Stop Thinking IPv4

IPv6 is Here

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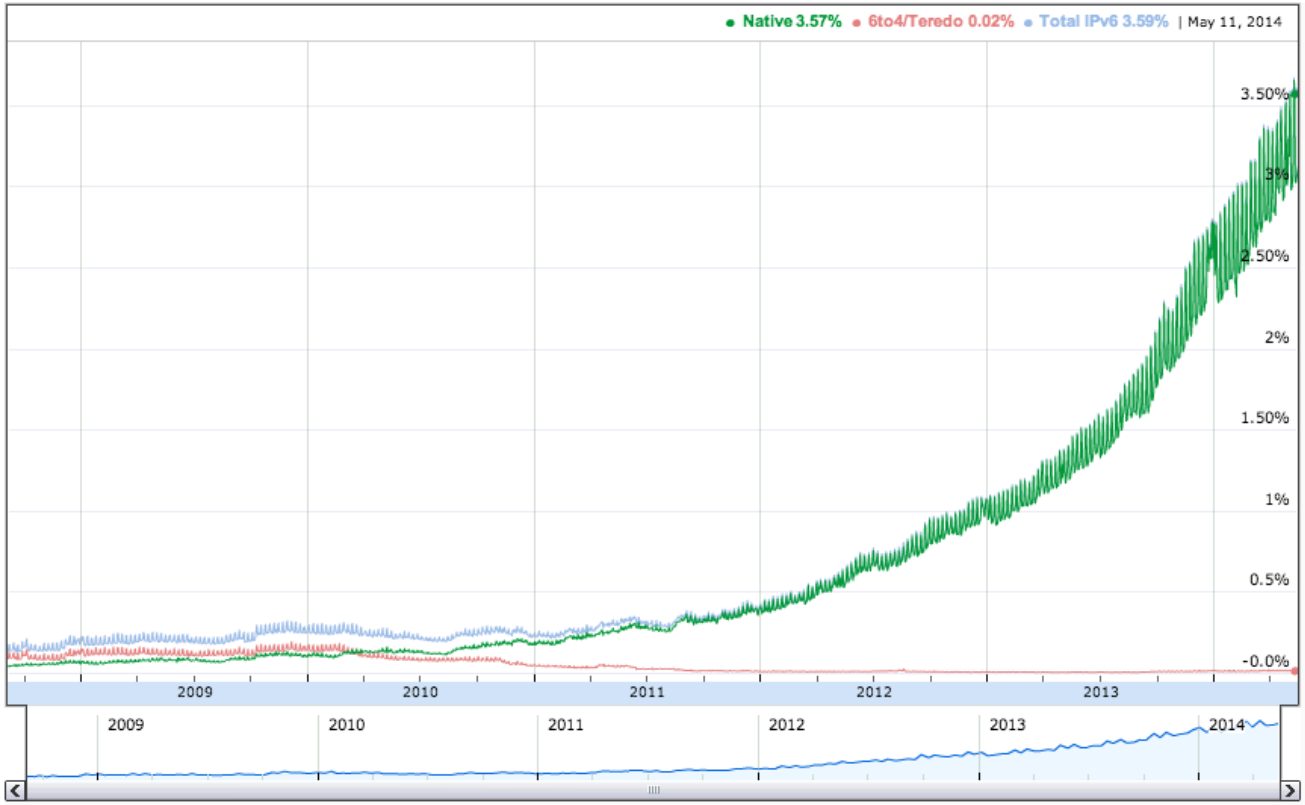
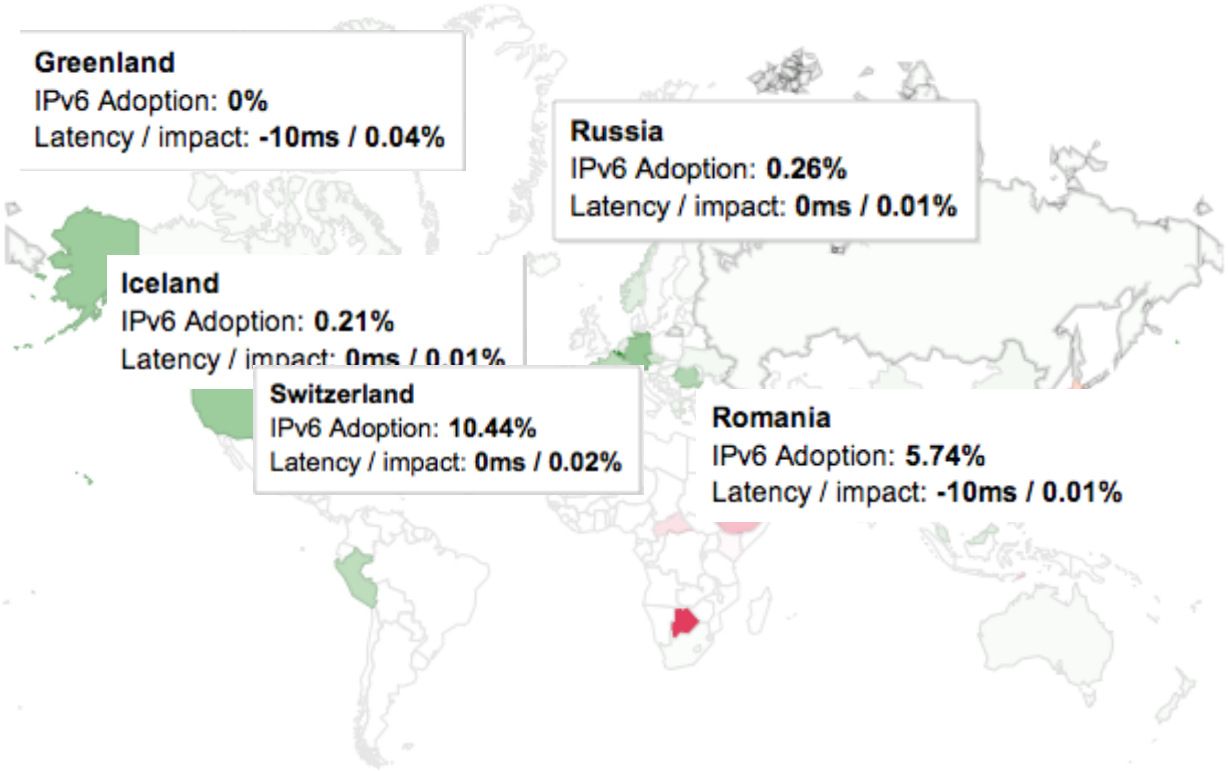
ENOG7, May 2014, Moscow

IPv6 is Already Here...



source: http://www.google.com/intl/en/ipv6/statistics.html

It's Just not Very *Evenly Distributed*



source: http://www.google.com/intl/en/ipv6/statistics.html

This Talk...

- is not about 'to deploy or not to deploy'
- is about 'how to deploy'

"Human Beings Are Great Adaptors" ©
Douglas Adams, HHGTTG

- **IPv4-Style:**
  - IPv6 is live IPv4 but more addresses
- **IPv6-Style:**
  - Scoped Address Architecture
  - Multiple addresses per host
  - Neighbor Discovery Protocol
  - Stateless Address AutoConfiguration
  - Fragmentation at source only
  - ...and other interesting stuff...

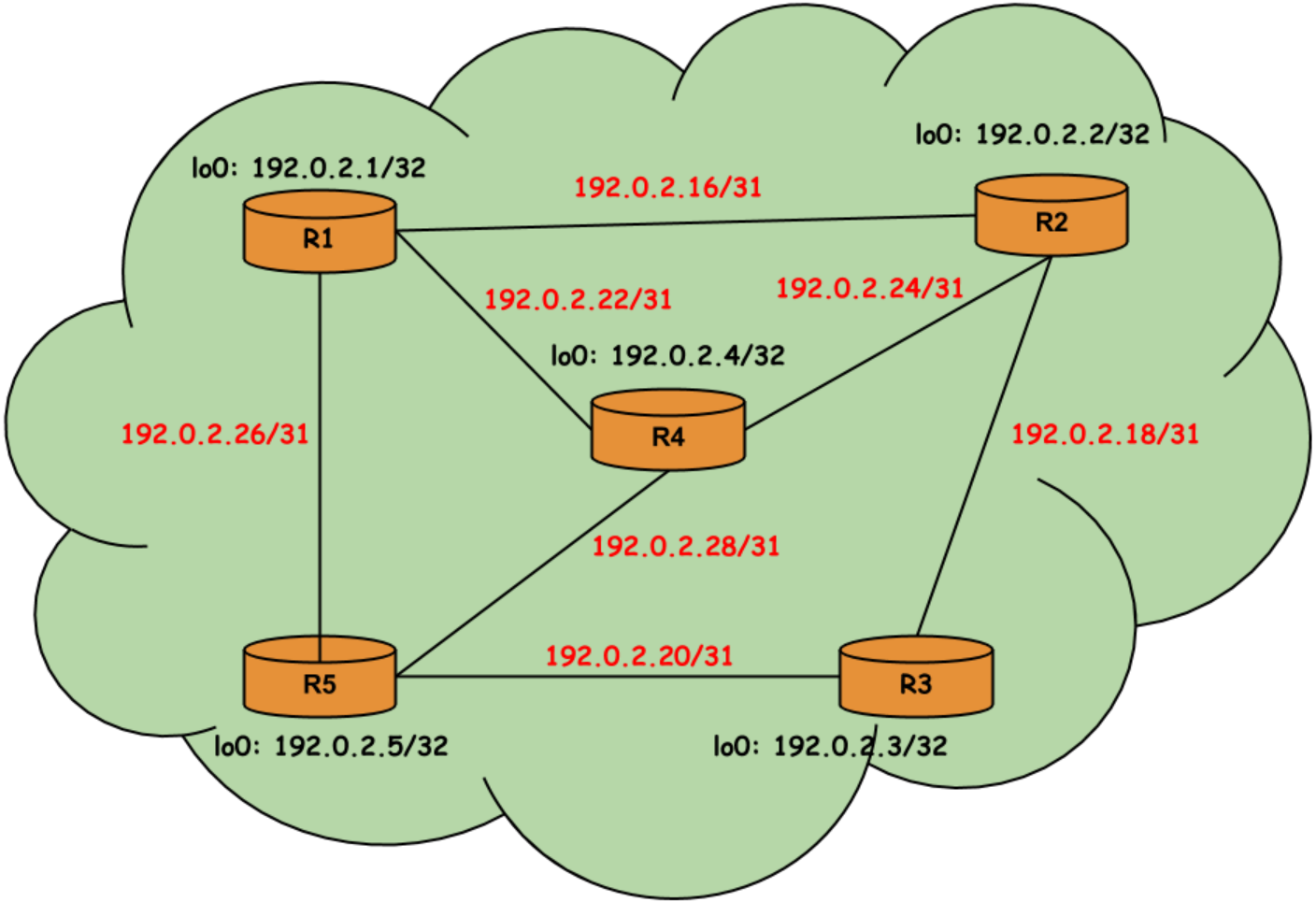
Scoped Address Architecture

- **IPv4-Style:**
  - All addresses are equal
- **IPv6-Style:**
  - Every unicast address has a scope* (encoded into address)
    - Link-local (fe80::/10)
    - ~~site-local**~~
    - global

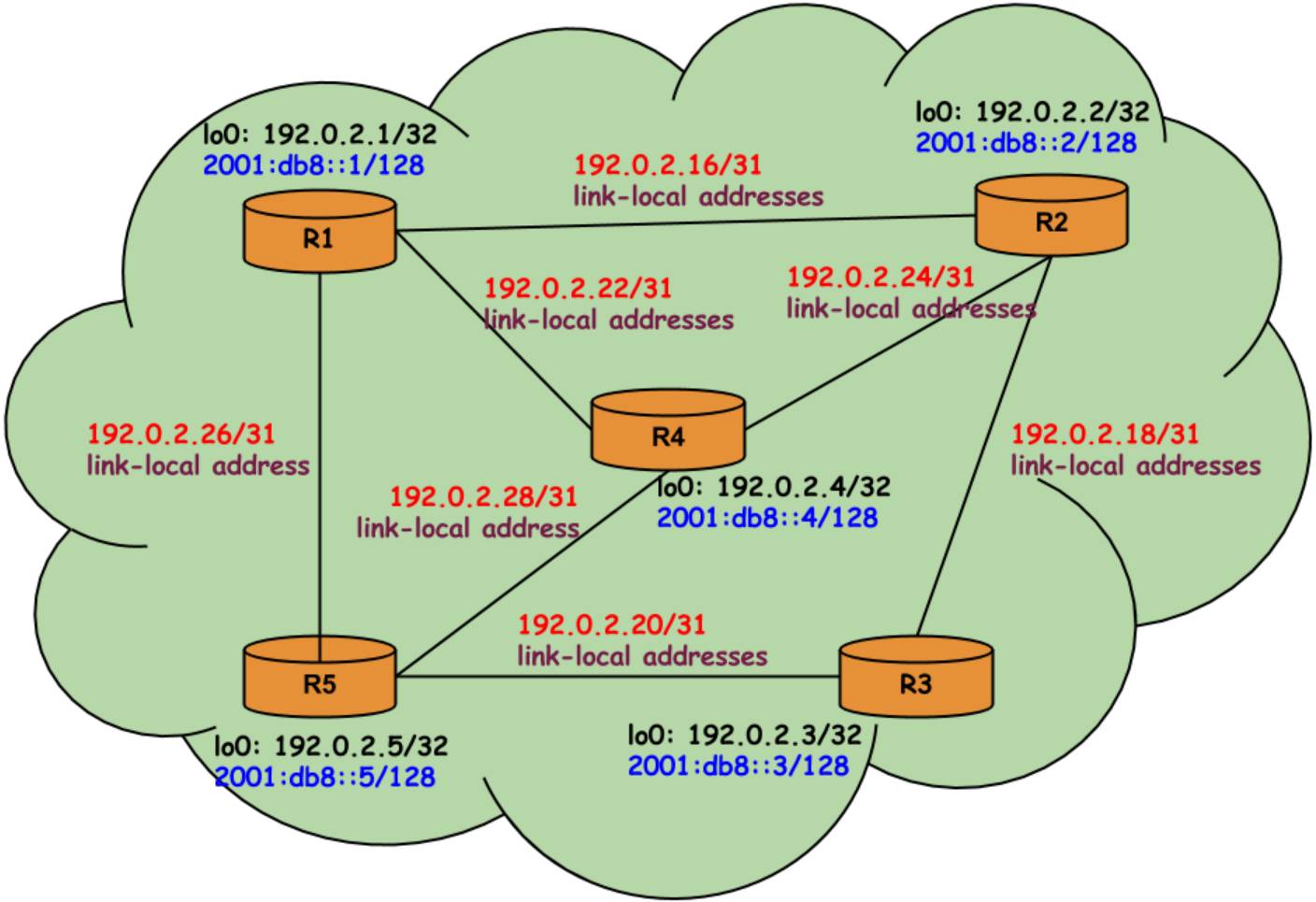
(*) other than unspecified address (::) (**) deprecated

Recommended reading: RFC4007 "IPv6 Scoped Address Architecture"

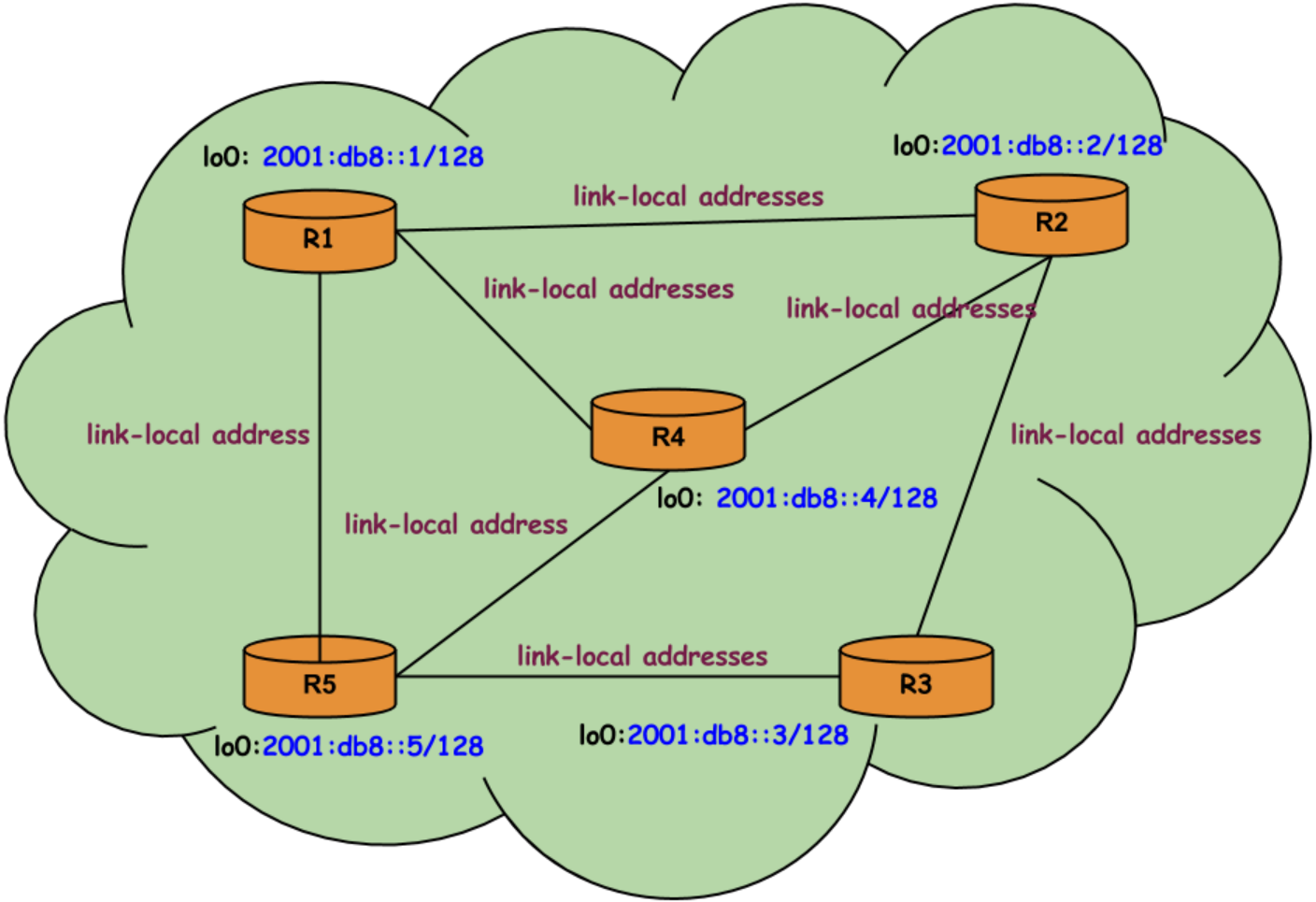
IPv4-Only Network



Dual-Stack Network



IPv6-Only Network



Address Plan

- **IPv4-Style:**
  - How to choose the subnet size? Shall we renumber later?
- **IPv6-Style:**
  - /128 for loopbacks
  - /127 for p2p links
  - /64 for **EVERYTHING ELSE**

"/64 ought to be enough for anybody"

Oh RFC1918, Where Art Thou?

- **IPv4-Style:**
  - I have 10/8, 172.16/12, 192.168/16 + NAT for v4
  - Let's use ULA (fc00:/7) for v6!
- **IPv6-Style:**
  - No NAT!
  - Global Unique Addresses (GUA) everywhere

Takeaway: ULAs are NOT a private space

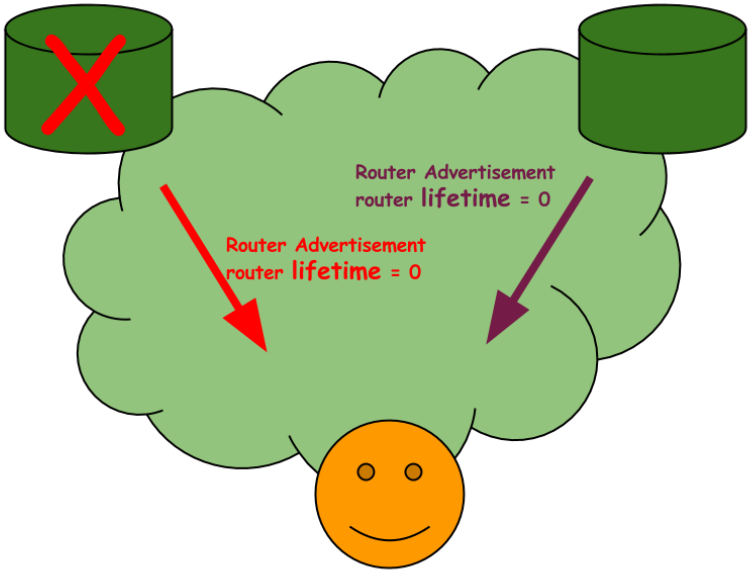
Recommended reading: http://tools.ietf.org/html/draft-ietf-v6ops-ula-usage-recommendations-02

Host Configuration

- **IPv4-Style:**
  - We used DHCP for v4. We want DHCP for v6!
- **IPv6-Style:**
  - Occam's razor: Do you *really* need DHCP?
  - Stateless Address Autoconfiguration (SLAAC)
  - SLAAC is here *anyway*
  - DHCPv6 support is not MANDATORY for hosts
  - RDNSS for configuring DNS information

First Hop Redundancy

- **IPv4-Style:**
  - We used VRRP/HSRP for v4. We want the same for v6!
- **IPv6-Style:**
  - SLAAC is here *anyway*
  - Router Advertisements:
    - do the job



The Host, the Link and the Subnet

- **IPv4-Style:**
  - Address + subnet mask => "on-link prefix"
  - packets to on-link prefix - directly, everything else - via routers

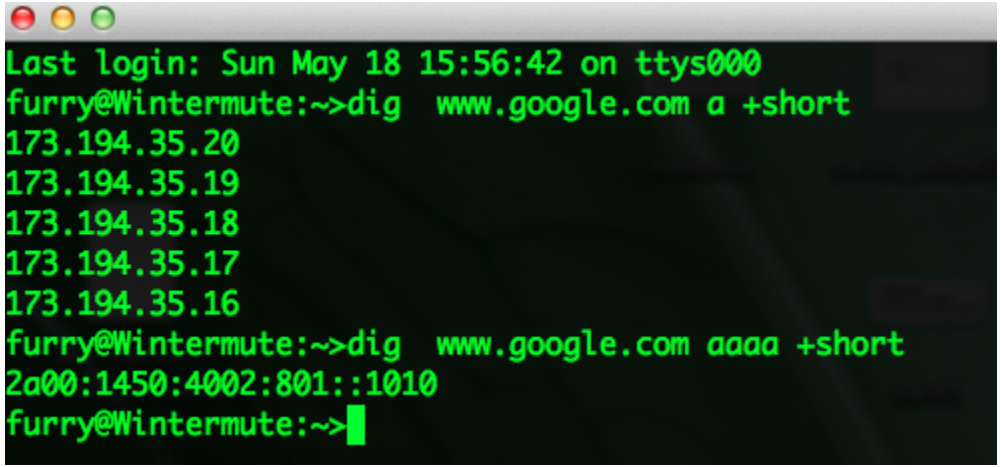
IPv6-Style: on-link determination is separate from the address assignment

- default: only LLA are on-link
- addresses from the same subnet may be off-link
- addresses from another subnet may be on-link

Recommended reading: RFC5942, "IPv6 Subnet Model: The Relationship between Links and Subnet Prefixes"

Dual-Stacking Services: WEB

- **IPv4-Style:**
  - Just replicate IPv4 config
- **IPv6-Style:**
  - Think about broken clients!
  - most stacks try IPv6 first



Dual-Stacking Services: SMTP

- **IPv4-Style:**
  - Just mimic IPv4 approach
- **IPv6-Style:**
  - Number of addresses does matter!
  - It is not about protocol version, it is about anti-spam

Strongly recommended reading:

"Sending and receiving emails over IPv6" article by Franck Martin

http://engineering.linkedin.com/email/sending-and-receiving-emails-over-ipv6

Do We Really Need DUAL-stack?

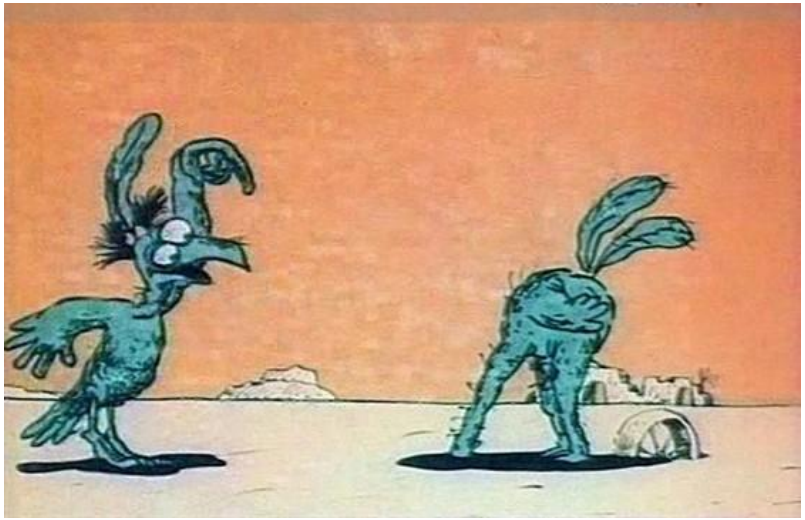
- **IPv4-Style:**
  - Just replicate IPv4 config
- **IPv6-Style:**
  - Why deploy/support/monitor/troubleshoot 2 networks?
  - IPv6-only may be an option
  - NAT64 (MAP-T, MAP-E etc)

Recommended reading: "The Case for IPv6-Only Data Centers" by Tore Anderson

https://ripe64.ripe.net/presentations/67-20120417-RIPE64-The_Case_for_IPv6_Only_Data_Centres.pdf

Security

- **IPv4-Style:**
  - no IPv6 - no problem!
- **IPv6-Style:**
  - if you won't come to IPv6 then IPv6 must come to you!



You don't have IPv6 enabled... Are you sure?

Security (contd.)

- **IPv4-Style:**
  - Just replicate IPv4 configs
- **IPv6-Style:**
  - Some IPv4 problems are addressed in IPv6
  - IPv6 introduces new functionality
  - New functionality might be misused

Some Examples: Firewall Filters

- **IPv4-Style:**
  - Copy IPv4 ACLs, replace v4 addresses with v6
- **IPv6-Style:**
  - Remember about link-local addresses
  - Remember about extension headers
  - IPv6 header might be pretty long: how deep can you hw look into packets?

References

- "IPv6 for IPv4 Experts" book by Yar Tikhiy
  - https://sites.google.com/site/yartikhiy/home/ipv6book
- RFC5942, "IPv6 Subnet Model: The Relationship between Links and Subnet Prefixes"
- RFC4007 "IPv6 Scoped Address Architecture"
  - http://tools.ietf.org/html/draft-ietf-v6ops-ula-usage-recommendations-02
- "Sending and receiving emails over IPv6" article by Franck Martin
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- "The Case for IPv6-Only Data Centers" by Tore Anderson
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Have You

Enabled IPv6?