

# 464XLAT Deployment in a mid-size Operator

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# What is mid-size? (1)

- Wired-Broadband
  - 5.000 ADSL subscribers
  - 100 GPON subscribers
  - 150 business customers
- PPPoE
  - Pre-paid (Diameter)
  - Post-paid (Radius)
- Issue: There is no provisioning system (ACS for TR-069), all done manually

# What is mid-size? (2)

- Cellular
  - Ready for 70.000 subscribers
  - Actually 40.000 contracts, typical concurrency is just 25.000
  - 80% is Android, 20% iOS
  - 3G/4G/5G modems for broadband
  - VoLTE supported
- Issue: There no OTA capability

# Initial Network Status

- Using CGN for subscribers
- The core is ready for good IPv6 support
- MPLS with 6PE, OSPFv2/3 for IGP
- Single upstream provider (dual-stack), with has a single upstream (...)
  - Cache for only one content provider, (not IPv6 enabled)
- Outer islands with fiber or satellite links (L2TP, GRE)

# IPv6 Prefix

- Already allocated a /32 (APNIC) and sufficient
- There was an addressing plan, which has been redesigned and deployed
  - Considering number of customers and forecast
    - Home, Corporate, Others
- Each customer: /48
- Each p2p: /64 (GUA)
- Some corporate customers (including government and DC) needs multihoming
  - Change from LIR assigned /48 to IPv6 PI from APNIC

# Training and Network Audit

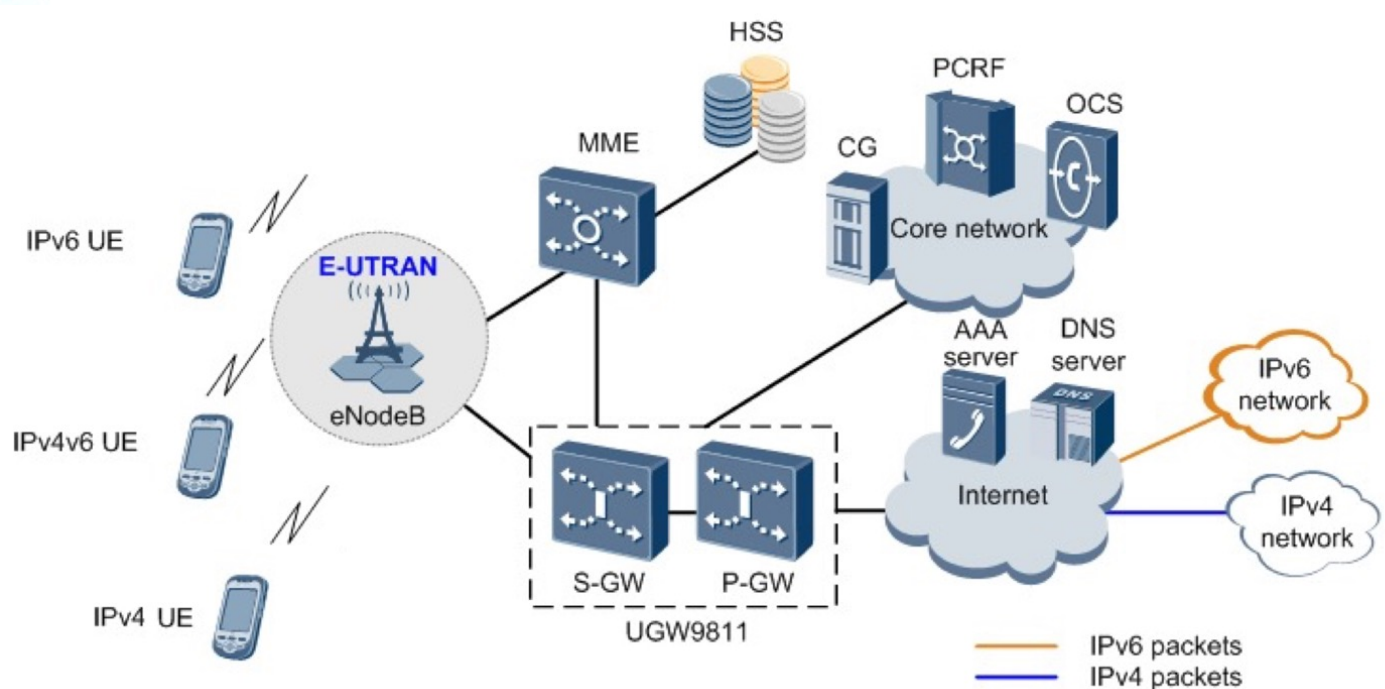
- Work started several years ago, as some staff attended our IPv6 training in New Caledonia APNIC meeting
- We did an on-site training covering staff from all departments (network architecture/design, ops, others)
  - Also a workshop for customers and executives “Why IPv6?”
- Key items of the training:
  - IPv6 is easier than IPv4
  - They are different, the difficulty is to “change your mindset”
    - Need to “unlearn” IPv4 to correctly understand IPv6
- A review of the core/distribution/access equipment showed the level of IPv6 support
  - What needs to be updated (firmware/software) or just “enabled”
  - Upgraded (hardware)
  - Some equipment was already on the way to be installed
  - Some bugs discovered

# Choosing the Right Transition

- Existing broadband (ADSL and GPON) CPEs, support dual-stack, but not 464XLAT
  - At the moment stay dual-stack, but looking for a provisioning system to update the CPEs so we can move soon to 464XLAT (RFC6877)
- The mobile network CGN devices already support NAT64 as well, so easy to move to 464XLAT

# Cellular Setup (1)

- Single APN to support IPv4-only, IPv6-only and dual-stack
  - Supporting Dual-Stack and “any” Single-Stack
  - Cellular IPv6 deployment is easy because the network supports whatever the UE ask.
  - Progressive deployment, as slow or fast as you want
  - One new phone, all new phones, then OTA old ones





# Cellular Setup (2)

- Review billing support for IPv6
- Use PCRF (Policy and Charging Control Function) to selectively enable IPv6 in roaming customers sessions
  - Depending on “roaming partner”
  - Analysis of Failure Cases in IPv6 Roaming Scenarios (RFC7445)
- Other important docs: RFC6459, RFC7050, RFC7278

# Some General Deployment Aspects

- There was no IPAM, so started with open source
- The monitoring systems are IPv6 capable
- Obtain data from netflow/sflow and the DPI, so top-20 apps can be tracked for expected % of traffic and then measure the impact of the IPv6 deployment
  - Calculate the expected workload on the NAT64
- Added support for 6VPE
- Configured IPv6 PTRs and DNS64 in existing bind
- Configured NAT64 with WKP in existing CGN devices

# Review of Security Policies

- Started with equivalent policies as with IPv4
- However:
  - Avoid filtering ICMPv6
  - And double check PMTUD is working
- Update BGP filtering specific for IPv6 (bogons, others)
- RPKI with AS0
- Issue, no DNSSEC yet, the ccTLD is not yet ready ...

# Major Issues

- The most difficult part, as usual, is the CPE support
  - Looking into **RFC8585**
- Major problem is that we don't have a provisioning system, so manual config on-site to each CPE.
  - There are know bugs/threads in existing CPEs (with IPv4), which can be exploited.
- Decision: Will install ACS simultaneously with the replacement/update of the CPEs
  - IPv6 becomes an opportunity to innovate
- Some Androids require a manual selection of the PDP type by the end-user... message sent to all the users with advantages of IPv6-only with IPv4aaS. Considering a carrot (free extra bandwidth, etc.)
- Apple is another history ... start very early!

# Other Aspects

- Lot of testing: Some dual-stack broadband customers already setup (initially employees)
- Project timing:
  - Early training some years ago
  - Some initial remote work, then 2 weeks on-site
  - 2 months extra remote work
  - 6 months customer “internal” work
- Comparison: in about the same time did the same job for a 30 million subscribers customer
- Most of this work is well documented in RFC8683 (Additional Deployment Guidelines for NAT64/464XLAT in Operator and Enterprise Networks)

# Thanks !

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