

The background is a vibrant, abstract graphic. It features a central bright white light source from which numerous colorful rays emanate, creating a sunburst or starburst effect. The rays transition through a spectrum of colors including yellow, orange, red, and various shades of blue and green. Overlaid on this are several large, semi-transparent, wavy shapes in similar color tones, giving the overall image a sense of motion and energy.

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Let's go

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The bridge to possible

Goodbye Legacy,

the move to an IPv6-Only Enterprise

David Prall Systems Architect
@pralldc
BRKENT-2008

CISCO *Live!*

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Cisco Webex App

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- 1 Find this session in the Cisco Live Mobile App
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<https://ciscolive.ciscoevents.com/ciscolivebot/#BRKENT-2008>

Agenda

- Introduction
- Our Dual Stacked Network
- IPv4 vs IPv6
- NAT64/DNS64
- IPv6-Only
- Additional Learning
- Conclusion

Introduction

Your speaker



- David Prall
- Systems Architect
- US Federal NSD Operation
- dprall@cisco.com
- CCIE 6508 (R&S/SP/Security)
- 22 Years at Cisco
- Washington, DC
- House Dual-Stacked since September 2007

IPv6-Only is the Future

- RFC1883 - December 1995
 - Updated RFC8200 (STD86) - July 2017
- US Government Memorandum M-21-07, Completing the Transition to Internet Protocol Version 6 (IPv6) - November 2020
 - September 2025 for 80% IPv6-Only completion
 - US Government Memorandum M-05-22, Transition Planning for Internet Protocol Version 6 (IPv6) - August 2005
 - Transition to IPv6 - September 2010
- Germany Defense, China, and others have released 2030 dates for IPv6-Only completion

Our Dual Stacked Network

Our Dual Stacked Network

- IPv4 and IPv6 are both available for use
- How did my Web Browser Connect
- NetFlow shows us what is being utilized

IPv4 and IPv6 are both available for use

```
C:\>ipconfig
Windows IP Configuration

Ethernet adapter Ethernet0:

    Connection-specific DNS Suffix  . : 
    IPv6 Address. . . . . : 2001db8:8000:103::190
    Link-local IPv6 Address . . . . . : fe80::12a8:6d5:b492:dd26%12
    IPv4 Address. . . . . : 192.168.124.190
    Subnet Mask . . . . . : 255.255.255.192
    Default Gateway . . . . . : 2001:db8:8000:103::1
                                fe80::272:78ff:fe55:15d%12
                                192.168.124.129
```

```
$ ifconfig en0
en0: flags=8863<UP,BROADCAST,SMART,RUNNING,SIMPLEX,MULTICAST> mtu 1500
options=400<CHANNEL_IO>
ether 88:66:5a:4b:a2:38
inet6 fe80::c5:d6d9:3a53:5bb3%en0 prefixlen 64 secured scopeid 0x6
inet 192.168.141.108 netmask 0xfffffe00 broadcast 192.168.141.255
inet6 2001:db8:8000:140:58d:6787:27f2:9aab prefixlen 64 dynamic
nd6 options=201<PERFORMNUD,DAD>
media: autoselect
status: active
```

Are you sure both are available?

- Android doesn't support DHCPv6

```
show run interface vlan 150
<snip>
  ipv6 nd prefix default 2592000 604800 no-autoconfig
  ipv6 nd managed-config-flag
  ipv6 nd other-config-flag
  ipv6 dhcp relay destination 2001:DB8::100
<snip>
```

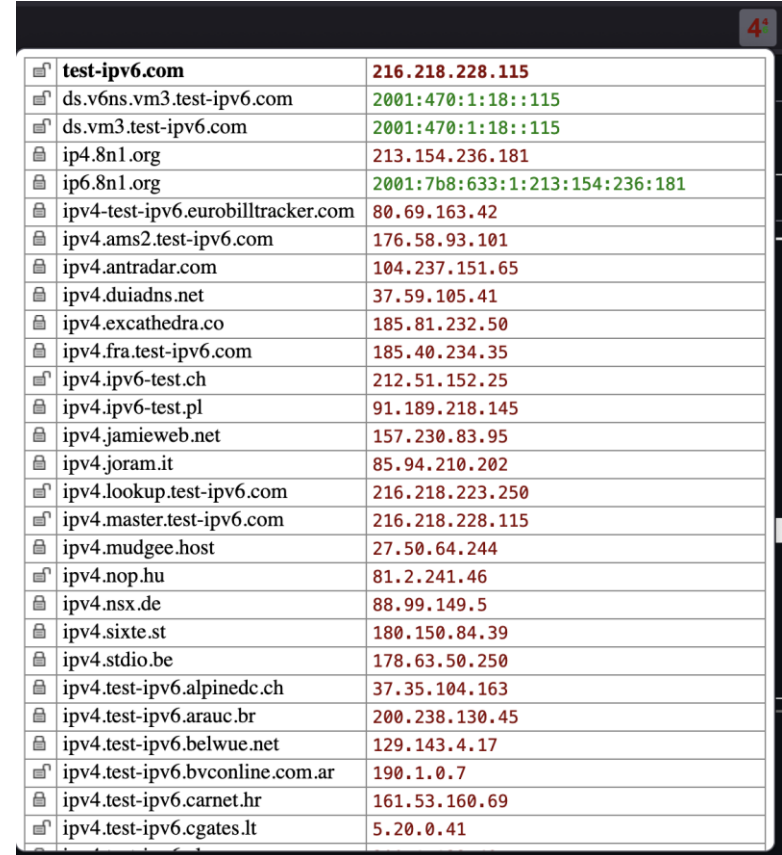
Clears A bit
disables SLAAC

- For Android we must leave SLAAC enabled and provide DNS

```
conf t
int vlan 150
  no ipv6 nd prefix default
  ipv6 nd ra dns server 2001:DB8::111
  ipv6 nd ra dns server 2001:DB8::112
end
```

How did my Web Browser Connect

- IPvFoo
 - Extension for Firefox and Chrome
 - Can be added to Edge enabling “Allow extensions from other stores.”



test-ipv6.com	216.218.228.115
ds.v6ns.vm3.test-ipv6.com	2001:470:1:18::115
ds.vm3.test-ipv6.com	2001:470:1:18::115
ip4.8n1.org	213.154.236.181
ip6.8n1.org	2001:7b8:633:1:213:154:236:181
ipv4-test-ipv6.eurobilltracker.com	80.69.163.42
ipv4.ams2.test-ipv6.com	176.58.93.101
ipv4.antradar.com	104.237.151.65
ipv4.duiadns.net	37.59.105.41
ipv4.excathedra.co	185.81.232.50
ipv4.fra.test-ipv6.com	185.40.234.35
ipv4.ipv6-test.ch	212.51.152.25
ipv4.ipv6-test.pl	91.189.218.145
ipv4.jamieweb.net	157.230.83.95
ipv4.joram.it	85.94.210.202
ipv4.lookup.test-ipv6.com	216.218.223.250
ipv4.master.test-ipv6.com	216.218.228.115
ipv4.mudgee.host	27.50.64.244
ipv4.nop.hu	81.2.241.46
ipv4.nsx.de	88.99.149.5
ipv4.sixte.st	180.150.84.39
ipv4.stdio.be	178.63.50.250
ipv4.test-ipv6.alpinedc.ch	37.35.104.163
ipv4.test-ipv6.arauc.br	200.238.130.45
ipv4.test-ipv6.belwue.net	129.143.4.17
ipv4.test-ipv6.bvonline.com.ar	190.1.0.7
ipv4.test-ipv6.carnet.hr	161.53.160.69
ipv4.test-ipv6.cgates.lt	5.20.0.41

NetFlow shows us what is being utilized

- NetFlow allows the network operator to see what is flowing on the network.
 - Secure Network Analytics / StealthWatch
 - DNA Center Assurance
 - Other Third Party
- What is using IPv4 still?
 - Internal or External?
- Why is it using IPv4 still?
 - Focus on Internal.

Network Analytics

Monitor • Investigate • Report • Configure

Flow Search Results (19)

Edit Search

Last 5 minutes 2,000 Rows Selected

Subject: Inside Hosts Host Group Other Classifications

Connection: Validated Hosts Host Group All Classifications

Peer: DNS Servers Host Group

Save Search Save F

Start	Duration	Subject IP Address	Subject Port/Proto...	Subject Host Group...	Subject Bytes	Application	Total Bytes	Peer IP Address	Peer Port/Protocol	Peer Host Group	Peer Bytes
Ex. 05/05/2021	Ex. <=30minAgo	Ex. 10.10.10.10	Ex. 57100/UDP	Ex. "Switch-A"	Ex. <=50M	Ex. "Corporate-E"	Ex. <=50M	Ex. 10.200.200.20	Ex. 20000/UDP	Ex. "Switch-A"	Ex. <=50M
Apr 2, 2023 12:40:04 PM (3d 22hr 56min 46s ago)	3d 22hr 56min 53s	199.212.124.195	53468/UDP	Web Servers, Mail Servers, NTP Servers	612.93 K	DNS (unclassified)	2.92 M	199.212.124.111	53/UDP	Servers, DNS Servers	2.32 M
Apr 4, 2023 3:15:57 PM (1d 20hr 23min 53s ago)	1d 20hr 21min	192.168.141.108	56893/UDP	Client IP Ranges (DHCP Range)	3.43 K	DNS (unclassified)	45.17 K	199.212.124.112	53/UDP	Servers, DNS Servers	41.74 K
Apr 4, 2023 3:15:57 PM (1d 20hr 23min 53s ago)	1d 20hr 21min	192.168.141.108	63318/UDP	Client IP Ranges (DHCP Range)	3.43 K	DNS (unclassified)	45.05 K	199.212.124.111	53/UDP	Servers, DNS Servers	41.63 K
Apr 6, 2023 11:02:01 AM (37min 49s ago)	34min 53s	2620.ae:8000::cc:1e:5:508	51862/UDP	Web Servers	1.66 K	DNS (unclassified)	11.62 K	2620.ae:8000:102::11	53/UDP	DNS Servers	9.97 K
Apr 6, 2023 8:08:26 AM (3hr 31min 24s ago)	3hr 27min 39s	192.168.140.161	19625/UDP	Client IP Ranges (DHCP Range)	1.12 K	DNS (unclassified)	8.63 K	199.212.124.112	53/UDP	Servers, DNS Servers	7.51 K
Apr 6, 2023 11:20:16 AM (19min 34s ago)	15min 40s	192.168.141.16	15815/UDP	Client IP Ranges (DHCP Range)	852	DNS (unclassified)	7.66 K	199.212.124.111	53/UDP	Servers, DNS Servers	6.83 K
Apr 6, 2023 11:30:39 AM (9min 11s ago)	4min 46s	199.212.124.13	35101/TCP	Web Servers, Mail Servers	634	DNS (unclassified)	5.96 K	199.212.124.112	53/TCP	Servers, DNS Servers	5.34 K

IPv4 vs IPv6



IPv4 vs IPv6

- Address Selection
- Happy Eyeballs RFC6555/8305 – Users are happy
- IPv6 is Faster

Address Selection

- RFC6724 Default Address Selection for IPv6
- Globally Unique Addresses (GUA) are the only option
- Unique Local Addresses (ULA) are of limited use
 - Not the same as RFC1918
 - There is no NATv6
 - NPTv6 as defined changes only the prefix
 - As of RFC6724 IPv4 is preferred over IPv6 ULA
 - Unless IPv6 ULA to IPv6 ULA

Happy Eyeballs RFC6555/8305

- On a dual-stacked system give IPv6 the edge but start an IPv4 session and see which is fastest.
- Before Happy Eyeballs dual-stacked systems would start an IPv6 session and if it didn't work after several attempts. Possibly fallback to IPv4.
- Typically, only needed when a site is advertising an IPv6 AAAA but not functioning. Or when Cogent (AS174) and Hurricane Electric (AS6939) are involved.

IPv6 is Faster

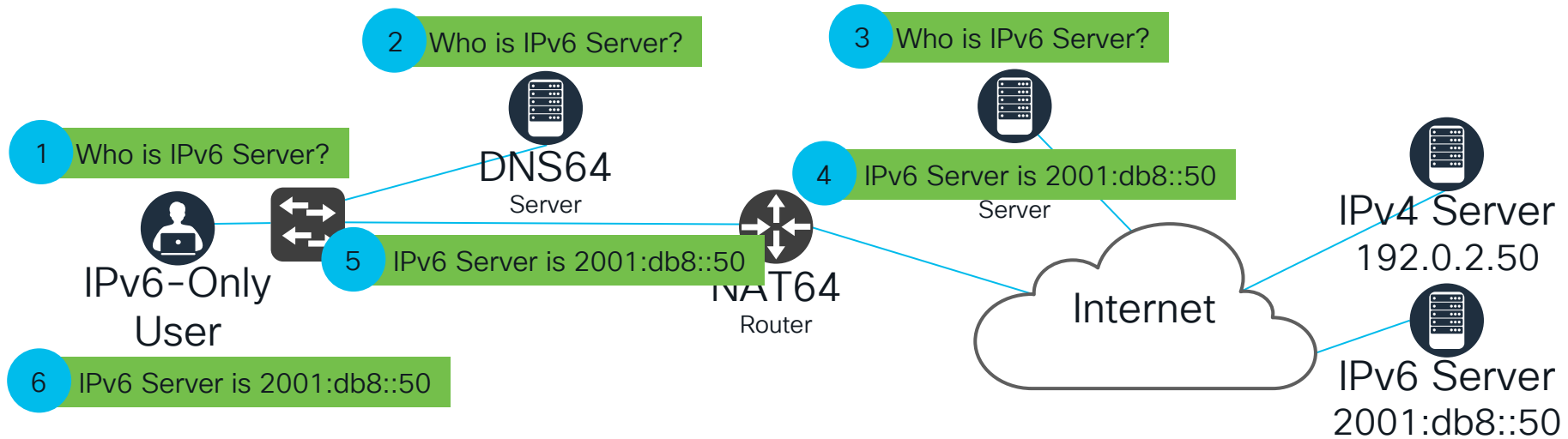
- “Several years ago, Facebook decided to move early and migrate to IPv6. We’ve observed that accessing Facebook can be 10-15 percent faster over IPv6. We believe other developers will see similar advantages from migrating.” [IPv6: It’s time to get on board](#)
- “Akamai’s customer AbemaTV did a case study in 2019, which showed that IPv6 improved the throughput by 38% on average when compared with connections via IPv4.” [10 Years Since World IPv6 Launch](#)

NAT64/DNS64

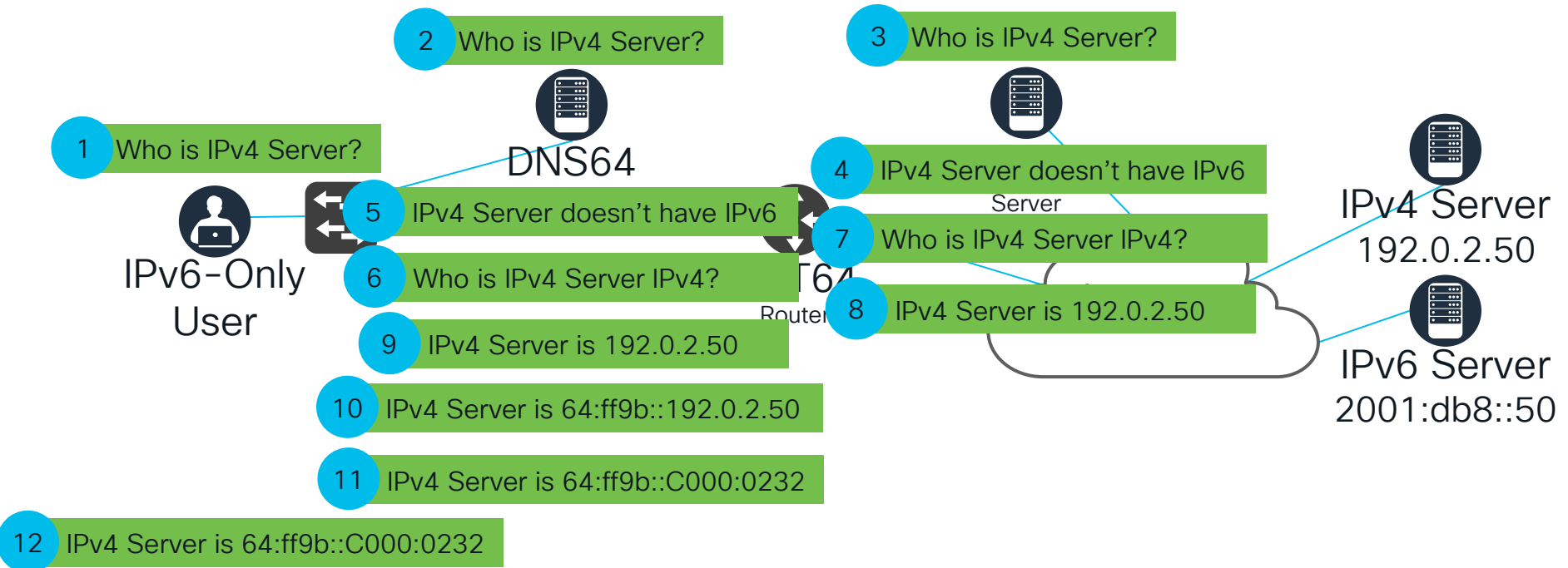
NAT64/DNS64

- RFC6052 IPv6 Addressing of IPv4/IPv6 Translators
 - Well Known Prefix for NAT64 – 64:ff9b::/96
- RFC6145 Stateless IP/ICMP Translation Algorithm
- RFC6146 Stateful NAT64: Network Address and Protocol Translation from IPv6 Clients to IPv4 Servers
- RFC6147 DNS64: DNS Extensions for Network Address Translation from IPv6 Clients to IPv4 Servers

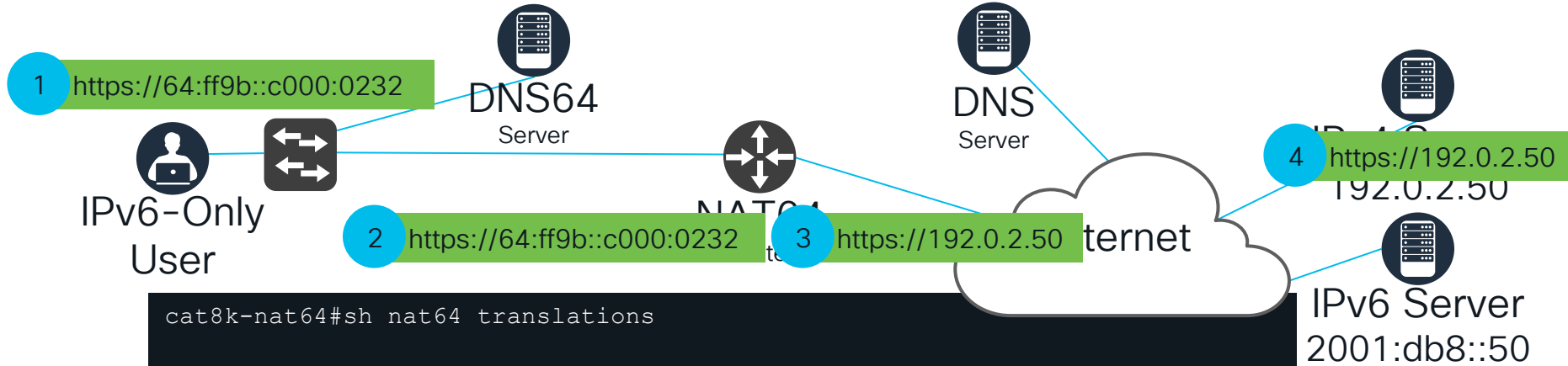
IPv6 AAAA DNS Request



IPv6 AAAA DNS64 Request



NAT64 Traffic Flow



```
cat8k-nat64#sh nat64 translations
```

Proto	Original IPv4	Translated IPv4
	Translated IPv6	Original IPv6

-		
tcp	192.0.2.50:443	[64:ff9b::c000:0232]:443
	192.0.2.252:52362	[2001:db8:8000:150::2]:52362

IOS-XE Router Configuration

IP NAT and NAT64
cannot be together

- When using Well-Known Prefix 64:ff9b::/96

```
interface GigabitEthernet1
  ip address 192.168.67.2 255.255.255.0
  nat64 enable
interface GigabitEthernet2
  no ip address
  nat64 enable
  ipv6 address 2001:DB8:8000:666::5/64
  ipv6 access-list nat64-acl
    sequence 10 permit ipv6 2001:DB8::/32 any
  nat64 v4 pool nat64-pool 192.0.2.252 192.0.2.252
  nat64 v6v4 list nat64-acl pool nat64-pool overload
```

Must be Public
per RFC6052

IOS-XE Router Configuration

- Let's use an Internal Prefix
 - Must utilize own DNS64 server

```
interface GigabitEthernet1
  ip address 192.168.67.2 255.255.255.0
  nat64 enable
interface GigabitEthernet2
  no ip address
  nat64 enable
  ipv6 address 2001:DB8:8000:666::5/64
  ipv6 access-list nat64-acl
    sequence 10 permit ipv6 2001:DB8::/32 any
nat64 prefix stateful 2001:DB8:FFF::/96
  nat64 v4 pool nat64-pool 192.168.255.254 192.168.255.254
  nat64 v6v4 list nat64-acl pool nat64-pool overload
```

Public Recursive DNS64 Servers

- <https://gist.github.com/mutin-sa/5dcbd35ee436eb629db7872581093bc5>
- Google Public DNS64
<https://developers.google.com/speed/public-dns/docs/dns64>
 - 2001:4860:4860::6464
 - 2001:4860:4860::64
- Cloudflare DNS64
 - 2606:4700:4700::64
 - 2606:4700:4700::6400

DNS64 Configuration

- Bind 9 <https://www.oreilly.com/library/view/dns-and-bind/9781449308025/ch04.html>

Limit DNS64
to specific clients

```
! 64:ff9b::/96 {  
  clients { 2001:db8:8000:150::/64; };  
  mapped { !10/8; !172.16/12; !192.168/16;  
    !100.64/10;!169.254/16;!127/8;!192.0.0/24;!192.0.2/24;!192.88.99/24;!198.18/15;!1  
    98.51.100/24;!203.0.113/24;!224/4;!240/4; any; };  
  exclude { 64:ff9b::/96; };  
  recursive-only yes;  
};
```

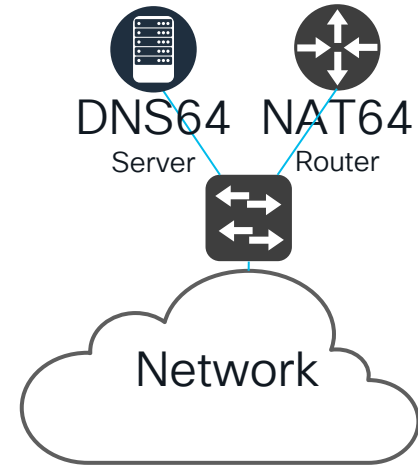
Well-Known or
Chosen Prefix

Deny(!) Private
Allow any; others

- Infoblox <https://docs.infoblox.com/space/nios86/36704017/About+DNS64>

Placement NAT64/DNS64

- Service Block
 - Placed near IPv6-Only Users
 - Can reach internal IPv4 resources
- Integrated
 - DNS64 can be limited to specific IPv6 addresses
 - Translation prefix can be advertised to network
- Edge
 - IPv6 is fully functional internally for **everything(?)**
 - IPv6-Only Users can reach internal IPv6-Only and Dual Stack Resources
 - Only required for external sites that haven't Dual Stacked



IPv6-Only

IPv6-Only

- Where do we start?
- Do I need to disable IPv4 in OS?
- Stop IPv4 on the Network
- How did my Web Browser Connect
- NetFlow shows us what is being utilized
- Network Equipment

Where do we start?

- Outside In
 - Network Engineers
 - Help Desk
 - Select user VLAN's
 - VLAN by VLAN
 - Site by Site
 - Data Center
 - Network Infrastructure

Do I need to disable IPv4 in OS?

- On an IPv6-Only VLAN

```
C:\>ipconfig
Windows IP Configuration

Ethernet adapter Ethernet0:

    Connection-specific DNS Suffix  . : 
    IPv6 Address. . . . .           : 2001:db8:8000:150::2
    Link-local IPv6 Address . . . . : fe80::9c73:7c11:8a59:3f3d%13
    Autoconfiguration IPv4 Address. . : 169.254.42.133
    Subnet Mask . . . . .           : 255.255.0.0
    Default Gateway . . . . .       : 2001:db8:8000:150::1
                                      fe80::272:78ff:fe55:17d%13
```

- What happens while travelling?

Stop IPv4 at Layer 2

- VLAN Map, example for limited address space

```
vlan access-map vlan-map-ipv4-link-local 10
  match ip address ipv4-link-local-deny
  action forward
vlan access-map vlan-map-ipv4-link-local 20
  match ip address ipv4-link-local-permit
  action drop
vlan filter vlan-map-ipv4-link-local vlan-list 150
ip access-list extended ipv4-link-local-deny
  10 deny ip 169.254.0.0 0.0.255.255 any
  20 permit ip any any
ip access-list extended ipv4-link-local-permit
  10 permit ip 169.254.0.0 0.0.255.255 any
```

Stop IPv4 at Layer 3

- Unicast Reverse Path Forwarding

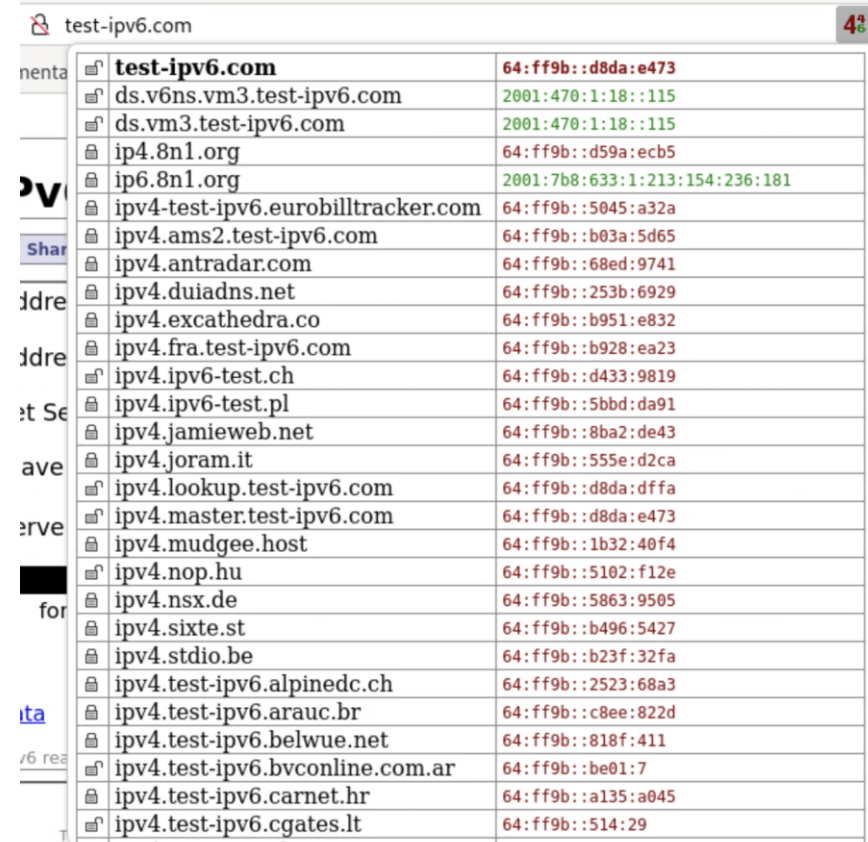
```
interface Vlan150
  no ip address
  ip verify unicast source reachable-via rx
```

- Access List

```
interface Vlan150
  no ip address
  ip access-group no-ipv4 in
  ip access-group no-ipv4 out
  ip access-list extended no-ipv4
  10 deny ip any any
```

How did my Web Browser Connect

- IPvFoo
 - Extension for Firefox and Chrome
 - Can be added to Edge enabling “Allow extensions from other stores.”
 - By using the Well-Known Prefix, we still know what is only IPv4

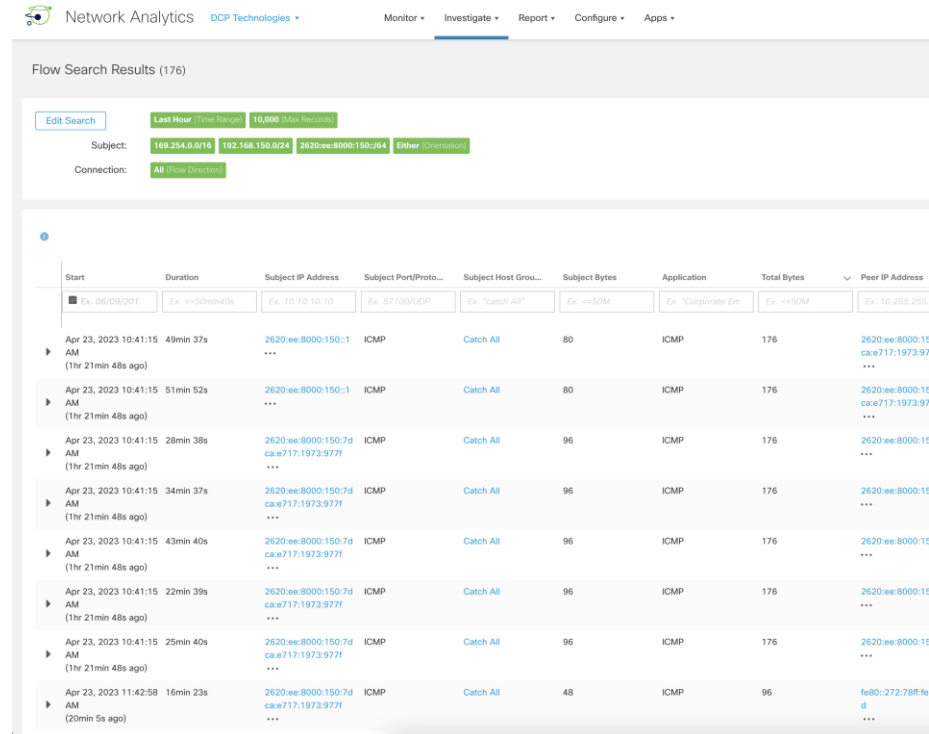


The screenshot shows the IPvFoo extension interface in a web browser. At the top, the address bar displays 'test-ipv6.com' with a red lock icon on the left and a red '4' icon on the right. Below the address bar, a table lists various domains and their corresponding IPv6 addresses. The table has two columns: the domain name and the IPv6 address. The domains listed include test-ipv6.com, ds.v6ns.vm3.test-ipv6.com, ds.vm3.test-ipv6.com, ip4.8n1.org, ip6.8n1.org, ipv4-test-ipv6.eurobilltracker.com, ipv4.ams2.test-ipv6.com, ipv4.antradar.com, ipv4.duiadns.net, ipv4.excathedra.co, ipv4.fra.test-ipv6.com, ipv4.ipv6-test.ch, ipv4.ipv6-test.pl, ipv4.jamieweb.net, ipv4.joram.it, ipv4.lookup.test-ipv6.com, ipv4.master.test-ipv6.com, ipv4.mudgee.host, ipv4.nop.hu, ipv4.nsx.de, ipv4.sixte.st, ipv4.stdio.be, ipv4.test-ipv6.alpinedc.ch, ipv4.test-ipv6.arauc.br, ipv4.test-ipv6.belwue.net, ipv4.test-ipv6.bvconline.com.ar, ipv4.test-ipv6.carnet.hr, and ipv4.test-ipv6.cgates.lt. The IPv6 addresses are displayed in green text.

Domain	IPv6 Address
test-ipv6.com	64:ff9b::d8da:e473
ds.v6ns.vm3.test-ipv6.com	2001:470:1:18::115
ds.vm3.test-ipv6.com	2001:470:1:18::115
ip4.8n1.org	64:ff9b::d59a:ecb5
ip6.8n1.org	2001:7b8:633:1:213:154:236:181
ipv4-test-ipv6.eurobilltracker.com	64:ff9b::5045:a32a
ipv4.ams2.test-ipv6.com	64:ff9b::b03a:5d65
ipv4.antradar.com	64:ff9b::68ed:9741
ipv4.duiadns.net	64:ff9b::253b:6929
ipv4.excathedra.co	64:ff9b::b951:e832
ipv4.fra.test-ipv6.com	64:ff9b::b928:ea23
ipv4.ipv6-test.ch	64:ff9b::d433:9819
ipv4.ipv6-test.pl	64:ff9b::5bbd:da91
ipv4.jamieweb.net	64:ff9b::8ba2:de43
ipv4.joram.it	64:ff9b::555e:d2ca
ipv4.lookup.test-ipv6.com	64:ff9b::d8da:dffa
ipv4.master.test-ipv6.com	64:ff9b::d8da:e473
ipv4.mudgee.host	64:ff9b::1b32:40f4
ipv4.nop.hu	64:ff9b::5102:f12e
ipv4.nsx.de	64:ff9b::5863:9505
ipv4.sixte.st	64:ff9b::b496:5427
ipv4.stdio.be	64:ff9b::b23f:32fa
ipv4.test-ipv6.alpinedc.ch	64:ff9b::2523:68a3
ipv4.test-ipv6.arauc.br	64:ff9b::c8ee:822d
ipv4.test-ipv6.belwue.net	64:ff9b::818f:411
ipv4.test-ipv6.bvconline.com.ar	64:ff9b::be01:7
ipv4.test-ipv6.carnet.hr	64:ff9b::a135:a045
ipv4.test-ipv6.cgates.lt	64:ff9b::514:29

NetFlow shows us what is being utilized

- Why do we still see IPv4?
 - NetFlow on L2 interfaces happens before L3 processing.
 - 169.254.0.0/16 link-local IPv4
 - UPnP/SSDP 239.255.255.250:UDP/1900
 - Multicast DNS 224.0.0.251:UDP/5353
 - Static Configuration?
- IPv6 is all that is active!



The screenshot displays the 'Flow Search Results' interface in Cisco Network Analytics. The search criteria are set to 'Last Hour' (Time Range) and '10,000' (Max Records). The subject is '169.254.0.0/16' and the connection is 'All' (Flow Direction). The results table shows a list of ICMP flows. Each row includes a start time, duration, subject IP address, subject port/protocol, subject host group, subject bytes, application, total bytes, and peer IP address. The flows are categorized by time intervals (e.g., 49min 37s, 51min 52s, 28min 38s, 34min 37s, 43min 40s, 22min 39s, 25min 40s, 16min 23s).

Start	Duration	Subject IP Address	Subject Port/Proto...	Subject Host Grou...	Subject Bytes	Application	Total Bytes	Peer IP Address
Ex. 06/09/2017	Ex. <=50min 40s	Ex. 10.10.10.10	Ex. 57100/UDP	Ex. "catch all"	Ex. <=50M	Ex. "Corporate Em...	Ex. <=50M	Ex. 10.255.255...
Apr 23, 2023 10:41:15 AM (1hr 21min 48s ago)	49min 37s	2620:ee:8000:150:1 ...	ICMP	Catch All	80	ICMP	176	2620:ee:8000:150:1 ca:e717:1973:97f1 ...
Apr 23, 2023 10:41:15 AM (1hr 21min 48s ago)	51min 52s	2620:ee:8000:150:1 ...	ICMP	Catch All	80	ICMP	176	2620:ee:8000:150:1 ca:e717:1973:97f1 ...
Apr 23, 2023 10:41:15 AM (1hr 21min 48s ago)	28min 38s	2620:ee:8000:150:7d ca:e717:1973:97f1 ...	ICMP	Catch All	96	ICMP	176	2620:ee:8000:150:1 ca:e717:1973:97f1 ...
Apr 23, 2023 10:41:15 AM (1hr 21min 48s ago)	34min 37s	2620:ee:8000:150:7d ca:e717:1973:97f1 ...	ICMP	Catch All	96	ICMP	176	2620:ee:8000:150:1 ca:e717:1973:97f1 ...
Apr 23, 2023 10:41:15 AM (1hr 21min 48s ago)	43min 40s	2620:ee:8000:150:7d ca:e717:1973:97f1 ...	ICMP	Catch All	96	ICMP	176	2620:ee:8000:150:1 ca:e717:1973:97f1 ...
Apr 23, 2023 10:41:15 AM (1hr 21min 48s ago)	22min 39s	2620:ee:8000:150:7d ca:e717:1973:97f1 ...	ICMP	Catch All	96	ICMP	176	2620:ee:8000:150:1 ca:e717:1973:97f1 ...
Apr 23, 2023 10:41:15 AM (1hr 21min 48s ago)	25min 40s	2620:ee:8000:150:7d ca:e717:1973:97f1 ...	ICMP	Catch All	96	ICMP	176	2620:ee:8000:150:1 ca:e717:1973:97f1 ...
Apr 23, 2023 11:42:58 AM (20min 5s ago)	16min 23s	2620:ee:8000:150:7d ca:e717:1973:97f1 ...	ICMP	Catch All	48	ICMP	96	fe80::272:78ff:fe d ...

Network Equipment

- Services converted to IPv6? All services support IPv6?

- NTP - `ntp peer ipv6 time.example.com`

- NetFlow

- `flow exporter FLOWEXPORTER
destination 2001:DB8::2055`

FQDN converted
IPv6 Preferred

- Logging - `logging host fqdn ipv6 syslog.example.com`

- DNS - `ip name-server 2001:DB8:53::111 2001:DB8:53::112`

But do the services
support IPv6?

Network Equipment

- Services converted to IPv6? All services support IPv6?

- SNMP

```
snmp-server group <v3-group-name> v3 [auth|noauth|priv] access ipv6 <ipv6-acl> <ipv4-std-acl>  
snmp-server community private RW ipv6 <ipv6-acl> <ipv4-std-acl>  
snmp-server community public RO ipv6 <ipv6-acl> <ipv4-std-acl>  
  
snmp-server host 192.0.2.162 <snip>
```

Adding IPv6
requires restating
IPv4

- VTY Access-Lists

```
line vty 0 4  
  ipv6 access-class <ipv6-acl> in  
  access-class <ipv4-std-acl> in
```

FQDN converted
IPv4 Preferred

- Authentication

```
tacacs server TACACS  
  address fqdn tacacs.example.com  
  
radius server RADIUS  
  address fqdn radius.example.com
```

But do the services
support IPv6?

Routing Protocols

- Router ID's are 32-bit values
- Commonly represented as 4 dotted octets
- Cisco Routers are nice enough to utilize an interface IPv4 address
- IPv6-Only must manually configure router-id
 - Majority will not work
- Don't be surprised with the first router reload

Routing Protocols

- BGP

- `%BGP-4-NORTRID: BGP could not pick a router-id. Please configure manually.`
- `bgp router-id x.x.x.x`

- OSPFv3

- `%OSPFv3-4-NORTRID: Process OSPFv3-<area>-IPv6 could not pick a router-id, please configure manually`
- `router-id x.x.x.x`

- EIGRP

- **NOTHING**
- `eigrp router-id x.x.x.x`

- RIPng and ISIS could care less

Remove IP Routing



- no ip routing
 - BGP goes down immediately
 - Can't be configured, current configuration removed
 - %BGP-5-ADJCHANGE: neighbor 2001:DB8::2 Down Unknown path error
%BGP_SESSION-5-ADJCHANGE: neighbor 2001:DB8::2 IPv6 Unicast topology base removed from session Unknown path error
 - EIGRP goes down after hold time
 - Both Numbered and Named
 - %DUAL-5-NBRCHANGE: EIGRP-IPv6 1: Neighbor FE80::5054:FF:FE1B:C299 (GigabitEthernet1) is down: holding time expired
 - OSPFv3 goes down after dead time
 - %OSPFv3-5-ADJCHG: Process 1, Nbr 192.168.0.1 on GigabitEthernet1 from FULL to DOWN, Neighbor Down: Dead timer expired
 - RIPvng goes down after holddown time
 - ISIS could care less

Additional Learning



Further Reading

- Validated Solution: IPv6 Integration with Cisco SD-Access, SD-WAN, and Firepower
 - https://www.cisco.com/c/en/us/td/docs/cloud-systems-management/network-automation-and-management/dna-center/Cisco-Validated-Solution-Profiles/b_cisco_validated_solution_ipv6.html
- An IPv6 Campus of the Future
 - <https://blogs.cisco.com/networking/an-ipv6-campus-of-the-future>
- RFC6586 - Experiences from an IPv6-Only Network - April 2012



IPv6

Deploying and Securing IPv6

Learn from specialists about IPv6 in their respective area. From the fundamentals of the Neighbor Discovery Protocol, deployment guidelines, security in the network, and troubleshooting.

START

Monday, June 5 | 8:30 a.m.

BRKENT-2109

Let's Deploy IPv6 NOW

Monday, June 5 | 9:30 a.m.

BRKSEC-2044

Secure Operations for an IPv6 Network

Monday, June 5 | 11:00 a.m.

BRKMER-1752

Experience the Journey to IPv6-Only With Cisco Meraki

Monday, June 5 | 1:00 p.m.

BRKIPV-2191

IPv6:: It's Happening!

Tuesday, June 6 | 10:30 a.m.

BRKIPV-2000

Verifying your Systems Transition to IPv6

Tuesday, June 6 | 1:00 p.m.

BRKIPV-2751

IPv6 with Cisco IOS Routing and Meraki Access - A Practical Guide

Tuesday, June 6 | 2:30 p.m.

BRKENT-2008

Goodbye Legacy, the move to an IPv6-Only Enterprise

Tuesday, June 6 | 3:00 p.m.

BRKENT-3002

IPv6 Security in the Local Area with First Hop Security

Tuesday, June 6 | 3:00 p.m.

BRKIPV-1616

IPv6 - What Do you Mean there isn't a Broadcast?

Wednesday, June 7 | 10:30 a.m.

BRKIPV-3927

Deploying IPv6 in the Cloud

FINISH

Conclusion



Get to it, IPv6 is approaching 30

- NetFlow is required to see what is happening on the network.
- IPv6-Only User VLAN's are ready to be deployed
 - If your applications are ready
 - Cogent and Hurricane Electric are both reachable directly
- IPng Working Group proposed October 1994
 - <https://datatracker.ietf.org/wg/ipngwg/history/>
- RFC1883 - December 1995
 - Updated RFC8200 (STD 86) - July 2017
- RFC6586 - Experiences from an IPv6-Only Network - April 2012

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- Book your one-on-one Meet the Engineer meeting
- Attend the interactive education with DevNet, Capture the Flag, and Walk-in Labs
- Visit the On-Demand Library for more sessions at www.CiscoLive.com/on-demand



The bridge to possible

Thank you

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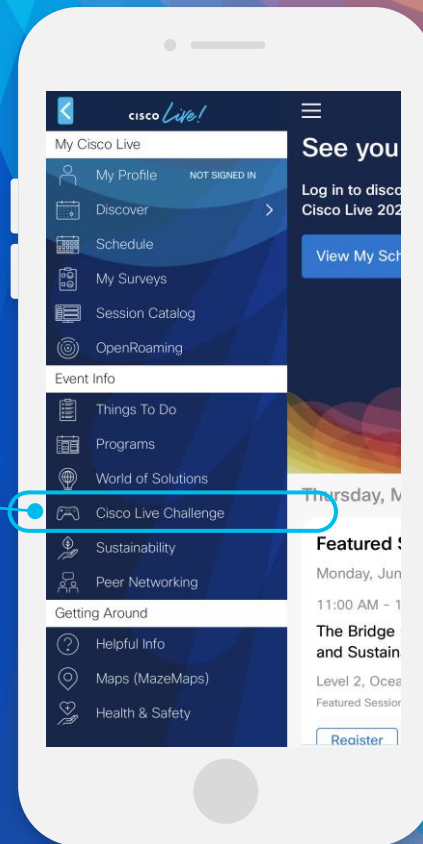
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Let's go

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