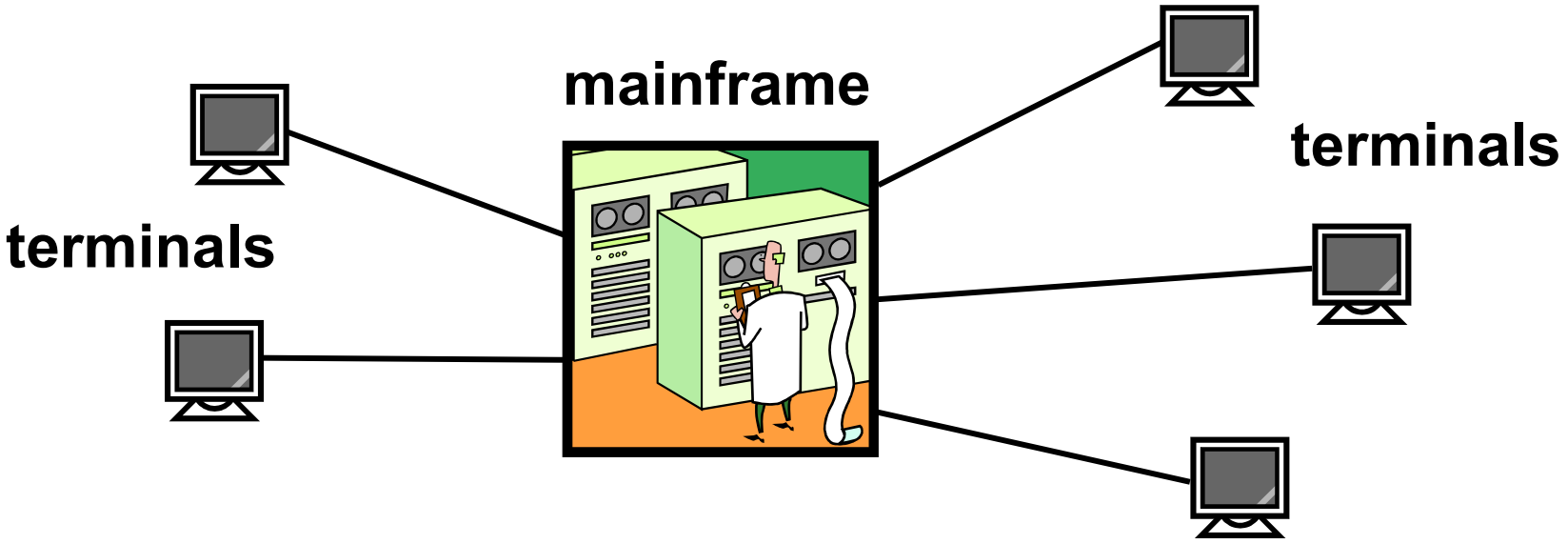
Java platform editions

- Java Card
- Java ME (Micro Edition)
- Java SE (Standard Edition)
- **Jakarta EE** (Enterprise Edition)
- JavaFX (bundled in Oracle's JDK from versions 8 to 10 but separately since 11)
- PersonalJava (Discontinued)

by
Uday Kumar

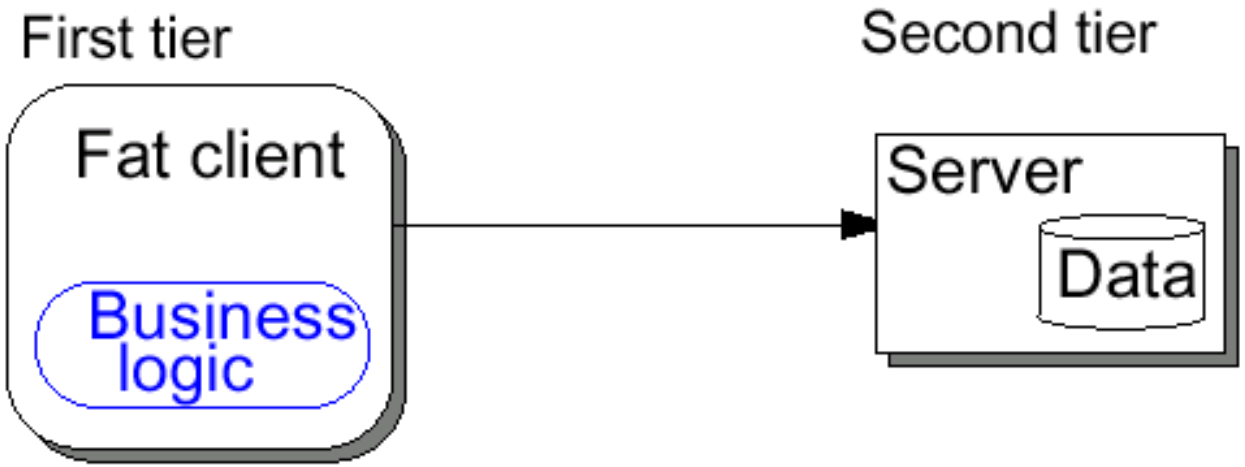
In the beginning,

- *In the beginning, there was darkness and cold. Then, …*

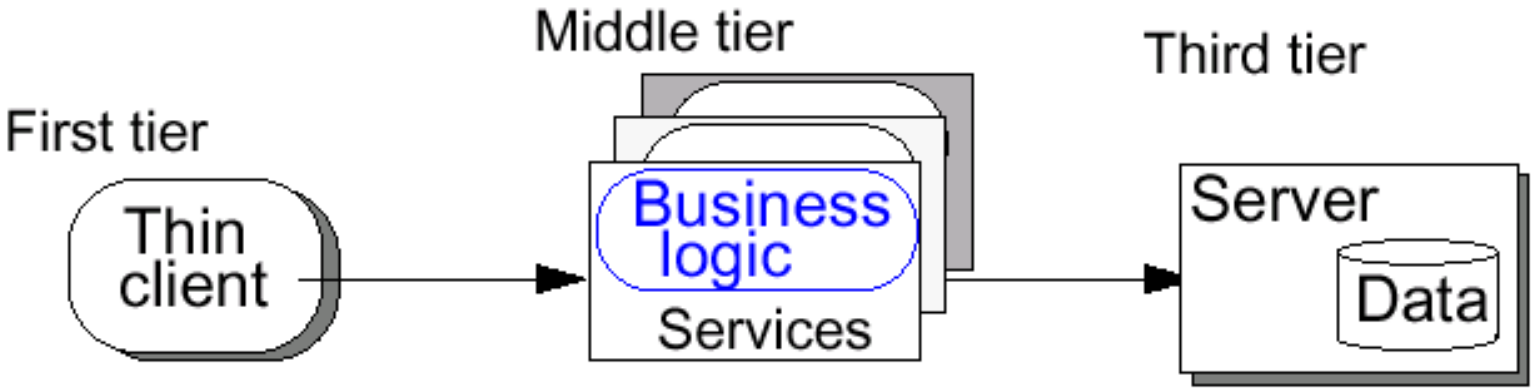


Centralized, non-distributed

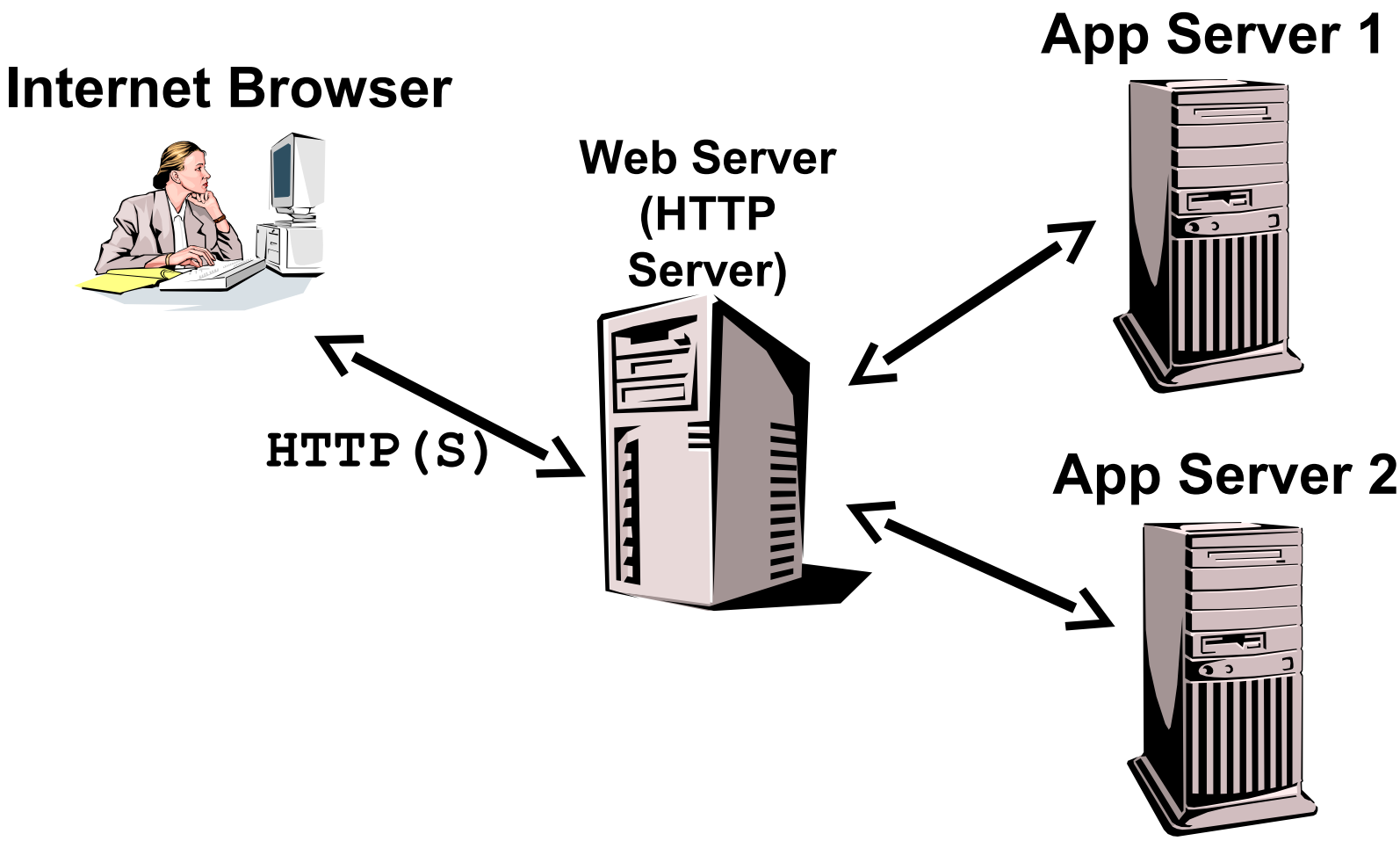
- In the 90’s, systems should be *client-server*



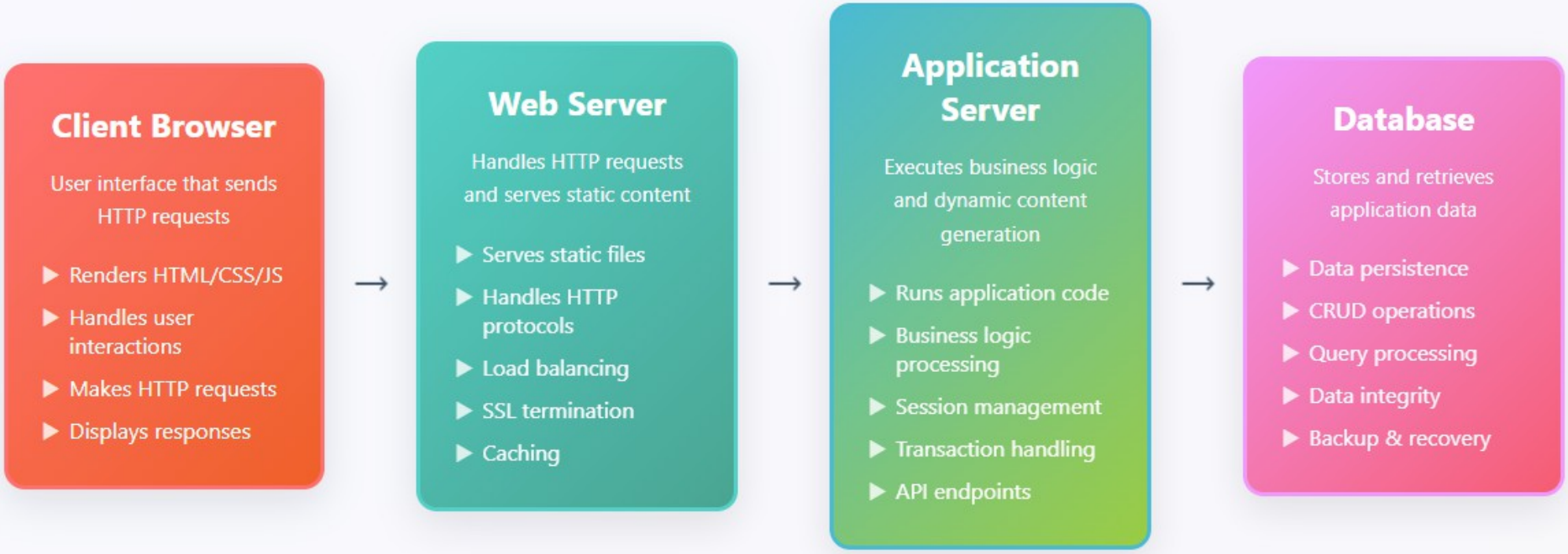
- Today, enterprise applications use the *multi-tier* model



Web Server and Application Server



Web Server vs Application Server Architecture



🌐 Web Server

Primary Function: Handle HTTP requests and serve static content

Key Responsibilities:

- Serve HTML, CSS, JavaScript, images
- Handle HTTP/HTTPS protocols
- Implement security (SSL/TLS)
- Manage concurrent connections
- Perform load balancing
- Cache static content

Popular Examples:

Apache HTTP Server | Nginx | IIS | LiteSpeed

⚙️ Application Server

Primary Function: Execute business logic and generate dynamic content

Key Responsibilities:

- Execute application code
- Process business logic
- Manage database connections
- Handle user sessions
- Manage transactions
- Provide APIs and services

Popular Examples:

Tomcat | JBoss/WildFly | WebLogic | Node.js | Express.js

Jakarta EE, formerly Java Platform, Enterprise Edition (Java EE) and Java 2 Platform, Enterprise Edition (J2EE)

What is Jakarta EE?

- Short for ***J****ava Platform,* ***E****nterprise* ***E****dition*.
- Java EE is a platform-independent, Java-centric environment from Oracle for developing, building and deploying Web-based enterprise applications online.
- The Java EE is a set of specifications, extending Java SE with specifications for enterprise features such as distributed computing and web services..

What is Jakarta EE? Contd..

The platform provides an API and runtime environment for developing and running enterprise software, including network and web services, and other large-scale, multi-tiered, scalable, reliable, and secure network applications.

Current version is Jakarta EE 11

Java SE

- When most people think of the Java programming language, they think of the Java SE API.

- Java SE's API provides the core functionality of the Java programming language.

- In addition to the core API, the Java SE platform consists of a virtual machine, development tools, deployment technologies, and other class libraries and toolkits commonly used in Java technology applications.

What & Who?

- The aim of the Java EE platform is to provide developers with a powerful set of APIs while shortening development time, reducing application complexity, and improving application performance.
- The Java EE platform is developed through the Java Community Process (JCP), which is responsible for all Java technologies.
- Java EE was maintained by Oracle under the Java Community Process, was submitted to **Eclipse Foundation**

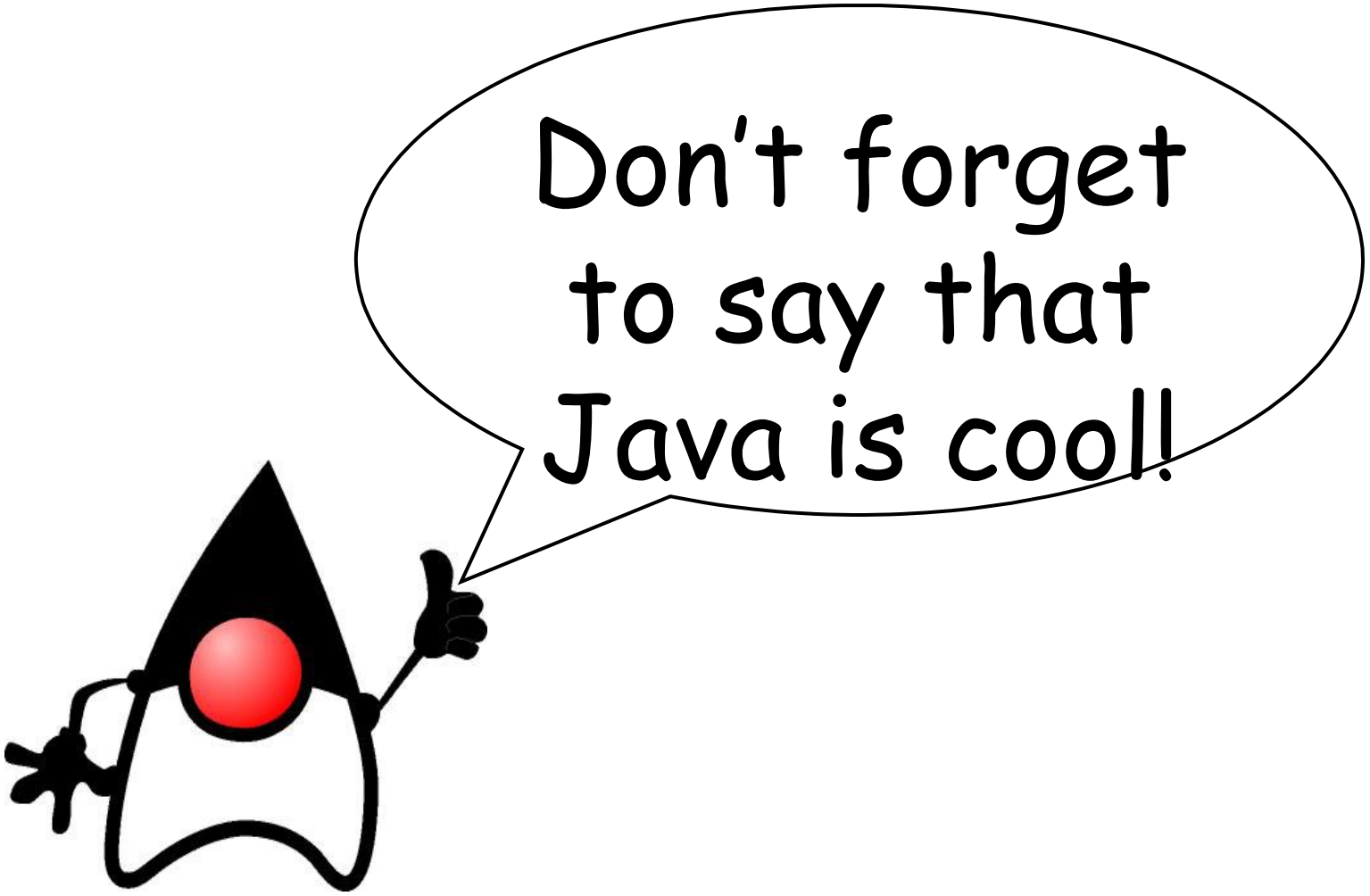
Java EE Benefits

- High availability
- Scalability
- Integration with existing systems
- Freedom to choose vendors of application servers, tools, components
- Multi-platform

Development Roles

- **Java EE Product Provider:** Product providers are typically application server vendors that implement the Java EE platform according to the Java EE 6 Platform specification.
- **Tool Provider:** who creates development, assembly, and packaging tools used by component providers, assemblers, and deployers.
- **Application Component Provider:** who creates web components, enterprise beans, applets, or application clients for use in Java EE applications.
- **Enterprise Bean Developer:** develops and Packages the .class files and deployment descriptor into the EJB JAR file
- **Web Component Developer:** Develops and Packages the .class, .jsp, and.html files and deployment descriptor into the WAR file
- **Application Client Developer:** Develops and Delivers a JAR file containing the application client
- **Application Assembler:** who receives application modules from component providers and may assemble them into a Java EE application EAR file.
- **Application Deployer and Administrator:** configures and deploys application clients, web applications, Enterprise JavaBeans components, and Java EE applications, administers the computing and networking infrastructure where Java EE components and applications run, and oversees the runtime environment.

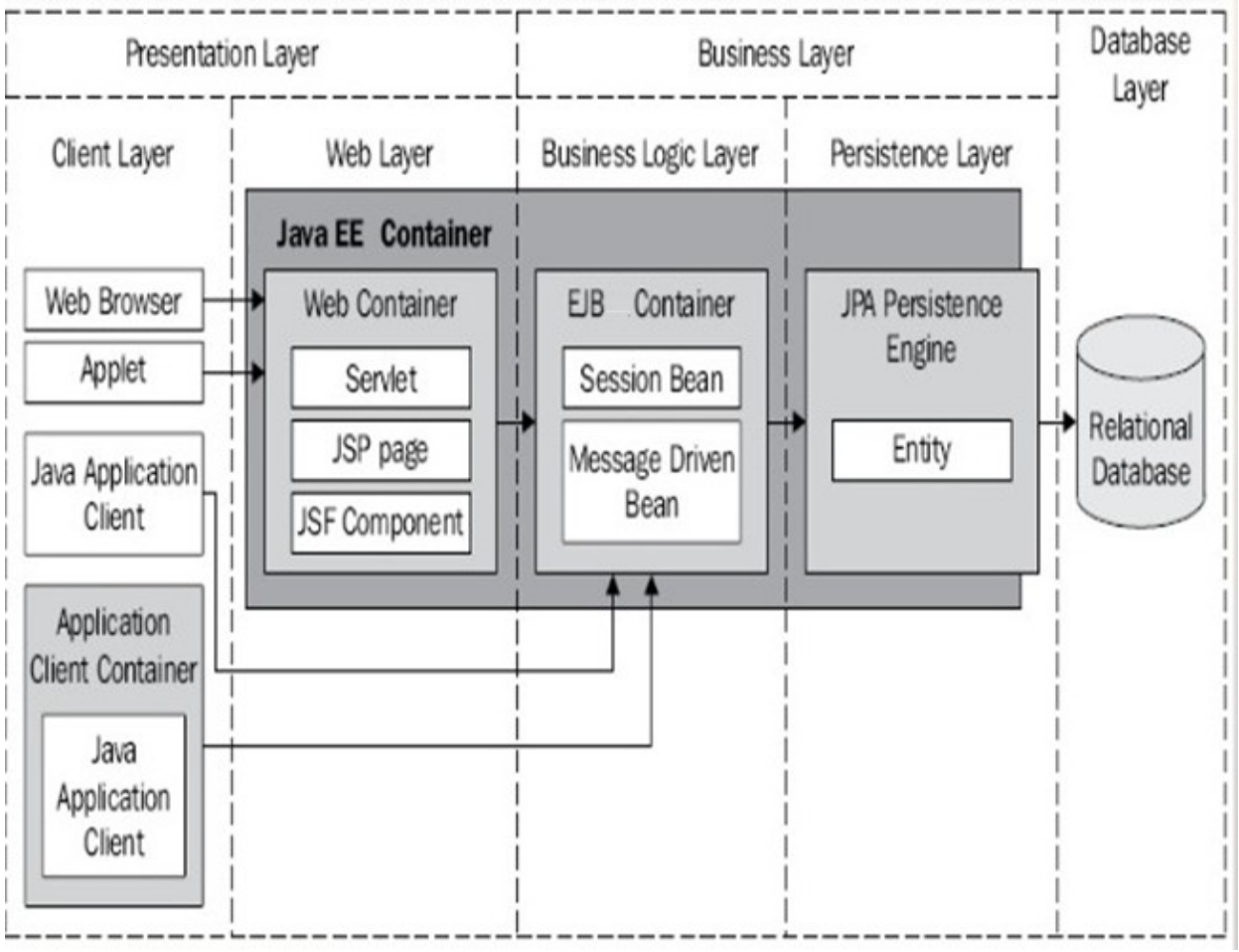
Java EE Benefits

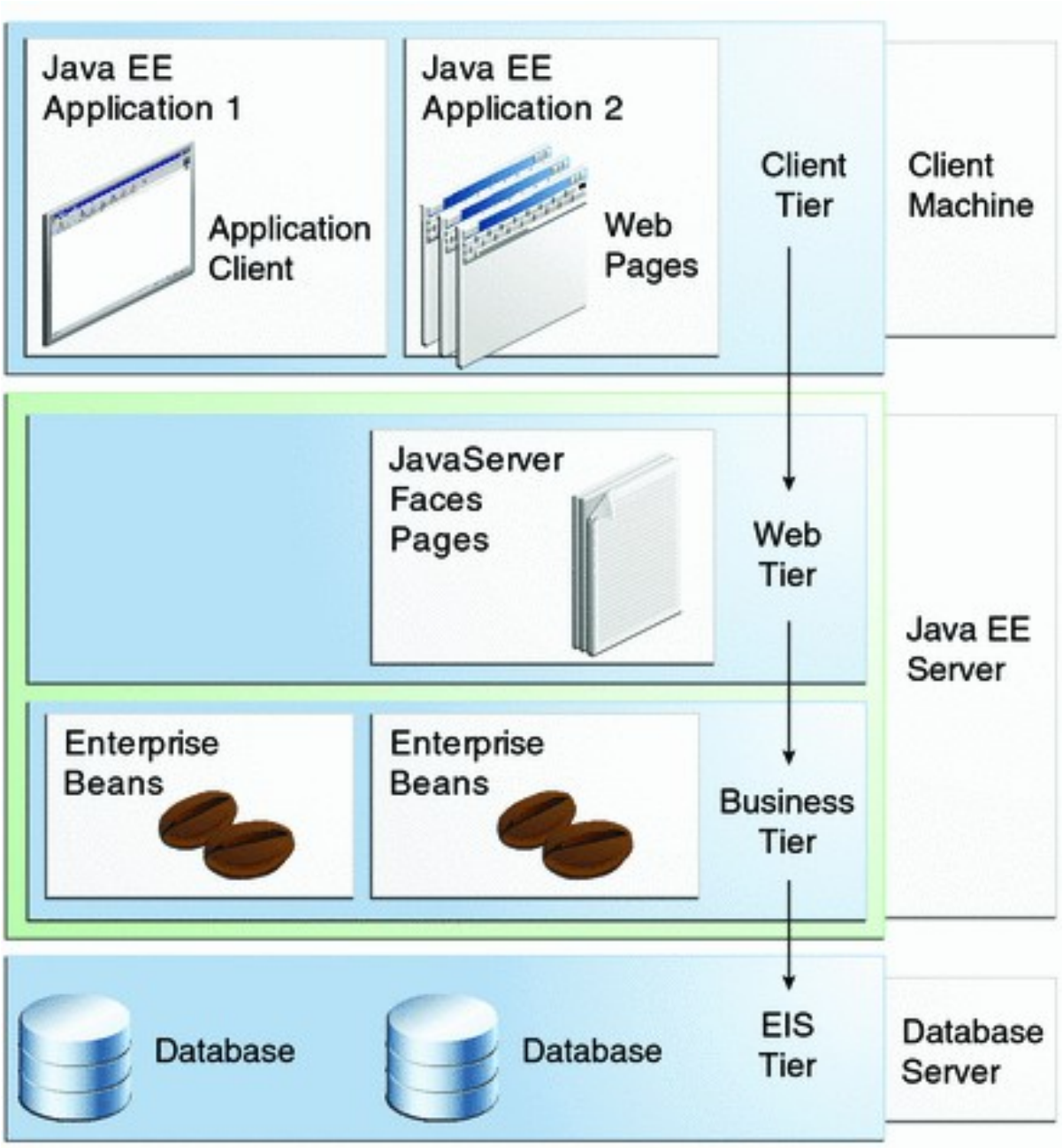


J2EE Application Model

- This model partitions the work needed to implement a multitier service into the following parts:
  - The business and presentation logic to be implemented by the developer
  - The standard system services provided by the Java EE platform

A glance at Java EE architecture





Multi-tiered Applications

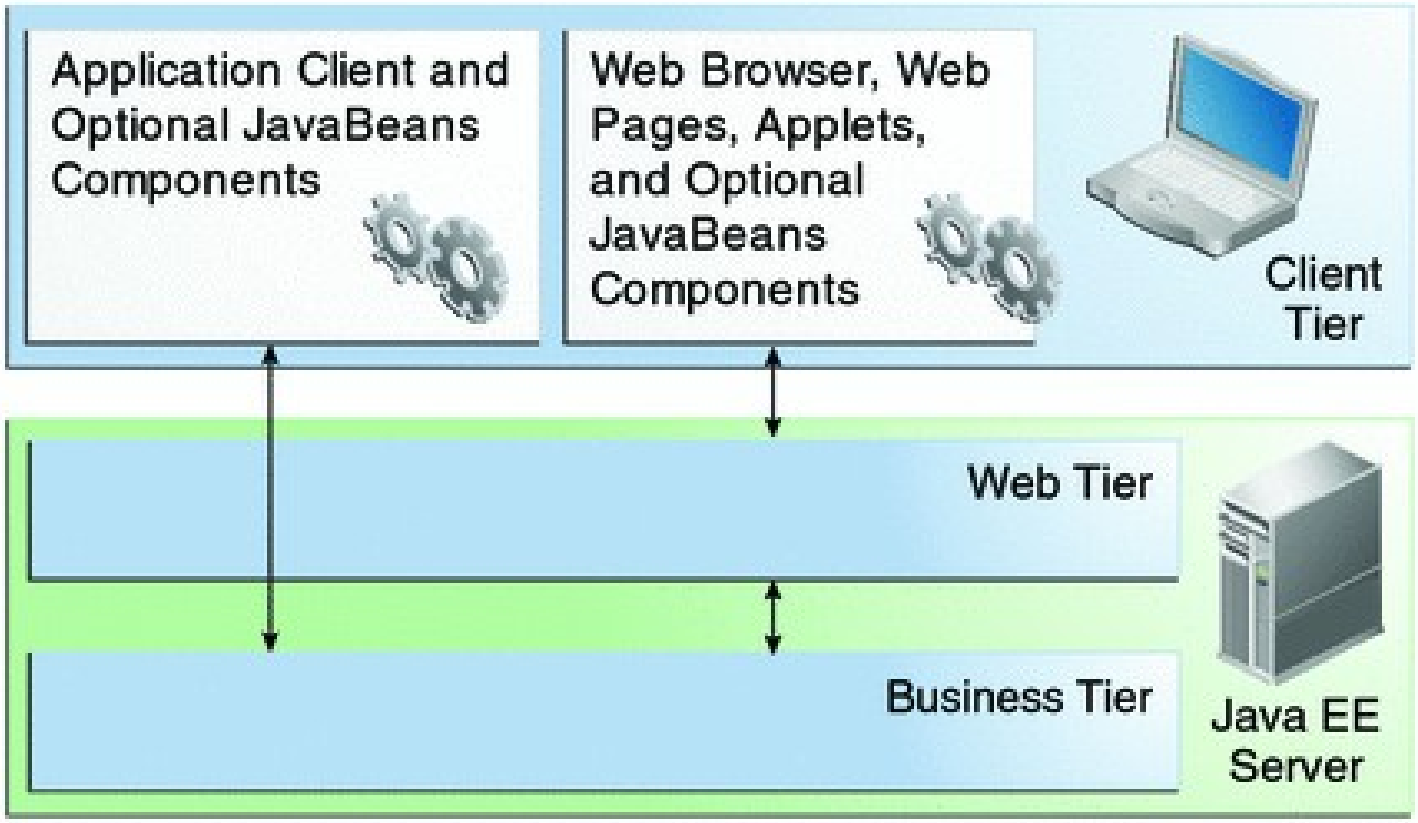
Java EE Components

- Client-tier components run on the client machine.
- Web-tier components run on the Java EE server.
- Business-tier components run on the Java EE server.
- Enterprise information system (EIS)-tier software runs on the EIS server.

J2EE Components

- Java EE applications are made up of components.
- A **Java EE component** is a self-contained functional software unit that is assembled into a Java EE application with its related classes and files and that communicates with other components.
- The Java EE specification defines the following Java EE components:
  - Application clients and applets are components that run on the client.
  - Java Servlet, JavaServer Faces, and JavaServer Pages (JSP) technology components are web components that run on the server.
  - Enterprise JavaBeans (EJB) components (enterprise beans) are business components that run on the server.

J2EE Server Communication



The client communicates with the business tier running on the Java EE server either directly or, as in the case of a client running in a browser, by going through web pages or servlets running in the web tier.

Java EE Clients

- **A Java EE client is usually either a web client or an application client**.
- A **web client** consists of two parts:
  - Dynamic web pages containing various types of markup language (HTML, XML, and so on), which are generated by web components running in the web tier
  - A web browser, which renders the pages received from the server
- A web client is sometimes called a **thin client**. Thin clients usually do not query databases, execute complex business rules, or connect to legacy applications.
- When you use a thin client, such heavyweight operations are off-loaded to enterprise beans executing on the Java EE server, where they can leverage the security, speed, services, and reliability of Java EE server-side technologies.

J2EE Clients

Application Clients:

- An **application client** runs on a client machine and provides a way for users to handle tasks that require a richer user interface than can be provided by a markup language.
- An application client typically has a graphical user interface (GUI) created from the Swing or the Abstract Window Toolkit (AWT) API.
- Application clients directly access enterprise beans running in the business tier.
- Application clients written in languages other than Java can interact with Java EE servers, enabling the Java EE platform to interoperate with legacy systems, clients, and non-Java languages.

Web Components

- Java EE web components are either servlets or web pages created using JavaServer Faces technology and/or JSP technology (JSP pages).
  - **Servlets** are Java programming language classes that dynamically process requests and construct responses.
  - **JSP pages** are text-based documents that execute as servlets but allow a more natural approach to creating static content.
  - **JavaServer Faces technology** builds on servlets and JSP technology and provides a user interface component framework for web applications.

Web Components

- Static HTML pages and applets are bundled with web components during application assembly but are not considered web components by the Java EE specification.

- Server-side utility classes can also be bundled with web components and, like HTML pages, are not considered web components.

JSP

- Used for web pages with dynamic content
- Processes HTTP requests (non-blocking call-and-return)
- Accepts HTML tags, special JSP tags, and scriptlets of Java code
- Separates static content from presentation logic
- Can be created by web designer using HTML tools

Servlet

- Used for web pages with dynamic content
- Processes HTTP requests (non-blocking call-and-return)
- Written in Java; uses print statements to render HTML
- Loaded into memory once and then called many times
- Provides APIs for session management

EJB

- EJBs are *distributed components* used to implement business logic (no UI)

- Developer concentrates on business logic

- Client of EJBs can be JSPs, servlets, other EJBs and external applications

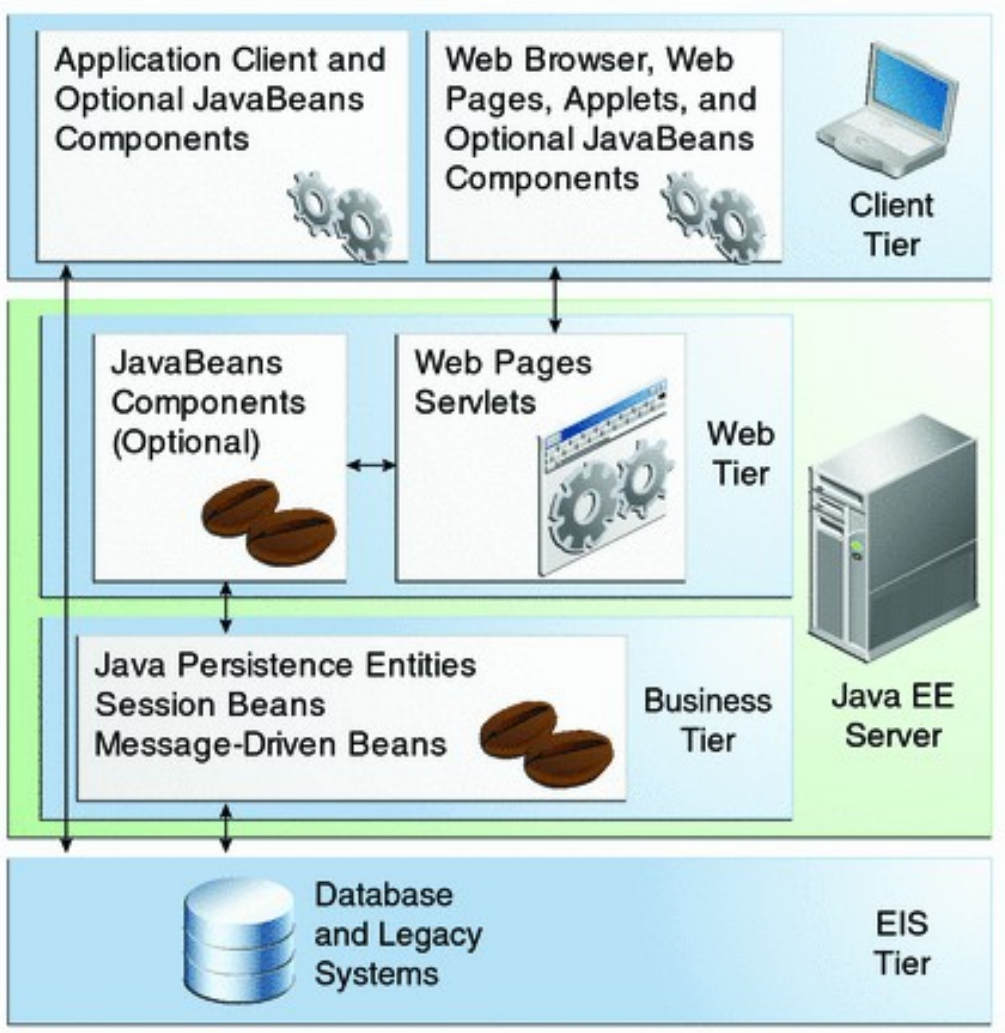
Business Components

Business code, which is logic that solves or meets the needs of a particular business domain such as banking, retail, or finance, is handled by enterprise beans running in either the business tier or the web tier.

Business and EIS tier

Enterprise bean receives data from client programs, processes it (if necessary), and sends it to the enterprise information system tier for storage.

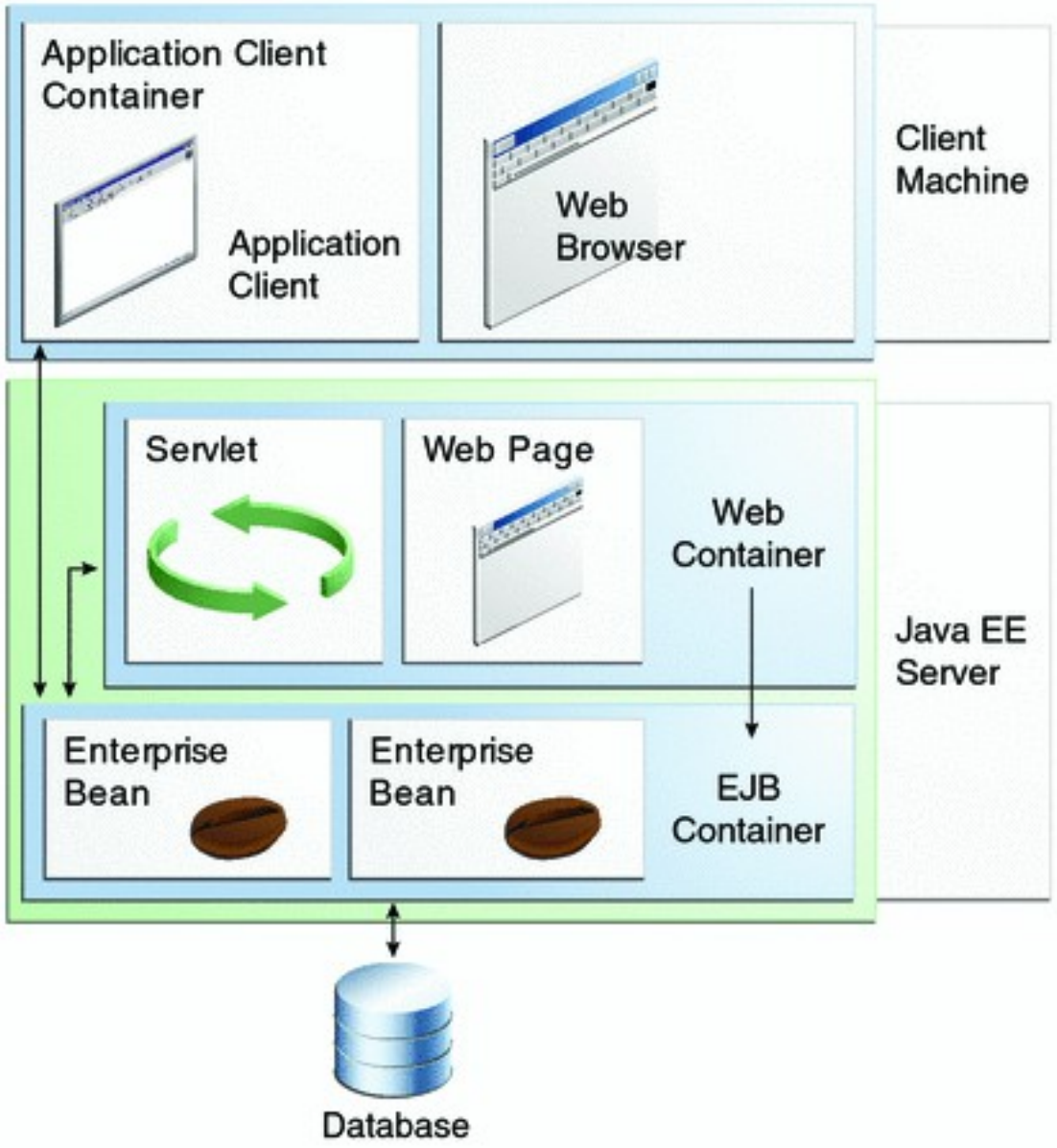
An enterprise bean also retrieves data from storage, processes it (if necessary), and sends it back to the client program.



Enterprise Information System Tier

- The enterprise information system tier handles EIS software and includes enterprise infrastructure systems, such as enterprise resource planning (ERP), mainframe transaction processing, database systems, and other legacy information systems.
- For example, Java EE application components might need access to enterprise information systems for database connectivity

Java EE Server and Containers



J2EE Containers

- Web components are supported by the services of a runtime platform called a **web container**.

- A web container provides such services as request dispatching, security, concurrency, and lifecycle management. A web container also gives web components access to such APIs as naming, transactions, and email.

Java EE Servers and Containers

- **Java EE server**: The runtime portion of a Java EE product. A Java EE server provides EJB and web containers.
- **Enterprise JavaBeans (EJB) container**: Manages the execution of enterprise beans for Java EE applications. Enterprise beans and their container run on the Java EE server.
- **Web container**: Manages the execution of web pages, servlets, and some EJB components for Java EE applications. Web components and their container run on the Java EE server.
- **Application client container**: Manages the execution of application client components. Application clients and their container run on the client.
- **Applet container**: Manages the execution of applets. Consists of a web browser and Java Plug-in running on the client together.

Java EE Application Assembly and Deployment

- A Java EE application is packaged into one or more standard units for deployment to any Java EE platform-compliant system. Each unit contains
  - A functional component or components, such as an enterprise bean, web page, servlet, or applet
  - An optional deployment descriptor that describes its content
- Once a Java EE unit has been produced, it is ready to be deployed. Deployment typically involves using a platform's deployment tool to specify location-specific information, such as a list of local users who can access it and the name of the local database.
- Once deployed on a local platform, the application is ready to run.

Packaging Applications

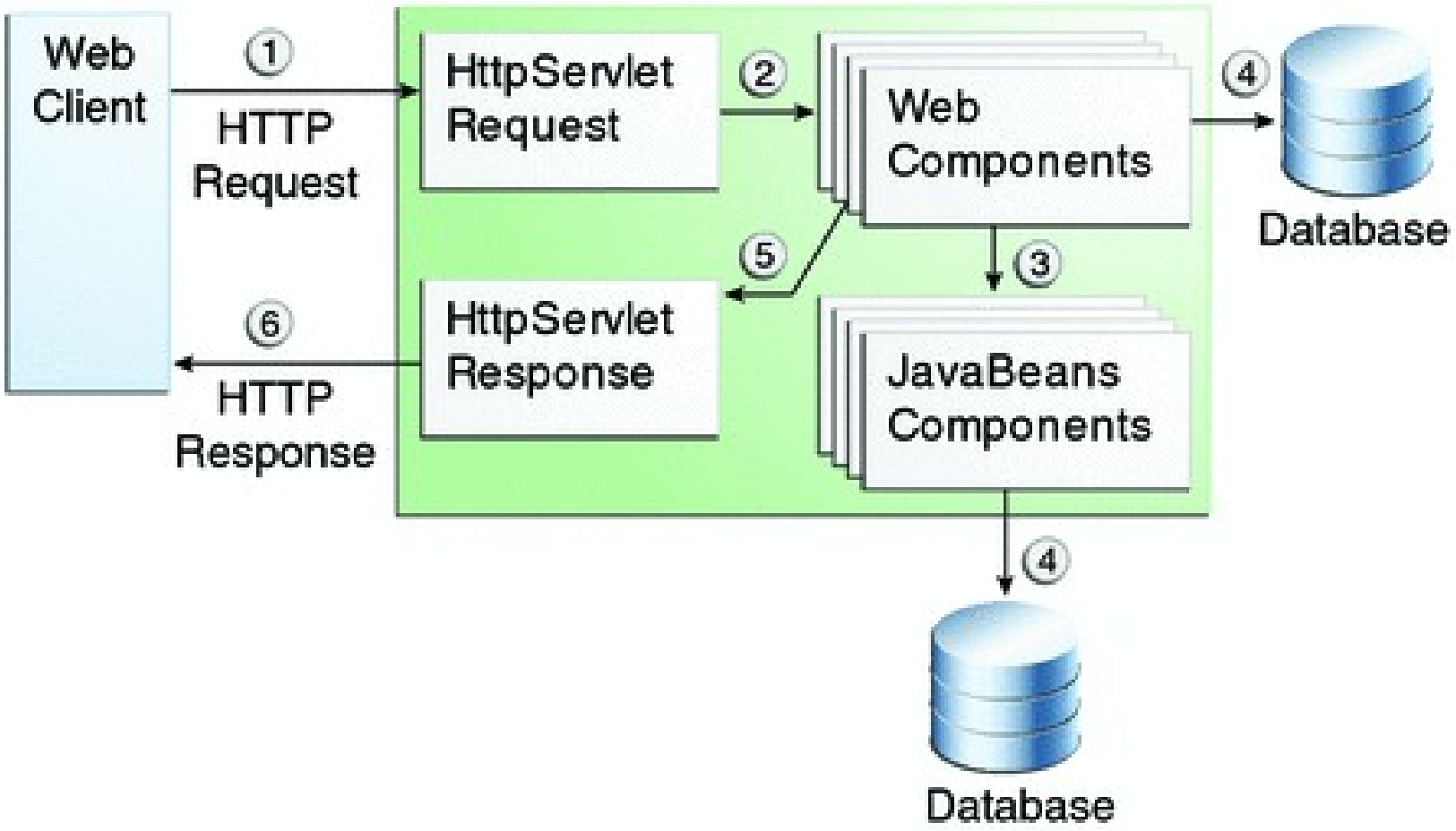
- A Java EE application is delivered in a Java Archive (JAR) file, a Web Archive (WAR) file, or an Enterprise Archive (EAR) file.
- A WAR or EAR file is a standard JAR (.jar) file with a .war or .ear extension.
- Using JAR, WAR, and EAR files and modules makes it possible to assemble a number of different Java EE applications using some of the same components.
- No extra coding is needed; it is only a matter of assembling (or packaging) various Java EE modules into Java EE JAR, WAR, or EAR files.

Web applications

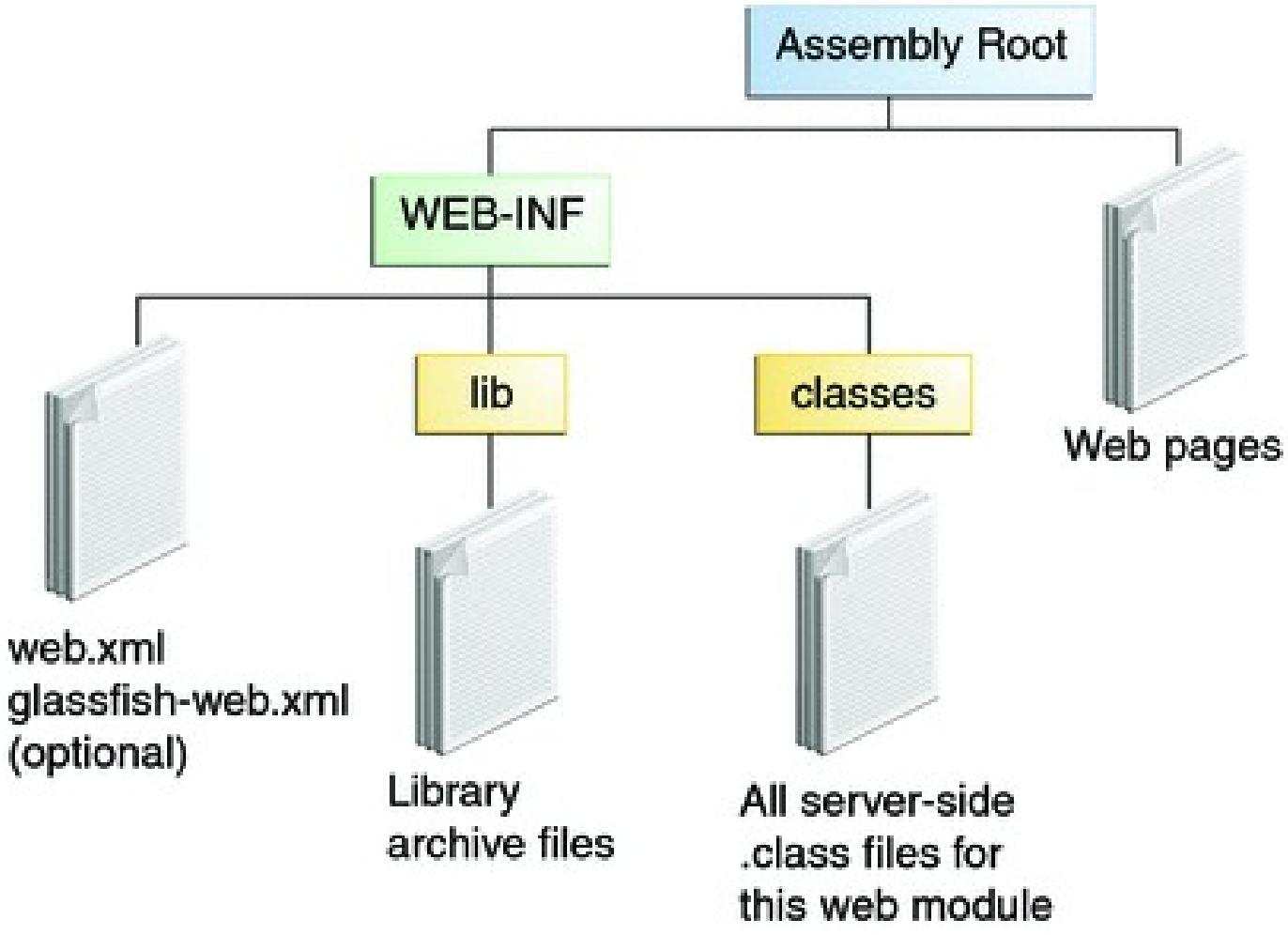
Web Applications

- A **web application** is a dynamic extension of a web or application server.
- Web applications are of the following types:
  - **Presentation-oriented**: A **presentation-oriented web application** generates interactive web pages containing various types of markup language (HTML, XHTML, XML, and so on) and dynamic content in response to requests.
  - **Service-oriented**: A **service-oriented web application** implements the endpoint of a web service. Presentation-oriented applications are often clients of service-oriented web applications

Java Web Application Request Handling



Web Module Structure



Web Services Support

- Web services are web-based enterprise applications that use open, XML-based standards and transport protocols to exchange data with calling clients.
- The J2EE platform provides the XML APIs and tools you need to quickly design, develop, test, and deploy web services and clients that fully interoperate with other web services and clients running on Java-based or non-Java-based platforms.

XML

- XML is a cross-platform, extensible, text-based standard for representing data.
- When XML data is exchanged between parties, the parties are free to create their own tags to describe the data, set up schemas to specify which tags can be used in a particular kind of XML document, and use XML stylesheets to manage the display and handling of the data.

SOAP Transport Protocol

- Client requests and web service responses are transmitted as Simple Object Access Protocol (SOAP) messages over HTTP to enable a completely interoperable exchange between clients and web services, all running on different platforms and at various locations on the Internet.
- HTTP is a familiar request-and response standard for sending messages over the Internet, and SOAP is an XML-based protocol that follows the HTTP request-and-response model.

WSDL & UDDI

- **WSDL Standard Format :** The Web Services Description Language (WSDL) is a standardized XML format for describing network services. The description includes the name of the service, the location of the service, and ways to communicate with the service.

- **UDDI and ebXML Standard Formats:** Universal Description, Discovery and Integration (UDDI) and ebXML, make it possible for businesses to publish information on the Internet about their products and web services, where the information can be readily and globally accessed by clients who want to do business.