

BLOX FEST

Infoblox 

Behold! The field in which I
grow my IPv4

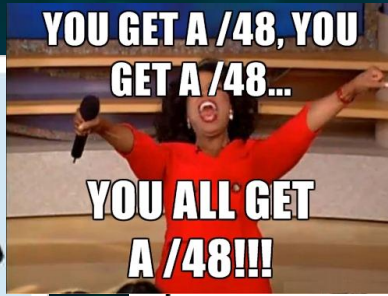
Lay thine eyes
upon it and thou
shalt see that it
is barren.

someecards
user card



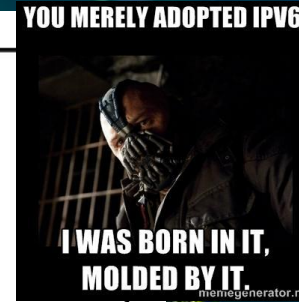
YOU GET A /48, YOU
GET A /48...

YOU ALL GET
A /48!!!



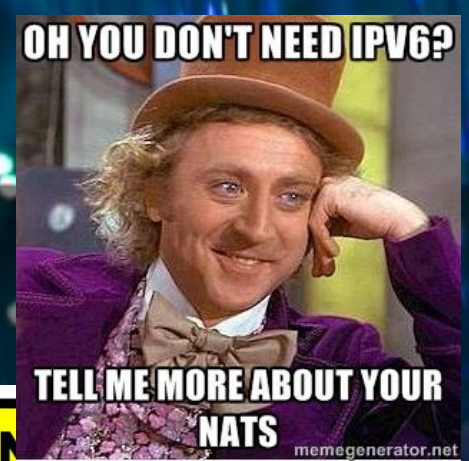
YOU MERELY ADOPTED IPV6;

I WAS BORN IN IT,
MOLDED BY IT.



OH YOU DON'T NEED IPV6?

TELL ME MORE ABOUT YOUR
NATS



IPV4 DEPLETED SO
IPV6



WHAT WAS WRONG WITH
IPV5

memegenerator.net

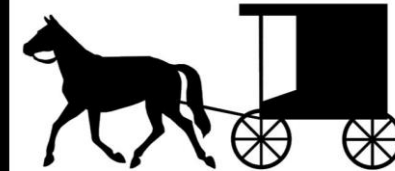
I WANT YOU
TO USE IPv6

— VINT CERF

www.cs.brown.edu/~aaf/cerf/



CAUTION



Legacy IP Only

This product does not
support the current
generation of the
Internet Protocol, IPv6.

ONLY YOU CAN
PREVENT
SMOKEY



IPV6 PREFIX DISAGGREGATION

LOOKING FOR A /18?



BEST I CAN DO IS A /22

Scott Hogg

CTO @GTRI

Ed Horley

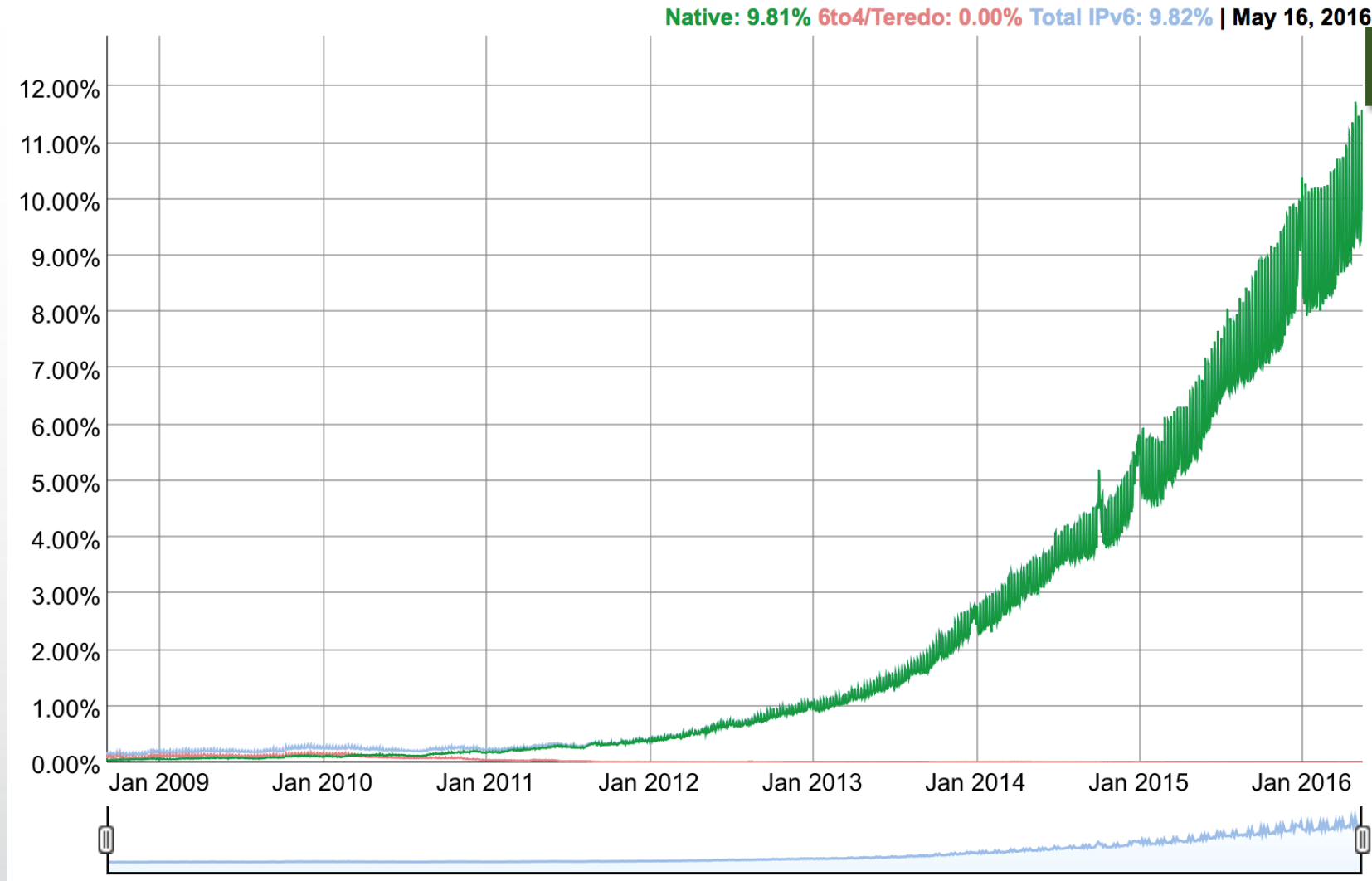
IPv6 Practice Lead @Groupware

Tom Coffeen

Chief IPv6 Evangelist @Infoblox



Global Internet Traffic to Google via IPv6

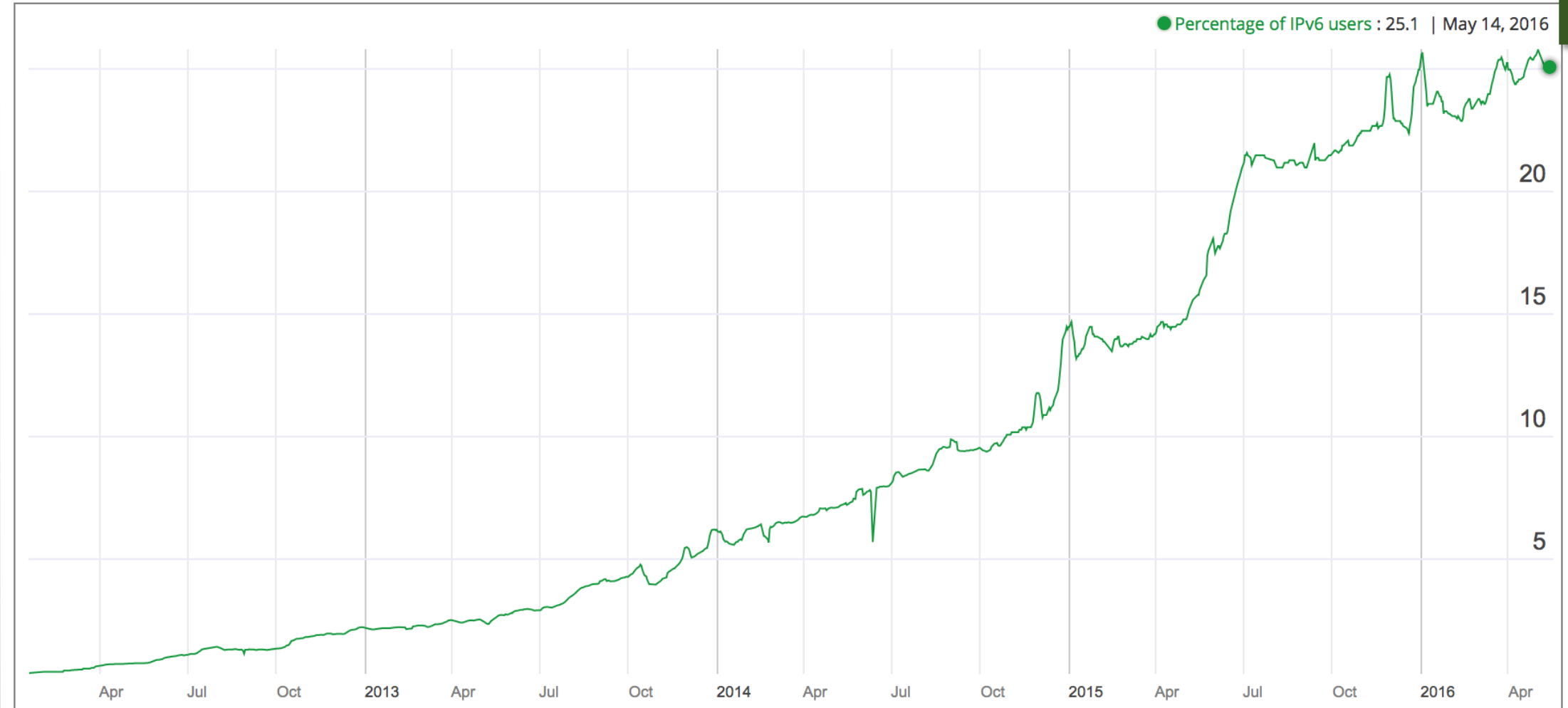


10%



Source: <https://www.google.com/intl/en/ipv6/statistics.html>

US Internet Traffic to Google via IPv6

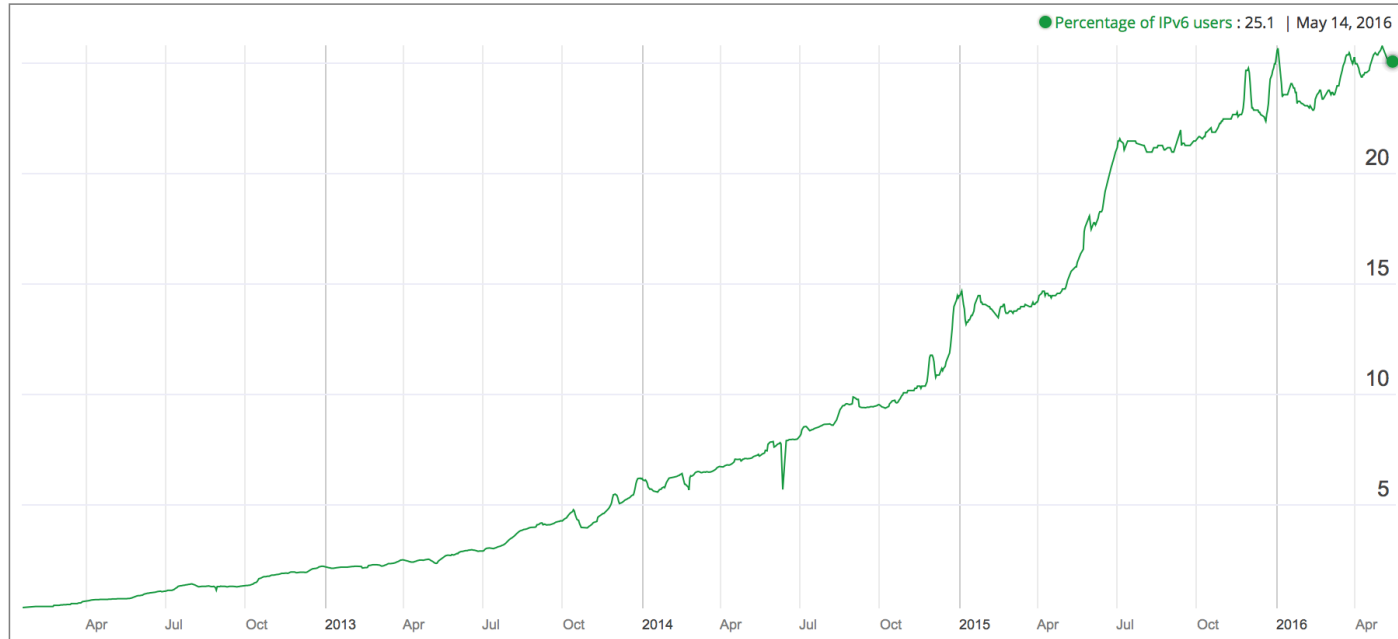


25%



Source: <http://6lab.cisco.com/stats/cible.php?country=US>

US IPv6 Users



25%

- US Population: 323M
- US Internet penetration: 70%
- Number of Internet Users: 226M
- Percentage of IPv6 Users: 25%

18% of US population uses IPv6:
57 Million IPv6 users

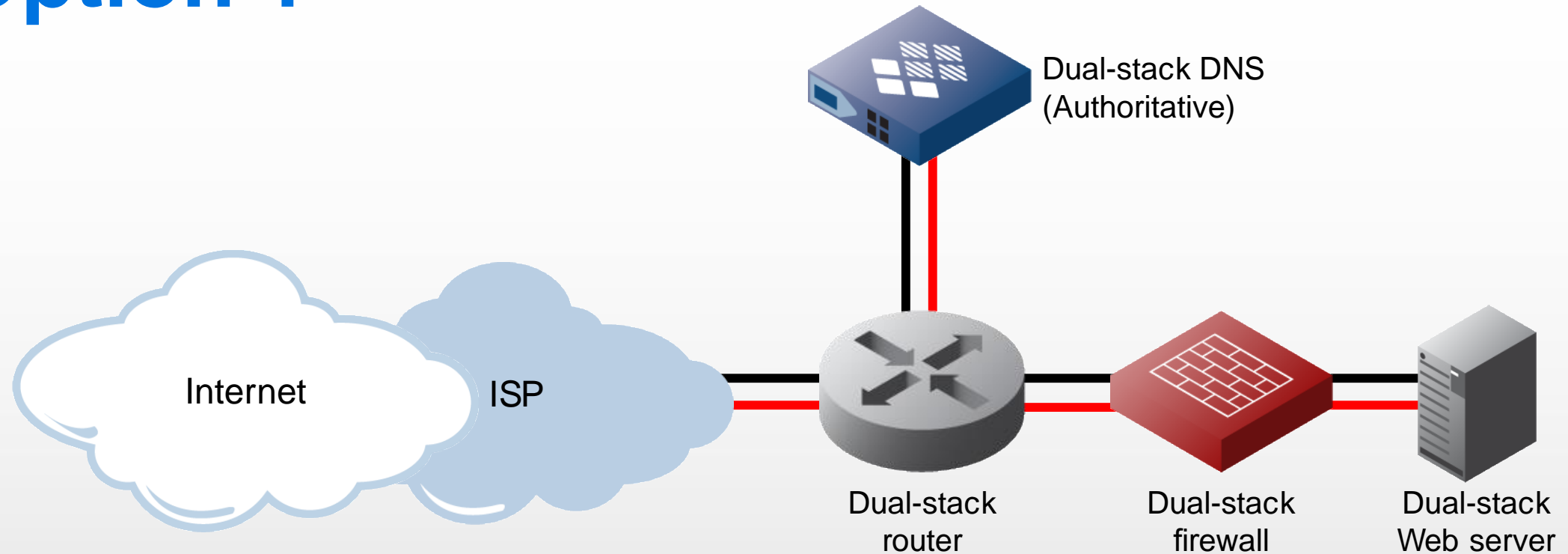


A Phased Approach to IPv6 Adoption

- Phase 1: Training and planning
- Phase 2: External IPv6 adoption
 - E.g., Making websites and content available on the Internet over IPv6
- Phase 3: Internal IPv6 adoption
 - E.g., Enabling IPv6 to clients in the corporate LAN
- RFC 7381 Enterprise IPv6 Deployment Guidelines



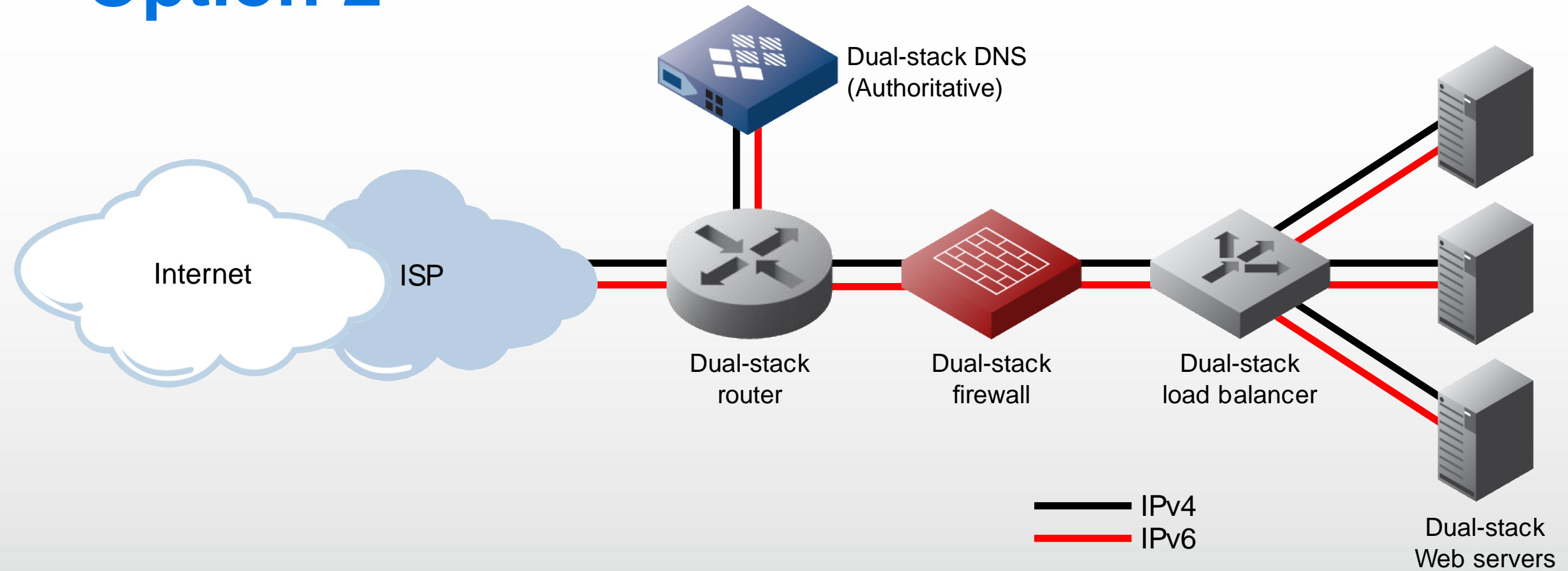
Getting Your Website Online Over IPv6: Option 1



— IPv4
— IPv6



Getting Your Website Online Over IPv6: Option 2



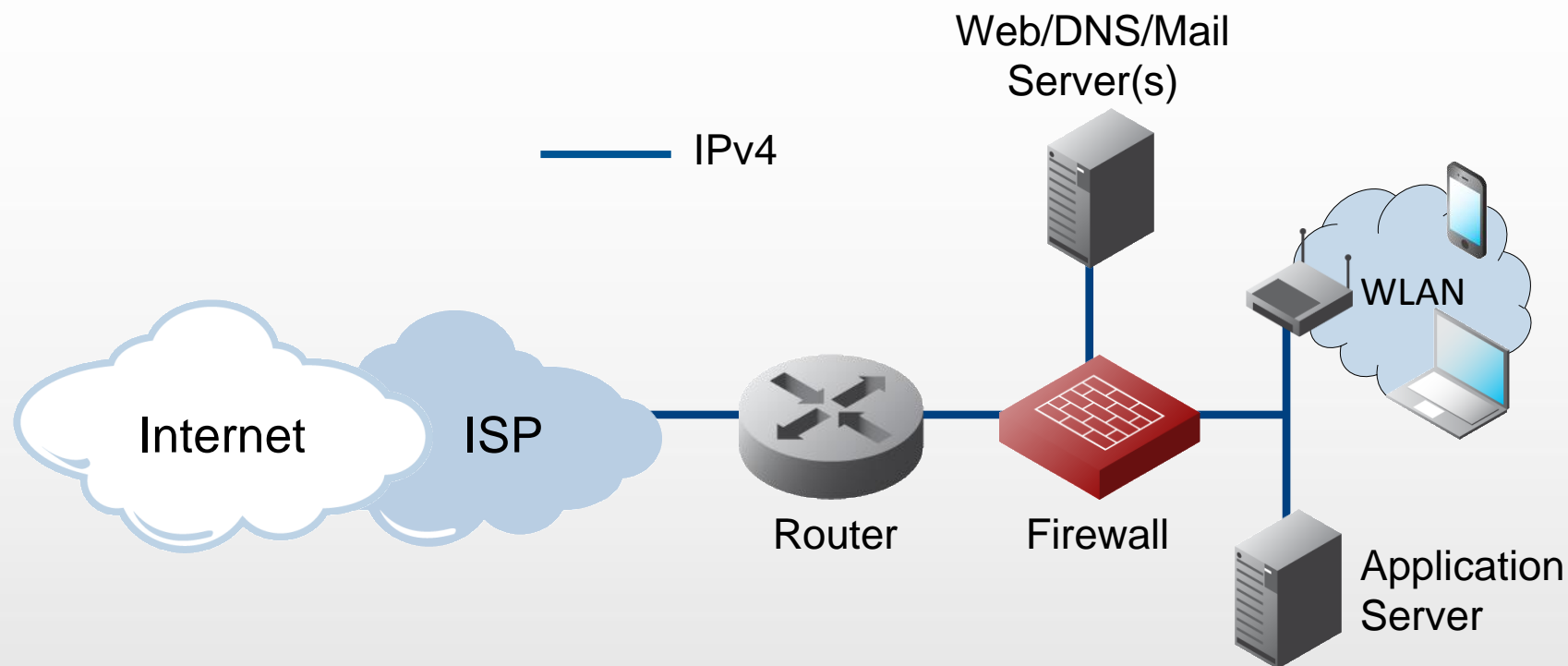
Getting Your Website Online Over IPv6: Option 3



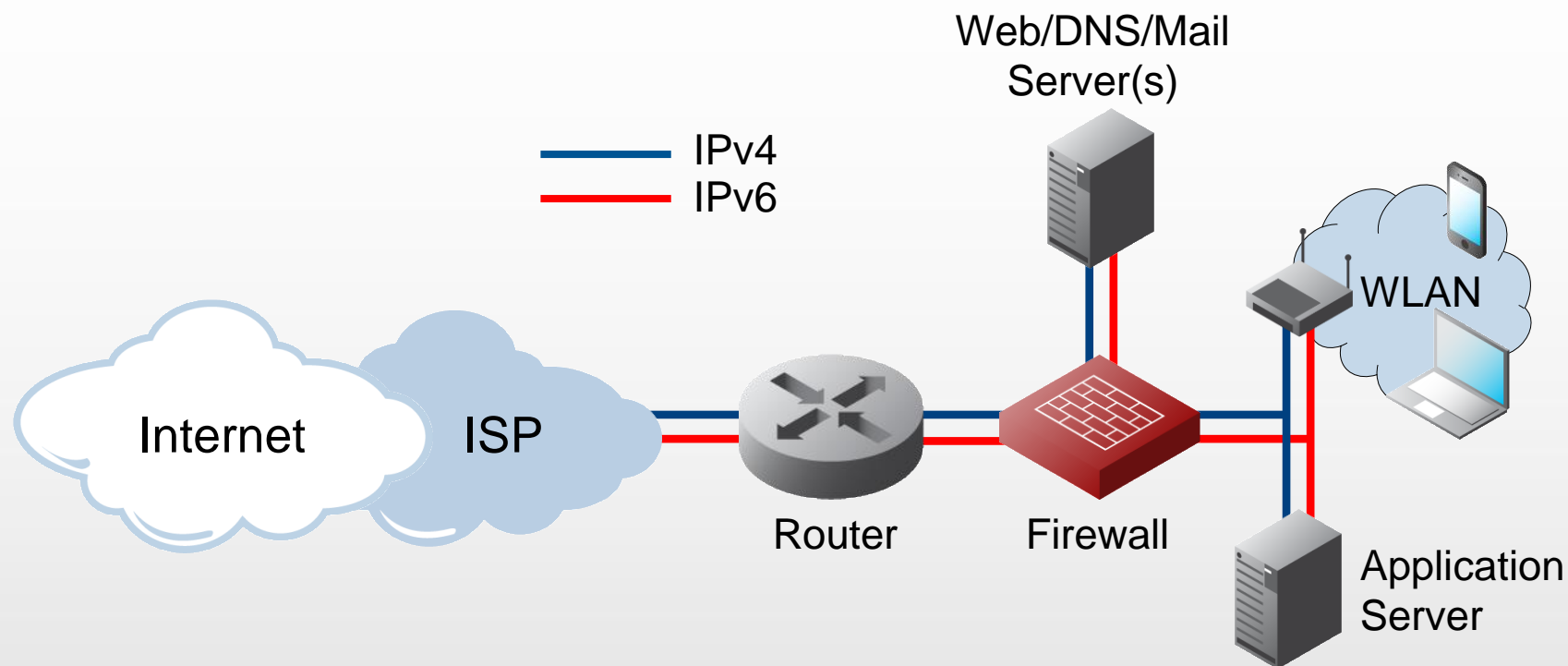
Why IPv6 Dual-Stack?

- Deploying a new addressing protocol is a complex and broad challenge
 - A gradual transition from IPv4 to IPv6 is required
- No “flag day” for IPv6
- Not all hardware and software has an upgrade path to IPv6
- IPv4 networks must continue to provide services and applications

Dual-Stack: Corporate LAN Example



Dual-Stack: Corporate LAN Example



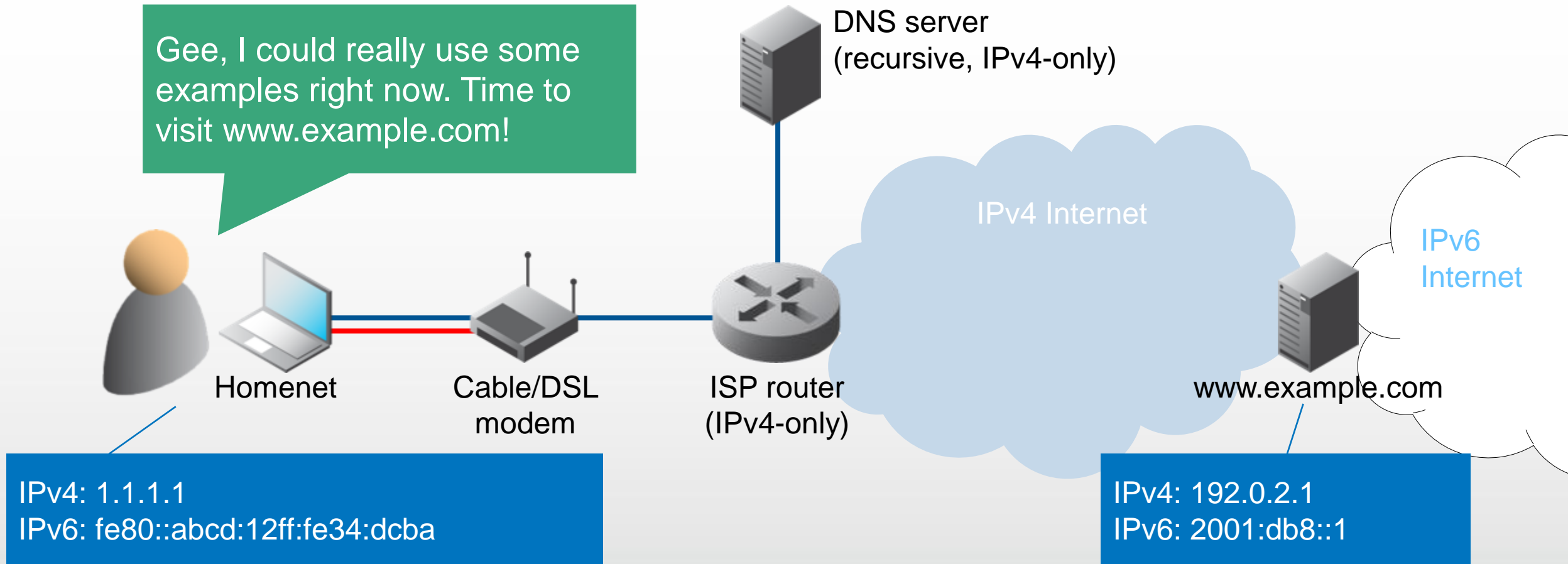
So, In Dual-Stack, Which Address Family Gets Used?

- The legacy method
 - RFC 6724
 - “Prefer IPv6”
- The new method
 - RFC 6555
 - aka...

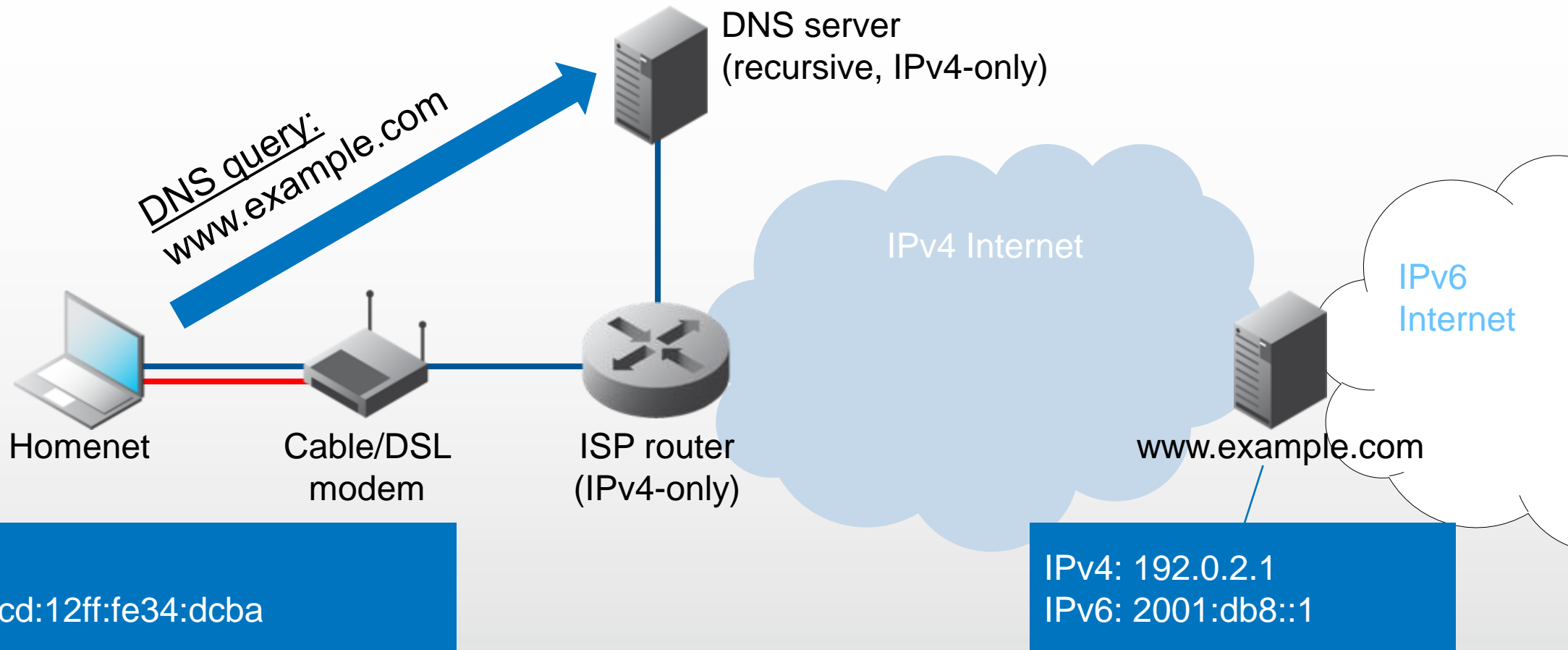


RFC 6724 Example

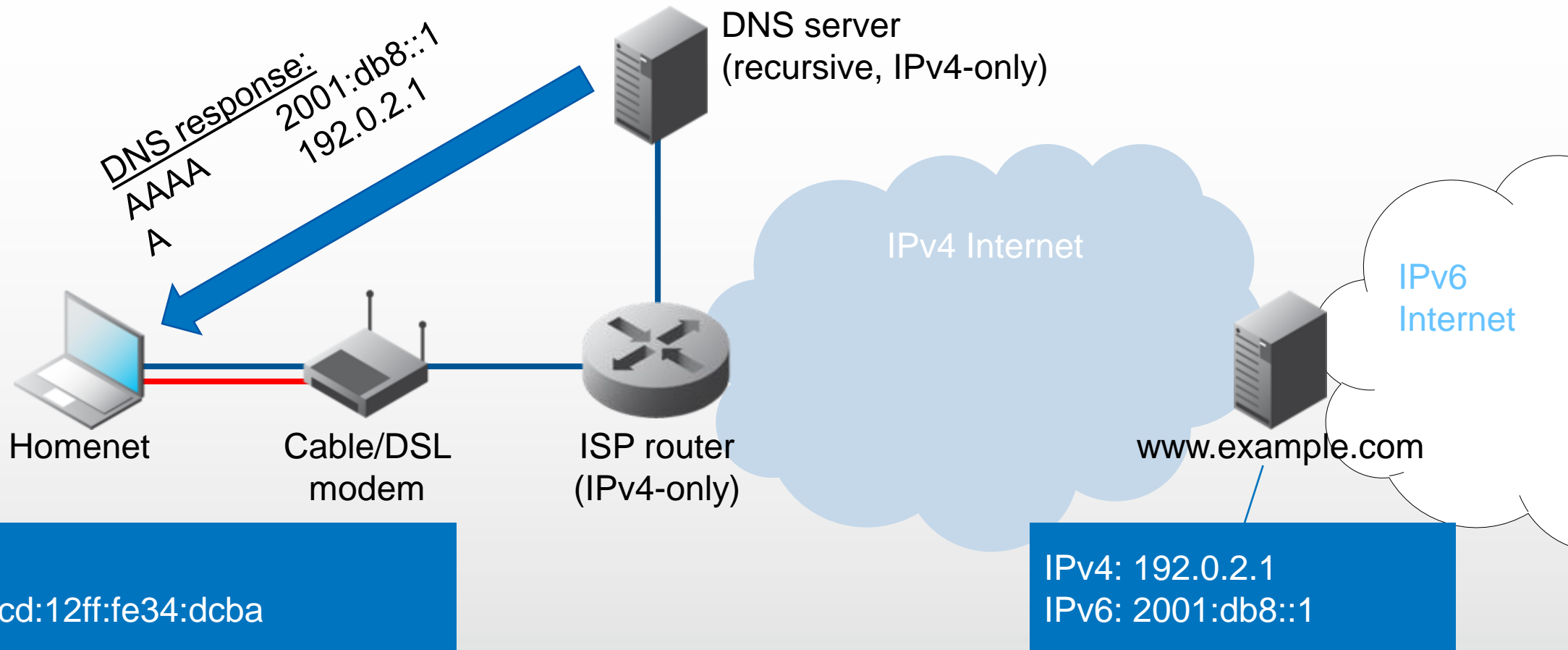
Gee, I could really use some examples right now. Time to visit www.example.com!



RFC 6724 Example

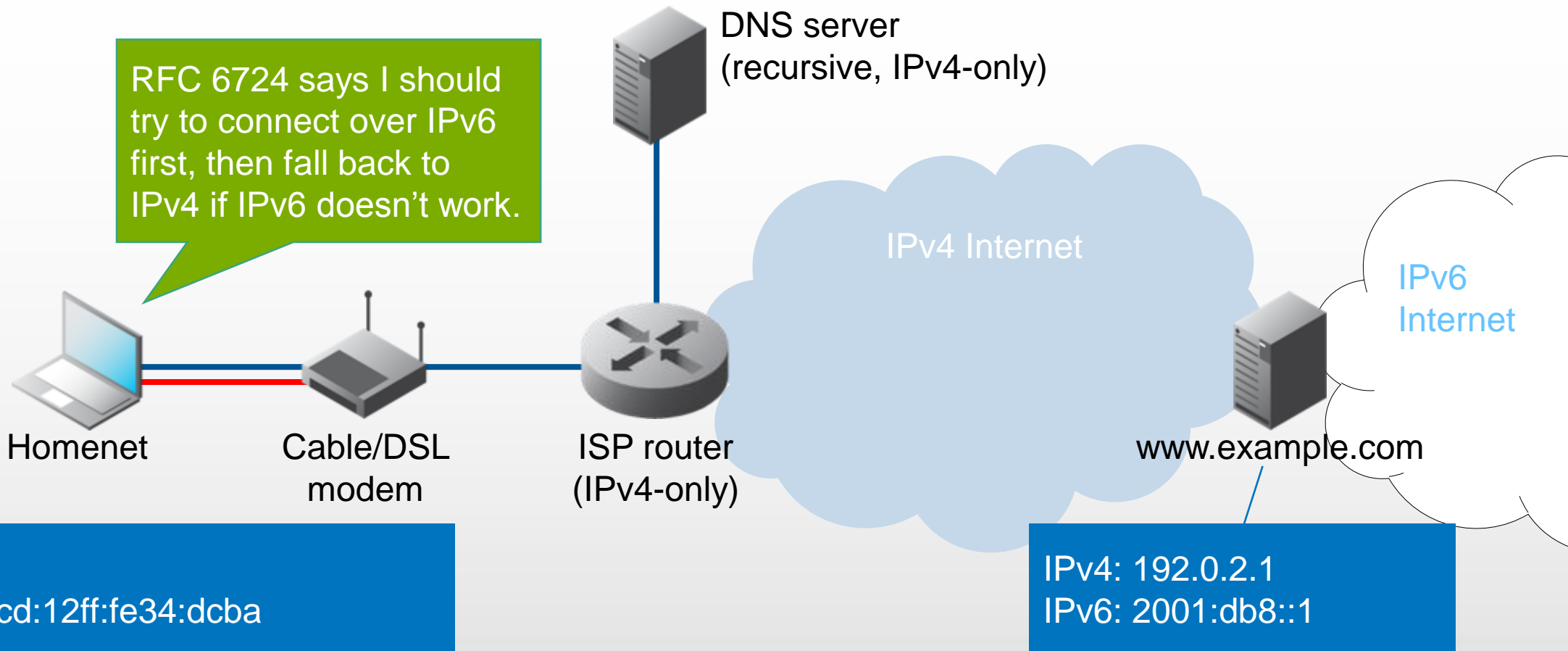


RFC 6724 Example

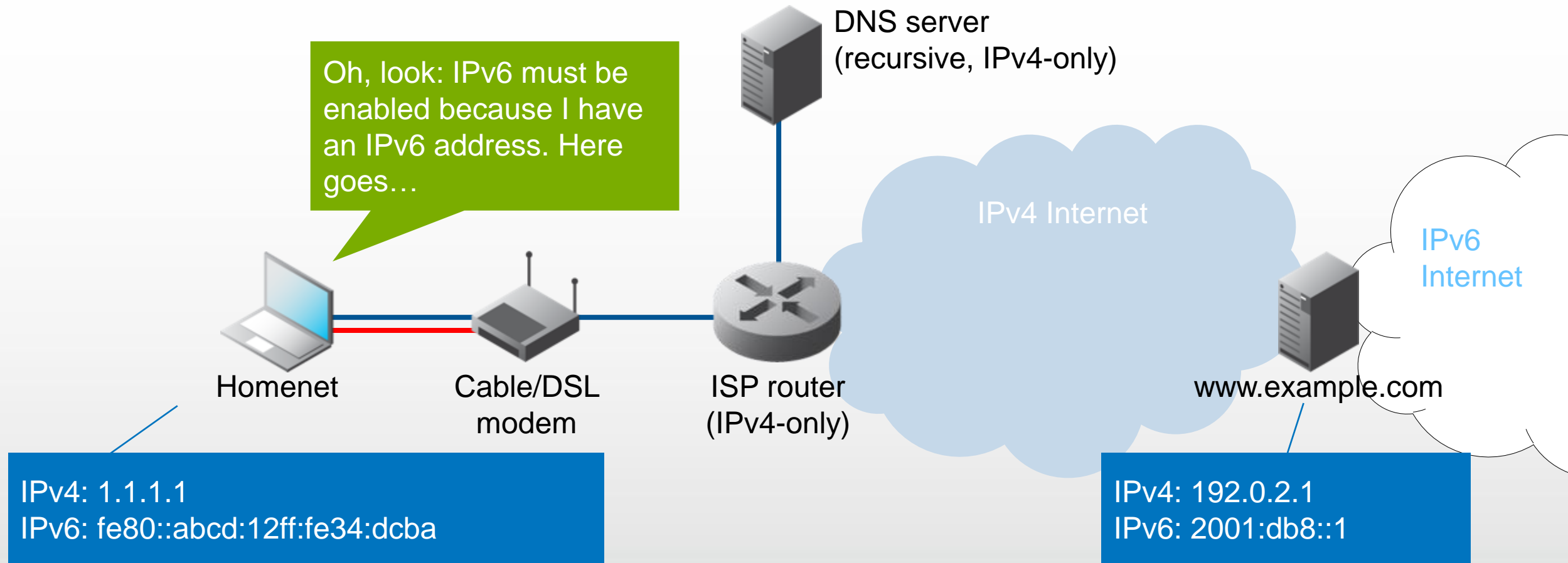


RFC 6724 Example

RFC 6724 says I should try to connect over IPv6 first, then fall back to IPv4 if IPv6 doesn't work.



RFC 6724 Example



RFC 6724 Example

HTTP connection to 2001:db8::1 attempted



Homenet



Cable/DSL
modem



ISP router
(IPv4-only)



DNS server
(recursive, IPv4-only)

IPv4 Internet



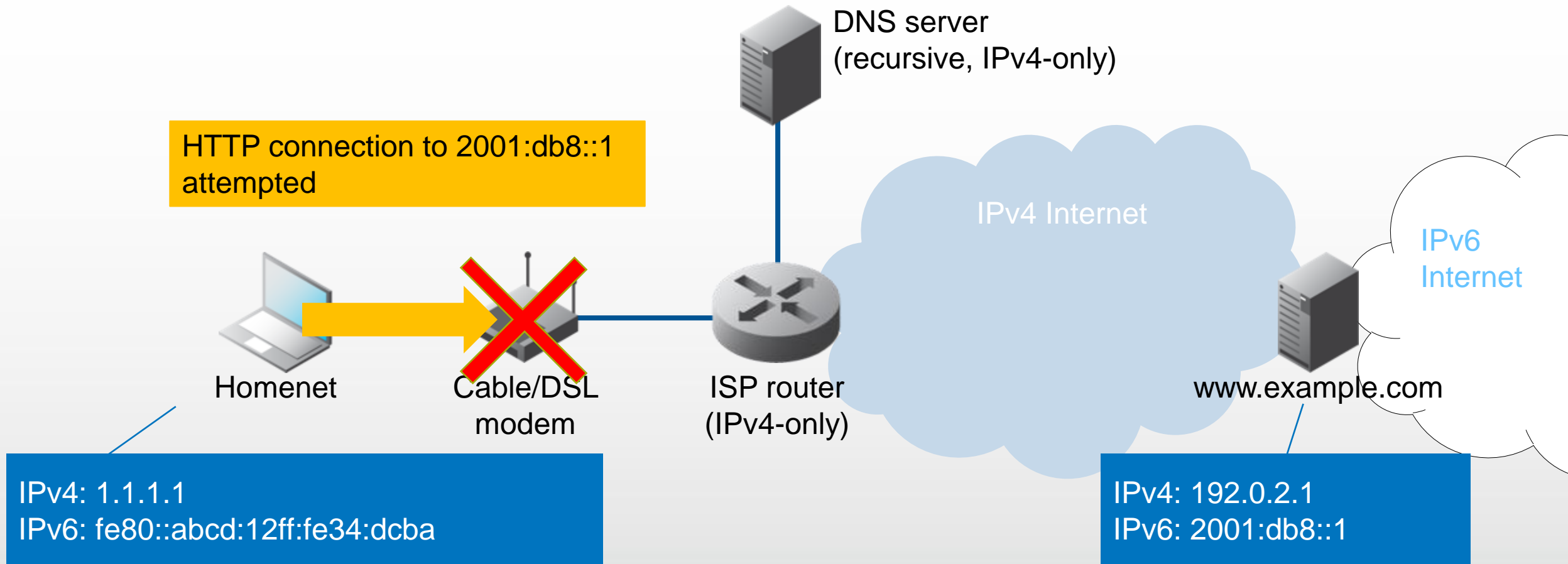
www.example.com

IPv6
Internet

IPv4: 1.1.1.1
IPv6: fe80::abcd:12ff:fe34:dcba

IPv4: 192.0.2.1
IPv6: 2001:db8::1

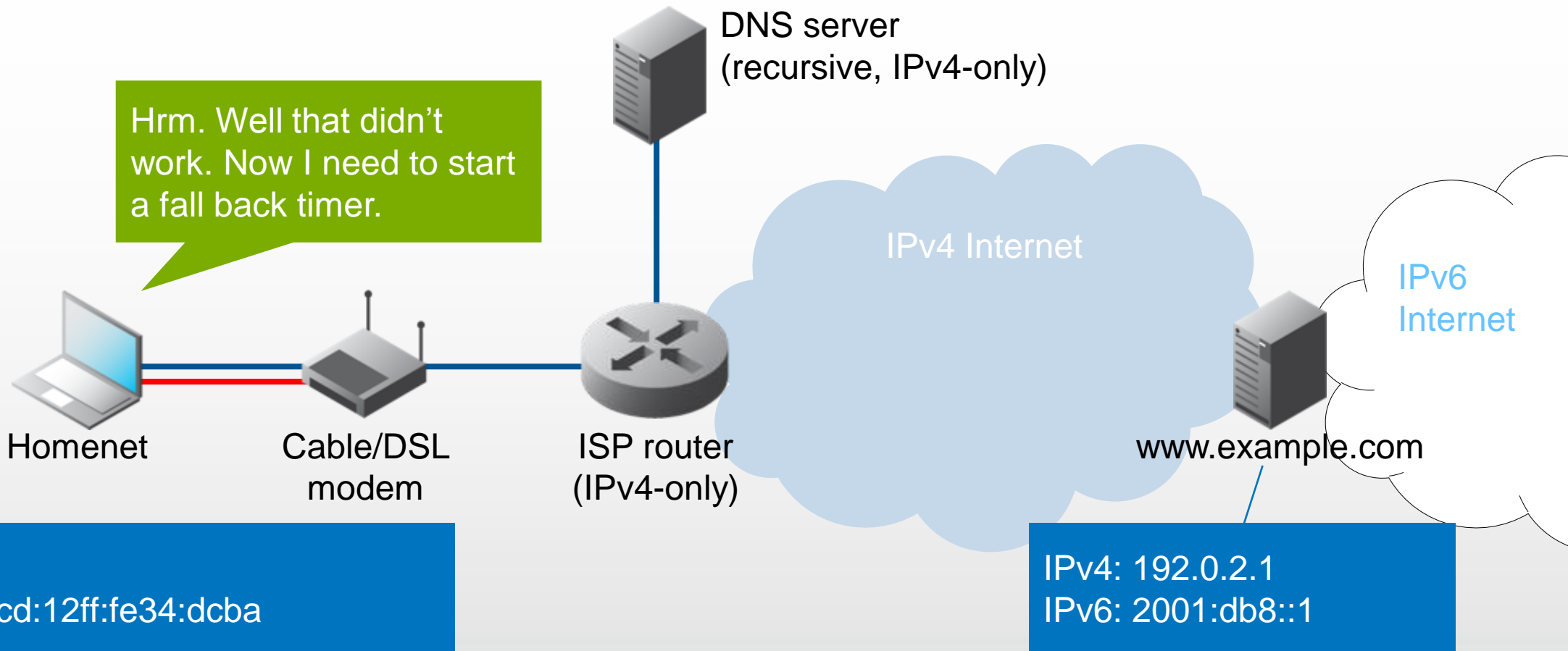
RFC 6724 Example



RFC 6724 Example



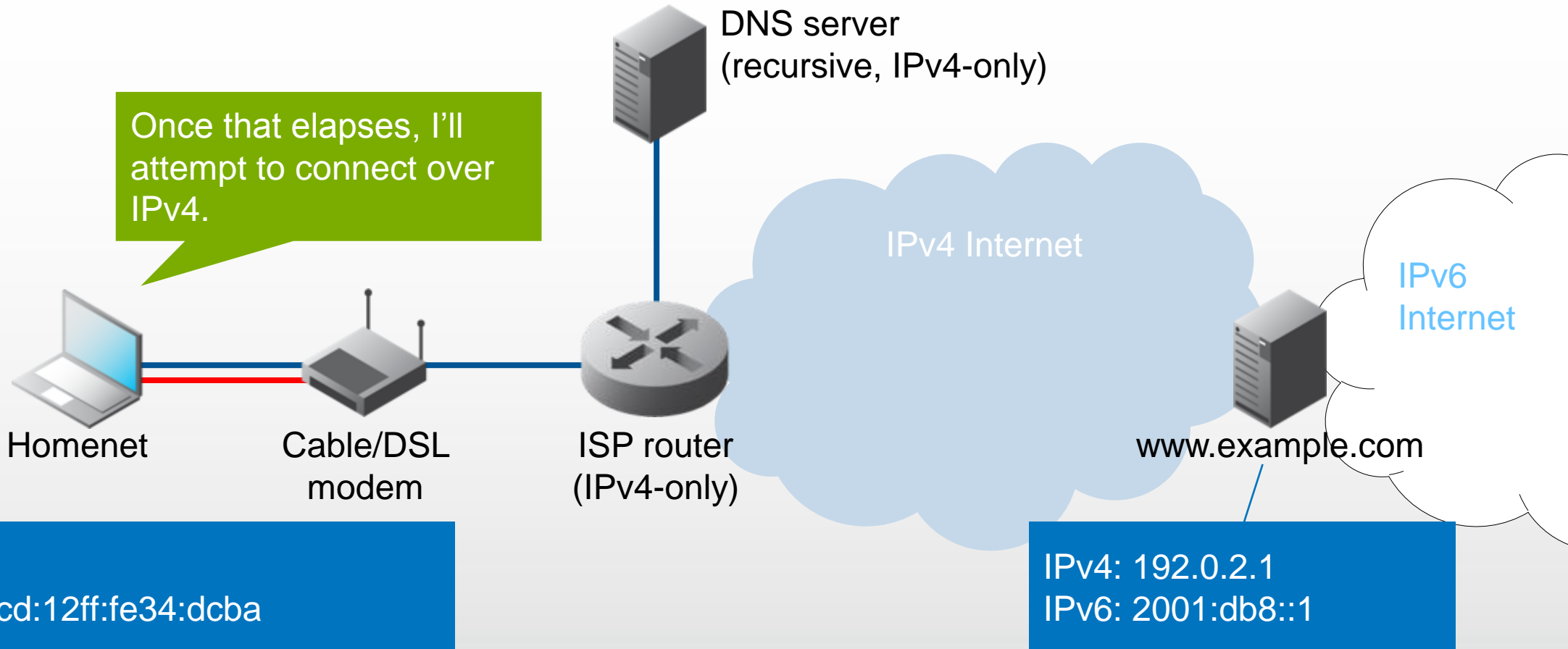
Hrm. Well that didn't work. Now I need to start a fall back timer.



RFC 6724 Example



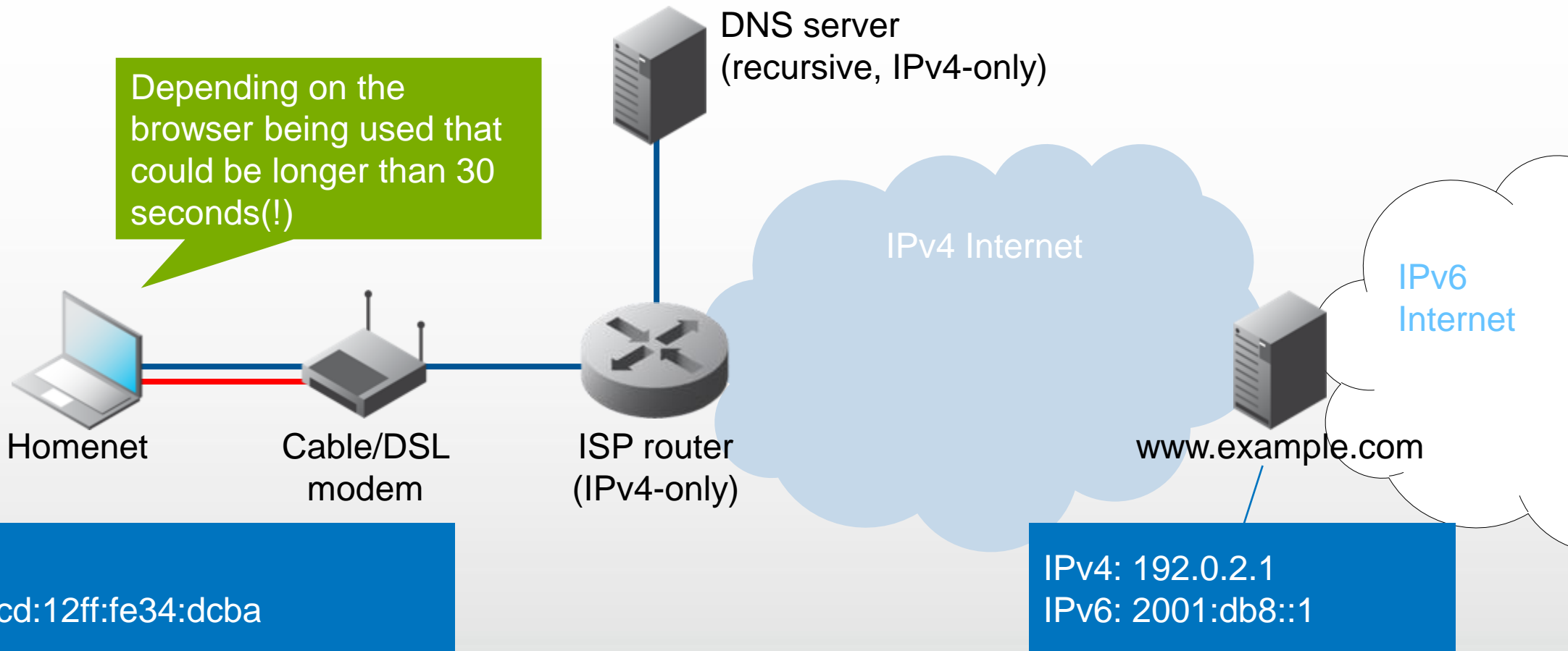
Once that elapses, I'll attempt to connect over IPv4.



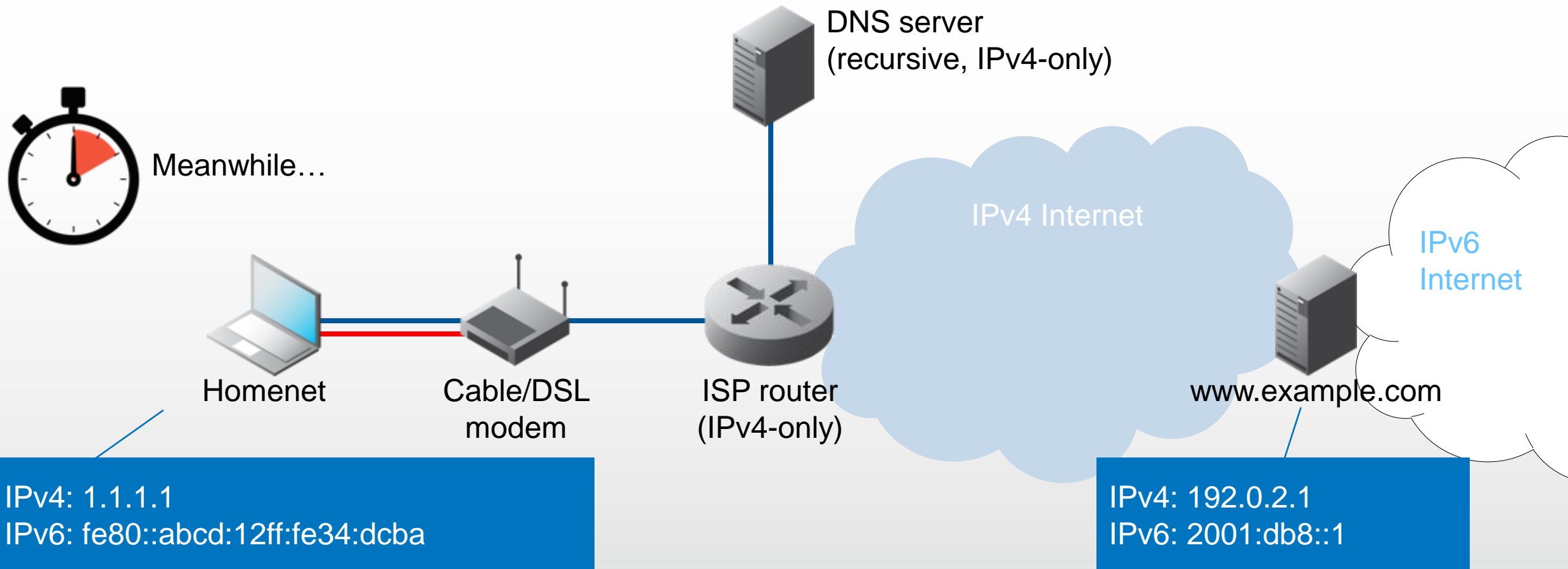
RFC 6724 Example



Depending on the browser being used that could be longer than 30 seconds(!)



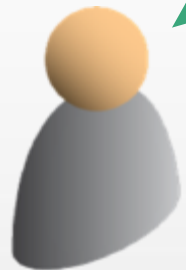
RFC 6724 Example



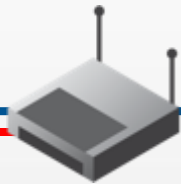
RFC 6724 Example

Hrm. www.example.com is broken.
Guess I'll have to use their
competitor www.ersatzweb.net
instead.

(What's an IPv6?)



Homenet



Cable/DSL
modem



ISP router
(IPv4-only)



DNS server
(recursive, IPv4-only)

IPv4 Internet



www.example.com

IPv6
Internet

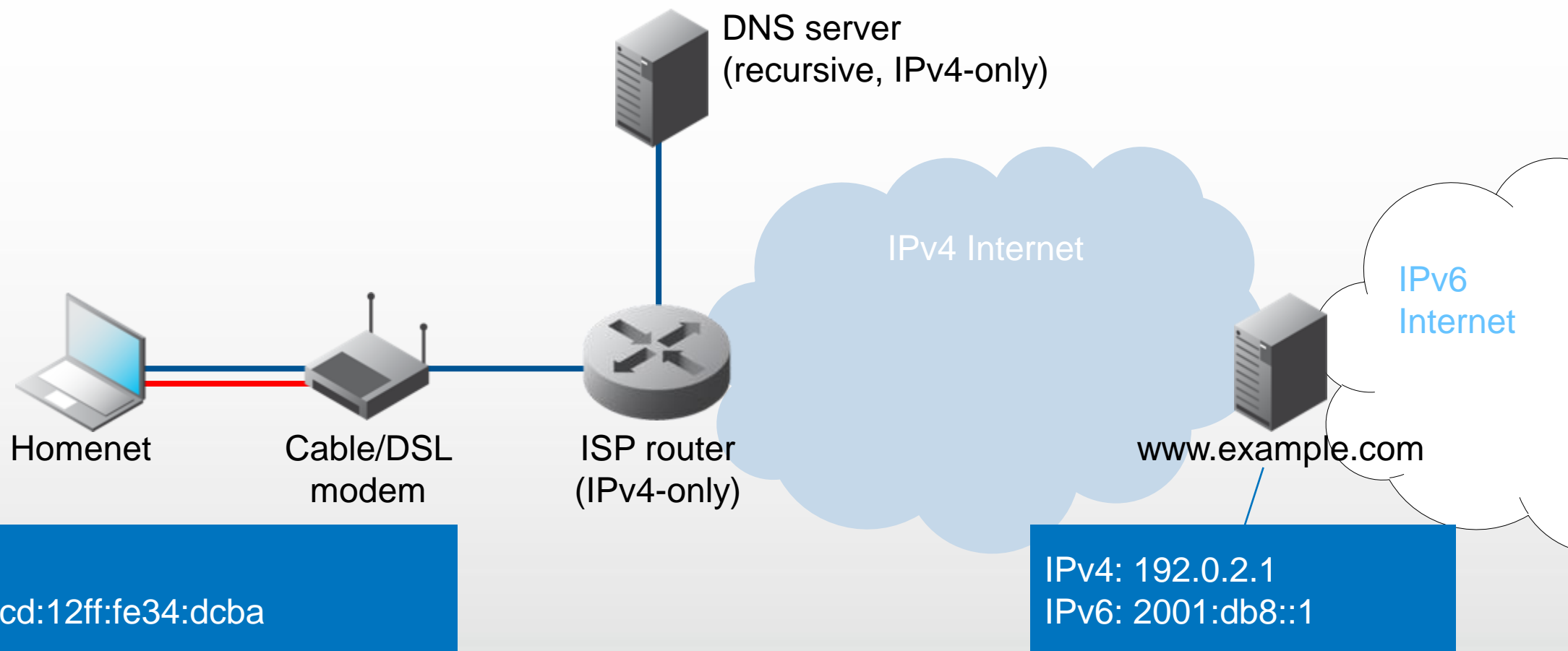
IPv4: 1.1.1.1

IPv6: fe80::abcd:12ff:fe34:dcba

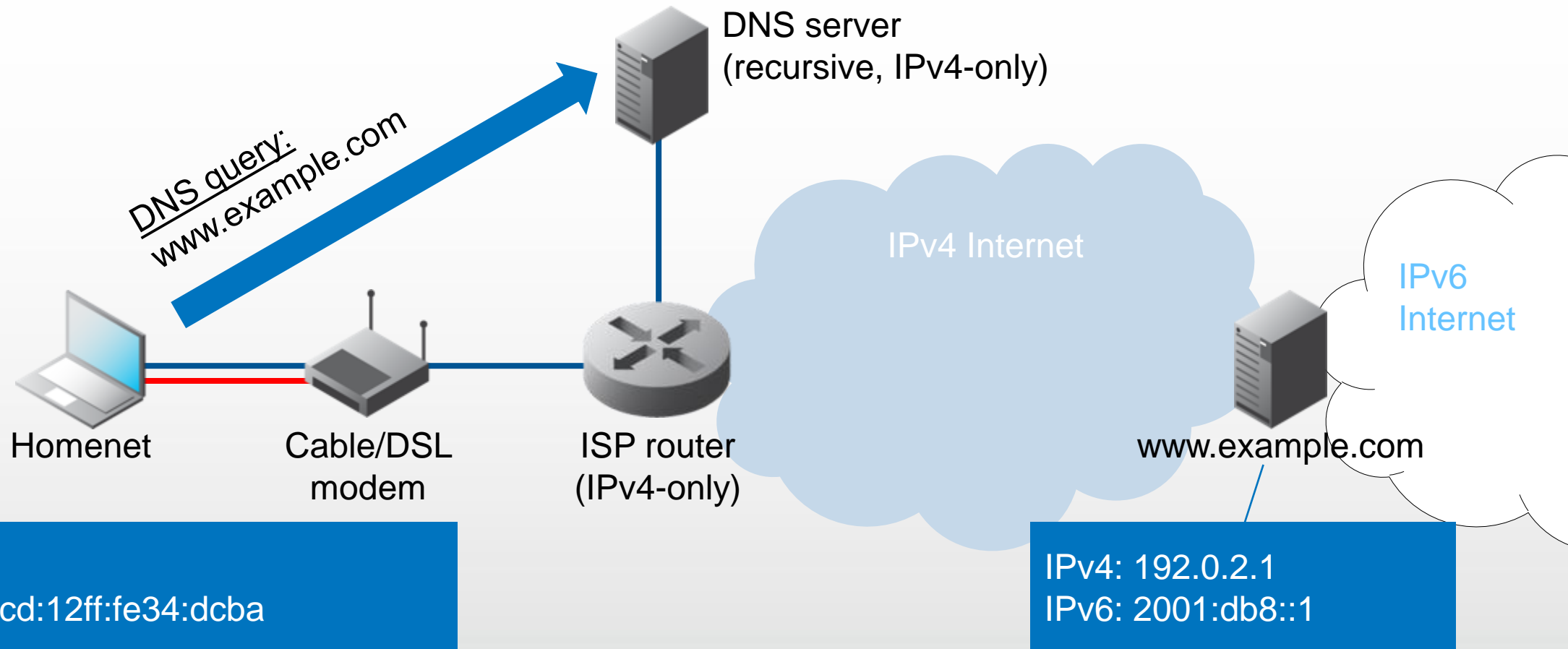
IPv4: 192.0.2.1

IPv6: 2001:db8::1

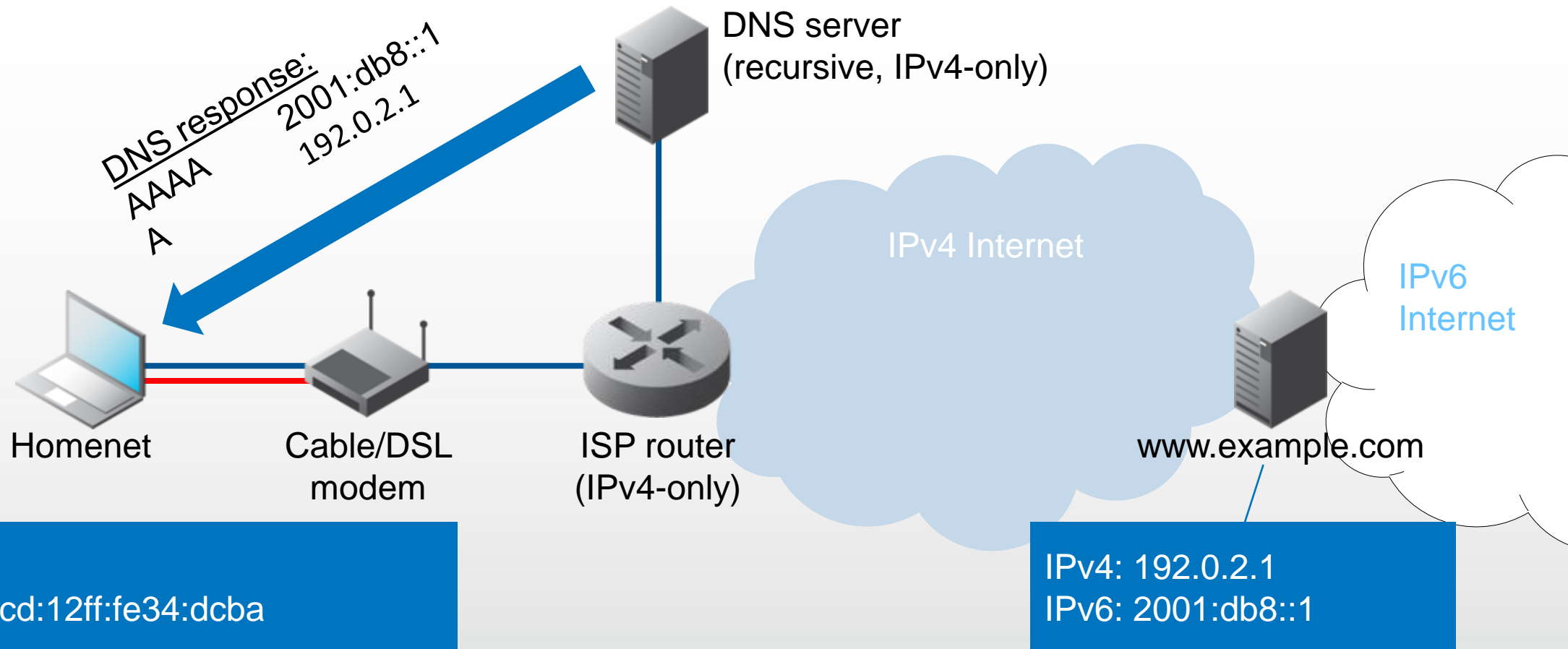
RFC 6555 Example: Happy Eyeballs



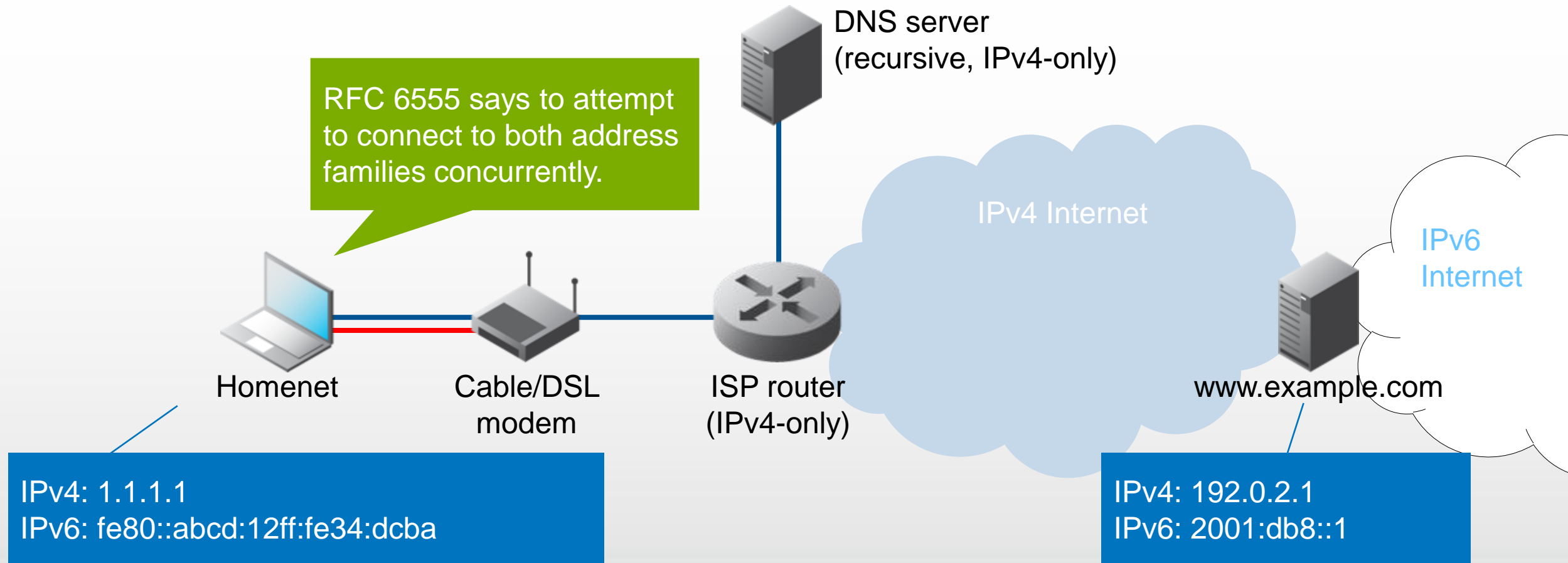
RFC 6555 Example: Happy Eyeballs



RFC 6555 Example: Happy Eyeballs



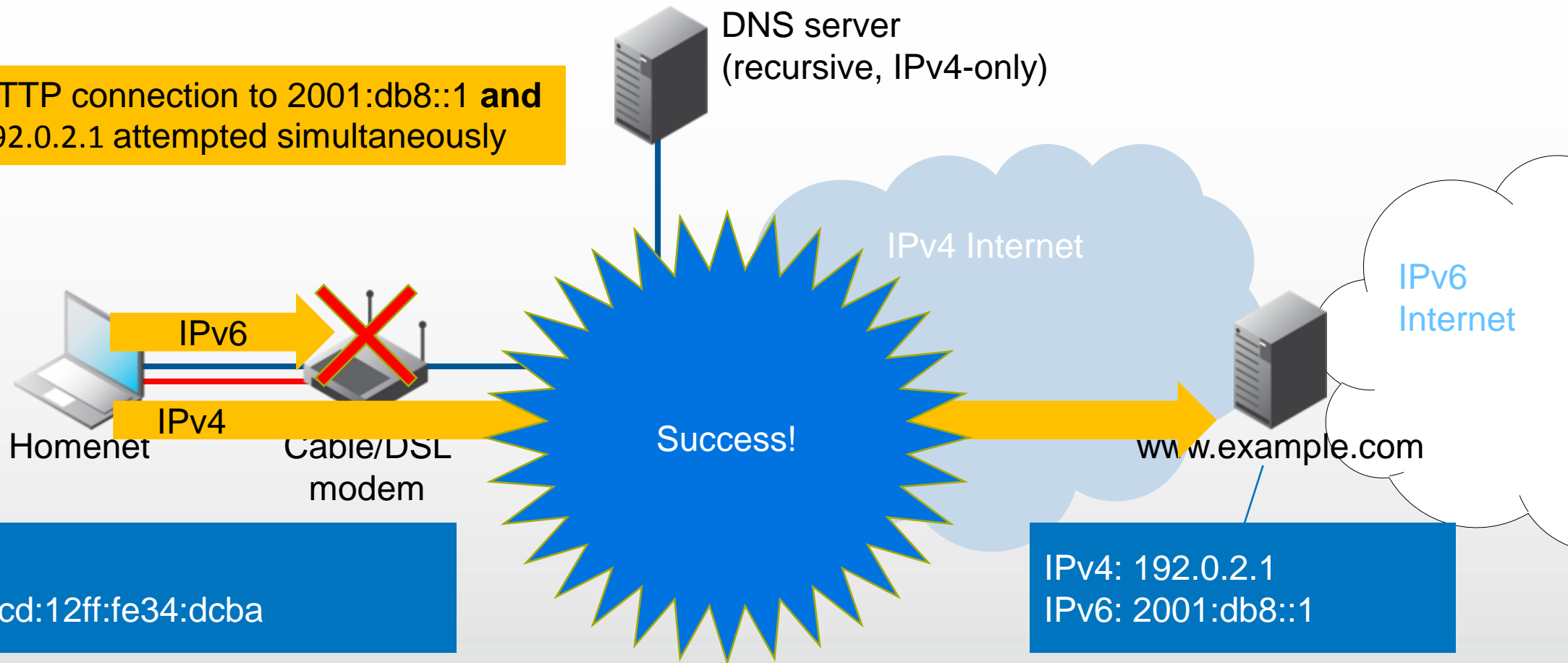
RFC 6555 Example: Happy Eyeballs



RFC 6555 Example: Happy Eyeballs

HTTP connection to 2001:db8::1 and 192.0.2.1 attempted simultaneously

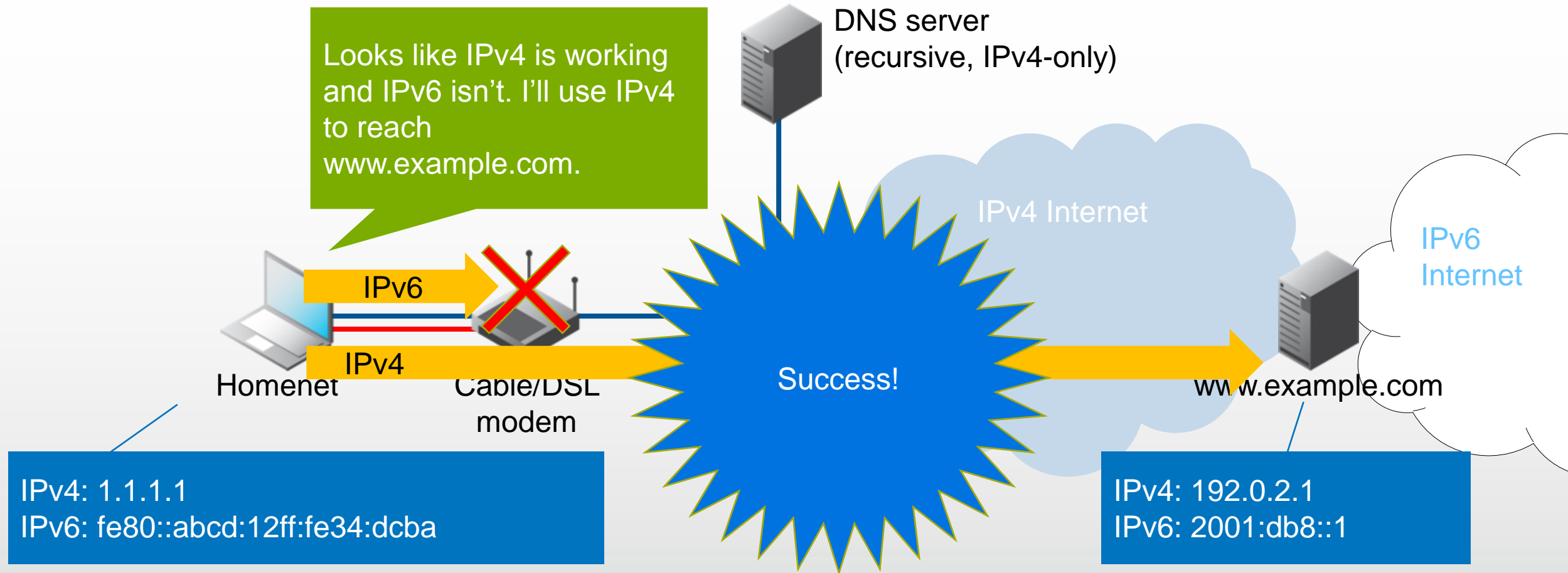
DNS server
(recursive, IPv4-only)



IPv4: 1.1.1.1
IPv6: fe80::abcd:12ff:fe34:dcba

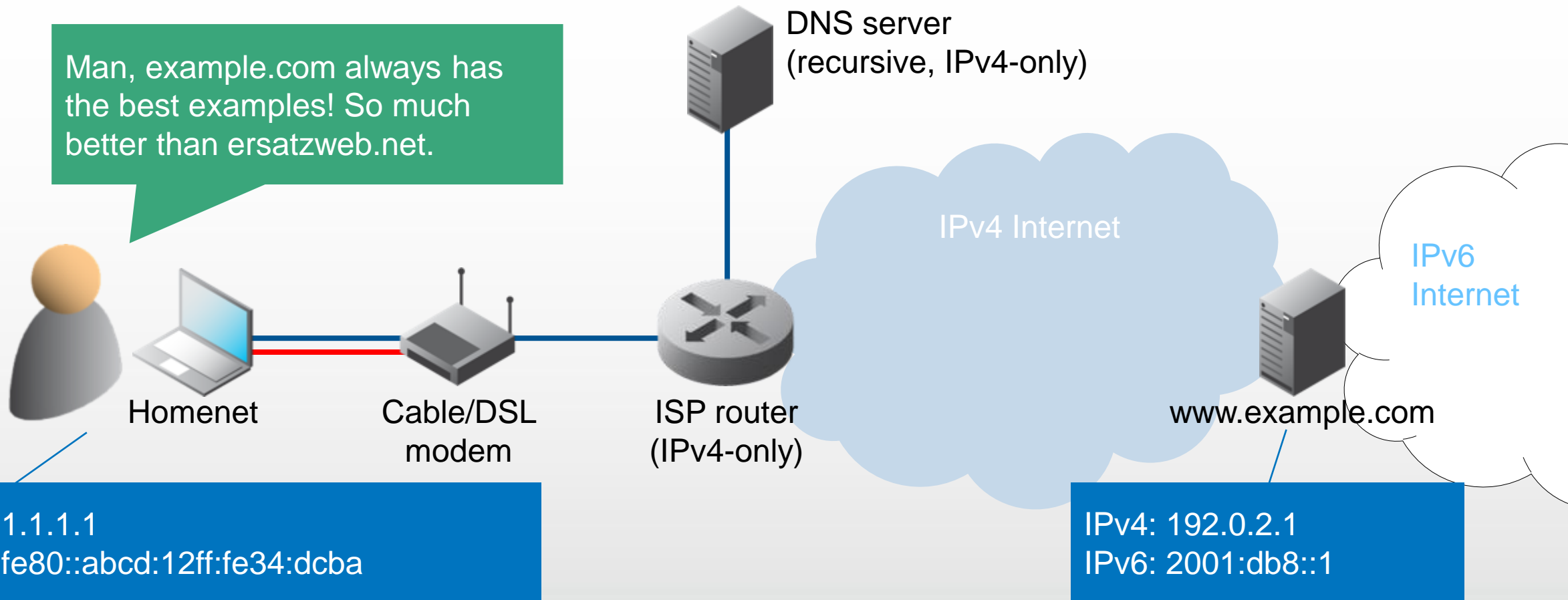
IPv4: 192.0.2.1
IPv6: 2001:db8::1

RFC 6555 Example: Happy Eyeballs



RFC 6555 Example: Happy Eyeballs

Man, example.com always has the best examples! So much better than ersatzweb.net.

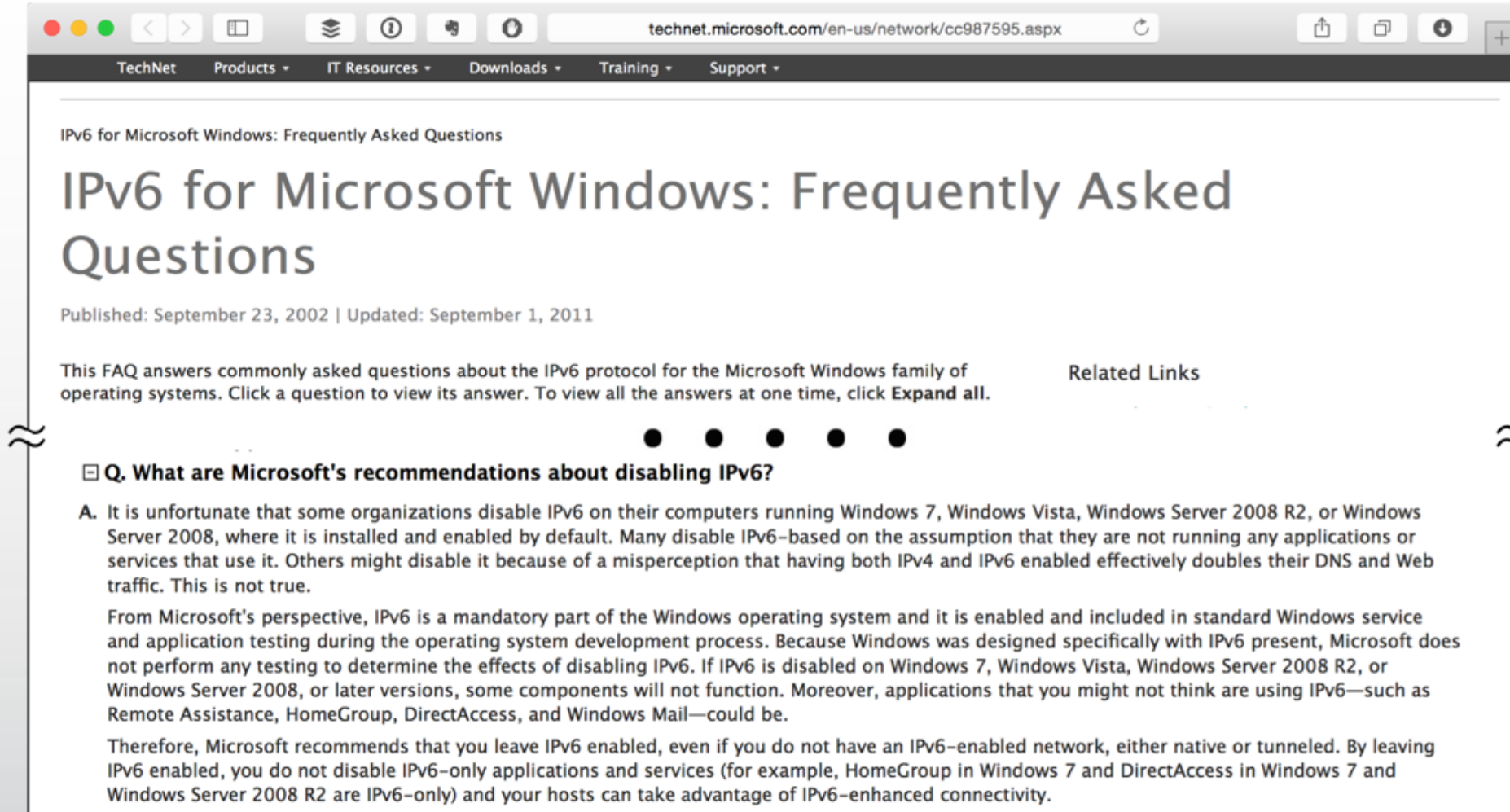


IPv6 Is Already Running on Your Network!

- It's supported and enabled by default:
 - Windows (7, 8, 10, Server 2008/2012/2012R2)
 - Linux
 - Mac OSX
 - Android
 - IOS



“We’re not managing IPv6. Let’s just disable it.”



The screenshot shows a web browser window with the URL `technet.microsoft.com/en-us/network/cc987595.aspx`. The page title is "IPv6 for Microsoft Windows: Frequently Asked Questions". The article is dated "Published: September 23, 2002 | Updated: September 1, 2011". The main text states: "This FAQ answers commonly asked questions about the IPv6 protocol for the Microsoft Windows family of operating systems. Click a question to view its answer. To view all the answers at one time, click **Expand all**." Below this, there is a section titled "Q. What are Microsoft's recommendations about disabling IPv6?". The answer (A.) explains that while some organizations disable IPv6, it is not recommended by Microsoft because it can cause various issues, including DNS and Web traffic doubling, and some services like Remote Assistance, HomeGroup, DirectAccess, and Windows Mail may not function. The article concludes by recommending that IPv6 be left enabled for better connectivity.

IPv6 for Microsoft Windows: Frequently Asked Questions

IPv6 for Microsoft Windows: Frequently Asked Questions

Published: September 23, 2002 | Updated: September 1, 2011

This FAQ answers commonly asked questions about the IPv6 protocol for the Microsoft Windows family of operating systems. Click a question to view its answer. To view all the answers at one time, click **Expand all**.

Related Links

● ● ● ● ●

Q. What are Microsoft's recommendations about disabling IPv6?

A. It is unfortunate that some organizations disable IPv6 on their computers running Windows 7, Windows Vista, Windows Server 2008 R2, or Windows Server 2008, where it is installed and enabled by default. Many disable IPv6—based on the assumption that they are not running any applications or services that use it. Others might disable it because of a misperception that having both IPv4 and IPv6 enabled effectively doubles their DNS and Web traffic. This is not true.

From Microsoft's perspective, IPv6 is a mandatory part of the Windows operating system and it is enabled and included in standard Windows service and application testing during the operating system development process. Because Windows was designed specifically with IPv6 present, Microsoft does not perform any testing to determine the effects of disabling IPv6. If IPv6 is disabled on Windows 7, Windows Vista, Windows Server 2008 R2, or Windows Server 2008, or later versions, some components will not function. Moreover, applications that you might not think are using IPv6—such as Remote Assistance, HomeGroup, DirectAccess, and Windows Mail—could be.

Therefore, Microsoft recommends that you leave IPv6 enabled, even if you do not have an IPv6-enabled network, either native or tunneled. By leaving IPv6 enabled, you do not disable IPv6-only applications and services (for example, HomeGroup in Windows 7 and DirectAccess in Windows 7 and Windows Server 2008 R2 are IPv6-only) and your hosts can take advantage of IPv6-enhanced connectivity.



“We’re not managing IPv6. Let’s just disable it.”

Q. What are Microsoft's recommendations about disabling IPv6?

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So, Since You Can't Turn IPv6 Off, Secure and Monitor It!

- Use Cisco IPv6 First-hop Security on the local segment
 - RA Guard
 - DHCPv6 Guard (RFC 7610)
 - IPv6 Snooping
 - More info here: http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/ipv6_fhsec/configuration/xr-3e/ip6f-xr-3e-book.pdf
 - IPv6 Source Guard
 - IPv6 Prefix Guard
 - IPv6 Destination Guard
- Validate router configurations and that IPv6 is only running on the interfaces you want it to



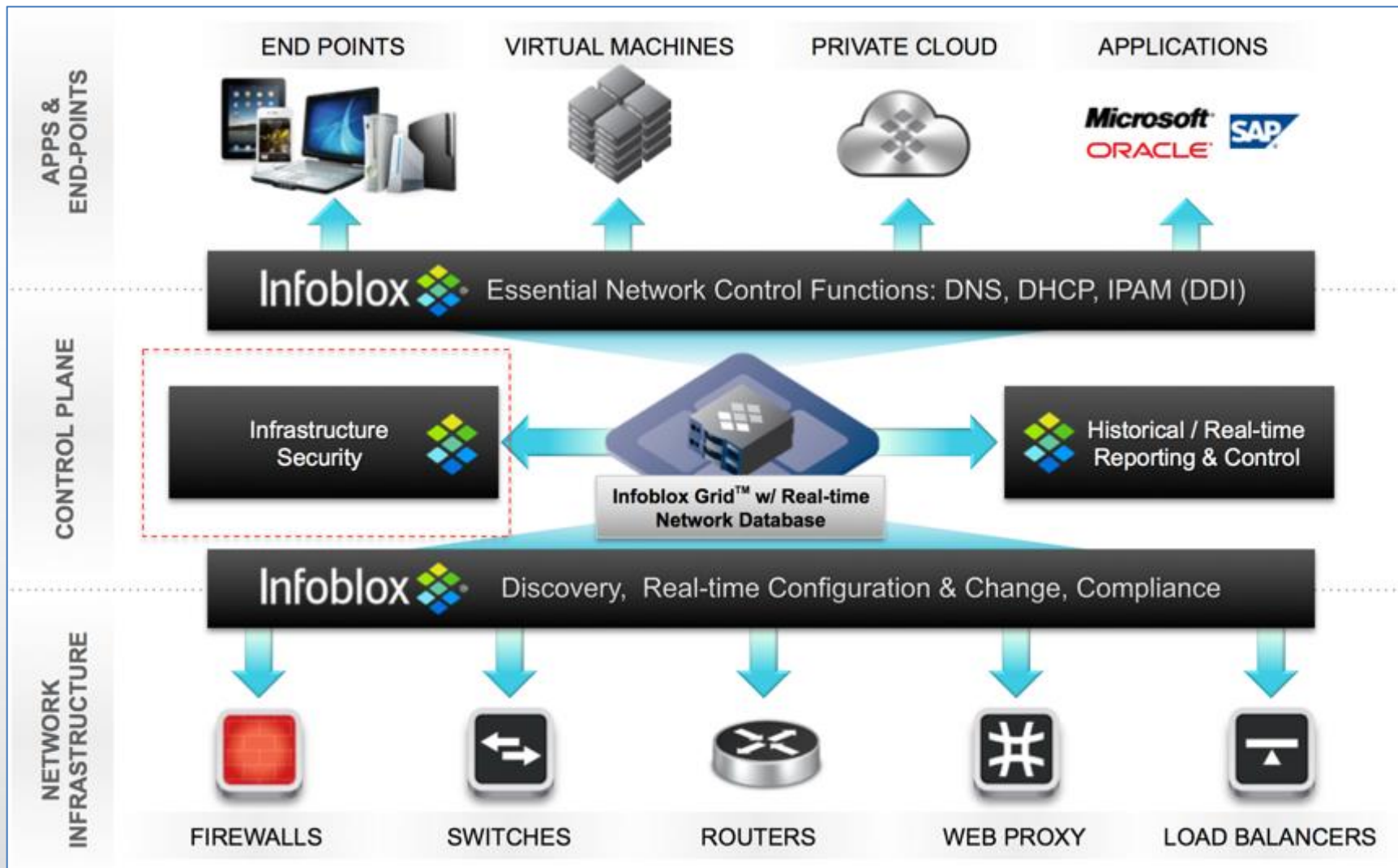
So Since You Can't Turn IPv6 Off, Secure and Monitor It!

- Block inbound and outbound IPv6 traffic on border routers (native and tunneled)
 - Native IPv6 traffic
 - Tunneled traffic
 - Teredo, ISATAP, 6in4, and 6to4

Tunneling method	Protocol number	Layer 4 port used (if any)	Notes
Teredo	n/a	UDP 3544*	Uses teredo.ipv6.microsoft.com; block UDP for addresses in 2001::/32
ISATAP	41		access-list deny 41 any any
6to4	41		Uses anycast 192.88.99.1; access-list deny 41 any any

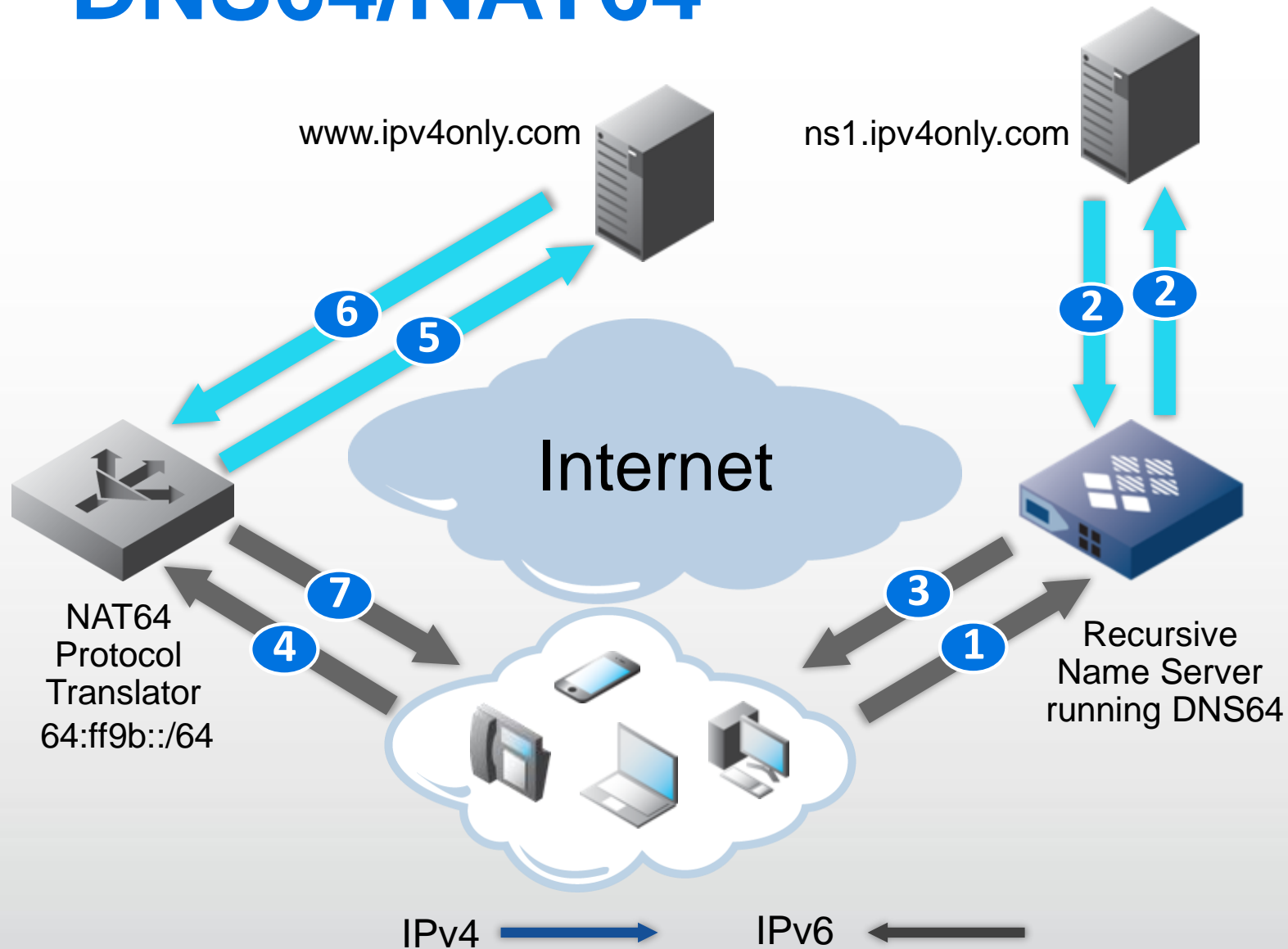


IPv6 DDI



- General IPv4/IPv6 feature parity
 - DNS queries
 - DNS responses over v6
 - AAAA records
 - IPAM/DHCP networks/ranges
 - Fixed addresses
 - Hosts – dual stack
 - IPv6 NetMap
 - IPv6 Discovery
 - GUI/API/SNMP
 - Gateway discovery
 - RIR allocation and updates
- Transition technology
 - DNS64(NAT64)

DNS64/NAT64



- 1 Client sends a query for www.ipv4only.com/AAAA to the local recursive name server
- 2 Recursive name server sends www.ipv4only.com/AAAA query to name server, gets a negative response, sends www.ipv4only.com/A query, gets response
- 3 Using the 64:ff9b::/64 prefix, recursive name server synthesizes an IPv6 address to return to client in AAAA record
- 4 Client sends the packet to synthesized IPv6 address, which routes to NAT64
- 5 NAT64 sends the packet to the destination IPv4 address
- 6 IPv4-only web server returns response over IPv4 to NAT64
- 7 NAT64 converts packet to IPv6, returns it to originating client

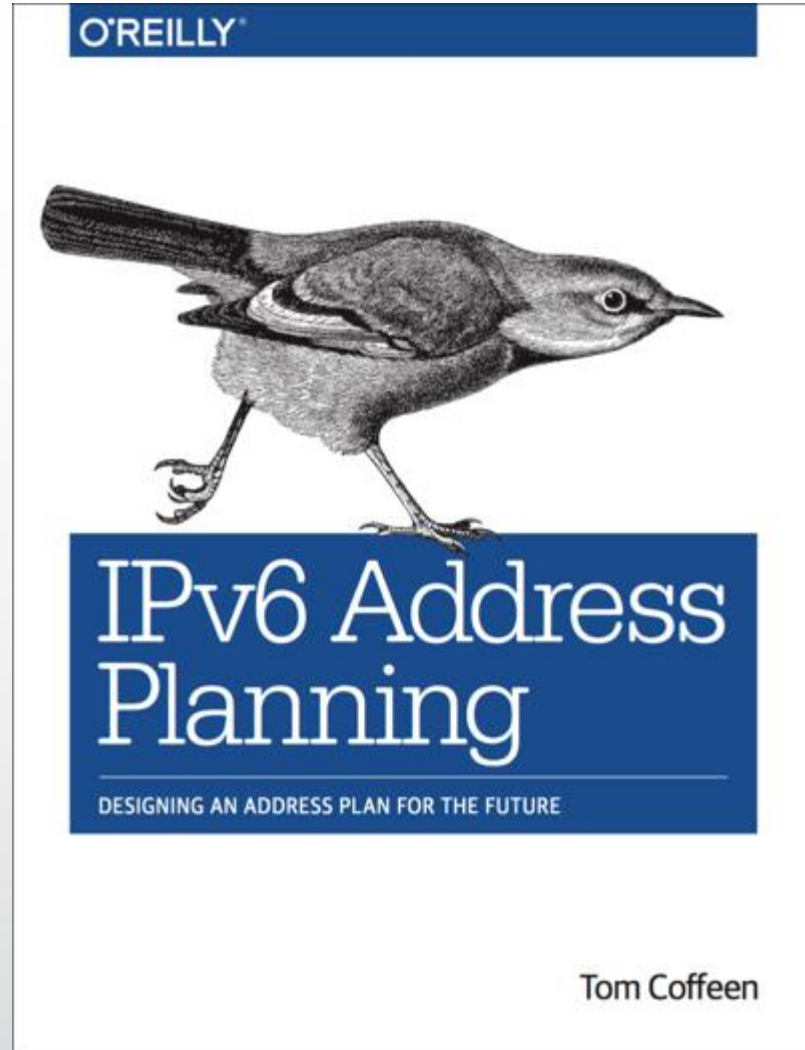


- White papers, solution notes, videos, webinars, guides, podcasts, and a new blog post at least every week
- Industry thought leadership around IPv6 adoption through participation in Internet engineering, address resource, and standards development forums

<http://www.infoblox.com/ipv6>



IPv6 Address Planning, O'Reilly Media, 2015



- For IT network architects, engineers, and administrators
- Comprehensive overview and current best-practices for designing, deploying, and maintaining an effective IPv6 addressing plan

Thank you!

Q&A...

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