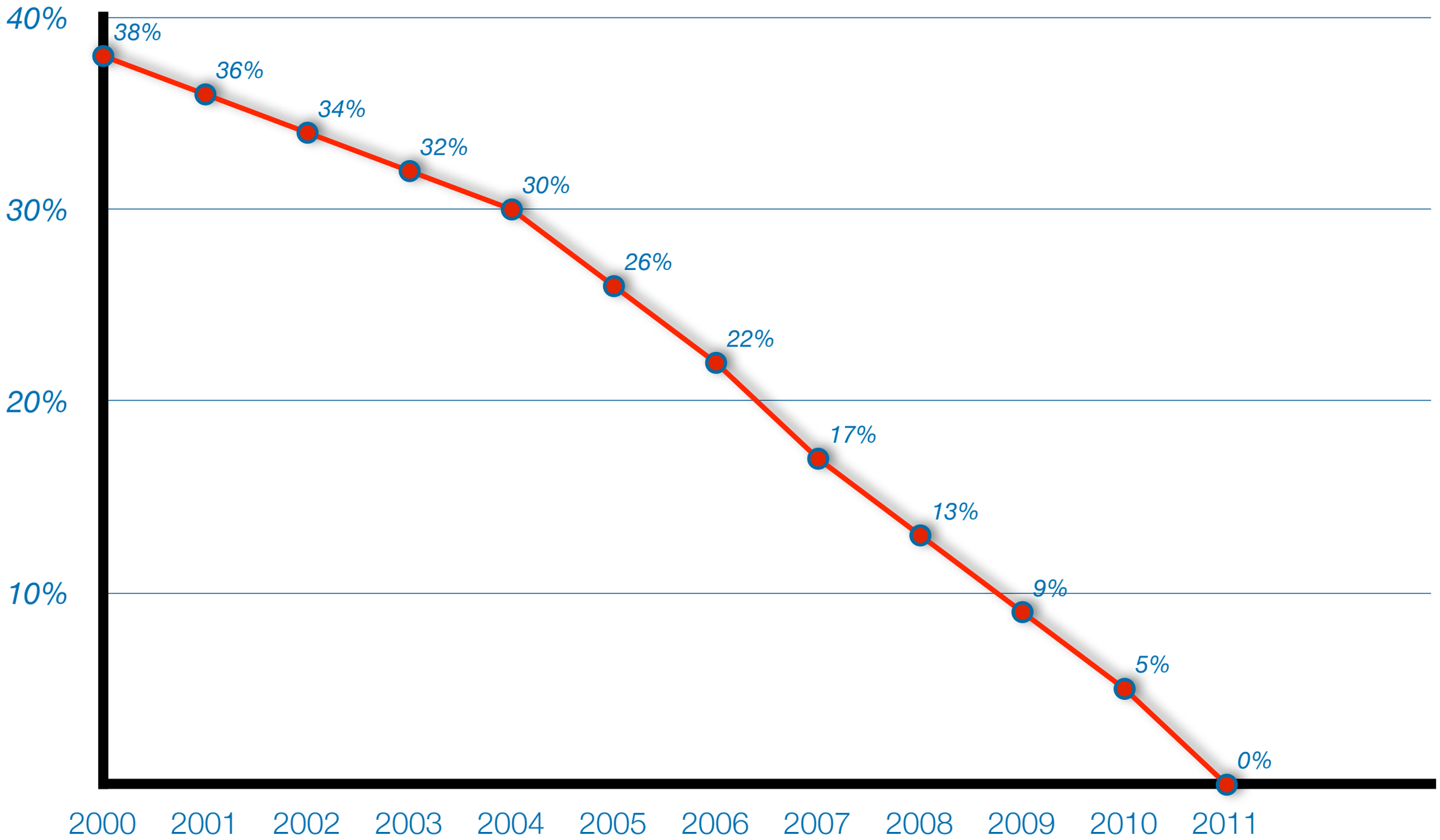
IPv4 and IPv6

current situation

Marco Hogewoning, trainer

Roundtable meeting
4 April 2011, Amsterdam (NL)

IPv4 addresses in the global pool



Reaching the next level

- The Internet has around 1.6 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

IPv4 still available. RIPE NCC continues normal operation

Final /8 policy triggered

RIPE NCC can only distribute IPv6

now

time

IANA pool exhausted

Each of the 5 RIRs received a /8

RIPE NCC reaches final /8

RIPE NCC pool exhausted

Business as usual

- 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-509)
- Until the final /8 is reached

“Run Out Fairly”

- 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

- 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

- 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

- 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!**

Questions?

IPv4 vs IPv6

RIPE NCC

Address format

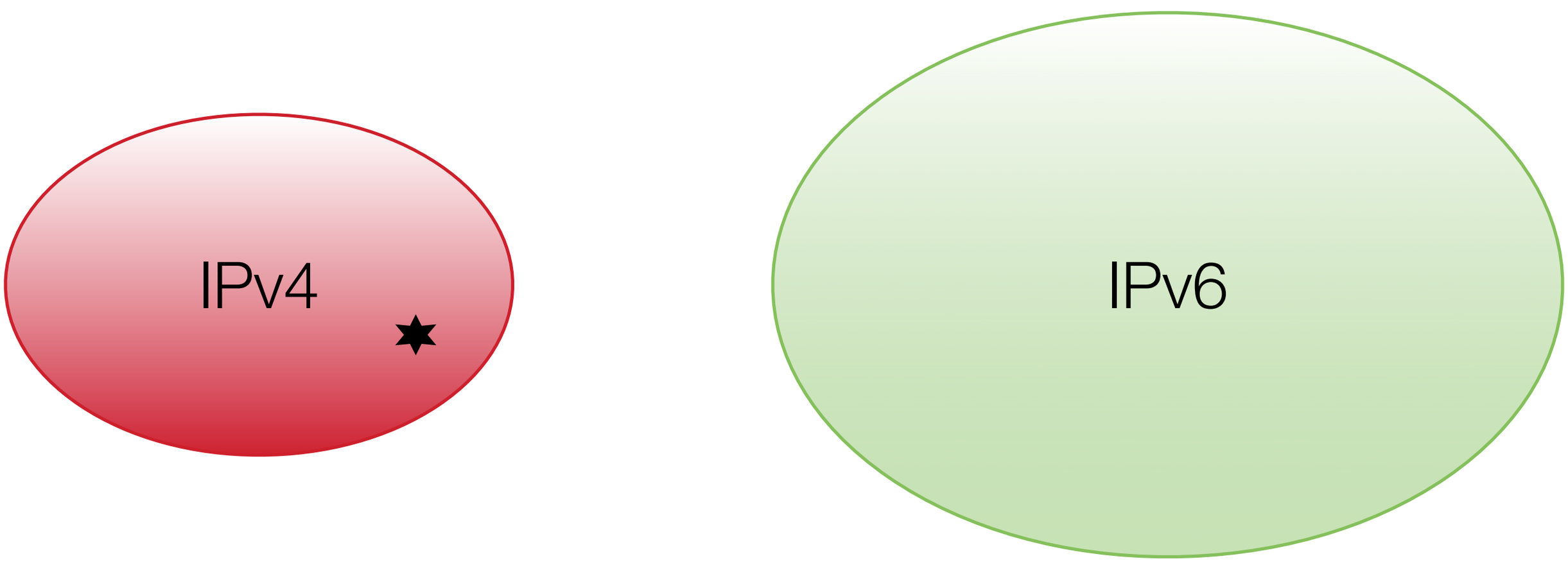
- IPv4 uses 32 bit addresses
  - ‘Dotted decimal’
  - 0.0.0.0 - 255.255.255.255
- IPv6 uses 128 bit addresses
  - Hexadecimal notation, numbers between 0 and **f**
  - Separated by colons
  - ‘2001:980:3042:2:5a55:caff:fef6:bdbf’

- **IPv4 and IPv6 are not compatible**

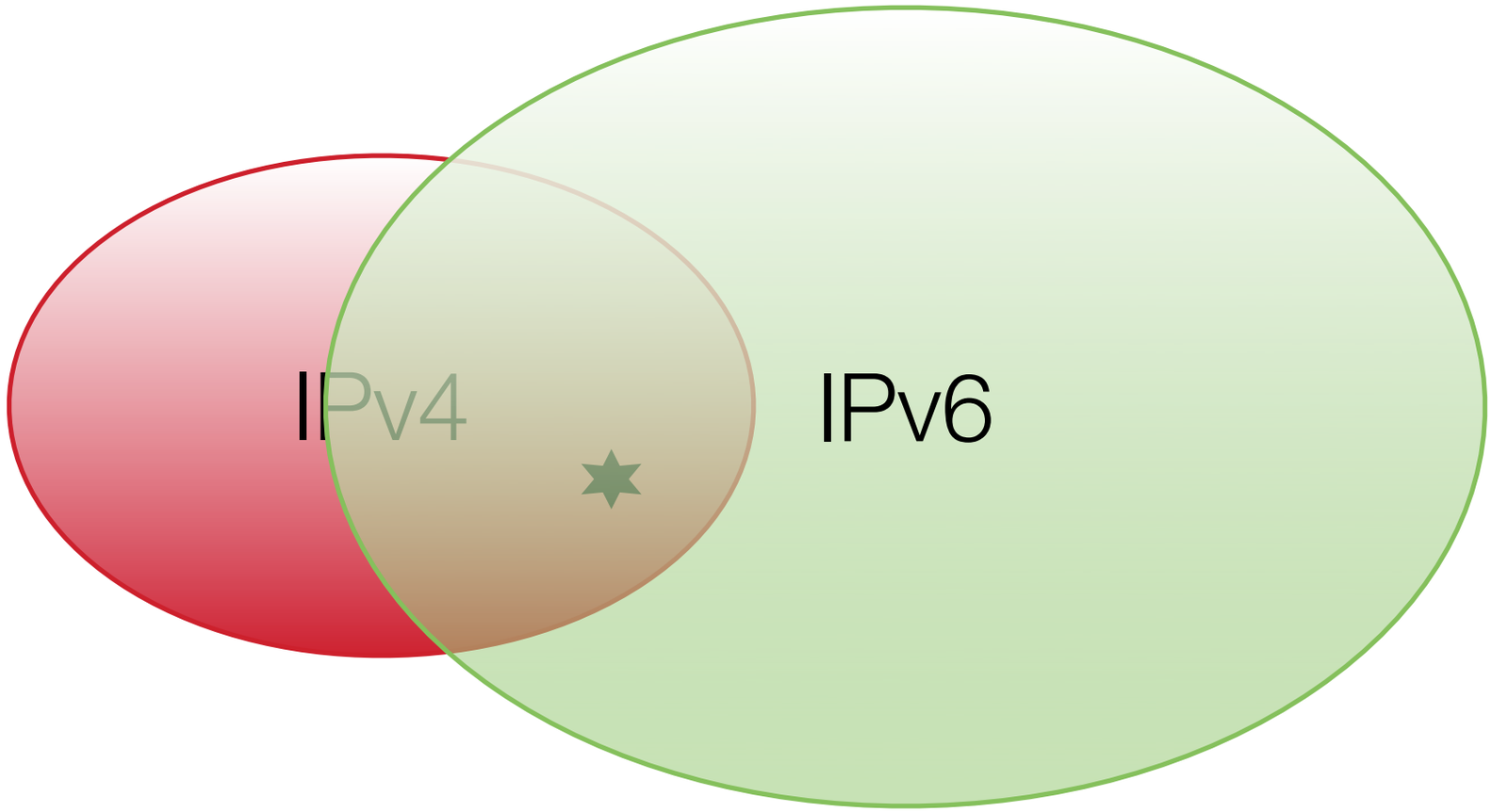
Coexistence

- 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



A perfect world



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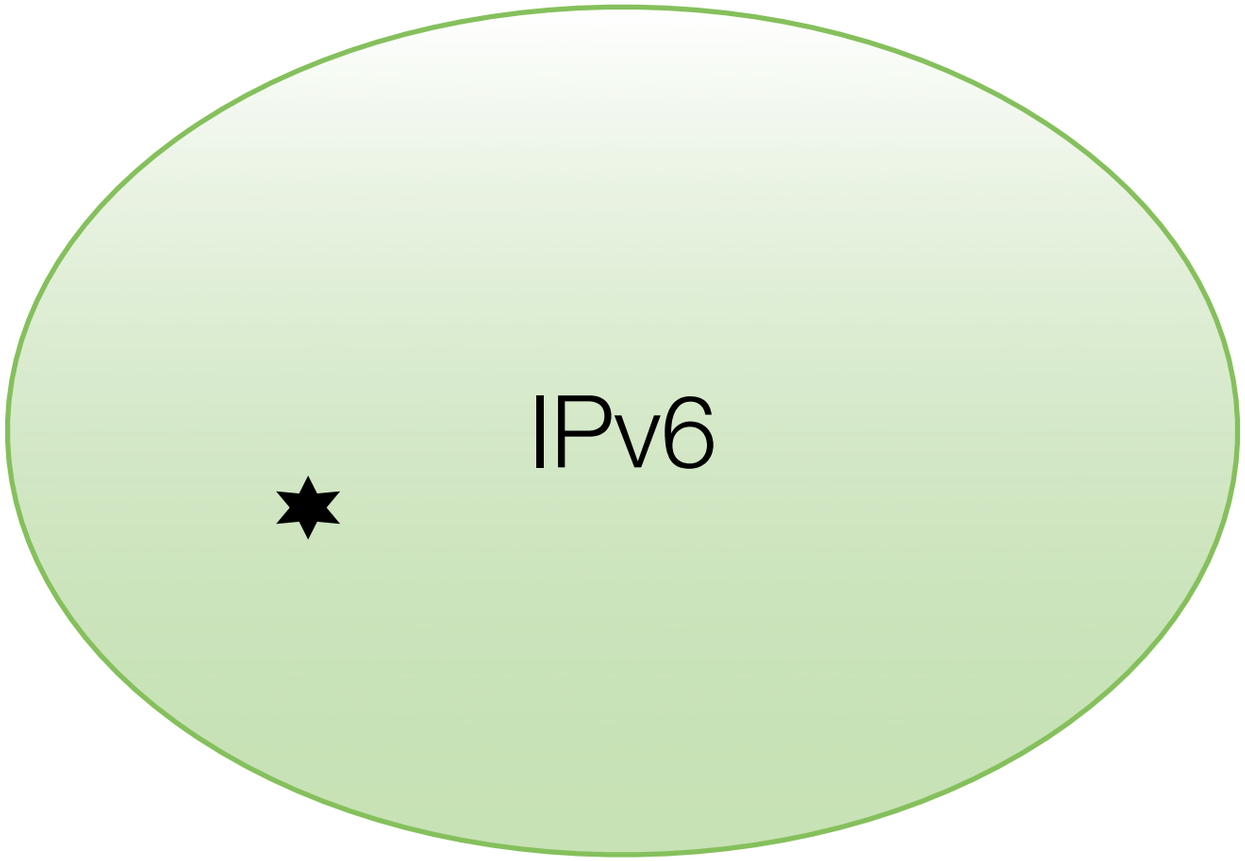
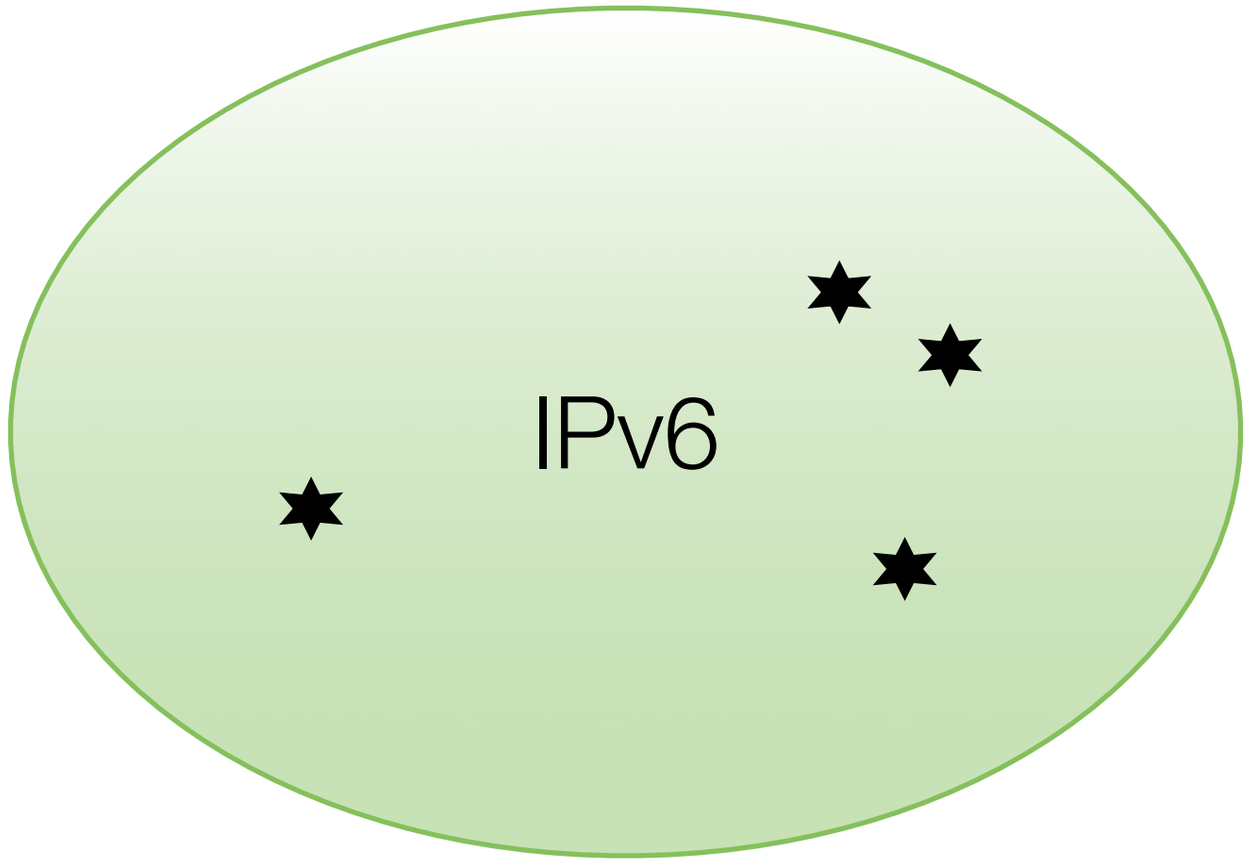


A perfect world



The plan (1995 - 2009)

- 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

- 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 ?

Questions?

Alternatives

RIPE NCC

Extending the IPv4 pool

- 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

- 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

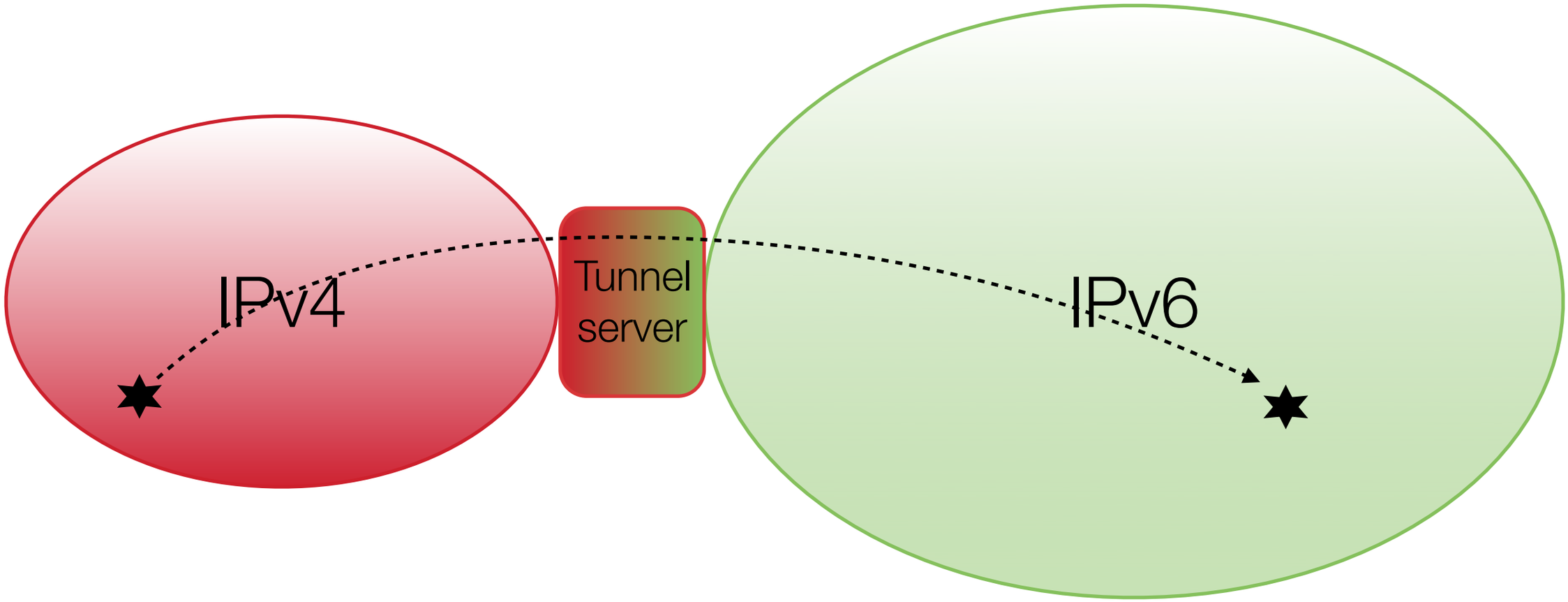
- Technical community is very active
- Countless protocols and proposals are around
  - 6in4
  - 6to4
  - 6RD
  - TSP
  - A+P
  - 4RD
  - ...etc

Transitioning techniques

- 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



Drawbacks of tunnels

- 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)

- 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

- “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!

What does this mean for you?

- Remember you are a customer
  - Same problems apply
  - Can you still reach all the data you require ?
  - Are your services still available to everybody ?
- Use your buying power
- Be sure to be future proof

Is there any impact ?

- Law enforcement:
  - Do you still know who you are after ?
  - Can your lawful Interception handle X in Y ?
  - Data retention will grow beyond imagination
- Economic effects ?
- What about that future:
  - Smart grid ?
  - Internet of things ?
  - Education ?

Questions?

IPv6 statistics

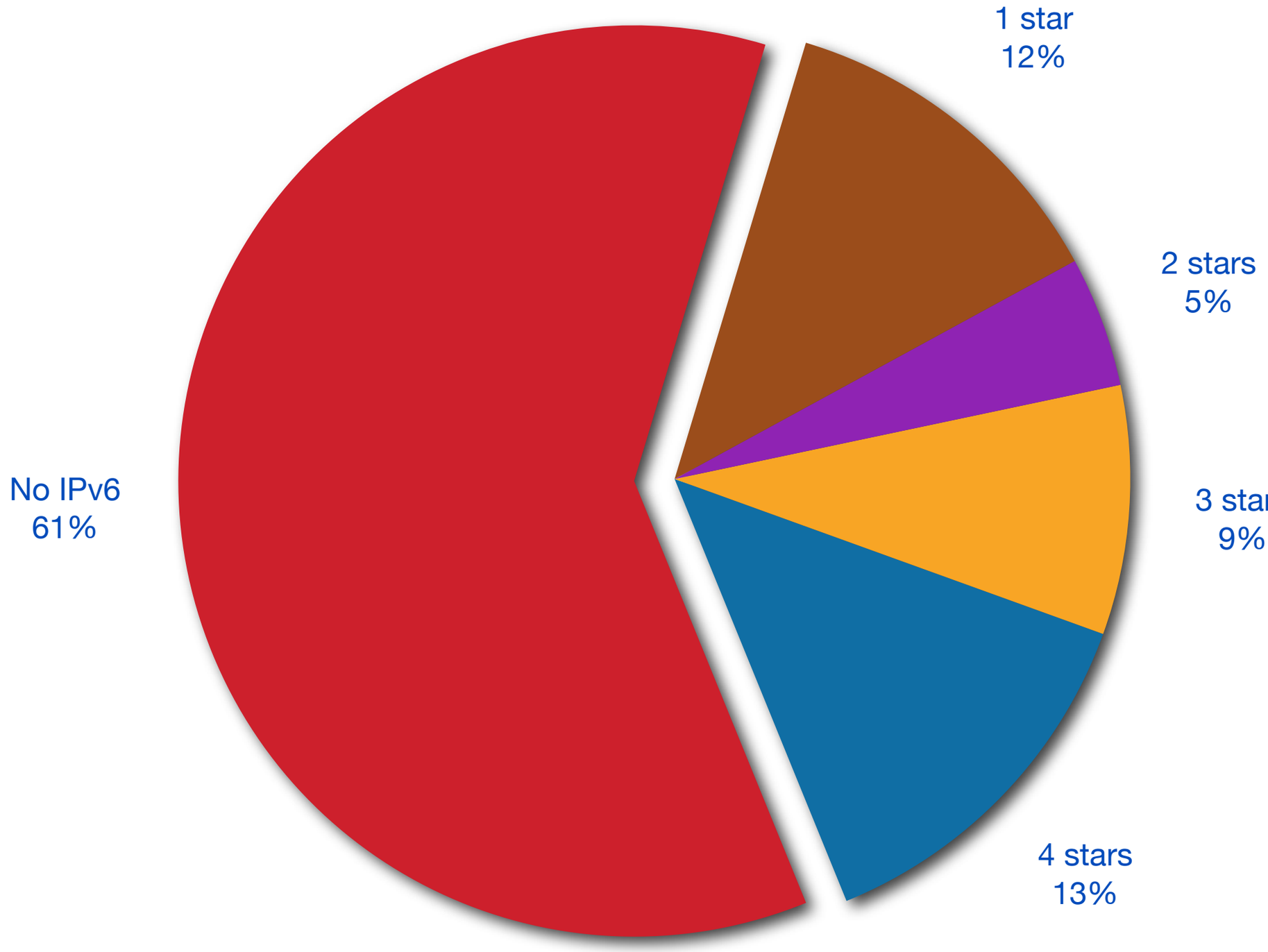
Marco Hogewoning, trainer

RIPE NCC

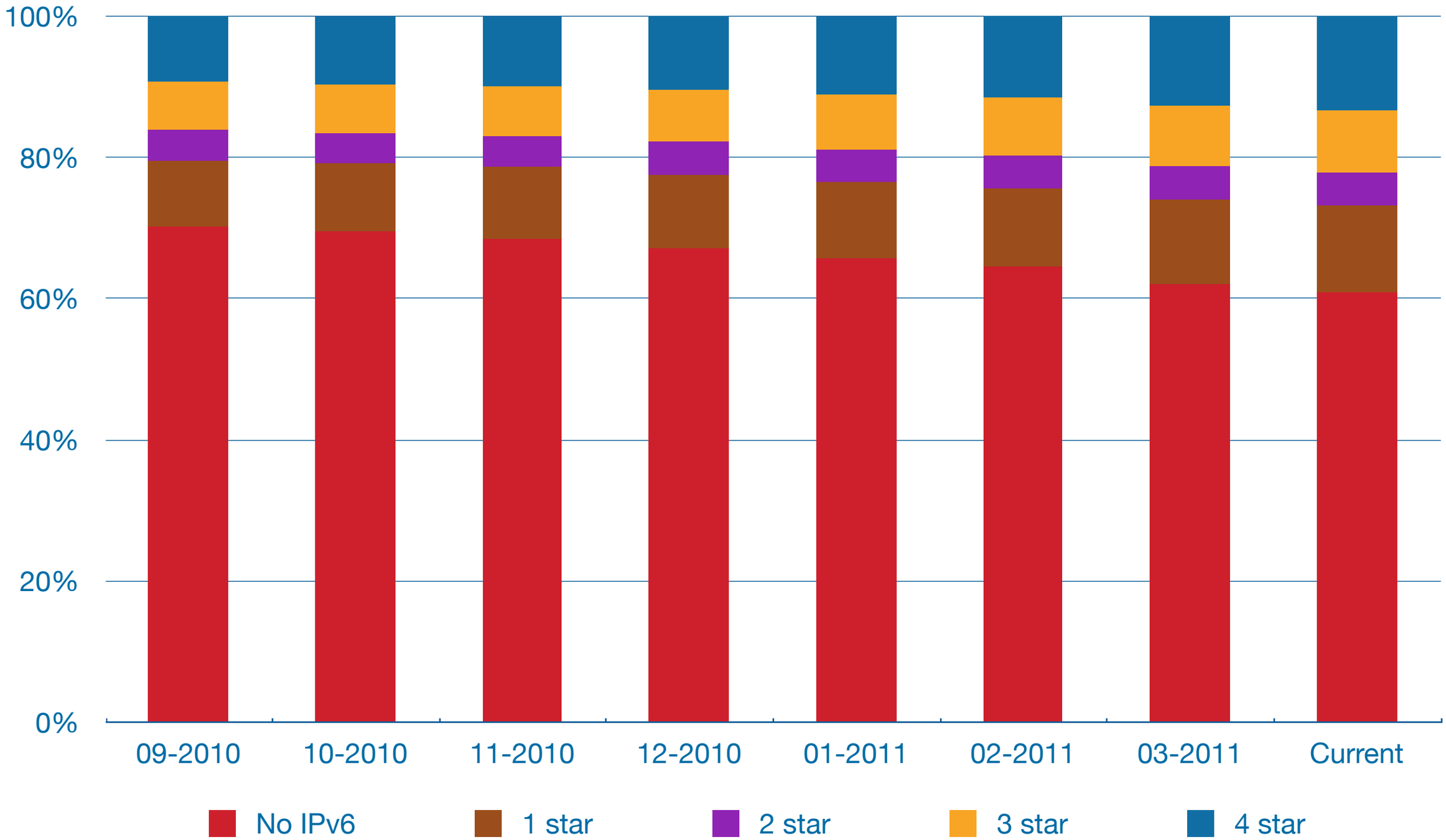
IPv6 RIPEness

- 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/

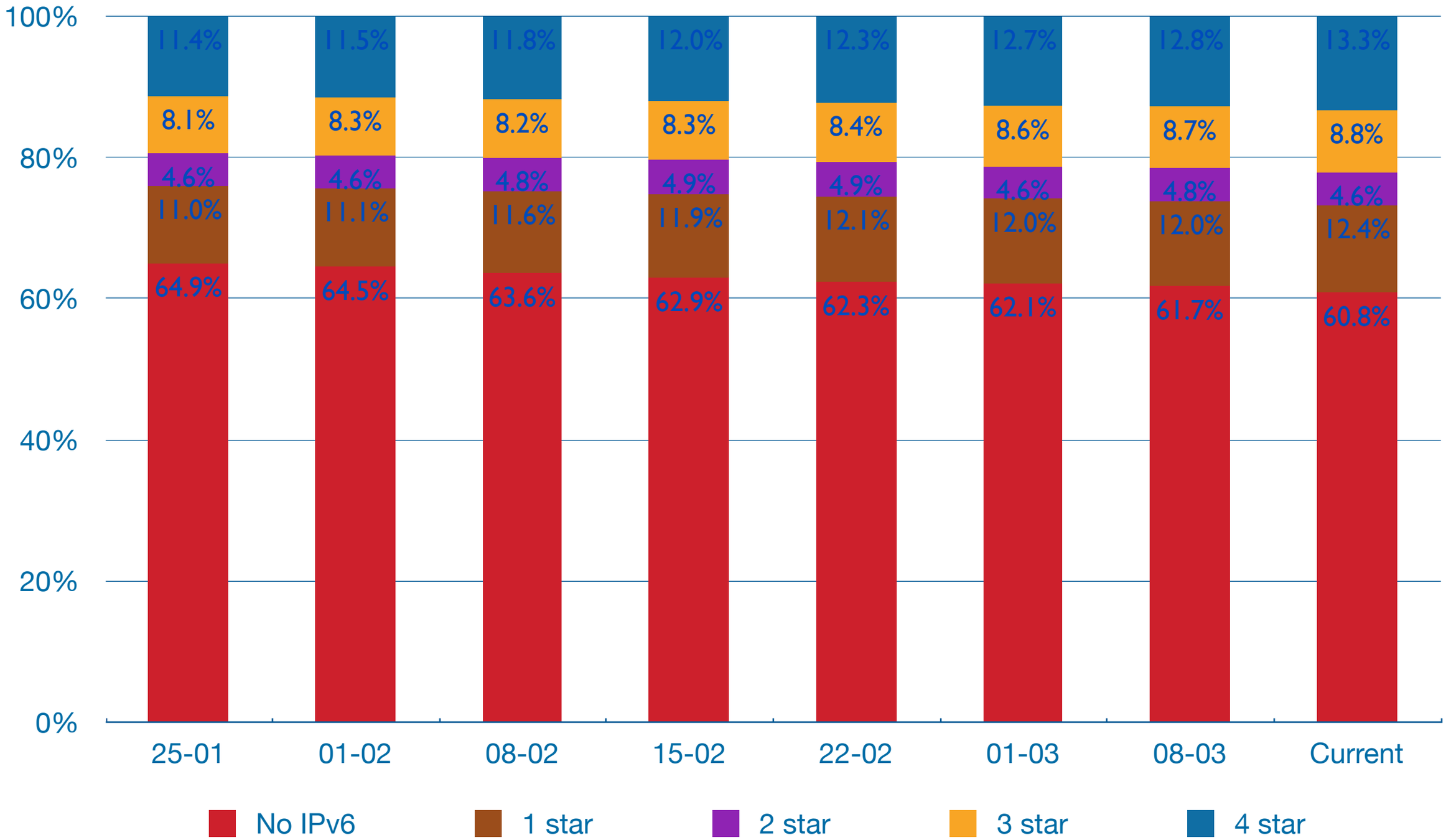
IPv6 RIPEness: 7433 LIRs



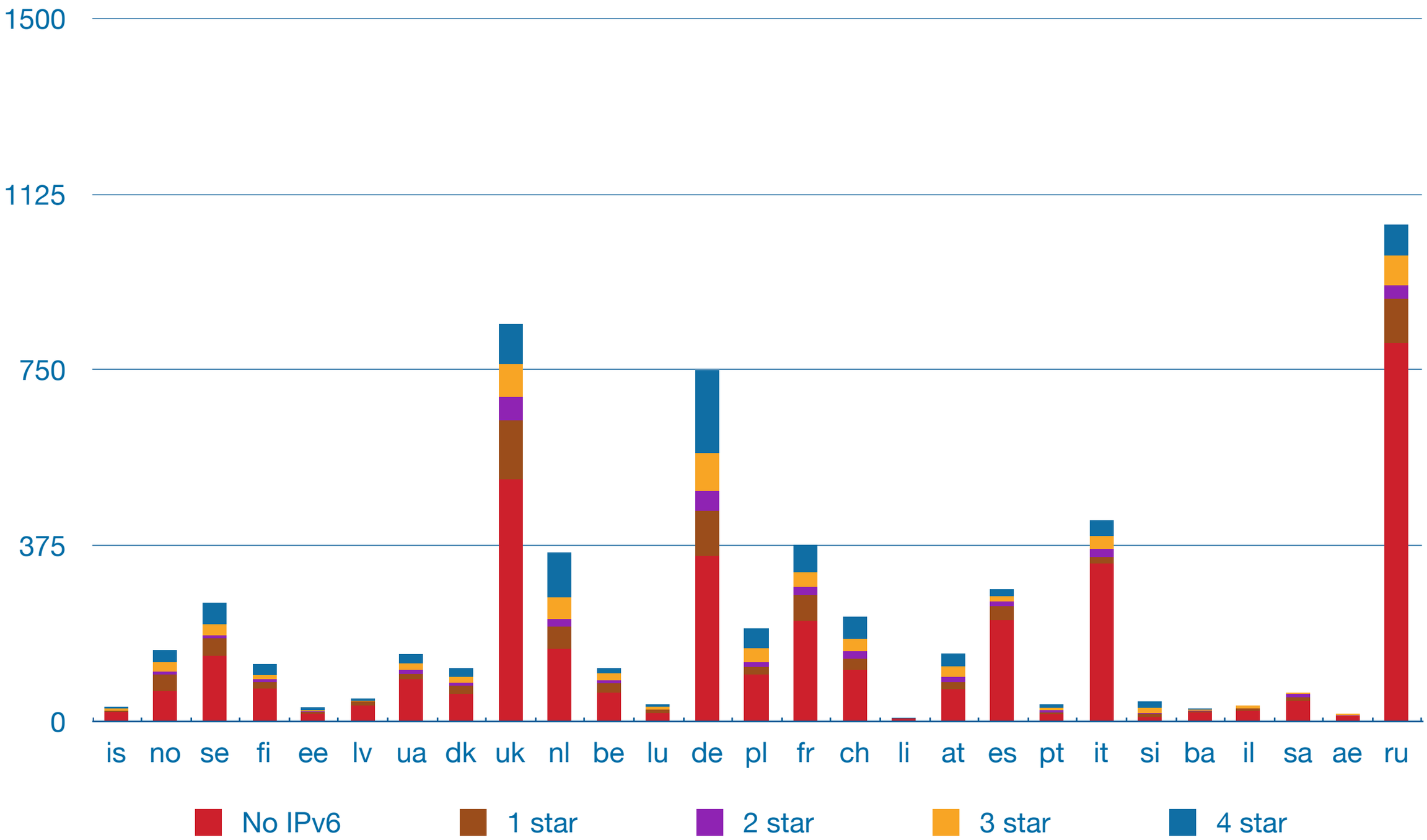
IPv6 RIPEness over time



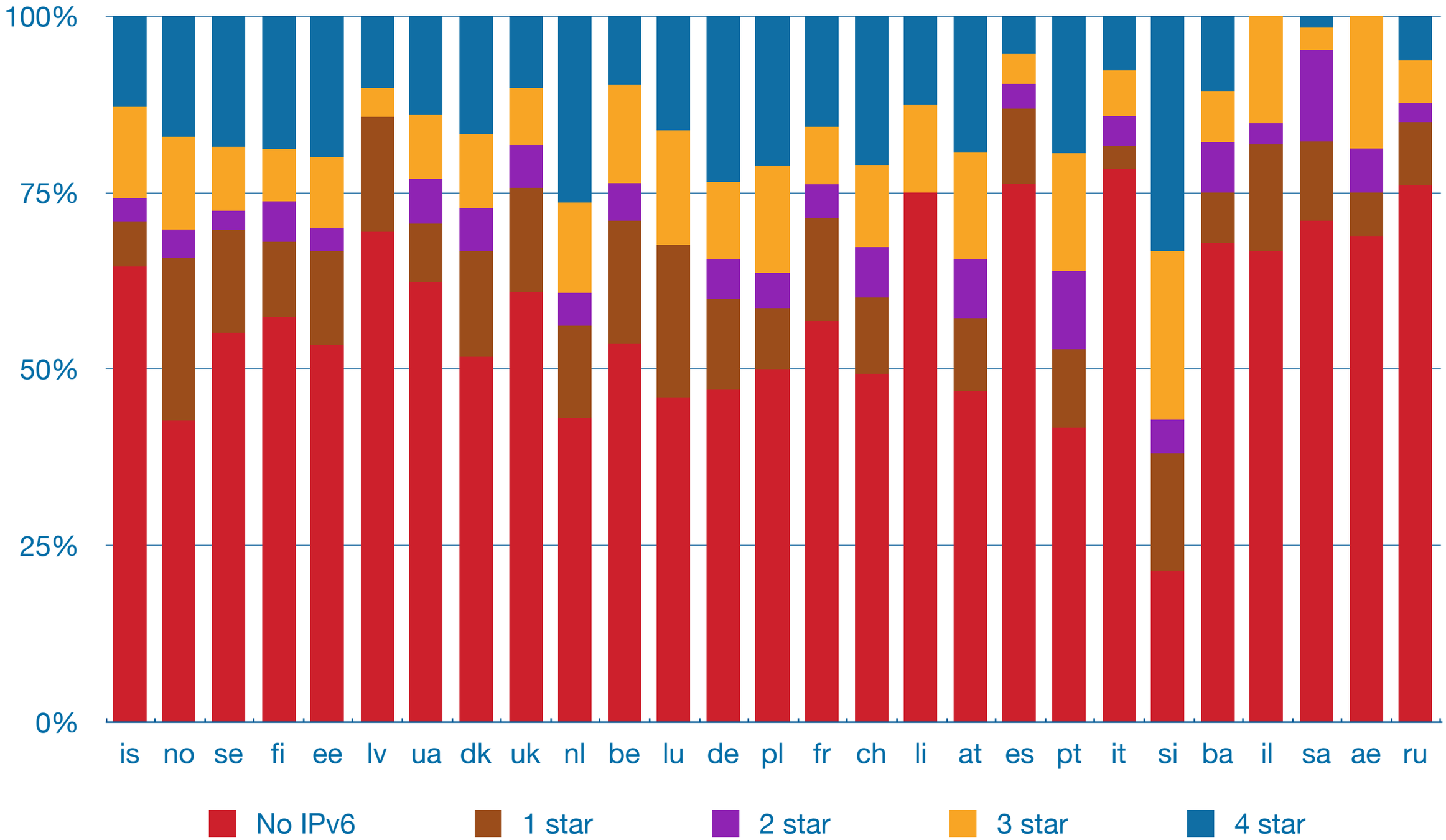
IPv6 RIPEness February 2011



IPv6 RIPEness per country



IPv6 RIPEness per country



Questions?

The End!

Край

Y Diwedd

Fí

Finis

النهاية

Соңы

Վերջ

Liðugt

Ende

Finvezh

Kінець

Konec

Kraj

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Fund

پایان

Son

Kpaj

Lõpp

Beigas

Vége

An Críoch

הסוף

Endir

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Sfârşit

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Pabaiga

Tmiem

Koniec

Fim

Amaia

Loppu