

개발환경 구성, JSP 기본구조

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박경신

인터넷과 웹 서비스

- 인터넷과 WWW(World Wide Web)
 - 인터넷은 TCP/IP 기반의 네트워크가 전세계적으로 확대되어 하나로 연결된 '네트워크의 네트워크'
 - WWW(World Wide Web)는 인터넷 기반의 서비스 중 하나

이름	프로토콜	포트	기능
WWW	http	80	웹 서비스
Email	SMTP/POP3/IMAP	25/110/114	이메일 서비스
FTP	ftp	21	파일 전송 서비스
telnet	telnet	23	원격 호스트 접속 서비스
DNS	DNS	83	도메인 이름 변환 서비스
News	NNTP	119	인터넷 뉴스 서비스

인터넷과 웹 서비스

□ HTTP (Hyper Text Transfer Protocol)

- Protocol이란 네트워크에 연결된 컴퓨터가 서로 통신(대화)하기 위한 규약
- HTTP는 www 서비스를 위한 프로토콜
- 웹 서버와 클라이언트는 HTTP를 이용해 통신

□ URL (Uniform Resource Locator)

- URL은 웹 어플리케이션에 요청을 구분하기 위한 용도로 사용됨
- 예: `http://www.google.com/search?hl=en&q=jsp&aq=f&oq=`
 - 프로토콜: http
 - 호스트: www.google.com
 - 포트: 80 (http 프로토콜의 기본 포트)
 - 경로: /search
 - 쿼리문자열: hl=en&q=jsp&aq=f&oq=

웹 프로그래밍 기술

□ HTML과 웹 프로그래밍 기술

- HTML(HyperText Markup Language): www 서비스를 표현하기 위해 사용하는 언어
- HTML은 텍스트 파일로 정적인 정보만 처리 가능
- 동적인 콘텐츠 처리하기 위해 CGI(Common Gateway Interface), Fast CGI, PHP(Personal Home Page), ASP(Active Server Page), JSP(Java Server Page) 등의 기술이 사용

□ 클라이언트 스크립트

- Javascript가 대표적. 웹 브라우저가 스크립트 해석의 주체
- 웹 브라우저 핸들링은 가능하지만 서버 연동은 불가능

□ 서버 스크립트

- ASP.NET, PHP, Servlet, JSP 등. HTML과 스크립트 언어를 함께 사용할 수 있는 기술로 웹 서버에서 해석.
- 데이터베이스 연동 처리 등 다양한 구현이 가능
- 별도의 컴파일 과정없이 HTML 태그 수정 가능

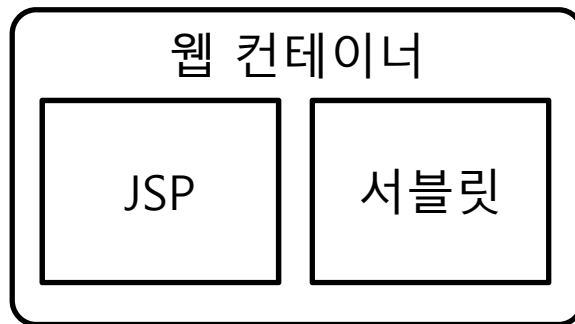
서블릿과 JSP

- 자바를 만든 Sun에서 정한 웹 개발 표준
 - 서블릿(Servlet): 웹 어플리케이션을 구현하기 위해 작성하는 **실행 코드**
 - JSP(Java Server Page): 서블릿 기반의 서버 **스크립트** 기술
- JSP의 특징
 - 자바 기반 스크립트 언어: 자바의 기능을 그대로 사용 가능
 - HTTP에 대한 클라이언트의 요청 처리/응답
 - 웹 어플리케이션에서 결과 화면을 생성할 때 주로 사용
- JSP를 사용하는 이유
 - 자바 언어에 기반하여 플랫폼(리눅스, 윈도우 등)에 독립적
 - 자바 언어에 대한 깊은 이해 없이도 초기 학습 가능 - 스크립트 언어는 상대적으로 자바 언어보다 단순
 - **스프링(Spring)**이나 스트러츠(Struts)와 같은 **프레임워크**와 완벽하게 연동

웹 컨테이너

□ 웹 컨테이너

- JSP, Servlet 실행 환경을 제공하며, WAS (Web Application Server)라고 함
- 웹 브라우저의 요청에 대한 응답을 웹 서버에 전달하는 기능을 제공하며 웹 응용 프로그램의 보안, 관리, 라이프 사이클관리 등의 서비스를 제공

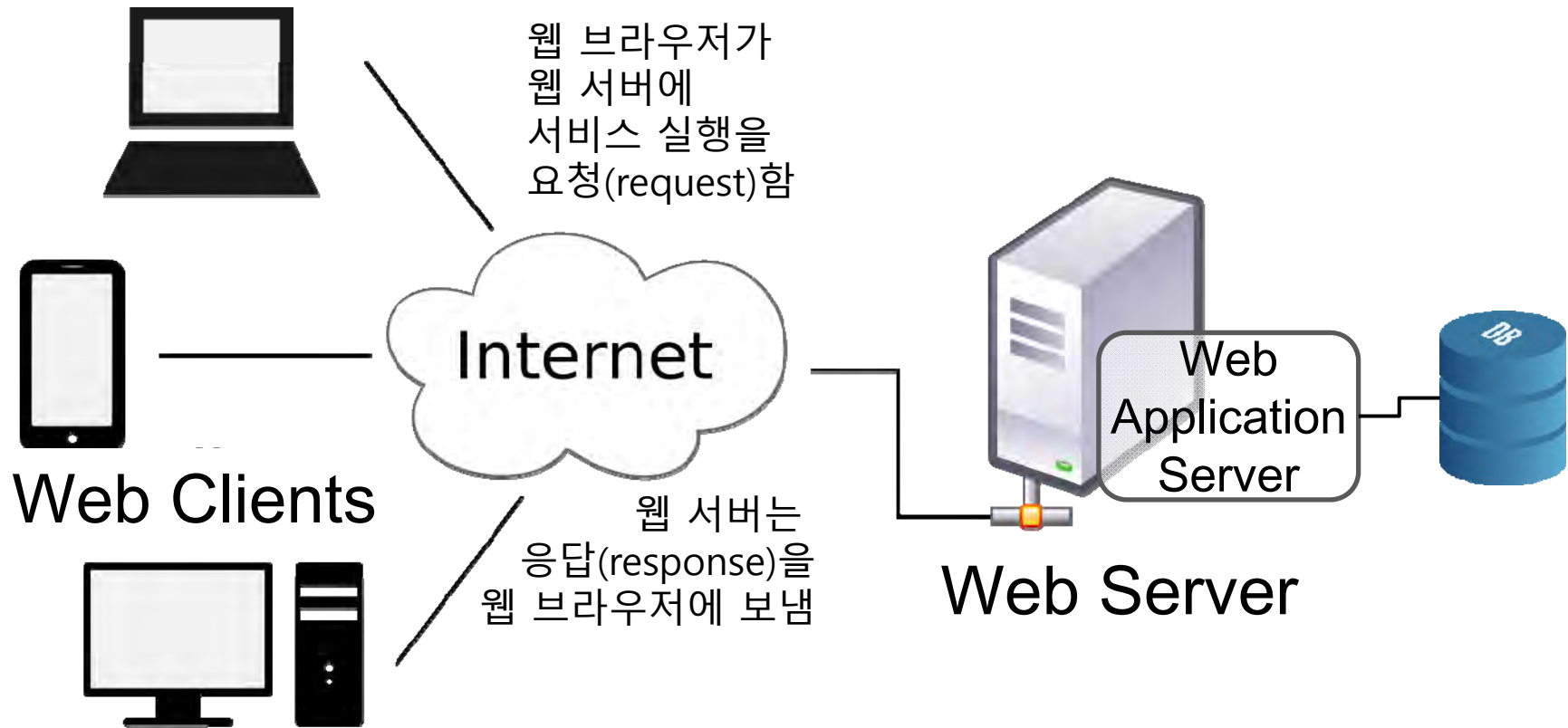


□ 주요 웹 컨테이너

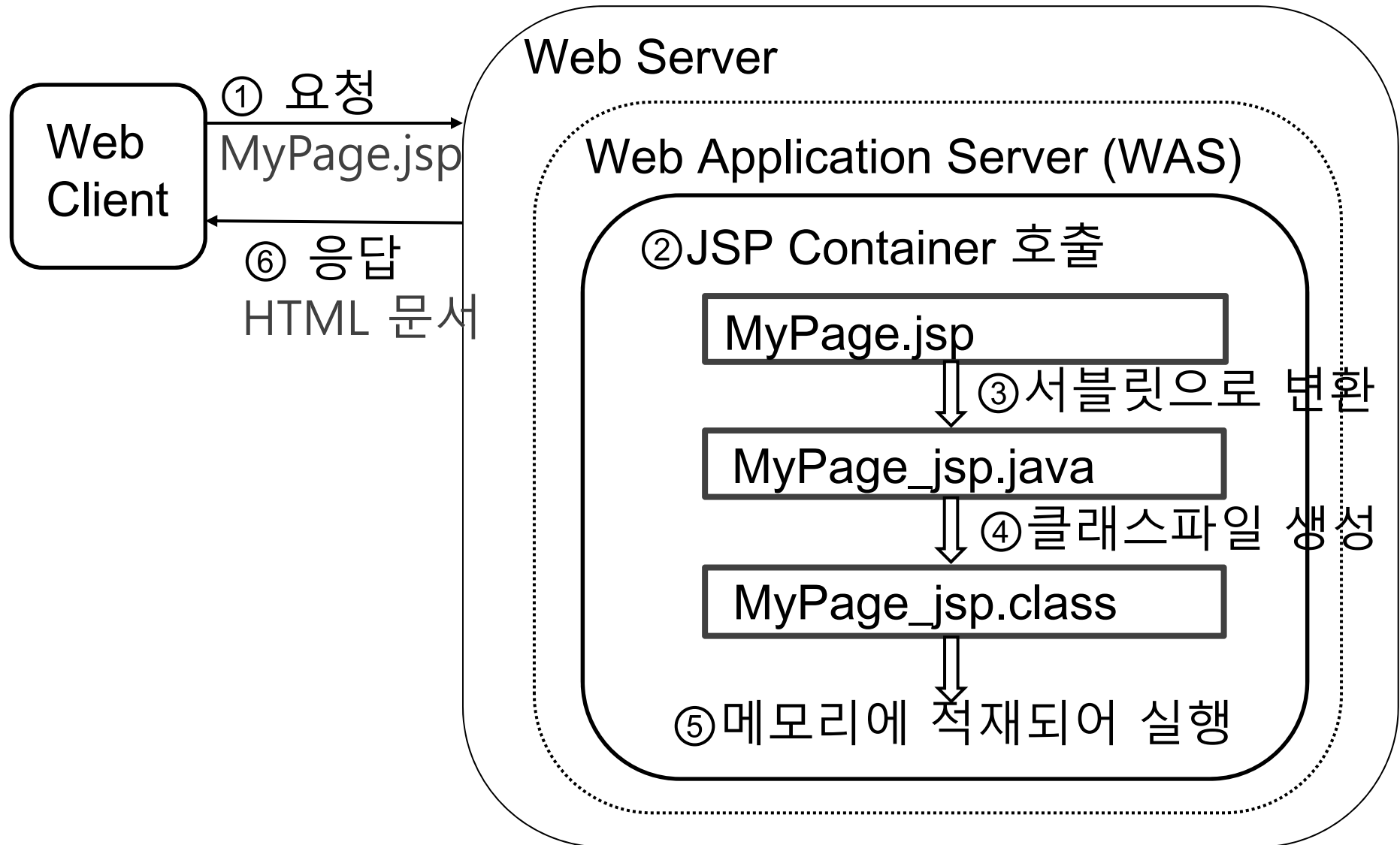
- 톰캣(Tomcat) : <http://tomcat.apache.org/>
- 제티(Jetty) : <http://www.mortbay.org/jetty/>

JSP Architecture

□ JSP(Java Server Pages) 웹 어플리케이션 구조



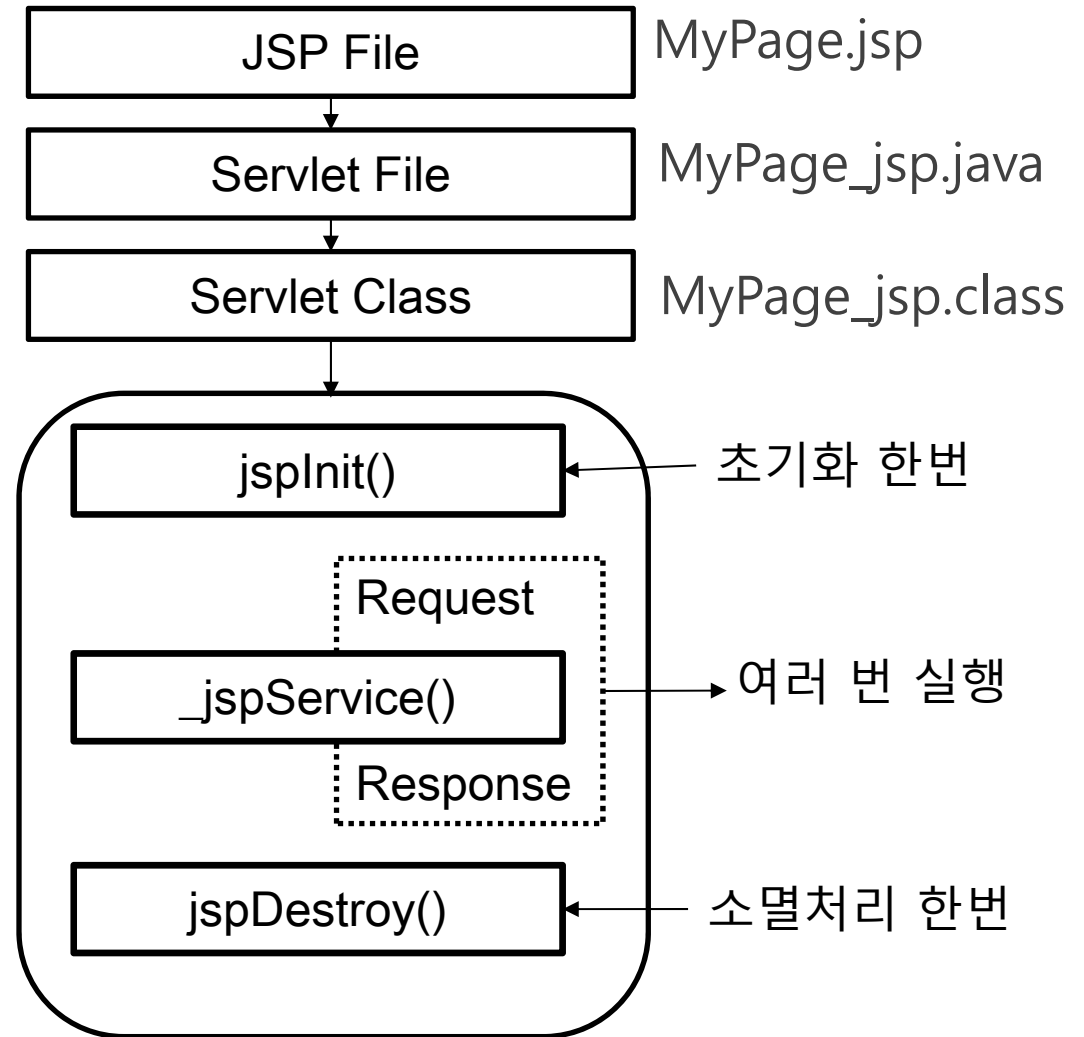
JSP 동작 원리



JSP Lifecycle

□ JSP 생명주기

- JSP Page Translation
- JSP Page Compilation
- Class Loading
- Initialization
- Execution
- Cleanup

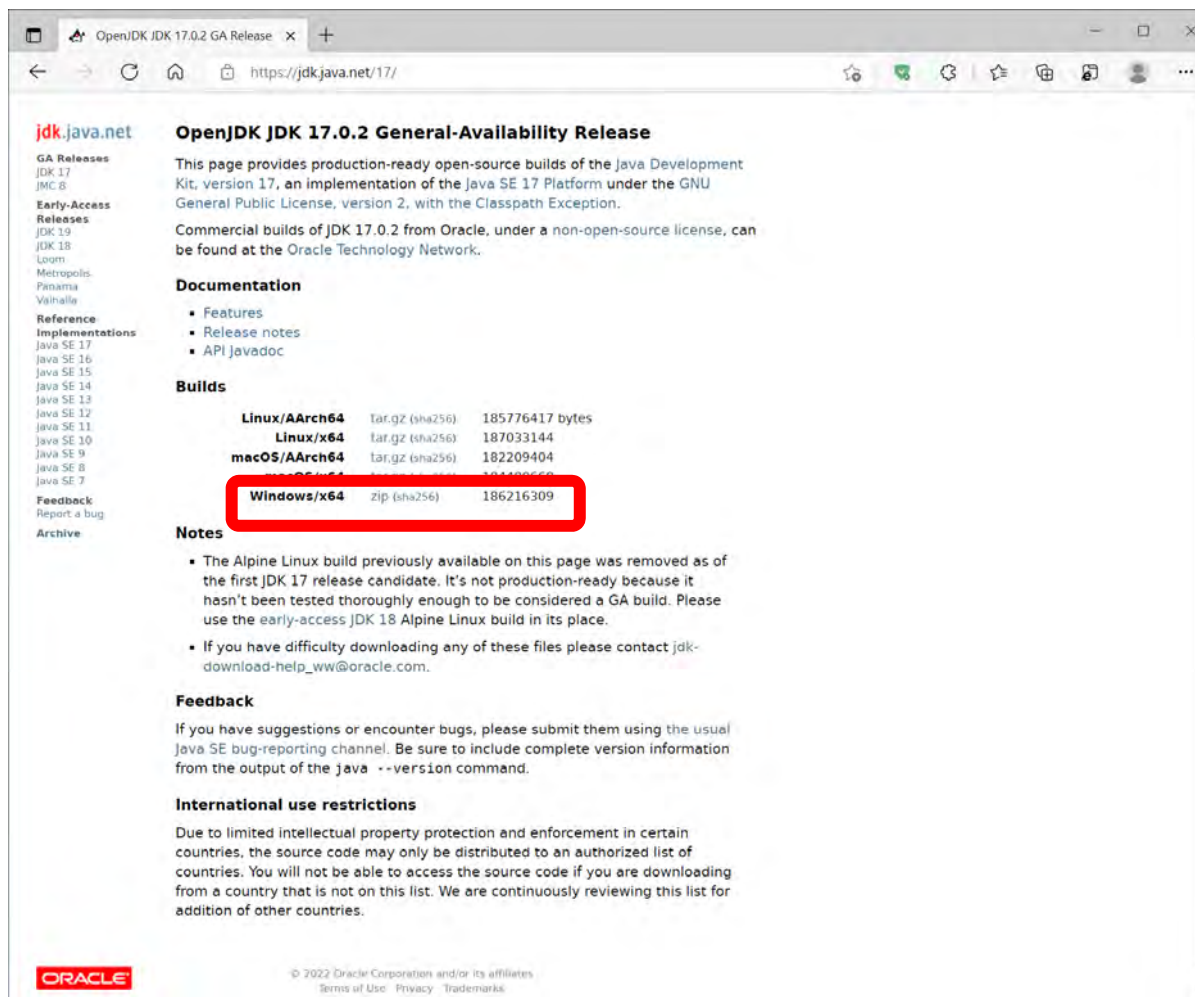


JSP 개발 환경 셋팅

- JDK 설치 : 자바 개발 도구
 - 환경변수 **JAVA_HOME** 설정
- 웹컨테이너 설치 : 톰캣, 제티 등
 - 환경변수 **CATALINA_HOME** 설정 (톰캣 설치 디렉토리)
- IDE 설치 : 이클립스 등
 - **elipse-workspace** 이클립스 작업 디렉토리 설정

JDK 설치

- Java SE Development Kit (OpenJDK17.0.2) Download
 - <https://jdk.java.net/17/>



The screenshot shows the OpenJDK 17.0.2 GA Release page. The page title is "OpenJDK JDK 17.0.2 General-Availability Release". The main content includes a description of the release, a table of builds, and sections for documentation, notes, feedback, and international use restrictions. The "Builds" section contains the following table:

Platform	Format	SHA-256	Bytes
Linux/AArch64	tar.gz	(sha256)	185776417
Linux/x64	tar.gz	(sha256)	187033144
macOS/AArch64	tar.gz	(sha256)	182209404
macOS/x64	tar.gz	(sha256)	184498560
Windows/x64	zip	(sha256)	186216309

The "Windows/x64" row is highlighted with a red box. The page also includes a sidebar with navigation links, a "Feedback" section, and an "International use restrictions" section.

JDK 설치

□ 경로 설정하기

The image shows a sequence of Windows system settings windows for configuring the Java Development Kit (JDK) environment. Red boxes highlight the key steps:

- Control Panel > System > Advanced system settings**: The 'Advanced system settings' link is highlighted.
- System Properties > Environment Variables...**: The 'Environment Variables...' button is highlighted.
- Edit System Variable**: A dialog box where the 'Variable name' is set to `JAVA_HOME` and the 'Variable value' is set to `C:\Program Files\Java\jdk-17.0.2`. Both fields are highlighted.
- Edit environment variable**: A dialog box showing the list of environment variables. The variable `%JAVA_HOME%\bin` is highlighted in the list.
- System Properties > Environment Variables**: The main 'Environment Variables' window showing the 'Path' variable under 'User variables for Administrator' with the value `C:\Python\Python35-32\Scripts\;C:\Python\Python35-32\;C:\Program Files\Java\jdk-17.0.2\bin`. The 'Path' variable and its value are highlighted.

JDK 설치

□ 설치된 자바 버전 확인



```
Command Prompt
Microsoft Windows [Version 10.0.19041.1165]
(c) Microsoft Corporation. All rights reserved.

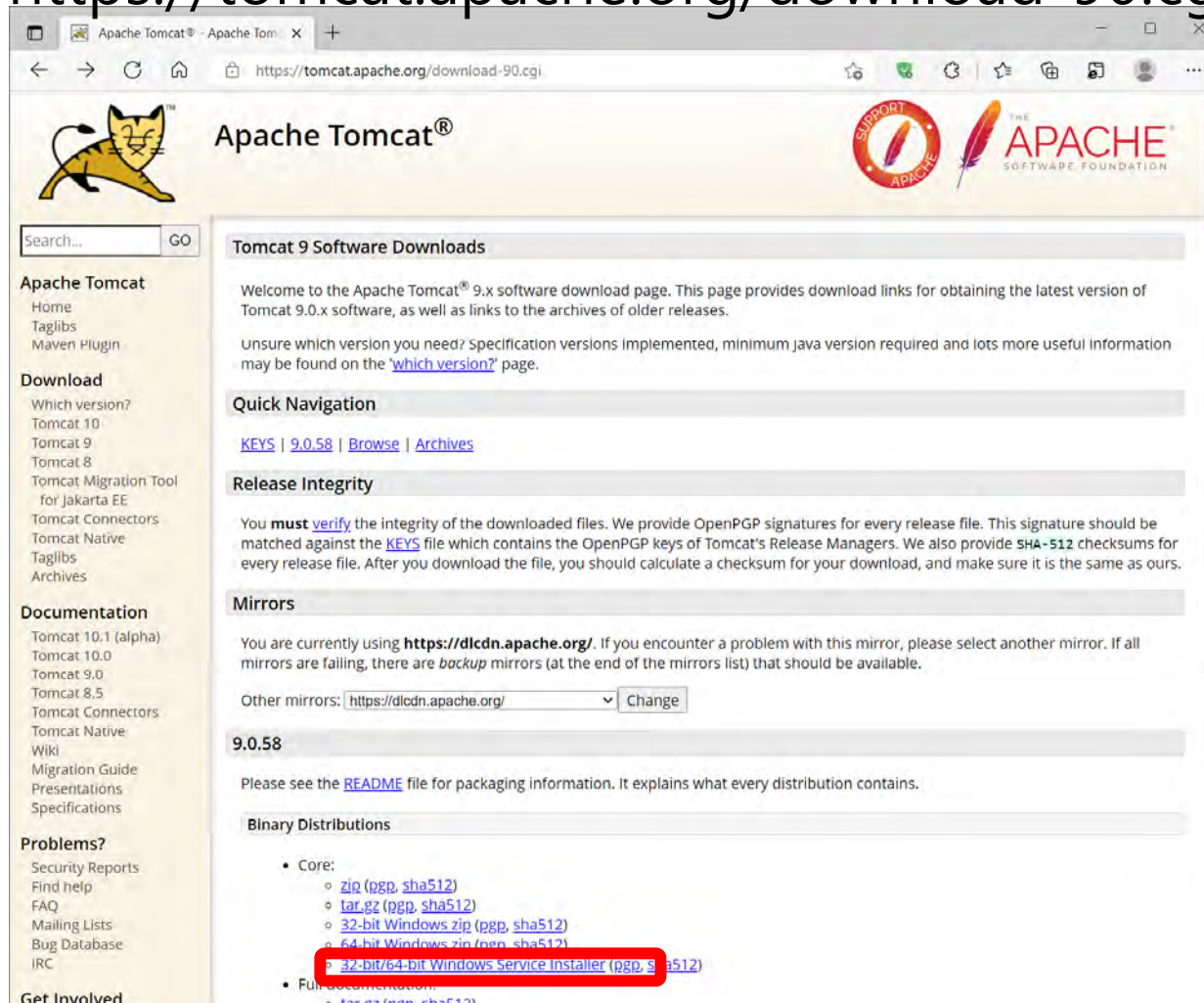
C:\Users\Wpark>javac -version
javac 17.0.2

C:\Users\Wpark>
```

Tomcat 설치하기

□ Tomcat9 (apache-tomcat-9.0.58.exe)

<https://tomcat.apache.org/download-90.cgi> 다운로드



The screenshot shows the Apache Tomcat 9.0.58 download page. The page includes a search bar, a navigation menu on the left, and a main content area with sections for 'Tomcat 9 Software Downloads', 'Quick Navigation', 'Release Integrity', 'Mirrors', and '9.0.58'. Under the 'Binary Distributions' section, there is a list of download links. The link for '32-bit/64-bit Windows Service Installer (pgp, sha512)' is highlighted with a red box.

Tomcat 9 Software Downloads

Welcome to the Apache Tomcat® 9.x software download page. This page provides download links for obtaining the latest version of Tomcat 9.0.x software, as well as links to the archives of older releases.

Unsure which version you need? Specification versions implemented, minimum java version required and lots more useful information may be found on the ["which version?"](#) page.

Quick Navigation

[KEYS](#) | [9.0.58](#) | [Browse](#) | [Archives](#)

Release Integrity

You **must** [verify](#) the integrity of the downloaded files. We provide OpenPGP signatures for every release file. This signature should be matched against the [KEYS](#) file which contains the OpenPGP keys of Tomcat's Release Managers. We also provide **SHA-512** checksums for every release file. After you download the file, you should calculate a checksum for your download, and make sure it is the same as ours.

Mirrors

You are currently using <https://d1cdn.apache.org/>. If you encounter a problem with this mirror, please select another mirror. If all mirrors are failing, there are *backup* mirrors (at the end of the mirrors list) that should be available.

Other mirrors:

9.0.58

Please see the [README](#) file for packaging information. It explains what every distribution contains.

Binary Distributions

- Core:
 - [zip \(pgp, sha512\)](#)
 - [tar_gz \(pgp, sha512\)](#)
 - [32-bit Windows zip \(pgp, sha512\)](#)
 - [64-bit Windows zip \(pgp, sha512\)](#)
 - [32-bit/64-bit Windows Service Installer \(pgp, sha512\)](#)
- Full Documentation:
 - [tar_gz \(pgp, sha512\)](#)

Tomcat 설치하기

□ 톰캣 설치하기 및 설치 후 환경변수 설정

Apache Tomcat Setup: Configuration Options

Configuration
Tomcat basic configuration.

Server Shutdown Port: 8005

HTTP/1.1 Connector Port: 8085

Windows Service Name: Tomcat9

Create shortcuts for all users:

Tomcat Administrator Login (optional)

User Name:

Password:

Roles: manager-gui

Nullsoft Install System v3.04

< Back Next > Cancel

Apache Tomcat Setup: Java Virtual Machine path selection

Java Virtual Machine
Java Virtual Machine path selection.

Please select the path of a Java 8 or later JRE installed on your system.

C:\Program Files\Java\jdk-17.0.2

Nullsoft Install System v3.08

< Back Next > Cancel

Edit System Variable

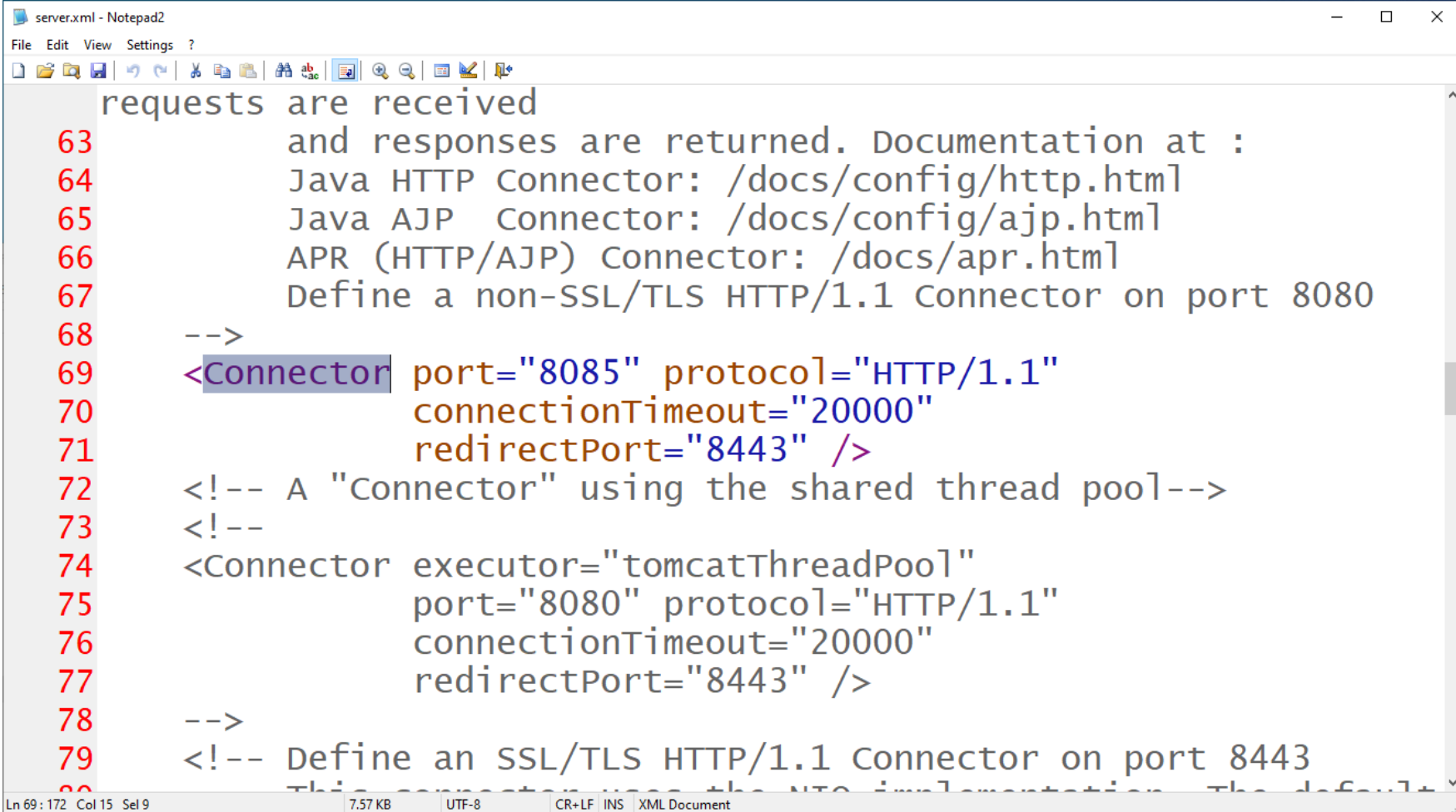
Variable name: CATALINA_HOME

Variable value: C:\Program Files\Apache Software Foundation\Tomcat 9.0

Browse Directory... Browse File... OK Cancel

Tomcat 실행

- 톰캣 설치 디렉토리 C:\Program Files\Apache Software Foundation\Tomcat 9.0\conf\server.xml



```
server.xml - Notepad2
File Edit View Settings ?
requests are received
63     and responses are returned. Documentation at :
64     Java HTTP Connector: /docs/config/http.html
65     Java AJP  Connector: /docs/config/ajp.html
66     APR (HTTP/AJP) Connector: /docs/apr.html
67     Define a non-SSL/TLS HTTP/1.1 Connector on port 8080
68     -->
69     <Connector port="8085" protocol="HTTP/1.1"
70             connectionTimeout="20000"
71             redirectPort="8443" />
72     <!-- A "Connector" using the shared thread pool-->
73     <!--
74     <Connector executor="tomcatThreadPool"
75             port="8080" protocol="HTTP/1.1"
76             connectionTimeout="20000"
77             redirectPort="8443" />
78     -->
79     <!-- Define an SSL/TLS HTTP/1.1 Connector on port 8443
80     This connector uses the NIO implementation. The default
```

Ln 69 : 172 Col 15 Sel 9 7.57 KB UTF-8 CR+LF INS XML Document

Tomcat 실행

- 톰캣 실행하기 <http://localhost:8085/>

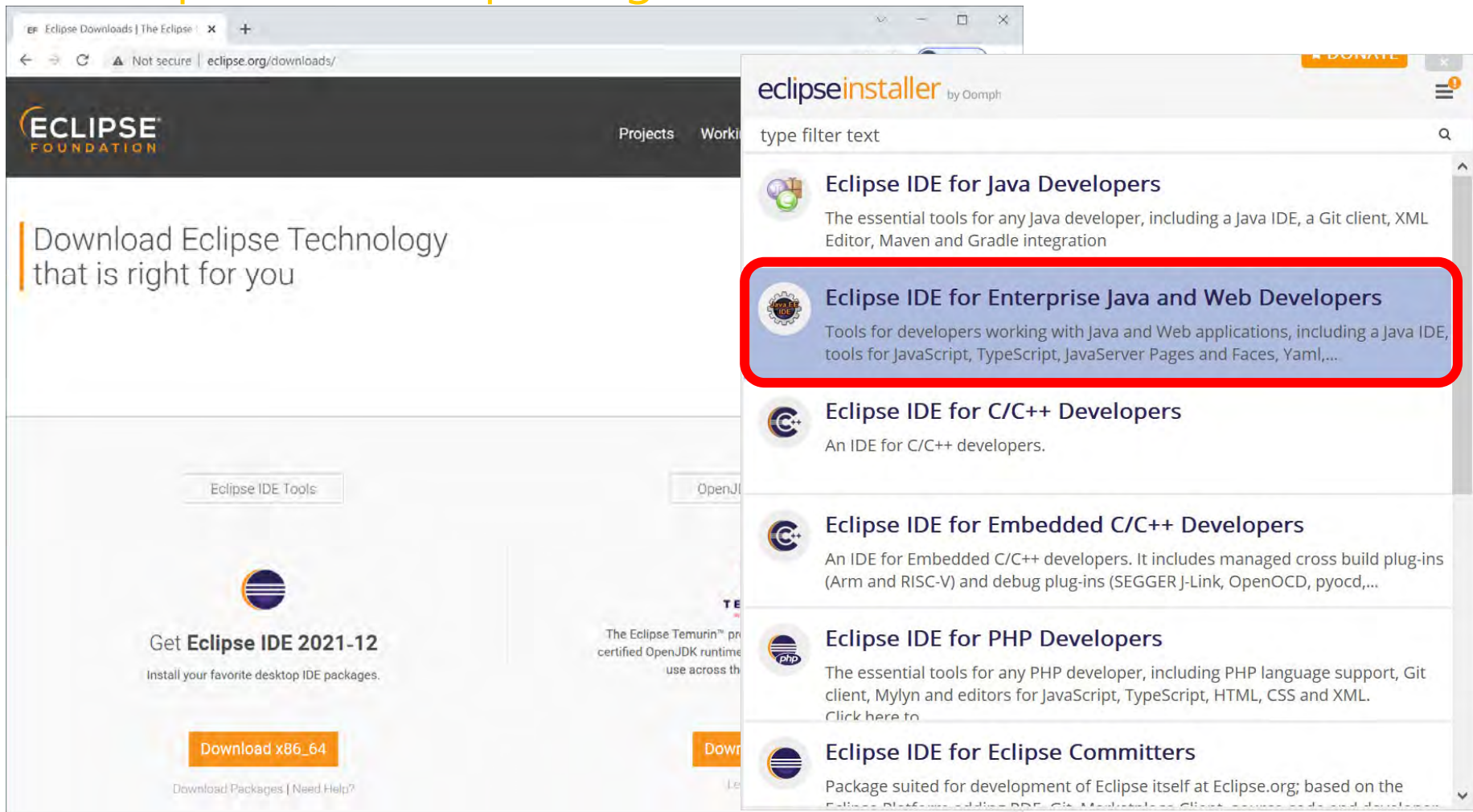
The screenshot shows a web browser window with the Apache Tomcat 9.0.58 interface. The browser's address bar contains 'localhost:8085', which is highlighted with a red rectangular box. The page content includes a navigation menu with 'Home', 'Documentation', 'Configuration', 'Examples', 'Wiki', and 'Mailing Lists'. A green banner at the top reads 'If you're seeing this, you've successfully installed Tomcat. Congratulations!'. Below this, there is a 'Recommended Reading' section with links to 'Security Considerations How-To', 'Manager Application How-To', and 'Clustering/Session Replication How-To'. To the right of these links are buttons for 'Server Status', 'Manager App', and 'Host Manager'. A 'Developer Quick Start' section contains links for 'Tomcat Setup', 'First Web Application', 'Realms & AAA', 'JDBC DataSources', 'Examples', 'Servlet Specifications', and 'Tomcat Versions'. The page is divided into three main columns: 'Managing Tomcat', 'Documentation', and 'Getting Help'. The 'Managing Tomcat' column includes links for 'Release Notes', 'ChangeLog', 'Migration Guide', and 'Security Notices'. The 'Documentation' column includes links for 'Tomcat 9.0 Documentation', 'Tomcat 9.0 Configuration', and 'Tomcat Wiki'. The 'Getting Help' column includes links for 'FAQ and Mailing Lists' and a list of available mailing lists. At the bottom, there are sections for 'Other Downloads', 'Other Documentation', 'Get Involved', 'Miscellaneous', and 'Apache Software Foundation'.

자바 IDE 소개와 설치

- 자바 IDE (Integrated Development Environment)
 - 통합 개발 환경
 - 편집, 컴파일, 디버깅을 한번에 할 수 있는 통합된 개발 환경
- 이클립스(Eclipse)
 - 자바 응용 프로그램 개발을 위한 통합 개발 환경
 - IBM에 의해 개발된 오픈 소스 프로젝트
 - <http://www.eclipse.org/downloads/> 에서 다운로드
- 넷빈즈(Netbeans)
 - <https://netbeans.org/>
- IntelliJ Idea
 - <http://www.jetbrains.com/idea/download/>

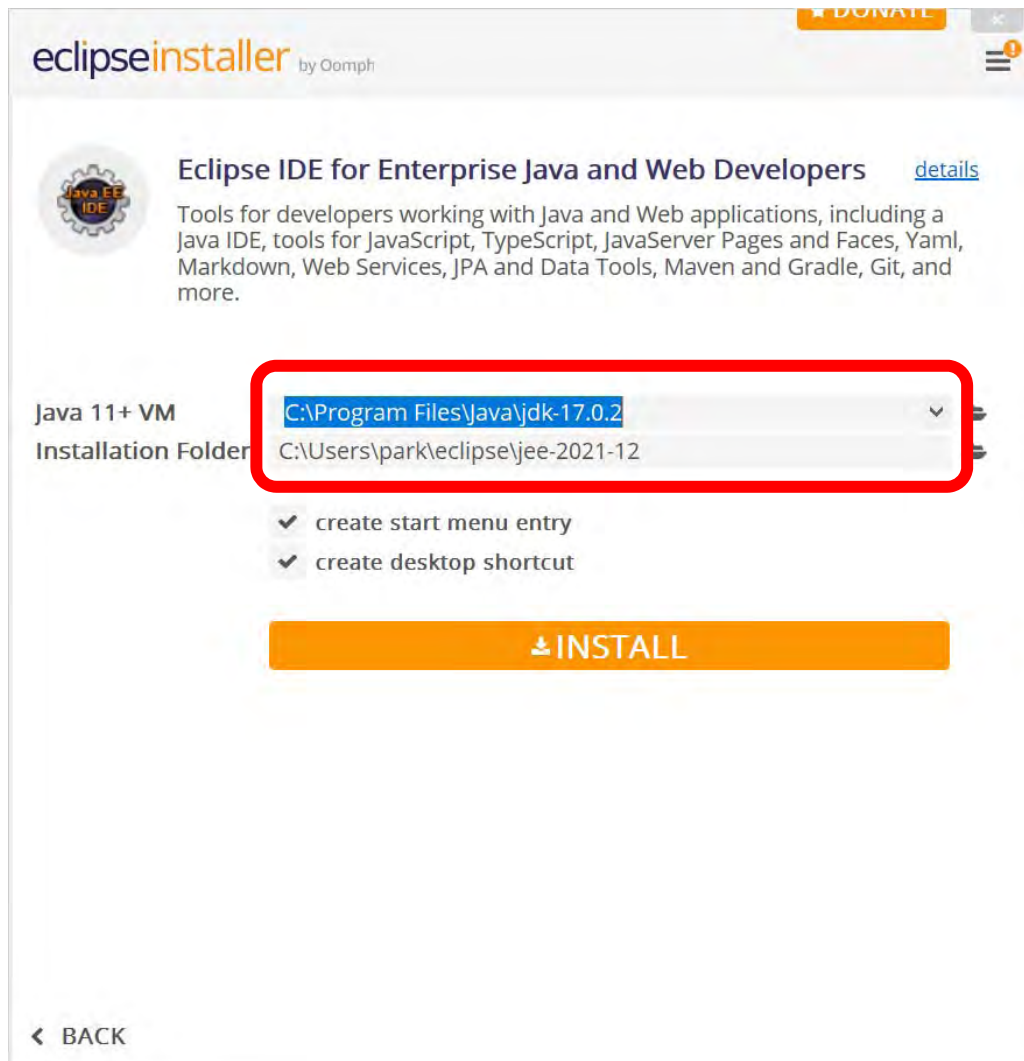
Eclipse 설치하기

- 이클립스 IDE 2021-12 (eclipse-inst-jre-win64.exe)
<https://www.eclipse.org/downloads/> 다운로드



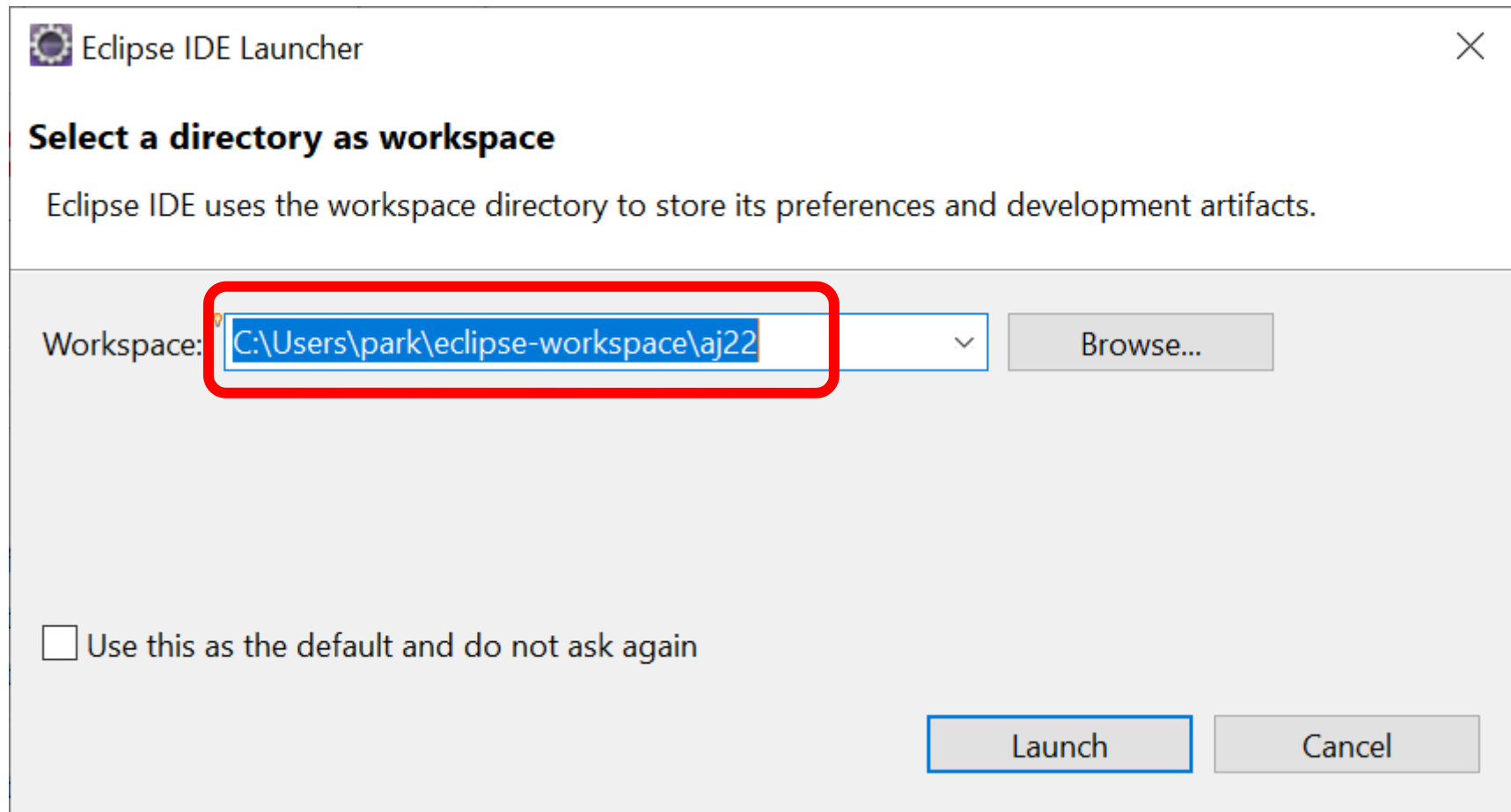
Eclipse 설치하기

□ 이클립스 설치 디렉토리 설정하기



Eclipse 설치하기

이클립스 작업 디렉토리 설정하기



Eclipse 설치하기

- 이클립스에 서버 실행 환경 설정하기
 - Window - Preference - Server - Runtime Environments - Add - Tomcat v9.0

The image shows two overlapping dialog boxes in the Eclipse IDE. The 'New Server Runtime Environment' dialog is in the foreground, and the 'Preferences' dialog is in the background.

New Server Runtime Environment Dialog:

- Title: New Server Runtime Environment
- Subtitle: Define a new server runtime environment
- Section: Select the type of runtime environment:
 - type filter text
 - Apache Tomcat v8.5
 - Apache Tomcat v9.0 (selected)
 - Apache Tomcat v10.0
 - New Server Runtime Environment
- Section: Tomcat Server
 - Specify the installation directory
 - Name: Apache Tomcat v9.0
 - Tomcat installation directory: C:\Program Files\Apache Software Foundation\Tomcat 9.0
 - JRE: jdk-17.0.2
- Buttons: < Back, Next >, Finish, Cancel

Preferences Dialog:

- Title: Preferences
- Section: Server Runtime Environments
 - Add, remove, or edit server runtime environments.
 - Server runtime environments:
 - Table:

Name	Type
Apache Tomcat v9.0	Apache Tomcat v9.0
 - Buttons: Add..., Edit..., Remove, Search..., Columns...
 - Path: C:/Program Files/Apache Software Foundation/Tomcat 9.0
 - Buttons: Apply and Close, Cancel

Eclipse 설치하기

이클립스에 서버 확인하기

The screenshot shows the Eclipse IDE interface with the 'Tomcat v9.0 Server at localhost' configuration window open. The window is divided into several sections:

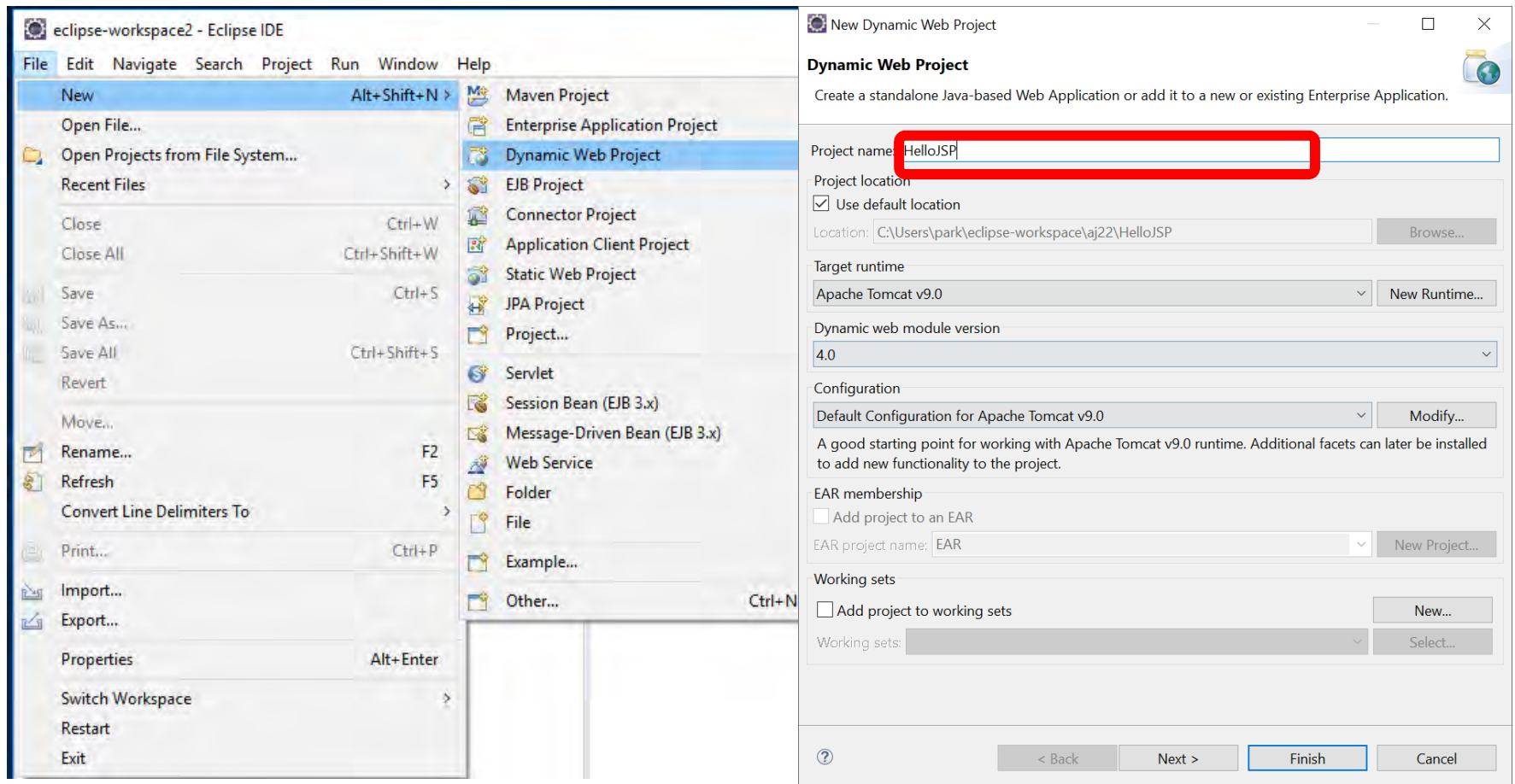
- General Information:** Contains fields for 'Server name' (Tomcat v9.0 Server at localhost), 'Host name' (localhost), 'Runtime Environment' (Apache Tomcat v9.0), and 'Configuration path' (/Servers/Tomcat v9.0 Server at localhost-confi). There are 'Browse...' buttons for the configuration path and a link to 'Open launch configuration'.
- Server Locations:** Includes instructions to specify the server path and deploy path. It has three radio buttons: 'Use workspace metadata (does not modify Tomcat installation)' (selected), 'Use Tomcat installation (takes control of Tomcat installation)', and 'Use custom location (does not modify Tomcat installation)'. Below are 'Server path' and 'Deploy path' fields with 'Browse...' buttons.
- Server Options:** Contains checkboxes for 'Serve modules without publishing', 'Publish module contexts to separate XML files', 'Modules auto reload by default' (checked), 'Enable security', and 'Enable Tomcat debug logging (not supported by this Tomcat version)'.
- Ports:** A table for modifying server ports.

Port Name	Port Number
Tomcat admin port	8005
HTTP/1.1	8085

At the bottom of the IDE, the 'Overview' tab is active, and the 'Servers' view shows 'Tomcat v9.0 Server at localhost [Stopped, Republish]'.

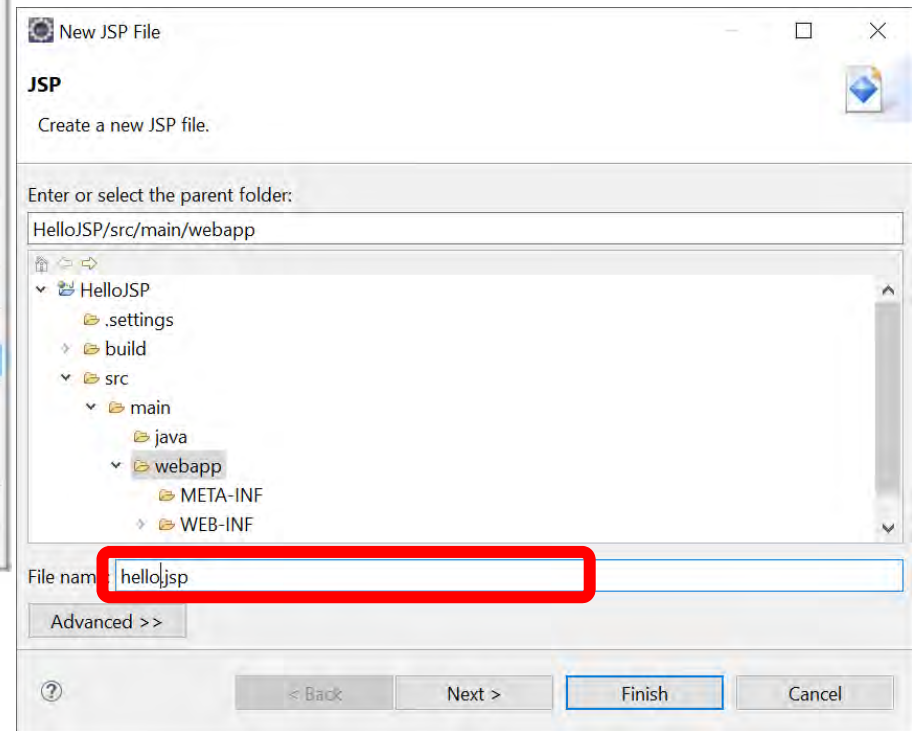
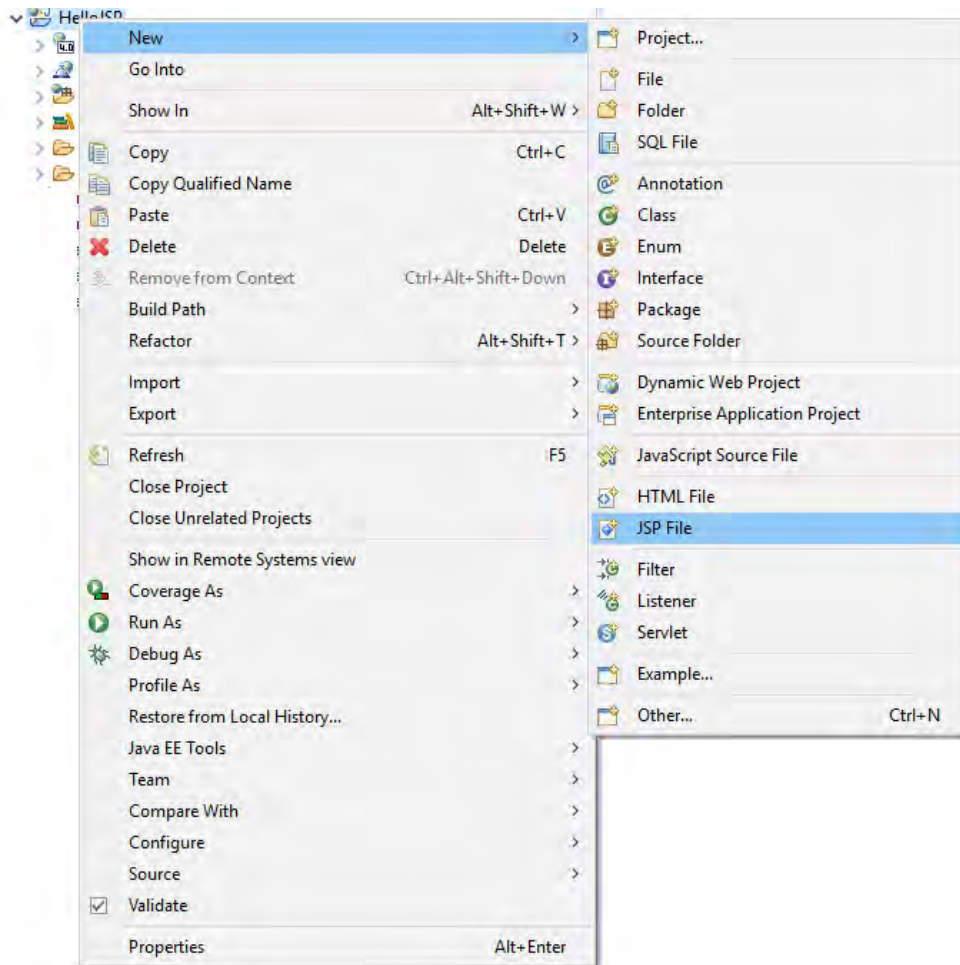
JSP 프로그램 작성

- 이클립스 프로젝트 생성 File->New->Dynamic Web Project -> Project Name: HelloJSP



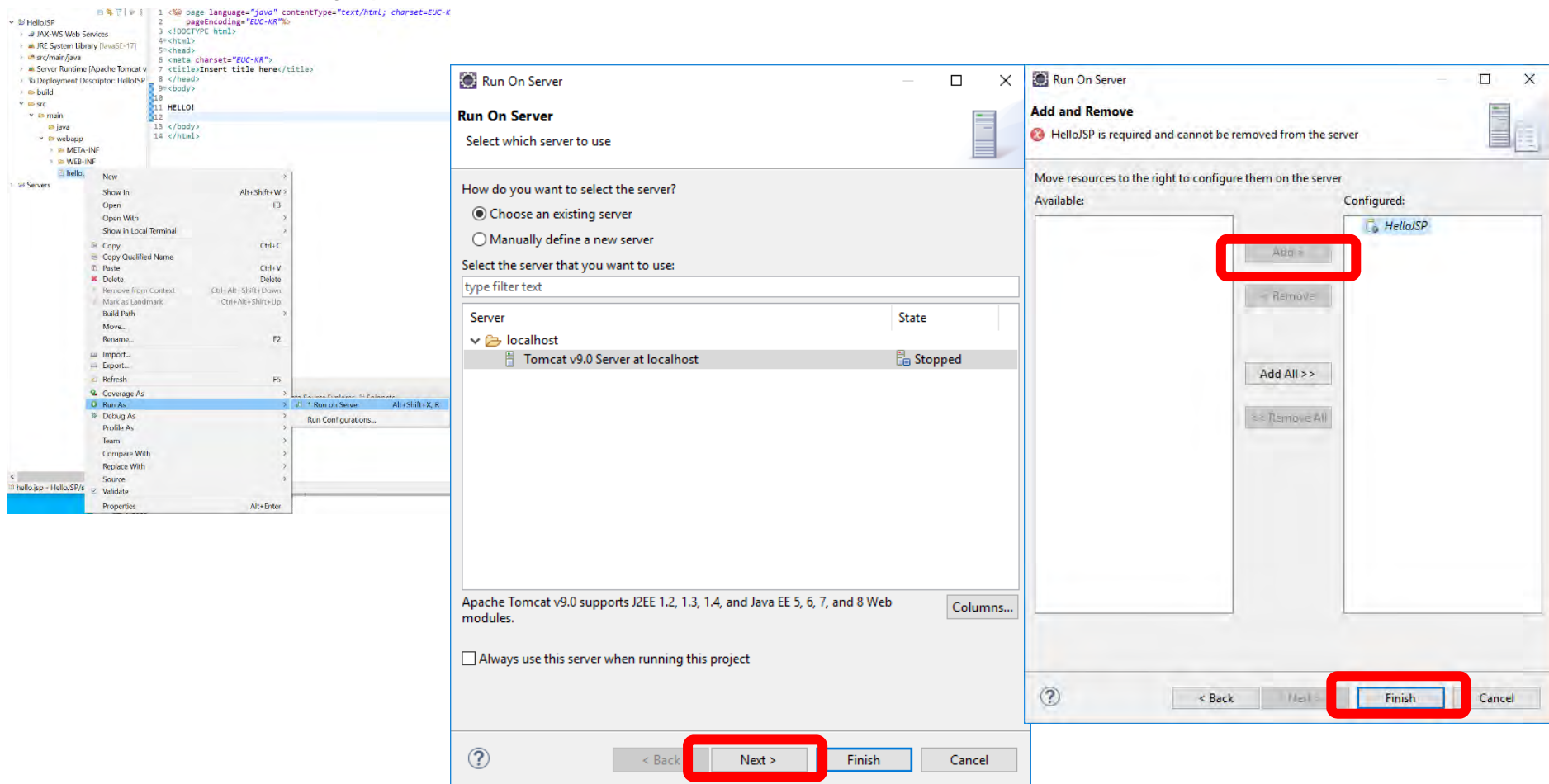
JSP 프로그램 작성

□ 프로젝트에 hello.jsp 소스 코드 추가



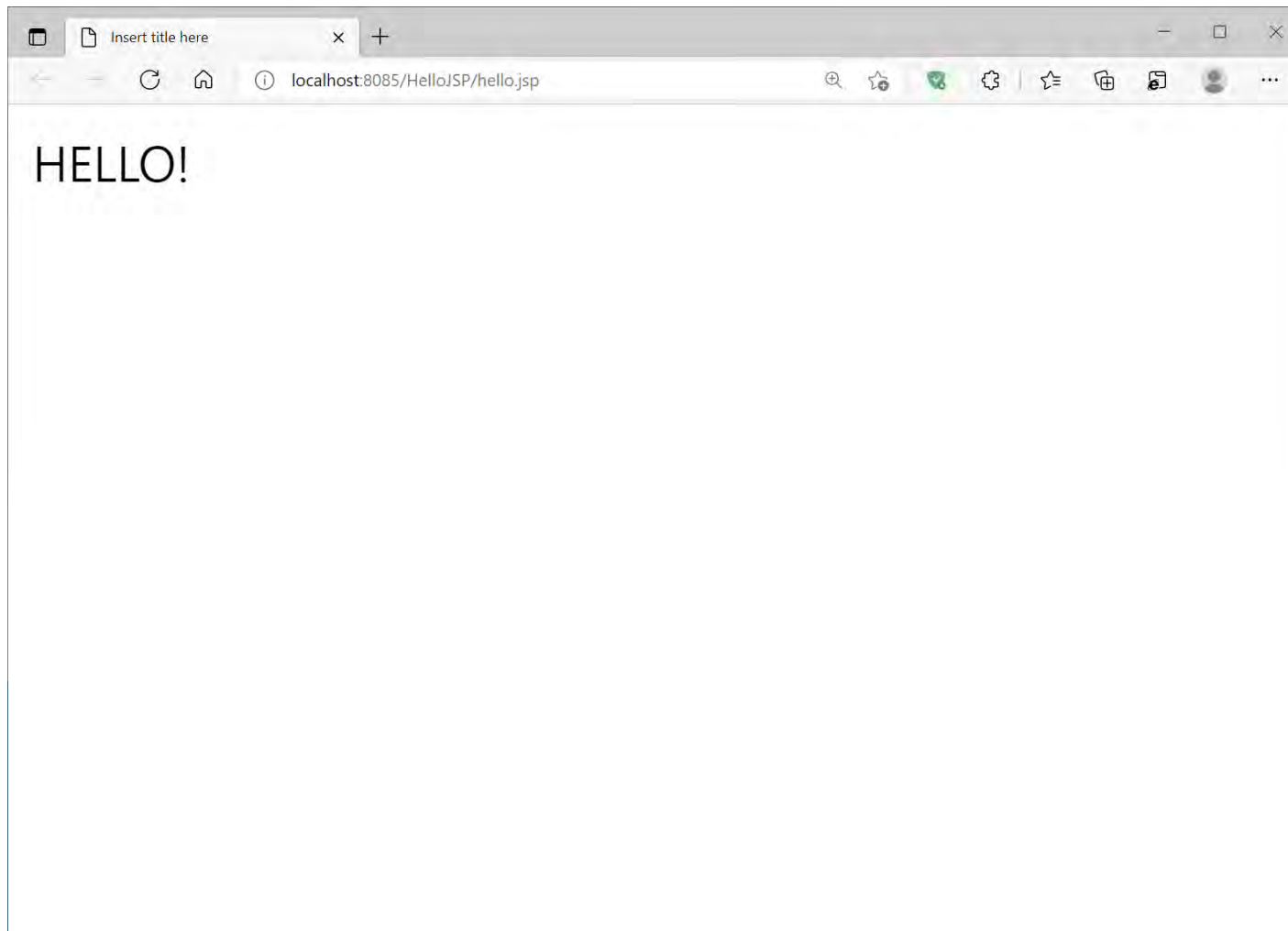
JSP 프로그램 실행

- 톰캣 서버에 등록하여 실행
 - hello.jsp - 우클릭 - Run on Server



JSP 프로그램 실행

□ 실행결과 확인하기



JSP 프로그램 실행

- 'Starting Tomcat v9.0 Server at localhost' has encountered a problem 에러가 발생 시

Problem Occurred

'Starting Tomcat v9.0 Server at localhost' has encountered a problem.

Port 8009 required by Tomcat v9.0 Server at localhost is already in use. The server may already be running in another process, or a system process may be using the port. To start this server you will need to stop the other process or change the port number(s).

OK << Details

Port 8009 required by Tomcat v9.0 Server at localhost is already in use. The server may already be running in another process, or a system process may be using the port. To start this server you will need to stop the other process or change the port number(s).

Tomcat v9.0 Server at localhost

localhost

Apache Tomcat v9.0

/Servers/Tomcat v9.0 Server at localhost-confi

Ports

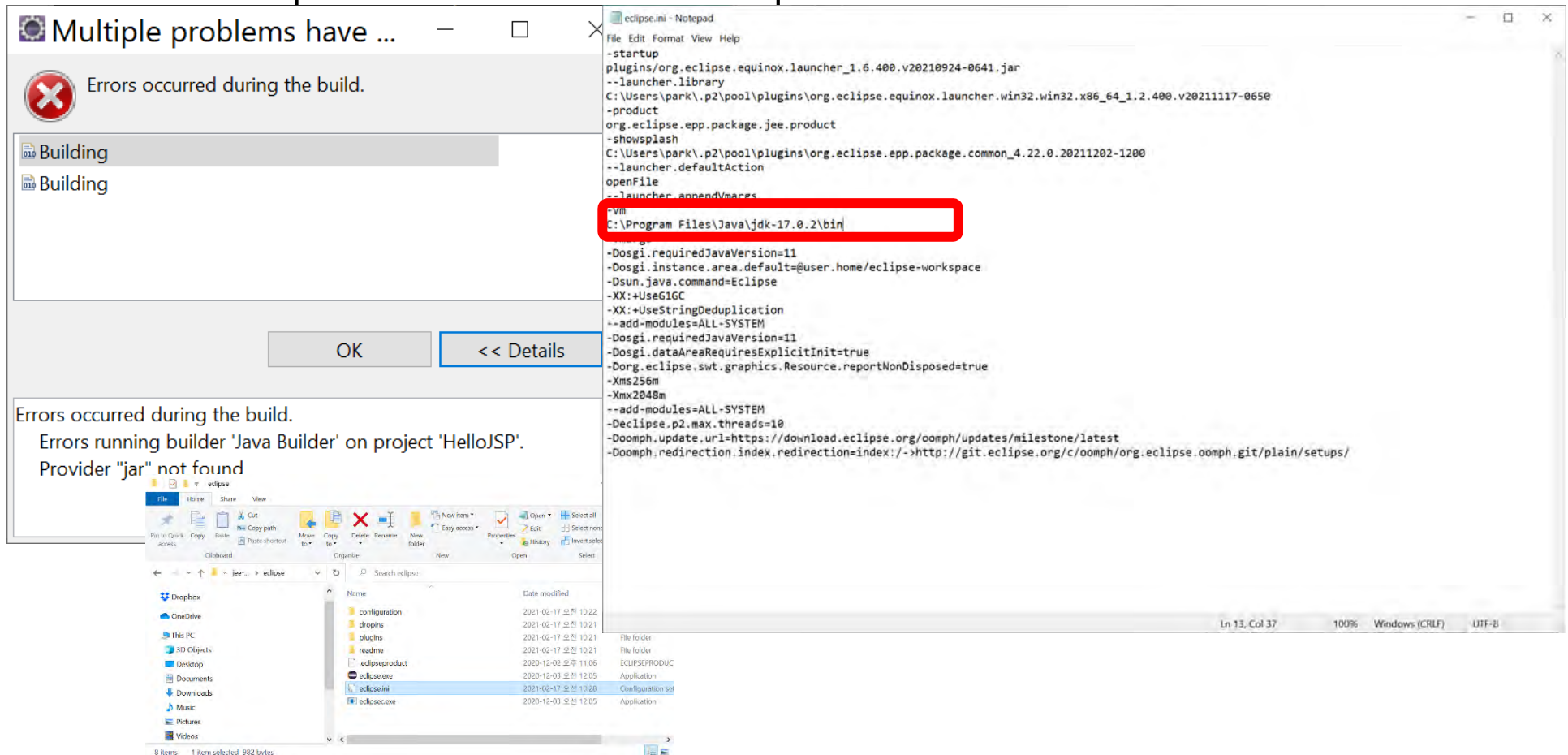
Port Name	Port Number
Tomcat admin port	8005
HTTP/1.1	8085

Tomcat v9.0 Server at localhost [Started, Synchronized]

Double click

JSP 프로그램 실행

- ❑ Errors running builder 'Java Builder' on project 'HelloJSP'. Provider "jar" not found 에러가 발생 시
 - Eclipse 설치 디렉토리의 eclipse.ini 파일 수정



톰캣에 JSP 프로젝트 배포하기

1. JSP 프로젝트를 **war** 파일로 Export
 - File->Export->Select Web WAR file
2. **war** 파일을 톰캣의 웹루트(webapps)에 저장
3. `http://localhost:8085/HelloJSP/hello.jsp` 접속

The image shows the 'Export' dialog box in an IDE, the 'webapps' directory in a file explorer, and a browser window displaying the result.

Export Dialog: The 'WAR Export' dialog is shown with 'Web project' set to 'HelloJSP' and 'Destination' set to 'C:\Program Files\Apache Software Foundation\Tomcat 9.0\webapps\HelloJSP'. The 'Target runtime' is 'Apache Tomcat v9.0'. The 'HelloJSP.war' file is highlighted in the file explorer.

Name	Date modified	Type	Size
docs	2022-02-27 오후 7:37	File folder	
manager	2022-02-27 오후 7:37	File folder	
ROOT	2022-02-27 오후 7:37	File folder	
HelloJSP.war	2022-02-27 오후 8:29	WAR File	1 KB

Browser: The browser address bar shows 'localhost:8085/HelloJSP/hello.jsp' and the page displays 'HELLO!'.

동적 웹 프로젝트 구조

□ Dynamic Web Project 디렉토리 구조

- ▼ HelloJSP
 - > Deployment Descriptor: HelloJSP
 - > JAX-WS Web Services
 - > JRE System Library [JavaSE-17]
 - > src/main/java
 - > Server Runtime [Apache Tomcat v9.0]
 - > build
 - ▼ src
 - ▼ main
 - java
 - ▼ webapp
 - > META-INF
 - > WEB-INF
 - hello.jsp

Lab0

- HelloJSP 프로그램을 작성한다.
 - OpenJDK 설치 (**JDK17.0.2**)
 - WAS 설치 (Apache Tomcat9 **apache-tomcat-9.0.58.exe**)
 - IDE 설치 (**Eclipse Jee 2021-12** (eclipse-inst-win64.exe))
 - 환경설정
 - 이클립스를 사용한 JSP 프로그램 작성
- Lab0 프로젝트와 배포 파일을 전체적으로 묶어서 보고서(1~2장)와 함께 Lab0_학번_이름.zip 압축한 후 e-learning에 과제 제출한다.
- 보고서에 실행결과 화면을 캡처하여 첨부한다.