Orange Polska S.A.

IPv6-only mobile network

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IPv6 Day Kopenhagen, 06.11.2017

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Possible IPv6 implementations

- DualStack
  - single PDP IPv4v6
  - dual PDP, IPv4 & IPv6 simultaneously
- IPv6-only
  - Single PDP IPv6

DualStack

Single PDP IPv4v6

- PROS :
  - 100% IPv4/IPv6 content access
  - More?
- CONS:
  - **Does not solve IPv4 depletition problem**
  - Roaming issues
  - 2 adresses IPv4&IPv6 per one PDP
  - Licences cost, PCRF, LI, HSS etc

DualStack

Dual PDP IPv4&IPv6

- PROS :
  - 100% IPv4/IPv6 content access
- CONS:
  - **Does not solve IPv4 number problem**
  - 2 addresses IPv4&IPv6 per subscriber
  - 2 PDP’s per subscriber
  - High costs

IPv6-only - NAT64+DNS64

IPv6-only PDP

- PROS:
  - One PDP per subscriber
  - IPv6 unlimited capacity
  - Cost effective
  - WP, Symbian, Android supported
- CONS:
  - **IPv4 literals translation missing***
  - * Android/iOS IPv4literals translation will take place by default (RFC6877) (if PDPIPv6 is active)

N/A for mobile.*

IPv6-only - CLAT+NAT64+DNS64

IPv6-only PDP

- PROS :
  - One PDP per subscriber
  - IPv6 unlimited capacity
  - Cost effective
  - **Solve IPv4 depletation problem**
  - **Resign from DNS type=A querries* ?**
- CONS:
  - User device must support RFC 6877
  - CLAT+DNS64 - problems with apps where IPv4 literals&domain names are used

IPv6-only CLAT+NAT64+DNS/DualStack Orange Poland choice

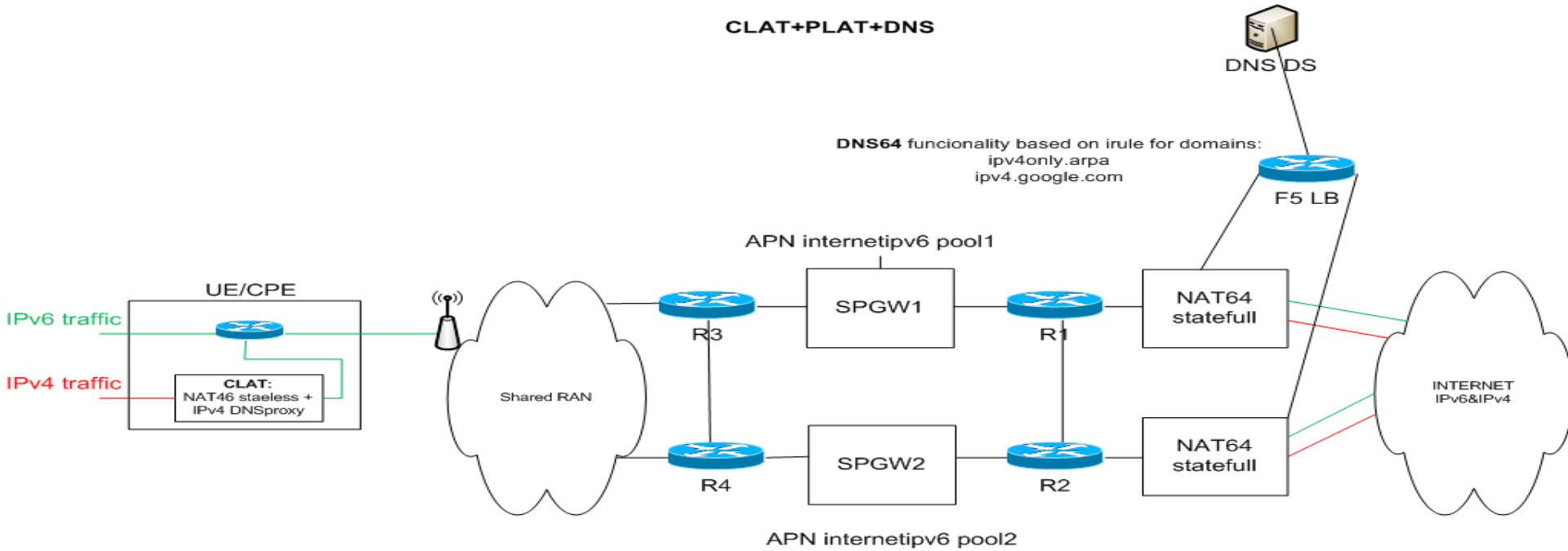
- PROS :
  - No issues with apps seen in CLAT/DNS64
  - No „modification” to DNS responses
  - Controlled statefull NAT64 translation (CLAT statlessly translate whole IPv4 traffic)
- CONS:

–Each end device must support CLAT (RFC 6877)

- DNS A querry required

https://tools.ietf.org/html/rfc6877#section-6.2

DNS64 only for NAT64 prefix discovery



NAT64 box – Alg's

- FTP active, passive
- RTSP
- PPTP

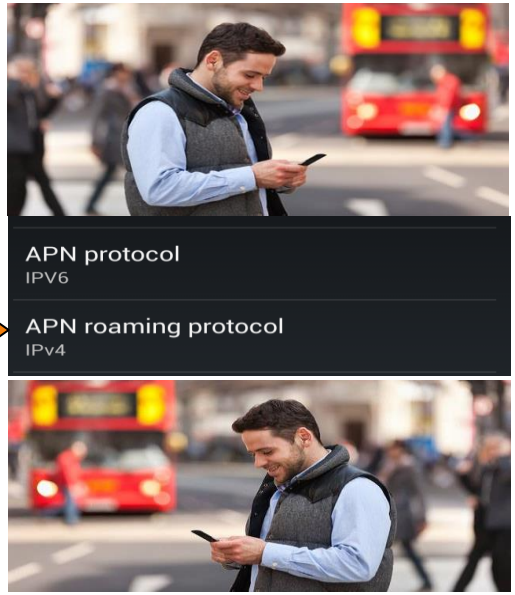
TCP MSS – maximum segment size override

- NAT64 traffic – 1220 B
- Native IPv6 – traffic – 1344 B
- This values are optimal to avoid fragmentation

Roaming 2G/3G & IPv6-only

- IPv6 or IPv4v6 not guaranteed for all roaming partners
  - IPv4 PDP fallback solution for automatic data roaming regardless of visitied network
  - Mechanism works for Android, Windowsphone
  - Roaming indicator (OS/terminal level) triggers fallback to IPv4 APN/PDP

Roaming 2G/3G & IPv6-only fallback to IPv4 mechanism



LTE Roaming & IPv6-only

- Roaming LTE require IPv6 support on visted network
  - LTE is data only network – Terminal first attach always is HPLMN-default bearer*
  - * if ESM info transflag feature is used - selected bearer (terminal settings)
- Launching roaming LTE outbound require IPv6-only test scenarios
  - To avoid problems allow IPv4 attach for your IPv6 APN when roaming (HSS/PGW)

LTE Roaming & IPv6-only – APN/HSS settings

APN	Aktywność	Id	Nazwa	Typ
2g/3g	✓	1	www.idea.pl	ipv4
		3	mms	ipv4
		8	internet	ipv4
		9	wap	ipv4
		18	internetipv6	ipv6
		19	internetipv6	ipv4
		21	euinternet	ipv4
LTE	✓	3	mms	ipv4
		8 *	internet	ipv4
		9	wap	ipv4
		18	internetipv6	ipv4oripv6

Selected bearer with EIT bit set

Host	Service	Access Tech	Call State	Status	Network Type	Call ID	MSID	Username	User IP	Idle time
SPGW-WAR04	S-GW	eUTRAN (4G)	Connected	Online/Active	IPv6	3aced48a	260032339XXXXXX	485XXXXXX	2a00:f41:1c2a:d681:0:3a:ced4:8b01	00h00m06s
SPGW-WAR04	P-GW	eUTRAN (4G)	Connected	Online/Active	IPv6	3aced48b	260032339XXXXXX	485XXXXXX@internetipv6-hplmn	2a00:f41:1c2a:d681:0:3a:ced4:8b01	00h00m06s

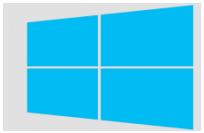
Selected bearer with EIT bit not set

Host	Service	Access Tech	Call State	Status	Network Type	Call ID	MSID	Username	User IP	Idle time
SPGW-WAR04	S-GW	eUTRAN (4G)	Connected	Online/Active	IPv4	4e448e48	2600323XXXXXXXX	48506XXXXXX	10.94.32.101	00h00m34s
SPGW-WAR04	S-GW	eUTRAN (4G)	Connected	Online/Active	IPv6	4e448e48	2600XXXXXXXX	48506XXXXX	2a00:f41:1c2c:439d:0:4e:448e:4e01	00h00m34s
SPGW-WAR04	P-GW	eUTRAN (4G)	Connected	Online/Active	IPv4	4e448e49	260XXXXXXXX	4850XXXXX@internet-hplmn	10.94.32.101	00h03m39s
SPGW-WAR04	P-GW	eUTRAN (4G)	Connected	Online/Active	IPv6	4e448e4e	260032XXXXXXXX	48506XXXX@internetipv6-hplmn	2a00:f41:1c2c:439d:0:4e:448e:4e01	00h00m34s

NOK multiple bearer activation

IPv6 devices

- Android – JB4.3+
- WP 8.1+ – Nokia /Lumia
- Routers(Huawei/ZTE)
- iOS 10* - require DNS64, DNS AAAA query only



IPv6 & IoT

- Not easy to connect from IPv4 to IPv6 (NAT46?, tunnel brokers)
- Dynamic DNS providers necessary to add options to assign only AAAA for domains
- IoT-IPv6 rather will talk with dualstack clouds than becomes part of Internet for peer2peer communication.

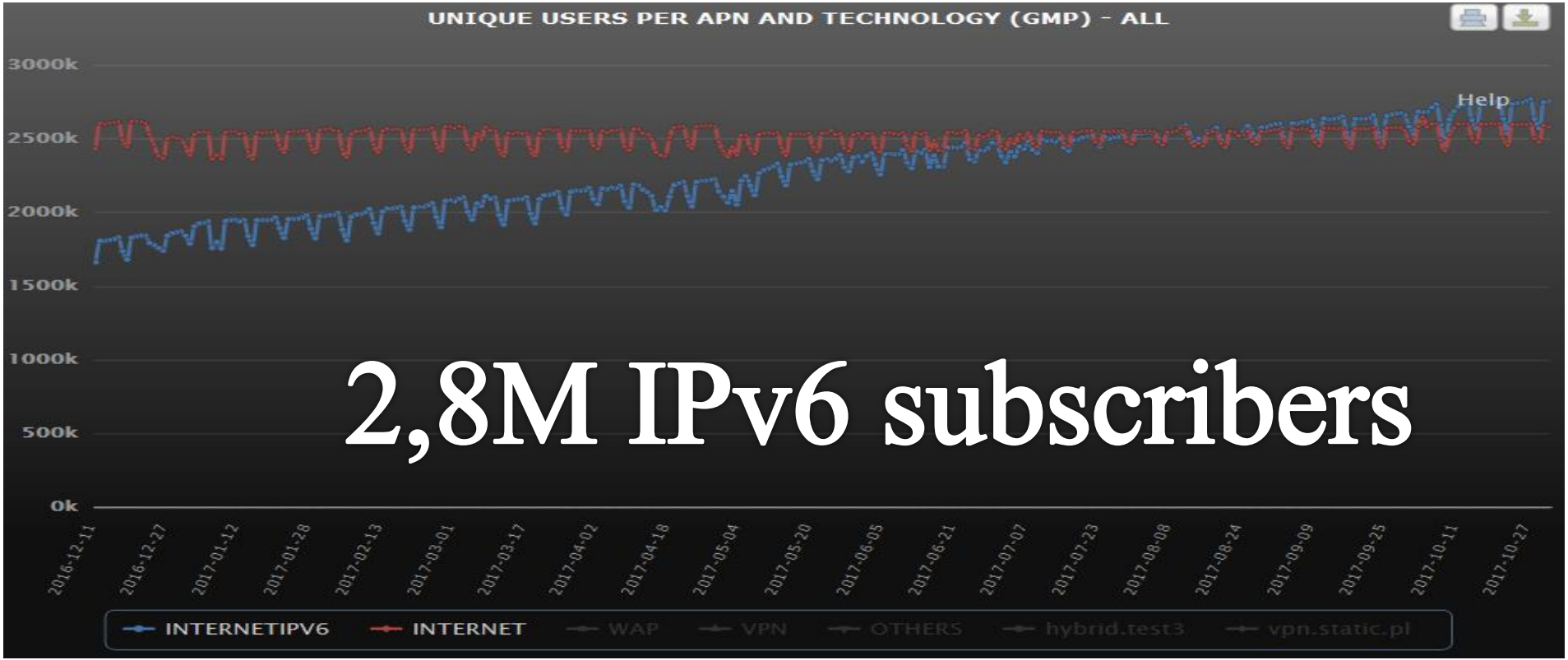
Tethering & IPv6-only

- Supported in Widowsphone & Android & iOS *
  - * iOS IPv4 literals will not work - host interfaces are configured with IPv6-only – that means host must support IPv6

TIP:

- IPv4 APN can be set for tethering...(customization)

- Orange Poland Statistics



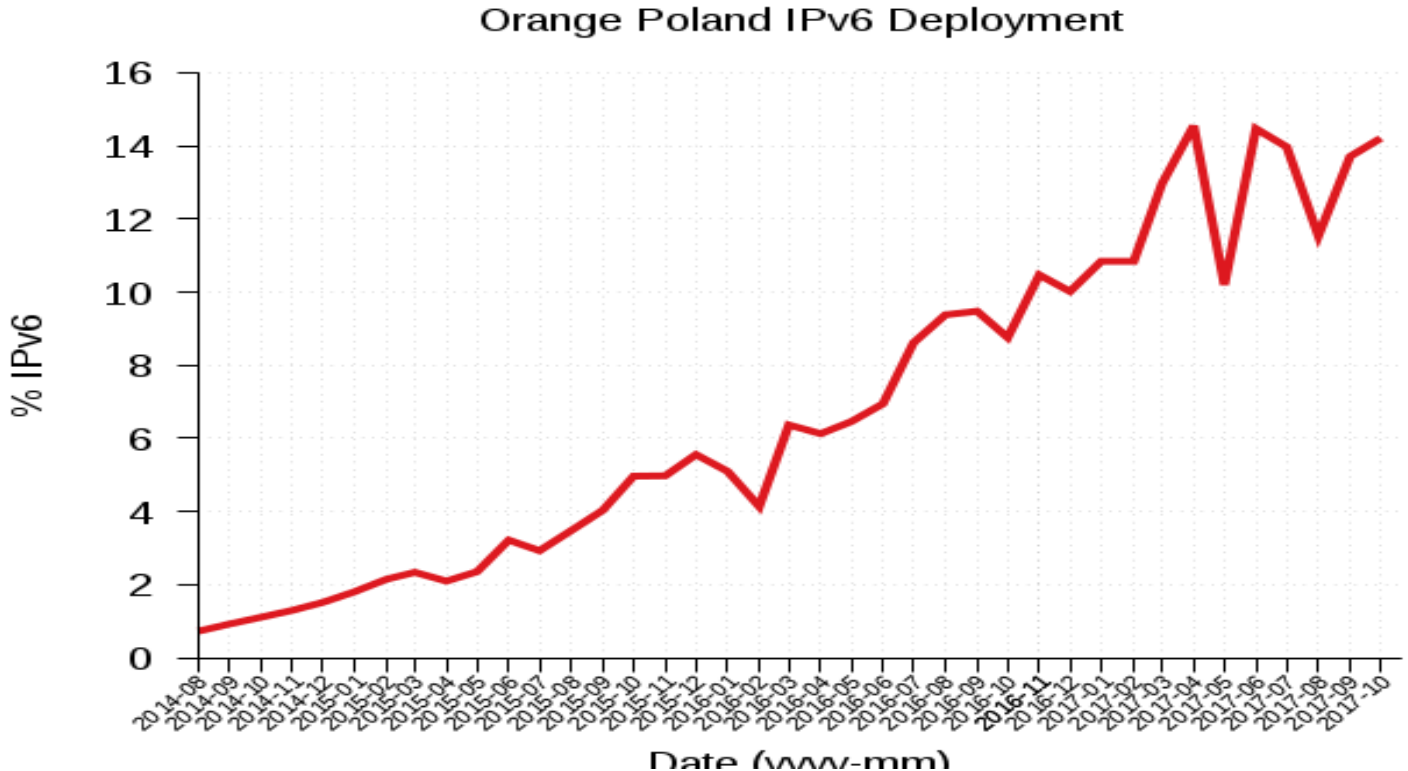
World IPv6 Stats

37	MO	451983	5.87	26548	622567	Macao Special Administrative Region of
38	KR	43691755	5.67	2477520	50982212	Republic of Korea
39	AX	0	4.41	0	28007	Aland Islands
40	BO	4542207	4.38	199021	11051600	Bolivia
41	SE	9226862	4.32	398936	9910701	Sweden
42	PL	27635595	4.28	1183734	38170712	Poland
43	UY	2246887	4.28	96144	3456750	Uruguay
44	LK	6116936	4.18	255829	20876917	Sri Lanka
45	SG	4709796	4.08	192069	5708844	Singapore
46	MX	58252637	3.20	1866494	129163276	Mexico
47	DK	5521408	3.19	176196	5733550	Denmark
48	BA	2160322	3.13	67665	3507017	Bosnia and Herzegovina
49	AR	30635560	2.68	819702	44271041	Argentina

1,2 M vs 2,8M?

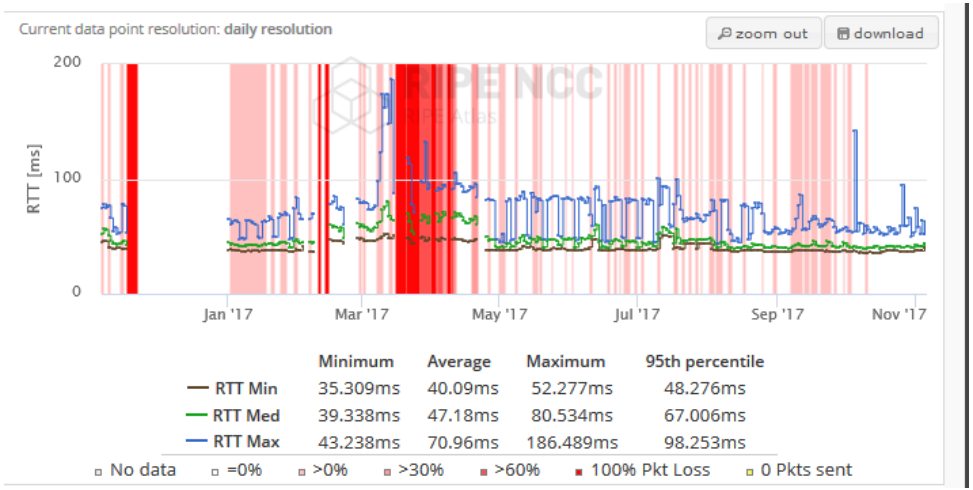
https://labs.apnic.net/dists/v6dcc.html

World IPv6 stats



http://www.worldipv6launch.org/apps/ipv6week/measurement/images/graphs/OrangePoland.png

World IPv6 stats (atlas probe 28569)



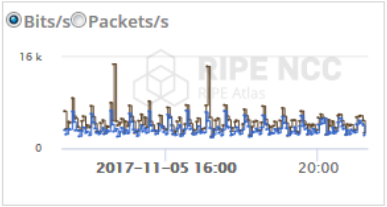
OPL IPv6-only

General | Network | Built-ins | UDMs

General Information

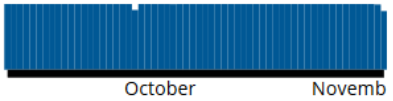
Id	28569
Architecture	tl-mr3020
Firmware Version	4780 (1080)
Router Type	Huawei b525
Shared Publicly	Yes
User Tags	Mobile, Native IPv6, NAT64, IPv6, 464XLAT
System Tags	V3, Resolves A Correctly, Resolves AAAA Correctly, IPv4 Works, IPv6 Works, IPv4 Capable, IPv6 Capable, IPv6 ULA, IPv4 RFC1918, IPv4 Stable 30d, IPv4 Stable 90d, IPv4 Stable 1d

Connection & Traffic



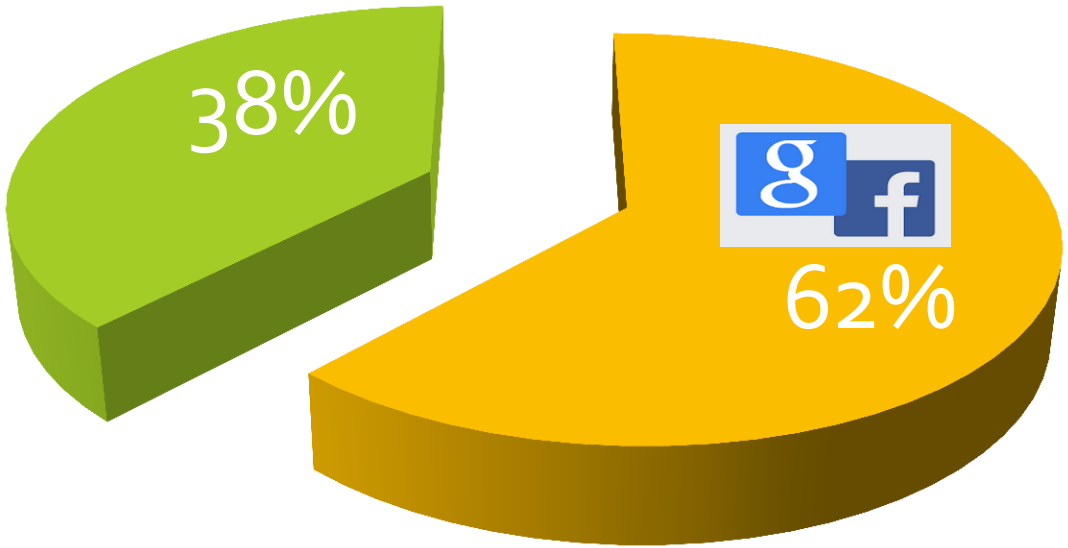
Connected Time

1 day, 1 hour



https://atlas.ripe.net/probes/28569/

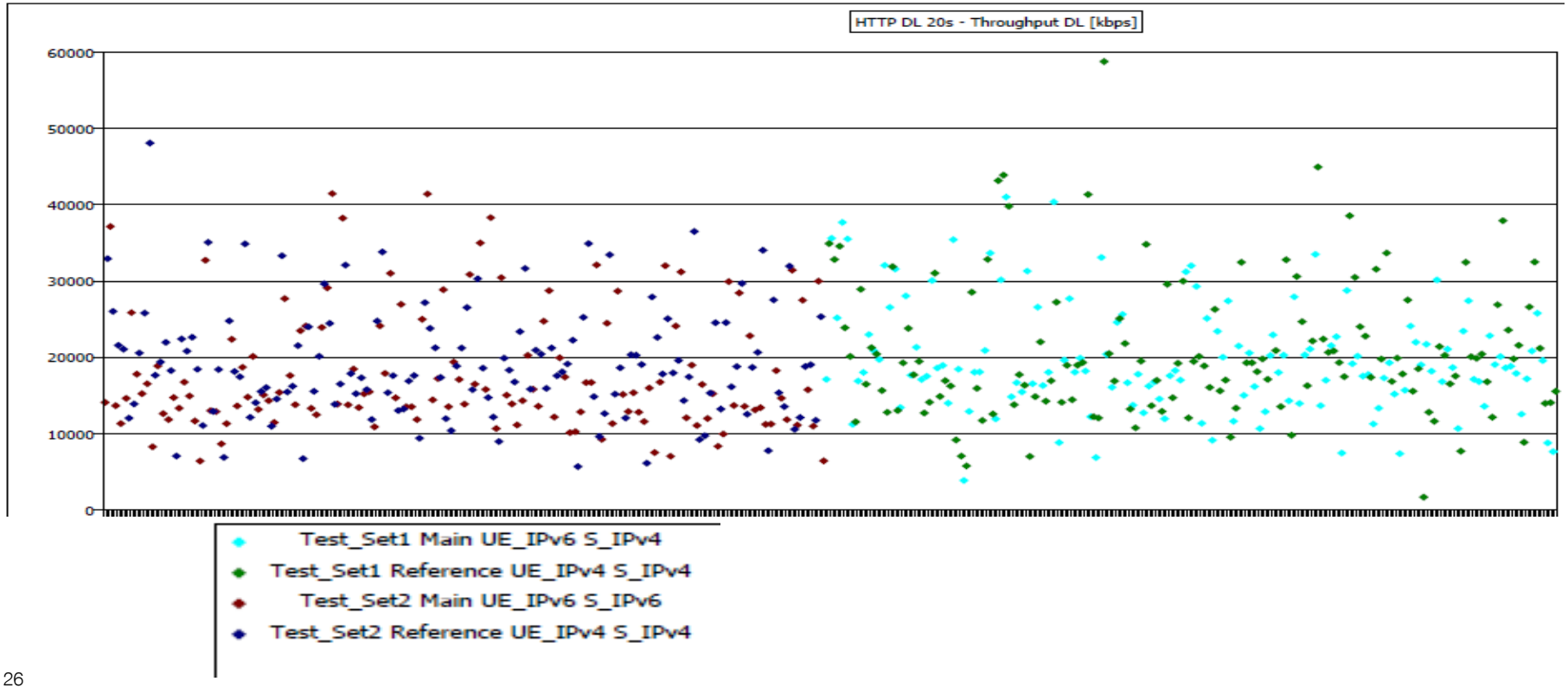
OPL NAT64 flows



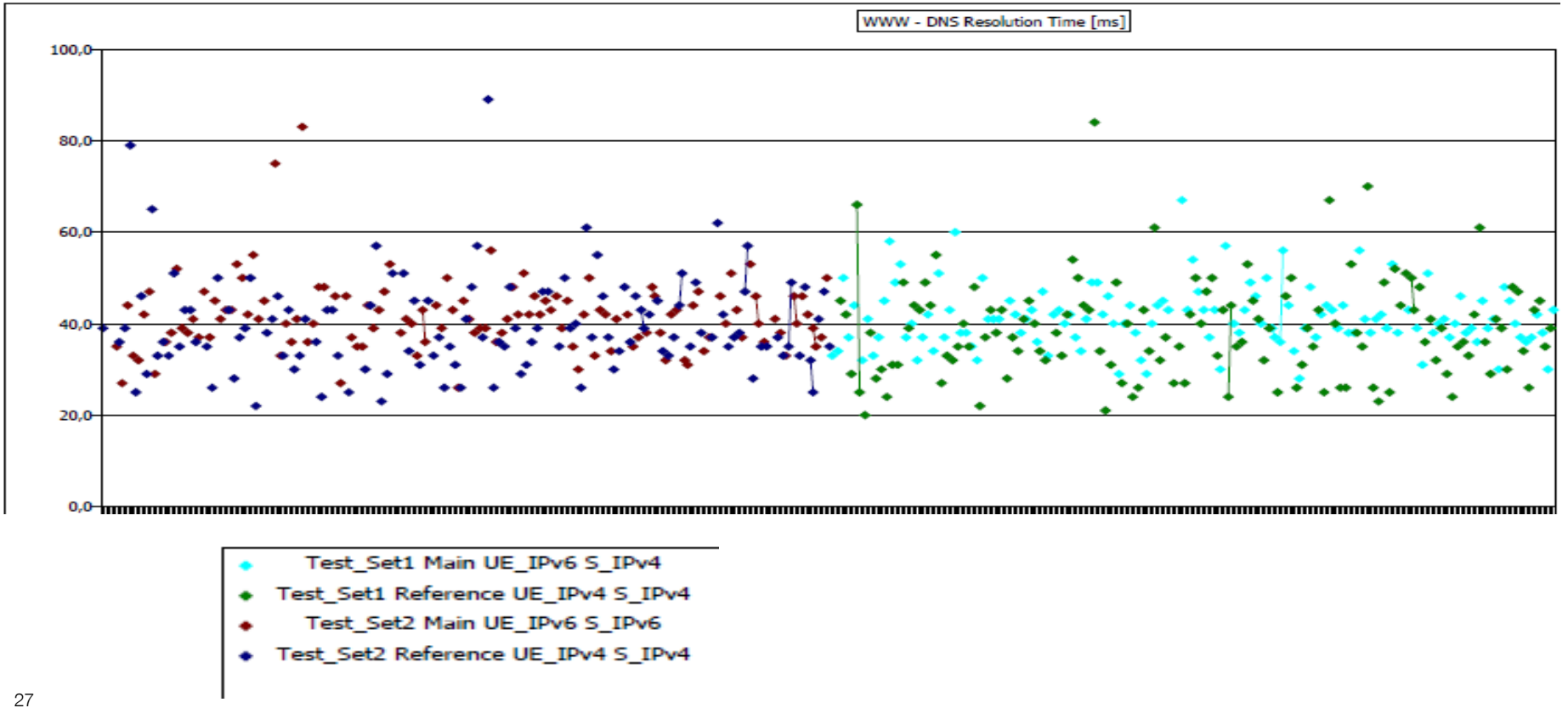
IPv6 is faster than IPv4?

DRIVE

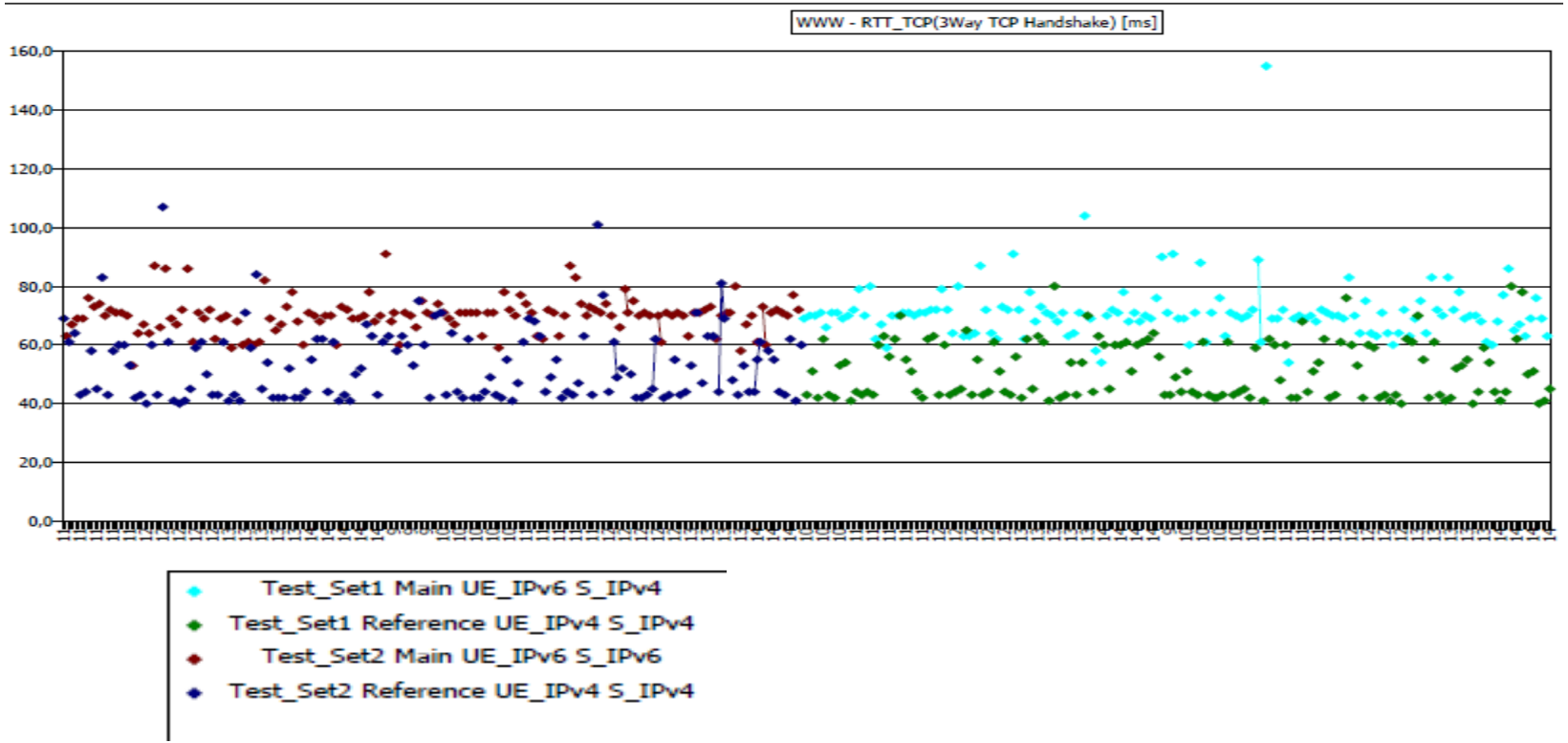
FM

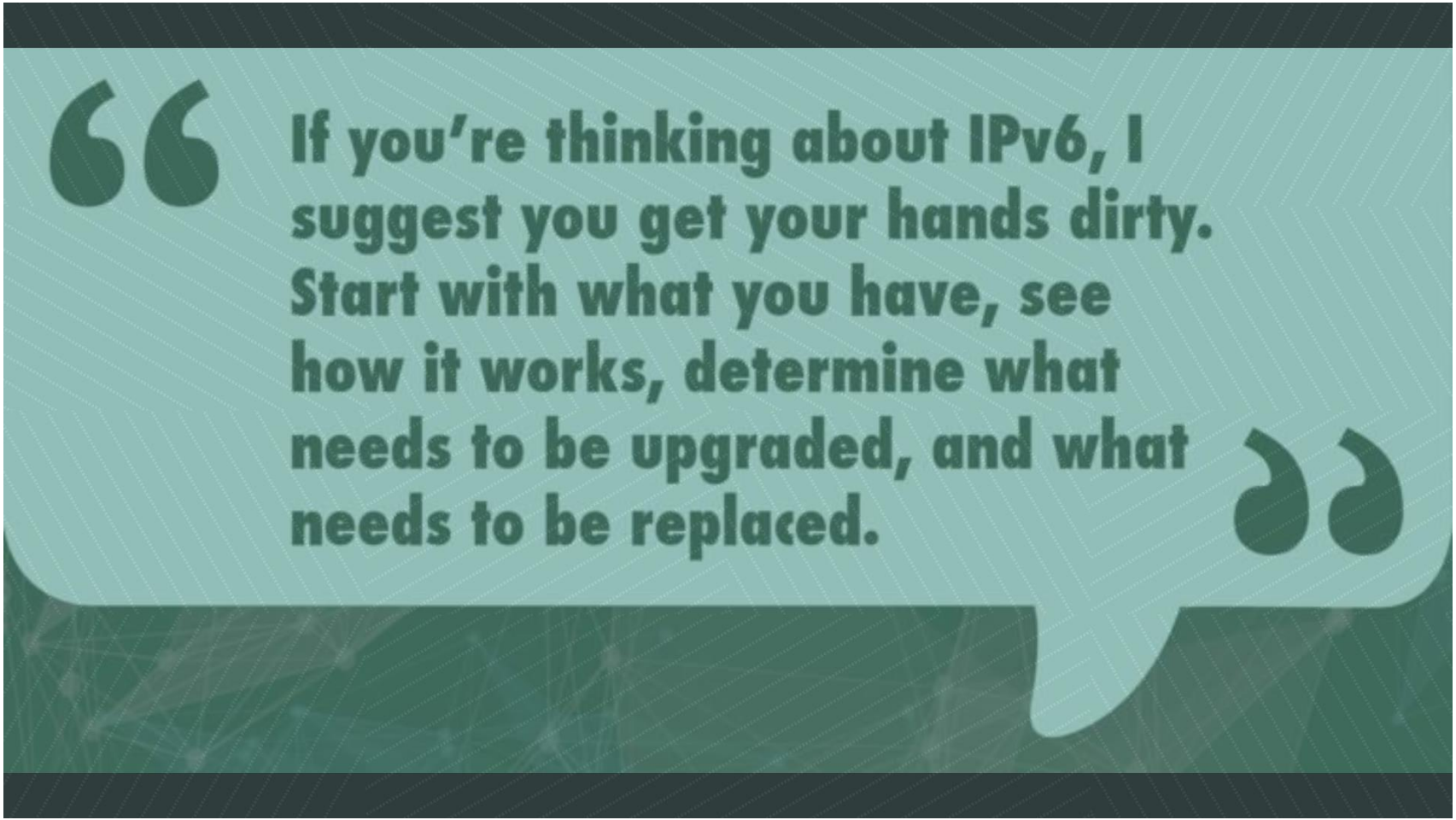


IPv6 is faster than IPv4?



IPv6 is faster than IPv4?




If you're thinking about IPv6, I suggest you get your hands dirty. Start with what you have, see how it works, determine what needs to be upgraded, and what needs to be replaced.

Live demo

Connect to IPv6 hotspot

SSID: voyager

PASSWORD: 12345678

IMPORTANT: please visit below page:

vyncke.org

thank you

backup

Google traffic & latency

If the Google system detects that for a given resolver IPv6 is substantially less reliable or significantly higher latency than IPv4, then **it stops returning AAAA records to that resolver. Penalty time may occure - +3,7 days.**

No AAAA for IPv6 network

No AAAA switch all native IPv6 traffic to NAT64

All native Google IPv6 traffic is NAT64 traffic = NAT64/logs +100%

```
tomasz@tomasz-Latitude-D830:~$ dig AAAA @2a00:f40:fffb::b53 google.pl

; <<>> DiG 9.8.1-P1 <<>> AAAA @2a00:f40:fffb::b53 google.pl
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 35979
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 1, ADDITIONAL: 0

;; QUESTION SECTION:
;google.pl.          IN    AAAA

;; AUTHORITY SECTION:
google.pl.      125    IN    SOA    ns2.google.com.  dns-admin.google.com.  1571285 900 900
1800 60

;; Query time: 46 msec
;; SERVER: 2a00:f40:fffb::b53#53(2a00:f40:fffb::b53)
;; WHEN: Fri Oct 24 15:28:39 2014
;; MSG SIZE  rcvd: 87
```

OPL APN design&architecture - available internet APN's

APN's	internet	vpn	vpn.static.pl
Address	IPv4	IPv4	IPv4
Routable	Private	Public	Public
Type	Dynamic	Dynamic	Static
Routing In	No	Yes	Yes

IPV6 APN's

APN's	internetipv6	vpnipv6	vpnipv6.static.pl
Address	IPv6	IPv6	IPv6
Routable	Global	Global	Global
Type	Dynamic	Dynamic	Static
Routing In	No	Yes	Yes

Windows 7/10 ipconfig /all – during tethering – WP/Android

```
Karta bezprzewodowej sieci LAN Połączenie sieci bezprzewodowej:

   Sufiks DNS konkretnego połączenia :
   Opis. . . . . . . . . . . . . . . : TP-LINK 150Mbps Wireless N PCI Express Adapter
   Adres fizyczny. . . . . . . . . . : A0-F3-C1-F3-B9-95
   DHCP włączone . . . . . . . . . . : Tak
   Autokonfiguracja włączona . . . . : Tak
   Adres IPv6. . . . . . . . . . . . : 2a00:f41:1000:a460:2d30:3d4f:8e0c:bbb4(Preferowane)
   Tymczasowy adres IPv6 . . . . . . : 2a00:f41:1000:a460:3c5c:8897:7a76:ba94(Preferowane)
   Adres IPv6 połączenia lokalnego . : fe80::2d30:3d4f:8e0c:bbb4%15(Preferowane)
   Adres IPv4. . . . . . . . . . . . : 192.168.1.199(Preferowane)
   Maska podsieci. . . . . . . . . . : 255.255.255.0
   Dzierżawa uzyskana. . . . . . . . : 3 marca 2014 20:23:44
   Dzierżawa wygasa. . . . . . . . . : 3 marca 2014 21:23:44
   Brama domyślna. . . . . . . . . . : fe80::d957:155a:5708:f9bc%15
                                       192.168.1.1
   Serwer DHCP . . . . . . . . . . . : 192.168.1.1
   Identyfikator IAID DHCPv6 . . . . : 346092481
   Identyfikator DUID klienta DHCPv6 : 00-01-00-01-18-FA-27-D6-00-1A-A0-D3-6C-5C
   Serwery DNS . . . . . . . . . . . : 2a00:f40:fffb::b53
                                       2a00:f40:fffa::a53
                                       192.168.1.1
   NetBIOS przez Tcpip . . . . . . . : Wyłączony
```

Terminal detailed IPv6 requirements

Adobe Acrobat
Document