Java Technologies
Java EE - Introduction

First of All – Course Information

- The Goal
- The Motivation
- Teaching / Learning
- Bibliography
- Evaluation
  - Lab: problems, personal projects, essays → easy
  - Exam: written test / quiz → hard

The Context

- We are in the situation of developing a **complex, large-scale, portable, scalable, reliable, secure, transactional, distributed system.**
- *Who is the customer?* A HUGE bank, a chain of hypermarkets, a Fortune 500 company, etc.
- *What do we know?* Programming languages (Java, Groovy, Scala, Kotlin, etc.), various protocols (TCP, UDP, HTTP, SOAP, etc.), specifications, etc.
- *What do we want?* A framework that will make our lives as easy as possible.
- *When do we want it?*

Java Enterprise Edition (Java EE)

“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.”

- Specifications

  Java EE API describes how an enterprise application should be created, what components should contain, etc.

- Implementations → Application Servers
  - Oracle GlassFish (reference implementation)
  - WebLogicServer, JBoss Application Server / WildFly,

    IBM WebSphere, Apache Tomcat / Geronimo / TomEE, etc.
- Portability

Downloads

- **NetBeans IDE**
  - Bundle: *Java EE* or *All*
  - Includes Tomcat and GlassFish Application Servers
  - Free
- **Eclipse IDE for Java EE Developers**
  - An application server must be installed separately
  - Free
- **IntelliJ IDEA Ultimate Edition**
  - Free 30 day trial / Free for students and teachers

Java EE Technologies

- **Servlets**
- **JSP** Java Server Pages
- **JSF** Java Server Faces
- **JNDI** Java Naming and Directoy Interface
- **JPA** Java Persistence API
- **EJB** Enterprise Java Beans
- **JAX-WS, JAX-RS** Web Services
- **CDI** Context and Dependency Injection
- **JMS, JTA, ...**

Other EE Alternatives

- Microsoft ASP.NET Core
  - OK
- PHP, Python, Perl, Ruby, JS, etc. frameworks
  - These are Web Frameworks
  - What about security, transactions, scalability, etc?
- "Do It Yourself" framework
  - What about standards, maintanability, interoperability?

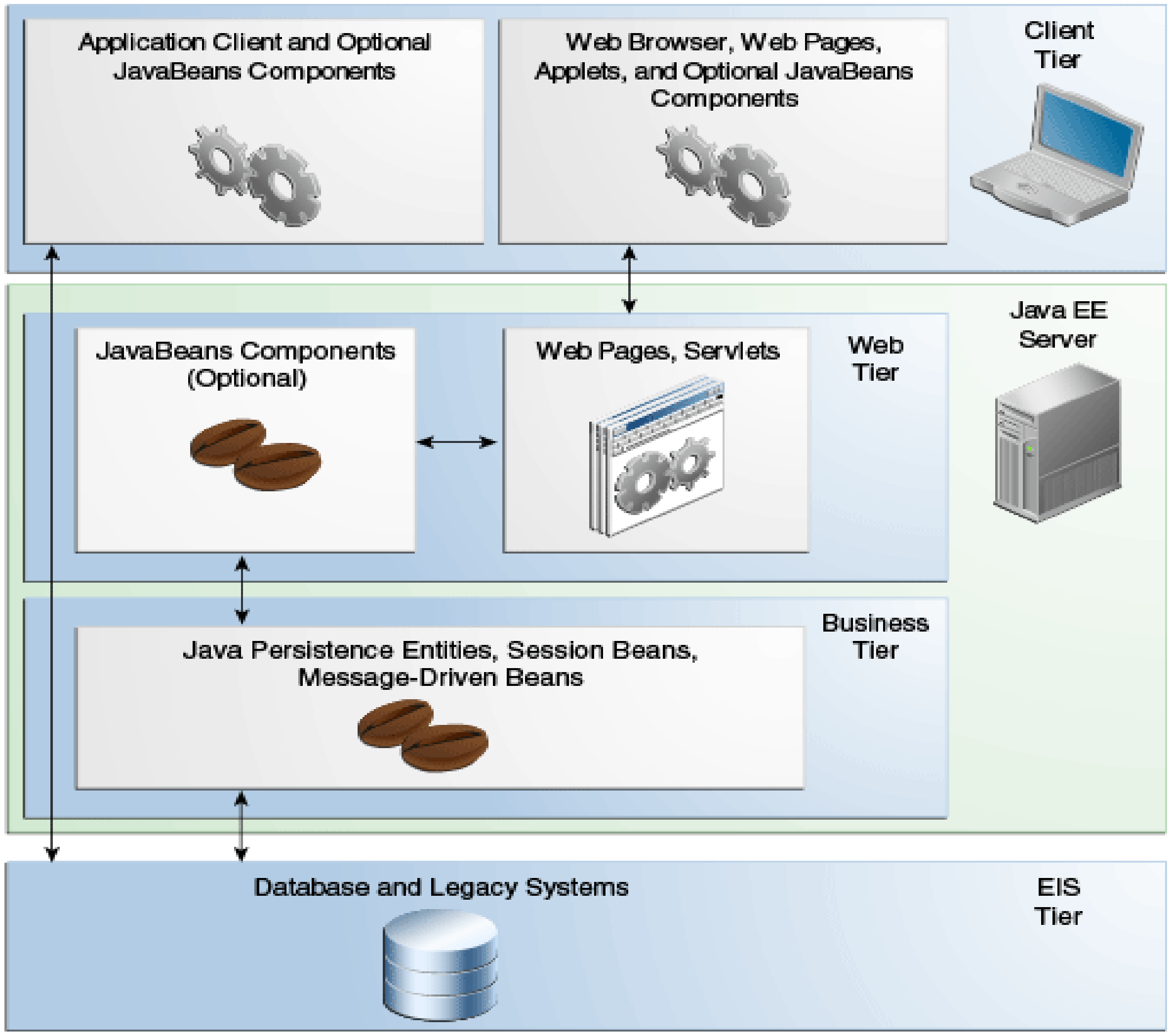
Client- vs Server Centric Web Frameworks

- In both cases, the bussiness logic is implemented using server-side components (or services)
- **Server - Centric** (JavaEE approach)
  - The UI component tree is stored on the server and rendered to the client upon page requests.
  - Binding UI components and server-side data is easy, (client and server are synchronized)
- **Client – Centric** (Angular, React, Vue + Services)
  - The UI is written in JavaScript (or TypeScript, etc) and runs on the client (browser)
  - UI communicates with server-side services in order to receive and send data

A Note about Spring Framework

- JavaEE is *a set of specifications* supervised by The Eclipse Foundation (having various implementations) / Spring is an *application framework* developed by PivotalSoftware.
- Both **depend on the same core** APIs (Servlet, JPA, JMS, BeanValidation etc).
- They **look and behave pretty similar** to each other.
- Spring is more “friendly” to beginners, offering a lot of ready-to-use tools (like SpringBoot, for example).
- JavaEE offers “heavy guns” (like EJB, for example) for achieving scalability in a standard manner
- Both are “relevant”, being used in large projects and are here to stay for a long time.

Distributed Multitiered Applications


Application Client and Optional JavaBeans Components
Web Browser, Web Pages, Applets, and Optional JavaBeans Components
Client Tier
JavaBeans Components (Optional)
Web Pages, Servlets
Web Tier
Java EE Server
Java Persistence Entities, Session Beans, Message-Driven Beans
Business Tier
Database and Legacy Systems
EIS Tier

Application logic is divided into **components** according to function, and the application components that make up a Java EE application are installed on various machines depending on the tier in the multitiered Java EE environment to which the application component belongs.

Java EE Components

- Java EE applications are made up of components.
- A Java EE component is a self-contained functional software unit that is assembled into an application at a specific tier and communicates with other components.
- **Client Tier**: application clients, ~~applets~~
- **Web Tier**: Java Servlet, JavaServer Faces, and JavaServer Pages (JSP) technology components,

  HTML, XHTML, CSS, etc
- **Bussiness Tier**: EJB components (enterprise beans)
- **Model Tier**: The entity beans or any other beans :)

Containers

*“**Containers are the interface between a component and the low-level platform-specific functionality that supports the component.** Before a web, enterprise bean, or application client component can be executed, it must be assembled into a Java EE module and deployed into its container.”*

- **Web containers** manages the execution of web pages, servlets, etc. Implemented in most application servers, such as Tomcat: “Apache Tomcat™ is an open source software implementation of the Java Servlet, JavaServer Pages, Java Expression Language and Java WebSocket technologies. The Java Servlet, JavaServer Pages, Java Expression Language and Java WebSocket specifications”
- **Java EE containers** manages the execution of EJB, JMS, etc. and are implemented in the “heavy” Java EE servers, such as Glassfish: “GlassFish is the reference implementation of Java EE and as such supports Enterprise JavaBeans, JPA, JavaServer Faces, JMS, RMI, JavaServer Pages, servlets, etc.”

Application Lifecycle

- **Develop** the components code and the application deployment descriptors, if necessary.
- **Compile** the application components and helper classes referenced by the components.
- **Package** the application into a deployable unit.

  → **war, ear**
- **Deploy** the application into dedicated containers, using the application server tools.
- **Access a URL** that references the web application.

Organizing the Components

- **Source Level: *Java EE blueprints***
- **Build Level**

```
\MyApplication
   Web Pages
   Resources
   \WEB-INF
      web.xml
      Configuration files

      \classes
         .class, .properties

      \lib
         .jar
```

web.xml = the deployment descriptor file: determines how URLs map to components, which URLs require authentication, etc.

A "web application" is a collection of servlets and content installed under a specific subset of the server's URL namespace such as /MyApplication and installed via a .war file

Sample *web.xml* File

```
<web-app>
    <display-name>HelloWorld Application</display-name>
    <description>
        This is a complex, large-scale web application
    </description>

    <session-timeout>30</session-timeout>

    <welcome-file-list>
      <welcome-file>index.html</welcome-file>
    </welcome-file-list>

    <servlet>
        <servlet-name>HelloServlet</servlet-name>
        <servlet-class>examples.Hello</servlet-class>
    </servlet>

    <servlet-mapping>
        <servlet-name>HelloServlet</servlet-name>
        <url-pattern>/hello</url-pattern>
    </servlet-mapping>
</web-app>
```

Most of these metadata will be specified using **annotations**.
Sometimes, the web.xml file may not be required.

Bibliography

- The Java EE Tutorial
- The Java EE API
- ...