University of BRISTOL

Computer System- B Security

Introduction to Web Security P1

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We will learn about...

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- Basics of Web application and deployment

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- Web vulnerabilities
  - SQL injection
  - XSS
  - CSRF
  - …

Background

- HTTP – de facto protocol when talking about WEB.
- Historically designed for static contents.
- Security was never a concern.
- Based on a *simple* client-server model.
- This is not what we see in today’s Web Applications.
- Highly technical and complex in nature

Typical web model

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- modern web pages allow personalized dynamic contents.
- web pages may also run client-side scripts that “change” the Internet browser into an interface.
- modern web sites allow the capture, processing, storage and transmission of sensitive customer data.

HTTP protocol

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- HTTP requests
  - GET (part of the URL)
  - POST (part of the header body)
  - Because of stateless property, a fresh request is made with no memory of the previous interactions.

HTML

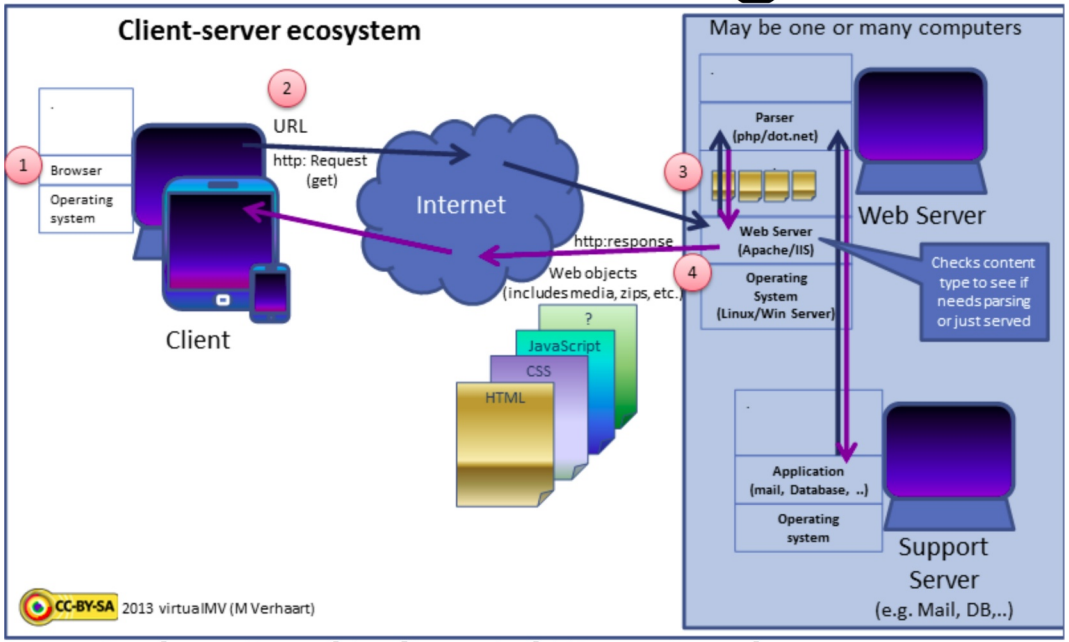
- HTTP request and response are rendered in HTML
- HTML forms
  - Allow for using key-value pairs to be processed by the server
  - Together with other languages (LabaScript/PHP) provide a very powerful interaction mode
  - `img, iframe, href, etc.`

Static vs Dynamic pages

- Static pages
  - Static pages are a typical HTML + CSS assisted
  - Rendered the same content each time
  - Only way to change is to manually change the server side page!
  - Interaction is via hyperlinks on the page.
  - Was good from security point of view!

- Dynamic pages (from https://en.wikipedia.org/wiki/Dynamic_web_page)
  - Are interactive in the sense that based on the request parameters, a new page is rendered (server side).
  - Pages contain other scripting code (JavaScript) that changes rendering on the client-side (client side)
  - It also involves other entities, like application serves, DB etc.

Typical Dynamic webpage rendering



Src: https://en.wikipedia.org/wiki/Dynamic_web_page

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- Web applications query and dynamically generate web documents.
- The documents are generated in a standard format to allow support by all browsers (e.g., HTML or XHTML +

- JavaScript is one form of client side script that permits dynamic elements on each page.
- The web browser is key – it interprets and runs all scripts!!
- All requests and responses are nothing but codes written in various languages/scripts.
- And, as we have seen, codes are powerful and dangerous, if not managed!!
-

Some features

- HTML for look and feel
- JavaScript- a powerful language for dynamic content

```
<html>
   …
   <script> javascript code </script>

      …
   </html>
```

- JavaScript can perform many tasks, including:
  - Access to files (e.g. **readAsText**)
  - Access to system resources…. Thus
- Javascript is a language and can do whatever the hosting environment allows it to do.
- Javascript in the **Browser** is sandboxed.

So??

- We also know that now a days, many web sites stores data on local machine, e.g. cookies, user data (auto fill), passwords etc.
- JavaScript can read resources -> we can steal any information???
- There are security mechanisms to take care of it!!

- Wiki says….
  - … Browser authors contain this risk using two restrictions.
  - Scripts run in a sandbox in which they can only perform web-related actions, not general-purpose programming tasks like creating files.
  - Scripts are constrained by the same origin policy:

- scripts from one web site do not have access to information such as usernames, passwords, or cookies sent to another site.

- Most JavaScript-related security bugs are breaches of either the *same origin policy* or the sandbox.

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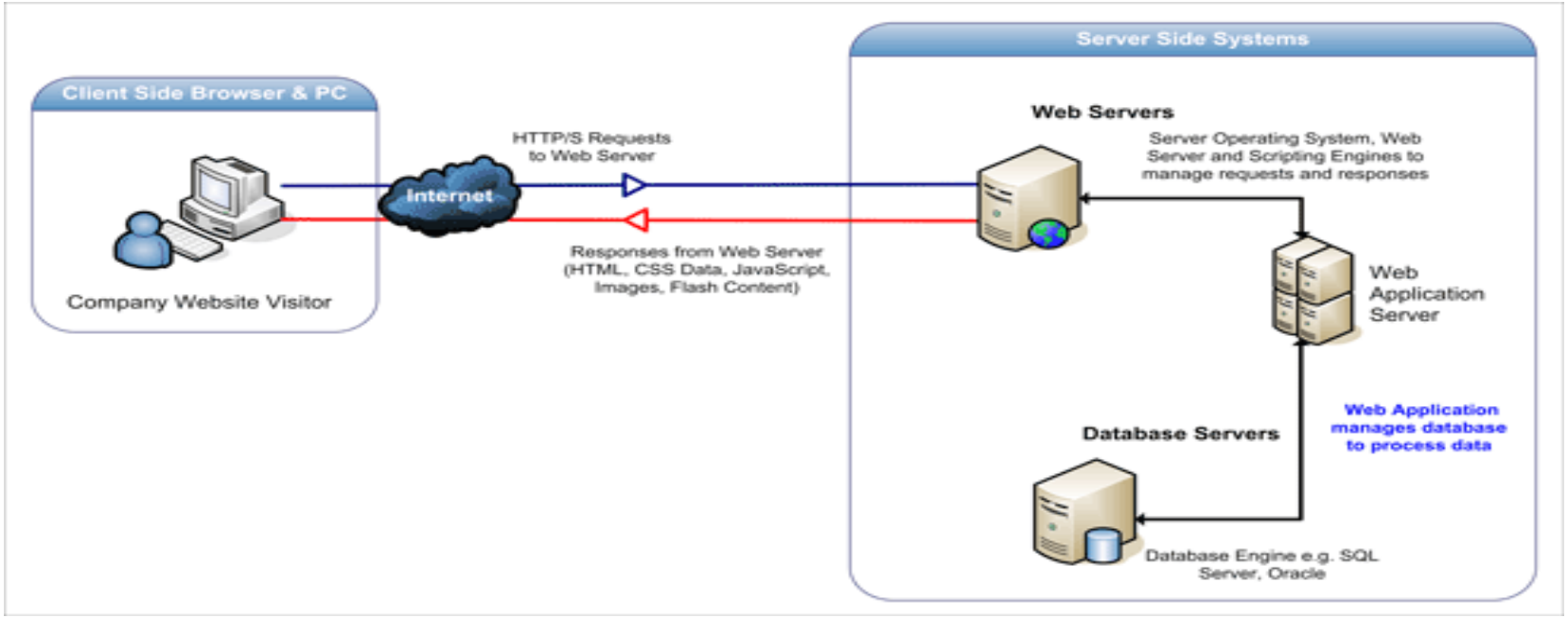
- Example:
  - Allowed: http://www.abc.com/doc1.html & http://www.abc.com/doc2.html
  - Not allowed: http://www.abc.com:8080/doc1.html

Typical Web Application Vulnerabilities



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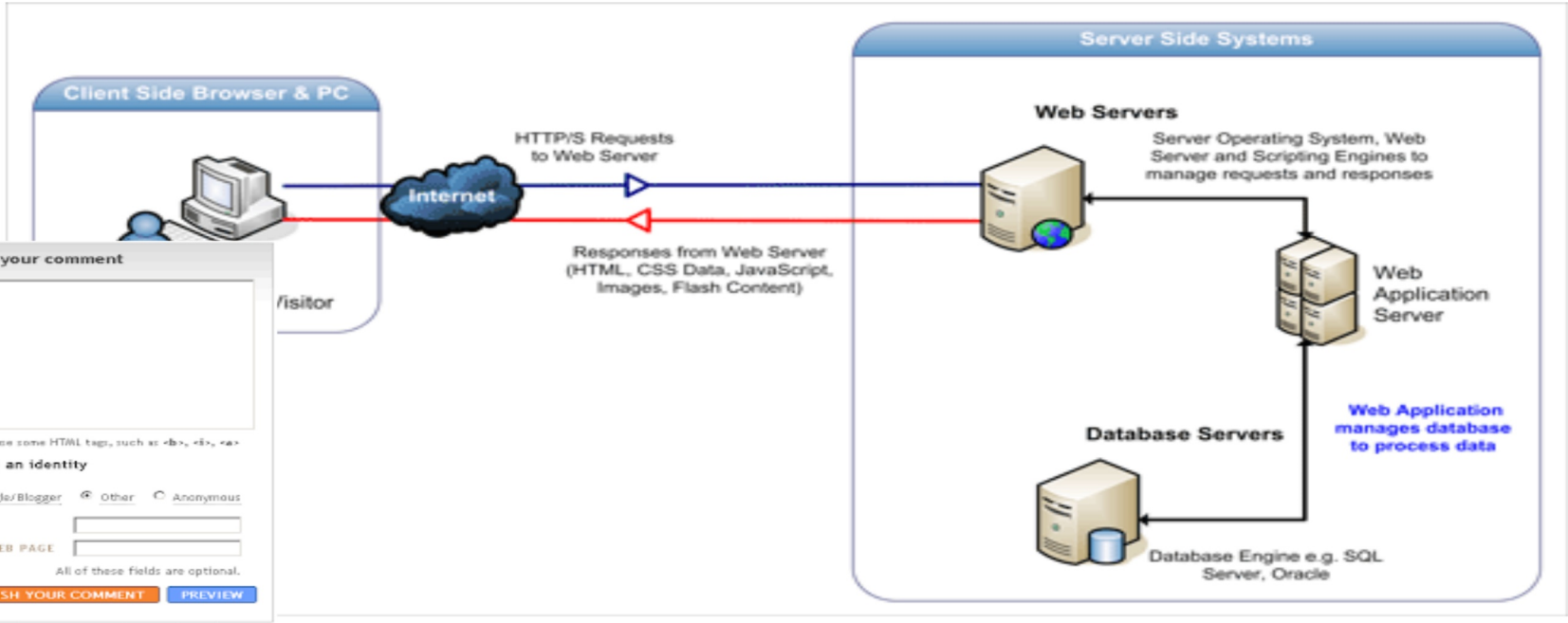

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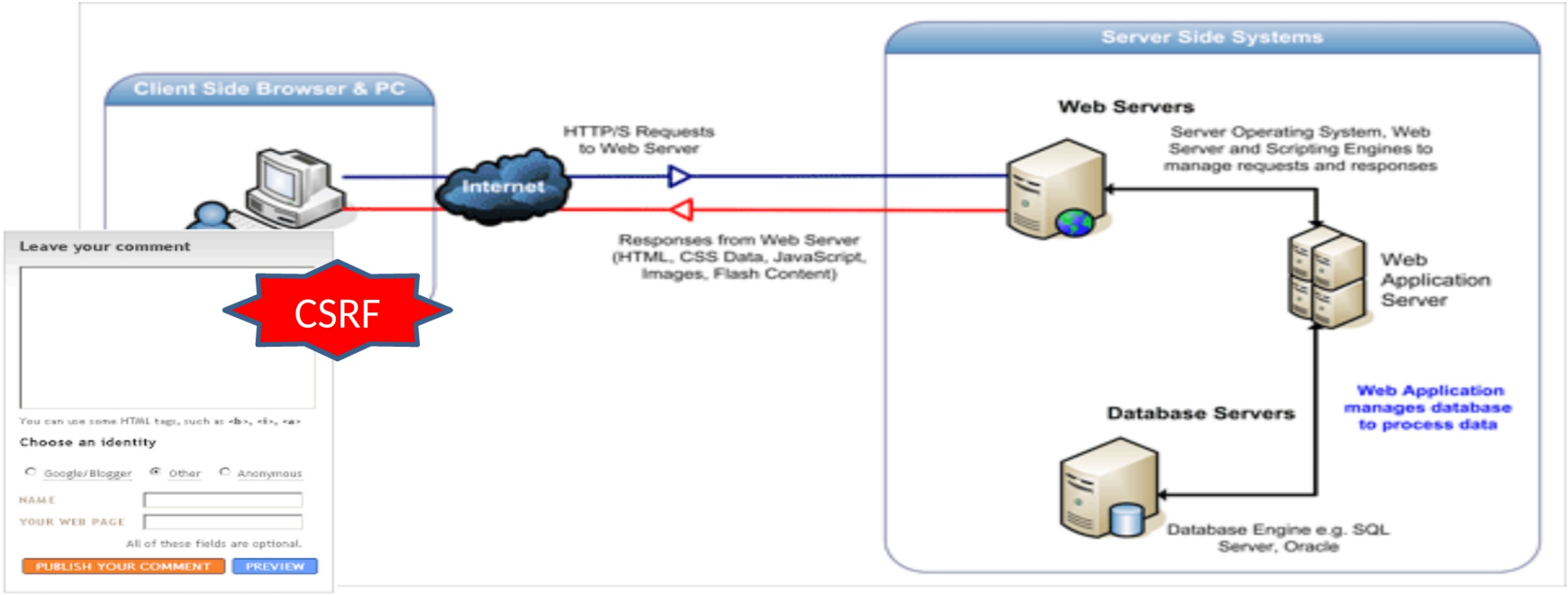

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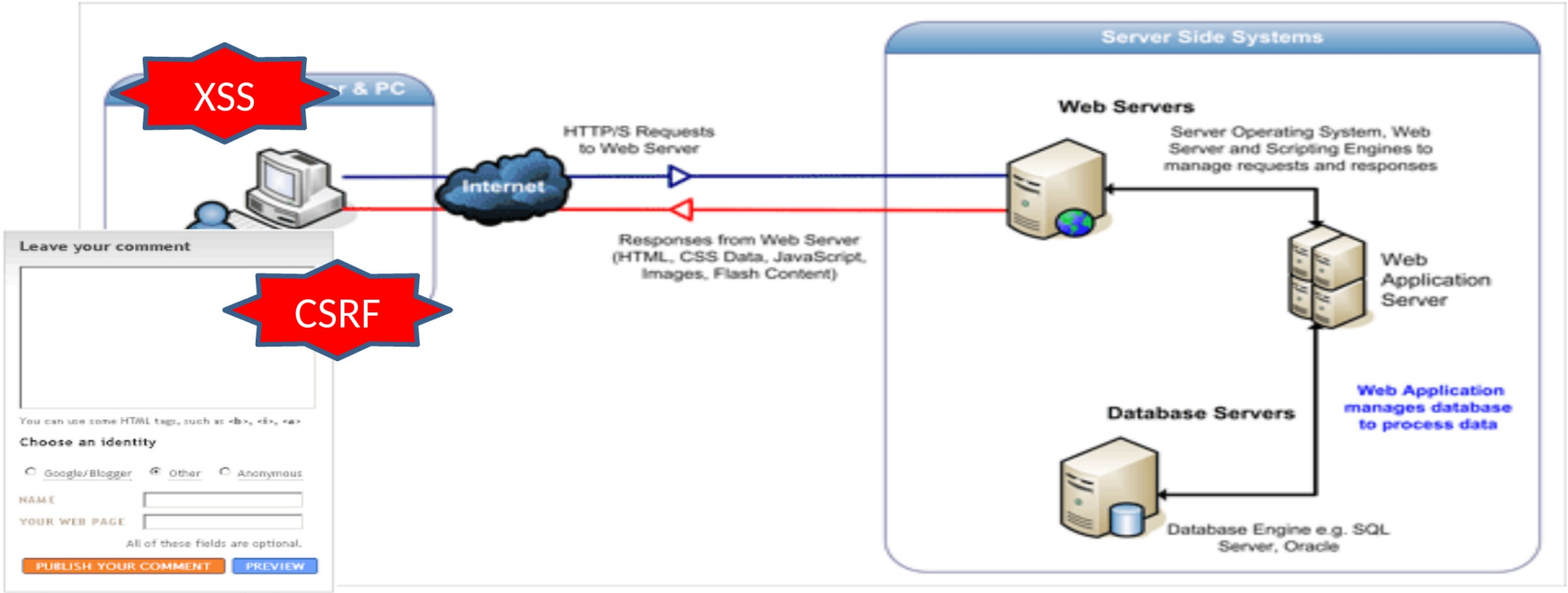

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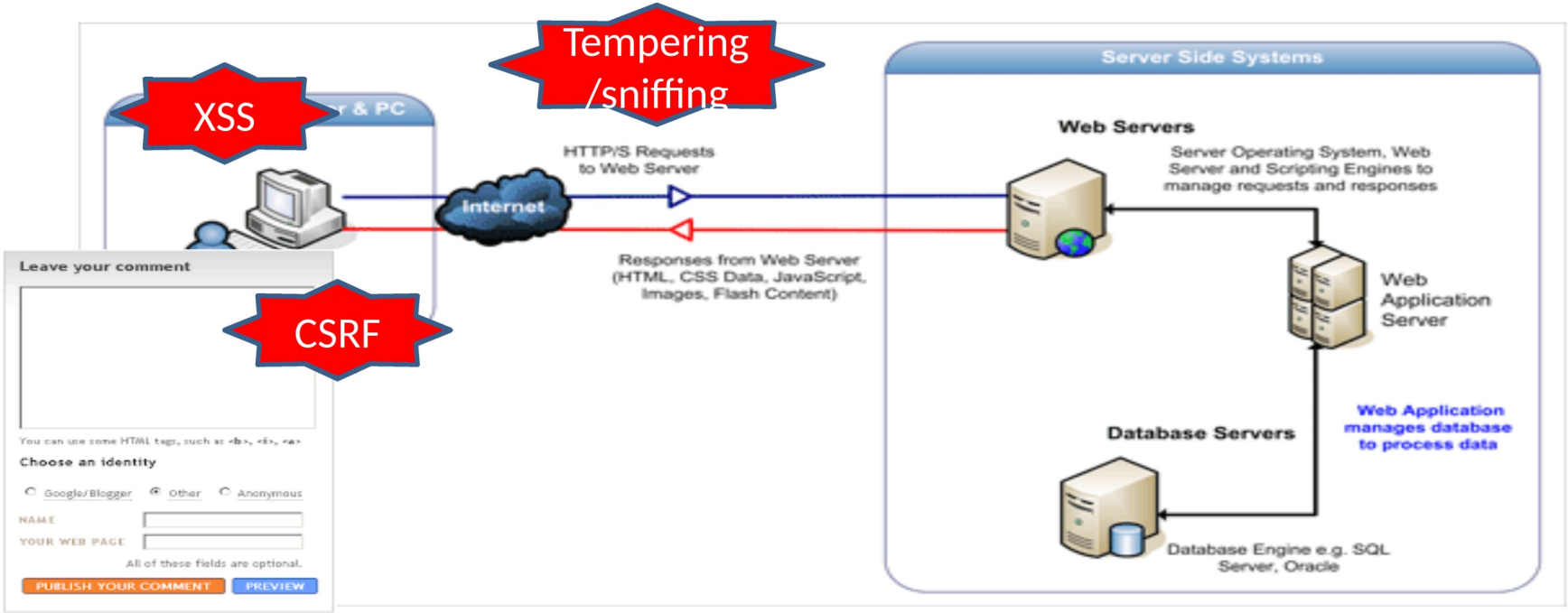

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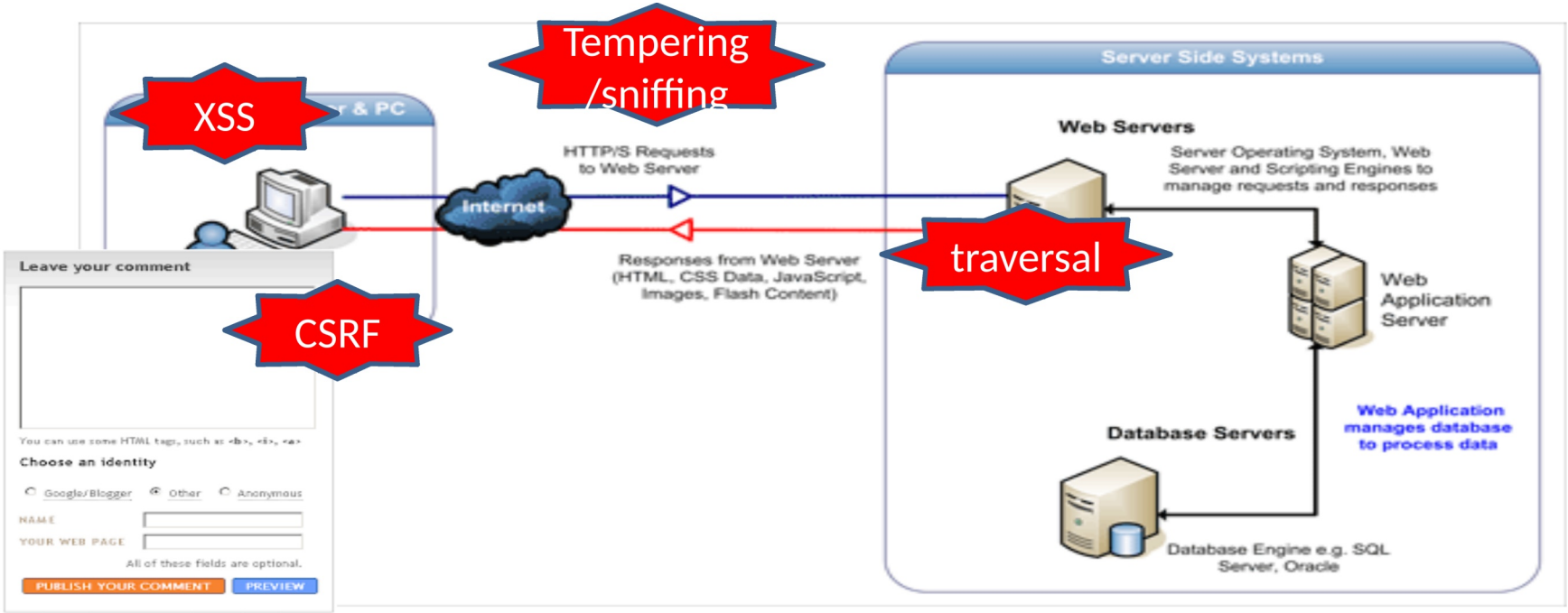

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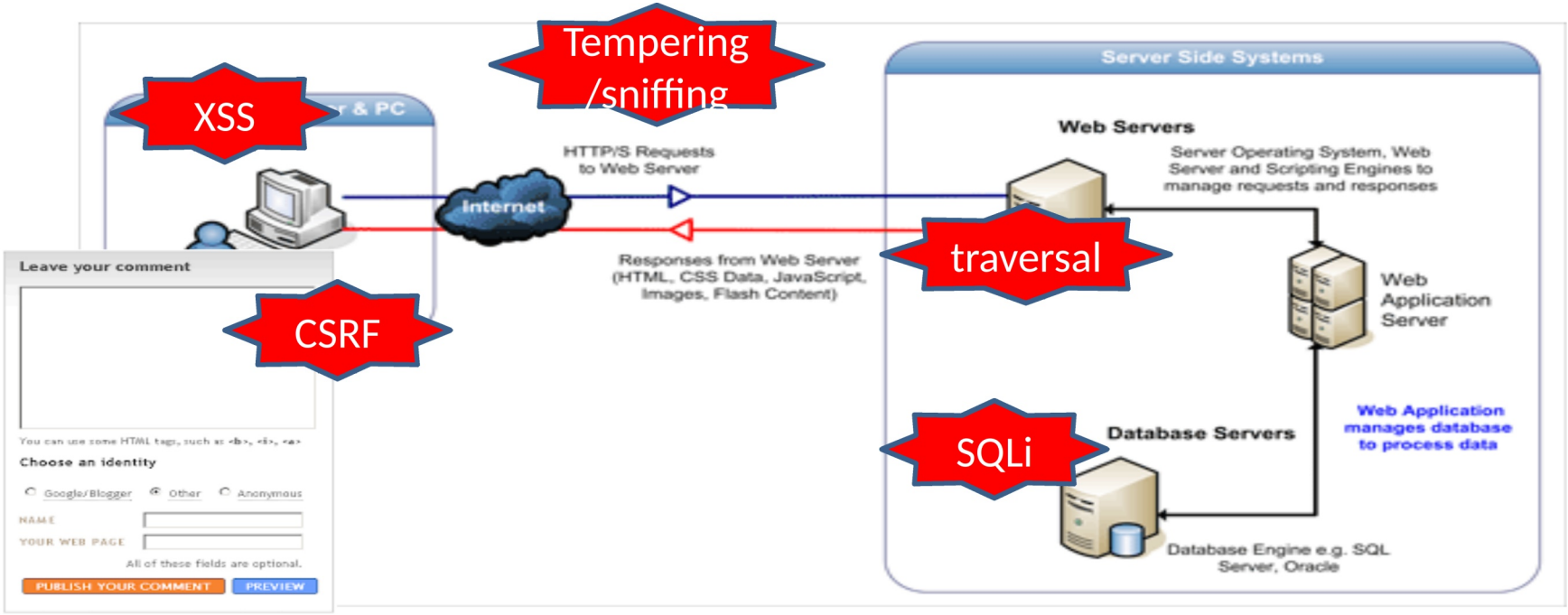

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