IPv6 Insecurity Revolutions

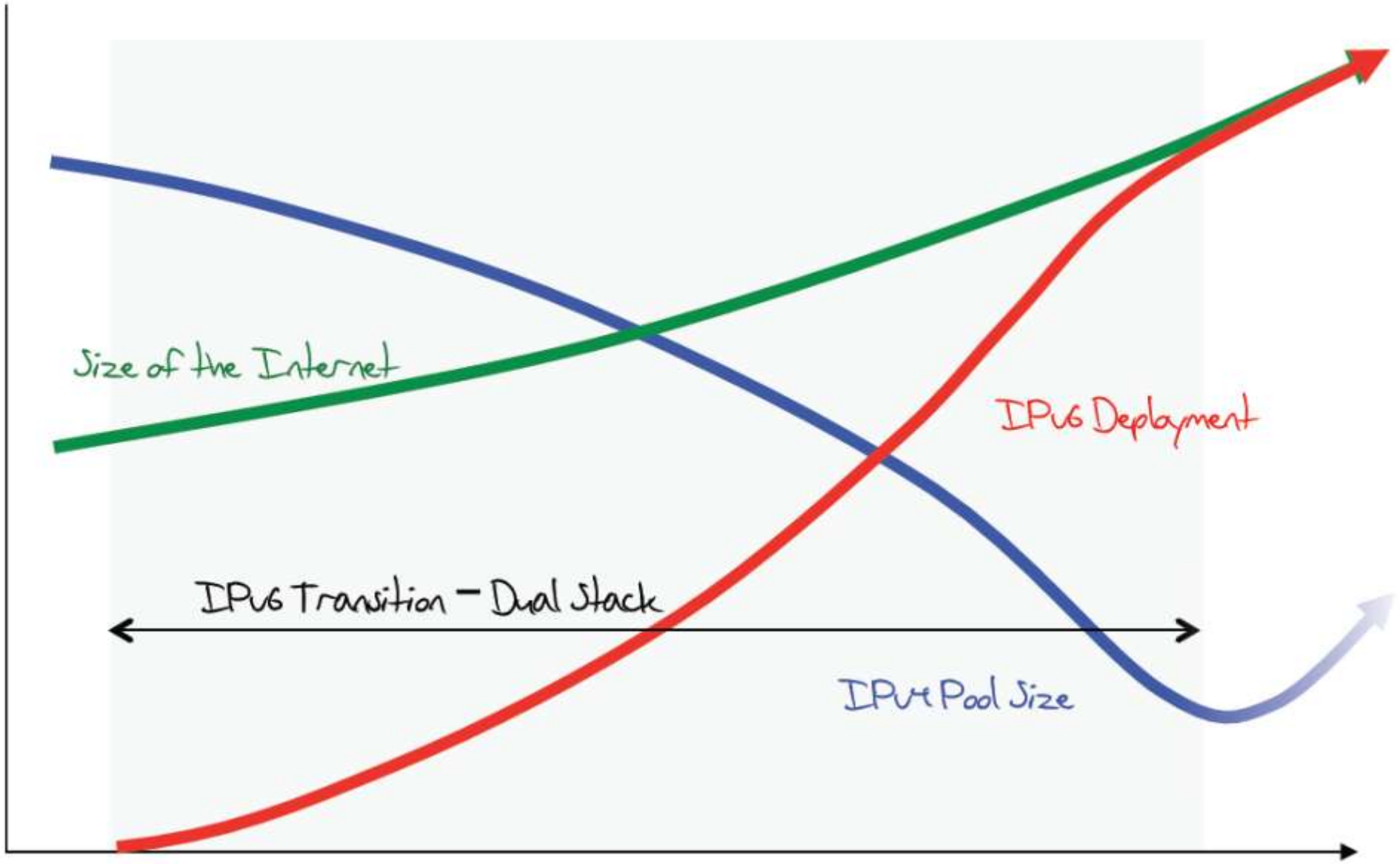
Marc “van Hauser” Heuse

Hack in the Box 2012, Kuala Lumpur

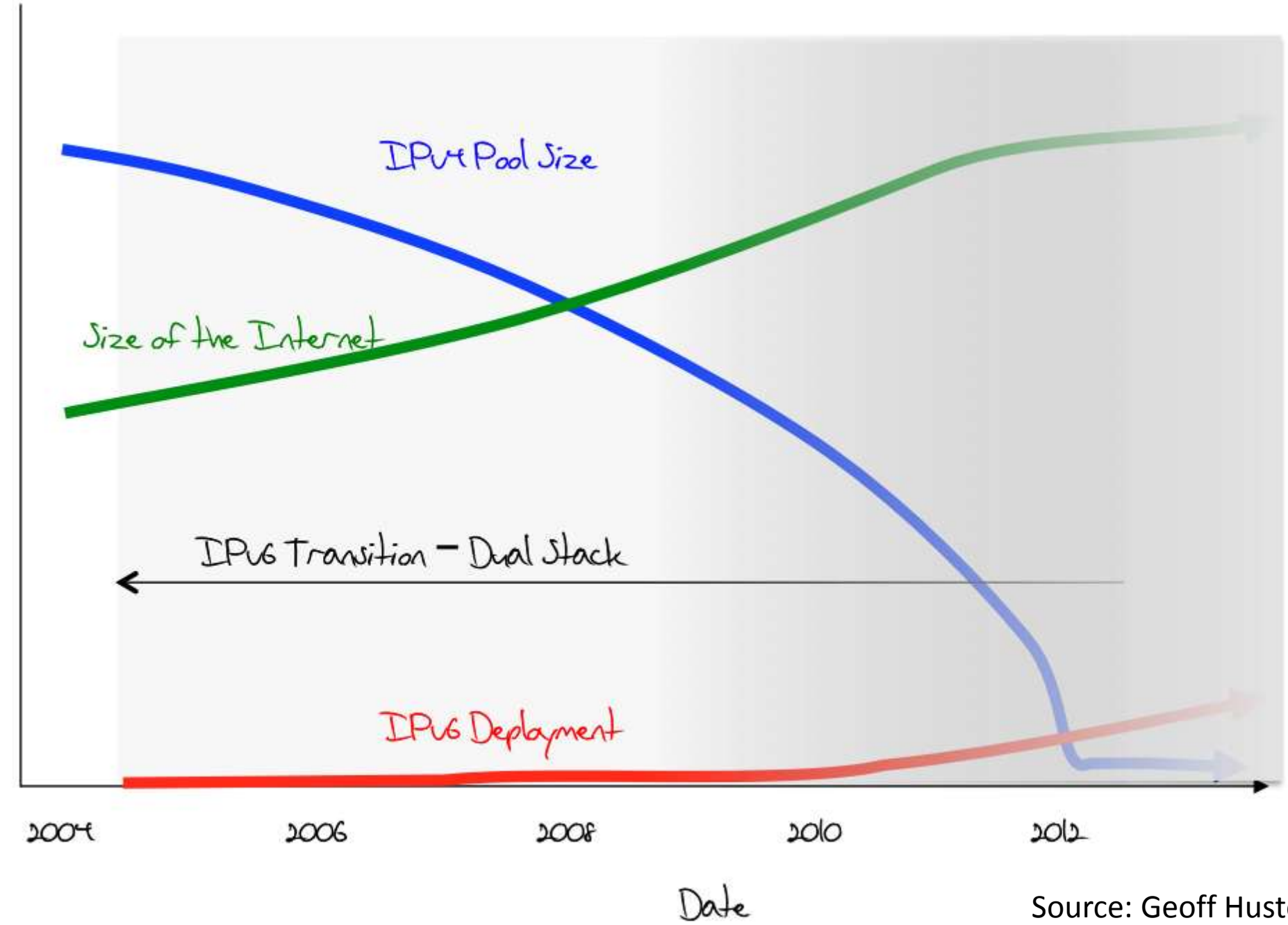
Hello, my name is …


The Situation
Vulnera-bilities
Pentesting
Hope?

Once upon a time …



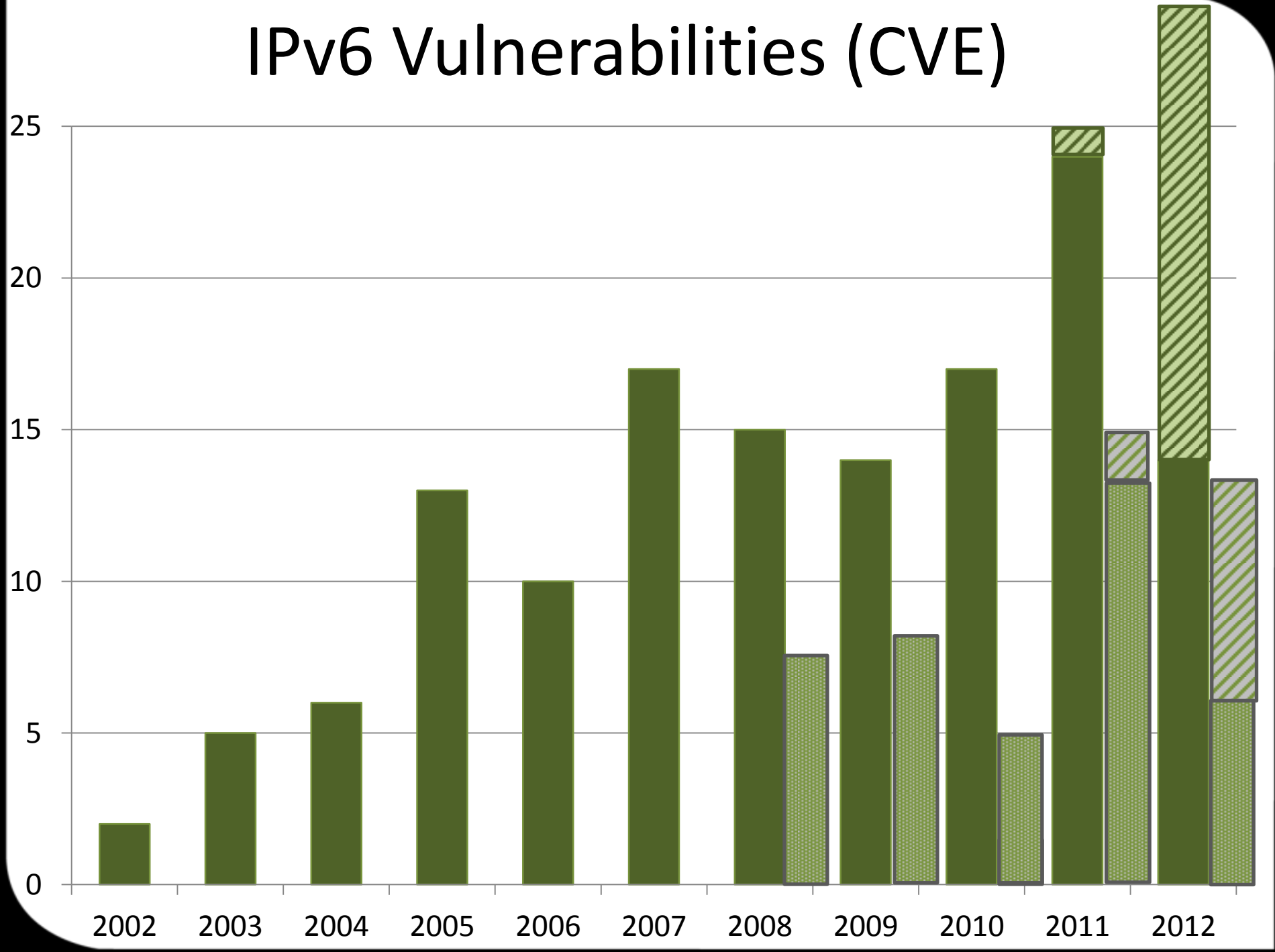
Source: Geoff Huston



Source: Geoff Huston


THE END
IS NEAR

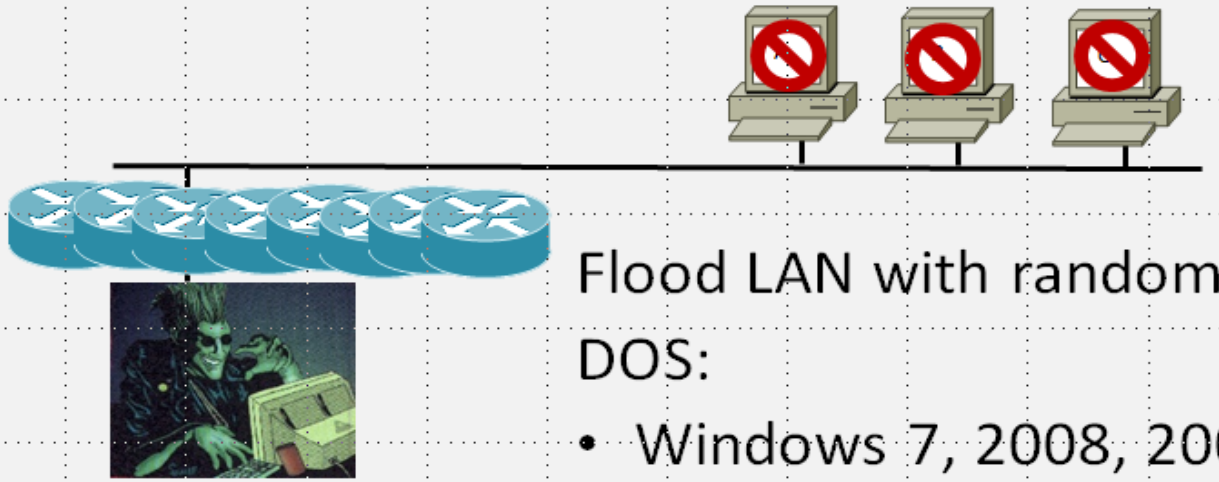
IPv6 Vulnerabilities (CVE)




Flooding Surprises

From 2010 – M$ still didn‘t fix it

Router Advertisement Flooding

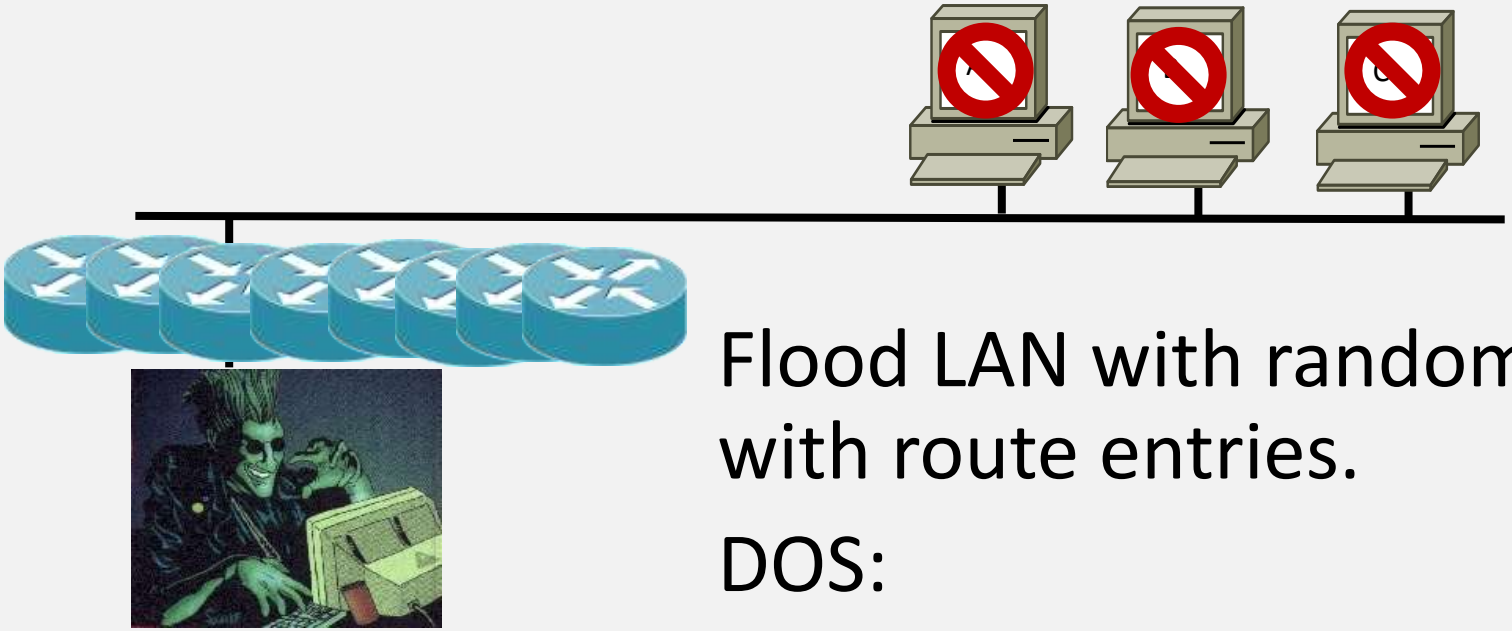


Flood LAN with random RAs.

DOS:

- Windows 7, 2008, 2003, XP
- Cisco IOS+ASA (fixed)
- Juniper Netscreen
- Free/NetBSD (fixed)

Router Advertisement Flooding Revisited



Flood LAN with random RA with route entries.

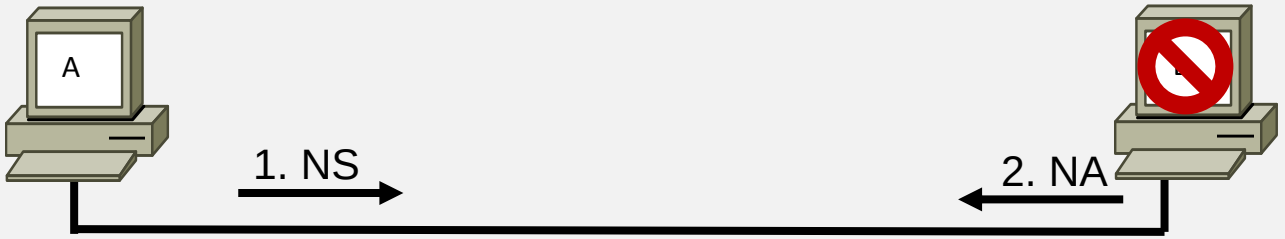
DOS:

- Windows 7, 8, 20xx, XP
- Free-/NetBSD
- OS X

flood_router26 eth0

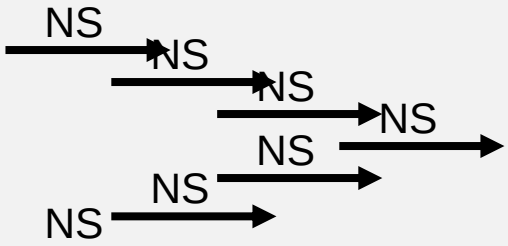
Neighbor Solicitation Flooding

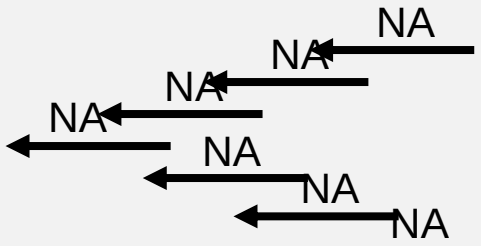
flood_solicitate6



1. NS:
   ICMP Type = 135
   Src = A
   Dst = All-Nodes Mulitcast
   Query= Who-has IP B?

2. NA:
   ICMP Type = 136
   Src = B
   Dst = A
   Data= MAC



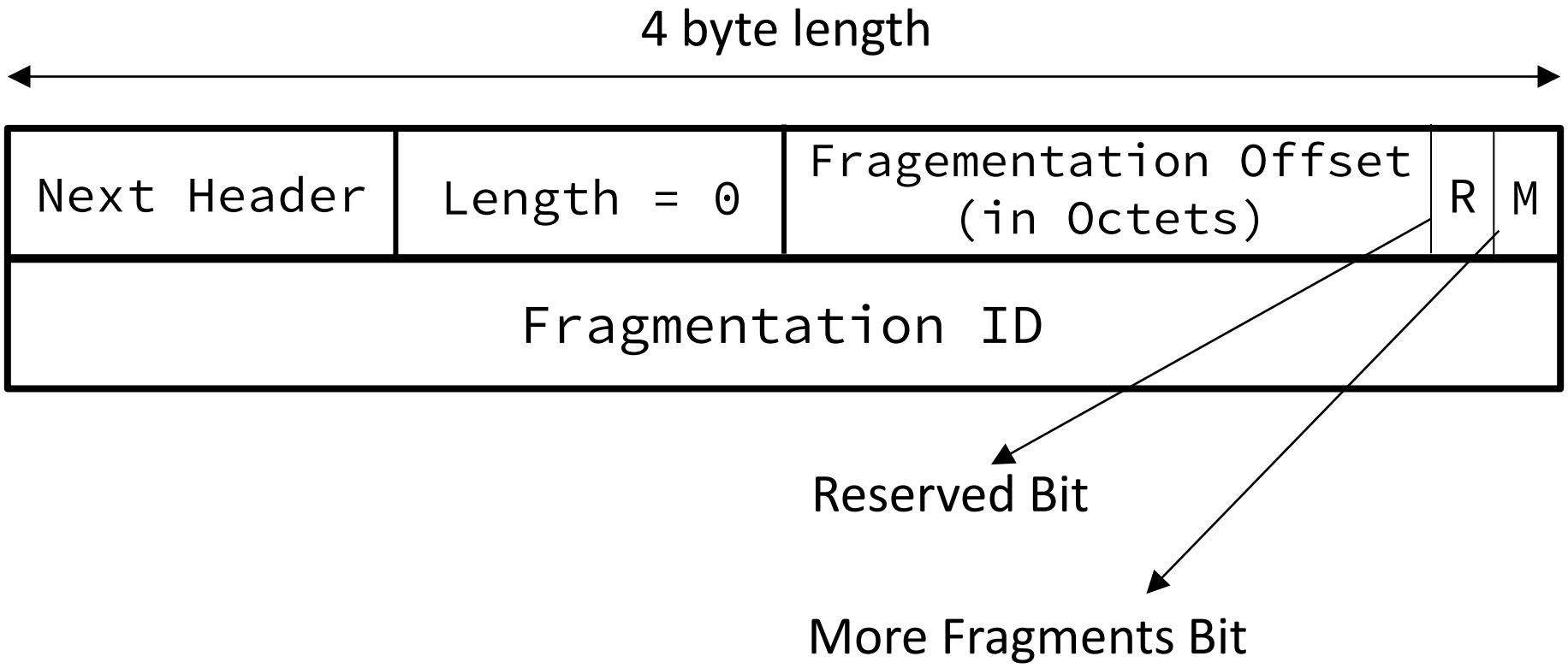


Affected:

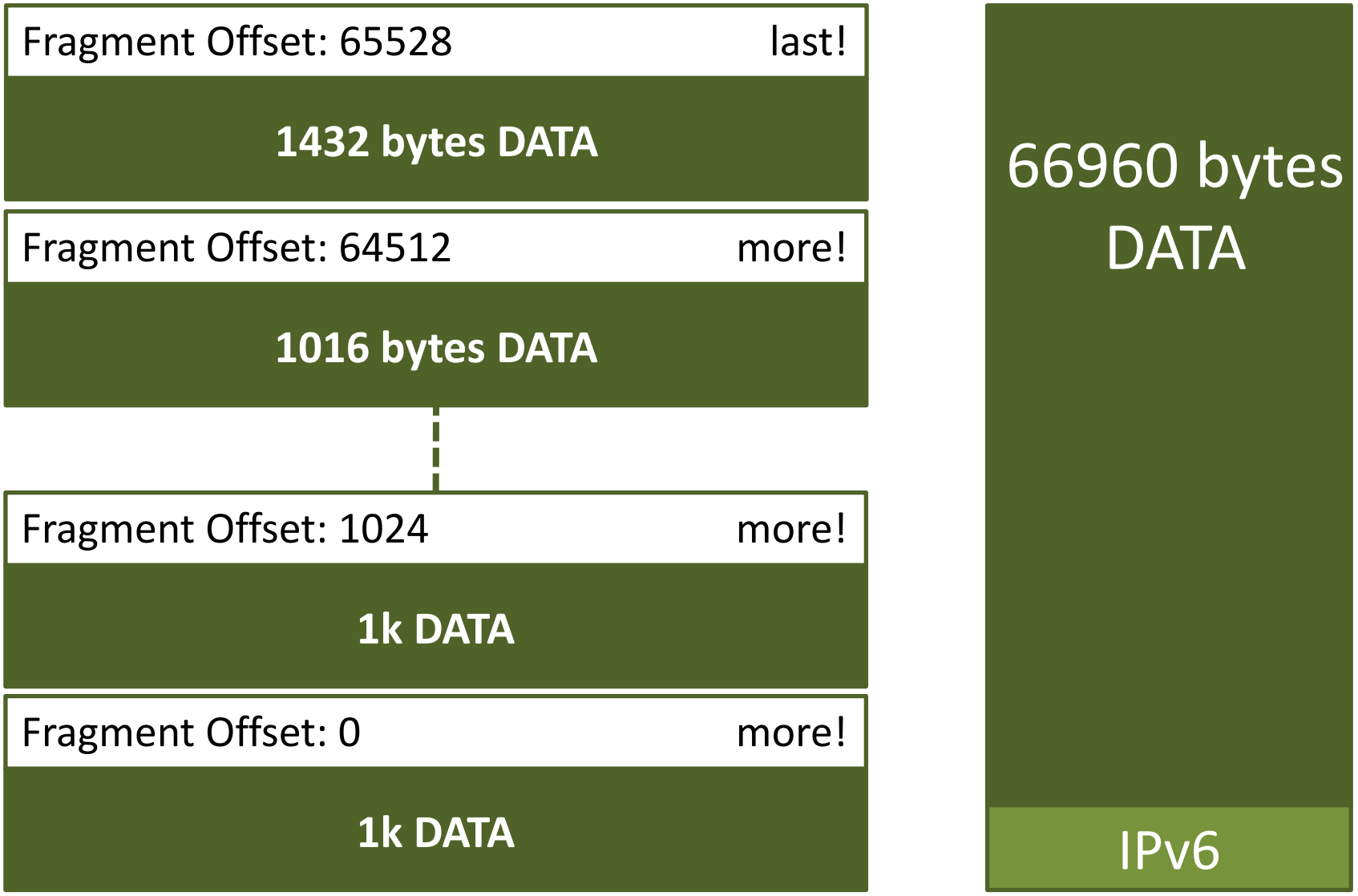
- Windows (all)
- Solaris
- OS X
- FreeBSD/NetBSD

Fragmentation Surprises

Fragmentation Header

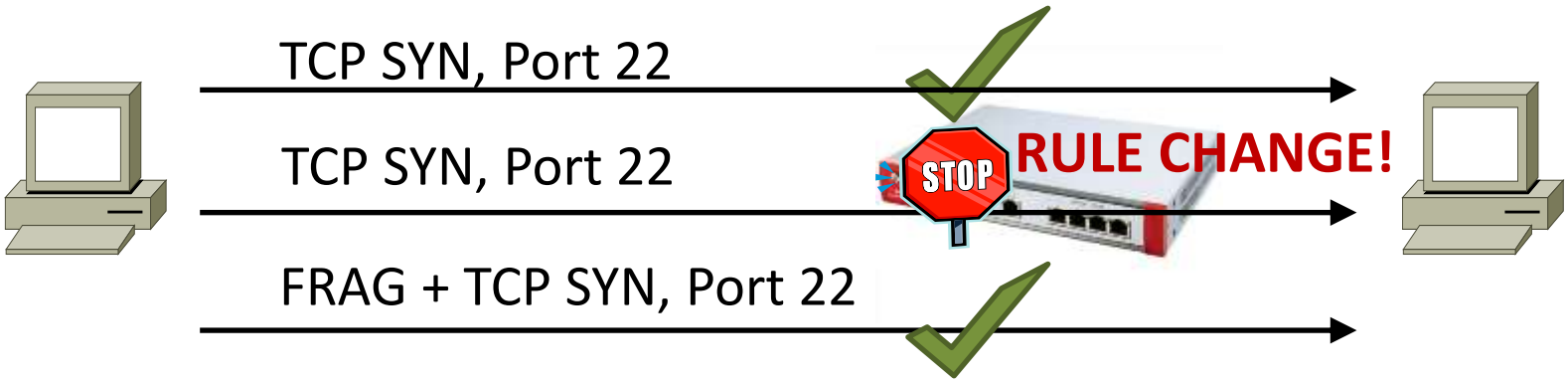


Fragmentation Surprises



Avira Personal Firewall 2012

Fragmentation Surprises II



Zyxel does not consider this a bug …

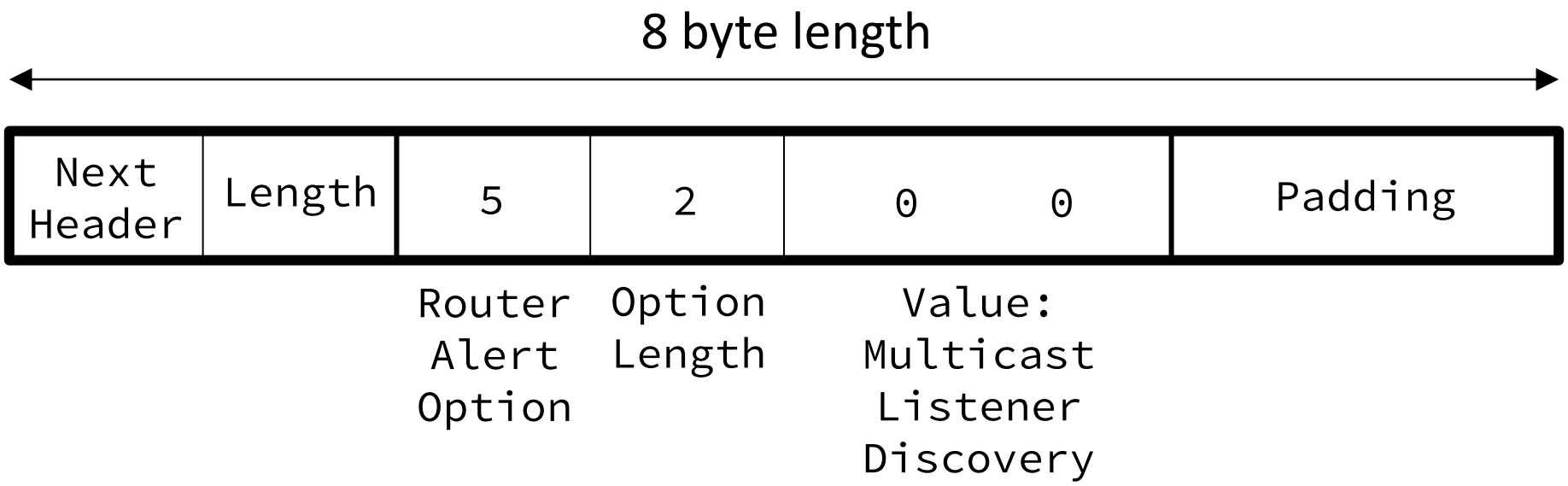
Fragmentation Surprises III

FRAG ID A, Offset 0	FRAG ID A, Offset 20.000	FRAG ID A, Offset 60.000
FRAG ID B, Offset 0	FRAG ID B, Offset 20.000	FRAG ID B, Offset 60.000
FRAG ID C, Offset 0	FRAG ID C, Offset 20.000	FRAG ID C, Offset 60.000

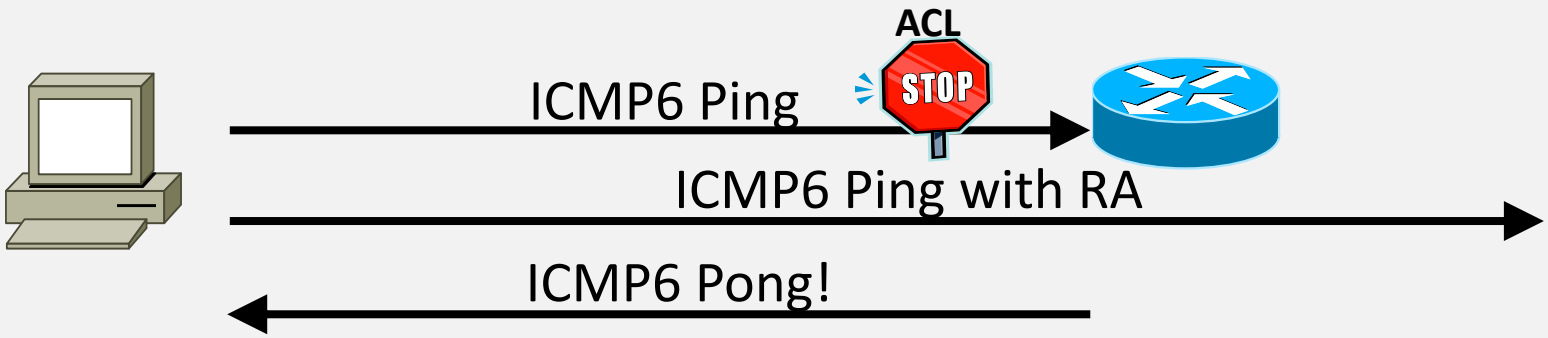
Router Alert Magic

Router Alert Option

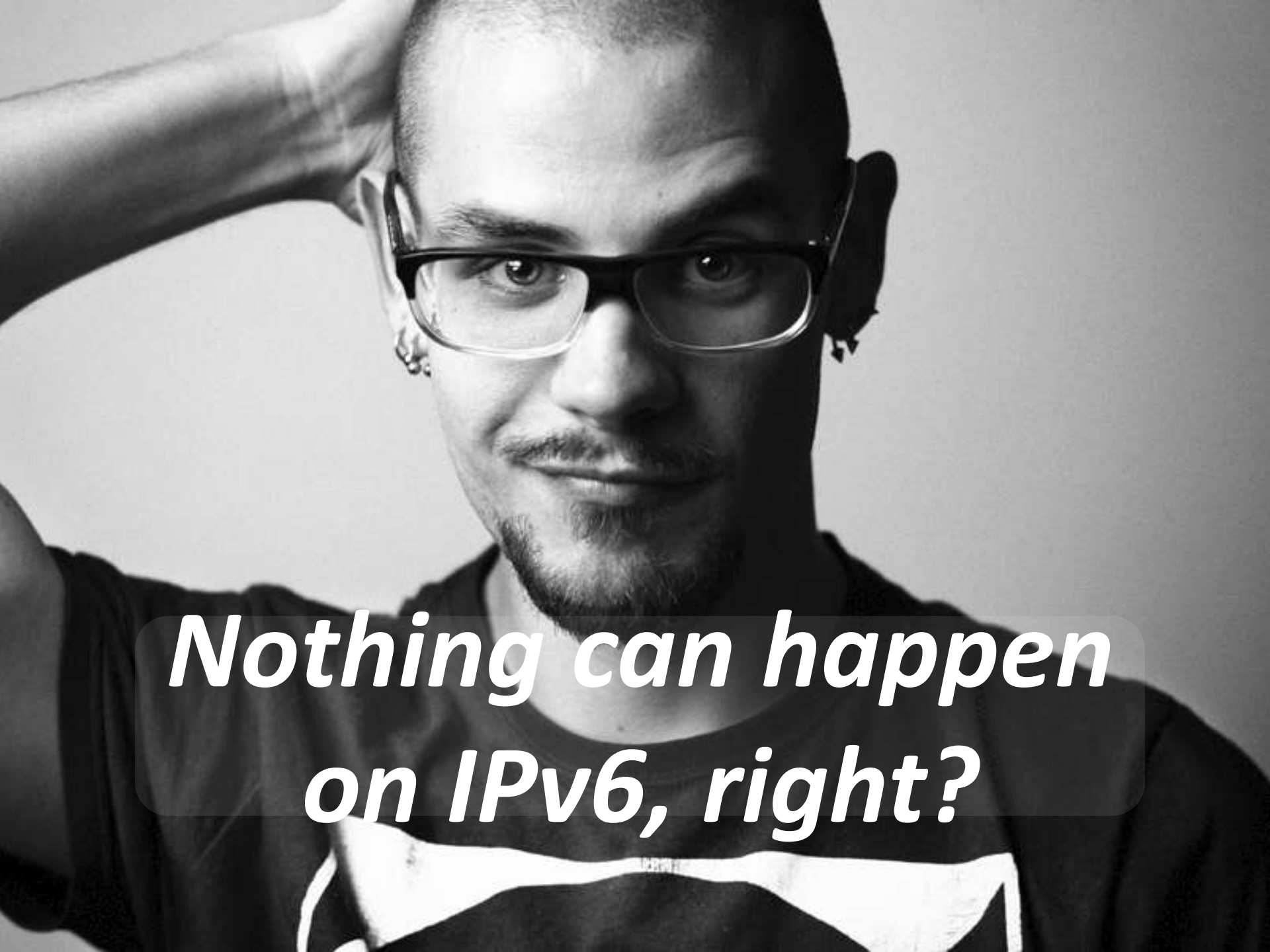
Hop-by-Hop Extension Header



Cisco ICMP ACL Bypass

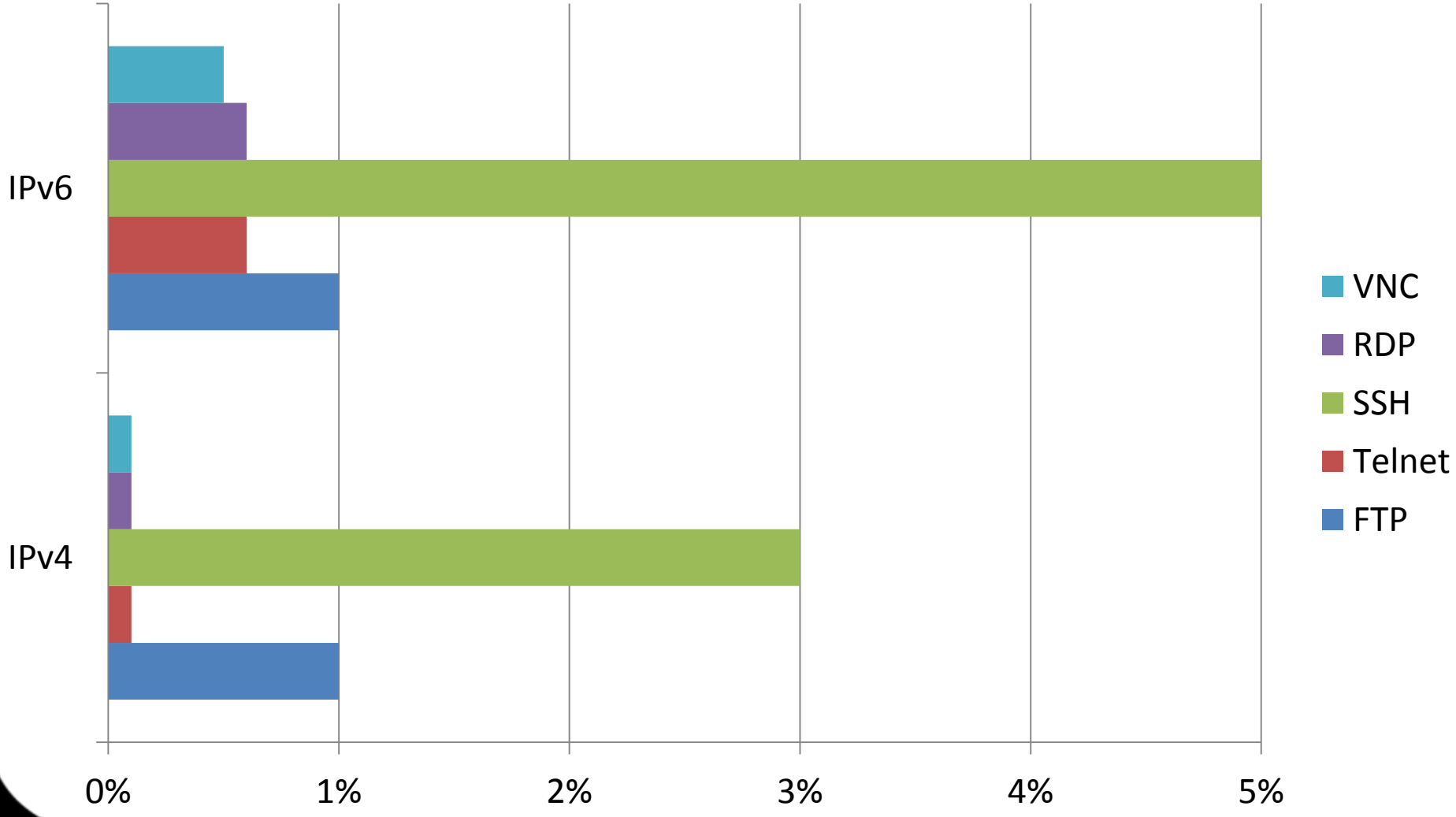



RA
Speeeeeeeeeeeeeeeed
YOU
RANG?

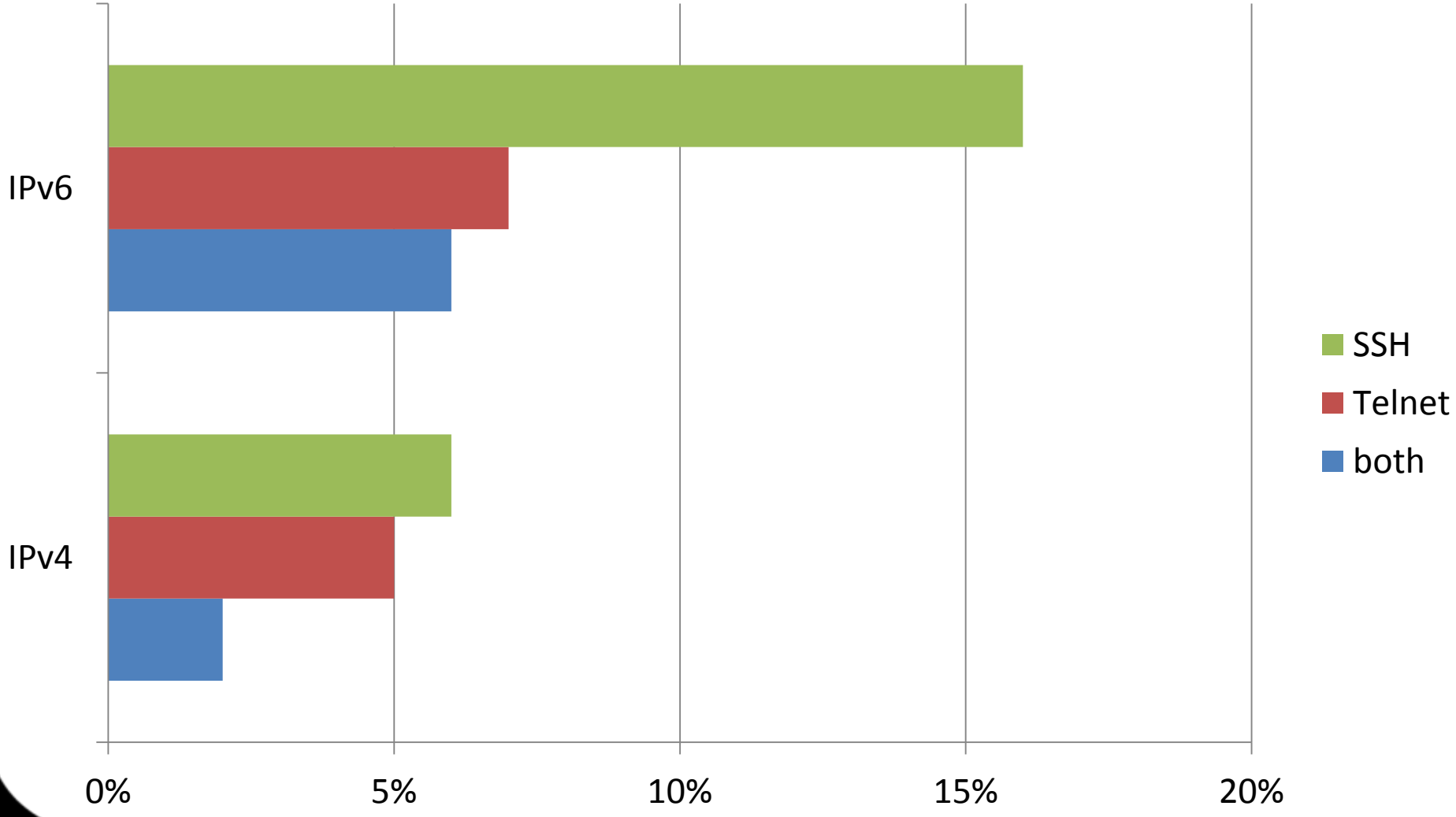

Nothing can happen
on IPv6, right?

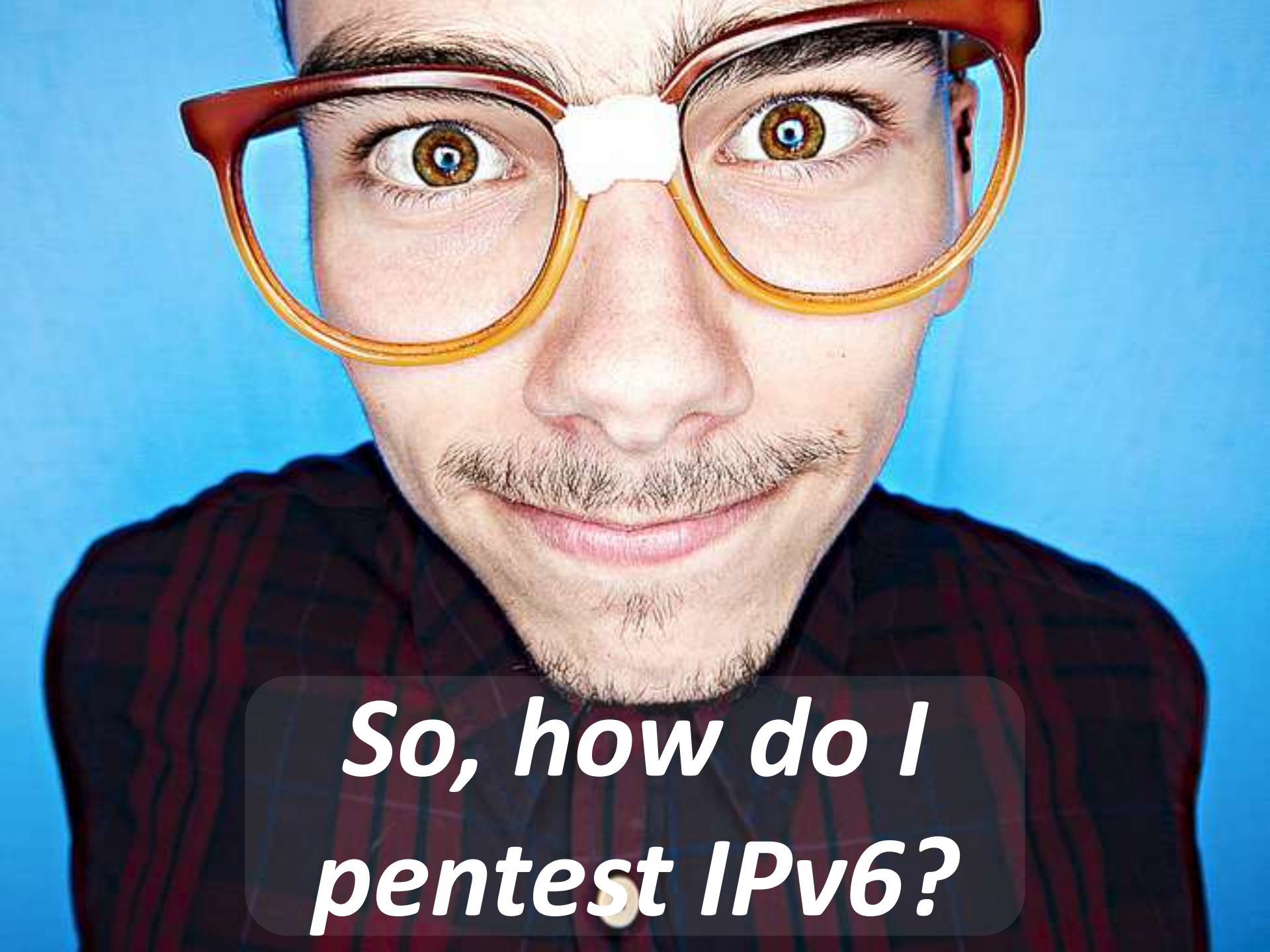

2500

Company Server protection



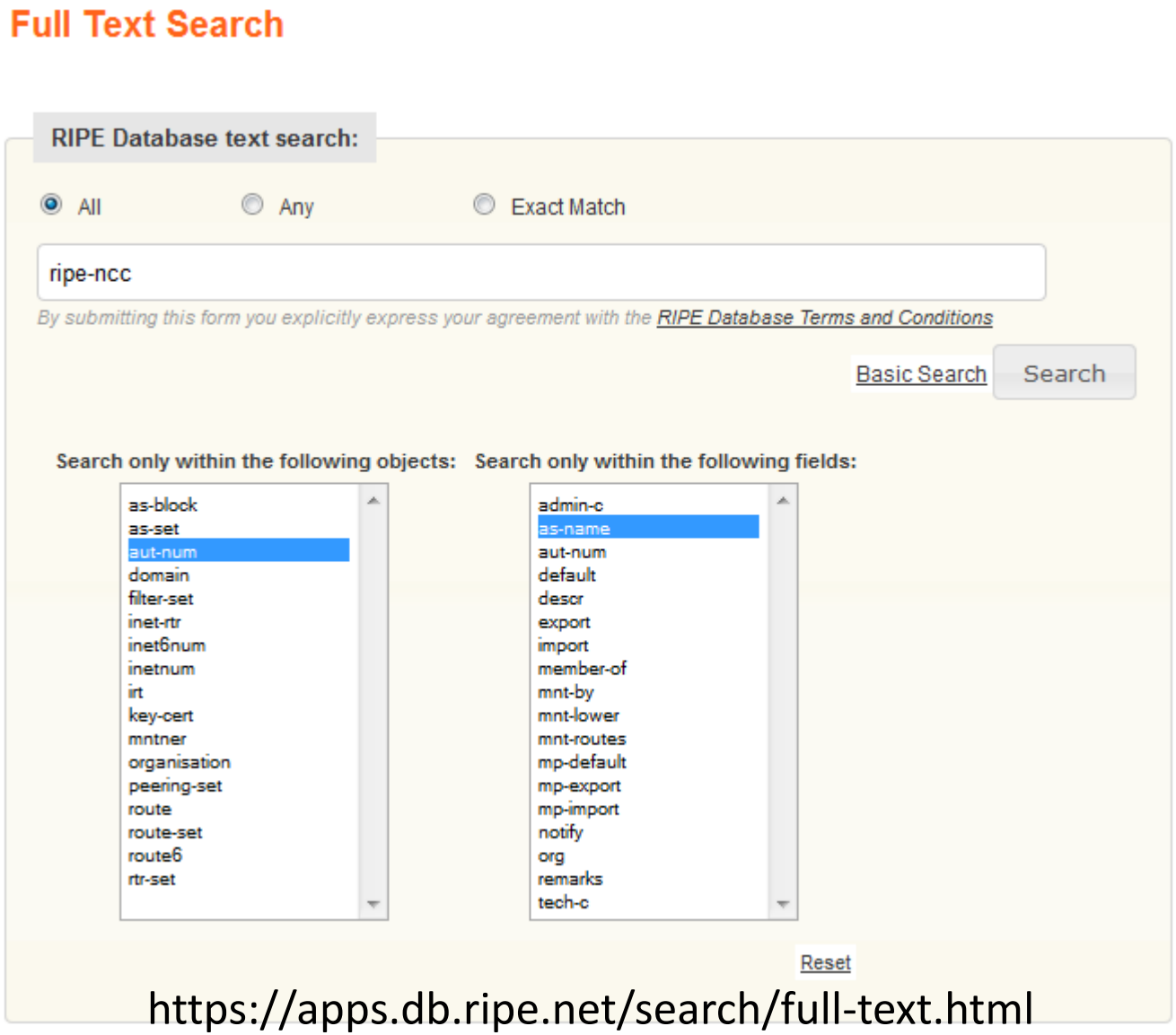
ISP Router protection




So, how do I
pentest IPv6?

Thank you RIPE!

Find the AS for the target



https://apps.db.ripe.net/search/full-text.html

Search results

This is the RIPE Database full text search service.
The RIPE Database is subject to Terms and Conditions.
See http://www.ripe.net/db/support/db-terms-conditions.pdf

aut-num: AS3333

*as-name=**RIPE-NCC**-AS, mnt-by=**RIPE-NCC**-END-MNT **RIPE-NCC**-MNT, remarks=:*
*++ | AS3333 **RIPE-NCC**-AS | | **RIPE NCC** (Network Coordination Centre, descr=Reseaux IP Europeens Network Coordination Centre (**RIPE NCC**)*

aut-num: AS12654

*as-name=**RIPE-NCC**-RIS-AS, mnt-by=**RIPE-NCC**-END-MNT **RIPE-NCC**-RIS-MNT, remarks=**RIPE NCC** RIS project http://www.ripe.net/ris/ The **RIPE NCC** RIS collects routing data using several, descr=Reseaux IP Europeens Network Coordination Centre (**RIPE NCC**)*

aut-num: AS197000

*as-name=**RIPE-NCC**-AUTHDNS-AS, mnt-by=**RIPE-NCC**-END-MNT RIPE-GII-MNT, remarks=remarks:*
*+--+ | **RIPE NCC** anycast DNS, descr=Reseaux IP Europeens Network Coordination Centre (**RIPE NCC**)*

aut-num: AS196615

*as-name=**RIPE-NCC**-RIS-4BYTE-AS, mnt-routes=**RIPE-NCC**-RIS-MNT, mnt-by=**RIPE-NCC**-END-MNT **RIPE-NCC**-RIS-MNT, remarks=**RIPE NCC** RIS beacon from a 4-byte AS asdot to asplain conversion, descr=Reseaux IP Europeens Network Coordination Centre (**RIPE NCC**)*

Do the AS announce IPv6?

http://bgp.he.net/ASxxxx#_prefixes6

AS12654 Reseaux IP Europeens Network Coordination Centre (RIPE NCC)

Prefix	Description
2001:07fb:fd02::/48	Reseaux IP Europeens Network Coordination Centre (RIPE NCC)
2001:07fb:fd03::/48	Reseaux IP Europeens Network Coordination Centre (RIPE NCC)
2001:07fb:fe00::/48	Reseaux IP Europeens Network Coordination Centre (RIPE NCC)
2001:07fb:fe05::/48	Reseaux IP Europeens Network Coordination Centre (RIPE NCC)
2001:07fb:fe0a::/48	Reseaux IP Europeens Network Coordination Centre (RIPE NCC)
2001:07fb:fe0b::/48	Reseaux IP Europeens Network Coordination Centre (RIPE NCC)
2001:07fb:fe0c::/48	Reseaux IP Europeens Network Coordination Centre (RIPE NCC)
2001:07fb:fe0e::/48	Reseaux IP Europeens Network Coordination Centre (RIPE NCC)
2001:07fb:fe0f::/48	Reseaux IP Europeens Network Coordination Centre (RIPE NCC)
2001:07fb:fe10::/48	Reseaux IP Europeens Network Coordination Centre (RIPE NCC)
2001:07fb:ff00::/48	Reseaux IP Europeens Network Coordination Centre (RIPE NCC)
2001:07fb:ff01::/48	Reseaux IP Europeens Network Coordination Centre (RIPE NCC)
2001:07fb:ff03::/48	Reseaux IP Europeens Network Coordination Centre (RIPE NCC)
2001:07fb:ff04::/48	Reseaux IP Europeens Network Coordination Centre (RIPE NCC)
2001:07fb:ff05::/48	Reseaux IP Europeens Network Coordination Centre (RIPE NCC)
2001:07fb:ff07::/48	Reseaux IP Europeens Network Coordination Centre (RIPE NCC)
2001:07fb:ff0a::/48	Reseaux IP Europeens Network Coordination Centre (RIPE NCC)
2001:07fb:ff0b::/48	Reseaux IP Europeens Network Coordination Centre (RIPE NCC)
2001:07fb:ff0c::/48	Reseaux IP Europeens Network Coordination Centre (RIPE NCC)
2001:07fb:ff0e::/48	Reseaux IP Europeens Network Coordination Centre (RIPE NCC)
2001:07fb:ff10::/48	Reseaux IP Europeens Network Coordination Centre (RIPE NCC)

63% ::1

76% ::1, ::2

79% ::0, ::1, ::2

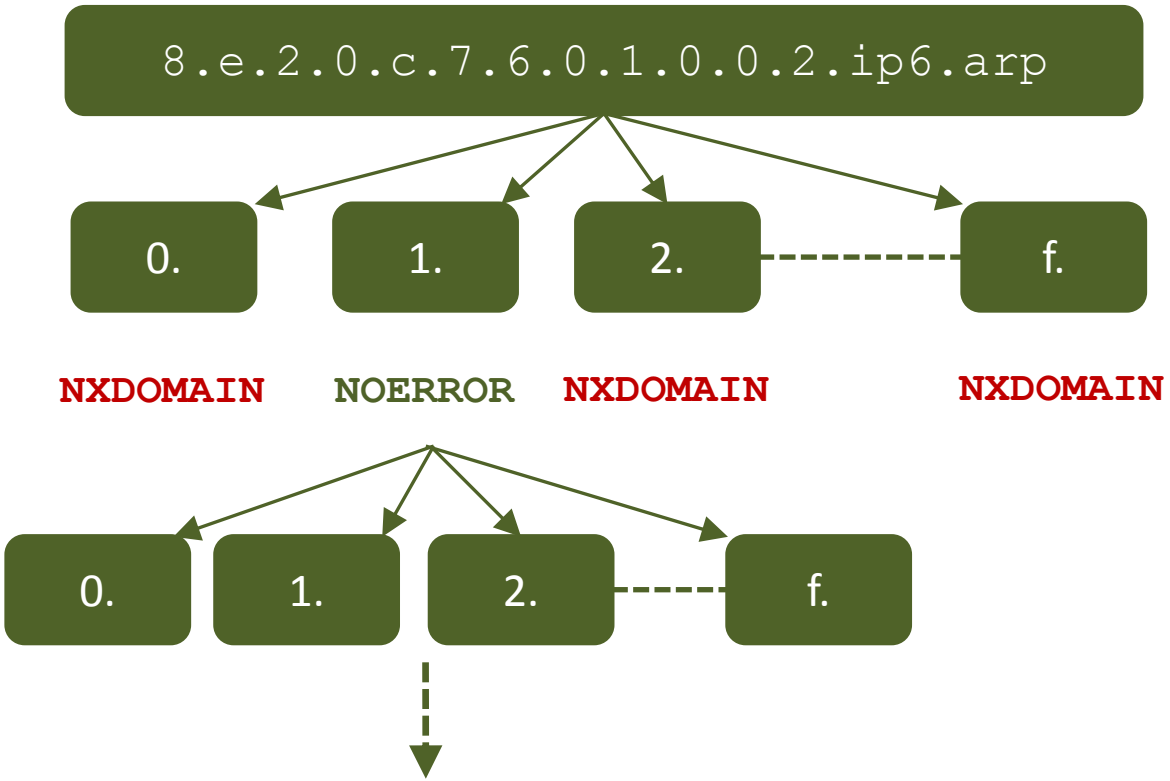
(statistic based on 8200 networks)

```
# alive6 -p eth0 2001:67c:238::0-ffff::0-2

Alive: 2001:67c:238:1::2 [ICMP echo-reply]
Alive: 2001:67c:238:3::1 [ICMP echo-reply]
Alive: 2001:67c:238:3::2 [ICMP echo-reply]
Alive: 2001:67c:238:300::1 [ICMP echo-reply]

Scanned 65536 systems in 29 seconds and found 4
systems alive
```

Reverse DNS Enumeration



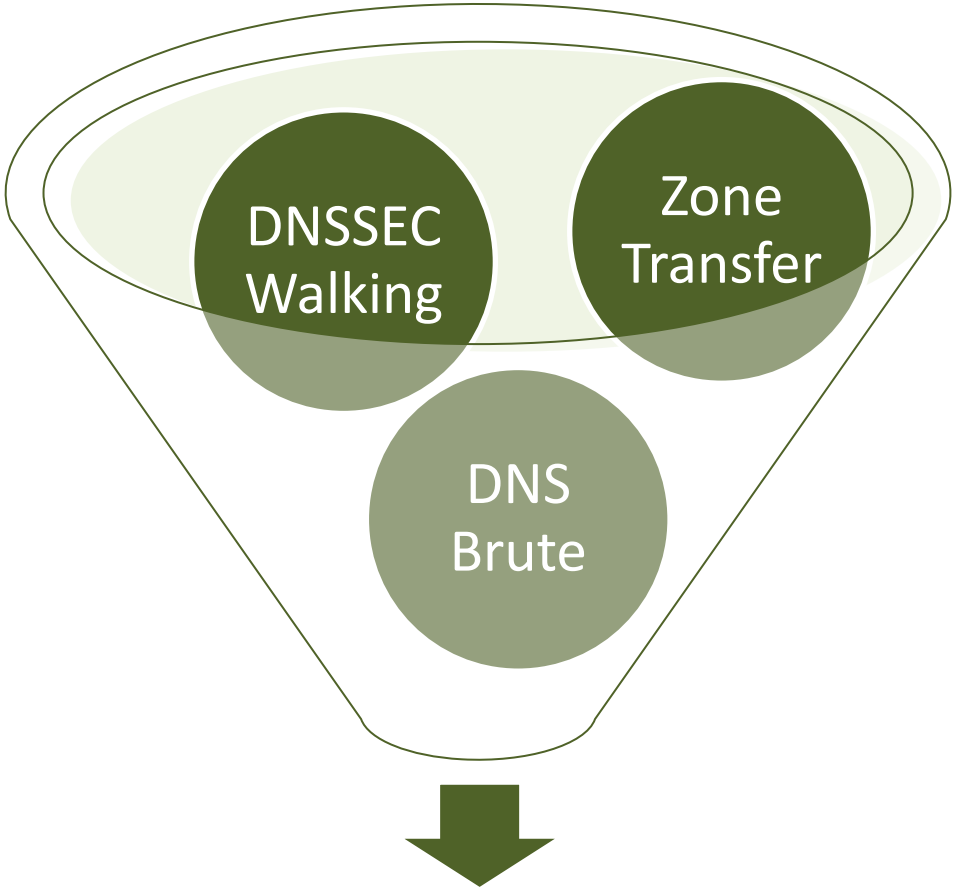

```
e.6.1.0.0.0.1.c.0.0.0.0.0.0.0.0.1.0.0.0.8.e.2.0.c.7.6.0.1.0.0.2.ip6.arp
    PTR  db-int.ipv6.ripe.net. (2001:67c:2e8:1::c100:16e)
```

Reverse DNS Enumeration

```
# dnsrevenum6 pri.authdns.ripe.net. 2001:67c:2e8::/48

2001:67c:2e8:1::1 is gw.ipv6.office.nsrp.ripe.net.
2001:67c:2e8:1::c100:102 is alfresco.ripe.net.
2001:67c:2e8:1::c100:10c is pademelon.ipv6.ripe.net.
2001:67c:2e8:1::c100:114 is otter.ipv6.ripe.net.
2001:67c:2e8:1::c100:11c is int.db.ipv6.ripe.net.
2001:67c:2e8:1::c100:115 is jaguar.ipv6.ripe.net.
2001:67c:2e8:1::c100:117 is cougar.ipv6.ripe.net.
2001:67c:2e8:1::c100:123 is db-apps.ipv6.ripe.net.
2001:67c:2e8:1::c100:128 is coral.ipv6.ripe.net.
2001:67c:2e8:1::c100:12b is tarsier.ipv6.ripe.net.
...
```

Extract DNS Information



DNS Name → IPv6 Addresses

Try it

```
# dig @pri.authdns.ripe.net.  ripe.net.  axfr
ripe.net. 3600 IN SOA    pri.authdns.ripe.net.
ripe.net. 2160 IN A    193.0.6.139
ripe.net. 300  IN AAAA 2001:67c:2e8:22::c100:68b
...
```

Try it

```
# dnssecwalk pri.authdns.ripe.net.  ripe.net.
Found: 256cns.ripe.net.
Found: _jabber._tcp.ripe.net.
Found: _xmpp-client._tcp.ripe.net.
Found: _xmpp-server._tcp.ripe.net.
Found: access.ripe.net.
Found: addax.ripe.net.
Found: ox.admin.ripe.net.
Found: adp.ripe.net.
Found: albatross.ripe.net.
...
```

Try it

```
# dnsdict6 ripe.net.
access.ripe.net. => 2001:67c:2e8:22::c100:685
atlas.ripe.net. => 2a01:4f8:121:30a3::78:16
calendar.ripe.net. => 2a00:1450:4008:c01::79
cgi.ripe.net. => 2001:67c:2e8:1::c100:117
dns.ripe.net. => 2001:67c:e0::6
eagle.ripe.net. => 2001:67c:2e8:1::c100:159
eb.ripe.net. => 2001:67c:2e8:11::c100:1333
fax.ripe.net. => 2001:67c:2e8:11::c100:1310
falcon.ripe.net. => 2001:67c:2e8:16::c100:58a
...
```

Scan all addresses found

```
# alive6 -i found.txt -D -M -F eth0
```

All addresses found from alive6, dnsrevenum6 and DNS information

Perform common address scan on each network in the input file

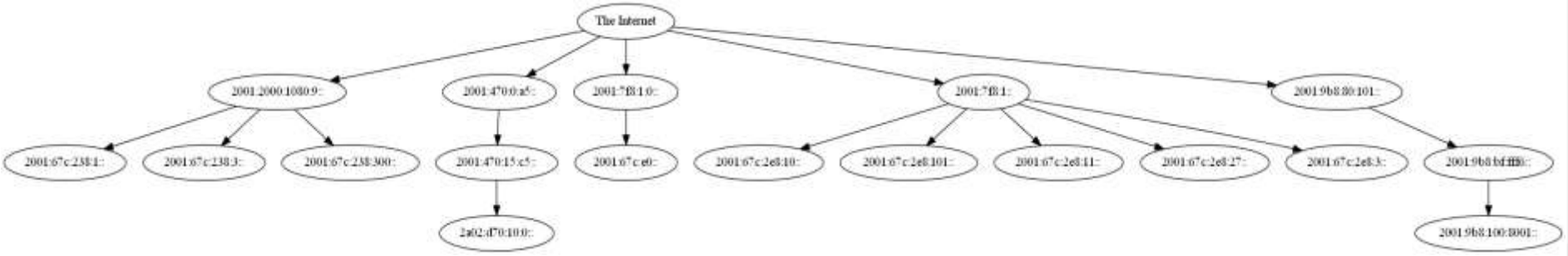
Perform MAC address scan on each SLAAC address in the input file

Firewall piercing mode

Alive systems …

```
# alive6 -i found.txt -D -M -F eth0
Alive: 2001:67c:238:1::2 [ICMP echo-reply]
Alive: 2001:67c:238:1::a [ICMP echo-reply]
Alive: 2001:67c:238:1::b [22/TCP ACK]
Alive: 2001:67c:238:3::1 [22/TCP ACK]
Alive: 2001:67c:238:300::1 [ICMP echo-reply]
Alive: 2001:67c:2e8:10::1 [ICMP echo-reply]
Alive: 2001:67c:2e8:10::1:1 [ICMP parameter problem]
Alive: 2001:67c:2e8:10::1:2 [ICMP echo-reply]
Alive: 2001:67c:2e8:101::1 [ICMP echo-reply]
Alive: 2001:67c:2e8:101::1:2 [ICMP echo-reply]
Alive: 2001:67c:2e8:13::14 [22/TCP SYN-ACK]
...
Scanned 553212 addresses and found 671 systems alive
```

Nice maps possible too …




IP
v6

all tools at **www.thc.org/thc-ipv6**

Contact

Marc Heuse


+49 (0)177 961 15 60


+49 (0)30 37 30 97 26


mh@mh-sec.de


www.mh-sec.de


winsstrasse 68
d-10405 berlin

Picture Credits

- Potpourri – sxc.hu/profile/saflora
- The end is near – furiousideas.deviantart.com
- Dam – sxc.hu/profile/linder6580
- Broken brick – www.sxc.hu/profile/guitargoa
- Magician – mrpunto @ Flickr
- Flash Hero – Maggie Osterberg @ Flickr
- Admin – astragony @ Flickr
- Nerd – pitadel @ Flickr

End