TAPPING THE BENEFITS OF IPV6
Opportunities and Obstacles

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Akamai's Goals in IPv6

Help customers with a smooth transition

- Enable customers to make IPv6 content available to users
- Maintain or improve performance & reliability
- Deliver content from nearby dual-stack servers
- Provide opt-in control to customers

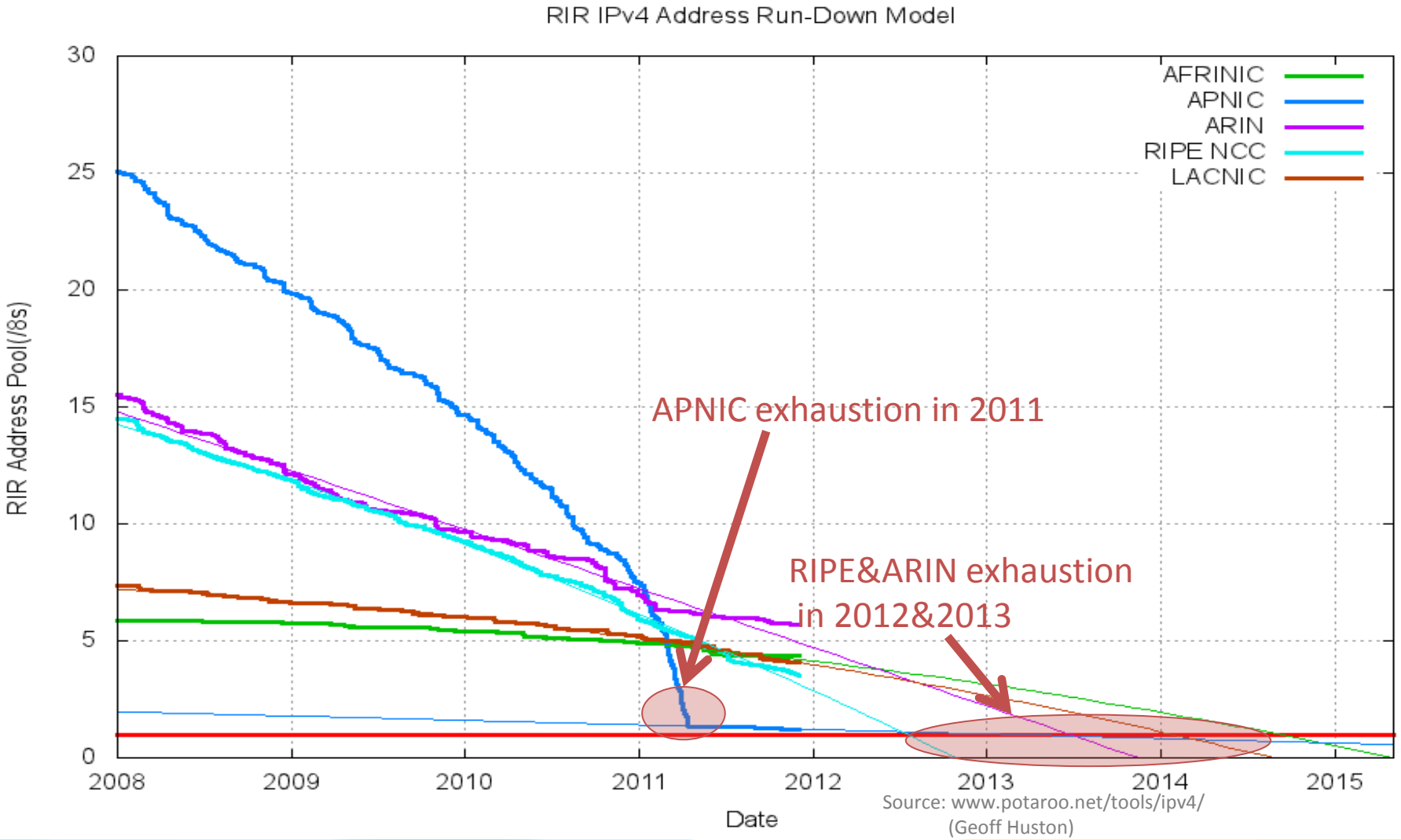
Help IPv6 transition: make more IPv6 content available

Any experience. Any device. Anywhere.

Agenda

- The Opportunity of IPv6
- The Transition and Obstacles
- Akamai's Approach to a Smooth Transition
- Lessons Learned

Why we are here…



Source: www.potaroo.net/tools/ipv4/
(Geoff Huston)

IPv6 and 128-bit address: Problem Solved!

Allocate an entire IPv4 address space per second and you will run out in ….

10^{21} years

~100 billion times the age of the universe

Opportunities

Near Term: The Plumbing

- System builders (hw/sw): good IPv6 support & fast IPv6/IPv4 fallback is a differentiator
- Content providers: without IPv6, pockets of end-users (for instance in some mobile networks) may not be able to view your content.
- For service providers (hosting, cloud): IPv6 stack will be demanded by customers.

Medium Term: The Flattening

- Direct addressability will remove many ugly NAT structures
- Enables better for device-to-device connections without relays
- But firewalls will still remain…
- IP instead of specialized protocols (e.g. auto controls)?

Long Term: The Cyber and Physical worlds "merge"

- With IPv6, every physical object can have a unique name: an IPv6 address
- Connected sensors everywhere: roadways, bolts, paint, crops
- Of course, addressability is only part of the problem of connectivity…

But before that, *The Transition…*

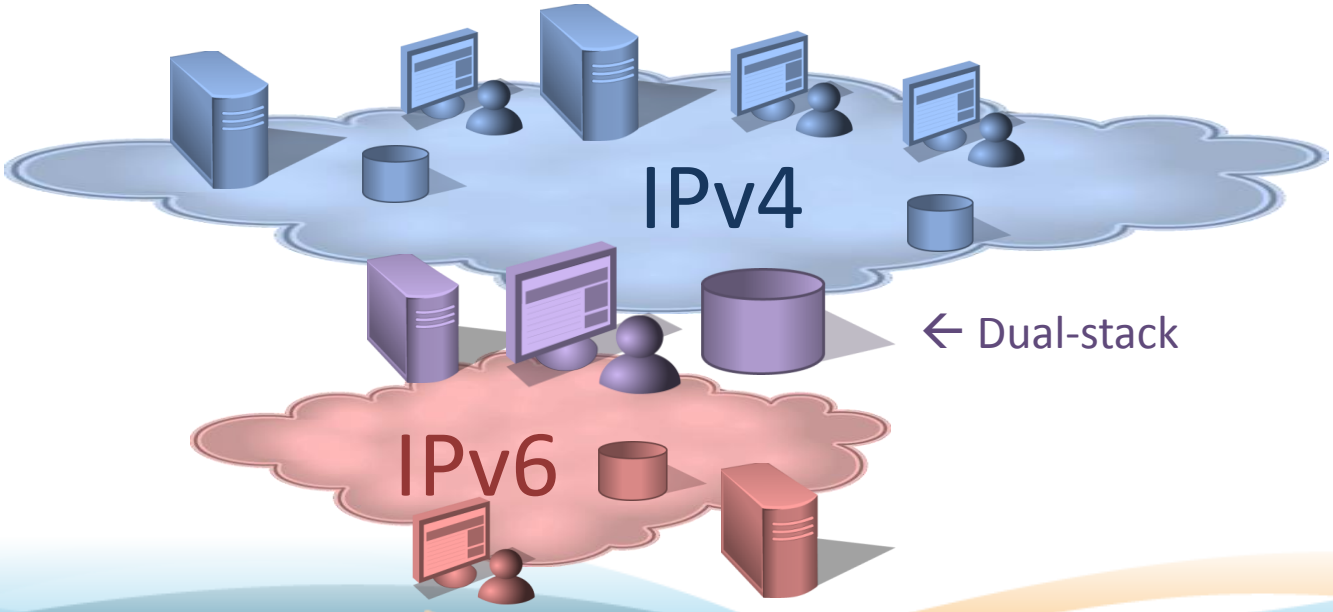
The Transition: how does IPv6 relate to IPv4?

No direct compatibility, so effectively two Internets

Many hosts and devices will live on both *("dual-stack")*

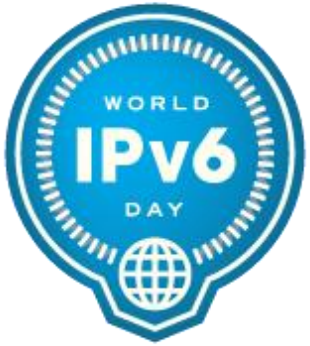
- *Dual-stack devices with have **both** IPv4 and IPv6 addresses*

NAT technologies can adapt IPv6 to IPv4 (e.g., NAT64)



The Transition: Major IPv6 Milestones

June 2011: World IPv6 Day: test drive



June 2012: World IPv6 Launch

- Focused on eyeballs and CPE devices
- 400x more requests than 2011

September 2012: US Govt sites must be IPv6-available

The Transition: Long and Bumpy

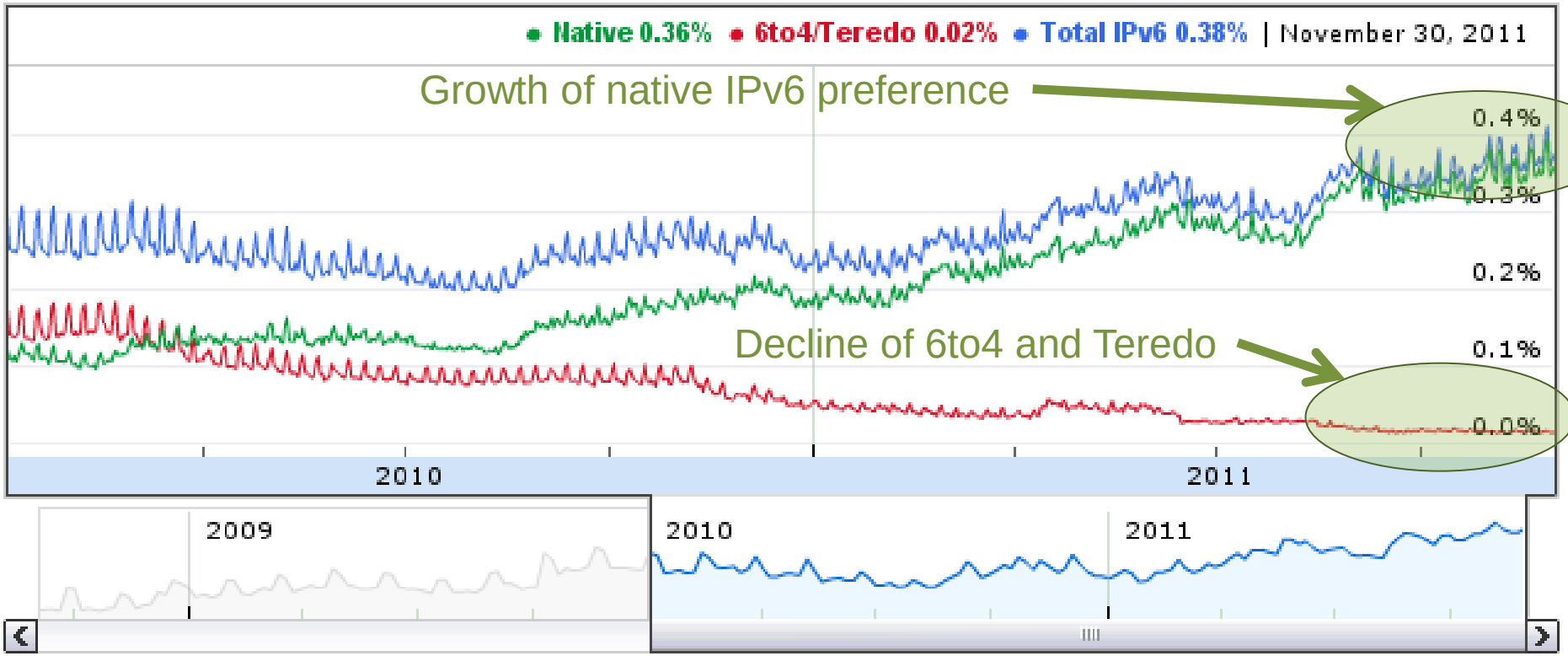
Probably will last a decade or more (?)

- First IPv6 spec in 1995, first public allocation in 1999
- Current adoption still pretty low (graphs on next slide)

End Users will Experience Problems During Transition

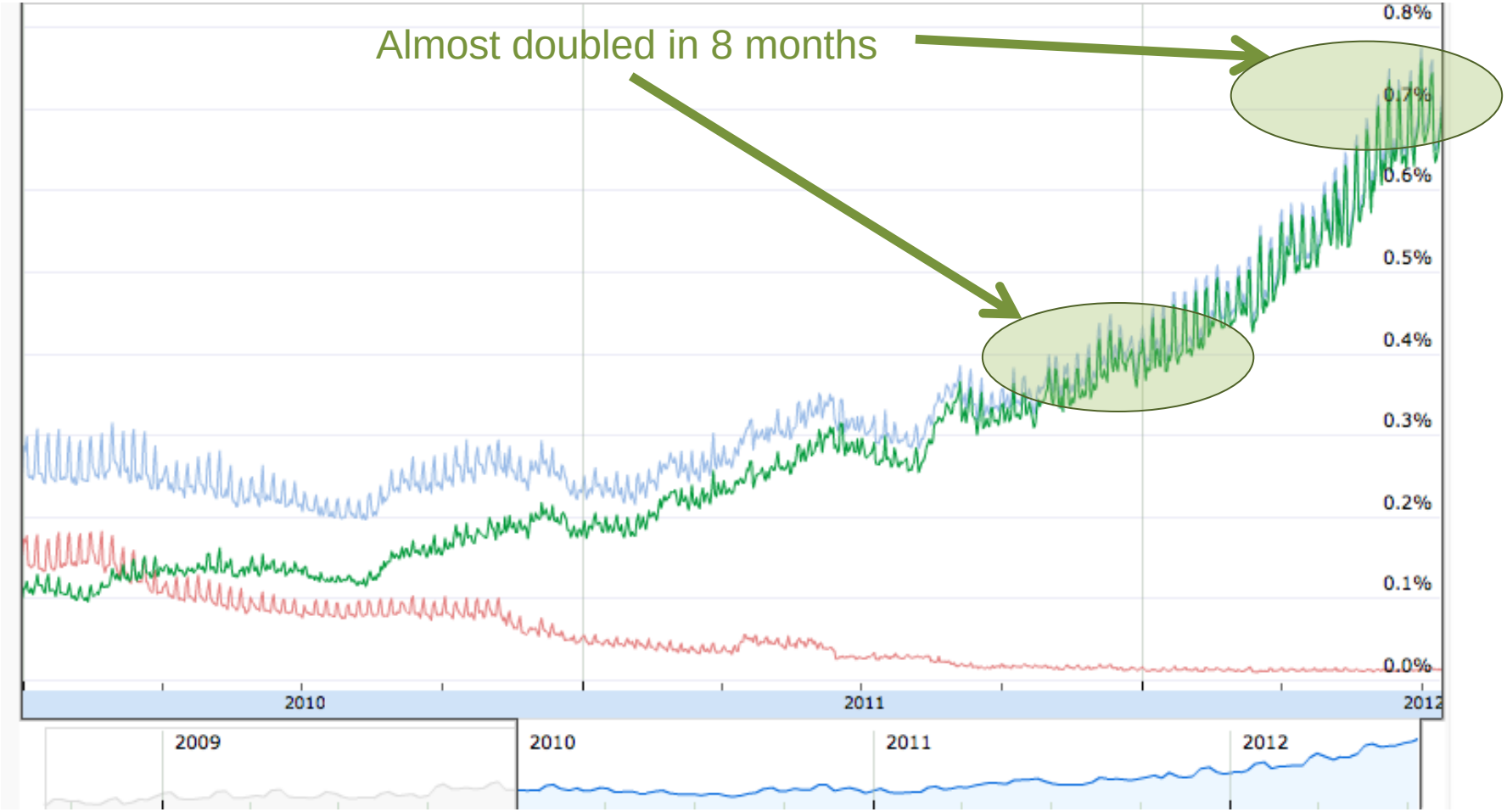
- Uneven performance: IPv6 internet is sparsely connected
- Less Reliability: IPv6 internet is less redundant
- Lots of Bugs due to less testing and less frequent use
  - Browser/OS
  - Misconfigured network devices
  - Slow fallback to IPv4 when IPv6 not available.

The Transition: as of November 2011



Source: http://www.google.com/intl/en/ipv6/statistics/

The Transition: as of July 2012



Source: http://www.google.com/intl/en/ipv6/statistics/

Akamai Observations

Asia was an early leader in IPv6, but efforts seem to have slowed.

- China: experimental deployments, CNGI are promising, but little commercially available IPv6 service.
- South Korea: pushed IPv6 several years ago, but almost no IPv6 end users.
- Japan: KDDI making progress to end-users, but NTT East & West walled gardens are causing problems for content providers.
- Singapore
  - End-user adoption appears low: 0.1% visits to consumer sites and 0.8% for users going to high-tech sites. (Equivalent numbers for Taiwan are 0.4% and 1.6%)
  - During IPv6 Launch: saw only 281 unique native IPv6 addresses

Europe shows steady progress in deployments to end users, particularly in France and Romania.

US is in middle of the pack with key ISPs Verizon, Comcast, and AT&T pushing hard.

Akamai

… the leading cloud platform for helping enterprises provide secure, high-performance user experiences.

The Akamai EdgePlatform

107,000+ Servers	1,928 POPs	1060+ Networks	660+ Cities	83 Countries

Resulting in traffic of:

9.3 Tbps peak traffic
68 petabytes / day
1280+ billion hits / day
471+ million unique clients IPs / day

How Akamai Enables IPv6

Dual-stacking edge servers

Customer properties can be dual-stacked

- Terminate IPv4 and IPv6 connections in server software
- Can go forwards to customer origin via IPv4
- Occasional origin changes needed

Akamai: Two Modes for website dual-stacking

Compliance ➔ always A + AAAA

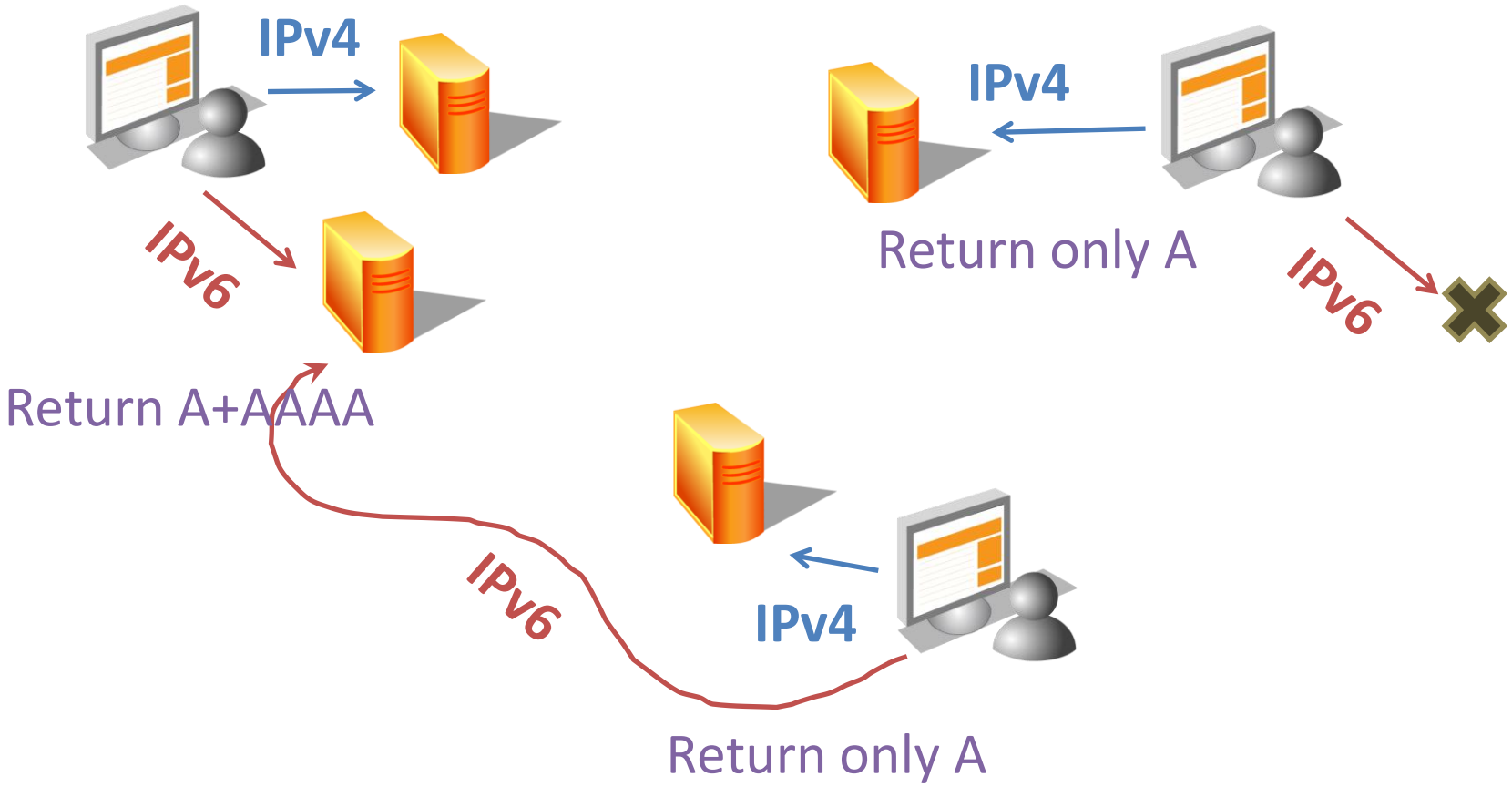
- Pro: easy & what some companies (e.g., US Gov agencies) want
- Con: some clients may be hurt by trying IPv6

Performance ➔ always A, sometimes AAAA

- Don’t send users to far-off IPv6 if near-by IPv4 is available
- May also incorporate whitelist/blacklist data as-appropriate
- Pro: reduces risk of enabling IPv6

Performance-mode dual-stacking

Return AAAA only when won't hurt performance



Akamai Intelligent Platform: IPv6 Status

Akamai IPv6 now live in…

- 53 countries, 180 cities & all continents except Antarctica
- 230 networks
- 600 POPs
- 37,000 servers

Limit: many network providers don't have working IPv6 yet.

Required modifications to 200 software components.

Akamai: Lessons Learned Over the Past Three Years

IPv6 requires pervasive hardware and software changes in the enterprise

Need to prioritize efforts to key areas. We looked at the following:

- Staff Training
- Establishing common reliability metrics across IPv4 and IPv6 services
- End-user CPE equipment
- Enabling IPv6 to end users
- Publishing content of IPv6

IPv4/IPv6 Hybrid Internet is complex to debug

- End-users may switch back and forth
- Different failure modes exist on each network
- Carrier Grade NATs cripple geo-location as well as black/whitelists.
- Breaks systems that assume fairly stable IP address: session affinity, federated authentication systems, etc…

Malware is already IPv6 enabled. Think about security now!

Thank you!

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