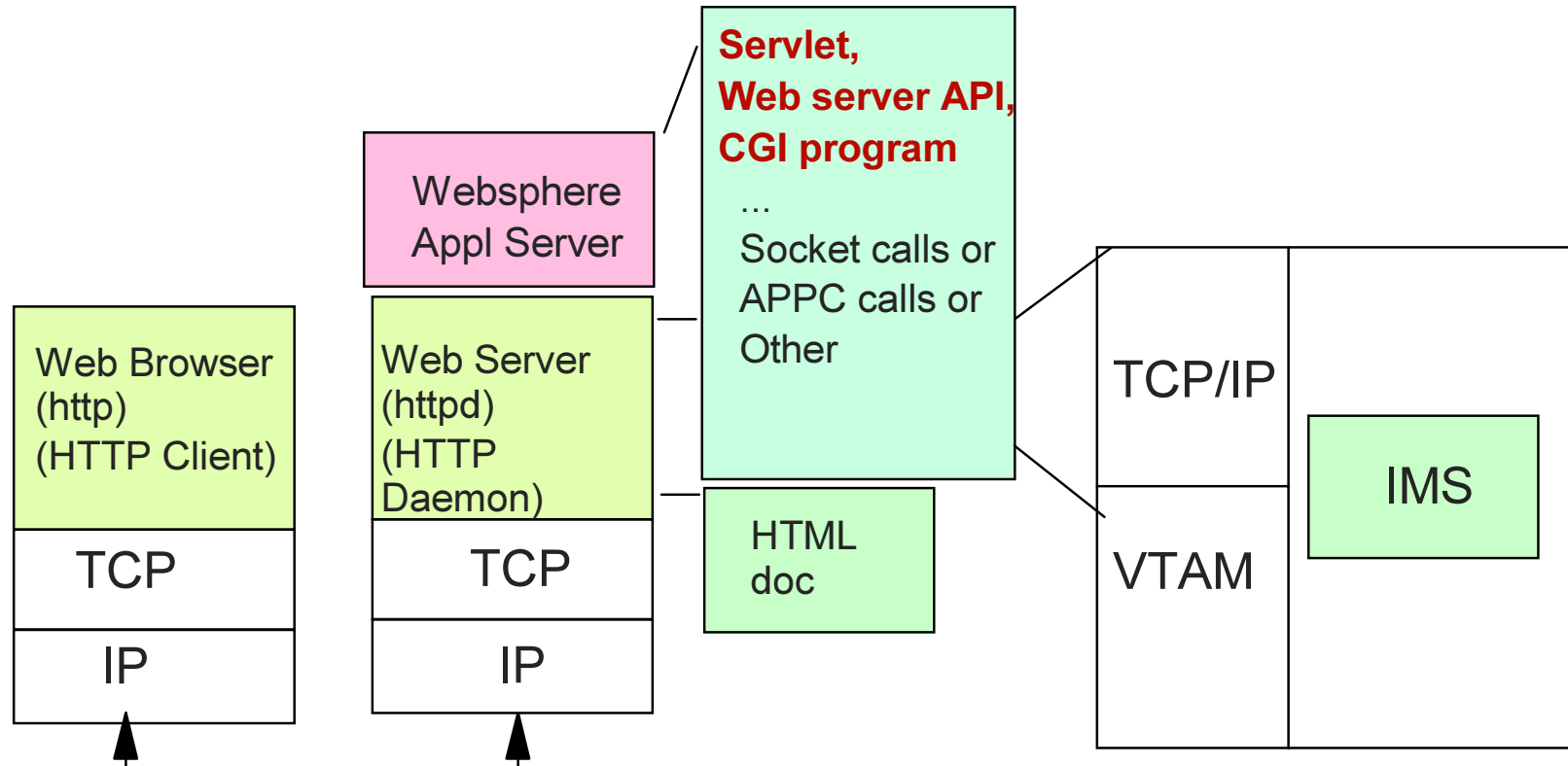| CGI	Fast CGI	Server APIs (Plug-ins)	Java servlets

... And all can be used today

Accessing IMS

Accessing IMS

Web Server Program Considerations:

1. Access IMS using any supported protocol

2. Convert transaction input/output to HTML (parse the data)

Define the Environment
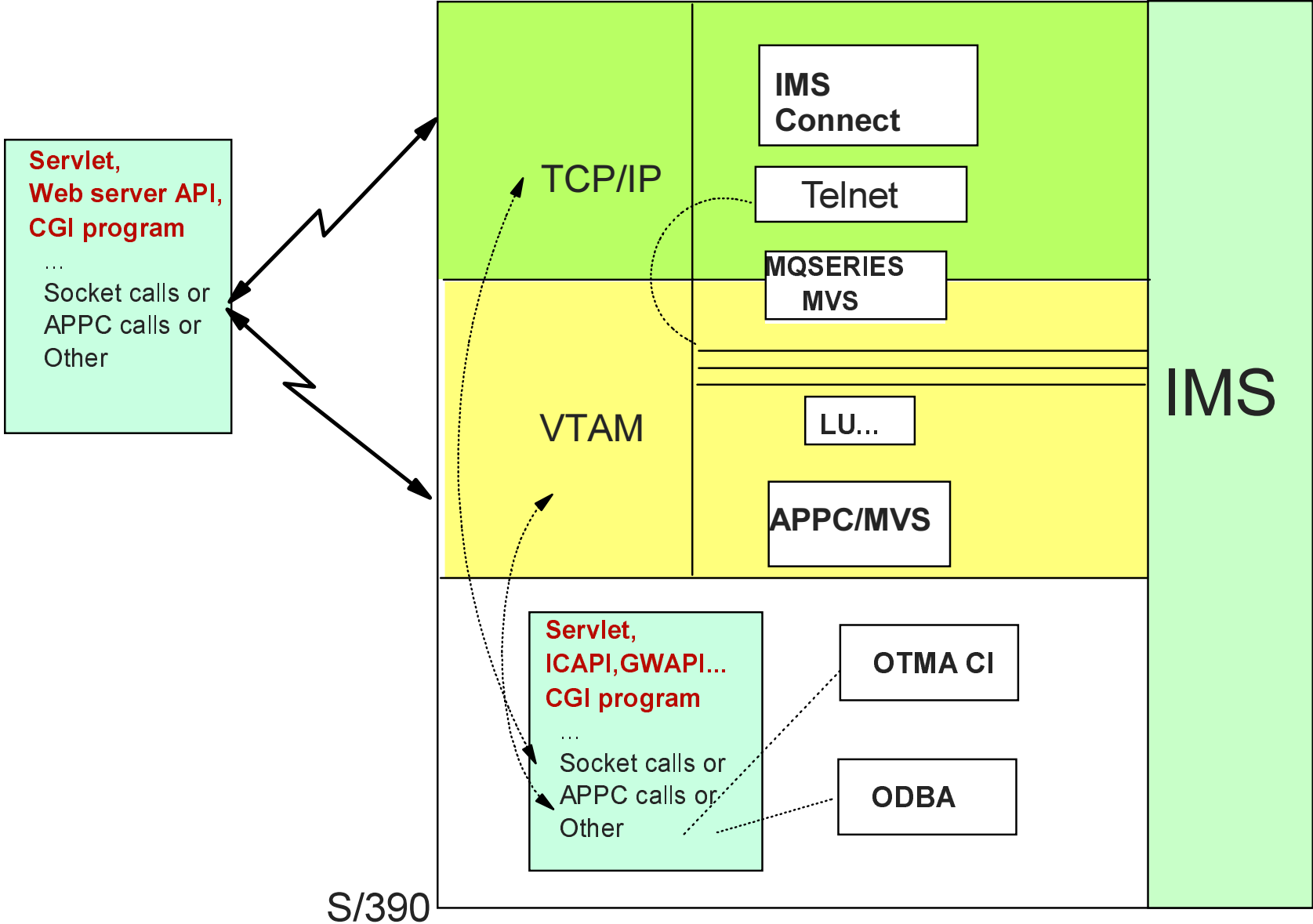
⬥ **Where is the Web Server**

  ▪ On the S/390 or on a remote platform?

⬥ **For remote Web Servers**

  ▪ What network is to be used
    ▸ TCP/IP or SNA?

Define the Environment ...

Servlet,
Web server API,
CGI program
...
Socket calls or
APPC calls or
Other

TCP/IP

IMS
Connect

Telnet

MQSERIES
MVS

VTAM

LU...

APPC/MVS

IMS

Servlet,
ICAPI,GWAPI...
CGI program
...
Socket calls or
APPC calls or
Other

OTMA CI

ODBA

S/390

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Choice of Protocols

⚠ **Network requirements - SNA or TCP/IP**

⚠ **Application requirements**

- Direct connection model vs. Messaging and Queuing model

- Access to transactions versus direct access to data

- Inquiry (read-only) or Update

- Simplicity or extensibility

- ...

⚠ **Development requirements**

- Programming language

- Skill

- Cost - Build versus Buy and Modify
  - ▸ Toolkits

Application Requirements

⧊ Direct Connection Model (transactions)

- Characteristics
  - Processing begins only if connections can be established
  - Immediate notification of problems
    - Error indicators sent in the case of failures

- Most popular types of support

  - 3270 emulation - Traditional interface
    - SNA=EHLLAPI, TCP/IP=TN3270

  - Program-to-Program support
    - SNA=APPC, TCP/IP=Sockets
    - Interactive processing
    - Output messages can be sent before/after IMS syncpoint
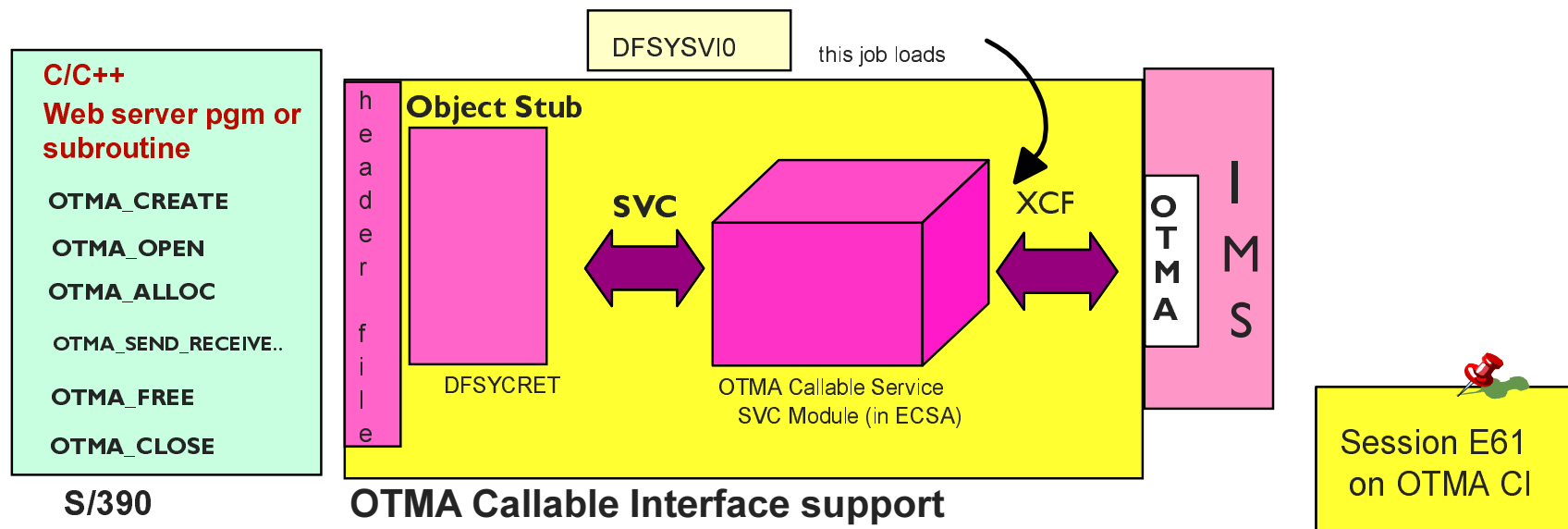
Application Requirements...

⚠ Direct Connection Model (transactions)...

- Considerations
  - ► Programs are sensitive to network type
    - Communication interface APIs are different
    - Switching between SNA and TCP/IP requires re-writes

- Designing for failure (when transactions in IMS do updates)
  - ► Did the commit occur in IMS?
    - Depends on
      - Commit mode (commit-then-send vs send-then-commit)
      - Synchronization level (none vs confirm)
      - Whether any output messages have been received
  - ► Possible actions
    - Act on error indicators
    - Provide the ability to send an inquiry
    - ...

Application Requirements...

⚠️ **Direct Connection Model (transactions) ...**

- Additionally, if the web server is on the S/390
  - ▶ The OTMA Callable Interface
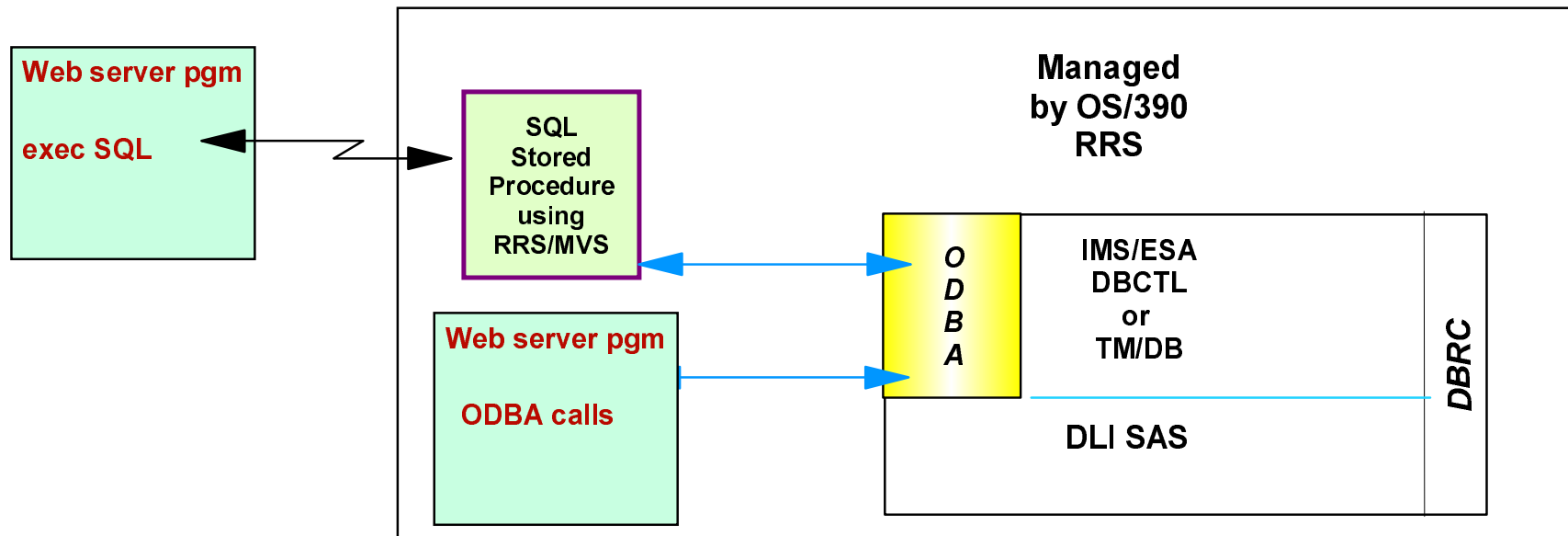   - ● Provides C/C++ programs or subroutines to access IMS transactions

DFSYSVI0   this job loads

C/C++
Web server pgm or subroutine

OTMA_CREATE

OTMA_OPEN

OTMA_ALLOC

OTMA_SEND_RECEIVE..

OTMA_FREE

OTMA_CLOSE

header file

Object Stub

DFSYCRET

SVC

OTMA Callable Service
SVC Module (in ECSA)

XCF

OTMA   IMS

Session E61
on OTMA CI

S/390   **OTMA Callable Interface support**

JAVA Wrapper for OTMA C/I can be found in OTMAWWWX which is part of

package DB2IMSRX at http://www.s390.ibm.com/nc/download.html.

Application Requirements...

⚶ Direct Connection Model (<u>database</u>) ...

- **ODBA interface (Open DataBase Access)**
  - Programs that issue database calls must reside on the same MVS as IMS

Web server pgm

exec SQL

SQL Stored Procedure using RRS/MVS

Web server pgm

ODBA calls

Managed by OS/390 RRS

O D B A

IMS/ESA DBCTL or TM/DB

DLI SAS

DBRC

Sessions E66 and E67

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Application Requirements ...

△ **Messaging and Queuing Model (transactions)**

- Characteristics
  - ‣ Processing occurs whether or not a connection is made
    - Guaranteed delivery of messages (inbound/outbound) when components and/or network are available

- Support
  - ‣ MQSeries
    - Application API does not depend on the network
      - High level API unique to MQ
      - Same applications can be deployed on TCP/IP or SNA

Session E04 on MQSeries

Application Requirements ...

⚜ Messaging and Queuing Model...

- Designing for failure
  - ► Determine what messages could go to the dead-letter queue
  - ► If a web server program times out waiting for a message reply
    - Did the commit occur in IMS?
    - Is there a forthcoming output reply that needs to be handled,
      - Application output or DFS error message
  - ► Possible actions
    - Create a process to respond to the reply - save/ print/ route, ...
    - Provide the ability to send an inquiry
    - ...

Choices

⚠ **Build**

- Create and build your own program
  - ▸ Access to IMS can use any available communication protocol

⚠ **Buy and modify**

- End-to-end solutions
  - ▸ e.g., IBM Websphere Commerce Suite (Net.Commerce)
    - ● Catalog and storefront creation, merchandising, relationship marketing, payment processing, etc.
      - – www.ibm.com/software/webservers/commerce/
  - ▸ Industry-based
- Products and toolkits to help generate the web server program
  - ▸ General purpose
  - ▸ Web server vendor specific
  - ▸ Language specific
  - ▸ ...

Products, Tools, Toolkits, and Assists

Starting Simple - 3270 emulation

⬨ **3270 emulation**

- Straightforward and simple
  - ‣ IMS is unaware that the access is from the Web
- Traditional IMS communication model

⬨ **Initial Web approaches to 3270 emulation**

- Some browsers packaged 3270 emulators in the browser
- Some software mapped 3270 data streams to HTML

⬨ **Java-based approach**

- Applet provides 3270 emulation at the browser when needed
- Products / tools
  - ‣ Host On-Demand - www.ibm.com/software/webservers/hostondemand
  - ‣ ResQNet - www.resqnet.com
  - ‣ Jacada - www.jacada.com

Starting Simple - 3270 emulation

⚠ **Host On-Demand**

- IBM product - part of Host Integration Solution
  - ▸ Downloads a Java applet (includes a TN3270 emulator)
  - ▸ Provides GUI functions, screen customization
  - ▸ Host Access Class Library API
    - ● Allows access to the emulator data stream to extend
      - – Create customized e-business applications
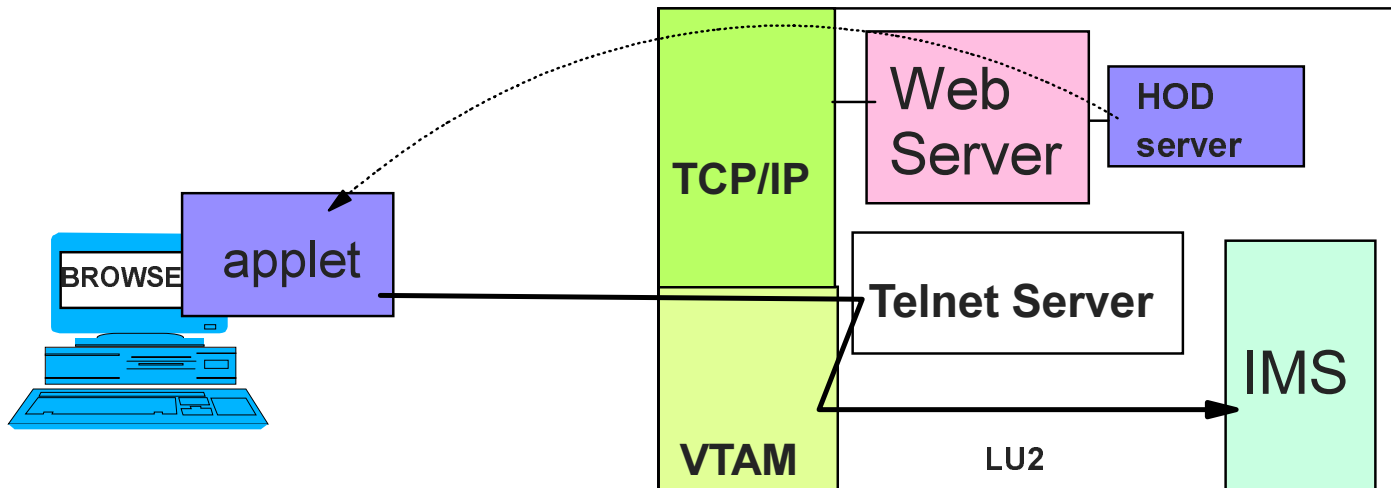
Starting Simple - 3270 emulation

⚠ **Benefits**

- Straightforward implementation

- IMS continues to communicate using SNA LU2 protocols
  - ► Web browser does sees more than just a "green screen"
    - ● Customized web screens

- Easy way to web-enable existing 3270-based transactions
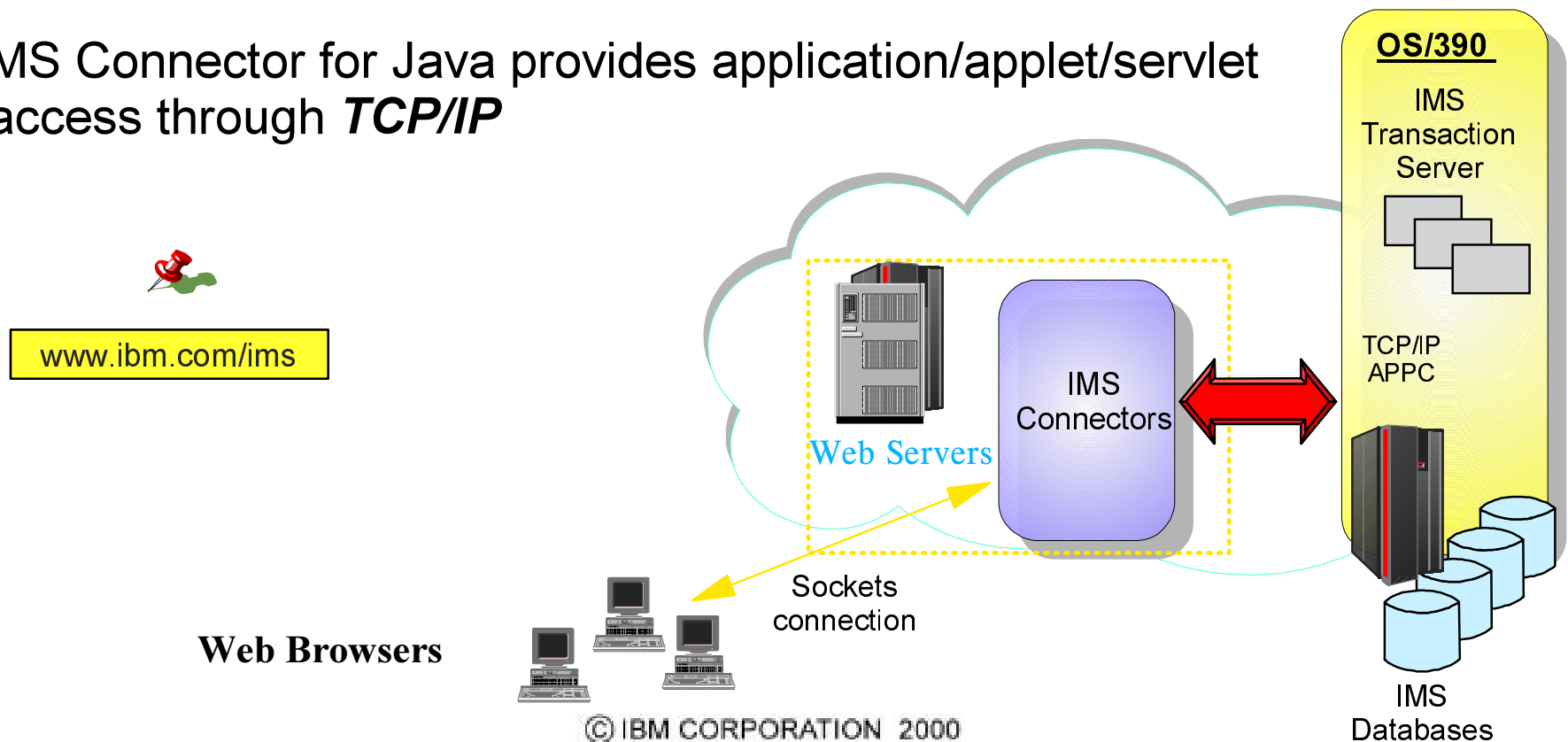
⚠ **Why consider any other solution?**

- Need for greater extensibility and a solution based on something other than 3270 emulation

IMS Connectors

⚠ **IMS Connectors**

- IMS WWW Templates provide mapping aids and access through *APPC*

- IMS Connect provides *TCP/IP sockets access*

- IMS Client for Java provides Java application and applet access through *TCP/IP*

- IMS Connector for Java provides application/applet/servlet access through *TCP/IP*

www.ibm.com/ims

OS/390

IMS Transaction Server

TCP/IP APPC

IMS Connectors

Web Servers

Sockets connection

Web Browsers

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IMS Databases

IMS Connectors - SNA

⚠ **IF your network is SNA or you have a S/390 Web Server then consider an APPC solution**

- IMS WWW Templates
  - ▶ www.s390.ibm.com/nc/sntc/Templates.html
  - ▶ General purpose C++ CGI or ICAPI Web Server program (also provided with a Java wrapper for servlet support)
    - Accesses IMS using APPC
    - Provides a mapping aid to define the input/output message layout
    - Can be used to access any IMS transaction

IWT
1) Converts IMS transaction input/output to HTML
2) Communicates with IMS

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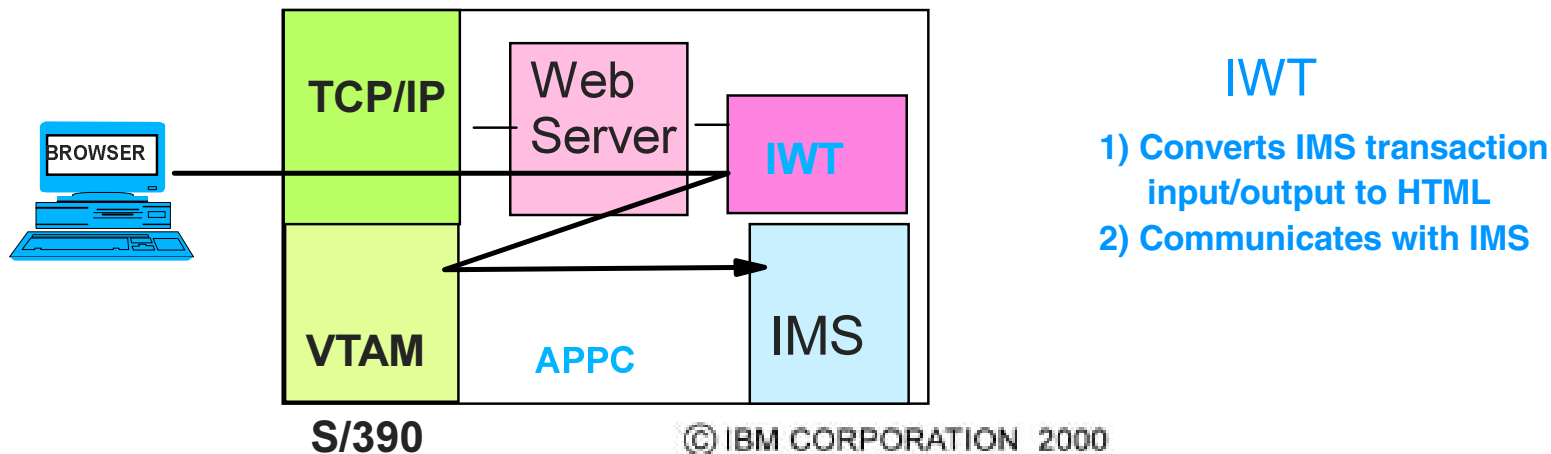
IMS Connectors - TCPIP

⚠ **IF your network is TCP/IP or you have a S/390 Web Server then consider a TCP/IP solution**
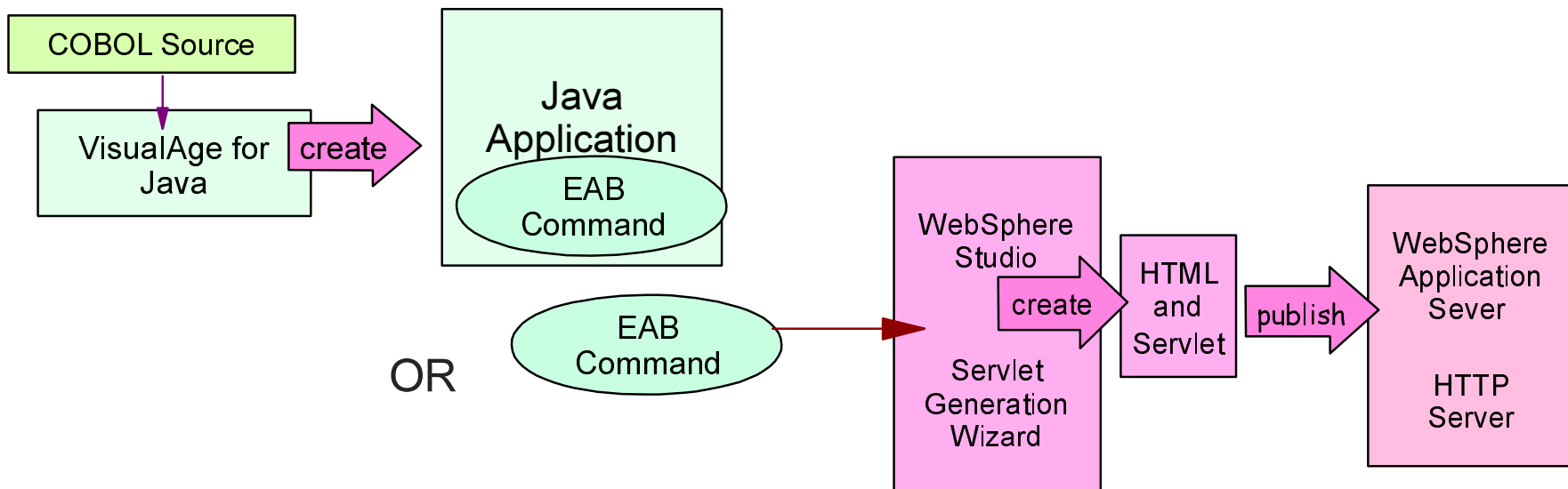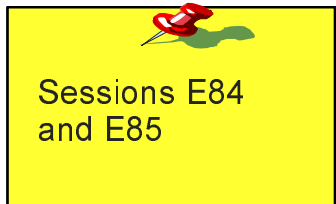
- IMS Connect - provides the IMS support for TCP/IP sockets
  - ▸ Generalized interface that can be used by any sockets program

- IMS Client for Java - sample program (run as application or applet)
  - ▸ Issues TCP/IP sockets calls

Sessions E63
and E64

browser

application
or applet

TCP/IP

Web
Server

**IMS
CONNECT**

XCF

IMS
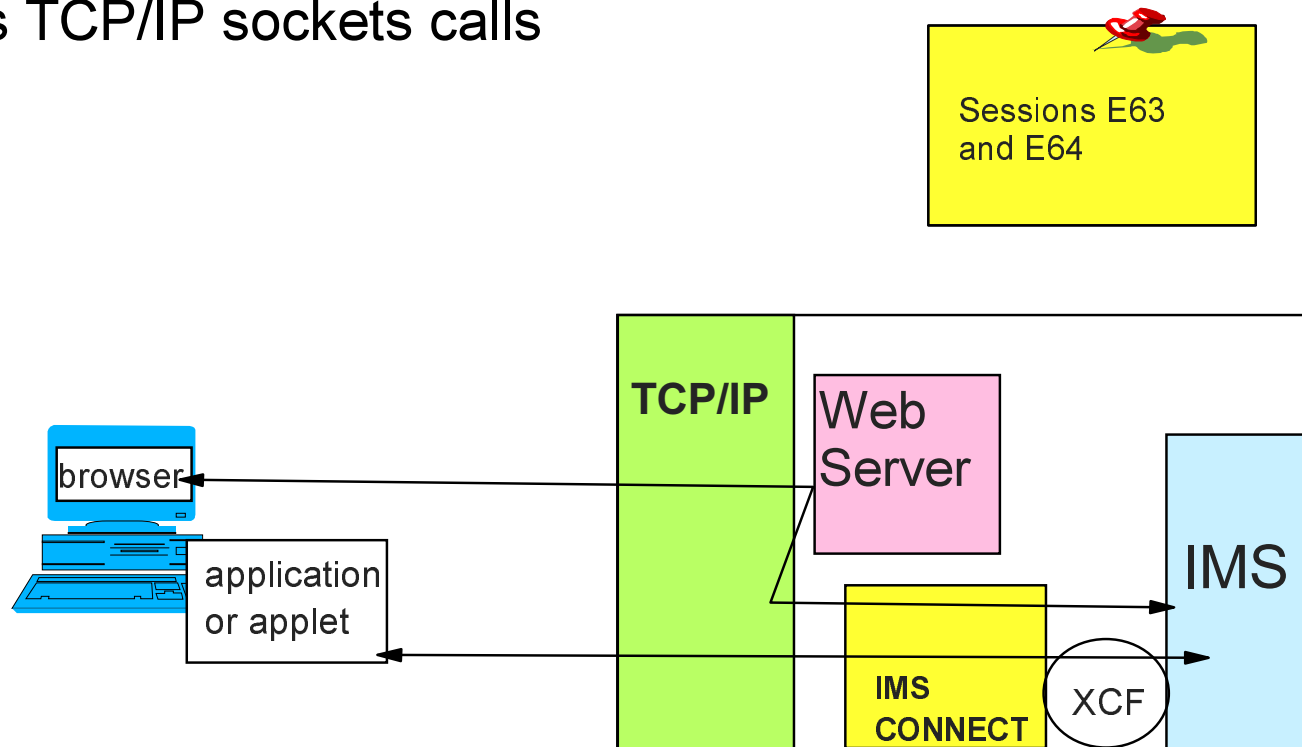
IMS Connectors - TCPIP...

⚠ TCP/IP solution ...

- **VisualAge for Java Enterprise Edition**
  - ► Connectors
    - IMS Connector for Java - provides socket code to access IMS
    - MQ Connector - provides MQ code to access IMS
    - ...
  - ► Allows developers to create Java applications or servlets that access IMS Transactions using pre-packaged code

Sessions E84 and E85

COBOL Source

| VisualAge for Java | create → | Java Application (EAB Command) |

OR

EAB Command → WebSphere Studio | create → | HTML and Servlet | publish → | WebSphere Application Sever — HTTP Server |

Servlet Generation Wizard

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IMS Connectors - Data

⚠ **On the other hands, if your goal is to access IMS data directly and not transactions, consider**

- Classic Connect and Data Joiner
  - ► Provide support for standard SQL access to IMS data

  Session E72

- Develop a process that uses the ODBA interface
  - ► DB2 stored procedure
  - ► S/390 Web Server program

  Session E66
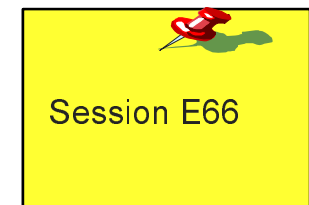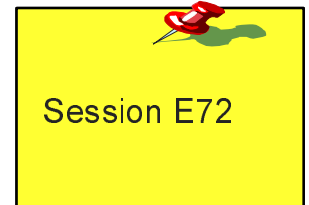
Additionally - Other Products, Other Vendors

⬧ **Neon - www.neonsys.com**

   ▪ Mainframe-based web server and access to IMS

⬧ **Microsoft - www.microsoft.com**

   ▪ Access to IMS using COMTI

⬧ **...**

   Many solutions are being provided by IBM and other vendors

The OS/390 Planning Assistant

http://www.s390.ibm.com/os390/wizards/ebiz/

to guide you through IBM solutions

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OS/390 Planning Assistant for e-business

Do you want to know how to use WebSphere products to access CICS, IMS, DB2 or other databases on OS/390? This interactive tool will ask you some questions, and based on your answers, provides an recommended scenario, as well as an introduction and overview of the products and functions you can use for your e-business applications on OS/390.

To get started, click on "Start the Interview", and answer a series of questions about your current system environment and the applications running on OS/390 that you would like to access from the Web. We will use this information to choose a scenario for e-business in your OS/390 environment.

For a list of all the recommended scenarios, click on the Scenario Summary Page.

Please read legal information before starting.

Start the interview

OS/390 Planning Assistant for e-business - Netscape

File   Edit   View   Go   Communicator   Help

Back   Forward   Reload   Home   Search   Netscape   Print   Security   Stop

IBM   WebMail   Contact   People   Yellow Pages   Download   Find S

Bookmarks   Location: http://www.s390.ibm.com/os390/wizards/ebiz/

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OS/390 Planning Assistant for e-business: Scenario

What do you want to do?

○ **Web enable existing application and databases (CICS, IMS,**

○ **Do e-transactions on the Web using Enterprise Java Beans(EJBs).**

? Help

OS/390 Planning Assistant for e-busine

File   Edit   View   Go   Communicator

Back   Forward   Reload   Home   Search

IBM   WebMail   Contact   People

Bookmarks   Location: http://www.s390.ibm.

IBM   United States

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OS/390 Planning Assistant for e-business: Ja

Several connectors are available for access
host-based Java, such as CTG, JDBC, and IM
as CICS Web Support, IMS TOC, Net.Data, a

Do you want to use a Java application deve

⦿ Yes, I want to use Java

○ No, I do not want to use Java

? Help

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OS/390 Planning Assistant for e-business: Transactions per Day

The transaction load that your Web site experiences in a day a
performance and scalability options.

Specify the total number of transactions per day that you expe
press Finish.

○ Hundreds
○ Thousands
⦿ Hundreds of Thousands
○ Millions
○ Don't Know

? Help

< Back

Privacy | Legal | Contact

Accessing IMS using the IMS Connector for Java with a Web Server on a non-O... ─
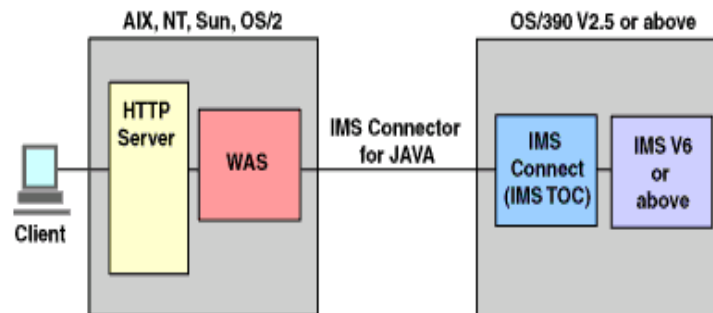
File | Edit | View | Go | Communicator | Help

Platform

Input Summary

What: Web enable apps & DBs.   Browser Control: No
Java: Yes   OS: OS/390 V2.7
Subsystem: IMS V6   Upgrade Subsystem: Yes
Web Server: OS/390 Web Server
Transactions Per Day: Hundreds of Thousands   LPAR: No

Benefits and Considerations | Variations | Software Requirements | Hardware Requirements |
Packaging and Ordering | Security Considerations | Supporting Documentation |
Services and Offerings

AIX, NT, Sun, OS/2 — HTTP Server — WAS — IMS Connector for JAVA — OS/390 V2.5 or above — IMS Connect (IMS TOC) — IMS V6 or above — Client

Description

The IMS Connector for Java (formerly called the IMS TOC Connecor for

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Summary

IMS - continues to be the best