

Unit - 4 Servlet

a. What is servlet ? Explain the life cycle of servlet and how it is different from CGI. 8

(b) What are the security issues which can be handled with help of servlet ? Explain. 5

(c) Explain use of javax.servelet HTTP package.

(a) What is a Servlet? Explain the Life Cycle of a Servlet and How it is Different from CGI.

What is a Servlet?

A **Servlet** is a Java program that runs on a web server, handling requests and generating dynamic responses to client requests. It is a server-side technology that is used to create web applications.

Servlets are commonly used for tasks such as handling form data, generating dynamic web pages, managing session information, and interacting with databases.

Servlets are part of the **Java EE** (Enterprise Edition) specification and are managed by a **Servlet Container** (such as Apache Tomcat, Jetty, etc.).

Life Cycle of a Servlet:

The life cycle of a servlet is controlled by the **Servlet Container**, which is responsible for creating, initializing, handling requests, and destroying servlets. The key stages in the life cycle are:

1. Loading and Instantiation:

- When a servlet is first requested, the servlet container loads the servlet class and instantiates it.
- The servlet is loaded only once during the application's lifetime (unless the server is restarted or the servlet is reloaded explicitly).

2. Initialization (init() method):

- After instantiating the servlet, the servlet container initializes it by calling the init() method.
- The init() method is called only once in the life cycle and is typically used for setup operations, such as initializing resources or reading configuration settings.

3. java

Copy code

```
public void init() throws ServletException {  
4.    // Initialization code  
5.}  
6.
```

7. Request Handling (service() method):

- The servlet container calls the service() method to handle each client request.
- The service() method takes two parameters: ServletRequest and ServletResponse.
- Based on the request type (GET, POST, etc.), the service() method delegates the request to the appropriate doGet(), doPost(), doPut(), etc.

8. java
Copy code

```
public void service(ServletRequest req, ServletResponse res)  
throws ServletException, IOException {  
9.    // Handle request  
10.}  
11.
```

12. Destruction (destroy() method):

- When the servlet container needs to remove the servlet (usually during server shutdown or when the servlet is unloaded), it calls the destroy() method.
- The destroy() method is called once during the servlet's life cycle and is typically used for releasing resources, closing connections, etc.

13. java
Copy code

```
public void destroy() {  
14.    // Cleanup code
```

15. }

16.

Difference between Servlet and CGI (Common Gateway Interface):

Feature	Servlet	CGI
Execution	A servlet runs within the server's JVM (Java Virtual Machine).	CGI runs as a separate process on the web server.
Performance	Servlets are faster because they are loaded once and reside in memory throughout the server's lifetime.	CGI processes are launched each time a request is made, resulting in overhead for each request.
Concurrency	Servlets handle multiple requests concurrently using multiple threads.	CGI handles each request in a separate process, leading to more overhead and less concurrency.
Platform Dependency	Platform-independent (Java-based).	Platform-dependent (usually implemented in languages like Perl, C, etc.).
Resource Management	Servlets can manage resources efficiently as they are executed within the server's lifecycle.	CGI programs have to manage resources for each request, leading to possible inefficiencies.

Configuration	Servlet configuration is done via web.xml or annotations.	CGI scripts often require more manual configuration.
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(b) What are the Security Issues Which Can Be Handled with the Help of Servlets?

Servlets can handle several **security issues** in web applications. These include:

1. Authentication:

- Authentication refers to verifying the identity of users. Servlets can be used to implement user authentication by checking credentials (username and password).
- This can be done using mechanisms such as:
 - ◆ **Basic Authentication:** Requires the user to provide a username and password.
 - ◆ **Form-based Authentication:** A servlet checks the user credentials against a database or other backend service.

2. Example of authentication in a servlet:

java

Copy code

```
if (username.equals("admin") &&
    password.equals("admin123")) {
```

```
3.    // Proceed to next page
```

```
4. } else {
```

```
5.    // Redirect to login page
```

```
6. }
```

```
7.
```

8. Authorization:

- Once a user is authenticated, servlets can enforce **authorization** by checking the user's role or permissions

before allowing access to certain resources.

- This can be done by using the `HttpServletRequest.isUserInRole()` method, which checks if the user has the required role.

9. Session Management:

- Servlets can manage **sessions** using the `HttpSession` object to maintain the state of a user across multiple requests.
- This ensures that users can stay logged in and access personalized content as they interact with the application.
- Sessions can be tracked using cookies or URL rewriting.

10. Input Validation:

- Servlets help mitigate **cross-site scripting (XSS)** and **SQL injection attacks** by validating and sanitizing user inputs.
- Input validation can be done in servlets to ensure that only valid data is passed to the application, thereby preventing malicious scripts or SQL queries from executing.

11. Example of input validation:

java
Copy code

```
String userInput = request.getParameter("username");
```

```
12. if (!userInput.matches("[a-zA-Z0-9_]+")) {
```

```
13.     // Invalid input, reject the request
```

```
14. }
```

```
15.
```

16. Secure Communication (HTTPS):

- Servlets can be configured to ensure that communication between the client and the server is encrypted using **HTTPS**.
- This helps in preventing eavesdropping and man-in-the-middle attacks.

17. Access Control:

- Servlets can be used to implement fine-grained access control, such as IP-based restrictions or limiting access to certain resources based on the user's credentials or roles.

(c) Explain the Use of javax.servlet.http Package.

The **javax.servlet.http** package contains classes and interfaces that provide HTTP-specific functionality to servlets. This package is an extension of the javax.servlet package and is used for handling HTTP requests and responses.

Key Classes and Interfaces in javax.servlet.http

1. HttpServlet:

- HttpServlet is a subclass of GenericServlet designed specifically for HTTP requests. It simplifies the process of handling HTTP requests by providing the doGet(), doPost(), doPut(), and doDelete() methods to handle different types of HTTP requests (GET, POST, etc.).

2. Example:

java

Copy code

```
public class MyServlet extends HttpServlet {  
3.  @Override  
4.  protected void doGet(HttpServletRequest request,  
    HttpServletResponse response)  
5.      throws ServletException, IOException {  
6.      response.getWriter().println("Hello, World!");  
7.  }  
8. }  
9.
```

10. HttpServletRequest:

- This interface provides methods to obtain data from the client's HTTP request, such as request parameters, headers, and cookies.
- Methods like getParameter(), getHeader(), and getCookies() are used to get request details.

11. Example:

java

Copy code

```
String username = request.getParameter("username");  
12. String password = request.getParameter("password");  
13.
```

14. **HttpServletResponse:**

- This interface provides methods to set response headers, cookies, and send output back to the client.
- Methods like `setHeader()`, `setStatus()`, and `getWriter()` are used to control the response.

15. Example:

```
java  
Copy code
```

```
response.setContentType("text/html");  
16. response.getWriter().println("<h1>Hello, World!</h1>");  
17.
```

18. **HttpSession:**

- The `HttpSession` interface is used to create and manage sessions between the client and the server. It allows the servlet to maintain state across multiple HTTP requests.

19. Example:

```
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```
HttpSession session = request.getSession();  
20. session.setAttribute("username", "admin");  
21.
```

22. **Cookie:**

- The `Cookie` class is used to handle cookies in an HTTP request and response. Cookies are small pieces of data

sent from the server and stored in the client's browser.

23. Example:

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```
Cookie cookie = new Cookie("user", "admin");
```

```
24. response.addCookie(cookie);
```

```
25.
```

26. **HttpServletRequestWrapper and HttpServletResponseWrapper:**

- These classes are used to wrap request and response objects to modify or extend their functionality (such as logging, modifying headers, etc.).

Summary:

- **Servlets** are Java programs that handle HTTP requests and responses and are used for dynamic web applications.
- The **life cycle of a servlet** includes loading, initialization, request handling, and destruction.
- **Servlets differ from CGI** in terms of performance, concurrency, and resource management.
- **Servlets can handle security issues** like authentication, authorization, session management, input validation, and secure communication.
- The **javax.servlet.http** package provides classes and interfaces to handle HTTP-specific tasks like request and response processing, session management, and cookies.

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ChatGPT said:

ChatGPT

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