



# IPv6 Only DNS-OARC

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# Introduction

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@ipv4depletion

# Agenda

- T-Mobile's IPv6 journey
- Background DNS64 and 464XLAT
- Testing DNS64 failure scenarios
- Conclusion

# T-Mobile Customer Base

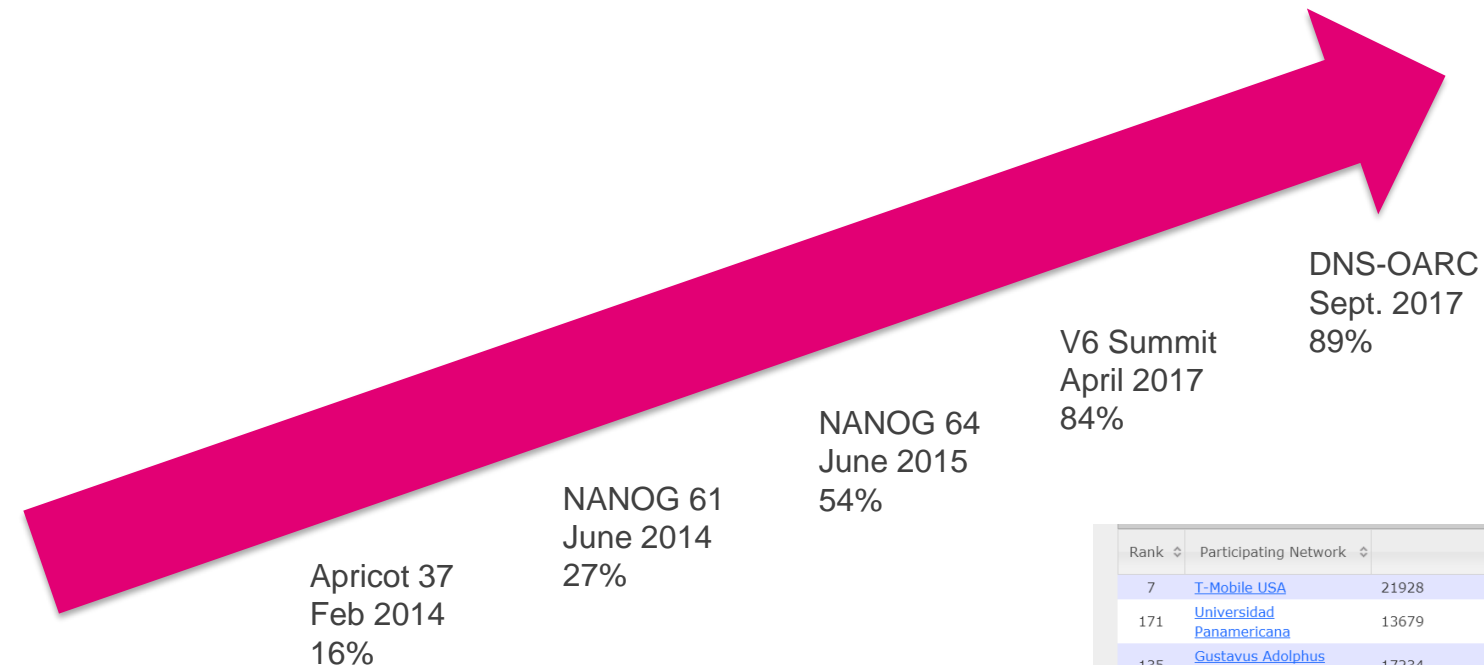


- At WWDC 2015 Apple announced the transition to IPv6-only network services in iOS 9. Starting June 1, 2016 all apps submitted to the App Store must support IPv6-only networking.
- IOS 10.3 is IPv6 only on the T-Mobile network



- Android 4.3 and later have support for IPv6 + 464XLAT

# Our Progress towards IPv6



<http://www.worldipv6launch.org/measurements/>

Rank	Participating Network	ASN(s)	IPv6 deployment
7	<a href="#">T-Mobile USA</a>	21928	89.28%
171	<a href="#">Universidad Panamericana</a>	13679	88.18%
135	<a href="#">Gustavus Adolphus College</a>	17234	87.53%
93	<a href="#">Virginia Tech</a>	1312	85.63%
5	<a href="#">RELIANCE JIO INFOCOMM LTD</a>	55836, 64049	83.63%
8	<a href="#">Verizon Wireless</a>	6167, 22394	83.47%
89	<a href="#">University of Pennsylvania</a>	55	82.69%
10	<a href="#">British Sky Broadcasting</a>	5607	82.29%
46	<a href="#">Google Fiber</a>	16591	80.11%
103	<a href="#">University of Iowa</a>	3676	78.25%

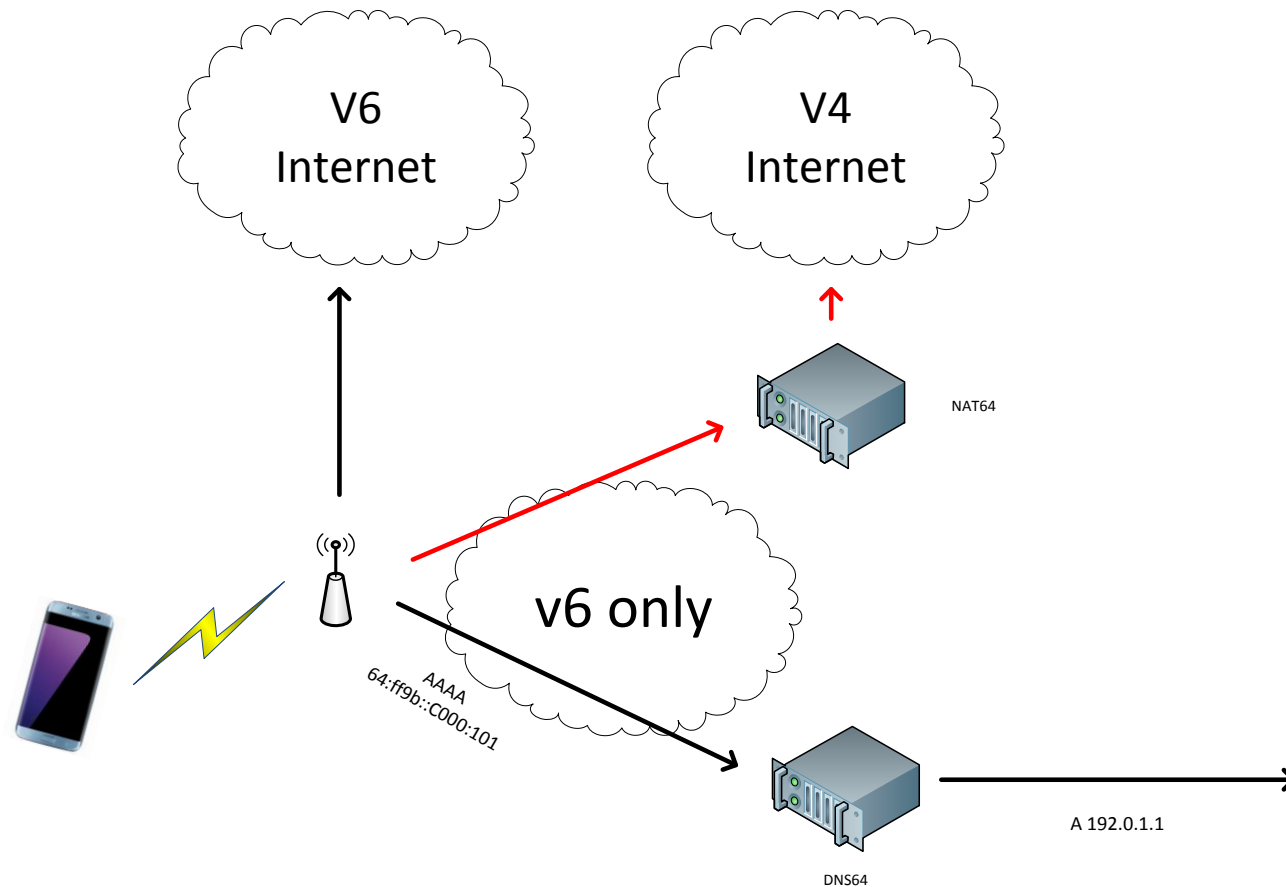
Showing 1 to 10 of 172 entries

First Previous 1 2 3 4 5 Next Last

# The remaining 11%

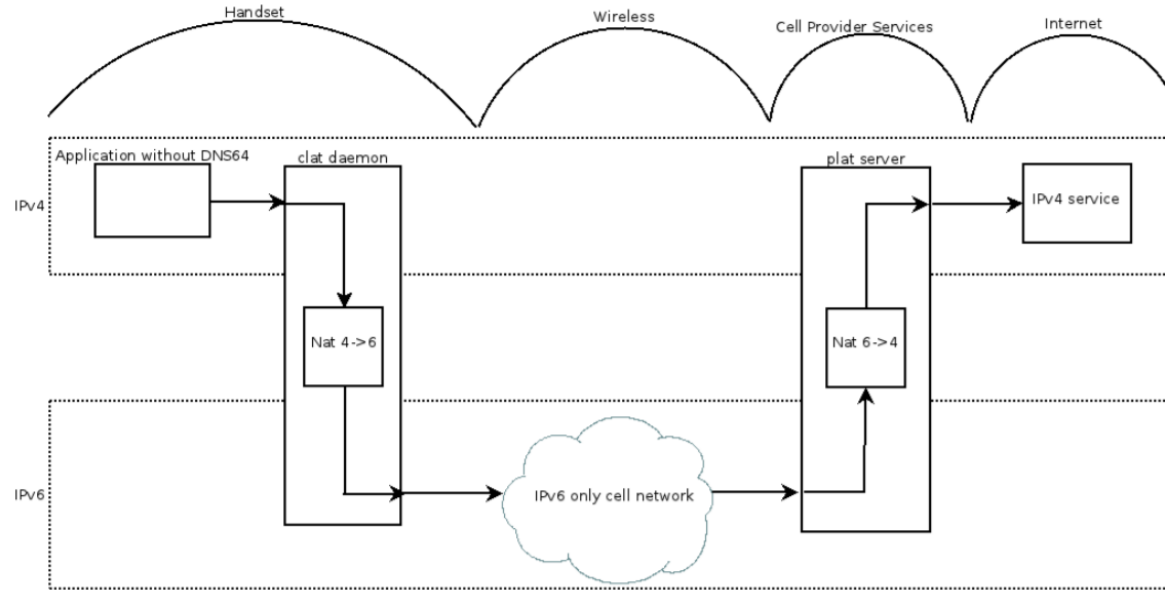
- TMUS Enterprise clients
- Really old handsets
- Tethering
- MVNO (Mobile Virtual Network Operators)
- Retries over IPv4 for one or another reason

# DNS64/NAT64 (RFC6147)



# 464 XLAT

# (RFC 6877)



464XLAT for Windows 10 coming?



# Discovery of IPv6 Prefix (RFC 7050)

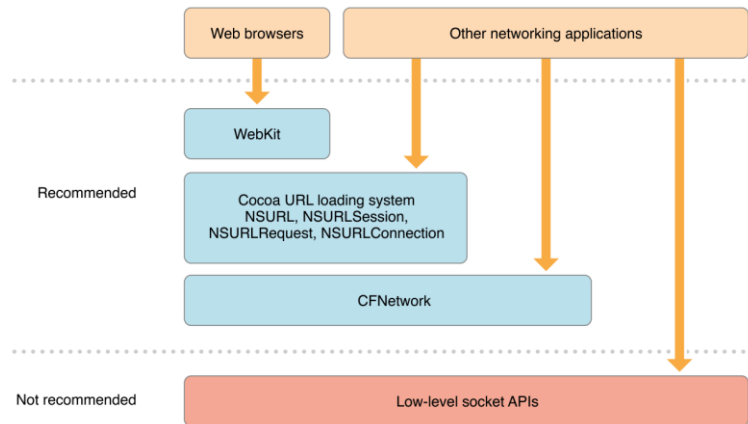
- Alternative to hardcoded pref64
- Sends DNS query for ipv4only.arpa
- Extract the pref64
- Happens during startup of 464XLAT

# Happy Eyeballs (RFC6555)

- Fallback to IPv4 after a reasonable time
- Happy Eyeballs work well for Dual Stack and 464XLAT clients
- Note! Happy Eyeballs have no effect on IPv6 only devices
- New version being worked on: draft-ietf-v6ops-rfc6555bis-05

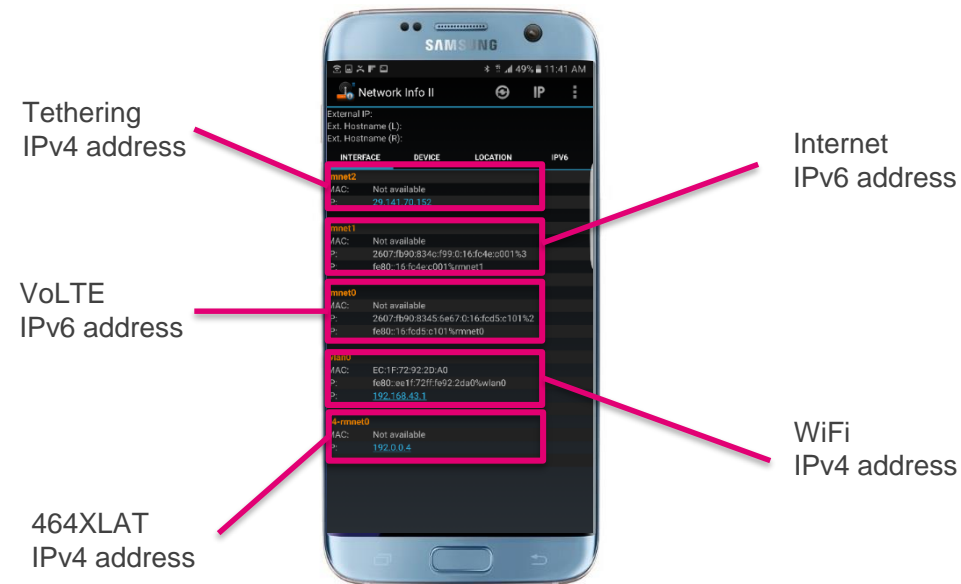
# Application level fallback

- NSURLSession on Apple devices handles IPv4 literals
- Note there is no fallback if IPv6 fails, no Happy Eyeballs



[https://developer.apple.com/library/content/documentation/NetworkingInternetWeb/Conceptual/NetworkingOverview/UnderstandingandPreparingfortheIPv6Transition/UnderstandingandPreparingfortheIPv6Transition.html#//apple\\_ref/doc/uid/TP40010220-CH213-SW13](https://developer.apple.com/library/content/documentation/NetworkingInternetWeb/Conceptual/NetworkingOverview/UnderstandingandPreparingfortheIPv6Transition/UnderstandingandPreparingfortheIPv6Transition.html#//apple_ref/doc/uid/TP40010220-CH213-SW13)

# Android Interfaces



Network Info II app can be found  
In Google/Apple Store

# Failure scenarios

## Network related failures

Special use – Special use  
AAAA record such as ::1,  
link-local, etc (common)

Edu22.info

Routing – AAAA  
returned, but unable to  
connect to the IP, :: (very  
common)

www.ericsson.se

<http://www.employees.org/~dwing/aaaa-stats/>

## DNS Related failures

RCODE – Does not return  
EMPTY NOERROR or  
NXDOMAIN (rare)

www.nuevosvecinos.com

Flag – Does not return  
the AA flag in the empty  
answer (rare)

Major cloud storage app

SOA – Does not provide  
SOA for the same domain  
as asked for (somewhat  
common)

Photo site

Timeout – Simply does  
not return anything when  
asked for AAAA  
(common)

www.sky.com.mx

# Testbed for failure scenarios

example:

```
dig @2001:4860:4860::6464 soa.dns64.lagerholm.com AAAA
dig @2001:4860:4860::6464 flag.dns64.lagerholm.com AAAA
dig @2001:4860:4860::6464 rcode.dns64.lagerholm.com AAAA
dig @2001:4860:4860::6464 timeout.dns64.lagerholm.com AAAA
```

Expected result:

```
timeout.dns64.lagerholm.com. 3 IN AAAA 64:ff9b::6464:6464
```

# Results response to failure scenarios

	Google DNS64 As of 9/29/2017	Secure64 CEM 3.2.4 A	Bind	Unbound 1.6.2
Soa	SERVFAIL	OK	SERVFAIL	OK
Timeout	OK	SERVFAIL	TIMEOUT	TIMEOUT*
Flag	SERVFAIL	SERVFAIL	SERVFAIL	OK
Rcode	OK	OK	SERVFAIL	SERVFAIL*

\* On first try and after TTL expire

# Conclusion

- DNS64 and 464XLAT works well and scales
- Determine what sites/apps are important
- Proactively scan top sites
- Reach out to broken sites
- Don't try to fix things with local overrides
- Scan social media for direct customer feedback
- Don't try to change the world
- Keep things in perspective
- Enterprise rollout





# Questions

