Securing AJAX Applications

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Writing Web Apps is Hard

- AJAX is cool, but also complicated & quirky
- Hard enough just to make it work
- **Securing against attacks is even harder**

Web Apps are Easy Targets

- Can directly attack server
- Can attack via users' web browsers

Outline

1. Client Side Logic and State

2. Cross Site Scripting

3. Cross Site Request Forgery

4. JavaScript Hijacking

(5. Advanced Topics)

1. Client-Side Logic & State

- **Do NOT trust the client, ever**
  - Don’t trust the user
  - Don’t trust the client hardware
  - Don’t trust the client OS
  - Definitely don’t trust the client browser

Clients are Still Useful

- AJAX puts more content, logic, & state at client
- **Implications**:
  - Check any user-supplied data on the server
  - Know that any client-side check may be skipped
  - Be careful when exposing AJAX APIs on server
    - *e.g., all public methods of objects*

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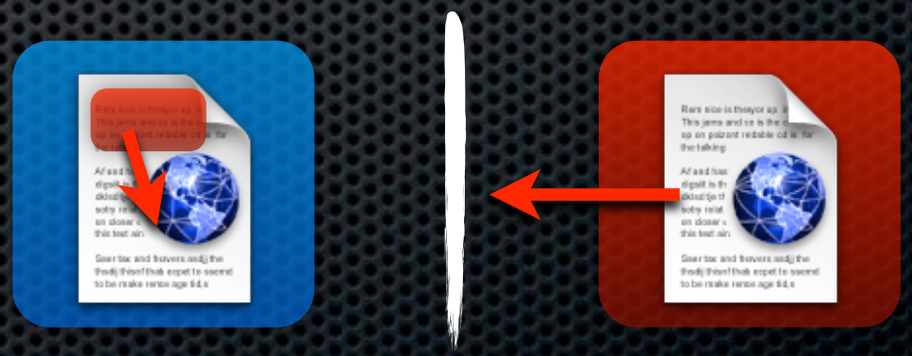
2. Cross-Site Scripting

- One of the most common web app vulnerabilities
- Web client security boils down to **Same Origin Policy**
- XSS gets around it
  - Attacker runs scripts inside your web page



XSS Consequences

- With XSS, attackers can:
  - Steal cookies (then take over user account)
  - Phish users (e.g., fake login dialog)
  - Control almost ALL content/code in entire origin

Types of XSS

- **Reflected XSS**
  - Some input echoed on the page (e.g., search query)
  - Victim must follow an evil link
- **Stored XSS**
  - Some input stored in a DB (e.g., blog comment)
  - All later visitors become victims
- **DOM-Based XSS**
  - Client-side JS code echoes input into page

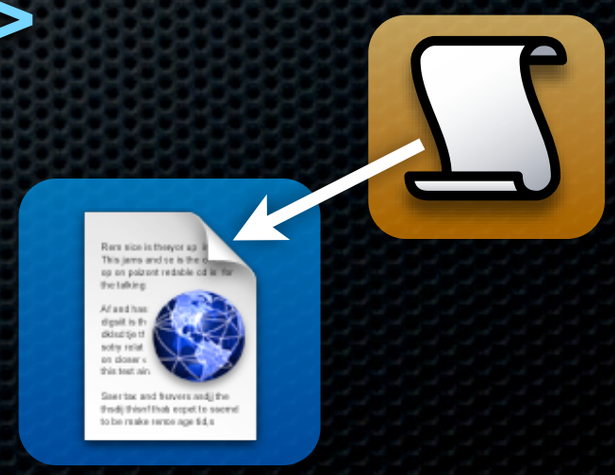
Defense: Data Sanitization

- Don’t ever trust user input
  - Escape all **output data** to prevent scripts
- Important: escaping must be **context sensitive**
  - In HTML? Within a tag? A script? A URL?
- Don’t invent your own sanitizer. It will be wrong.
  - Use template systems or frameworks if possible

    See: ClearSilver, Google CTemplate, GWT, etc

Related Threats:

- **SQL Injection** (older news, but similar issue)
- **JSON data**
  - Bad idea: *running* someone else's code to get data
  - Good idea: passing it to a JSON parser
- **<script src=http://differentsite.com>**
  - Be careful: do you trust that site?



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3. Cross-Site Request Forgery

- Who's logged in? The user, or his browser?
- Pages in background can make requests to your site
  - Browser sends user's cookies
- Evil pages can take actions in user's name
  - Transfer funds, delete data, change state

Non-Defenses

- Check referrer of request
  - Often blocked by proxies, can sometimes be faked
- Require POST, not GET, for state-changing requests
  - Do this anyway! (important for crawlers, etc)
  - Won’t stop CSRF via JavaScript, though

Defense: Prevent Forging

- Make state-changing requests hard to guess
  - Avoid predictable URLs if possible
- **Tokens**: verify request comes from a page you trust
  - Put a hard-to-forge token in your page
  - Verify its presence in the request

Related Threats:

- **Session Fixation**
  - User gets logged in as the attacker
  - Queries, credit card entries, etc, go to attacker
  - Prevent using CSRF tokens on login pages
- **Clickjacking**
  - Attacker puts your page as a frame under mouse
  - Frame-busting defense, but tough to get right

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4. JavaScript Hijacking

- Many JS files have sensitive data (e.g., JSON)
- **Any web site can embed them with <script src=>**
- Can't *read* their contents, but can *run* them
- That's enough for attackers to get the data (e.g., Gmail contacts)

Defense: Don’t let data run

- Put something at the top to prevent execution
  - e.g., **while(1);** or unparseable characters
  - Remove before parsing the JSON
- Don’t use predictable URLs

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5. Advanced Topics

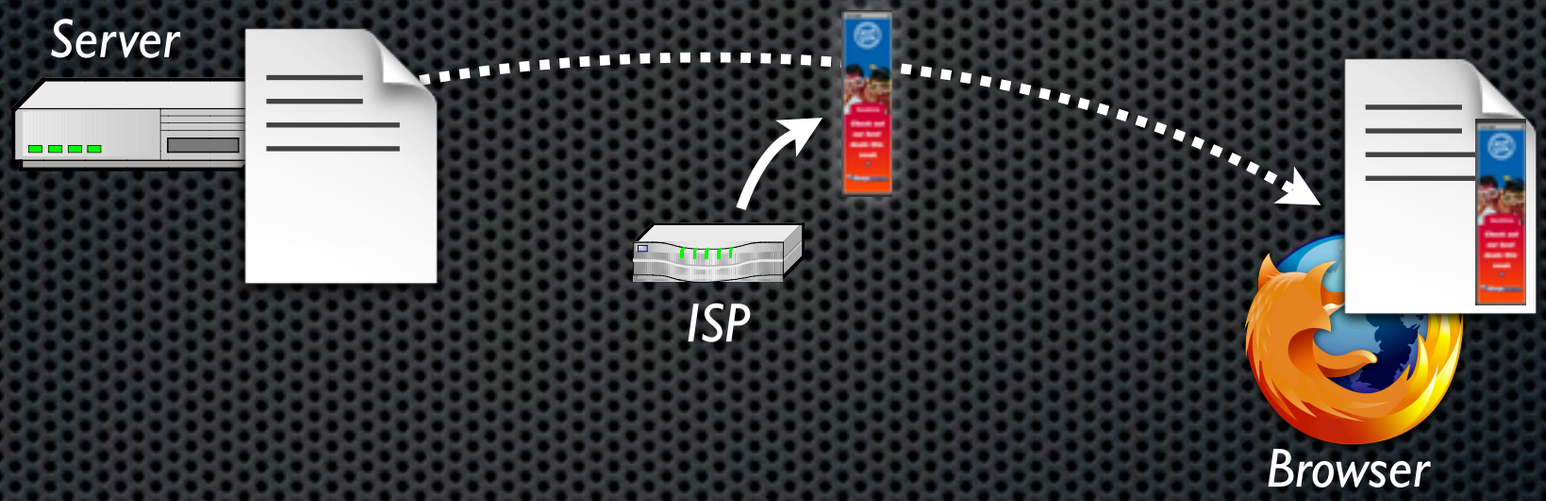
- Content Hosting
- Don’t trust the network
- Cutting-edge security features

Content Hosting

- Be careful before allowing users to upload content
  - Browsers guess content types poorly
    - e.g., GIFAR: both a valid GIF and a JAR (applet)
    - Flash cross-domain policy files loosely parsed
- Leads to XSS

Don’t Trust the Network

- ISPs and client proxies modify web pages (1%)



- Have observed XSS vulns as a result
- Use HTTPS whenever possible

Cutting Edge Security

- **Caja**: JS subset for untrusted gadgets
- **HTTP Only Cookies**: harder to get via XSS
- **Strict Transport Security**: only allow HTTPS
- **Mozilla Content Security Policies**:
  ways to tell browser how to help with security
- **Reflective XSS Filters** (IE8, Chrome)

Summary

- Be wary of your users, think like an attacker
- Use security-minded frameworks whenever possible
  - Encapsulate the hard stuff

References & Tools

- **Browser Security Handbook**
  http://code.google.com/p/browsersec/wiki/Main
- **Foundations of Security: What Every Web Programmer Needs to Know**
  (Daswani, Kern, Kesavan)
- **RatProxy**
  http://code.google.com/p/ratproxy/