LET’S BREAK STUFF

CONTENT SECURITY POLICIES

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THINGS I DO

- Dungeon master for D&D campaigns
- Mentor, lead & teach apprentices & junior developers
- Run and organise a user group and Unconference in the UK
- Speak at user groups and conferences
- **Break production sites with incorrectly configured content security policies**

A TALK IN 3 PARTS

XSS

CSP

BREAK STUFF

THE SCARY STUFF

WHAT IS CROSS-SITE-SCRIPTING (XSS)?

- XSS enables an attacker to inject client-side scripts into **non-malicious** web pages viewed by other users
- It's (still) in the OWASP top 10
- In 2016 there was a 61% likelihood of a **browser-based** vulnerability being found in a web application
- Of those browser based vulnerabilities, **86% were found to be XSS related**
- **That's just over 52% of all web application vulnerabilities**
  https://www.edgescan.com/assets/docs/reports/2016-edgescan-stats-report.pdf

WHAT CAN BE DONE WITH XSS?

- Put pictures of ~~cats~~ dogs in web pages
- `alert('💩');`
- Rickroll a user
- Twitter self-retweeting tweet
  https://www.youtube.com/watch?v=zv0kZKC6GAM
- Samy worm
  https://en.wikipedia.org/wiki/Samy_(computer_worm)

WHAT CAN BE DONE WITH XSS?

- Make modifications to the DOM - replace a form action to point to your own script to capture credentials.
- Load in additional scripts, resources, styles, images etc
  (such as a crypto miner to make some $$$)
- Access HTML5 APIs - webcam, microphone, geolocation
- Keylogging
- Phishing
- Steal cookies (and therefore steal session cookies)

WHAT CAN BE DONE WITH XSS?

KEVIN POULSEN SECURITY 03.28.08 08:00 PM

HACKERS ASSAULT EPILEPSY PATIENTS VIA COMPUTER

https://www.wired.com/2008/03/hackers-assault-epilepsy-patients-via-computer/

STORED XSS (AKA PERSISTENT OR TYPE I)

- Occurs when input is stored - generally in a server-side database, but not always
- This could also be within a HTML5 database, thus never being sent to the server at all
- who.is was a site Rickrolled by a TXT record in the DNS of a website **(yes, really)**

REFLECTED XSS (AKA NON-PERSISTENT OR TYPE II)

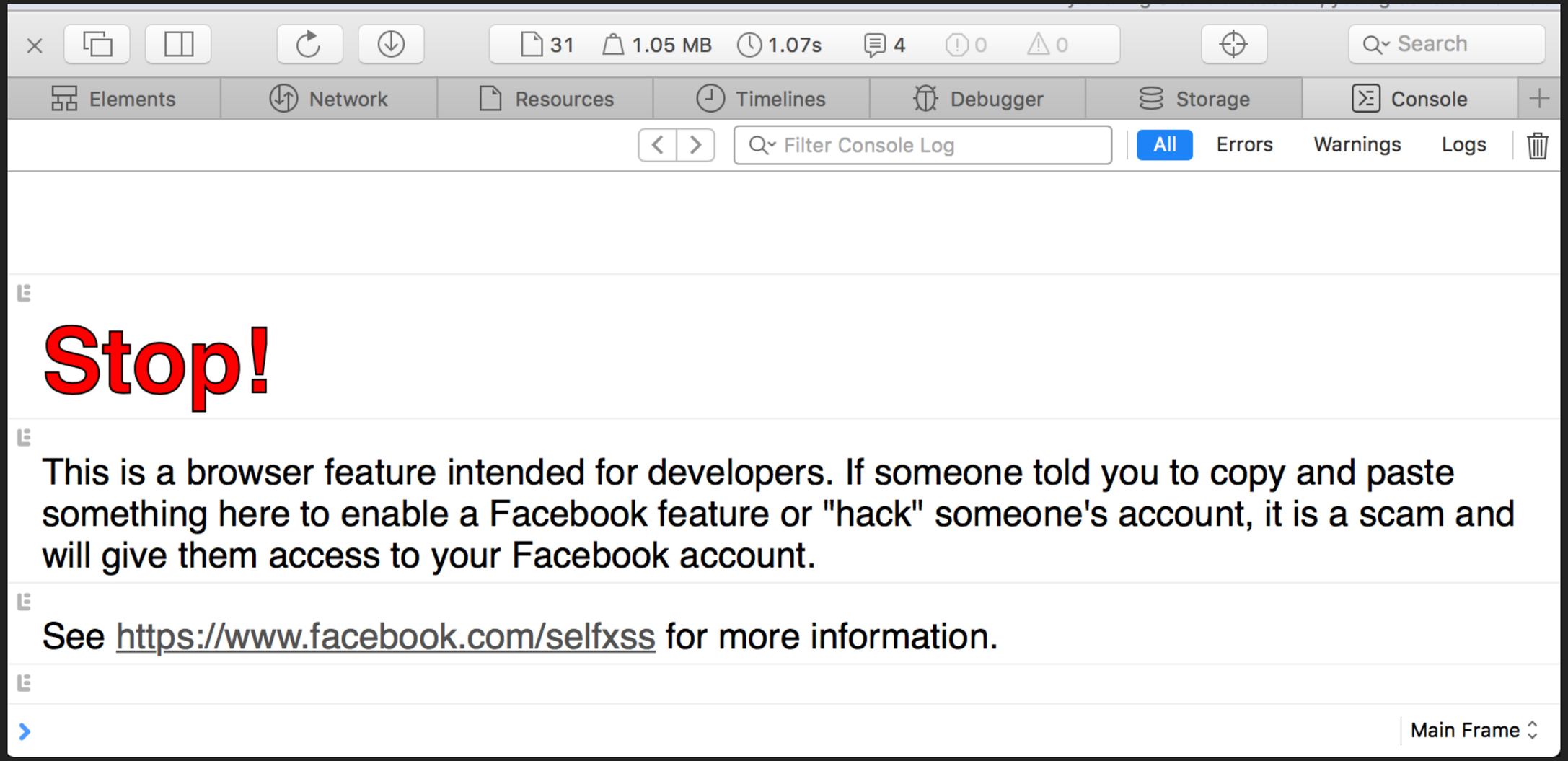
- Occurs when user input provided in the request is immediately returned - such as in an error message, search string etc
- Data is not stored, and in some instances, may not even reach the server (see the next type of XSS)

DOM-BASED XSS (AKA TYPE-0)

- The entire flow of the attack takes place within the browser
- For example, if JavaScript in the site takes input, and uses something like document.write based on that input, it can be vulnerable to a DOM-based XSS attack

SELF XSS

- Social-engineering form of XSS
- Requires the user to execute code in the browser
- Doing so via the console can’t be protected by a lot of methods
- Not considered a ‘true’ XSS attack due to requiring the user to execute the code


31
1.05 MB
1.07s
4
0
0
Search
Elements
Network
Resources
Timelines
Debugger
Storage
Console
Filter Console Log
All
Errors
Warnings
Logs
Stop!
This is a browser feature intended for developers. If someone told you to copy and paste something here to enable a Facebook feature or "hack" someone's account, it is a scam and will give them access to your Facebook account.
See https://www.facebook.com/selfxss for more information.
Main Frame

LET’S FIGHT BACK

WHAT IS A CSP?

HTTP RESPONSE HEADER TO HELP REDUCE XSS RISKS

WHAT IS A CSP?

IT IS NOT A SILVER BULLET

WHAT IS A CSP?

IT IS AN EXTRA LAYER OF SECURITY

HOW DOES A CSP WORK?

DECLARES WHAT RESOURCES ARE ALLOWED TO LOAD

IT CAN EVEN HELP WITH

BLOCKING THOSE PESKY CRYPTO-MINING SCRIPTS THAT HAVE BEEN POPPING UP

BROWSER SUPPORT

Header	Chrome	FireFox	Safari	IE	Edge
`Content-Security-Policy` CSP Level 2	40+ Full January 2015	31+ *Partial* July 2014	10+	-	Edge 15 build 15002+
`Content-Security-Policy` CSP 1.0	25+	23+	7+	-	Edge 12 build 10240+
`X-Content-Security-Policy` Deprecated	-	4+	-	10+ *Limited*	12+ *Limited*
`X-Webkit-CSP` Deprecated	14+	-	6+	-	-

It’s sort-of alright
Sorry IE users

WHAT CAN WE PROTECT?

- default-src
- script-src
- style-src
- img-src
- form-action
- upgrade-insecure-requests
- and so much more…

CONTENT-SECURITY-POLICY.COM

`img-src *`

ALLOWS ANY URL EXCEPT DATA: BLOB: FILESYSTEM: SCHEMES.

`object-src 'none'`

DON’T LOAD RESOURCES FROM ANY SOURCE

`style-src 'self'`

ALLOW LOADING FROM SAME SCHEME, HOST AND PORT

`script-src 'unsafe-inline'`

ALLOWS USE OF INLINE SOURCE ELEMENTS SUCH AS STYLE ATTRIBUTE, ONCLICK, OR SCRIPT TAG BODIES

DON’T USE UNSAFE-INLINE

```
script-src 'self' 'nonce-$RANDOM'
```

```
<script nonce="$RANDOM">...</script>
```

```
Content-Security-Policy: default-src 'none';
script-src 'self' https://*.google.com 'nonce-
random123'; style-src 'self'; img-src 'self';
upgrade-insecure-requests; form-action 'self';
```

LEARN FROM MY MISTAKES

I BROKE PRODUCTION WITH A BAD CSP

DON’T DO WHAT I DID

REPORT-URI

WHEN A POLICY FAILURE OCCURS, THE BROWSER SENDS A JSON PAYLOAD TO THAT URL

```
{
    "csp-report": {
        "blocked-uri": "self",
        "document-uri": "https://mysite.com",
        "line-number": 1,
        "original-policy": "script-src 'self'",
        "script-sample": "try {  for(var lastpass_iter=0; lastpass...",
        "source-file": "https://mysite.com",
        "violated-directive": "script-src 'self'"
    }
}
```

REPORT-URI.IO

Directive	Blocked URI	Raw	Count
All	blocked hostname blocked path		All
script-src	https://disqus.com/next/config.js	show/hide	1
script-src	eval	show/hide	1
script-src	https://c.disquscdn.com/next/embed/common.bundle.8acee1de90e869efdb244e45c7f66630.js	show/hide	1
script-src	eval	show/hide	1
script-src	eval	show/hide	1
script-src	https://c.disquscdn.com/next/embed/lounge.bundle.9becee0326ce4d1840f8985f1dc0ce21.js	show/hide	1

REPORT-ONLY

```
Content-Security-Policy-Report-Only:
[policy]; report-uri [URL];
```

TRIAL STUFF BEFORE ENFORCING

THERE WILL BE NOISE, LOTS OF NOISE

DEMO TIME!
LET’S BREAK STUFF

TIPS

- Have an easy and quick way to disable the CSP in production if required
- Better yet, have a way to switch it from enforced to report only so you can get violations reported to help you debug
- Add the CSP at an application level if you need a nonce

NONCES

- Don’t generate multiple nonces in the same request (but **do** generate a new nonce on each separate request)
- If using a templating engine (such as twig) - add the nonce as a global so it’s available in every template by default
- Write a helper in your template engine to generate script tags with a nonce if it’s available

MULTIPLE POLICIES

- They complicate things
- For a resource to be allowed, it must be allowed by all policies declared (problematic if an enforced policy)
- I tend to avoid them where possible on enforced policies
- But with report-only mode they can be very useful to deploy and test multiple policies at the same time (as nothing breaks for the user)

@SCOTT_HELME

HE KNOWS HIS STUFF!

@MR_GOODWIN

HE FIRST INTRODUCED ME TO WHAT A CSP IS

LINKS & FURTHER READING

- https://www.owasp.org/index.php/Cross-site_Scripting_(XSS)
- https://content-security-policy.com
- https://developer.mozilla.org/en-US/docs/Web/HTTP/Headers/Content-Security-Policy
- https://report-uri.io
- https://scotthelme.co.uk/just-how-much-traffic-can-you-generate-using-csp/
- https://www.edgescan.com/assets/docs/reports/2016-edgescan-stats-report.pdf
- http://theharmonyguy.com/oldsite/2011/04/21/recent-facebook-xss-attacks-show-increasing-sophistication/
- https://github.com/Brunty/csp-demo

THANK YOU

QUESTIONS?

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MFYU.CO.UK

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