Detour: Web Security

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Today, 10/24

• Web Security (intro to Lab 2)
  • Back to Asymmetric Cryptography in a bit
• CELT
• Office hours after class in CSE 210
• Homework 2 (Crypto) coming soon
Browser and Network

Browser
- OS
- Hardware

Network
- website

request
reply
Types of problems

- **Web browser problems (client side)**
  - Exploit vulnerabilities in browsers
  - Install botnets, keyloggers
  - Exfiltrate data

- **Web application code (server side)**
  - Exploit vulnerabilities in code running on servers (and coming from servers)
  - Examples: XSS, XSRF, SQL injection, insecure parameters, security misconfigurations
  - Steal user credentials, data from databases, ...
Example Questions

- How does website know who you are?
- How do you know who the website is?
- Can someone intercept traffic?
- Related: How can you better control flow of information?

- Our focus: High-level principles (lab focuses on pragmatics)
- Focus on a bit of history: How we got here
HTTP: HyperText Transfer Protocol

- Used to request and return data
  - Methods: GET, POST, HEAD, ...
- Stateless request/response protocol
  - Each request is independent of previous requests
  - Statelessness has a significant impact on design and implementation of applications
- Evolution
  - HTTP 1.0: simple
  - HTTP 1.1: more complex
  - ... Still evolving ...
HTTP Request

<table>
<thead>
<tr>
<th>Method</th>
<th>File</th>
<th>HTTP version</th>
<th>Headers</th>
</tr>
</thead>
<tbody>
<tr>
<td>GET</td>
<td>/default.asp</td>
<td>HTTP/1.0</td>
<td></td>
</tr>
<tr>
<td>Accept: image/gif, image/x-bitmap, image/jpeg, <em>/</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accept-Language: en</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>User-Agent: Mozilla/1.22 (compatible; MSIE 2.0; Windows 95)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection: Keep-Alive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If-Modified-Since: Sunday, 17-Apr-96 04:32:58 GMT</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data – none for GET

Blank line
HTTP Response

HTTP version  Status code  Reason phrase

HTTP/1.0 200 OK
Date: Sun, 21 Apr 1996 02:20:42 GMT
Server: Microsoft-Internet-Information-Server/5.0
Connection: keep-alive
Content-Type: text/html
Last-Modified: Thu, 18 Apr 1996 17:39:05 GMT
Content-Length: 2543

<HTML> Some data... blah, blah, blah </HTML>
Primitive Browser Session

Store session information in URL; easily read on network
FatBrain.com circa 1999  [due to Fu et al.]

- User logs into website with his password, authenticator is generated, user is given special URL containing the authenticator

  https://www.fatbrain.com/HelpAccount.asp?t=0&p1=me@me.com&p2=540555758

  - With special URL, user doesn’t need to re-authenticate
    – Reasoning: user could not have known the special URL without authenticating first. That’s true, BUT...

- Authenticators are global sequence numbers
  - It’s easy to guess sequence number for another user

    https://www.fatbrain.com/HelpAccount.asp?t=0&p1=SomeoneElse&p2=540555752

  - Partial fix: use random authenticators
Bad Idea: Encoding State in URL

- Unstable, frequently changing URLs
- Vulnerable to eavesdropping
- There is no guarantee that URL is private
  - Early versions of Opera used to send entire browsing history, including all visited URLs, to Google
  - Modern “browser bars” do similar things (possibly somewhat cleaned up, but this is not easy!)