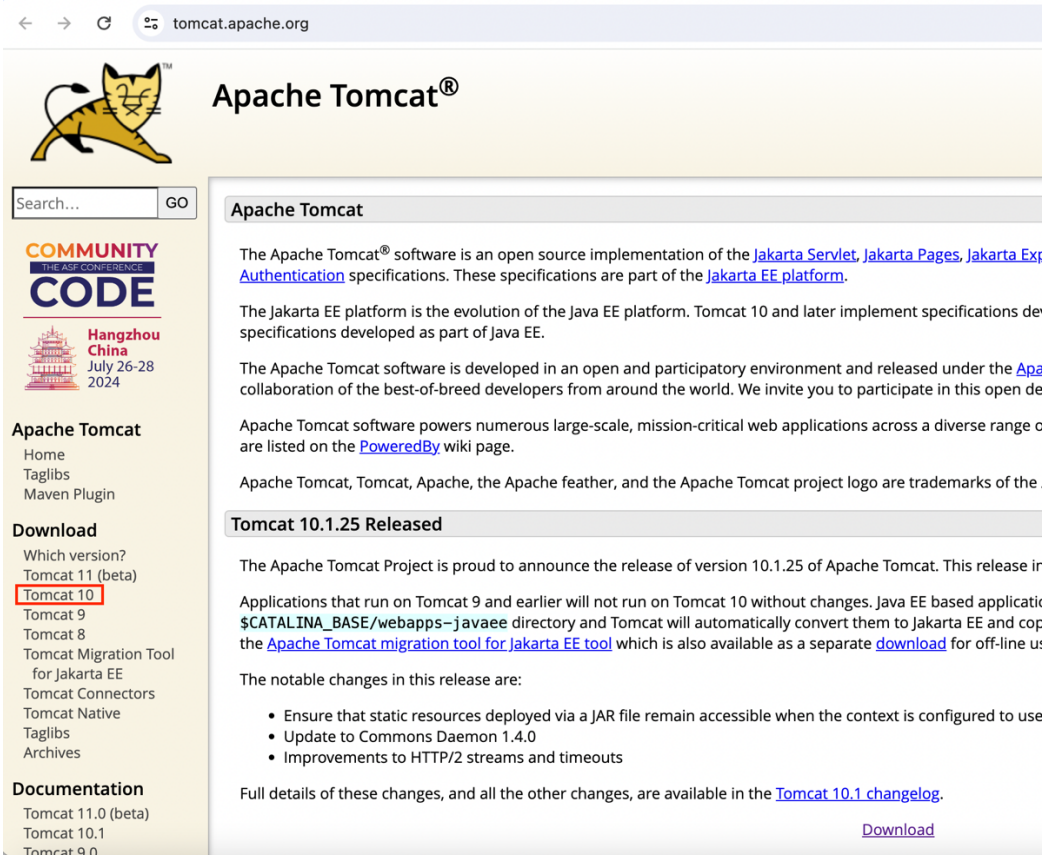
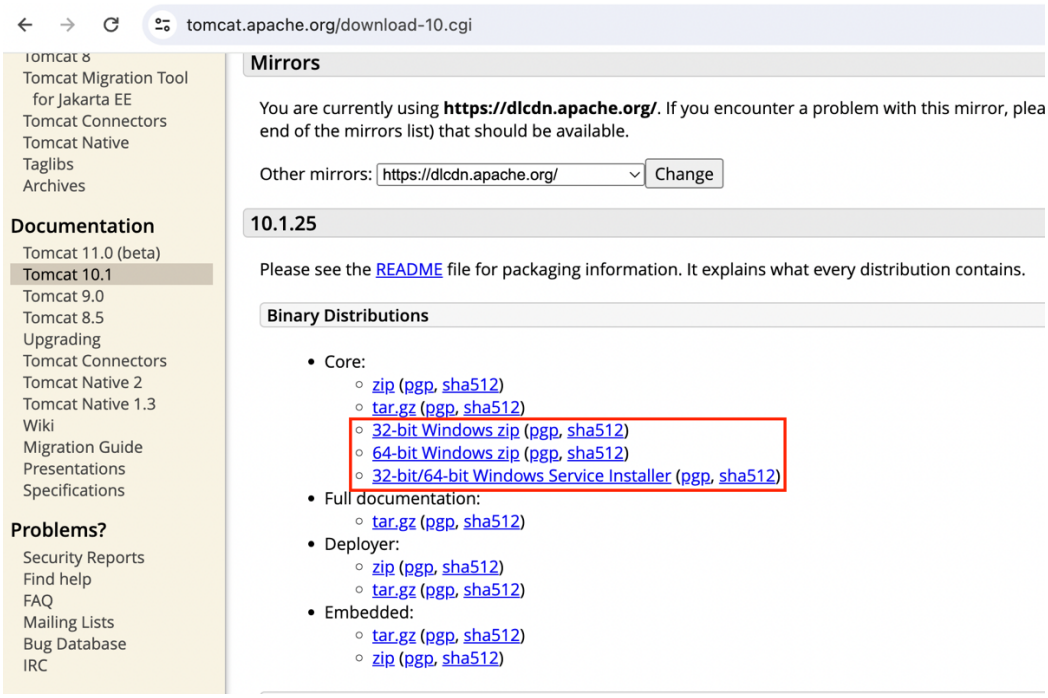
1. ***Required Software:***
   a. Must have the Java Development Kit (JDK)
      https://www.oracle.com/cis/java/technologies/downloads/#java17
   b. To build JSP/Servlet applications, you need:
      - Java Application Server – Tomcat
        https://tomcat.apache.org/download-10.cgi
      - Java Integrated Developer Environment (IDE) - **Eclipse IDE for Java EE Developers**
        https://www.eclipse.org/downloads/packages/release/2024-06/r
2. ***Install Tomcat on Windows***
   a. ***Step 1: Download Tomcat for Windows***
      - Browser to the site and Locate the *Download* section and click the **latest Tomcat version** available.

      https://tomcat.apache.org/

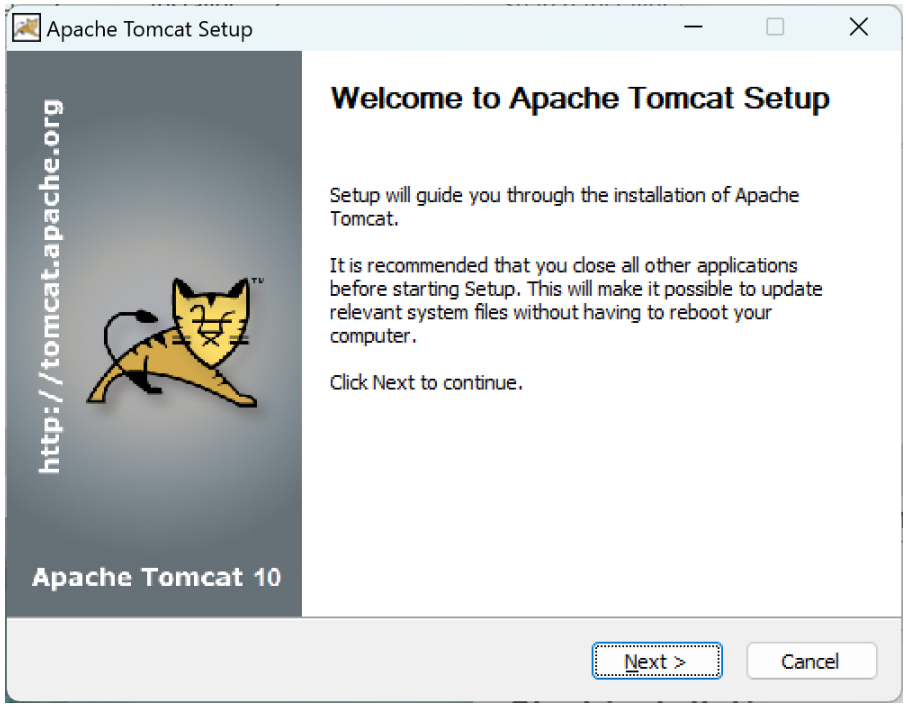


- **Click** download link for the **Windows Service Installer** or the **32bit/64bit Windows zip file**

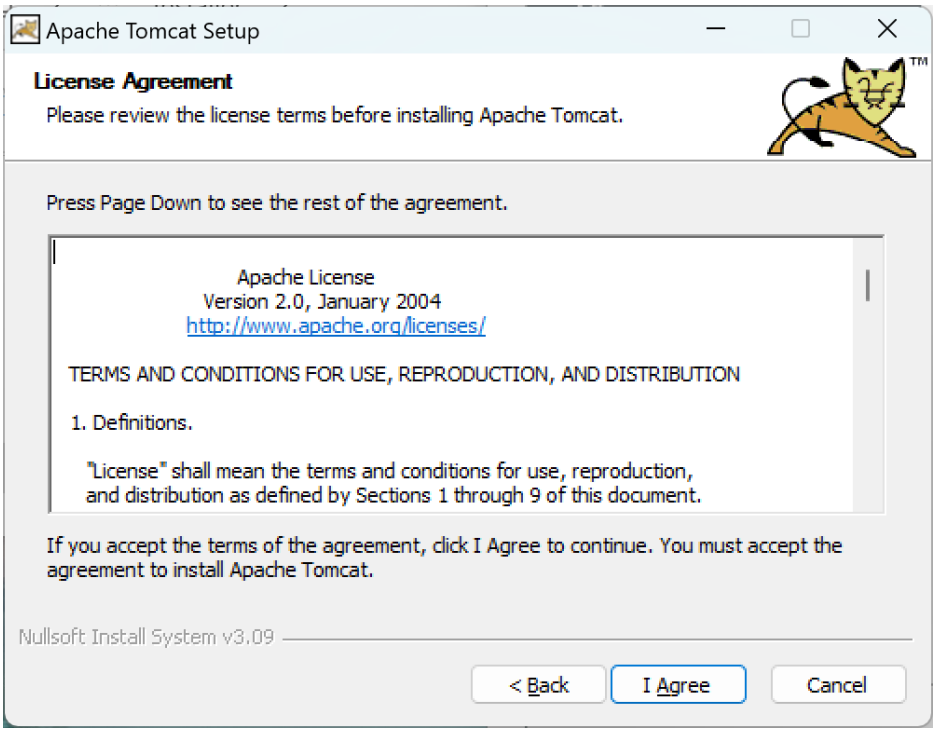


b. Step 2: Install Tomcat

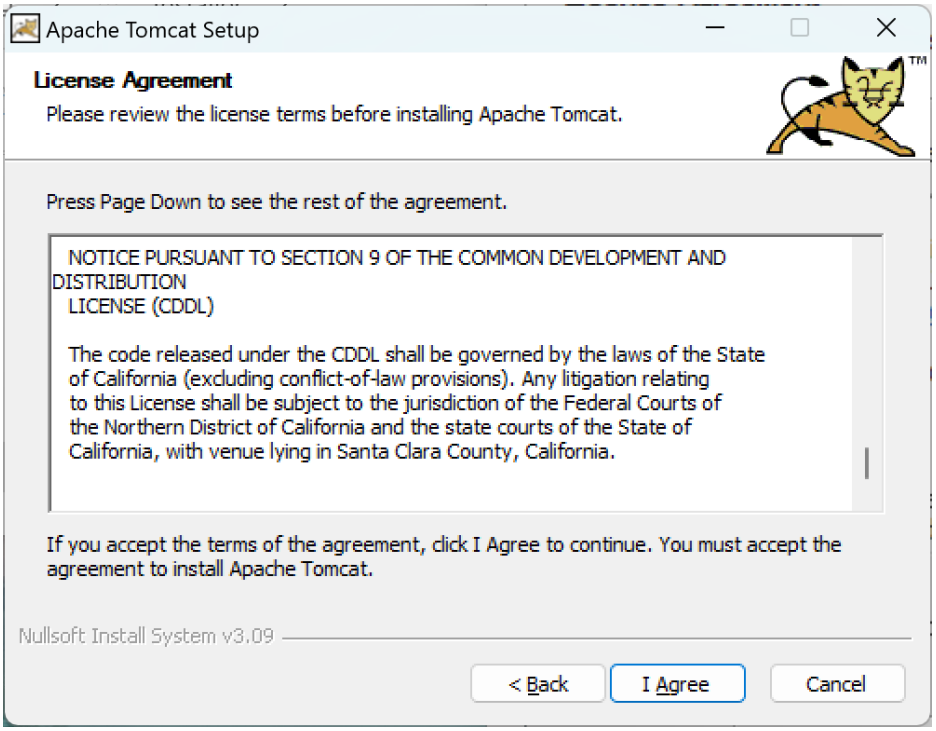
- Open the downloaded **Windows Service Installer** file to start the installation process.



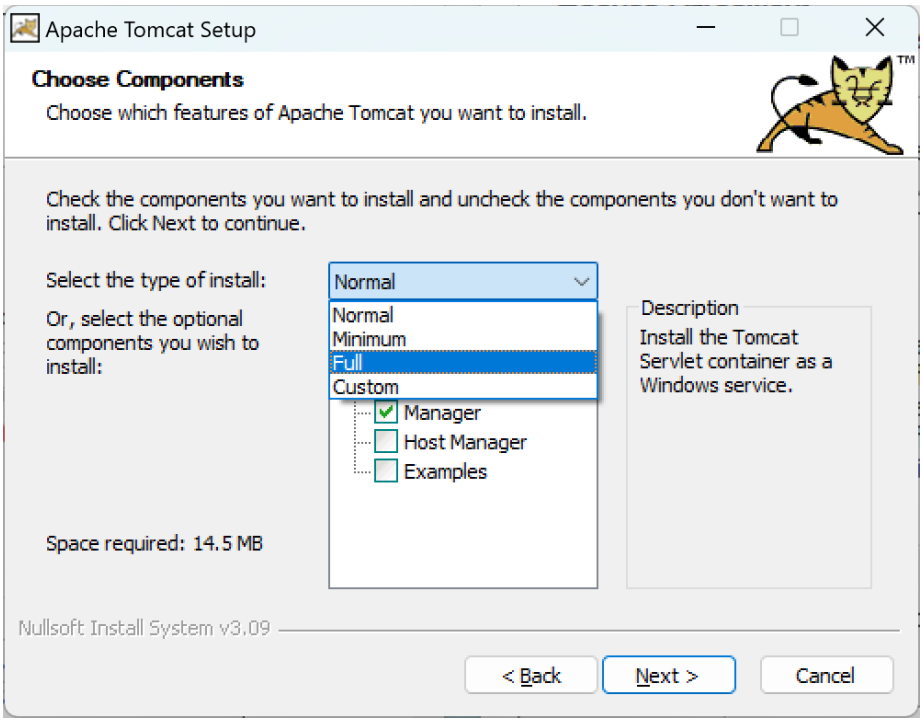
- In the Tomcat Setup welcome screen, click **Next** to proceed.



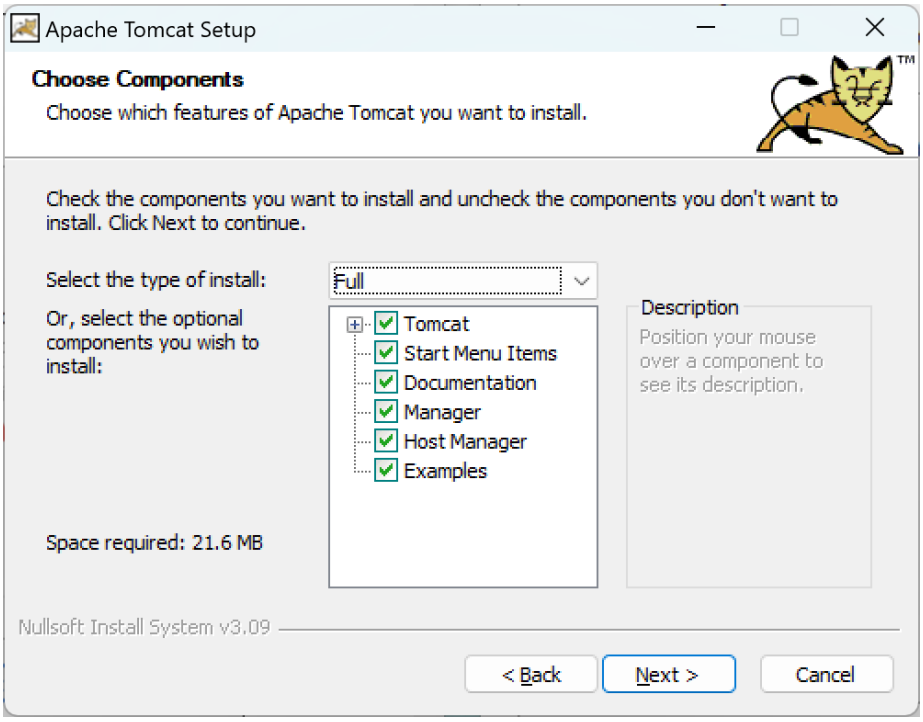
- Read the License Agreement and if you agree to the terms, click **I Agree** to proceed to the next step.



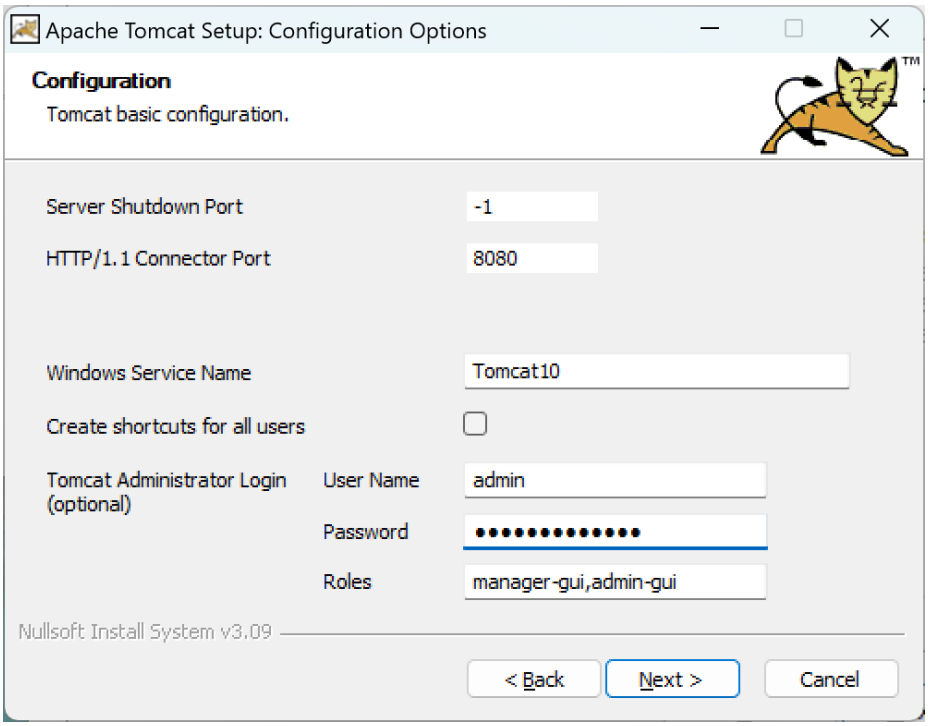
- Click **I Agree** button to continue



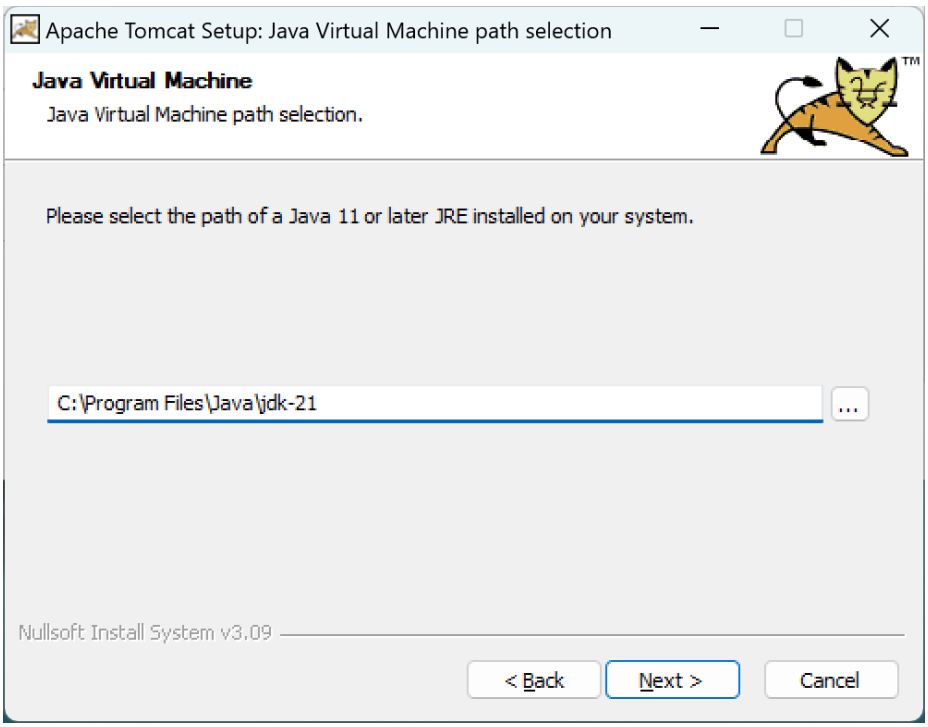
- Choose **Full** type of install



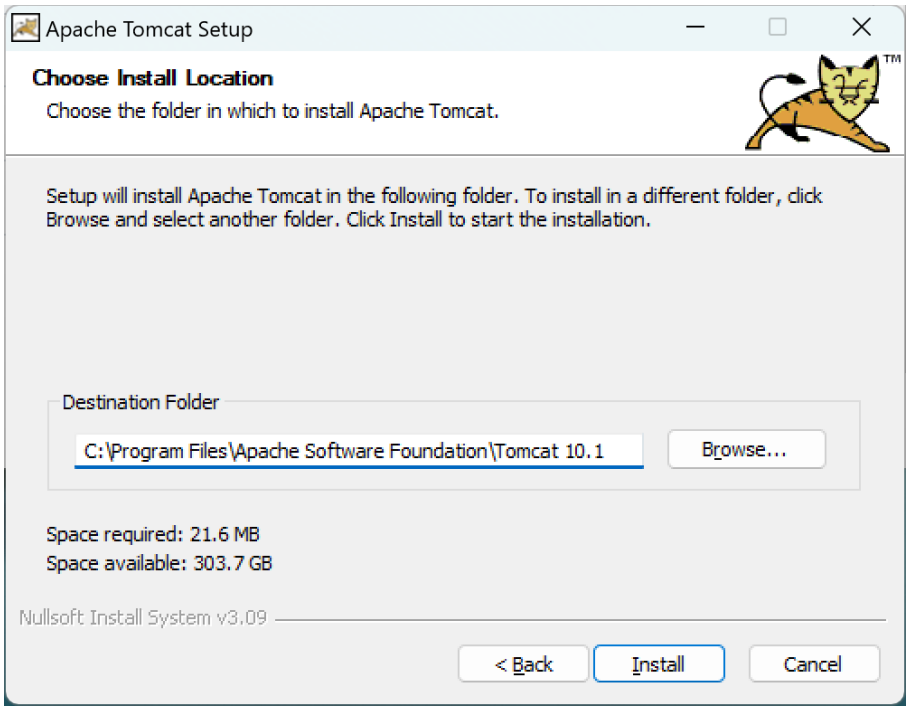
- Click **Next** button to continue. Fill user and password for Tomcat Administrator Login.



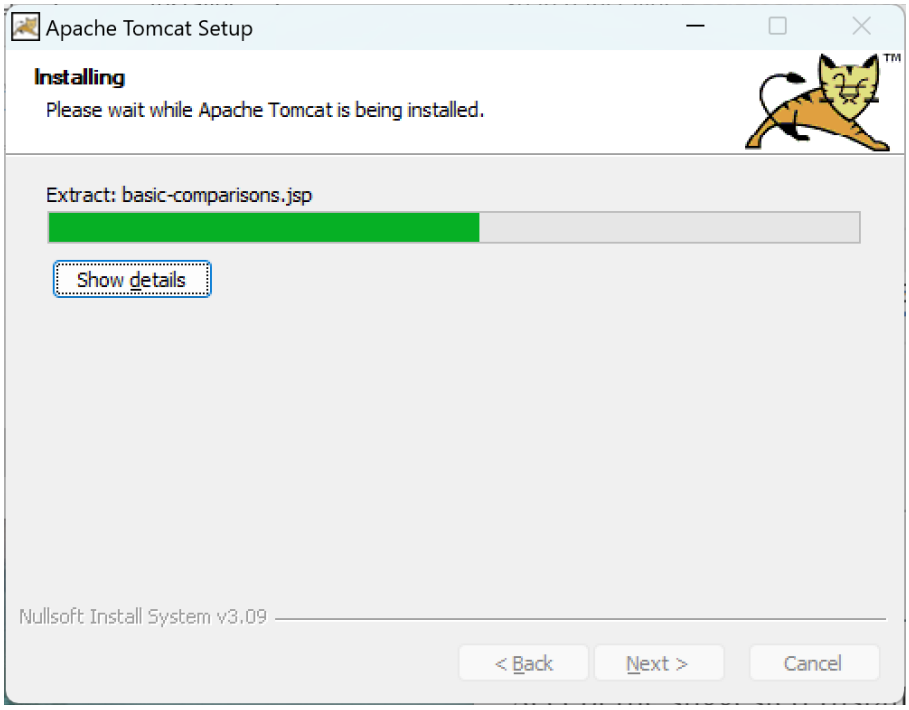
- Click **Next** button



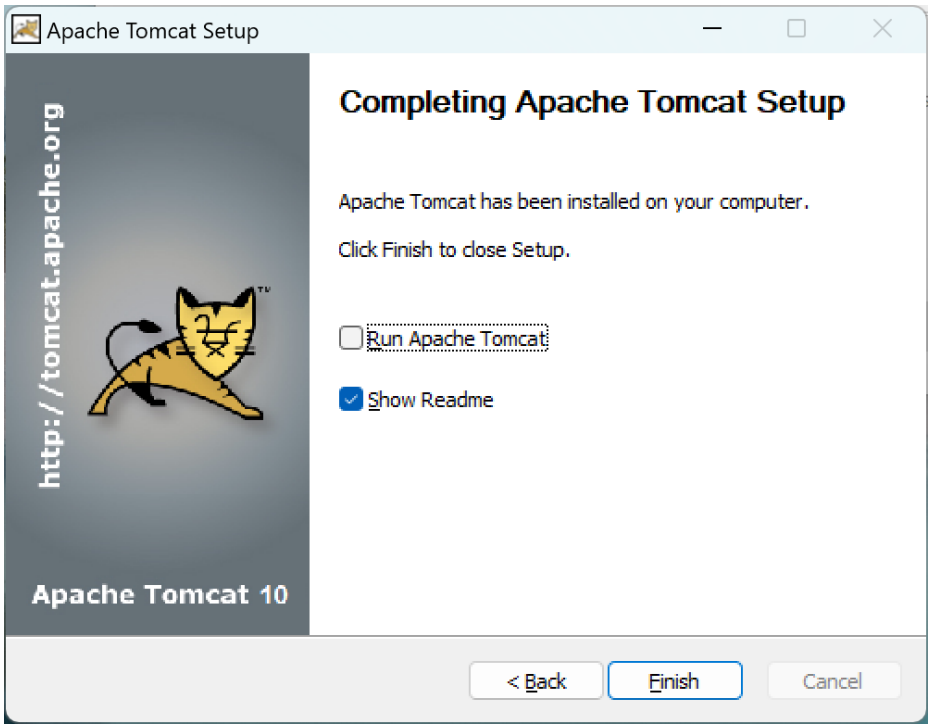
- Unless you have other installed version of Java that you want to use with Tomcat, just click Next button.



- Accept the suggested Install Location and click **Install** button



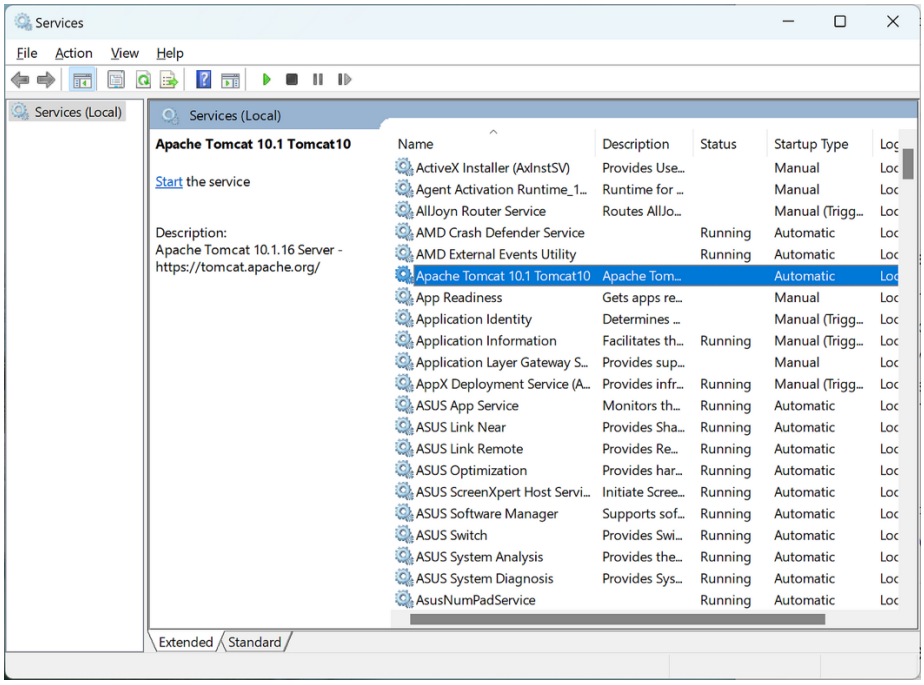
- Wait for the installation process.



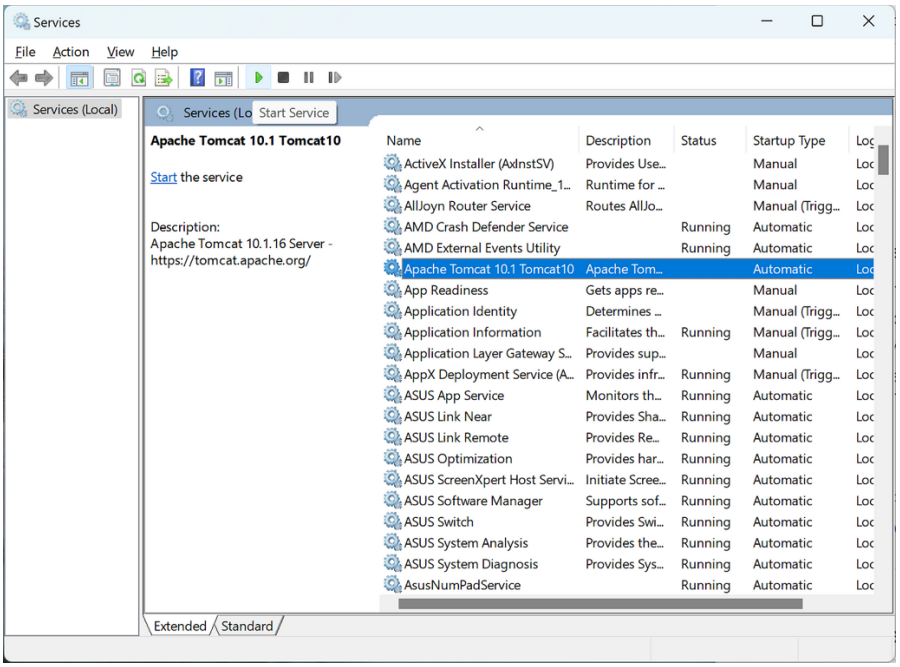
- Uncheck Run Apache Tomcat, then click **Finish** button to end installation.

c. *Run Apache TomCat*

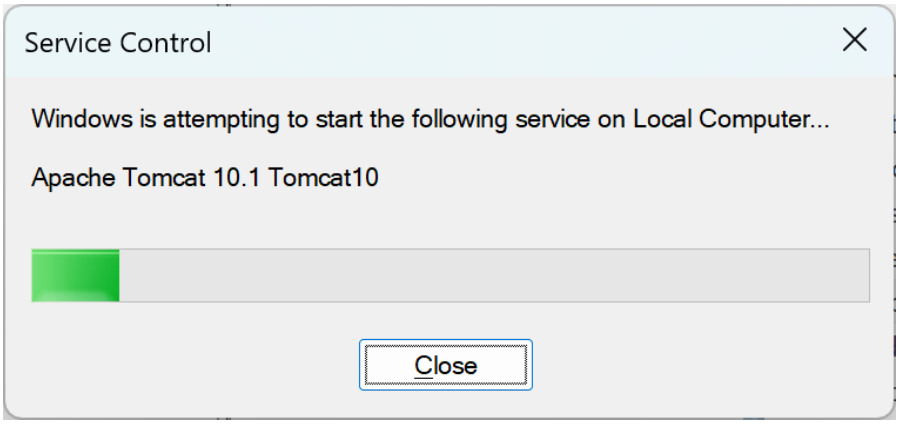
- Press Windows logo key ⊞, type **services**, and press **Enter** key



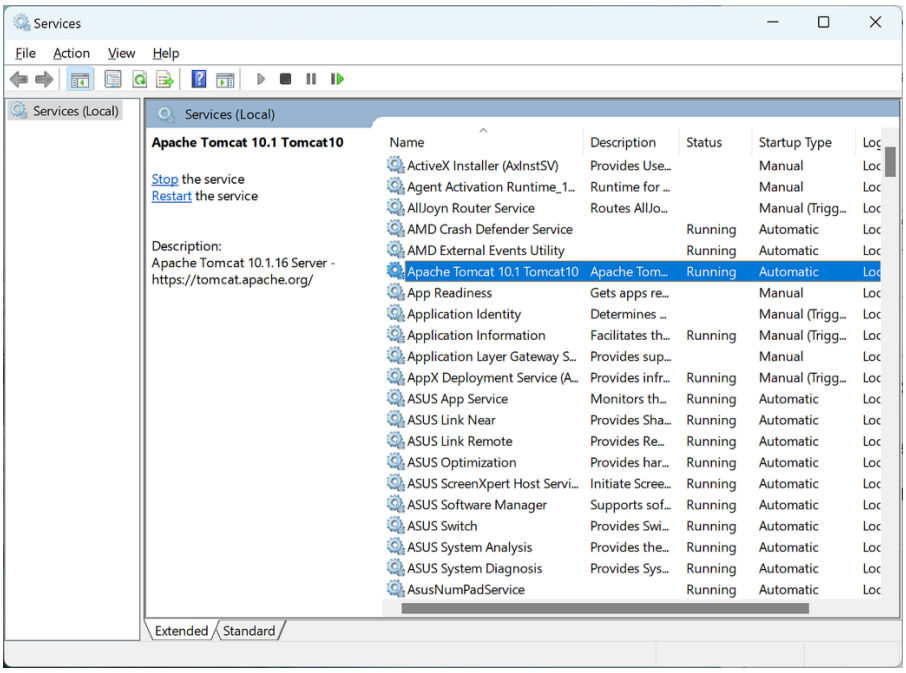
- Locate the **Apache Tomcat 10.1 Tomcat 10**



- Click green ▶ button to ***Start Service***

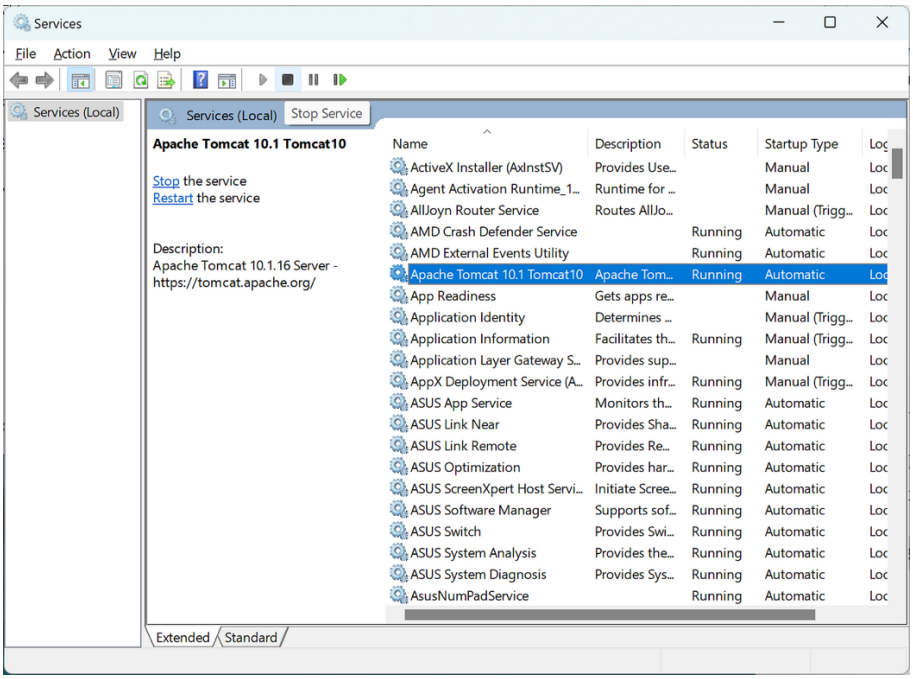


- Wait Windows to start the service

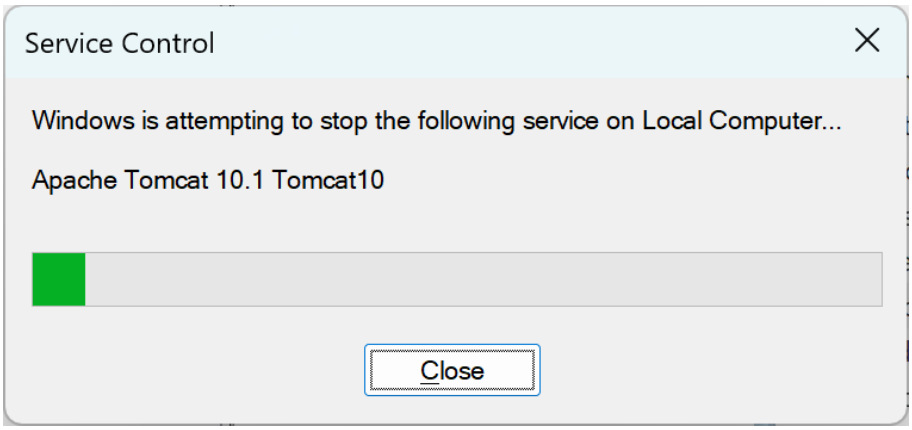


d. Stop Apache TomCat

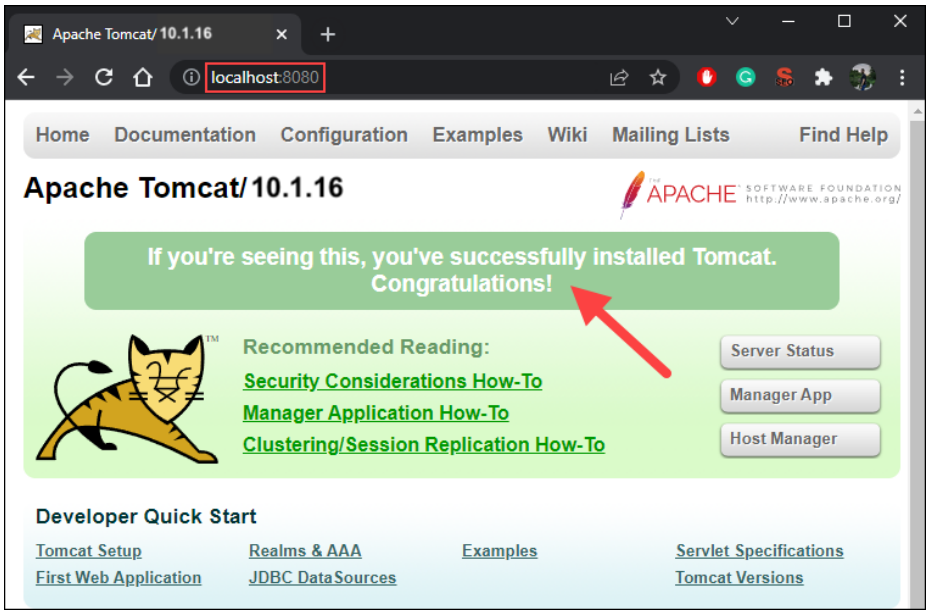
- Open Services Window and locate **Apache Tomcat 10.1 Tomcat 10**.



- Press ■ button to **stop** the service.

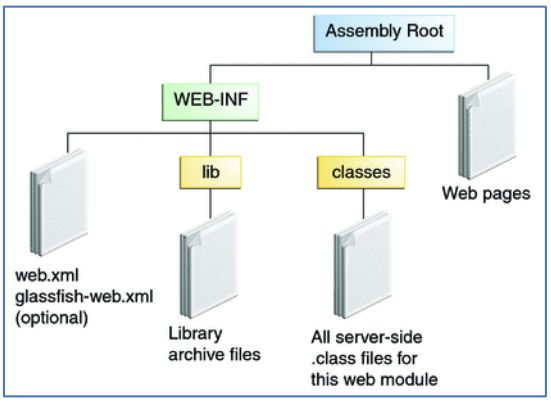


- Access the server using a browser as an HTTP client. Browse to ***http://localhost:8080*** and access the Tomcat welcome page to ensure the server works.



CÁCH TẠO 1 ỨNG DỤNG WEB VÀ SỬ DỤNG APACHE TOMCAT SERVER

1. Kiến trúc thư mục của 1 ứng dụng Web (Web Application)



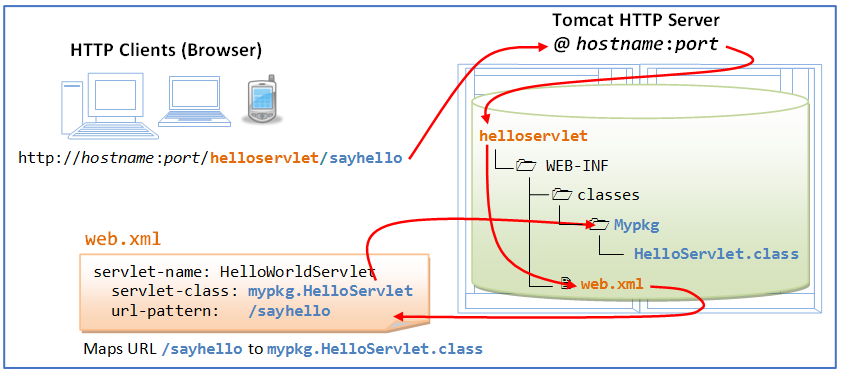


Fig1. Java web-application Structure

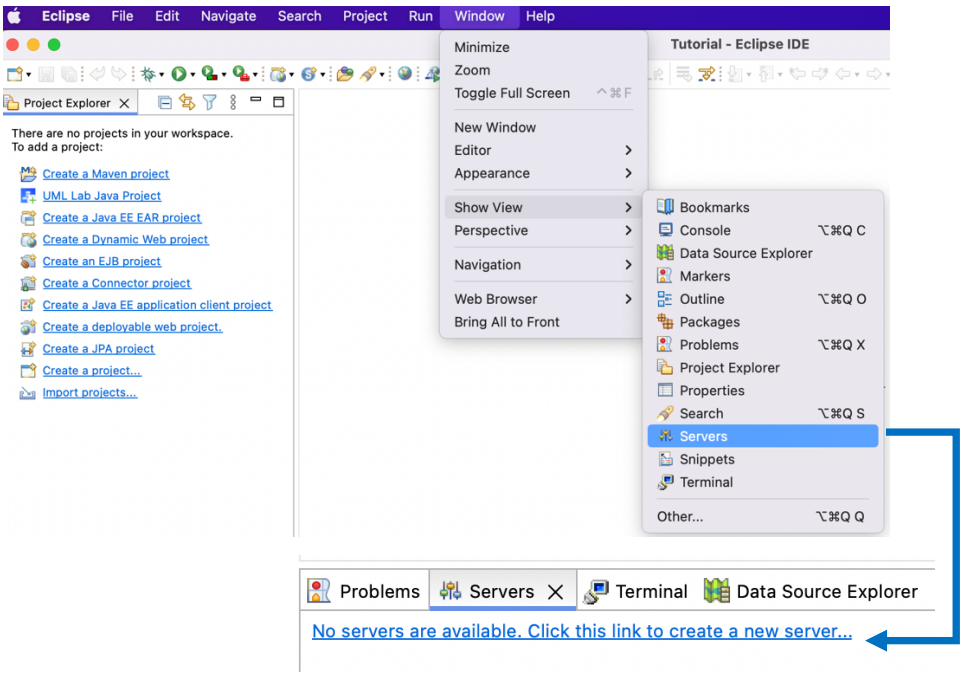
Fig2: Sample application

- Tạo cấu trúc thư mục
- Đặt resources vào thư mục tương ứng
- Copy chúng vào thư mục webapps của Tomcat Web server

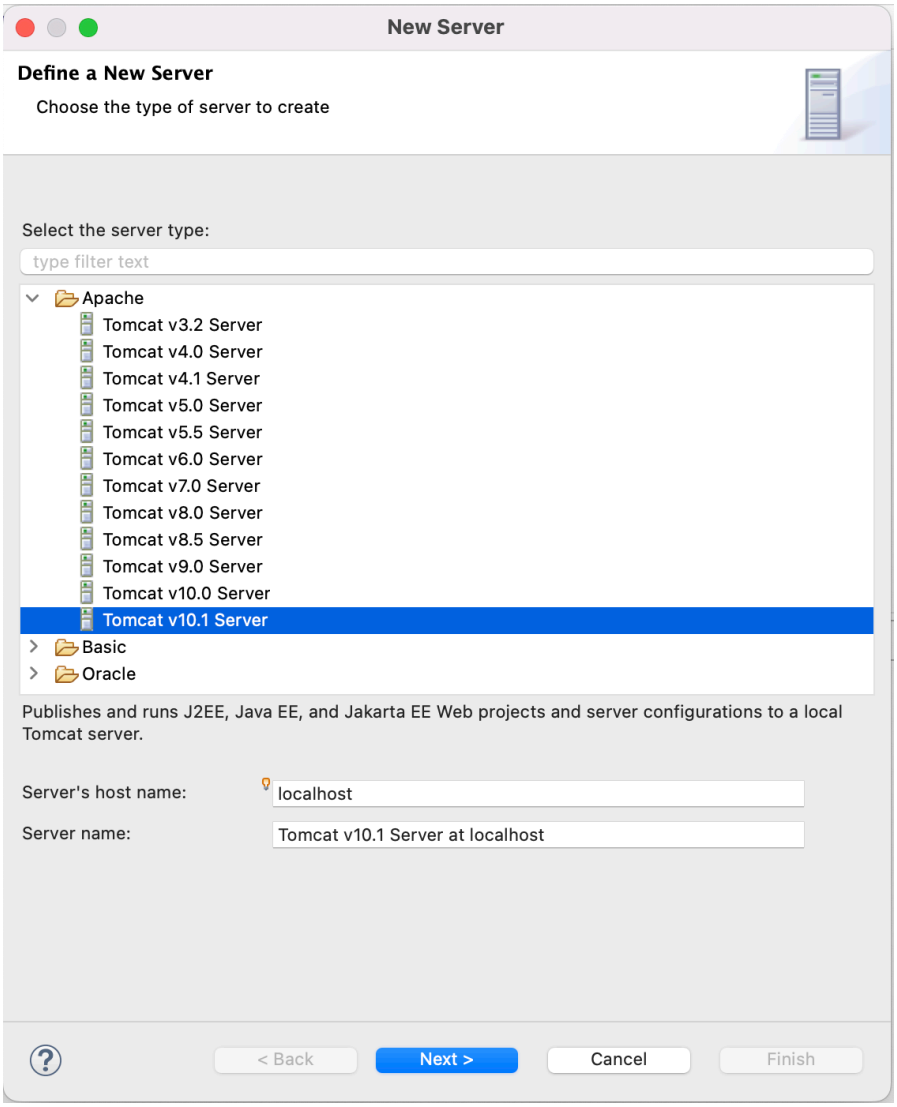
→ sẽ tự động deploy

2. Tạo kết nối giữa Eclipse và Apache Tomcat Server

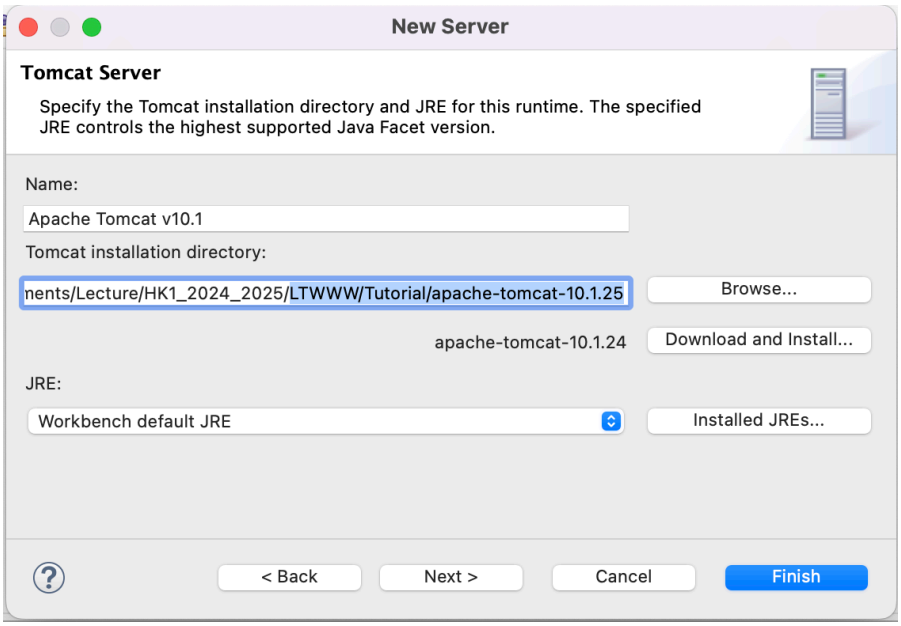
a. ***Step 1:*** Open Eclipse → Window → Show View → Servers



b. ***Step 2:*** Click link “No servers are available. Click this link to create a new server …” → Display popup



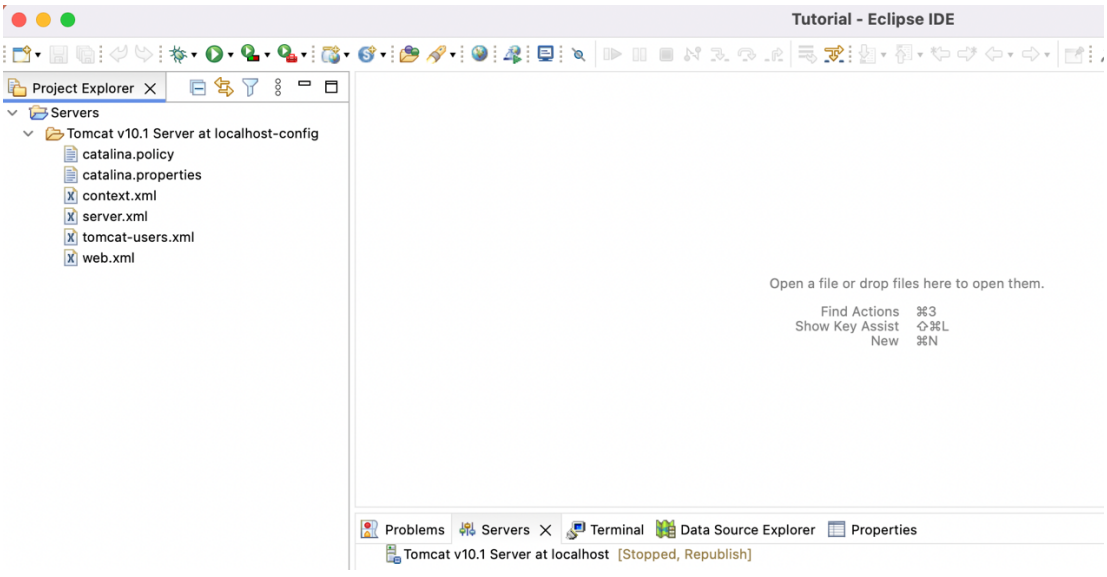
c. ***Step 3:*** Select “Tomcat v10.1 Server” → Click “Next”



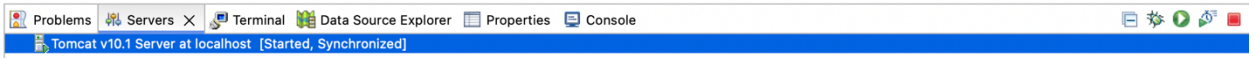
d. ***Step 4:***

i. Nếu Tomcat Server đã được download (hoặc đã được install)→ Click "Browse…" → Chọn đường dẫn folder chứa Tomcat Server đã được download (hoặc install) → Click "Finish"

ii. Nếu Tomcat Server chưa được download → Click "Download and Install …" → Click "Finish"



e. ***Step 5:*** Start Tomcat server



3. Triển khai Servlet. Có 2 cách triển khai:

a. Cách 1: thực hiện trong file WEB-INF/web.xml

```
<servlet>
    <servlet-name>UserServlet(Tên Servlet)</servlet-name>
    <servlet-name>UserServlet(Tên class của Servlet)</servlet-name>
    <init-param>
        <param-name>name(Tên parameter)</param-name>
        <param-value>Not provided(Value của parameter)</param-value>
    </init-param>
    <init-param>
        <param-name>email</param-name>
        <param-value>Not provided</param-value>
    </init-param>
</servlet>
<servlet-mapping>
    <servlet-name>UserServlet(Tên Servlet)</servlet-name>
    <url-pattern>/userServlet(url - route)</url-pattern >
</servlet-mapping>
```

b. Cách 2: sử dụng Annotation

```
@WebServlet(
     name = "UserServlet",
     urlPatterns = "/userServlet",
     initParams={
          @WebInitParam(name="name", value="Not provided"),
          @WebInitParam(name="email", value="Not provided")
     }
)
public class UserServlet extends HttpServlet {
   @Override
   protected void doGet( HttpServletRequest request,
HttpServletResponse response) throws ServletException, IOException {
     // TODO
```

```
    }
}
```

Name	Type	Required	Description
value or **urlPatterns**	*String[]*	Required	Specify one or more URL patterns of the servlet. Either of attribute can be used, but not both.
name	*String*	Optional	Name of the servlet
displayName	*String*	Optional	Display name of the servlet
description	*String*	Optional	Description of the servlet
asyncSupported	*boolean*	Optional	Specify whether the servlet supports asynchronous operation mode. Default is false.
initParams	*WebInitParam[]*	Optional	Specify one or more initialization parameters of the servlet. Each parameter is specified by @WebInitParam annotation type.
loadOnStartup	*int*	Optional	Specify load-on-startup order of the servlet. Default: -1 if the integer is negative: The container loads servlet at any time. if the integer is 0 or positive: The servlet marked with lower integers are loaded before servlets marked with higher integers.
smallIcon	*String*	Optional	Specify name of the small icon of the servlet.
largeIcon	*String*	Optional	Specify name of the large icon of the servlet.

4. Khởi tạo parameter (Init Paramaters):
    a. Sử dụng trong Servlet: sử dụng init-param (hoặc sử dụng annotation initParams) và khai báo bên trong Servlet

```
<servlet>
    <servlet-name>UserServlet(Tên Servlet)</servlet-name>
    <servlet-name>UserServlet(Tên class của Servlet)</servlet-name>
    <init-param>
        <param-name>name(Tên parameter)</param-name>
        <param-value>Not provided(Value của parameter)</param-value>
```

```
    </init-param>
    <init-param>
        <param-name>email</param-name>
        <param-value>Not provided</param-value>
    </init-param>
</servlet>
```

```
@WebServlet(
    name = "UserServlet",
    urlPatterns = "/userServlet",
    initParams={
        @WebInitParam(name="name", value="Not provided"),
        @WebInitParam(name="email", value="Not provided")
    }
)
```

b. Sử dụng trong toàn cục (global): khi cần sử dụng các bất biến (immutable data) và truy xuất toàn cục thì chúng ta nên sử dụng application-wide context để khởi tạo parameters để lưu trữ dữ liệu (web.xml).

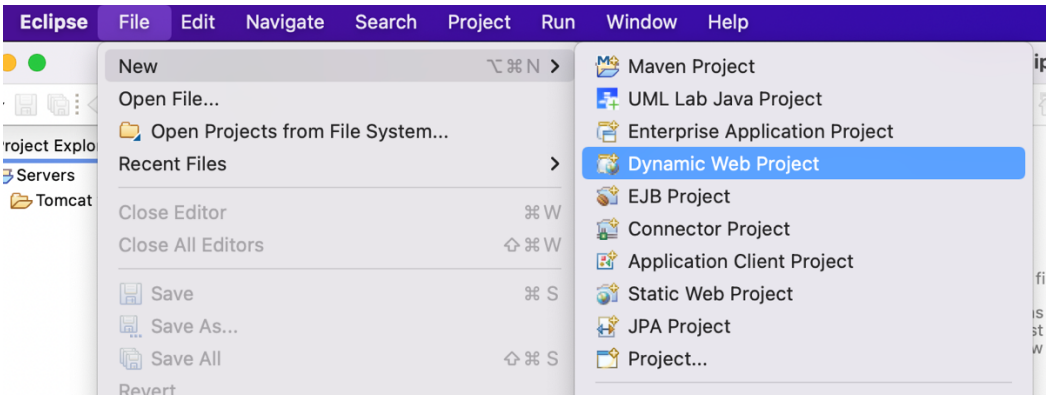
```
<?xml version="1.0" encoding="UTF-8"?>
<web-app xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns="https://jakarta.ee/xml/ns/jakartaee"
xsi:schemaLocation="https://jakarta.ee/xml/ns/jakartaee
https://jakarta.ee/xml/ns/jakartaee/web-app_6_0.xsd"
id="WebApp_ID" version="6.0">
  <context-param>
    <param-name>province</param-name>
    <param-value>Mendoza</param-value>
  </context-param>

  <context-param>
     <param-name>country</param-name>
     <param-value>Argentina</param-value>
   </context-param>
</web-app>
```

Cách sử dụng trong Servlet:

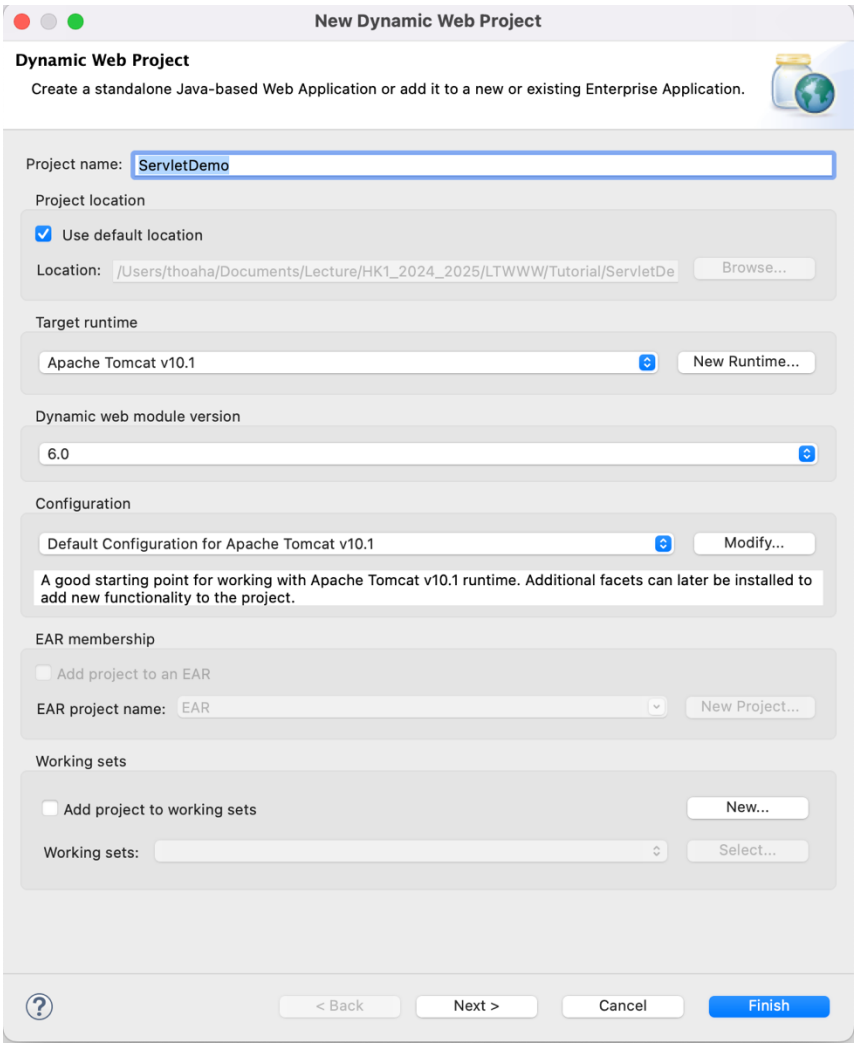
```
@WebServlet(
```

```
    name = "UserServlet",
    urlPatterns = "/userServlet",
    initParams={
        @WebInitParam(name="name", value="Not provided"),
        @WebInitParam(name="email", value="Not provided")
    }
)
public class UserServlet extends HttpServlet {
  @Override
  protected void doGet( HttpServletRequest request,
HttpServletResponse response) throws ServletException, IOException {
    // TODO
  }
  protected String getRequestParameter( HttpServletRequest request,
String name) {
    String param = request.getParameter(name);
    return !param.isEmpty() ? param : getInitParameter(name);
  }
}
```

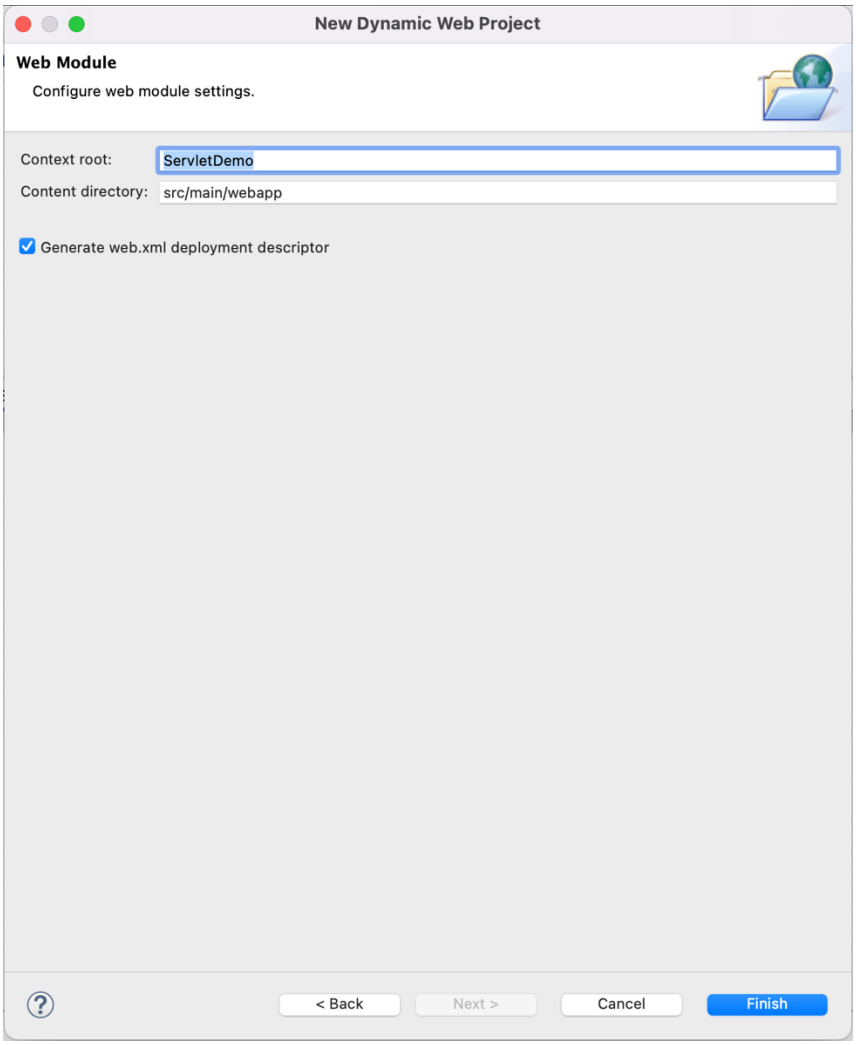
5. Tạo ứng dụng Servlet với Eclipse IDE
    a. ***Step 1:*** File → New → Dynamic Web Project



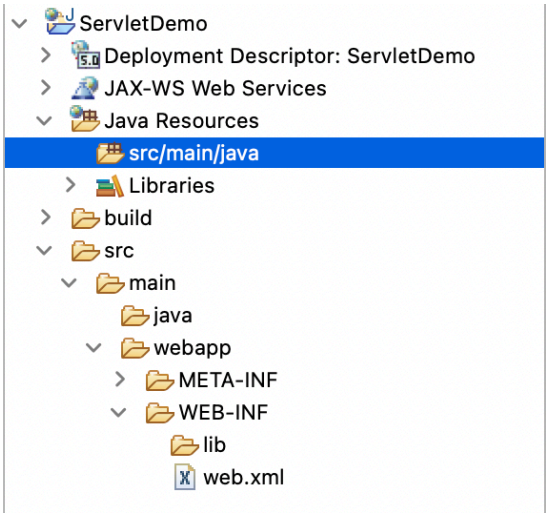
    b. ***Step 2:*** Điền tên Project và click Next



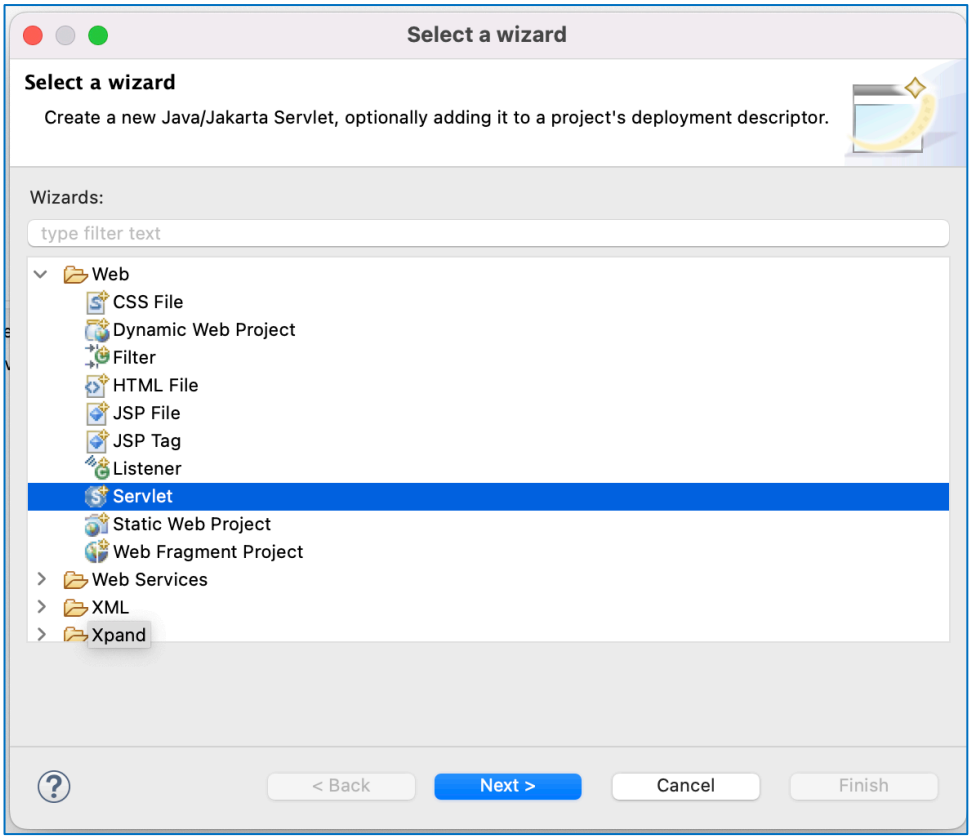
c. ***Step 3:*** Check Generate web.xml deplpyment descriptor và click Finish



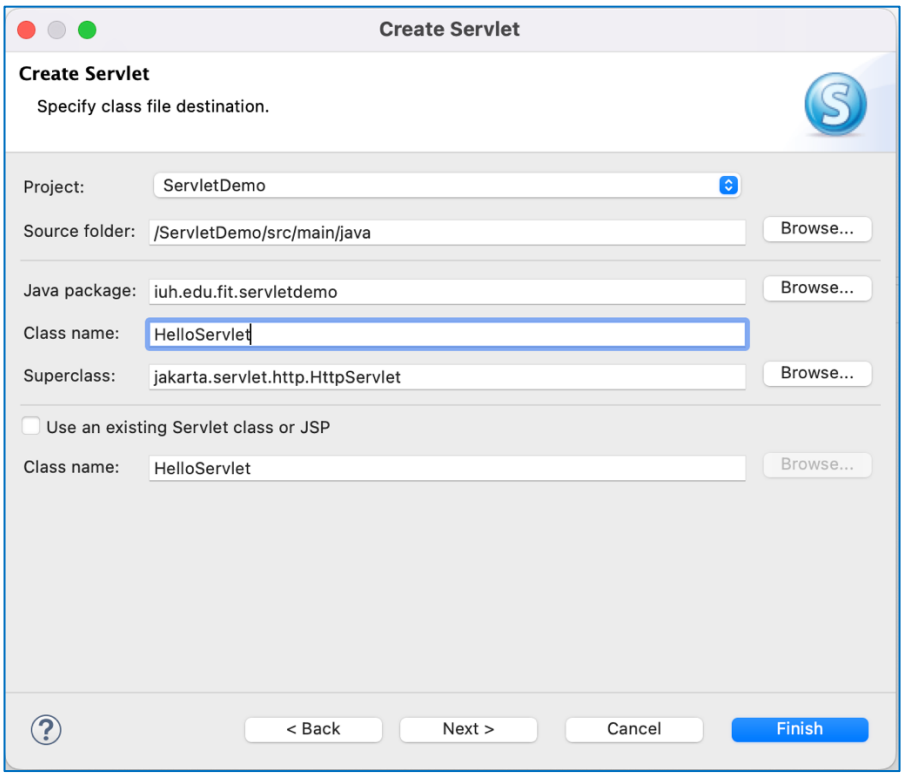
d. ***Step 4:*** Cấu trúc directory của Project sẽ được tạo như bên dưới

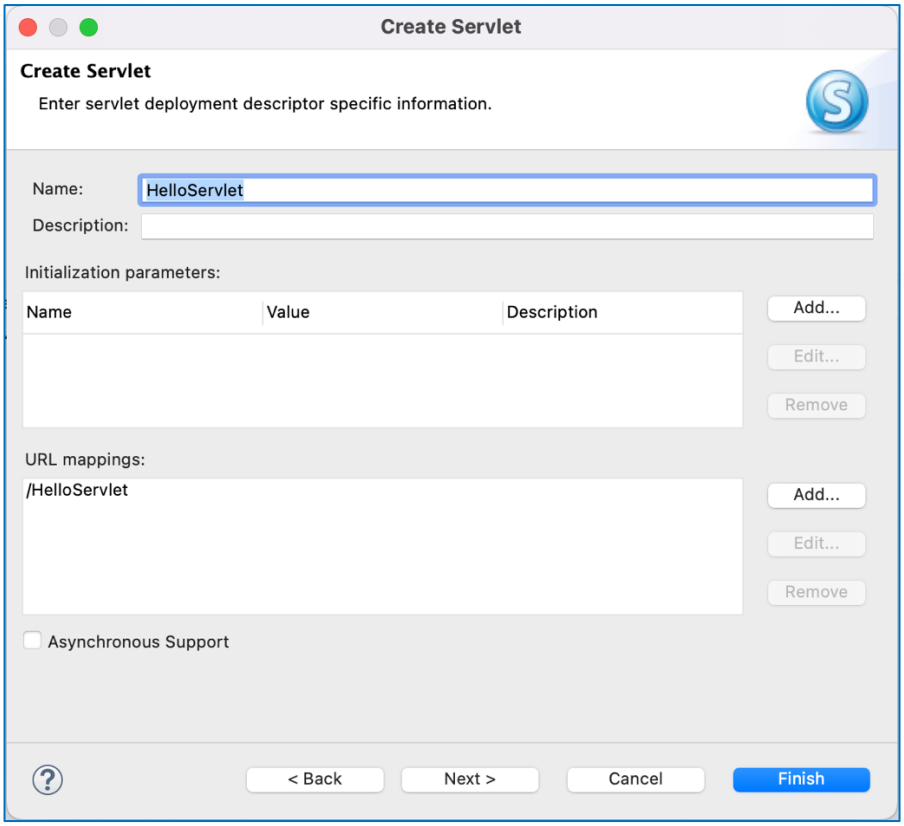


e. ***Step 5:*** Click vào Project Name vừa tạo: tìm Java Resources → src. Right click trên src → Chọn New → Servlet

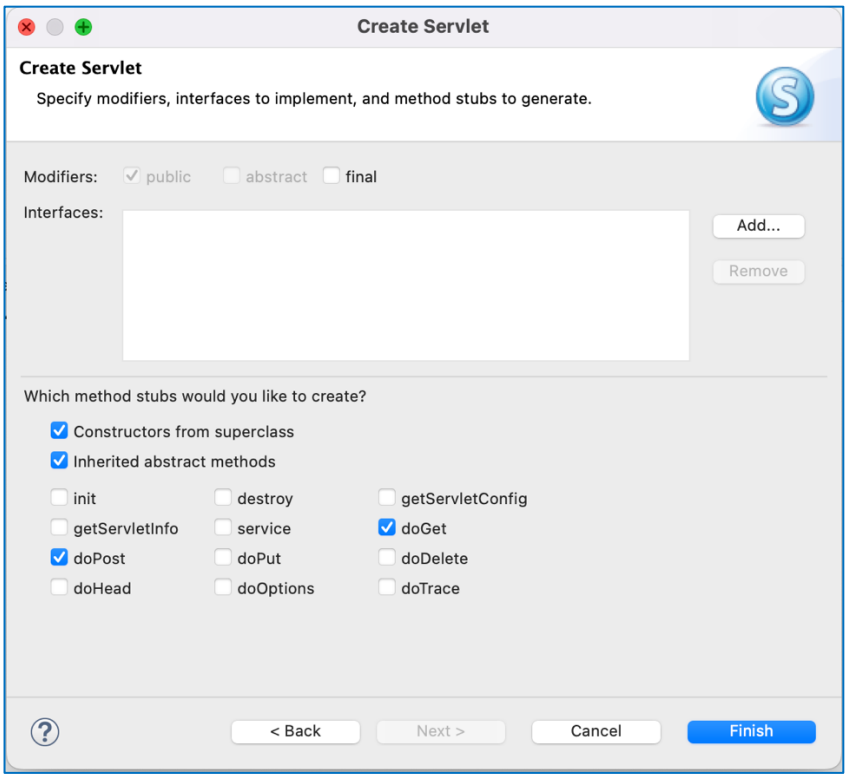


f. ***Step 6:*** Đặt tên cho Servlet và click Next

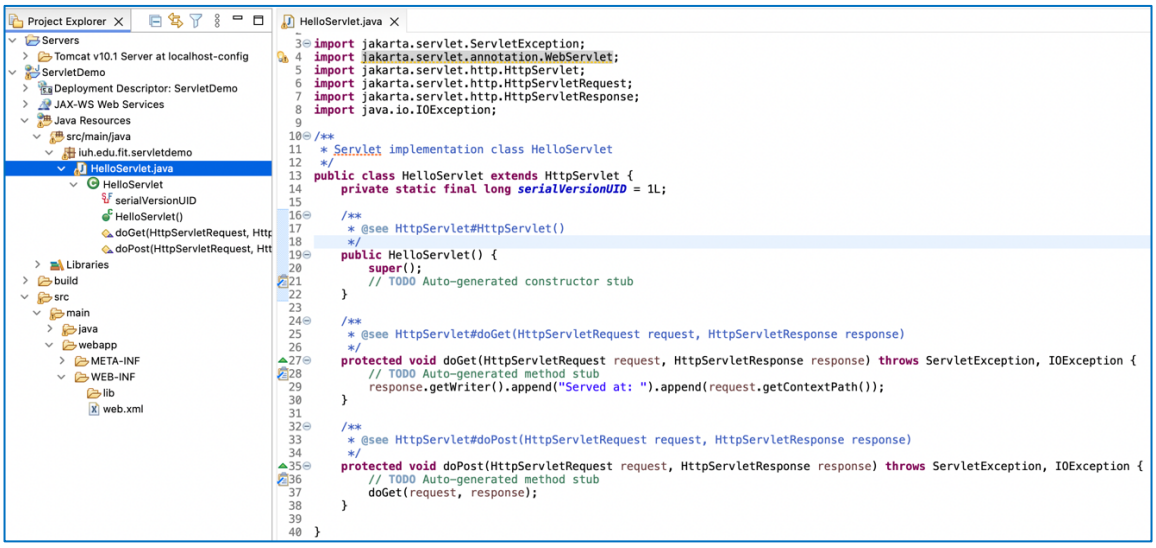




g. Để default hoặc chọn method cần thiết và click Next



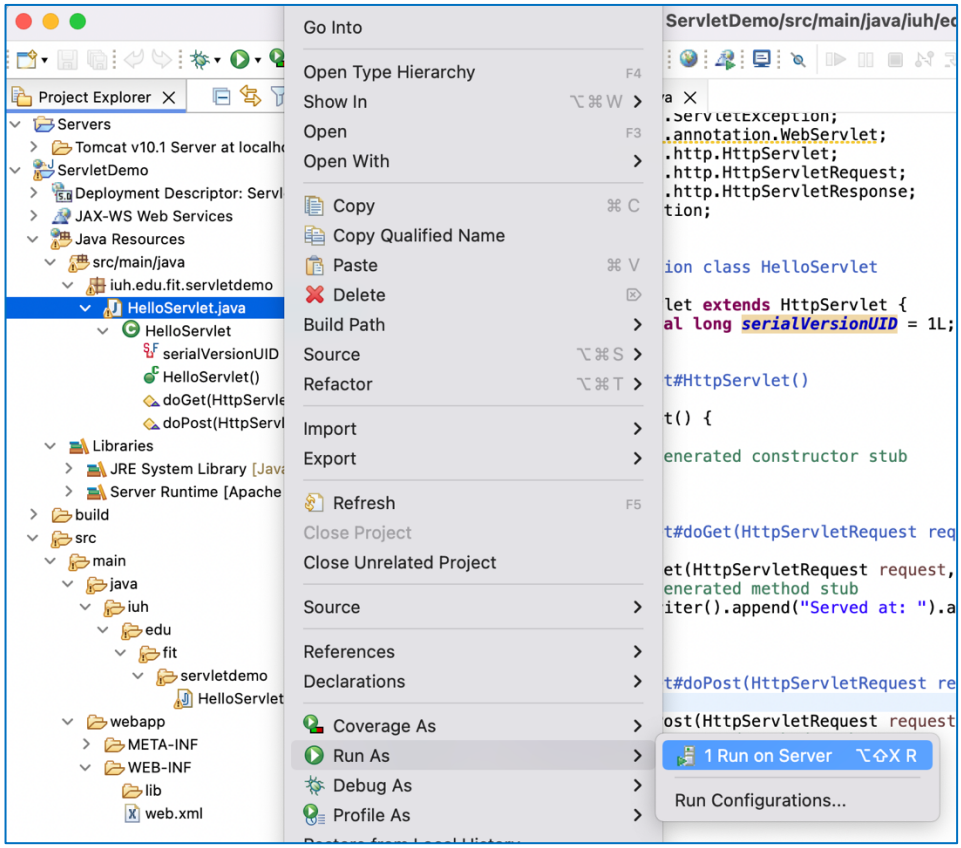
h. Servlet đã được tạo

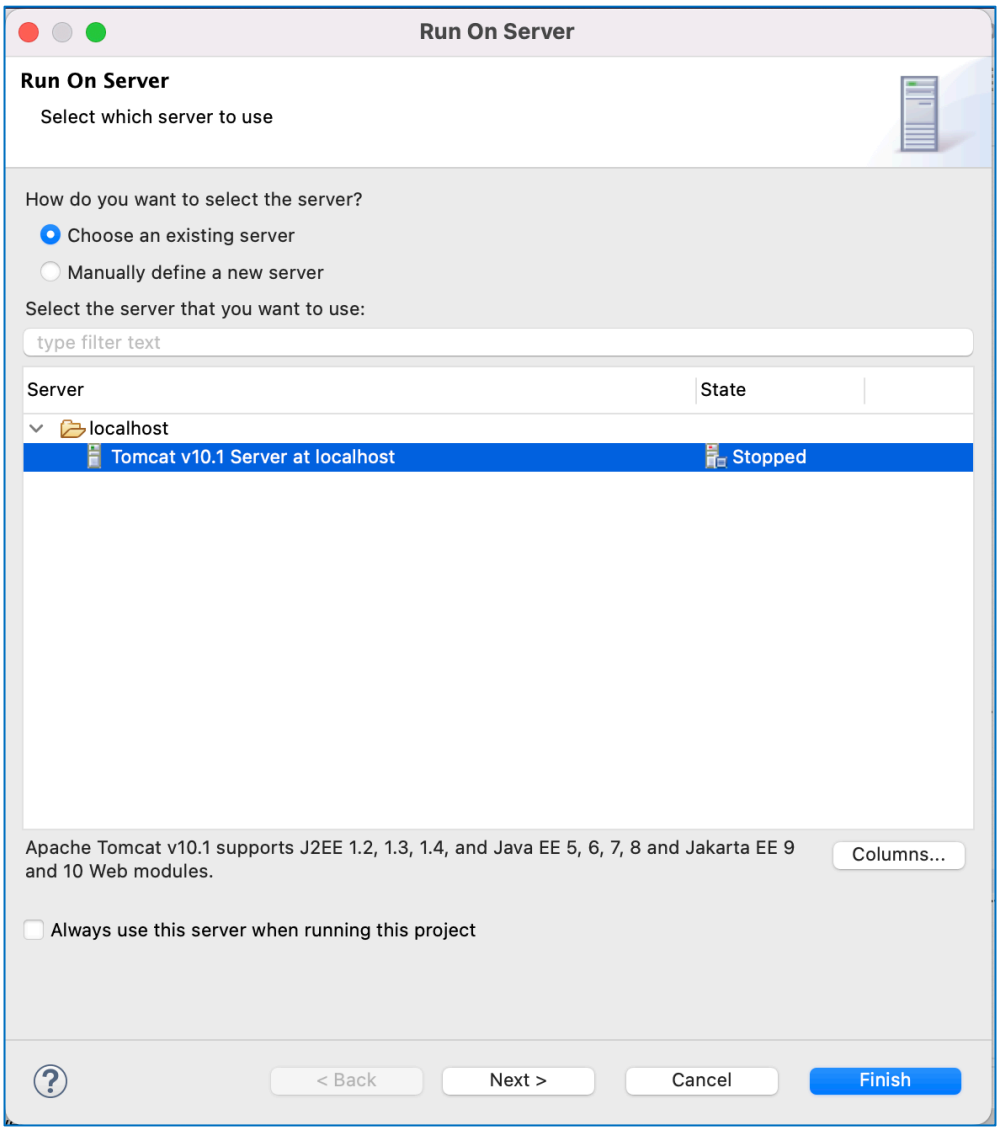


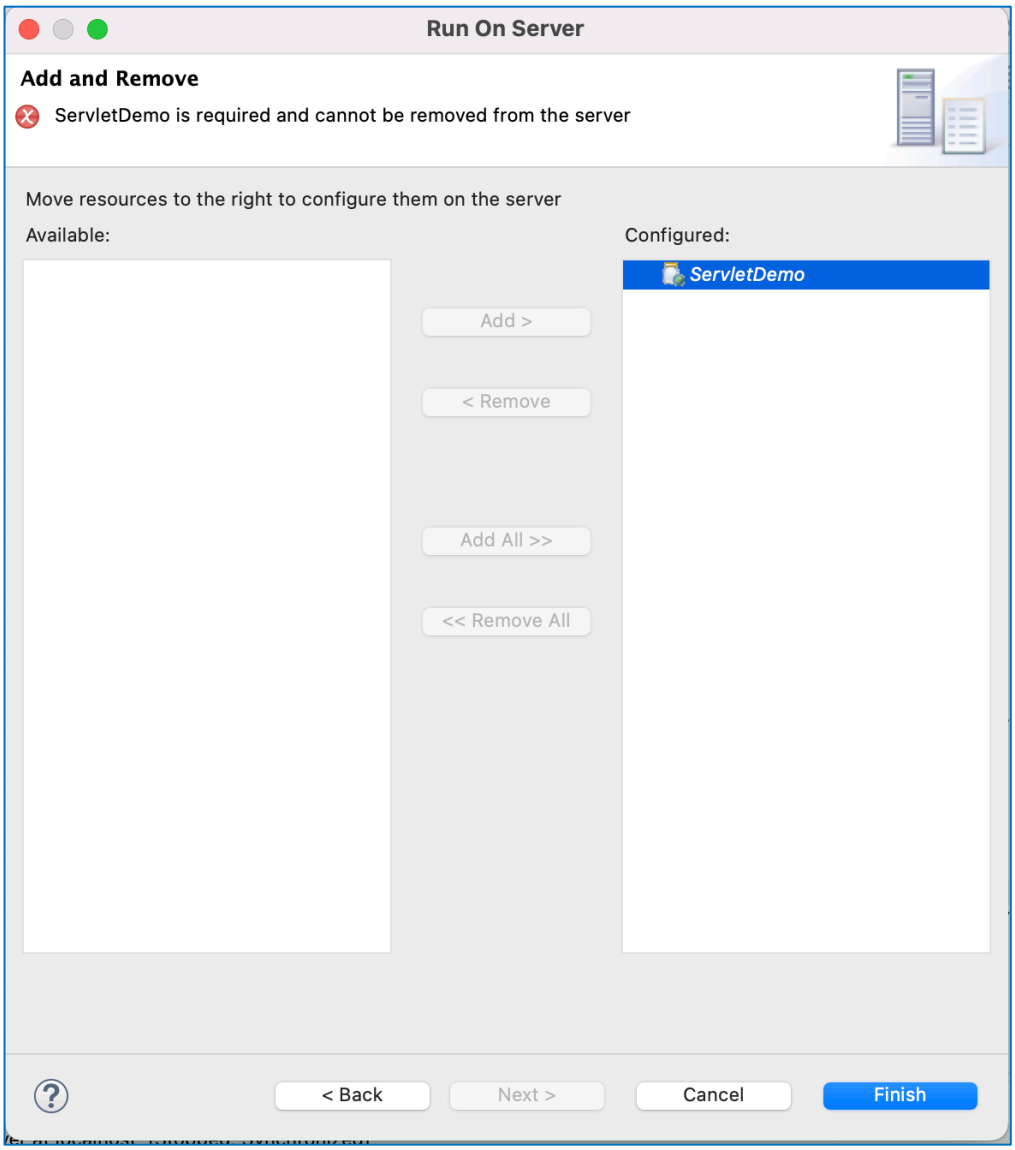
web.xml

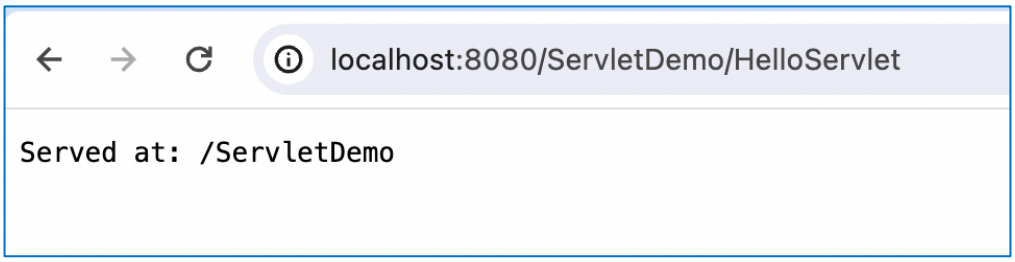
```
https://jakarta.ee/xml/ns/jakartaee/web-app_6_0.xsd (xsi:schemaLocation with catalog)
1  <?xml version="1.0" encoding="UTF-8"?>
2  <web-app xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="https://jakarta.ee/xml/ns/jakartaee" xsi:schemaLocation="http
3    <display-name>ServletDemo</display-name>
4    <welcome-file-list>
5      <welcome-file>index.html</welcome-file>
6      <welcome-file>index.jsp</welcome-file>
7      <welcome-file>index.htm</welcome-file>
8      <welcome-file>default.html</welcome-file>
9      <welcome-file>default.jsp</welcome-file>
10     <welcome-file>default.htm</welcome-file>
11   </welcome-file-list>
12   <servlet>
13     <description></description>
14     <display-name>HelloServlet</display-name>
15     <servlet-name>HelloServlet</servlet-name>
16     <servlet-class>iuh.edu.fit.servletdemo.HelloServlet</servlet-class>
17   </servlet>
18   <servlet-mapping>
19     <servlet-name>HelloServlet</servlet-name>
20     <url-pattern>/HelloServlet</url-pattern>
21   </servlet-mapping>
22 </web-app>
```

i. Start server Tomcat và run application




Run On Server
Run On Server
Select which server to use
How do you want to select the server?
Choose an existing server
Manually define a new server
Select the server that you want to use:
type filter text
Server
State
localhost
Tomcat v10.1 Server at localhost
Stopped
Apache Tomcat v10.1 supports J2EE 1.2, 1.3, 1.4, and Java EE 5, 6, 7, 8 and Jakarta EE 9 and 10 Web modules.
Columns...
Always use this server when running this project
< Back
Next >
Cancel
Finish

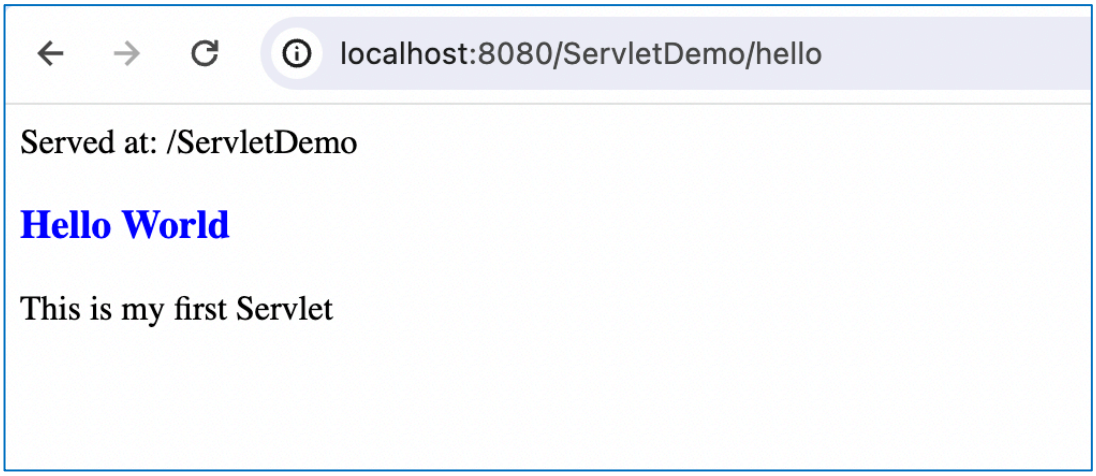




j. Apply code như bên dưới và thay đổi URL cho Servlet

```java
/**
 * @see HttpServlet#doGet(HttpServletRequest request, HttpServletResponse response)
 */
protected void doGet(HttpServletRequest request, HttpServletResponse response) throws ServletException, IOExcept
    // TODO Auto-generated method stub
    response.getWriter().append("Served at: ").append(request.getContextPath());

    response.setContentType("text/html");
    PrintWriter out = response.getWriter();
    out.println("<html>");
    out.println("<head><title>Hello Servlet</title></head>");

    out.println("<body>");
    out.println("<h3 style='color: blue'>Hello World</h3>");
    out.println("This is my first Servlet");
    out.println("</body>");
    out.println("</html>");
}
```

```xml
<!-- Định nghĩa servlet có tên helloServlet, gắn với class HelloServlet -->
<servlet>
  <description></description>
  <display-name>HelloServlet</display-name>
  <servlet-name>HelloServlet</servlet-name>
  <servlet-class>iuh.edu.fit.servletdemo.HelloServlet</servlet-class>
</servlet>

<!-- Định nghĩa đường dẫn truy cập vào Servlet này -->
<servlet-mapping>
  <servlet-name>HelloServlet</servlet-name>
  <url-pattern>/hello</url-pattern>
</servlet-mapping>
```



k. Nguyên tắc hoạt động của Servlet

(1) Browser

(2) web.xml

```
<!-- Định nghĩa servlet có tên helloServlet, gắn với class HelloServlet -->
<servlet>
  <description></description>
  <display-name>HelloServlet</display-name>
  <servlet-name>HelloServlet</servlet-name>
  <servlet-class>iuh.edu.fit.servletdemo.HelloServlet</servlet-class>
</servlet>

<!-- Định nghĩa đường dẫn truy cập vào Servlet này -->
<servlet-mapping>
  <servlet-name>HelloServlet</servlet-name>
  <url-pattern>/hello</url-pattern>
</servlet-mapping>
```

(3) HelloServlet.java

```
/**
 * @see HttpServlet#doGet(HttpServletRequest request, HttpServletResponse response)
 */
protected void doGet(HttpServletRequest request, HttpServletResponse response) throws ServletException, IOExcept
    // TODO Auto-generated method stub
    response.getWriter().append("Served at: ").append(request.getContextPath());

    response.setContentType("text/html");
    PrintWriter out = response.getWriter();
    out.println("<html>");
    out.println("<head><title>Hello Servlet</title></head>");

    out.println("<body>");
    out.println("<h3 style='color: blue'>Hello World</h3>");
    out.println("This is my first Servlet");
    out.println("</body>");
    out.println("</html>");
}
```

(4) Hiển thị ở Client Side & Page Source

l. Khi thêm Servlet mới (LoginServlet) thì file web.xml sẽ add thêm Servlet mới