Recent advances in IPv6 insecurities

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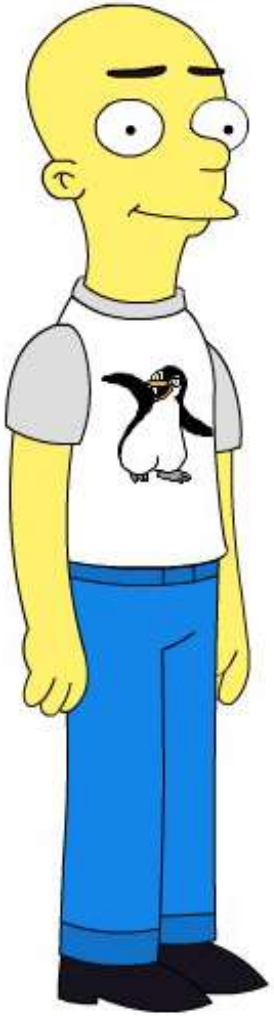
Tel Aviv 2011

Hello, my name is



Who has already

- heard my previous talk?
- played with IPv6?
- IPv6 at home?
- IPv6 at the office/university?

Episode 2

"In a distant future ...
IPv6 will come.
Maybe.
Hopefully never!"

The future is here already

Let’s start with the basics

IPv4

4 octets

4.294.967.296 addresses

192.168.1.1

IPv6

16 octets

340.282.366.920.938.463.463.374
.607.431.768.211.456 addresses

2a01:2b3:4:a::1

Separated by colons

Leading zeros are omitted

2a01:2b3:4:a::1

2 octets each, hexadecimal

The longest chain of :0:0: is replaced with ::

Subnets are /64

4.294.967.296 x the size of the Internet!

No broadcasts

Multicasts, but they are local only

Features!

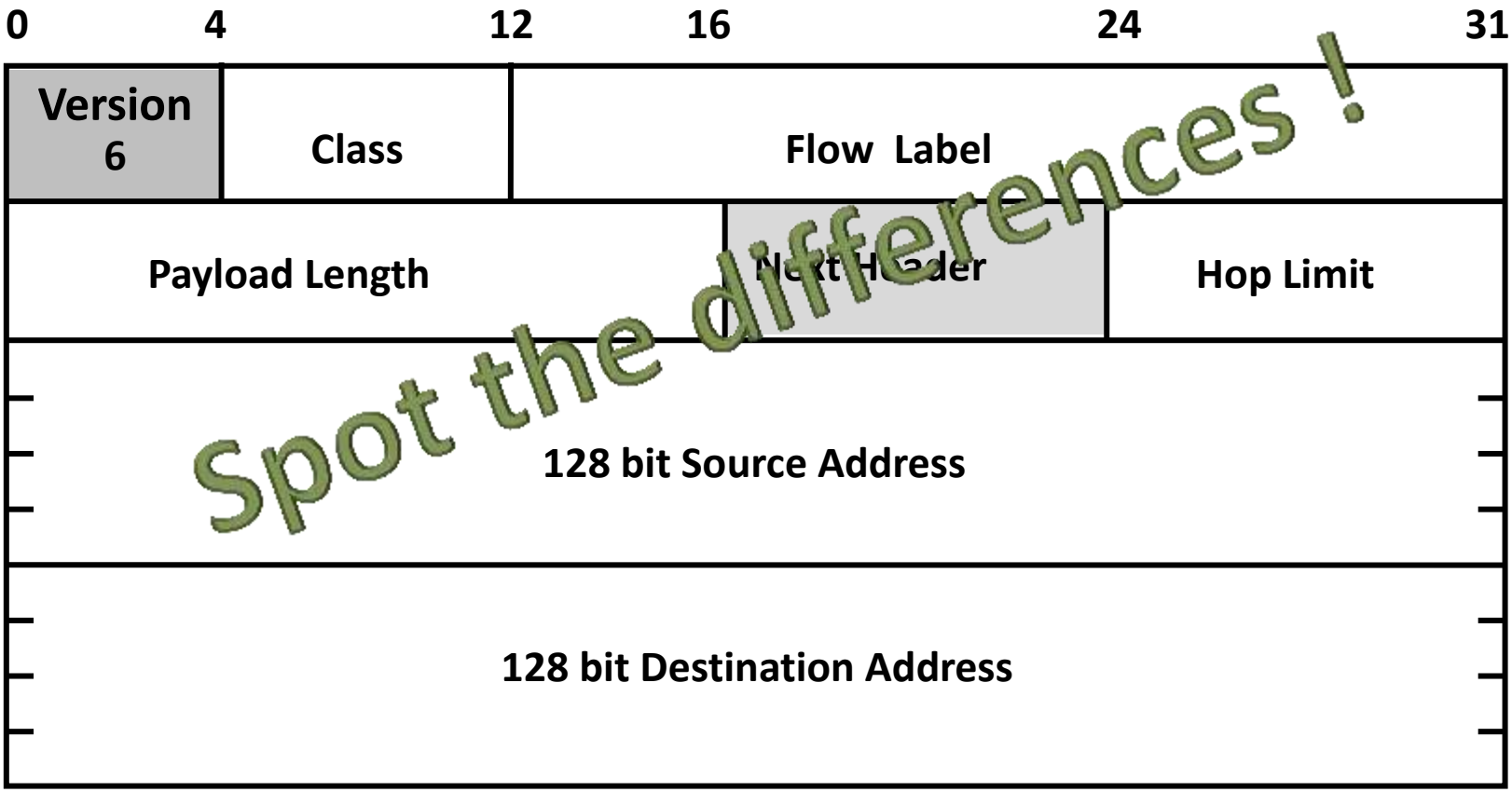
Autoconfiguration

IPSEC

Mobility

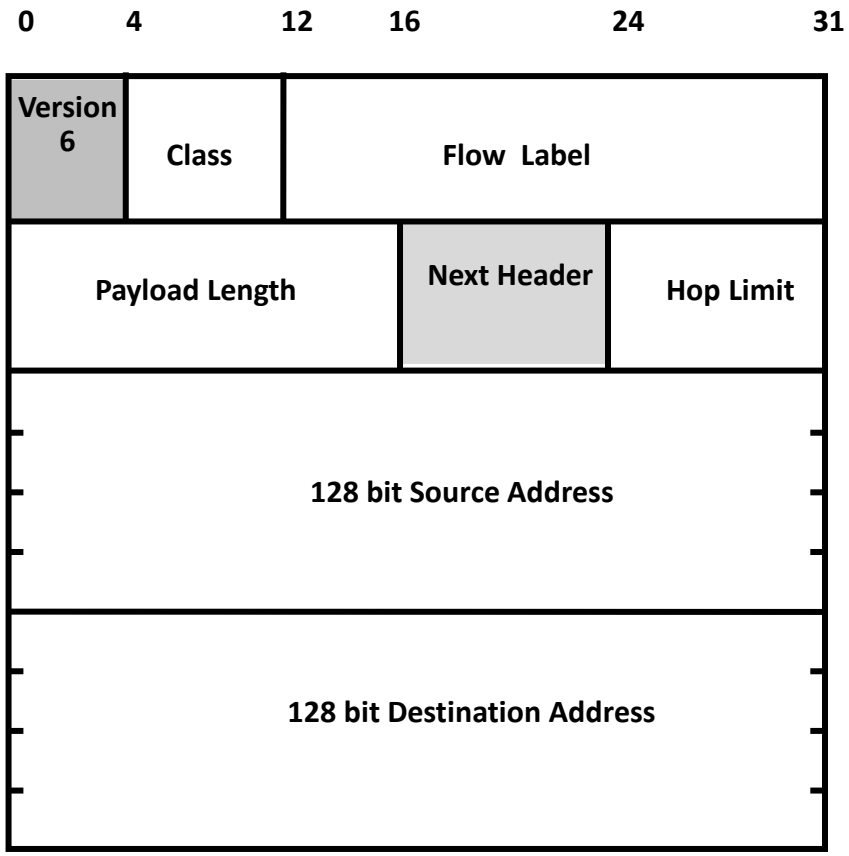
Enough addresses!

IPv6 header layout



Spot the differences !

IPv6 header layout



- No header length
- No identification
- No checksum
- No fragmentation
- No options

Every option is an extension header

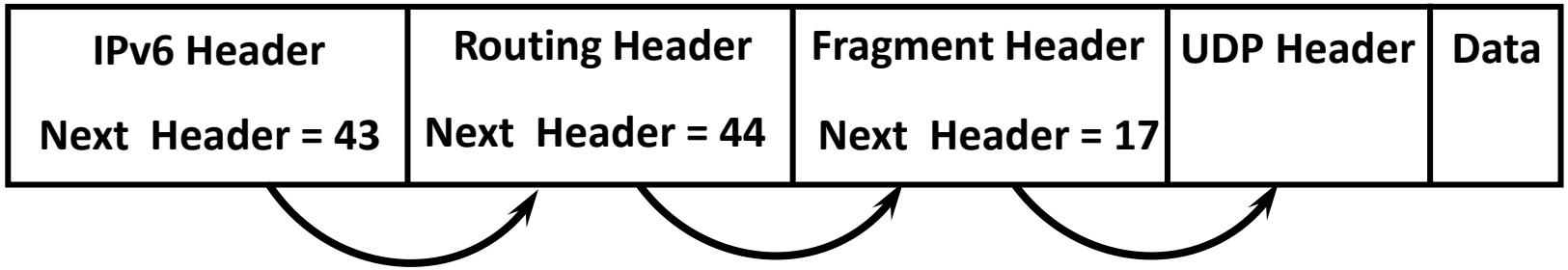
Fragmentation

Source routing

IPSEC

Destination Options

…


IPv6 Header
Next Header = 43
Routing Header
Next Header = 44
Fragment Header
Next Header = 17
UDP Header
Data

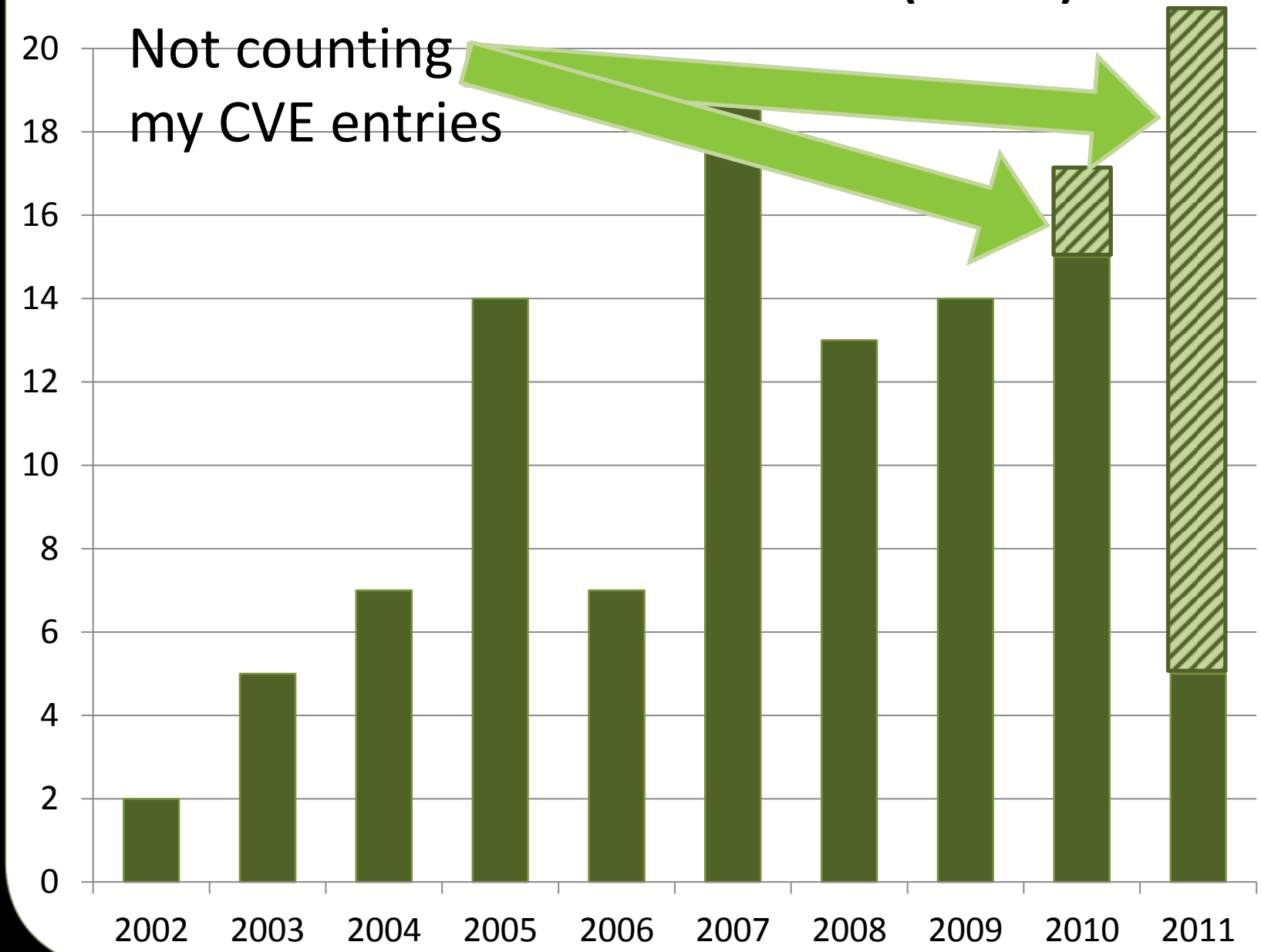
IPv6 is much simpler than IPv4

… in theory.

<rant>

</rant>

IPv6 Vulnerabilities (CVE)




Kids, in 2005 ...

The THC-IPv6 Attack Toolkit

ARP Spoofing => ND spoofing

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

parasite6:
Answers to every NS, claims to be every system on the LAN ☺

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

Duplicate Address Detection DOS

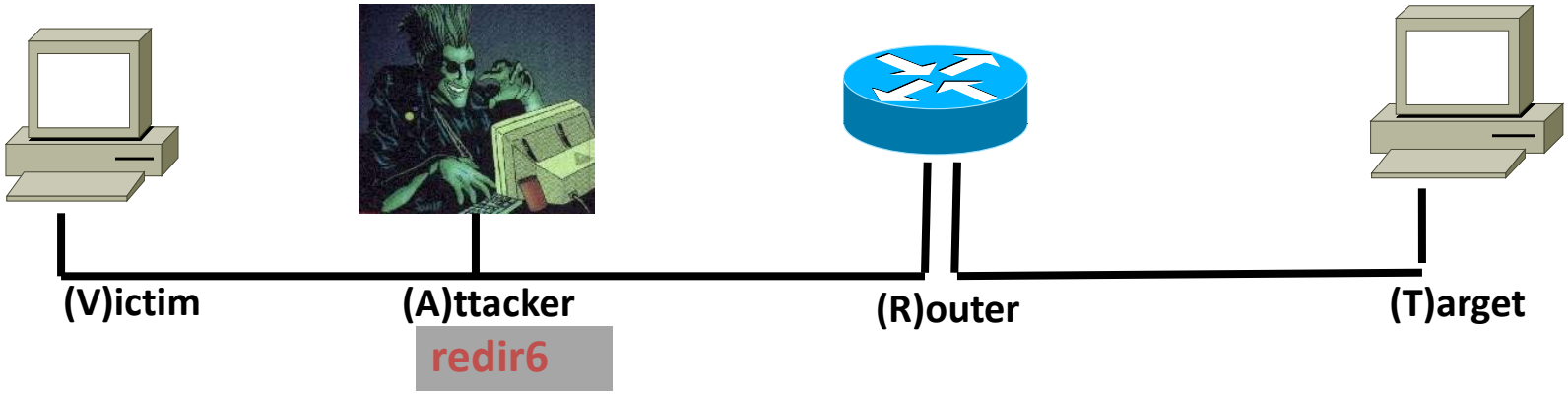
1. NS:
   ICMP Type = 135
   Src = :: (unspecified)
   Dst = All-Nodes Mulitcast Address
   query= Who-has IP A?

dos-new-ipv6:
Answer to every NS, claim to be every system on the LAN ☺

2.
No reply if nobody owns the IP address.

MITM with Redirects

MITM with Redirects



DHCP => Autoconfiguration

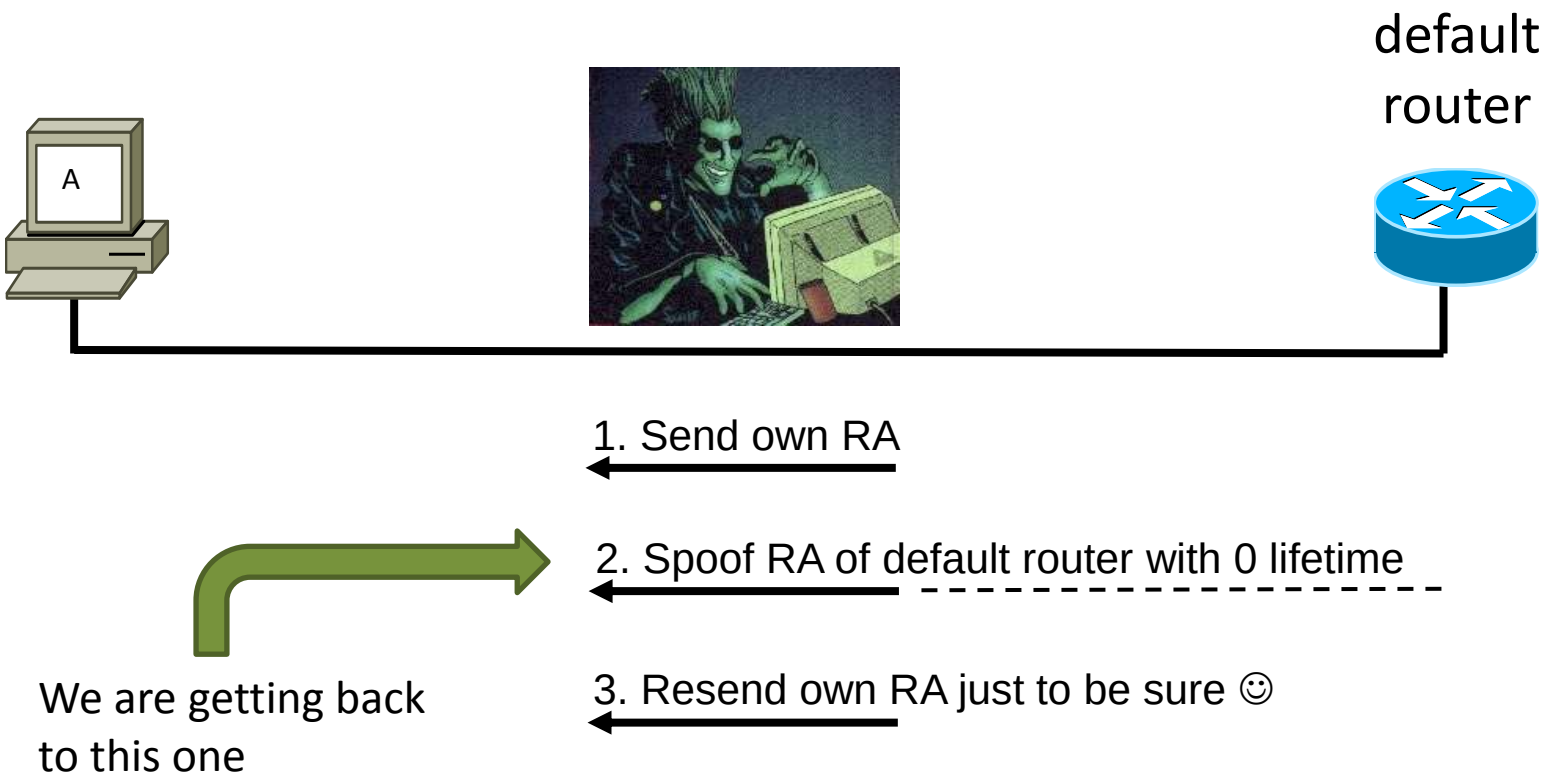
1. RS:
   ICMP Type = 133
   Src = ::
   Dst = FF02::2
   query= please send RA

fake_router6:
Sets any IP as default router, defines network prefixes and DNS servers ☺

2. RA:
   ICMP Type = 134
   Src = Router Link-local Address
   Dst = FF02::1
   Data= options, prefix, lifetime, autoconfig flag, DNS

new and improved!

Kick the default router!



RA => Systems become dual stack

- Can be port scanned on IPv6
  - No filtering on IPv6? Full port access
- Prefer IPv6
  - Will use your tunnel / MITM

How about announcing remote network addresses local?

(Paypal, …)

RA flooding!

Cisco ASA/PIX, Cisco IOS

Netscreen ScreenOS

Windows 2008, 2003, 7, Vista, XP

FreeBSD

old Linux

more… ?

Cisco:

Fixes for IOS and ASA available (CSCti24526 , CSCti33534)

Microsoft

“We consider this issue to be by design. [and will not fix this]“

Even Apple got this problem right!

flood_router6 eth0

Microsoft, Juniper urged to patch dangerous IPv6 DoS hole

Despite growing pressure from security experts, Microsoft and Juniper have so far refused to patch a dangerous hole that can freeze a Windows network in minutes.

By Julie Bort, Network World
May 03, 2011 05:26 PM ET

1 Comment Print

Security experts are urging Microsoft and Juniper to patch a year-old IPv6 vulnerability so dangerous it can freeze any Windows machine on a LAN in a matter of minutes.

Microsoft has downplayed the risk because the hole requires a physical connection to the wired LAN. Juniper says it has delayed a patch because the hole only affects a small number of its products and it wants the IETF to fix the protocol instead.

SEE IT YOURSELF: How to use a known IPv6 hole to fast-freeze a Windows network

The vulnerability was initially discovered in July 2010 by Marc Heuse, an IT security consultant in Berlin. He found that products from several vendors were vulnerable, including all recent versions of Windows, Cisco routers, Linux and Juniper's Netscreen. Cisco issued a patch in October 2010, and the Linux kernel has since been fixed as well. Microsoft and Juniper have acknowledged the vulnerability, but neither have committed to patches.

The hole is in a technology known as

Source: http://www.networkworld.com/news/2011/050311-microsoft-juniper-ipv6.html

“Remote alive scans (ping scans) as we know them are unfeasible on IPv6”

some jerk

(OK, that was me in 2005)

How to identify remote systems?

~~Broadcasts~~

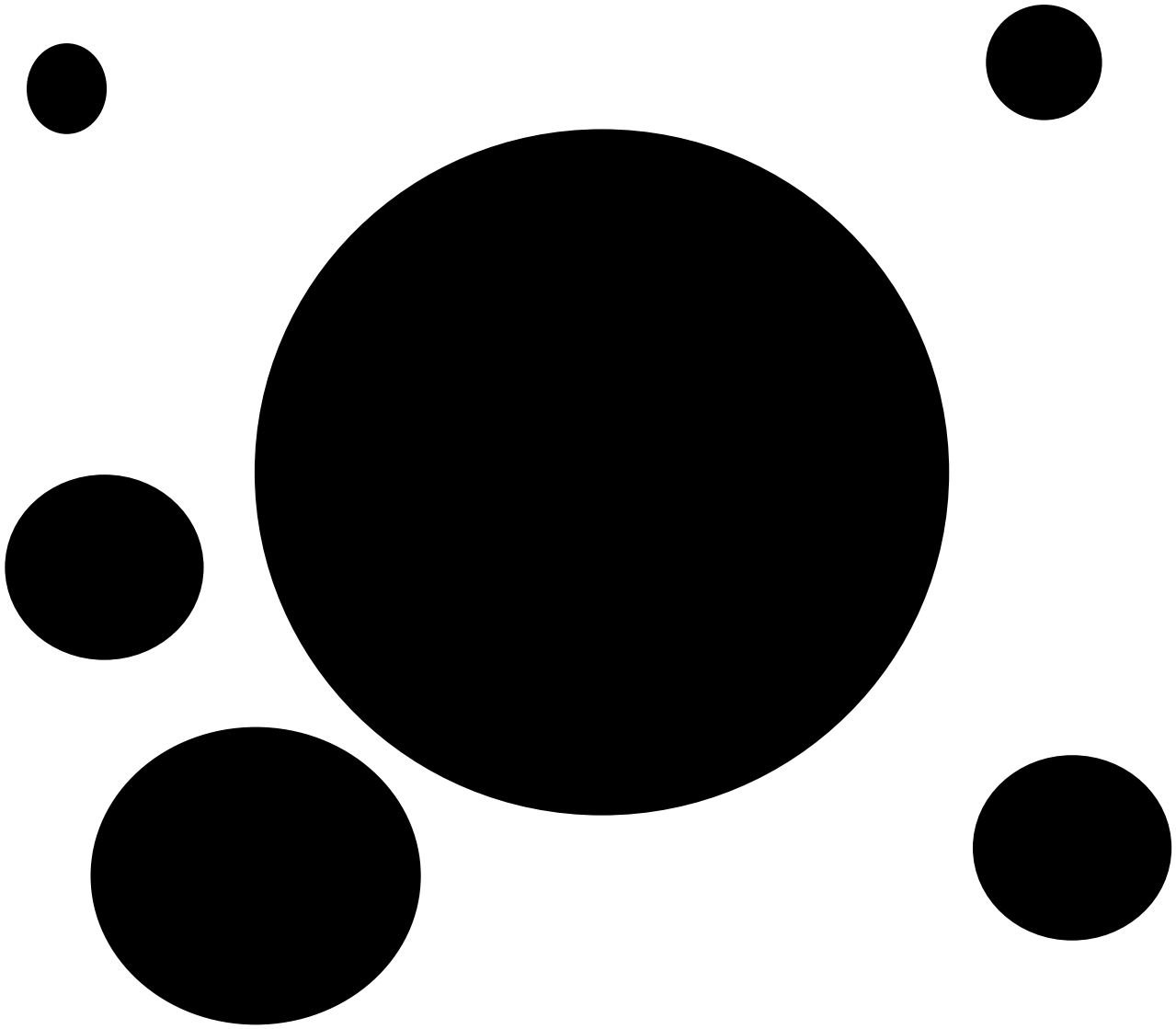
~~Scan the whole range~~

Search-engines / databases

DNS

Combining them

Common addresses



Search Engines

Dumped various IPv6 directories

↓

17.000 possible domains & subdomains identified

DNS

17.000 domains
bruteforcing 3217 hostnames

↓

23.334 DNS entries found
(2.011 unique hostnames)

DNS Results

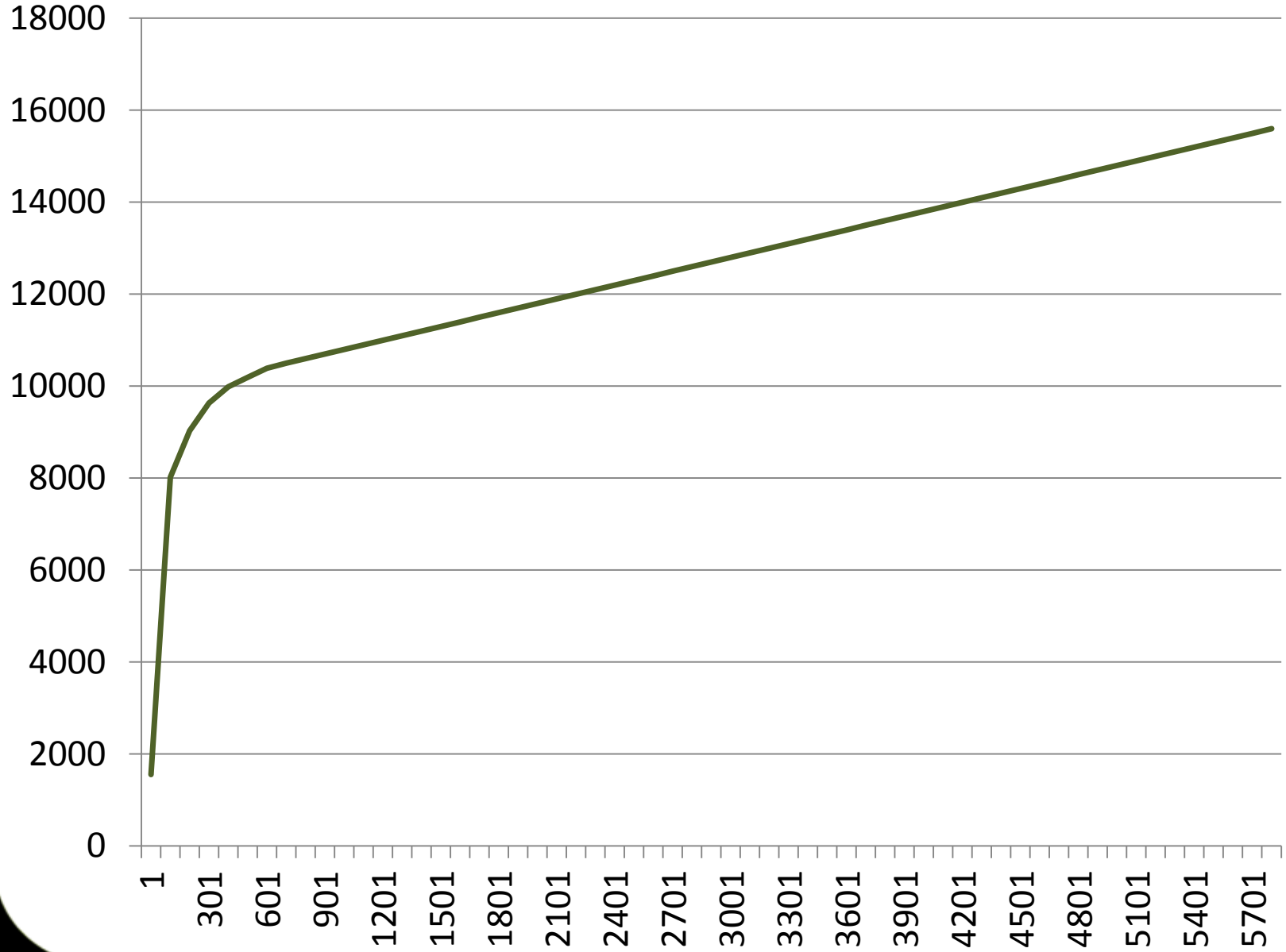
15.607 unique IPv6 addresses found

↓

7.305 networks

5.811 unique host addresses

IPv6 Host Addresses



Host address analysis

Autoconfiguration

- MAC address ⇒ ~24 bit key space per vendorID
- Privacy option ⇒ bad luck
- Fixed random ⇒ bad luck

by hand

- Pattern ⇒ got one, got all
- Random ⇒ bad luck

DHCP

- Sequential
- Got one, got all
- Usually easy to find

by hand

::1, ::2, ::3, …

::service_port

::1:service_port, ::2:service_port, …

::service_port:1, ::service_port:2, …

The IPv4 address

Funny stuff (::b00b:babe, etc.)

etc.

DHCP

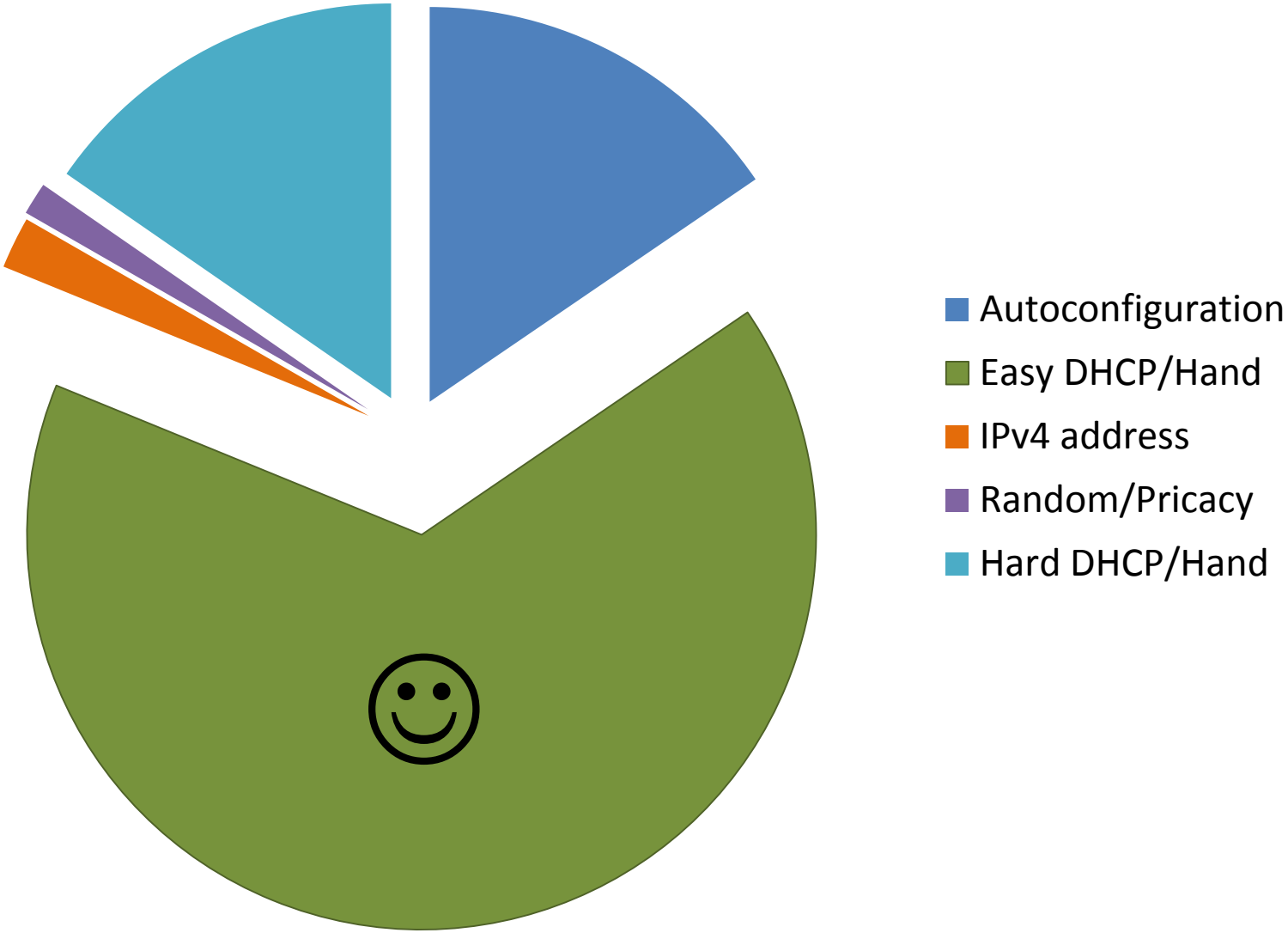
::1000-2000

::100-200

::1:0-1000

::1:1000-2000

IPv6 Host Address Distribution



Alive Scanning

7.305 networks
bruteforcing 3000 host addresses

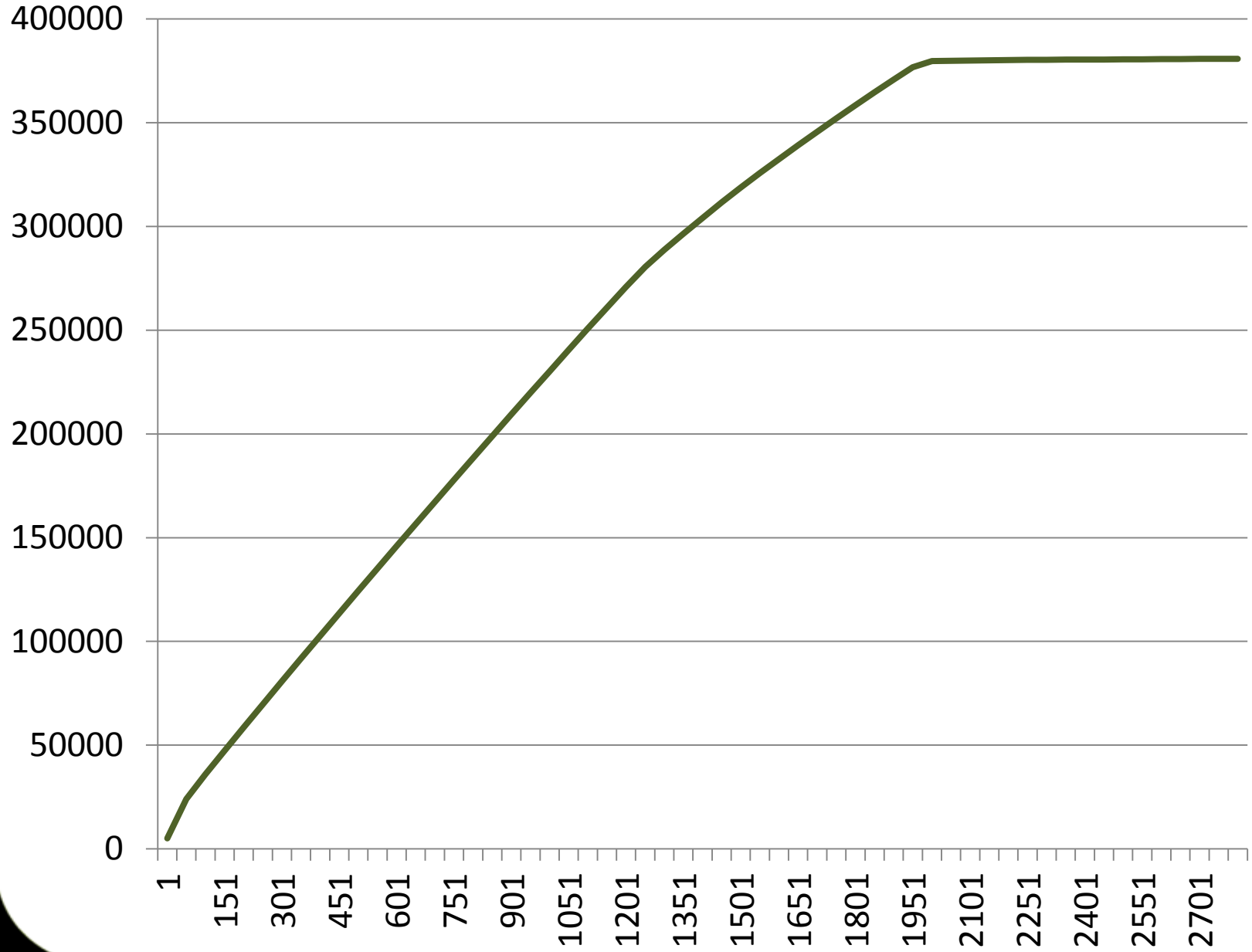
↓

380.766 alive systems

↓

8.160 networks
2.779 unique host addresses

Alive Host Addresses



Alive Scanning

380.776 alive systems

↓

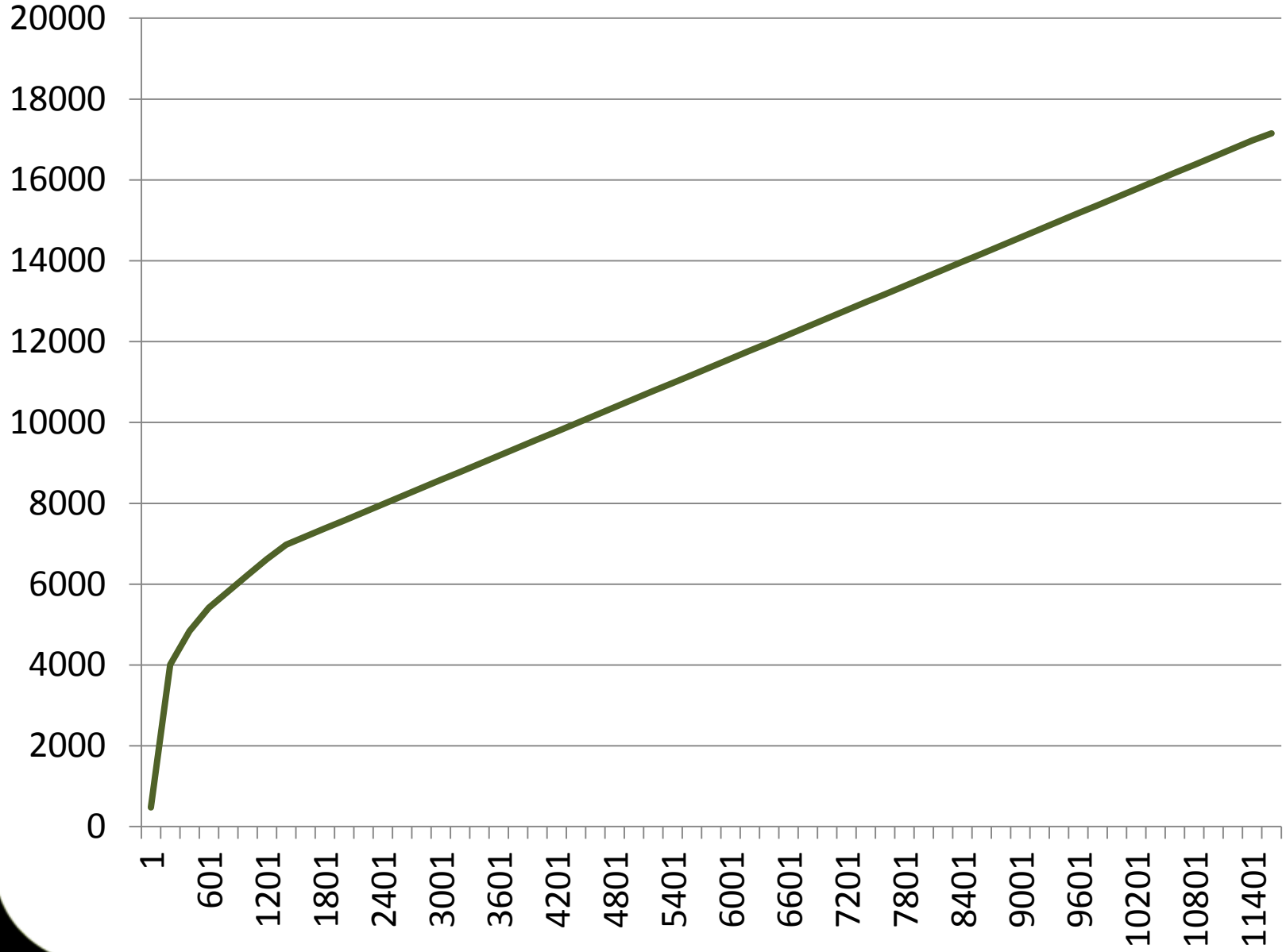
17.154 reverse DNS entries

↓

5.357 unique domains

11.578 unique hostnames

DNS Reverse Hostnames



```
do {
  new_dns=dns_brute(new_alive);
  new_alive=alive_brute(new_dns);
} while (new_dns || new_alive)
```

Conclusion

DNS bruteforcing: 90% of systems in DNS with 1900 words

Conclusion

Alive bruteforcing: 66% of systems with 2000 addresses

scanned in 1-20 seconds

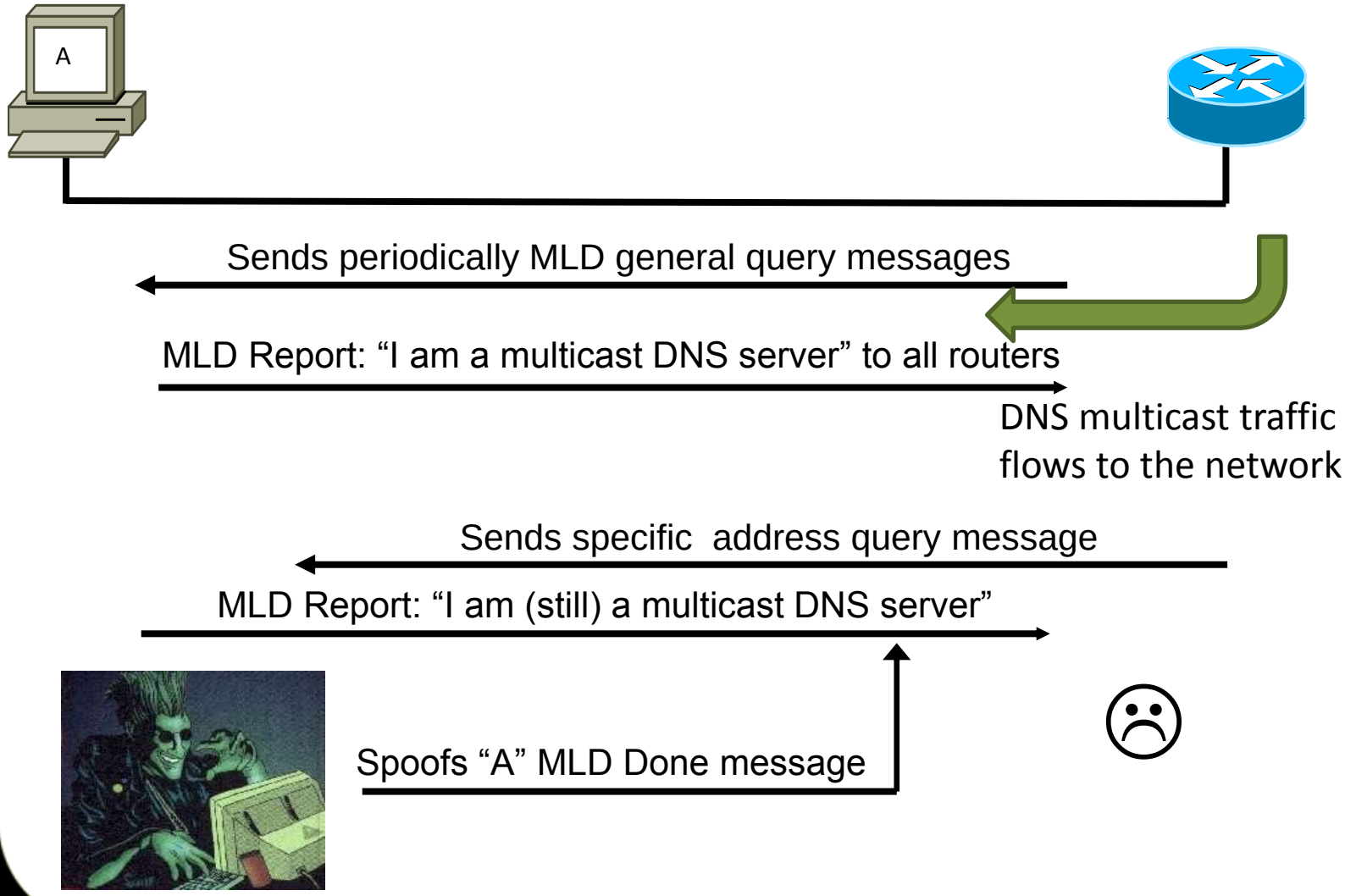
Conclusion

Combined (and use of brain)
~90-95% of **servers** are found

THERE IS MORE!

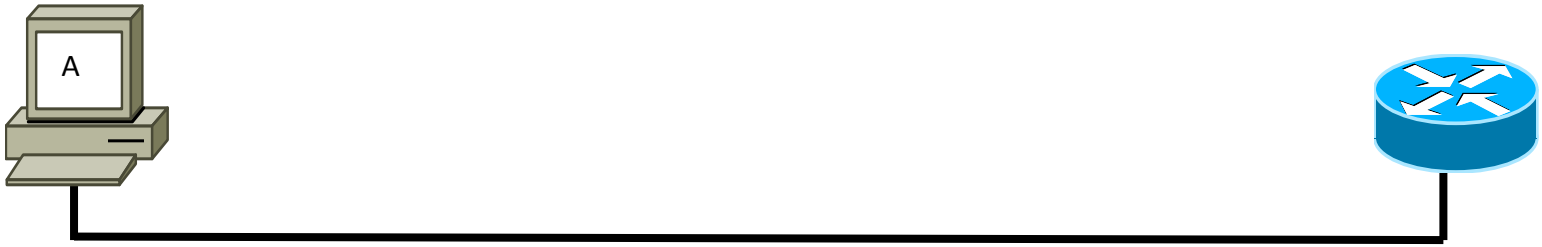
Taking over the Multicast Listener Discovery Protocol for fun and denying multicast traffic

How does MLD work?



First we want to become the MLD query router

```
if (router1 < router2)
   master(router1);
```



Sends periodically MLD general query messages

MLD Report: “I am a multicast DNS server” to all routers

DNS multicast traffic flows to the network

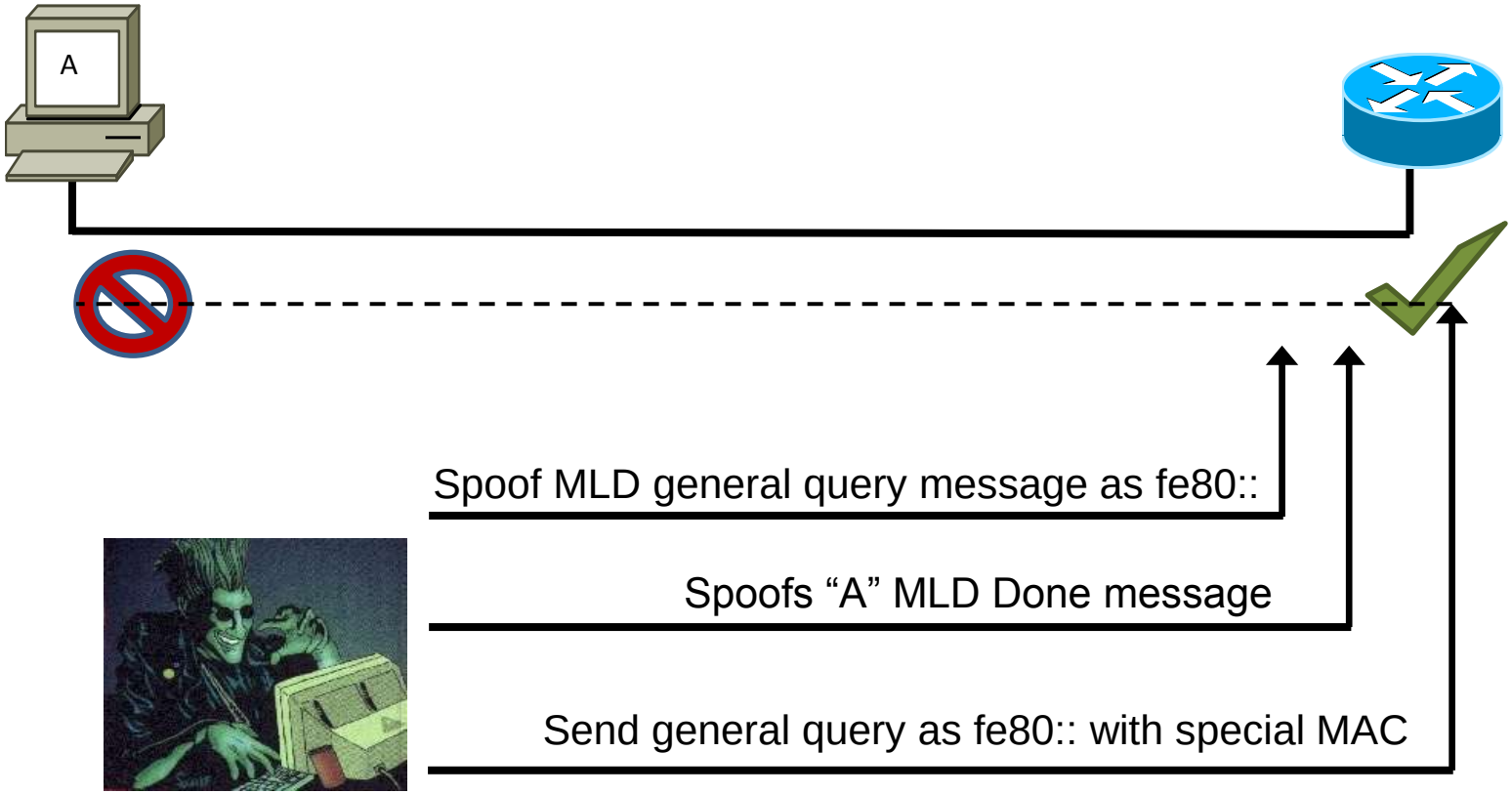
Spoofs MLD general query message as fe80::

Spoofs “A” MLD Done message

Problem: We must send an MLD general query message regularly

Solution:

Spoof query message with multicast all-router MAC address!


A
Spoof MLD general query message as fe80::
Spoofs “A” MLD Done message
Send general query as fe80:: with special MAC

☺


Anybody sniffing?

Send a ping to the target with an unused multicast MAC address

(Windows, Linux, FreeBSD, more?)

Side channels in IPv6?

IPv6 **is** a side channel.

Help?


SeND


RA
Guard

Don’t be scared.

IPv6

complex

intellectual challenge

tired … ?

be an explorer!

1PvB

Volnz!

Join researching IPv6!

How to get IPv6 to your home (1/4)

1. Create an account at Sixxs: http://www.sixxs.net/
2. Request tunnel (static if possible for you, heartbeat otherwise)
3. Request a subnet (a week later)

How to get IPv6 to your home (2/4)

4. a) Configure a static tunnel:

```
ip tunnel add sixxs mode sit local [Your IPv4 Endpoint] remote [Sixxs IPv4 Endpoint]
ip link set sixxs up
ip link set mtu 1280 dev sixxs
ip tunnel change sixxs ttl 64
ip -6 addr add [Your IPv6 Endpoint]/[Prefix Length] dev sixxs
ip -6 ro add default via [Your IPv6 endpoint] dev sixxs
```

How to get IPv6 to your home (3/4)

4. b) Configure a heartbeat tunnel:

a) Install aiccu

b) Configure aiccu.conf:

```
username xxxx-SIXXS
password xxxxxxxxx
tunnel_id T<your tunnel id>
daemonize true
automatic true
ipv6_interface sixxs
```

c) Start aiccu

How to get IPv6 to your home (4/4)

5. Configure your local network card

```
ip -6 addr add [Your IPv6
subnet]::1/[Prefix Length] dev eth0
```

6. Use fake_router6 for your local subnet:

```
fake_router6 eth0 <Your IPv6
subnet>::/<Prefix Length>
2a01:4f8:100:2283::2
```

What is new in thc-ipv6 since the 2005-2007 release?

- DNS6 bruteforcer
- More payloads for fake_router6
- Implementation test-case tool
- Fast traceroute6
- Fuzzer for IPv6
- Flood tools for RA and NA
- Several library bugfixes & enhancements

What is new in the current thc-ipv6 source state?

- alive6 rewritten with 250% new functionality
- Flood & spoofing for all multicast protocols
- DHCPs6 spoofer
- DHCPc6 flooder
- DNS6 spoofer
- … more new tools than fit the slide
- Enhancements for all previous tools
- Several library bugfixes & enhancements

How to get access to the current thc-ipv6 source code state?

Send in patches and new tools!

Small and limited updates will still get into the public version.

Complete public release in ~2011.

http://www.thc.org/thc-ipv6

Central information resource for IPv6 security (wiki, forum, news):

www.ipv6security.info
www.ipv6hacking.info

(Online end of June 2011)

Contact

Send an email to vh@thc.org

(add “antispam” to the subject line)

ThC nEwZ

Tel Aviv THC release

- Hydra v6.3 is available
- New:
  - SMTP user enumeration module
  - Oracle SID enumeration module
  - Oracle login module
  - Bugfixess ☺

http://www.thc.org/thc-hydra

Shameless plug

- Join the THC t-shirt contest!

http://www.thc.org/thc-contest

Thanks!

And have fun exploring IPv6!

☺

End