

Journey to IPv6: A Real-World deployment for Mobiles



IPv6 Deployment Workshop
SANOG 32
Dhaka

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Acknowledgements

- We would like to acknowledge Jeff Schmidt @ Telstra for permitting us to use his original APRICOT 2017 tutorial slides
 - <https://2017.apricot.net/program/schedule/#/day/9/journey-to-ipv6---a-real-world-deployment-for-mobiles>

Agenda

- Why IPv6?
- Business and Technical considerations
- Network Architectures
- Addressing and Subnetting
- Deployment Model
- Our Experience
- Q&A

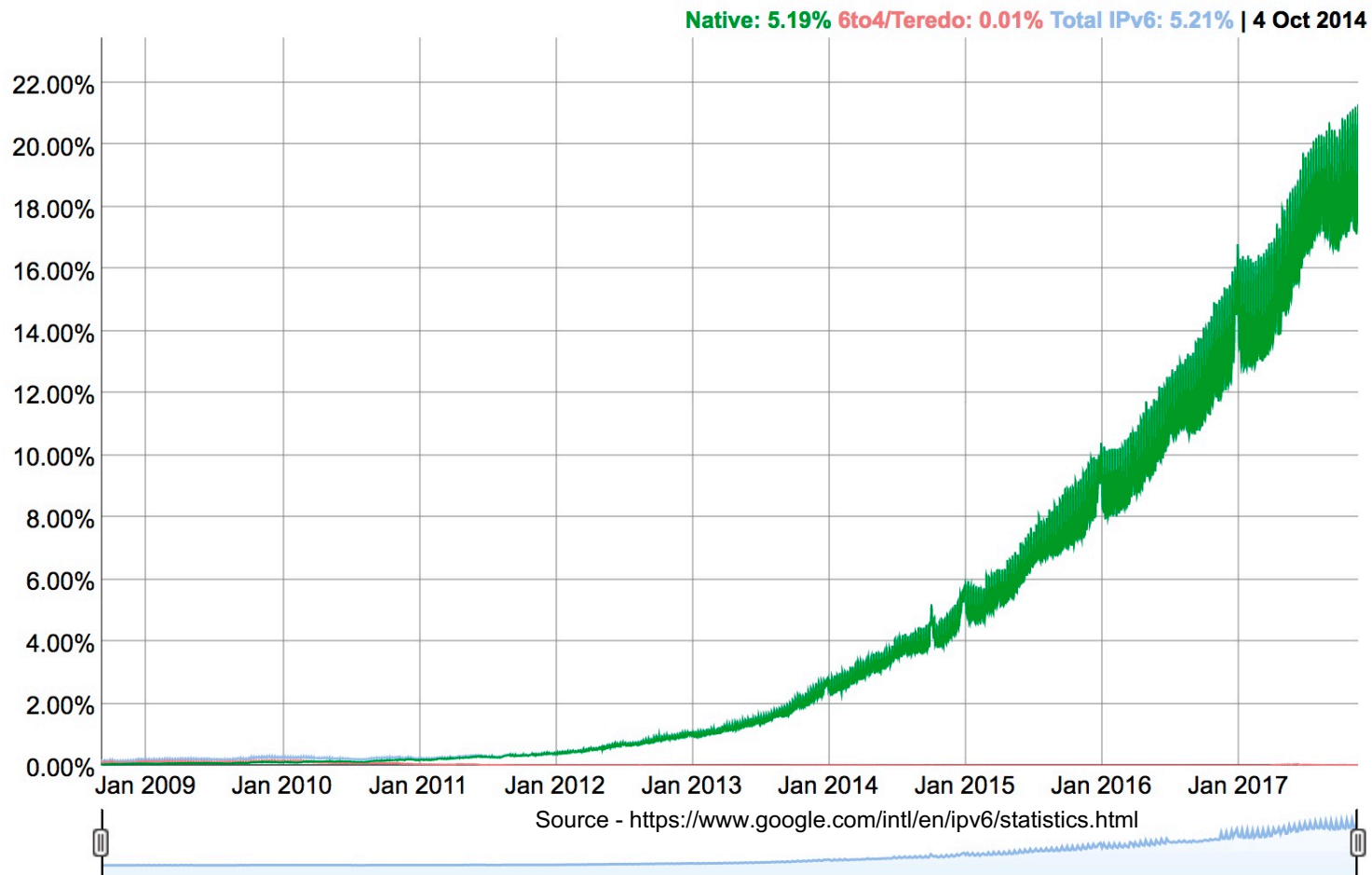
Why IPv6?



Why IPv6?

- Traffic growth and device per person
- Network readiness for new technologies:
 - Internet-of-Things
 - VoLTE/IMS
 - ViLTE
 - Management and Backhaul
- IPv4 public/private address depletion
- Reduction in network inefficiencies

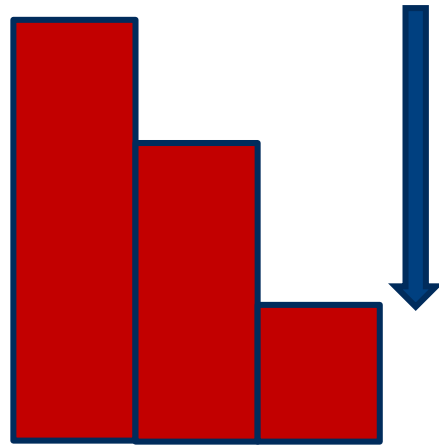
IPv6 Global Traffic



Business and Technical Considerations



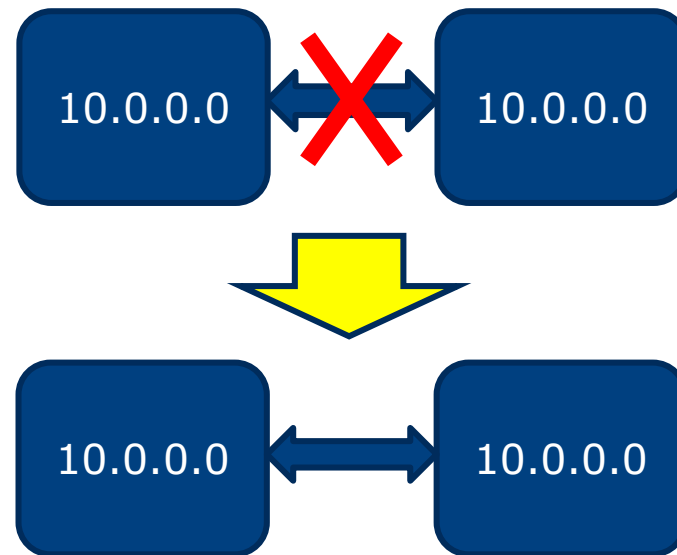
Business and Technical Considerations



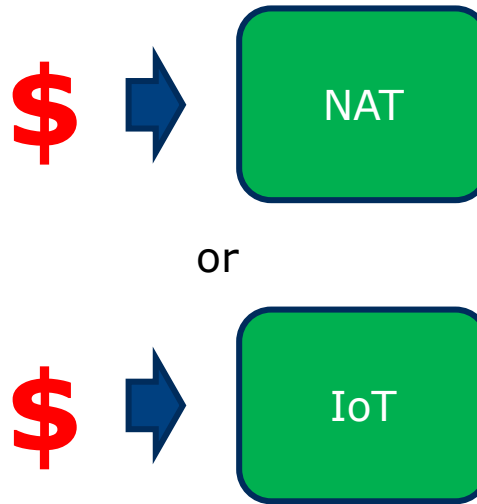
Depleting public and private IPv4 address range

Business and Technical Considerations

- ❑ Non-interworking private IPv4 address ranges duplicated between domains, that now require interworking



Business and Technical Considerations



Continual investment to extend
IPv4 resources vs IPv6 to future
proof our network

Business and Technical Considerations

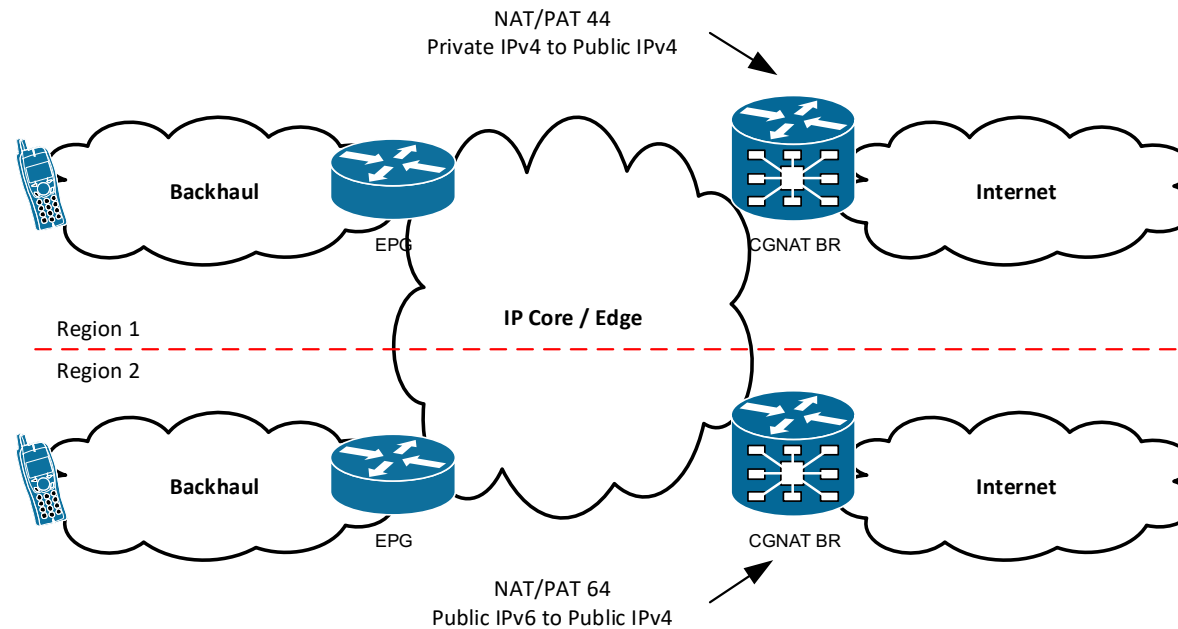
- ❑ As IPv4 addresses deplete, it will be more expensive to extend IPv4 resources
- ❑ Dual-Stack is an effective transition technology but does not solve the IPv4 depletion problem
- ❑ Introducing IPv6:
 - Reduced dependency on NAT
 - Remove the need for regionalisation
 - Pushes applications to move to IPv6

Network Architectures



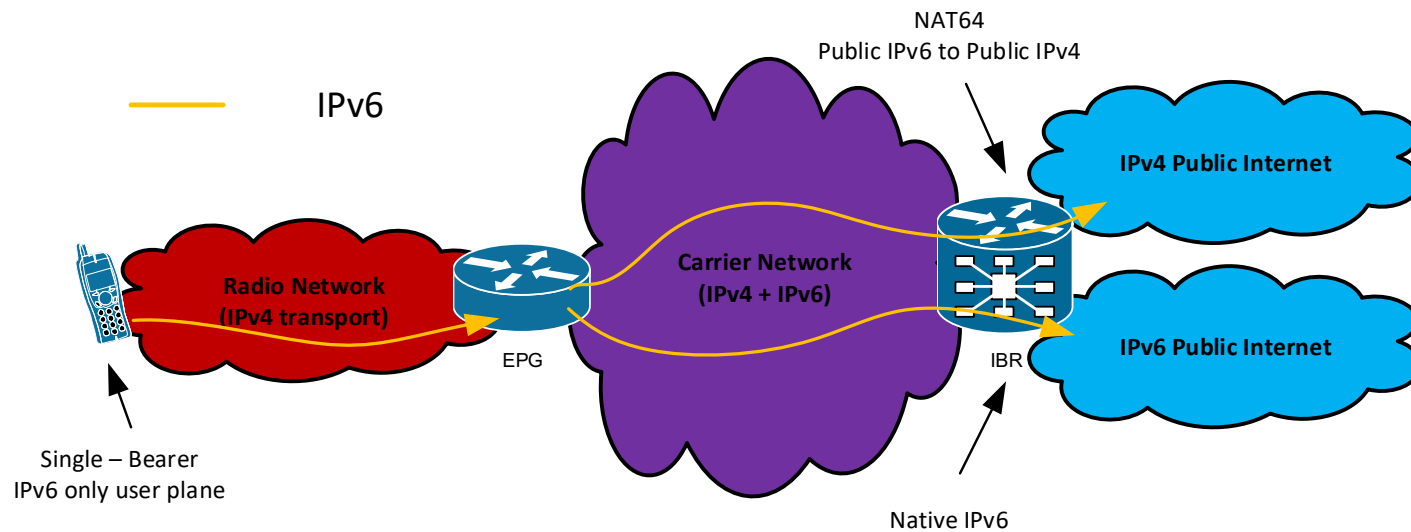
IPv6 Implementation

Centralised CGN



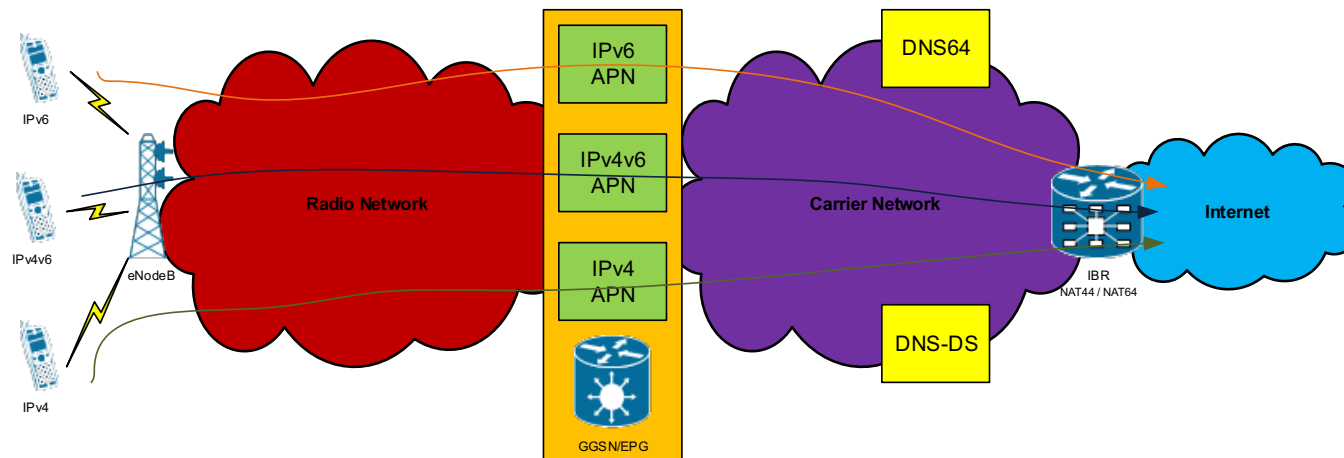
- ❑ CGN performs NAT/PAT 44 and NAT/PAT 64
 - PAT substantially reduces Public and Private IPv4 address demand, but does not prevent IPv4 address depletion.

IPv6 Implementation Traffic Flow



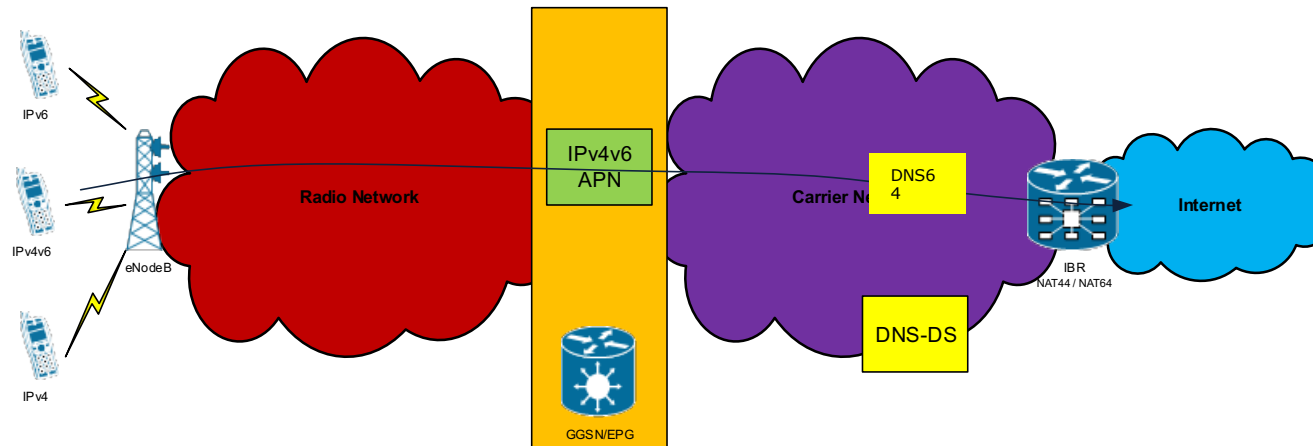
Running multiple APNs

- Create multiple real APNs that supports IPv4, IPv6, and IPv4v6 individually

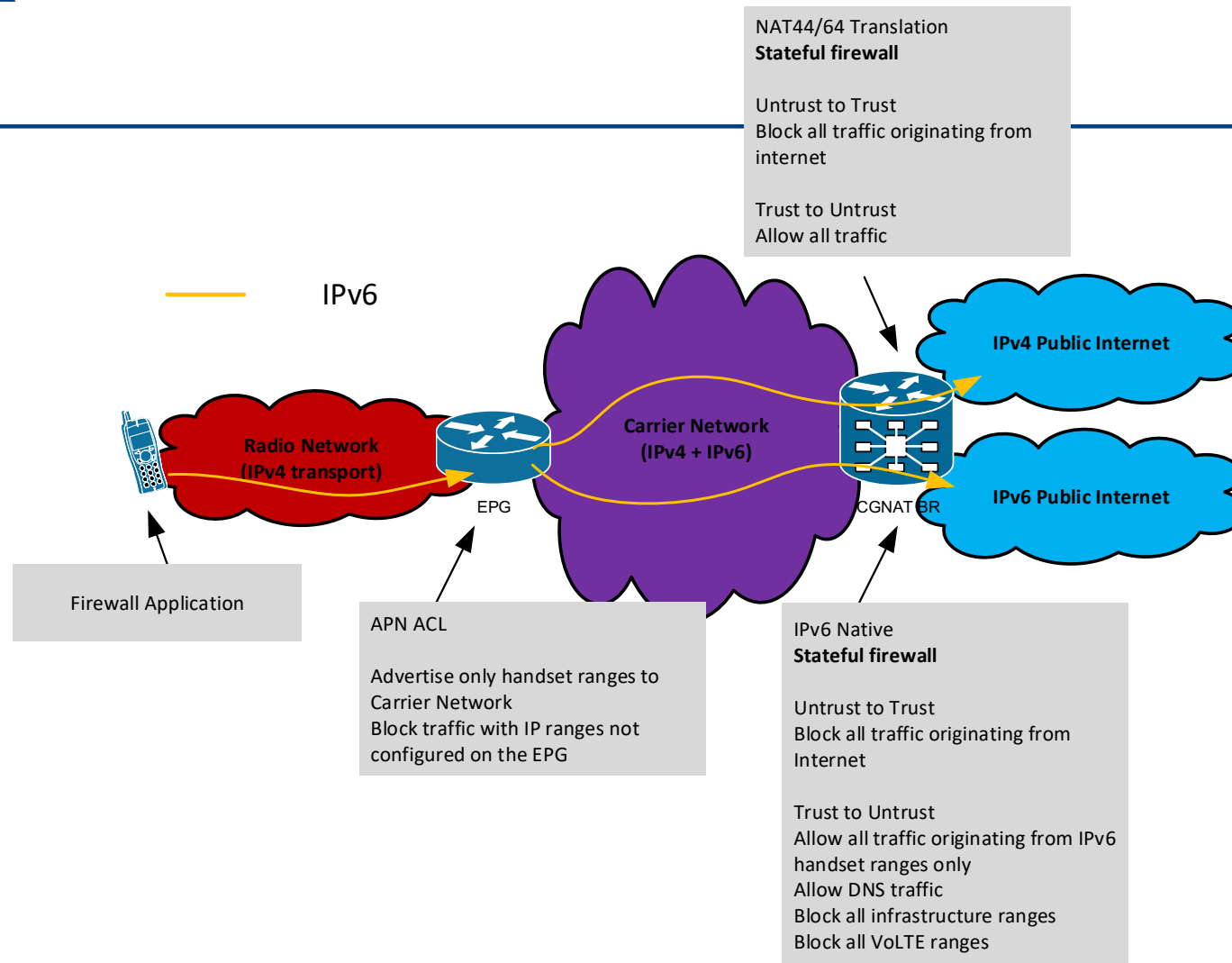


Running a Single APN

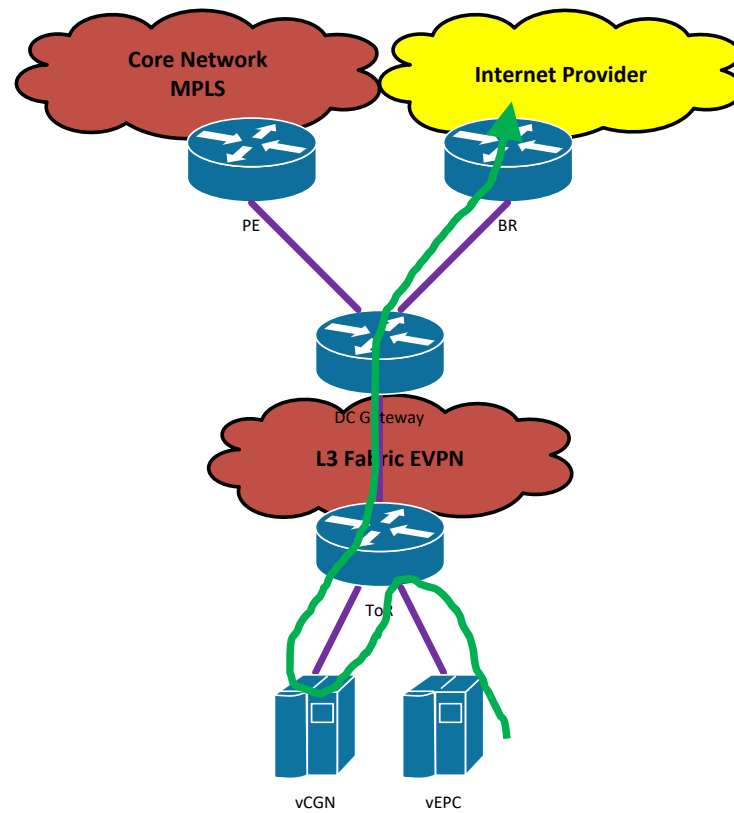
- Create a single real APN that supports both DS and SS



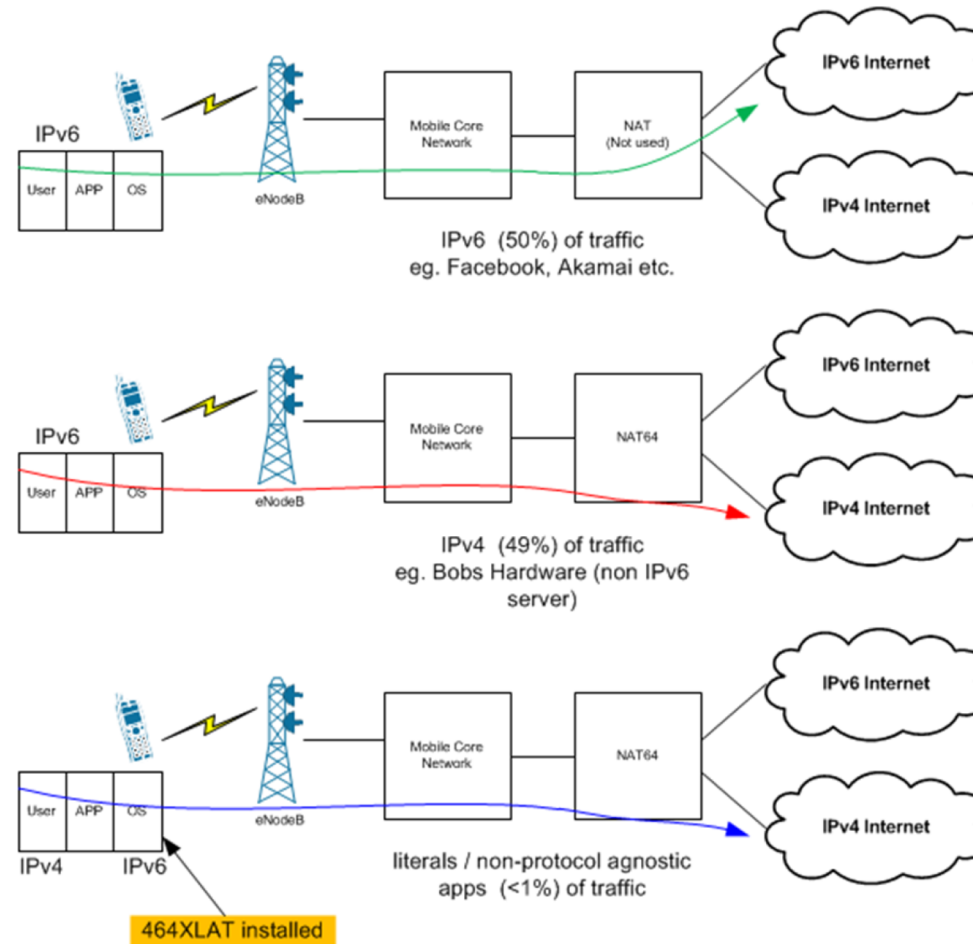
IPv6 Implementation Security



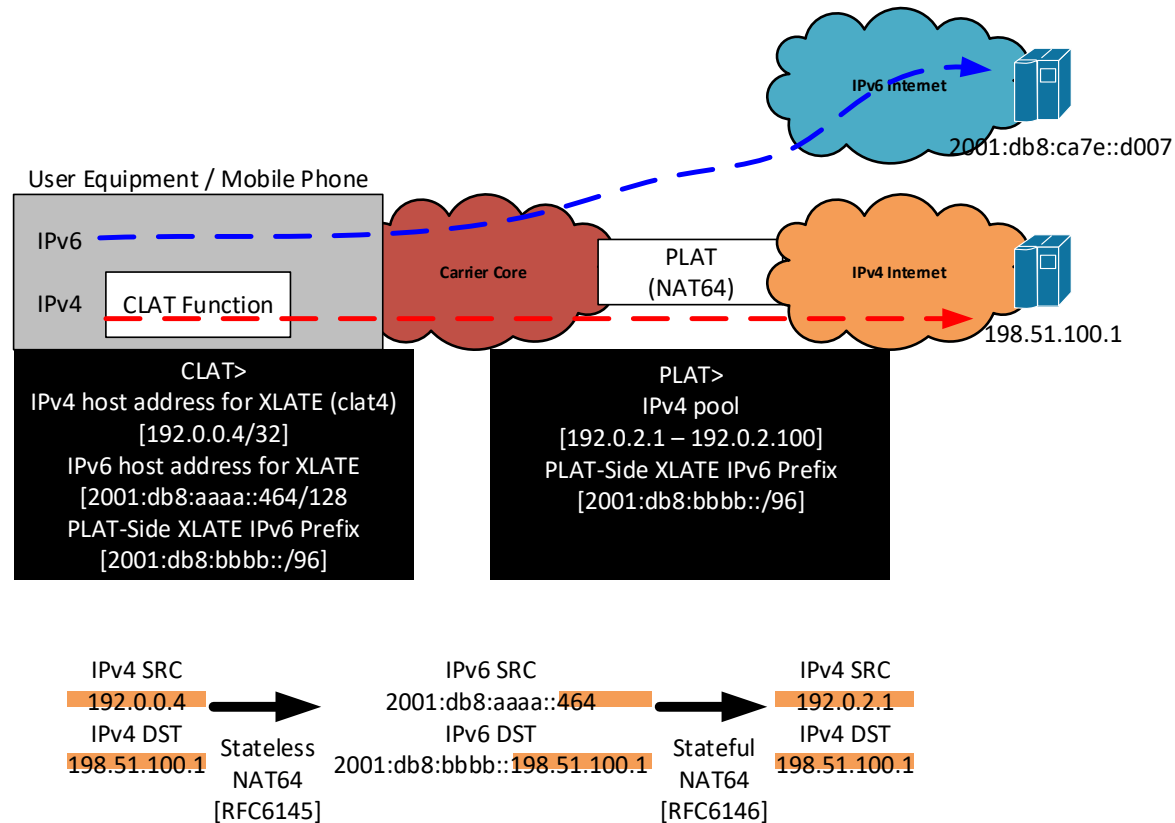
Infrastructure Cloud IPv6



How much traffic will use IPv6?



464XLAT Architecture for Mobiles



Addressing and Subnetting



Addressing and Subnetting

- ❑ 3GPP currently dictates each UE to receive a /64
- ❑ Future releases may require a /60 with DHCP-PD for single APN tethering
- ❑ 4x /44 per APN per EPG = 4M prefixes
- ❑ You will probably also need a similar range for VoLTE APNs
- ❑ KEY: make sure it is a structured subnetting schema so it is consistent nationally and across the entire organisation.

Addressing and Subnetting

□ Infrastructure Addressing:

- /64 per VLAN – Keep it simple!
- Private or Public – but remember to use a firewall and policies to avoid advertising the infrastructure out to the internet!
- NAT is not a security feature!

Deployment Model



Carrier Examples

SP1

Dual-Stack

SP2 / SP3

SS+NAT64+DNS64+CLAT

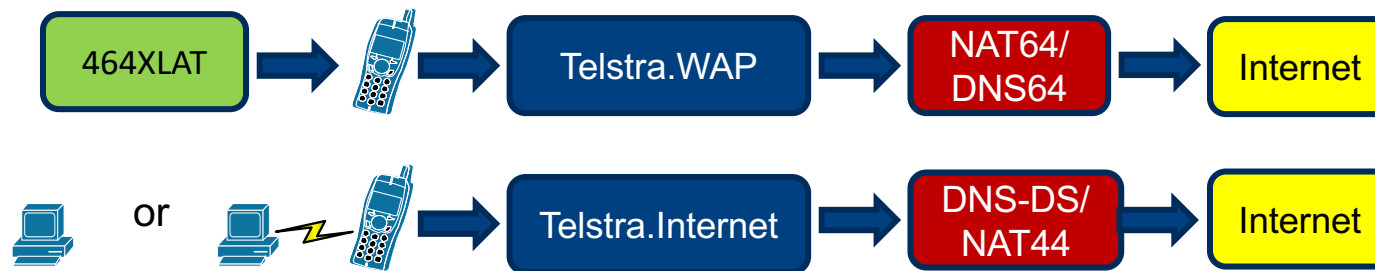
SP4

SS/DS+NAT64+DNS-HD+CLAT

- ❑ Every carrier will have a unique set of circumstances that dictates which transition method they will use. There is no standard way of doing this.
- ❑ You must determine which is the best method for your network.
- ❑ **In any method, remember to ensure you have a long-term strategy for the eventual deployment of native Single Stack IPv6!**

Different APNs for different purposes

Two existing APNs – one for Handsets, one for Mobile Broadband and Tethering



464XLAT + NAT64 + DNS64 for the Handset APN only

IPv6 enabled DNS for all other APNs

Packet Core Configuration

- HSS Configuration
 - PDP Context id = IPv4v6
- MME Configuration
 - DAF = set
- EPG Configuration
 - PDPTYPE = IPv4v6

- EPG will then also have the following as a minimum within each APN:
 - IPv6 Handset Range
 - IPv4 Handset Range
 - 2x IPv4 DNS Name Servers, 2x IPv6 DNS Name Servers

UE Requirements and Settings

- ❑ Android 4.3+ supports 4G/LTE. We recommend using anything that is 4.4.4+ or 5.1+
- ❑ Depending on your setup, either PDP selection is based on the UE or the Network.
- ❑ International Roaming over IPv6 works today! But we recommend the APN Roaming Protocol to be set to IPv4 only for the next two years.

Launch Considerations

- ❑ Informed Front of House and provided training, as well as Enterprise support and sales personnel
- ❑ Updated internal Knowledge Base
- ❑ Briefed Operations and provided training
- ❑ Created moderated forum with official details on the network change
- ❑ Provided direct email contact to Telstra Engineering
- ❑ Contacted the technical community via mailing lists and public forums before launch

Our Experience

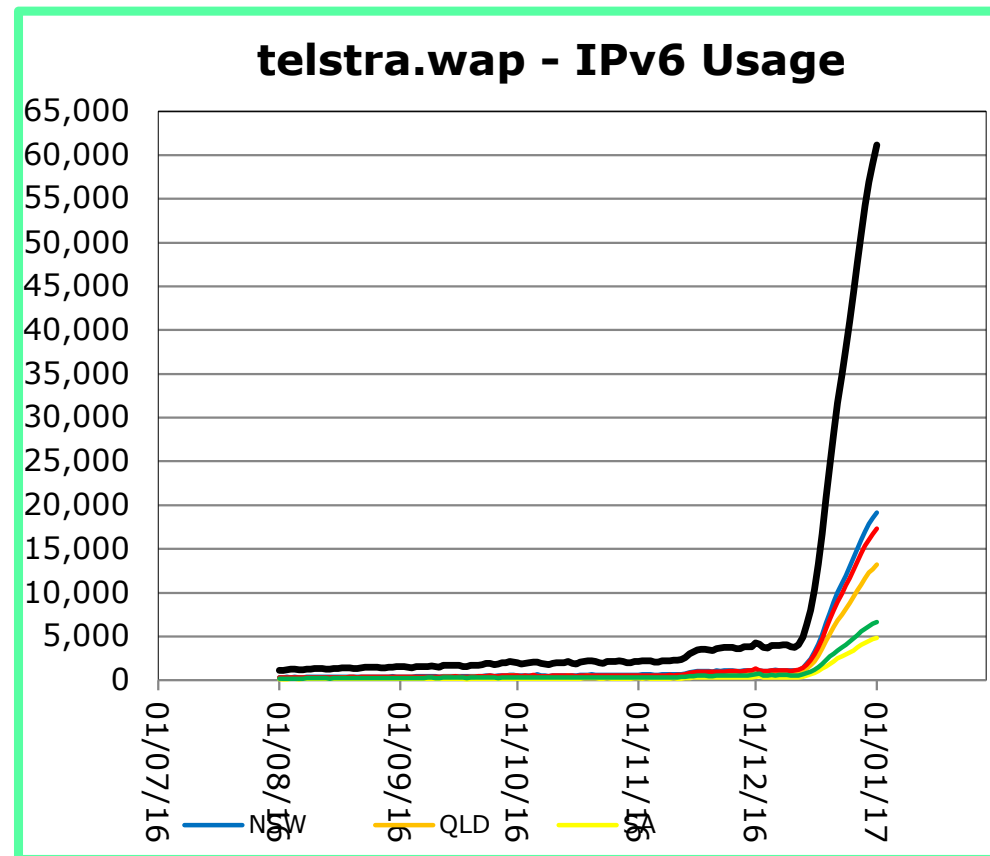


Our Experience

□ iPad Dual-Stack Carrier Settings

- Significant IPv6 takeup on iPads since carrier update was made available with Dual-Stack.
- Update made via iOS patch. Users are not immediately aware IPv6 is available on their iPads. **Transparent migration.**
- IPv6 take up occurs when iPads are patched to the latest version
- Single Stack will come later this year

Our Experience



BYO device and existing services

- ❑ **APN – IPv4v6, HLR/HSS – IPv4v6**
- ❑ Legacy devices configured with IPv4 only are not impacted
- ❑ New devices configured with IPv4v6 obtains both addresses and is currently growing significantly
- ❑ Existing devices configured with IPv6 only obtains IPv6 only

- ❑ **CGNAT**
- ❑ NAT64 ALGs: ftp, sip, pptp, rtsp, h323

IPv4 vs IPv6

- ❑ Some applications fail with IPv6 – even with 464XLAT. Routing issues?
- ❑ VPNs are a real problem – but is it a carrier problem or an application / server problem?
- ❑ HTTP / HTTPS works very well
- ❑ SSH is not a major problem
- ❑ IPv6 is faster in some cases – smaller BGP table, no NAT etc.
- ❑ Major apps work very well – especially from the major content providers

Customer Support

- ❑ Engage the community early so they know what's coming. They will appreciate you are still developing and they will want to be part of the journey!
- ❑ We receive support email through our contact points and reply as soon as possible. Don't keep your customers waiting
- ❑ Skip the red tape – let customers engage engineering directly
- ❑ Keep management happy! Report SIO and bandwidth usage!

Q&A



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