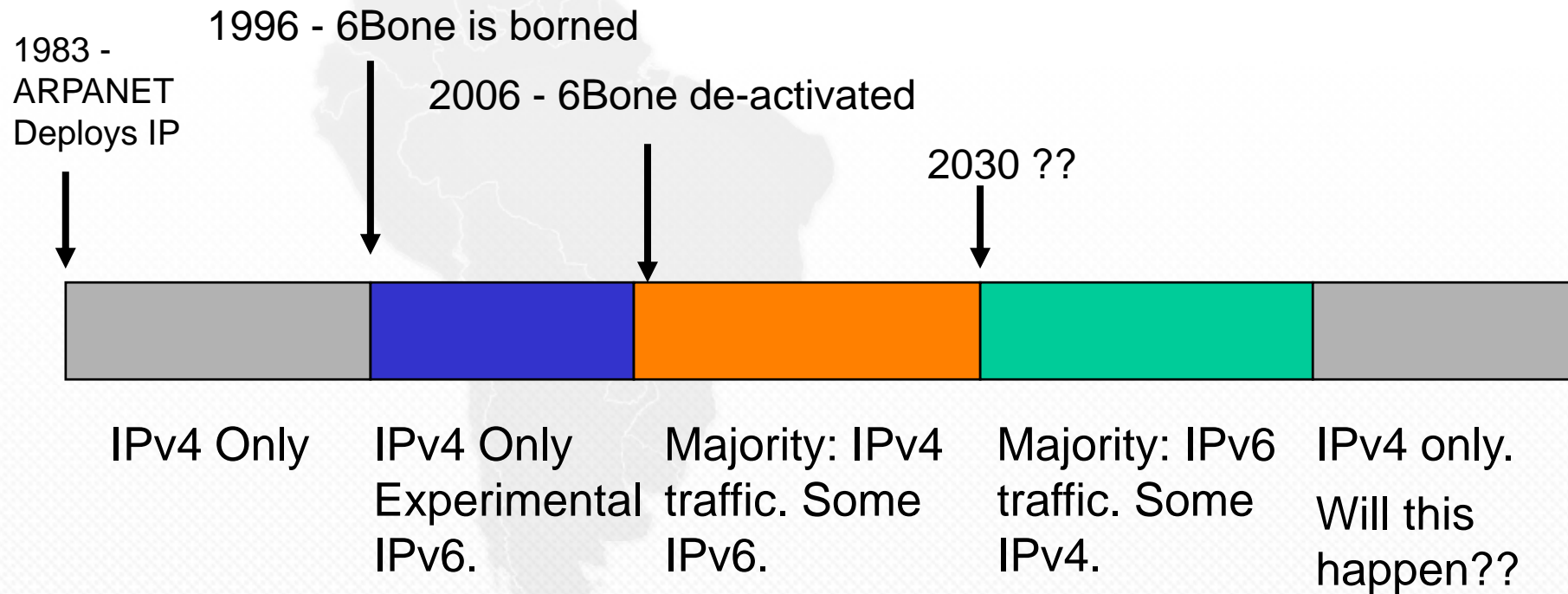
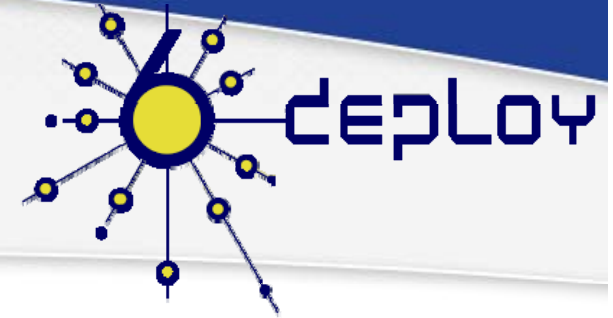


IPv6 Transition

Roque Gagliano
roque@lacnic.net

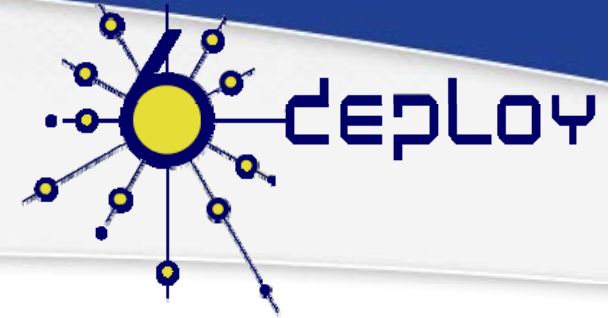


What is transition?





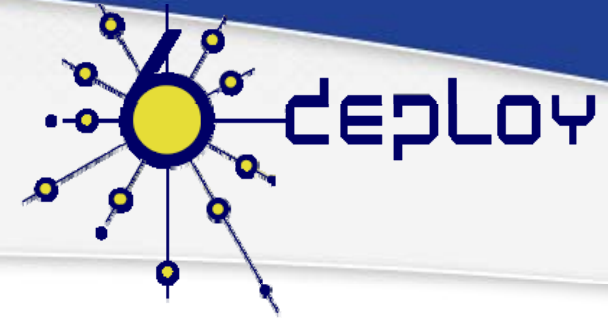
Questions.



- ◆ Today:
 - ◆ Does IPv6 only access make sense?
 - ◆ How to give access for both IPv4 and IPv6 using the same equipments? Answer: Dual Stack.
 - ◆ How to access IPv6 destinations if my provider is IPv4 only? Answer: Tunnels.
- ◆ Tomorrow, after IPv4 Depletion:
 - ◆ How to access IPv4 content through IPv6 only transit?
 - ◆ How to setup new servers without IPv4 addresses?
 - ◆ What would happen with old (Win98, etc) equipments?



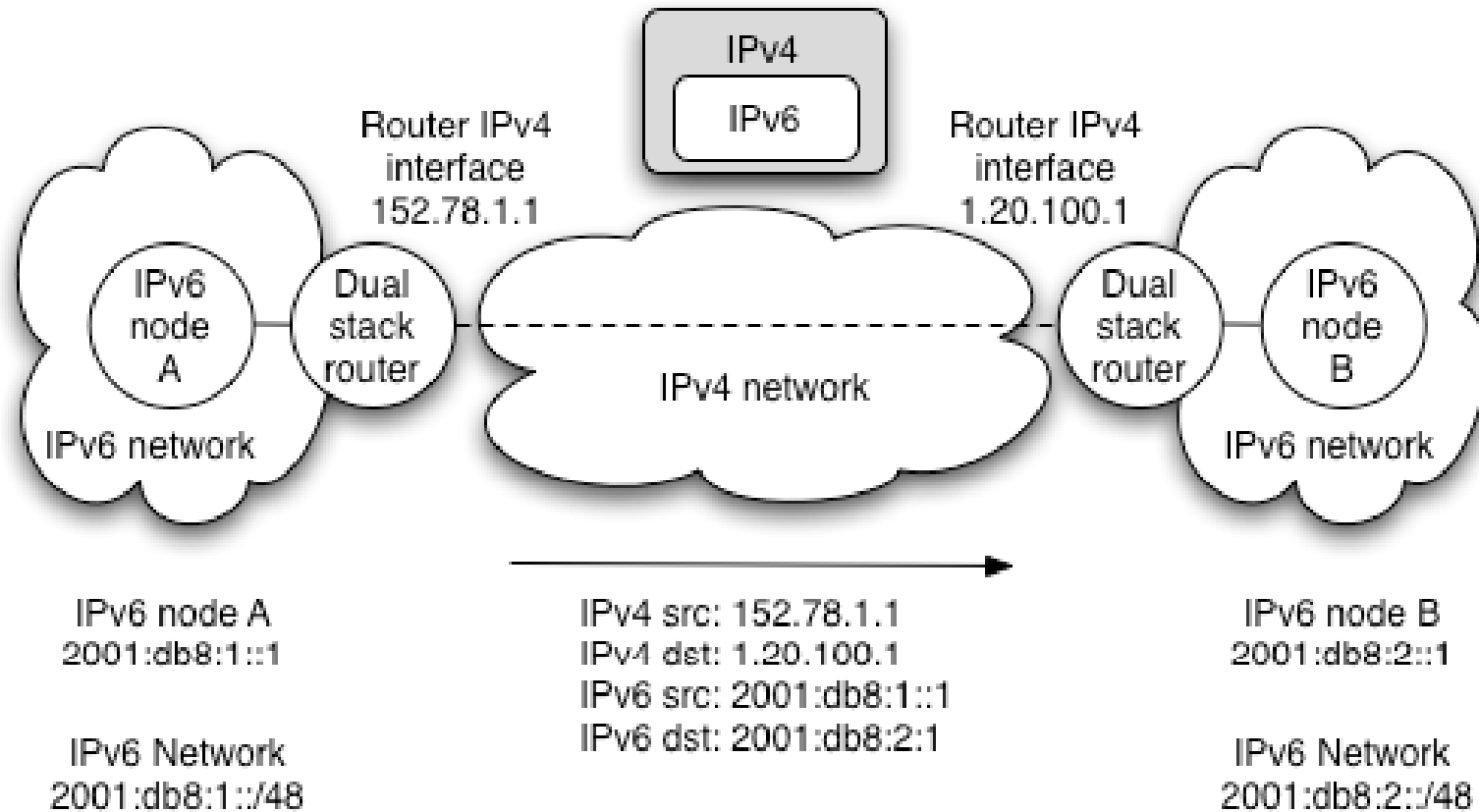
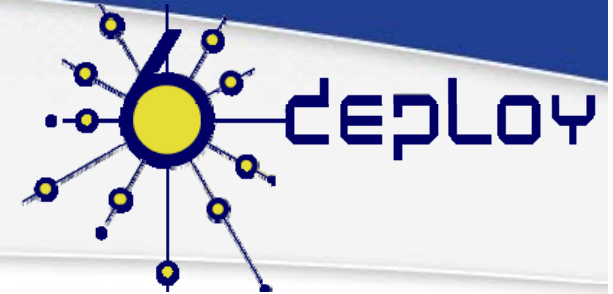
Dual Stack:



- ◆ You need native IPv6 and IPv4 support.
- ◆ IPv6 on top of link-layer (Ethernet, PPP, HSDPA, etc.)
- ◆ Needs supply of IPv4 address, ideally public.
- ◆ IPv6 network topology = IPv4 network topology.
- ◆ Equipment will prefer IPv6 from IPv4 if both are possible.

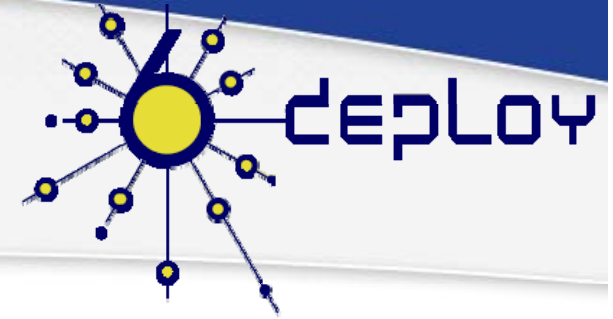


Tunnels:





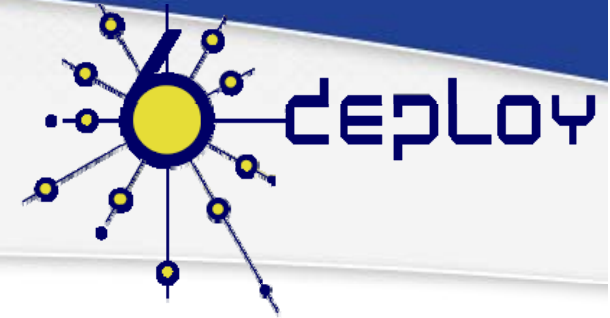
Manual Tunnels:



- ◆ Needs manual configurations in both sides.
- ◆ Used by ISP and Enterprises as need fix IPv4 addresses.
- ◆ Tunnel Brokers: Web application to perform the server side of the configuration.
- ◆ Not good for typical Residential customers.



Automatic Tunnels:



- ◆ **Automatic tunnels:**
 - ◆ **6to4.**
 - ◆ **Teredo.**
 - ◆ **Other: ISATAP, etc.**
- ◆ **IPv6 over IPv4 Tunnels are set automatically.**
- ◆ **IPv6 addresses are also allocated automatically.**
- ◆ **Already available in Apple Airport, Linux, OSX and Vista even sometimes by default.**



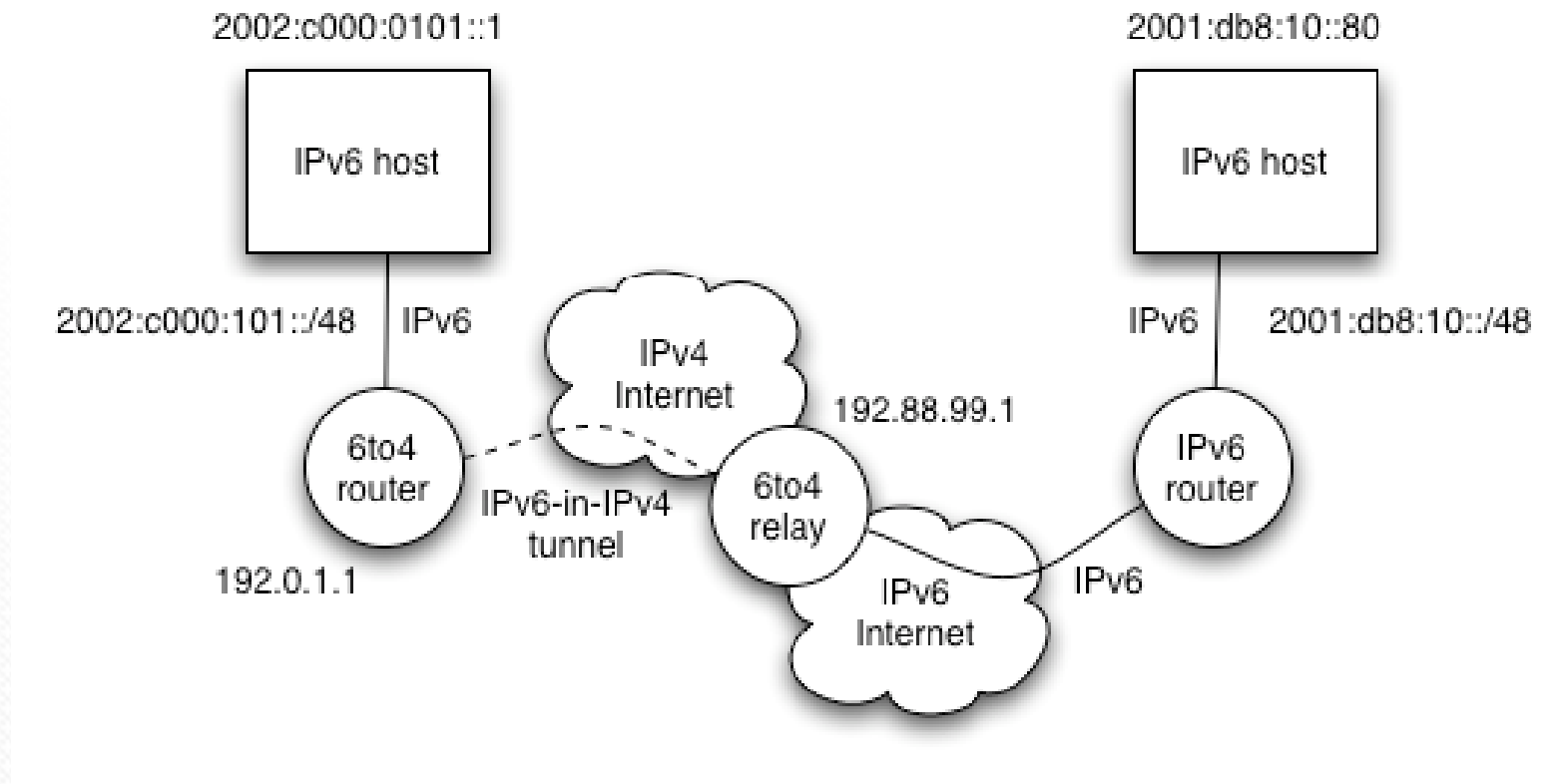
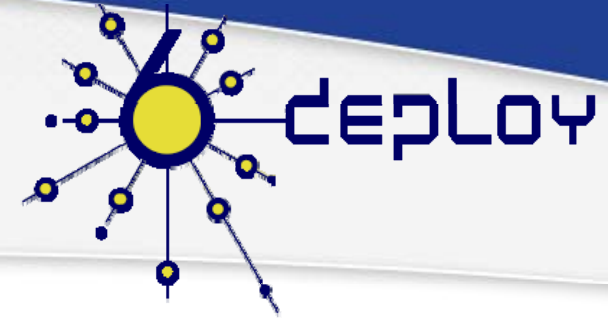
6to4 Basic Overview:



- ◆ In its basic configuration, 6to4 is used to connect two IPv6 islands across an IPv4 network
- ◆ Uses special 'trick' for the 2002::/16 IPv6 prefix that is reserved for 6to4 use
 - ◆ **Next 32 bits of the prefix are the 32 bits of the IPv4 address of the 6to4 router**
 - ◆ **For example, a 6to4 router on 192.0.1.1 would use an IPv6 prefix of 2002:c000:0101::/48 for its site network**
- ◆ When a 6to4 router sees a packet with destination prefix 2002::/16, it knows to tunnel the packet in IPv4 towards the IPv4 address indicated in the next 32 bits

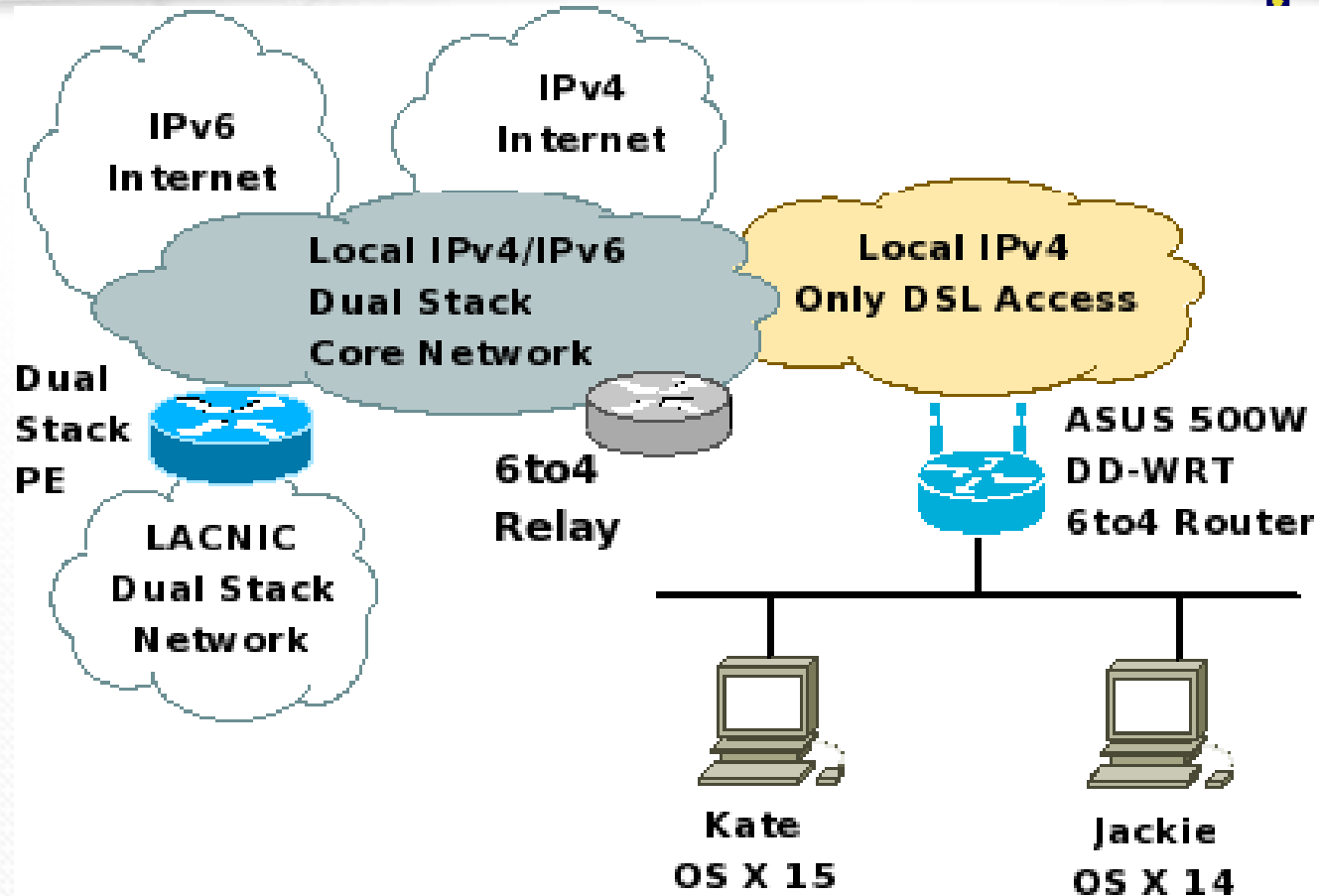
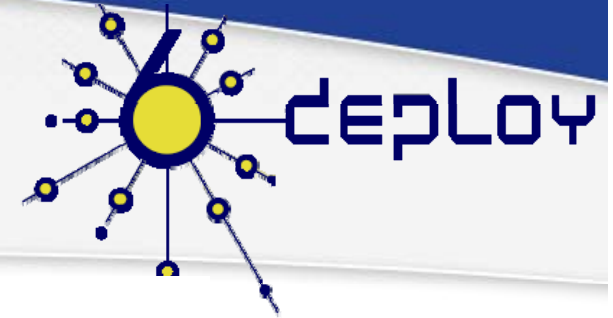


6to4 Basic Overview:



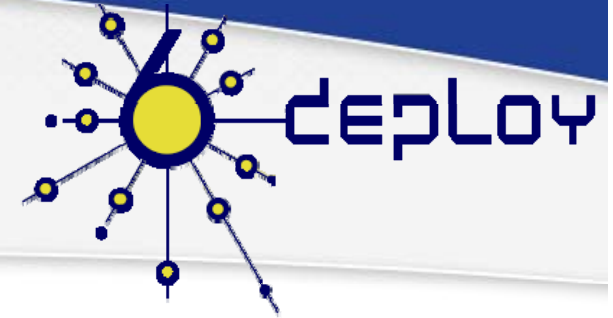


6to4 at my home





6to4 at my home:

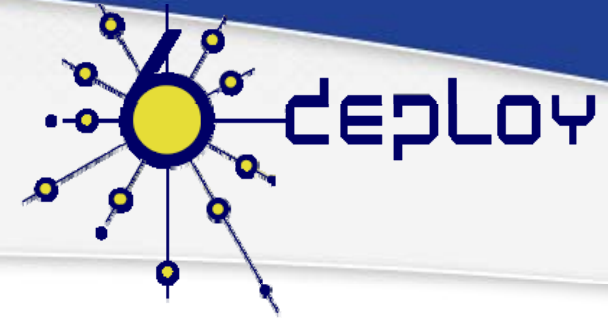


```
Terminal — telnet — 80x24
Kate:~ rgaglian$ ifconfig en1
en1: flags=8863<UP, BROADCAST, SMART, RUNNING, SIMPLEX, MULTICAST> mtu 1500
    inet6 fe80::217:f2ff:fe4d:a80e%en1 prefixlen 64 scopeid 0x6
    inet 192.168.1.133 netmask 0xfffff00 broadcast 192.168.1.255
    inet6 2002:be00:8acb:1:217:f2ff:fe4d:a80e prefixlen 64 autoconf
    ether 00:17:f2:4d:a8:0e
    media: autoselect status: active
    supported media: autoselect
Kate:~ rgaglian$ traceroute6 micron.lacnic.net.uy
traceroute6 to micron.lacnic.net.uy (2001:13c7:7001:4000::3) from 2002:be00:8acb:1:217:f2ff:fe4d:a80e, 30 hops max, 12 byte packets
 1  2002:be00:8acb:1::1  0.986 ms  0.724 ms  0.653 ms
 2  2002:c058:6301::1  23.636 ms  21.985 ms  23.233 ms
 3  ibb2agu2-3-7.antelv6.net.uy  22.601 ms  19.61 ms  20.379 ms
 4  ibb2cen2-1-3.antelv6.net.uy  20.49 ms  21.057 ms  19.298 ms
 5  iem2cen1-0-2.antelv6.net.uy  20.618 ms  20.806 ms  20.395 ms
 6  *^C
Kate:~ rgaglian$ telnet -6 m
Trying 2001:13c7:7001:4000::
Connected to micron.lacnic.net.uy.
Escape character is '^]'.
^C
```

The screenshot shows the APNIC website interface. On the left is a blue navigation menu with items: Home, MyAPNIC, Info & FAQ, Services, Training, Meetings, and Membership. The main content area features the APNIC logo and tagline: "Addressing the challenge of responsible Internet resource distribution in the Asia Pacific region". Below this are banners for "Relief.Asia" (Myanmar Cyclone 2008.05.03) and "Sichuan Earthquake" (2008.05.12). On the right, there is a "Whois search" section with a search box and a "Go" button, and a "News" section with two items: "[09-10-08] Fellowships for IGF 2008" and "[08-10-08] APNIC to participate in IGF 2008". A "via v6" badge is visible in the top left of the website area, and the user's IP address "2002:be00:8acb:1:217:f2ff:fe4d:a80e" is displayed at the top.



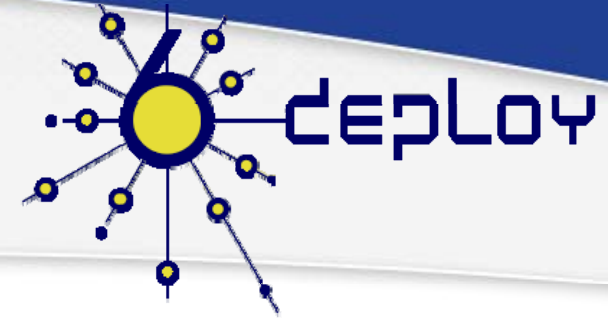
6to4 Issues:



- ◆ In principle 6to4 is attractive
 - ◆ **But there are operational concerns**
- ◆ Problem 1: possible relay abuse
 - ◆ **Relay could be used for a DoS attack**
 - ◆ **Tunnelled IPv6 traffic addresses may be spoofed**
- ◆ Problem 2: asymmetric model/reliability
 - ◆ **The 6to4 site may use a different 6to4 relay to the 'real' IPv6 site**
 - ◆ **One of the sites may not see a 6to4 relay at all, if ISPs choose to only deploy relays for their own customers, and thus filter routing information**
- ◆ But for 6to4 relay to 6to4 relay operation, it's good



After IPv4 Exhaustion:



- ◆ **No IPv4 addresses for new customers.**
- ◆ **Still will have old equipments which will not work with IPv6: Win98, Game Consoles, etc.**
- ◆ **Double NAT/ Triple NAT is a temptation for some people, but will not scale for service providers.**



Ex. Dual Stack Lite:

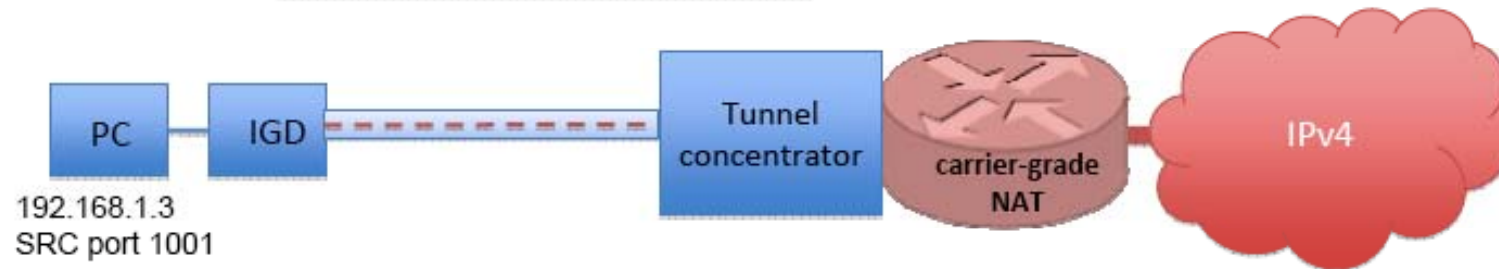


IPv6 packet

IPv6 src: IPv6 address of home gateway (IGD)
IPv6 dst: IPv6 address of tunnel concentrator, discovered with DHCPv6
IPv4 src: 192.168.1.3
IPv4 dst: www.nanog.org (198.108.95.21)
IPv4 src port: 1001
IPv4 dst port: 80

IPv4 packet

IPv4 src: from the pool of the ISP
IPv4 dst: www.nanog.org (198.108.95.21)
IPv4 src port: 45673
IPv4 dst port: 80



NAT binding

IN:

IPv6 src: IPv6 address of IGD + 192.168.1.3 + port1001

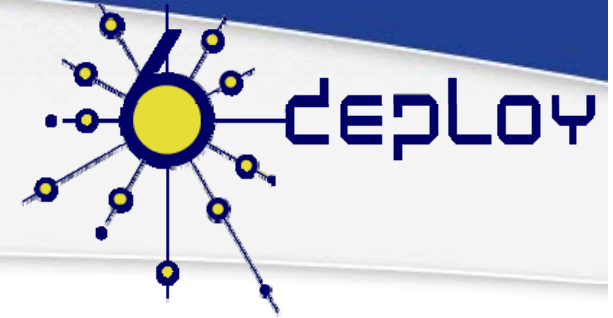
OUT:

IPv4 src address: from pool of the ISP + port: 45673

Ref: Alain Durand - Comcast - NANOG 44.



Conclusions



- ◆ **Native and Dual Stack support for IPv6 is the cleaner solution for IPv6 support.**
- ◆ **Tunnels are a tool for quick access to the IPv6 network.**
- ◆ **Tunnels are set up automatically by modern operative systems, please run RELAYS! (6to4 and Teredo).**
- ◆ **You also need to think about architectures after the run out.**