IPV6 IN MOBILE NETWORKS

SANOG24 IPV6 PRESENTATION

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AGENDA

1. Why IPv6 for Mobile Networks?
2. Current Wireless Architectures
3. Transition Methods
4. Setup and Testing
5. Solution testing and results
6. Considerations
7. Q&A

WHY IPV6 IN MOBILE NETWORKS?

IT'S HOW WE CONNECT

Drivers for IPv6 in Mobiles

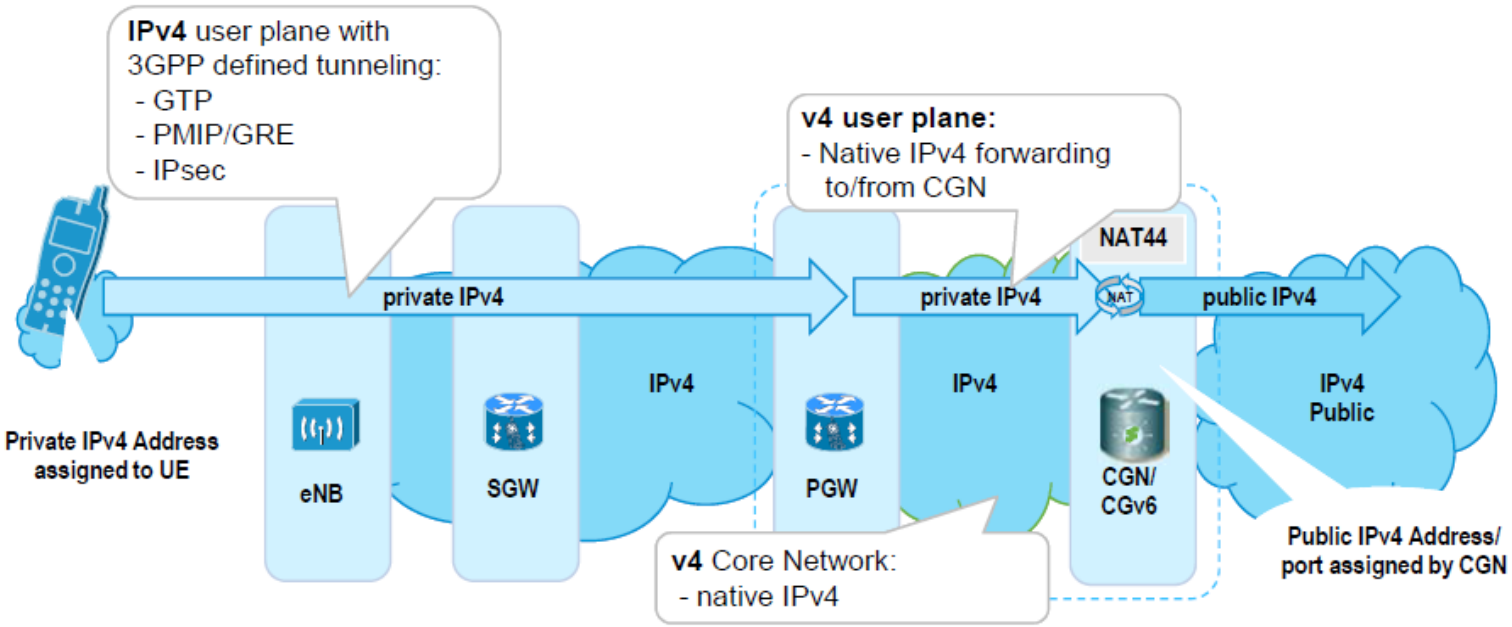
- Depleted IPv4 allocations from APNIC
- Sustained Growth in mobile data traffic
- Growth in the number of mobile user equipment
- New devices are session hungry, consuming multiple IP and ports
- Projected uptake of Sensor-Networks using 6LoWPAN and Machine to Machine (M2M) communications as well as the Internet of Things which uses IPv6 only
- IPv4 Public address depletion: Most operators started to deploy NAT44 very early on either on Internet gateways or dedicated devices.
- IPv4 Private address depletion: APN IP Address pools. Reuse subnets if/where possible.
- Offload the NAT44 Architecture and avoid complications and costs associated with development of NAT444 – more bandaid!
- VoLTE/IMS

Remember - The use of IPv6 services should be invisible to the end-user.

IT'S HOW WE CONNECT

CURRENT WIRELESS ARCHITECTURES

CURRENT IPV4 IMPLEMENTATION CENTRALISED CGN



- National non-overlapping Private Address space used for UE assignment.

  Large service numbers will mean high Private Address demand.

- CGN performs NAT/PAT 44.

  PAT substantially reduces Public and Private IPv4 address demand, but does not prevent IPv4 address depletion.

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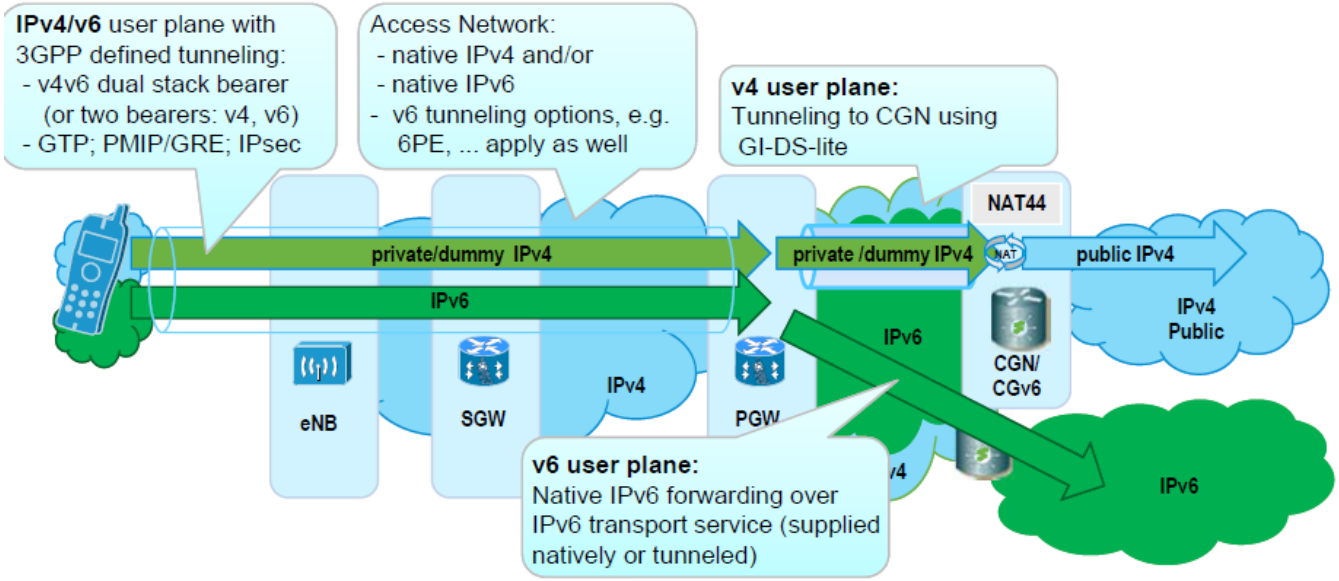
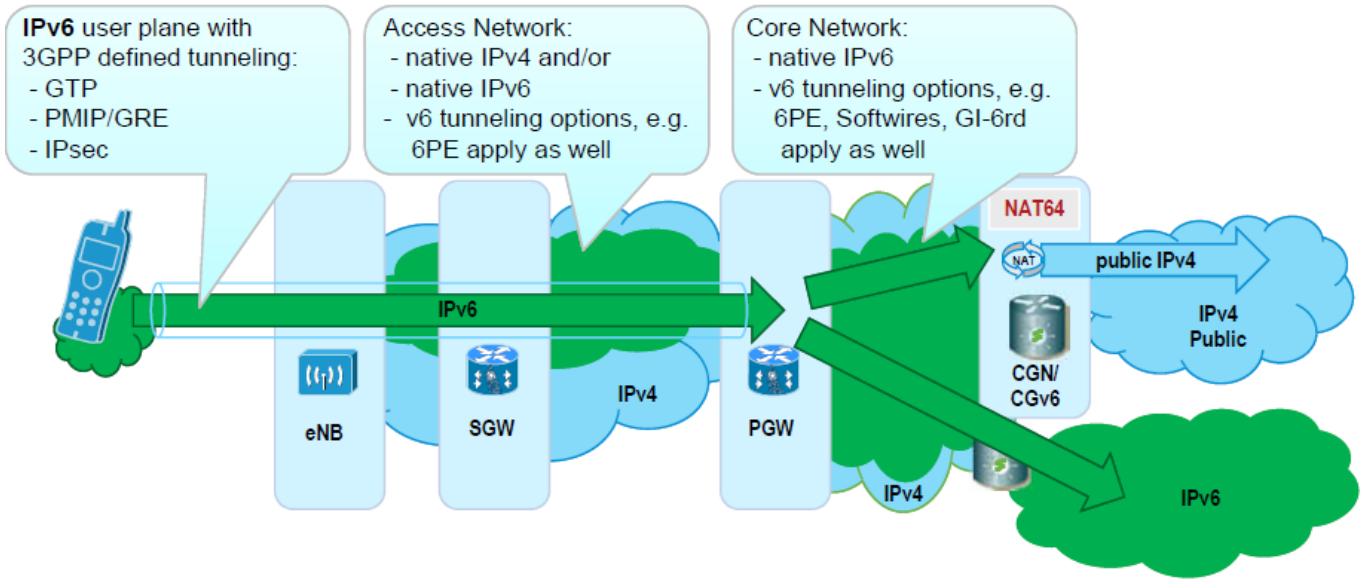
TRANSITION METHODS

TRANSITION METHOD 1
ENABLE IPV6 DUAL-STACK



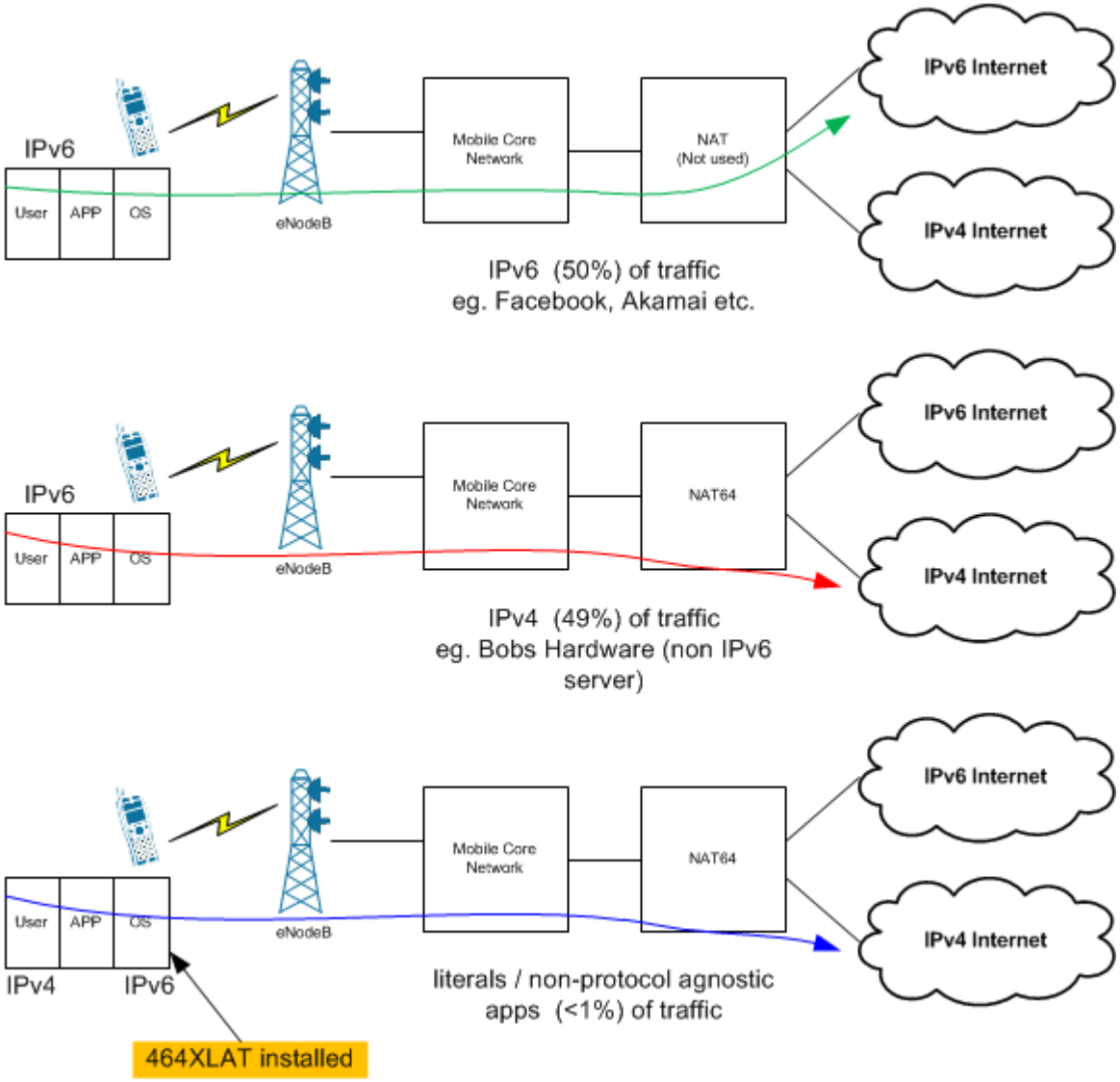
- Our self-imposed requirement is to run a single PDP context / bearer Dual-Stack implementation to reduce licensing costs if this is the way forward
- Network Core is enabled with Dual-Stack regardless
- Challenges with Dual-Stack:
  - It does not resolve any Private IPv4 depletion problem!
  - Requires IPv4v6 PDP context support on all network elements
  - Possible OS behaviour uncertain (preferences, stack selection) – RFC6555?
  - Operational overhead
  - Still requires IPv4 connectivity provisioning

TRANSITION METHOD 2
ENABLING IPV6 SINGLE STACK



- Preferred method when there is a risk of Private IPv4 depletion
- IPv4 used as backup in cases where IPv6 service is not available (eg. Roaming)
- Stateful NAT64 to replace NAT44 for IPv4 destined traffic.
- Network Core is enabled with Dual-Stack regardless.
- Challenges
  - DNS resolution issues (local and/or remote)
  - UE requires 464XLAT or similar due to many IPv4 only applications still out there. Requires UEs to support 464XLAT

TRANSITION METHOD 2
ENABLING IPV6 SINGLE STACK



WHICH METHOD?

SINGLE STACK + NAT64

- UE for Single Stack with NAT64 is available, but many network / application issues need to be resolved. IPv4 literals do not work and requires re-work from developers.
- 464XLAT need to be accepted as standard on the UE to accommodate for IPv4 only applications. This is now standard from Android 4.3.
- Single Stack relies heavily on NAT64 for the initial few years of transition and many applications require ALGs. These may not be fully supported by vendors.
- DNS issues
- Translation required to access self-hosted content but issues around header enrichment services must be addressed due to the translation and how radius is applied.

DUAL-STACK with IPv4v6

- Issues around which stack it selects on the OS of the UE
- Does not help with relieving Private IPv4 address depletion problems
- Works well for providers with a lot of self-hosted content that cannot be changed to IPv6 quickly or have alot of IPv4 private address space still available

IT'S HOW WE CONNECT

SETUP AND TESTING

SETUP AND TESTING

IT'S HOW WE CONNECT

A common configuration can be deployed across all APNs with the following context types. This will provide the maximum flexibility on establishing a successful connection to the network.

HLR = IPV4+DS

HSS = IPv4v6

MMS/SGSN = DAF set

PGW/GGSN = IPv4v6

- NAT64 (RFC6146) + DNS64 (RFC6147) MUST be used within each APN.

- 464XLAT (RFC6877) MUST be used for smartphones and handsets and establish a PDP context of type v6 only.

- An advantage of this setup is that you can support IPv4 only, and IPv4v6 handsets on the same APN.

SETUP AND TESTING

IT'S HOW WE CONNECT

IPv6 was tested using single stack again in 2013 after the release of 464XLAT code from Samsung on the Galaxy S4 device using test software.

Dongles may forego 464XLAT only if establishing a Dual-Stack PDP type of IPv4v6 only. In the future when dongles are set with IPv6 only, it MUST support 464XLAT.

Devices tested so far:

- Samsung Note 3 (Android 4.4.2)
- Samsung Galaxy S4 (Android 4.3)
- Samsung Galaxy S5 (Android 4.4)
- Samsung Note 10.1 2014 (Android 4.3)

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SOLUTION TESTING AND RESULTS

464XLAT TESTING
INDICATIVE RESULTS FROM 2013 TRIAL

IT'S HOW WE CONNECT

Most applications working reasonably well.

IPsec/VPN applications require more testing if running Android 4.3.
Some SSL VPN applications working better under Android 4.4.

https://code.google.com/p/android/issues/detail?id=62714

Latency difference at the moment is negligible

Some IPv4-only applications now working better with 464XLAT

Some applications still experiencing issues – we are still investigating why even though 464XLAT is implemented.

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CONSIDERATIONS FOR THE FUTURE

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IT'S HOW WE CONNECT

Telstra is committed to introducing IPv6 into its Mobile Network, with testing occurring over the last 3 years while the technology is maturing from our providers. CGN is part of this strategy during the transition.

These are the steps to introduce IPv6 and CGN:

- **Deploy IPv6 in the infrastructure**
- **Deploy CGN at the Internet Border Router with NAT64**
- **Introduce a DNS64 function into DNS resolvers/forwarders or poison your routes from the DNS with the WKP**
- **Connect user devices using Single Stack IPv6**
- **Implement 464XLAT on the user devices**

There will eventually be a time where the only function the CGN will perform is NAT64, and later, eventually completely removed.

CONSIDERATIONS FOR THE FUTURE

IT'S HOW WE CONNECT

Most networks usually use Dual-Stack first, but NAT44 networks with private address constraints, like many mobile networks, may benefit going directly to Single-Stack IPv6.

Be careful when defining what Single-Stack and Dual-Stack is for Mobiles – Dual-Stack is deployed in the Mobile IP Core for the foreseeable future. Single Stack is highly recommended for the PDP session but Dual-Stack is ok as well.

You can begin deploying IPv6 today in the Core! Check with your vendor to ensure the features needed are supported. Begin today, don't delay! The 'chicken or the egg first' scenario no longer applies.

Networks with IPv4v6 PDP enabled should not have DNS64 enabled simultaneously. Networks with IPv6 PDP only enabled must have DNS64 enabled or with route poisoning enabled on DNS.

Begin looking at enabling your content to support native IPv6

CGN may be required to extend the IPv4 depletion. Don't be afraid to use it but don't be over-reliant on it – the end goal is always native IPv6. CGN will not prevent the inevitable!

CONSIDERATIONS FOR THE FUTURE

IT'S HOW WE CONNECT

Note that the User's Public IPv6 addresses are presented to the internet. Ensure you have sufficient protections and access-lists to protect your users from internet-initiated attacks, but allow users out to the internet.

Devices on Single Stack IPv6 must support 464XLAT – until all applications have native IPv6 support and IPv4 literals disappear from the internet.

- Push your device Vendors to support 464XLAT as a standard release. This is already available for all Android devices 4.4.2+. Check with other manufacturers to support 464XLAT.
- Push for devices that support IPv6 and IPv4v6
- Make sure you include RFC6555 (Happy Eyeballs) as a requirement for DS devices

We need all Mobile operators to support 3GPP R9 and above so the transition to support IPv6 international roaming is simplified in the future. If everyone can get to R9+, then we can do IPv6 international roaming!

For the next 2-3 years, devices when roaming should default back to IPv4.

IT'S HOW WE CONNECT

QUESTIONS?

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