

TELECOM ITALIA GROUP

2011 September 30 – EURONOG, Krakow

Telecom Italia IPv6 strategy introduction: a case study

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Agenda

- ▶ Drivers and methodology
- ▶ TI implementation
- ▶ Addressing plan
- ▶ Conclusions

IPv4 addresses: no more time left

- ▶ **In February 2011 IANA has assigned all the remaining /8 classes**

- ▶ **RIPE will run out IPv4 classes in???**

- ▶ **New assignments from the latest /8 will follow specific rules:**
 - ▶ **These addresses will help for the transition phase to IPv6**
 - ▶ **Only if IPv6 is already in use in the network**

TI requirements

- ▶ **Consider the followings as the main drivers for IPv6 introduction in TI:**
 - ▶ **IPv4 public addresses exhaustion**
 - ▶ **Legal Interception and User Traceability**
 - ▶ **Future proof solutions for the network evolution**
 - ▶ **Business Customers request for IPv6 support**

- ▶ **TI network has to be ready when IPv4 public addresses will no longer available**

Target IPv6 architecture identification

- ▶ **The process used to define the TI target architecture for IPv6 introduction is based on the following steps:**
 - ▶ **IPv6 Support Analysis:** all the network components have considered in order to define the IPv6 support, the available features and the timeframe for their availability
 - ▶ **Model definition:** the network model and architecture have to be defined based on the info collected in the previous point. A timeframe has to be identified for the lab verifications to check if the features available are working
 - ▶ **Implementation Analysis:** it has to be defined a timeframe for the implementation in the network, considering a pilot service to be first introduced in the network
 - ▶ **Deployment:** based on the feedback from the pilot, define a plan for the introduction in the network



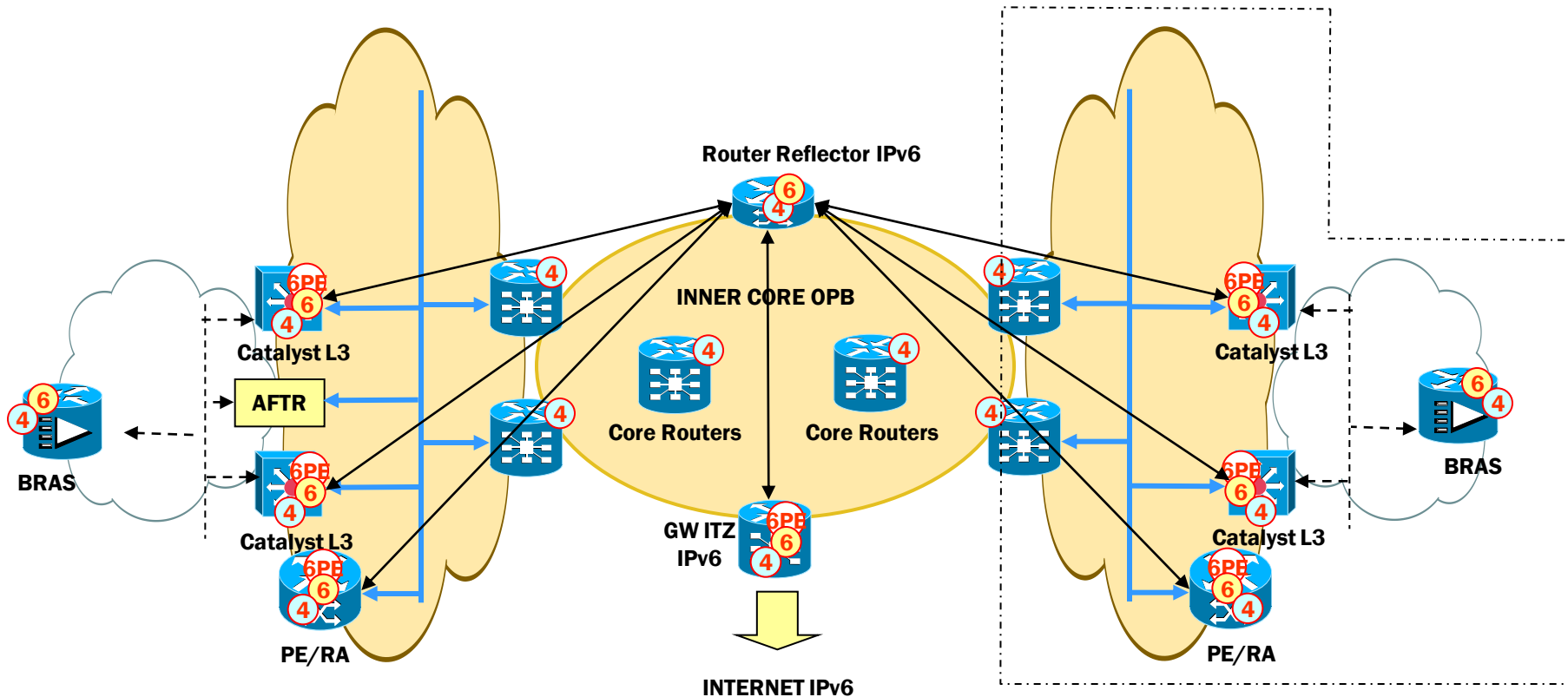
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How to introduce IPv6 in TI network

- ▶ **After the analysis run on TI network, the choice for IPv6 introduction is the following:**
 - ▶ **IPv6 on edge equipments**
 - ▶ **IPv6 only over PPP for new Residential customers (assuming that no more public IPv4 addresses are available)**
 - ▶ **Dual Stack IPv4 and IPv6 for Business customers**
 - ▶ **IPv6 over MPLS in the backbone**
 - ▶ **6PE on backbone edge devices**
 - ▶ **MPLS forwarding in backbone equipments**
 - ▶ **IPv6 dedicated Route Reflector Servers**
- ▶ **Long term scenario: Dual stack at Core and Edge layers**

Telecom Italia IPv6 architecture (1/2)



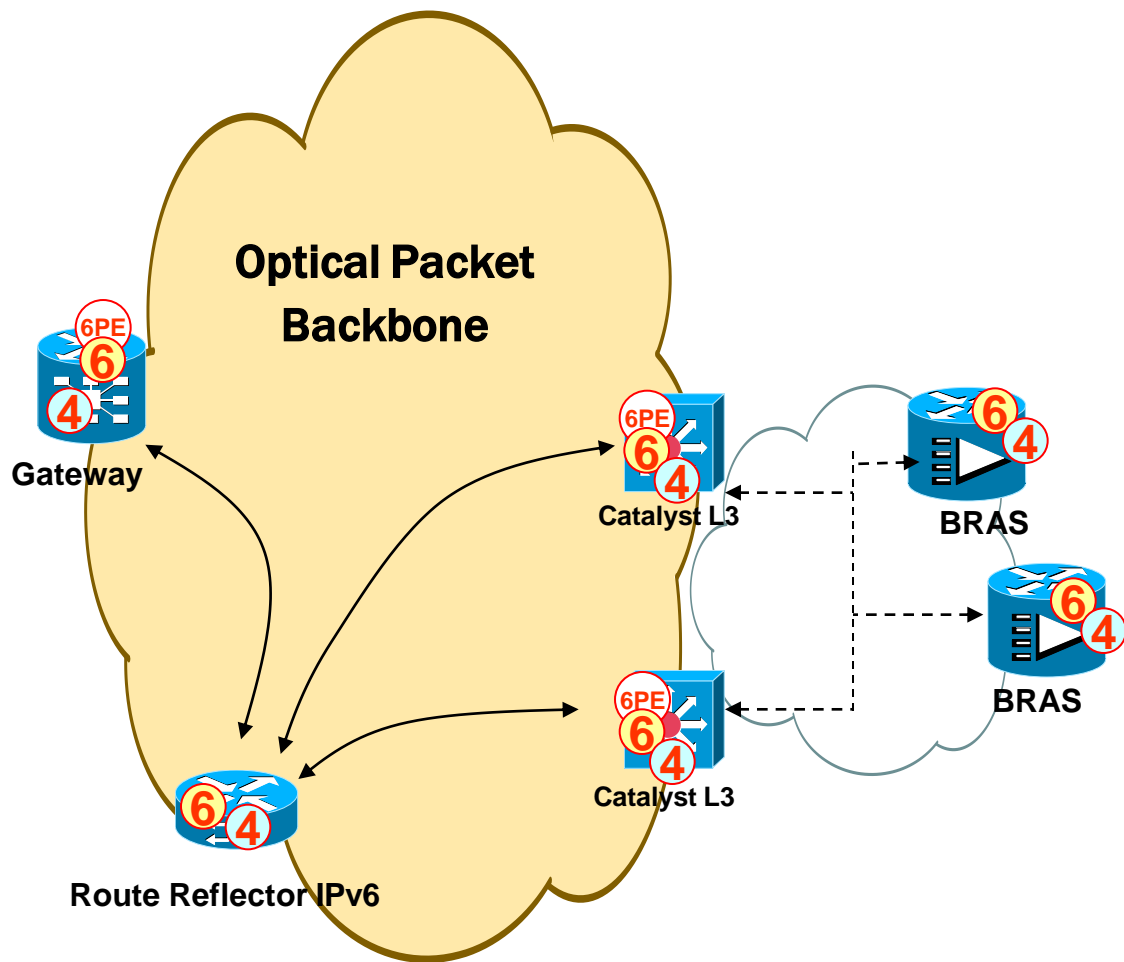
Legend

Forwarding plane		Control plane	
IPv6 native	IPv6 MPLS		MP-iBGP AF IPv6+label
			OSPFv2 + LDP
			OSPFv3
			RA = Router Access

Telecom Italia IPv6 architecture (2/2)

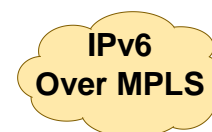
- ▶ **Medium term transport architecture based on 6PE model**
 - ▶ **IPv6 supported only at Network boundaries (IPv6 Edge “islands”);**
 - ▶ **MPLS switching at core layer**
- ▶ **Two different solution for residential and business segment**
 - ▶ **Residential segment: 6PE feature implemented by Catalyst Multilayer switches**
 - ▶ **Business segment: 6PE feature built in PE access node**
 - ▶ **This architecture extends also for mobile services**
- ▶ **Long term scenario: Dual stack at Core and Edge layers**

Residential segment



Legend

Forwarding plane



Control plane

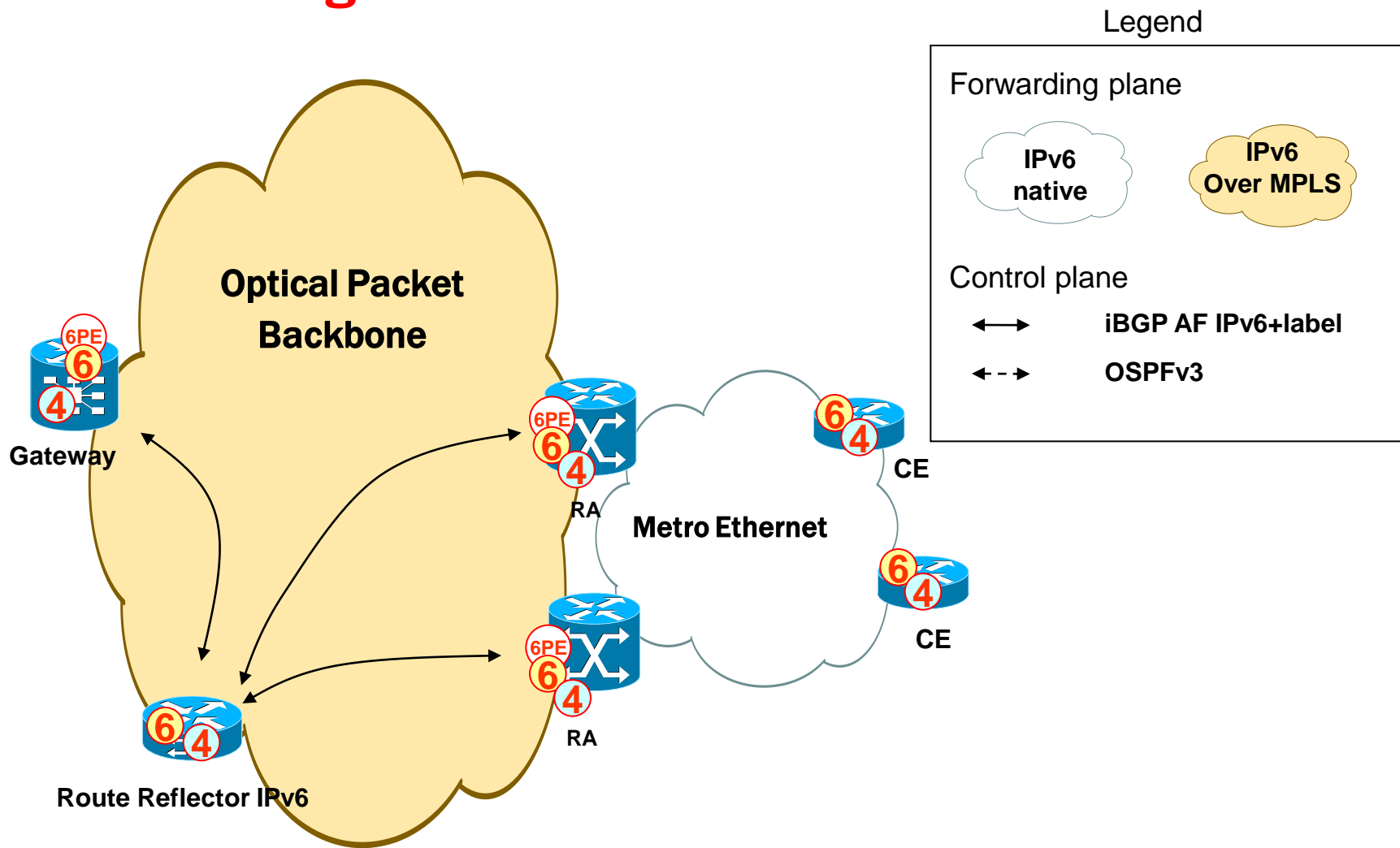


iBGP AF IPv6+label



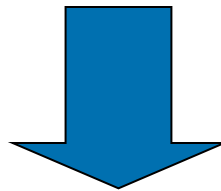
OSPFv3

Business segment



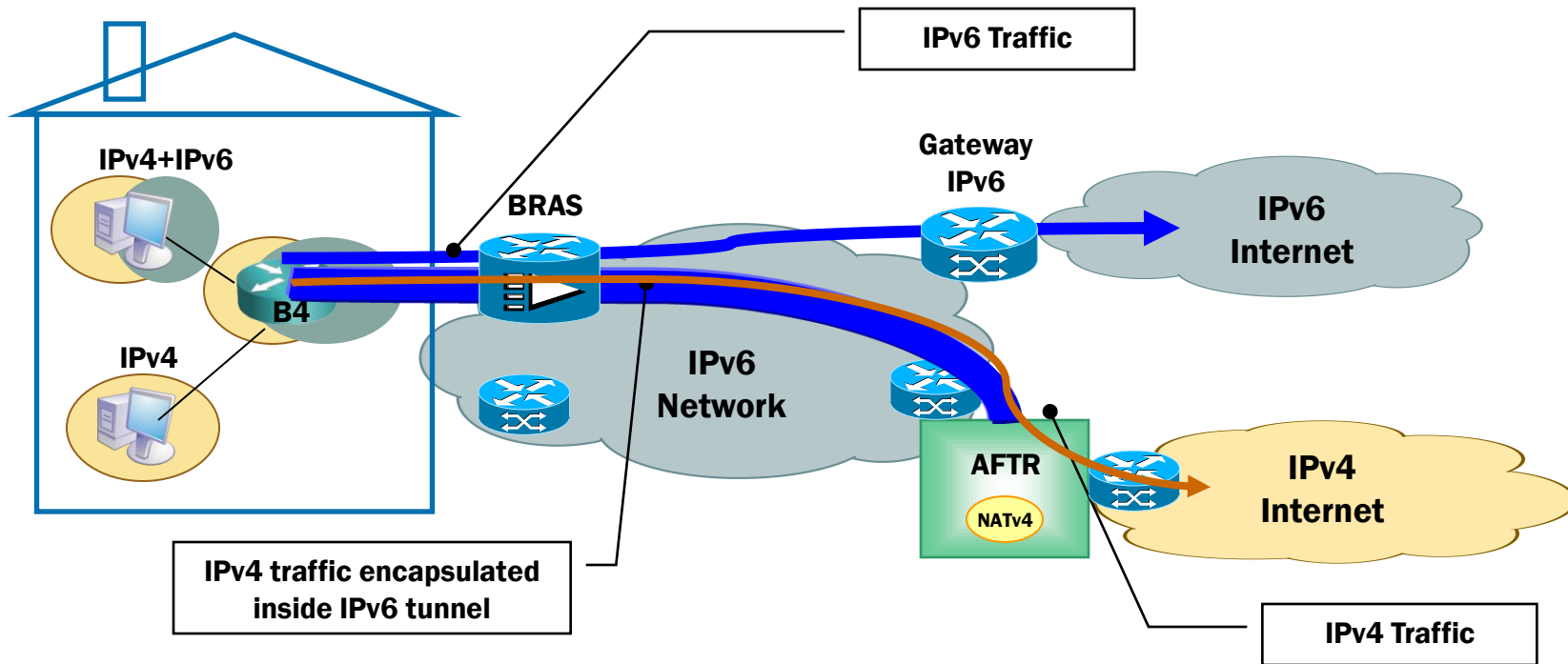
An interworking function is needed

- ▶ **New Residential Customers will obtain ONLY IPv6 public address, while using IPv4 private address for the internal LAN configuration**
- ▶ **Old Residential Customer will continue using IPv4, if they do not ask for an upgrade to IPv6**
- ▶ **Old PCs and servers that are using IPv4 and cannot be updated to IPv6, still need to be interconnect to IPv4 world**



- ▶ **Among all available solutions, TI selected interworking function is DSLite (IPv4 natting is still under evaluation by AGCOM)**

Dual-Stack Lite: reference architecture



- ▶ **B4 (Basic Bridging BroadBand) @ client site**
 - ▶ dual-stack IPv4/IPv6 (IPv4 private and IPv6 public addresses)
 - ▶ IPv6 traffic forwarding and IPv4 traffic encapsulation over an IPv4-in-IPv6 Tunnel
- ▶ **AFTR (Address Family Transition Router) as network element**
 - ▶ IPv4-in-IPv6 tunnel terminator
 - ▶ NATv4 translations

Where is TI in this moment?

- ▶ **The IPv6 process has already started, some activities are done while other are on going**
 - ▶ **Definition of the target solution: DONE**
 - ▶ **Interconnection to IPv6 Internet: DONE**
 - ▶ **Lab Testing of the target solution: DONE**
 - ▶ **TI network infrastructure DSLite predisposition: DONE**
 - ▶ **DSLite internal service trial: ON GOING**



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IPv6 addressing scheme

- ▶ **TI IPv6 Addressing scheme at moment is structured in two addressing plans**
 - ▶ **Customer Addressing Plan**
 - ▶ **infrastructure Addressing Plan**

IPv6 customer addressing scheme

- ▶ **Goal: develop a hierarchal addressing scheme for numbering customers networks, encoding some information of interest:**
 - ▶ **PoP Id: identifies a single PoP among the 32 PoPs matching the OSPF local area HEX value**
 - ▶ **Service field: identifies the type of customer distinguishing in Residential customer, Business customer, Mobile customer, Internal Customer and so on**
 - ▶ **Pool Id is used for numbering /64 prefixes assigned to customers. It is a progressive index. It could be useful to aggregate provisioned customer on access node base (BNAS or PE), considering that a sinle residential customer has a /64 IPv6 prefix**

IPv6 infrastructure addressing scheme

- ▶ **Goal: develop an easy addressing scheme with an hierarchal structure for numbering internal infrastructure (i.e. p2p, LAN, loopback interfaces):**
- ▶ **Basically the fields structure follow customer addressing scheme, in order to simplify the assignment and database management**
- ▶ **Most relevant fields:**
 - ▶ **PoP Id: identifies a single PoP among the 32 PoPs matching the OSPF local area HEX value**
 - ▶ **Type: identifies the specific internal segment, such as point-to-point, LAN, loopback and point-to-point network interfaces towards customers**
 - ▶ **Block Id: it is a progressive id to identify a generic node address pool**
 - ▶ **Note: Pool Id and Block are NOT related and they haven't the same value**



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Conclusions

- ▶ **Different drivers are addressing IPv6 introduction, but it is still a complex process**
- ▶ **A transition mechanism is a MUST in this long migration phase from IPv4 to IPv6**
- ▶ **TI has defined internally a structured process to accomplish the target IPv6 architecture**

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Thank you!

