Java 2 Enterprise Edition (J2EE)

Agenda

- Introduction to J2EE
- J2EE Framework
- Support to J2EE of big software vendors
- Software Architectures
- Features and Concepts in J2EE
- Sample J2EE Architectures

What Is J2EE?

- Say simply, J2EE is:
  - a suite of *specifications* for application programming interfaces
  - a distributed computing architecture
  - definitions for packaging of distributable components for deployment.
- It's a collection of standardized **components, containers**, and **services** for creating and deploying distributed applications within a well-defined distributed computing architecture.

When using J2EE?

- J2EE targets at **large-scale** business systems
- The software in the J2EE framework needs to be partitioned into functional pieces and deployed on the appropriate hardware platforms to provide the necessary computing power
- J2EE provides:
  - a collection of standardized components that facilitate software deployment
  - standard interfaces that define how the various software modules interconnect
  - standard services that define how the different software modules communicate.

Relate to J2SE

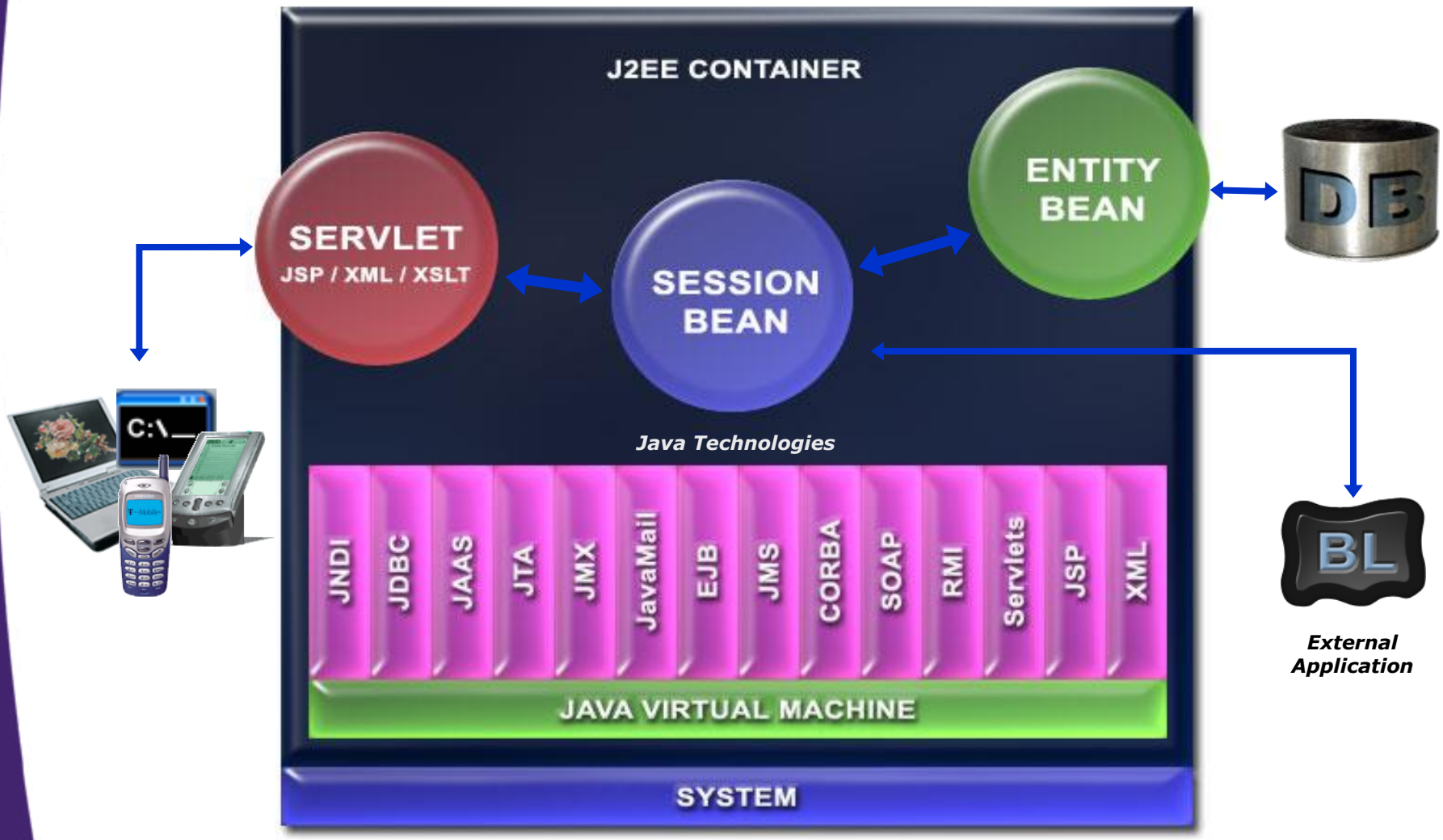
- J2SE (Java 2 Standard Edition) is the **core** upon which J2EE is based
- Use J2SE components and APIs in conjunction with the J2EE components and APIs to build your applications

Why using J2EE?

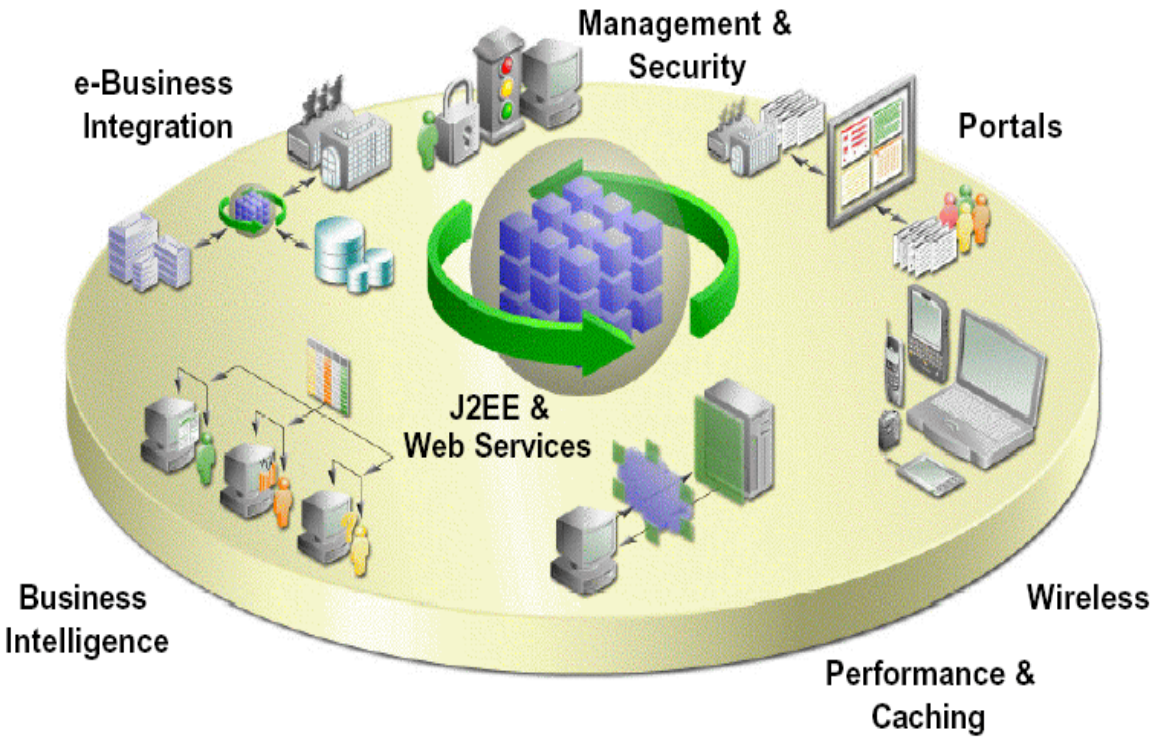
J2EE:

- Define a number of essential services to develop enterprise-class applications
- Provide infrastructure required to write enterprise-class applications: there are a bunch of different system-level capabilities to write distributed applications that are scalable, robust, secure, and maintainable
- Define a set of containers, connectors, and components that can run on any number of J2EE-compliant implementations

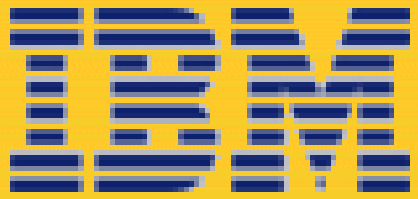
J2EE Framework



- Oracle 9*i*AS Internet Application Server Enterprise Edition used by SCT for Banner
- 100% compliant J2EE server



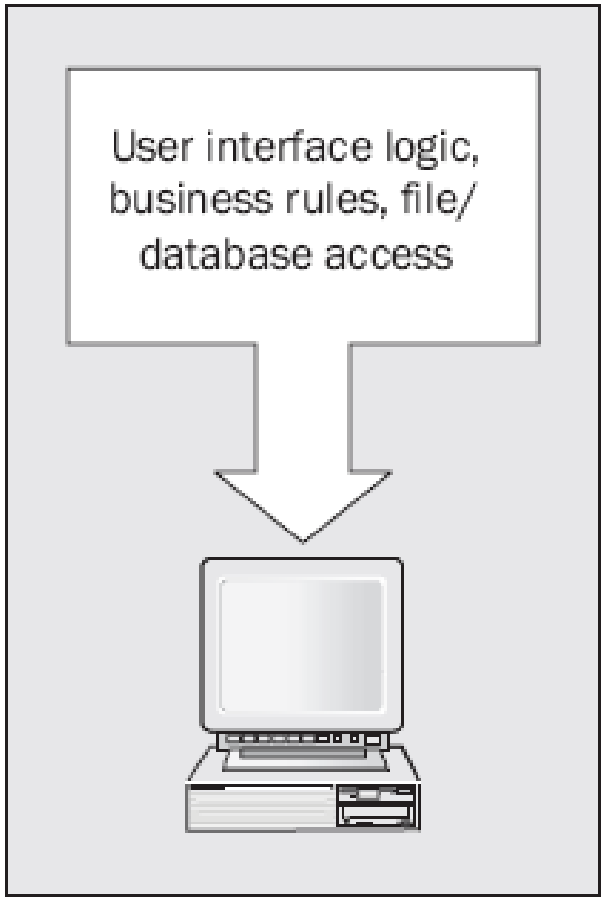
Oracle9i Application Server
http://www.oracle.com/ip/deploy/ias



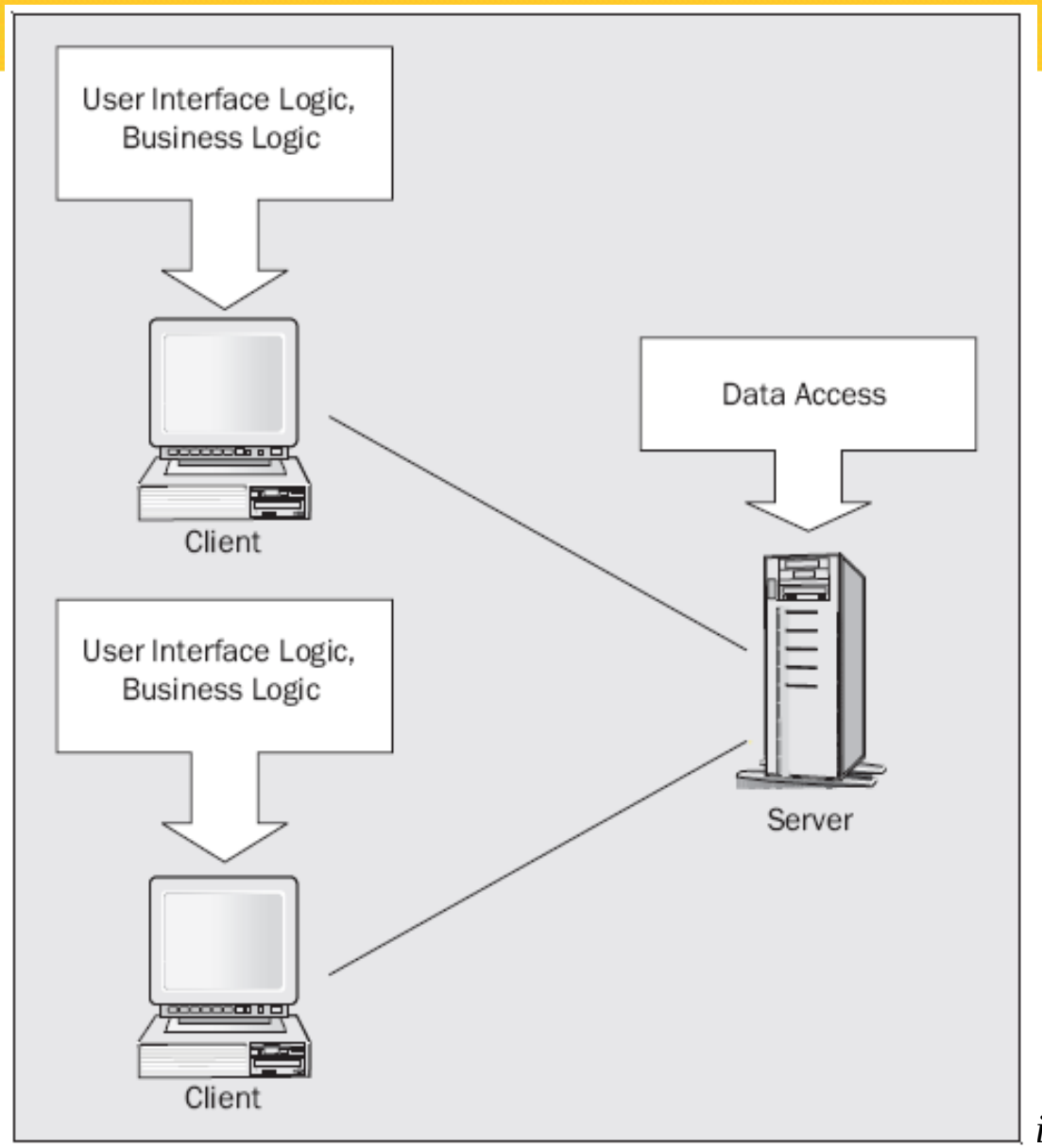
- "WebSphere continues the evolution to a single Web services-enabled, Java™ 2 Enterprise Edition (J2EE) application server and development environment that addresses the essential elements needed for an on demand operating environment."
  - *http://www-3.ibm.com/software/info1/websphere*

- IBM & Globus Project developing grid computing with JBoss and IBM WebSphere
  - *http://www-1.ibm.com/grid/grid_strategy.shtml*
  - *http://www.javaworld.com/javaworld/jw-09-2002/jw-0906-grid.html*

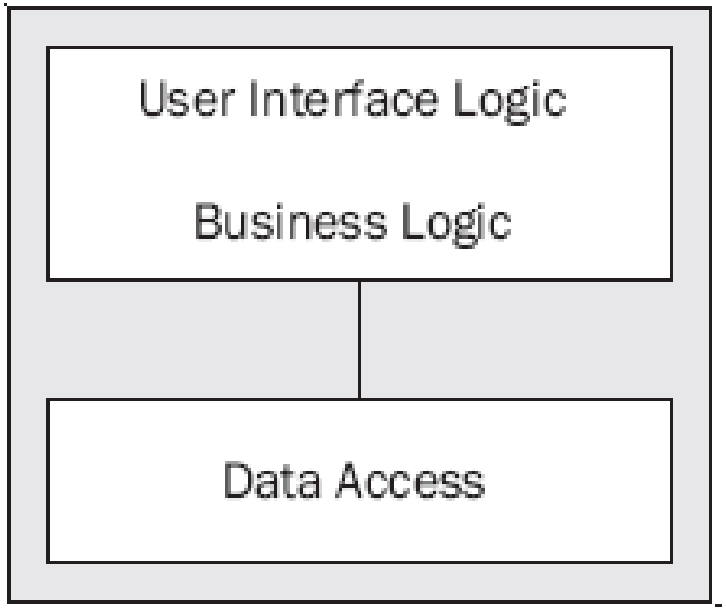
Single Tier Applications



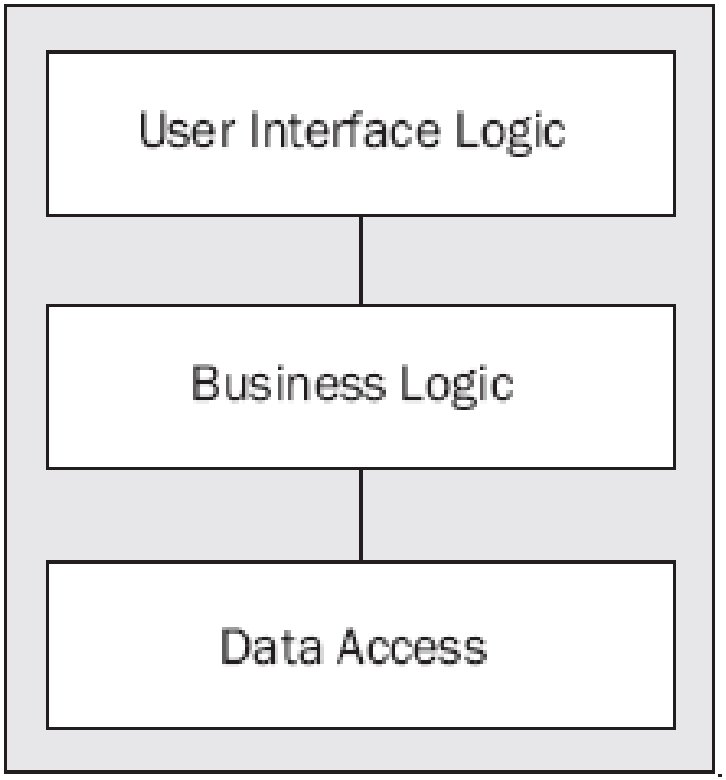
Client-Server Applications



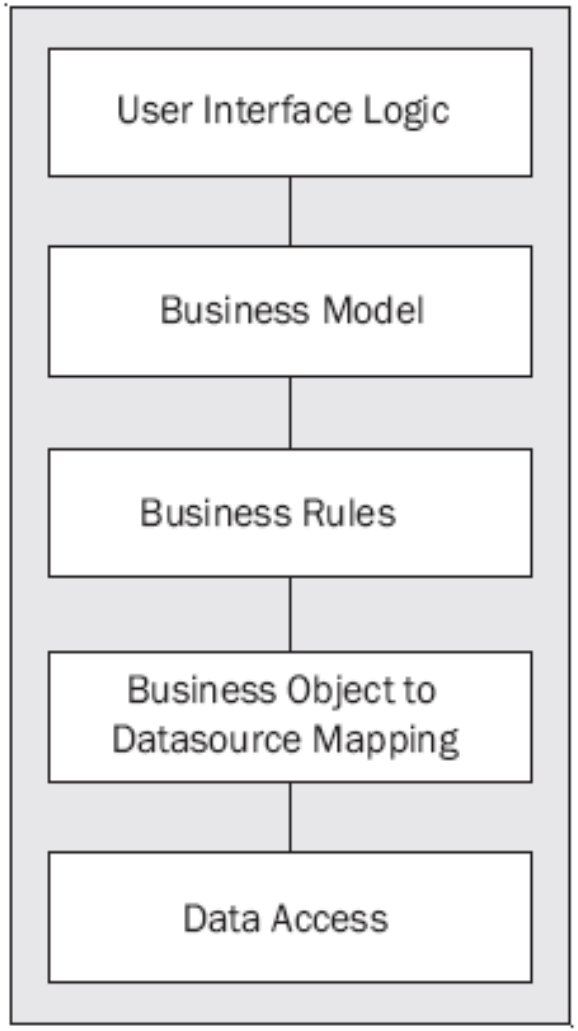
Two-Tier Architecture



Three-Tier Architecture



Multi-Tier Architecture



Vendor Independence

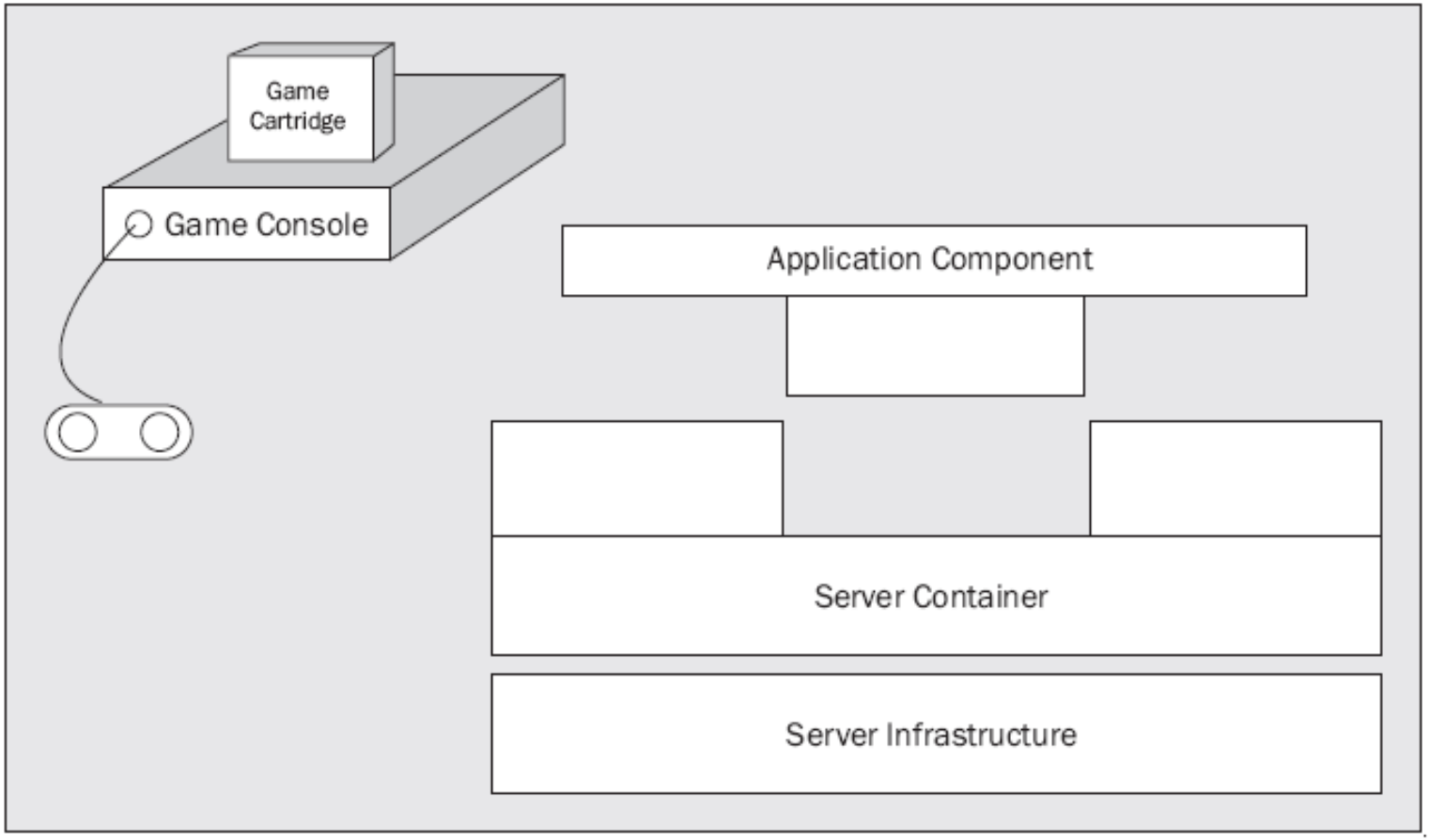
- Java (including J2EE) is designed to run on all platforms (platform-independence)
- The architects of J2EE has an open specification that can be implemented by vendors

Scalability

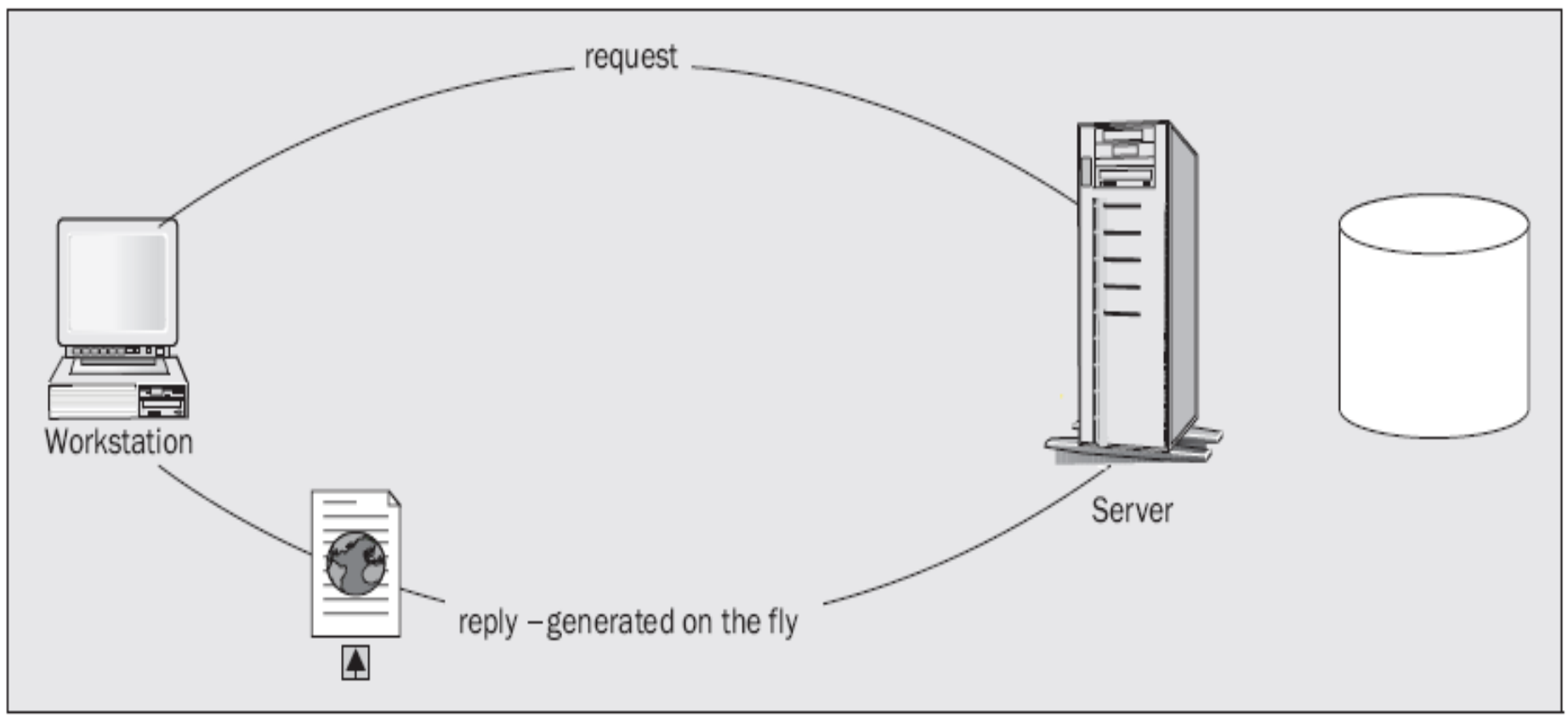
- Changes in requirements → changes have to be made in software
- The J2EE architecture provides much flexibility to accommodate changes as the requirements for throughput, performance, and capacity change
- J2EE also supports clustering, connection pooling, and failover

Containers

- A central theme in the J2EE architecture

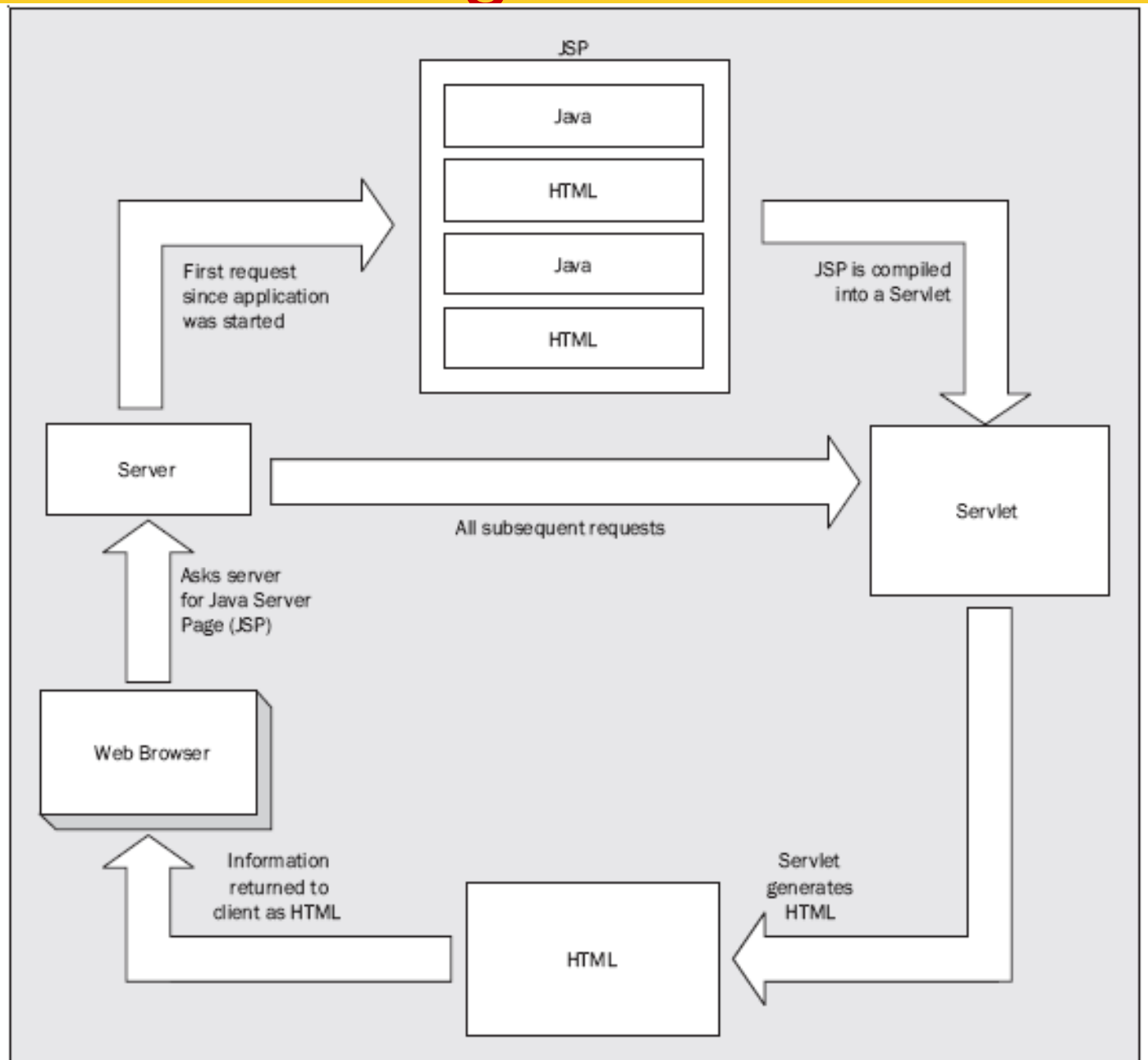


Java Servlets



- Provide for dynamically generated content

JavaServer Pages



Enterprise JavaBean (EJB)

- Developed based on Remote Method Invocation (RMI)
- EJBs are Java components that implement business logic. This allows the business logic of an application kept separate from the front-end applications that use that business logic
- The J2EE architecture includes a server that is a container for EJBs
- 3 types:
  - Session bean: maintain the state of sessions
  - Entity bean: represent business objects
  - Message bean: a component model for services that listen to Message Service messages

XML Support

- Extensible Markup Language (XML) is a significant cornerstone for several core techniques in J2EE
- Two 2 APIs to process XML:
  - Document Object Model (DOM): a tree-oriented model
  - SAX (Simple API for XML): a stream-based event-driven processing model
- Java API for XML Binding (JAXB): mapping XML to and from Java classes

Web Services

- A web service is a software function that:
  - Has its interface be public
  - Can be called by other services or programs
- A business service is often designed and implemented by a web service
- Web services become a new method to develop softwares
- Service-Oriented Architecture (SOA): a software architecture that is based on web services

Transaction Support

- J2EE—and EJB in particular—provides substantial transaction support.
- The EJB container provides built-in support for managing transactions, and allows the developer to specify and modify transaction boundaries without changing code.
- Where more complex transaction control is required, the EJB can take over the transaction control from the container and perform fine-grained or highly customized transaction handling.

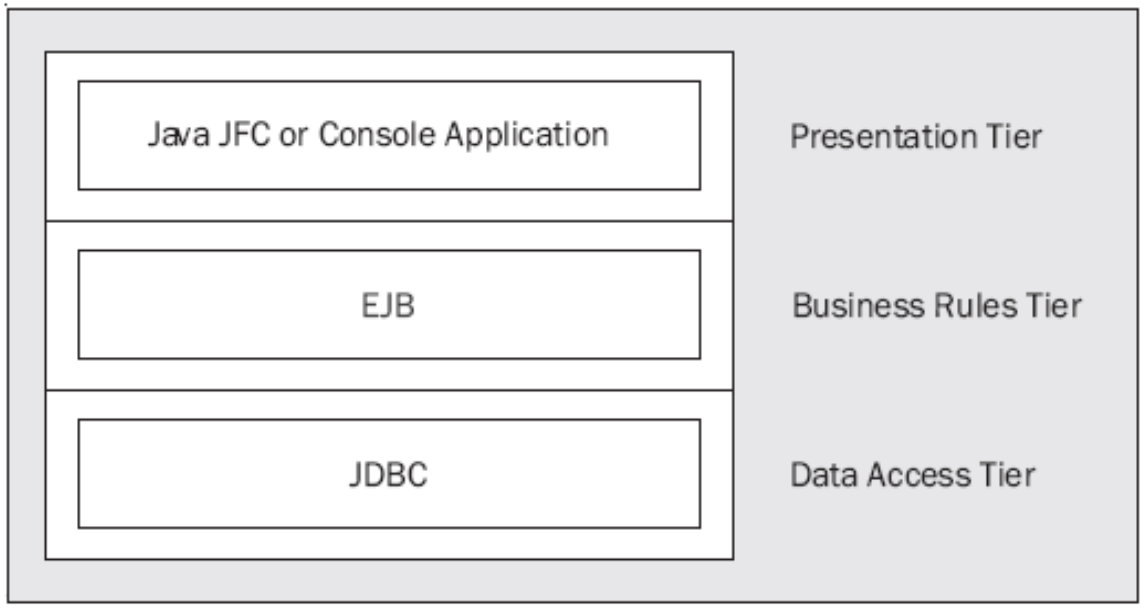
Security

- J2EE provides strong built-in security mechanisms
- Authorization in J2EE is based on roles of users of applications

Sample J2EE Architectures

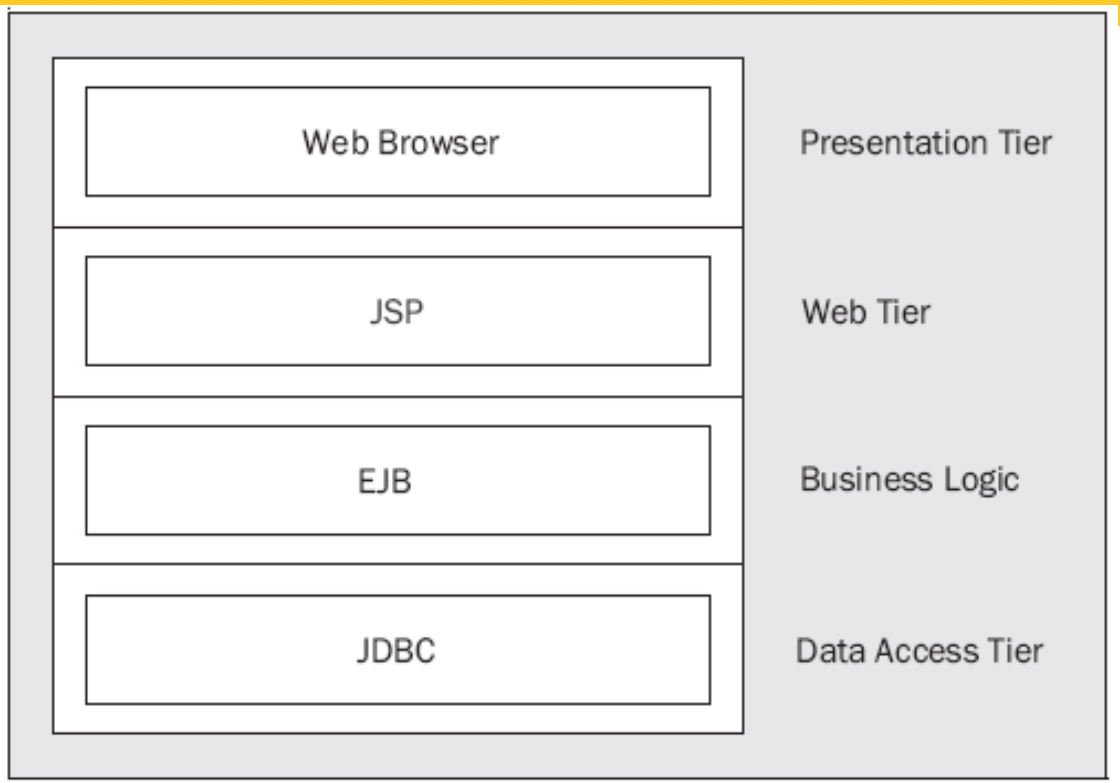
- Several different architectures for different types of applications, but some commons
- n-Tier Architecture is intended to solve:
  - High cost of maintenance when business rules change
  - Inconsistent business rule implementation between applications
  - Inability to share data or business rules between applications
  - Inability to provide web-based front ends to line-of-business applications
  - Poor performance and inability to scale applications to meet increased user load
  - Inadequate or inconsistent security across applications

Application Client with EJB



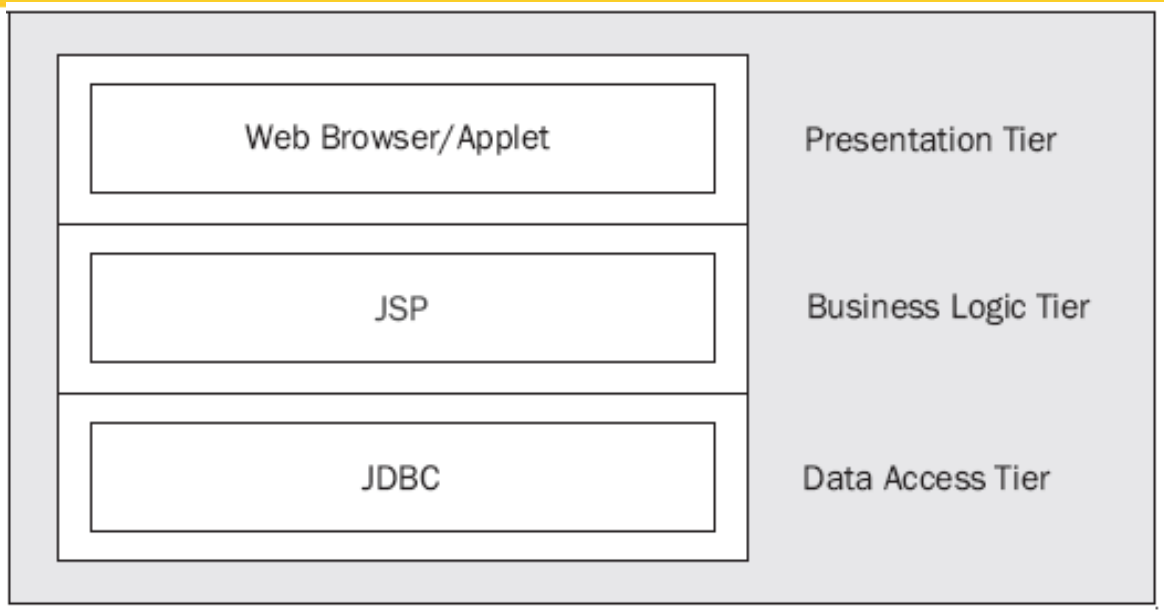
- The client application is built as a stand-alone (JFC/Swing or console) application.
- The application relies on business rules implemented as EJBs running on a separate machine.

JSP Client with EJB



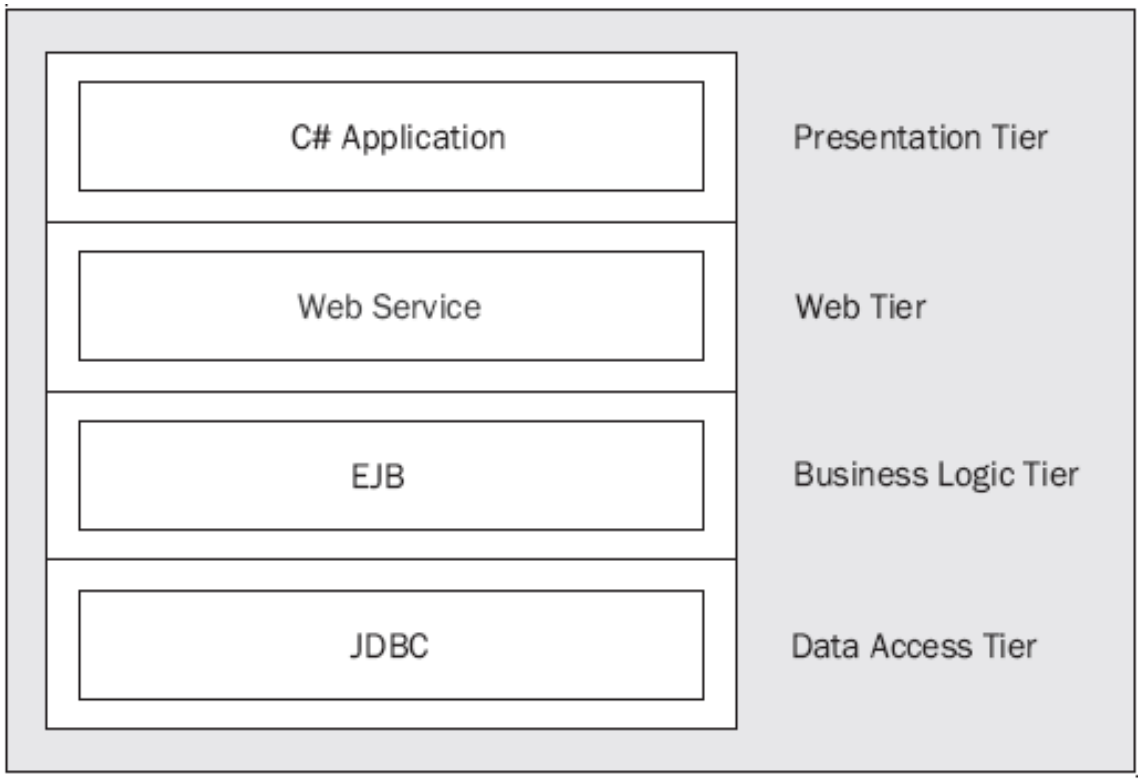
- The client in this architecture is a web browser.
- JavaServer Pages access business rules and generate content for the browser.

Applet Client with JSP and Database



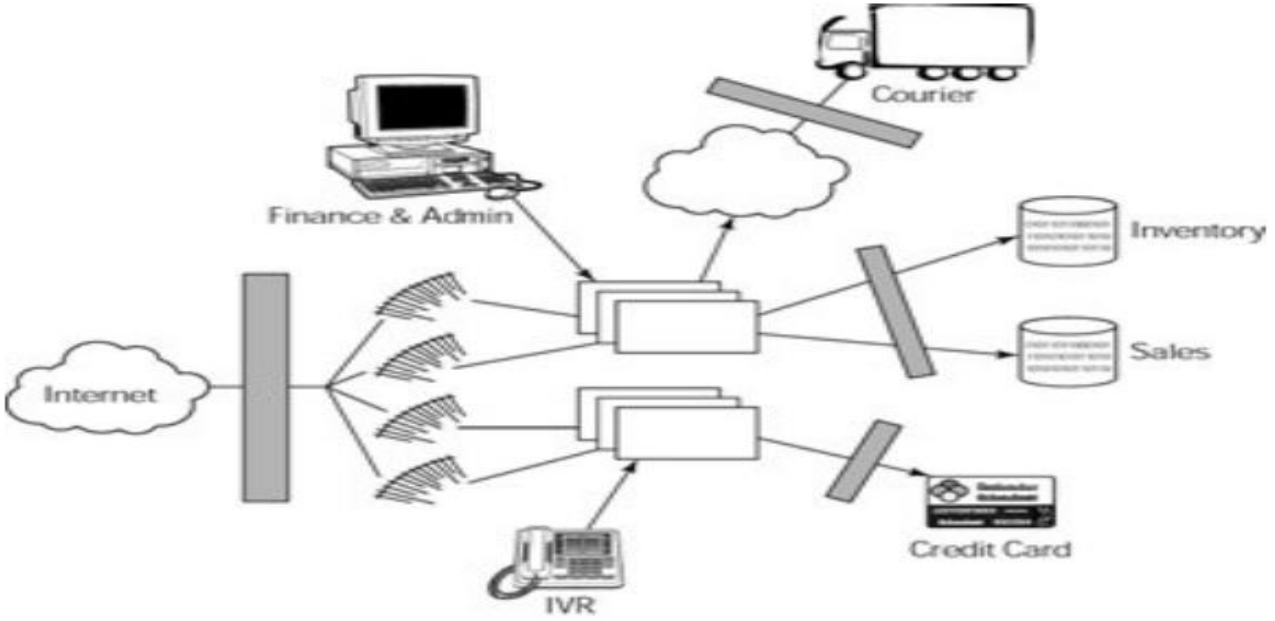
- The client application is a web browser, but in this case a Java applet is used within a web page to provide a more interactive, dynamic user interface for the user. That applet accesses additional content from JSPs.
- Data is accessed from the JSP via the JDBC API.

Using Web Services for Application Integration



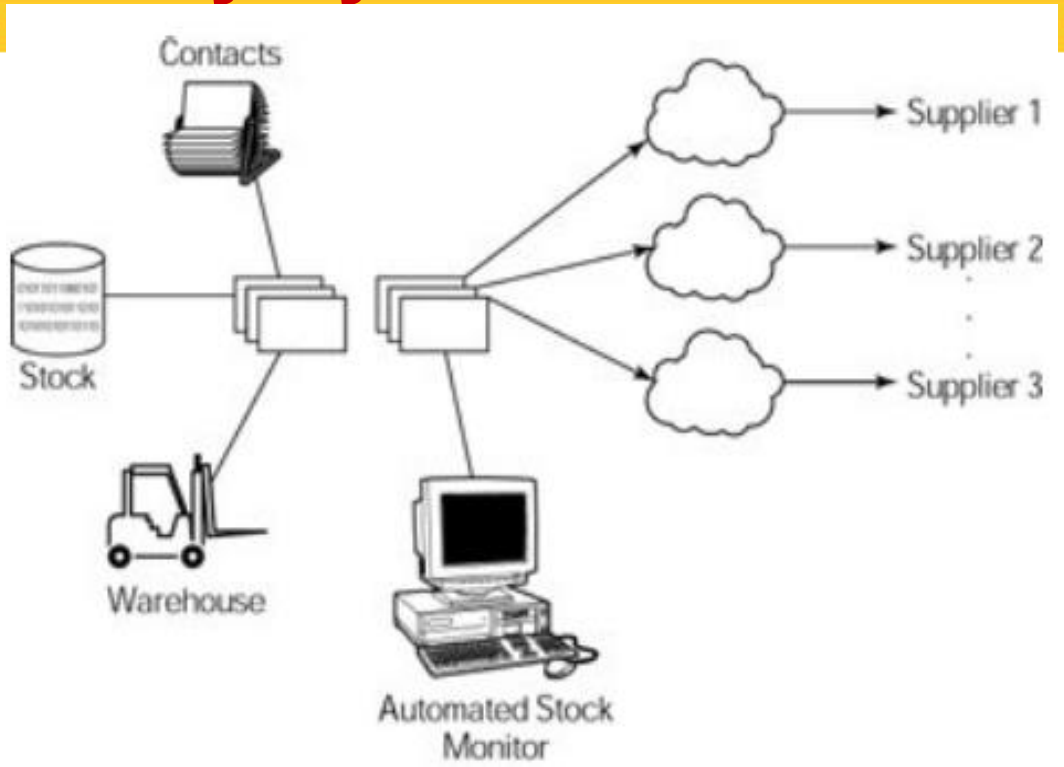
- A client application implemented in C# accesses data from a web service implemented in Java.

Sample J2EE Application 1 - B2C E−commerce Web site



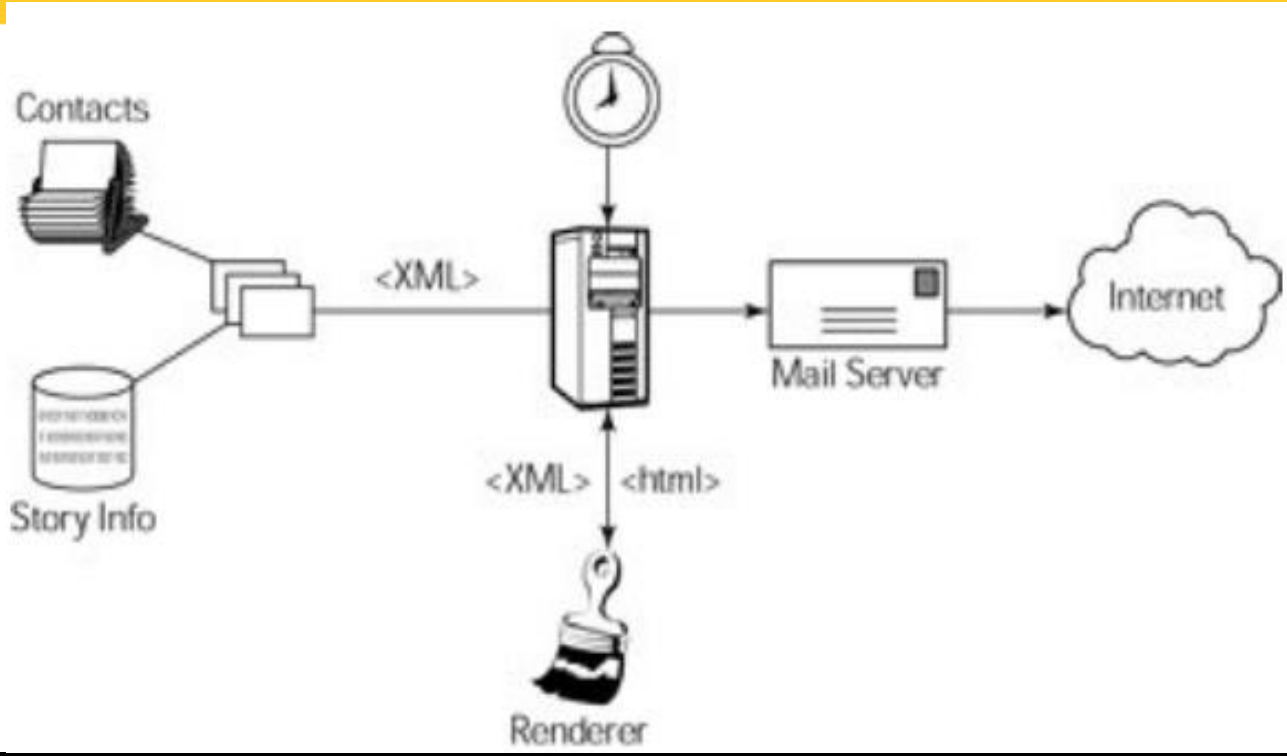
Web−Page Generation	Middleware	Database Server	Operating System
ASP	COM/DCOM	Usually SQLServer, but could be Oracle/Informix/Sybase	Microsoft
Servlet/JSP	EJB or CORBA	Oracle/Informix/Sybase	UNIX/Microsoft
CGI	CORBA	Oracle/Informix/Sybase	UNIX

Sample J2EE Application 2 - An Inventory System in B2B E−commerce



API	Use
EJB	Abstraction of business logic.
XML	Exchange of parts information and orders.
JNDI	Customer and supplier directory handling.

Sample J2EE Application 3 - Monthly electronic newsletter



API	Use
JavaMail	Interface to e−mail system.
XML	Stores formatted message information.
JDBC	Extracts address information directly from the database.