Bonitasoft

Web security: OWASP project, CSRF threat and solutions.

Fabio Lombardi

Be Efficient

About me

- Since 2013
  - Research & Development Engineer @Bonitasoft

- Past:
  - 2 years as Web Penetration Tester Consultant
  - Post-graduate studies in IT Security and Software engineering

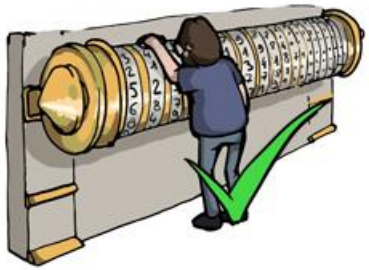
Security checklist

Anti-SQL-injection protection

SSL and OpenSSL up to date

AES encryption on sensitive data

Passwords hashed with salt



Multi-factor authentication on the back-office

Preventing the PM from sending the whole unencrypted database by email

CommitStrip.com

DID YOU KNOW

In the US

$5,400,000

Average organization cost
of a data breach

$277

Average cost per stolen record

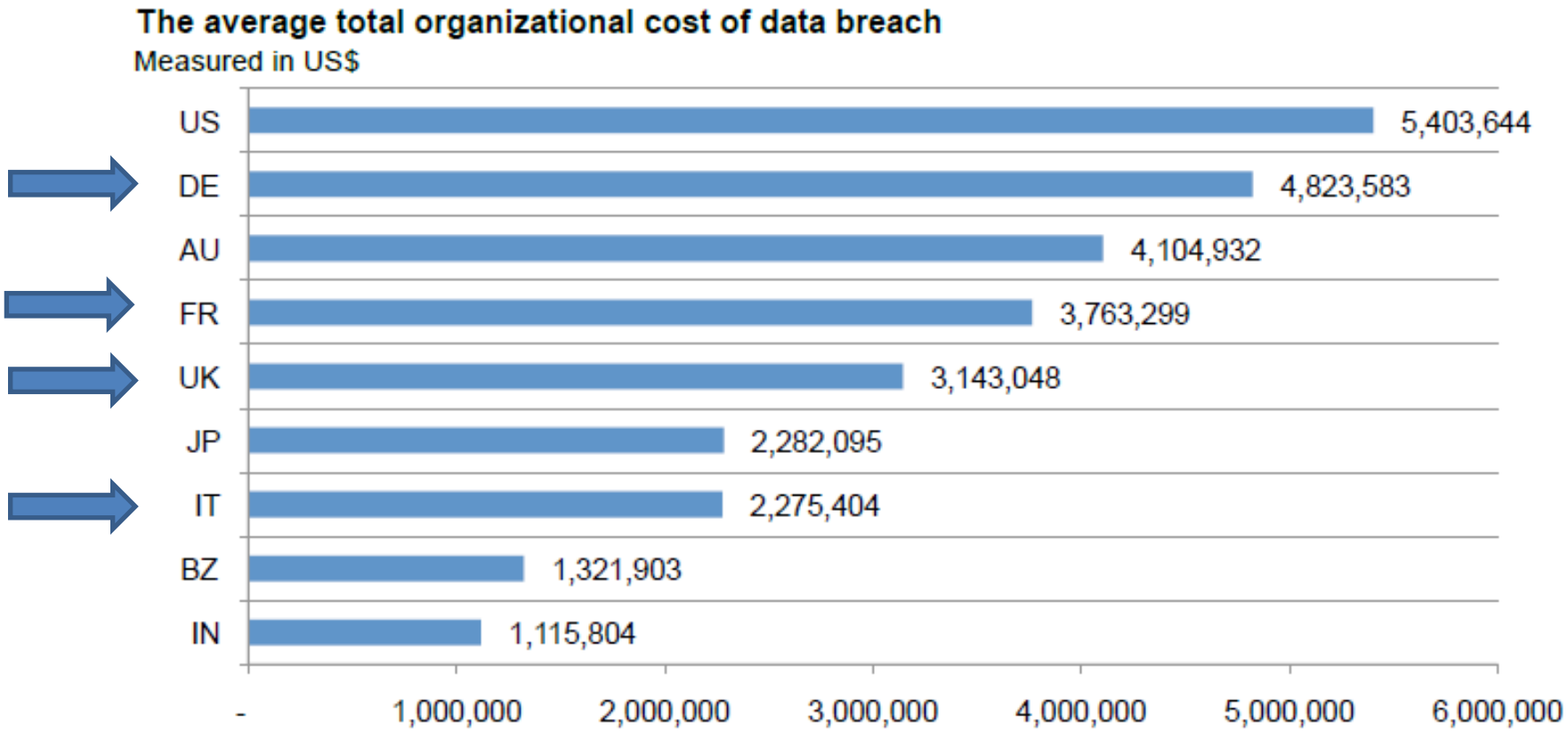
#

~ 10,000

Cyber attacks attempts against the US Navy since this talk started

From a 2013 Fonemon institute study: Cost of Data Breach Study: Global Analysis

... and in Europe



From a 2013 Fonemon institute study: Cost of Data Breach Study: Global Analysis

Seeing the financial consequences of a security breach

How do the costs of a breach add up across six categories?

Ref: http://www-935.ibm.com/services/us/en/it-services/security-services/data-breach/

It’s not just about money...

233 million users

1 million people

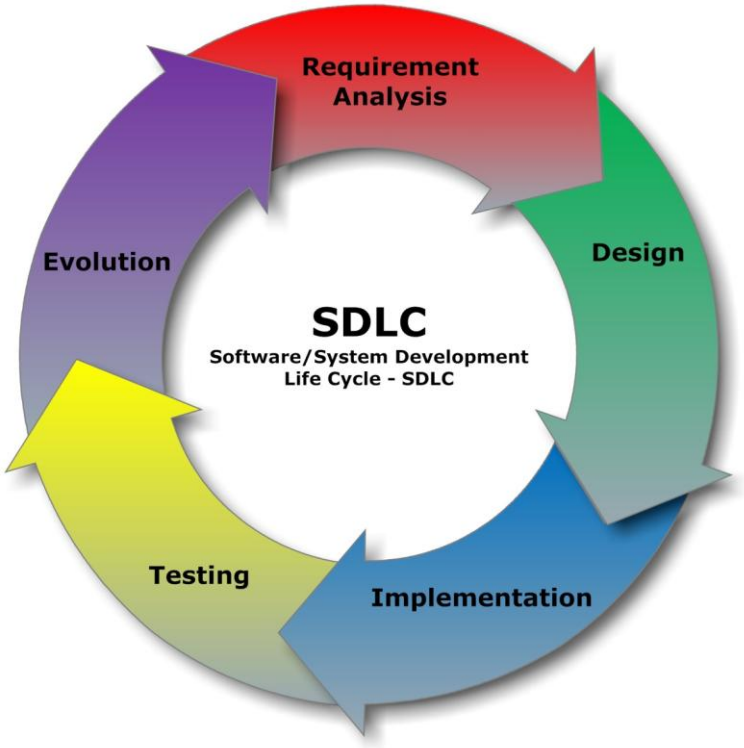
thousands credit cards

800,000 users

200,000 snapchats photos

personal photos leakage

Security has to be taken into account



How to change things?

The reference for web application security

OWASP

The Open Web Application Security Project

https://www.owasp.org

https://www.youtube.com/user/OWASPGLOBAL

LAPSE+ plugin for code source analysis

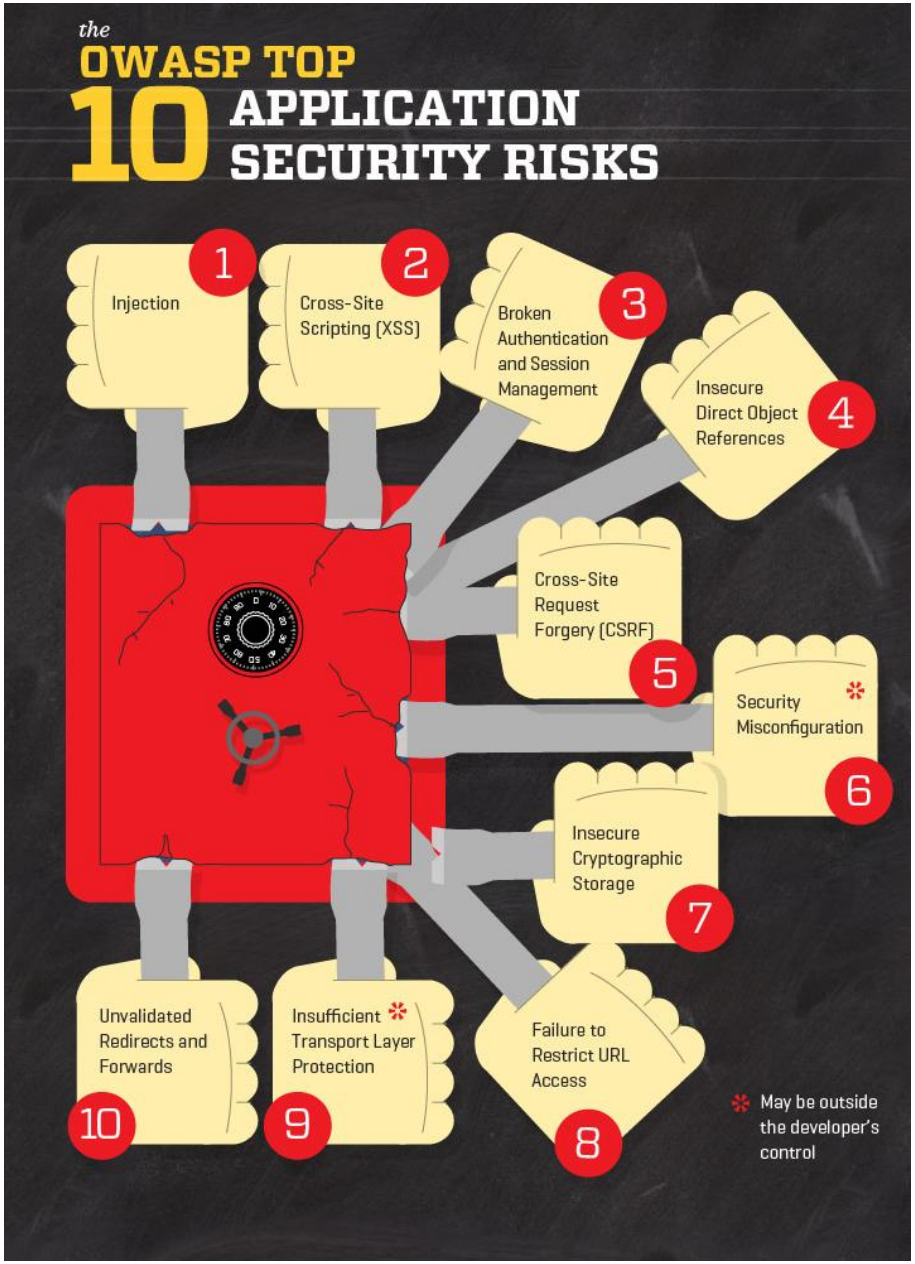
Example of a vulnerability description

2013 Top 10 List

Threat Agents	Attack Vectors	Security Weakness		Technical Impacts	Business Impacts
Application Specific	Exploitability AVERAGE	Prevalence COMMON	Detectability EASY	Impact MODERATE	Application / Business Specific
...	...	...		...	...

Am I Vulnerable To 'Cross-Site Request Forgery (CSRF)'?	How Do I Prevent 'Cross-Site Request Forgery (CSRF)'?
...	...
Example Attack Scenarios	**References**
...	...

Ref: https://www.owasp.org/index.php/Top_10_2013-A8-Cross-Site_Request_Forgery_(CSRF)



Ref: https://www.veracode.com/blog/2012/06/building-secure-web-applications-infographic

CSRF (Cross-Site request forgery)

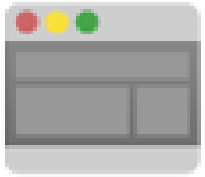
- Not well known (w.r.t. XSS or SQLInjection)

- Impacts
  - Malicious money transfers
  - User creation
  - Privilege escalation
  - Compromise end user data
  - The entire web application can be compromised
  - ...

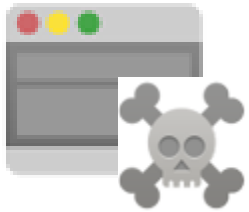
CSRF: The attack

data

My-site.com

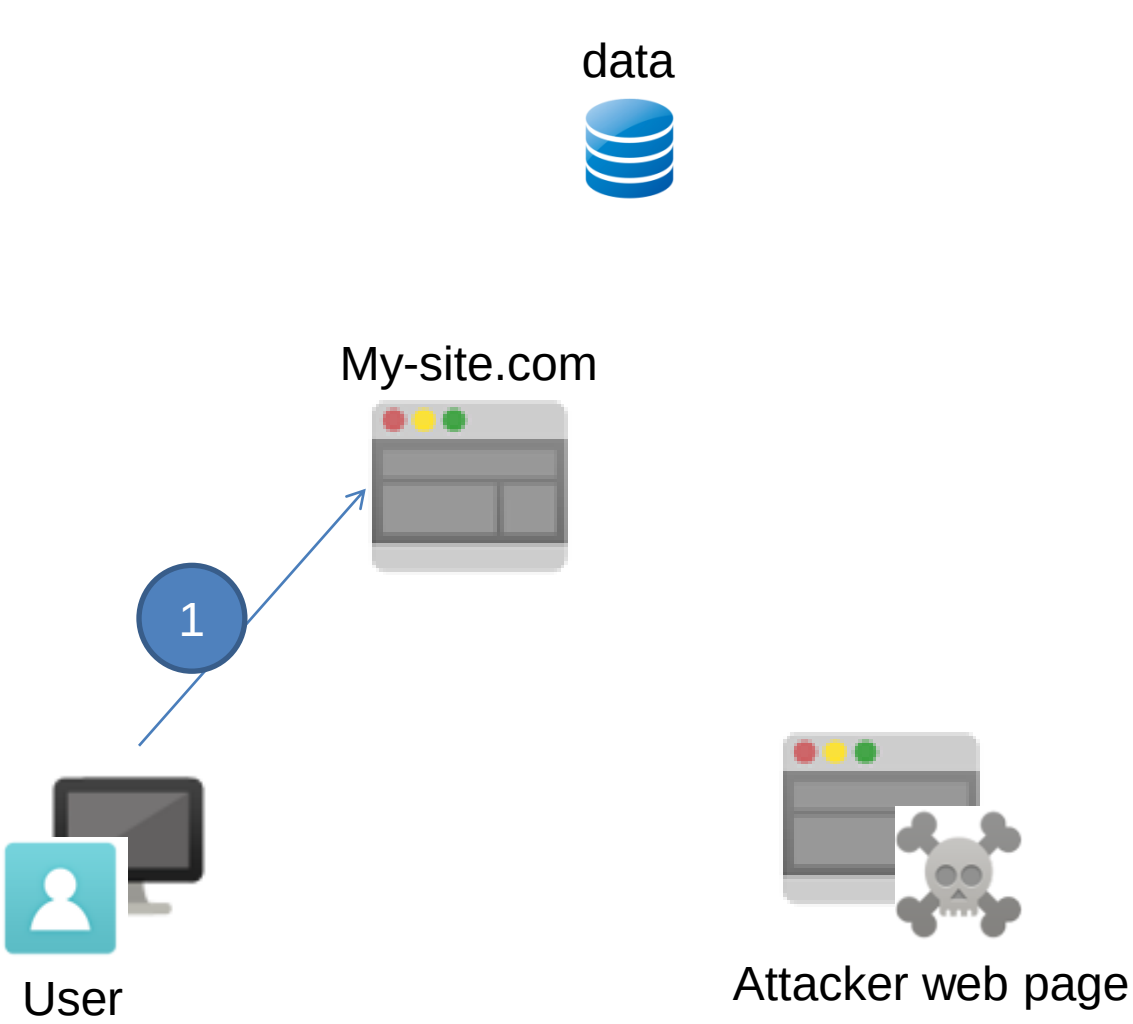


User



Attacker web page

CSRF: The attack



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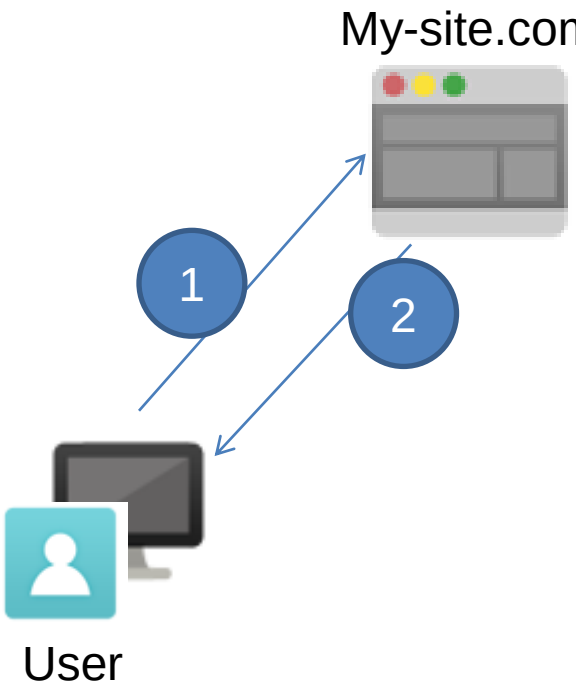
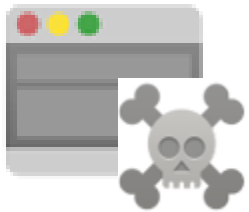
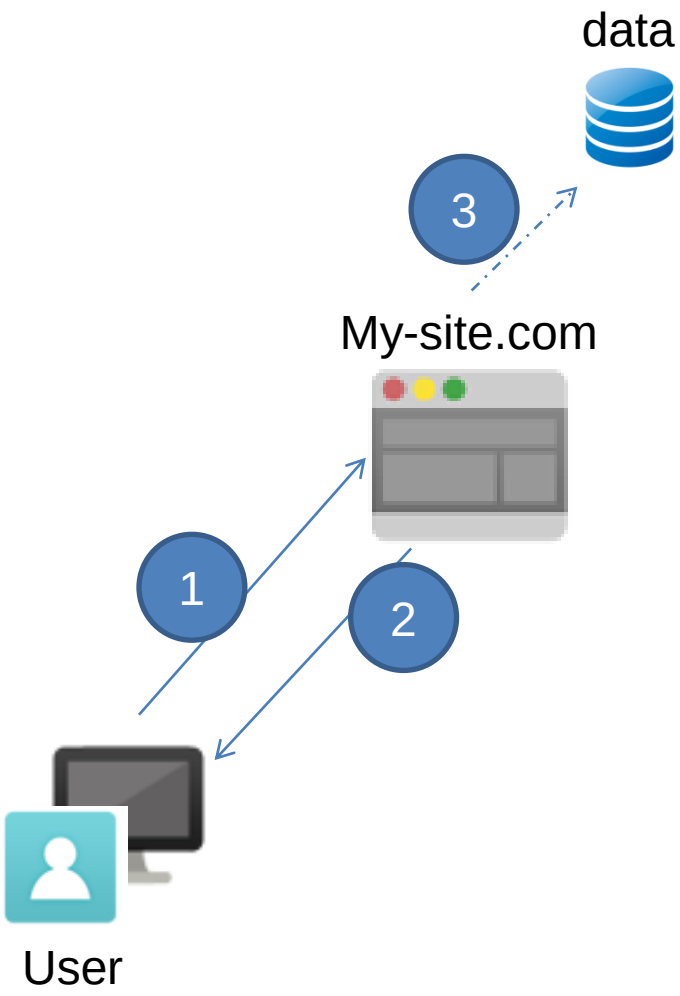
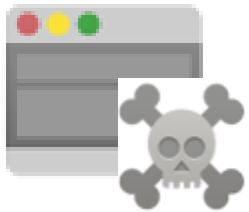




Attacker web page

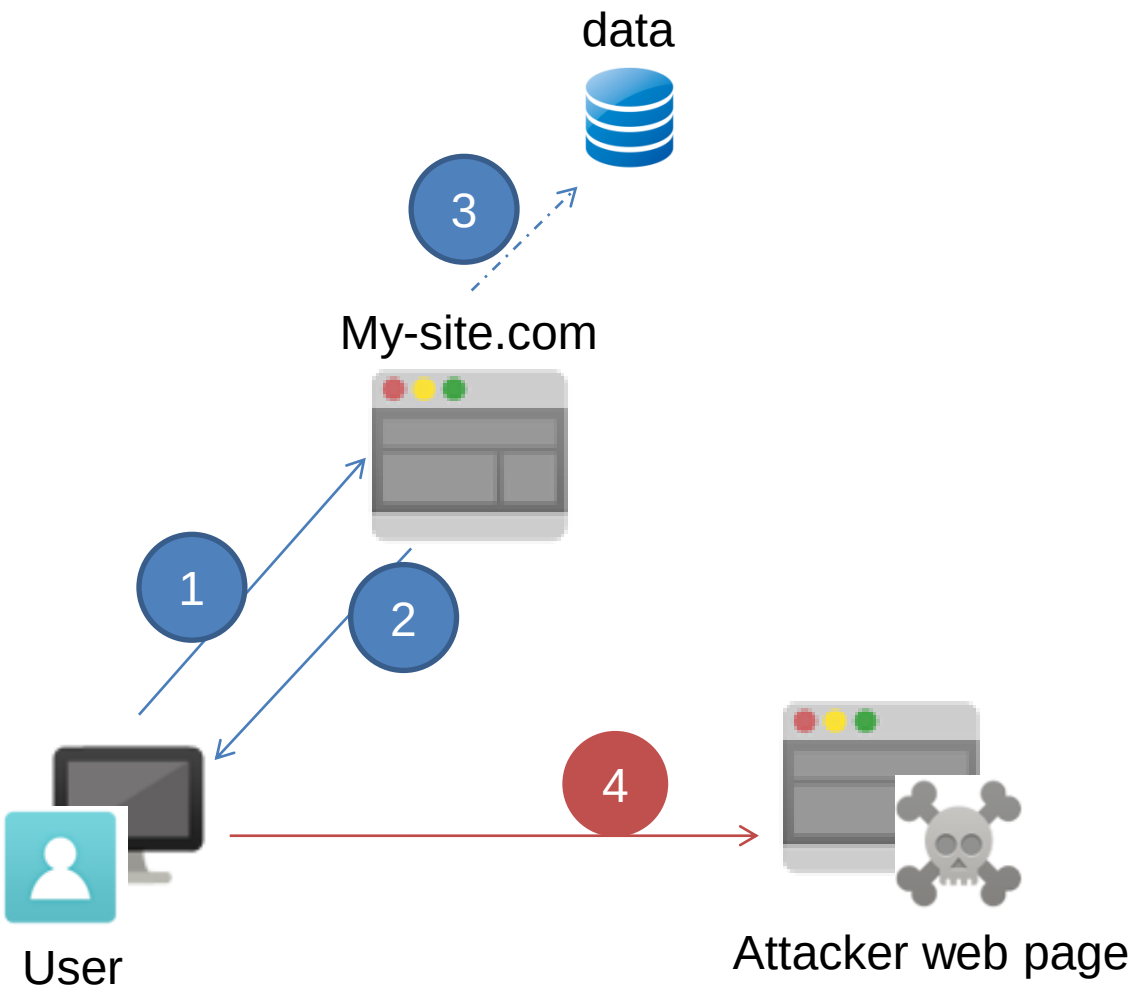
CSRF: The attack




Attacker web page

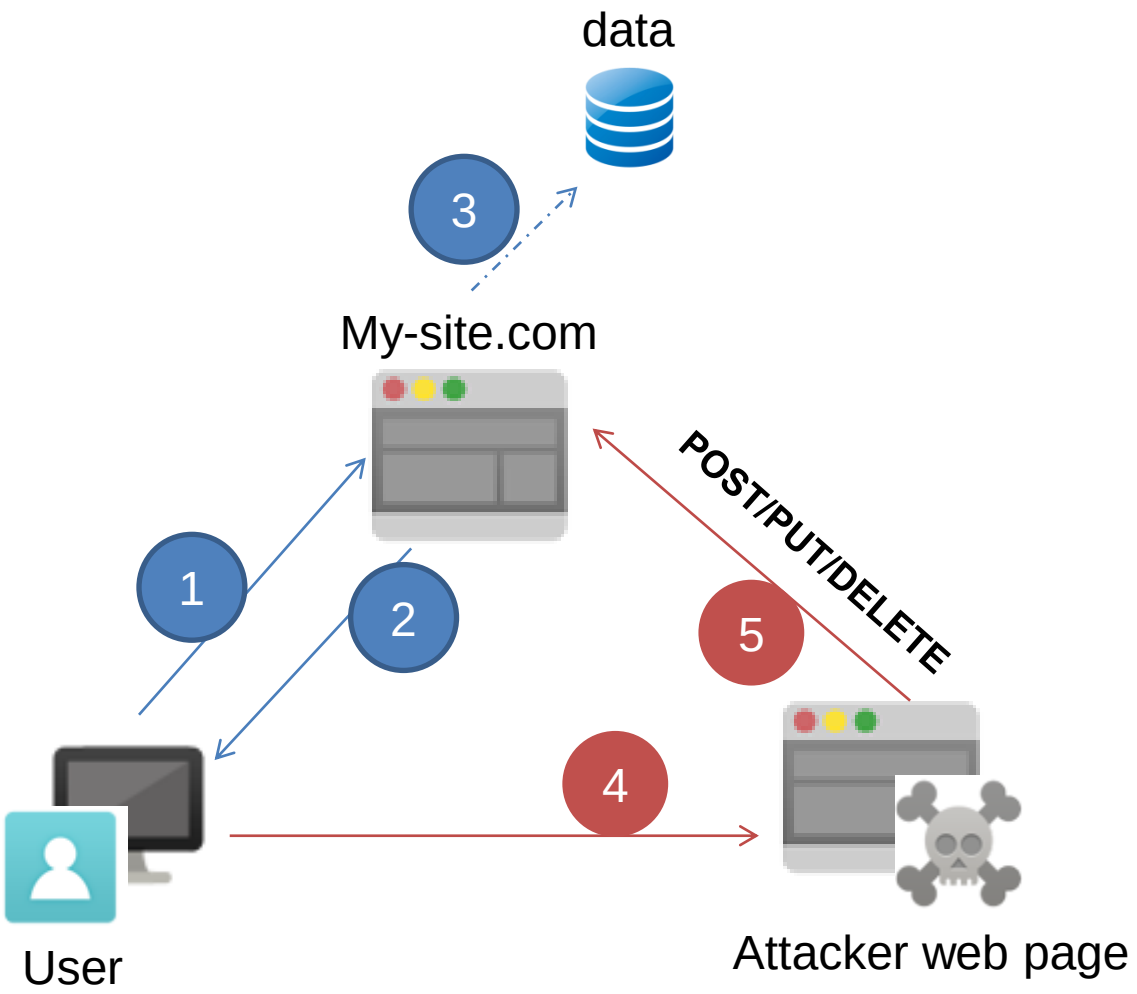
1. The user logs-in to My-site.com
2. My-site.com sends back a **session cookie**
3. The user is authorized to make API calls

CSRF: The attack



1. The user logs-in to My-site.com
2. My-site.com sends back a **session cookie**
3. The user is free to make API calls
4. The user **simply browses** the malicious web page

CSRF: The attack



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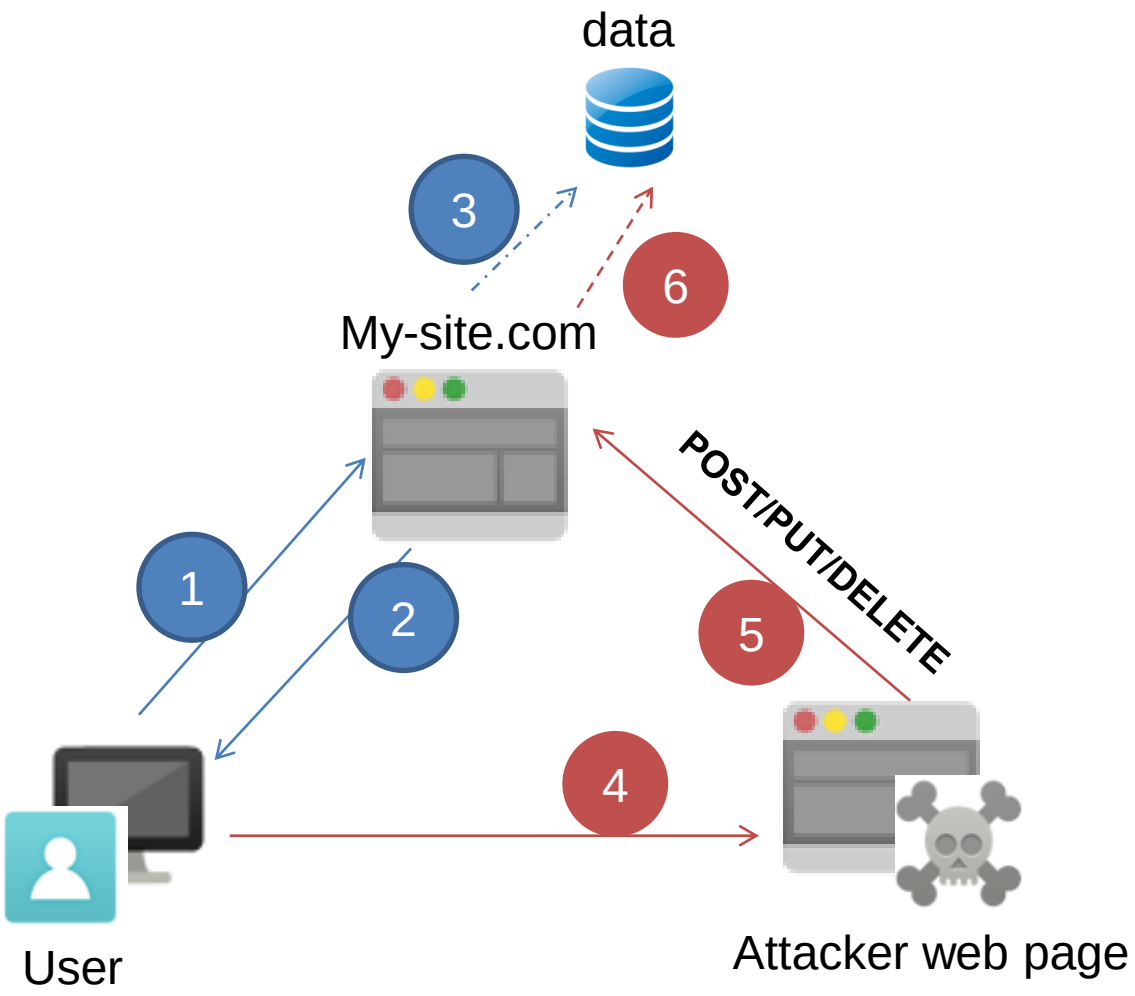

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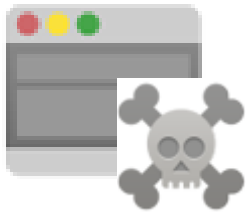
6. **Data** is compromised

The Attacker web page



- Example:
  - A popular web site clone (phishing tools) + hidden:

```
<iframe src=./attack_payload.html width=0 height=0> </iframe>
```

- attack_payload.html:

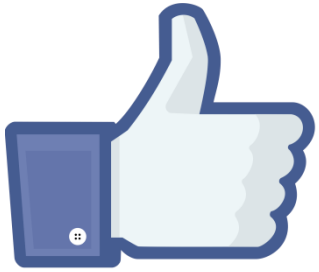
attack_payload.html

```
<form id="adduser" action="http://my-site.com/API/users/" method="POST" enctype="text/plain">
<input name='{"password_confirm":"password","userName":"newuser2","firstname":"test2","password":"password", "ignore_me":"'
value='test"}'type='hidden'>

<input type="submit" value="CSRF me !">
</form>

<script type="text/JavaScript">document.getElementById("adduser").submit(); </script>
```

- **action="http://my-site.com/API/users"** works using the session cookie obtained from my-site.com page
  - Generates a **HTTP POST** call to my-site.com on user behalf
  - **A new user is created**

Why the attack works?

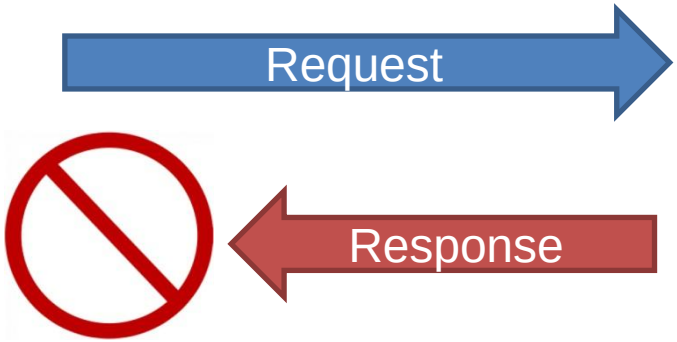
- It's due to a web browser feature



- The session is kept alive for multiple browser tabs

The attack weaknesses

- The attacker only attempts **blind attacks**
  - Cannot read the HTTP response

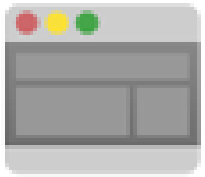


  - Cannot read the session cookie

CSRF: Solution

data

My-site.com



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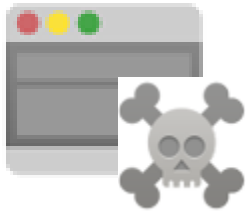

Attacker web page

CSRF: Solution

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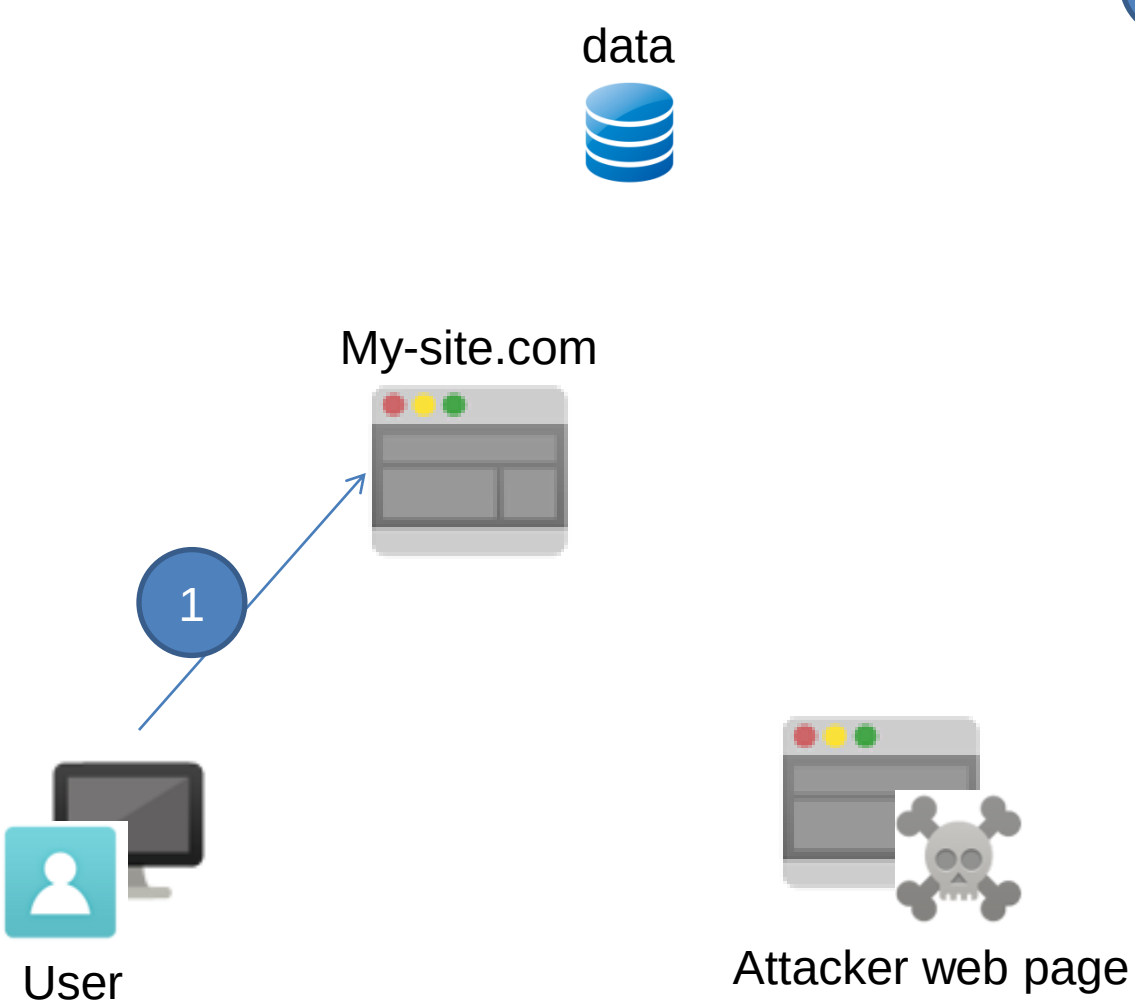
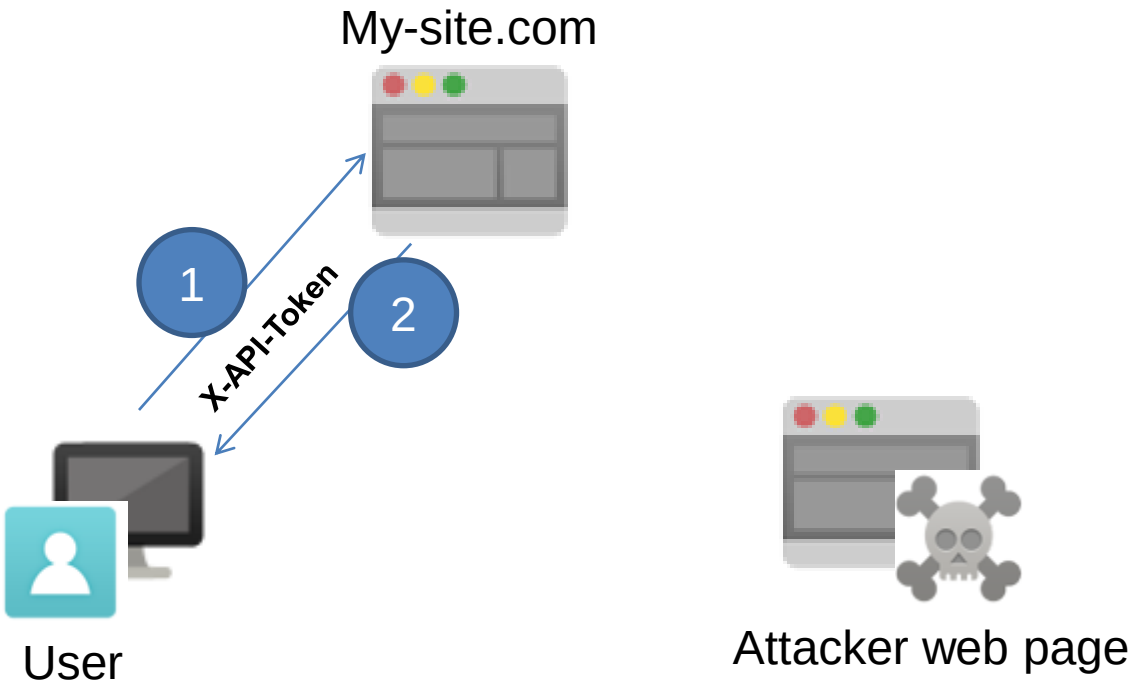


CSRF: Solution

1. The user logs-in to My-site.com
2. My-site.com sends back a session cookie **+ X-API-Token** in the **response header**



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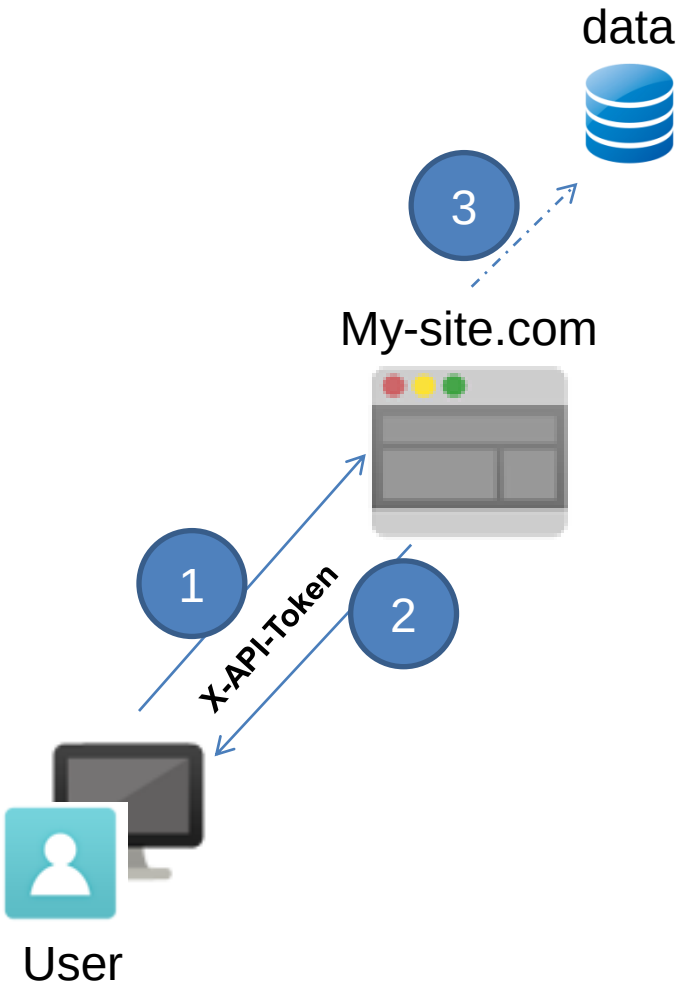

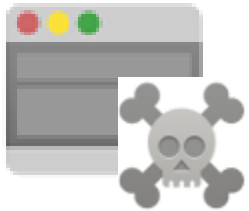

Attacker web page

1. The user logs-in to My-site.com
2. My-site.com sends back a session cookie **+ X-API-Token** in the **response header**
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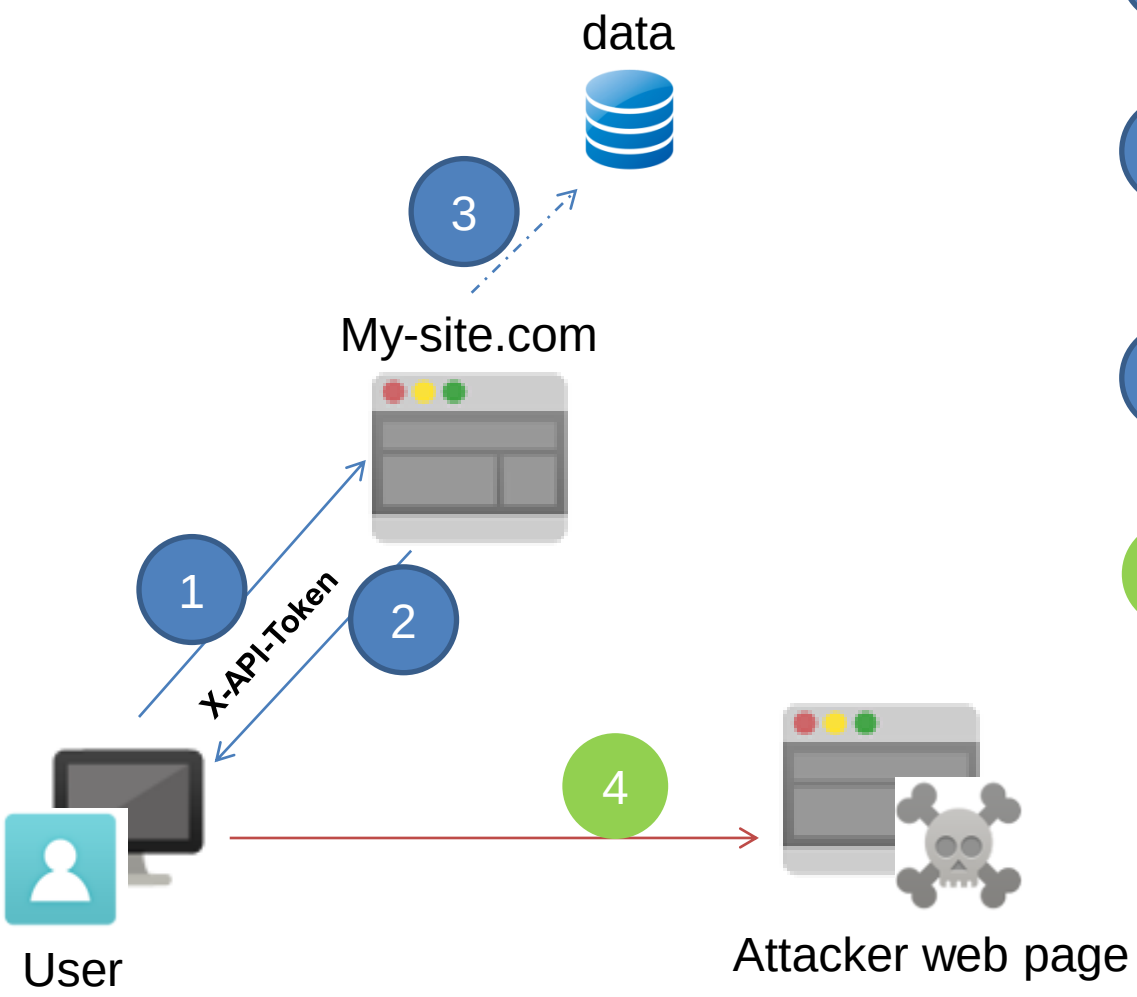
CSRF: Solution



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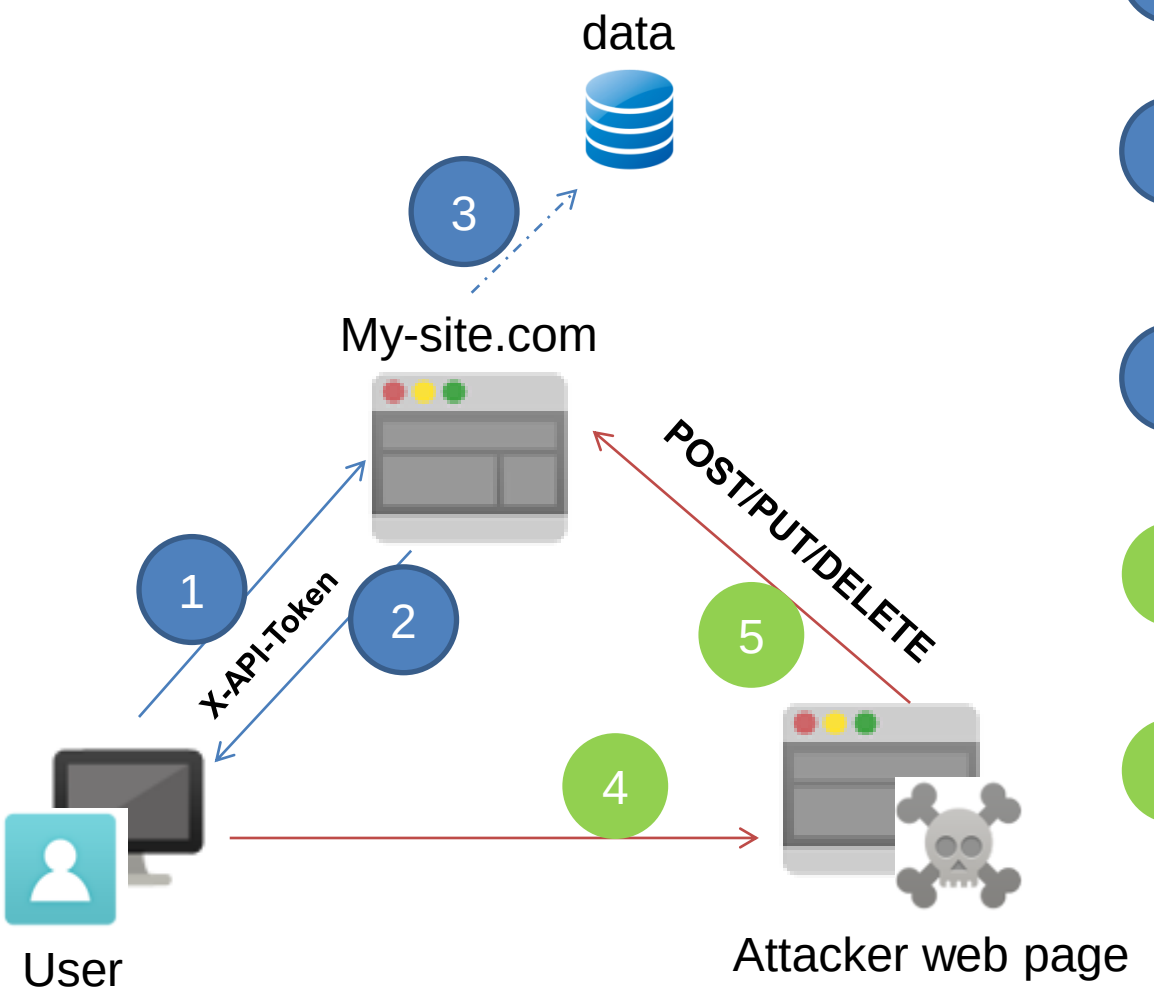

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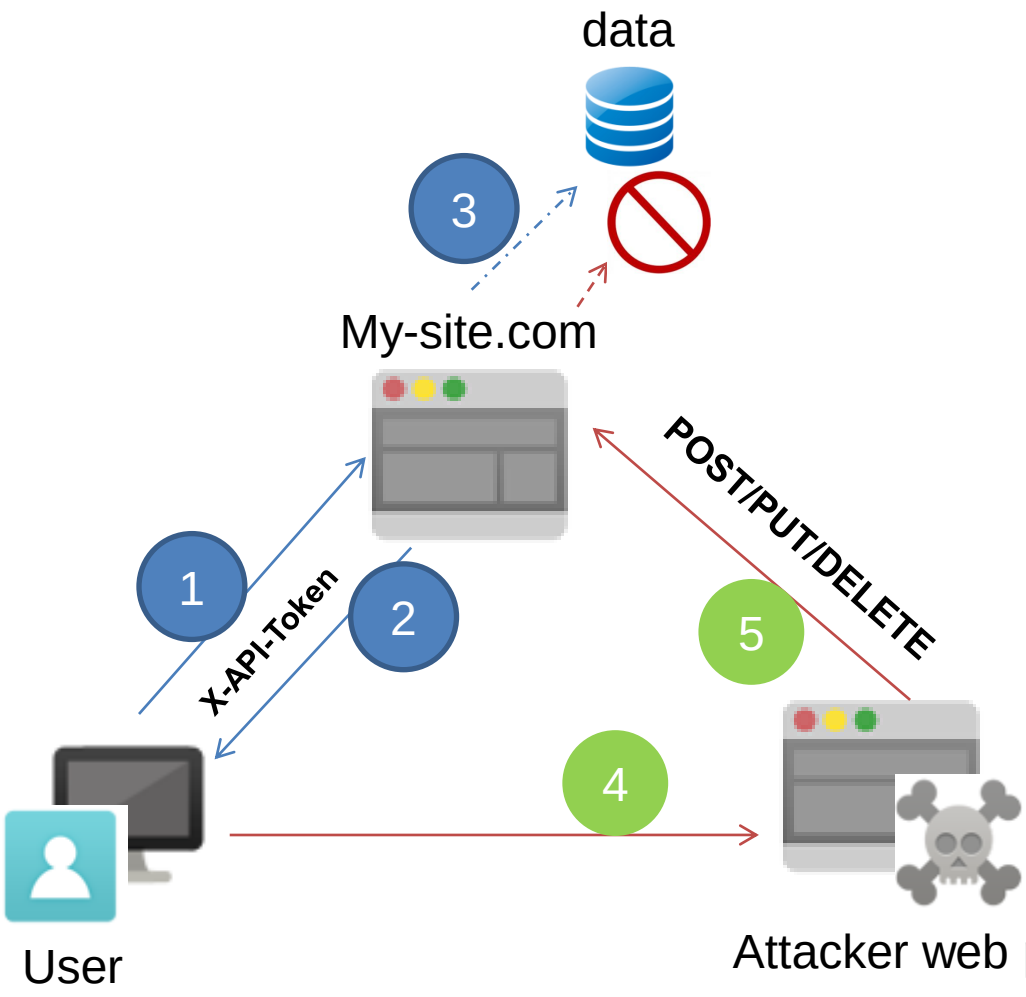

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The call is rejected as unauthorized

Solution: server side

- Token generation

```
public void doFilter(ServletRequest request, ServletResponse response, FilterChain chain) throws IOException, ServletException {
    final HttpServletRequest req = (HttpServletRequest) request;
    final HttpServletResponse res = (HttpServletResponse) response;

    // Create
    Object apiTokenFromClient = req.getSession().getAttribute("api_token");
    if (apiTokenFromClient == null) {
        apiTokenFromClient = new APIToken().getToken();
        req.getSession().setAttribute("api_token", apiTokenFromClient);
    }

    res.addHeader("X-API-Token", apiTokenFromClient.toString());
    chain.doFilter(req, res);
}
```

- Token check

```
boolean checkValidCondition(HttpServletRequest httpRequest, HttpServletResponse httpResponse) {
    String headerFromRequest = httpRequest.getHeader("X-API-Token");
    String apiToken = (String) httpRequest.getSession().getAttribute("api_token");

    if (headerFromRequest == null || !headerFromRequest.equals(apiToken)) {
        httpResponse.setStatus(HttpServletResponse.SC_UNAUTHORIZED);
        return false;
    }
    return true;
}
```

Solution: client side

- Session initialization

```
protected void initSession(final Action callback) {

        @Override
        public void onSuccess(final int httpStatusCode, final String response, final Map<String, String> headers) {
            if (headers.get("X-API-Token") != null) {
                UserSessionVariables.addUserVariable(UserSessionVariables.API_TOKEN, headers.get("X-API-Token"));
            }

        }
}
```

- API Requests

```
public void send(final Method method, final String url, final String datas, final String contentType, final HttpCallback callback) {
    final RequestBuilder builder = new RequestBuilder(method, url);
    if (datas != null) {
        builder.setRequestData(datas);
    }
    if (UserSessionVariables.getUserVariable(UserSessionVariables.API_TOKEN) != null) {
        builder.setHeader("X-API-Token", UserSessionVariables.getUserVariable(UserSessionVariables.API_TOKEN));
    }
    builder.setTimeoutMillis(30000);
    builder.setCallback(callback);
    Request request = null;
    try {
        request = builder.send();
    } catch (final RequestException e) {
        callback.onError(request, e);
    }
}
```

OWASP Eclipse plugin

LAPSE +

The Security Scanner for Java EE Applications

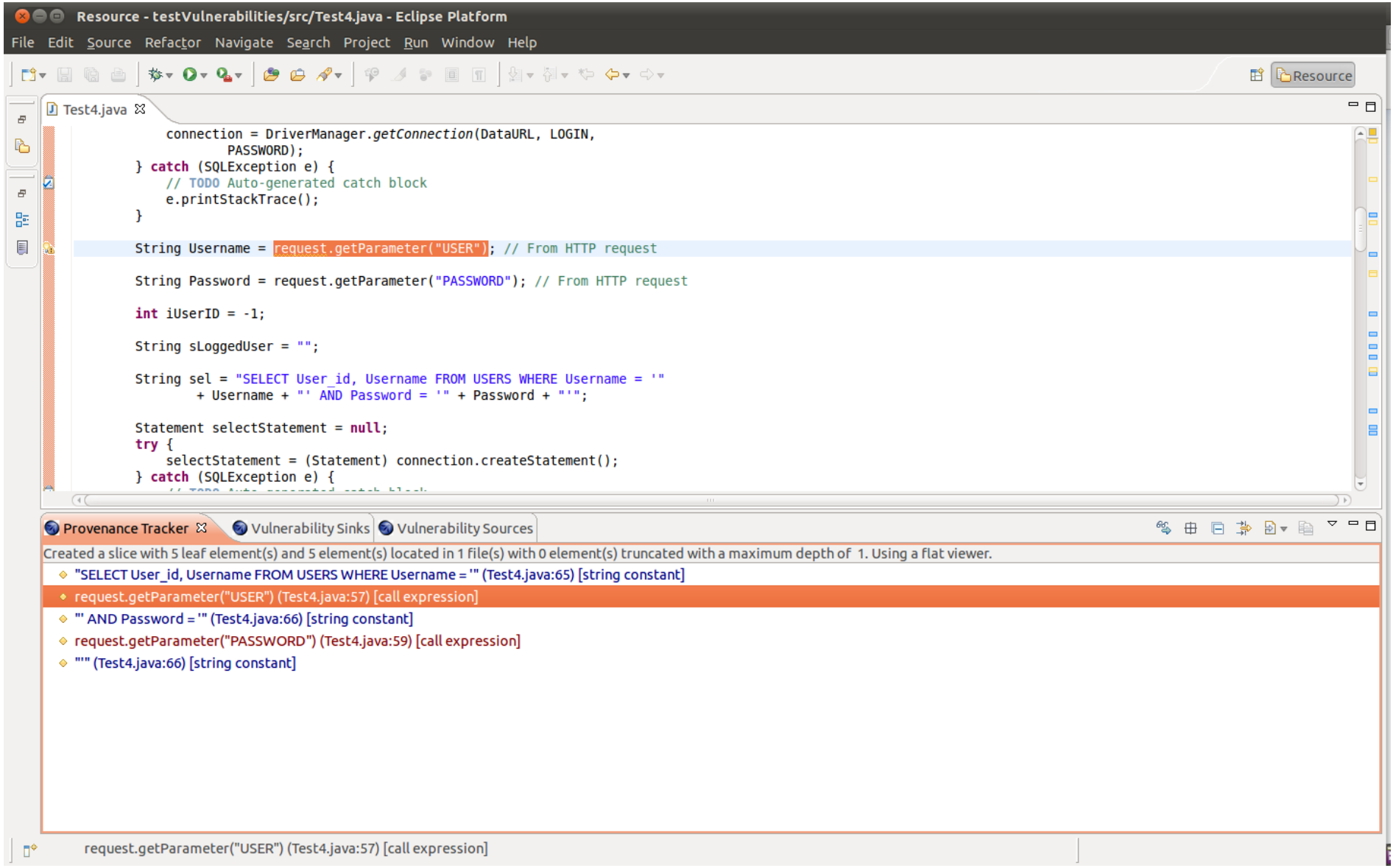
Static code analysis for detecting the some OWASP vulnerabilities.
Three steps:

Vulnerability Source, Vulnerability Sink and Provenance Tracker

https://www.owasp.org/index.php/OWASP_LAPSE_Project

https://code.google.com/p/lapse-plus/

http://suif.stanford.edu/~livshits/work/lapse/index.html



Thank you

@lomba_fabio

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