BT & EE Update

7th December 2018

BT IPv6 Business Broadband Rollout

- BT Business Broadband support was added in 2017
  - Business have a static IPv6 option (/56)
- High Speed Internet and VPN services have had IPv6 support for several years

BT IPv6 Consumer Broadband Rollout

- Network rollout completed October 2016
  - All BT Broadband lines support IPv6 with a compatible router, except legacy IPstream connections
  - Supported by the BT Consumer Smart Hub today

BT

New Smart Hub2 supports IPv6

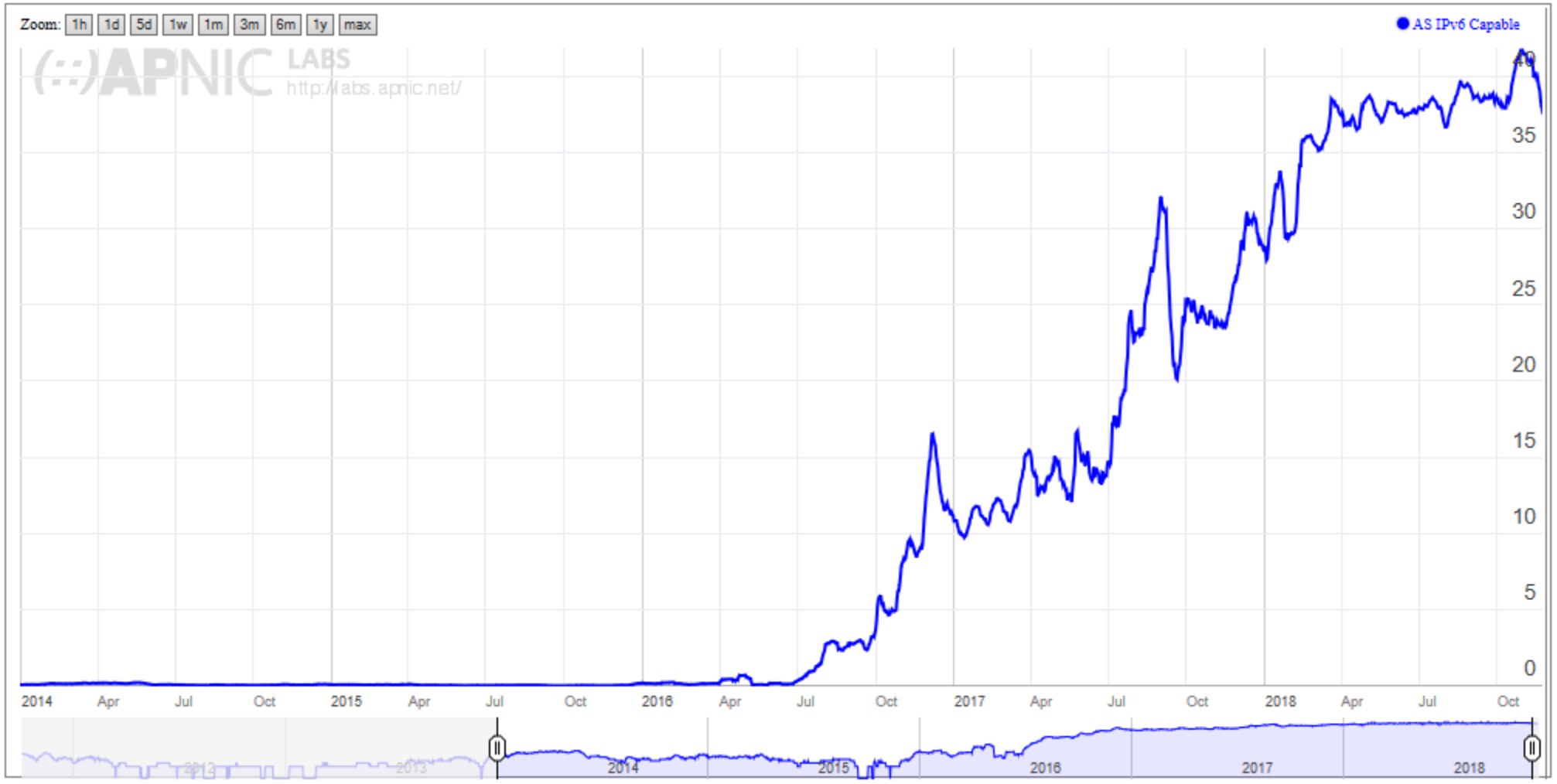
- Smart Hub2 available on BT plus with Wi-Fi guarantee
- Launched November 2018
- Supports IPv6 Dualstack

BT Smart Hub2

SMART HUB2 - BT calls an end to Wi-Fi black spots with 'Complete Wi-Fi' - BT Plus now comes with a Complete Wi-Fi guarantee – ensuring customers get strong wi-fi signal in every room of their home.
Unlike current Wi-Fi extenders, Complete Wi-Fi from BT uses unique Wi-Fi Discs which pair with BT's new Smart Hub 2 to create a single seamless, powerful wi-fi network in a customer's home. A four-bedroom home could see an increase in Wi-Fi speeds of up to 25% around the home with just one disc.

- **Best wi-fi tech on Smart Hub2 – 7 antenna, Wi-fi disk – 4 antenna**
- **Smart channel selection**
- **Smart scan**
- **Wi-Fi app manager**

Take up of IPv6 on BT to November 2018

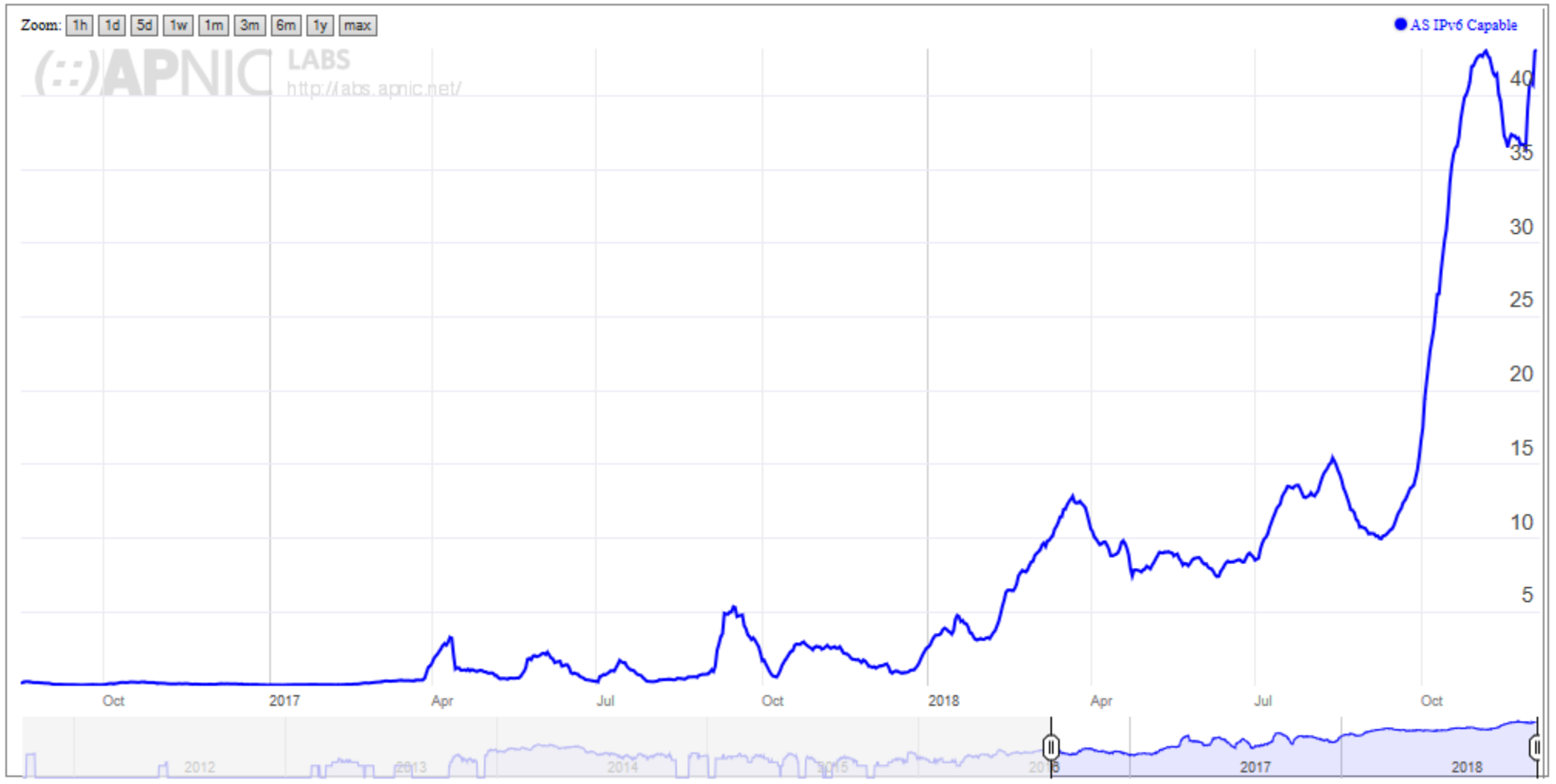


EE Update

IPv6 on EE

- IPv6-only internet services available to EE Consumer Postpay (Pay Monthly customers) with eligible device
- Switched on late 2016.
- Prior to that Voice-over-LTE and Voice-over-Wifi on an IPv6 bearer, internally within EE Core.
- Eligible handsets were Android….until…

Surge of IPv6-only on EE
In September 2018, ios12 was made available



Why IPv6 in cellular networks?

Major reason - Avoiding IPv4 private address exhaustion

- Increase in users of data, leading to increasing numbers of addressing, driven by:
  - > Customers demand (always connected)
  - > Customers devices (LTE, always IP)
  - > Number of addresses per customers (incl. VoLTE/IMS, tethering additional devices)
- Long term strategy, including IoT driving addressing demands

Other benefits - Advantage of global addressing of IPv6

- Avoiding IPv4 Public address exhaustion
- Cost avoidance for national regulatory obligations
- Long term strategy including 5G-Convergence

Mobile Operators have seen successful IPv6 transitions with 464xlat

464xlat (rfc6877):

- Translation based (i.e. NAT, CGN, already extensive in mobile)
- Avoids IPv4 Exhaustion; Eligible devices effectively IPv6-only as operator runs IPv6-only access/core network

464xlat (rfc6877) makes use of:

- stateful NAT64 (rfc6146), stateless client ("CLAT", as per rfc6145)
- NAT64 prefix discovery, (currently rfc7050 which uses DNS64)
- DNS64 (rfc6147) can be scoped for discovery or as part of a wider NAT64/DNS64 regime.

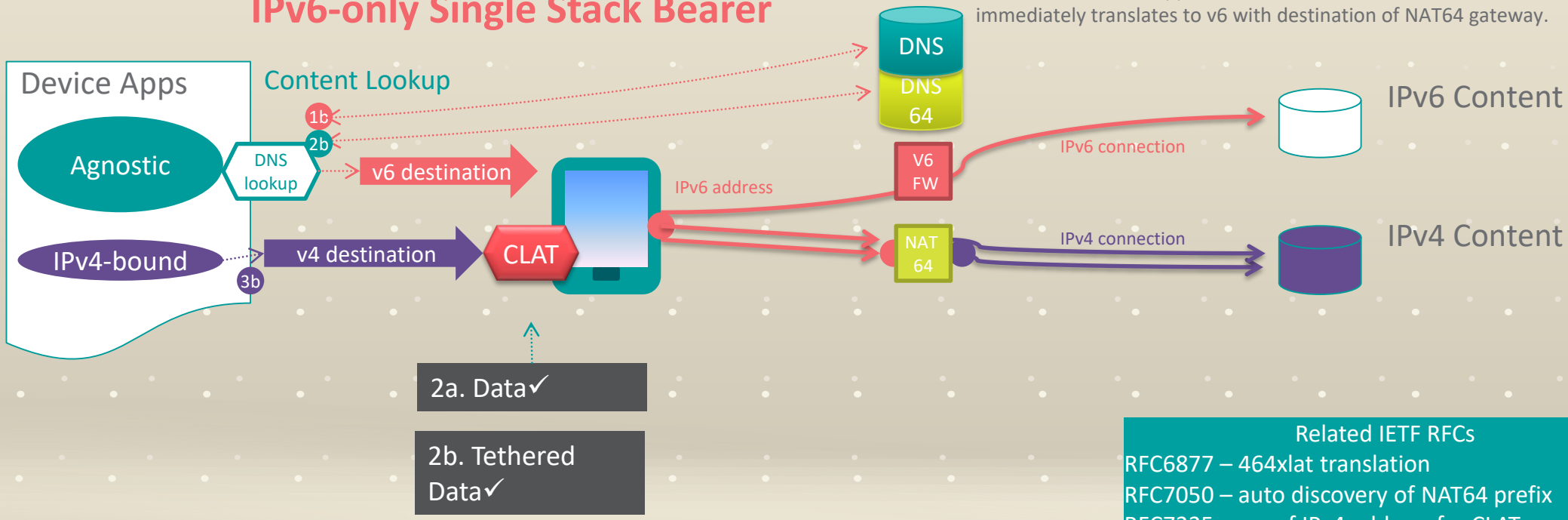
Traffic of ~100Millions of mobile customers:

- T-Mobile (US)
- Sprint(US)
- Reliance Jio (IN)
- Orange (PL)
- SK-Telecom(SK)
- Telstra(AU)
- Rogers(CA)
- EE(UK).

EE MOBILE USECASES

HOW 464XLAT FIXES IPV4-BOUND APPS
IPV6-ONLY WITH 464XLAT (RFC6877)

Case1b. Following DNS lookup, v6 dest selected. Pure IPv6 direct.
Case2b. As destination is IPv4 only, DNS64 synthesises v6 DNS response with v6 destination of the NAT64 gateway. NAT64 based connection.
Case3b. IPv4 bound app sends via v4 XLAT stack; 464XLAT 'CLAT' immediately translates to v6 with destination of NAT64 gateway.



Related IETF RFCs

RFC6877 – 464xlat translation
RFC7050 – auto discovery of NAT64 prefix
RFC7335 – spoof IPv4 address for CLATs
RFC7278 – V6 Prefix sharing on WiFi

Apple and Android

Both Android and Apple (from iOS12) make use of 464xlat technology; Implementations are different.

Apple

TETHERING (via single APN)

- iOS12 invokes 464xlat for tethering

ON-BOARD APPs

- App-store ecosystem immunised against IPv4 literals:
  - Police the Apps to ensure no literals
  - Fix other literals/Server-side:

    Happy Eyeballs v2 (RFC8305)

    A bump-in-the-host approach; let the OS help repair literals; clients can perform synthesis of NAT64 destinations (RFC6050) themselves (after the NAT64 prefix is discovered e.g. RFC7050)

Android

TETHERING (via single APN)

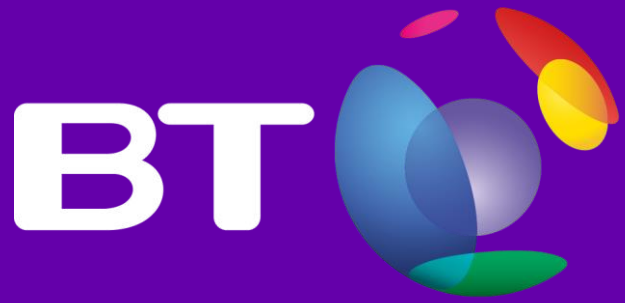
- Tethering interface mapped via 464xlat (CLAT)

ON-BOARD APPs

- Android uses 464xlat for any apps or server-calls bound to a IPv4-stack

Thank you
Any questions?

Nick Heatley, Network Architect
Chief Architect's Office, BT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