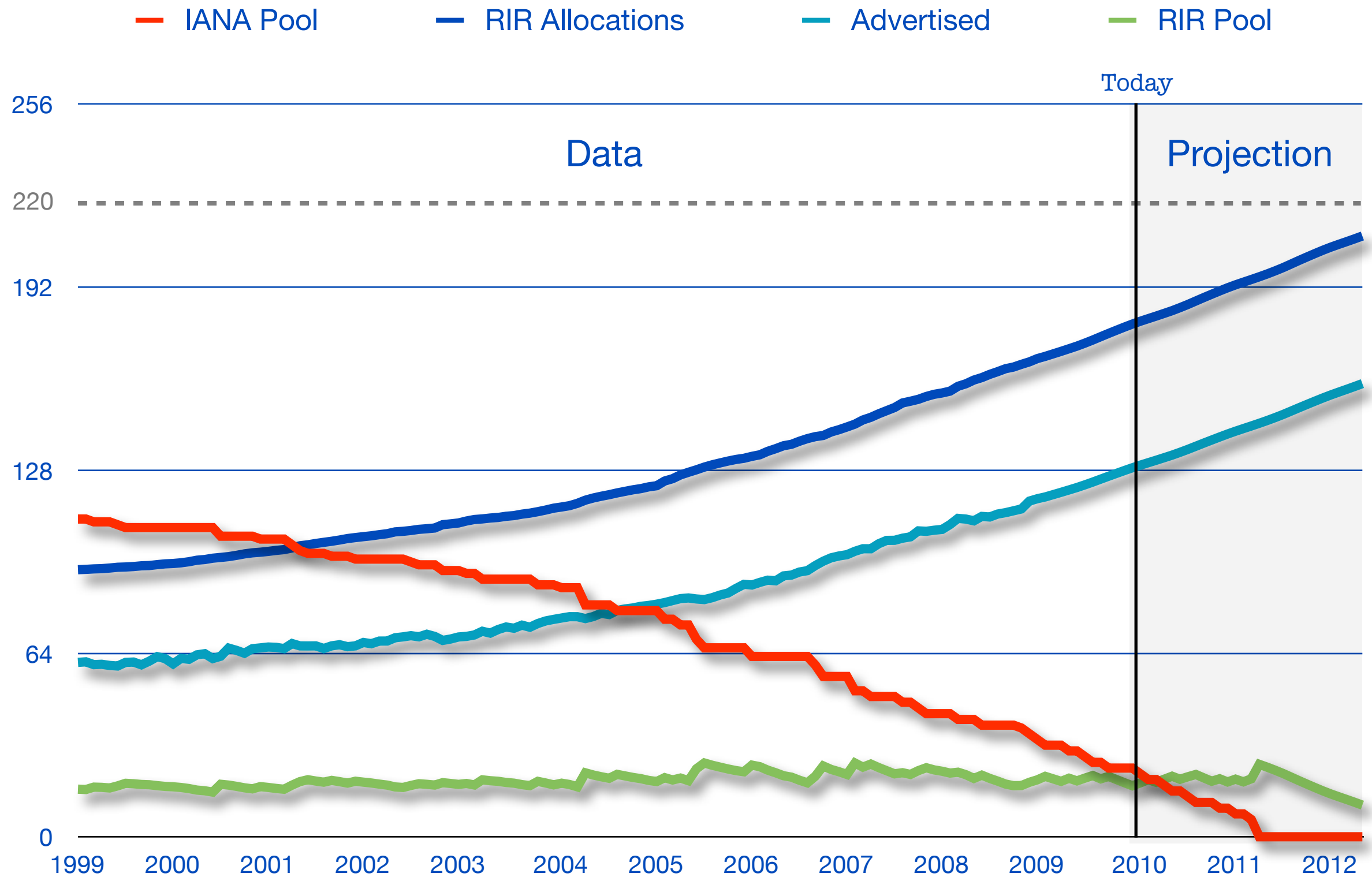


A yellow sphere, resembling a globe, is shown from a low angle, curving upwards. The surface of the sphere is covered with a grid of IP addresses in a light yellow, sans-serif font. The addresses are arranged in a way that they follow the curvature of the sphere, creating a sense of depth and perspective. Some of the visible IP addresses include 193.0.0.195, 101.0.0.195, 193.0.0.195, 45.64, 195.38.128, 162.138.0.0, and 193.0.0.195. The sphere is set against a plain white background.

3 May 2010

IPv4 Allocation Timeline



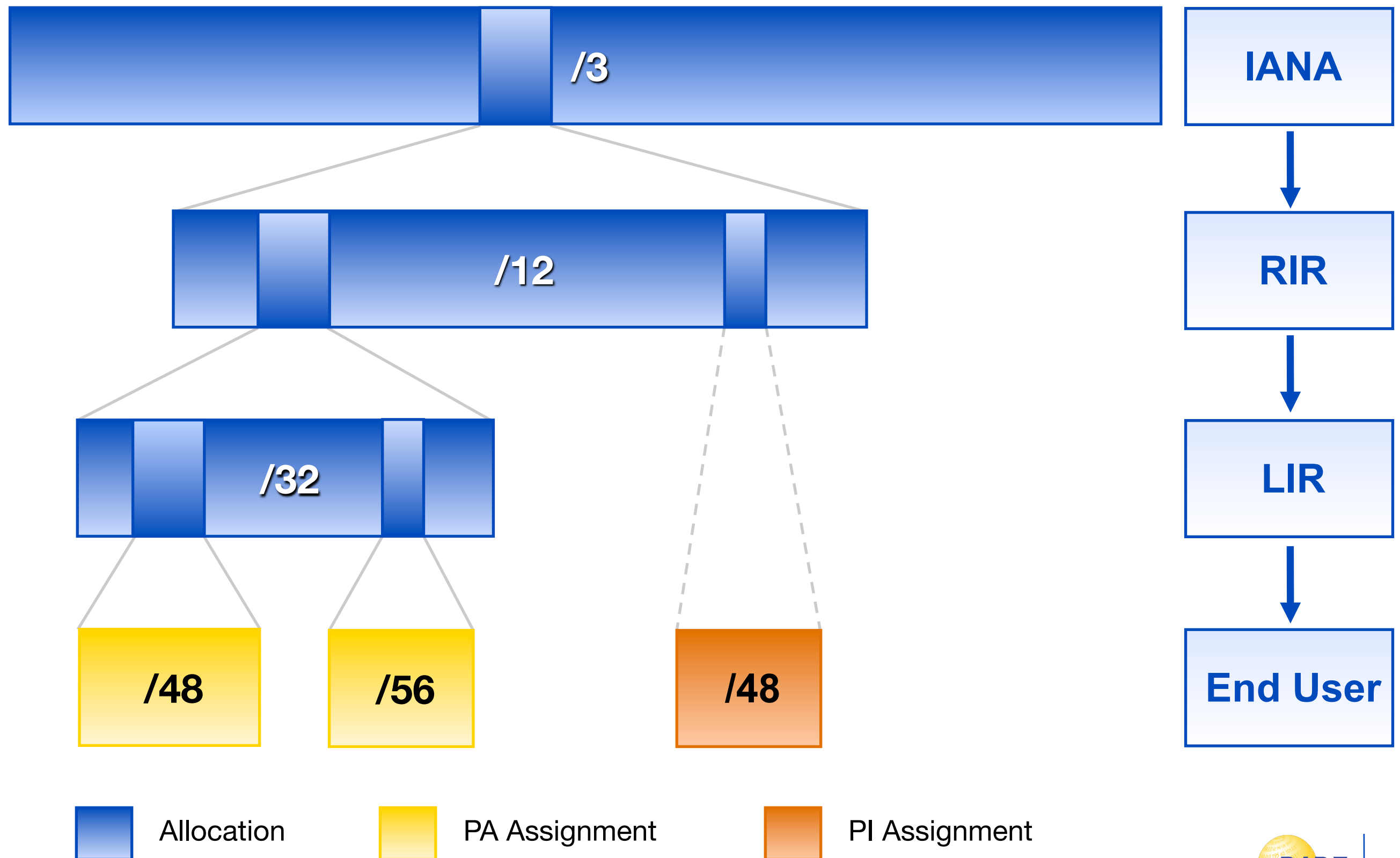
Reaching the next billion

- Around 1.6 billion Internet users now
 - around 25% of all people
- Mobile phones are becoming Internet devices
- The Internet of things



The Registry System

IP Address Distribution





Registration



Conservation



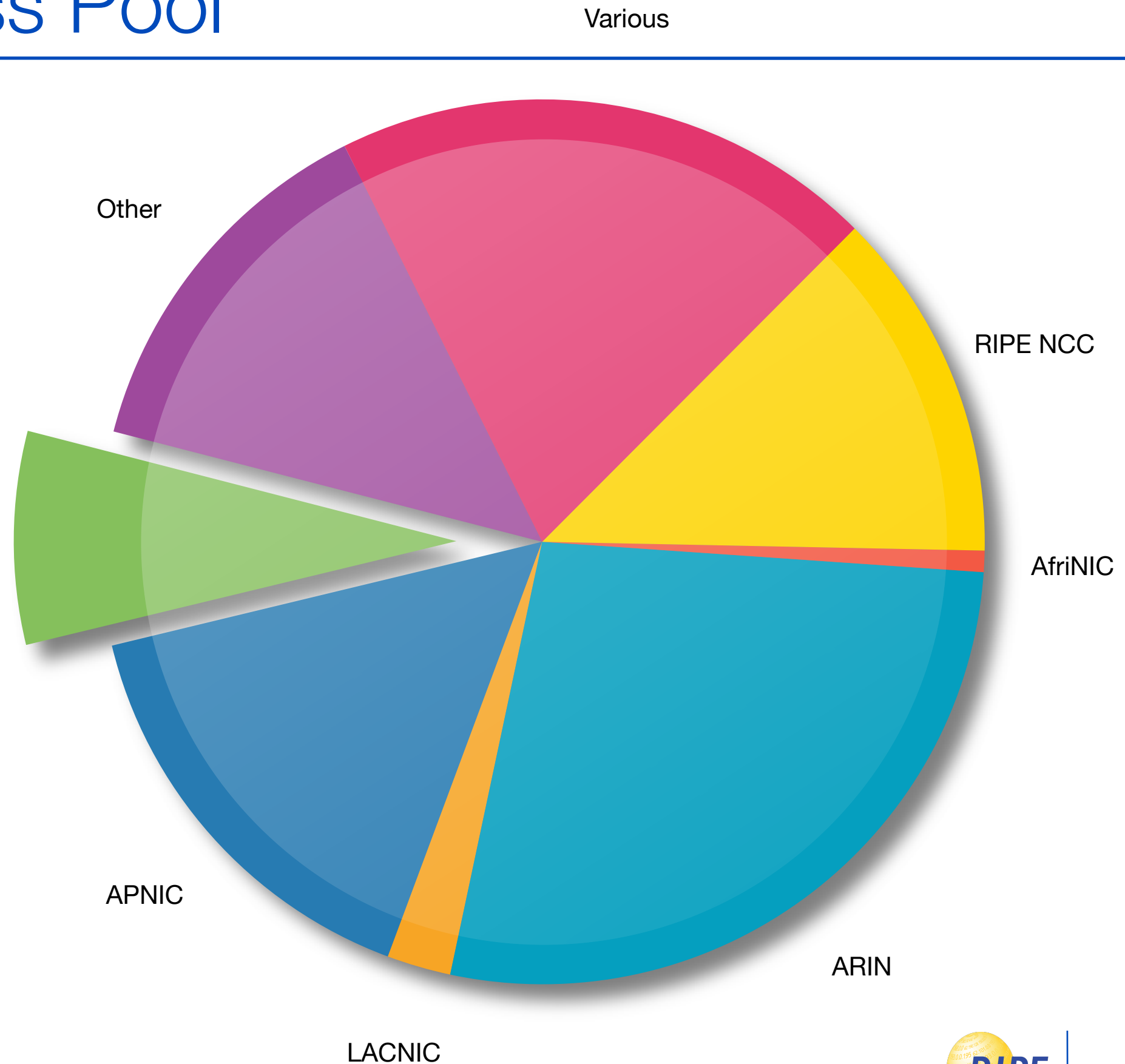
Aggregation



IPv4?

IPv4 Address Pool

7%
available



Hot IPv4 / IPv6 policy topics

- Allocations from the last /8 (2010-02)
 - new and existing LIRs can receive only one /22 allocation
 - only if they already have IPv6 space

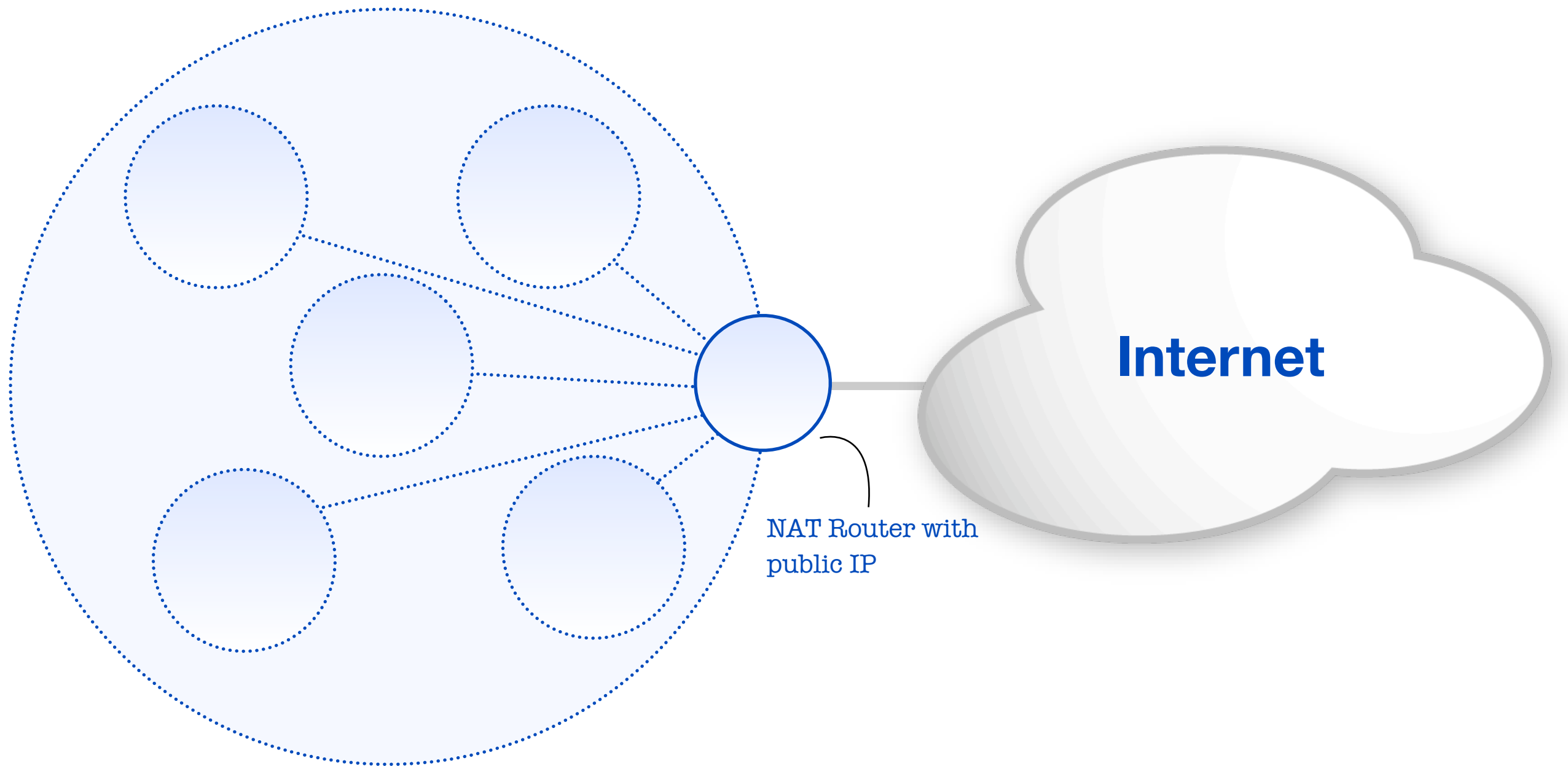
Just implemented: Run Out Fairly (of IPv4)

- Gradually reduced allocation / assignment periods
- Needs for “Entire Period” of up to...
 - 12 months (January 2010)
 - 9 months (July 2010)
 - 6 months (January 2011)
 - 3 months (July 2011)
- 50% has to be used up by half-period

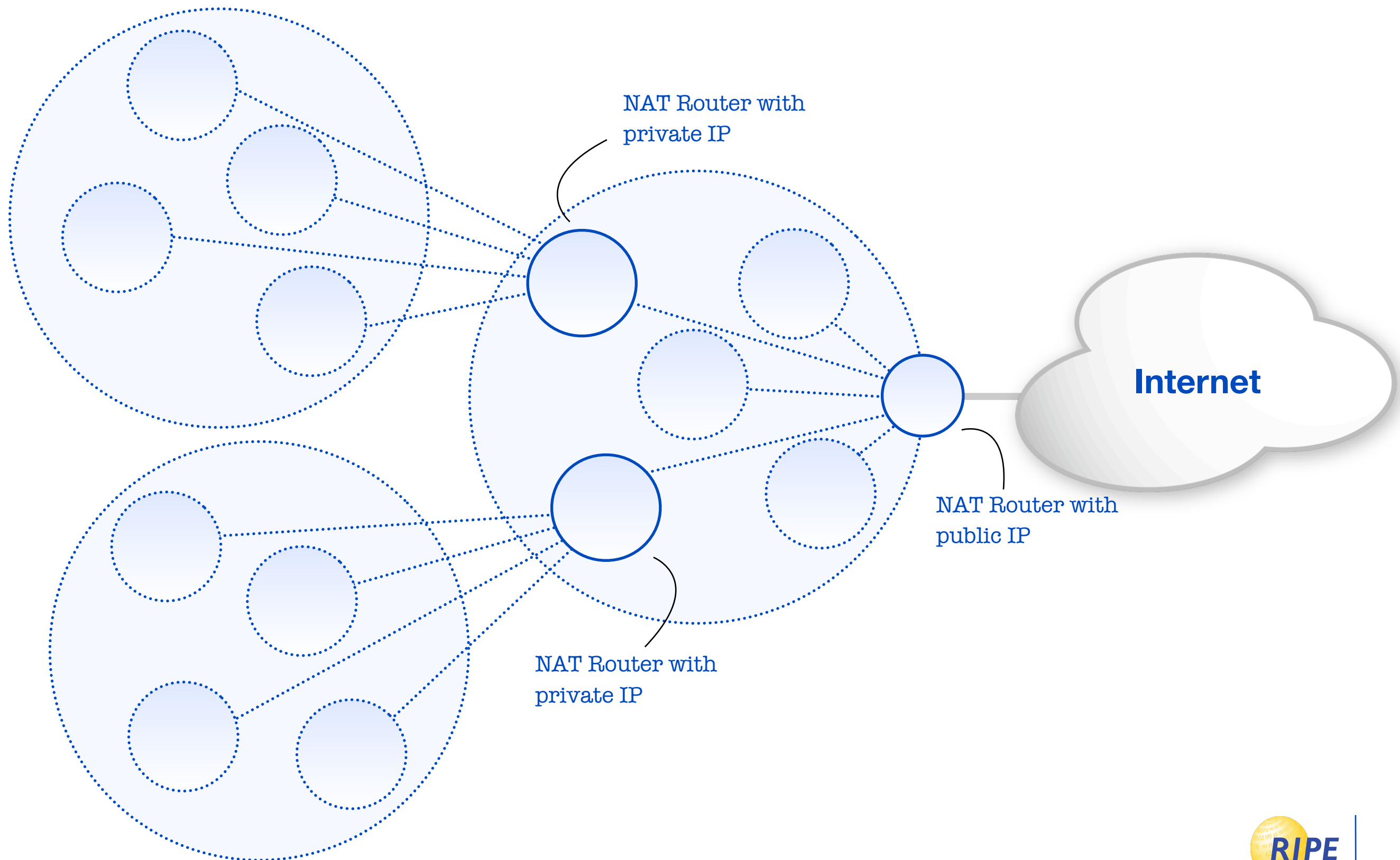
Wait and See?



Network Address Translation = Bad



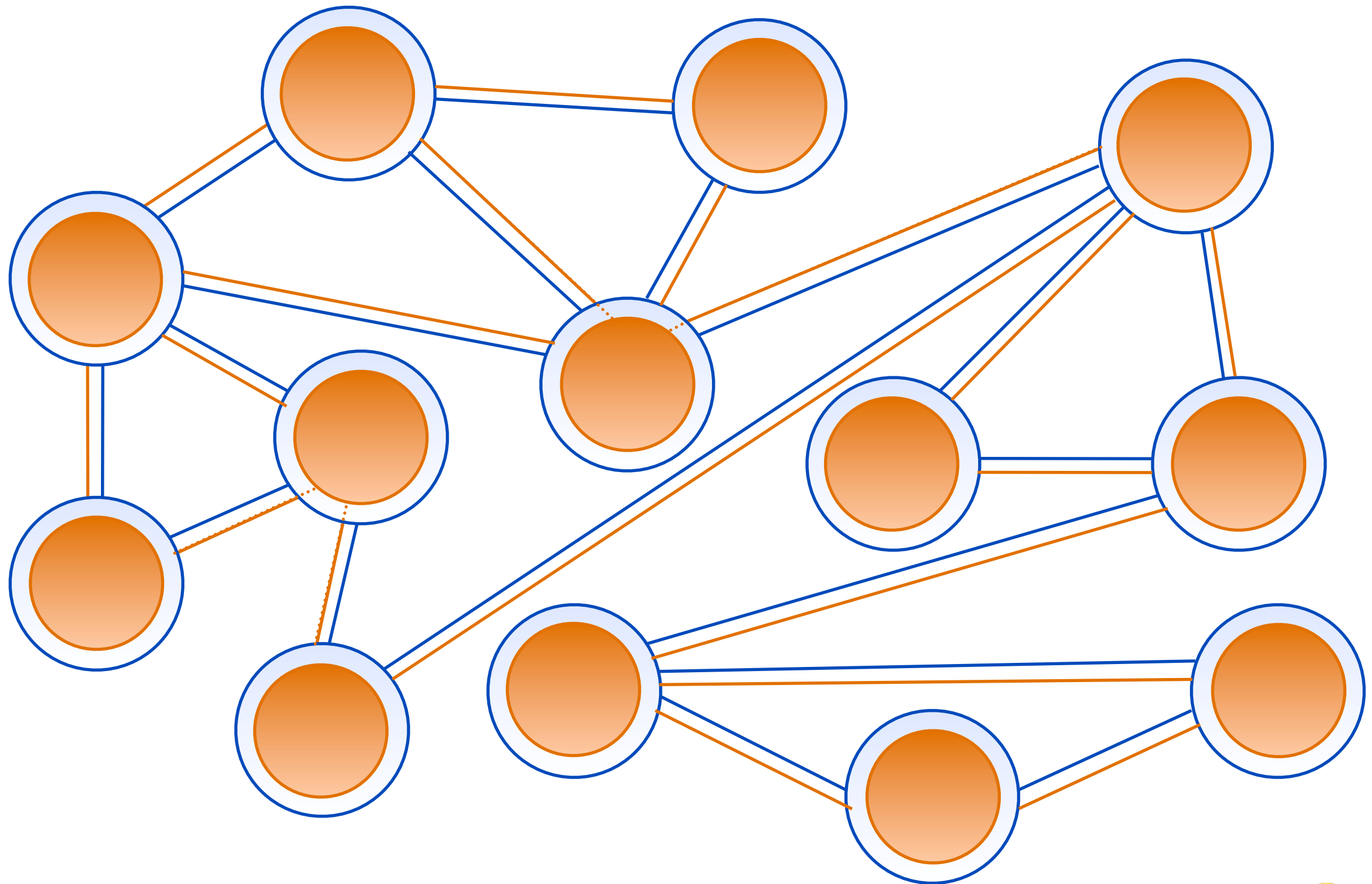
NAT behind NAT = Worse



Transition techniques

- Dual stack
- IP Tunneling: encapsulation
 - manual
 - automatic
 - 6to4: connect to IPv6 using your IPv4 connection
2002:x.y.z.a::/48
 - Teredo: through NAT. UDP encapsulation
- Tunnel Brokers: virtual IPv6 ISPs
- Protocol Translation

IPv6 Transition





IPv6 Basics

IPv6 Address Basics

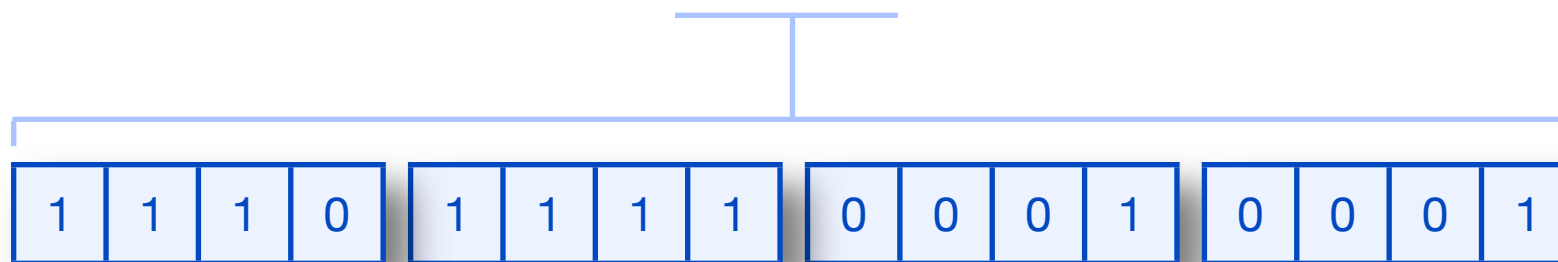
- IPv6 address: 128 bits
 - 32 bits in IPv4
- Every subnet is a /64
- Sites assignments between:
 - /64 (1 subnet)
 - /56 (256 subnets)
 - /48 (65,536 subnets)
- Usual allocation size /32

Address Notation

2001:0610:003E:EF11:0000:0000:C100:004D

2001:0610:003E:EF11:0000:0000:C100:004D

2001:610:3E:EF11:0:0:C100:4D

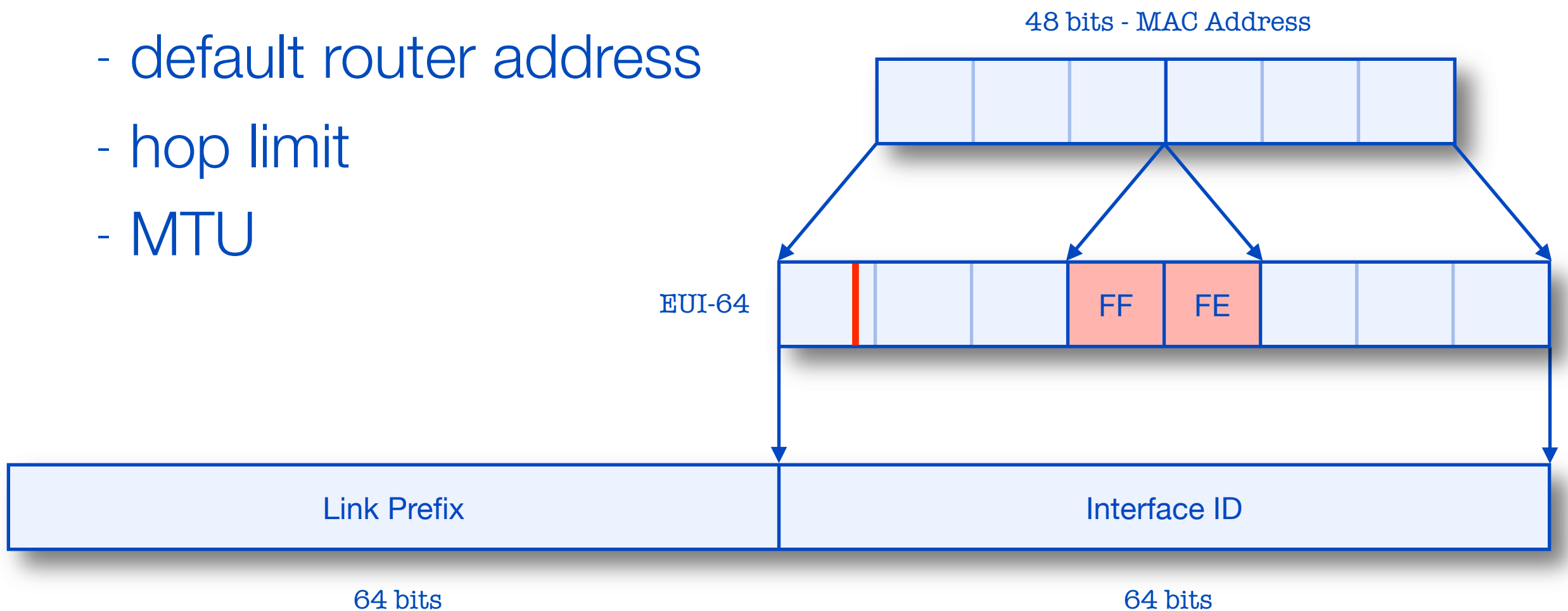


Multiple addresses

Addresses	Range	Scope
Loopback	::1	machine
Link Local	FE80::/10	link layer
Unique Local	FC00::/7	site
Global Unicast	2000::/3	global
6to4	2002::/16	global
Multicast	FF00::/8	variable

IPv6 Stateless Autoconfiguration

- Neighbor Discovery ICMPv6 messages
- host asks for network information:
 - IPv6 prefix (link prefix)
 - default router address
 - hop limit
 - MTU



IPv6 Stateful Autoconfiguration

- DHCPv6
 - used if no router is found
 - or if Router Advertisement Message enables use of DHCP
- With manual configuration subnet sizes other than /64 are possible

“96 More Bits, No Magic”

- Gaurab Upadhaya

Some pain points do exist

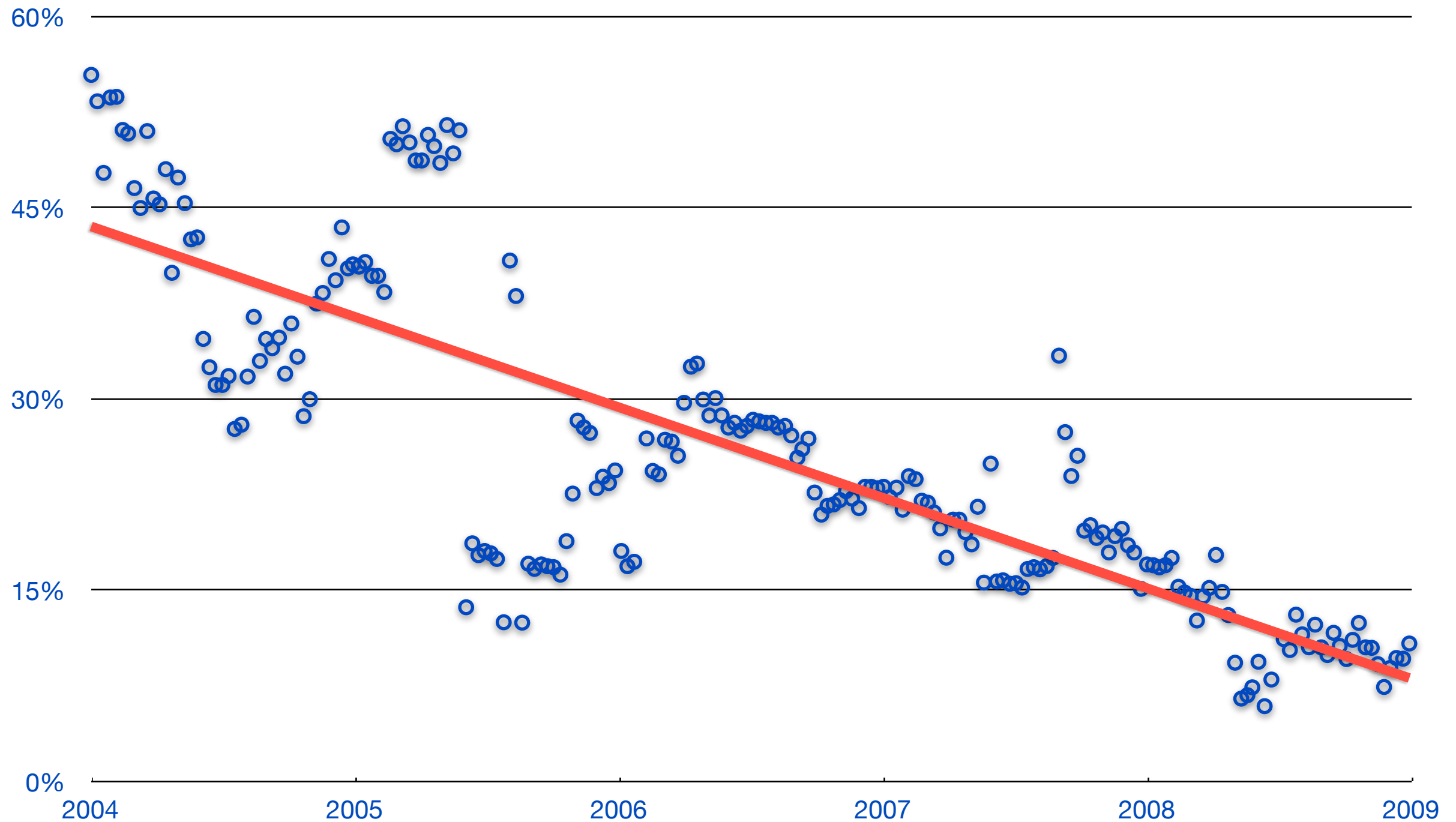
- CPE
- Firewalls
- Load balancers

“watch this space”

Training from scratch is needed

- IPv4 skills translate well to IPv6 skills
- Concepts have not changed
 - more addresses
 - slightly different features in some parts
- Problems are more psychological than technical!

IPv6 routing is tunnel hell



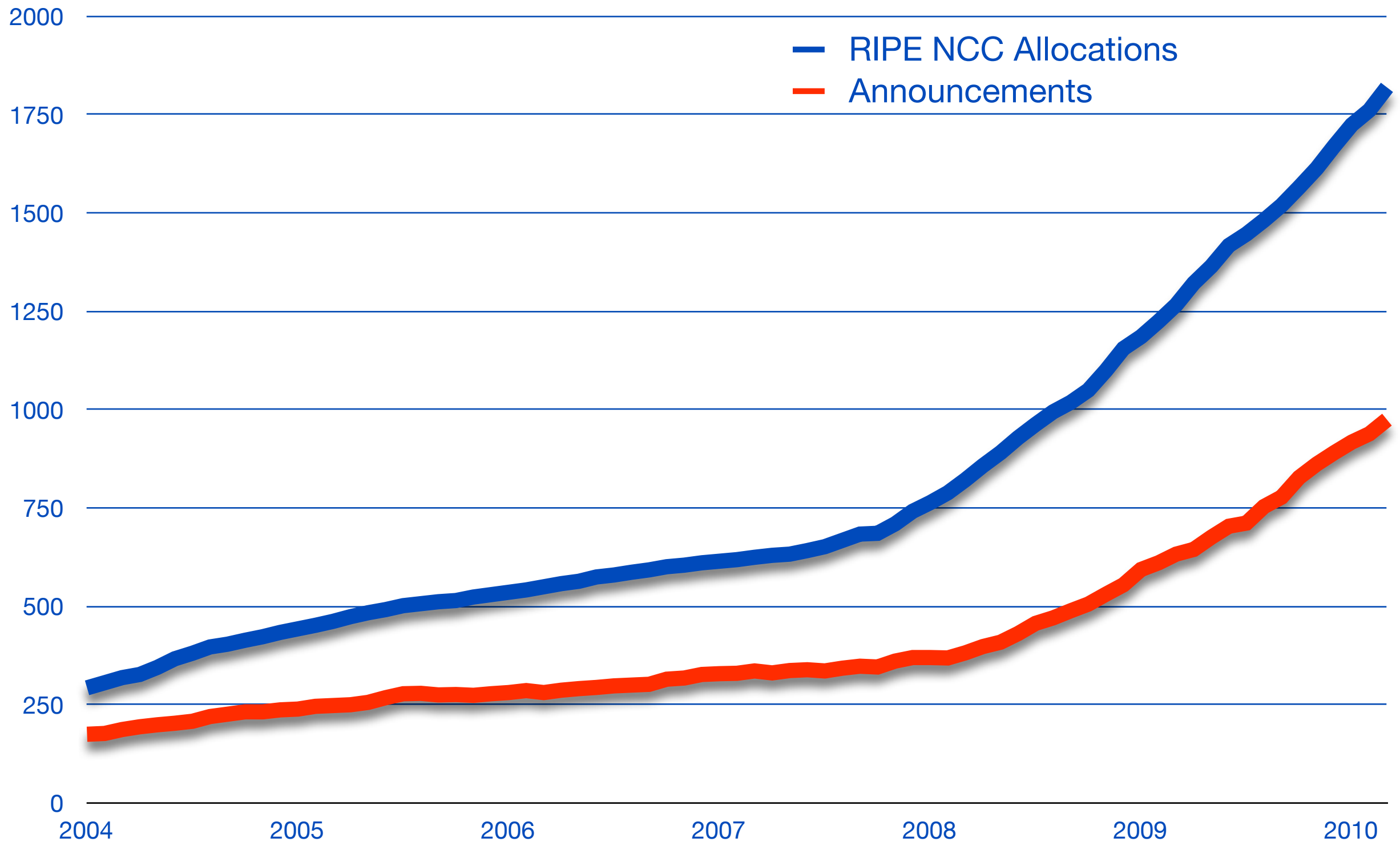


Getting it

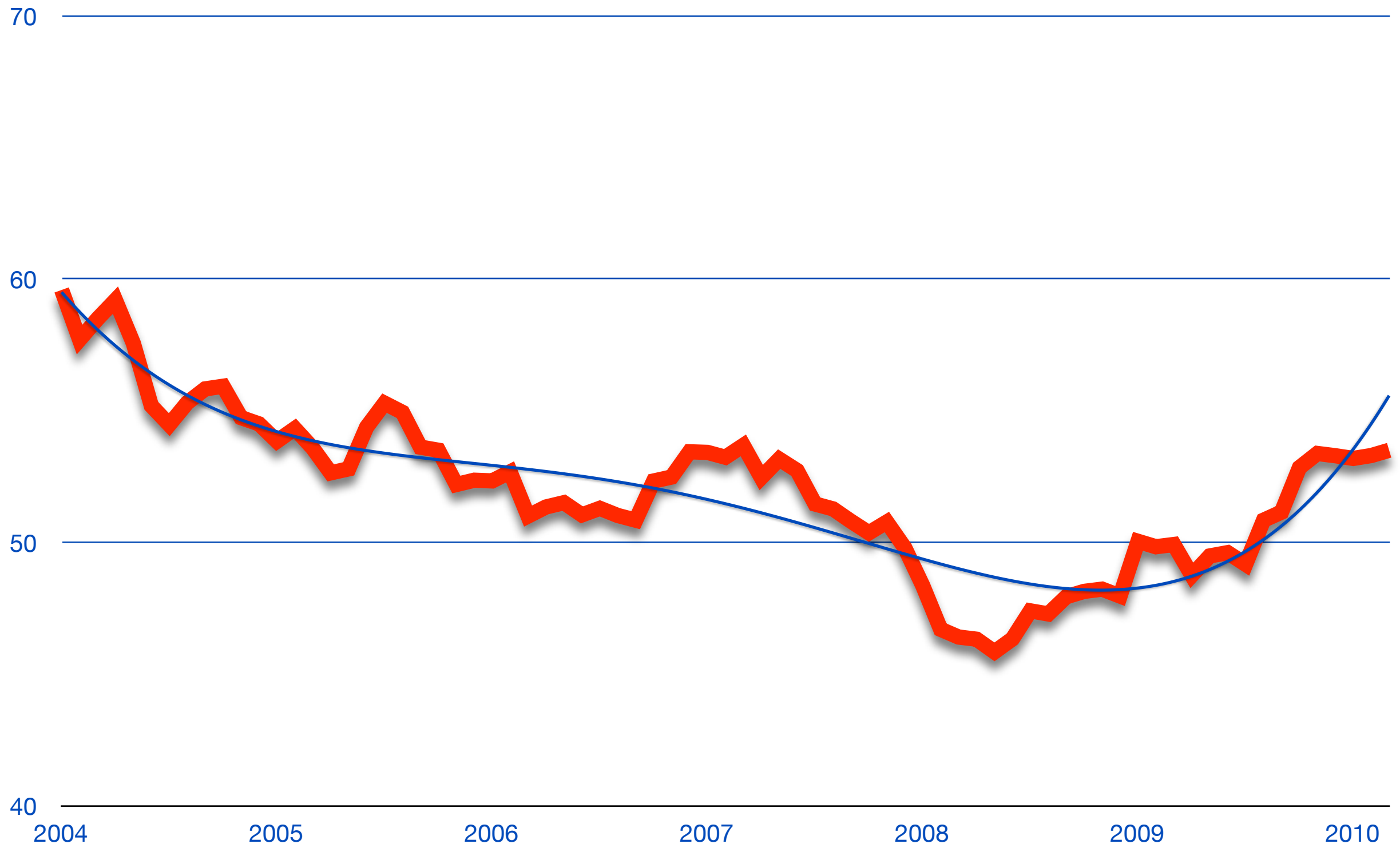
Getting an IPv6 allocation

- To qualify, an organisation must:
 - Be an LIR
 - Have a plan for making assignments within two years
- Minimum allocation size /32
- Announce your whole allocation as one prefix
 - recommended, not mandatory anymore

IPv6 Allocations and Announcements



Percentage of Routed IPv6 Allocations



Customer assignments

- Give your customers enough addresses
 - Up to a /48
- For more addresses, send in request form
 - Alternatively, make a sub-allocation
- Register sub-allocations in the RIPE DB
 - Put Assignments in a database accessible by the RIPE NCC

What does an IPv6 allocation cost?

- /32 = 1 scoring unit
- /31 = 2 scoring units
- points = $\sum (2010 - 1992) \times (\text{scoring unit}) = 18 \times 1 + \dots$

Category	Points	Fee 2010
Extra Small	0 - 16	€ 1300
Small	- 111	€ 1800
Medium	- 936	€ 2550
Large	- 7116	€ 4100
Extra Large	> 7116	€ 5500

Getting IPv6 PI address space

- To qualify, an organisation must:
 - Demonstrate it will multihome
 - Meet the contractual requirements for provider independent resources
 - LIRs must demonstrate special routing requirements
- Minimum assignment size /48

Reverse DNS

2001:610:3E:EF11::C100:4D

Reverse DNS

2001:0610:003E:EF11:0000:0000:C100:004D

.ip6.arpa

d.4.0.0.0.1.c.0.0.0.0.0.0.0.0.1.1.f.e.e.

3.0.0.0.1.6.0.1.0.0.2.ip6.arpa PTR

yourname.domain.tld

d.4.0.0.0.1.c.0.0.0.0.0.0.0.0.1.1.f.e.e.3.0.0.0.1.6.0.1.0.0.2.ip6.arpa PTR yourname.domain.tld

DNS in IPv6

- DNS is not IP layer dependent
- A record for IPv4
- AAAA record for IPv6
- Don't answer based on incoming protocol
- Only challenges are for translations
 - NAT-PT, NAT64, proxies

A yellow sphere, resembling a globe, is shown from a low angle, curving upwards. The surface of the sphere is covered with a grid of IP addresses in a light yellow, sans-serif font. The addresses are arranged in a way that they follow the curvature of the sphere, creating a sense of depth and perspective. The addresses include various octets, such as 193.0.0.195, 101.0.0.195, 193.0.0.195, 45.64, 195.38.128, 162.138.0.0, and 193.0.0.195. The sphere is set against a plain white background.

Scenario: Do Nothing

- No problems for next few years
- Some people won't be able to use your services
- No extra costs
 - until you hit the wall
- High costs for quick implementation
- Short planning times will mean some things go wrong

Scenario: Do It All Now!

- Hardware may have to be changed
- High investment in time and resources
- No direct return
- High costs for quick implementation
- Short planning times will mean some things go wrong

Scenario: Act Now, Phased Approach

- Change purchasing procedure (feature parity)
- Check your current hardware and software
- Plan every step and test
- One service at a time
 - face first
 - core
 - customers
- Prepare to be able to switch off IPv4

Change your face first

- Web
- Authoritative DNS
- Mail servers
- Outsiders see these services
- Multiple mature implementations exist

Don'ts

- Don't separate IPv6 features from IPv4
- Don't do everything in one go
- Don't appoint an IPv6 specialist
 - do you have an IPv4 specialist?
- Don't see IPv6 as a product
 - the Internet is the product

Do

- Phased approach
- Change requirements for new hardware
- Work outside-in, then inside-out
- Feature parity
- Dual stack
- Think about possible future renumbering

Business Case

- IPv4 is no longer equal to “the Internet”
- Avoiding the issue does not make it go away
- How much are you willing to spend now to save money later?
- Only IPv6 allows continued IP networking growth
- What do you want the Internet to be like in 5 years?

“IPv6, act now!”

The End!

Край

Y Diwedd

Fí

Finis

النهاية

Соңы

ჟღერა

Liðugt

Ende

Finvezh

Кінець

Konec

Kraj

Ěnn

Fund

پایان

Lõpp

Beigas

Vége

Son

Kraj

An Críoch

הסוף

Fine

Endir

Sfârșit

Fin

Τέλος

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Slut

Slutt

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