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IPv4/IPv6 multicast interoperation

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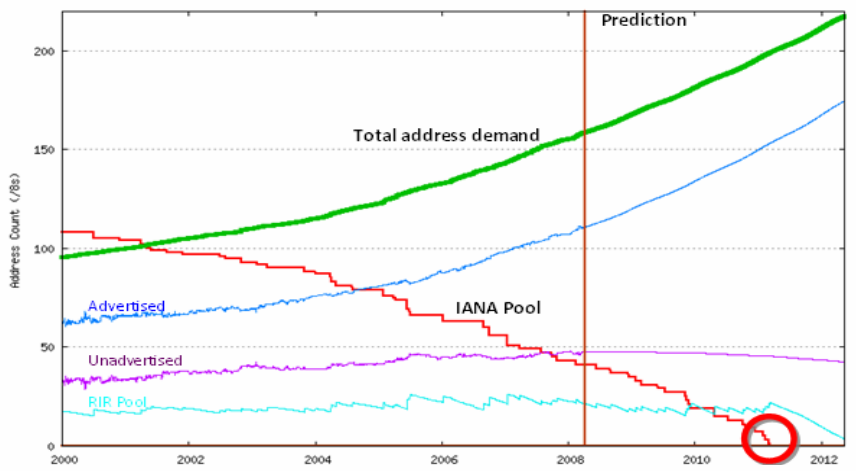
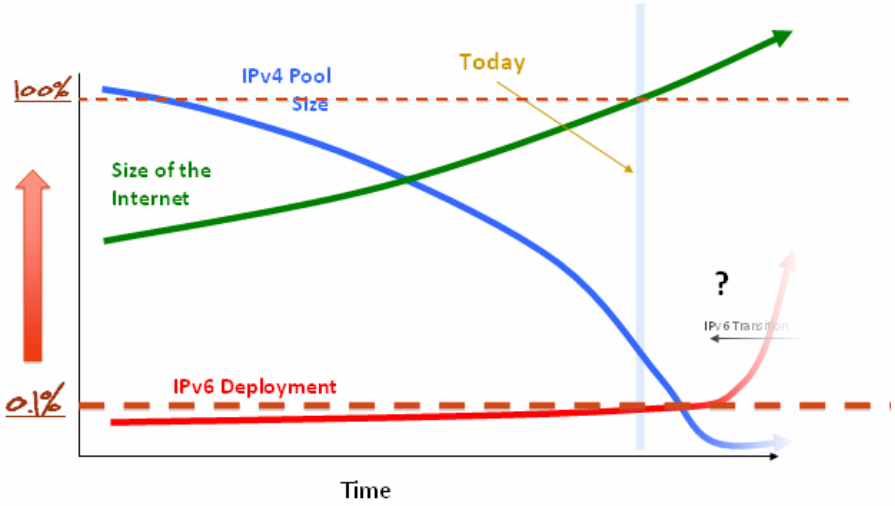
Outlines

- IPv4/IPv6 Transition Trends
- Brief Multicast Introduction
- Basic IPv4/IPv6 Multicast Interoperation Mechanisms
- Multicast Deployment in 46 Transition Scenarios

IPv6 Speed up - IPv4 Address Exhaustion

- **Public IPv4 address is expected to be exhausted**
  - IANA Unallocated Address Pool: 01-Aug-2011
  - RIR Unallocated Address Pool: 04-Mar-2012
  - Exhaustion prediction on June, 2010:
  - http://www.potaroo.net/tools/ipv4/index.html
- **More and more devices will be connected to the Internet. More and more addresses are needed**
- **IPv6 is the only right answer for the address exhaustion issue**
- **IPv4/IPv6 will co-exist for a long period. 15 year +**

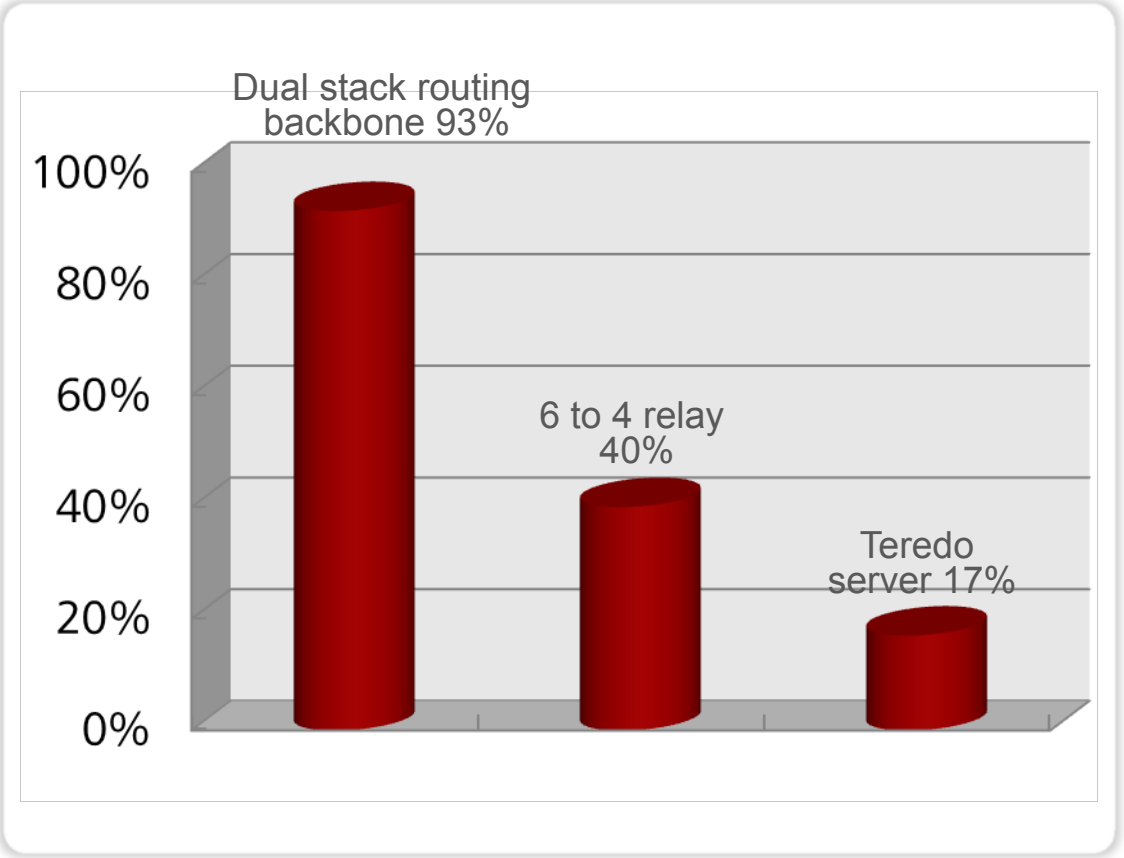




Major technology choices

RFC 6036 “Emerging Service Provider Scenarios for IPv6 Deployment”

- **93% choose a dual stack routing backbone**
- **40% run/plan a 6to4 relay**
- **17% run/plan a Teredo server**
- **Dual stack backbone + supplement transition mechanism are majority**
- **77% run/plan no equipment dedicated to IPv6**
- **(different) 77% do not see IPv6 as an opportunity to restructure topology**



IPv4-IPv6 interworking

- **57% of ISPs don't expect IPv6-only customers**
  - Mobile operators are certain they will have millions
  - 5 ISPs report customers who explicitly refused to consider IPv6
- **How long will users run IPv4-only applications?**
  - The most frequent answer is "more than ten years"
- **Is IPv6-IPv4 interworking at the the IP layer needed?**
  - 90% say yes
    - 30% plan NAT-PT or NAT64
    - 23% rely on dual stack
    - the others are in duh! space

IPv4/IPv6 Transition Technologies Choice

- **Global transport backhaul network must be dual stack**
- **European ISps prefer jump to IPv6, like DS-Lite**
- **NA ISPs prefer IPv4-based mechanism, like 6rd or incremental CGN**
- **JP, CN may choose Dual stack**
- **Observation only – trends for now**
  - Still new transition technologies proposed, like host-based 6a44, or Teredo extension

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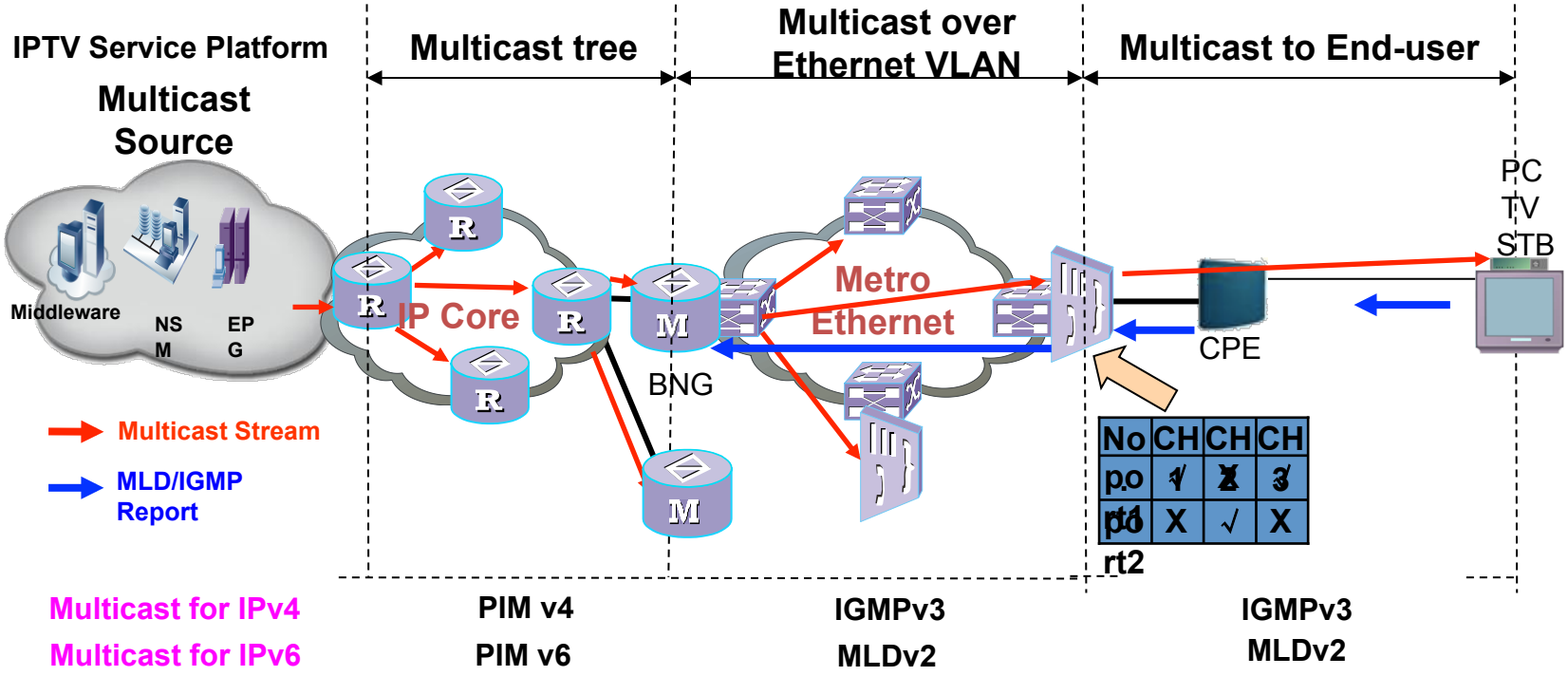
Multicast Brief Intro

- **Multicast is a technique for one-to-many communication over an IPv6 infrastructure in a network. It is often employed for streaming media and Internet television applications.**
- **In multicast, routers create optimal distribution paths for datagrams sent to a multicast destination address spanning tree in real-time.**
- **Multicast uses network infrastructure efficiently by requiring the source to send a packet only once, even if it needs to be delivered to a large number of receivers. It is particularly suitable for the scenarios that involve large scale receivers.**

Multicast Architecture in IPv4 & IPv6



In IPv6/IPv4 multicast, routers use multicast routing protocol, such as PIM, to construct multicast tree for multicast routing table to forward the multicast datagrams.

In IPv6/IPv4 multicast, routers use multicast group management protocol, such as IGMPv3 for IPv4 and MLDv2 for IPv6, to manage multicast members, and set up and maintain member relationships between hosts and the multicast router to which the hosts are directly connected.

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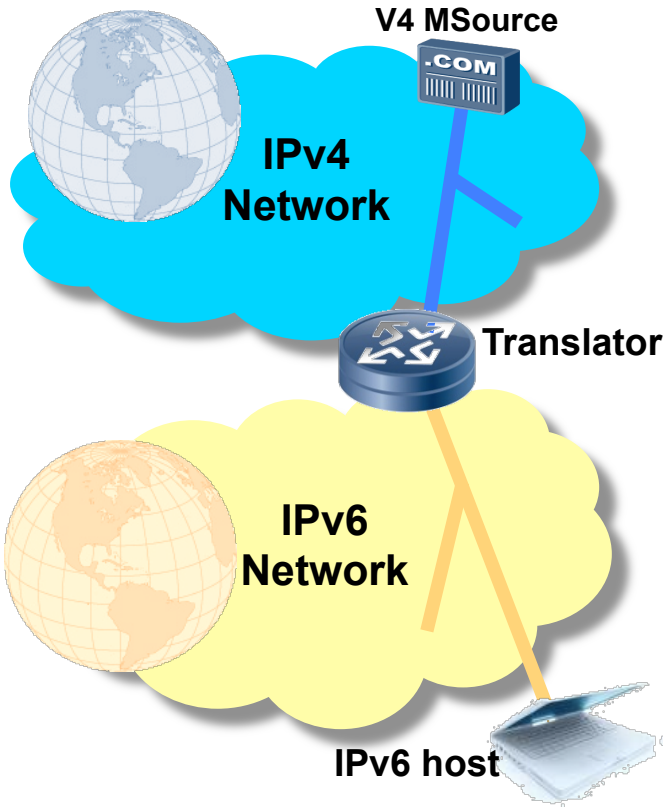
IPv4/IPv6 Multicast Interoperation Difficulties/Considerations

- How to allow IPv6 terminals to access a IPv4 multicast source?
- How to allow IPv4 terminals to access a new IPv6 multicast source?
- Avoid carrying each IPTV channel twice in IPv4/IPv6 (support nationally)
- Connecting IPv4 terminals and IPv4 multicast source through IPv6 networks
- Connecting IPv6 terminals and IPv6 multicast source through IPv4 networks

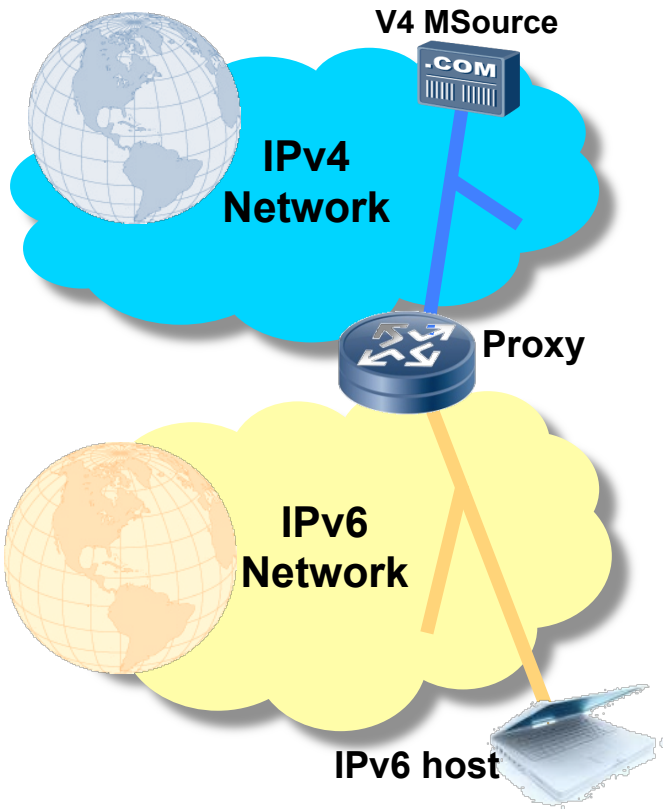
IPv4/IPv6 packet-based multicast translation

- **Mapping between IPv4 and IPv6**
  - Embedding IPv4 multicast addresses into IPv6
  - Translating IPv6 multicast addresses into IPv4
  - Every packets need to be transformed
- **Issues:**
  - RFC2766 NAT-PT has been moved into Historic Status by RFC4966
  - IETF has not yet produced new translation standard for multicast (NAT46 and NAT64 are separated)
  - Part of multicast tree is invisible



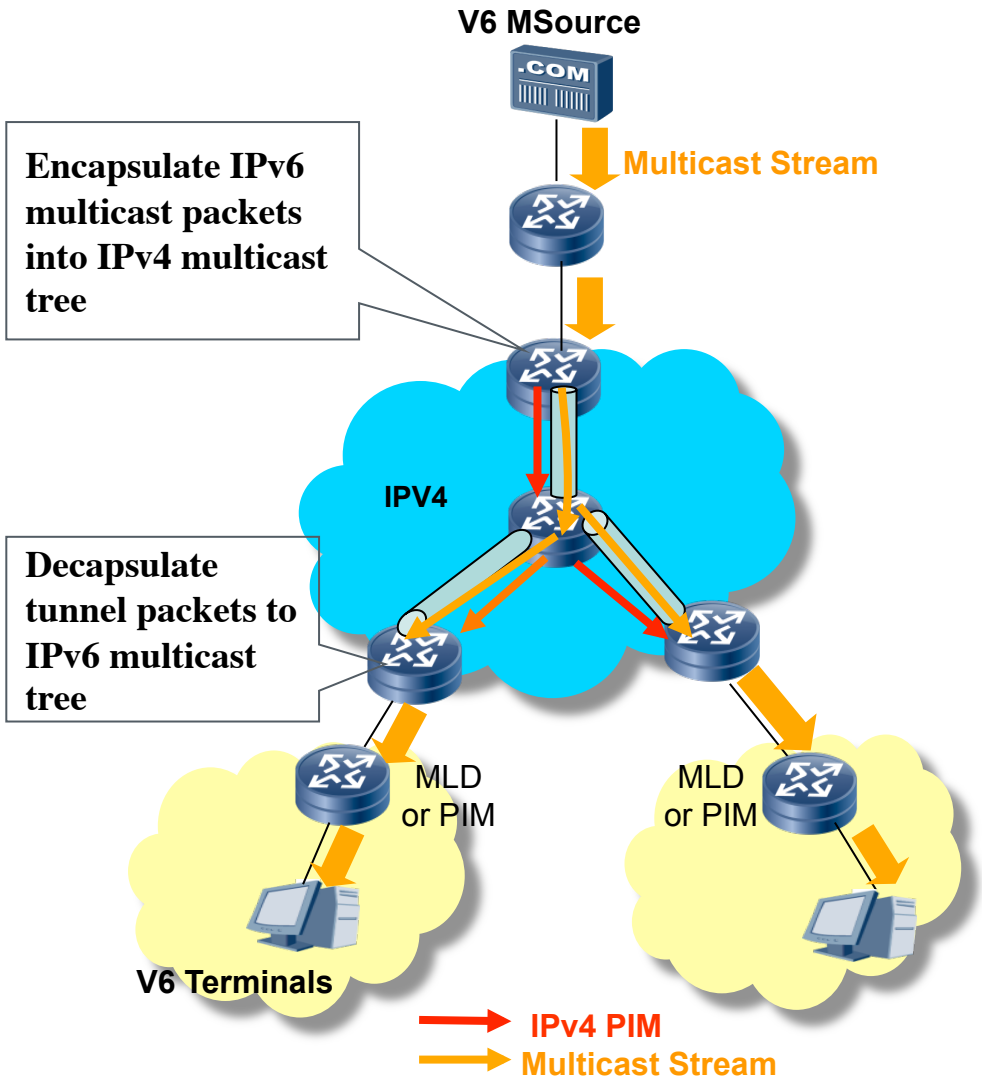
IPv4/IPv6 multicast proxy (ALG)

- **Mainly based on content cache concept**
  - The proxy retires the content data from IPvX network, caches the data, and multicasts the data in IPvY network
  - It acts as a multicast leaf in the IPvX network where the data source locates
  - It also acts as a multicast source in IPvY network where the multicast client locates
  - Two independent multicast trees
  - Within the proxy, multicast addresses or trees are mapped
- **No necessary need IETF standard**
  - Implementation or deployment level mechanism



Multicast Tunnel (part of the Tree)

- **The motivation for this method is to become fully functional IPv6 nodes by using an IPv4 domain that supports IPv4 multicast as their virtual local link. It uses IPv4 multicast as a "virtual Ethernet".**
  - Auto-tunnel transported IPv6 multicast packet across IPv4 multicast area
  - Multicast address mapping- Administratively Scoped IP v4 multicast map to IPv6 multicast address
- **For IPv4, instead IPv4 multicast, Point-to-point tunnel or last hop pushing is possible, but high cost**



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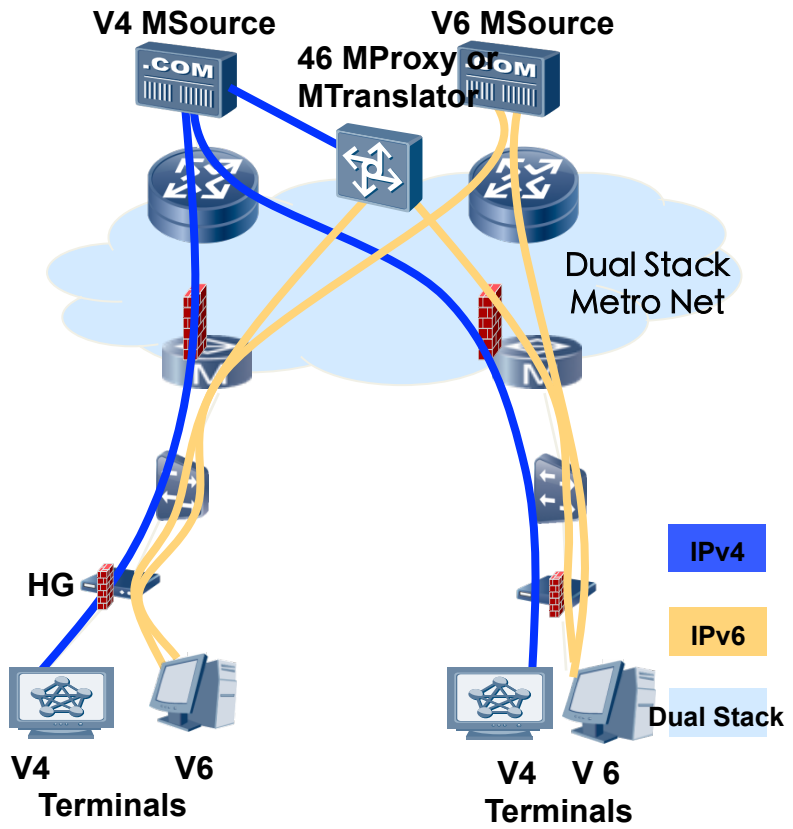
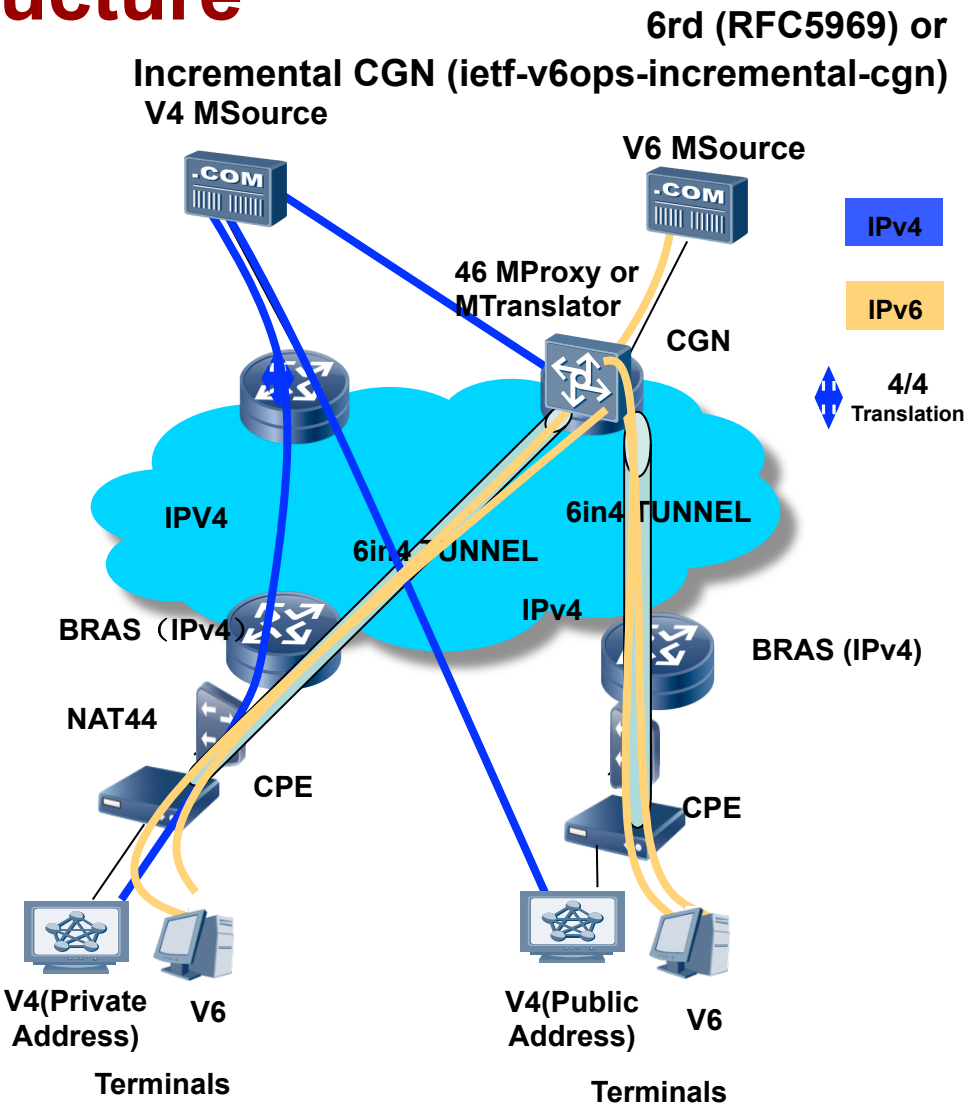
Dual Stack

- **Suitable Scenarios: new dual-stack network**
  - Advantage：Both IPv6 and IPv4 services are native. Minimize the inter-communication between IPv6 and IPv4
  - Require all forwarding devices, include CPE to be upgraded
- **Two parallel forwarding plate**
  - native IPv6 services
  - IPv4 services remain the same
- **Carrier may provide private IPv4 address to CPE and terminals**
  - Source and Terminals should be in the same address space in order to avoid NAT44
- **If no IPv6 source, 46 multicast proxy or translator is needed**



IPv4 Network Infrastructure

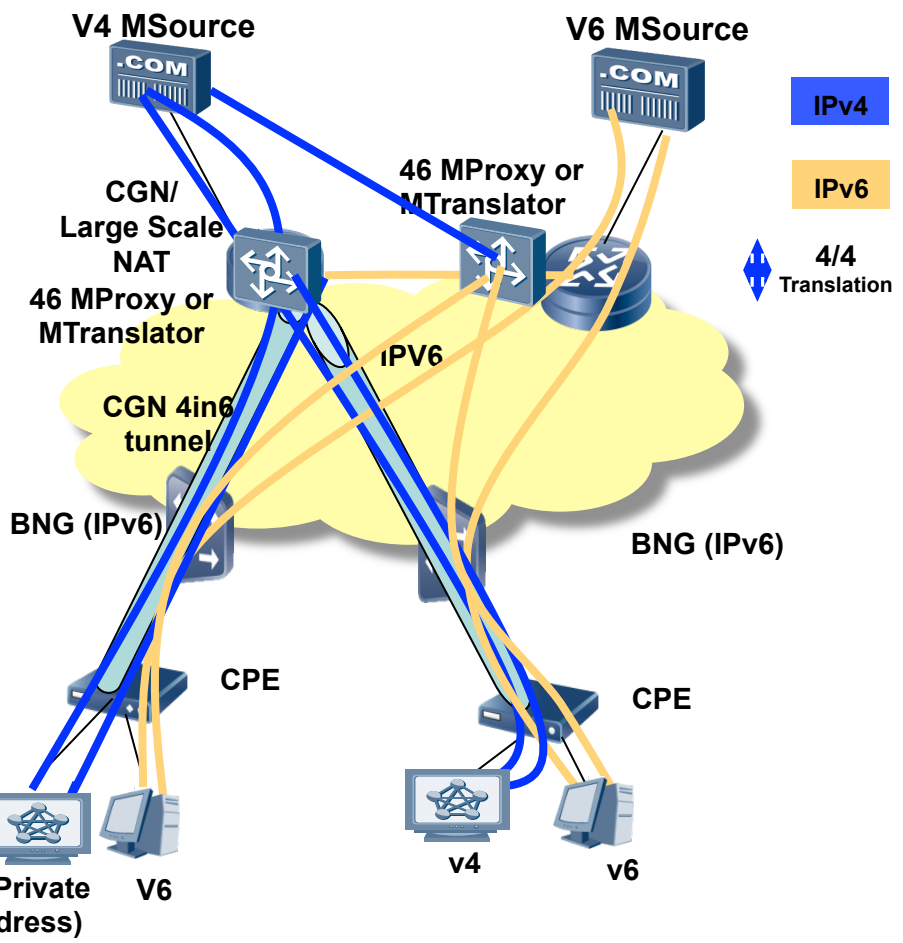
- **Suitable Scenarios: IPv4 Network Infra-structure**
  - Advantage：most of network devices remain unmodified, minimum investment, Deployment quick and simple
  - Require new CPEs and an tunnel end devices
- **IPv4 forwarding still dominate**
  - IPv4 services remain the same
  - Part of IPv6 multicast tree is encapsulated into 6over4 tunnels
- **Carrier may provide private IPv4 address to CPE and terminals**
  - Source and Terminals should be in the same address space in order to avoid NAT44
- **If no IPv6 source, 46 multicast proxy or translator is needed**



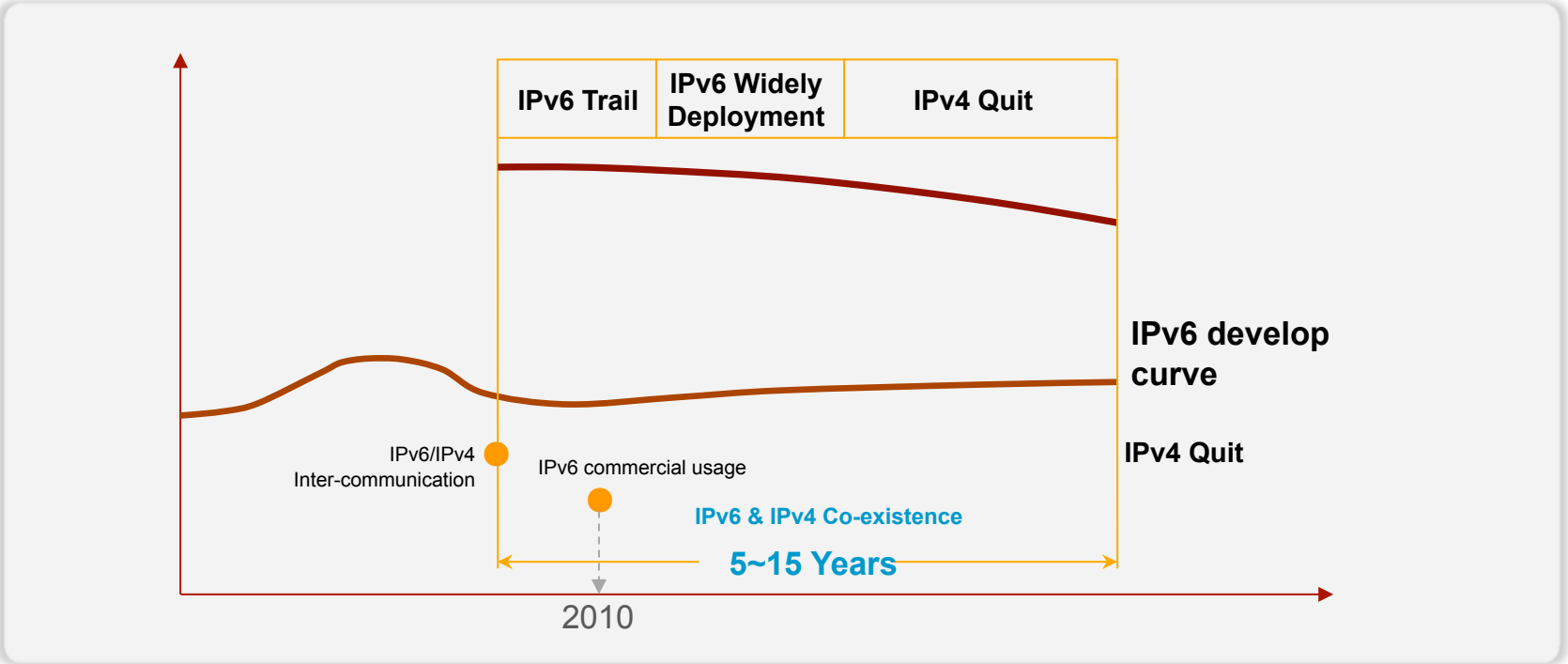
IPv6 Network Infrastructure

- **Suitable Scenarios: IPv6 Network Infrastructure**
  - Advantage：IPv6-only network is simple and easy for management, provide IPv4 services too
  - Do not require any public IPv4 addresses
  - Require all forwarding devices, include CPE to be upgraded
- **Mainly IPv6 traffics, continuously provide IPv4 access services**
  - native IPv6 services
  - Part of IPv4 multicast tree is encapsulated into 4over6 tunnels
- **If no IPv4 source, 64 multicast proxy or translator is needed**
- **If no IPv6 source, 46 multicast proxy or translator is needed**

DS-Lite (ietf-softwire-dual-stack-lite)



IPv6 Era is coming



- The later IPv6 deployment starts, the higher the overall network transition cost is
- ISPs face both IPv6 transition and IPv4 address shortage problems. The combination of mechanisms from two categories is needed

Thank you

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