

France Telecom's IPv6 Strategy

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- Rationale
- FT Group-wise IPv6 program
 - Objectives
 - Phased approach
- Design principles
- Current status
 - Program-derived, affiliate-specific projects and pilot deployments
- Lessons learnt
- Next steps

- Make sure France Telecom's ready to face the depletion
- Make sure depletion does not negatively affect business growth nor customers' QoE
 - Regardless of IPv4 address availability
- Therefore:
 - Networks must convey both IPv4 and IPv6 traffic
 - Networks and services must cope with address translation design and operation during transition

Program's Objectives

- *Federate* IPv6 initiatives
 - For the sake of consistency and sync, covering both residential and corporate markets
- *Specify* and consolidate a set of design and operational guidelines documents
 - To serve as the cornerstone of the IPv6 strategy
 - To be further derived into DNF-specific engineering rules and operating procedures
- *Validate* by driving and monitoring IPv6 field trials, meant to:
 - Validate design principles
 - Assess (service-driven) performance and scalability aspects
- *Communicate* on IPv6 program-driven activities
 - Both internally (e.g. newsletter, "IPv6 days", etc.) and externally (contribution to the standardization effort, PR, etc.)

A Phased Approach

- Phase 1 (2008-2009): IPv6 Introduction
 - Publish a reference architectural framework
 - Conduct a scope-restricted pilot deployment
 - Validate design guidelines with basic Internet service
 - Assumes Group's affiliate involvement from Day 1
- Phase 2 (2009-2010): IPv6 Migration
 - Refine reference architectural framework with further (VoIP, IPTV-inferred) design recommendations
 - Including IPv6-inferred Multicast, VPN, SIP capabilities
 - Conduct service-wise experiment accordingly
- Phase 3 (2010-): IPv6 Production
 - Publish consolidated IPv6 service production procedures
 - Towards IPv6-only backbone and customer environmental infrastructures, gracefully coping with IPv4 address depletion

Introducing FT Design

- Dual Stack architecture
 - CPE and devices of the access layer are DS-enabled
- IPv6 prefixes are dynamically assigned to CPE/UE by means of DHCPv6
 - Prefix Delegation context where the DR is the DHCPv6 server itself
 - Hosts connected to CPE devices dynamically form their addresses by means of SLAAC (stateless address autoconfiguration)
 - Privacy is encouraged by adequate extensions (RFC 4941) and walled garden design for some services (IPTV, VoIP)
 - CPE IPv6 reachability information is acquired by first hop router by means of DHCPv6 RAAN (Relay Agent Assignment Notification) option

A Necessary Evil?

- Make sure IPv4-to-IPv4 communications can still be established during transition period is a MUST
- But global IPv4 addresses become scarce resource
 - Hence the need to share them between several customers
- Inevitably yielding the deployment of NAT capabilities in the network
 - Because of current SoA

Two CGN Flavors

- “Double NAT” approach
 - Addresses are translated at the CPE level then at the CGN level
 - Assumes forwarding scheme is based on non-routable addresses within a domain
 - Overlapping private addressing schemes and subsequent operational complexity are likely to become the rule, not the exception
- “DS-Lite” approach
 - Privately-addressed IPv4 traffic is encapsulated in IPv6 datagrams (by the CPE or the UE)
 - CGN IPv6 reachability information can be provided to the CPE/UE by means of DHCPv6

The Choice of DS-Lite

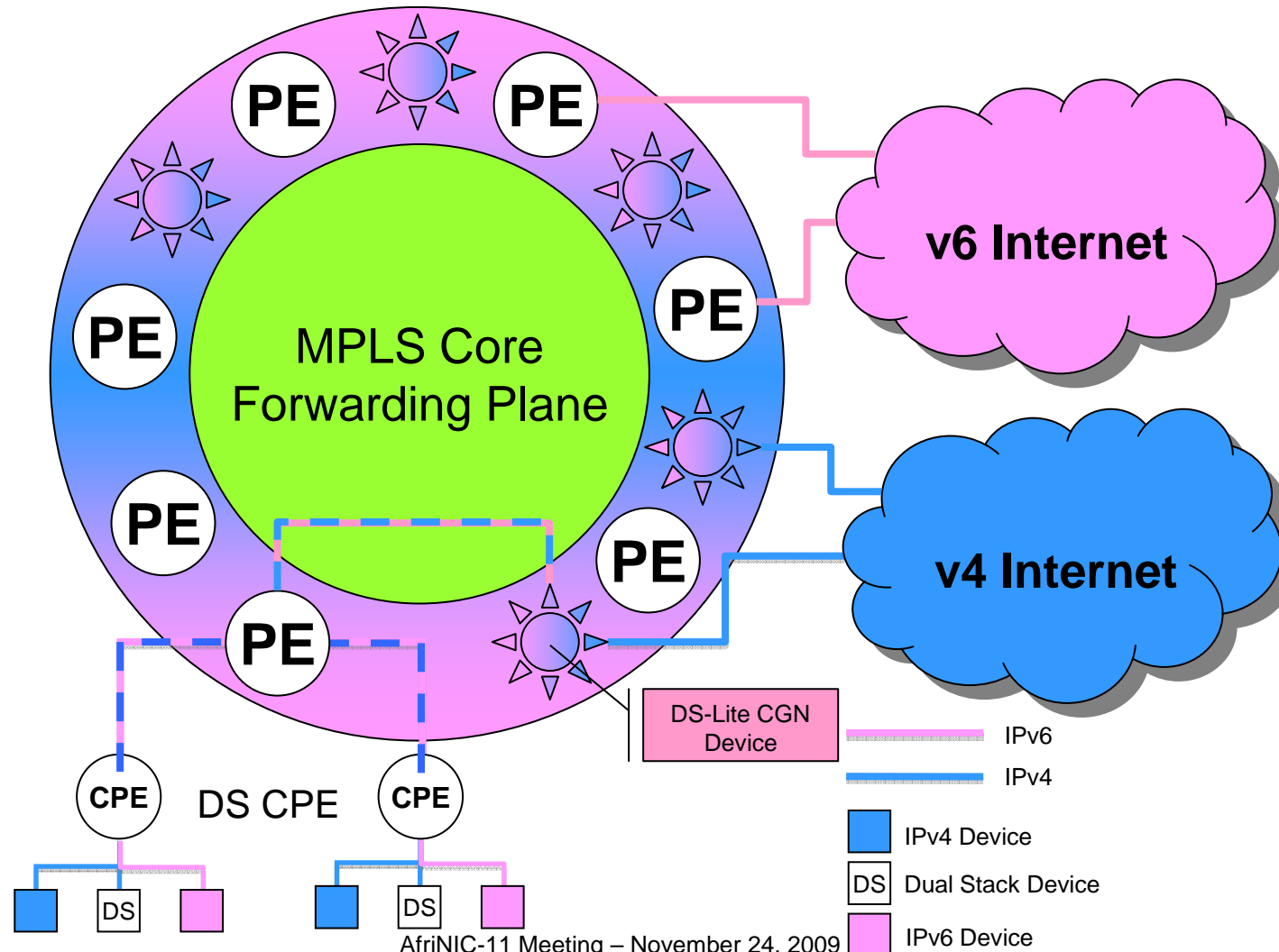
- A **catalyst** of IPv6 deployment
 - CPE and UE devices need to be provided with IPv6 connectivity and IPv4-in-IPv6 encapsulation capabilities
 - Unlike “double NAT” and 6to4(-like) solutions which still mandate (global) IPv4 addresses
- Maintains only one level of NAT
 - CPE-embedded NAT capabilities are de-activated and “outsourced” in the network
- Technology is commercially available
 - While standardization is straightforward and underway
- DS-Lite extensions also facilitate IPv4-to-IPv6 stateless communication as well as graceful migration towards A+P
 - See <http://tools.ietf.org/html/draft-boucadair-dslite-interco-v4v6-01> and <http://tools.ietf.org/html/draft-boucadair-behave-ipv6-portrange-02>, respectively

- DS CPE embeds DHCPv6 client
 - Delegating Router uses IA_PD identity association to assign /56 global prefixes (in RIPE-dependent countries)
 - DS and IPv6 hosts automatically form their own IPv6 address by means of SLAAC
- DS CPE still embeds a DHCPv4 server
 - To provide IPv4 private addresses to DS and IPv4 hosts

- CPE is a DS router
 - Default route is acquired by means of RS/RA exchange between CPE and first hop DS router
- IPv6 traffic is natively forwarded
 - Based upon 6PE design
 - No need for an IPv6 IGP
 - Reduces OPEX costs
 - Encourages QoS-guaranteed MPLS-based P2MP tree structures for multicast-based services such as live TV broadcasting
- Privately-addressed IPv4 traffic is:
 - Forwarded to and translated by DS-Lite CGN devices
 - Encapsulated in IPv6 datagrams *a la* RFC 2473

- Device management remains v4-based by default
 - Because of DS routers and preserved IPv4 core
 - But DS-Lite design assumes CPE is IPv6-managed
- Customer management relies upon DHCPv6 information
 - Including use of Options #18 and #37 (equivalent of sub-options #1 “Circuit-ID” and #2 “Remote-ID” of RFC 3046, respectively)

Global Networking Picture





Pilot Deployments are Underway

- Program-derived affiliate-specific projects
 - Meant to enforce group's strategy according to environmental and technological contexts
 - Primarily focused on residential (fixed) market
 - But 6VPE-based IPv6 VPN (including IPv6 access to global Internet from corporate sites) service offering has been launched in May for corporate customers
 - See http://www.orange-business.com/mnc/press/press_releases/2009/IPv6.html
- France, Poland, Senegal and Switzerland projects have kicked off
 - First (Internet service-restricted) phase starts on Q4 2009/H1 2010 with several hundreds of (internal) customers
 - Generalization to follow as per program's milestones

- Two-phased, residential and corporate-scoped pilot deployment
 - Phase 1 (Nov. 2009) focuses on Internet access and IPv6 VPN services
 - Phase 2 (early 2010) extends scope to VoIP and IPTV (including e-learning) services
- Design enforces Group's IPv6 strategy
 - ADSL-connected DS CPE devices are assigned /48 prefixes
 - BAS is the DR
 - 6(V)PE control plane
 - BAS is a 6PE router too
 - No CGN, as focus is on IPv6
 - Customers and devices remain IPv4-managed

(Some) Lessons Learnt...

- Information systems (OSS/BSS) should be upgraded first
- Some vendors are not IPv6-minded yet
 - This sometimes mandates in-house workarounds (e.g. outsourcing of DHCPv6 Relay-Agent capabilities) that may delay generalized deployment
 - Encourages service providers' community to unite and consolidate (functional) requirements in light of possible design options
 - Standardization can surely help

- Early pilot deployments are meant to assess functional design in-the-field
 - Hundreds of customers are not sufficient to discuss performance and scalability
- Access to the IPv4 Internet will change
 - DS-Lite CGN introduction encourages customer education
- IPv6 introduction is isotropous
 - Keeping a global, systemic view of the problem is key
 - But who can claim everything's under control 😊?

- Specification
 - Specification of IPv6 flavors of the whole range of service offerings to be completed by December
- Standardization
 - Promote the adoption of IETF-, 3GPP-, and BBF-targeted contributions by the end of 2009 (CGN-, A+P-, sensor- and DHCPv6-related matters)
- Support
 - Generalize IPv6 training (Q4 2009/Q1 2010)
 - Drive forthcoming pilot deployments