SECURITY IN AN IPv6 WORLD
MYTH & REALITY

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WHO AM I?

- “DO” Director @ Internet Society
- CO ISOC Founding Chair
- NANOG PC
- RMv6TF Board
- NANOG-BCOP Founder & Chair
- IPv6 Author (Juniper Day One Books)
- IETF Contributor (Homenet)

- Past: ARIN, UPnP, DLNA, CEA…

THIS TALK…

- Aims to debunk the most common IPv6 security myths
- Is NOT a comprehensive look at IPv6 security practices

Let's get to busting

SOME MYTHS…

MYTH:
I'M NOT RUNNING IPV6, I DON'T HAVE TO WORRY

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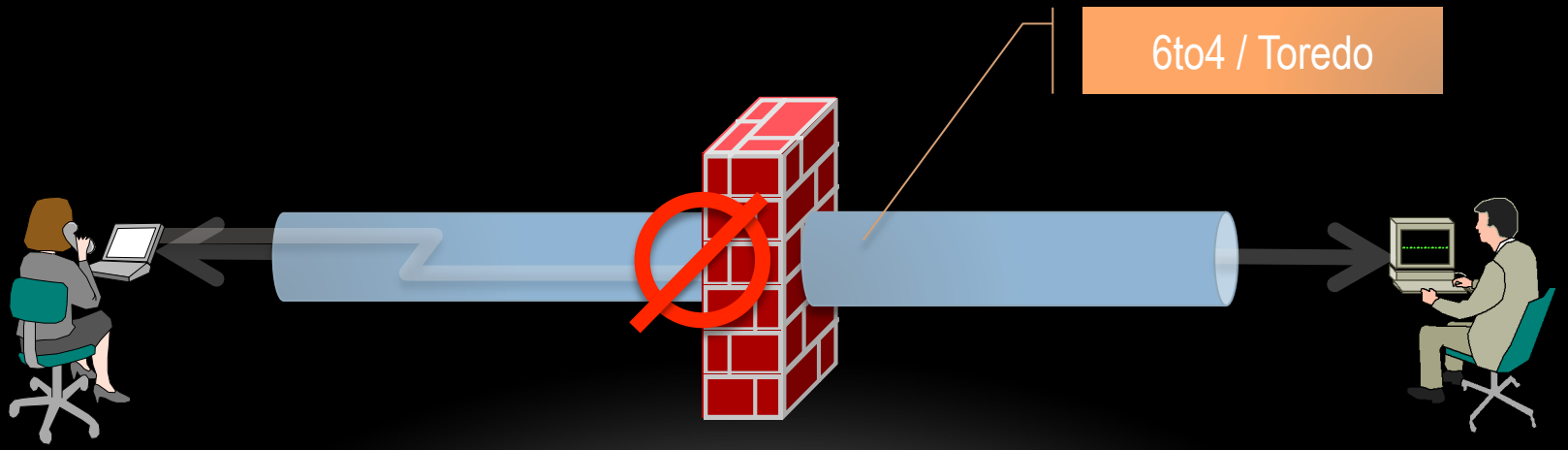
REALITY:
YOUR APPLICATIONS ARE USING IPV6 ALREADY

- Linux, Mac OS X, BSD, and Microsoft Vista/Windows 7 systems all come with IPv6 capability, some even have IPv6 enabled by default (IPv6 preferred)
  - They may try to use IPv6 first and then fall-back to IPv4
- If you are not protecting your IPv6 nodes then you have just allowed a huge back-door to exist!

MYTH:
I'M NOT RUNNING IPV6, I DON'T HAVE TO WORRY

REALITY:
YOUR USERS ARE USING IPV6 ALREADY



MYTH:
IPV6 HAS SECURITY DESIGNED IN

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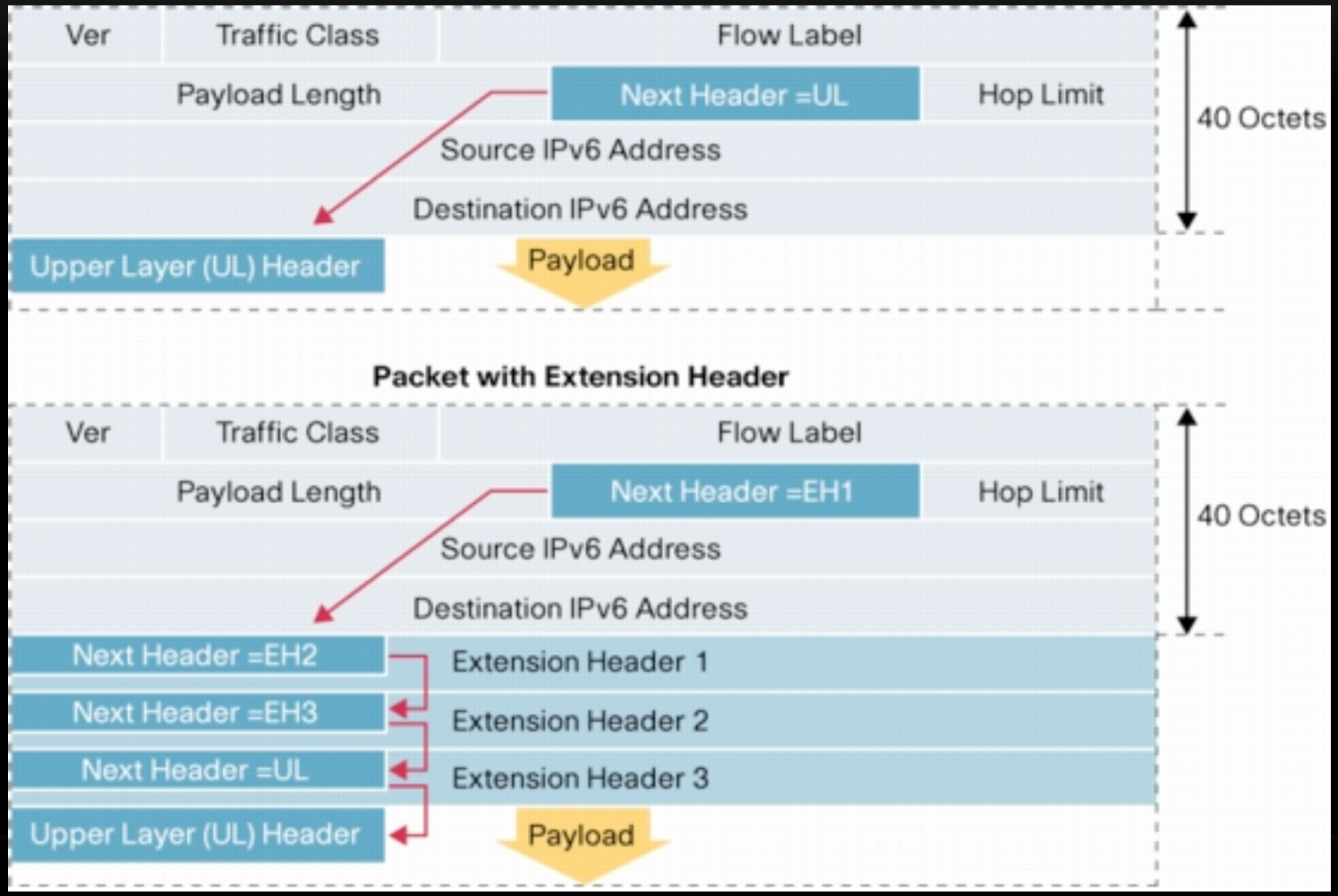
REALITY:
IPSEC IS NOT NEW

- IPsec exists for IPv4
- IPsec mandates in IPv6 are no guarantee of security

MYTH:
IPV6 HAS SECURITY DESIGNED IN

REALITY:
IPV6 WAS DESIGNED 15-20 YEARS AGO

REALITY: EXTENSION HEADERS



http://www.cisco.com/en/US/technologies/tk648/tk872/technologies_white_paper0900aecd8054d37d.html

MYTH:
IPV6 HAS SECURITY DESIGNED IN

REALITY:

- Routing Header Type 0 (RH0) – Source Routing
  - Deprecated in RFC 5095:

The functionality provided by IPv6's Type 0 Routing Header can be exploited in order to achieve traffic amplification over a remote path for the purposes of generating denial-of-service traffic.

MYTH:
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REALITY:

- Hop-by-Hop Options Header
  - Vulnerable to low bandwidth DOS attacks
  - Threat detailed in draft-krishnan-ipv6-hopbyhop

MYTH:
IPV6 HAS SECURITY DESIGNED IN

REALITY:

- Extension Headers are vulnerable in general
  - Large extension headers
  - Lots of extension headers
  - Invalid extension headers

MYTH:
IPV6 HAS SECURITY DESIGNED IN

REALITY:

- Rogue Router Advertisements (RAs)
  - Can renumber hosts
  - Can launch a Man In The Middle attack
  - Problem documented in RFC 6104

In this document, we summarise the scenarios in which rogue RAs may be observed and present a list of possible solutions to the problem.

MYTH:
IPV6 HAS SECURITY DESIGNED IN

REALITY:

- Forged Neighbor Discovery messages
- ICMP Redirects – just like IPv4 redirects

MYTH:
IPV6 HAS SECURITY DESIGNED IN

REALITY:
MANY ATTACKS ARE ABOVE OR BELOW IP

- Buffer overflows
- SQL Injection
- Cross-site scripting
- E-mail/SPAM (open relays)

MYTH:
NO IPV6 NAT MEANS LESS SECURITY

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REALITY:
STATEFUL FIREWALLS PROVIDE SECURITY

- NAT can actually reduce security

MYTH:
IPV6 NETWORKS ARE TOO BIG TO SCAN

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REALITY:

- SLAAC - EUI-64 addresses (well known OUIs)
  - Tracking!
- DHCPv6 sequential addressing (scan low numbers)
- 6to4, ISATAP, Teredo (well known addresses)
- Manual configured addresses (scan low numbers, vanity addresses)
- Exploiting a local node
  - ff02::1 - all nodes on the local network segment
  - IPv6 Node Information Queries (RFC 4620)
  - Neighbor discovery
    - Leveraging IPv4 (Metasploit Framework "ipv6_neighbor")
- IPv6 addresses leaked out by application-layer protocols (email)

MYTH:
IPV6 NETWORKS ARE TOO BIG TO SCAN

REALITY:
PRIVACY ADDRESSES (RFC 4941)

- Privacy addresses use MD5 hash on EUI-64 and random number
- Often temporary – rotate addresses
  - Frequency varies
  - Often paired with dynamic DNS (firewall state updates?)
- Makes filtering, troubleshooting, and forensics difficult
- Alternative: Randomized DHCPv6
  - Host: Randomized IIDs
  - Server: Short leases, randomized assignments

MYTH:
IPV6 IS TOO NEW TO BE ATTACKED

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REALITY:
TOOLS ARE ALREADY AVAILABLE

- THC IPv6 Attack Toolkit
- IPv6 port scan tools
- IPv6 packet forgery tools
- IPv6 DoS tools

MYTH:
IPV6 IS TOO NEW TO BE ATTACKED

REALITY:
BUGS AND VULNERABILITIES PUBLISHED

- Vendors
- Open source software

MYTH:
IPV6 IS TOO NEW TO BE ATTACKED

REALITY:
SEARCH FOR "*SECURITYFOCUS.COM INURL:BID IPV6*"

MYTH:
96 MORE BITS, NO MAGIC (IT'S JUST LIKE IPV4)

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REALITY:
IPV6 ADDRESS FORMAT IS DRASTICALLY NEW

- 128 bits vs. 32 bits
- Hex vs. Decimal
- Colon vs. Period
- Multiple possible formats (zero suppression, zero compression)
- Logging, grep, filters, etc.

MYTH:
96 MORE BITS, NO MAGIC (IT'S JUST LIKE IPV4)

REALITY:
MULTIPLE ADDRESSES ON EACH HOST

- Same host appears in logs with different addresses

MYTH:
96 MORE BITS, NO MAGIC (IT'S JUST LIKE IPV4)

REALITY:
SYNTAX CHANGES

- Training!

MYTH:
CONFIGURE IPV6 FILTERS SAME AS IPV4

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REALITY:
DHCPV6 && ND INTRODUCE NUANCE

- Neighbor Discovery uses ICMP
- DHCPv6 message exchange:
  - Solicit: [your link local]:546 -> [ff02::1:2]:547
  - Advertise: [upstream link local]:547 -> [your link local]:546
  - and two more packets, both between your link locals.

REALITY: EXAMPLE FIREWALL FILTER (MIKROTIK)

Flags: X - disabled, I - invalid, D - dynamic

0 ;;; Not just ping - ND runs over icmp6.

chain=input action=accept protocol=icmpv6 in-interface=ether1-gateway

1 chain=input action=accept connection-state=established in-interface=ether1-gateway

2 ;;; related means stuff like FTP-DATA

chain=input action=accept connection-state=related in-interface=ether1-gateway

3 ;;; for DHCP6 advertisement (second packet, first server response)

chain=input action=accept protocol=udp src-address=fe80::/16 dst-address=fe80::/16 in-interface=ether1-gateway dst-port=546

4 ;;; ssh to this box for management (note non standard port)

chain=input action=accept protocol=tcp dst-address=[myaddr]/128 dst-port=2222

5 chain=input action=drop in-interface=ether1-gateway

MYTH:
IT SUPPORTS IPV6

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REALITY:
IT PROBABLY DOESN'T

- Detailed requirements (RFP)
  - RIPE-554
- Lab testing
- Independent/outside verification

MYTH:
THERE ARE NO IPV6 SECURITY BCPS YET

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REALITY:
THERE ARE!

- Perform IPv6 filtering at the perimeter
- Use RFC2827 filtering and Unicast RPF checks throughout the network
- Use manual tunnels (with IPsec whenever possible) instead of dynamic tunnels and deny packets for transition techniques not used
- Use common access-network security measures (NAC/802.1X, disable unused switch ports, Ethernet port security, MACSec/TrustSec) because SEND won't be available any time soon
- Strive to achieve equal protections for IPv6 as with IPv4
- Continue to let vendors know what you expect in terms of IPv6 security features

MYTH:
THERE ARE NO IPV6 SECURITY RESOURCES

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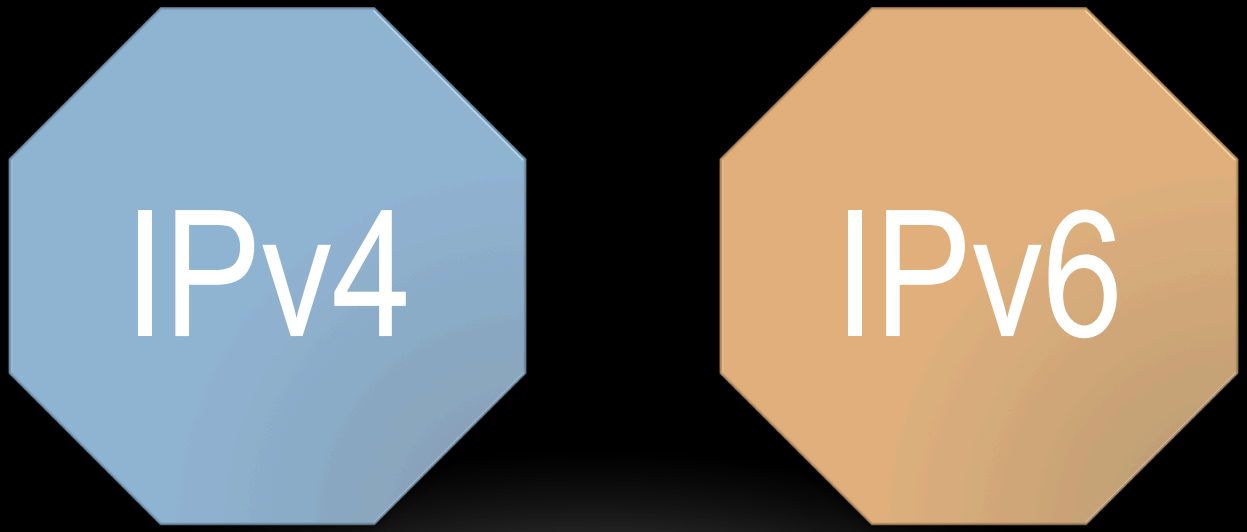
REALITY:
THERE ARE!

- *IPv6 Security*, By Scott Hogg and Eric Vyncke, Cisco Press, 2009
- Guidelines for the Secure Deployment of IPv6 Recommendations of the National Institute of Standards and Technology
- Search engines are your friend!

THE REALITY OF DUAL-STACK

- Two sets of filters
- Two sets of bugs



THANK YOU!

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- Rob Seastrom – For the Mikrotik example
- The Internet – Lots of searching
- You – Thanks for listening!

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