Mobile Networks Considerations for IPv6 Deployment

http://tools.ietf.org/html/draft-koodli-ipv6-in-mobile-networks-01

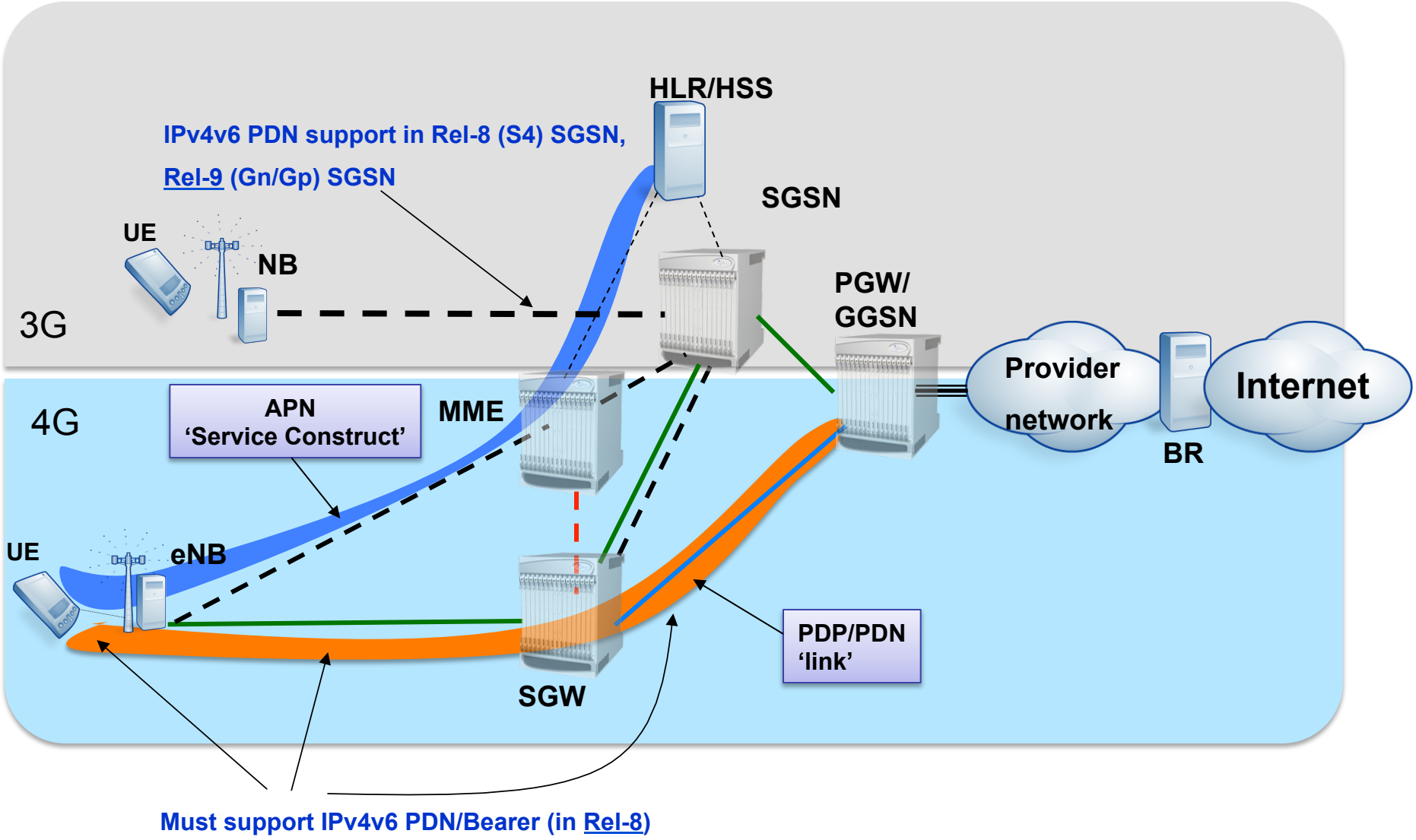
v6ops Working Group
Internet-Draft

Rajeev Koodli
Cisco Systems

Outline

- Public and Private IPv4 Exhaustion
- NAT Placement
- IPv6-only Deployments
- Fixed-Mobile Convergence
- Summary

3GPP 4G/3G Architecture



Address Exhaustion

- LTE Architecture requires always-on connection, which, along with
  - Mobile Internet Growth, and
  - Depletion of IANA ‘/8’ blocks leads to

    Public IPv4 address exhaustion

- In the interim, there is a need for delaying the IPv4 exhaustion as IPv6 is being introduced
  - Need for IPv4 translation

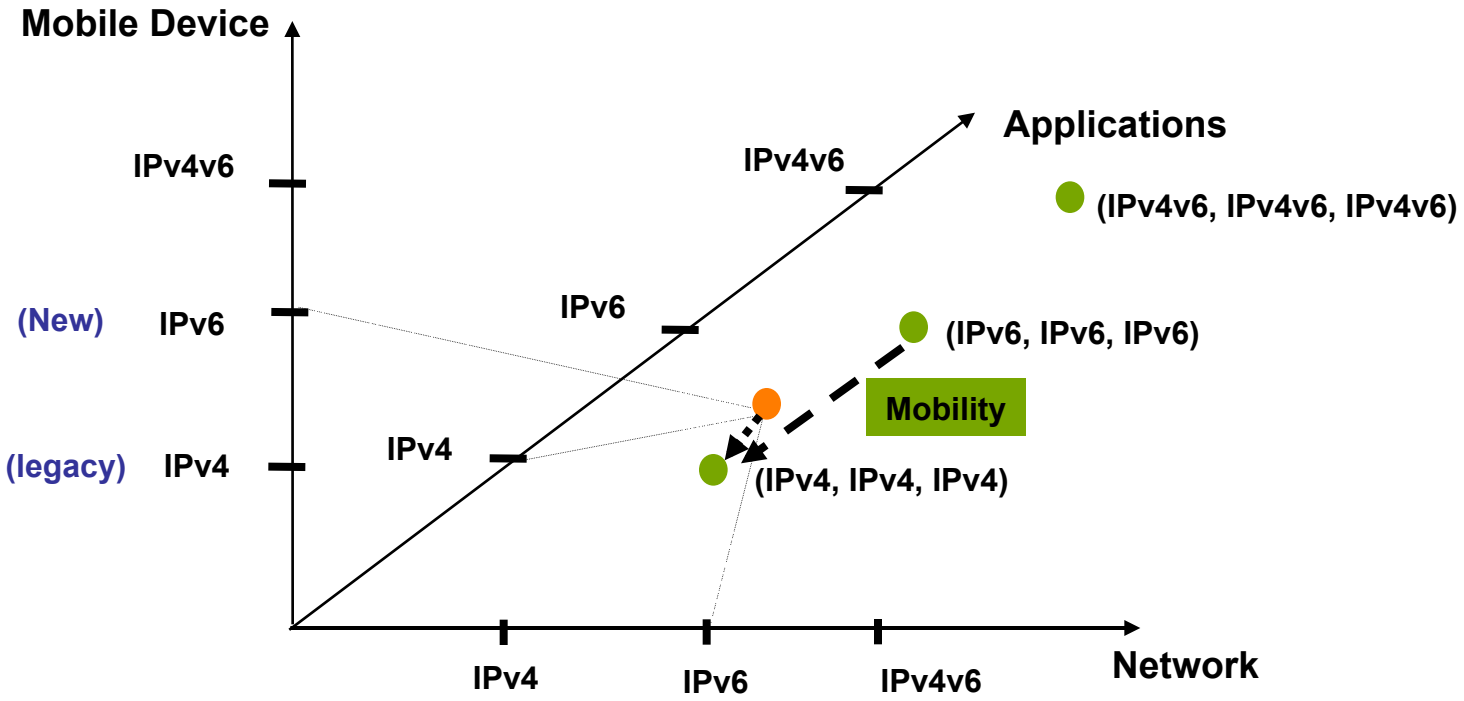
- Providers can introduce IPv6 using PDP/PDNs for their own services and applications

- Private IPv4 address assignment is tied to the respective PDP/PDN management

NAT Placement in the mobile network

- Need for correlating NAT bindings with subscriber session management state ("subscriber management")
  - QoS, Policy
  - Usage records (for billing and accounting)
- 'Centralized' NAT
  - Gateways share a common NAT (e.g., on the BR)
  - Need for supporting overlapping private IPv4 address within and across gateways, i.e., two or more UEs attached to the same gateway can share the same private IPv4 address
  - Need to support extensions to correlate NAT bindings with usage records
- 'Distributed' NAT
  - Each gateway has a NAT functionality and manages its own (NET10) address pool
  - Unique addresses within a gateway, address re-use across gateways
  - NAT state correlation with subscriber state, use of existing interfaces to AAA, PCRF

IPv6 Transition points



IPv6-only Deployments

- Expedite IPv6 usage
  - Do we have the luxury of actually waiting until we run out of public IPv4 addresses?
  - Relatively easier for a provider's own services and applications
  - Need IPv6 – IPv4 interworking for Internet access
- Roaming Considerations
  - Visited network support for outbound roaming users
  - Mobile Node support on inbound roaming users
- Applications and Services
  - Applications need to use IPv6 on mobile network interface
  - "long tail" challenge; few "prominent" applications can lead the way
  - IPv4-only applications may be able to use complementary access (such as WiFi) when available

Fixed-Mobile Convergence

- Different access networks (mobile, fixed) share the common problem of IPv4 address exhaustion
- Access networks have disparate characteristics
  - End-points (Residential Gateways/Modems, Mobile Nodes) have different capabilities and requirements
  - Roaming is not a consideration in fixed networks
- Different transition mechanisms likely apply for individual access networks
- Common mechanisms could be used at the provider's core, which is shared by different access networks

Input from ML

- IPv4 applications on IPv6-only networks
  - Added a paragraph in Section 3.3

- On-demand IPv4 management
  - Tied to PDN/PDP management for IPv4 PDN/PDPs
  - IPv4v6 PDN/PDP can use DHCPv4 with shorter lease times
  - Added text that there are implications to mobile nodes

Input from ML

- Possible to enable IPv6 in mobile nodes already in use?
  - A percentage of phones in use may have IPv6 stack
  - Unlikely that providers have tested such stack?
  - Reasonable to expect IPv6 support and compliance in newer devices

Input from ML

- Possible to rely on existing (pre-Release-8) nodes to provide IPv6 support?
  - Some experimental evidence suggests that many network nodes already support IPv6
  - Unclear whether accounting and charging functions are in place
  - Providers need to ensure that roaming SLAs include IPv6 support

Other input

- Centralized vs. Distributed NAT
  - Failure at a centralized NAT affects all the connected gateways, whereas failure at a gateway NAT only affects that gateway
  - Does distributed NAT mean disincentive to move to IPv6?
    - NAT is a function which can be turned off when necessary
    - May provide incremental transition from NAT on individual networks

Other input to address

- Elaborate the impact of Always-ON connection on NAT-based network
- Include issues related to NAT – ALG, performance, etc.
- Reference to NAT binding storage for legal purpose

Summary

- Using APNs, PDP/PDN support in 3GPP architecture and IETF's dual-stack model (RFC 4213) mobile network providers can introduce IPv6 (with NAT44 for IPv4)

- Distributed NAT model:
  - Deployments with need for subscriber management at the mobile gateway can benefit from NAT placement at the gateway
- Centralized NAT model:
  - Deployments with common NAT today can continue their legacy architecture

- IPv6-only deployments should be encouraged, with considerations to roaming, IPv6 – IPv4 interworking, and applications support

- Different mechanisms are likely applicable for different access networks, while the core network may utilize common solutions

Question to the WG

Useful to document the considerations?