CSE 484 / CSE M 584: Computer Security and Privacy

Web Security: Basic Web Security Model [continued]

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Reminder: 2 Sides of Web Security

- Web browser
  - Responsible for securely confining Web content presented by visited websites
- Web applications
  - Online merchants, banks, blogs, Google Apps …
  - Mix of server-side and client-side code
    - Server-side code written in PHP, Ruby, ASP, JSP… runs on the Web server
    - Client-side code written in JavaScript… runs in the Web browser
  - Many potential bugs: XSS, XSRF, SQL injection

Reminder: Browser Sandbox

- Goal: safely execute JavaScript code provided by a website
  - No direct file access, limited access to OS, network, browser data, content that came from other websites
- Same origin policy
  - Can only access properties of documents and windows from the same domain, protocol, and port

Recap: Same-Origin Policy

- Goal: ensure that sites from different origins can't interfere with each other:
  - DOM manipulation
  - Window navigation
  - Cookies (reading and writing)
  - Cross-site content
- Implemented in various places by the browser – some inconsistencies!

Cross-Origin Communication?

- Websites can embed scripts, images, etc. from other origins.
- **But:** AJAX requests (aka XMLHttpRequests) are not allowed across origins.

On example.com:

```
<script>
var xhr = new XMLHttpRequest();
xhr.onreadystatechange = handleStateChange; // Elsewhere
xhr.open("GET", "https://bank.com/account_info", true);
xhr.send();
</script>
```

Cross-Origin Communication?

- Websites can embed scripts, images, etc. from other origins.
- **But:** AJAX requests (aka XMLHttpRequests) are not allowed across origins.

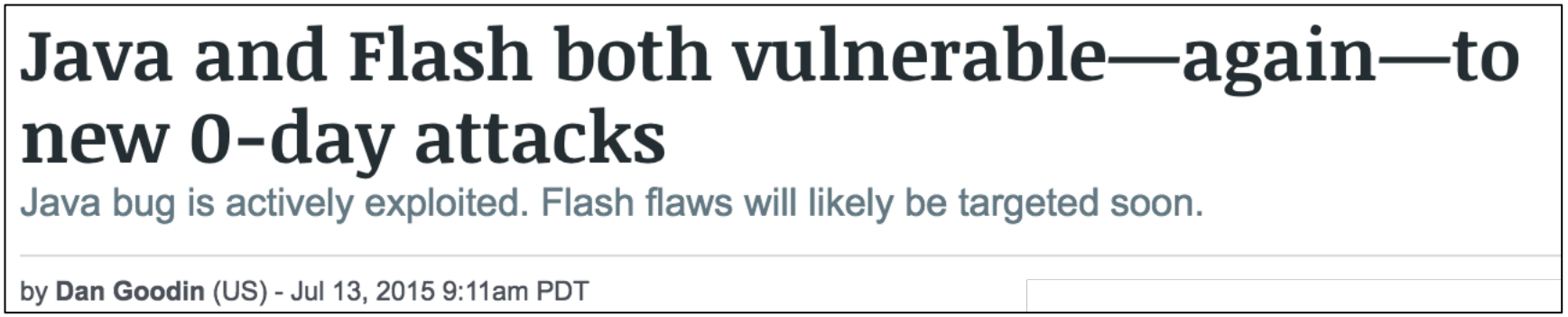
- Why not?
  - Browser automatically includes cookies with requests (i.e., user credentials are sent)
  - Caller can read returned data (clear SOP violation)

Allowing Cross-Origin Communication

- Domain relaxation
  - If two frames each set document.domain to the same value, then they can communicate
    - E.g. www.facebook.com, facebook.com, and chat.facebook.com
    - Must be a suffix of the actual domain
- Access-Control-Allow-Origin: <list of domains>
  - Specifies one or more domains that may access DOM
  - Typical usage: Access-Control-Allow-Origin: *
- HTML5 postMessage
  - Lets frames send messages to each other in controlled fashion
  - Unfortunately, many bugs in how frames check sender's origin

What about Browser Plugins?

- **Examples:** Flash, Silverlight, Java, PDF reader
- **Goal:** enable functionality that requires transcending the browser sandbox
- Increases browser's attack surface



Java and Flash both vulnerable—again—to new 0-day attacks

Java bug is actively exploited. Flash flaws will likely be targeted soon.

by **Dan Goodin** (US) - Jul 13, 2015 9:11am PDT

- Good news: plugin sandboxing improving, and need for plugins decreasing (due to HTML5 and extensions)

What about Browser Extensions?

- Most things you use today are probably extensions
- **Examples:** AdBlock, Ghostery, Mailvelope
- **Goal:** Extend the functionality of the browser

- (Chrome:) Carefully designed security model to **protect from malicious websites**
  - Privilege separation: extensions consist of multiple components with well-defined communication
  - Least privilege: extensions request permissions

What about Browser Extensions?

- But be wary of malicious extensions: **not subject to the same-origin policy** – can inject code into any webpage!