Introduction to IMS e-business Solutions

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As the 21st century approaches, IMS still leads the industry in providing strategic support for mission-critical applications and data. With the GA of Version 6, IMS continues to provide Enterprise technological leadership for customers well into the 21st century. As we extend the large base of IMS applications and data out into the enterprise and to its customers and partners, we are taking the information already in a company and making it acceptable with a browser for internet, intranet and Java use. IBM is providing IMS enterprise business solutions for this. This can help customers expand their existing markets by increasing visibility with the web into larger global markets. Small companies can compete with large ones in this Internet world. This presentation introduces the Internet and the world of Enterprise Java, the IMS solutions for these evolving technologies, and their future directions.
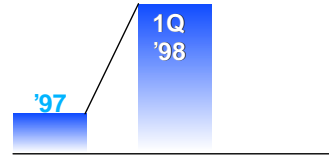
Changing Business Environment

Extended Reach

65,000 new web sites created every hour...

- 147M users connected in 1998
- 320M connected in 2000
- 720M by 2005

Cost Reduction

Online Banking:
7.3 million users by 2001
Cost on one transaction
- Bank Branch   = $ 1.08
- Telephone   = $ 0.54
- Internet   = $ 0.13

New Competition

'97   1Q '98

Extended Enterprise

- Business-to-business commerce to grow to $426 Billion by 2002

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e-business powered by IMS / IMS

▶ The internet is the fastest growing mass medium of all time. It has raised customer expectations and permitted new competitors to develop entirely different, often more cost effective, business models. It has demanded drastic changes in products and delivery systems. The growth of the Internet, with its global reach and new commerce channels, is changing the way everybody does business. It's about universal access.

The Path to e-business: Two Cultures

e-business powered by IMS
IMS

Web - from publishing to collaboration to commerce

- **Universal access**
- **Standards**

Transforming Relationships:
Customers from *a transaction to lifetime loyalty*
Employees from *competent to responsive*
Suppliers from *independence to interdependence*

e-business
Using Internet technologies to transform key business processes & relationships.
Converging at the need to connect to enterprise data and transactions.

IT - from the existing infrastructure

- **Data/applications**
- **Core business processes**
- **Reliability, security and availability**

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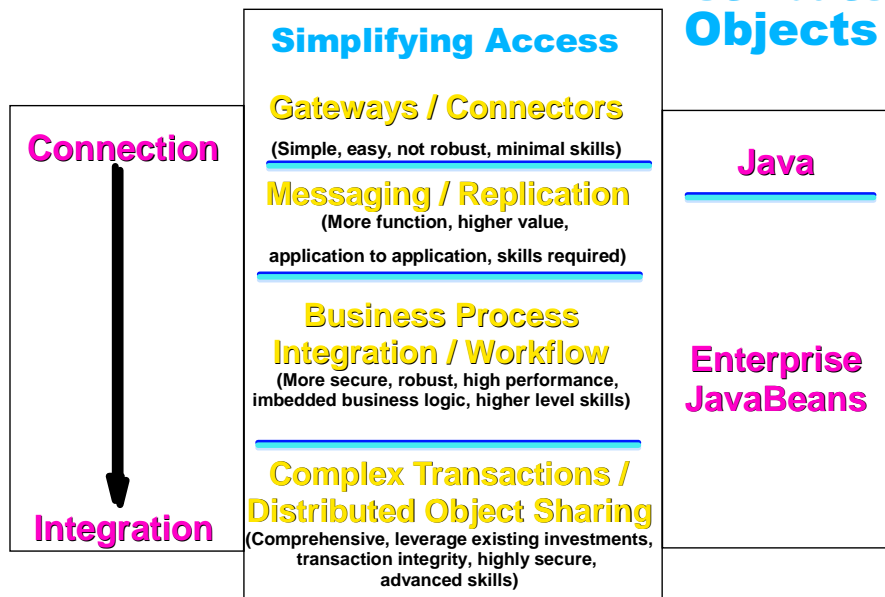© IBM 1999   ebusIMS. prz

▸ The internet is defining an entirely new way of doing business -- a marketplace where businesses are using Internet technologies and network computing to securely transform their internal business processes (via intranets); their business relationships (via extranets), and the buying and selling of goods, services, and information (via electronic commerce). It is dramatically reshaping the way we engage with customers, employees, and business partners worldwide. As businesses make the move to providing services utilizing Internet technology, they are also seeing the need to tightly integrate their business processes to the web in order to get the desired return on investment. People are asking for increased services and offerings, improved customer care -- the ability to provide customers with the information they need when they need it. New applications are being developed, but need to use the infrastructure and all of the applications and transactions that are already there. It's the integration of IT and the Internet that's going to provide these e-businesses. Millions of already spent dollars on applications, database and transaction systems will need to be used, not replaced, to do this. And all must be done with scalability. You've got to leverage the knowledge and information you already have about your customer set to move quickly into the world of mass customization. And in all of this we need to extend the existing infrastructures for management with reliability, security, availability. When you are marrying the capability of IT with the universal access and standards of the web, you are really creating the capability to do e-business.

Application Integration

e-business powered by IMS
IMS

Native API's

Distributed Objects

Connection

↓

Integration

Simplifying Access

Gateways / Connectors
(Simple, easy, not robust, minimal skills)

Messaging / Replication
(More function, higher value,
application to application, skills required)

**Business Process
Integration / Workflow**
(More secure, robust, high performance,
imbedded business logic, higher level skills)

**Complex Transactions /
Distributed Object Sharing**
(Comprehensive, leverage existing investments,
transaction integrity, highly secure,
advanced skills)

Java

**Enterprise
JavaBeans**

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► The problems companies have in this include the degree of reuse with existing assets. They don't want to build from scratch, but reuse whatever they have. They are also worried about the development skills of their people. And they are worried about complexity. With tools and components we want to help our customers extend and leverage their current application and data assets. We need to support multiple developer types, be they Java, COBOL, or HTML developers, graphic artists, script writers, etc. There are a lot more disparate data types and assets too that need to be managed. Customers need a set of application and integration servers. IBM is starting to integrate all of these services. Integration comes in different levels. At the very basic level, its integration of an application with data, with a database call. At the next level, there is integration of application to application. And then in addition to managing the messages going through, there is managing some kind of process flow. MQSeries can be used to manage that flow. The last level of integration is within the application. Information may be gathered from multiple back ends, with integration in the application or in the process. But they want a single view of the object that can be used with multiple backend data servers. As we move up the integration stack the level of complexity increases. IBM ships base connectors with VisualAge Java and WebSphere today. When the customer wants component integration there's Component Broker Technology.

►
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Connection Components

- **IMS Connectors**
  - **eNetwork Host On-Demand**
    - **CICS Internet Gateway**
      - **CICS Gateway for Java**
        - **DCE Encina Lightweight Client**
        - **MQSeries Internet Gateway**
      - **MQSeries Client for Java**
    - **Net.Data**
  - **NotesPump**
- **JDBC**

- ■ Universal Web access to all IT assets
- ■ Increased productivity
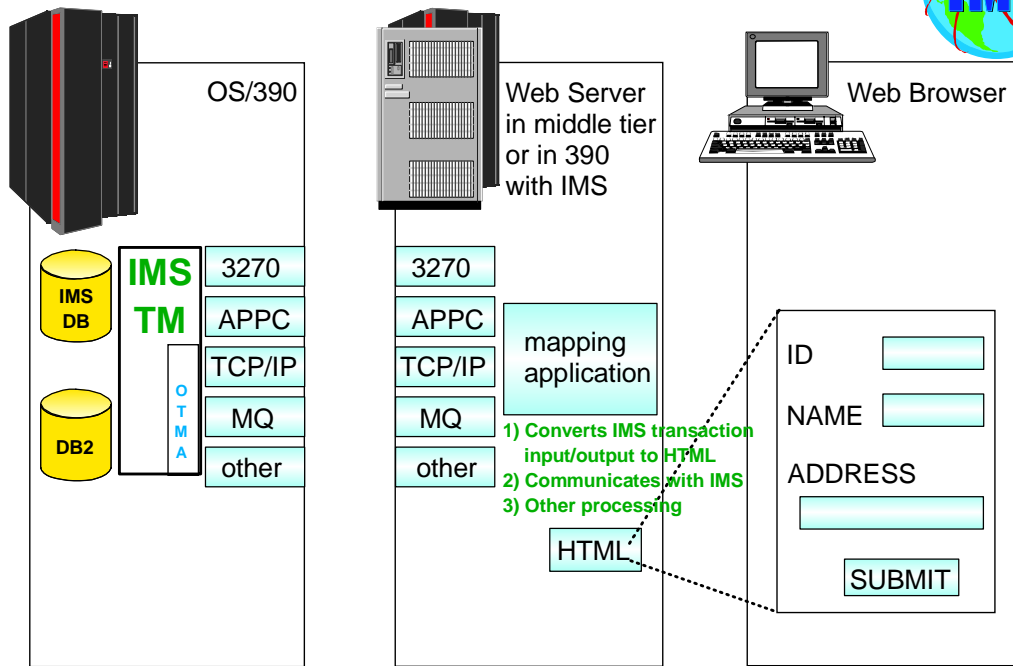
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► At the simplest level, a wide range of integrated middleware functions, defined by the IBM Network Computing framework as "Connectors", are supported to link incoming requests for service from the Internet or intranets to the commerce, collaborative and content management services. Integrated e-business Enterprise Connectors include: IMS Connectors, Net.Data, Host On-Demand, CICS Internet Gateway and CICS Gateway for Java, MQSeries Internet Gateway and MQSeries Gateway for Java, DCE Encina Lightweight Gateway, and a selection of Gateways for Domino. Our strategy here is to ship connectors with their tooling, with VisualAge Java, with WebSphere. We want people to connect regardless of the tool they are using and regardless of what they want to connect with. IBM's goal is to do the best job of integrating our tools

Web Application Development

OS/390

IMS DB

IMS TM

O T M A

DB2

3270
APPC
TCP/IP
MQ
other

Web Server in middle tier or in 390 with IMS

3270
APPC
TCP/IP
MQ
other

mapping application

1) Converts IMS transaction input/output to HTML
2) Communicates with IMS
3) Other processing

HTML

Web Browser

ID
NAME
ADDRESS

SUBMIT

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   A number of communications facilities are available for use (eg. 3270, APPC, TCP/IP, MQSeries, etc.). These solutions can use workstation or S/390 servers to access IMS. Information can be retrieved from the server system in a two-tier environment or in a three-tier environment. A scripting language has been used to program at the CGI (Common Gateway Interface) or other gateway level. This is a means of allowing a Web server to execute a program that is provided, rather than just to be able to retrieve a file. The Web serves have used the gateway interface as a mechanism to call a program to generate the formatted screen to be displayed on the browser. Communication of these pages has been taking place across the network with HTTP. Applications can be made available on the internet using HTML (HyperText Markup Language), a markup language for describing pages of information displayed. The HTML defines the format and contents of documents sent from the web server to a Web browser for formatting and display. HTML uses tags to specify formatting and document structure. It is a subset of the SGML standard, derived from IBM's GML. There are many software editors and tools that support HTML. HTML also uses tags to identify hypertext links. These pages can be linked to additional information. Names of other pages (URLs) can be referenced in a page and accessed typically by a mouse click. The linked-to pages can be on totally different systems. Mapping activities take place between web and existing network protocols and input/output streams.
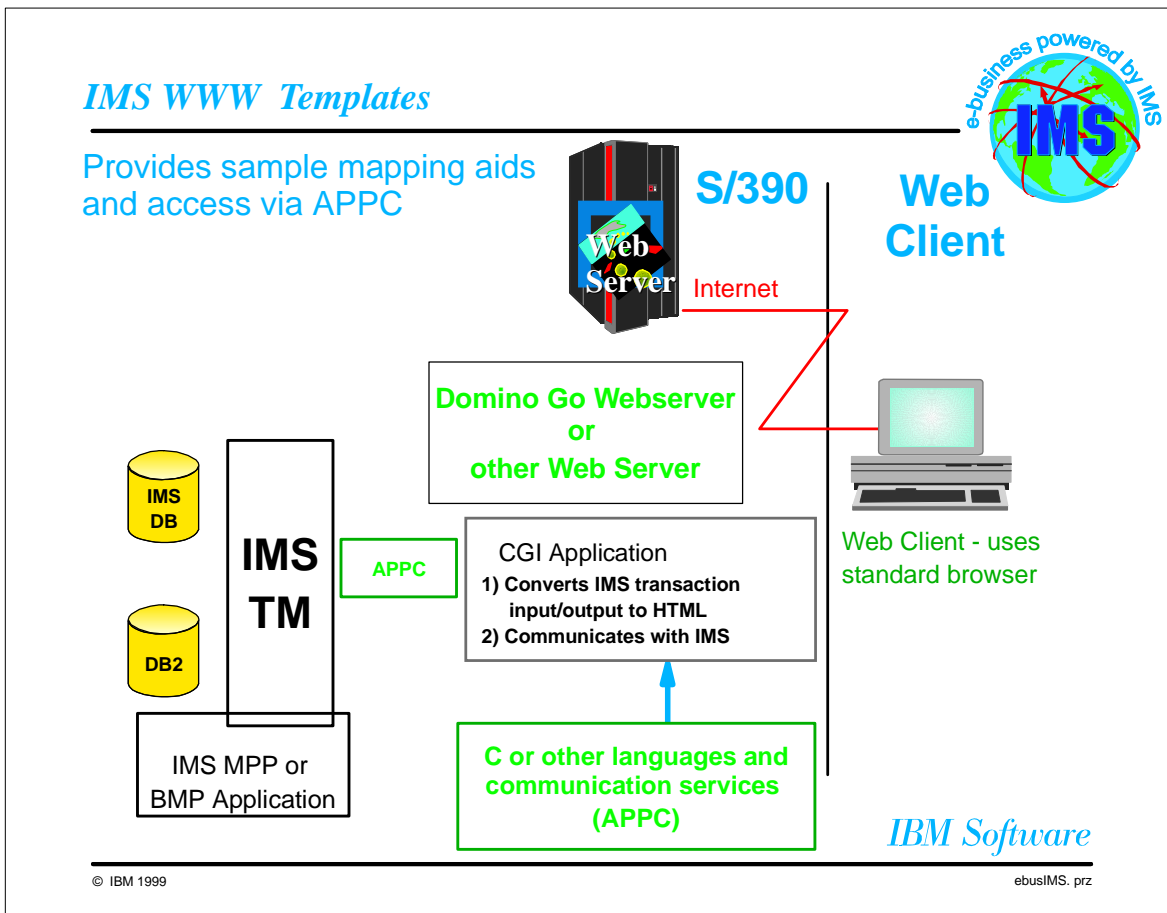
eNetwork Host On-Demand

- Host On-Demand provides fast and easy access to host 3270/SNA/5250/VT1xx/VT2xx applications
- Java-based solution that uses telnet protocols
- Customized windows; multiple sessions
- Provides high-performance, low-cost solution for intranet and Web users who need access to central site applications or databases
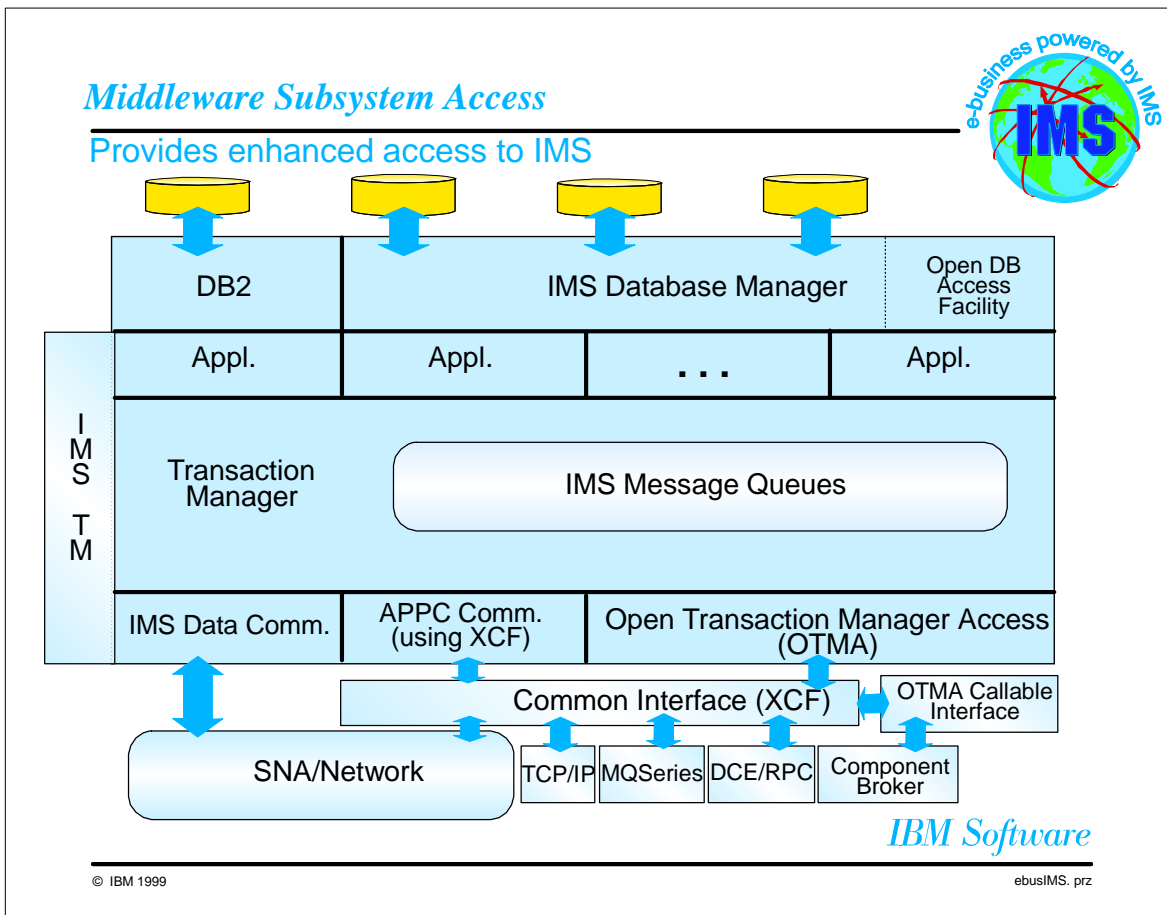
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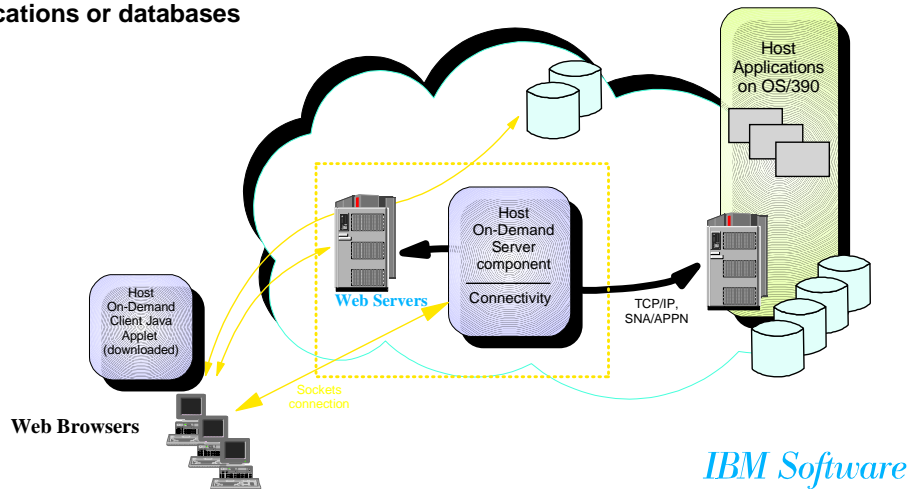
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IBM Host On-Demand at the simplest connectivity level is an Internet-to-SNA connectivity solution that provides 3270 application discovery and access through the WWW. It brings network computing to the web by letting Java-enabled browsers seamlessly access non-Internet-based content and services. It provides a general-purpose Java-based TN3270 solution for SNA application access for web-based users. Host On-Demand exploits the Java environment and uses industry standard TN3270 protocols to deliver significantly better response time, while using less network bandwidth than HTML-to-3270 mapper implementations. It also provides multiple options for emulator screen presentations; a screen can be presented within the Web browser window or as a separate window on the end-user desktop.

IMS WWW Templates

Provides sample mapping aids and access via APPC

S/390 · Web Server · Internet · Web Client · e-business powered by IMS · IMS

Domino Go Webserver or other Web Server

IMS DB · DB2 · IMS TM · APPC

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

Web Client - uses standard browser

IMS MPP or BMP Application

C or other languages and communication services (APPC)

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Early in the Internet world, IMS also began providing preliminary connectors for web access. IMS WWW Templates contained samples and templates for providing Web access to IMS programs that accept APPC connections. The templates are invoked from the Web server on any APPC platform (such as S/390, OS/2, Windows, AIX, Sun Solaris, or OS/400) and provide the conversion between URL and HTTP information and APPC protocols. These gateway programs provide a combination of formatting routines and macros for customers to use as models in providing their own access. These are available along with a number of other samples and tools through the OS/390 BonusPakII and its home page at: http://www.s390.ibm.com/nc/bonuspak.

The IMS WWW Templates are used to access IMS systems with CGI or ICAPI used to communicate with IMS transactions. Requested IMS transaction information is provided, mapped to HTML, and returned to the Web Browser for display or manipulation. This program is written in C and calls APPC routines to communicate with IMS, thus providing a flexible, interactive, portable interface into IMS. It can be used as a starter to assist customers in preparing their own programs for accessing their IMS applications/data, mapping the results into an attractive page for their users and sending the results back to the end users on their Web browsers. It can also be used to demonstrate web access capabilities, or modified to individual customer applications.

Middleware Subsystem Access
Provides enhanced access to IMS

	DB2	IMS Database Manager	Open DB Access Facility

IMS TM

| Appl. | Appl. | . . . | Appl. |

Transaction Manager — IMS Message Queues

| IMS Data Comm. | APPC Comm. (using XCF) | Open Transaction Manager Access (OTMA) |

Common Interface (XCF) — OTMA Callable Interface

SNA/Network

TCP/IP | MQSeries | DCE/RPC | Component Broker

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   Traditionally messages come into IMS through its SNA data communication protocol from VTAM. With APPC/IMS support in Version 4, IMS took advantage of the new Cross Coupling facility (XCF) to communicate with APPC/MVS. This was a software facility that allowed MVS subsystems to communicate more efficiently. With the IMS Version 5 Open Transaction Management Access (OTMA) facility, IMS extended its use of XCF for use by other IBM subsystems, such as TCP/IP, MQSeries, and DCE/RPC, providing them more efficient and richer capabilities in accessing IMS. OTMA allows access to existing, unchanged IMS applications on any IMS TM system on any MVS system of an MVS sysplex as well.
   The recently available IMS OTMA Callable interface provides a high level interface for access to IMS applications from other OS/390 subsystems. It presents an API to a C or C++ program to enable access and execution of IMS transactions through the IMS OTMA facilities. With this simple and easy-to-use interface, the invoker of the APIs can submit a transaction or command to IMS from within the OS/390 environment without the necessity of understanding the more technical protocols of the MVS Cross Coupling Facility or the IMS OTMA. This enhancement makes OTMA easier to use, providing a callable interface for other IBM subsystems, such as those of the Component Broker technology, and for non-IBM subsystems as well. The Open Database Access facility (ODBA), for easier database access, has also been recently provided.

Provides improved access via TCP/IP
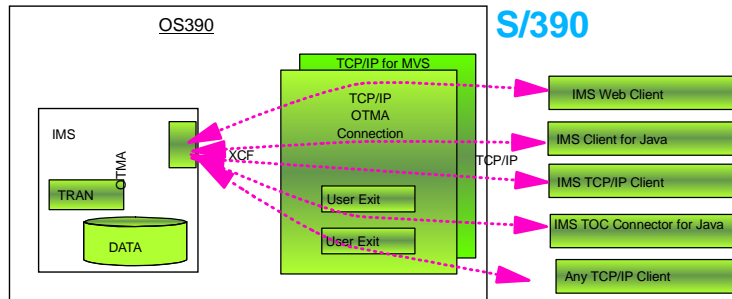
- **IMS provides host components enabling remote workstations to exchange messages with the IMS:**
  - Host Web Service (HWS): An MVS application program that provides:
    - TCP/IP communications to TCP/IP clients or Web browsers
    - IMS OTMA communications to IMS
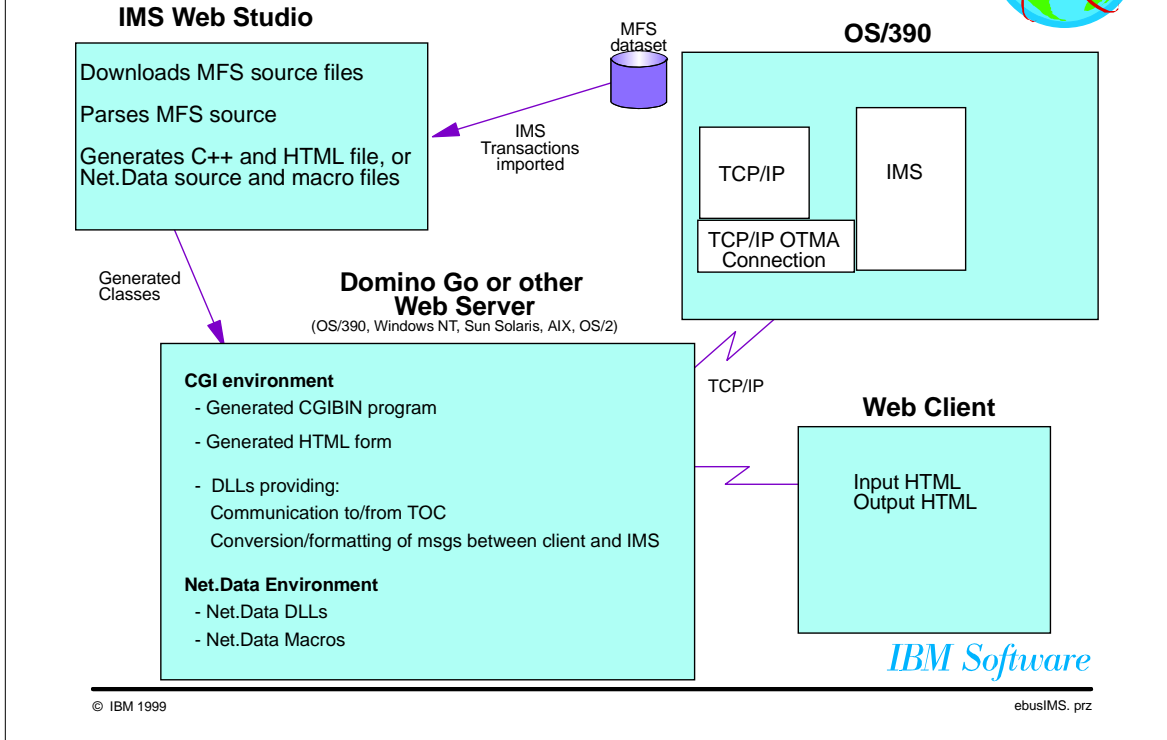 - Base Primitive Environment (BPE): A system-service component that runs under the HWS

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TCP/IP allows interoperability between equipment supplied by different vendors on multiple platforms, and it provides access to the Internet. The IMS TCP/IP OTMA Connection (ITOC) provides enhanced communication linkages between remote workstations and IMS. It provides improved performance and access for users of TCP/IP in accessing IMS applications and data. It supports multiple TCP/IP clients accessing multiple IMS systems. ITOC provides access from any TCP/IP-supported environment into IMS. This support utilizes OTMA. OTMA is an alternative to the earlier TCP/IP IMS Sockets support via an IMS Listener and IMS Assist modules. With OTMA, all output from the IMS transaction is passed to the IMS message queue for routing as in normal IMS processing, which preserves data integrity. Both RACF and MSC transactions are support. The TCP/IP client GIVESOCT/TAKESOCKET logic is eliminated, improving performance and reliability. ITOC provides TCP/IP access for Internet communication with IMS for use with the IMS Web tool, the IMS Client for Java, or for independent access across a TCP/IP network into IMS. Support for the latter will also utilize specially-provided exit code. ITOC allows user-written programs running in its address space to convert customer message format to OTMA message format before it ships to IMS. The same user-written programs can also convert OTMA message format to customer message format before sending a message back to a client. MVS TCP/IP already has an exit written for general customer use.
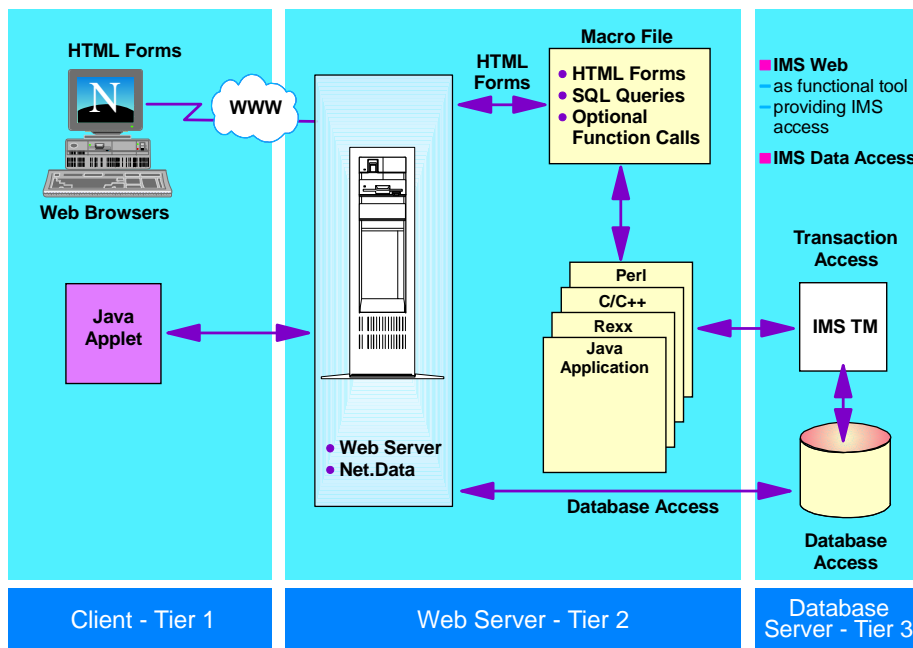
Provides mapping prep tool and access through IMS TOC

IMS Web Studio

Downloads MFS source files

Parses MFS source

Generates C++ and HTML file, or Net.Data source and macro files

MFS dataset

IMS Transactions imported

OS/390

TCP/IP

IMS

TCP/IP OTMA Connection

Generated Classes

Domino Go or other Web Server
(OS/390, Windows NT, Sun Solaris, AIX, OS/2)

CGI environment
 - Generated CGIBIN program
 - Generated HTML form
 - DLLs providing:
   Communication to/from TOC
   Conversion/formatting of msgs between client and IMS

Net.Data Environment
 - Net.Data DLLs
 - Net.Data Macros

TCP/IP

Web Client

Input HTML
Output HTML

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   IMS Web was provided as an early tool for internet use by customers in preparing for and providing access to IMS applications across the internet. Utilizing information available from IMS, it generates the code necessary for mapping and communication between the web and IMS. It contains a preparatory tool as well as run time code for the specific server environment. It then accesses IMS through the IMS TCP/IP OTMA Connection. The preparation tool generates applications and classes for a variety of server environments. It draws information from the Message Format Services (MFS) of IMS, allowing a customer t o browse and download a set of MFS source files for conversational or non-conversational transactions and then generates web applications for access between web browsers and IMS applications.

Net.Data with any Application

e-business powered by IMS
IMS

HTML Forms

Web Browsers

Java Applet

WWW

HTML Forms

Web Server
Net.Data

Macro File
- HTML Forms
- SQL Queries
- Optional Function Calls

Perl
C/C++
Rexx
Java Application

Database Access

IMS Web
- as functional tool
- providing IMS access

IMS Data Access

Transaction Access

IMS TM

Database Access

Client - Tier 1

Web Server - Tier 2

Database Server - Tier 3
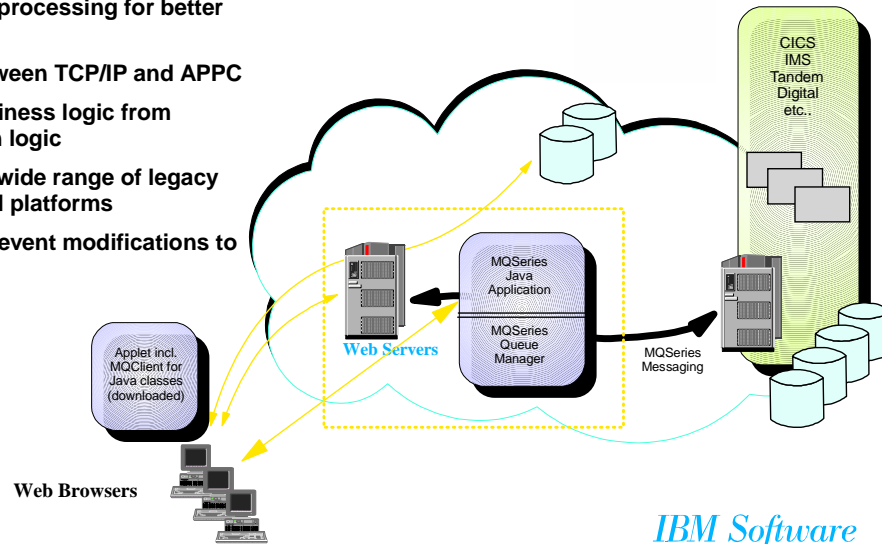
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IMS Web provided the capability to generate the Net.Data Web macro and run IMS transactions from a Net.Data environment. In the preparation stage, IMS Web generated the macros and created the Transaction Data Link Library for run-time access to IMS transactions through Net.Data. IMS Web extended this capability from Windows NT to OS/390 and AIX Net.Data servers. Other IMS access is also possible through additional IMS Connector access. With the availability of the new IMS V6 Open Database Access facility, access could be provided through DB2 Stored procedures to IMS DB data directly. The IMS Open Database Access (ODBA) facility provides a callable interface for improved access using the IMS Database Resource Adapter (DRA) facilities, to enable a connection from any OS/390 Recoverable Resource Management Services (RRMS) managed application-enabled environment to access IMS DB databases. These OS/390 applications accessing IMS DB could include, for example, not only DB2 Stored Procedures, but also OS/390 Web Server applications, APPC/MVS Transaction programs, and/or batch programs.

MQSeries Internet Gateway - Application Access

- ■ **Reliable message delivery through a middle-tier web server to backend applications**
- ■ **Provides transactional message store**
- ■ **Overlapped processing for better throughput**
- ■ **Bridges between TCP/IP and APPC**
- ■ **Isolates business logic from presentation logic**
- ■ **Accesses a wide range of legacy systems and platforms**
- ■ **Can "push" event modifications to the browser**

CICS
IMS
Tandem
Digital
etc..

MQSeries
Java
Application

MQSeries
Queue
Manager

Web Servers

MQSeries
Messaging

Applet incl.
MQClient for
Java classes
(downloaded)

Web Browsers

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MQSeries addresses Internet challenges by providing robust communications between application components (running across the internet or a customer's private network) and a flexible and scalable environment in which to develop complex, reliable, WWW applications. MQSeries brings assured message delivery, time-independent (offline) communications, synchronization of messages into logical units of work, and connectivity between applications in many different system environments connected over IP or SNA networks. MQSeries provides a natural extension to IMS to the Internet and now uses the IMS V5 OTMA interface for efficient access. It provides a connector for web and Java access as well.

e-business powered by IMS

IMS

MQSeries Family

Family Traits

MQSeries Workflow
- Workflow, Process Flow
- Application Services
- Tools

MQSeries Integrator
- Xform, Rules, Routing
- API Framework
- Templates, Utilities

MQSeries
- Messaging Services
- Standard Formats
- Tools

- Modular Set of Offerings
- MQSeries Foundation
- Common Look and Feel
- Management/Monitoring
- Messaging Tools

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► MQSeries is also becoming the foundation of Business integration solutions, reducing the time and cost of integration and the distributed messaging infrastructure. It simplifies the process of information exchange between a company's different business applications. And it functions across a total of more than 35 different operating environments. By centralizing data formatting and simplifying data routing information, the MQSeries Integrator takes the burden off an organizations programmers. It can help us do the transformation, the rules, and the routing. And MQSeries Workflow can be used to manage the workflow.

IMS Object Connector
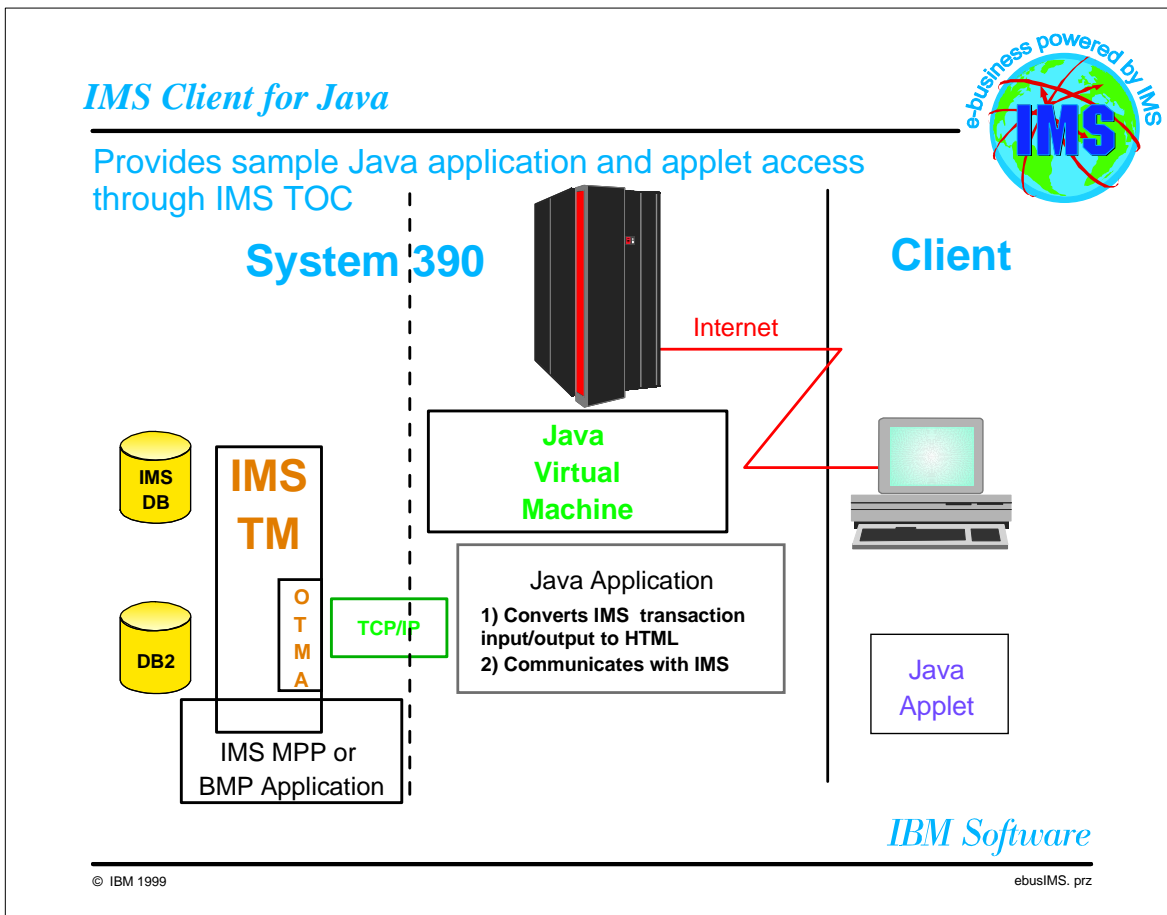
Provides object mapping tool and access to IMS
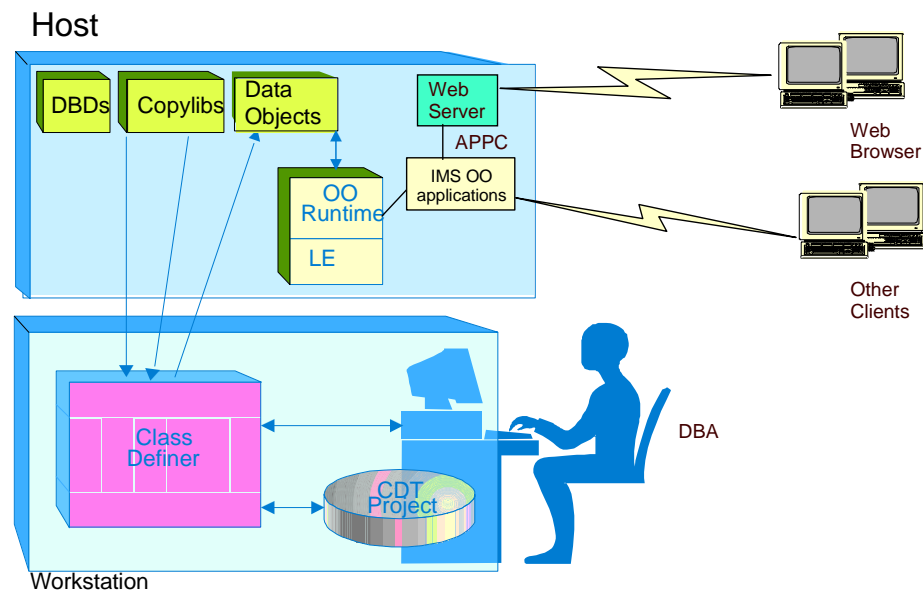
- ► The IMS Object Connector another early tool deployed new C++ OO application programs to access IMS transactions and data. The OO applications are either IMS DB batch or IMS TM applications. The IMS Object Connector generates C++ classes which wrap IMS DB segments. And with its runtime support, OO application programs can access IMS DB data through these generated classes. This offers improved application programmer productivity by supporting OO programming, eliminating DL/I coding, and supporting use of OO programming tools.

- ► Using the Java-based IMS Object Connector Class Definition Tool (CDT), you are able to define and generate IMS data object classes using an interactive user interface or using a command-line interface. IMS database information is stored in the CDT catalog. IMS Object application programs can use these generated data objects.

- ► The IMS DL/I Objects Framework is the run-time environment for the IMS data objects that you define using the CDT. This framework manages these IMS objects from creation to deletion and dynamically constructs application requests to DL/I calls.

- ► Reuse would be used of some of the Object Connector tools in developing Java applications to run in IMS.

IMS Client for Java

Provides sample Java application and applet access through IMS TOC

System 390

Client

Internet

Java Virtual Machine

IMS DB

IMS TM

DB2

O T M A

TCP/IP

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

Java Applet

IMS MPP or BMP Application

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IMS is exploiting the latest programming technologies for the Internet. This includes Java, which enables interactive and multimedia applications in a simplified fashion. With Java, users can transparently download and seamlessly run applications. This may be something as simple as animating the title of the HTML file, or something more complex, such as automatically retrieving desired information from various sites around the Internet and manipulating it. Java is multithreaded and interpreted. It can thus be widely used and is platform independent.

Initially provided here for this environment was the IMS Client for Java, which consists of application and applet sample code for preparing a Java program to access IMS applications and data, and a user exit to translate the message into the format required by the IMS Version 5 Open Transaction Manager Access (OTMA) interface. This code uses the IMS TCP/IP OTMA Connection to access IMS.

IBM has ported Java to the S/390, providing the popular Java run-time environment from PCs to S/390s. IBM Webserver for OS/390 have been able to host Java applets for downloading to Java-enabled Web browsers. And the IMS Client for Java provided an initial applet for this purpose.

Extending the Enterprise with Java

- Multi-tiered Architecture
  - Web Application Platform
  - Server-side business logic
  - Web server functions -- HTTP/IIOP
  - Mid-tier gateways and servers providing web access
- Gateway function
  - Maps HTML to native languages
  - Utilizes middle-tier web servers
- Applets and Beans
  - Java-based access and visual beans
- Enterprise systems
  - Enterprise databases
  - Enterprise appls
  - Transaction-based Systems
- Enterprise Java Technologies
  - Provides more server-side processing
  - Provides greater control, security, and performance for data access

Web Application Platform

Web Browsers

Web Servers

Connectors

Java Clients

Databases Transaction Systems Applications

Applets
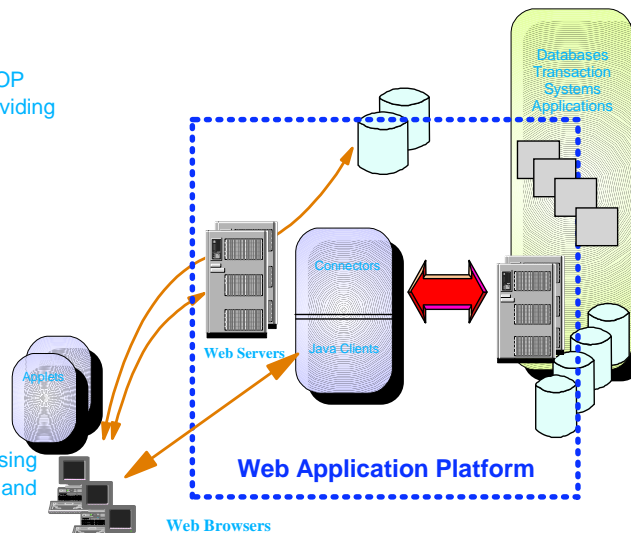
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▸ Java is an important new technology in the world of the Internet. It is a simple, robust, object-oriented, platform-independent, multithreaded, dynamic, general-purpose programming environment for creating applications for the Internet and Intranet. Developed by Sun Microsystems, it is object-oriented, distributed, interpreted, architecture-neutral, and portable.

▸ Java can be used in a multi-tiered architecture, built on a web application platform with server-side business logic and mid-tier gateways and servers, providing web access, mapping HTML to native programming, and utilizing web server functions with Hypertext Transport Protocols (HTTP) and Internet Interoperability protocols (IIOP).

▸ It can be used to create downloadable program fragments, called applets, that augment the function of a Java-capable browser, such as Netscape Navigator. Java applets are being developed for use with each of the IBM Connectors.

▸ An initiative called Java Beans has been developing a set of APIs that will make it easy to create Java applications from reusable components. Java Beans will be used in a wide range of applications from simple to full-scale, mission critical applications. Java Beans are being provided by the IBM Connectors for more integrated, reusable access among the pieces.

▸ Enterprise solutions for Java area also being provided for access to enterprise applications, databases, and transaction-based systems, like IMS. These Enterprise Java Technologies provide more server-side processing and greater control, security, performance for data access.

- **Extending the Enterprise**
  - Enabling web access to distributed enterprise-wide data and information systems for content serving, collaboration, and/or commerce
- **Web Application Server**
  - A physical or logical mid-tier, middleware application server connecting a web client to back-tier databases and transaction systems.
- **e-business Software Portfolio ("playbook")**
  - Set of Internet-based software solutions for doing business on the web
  - Roadmap of IBM/Lotus/Tivoli products and tools within a structure for content management, collaboration, and commerce
  - Cohesive strategy for Internet/intranet opportunities
- **Network Computing Framework ("rulebook")**
  - Open, flexible software architectural model
  - Technologies, industry/de facto standards, protocols and interfaces positioned within a multi-tiered architecture
  - Maps requirements and core components back to the e-business Software Portfolio
- **Java Bean**
  - A reusable software component that can be manipulated visually in a builder tool.
- **Enterprise Java**
  - Server-side Java programs to help extend enterprise-wide data and information to the web
  - A suite of Java APIs to existing platforms (EJB, JDBC, JMS, JNDI, JTS, ...)
- **Enterprise JavaBean (EJB)**
  - A Java Bean which operates on a server
- **Enterprise Java Server (EJS)**
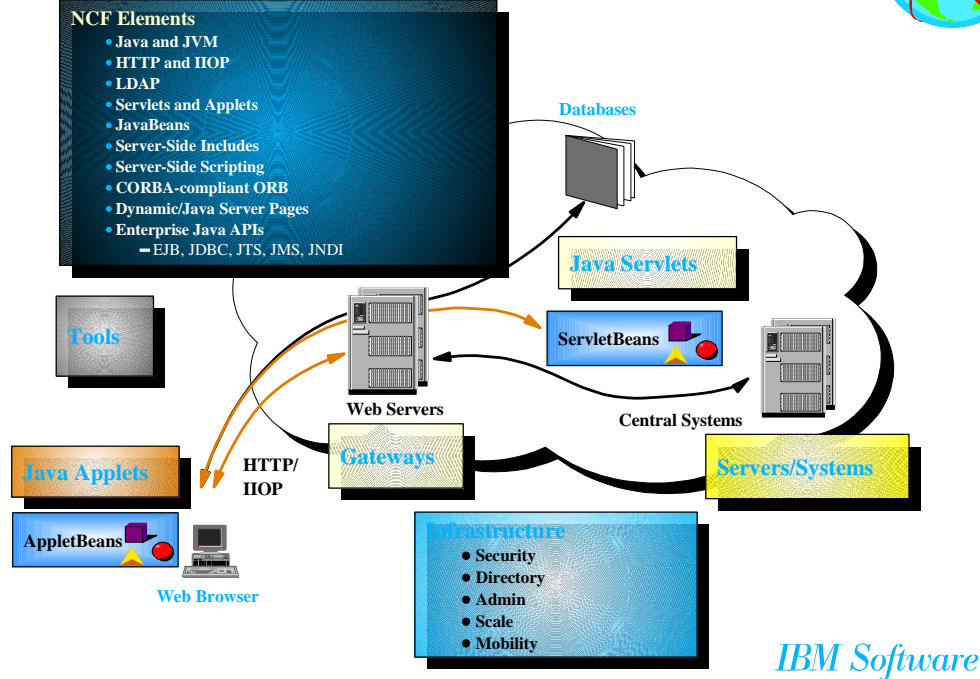 - A server focused on providing a Java infrastructure for EJBs

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► First, let's start with some definitions for what we are about to cover here. We start out extending the enterprise, enabling web access to distributed enterprise-wide data and information systems for content serving, collaboration, and/or commerce. We provide web application servers as physical or logical mid-tier, middleware application servers connecting a web client to back tier databases and transaction systems. We have an e-business software portfolio -- a set of software solutions, a roadmap of products and tools, and a cohesive strategy for using the internet/intranet. We provide a Network Computing framework, offering an open model of technologies, standards, protocols, and interfaces, and mapping back to the portfolio. Then we introduce the Java Bean, a reusable software component that can be visually manipulated, and Enterprise Java, server-side Java programs and suite of APIs, rolled up into Enterprise JavaBeans and running on an Enterprise Java Server, providing the infrastructure for all of this.

Multi-tiered Architecture

Standards makes it possible. The Framework makes it work.

NCF Elements
- Java and JVM
- HTTP and IIOP
- LDAP
- Servlets and Applets
- JavaBeans
- Server-Side Includes
- Server-Side Scripting
- CORBA-compliant ORB
- Dynamic/Java Server Pages
- Enterprise Java APIs
  - EJB, JDBC, JTS, JMS, JNDI

Databases

Java Servlets

Tools

ServletBeans

Web Servers

Central Systems

Java Applets

HTTP/ IIOP

Gateways

Servers/Systems

AppletBeans

Web Browser

Infrastructure
- Security
- Directory
- Admin
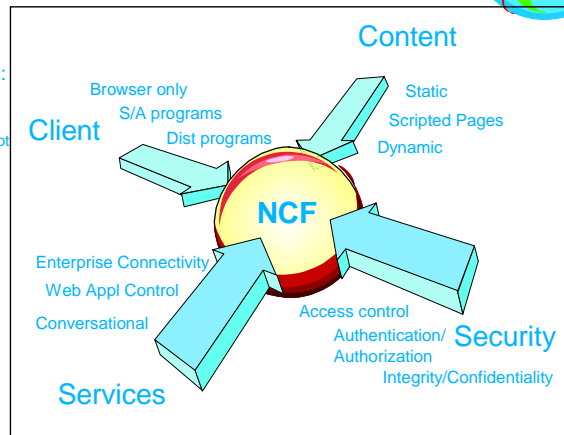- Scale
- Mobility

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▶ NCF consists of the following components: an open pluggable framework centered on Java, a set of software servers that are accessed through standard protocols and Java interfaces, a set of clients that exploit just-in time downloadable components, tools that exploit the JavaBeans component standard, standard technologies to link components, such as HTTP and IIOP, A set of built-in groupware solutions and a foundation for e-business applications, and a set of connectors to existing data and transactions. NCF provides for a Web server and Java Virtual Machine together with Java interfaces to many services. NCF provides application programming support in the form of development tools and support for JavaBeans, applets, and servlets. In addition to the Web server and Java-oriented application programming environment, are services that include software servers for community (mail and related services), collaboration, storing and retrieving data, transaction support and delivery services ices. These services are made available to Java applications by means of Java APIs and JavaBeans. NCF also includes systems management services. NCF supports both e-business applications written in programming languages such as C and C++ and applications written in Java.

NCF and WebSphere

Typical web application scenarios drive the need to consider various functional dimensions that "start simple and grow fast":

- Client
  - HTML, MIME, XML
  - Java Applets, JavaBeans, DHTML, JavaScript
  - EJB, RMI/IIOP
- Content
  - HTML, MIME
  - Java Server Pages
  - HTTP Servlets
- Security
  - HTTPS, SSL
  - x.509V3 certificates
  - HTTP Servlets, JCE
- Services
  - HTTP Request, HTTP Session operations
  - JNDI, JDBC, JTS, ...
  - EJB, RMI/IIOP

Content — Browser only, S/A programs, Dist programs — Static, Scripted Pages, Dynamic

Client — NCF

Enterprise Connectivity, Web Appl Control, Conversational

Access control, Authentication/Authorization, Integrity/Confidentiality — Security

Services

NCF is a web application architecture identifying industry standard components, services, and protocols used to design web applications

IBM WebSphere is the implementation of NCF providing tools and a runtime environment used to develop and deploy web applications
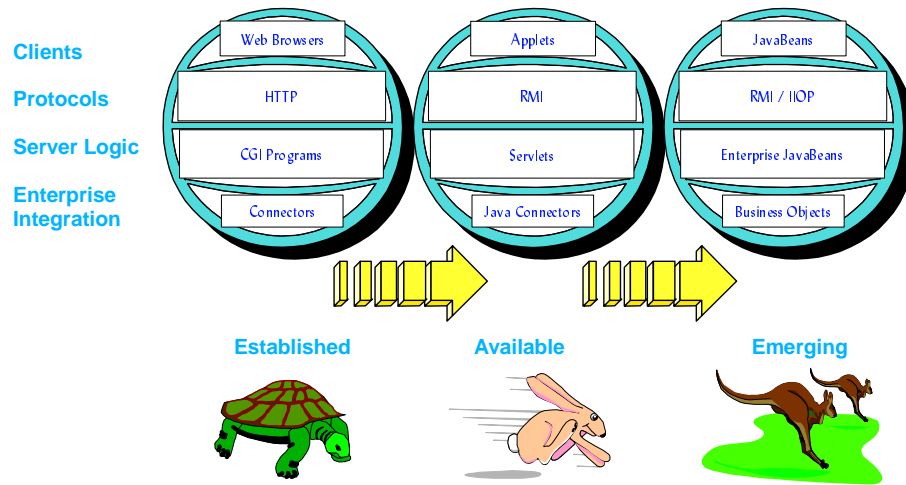
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➤ Typical web application scenarios drive the need to consider various functional dimensions that "start simple and grow fast. They must address web and other Java clients, their standards and protocols, and the content, security, and services required.

➤ NCF is thus a web application architecture identifying industry standard components, services and protocols used to design web applications. It defines the standards for client, content, security, and services. IBM WebSphere is the implementation of NC, providing the tools and a runtime environment used to develop and deploy web applications. It addresses clients, which can be browsers, simple access programs. and distributed programs. It supports services for enterprise connectivity, web application control and conversational. It addresses static, scripted pages and dynamic content. And it supports security through access control, authentication, authorization, integrity and confidentiality.

Web Application Runtime Evolution

Clients	Web Browsers	Applets	JavaBeans
Protocols	HTTP	RMI	RMI / IIOP
Server Logic	CGI Programs	Servlets	Enterprise JavaBeans
Enterprise Integration	Connectors	Java Connectors	Business Objects

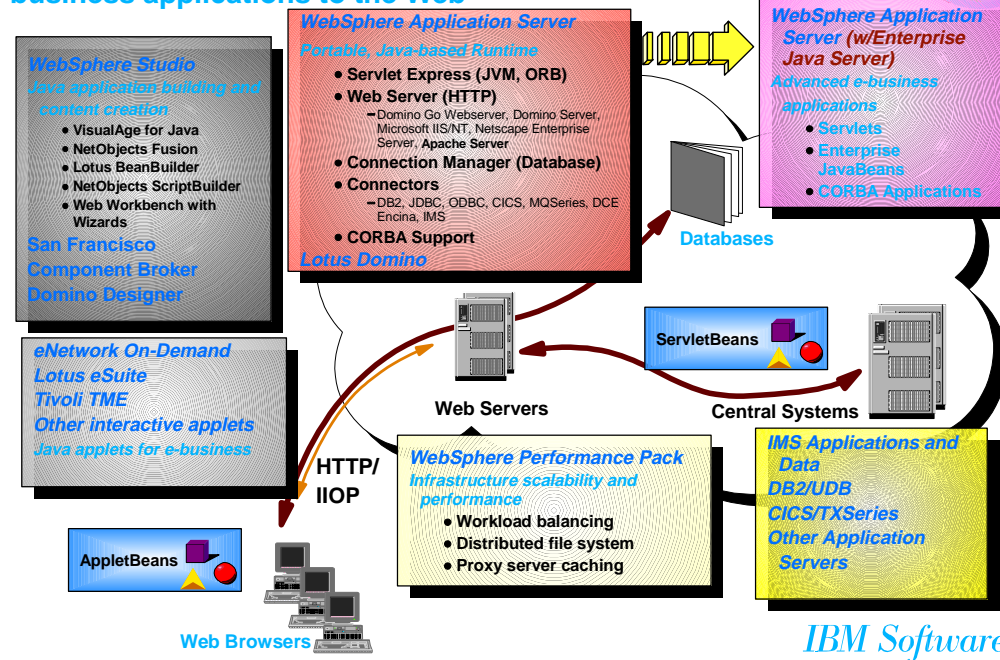Established   Available   Emerging

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► The evolution has brought us from a simple web browser, using HTTP protocols, accessing Common Gateway Interface (CGI) programs and connecting into the enterprise. Today we have solutions that generate downloadable Java applets, utilizing Resource Management Interface (RMI) protocols, communicating to servlets and utilizing Java connectors for enterprise integration. We are also already seeing emerge, JavaBeans using RMI or the Java Internet Interoperability Protocol (IIOP) to talk to Enterprise Java Beans and access Enterprise Business Objects.

Building Solutions

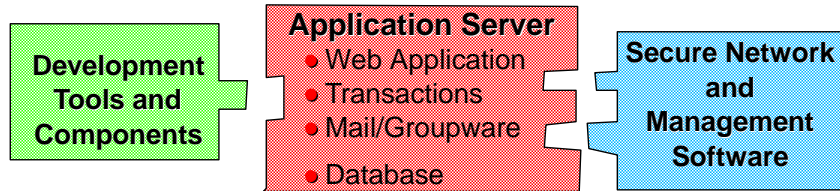A comprehensive set for extending core
business applications to the Web

e-business powered by IMS
IMS

WebSphere Studio
*Java application building and
content creation*
- VisualAge for Java
- NetObjects Fusion
- Lotus BeanBuilder
- NetObjects ScriptBuilder
- Web Workbench with
  Wizards

San Francisco
Component Broker
Domino Designer

WebSphere Application Server
Portable, Java-based Runtime
- **Servlet Express (JVM, ORB)**
- **Web Server (HTTP)**
  - Domino Go Webserver, Domino Server,
    Microsoft IIS/NT, Netscape Enterprise
    Server, **Apache Server**
- **Connection Manager (Database)**
- **Connectors**
  - DB2, JDBC, ODBC, CICS, MQSeries, DCE
    Encina, IMS
- **CORBA Support**

Lotus Domino

*WebSphere Application
Server (w/Enterprise
Java Server)*
*Advanced e-business
applications*
- Servlets
- Enterprise
  JavaBeans
- CORBA Applications

Databases

eNetwork On-Demand
Lotus eSuite
Tivoli TME
Other interactive applets
Java applets for e-business

ServletBeans

Web Servers

Central Systems

HTTP/
IIOP

WebSphere Performance Pack
*Infrastructure scalability and
performance*
- **Workload balancing**
- **Distributed file system**
- **Proxy server caching**

*IMS Applications and
Data*
DB2/UDB
CICS/TXSeries
*Other Application
Servers*

AppletBeans

Web Browsers

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- ► WebSphere has been providing the products for building end-to-end solutions with runtime, infrastructure, development, deployment, and management tools.
- ► WebSphere Application Server combines a portable Java-based runtime environment for Java servlets with connectors to back-end services, like databases, transactions, and enterprise middleware, as well as the necessary services to best utilize this environment.
- ► WebSphere Studio is providing Java application building and content creation tools.
- ► Java applets for e-business and tools for their creation are already being provided for access in a number of environments.
- ► WebSphere Performance Pak is providing an infrastructure for scalability and performance.
- ► Solutions are already being provided for access to IMS applications and data, with Java applications, applets and servlets. IMS beans and IMS as a server environment would also be provided.

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Application Framework for e-business

Application Framework for e-business

Development Tools and Components

Application Server
- Web Application
- Transactions
- Mail/Groupware
- Database

Secure Network and Management Software
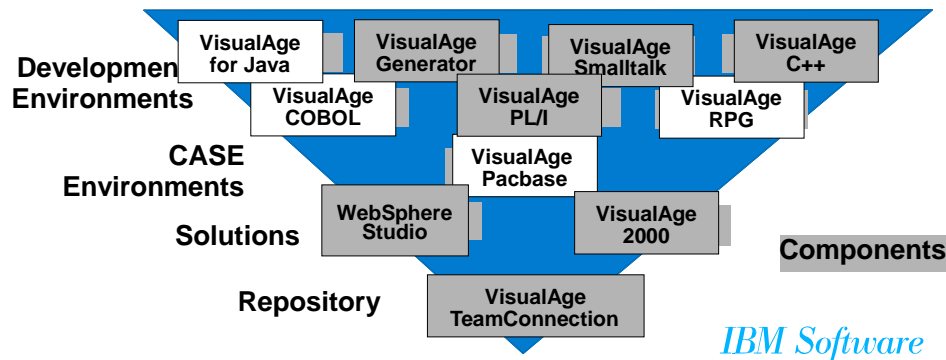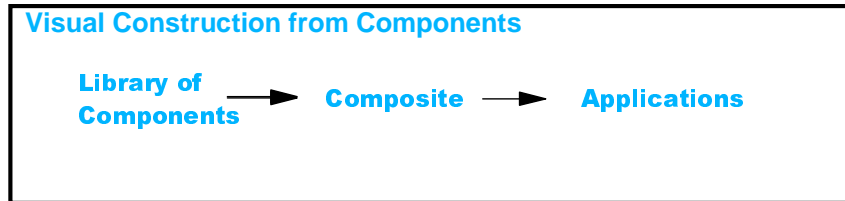
OS/390 OS/400 AIX Solaris HP-UX Linux OS/2 NT

- Extends existing applications into the world of e-business
- Rich capabilities to support simple to sophisticated applications with
- Rapid application development environment based on cross-platform standards including Java
- Systems managed for 24X7X365Xmillions

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▶ Over the past few years IBM has been helping customers develop and deploy applications that use the e-business application model. We've captured what we've learned in a family of battle-tested products and a prescriptive methodology that we call the application framework for e-business. Together they deliver a productive environment that lets developers leverage their existing skills to deliver a new generation of high-value internet, intranet and extranet applications. It helps developers extend existing applications by connecting them to the web and or integrating them with other applications. It enables multi-platform, multi-vendor systems for flexibility in meeting unknown business challenges. Based on industry standards it allows developers to continue with their choice of tools and middleware.

Visual Programming & Construction

Visual Construction from Components

Library of Components → Composite → Applications

Development Environments	VisualAge for Java	VisualAge Generator	VisualAge Smalltalk	VisualAge C++
	VisualAge COBOL	VisualAge PL/I		VisualAge RPG
CASE Environments		VisualAge Pacbase		
Solutions	WebSphere Studio		VisualAge 2000	Components
Repository		VisualAge TeamConnection		

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▸ We are also delivering a rich set of development tools and reusable application components. We start with VisualAge, an industry leading solution for developing applications that provide a consistent development environment across all programming languages. This allows skills developed for COBOL to transfer easily to Java. VisualAge also contains a rich set of connectors that tie in to existing applications and servers to get e-businesses up an running quickly. WebSphere Studio packages the best of VisualAge with the NetObjects family of Web publishing tools. Completing the development picture is a set of reusable components and frameworks designed to drastically reduce development costs and improve customers' ability to develop and deploy e-business applications.
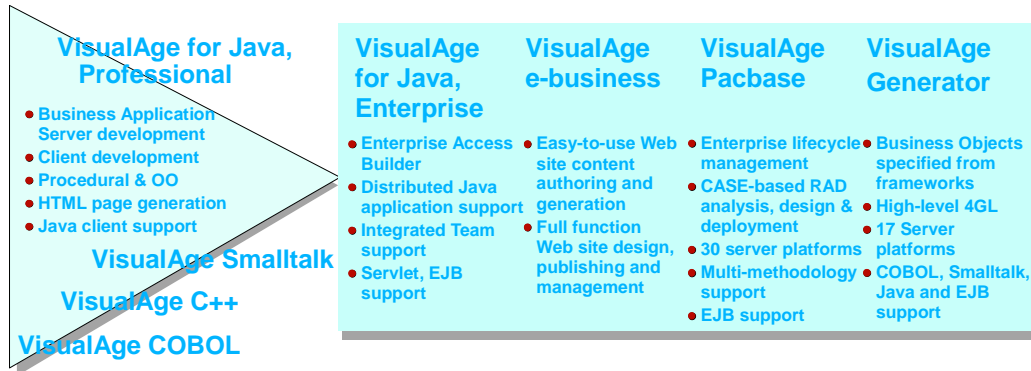
Developing e-business Applications

Language Centric → **Task Centric**

Web Environments

VisualAge for Java, Professional
- Business Application Server development
- Client development
- Procedural & OO
- HTML page generation
- Java client support

VisualAge Smalltalk

VisualAge C++

VisualAge COBOL

VisualAge for Java, Enterprise
- Enterprise Access Builder
- Distributed Java application support
- Integrated Team support
- Servlet, EJB support

VisualAge e-business
- Easy-to-use Web site content authoring and generation
- Full function Web site design, publishing and management

VisualAge Pacbase
- Enterprise lifecycle management
- CASE-based RAD analysis, design & deployment
- 30 server platforms
- Multi-methodology support
- EJB support

VisualAge Generator
- Business Objects specified from frameworks
- High-level 4GL
- 17 Server platforms
- COBOL, Smalltalk, Java and EJB support

Traditional Environments

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▶ VisualAge continues to drive the visual programming as we move into the world of Java and provides a range of supporting products for developing e-business applications. These can be used whether in traditional or web environments, and whether focused on language centric or task centric programming.
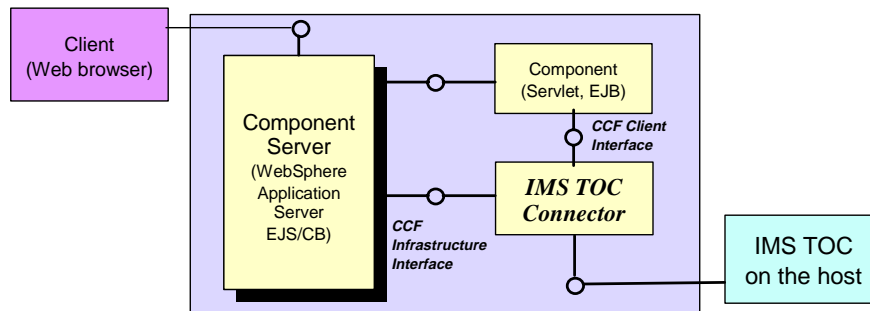
VisualAge Java Servlet Development Environment
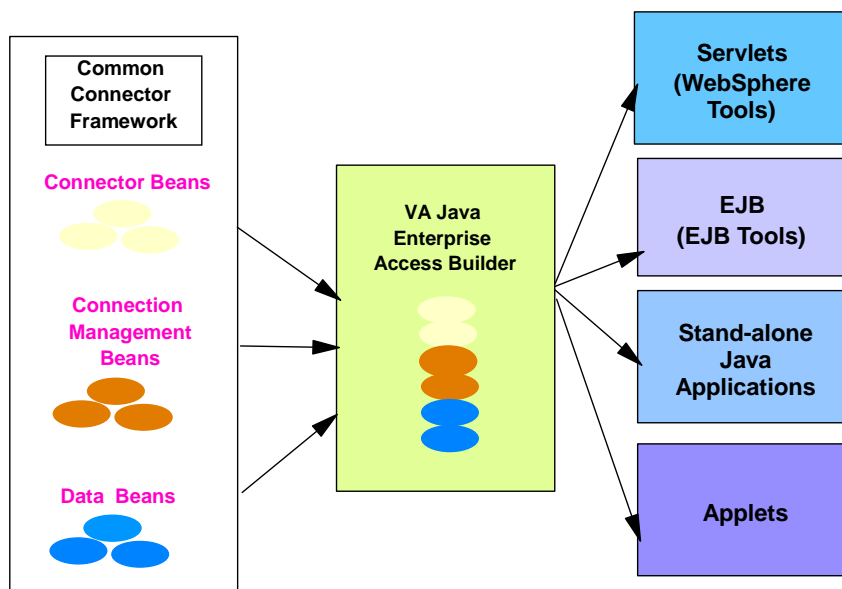
- ▸ IMS has provided the IMS Client for Java to help customers get started. Along with VisualAge Java and the WebSphere Application Server, IMS is also providing Java Connector beans (session objects) for IMS access from a Java servlet, through Visual Age Java and the IMS TCP/IP OTMA Connection. IMS Java Connector beans enable the use of visual tools in generating Java applications with IMS access. Servlets could be created by the WebSphere suite of tools and deployed in the WebSphere runtime environment. Connectors can be "wired" into these servlets to provide remote access to Database, Transactional, and other back-end applications. The Programmer wires the beans using VA Java, and uploads the wired Navigator bean for servlet building. The Page Designer builds servlets using WebSphere Application Server tools and uploads completed Servlet for producer to deploy.
- ▸ There will be many different Connectors shipped with WebSphere and VA Java. It is important that these connectors fit into a consistent usage model to minimize differences that programmers deal with to create servlets with remote system access. To this end, there will be consistency requirements and a Common Connection Framework specification to define Java interfaces that Connectors are implementing to better fit with IDEs and VA Java EAB.
- ▸ The Enterprise JavaBean Server and Container could also provide a scaleable runtime environment to execute a large number of these IMS and other session objects concurrently. IMS could also provide distributed coordinated commit for the generated servlet application with IMS applications.

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Common Connector Framework

- Defines a common and consistent set of Java interfaces that all connectors implement
- Implements common functions like connections and interactions with back-end resources
- Programmer does not have to deal with many differences among different connectors when building applications
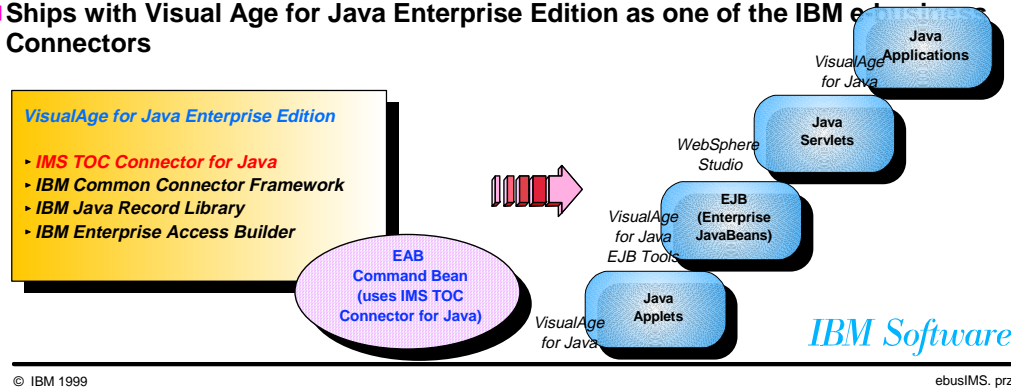- Other connectors include CICS, MQ, Encina, SAP, HOD, etc.

Client (Web browser)

Component Server (WebSphere Application Server EJS/CB)

Component (Servlet, EJB)

CCF Client Interface

IMS TOC Connector

CCF Infrastructure Interface

IMS TOC on the host

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► The Common Connector Framework is a set of common, consistent Java interfaces that connectors for any subsystem can and are implementing, making it easier for programmers not to worry about the differences between those subsystems.

►

► Common Connector Framework (CCF) provides a common client programming model for connectors. It provides a common and consistent set of Java interfaces that gives a component environment view of a connector and vice-versa. Therefore, a developer does not need to deal all the differences among different connectors

►

► By being compliant with the Common Connector Framework, IMS TOC Connector could be used in any component server environment that support CCF.

IMS TOC Connector for Java Overview

- **Helps customer make the transition to e-business by providing easy Java access to IMS**
- **Provides a way to create Java applications or servlets that can access existing IMS transactions**
- **Provides CCF-compliant Java Class libraries which interact with IMS via the IMS TCP/IP OTMA Connection (IMS TOC) on the host**
- **Provides Java bean classes to aid in visually composing applications. Applications can be easily and rapidly built by 'wiring' the Java beans and components together using the VisualAge for Java visual development tool.**
- **Ships with Visual Age for Java Enterprise Edition as one of the IBM e-business Connectors**

VisualAge for Java Enterprise Edition
- *IMS TOC Connector for Java*
- *IBM Common Connector Framework*
- *IBM Java Record Library*
- *IBM Enterprise Access Builder*

EAB Command Bean (uses IMS TOC Connector for Java)

VisualAge for Java — Java Applets

VisualAge for Java EJB Tools — EJB (Enterprise JavaBeans)

WebSphere Studio — Java Servlets

VisualAge for Java — Java Applications

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IMS TOC Connector for Java provides a way to create Java applications or servlets run on a Web server that can access existing and/or new IMS transactions.
It provides Java class libraries that are compliant with the Common Connector Framework. It is a Java bean component which connects to the IMS TCP/IP Connection (TOC) through TCP/IP to invoke IMS transactions.

IMS TOC is a separately provided component of IMS, running on the host IMS. IMS   TOC accepts messages from its TCP/IP clients and routes them to IMS OTMA using XCF (the Cross System Coupling Facility, a software facility of OS390, which makes it easier and more efficient for OS390 subsystems to communicate with or without the use of a hardware coupling facility).

The IMS Connector for Java has been shipped as a connector bean with Visual Age for Java, along with other IBM e-business Connectors for easy, consistent point and click development of your new Java applications.

IMS TOC Connector for Java enables customer to build new Java application or Java software components with the development provided by IMS. In conjunction with VisualAge for Java development environment , IMS TOC Connector for Java lets you rapidly develop Java applets, applications, EJBs that run your IMS transactions. With additional support from the IBM WebSphere Studio and IBM WebSphere Application Server, you can build and run Java servlets or EJBs that access your IMS transactions from Web sites.

Java Application Development

COBOL Source

VisualAge for Java COBOL Parser

Development Environment

Runtime Environment

IMS

VisualAge for Java

Java Application

Create

VisualAge for Java Enterprise Access Builder

EAB Command or Navigator

IMS TOC

IMS OTMA
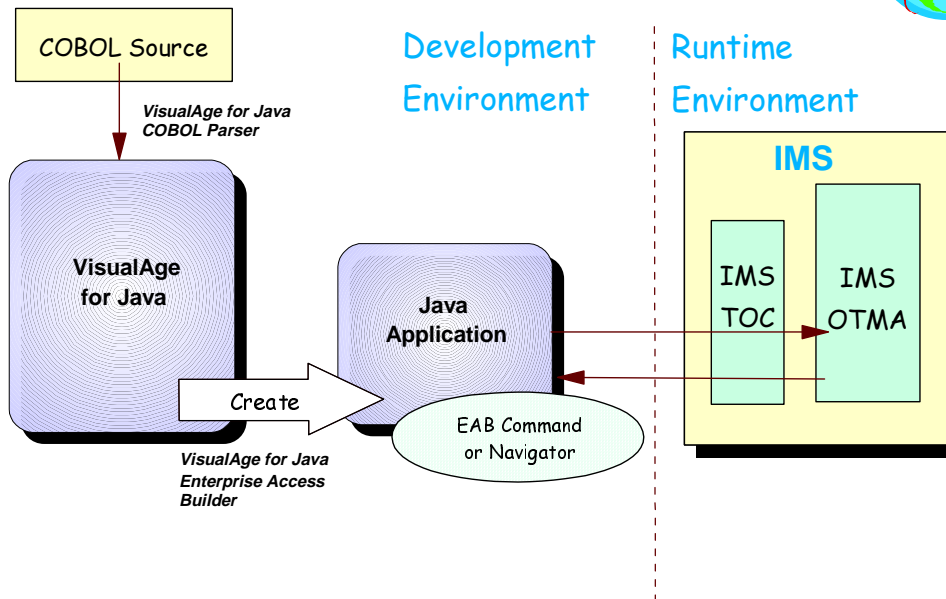
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▶ Customer can easily build Java application using VisualAge for Java tools. The diagram shows the steps to build a Java application.
▶ 1. Provide your COBOL source files to VisualAge for Java. These COBOL files contain definitions of the IMS transaction input and output messages. The COBOL Parser tool in VisualAge for Java will be used to parse the message definitions and generate input and output Java record beans.
▶ 2. In conjunction with Java beans provided by IMS TOC Connector and the input/output Java beans created in the previous step, an EAB command can be build visually using VisualAge for Java Composition Editor or Command Editor. An EAB command is a Java bean component which encapsulates a single interaction with the backend system.
▶ 3. Utilize the EAB command to build either a stand-alone Java application program that accesses IMS transactions via IMS TOC on the host.
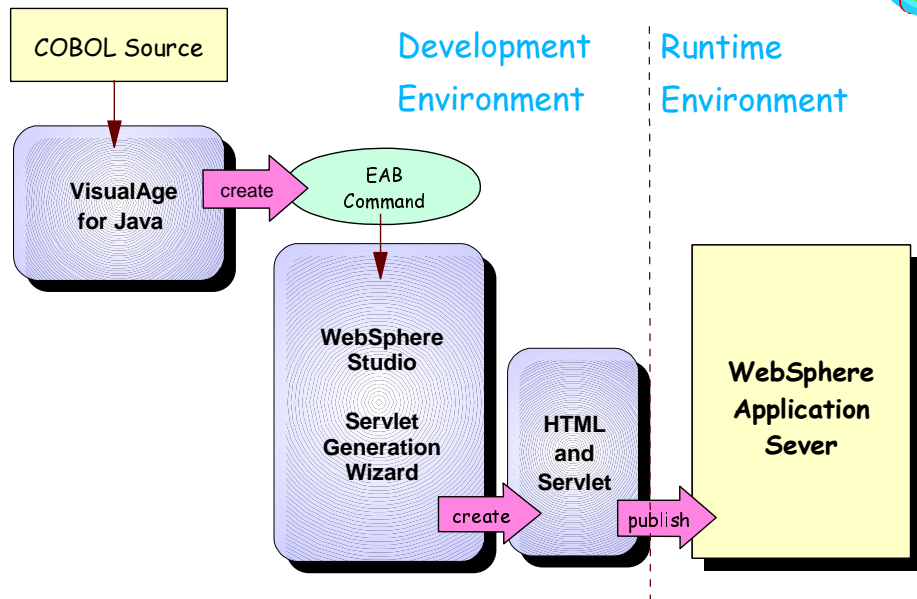
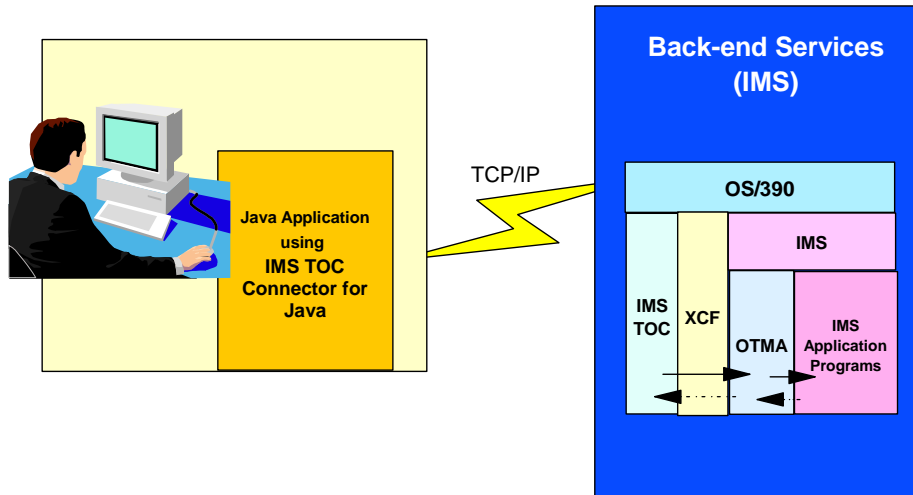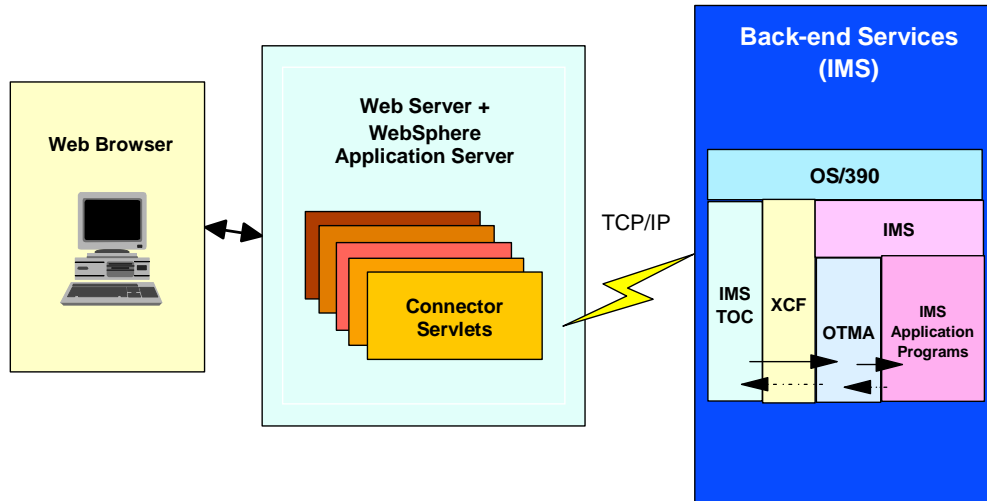*IBM Software*

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► Customer can easily build Java servlet using VisualAge for Java tools and WebSphere Studio tool. The diagram shows the steps to build a Java servlet.
► 1. Provide your COBOL source files to VisualAge for Java. These COBOL files contain definitions of the IMS transaction input and output messages. The COBOL Parser tool in VisualAge for Java will be used to parse the message definitions and generate input and output Java record beans.
► 2. In conjunction with Java beans provided by IMS TOC Connector and the input/output Java beans created in the previous step, an EAB command can be build visually using VisualAge for Java Composition Editor or Command Editor. An EAB command is a Java bean component which encapsulates a single interaction with the backend system.
► 3. Provide the EAB command to WebSphere Studio and its servlet generation wizard to generate HTML, .jsp files and a Java servlet.
► 4. Move the HTML and .jsp files and the Java servlet to the WebSphere Application Server to enable users to access your IMS transactions from a Web browser.

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Java Application Runtime Environment

Back-end Services
(IMS)

TCP/IP

OS/390

IMS

IMS
TOC | XCF

OTMA | IMS
Application
Programs

Java Application
using
IMS TOC
Connector for
Java

e-business powered by IMS

IMS

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The Java applet can run in any Java Virtual Machine environment, either
stand-alone or as an integrated part of a Web browser. The back end services on
OS390 are provided. The IMS TOC Connector for Java enables customers to
build new Java applications or servlets to invoke the existing IMS transactions.
Customers could build Java applications utilizing IMS TOC Connector for Java to
invoke existing IMS transaction. IMS TOC Connector for Java establishes a
TCP/IP connection with the IMS TOC component on the host. IMS TOC would
route the messages from and to IMS OTMA using XCF (Cross-system Coupling
Facility).
Customer could also build Java servlets or Enterprise Java Beans (EJB) that run
in WebSphere Application Server. The servlets or EJB utilizes IMS TOC
Connector for Java and establish a TCP/IP connection with the IMS TOC
component on the host. IMS TOC would routes the messages from to IMS
OTMA using XCF (Cross-system Coupling Facility).   User could then invoke the
Java servlets or EJBs to access IMS transactions from a web browser. through
the IMS TOC to IMS OTMA.

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Back-end Services (IMS)

Web Browser

Web Server + WebSphere Application Server

Connector Servlets

TCP/IP

OS/390

IMS

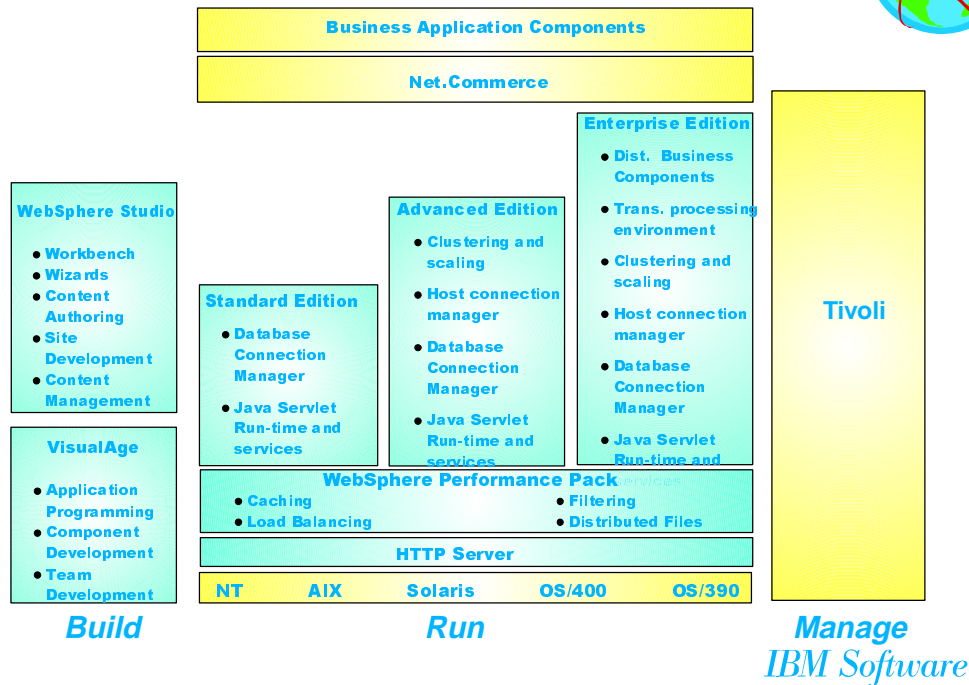**IMS TOC** | **XCF** | **OTMA** | **IMS Application Programs**

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If the Java application is published as a servlet, as would probably be the case, access to the Java application is via a Web Server from a Web browser.

e-business powered by IMS

IMS

Business Application Components

Net.Commerce

Enterprise Edition
- Dist. Business Components
- Trans. processing environment
- Clustering and scaling
- Host connection manager
- Database Connection Manager
- Java Servlet Run-time and services

Advanced Edition
- Clustering and scaling
- Host connection manager
- Database Connection Manager
- Java Servlet Run-time and services

WebSphere Studio
- Workbench
- Wizards
- Content Authoring
- Site Development
- Content Management

Standard Edition
- Database Connection Manager
- Java Servlet Run-time and services

VisualAge
- Application Programming
- Component Development
- Team Development

Tivoli

WebSphere Performance Pack
- Caching
- Load Balancing
- Filtering
- Distributed Files

HTTP Server

| NT | AIX | Solaris | OS/400 | OS/390 |

Build   **Run**   **Manage**

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▶ The WebSphere family of products simplifies the process of creating advanced e-business applications. In addition to the VisualAge tools and connectors, and the business applications components, there are a number of other pieces that make up the family. WebSphere Studio combines a visual interface with object oriented methods to help build web based applications.   The family allows for development on a platform of choice but also provides Information Systems operations management with the flexibility to choose deployment platforms based on business needs for security, availability, scalability, and access to existing data and applications. WebSphere comes in several flavors -- a standard, advanced and enterprise edition, depending on the company's sophistication of needs. The IBM WebSphere family of products support customers needs in the building, running (deploying) and managing of key e-business applications ranging from Web publishing to enterprise-level transaction processing. WebSphere standard, Advanced, and Enterprise Edition for Windows NT and Unix platforms provide specific solutions for Web presence, content hosting and application deployment needs. Security management is being provided through Tivoli. And Net.Commerce provides the tools for offering commerce across the web.

WebSphere Enterprise Edition for OS/390

e-business powered by IMS
IMS

Delivery
- Available today as part of Connectors integrated within key S/390 subsystems
- WebSphere Enterprise Edition for OS/390: available today as part of S/390 HW and SW configurations
- Available via FTP
- AD Tools - Available Separately
- Systems Management - Available Separately
- Application Layer

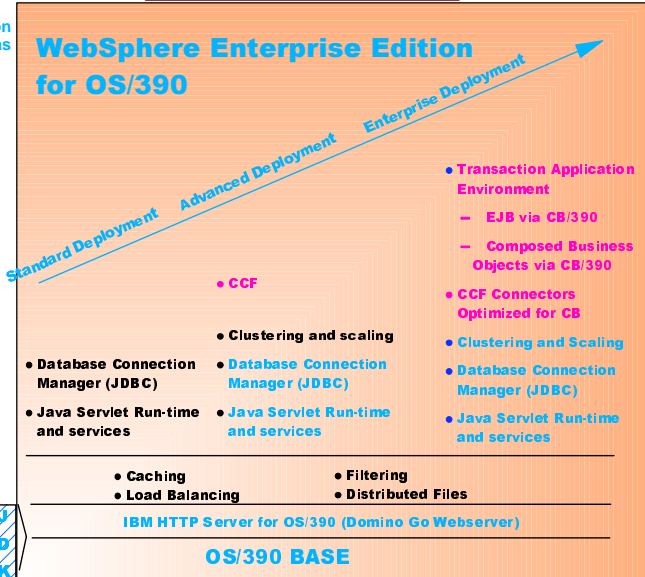Business / ISV Applications   Net.Commerce

Subsystems and Connectors

WebSphere Enterprise Edition for OS/390

Standard Deployment   Advanced Deployment   Enterprise Deployment

- Transaction Application Environment
  - EJB via CB/390
  - Composed Business Objects via CB/390
- CCF Connectors Optimized for CB

- CCF

- Clustering and scaling
- Clustering and Scaling

- Database Connection Manager (JDBC)
- Database Connection Manager (JDBC)
- Database Connection Manager (JDBC)

- Java Servlet Run-time and services
- Java Servlet Run-time and services
- Java Servlet Run-time and services

- Caching
- Load Balancing
- Filtering
- Distributed Files

JDK

IBM HTTP Server for OS/390 (Domino Go Webserver)

OS/390 BASE

WebSphere Studio
- Workbench
- Wizards
- Content Authoring
- Site Development
- Content Management

VisualAge
- Application Programming
- Component Development
- Team Development

Tivoli Agent and Framework

Build   *Run*   *Manage*

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▶ S/390s WebSphere Application server Enterprise Edition offers similar functionality and scales to the requirements of today's exiting S/3980 users. The WebSphere Application Server Enterprise Edition for OS/390 contains an integrated HTTP server a Java servlet engine, Java for OS/390, the WebSphere Common Connector Framework and Enterprise JavaBean enablement. IBM plans to continue to invest in delivering S/390 strengths into the WebSphere family of products, along with extensions to existing Internet technologies and application programming models. WebSphere Application Server Enterprise Edition for OS/390 includes delivery of and integration of Component Broker technology for the development of Enterprise JavaBeans (EJBs) for IMS with high qualities of service. IBM intends to combine the benefits of the IBM HTTP server for OS390 with the advantages of the Apache implementation. IBM's directions is to ensure that WebSphere implementations for S/390 and those for alternative platforms are part of a family, supporting integrated application development, security, deployment and manageability. S/390 allows the WebSphere Application Server Enterprise Edition for OS/390 to directly and reliably integrate existing transactions and data to new Web applications. S/390s Enterprise Edition along with connector technology reduces the need to front-end the S/390 server with a physical middle tier, providing access to IMS, CICS, and DB2 applications and data, resulting in lower systems management costs. .

EJB Architecture

- **EJB Server**
  - Execution system
  - Standard set of services to support enterprise bean components
  - Access to a distributed transaction management service
  - Activation/deactivation services
  - Load balancing
  - Fail-over support
  - The home for all EJB objects
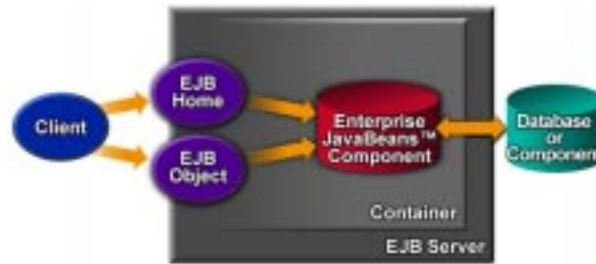
- **EJB Container**
  - Remote access/network interoperability
  - Transaction management
  - Authentication and authorization
  - Resource pooling
  - Concurrent service for multiple clients
  - Thread and process management
  - Clustering and high availability
  - Runtime for all EJBs

- **EJB Object**
  - External representation of EJB
  - Generated by the container at deployment
  - Exposes all application-related interfaces for the object but not interfaces that allow container to manage and control the object

- **EJB Home**
  - Container implements for each bean deployed in the container
  - makes available to a client via JNDI
  - Client uses Home interface to create and remove EJB objects

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► The EJB Architecture consists of EJB Servers, Containers, Objects, and Home elements. It is the infrastructure for the beans. The Enterprise JavaBean Server includes a set of predictable services (eg. logger-like function) that can be called, and Java classes that implement them. This allows the customer to write smaller business-oriented applications and call upon these services. It also supports portability, reuse, and assembly. These services can be passing data between objects and from a common access area. The EJB Server also provides changes in threading, i.e.. the address space/task structures changes are provided for improved performance. An EJB server must provide a single, simple programming model, be Java based, provide strong tools, be robust, secure and scalable. In this, different EJB servers and containers may offer different qualities of service or persistence, but transactions must be able to span multiple EJB Servers connected with IIOP. The EJB server provides object request brokers, the basic connectivity between users and objects. The EJB server can run the EJB, provide a container (reusable, encapsulated code with a well-defined interface), and provide access APIs. An EJB container runs in any EJB server and uses EJB application server services. An EJB container intercepts calls and inserts object services. It wraps around the bean and exposes the EJB home (the bean identifier) and the EJB object (client view of the bean). Beans consist of Session Beans, which are either stateful across methods or stateless, with no information maintained in the bean for storing, and Entity Beans for persistence (representing data in a database and with an identifier key).

►

e-business powered by IMS
IMS

Build applications & reusable components that leverage existing enterprise data & business logic

EJB   *Component Broker*

Build new workstation business logic and integrate with existing applications spread through a distributed environment

EJB   *TXSeries*

From simple assured delivery and multi-platform connectivity to intelligent messaging and business integration

EJB   *MQSeries*

Simple data access -- no application changes required

EJB   *Connectors*

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► We can move from the simplest level using Connectors through the more complex multi-platform connectivity and transaction integration levels to the most sophisticated   levels of application reuse, leveraging existing logic and data using Component Broker technology with EJBs.

Component Broker (CB)

CB enables new business processes from existing ones

Access Services

New Business Application

Direct Customer Access Appl.

Component Broker Managed Object Framework

Composed Customer

Composed Business Services

Component Broker Application Adaptors

Resource Services

CICS — Checking Account
IMS — Credit Card
DB2 — Personal Info
Oracle UNIX — Contact Mgmt
External Data Source Feed

IBM Software
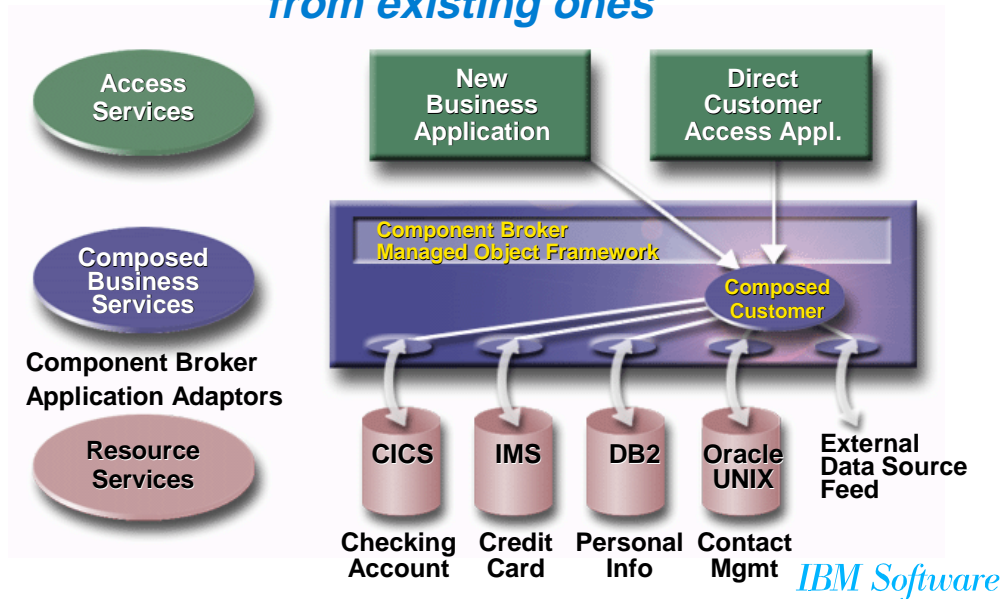
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► At the high end we've got what was known as Component Broker, now becoming part of WebSphere Enterprise. We're providing all of the services, very tight integration between the business objects or the application and the underlying services that are provided by the server, like security, integrity and life cycle. For example, when a Swiss Bank went through a merger, they needed to integrate all of the disparate systems and provide a unified front to the world. They needed to scale and run on various platforms. With Component Broker, they could continue to use all of their backend systems, including DB2, CICS, IMS, etc. They integrated around a set of core banking applications that included security, transactions, and foreign exchange. Today they run WebSphere Enterprise on an SP2 running AIX, on a 390 and on Sun Solaris. They provide a set of front ends for banking clients, including web browsers. They also provide connection to ATMs.

IMS Component Broker Access

A multi-tiered Distributed Computing Infrastructure for the Enterprise

- **Comprehensive Distributed Object Infrastructure**
- **Integrated Solution providing for:**
  - Development Environment
  - Runtime Environment with Client enablement and server objects
  - Server management environment
- **Enables operational reuse of existing logic and data controlled by a resource manager**
- **Offers the ability to 'compose' new combinations of information and function across multiple backend systems**
- **Cross Platform; adherence to OMG's CORBA standards; and desktop interoperability with de facto standards (MS's COM/DCOM/ActiveX)**
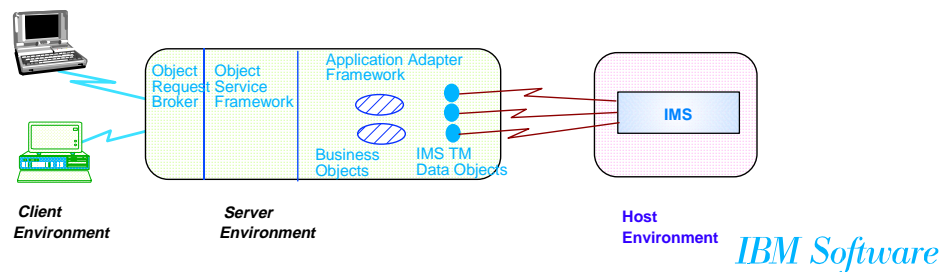
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► Component Broker is IBM's CORBA implementation. It provides a middleware solution for distributed object computing in a multi-tiered environment. It includes a CORBA 2.0-compliant ORB that permits a variety of clients to collaborate with business objects residing in multiple servers. State data is provided through data objects that map to various back-end systems, data sources, and transactions, including IMS. With Component Broker V1.3, IMS customers can already write first and second tier applications using C++ and Java objects to access IMS applications and data. IMS access is provided initially through APPC or Host on Demand facilities from any number of environments.

►

OS/390
CB/WebSphere
Environment

Object Request Broker | Object Service Framework | Application Adapter Framework

Business Objects | IMS TM Data Objects
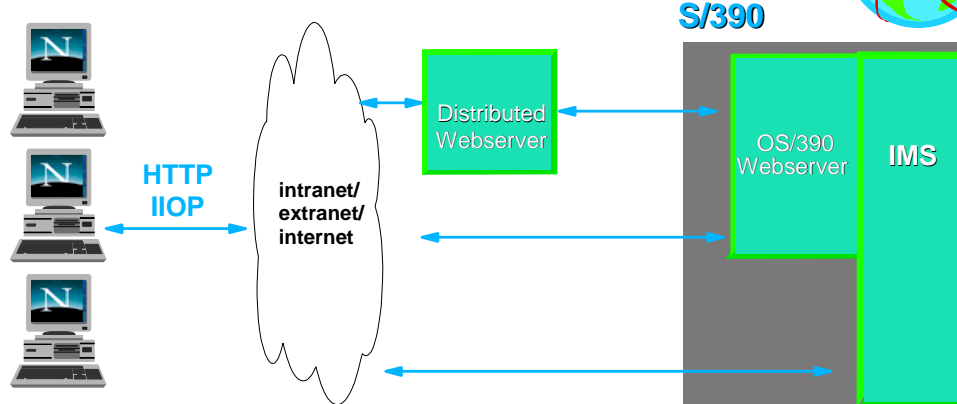
O T M A

IMS

Client Environment
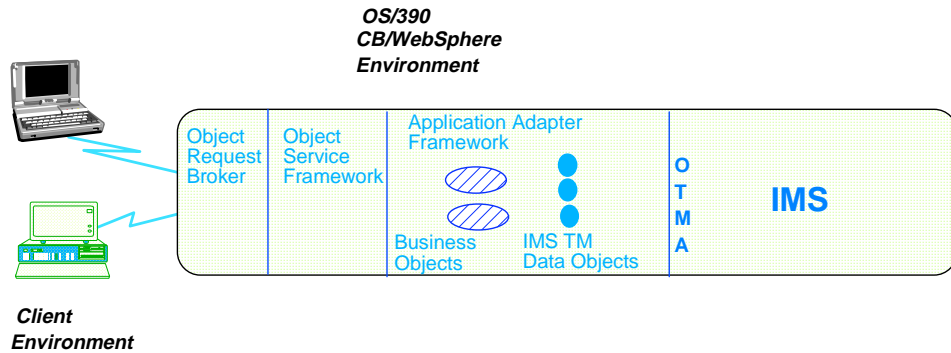
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▶ In a S/390 environment, access to IMS applications is also being provided through the IMS Version 5 OTMA Callable Interface.

▶

IMS Strategy

S/390

Distributed Webserver

OS/390 Webserver | **IMS**

HTTP IIOP

intranet/ extranet/ internet

- **Enable Web Browsers to invoke IMS applications**
- **Use standard HTTP and IIOP protocols**
- **Support both gateways and native access to IMS**
- **Enable Java as programming environment**

Scalable High Performance

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► Component Broker (CB) integrated with WebSphere can provide the EJB support for IMS in a two-tier or three-tier environment. Customers can use CB running in a mid-tier or in the S/390 with IMS to provide distributed two phase commit. CB provides the EJB container and the transaction manager capability for coordinated processing with IMS transactions. You can picture this as an EJB container on a mid-tier talking IIOP to a S/390 with CB and IMS. CB is evolving into an EJB container. IMS leverages the facilities of OS/390, which in this case includes the CB facilities. CB already provides a container to handle IMS transactions. When CB is not running on the S/390 then APPC protected conversation can be used for distributed two phase commit processing. CB on the S/390 will provide the container to handle IMS transactions. In this case OTMA will be used by CB and OS/390 Resource Recovery Services (RRS) to communicate with IMS and provide the synchpoint manager function. Customers can use entity beans if they do not need coordinated commit. If they need coordinated commit, they will want to use CB and RRS with IMS. As IMS has been designed to run only in a S/390 environment, it can therefore exploit the facilities of the S/390 and through it concentrate on providing the best performance/availability/cost for their customers in this environment. Unlike products that must run in other environments, IMS therefore does not need to provide this support independently of the S/390, but can use the S/390 facilities. IMS thus gets two-phase commit, security and other facilities for all this through the OS/390 facilities, thus simplifying the customers environment. The WebSphere Application Server environment thus provides Enterprise Java Server that supports EJB transactional processing (including Java Transactional Services) for IMS.
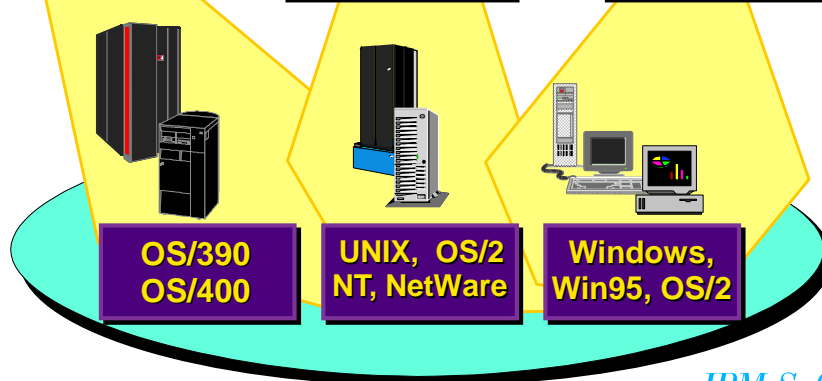
The Management Islands

Central Operations   Distributed Operations   LAN Administration

OS/390
OS/400

UNIX, OS/2
NT, NetWare

Windows,
Win95, OS/2

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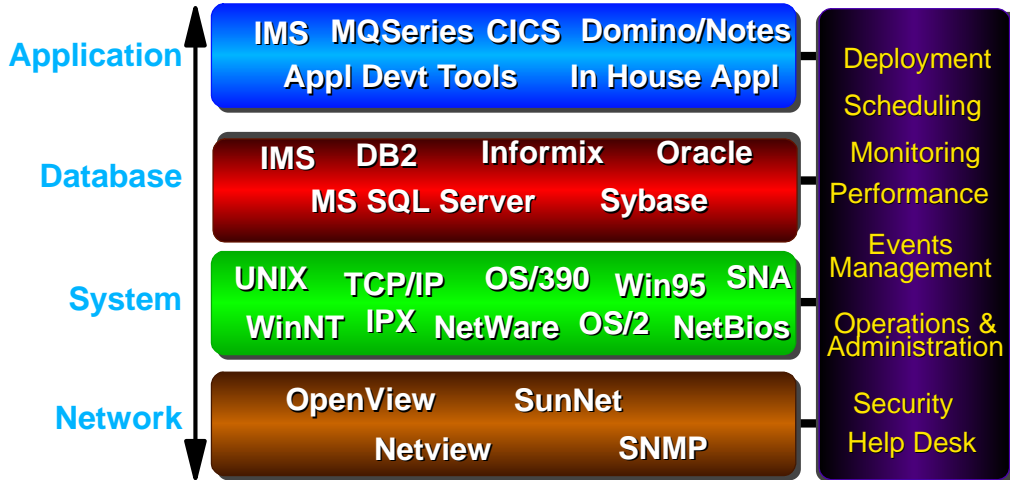
▶ IT organizations have had to manage using different tools that resulted in islands of management between host and distributed environments. The need for seamless end to end management becomes crucial to providing consistent quality and availability. Operations is a big concern for the distributed environment. The infrastructure needs to be there not only in each environment but for the consolidated bigger picture as well. Issues include security and management around the web, and scalability and availability, as well. How do I protect my assets? How do I ensure I've got connectivity with location transparency? When on the web, there's only certain pieces that you want to have go through the firewall. So we need to address these questions.

Systems Management

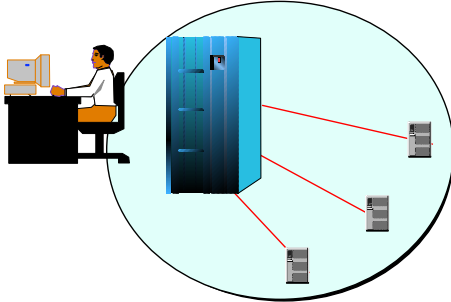**Tivoli**

A Complete Solution to Manage "the Stack"

e-business powered by IMS

Stack Layer	Components	Management
Application	IMS MQSeries CICS Domino/Notes Appl Devt Tools In House Appl	Deployment / Scheduling
Database	IMS DB2 Informix Oracle MS SQL Server Sybase	Monitoring / Performance
System	UNIX TCP/IP OS/390 Win95 SNA WinNT IPX NetWare OS/2 NetBios	Events Management / Operations & Administration
Network	OpenView SunNet Netview SNMP	Security / Help Desk

Tivoli *ready*

A Program to Increase Tivoli Product Technical Synergy

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▸ IBM wants to help our customers with the end-to-end ability to manage and secure their e-business. That's where Tivoli comes in. Tivoli helps us manage the application, do functional management for software distribution and inventory, manage the resources like networks, applications, and databases. We'll be continuing here to tighten up the integration and provide administrative capability. New Tivoli management products provide customers with integrated service level management, the ability to manage all host and distributed environments from OS/390 and extended network management support while providing business process views of all enterprise applications. Tivoli is delivering to customers a solution that addresses the cross-platform management challenges. Tivoli management is being made easier for customers since all IBM hardware and software products are being integrated and certified Tivoli Ready. These Tivoli enabled products will allow customers to automatically discover, inventory and mange the environments with Tivoli enterprise. Tivoli announced enhanced management support for OS/390 which include the Tivoli Manager for OS/390, Tivoli Service Desk, enhancements to Tivoli Netview for OS/390, and Tivoli Global Enterprise Manager and an OS/390 release of Tivoli Enterprise.

▸ IMS is becoming Tivoli ready. IMS management by Tivoli will be available in the Tivoli Manager for OS/390 in March, 2000. This uses the facilities of a common front end (the Global Enterprise Manager) for managing the systems.
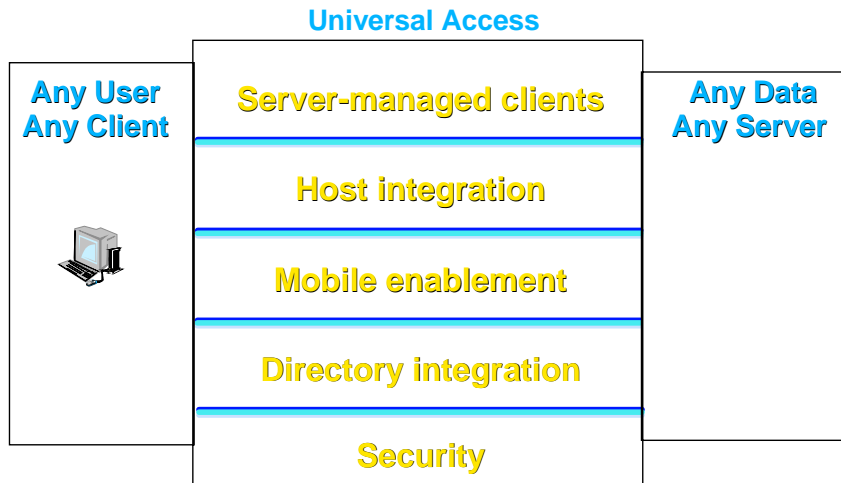
Systems Management

- Workload management and balancing
  - *C application interfaces*
- Systems Management Tools
  - *Enhanced for usability*
- Automation with *System Automation for OS/390 Release 3*
- Integration with Tivoli (Global Enterprise Manager and Tivoli Enterprise Connections)
- *SMP/E significantly enhanced*
- *Installation through ServerPac*

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S/390 capabilities, which centrally manage over half a million distributed resources scattered over an enterprise, are being enhanced to provide more robust control and automation. The S/390 Webserver takes full advantage of the OS/390 Workload Manager, permitting the system to automatically adjust to changing workloads, prioritizing and rescheduling tasks on the fly to make the most efficient use of available processing resources. The C API provides C language interfaces and underlying kernel support to facilitate use of WLM services. System Automation for OS/390 provides sysplex management, automation capabilities, and network management, supplying an integration of these applications with more comprehensive policies and less resource consumption. Tivoli management here is based on an open, architected, object-oriented framework and provides an end-to-end, cross system solution for managing the distributed computing environment. The connections between OS/390 and Tivoli are provided offering bi-directional connections between key management tasks in the OS/390 and distributed system environments -- thus allowing management functions to be performed from either environment. Additional enhancements for SMP/E are also being provided, focusing on performance, usability, and application growth capability.   And ServerPac for OS/390 allows selection of OS/390 platform products from a checklist. A single order is then delivered, integrating all selected products and recommended service.

Secure Distributed Networks

Universal Access

Any User Any Client	Server-managed clients	Any Data Any Server
	Host integration	
	Mobile enablement	
	Directory integration	
	Security	

- **Simplify and secure any-to-any access**
- **Reduce cost of ownership**
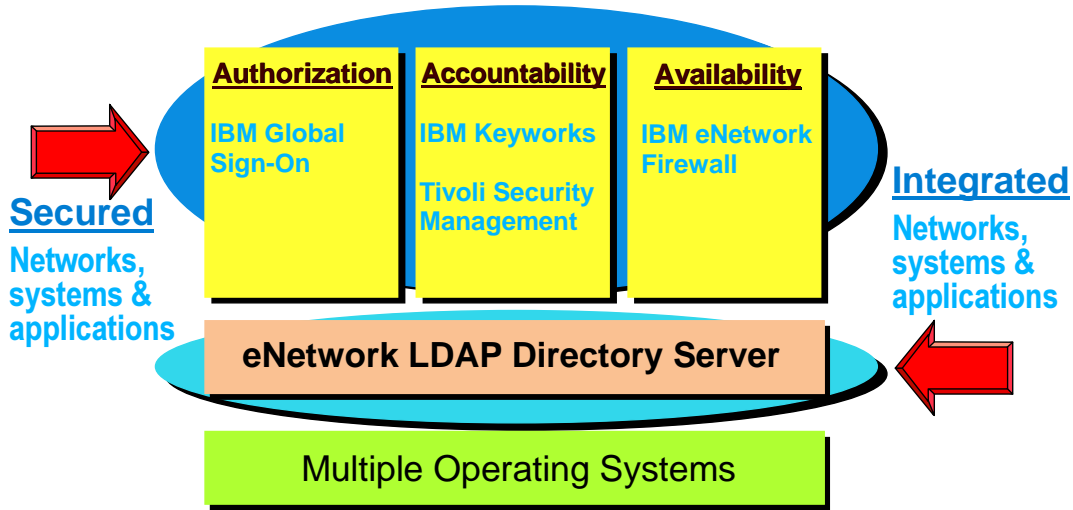- **Extend applications and networks to the Web**

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► This part of the integration strategy deals with How do I locate applications and data? How do I connect? How do I do it in a secure manner? And how do I manage it? IBM wants to help our customers with end-to-end ability to manage and secure their e-business. That's where Tivoli and SecureWay really helps us out here.

eNetwork Software Security and Directory

Comprehensive, end-to-end Security

Authorization	Accountability	Availability
IBM Global Sign-On	IBM Keyworks	IBM eNetwork Firewall
	Tivoli Security Management	

Secured
Networks, systems & applications

Integrated
Networks, systems & applications

eNetwork LDAP Directory Server

Multiple Operating Systems

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▸ IBM is focused on locate, connect and secure. We've defined a new family called SecureWay. It's end-to-end -- we're bringing disparate products together like the public key interface, like the directory. SecureWay ensures another level of integration. SecureWay host integration allows integration with existing disparate systems as well. For security, we focus on three areas: application, network and system security.

Initiating the Transaction

Negotiating the Details

Closing the Transaction

Identification & Authentication

Data Confidentiality & Integrity

Access Control

Non-Repudiation

- **Security is a built-in feature on S/390**
  - ► Security functions are integrated and tested
  - ► Integrated hardware and software for cryptography
  - ► Security integrated into key applications
  - ► FIPS 140-1 Level 4 certified
  - ► PR/SM (LPAR) certified at ITSEC E4 level of security
  - ► Digital certificate authentication integrated with access control to resources and data
  - ► Accountability back to authenticated user for all processes

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► The S/390 handles all key internet elements such as system, transaction, and network level security. Secure Sockets Layer (SSL) support, hardware and software encryption and firewall technologies all exist on S/390 systems. By exploiting logical partitions (LPARs) on S/390 you can put a Webserver in one LPAR and connect to web users using TCP/IP. The webserver will then be able to access existing applications and data in other LPARs via SNA or IP protocols -- hacker-, virus- and worm-resistant.

e-business Security Elements in OS/390

- **Network Level to help protect enterprise networks, exploit public networks, and provide authentication**
  - Firewall Technologies
    - IP Filtering
    - Network Address Translation (NAT)
    - Virtual Private Network (VPN) with Crypto HW
    - Proxy Servers
    - SOCKS server
    - Domain Name services
- **System Level for access control to all resources, change management, and workload isolation**
  - Integrity
  - Security Server
  - Security Access Facility (SAF)
  - LPAR Workload Isolation
- **Transaction Level for privacy/confidentiality, authentication, non-repudiation, and back-out capabilities**
  - WebSphere Application Server
    - SSL support
    - X.509 Digital Certificates
  - SET support
  - IBM CommercePoint Payment
  - S/390 Cryptographic Coprocessor

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For S/390 these include multiple technologies used together. Packet filters limit traffic. Network address translation provides the ability to hide IP address information in one network (intranet) from another (internet). Encrypted IP tunnels (or Virtual Private Networks) allow private communications to occur over public networks. Proxy and SOCKS servers mediate TCP/IP connections. Domain name services hide network information.

System level security starts with OS/390 integrity where every address space and every task within an address space runs under a security environment based on a resource control user ID like the OS/390 Security server. OS/390's Security Authorization facility (SAF) is utilized to route identification and authorization requests to resource control managers that help protect system resources and user databases from unauthorized access. Logical partitioning can be used for isolation of up to 32 Webservers from the rest of your S/390 workload.

Transaction level security includes the web server which supports the Secure Socket Layer and SAF to authenticate users. User IDs and passwords can be used to identify Web users as well as industry standard X.509 digital certificates. IBM CommercePoint Payment enables quick, easy, and highly secure credit card commerce on the internet, integrating the SET protocol into appropriate stages of the commerce life cycle by using digital certificate technology. The S/390 cryptographic coprocessor enables incoming and outgoing requests for cryptographic services be performed in hardware.

Secure e-business

- Security Server
  - ► Access control support
  - ► Host and distributed environment support
  - ► Digital certificate support
- Firewall Technologies integrated
  - ► Asset protection
- Cryptographic Coprocessor
  - ► Exploited by WebSphere Application Server
  - ► Can help reduce cost of encryption
- WebSphere Application Server for OS/390
  - ► Support for both Internet & intranets
  - ► Digital Certificate support

Intranet/Extranet

Internet

- Network level
- Transaction level
- System level

FIREWALL
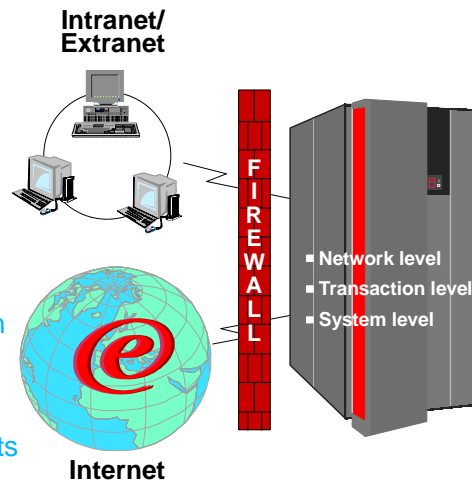
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► The OS/390 Security Server, an optional feature of OS/390, works closely with OS/390 system software and other products that support the IBM Security Architecture. It includes RACF for access control support (System level), DCE Security Server for the distributed environment, firewall technologies for asset protection (Network level) and LDAP Server support for new directory services. OS/390 Base services provide an LDAP client for OS/390 applications to use while basic Firewall Technologies is contained in the eNetwork Communication Server. ICSF, also in the OS/390 base, serves as an interface to the Cryptographic Coprocessor hardware. Together they provide support for a wide variety of cryptographic standards and functions.

► Businesses want to deliver product and services without endangering the integrity of the system. UNIX systems safely allow users unrestricted access to all resources (data or application), while OS/390 software protects the operating system from unauthorized access. The IBM cryptographic Coprocessor, Trusted Key Entry, Enablement/Configuration Diskettes and WebSphere Application Server for OS/390 all contribute to making security a reality. IBM SecureWay adds support services like consulting to further help customers.

►

48

Platform	Outages/Year	Availability
S/390 Parallel Sysplex	10 minutes	99.998%
UNIX systems averages	23.6 hours	99.73%
Windows NT systems averages	224.5 hours	97.44%

Source: *Platform Availability Data: Can You Spare a Minute,* Gartner Measurements, 1998

Unplanned outages

Planned outages

- **Capacity Upgrade on Demand**
- **Concurrent Conditioning**
- **Capacity Backup Upgrades**
- **Online database reorganization and backup**
- **Resource sharing**

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▸ Scalability and availability need to be addressed in a 7-by-24 environment with total integrity. Dynamic workload balancing must take place to distribute work anywhere in the network so customers receive consistent sets of services. All to this must be based on open standards while exploiting server technology. According to a Gartner Group study, a single S/390 provides 99.9% availability. In the same study, S/390 Parallel Sysplex clustering technology topped the list at 99/998% availability. Those numbers are only achievable with IMS. With years of experience and refinement, S/390 with OS/390, IMS, and Parallel Sysplex technology is considered an availability leader in the industry. The inherent strengths of the platform, such as redundant componentry, no single points of failure, and the availability of nondisruptive upgrades address customers major concerns with availability and reliability. IMS continues to provide availability enhancements in online recovery and reorganization, as well as resource sharing.

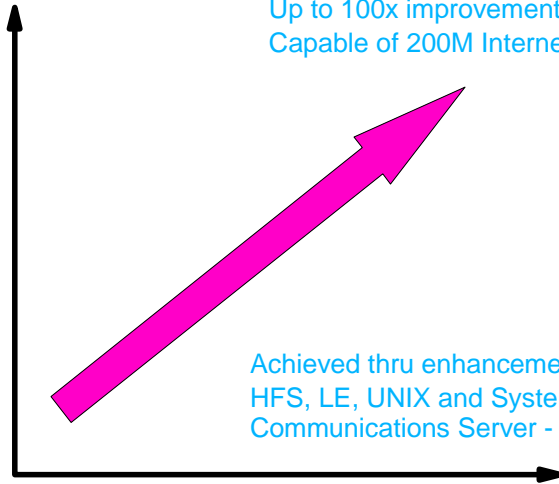**End-to-End Performance**

Transactions per second

S/390 Web Serving
- Scaleable TCP/IP SMP daemon
- Up to 98% pathlength improvement
- Up to 100x improvement in connects/sec.
- Capable of 200M Internet transaction hits per day

Achieved thru enhancements to Webserver, VAJava, HFS, LE, UNIX and System Services, eNetwork Communications Server - TCP/IP Services

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▶ In web computing the system must match capacity to business requirements on an as-needed basis and provide an easy growth path, minimize downtime and provide quick return on investment. These are available with the S/390 Webserver. Recent enhancements have included improvements to the processing of base server requests, yielding overall increases in request throughput. UNIX services are also being enhanced. Individual functions have been restructured and/or rewritten to help applications reduce the number of address spaces, resulting in both positive performance and storage usage. eNetwork Communications Server enhancements enable optimal IP communications over high-speed links, improves throughput and overhead for large FTP files. A newly restructured, enterprise-class TCP/IP service provides superior performance, reliability and scalability for OS/390 applications. A new Telnet server provides TN3270E with improved performance and reliability. Multiprotocol performance improvements, higher bandwidth networking, and numerous other enhancements continue to make the S/390 a powerful, flexible system for growth in web serving. Security enhancements also affect performance, eg. OS/390 V2R6 with the IBM HTTP Server for OS/390 enabled the use of hardware encryption to improve (over software based encryption) SSL performance. Using the WebSphere Application server scalable mode can allow some applications to scale to significant higher transaction rates.
▶ IMS solutions exploit the security, performance, and other facilities of the S/390 to optimize performance. Testing with IMS TOC and with the IMS Connector for Java have demonstrated very high transactions rates.

- **IMS Information available and code downloadable at http://www.ibm.com/ims**
  - Initial IMS Solutions provided at no additional charge, downloadable from the web
  - Strategic cross-product solutions are being integrated into respective products
- **IMS Redbooks at http://www.redbook.ibm.com**
  - Connecting IMS to the World Wide Web - A Practical Guide to IMS Connectivity
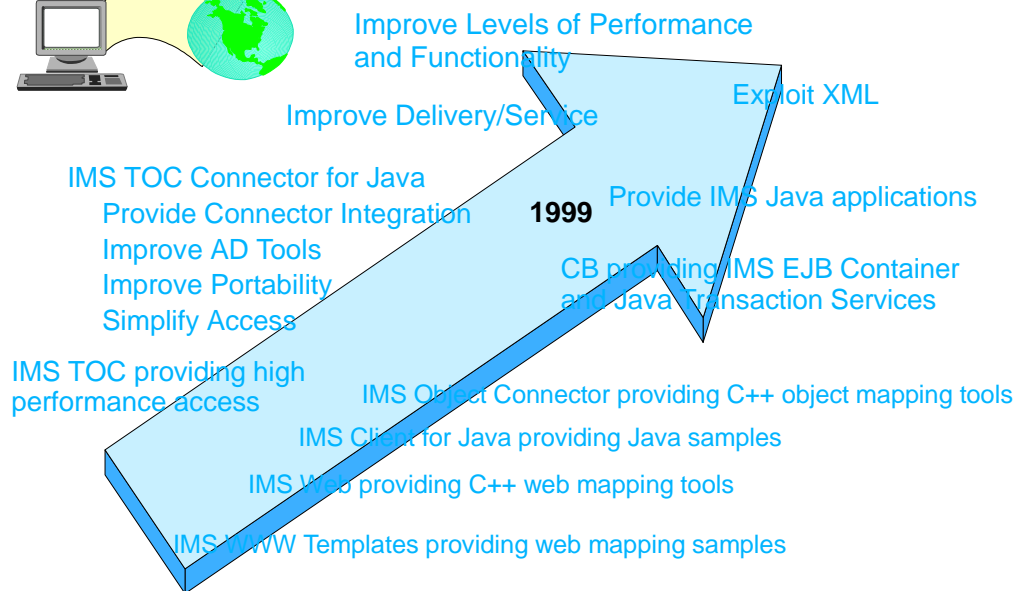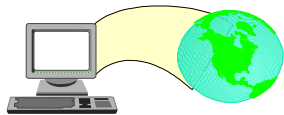 - IMS e-business connect (New)

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The IMS Connectivity solutions are generally available with IBM products. Some interim solutions have been made available at no additional charge over their IMS license for web download, along with additional documentation and information, from the IMS home page at http://www.ibm.com/ims.

The IBM International Technical Support Organization has been producing redbooks with additional information, one titled "A practical Guide to IMS Connectivity, Accessing IMS from the Internet", and a new one called IMS e-business connect.

The IMS Solutions offer a major step for IMS customers wanting to provide commercial services over the World Wide Web. Commercial services with access to IMS applications and data could include travel reservations, home banking, delivery tracking, service support, etc. Examples today exist in many industries. In a package delivery business, the company's customers track their individual packages from their own Internet access systems. The customer dials a server, asks for a package number, and sends it into the server to run the program to trace their package. A gateway server is provided for communication to the client and access to existing, unchanged IMS applications and data. The customers perceive this Internet access to delivery data as improved service. It also relieves staffing and support costs at he company, providing a good value on both sides. Another example exists in the banking industry. This project is home banking over the Internet. Forms are sent out and received back. Code formats messages and send them to the host S/390 system for processing by IMS. IMS applications accepts input and returns replies. Security is provided on the product server and S/390.

Internet Solutions Directions

Improve Levels of Performance
and Functionality

Exploit XML

Improve Delivery/Service

IMS TOC Connector for Java
Provide Connector Integration
Improve AD Tools
Improve Portability
Simplify Access

1999

Provide IMS Java applications

CB providing IMS EJB Container
and Java Transaction Services

IMS TOC providing high
performance access

IMS Object Connector providing C++ object mapping tools

IMS Client for Java providing Java samples

IMS Web providing C++ web mapping tools

IMS WWW Templates providing web mapping samples

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IMS is expanding into the world of Java. IMS customers can write Java applets, applications, or servlets that access IMS transactions and use the IMS tools which are 100% pure Java applications, in building an end-to-end solution for accessing IMS transactions from the Internet. This includes generating data objects for use by new IMS Object application programs.

IMS Connector enhancements continue to assist customers in broadening their use of Java technologies -- furthering the capabilities of writing IMS applications in Java, providing class libraries and JavaBeans to access IMS; and leveraging the latest technologies, eg. the Enterprise JavaBeans Server environment with IMS Enterprise JavaBeans.

IMS is also furthering the capabilities of Object technology, integrating Component Broker with IMS Transactions, These solutions could improve application programmer productivity by supporting the latest technologies and the use of OO programming and OO programming tools.

Continuing enhancements would also be provided to ensure production ready Internet solutions -- extending the utmost in performance, availability, security and integrity at the least cost per transaction through the S/390 Server, the IMS Connectors and IMS. To this end, better integration to optimize testing, packaging, delivery and servicing would also be offered.

- ■ **Product Integration**
  - – IMS Connect
  - – IMS Java
  - – WebSphere

- ■ **Application Integration**
  - – CB/EJB
  - – JDBC
  - – Unicode
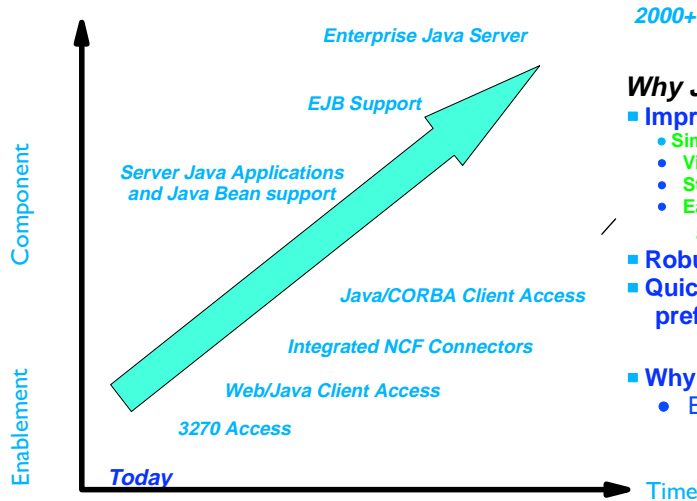 - – ODBA

- ■ **Operational integration**
  - – Tivoli
  - – XML

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▶ IMS is focused on Integration. This includes further e-business product integration into OS/390, WebSphere, VAJava, and IMS. The IMS Connection for Java is being provided as part of VAJava and WebSphere. IMS is providing a new feature, IMS Connect feature, which integrates into IMS new IMS TCP/IP enhancements for SMP enablement, performance, serviceability, and usability. Support for the Java language for use by IMS applications would also be integrated into IMS. Application Integration is also critical in this environment so that access to disparate products can take place. Functions provided for OS/390 have always been exploited by IMS. CB is becoming part of WebSphere and is being enhanced with additional EJB/ EJS/Java Transaction Services for IMS. IMS would also be providing support for JDBC and Unicode. The IMS Open Database Access facility would also be used to improve IMS DB access from other environments as well. And Tivoli systems management for IMS would continue to become better integrated with IMS Systems Management. Additionally, as the world moves from HTML to XML, for universal excahnge of data formats, IMS would be addressing requirements for XML mapping and data store.

IMS Java Roadmap

2000+

Enterprise Java Server

EJB Support

Server Java Applications and Java Bean support

Component

Java/CORBA Client Access

Integrated NCF Connectors

Enablement

Web/Java Client Access

3270 Access

Today

Time

Why Java?
- **Improves AD Productivity**
  - Simpler and faster to program
  - Visual AD tools
  - Strong component model (OO)
  - Easier application deployment and manageability
- **Robust, Portable, Ubiquitous**
- **Quickly becoming the preferred language**

- **Why in IMS?**
  - Exploit existing infrastructure

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▸ Over the past few years, IBM has adopted the Java programming language as a way to help IBM customers standardize on a common programming model that spans multiple operating systems. Java is the cornerstone of the WebSphere family of products. IBM believes that the simplicity, portability, scalability and security associated with Java will help IBM customers meet their challenges of becoming an e-business. IBM has crated an application development environment based on industry standards of Java, EJB, HTML, HTTP, and IIOP and merged the classic strengths of OS/390 and IMS with Internet technologies. This allows for development on a platform of choice, but also provides flexibility to choose deployment platforms based on business needs for security, availability, scalability, and access to existing data and applications. IMS continues to exploit and enhance these facilities for providing these capabilities to their customers.

Summary

What IBM is trying to do is

- Deliver the capability that our customers *want and need*
- Make it *simpler and more integrated*
- Continue the focus on software that *lasts forever*
- Help our customers *put it all together*

IMS supports a variety of solutions for IMS access from Java and the Internet with

- Consistency
- Flexibility
- High performance

IMS
Serving
the
World
Wide
Web

IBM Software

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IBM is trying to deliver on the capability that our customers want and need, providing simpler and more integrated solutions, and continuing the focus on software that lasts forever. They are also trying to help our customer put it all together with tools and services.

IMS customers, comprised of many of the largest, leading edge companies, demand solutions that can provide consistent support across a wide variety of products and flexibility in addressing a number of very specific, unique demands. For this, these solutions make use of standard communication protocols, flexible mapping, and application building tools on a variety of platforms.

In this continuing internet evolution, these solutions are continuing to be enhanced. Tools are continuing to be provided which improve internet security, performance, and predictability, help simplify Internet access, and offer more flexibility in enhancing and writing new applications to exploit the capability of the World Wide Web.