» Snuffleupagus

A elephant with some salt,
in your php stack,
killing bug classes,
and virtual-patching,
what is remaining.

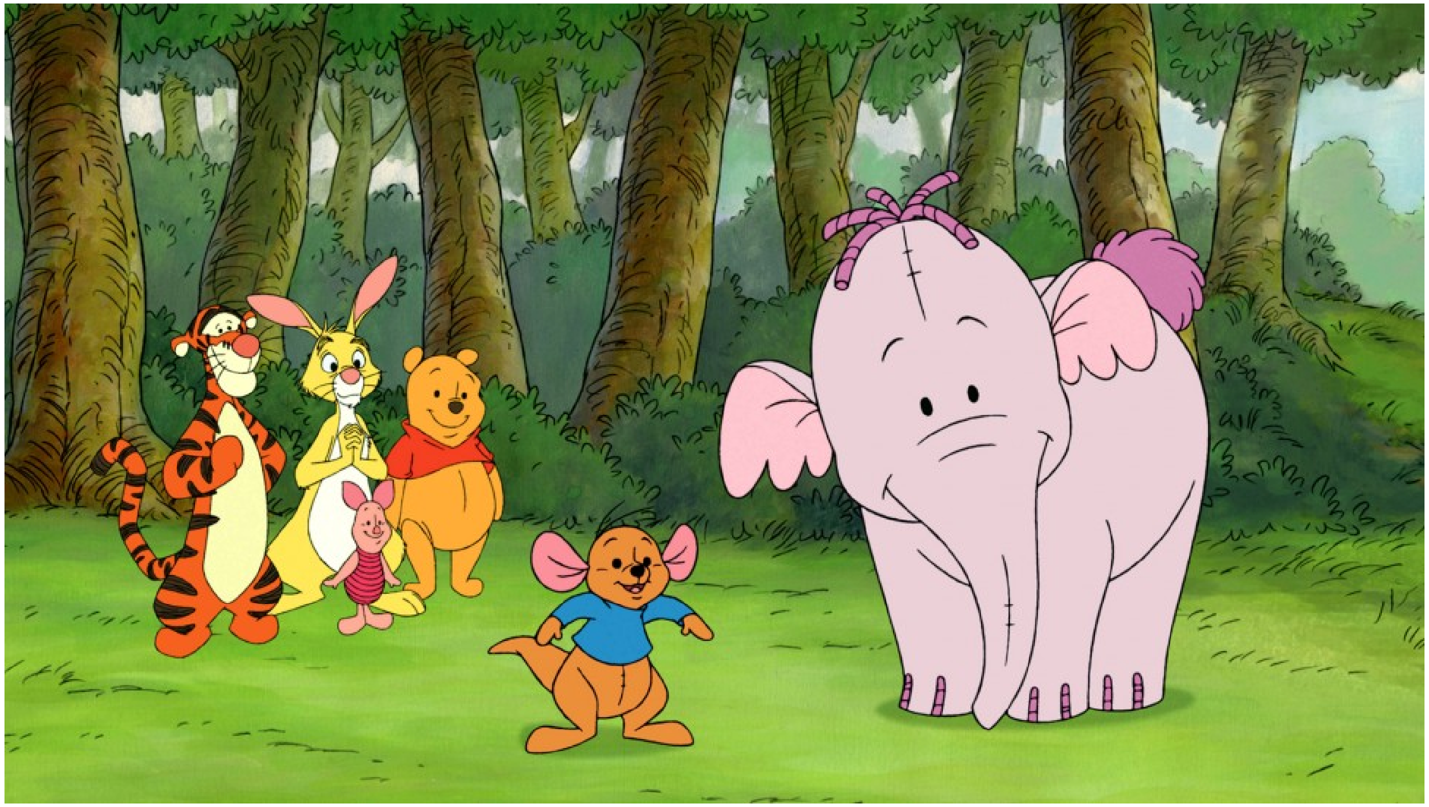
» Backlog

We gave subsets of this presentation at various conferences, using various themes.

» At an invite-only conference

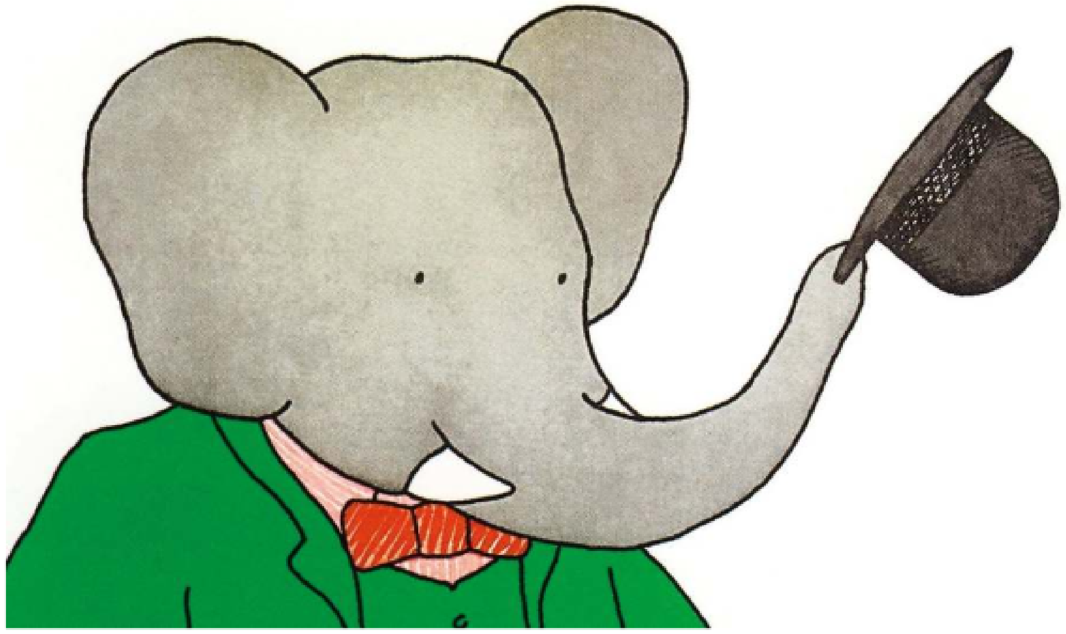
♥ BerlinSides ♥

» At a small conference in Switzerland



♥ Black Alps ♥

» At a big conference in Luxembourg



♥ Hacklu ♥

» **Can you guess our current theme?**

» Hint

» Helloooooooo

» Good evening

- We're super thrilled to be here
- We're working together at the same (French[1]) company
- In the security team.
- It's called ***NBS System***
- And it's a hosting company, you know, for websites.
- Also known as ***the cloud***.

[1] Hence why we have the same lovely accent than everyone here.

» Story time!

» Your security team

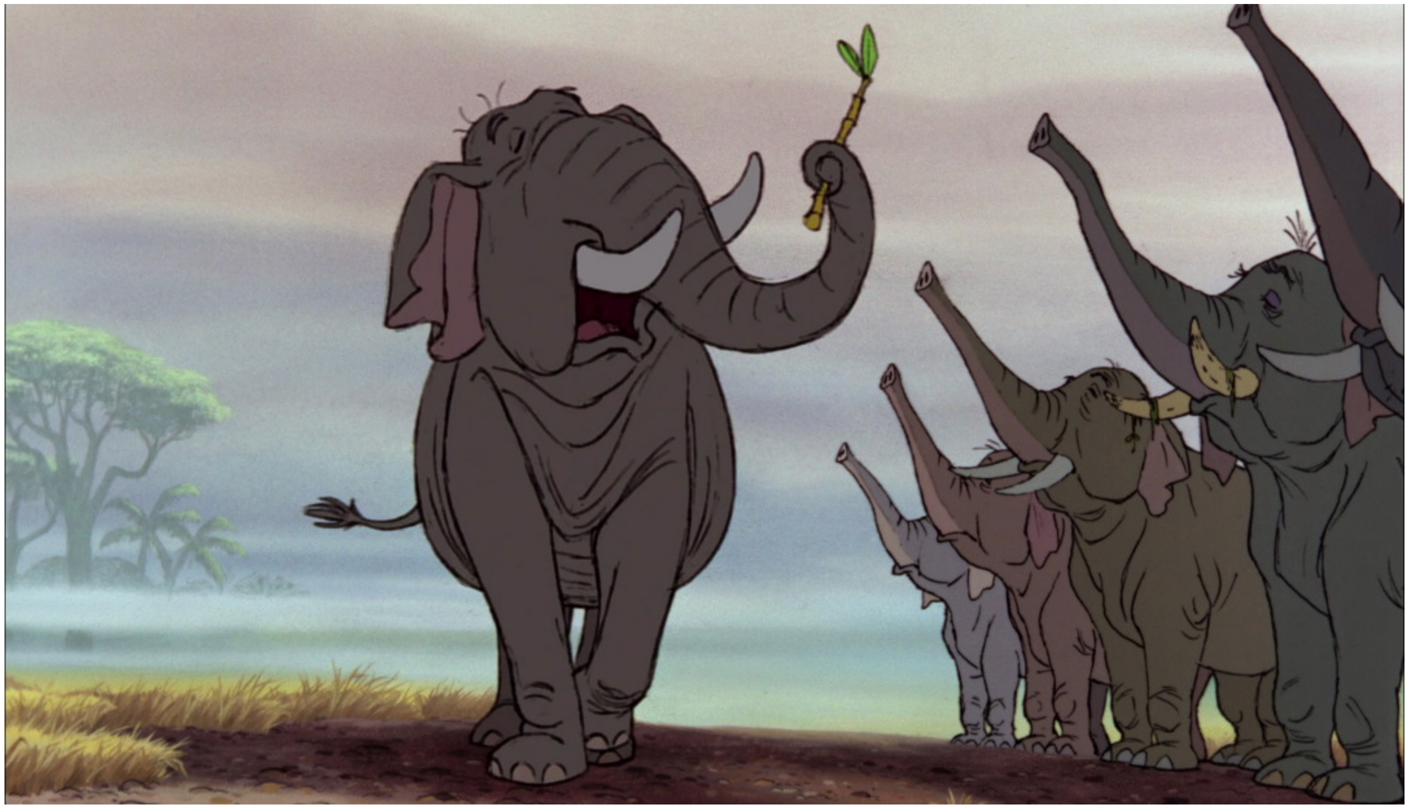


Fig 1. They are kick-ass and super-cool.

» There is a new $customer website

Fig 1. The marketing is so happy about it, it's so shiny

» Using a fixed version wordpress

Fig 1. Your security team reaction

» The web agency

Fig 1. Artistic's depiction of your web agency

» The agency was convincing

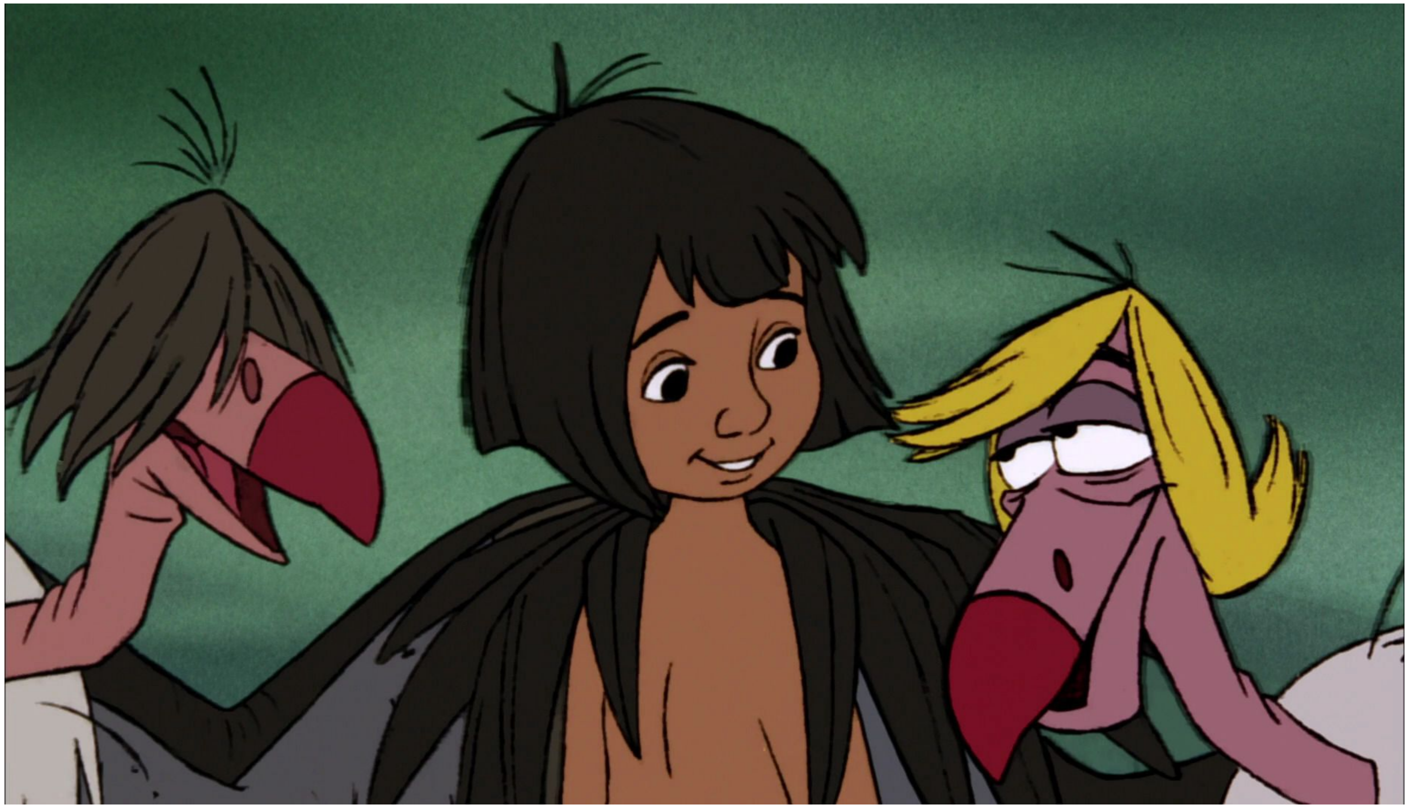


Fig 1. They told the management that they take security seriously

» Management

Fig 1. Management says that everything will be fine.

» Your security team isn't convinced

Fig 1. This isn't going to end well

» Hackers on the internet

Fig 1. Wow, look at this old-school wordpress, noice

» Surprise disclosure of a wordpress' RCE on FD

Fig 1. Your security team is "busy" at a conference: they aren't reachable

» Kiddies are pwning your website

Fig 1. Kiddies, launching exploits

» Your DB is encrypted by a lame ransomware

Fig 1. "Wait, what backups are you talking about", replied your admin

» Public image

Fig 1. Your company is looking like a bunch of idiots.

» Fixing the website

Fig 1. Your security team spent their week-end removing webshellz

» What problem are we trying to solve?

1. We're hosting several thousands of websites,
   most of them are written in PHP.

2. PHP is an ***old-school trigger-happy footgun language***,
   with massively creative users.

How do we prevent our customers from being pwned on a daily basis?

» What we were doing so far

- We have a dedicated security team
- We have cool OS-level hardening (grsecurity ♥)
- We have custom IDS
- We have a fancy WAF called ***naxsi***

But not everything is patchable with those and we can ***not***[2] touch the PHP code.

[1] And to be honest, we don't want to.

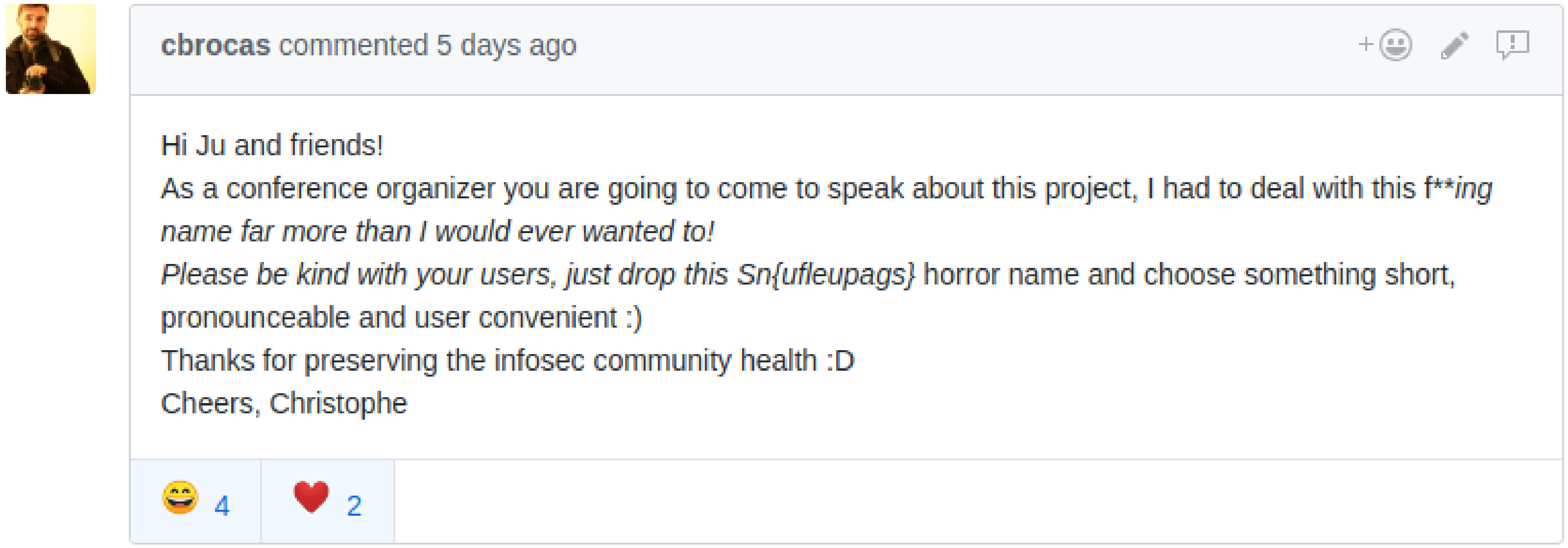
» Can't we harden PHP itself?

- Suhosin did it, and it worked great, but we're in 2018 and:
    - It has some useless features
    - It lacks some useful features
    - It is not very industrializable
    - It doesn't fly on PHP7

» So we wrote our own hardening module, in C!

Fig 1. Snuffleupagus

» Snuffleupagus?

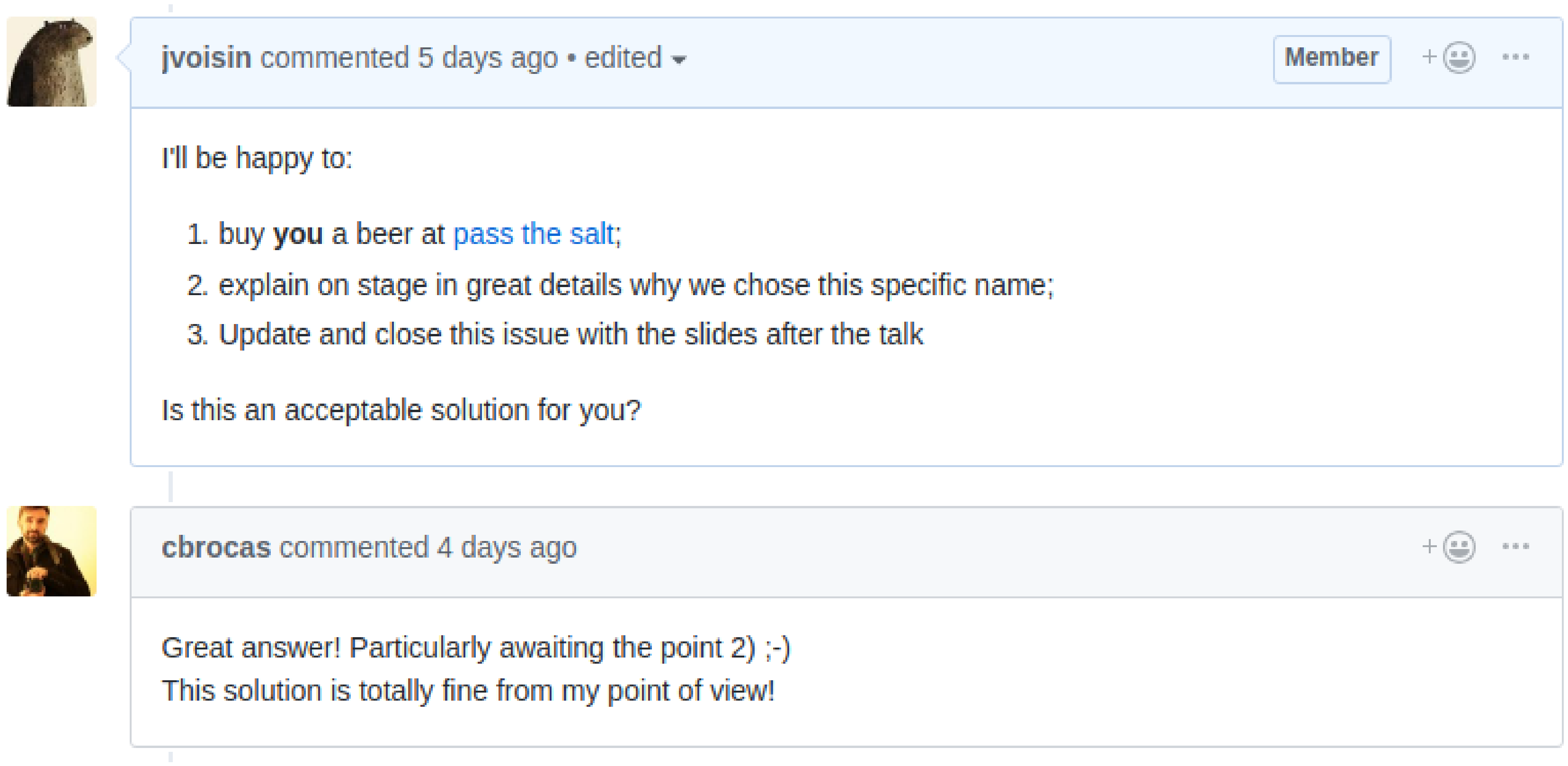


cbrocas commented 5 days ago

Hi Ju and friends!
As a conference organizer you are going to come to speak about this project, I had to deal with this f***ing name far more than I would ever wanted to!*
Please be kind with your users, just drop this Sn{ufleupags} horror name and choose something short, pronounceable and user convenient :)
Thanks for preserving the infosec community health :D
Cheers, Christophe

😄 4 ❤️ 2

» Snuffleupagus?



jvoisin commented 5 days ago • edited

Member

I'll be happy to:

1. buy **you** a beer at pass the salt;
2. explain on stage in great details why we chose this specific name;
3. Update and close this issue with the slides after the talk

Is this an acceptable solution for you?

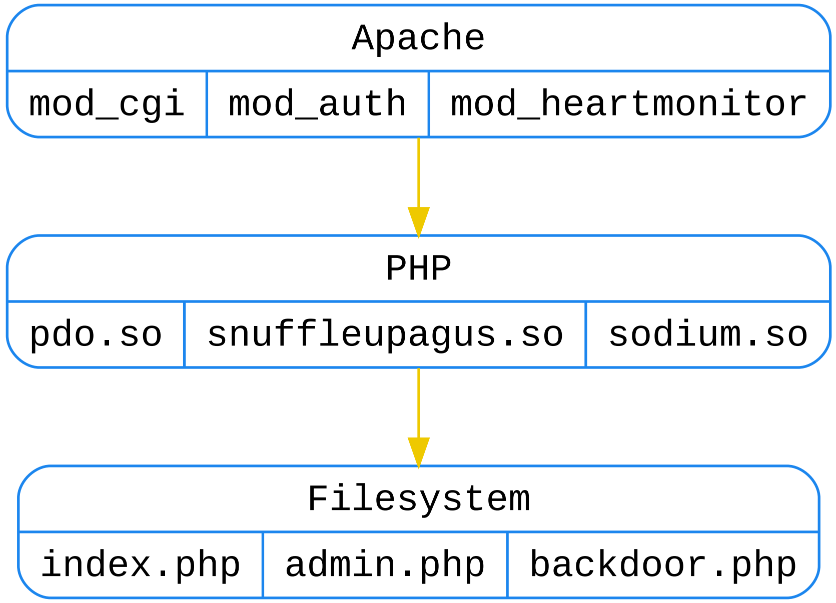
cbrocas commented 4 days ago

Great answer! Particularly awaiting the point 2) ;-)
This solution is totally fine from my point of view!

» Snuffleupagus?!

> Aloysius Snuffleupagus, more commonly known as Mr. Snuffleupagus, Snuffleupagus or Snuffy for short, is one of the characters on ***Sesame Street***.
>
> He was created as a woolly mammoth, without tusks or (visible) ears, and has a long thick pointed tail, similar in shape to that of a dinosaur or other reptile.
>
> — wikipedia

» Where does it live



» PHP-level virtual patching

» The issue

- `disable_function` can globally forbid usage of arbitrary functions
- Your CMS is using `system` for its update mechanism
- Either forbid `system` or keep your website up to date
- This is why we can't have nice things.

» How we're helping

- Disable `system` globally:

```
sp.disable_functions.function("system").drop();
```

- Allows `system` calls in a specific file

```
sp.disable_functions.function("system").filename("up.php").allow();
sp.disable_functions.function("system").drop();
```

- Allow `system` calls in a file, with a matching sha256:

```
sp.disable_functions.function("system").filename("up.php").hash("13..a").allow();
sp.disable_functions.function("system").drop();
```

We even provide a **user-friendly** script to generate a configuration file, freezing dangerous functions usage.

» What can we do with php-level virtual-patching?

» About the syntax

We designed[1] the rules syntax like this:

- 24 different filters
- Documentation for everything
- Lots of examples

to be able to easily patch:

- every ***wordpress*** CVE since 2010
- the ***RIPS advent calendar***
- a lot of ***high-profile*** web exploits
- our own 0dayz ;)

[1] Designing configuration formats is awful, if you're wondering.

» Examples

```
sp.disable_function("PHPThingy::MyClass::method_one>internal_func").drop();
sp.disable_function("admin_cron_thingy").cidr("127.0.0.1/32").allow();
sp.disable_function("admin_cron_thingy").drop();
sp.disable_function.function("render_tab3").var("_REQUEST[tab]").value_r("\"").drop();
sp.disable_function.function("system").pos("0").value_r("[^a-z]").drop();
```

» Regarding this morning

```
sp.disable_function.filename("change.php").param("confirmpassword").param_type("array").drop();
sp.disable_function.filename("change.php").param("newpassword").param_type("array").drop();
sp.disable_function.filename("change.php").param("oldpassword").param_type("array").drop();
sp.disable_function.filename("change.php").param("login").param_type("array").drop();

# Will this work ?
sp.disable_function.function("ldap_bind").ret("false").drop();
```

» What can we do with this?

» `system()` injections

» What the documentation is saying

> When allowing user-supplied data to be passed to this function, use `escapeshellarg()` or `escapeshellcmd()` to ensure that users cannot trick the system into ***executing arbitrary commands***.

» What people are doing

```php
<?php
$ip_addr = system("dig +short " . $_GET["address"]);
echo "The ip adress of $_GET['address'] is $ip_addr";
?>
```

» What we're getting

- `CVE-2017-7692`: Authen RCE on SquirrelMail
- `CVE-2016-9565`: Unauth RCE on Nagios Core
- `CVE-2014-1610`: Unauth RCE on DokuWiki
- ***Every single*** shitty modem/router/switch/IoT.

» How we're (kinda) killing it

```
sp.disable_function.function("system").param("command").value_r("[$|;&\n`]").drop();
```

» `mail` related RCE

» What the documentation is saying

> The `additional_parameters` parameter can be used to pass ***additional flags*** as command line options to the program configured to be used when sending mail

Known since 2011, popularized by RIPS.

» What people are doing

```
// Olol, sending some emails
mail(..., $_GET['a']);
```

» What we're getting

- `CVE-2017-7692`: Authen RCE in SquirrelMail
- `CVE-2016-10074`: RCE in SwiftMailer
- `CVE-2016-10033`: RCE in PHPMailer
- `CVE-2016-9920`: Unauth RCE in Roundcube
- RCE in a lot of webmails

» How we're (kinda) killing it

```
sp.disable_function.function("mail").param("additional_parameters").value_r("\-").drop();
```

» Writing rules

Fig 1. When the security team realises that it needs to write a lot of rules.

» Nobody has time to write rules

So lets kill some bug classes!

» Session-cookie stealing via XSS

Like suhosin, we're encrypting cookies with a secret key tied to:

- The ***user-agent*** of the client
- A ***static key***
- And ***environnment variable*** tat you can set to:
    - The ***ip address***[1]
    - The ***TLS extended master key***
    - …

[1] Not the best idea ever: in 2017, people are roaming ***a lot***.

» Misc cookies things

- If you're coming over https, your cookies get the `secure` flag
- If cookies are encrypted, they are `httpOnly`
- Support for `SameSite` to kill CSRF

» RCE via file-upload

» What the documentation is saying

> Not validating which file you operate on may mean that users can access *sensitive information* in other directories.

» What people are doing

```
$uploaddir = '/var/www/uploads/';
$uploadfile = $uploaddir . basename($_FILES['userfile']['name']);
move_uploaded_file($_FILES['userfile']['tmp_name'], $uploadfile)
```

» What we're getting

- `CVE-2001-1032` : RCE in PHP-Nuke via file-upload
- ...
- *15 years later*
- ...
- `CVE-2016-9187` : RCE in Moodle via file-upload

> ```
> There are 850 CVE entries that match your search
> ```
> — cve.mitre.org

» How we're killing it

Suhosin style:

```
sp.upload_validation.script("tests/upload_validation.sh").enable();
```

One trick is to rely on `vld`[1] to ensure file doesn't contain php code:

```
$ php -d vld.execute=0 -d vld.active=1 -d extension=vld.so $file
```

[1] Vulcan Logic Disassembler. (yes)

» Unserialize

» What the documentation is saying

> *Do not* pass untrusted user input to `unserialize()` [...]. Unserialization can result in code being loaded and executed [...].

» What people are doing

```
$my_object = unserialize($_GET['o']);
```

» Small aparté about `unserialize`

Fig 1. The security team reading PHP's mailing list

» What we're getting

- `CVE-2012-5692`: unauth RCE in IP.Board
- `CVE-2014-1691`: Unauth RCE in Horde
- `CVE-2015-7808`: Unauth RCE in vBulletin
- `CVE-2015-8562`: Unauth RCE in Joomla
- `CVE-2016-????`: Unauth RCE in Observium (leading to remote root)
- `CVE-2016-5726`: Unauth RCE in Simple Machines Forums
- `CVE-2016-4010`: Unauth RCE in Magento
- `CVE-2017-2641`: Unauth RCE in Moodle

» How we're killing it

Php will discard any garbage found at the end of a serialized object: we're simply appending a ***hmac*** at the end of strings generated by `serialize`.

It looks like this:

```
s:1:"a";650609b417904d0d9bbf1fc44a975d13ecdf6b02b715c1a06271fb3b673f25b1
```

» `rand` and its friends

» What the documentation is saying

> This function ***does not*** generate cryptographically secure values, and ***should not*** be used for cryptographic purposes.

» What people are doing

```
$password_reset_token = rand(1,9) . rand(1,9) . [...] . rand(1, 9);
```

» What we're getting

- `CVE-2008-4102`: Auth bypass in Joomla
- ...
- `CVE-2015-5267`: Auth bypass in Moodle
- Various captcha bypasses

» How we're killing it

We're simply replacing every call to `rand` and `mt_rand` with `random_int`.

» XXE

» What the documentation is saying

Not a single warning ;)

» What people are doing

```
$xmlfile = file_get_contents('php://input');
$dom = new DOMDocument();
$dom->loadXML($xmlfile);
$data = simplexml_import_dom($dom);
```

» What we're getting

- `CVE-2011-4107`: Authen LFI in PHPMyAdmin
- ...
- `CVE-2015-5161`: Unauth arbitrary file reading on Magento

» How we're killing it

We're calling `libxml_disable_entity_loader(true)` at startup, and ***nop'ing*** its call.

» Unrelated misc things

```
# chmod hardening
sp.disable_function.function("chmod").param("mode").value_r("7$");
sp.disable_function.function("chmod").param("mode").value_r("o\+w");

# backdoors detection
sp.disable_function.function("ini_get").param("var_name").value("open_basedir");
sp.disable_function.function("is_callable").param("var").value("system");

# prevent execution of writeable files
sp.readonly_exec.enable();

# Ghetto sqli detection
sp.disable_functions.function_r("mysqli?_query").ret("FALSE").dump().allow();
sp.disable_functions.function_r("PDO::query").ret("FALSE").dump().allow();
```

» Harvesting 0days

If you've got something like this

```
$line = system("grep $var dict.txt");
```

You can do something like that

```
sp.disable_function.function("system").var("var").regexp("[;`&|\n]").dump().allow();
```

And wait until someone finds a vuln to collect a working exploit.

» Performance impact

- Currently deployed on (at least) one Alexa1 top 1k website.
- We're using it on some customers
- No performance impact noticed
- We're (kinda) only hooking the functions that you specify
- Filter-matching is written with performances in mind

» What's left to do

- Killing more bug-classes, like sloppy-comparisons and SQLI[1]
- Improve the virtual patching capabilities
- Party party party

[1] We're working on it ;)

» How to get this wonder?

- https://github.com/nbs-system/snuffleupagus for the sauce code
- https://snuffleupagus.rtfd.io for the (amazing) documentation
- Come talk to us, we're friendly!

» Mandatory final quote

> There are only two kinds of languages: the ones people complain about and the ones nobody uses.
>
> — Bjarne Stroustrup

Did you know that more than ***¾ of the web*** is using PHP?

» Cheers

- The ***RIPS*** people for their awesome scanner
- ***SectionEins*** for Suhosin and inspiration
- The ***HardenedPHP*** project for leading the way
- ***websec.fr*** for showcasting our most convoluted exploits
- Our ~~guinea pigs~~ ***friends*** who alpha-tested everything
- Folks that ~~called us names~~ gave us constructive feedback
- Pass the Salt for accepting our talk ♥