Using 464XLAT in Residential Networks

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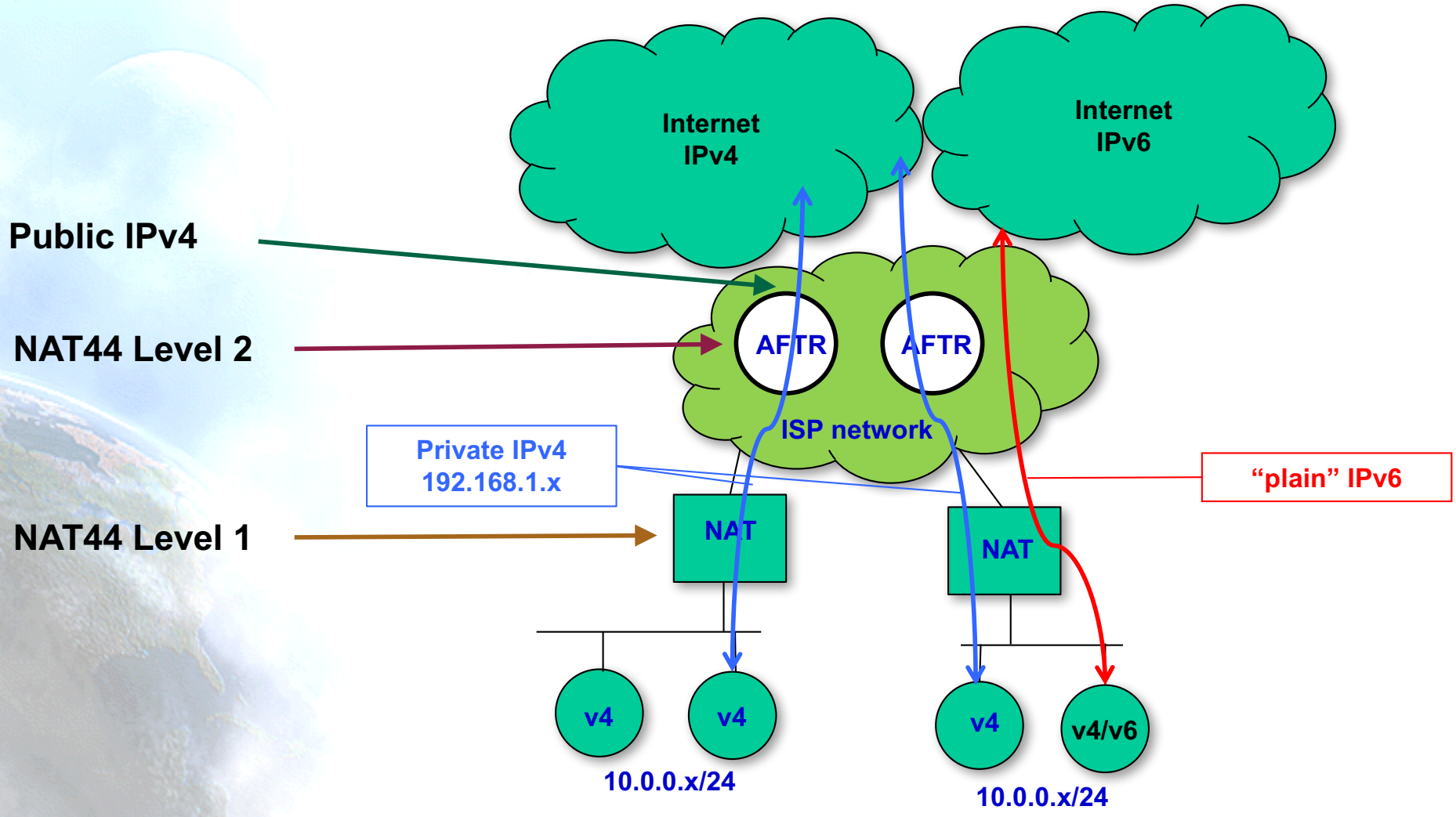
Do you know …

- We already run out of IPv4?
- How you keep deploying Internet access to your residential customers?
- Are you using IPv4 to deploy IPv6?
  - such as tunnel broker, 6RD and so?

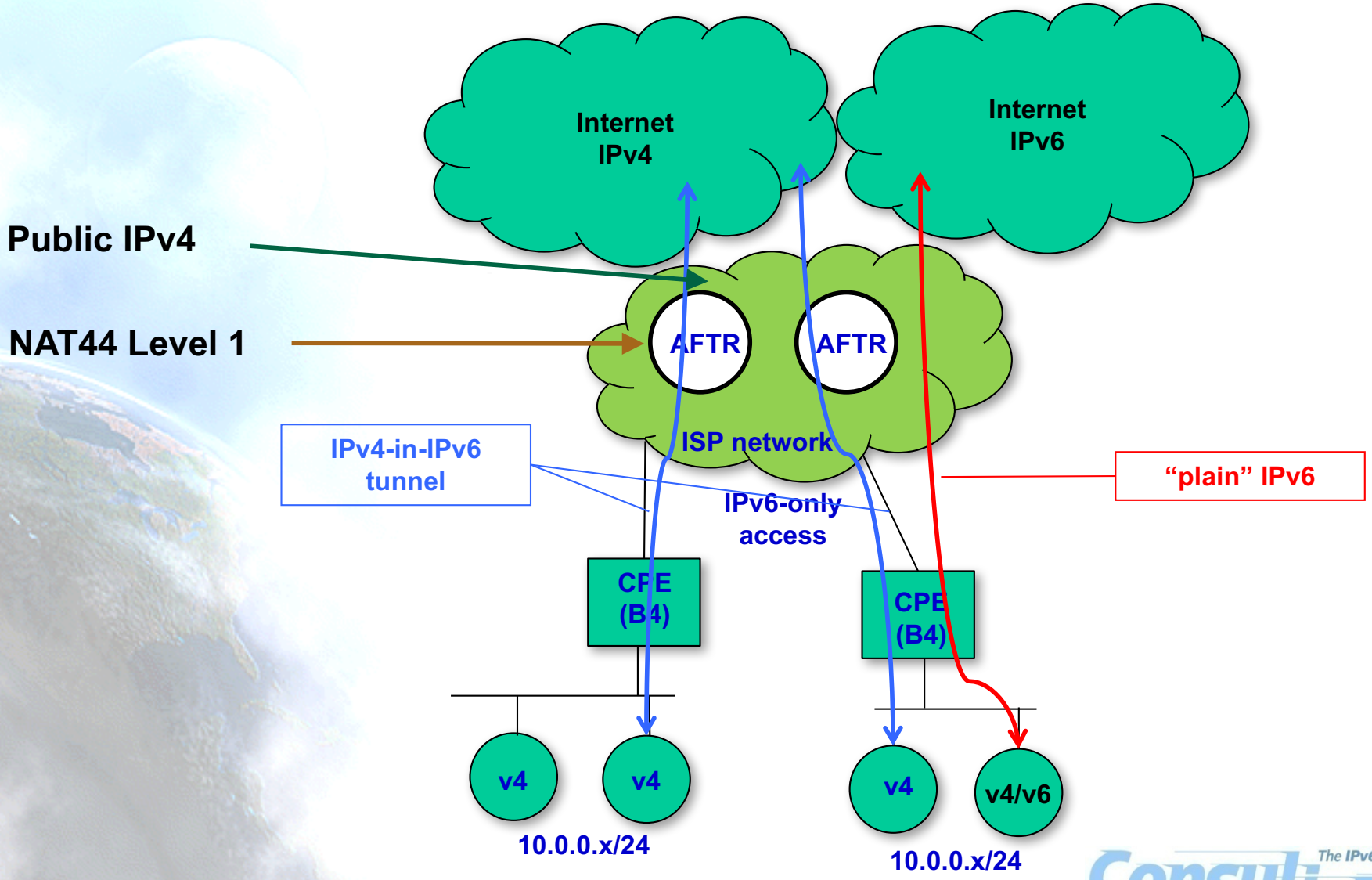
Once upon a time …

- IETF was considering to solve this problem by more tunneling …
- So we build up softwires, which decided to use L2TP, so we could do
  - IPv6 in IPv4, IPv4 in IPv6
  - (as well IPv4 in IPv4 and IPv6 in IPv6 for multicast in unicast)
- As a result we have, among others:
  - DS-Lite
  - Carrier Grade NAT (AFTR)
  - lw4o6

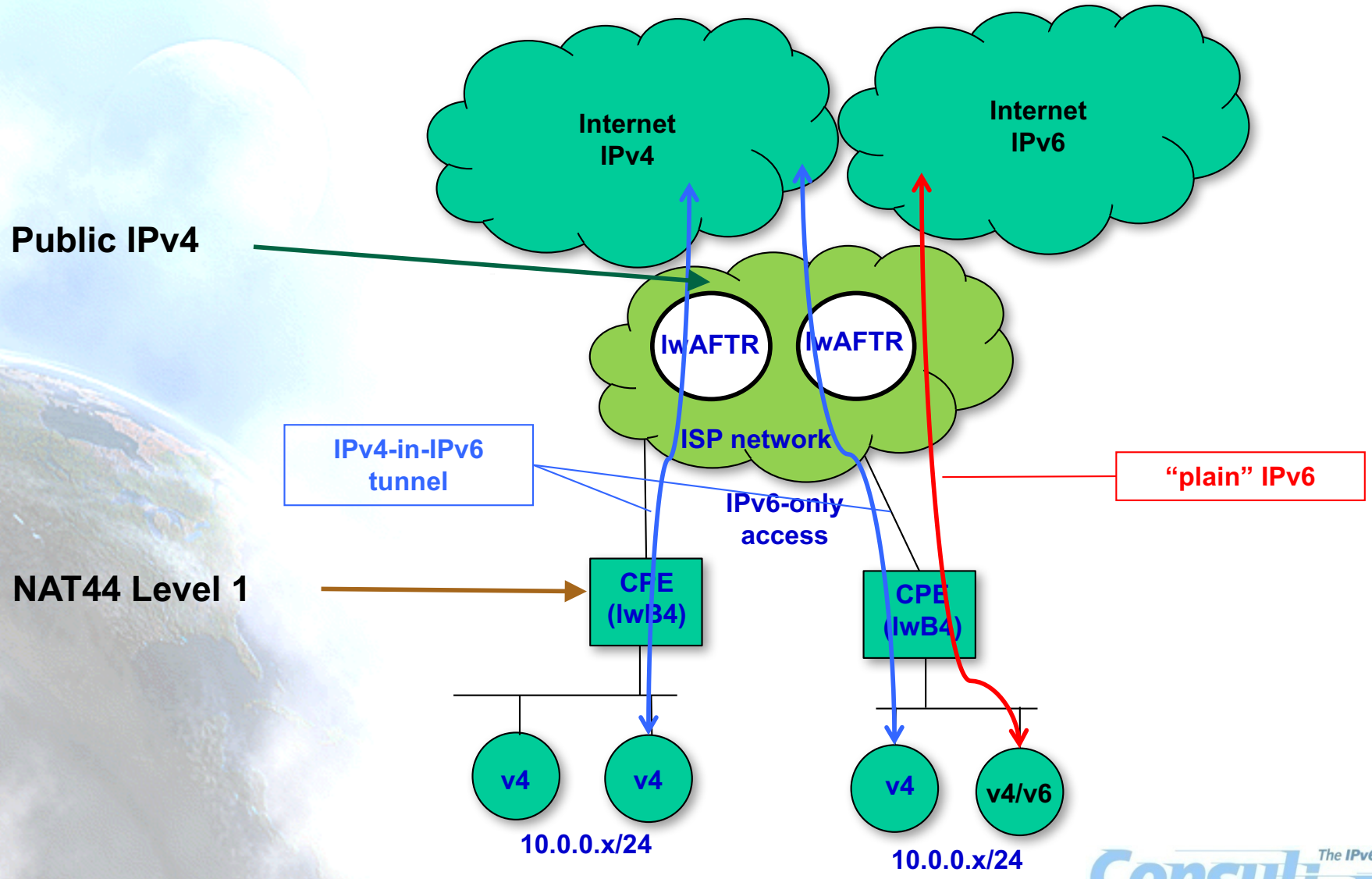
NAT444


Internet
IPv4
Internet
IPv6
Public IPv4
NAT44 Level 2
AFTR
AFTR
ISP network
Private IPv4
192.168.1.x
"plain" IPv6
NAT44 Level 1
NAT
NAT
v4
v4
v4
v4/v6
10.0.0.x/24
10.0.0.x/24

DS-Lite

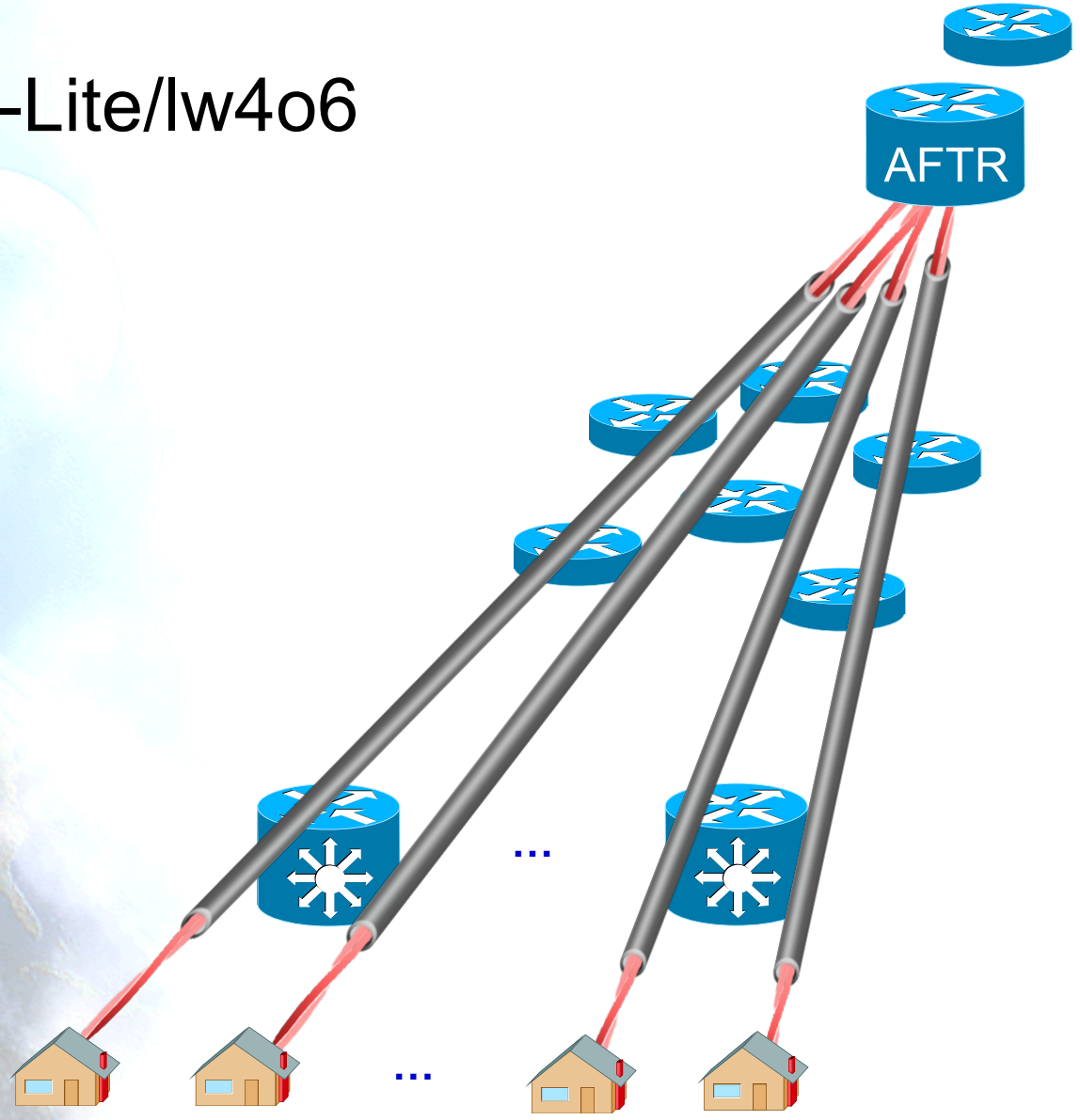

Internet
IPv4
Internet
IPv6
Public IPv4
NAT44 Level 1
AFTR
AFTR
ISP network
IPv4-in-IPv6
tunnel
IPv6-only
access
"plain" IPv6
CPE
(B4)
CPE
(B4)
v4
v4
v4
v4/v6
10.0.0.x/24
10.0.0.x/24

lw4o6


Internet
IPv4
Internet
IPv6
Public IPv4
lwAFTR
lwAFTR
ISP network
IPv4-in-IPv6
tunnel
IPv6-only
access
"plain" IPv6
NAT44 Level 1
CPE
(lwB4)
CPE
(lwB4)
v4
v4
v4
v4/v6
10.0.0.x/24
10.0.0.x/24

Tunnels per subscribers

- DS-Lite/lw4o6



BGP prefixes: Tens

Tunnels: Millions

IGP prefixes: Hundreds

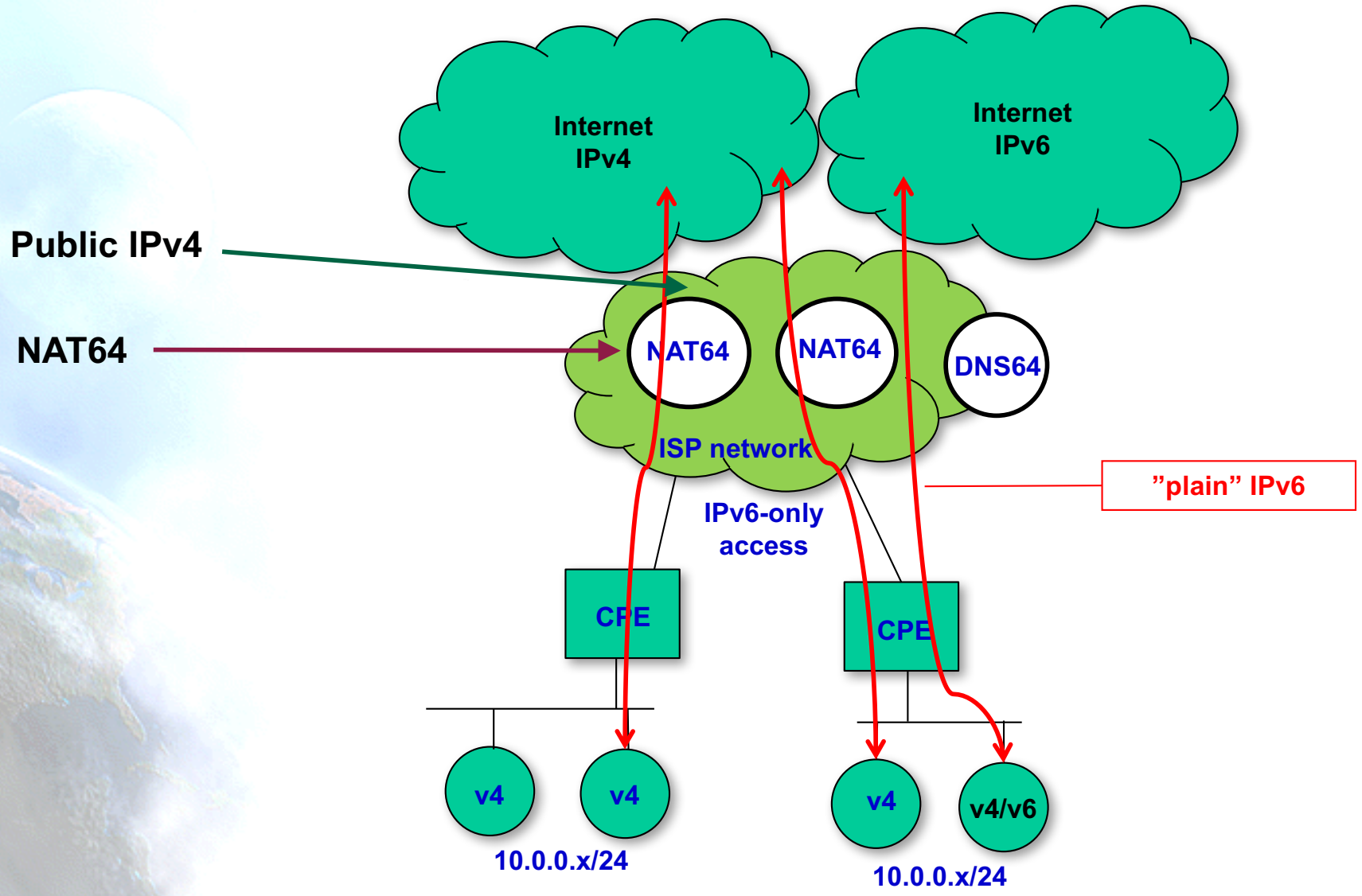
BNG routes: Thousands

Subscribers: Millions

CGN breaks …

- UPnP-IGD (Universal Plug & Play - Internet Gateway Device protocol)
- NAT-PMP (NAT Port Mapping Protocol)
- Other NAT Traversal mechs
- Security
- AJAX (Asyncronous Javascript And XML)
- FTP (big files)
- BitTorrent/Limewire (seeding – uploading)
- On-line gaming
- Video streaming (Netflix, Hulu, …)
- IP cameras
- Tunnels, VPN, IPsec, ...
- VoIP
- Port forwarding
- ...

NAT64


Internet
IPv4
Internet
IPv6
Public IPv4
NAT64
NAT64
NAT64
DNS64
ISP network
"plain" IPv6
IPv6-only
access
CPE
CPE
v4
v4
v4
v4/v6
10.0.0.x/24
10.0.0.x/24

NAT64 breaks …

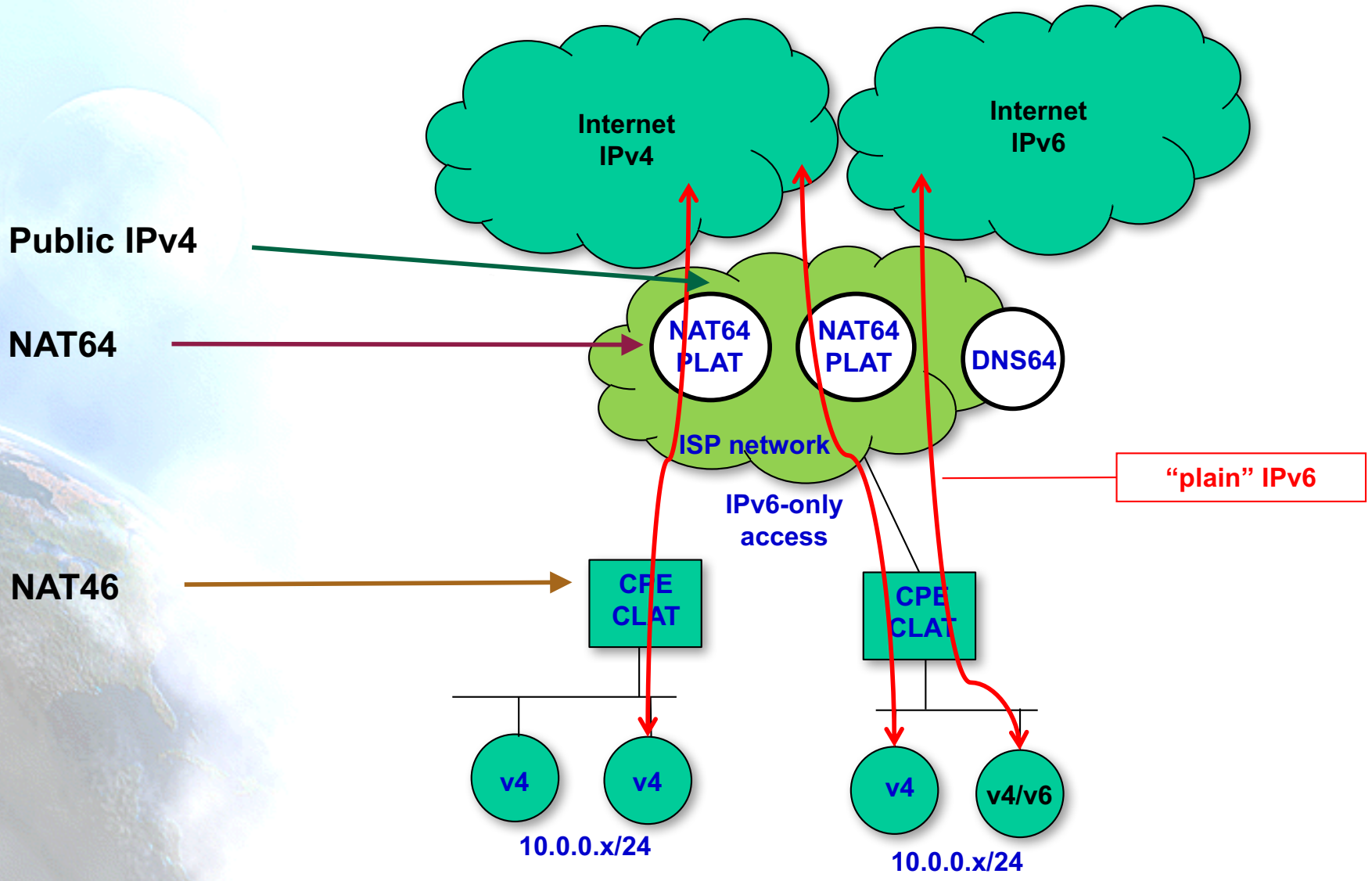
App Name	Functionality	Version	464XLAT Fixed
connection tracker	Broken	NA	NA
DoubleTwist	Broken	1.6.3	YES
Go SMS Pro	Broken	NA	YES
Google Talk	Broken	4.1.2	YES
Google+	Broken	3.3.1	YES
IP Track	Broken	NA	NA
Last.fm	Broken	NA	YES
Netflix	Broken	NA	YES
ooVoo	Broken	NA	YES
Pirates of the Caribean	Broken	NA	YES
Scrabble Free	Broken	1.12.57	YES
Skype	Broken	3.2.0.6673	YES
Spotify	Broken	NA	YES
Tango	Broken	NA	YES
Texas Poker	Broken	NA	YES
TiKL	Broken	2.7	YES
Tiny Towers	Broken	NA	YES
Trillian	Broken	NA	YES
TurboxTax Taxcaster	Broken	NA	
Voxer Walkie Talkie	Broken	NA	YES
Watch ESPN	Broken	1.3.1	
Zynga Poker	Broken	NA	YES
Xabber XMPP	Broken	NA	

*T-Mobile

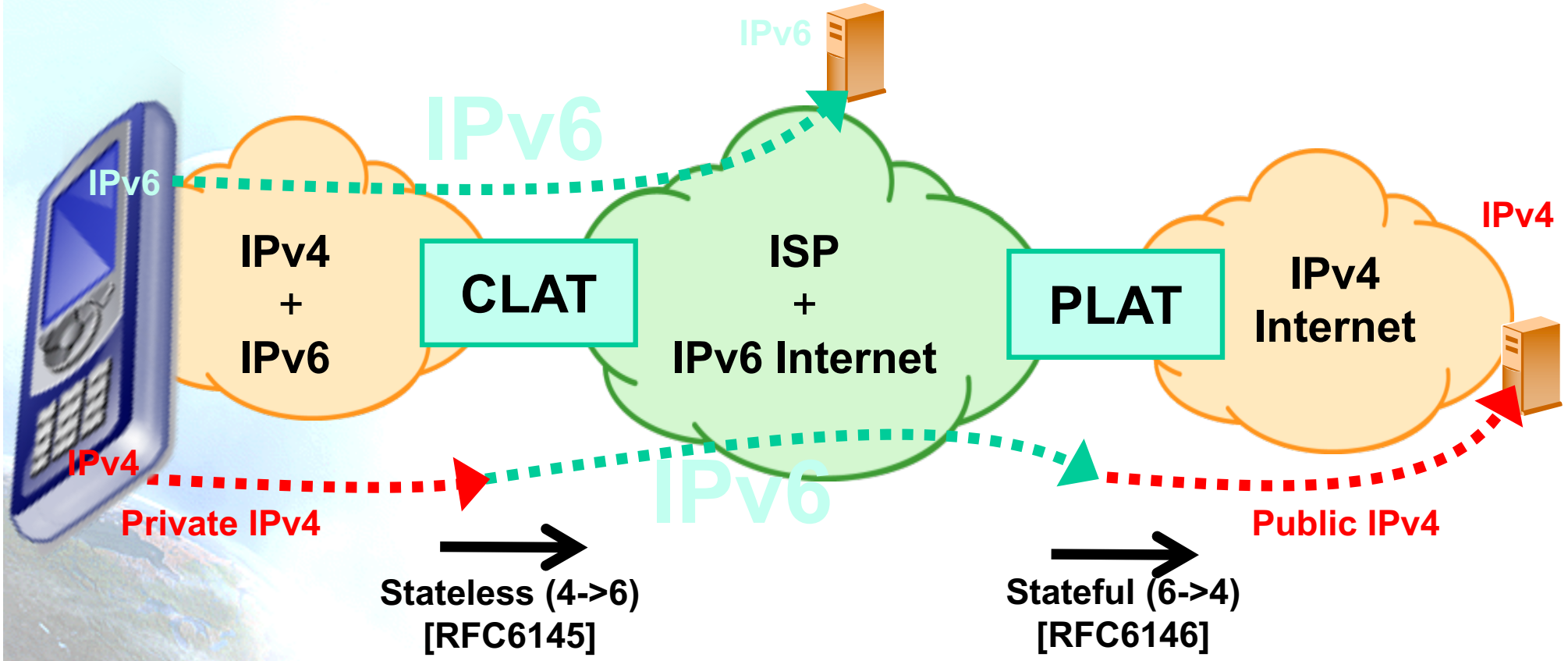
464XLAT

- 464XLAT (RFC6877): RFC6145 + RFC6146
- Very efficient use of scarce IPv4 resources
  - N*64.000 flows per each IPv4 address
  - Network growth not tied to IPv4 availability
- IPv4 basic service to customers over an-IPv6 only infrastructure
  - **WORKS** with applications that use socket APIs and literal IPv4 addresses (Skype, etc.)
- Allows traffic engineering
  - Without deep packet inspection
- Easy to deploy and available
  - Commercial solutions and open source

464XLAT


Internet
IPv4
Internet
IPv6
Public IPv4
NAT64
NAT64
PLAT
NAT64
PLAT
DNS64
ISP network
"plain" IPv6
IPv6-only
access
NAT46
CPE
CLAT
CPE
CLAT
v4
v4
v4
v4/v6
10.0.0.x/24
10.0.0.x/24

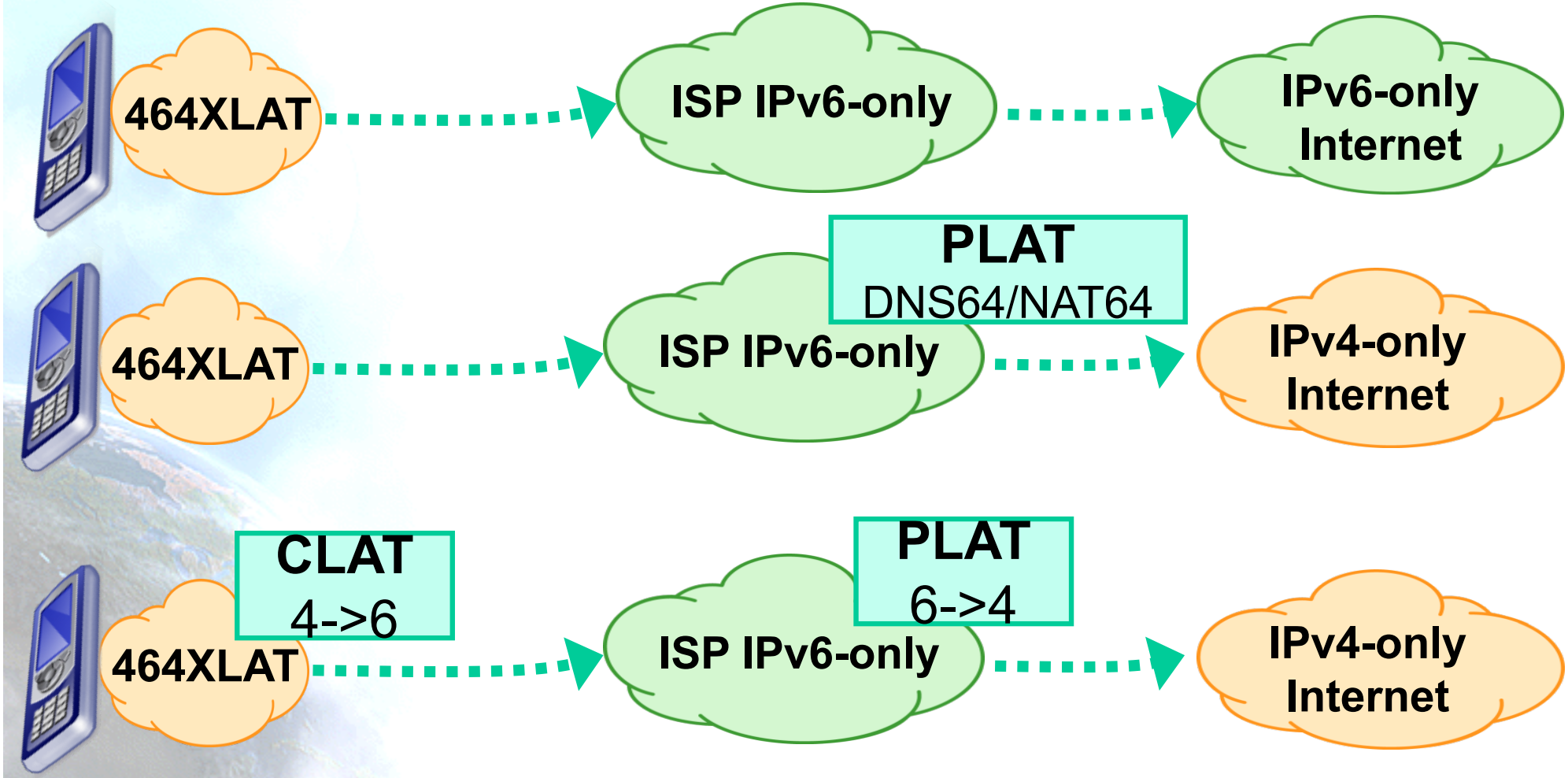
How it works 464XLAT?



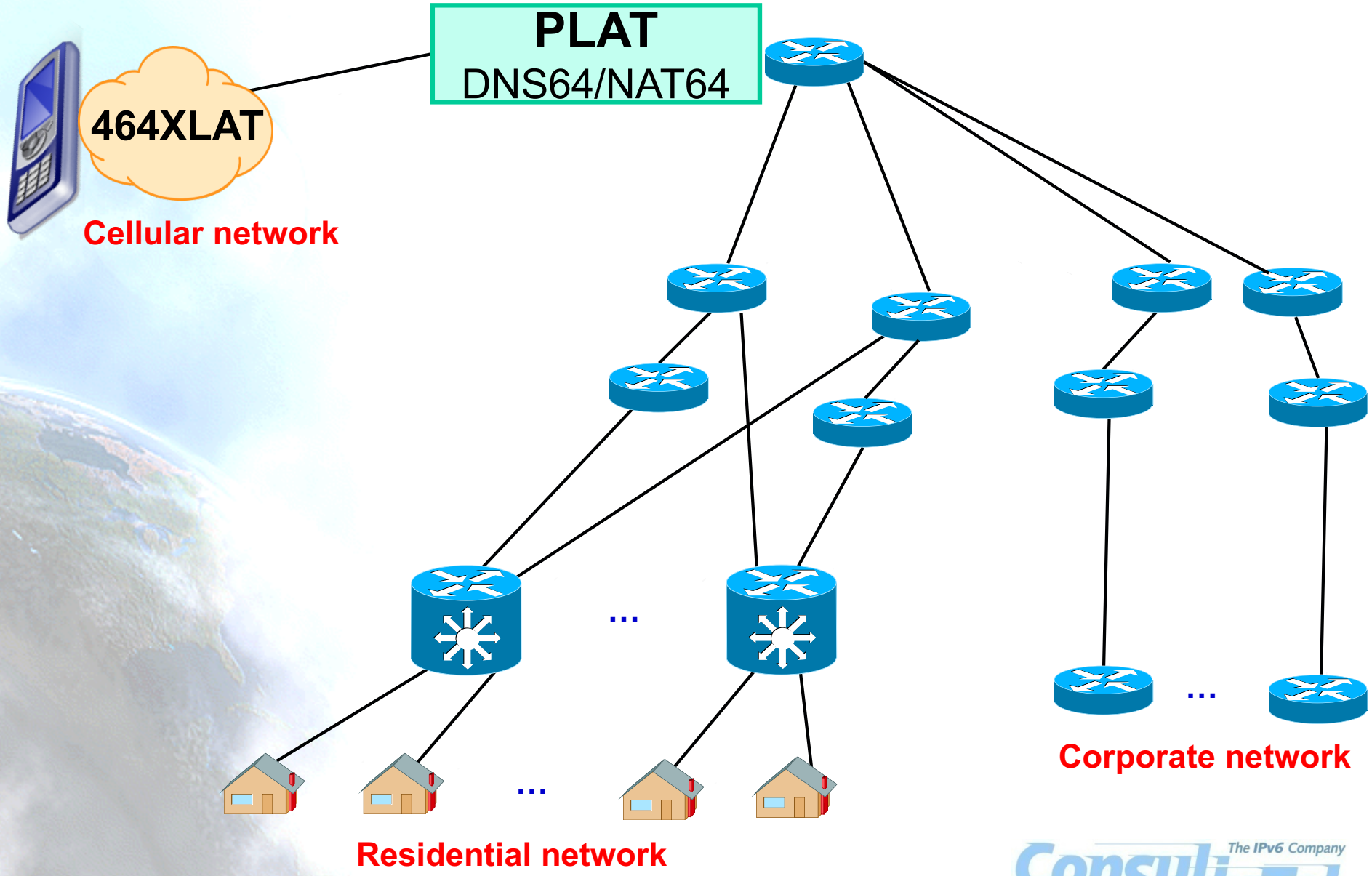
CLAT: Customer side translator (XLAT)

PLAT: Provider side translator (XLAT)

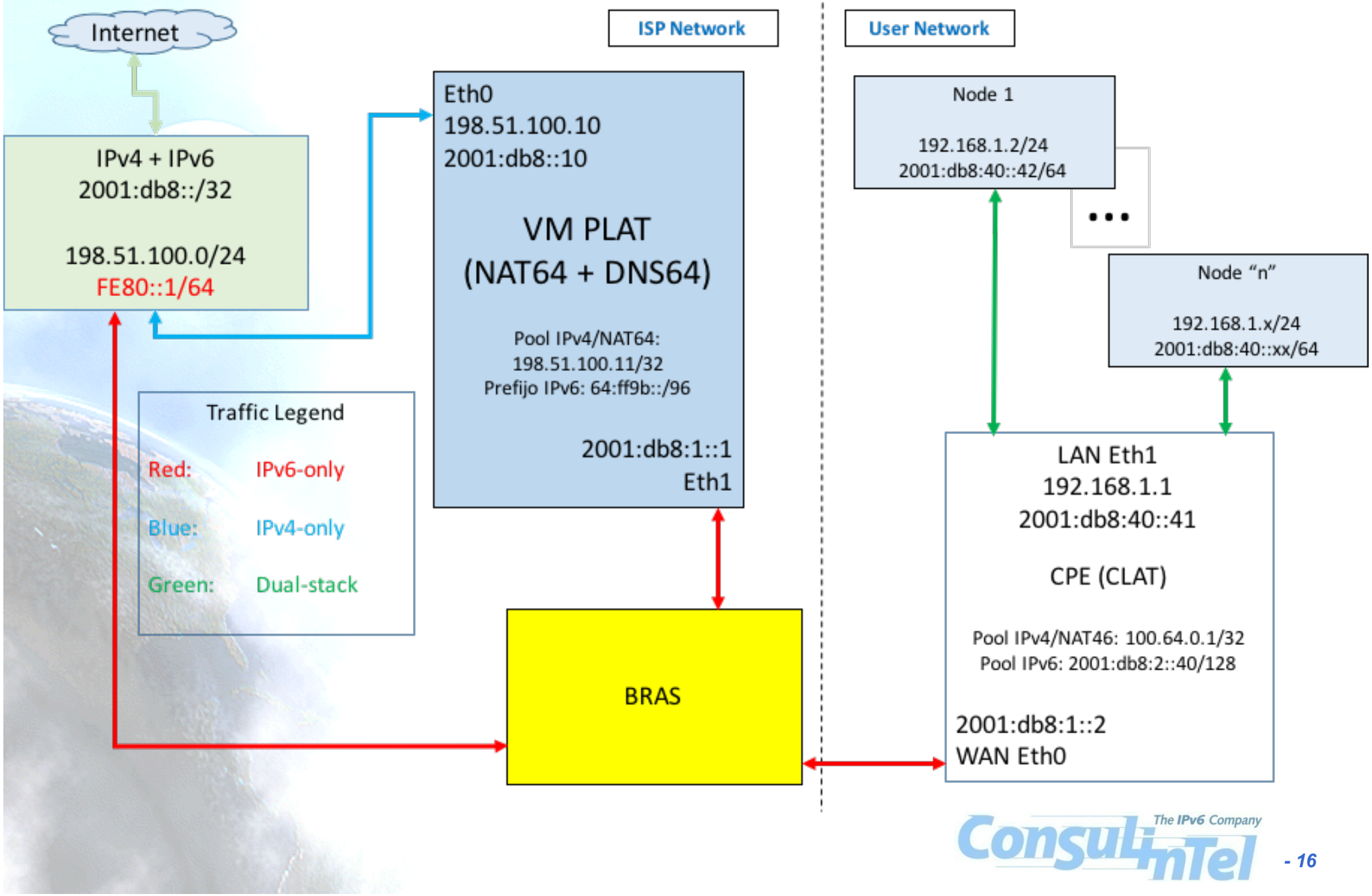
Possible “app” cases



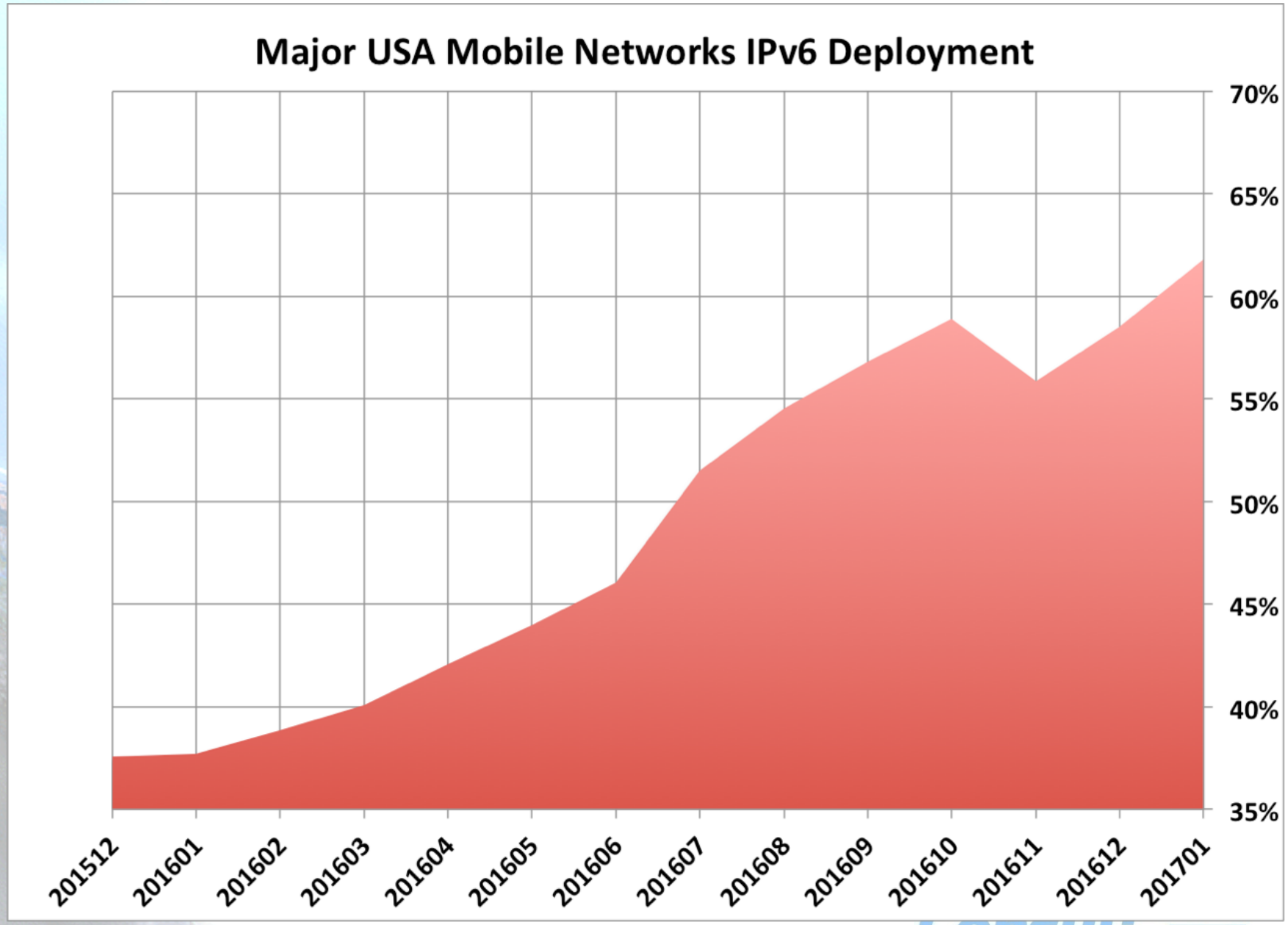
Multiservice Network



Example Residential Customer



IPv6 in Cellular/US



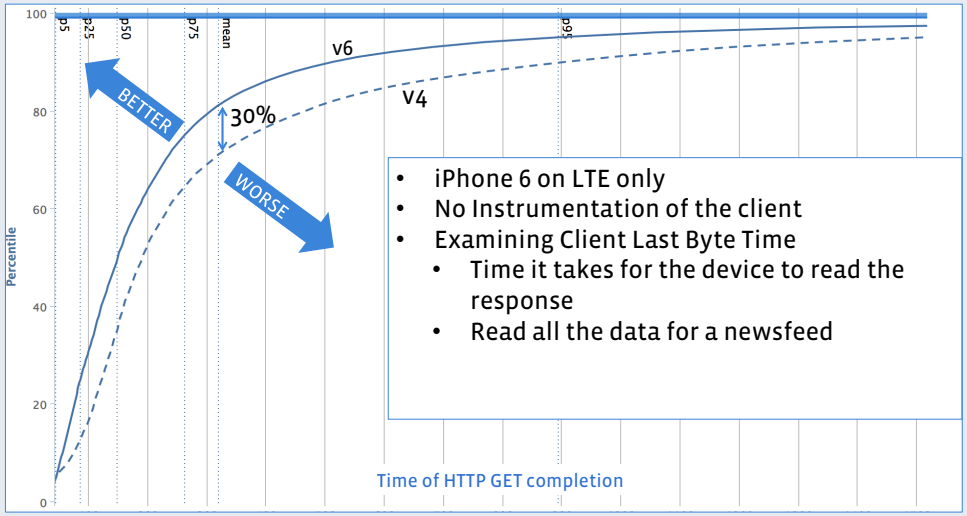
*ISOC/World IPv6 Launch data

464XLAT deployment

- NAT64:
  - A10
  - Cisco
  - F5
  - Juniper
  - NEC
  - Huawei
  - Jool, Tayga, Ecdsys, Linux, OpenBSD, …
- CLAT
  - Android
  - Nokia
  - Windows phone
  - NEC
  - OpenWRT
- Commercial deployments:
  - T-Mobile US: +68 Millions of users
  - Orange
  - Telstra
  - SK Telecom
  - …
  - Big trials in several ISPs (thousands of users)

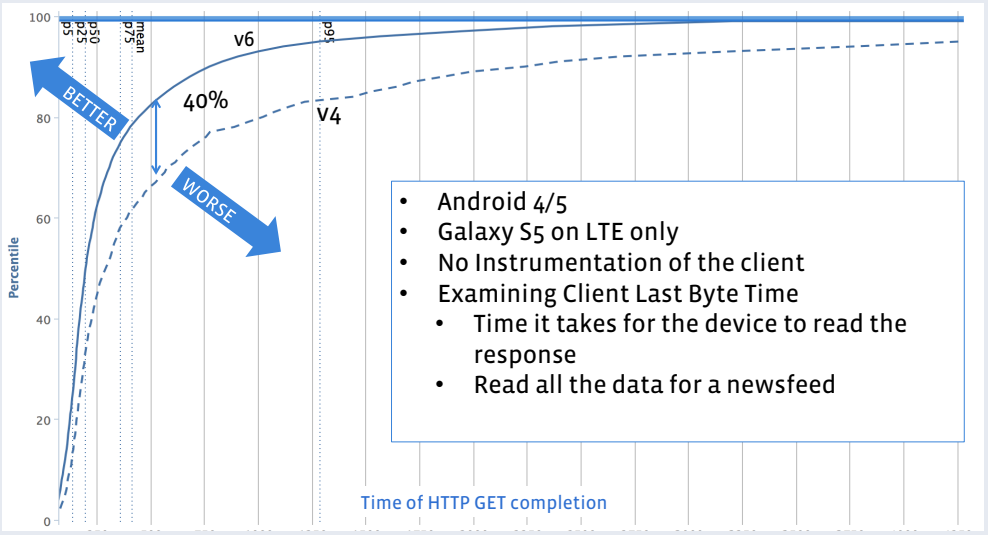
Performance

US Mobile Performance – Dual Stack Provider iOS



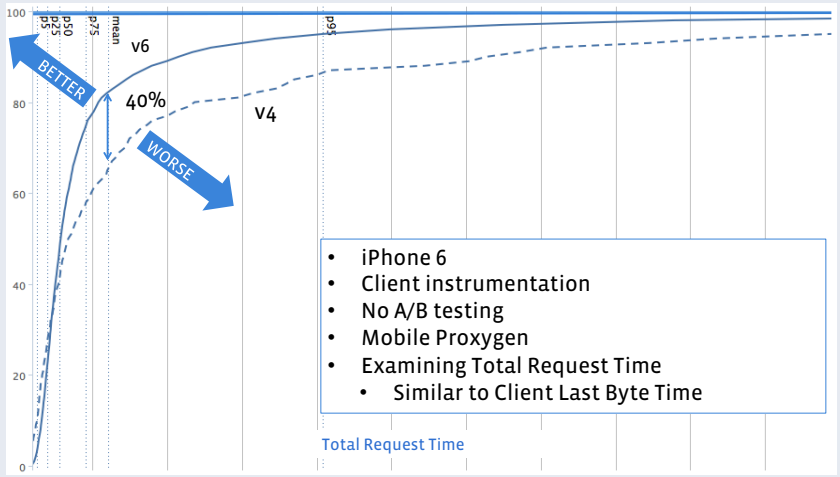
- iPhone 6 on LTE only
- No Instrumentation of the client
- Examining Client Last Byte Time
  - Time it takes for the device to read the response
  - Read all the data for a newsfeed

US Mobile Performance – Dual Stack Provider Android



- Android 4/5
- Galaxy S5 on LTE only
- No Instrumentation of the client
- Examining Client Last Byte Time
  - Time it takes for the device to read the response
  - Read all the data for a newsfeed

US Mobile Performance – Dual Stack Provider iOS



- iPhone 6
- Client instrumentation
- No A/B testing
- Mobile Proxygen
- Examining Total Request Time
  - Similar to Client Last Byte Time

***FaceBook data**

(17/3/2015)

Update of RFC7084

- Basic Requirements for IPv6 Customer Edge Routers
  - Originally include support only for 6RD and DS-LITE
  - Being updated to include support for 464XLAT, MAP T/E, lw4o6, …
- https://tools.ietf.org/html/draft-ietf-v6ops-rfc7084-bis

Thanks!

Contact:

- Jordi Palet (Consulintel): jordi.palet@consulintel.es