# Server-Side Template Injection (SSTI)

## Understanding the Difference between XSS and SSTI Attacks

Web applications are essential tools for businesses and individuals alike, but they can also be susceptible to various security vulnerabilities. Two common types of vulnerabilities are Cross-Site Scripting (XSS) and Server-Side Template Injection (SSTI). While both involve injection attacks, they target different components of a web application and can have distinct consequences.

XSS is a vulnerability that occurs when an attacker injects malicious scripts into a web application, which then get executed in the browsers of unsuspecting users. This type of attack targets the client-side of the application and aims to manipulate user interactions.

SSTI, on the other hand, focuses on the server-side of the web application and targets the templates used to dynamically generate content. In this vulnerability, an attacker injects malicious code into templates, which are later executed on the server. The primary goal of an SSTI attack is to manipulate the application's rendering process and potentially achieve remote code execution.

## What are Templates?

Templates are files that contain placeholders for dynamic data, such as HTML files with variables like {{greeting}}. The backend app replaces these placeholders with actual data, creating dynamic content to display on the web page.

## Exploiting SSTI

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### 3.1 Detect

To detect SSTI, try injecting special characters like $, {{, <%= %> into input fields and observe any differences in the server's response. Mathematical operations like ${7/0} can also help identify the vulnerability.

|  |  |  |
| --- | --- | --- |
| ${} | {{}} | <%= %> |
| ${7/0} | {{7/0}} | <%= 7/0 %> |
| ${foobar} | {{foobar}} | <%= foobar %> |
| ${7\*7} | {{7\*7}} | `` |
| #{7\*7} | \*{7\*7} |

Otherwise, you'll need to manually test different language-specific payloads and study how they are interpreted by the template engine. A common way of doing this is to inject arbitrary mathematical operations using syntax from different template engines. You can then observe whether they are successfully evaluated. To help with this process, you can use a decision tree like the following:

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You should be aware that the same payload can sometimes return a successful response in more than one template language. For example, the payload {{7\*'7'}} returns 49 in Twig and 7777777 in Jinja2. Therefore, it is important not to jump to conclusions based on a single successful response.

### Identify

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Find the template engine being used by causing errors with payloads like ${foobar}. Errors may reveal the template engine.

### 3.3 Explore & Exploit

Read the template engine's documentation and find available functions and objects. Attackers can then craft payloads to exploit vulnerabilities, like arbitrary object creation or remote code execution.

## How is that exploitable?

If attackers manage to inject malicious code that executes on the server, they can gain control over it. For instance, injecting OS commands like {{ import os; os.system("ls") }} can allow them to list files on the server.

## Prevention

* Jinja’s WTF forms provide extra protection by sanitizing input, escaping characters, and preventing malicious code execution.
* Avoid user-modifiable templates whenever possible.
* Use "logic-less" template engines, like Mustache, to separate logic from presentation.
* If you must use dynamic templates, sandbox untrusted code to limit its capabilities.
* Consider deploying the template environment in a secure container, like Docker, to add an extra layer of protection.
* By following these steps, you can better understand and protect your web application from SSTI attacks. Always prioritize security to keep your users and data safe.

## Try it!

https://ssti.secure-cookie.io/

## References

- https://secure-cookie.io/attacks/ssti/

- https://book.hacktricks.xyz/pentesting-web/ssti-server-side-template-injection

- https://portswigger.net/web-security/server