

# IPv4 and IPv6

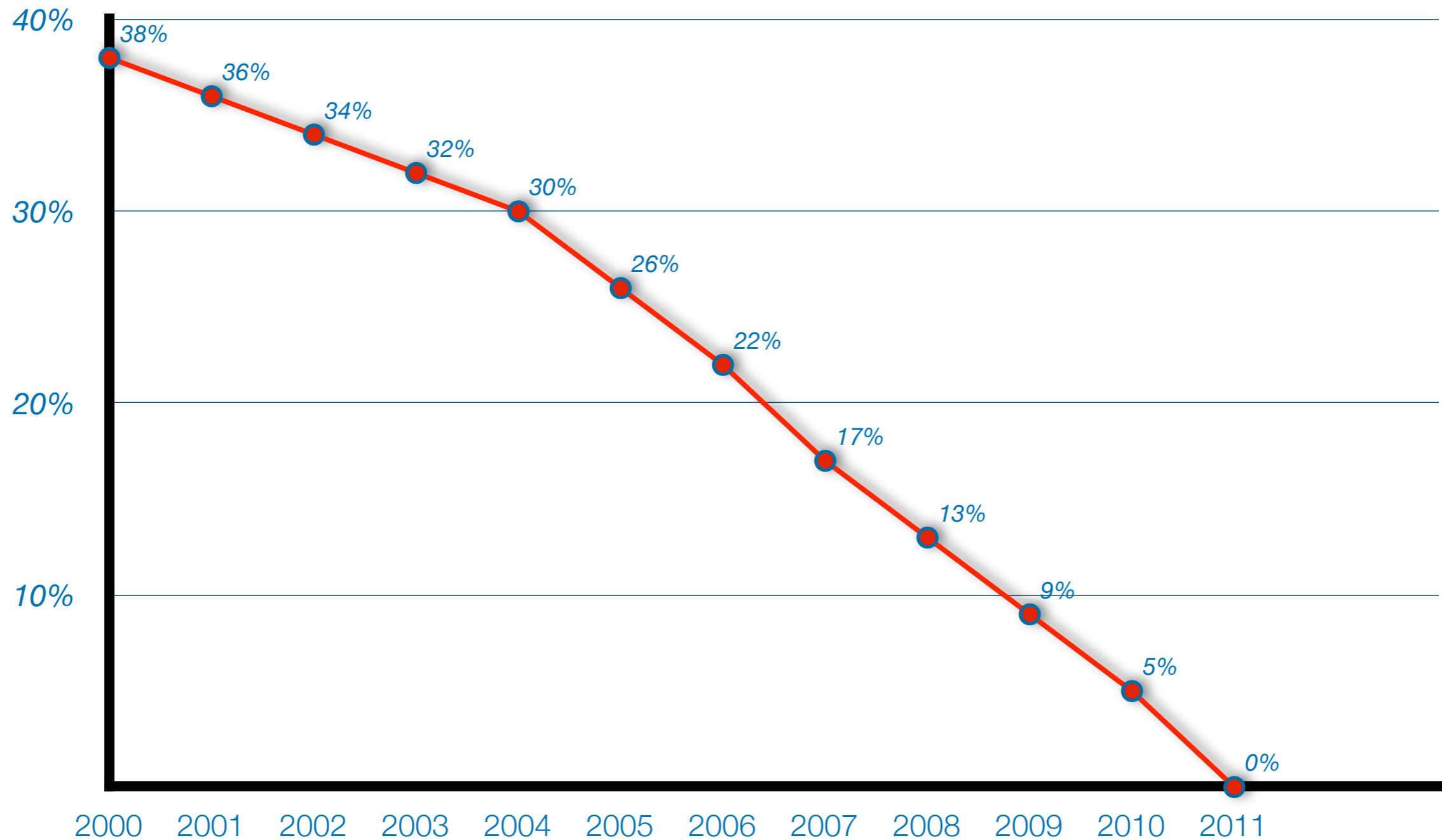
current situation

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Marco Hogewoning, trainer



# IPv4 addresses in the global pool

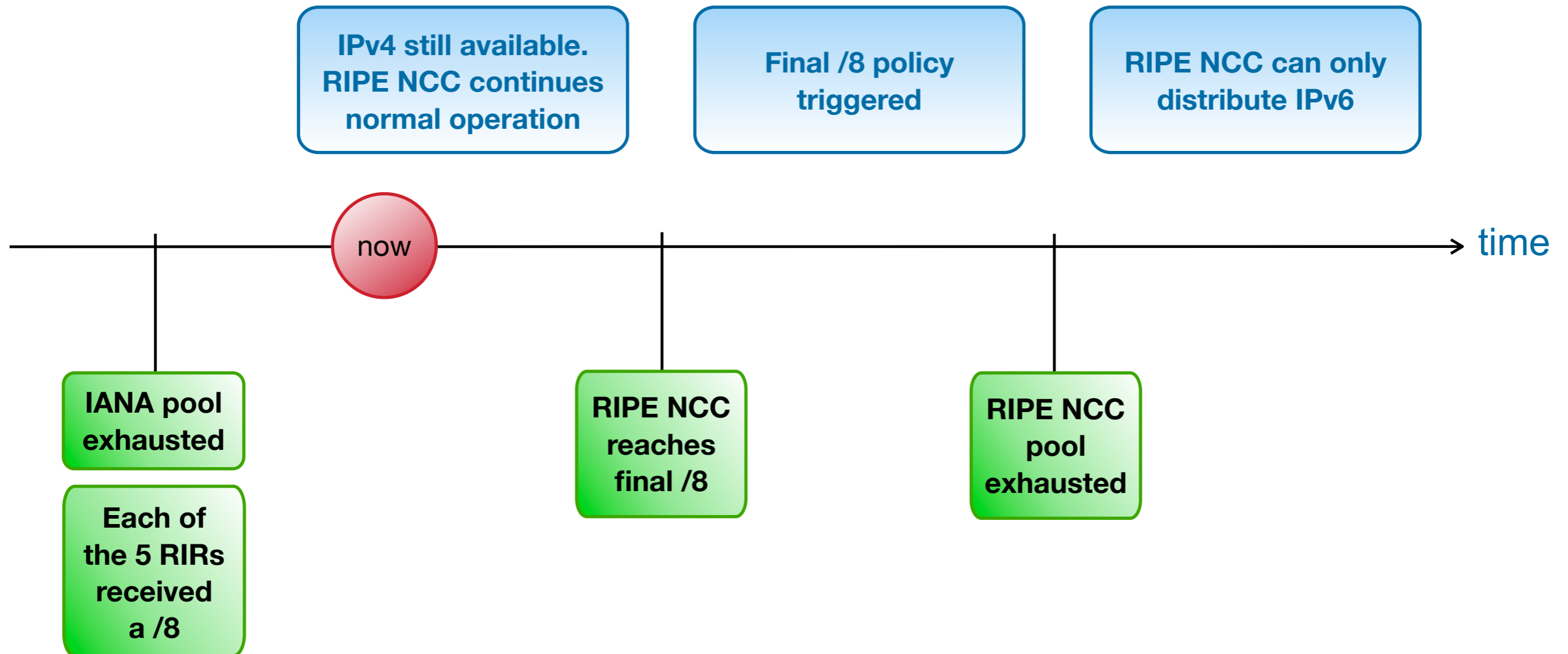


# Reaching the next level

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- The Internet has around 2 billion users
- They consumed 3.5 billion addresses
- Growing in all directions
  - More users join up
  - More connections become ‘always on’
  - More devices become ‘Internet aware’
- **IPv4 can no longer sustain this growth**

# IPv4 exhaustion phases



# Business as usual

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- As long as there are IPv4 addresses left, the RIPE NCC will keep on distributing them, based on justified need
- Same allocation and assignment policies still apply (RIPE-530)
- Until the final /8 is reached

# “Run Out Fairly”

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- Gradually reduced allocation and 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

# Final /8 policy

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- Each LIR can get **one** /22 allocation
  - 1024 IPv4 addresses
  - New and existing members
  - As long as supplies will last
- You must meet the criteria for an (additional) allocation
- Only when you already have IPv6 addresses

# Transfer of IPv4 allocations

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- LIRs can transfer IPv4 address blocks:
  - To another LIR
  - Only when the block is not in use
  - Meets minimum allocation size (/21)
- Requests are evaluated by the RIPE NCC
  - Justified need
- Registered in the RIPE Database



# No changes yet

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- Policy will only change when the RIPE NCC's final /8 is reached
- Be aware of the shorter assignment period!
- **And start deploying IPv6 now!**

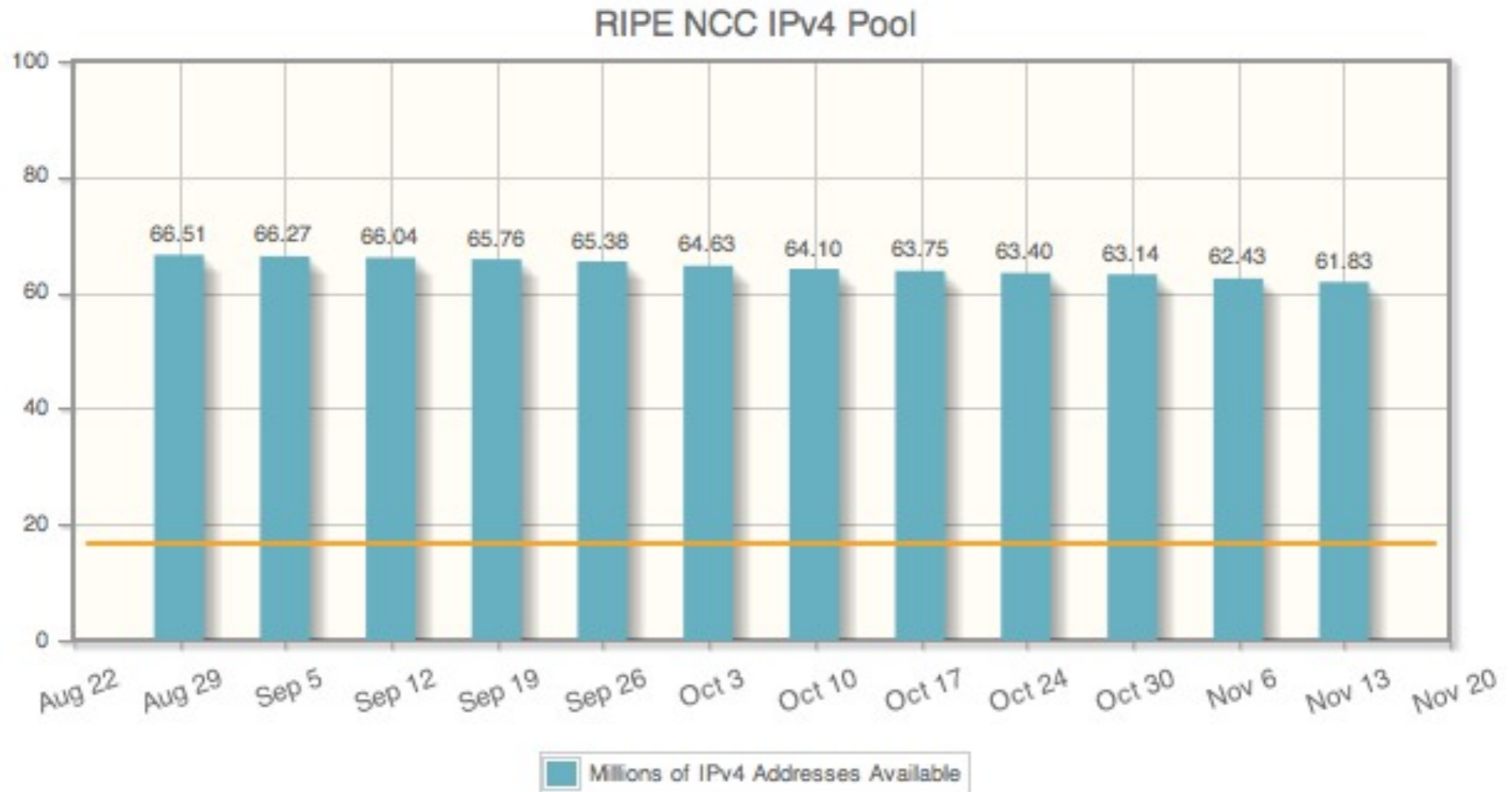
# Other RIRs

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- APNIC ran out on 14 April 2011, final /8 policy activated. Now allocating a maximum of /22
- ARIN plans for /28 - /24 when reaching final /8
- LACNIC policy is /22 for ISP, /24 for critical infrastructure
- AfriNIC has no specific final /8 policy

See <http://www.nro.net/rir-comparative-policy-overview>

# RIPE NCC Available Pool



<http://www.ripe.net/internet-coordination/ipv4-exhaustion/ipv4-available-pool-graph>

# IPv4 vs IPv6

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# Address format

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- IPv4 uses 32 bit addresses
  - ‘Dotted decimal’
  - 0.0.0.0 - 255.255.255.255
- IPv6 uses 128 bit addresses
  - Hexadecimal notation, numbers between 0 and **f**
  - Separated by colons
  - ‘2001:980:3042:2:5a55:caff:fef6:bdbf’
- **IPv4 and IPv6 are not compatible**

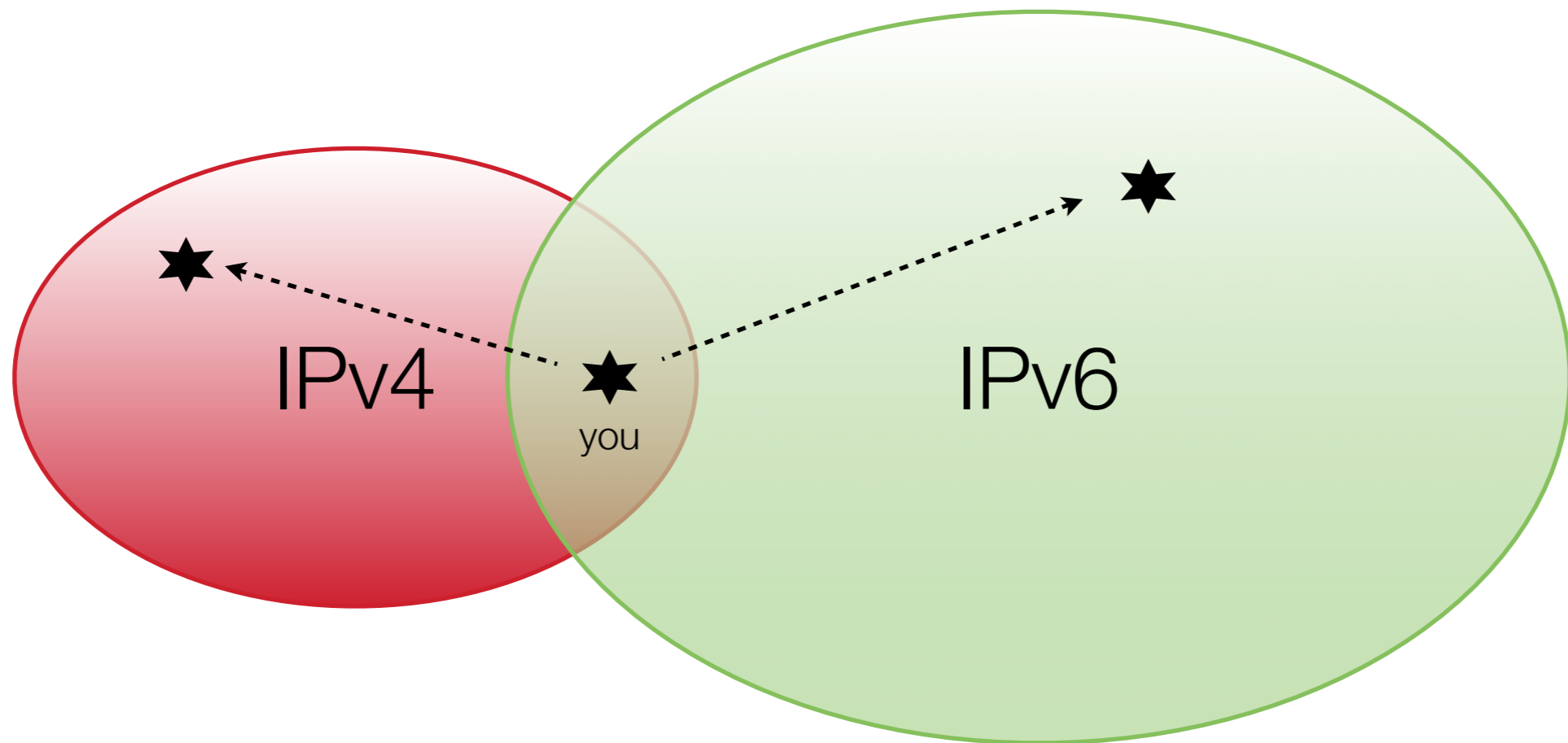
# Coexistence

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- IPv4 and IPv6 can not talk to each other
- But they can exist together on the same network
- Known as 'Dual stack'
  - Computer has both an IPv4 and IPv6 address
  - Uses one of the two when communicating
  - If IPv6 is available it usually has preference

# A perfect world

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# The plan (1995 - 2009)

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- To have most computers and networks dual stacked before the IPv4 pool runs out
- Traffic would have switched to IPv6
- Smooth transition from IPv4 to IPv6
  
- This failed :(



# IPv6 deployment issues

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- People are reluctant to change
  - If it isn't broken...
- Changes cost money
- There wasn't a business case
  - IPv4 run out was a long term problem
  - It is a 'hidden' problem
- Equipment wasn't available
  - Cause or side-effect ?

# Alternatives

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# Extending the IPv4 pool

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- Find unused addresses
- Use Network Address Translation (NAT)
  - Common technique in home environments
  - Machines get a ‘private IP address’
  - And share a single public IP for connections
- Do the same at the operator level
  - Customers will get a private IP
  - Carrier Grade NAT/Large Scale NAT

# Problems with NAT

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- Does it really scale ?
  - How many users can share a single address ?
- Who is using address X ?
  - Who am I talking to ?
  - Who to blame for abuse ?
- It doesn't allow to offer services
- Some protocols will break
- **It does not talk to IPv6!**

# Plan B

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- Technical community is very active
- Countless protocols and proposals are around
  - 6in4
  - 6to4
  - 6RD
  - TSP
  - A+P
  - 4RD
  - ...etc

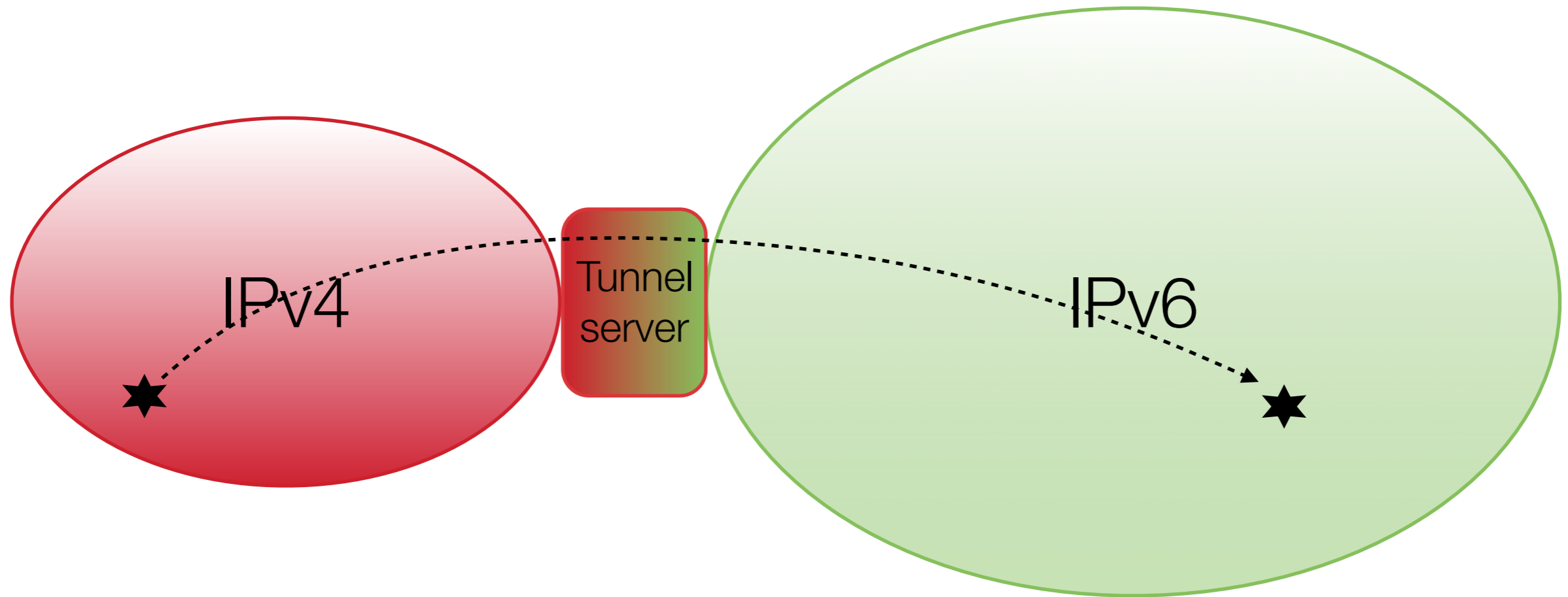
# Transitioning techniques

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- Most of them use ‘tunnels’
  - Put X in Y (IPv6 in IPv4)
- The end point has both protocols
- And the network in between doesn’t
- Requires assistance in the form of so called ‘tunnel servers’
  - ‘Bridge’ between the 2 worlds
  - Unpacking and repacking the data

# Tunnels

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# Drawbacks of tunnels

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- Still require (public) IPv4 addresses
- Most of them work one way (IPv4 -> IPv6)
  - IPv6 content ?
- Who owns the tunnel server ?
  - Does it come with some guarantee ?
  - Can you trust them ?
  - ‘man in the middle’
- Filtering prohibits tunnels



# Translation (NAT64/NAT-PT)

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- Alternative #3: translate IPv4 into IPv6
- Customer will only get one protocol
- Translator box sits in between
  - Talks to both IPv4 and IPv6
  - Shares addresses
- Drawbacks
  - Who is who
  - Can you trust the ‘man in the middle’
  - Breaks DNSsec

# Dual stack where you can

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- “The most customer friendly way of transitioning to IPv6”
- Long term solution
- IPv4 run out is everybody’s problem
- The key in solving it lies with those who already have IPv4 addresses
  
- Worst case scenario: split brain!

# IPv6 statistics

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Marco Hogewoning, trainer

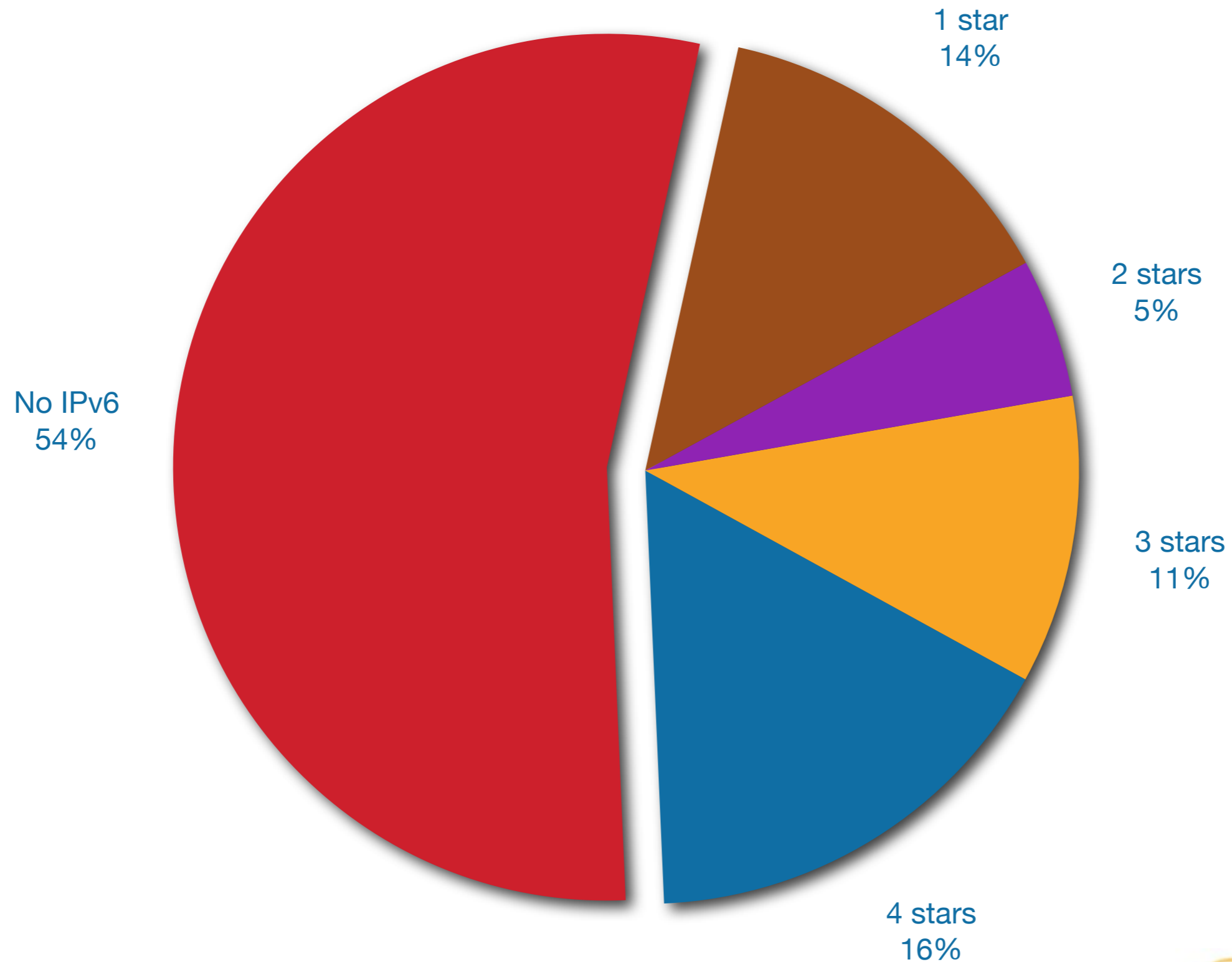


# IPv6 RIPEness

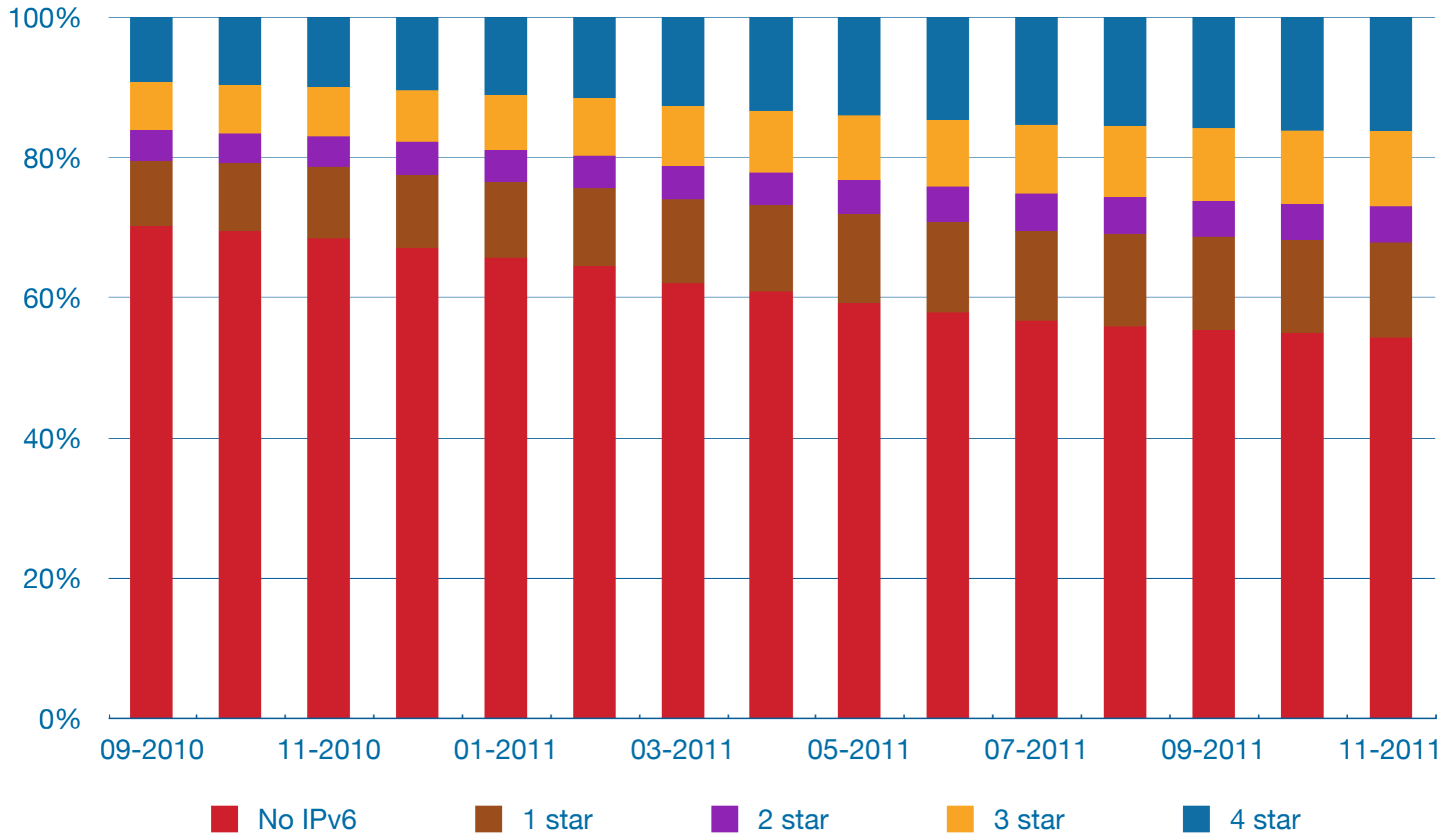
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- Rating system:
  - One star if the member has an IPv6 allocation
  - Additional stars if:
    - IPv6 Prefix is visible on the internet
    - A route6 object is in the RIPE Database
    - Reverse DNS is set up
  - A list of all 4 star LIRs: <http://ripeness.ripe.net/>

# IPv6 RIPEness: 7819 LIRs



# IPv6 RIPEness over time



Questions?



**The End!**

**Край**

**Y Diwedd**

**النهاية**

**Соңы**

**ჟღერა**

**Fí**

**Finis**

**Ende**

**Finvezh**

**Liðugt**

**Кінець**

**Konec**

**Kraj**

**Ěnn**

**Fund**

**پایان**

**Lõpp**

**Beigas**

**Vége**

**Son**

**Край**

**An Críoch**

**הסוף**

**Fine**

**Endir**

**Sfârșit**

**Fin**

**Τέλος**

**Einde**

**Конец**

**Slut**

**Slutt**

**დასასრული**

**Pabaiga**

**Fim**

**Amaia**

**Loppu**

**Tmíem**

**Koniec**