



# IPv6 Tutorial

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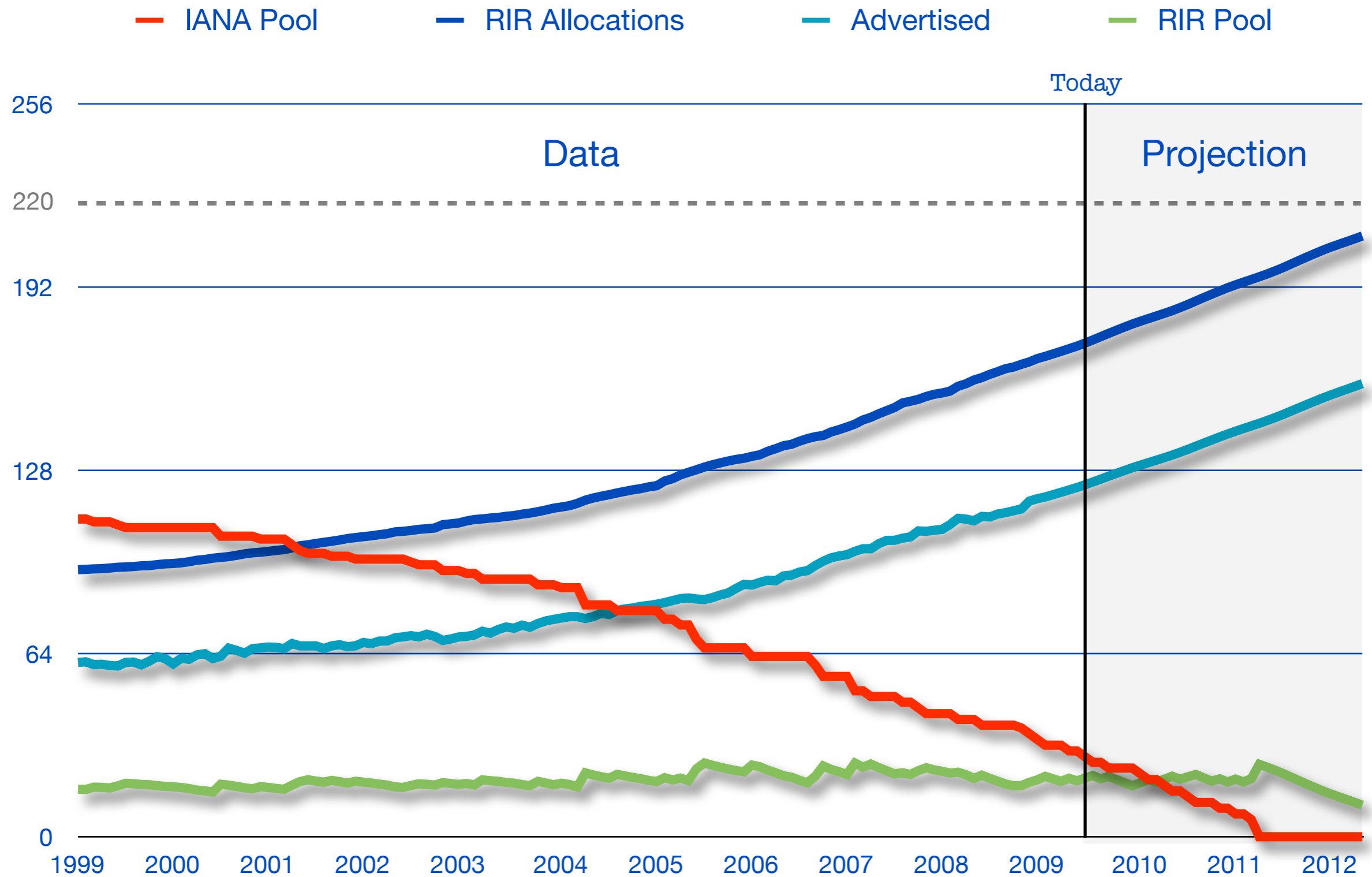
RIPE 59, 5 October 2009

# Reaching the next billion

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

# IPv4 Allocation Timeline



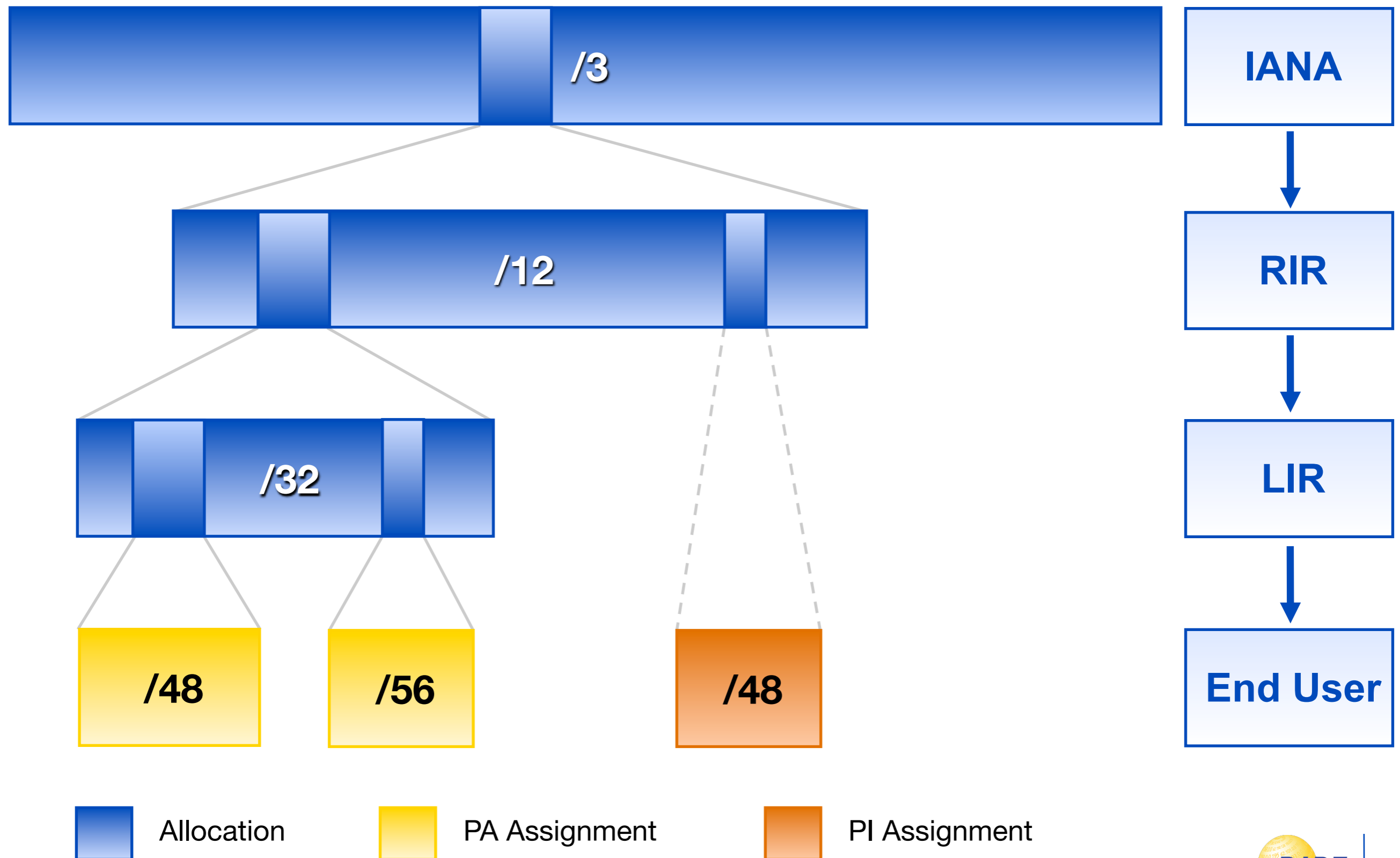
## A yellow sphere with a grid of IP addresses. The sphere is shown from a low angle, curving upwards and to the right. The IP addresses are printed in a light yellow color on the sphere's surface. The addresses include 193.0.0.195, 101.0.0, 193.0.0, 195.6, 45.64, 195.38.128, 162.138.0.0, and 193.0.0.195.

# The 5 RIRs

**ARIN**  
American Registry for Internet Numbers



# IP Address Distribution



# RIPE NCC

Started by the RIPE community in 1992

Located in Amsterdam

Not for profit membership organisation

6277 active members (1 july 2009)

695 new members in 2008

304 new members first half of 2009

# 2009-03

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## Run Out Fairly

This is a proposal to gradually reduce the allocation and assignment periods in step with the expected life time of the IPv4 unallocated pool in order to address the perception of unfairness once the pool has run out.

<http://ripe.net/ripe/policies/proposals/2009-03.html>

2009-04

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## IPv4 Allocation and Assignments to Facilitate IPv6 Deployment

The last IPv4 /8 that the RIPE NCC will hold is proposed to be dedicated to facilitate deployment of IPv6. The proposed minimum allocation size is to be a /27.

<http://ripe.net/ripe/policies/proposals/2009-04.html>

# 2008-07

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## Ensuring efficient use of historical IPv4 resources

This is a proposal to require documentation of all address resources held when assessing a RIPE NCC member's eligibility for further IPv4 address space.

<http://ripe.net/ripe/policies/proposals/2008-07.html>

# Policy-Announce Mailing List

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## Number of mails

2005	16
2006	43
2007	40
2008	40
2009	37

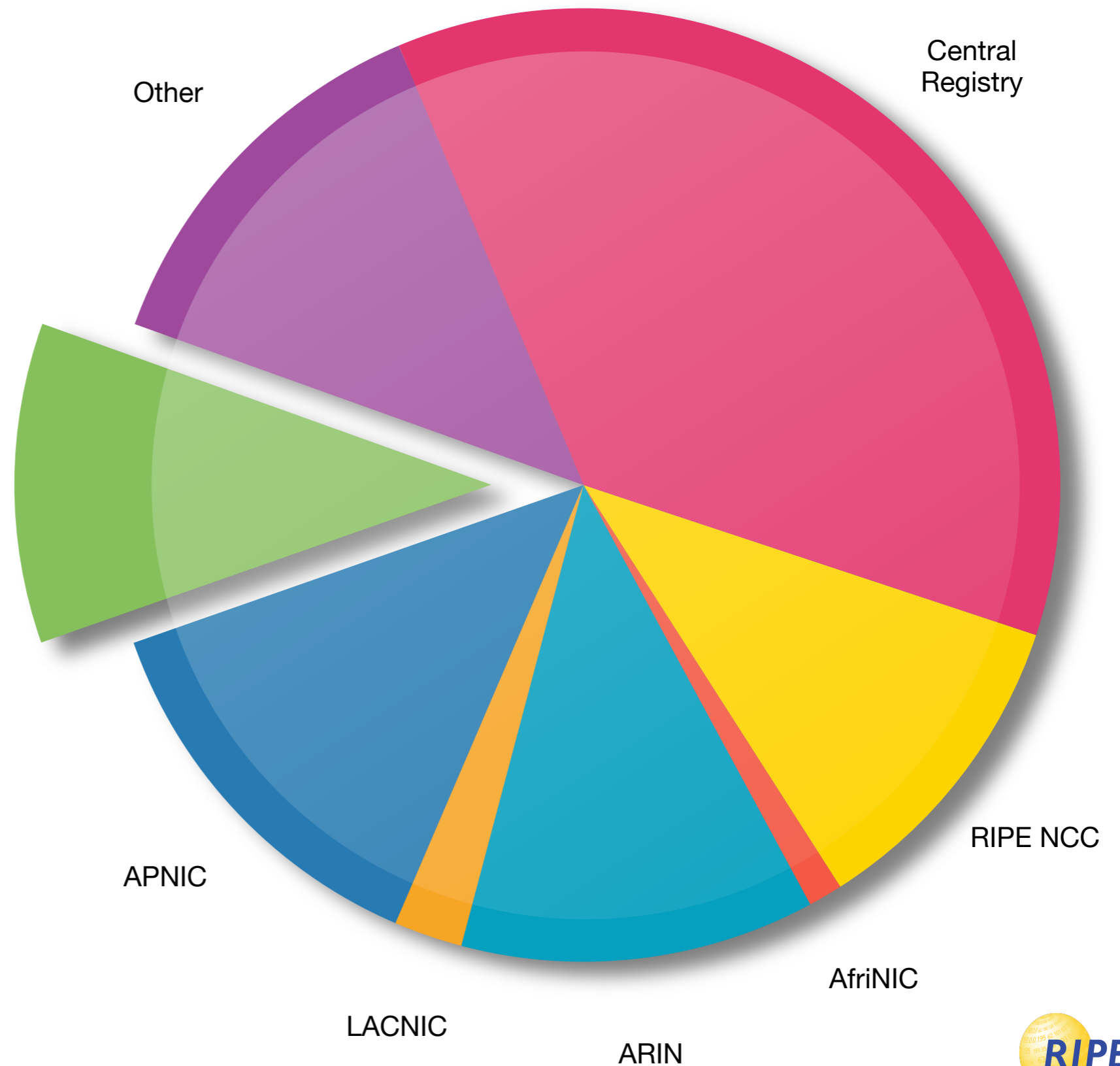
<http://www.ripe.net/mailman/listinfo/policy-announce>



IPv4?

# IPv4 Address Pool

10%  
available

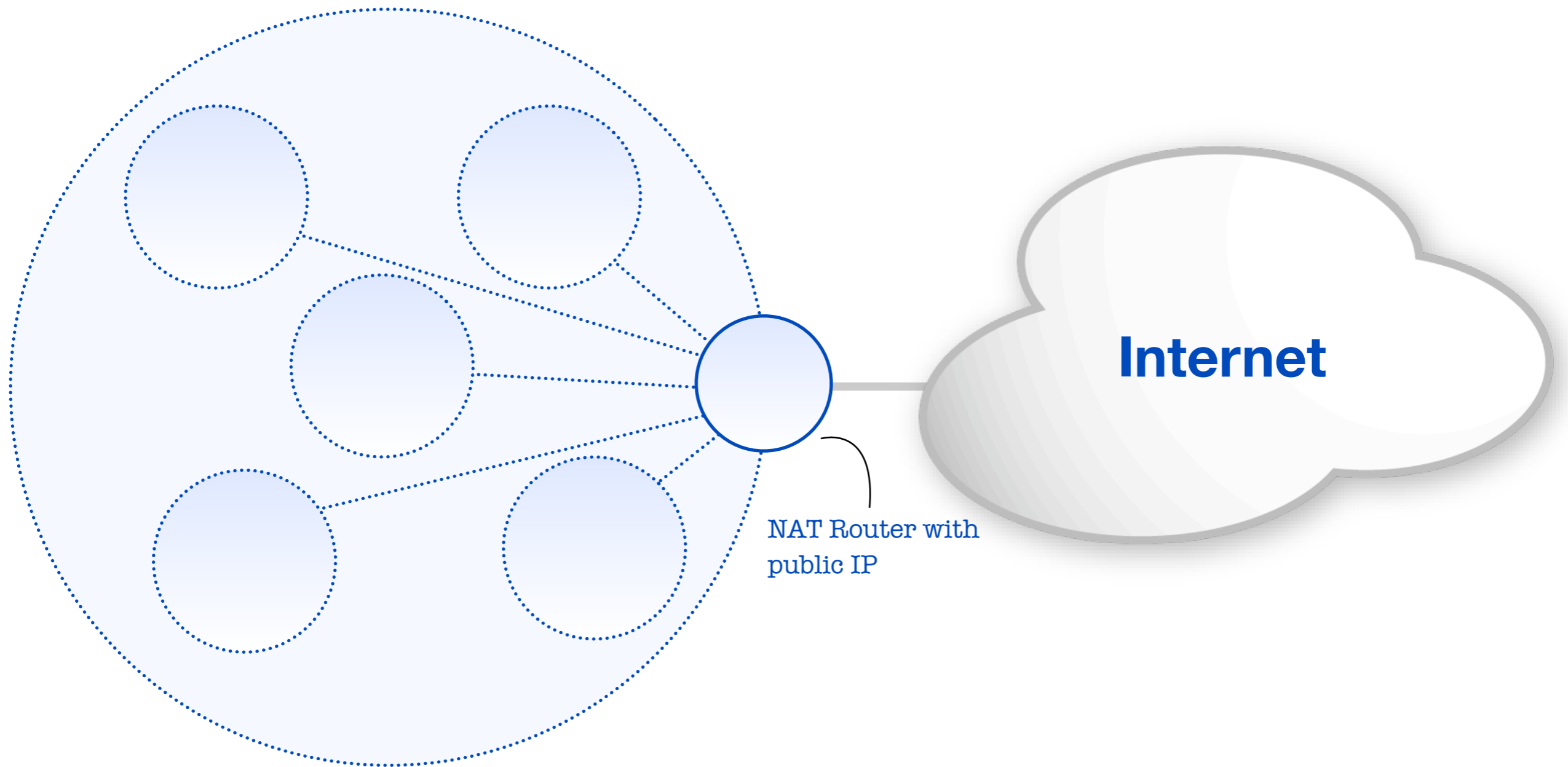


# Wait and See?

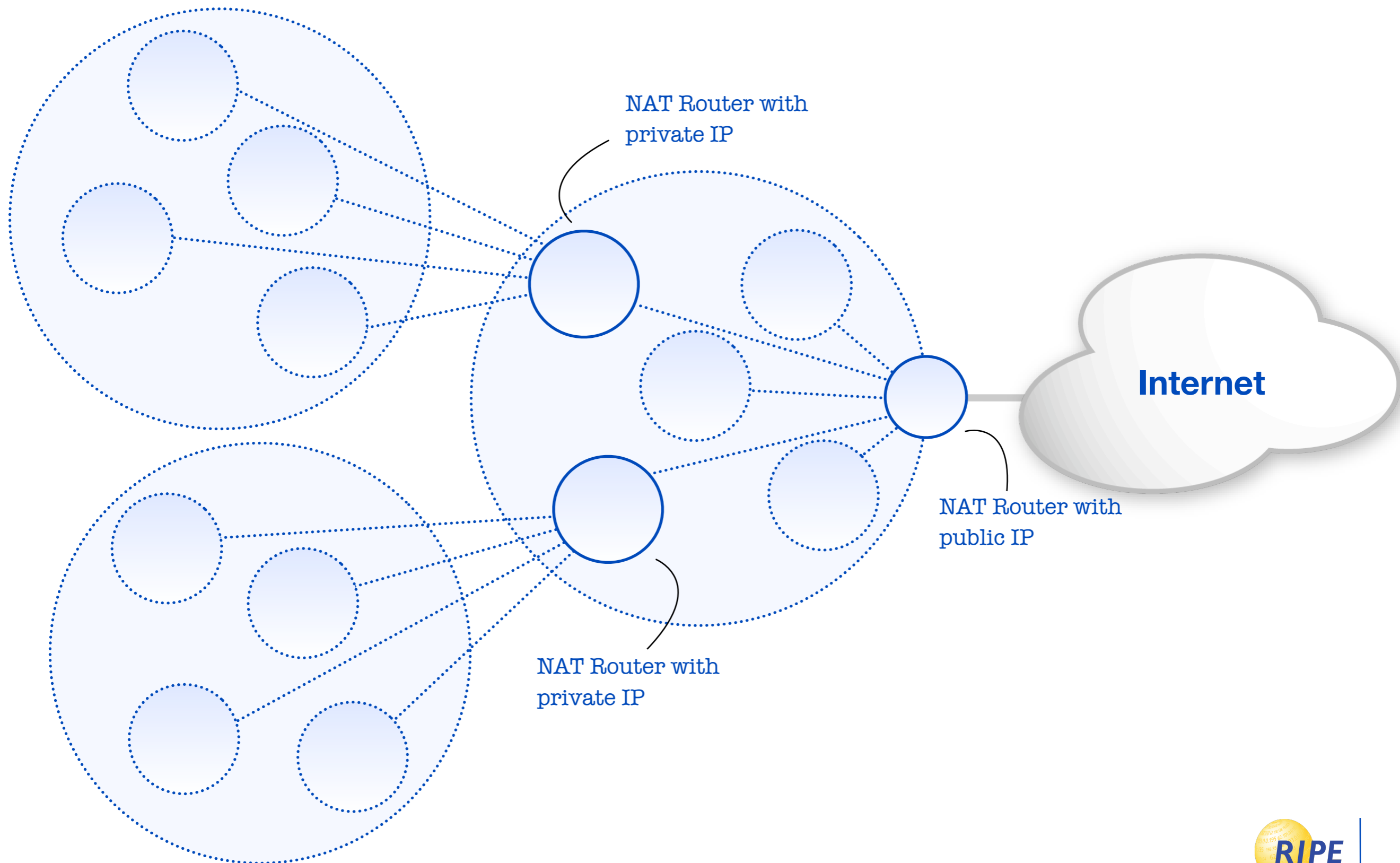


# Network Address Translation = Bad

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# NAT behind NAT = Worse





# Lasting Longer

# Where can you “reclaim” IPv4 addresses?

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- Review your subnetting and renumber
- Change to /31 point-to-point
- Change infrastructure to private addresses

How much would a restructure cost?

How much would implementing IPv6 cost?

# Punishing Customers

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- Give NAT'd private addresses by default
- Charge for public addresses
- Audit public address usage in customers
  - reclaim where possible
- Reclaim from "network abusers"
- Implement Carrier-Grade-NAT

Will your customers accept this?

# How Much longer?

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- We asked ISPs, their answers:
  - not much more time
  - 4 to 6 months max.

*“If you need to do this, you're probably too late”*



# Myths and other problems

# DNS in IPv6 is difficult

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- 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

# Training from scratch is needed

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- 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

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- Use looking glasses
  - check latency over IPv4 & IPv6
- Big improvements in last year
  - Differences still exist
- IPv6 transit is becoming a product, like IPv4 transit

# Some pain points do exist

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- CPE
- Firewalls
- Load balancers

*“watch this space”*

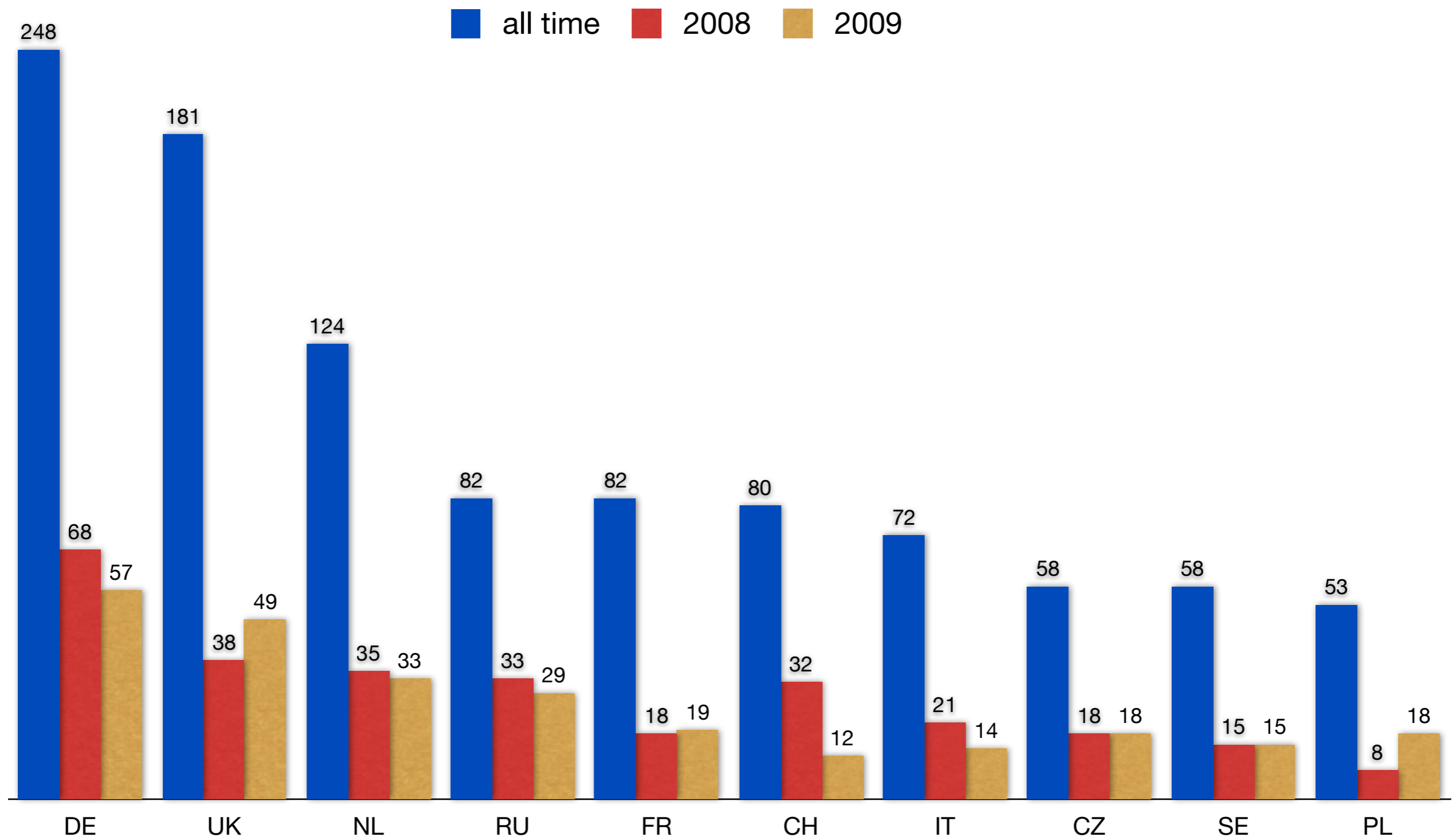
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# Getting an IPv6 allocation

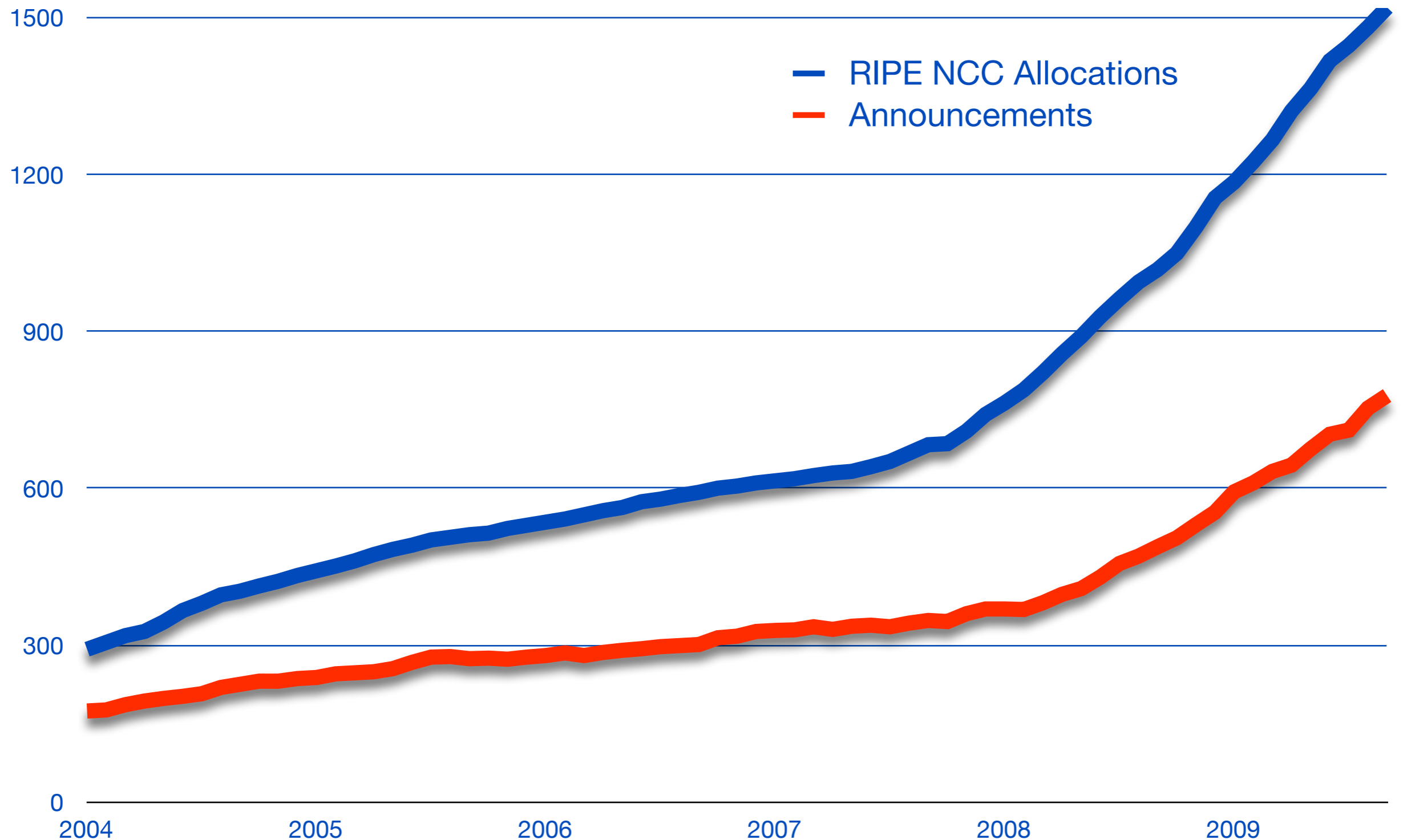
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- To qualify, an organisation must:
  - Be an LIR
  - Have a plan for making assignments within two years
- Minimum allocation size /32

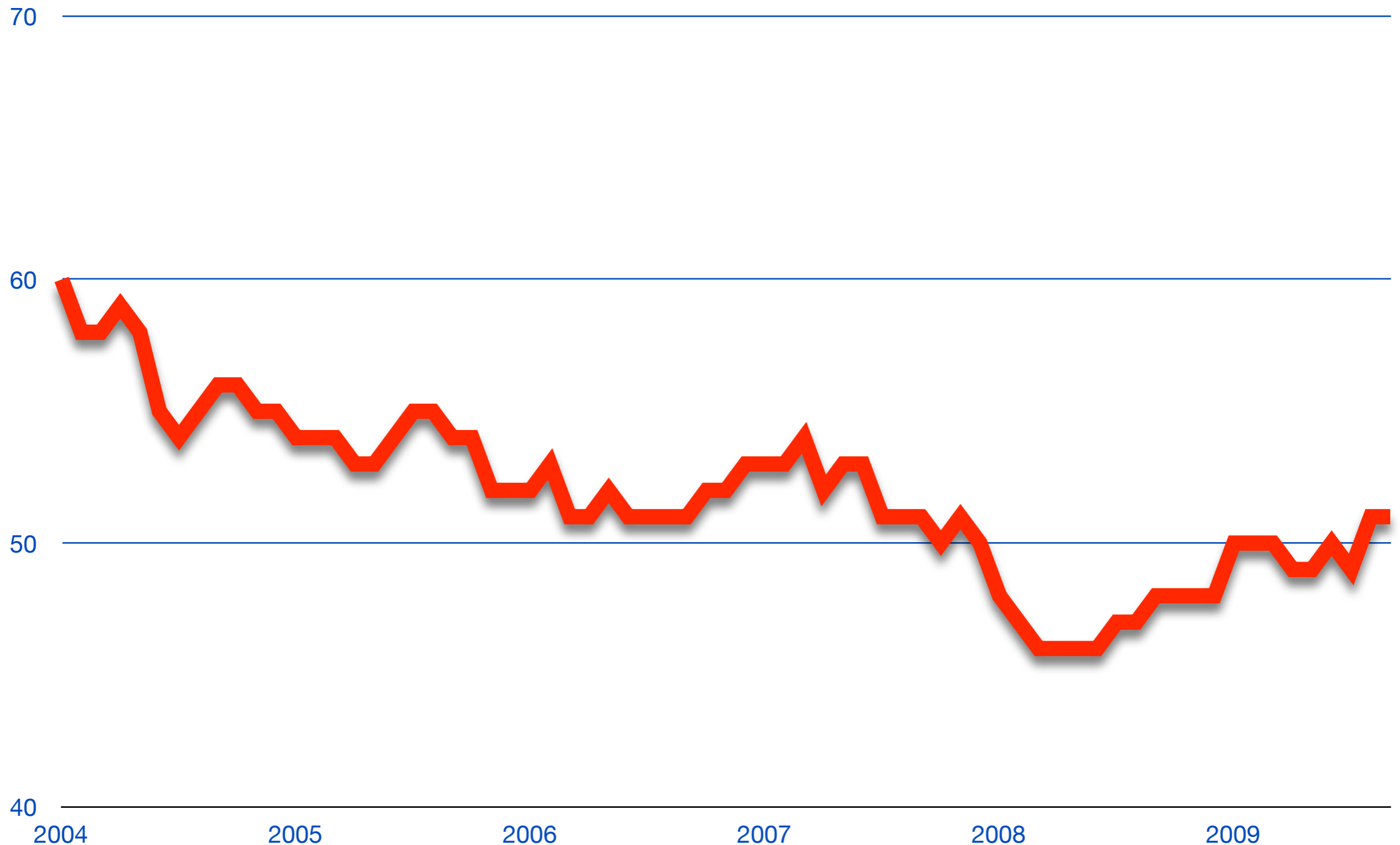
# IPv6 Allocations per Country



# IPv6 Allocations and Announcements



# Percentage of Routed IPv6 Allocations



## 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 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, 193.0.0, 45.64, 195.38.128, 162.138.0.0, and 193.0.0.195. The sphere is set against a white background, and its shadow is cast onto the surface below it.

# Scenario: Do Nothing

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- 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!

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- 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

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- 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

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

# Don'ts

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- 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

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- Phased approach
- Change requirements for new hardware
- Work outside-in, then inside-out
- Feature parity
- Dual stack

# Business Case

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- 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

*“IPv6, act now!”*

**The End!**

**Край**

**Y Diwedd**

**Fí**

**Finis**

**النهاية**

**Соңы**

**ჟღერა**

**Liðugt**

**Ende**

**Finvezh**

**Кінець**

**Konec**

**Kraj**

**Ěnn**

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**Son**

**Kraj**

**An Críoch**

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**Fine**

**Endir**

**Sfârșit**

**Fin**

**Τέλος**

**Einde**

**Конец**

**Slut**

**Slutt**

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