

IPv4 and IPv6 - addressing Internet infrastructure

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RIPE / RIPE NCC

RIPE ('89)

- Operators community
- Develops addressing policies
- Industry self-regulation
- Working group mailing lists
- Meetings/conferences twice a year

RIPE NCC ('92)

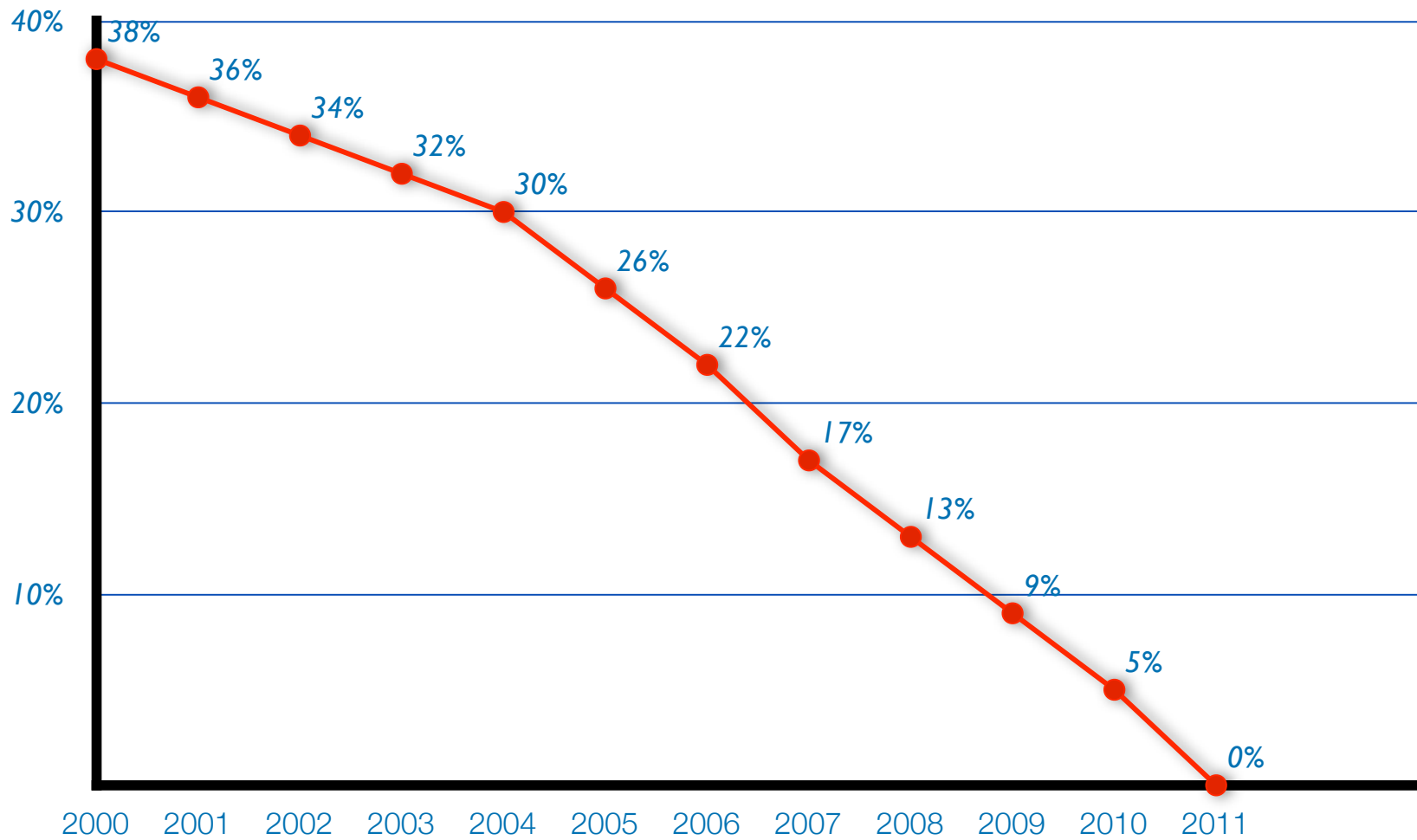
- Located in Amsterdam
- Not for profit membership organisation
- One of five RIRs - distributes IP & ASN
- Supports RIPE community



Topics:

- IPv4 Exhaustion:
 - IANA is out of IPv4 addresses since February 2011
- Policies for getting last chunks of IPv4
- Getting IPv6
- Transition from IPv4 to IPv6: statistics
 - IPv6 RIPEness in SEE region
- World IPv6 Day: 8. June 2011
- “Diving with Sharks”: IPv6 @ RIPE NCC
Regional Meeting in Dubrovnik, 6-9.9.2011

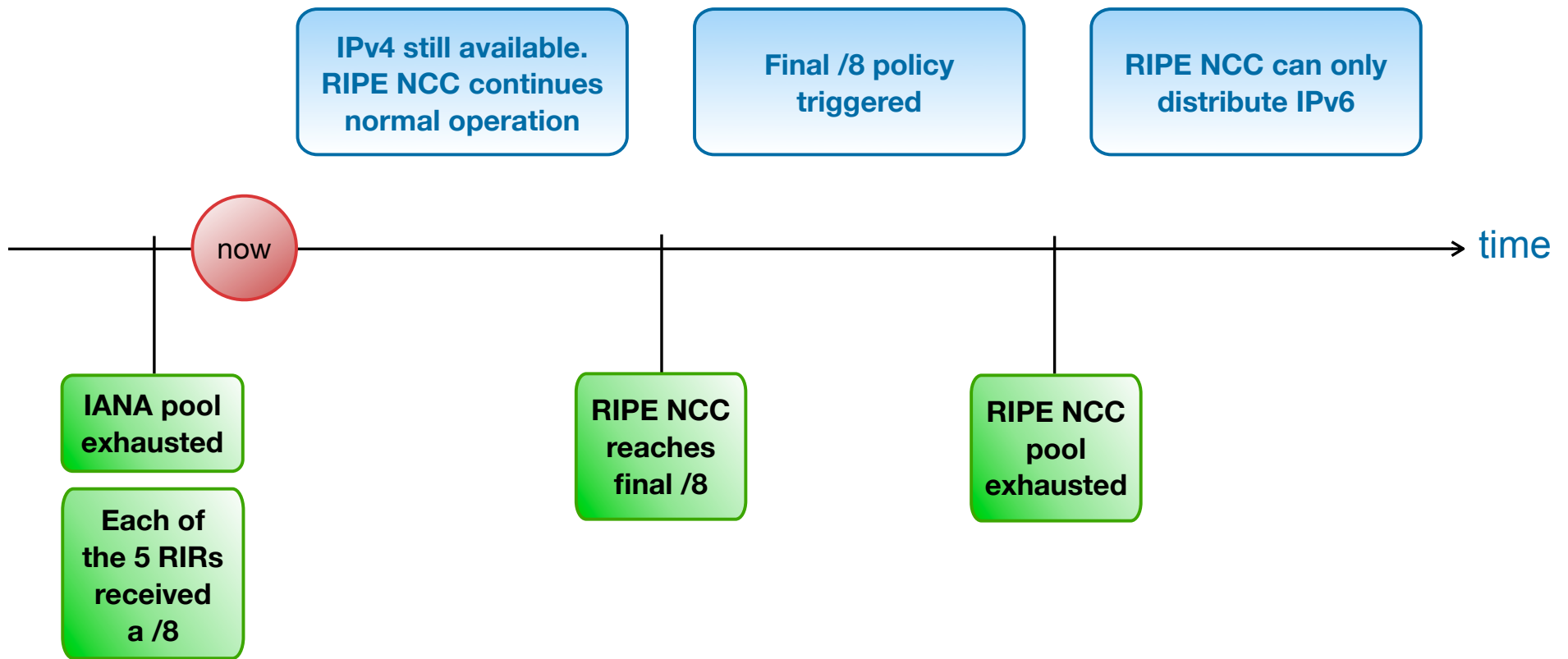
IPv4 addresses in the global pool



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



Current policy: “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

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

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

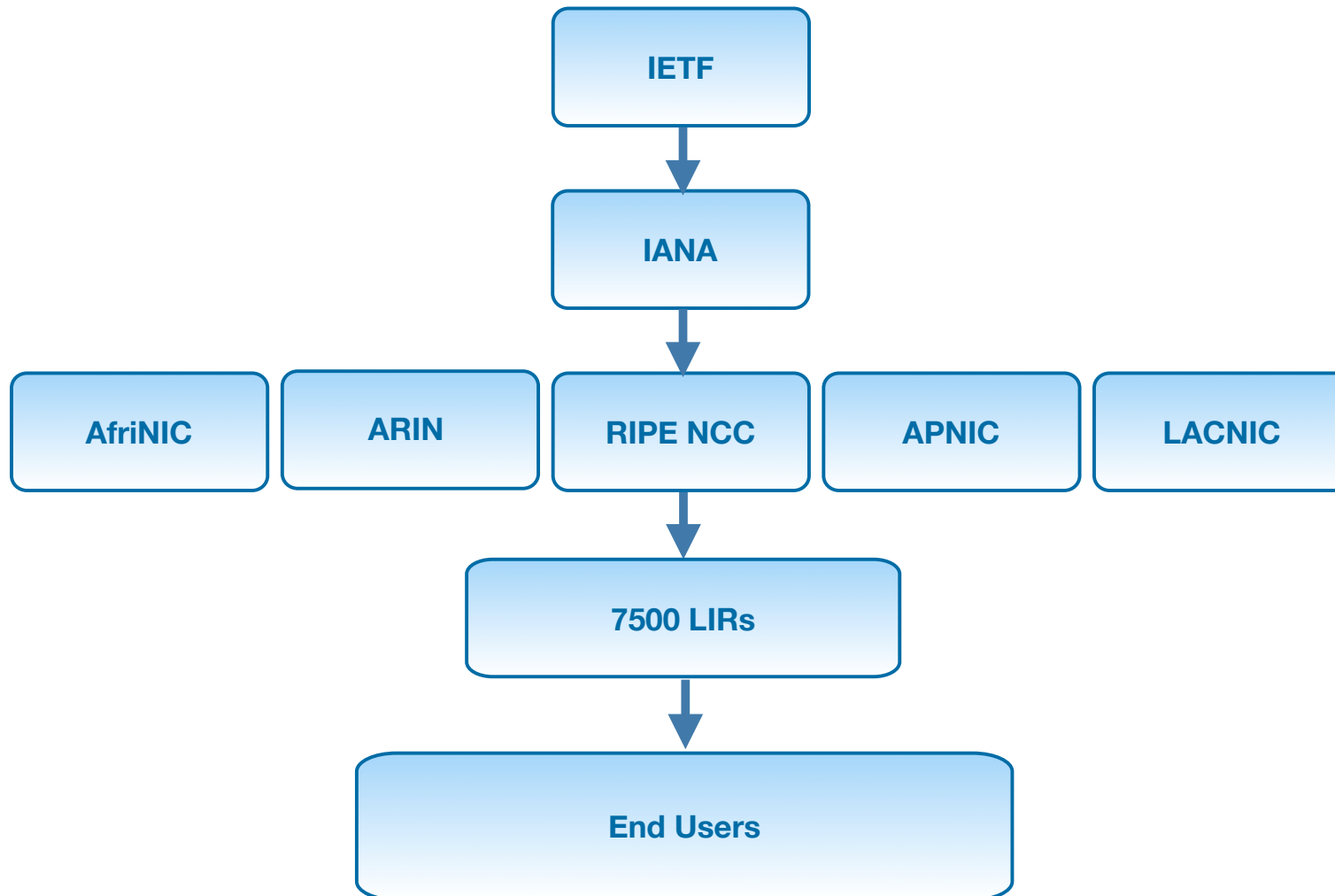
Final /8 policy

- Each LIR will be able to 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

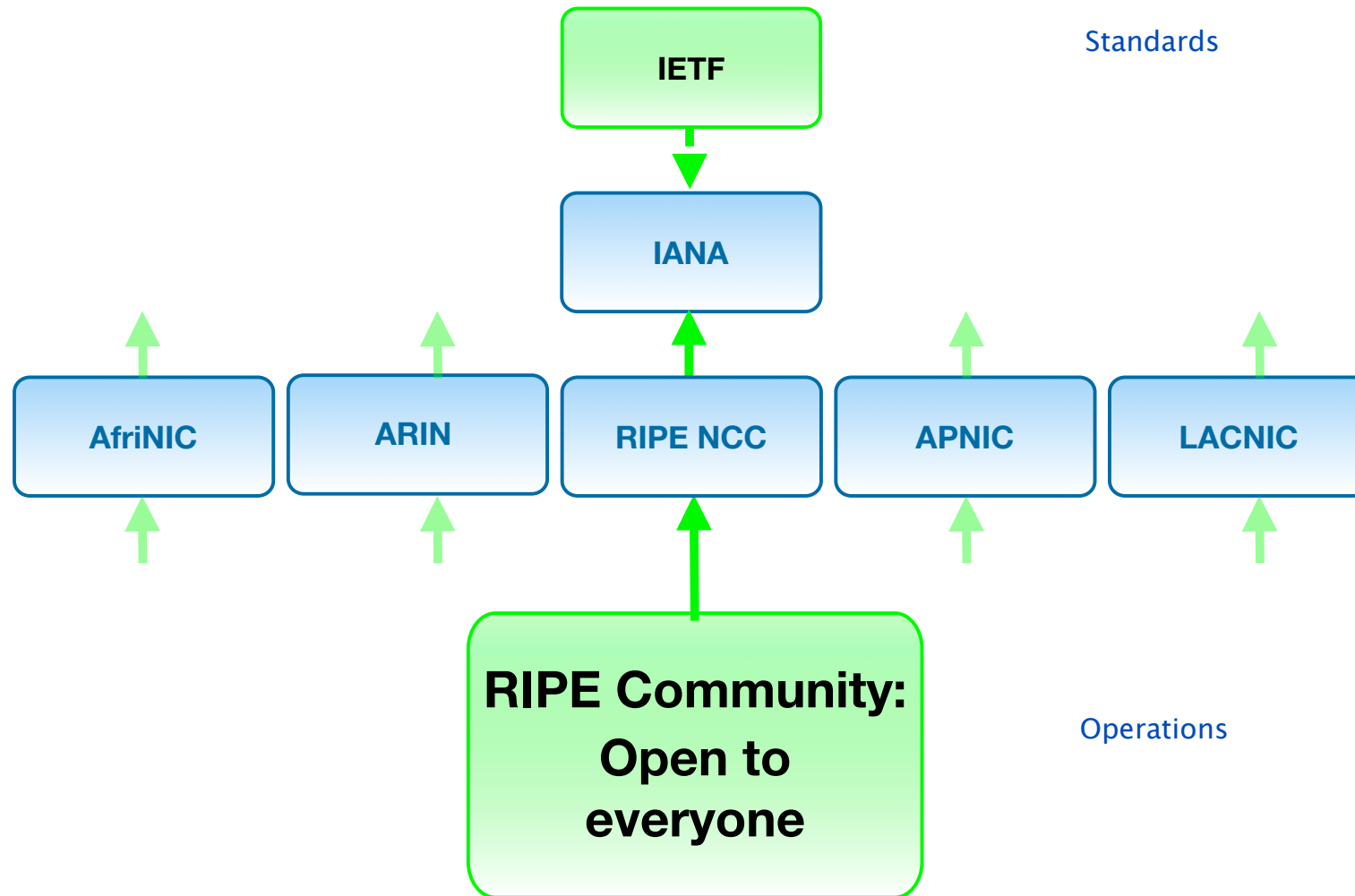
Getting IPv6



Where do all the addresses come from?



Policy process: decision making



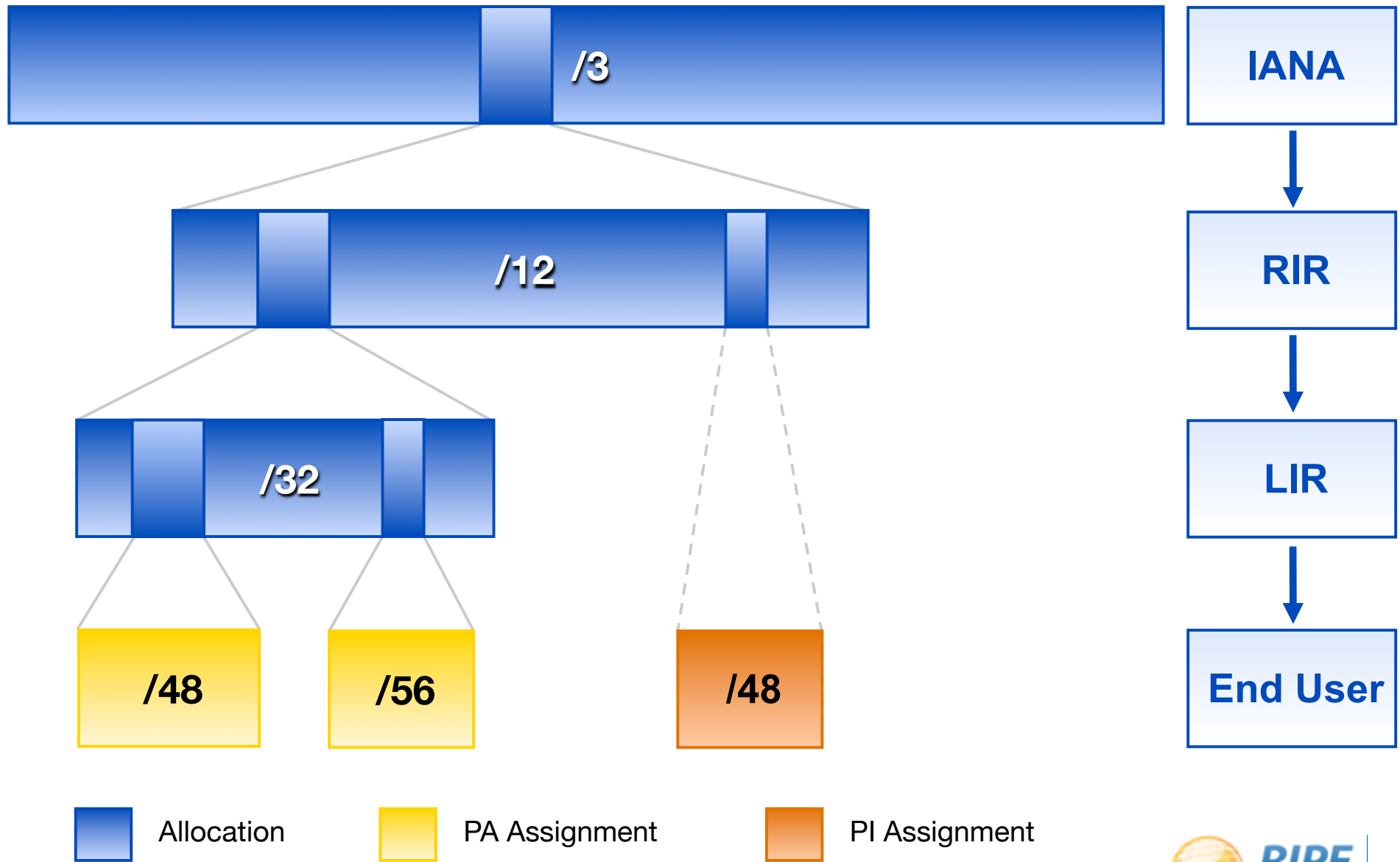
Governing principles of addressing policy

- Registration (in RIR whois databases)
 - to ensure uniqueness of Internet number resources
 - to provide contact information for users of resources
- Aggregation
 - introduction of Classless Inter Domain Routing (CIDR)
 - to provide scalable routing solution for Internet
- Conservation
 - prudent stewardship of scarce resources
 - policies to ensure fair usage
 - number resources are distributed based on need

IPv6 address basics

- IPv6 uses 128 bit addresses
 - Hexadecimal notation, numbers between 0 and f
 - Separated by colons
 - 2001:db8:3042:2:5a55:cafe:fef6:babe
- Every subnet should be a /64
 - (2⁶⁴ hosts)
 - End-site assignment of /48 has 65,536 subnets of /64
 - Allocation of /32 has 65,536 assignments of /48s

IPv6 Address Distribution



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
- Allocation size is based on customer numbers and growth

What does the first IPv6 allocation cost?

FREE

- for all
- pending General Meeting decision

or:

FREE

- for approximately 97% of the LIRs
- more points, but not higher category!

Getting IPv6 PI address space

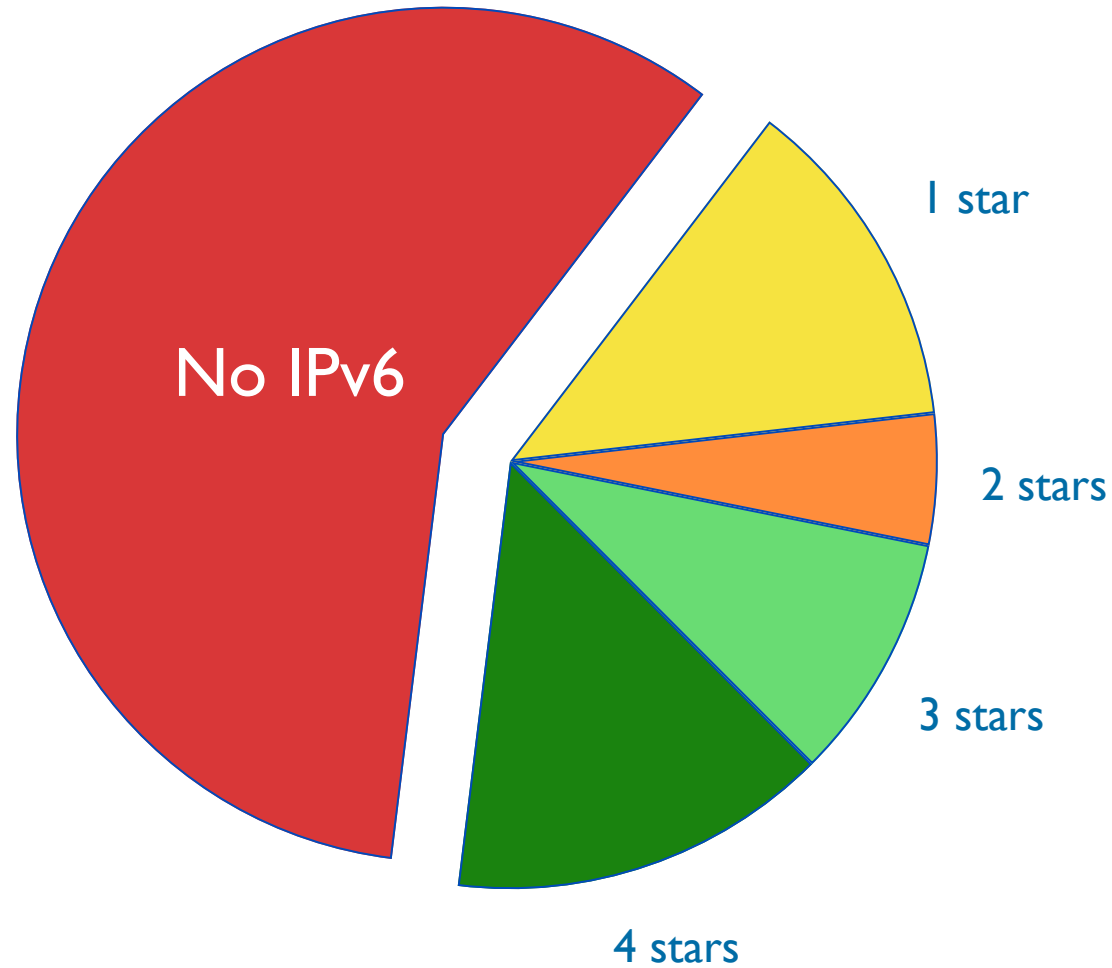
- To qualify, an organisation must:
 - Demonstrate it will multihome
 - Meet the contractual requirements for provider independent resources
 - Standard yearly fee for independent resources applies (50 Euro yearly)
- Minimum assignment size /48
- PI space can not be used for sub-assignment

IPv6 statistics

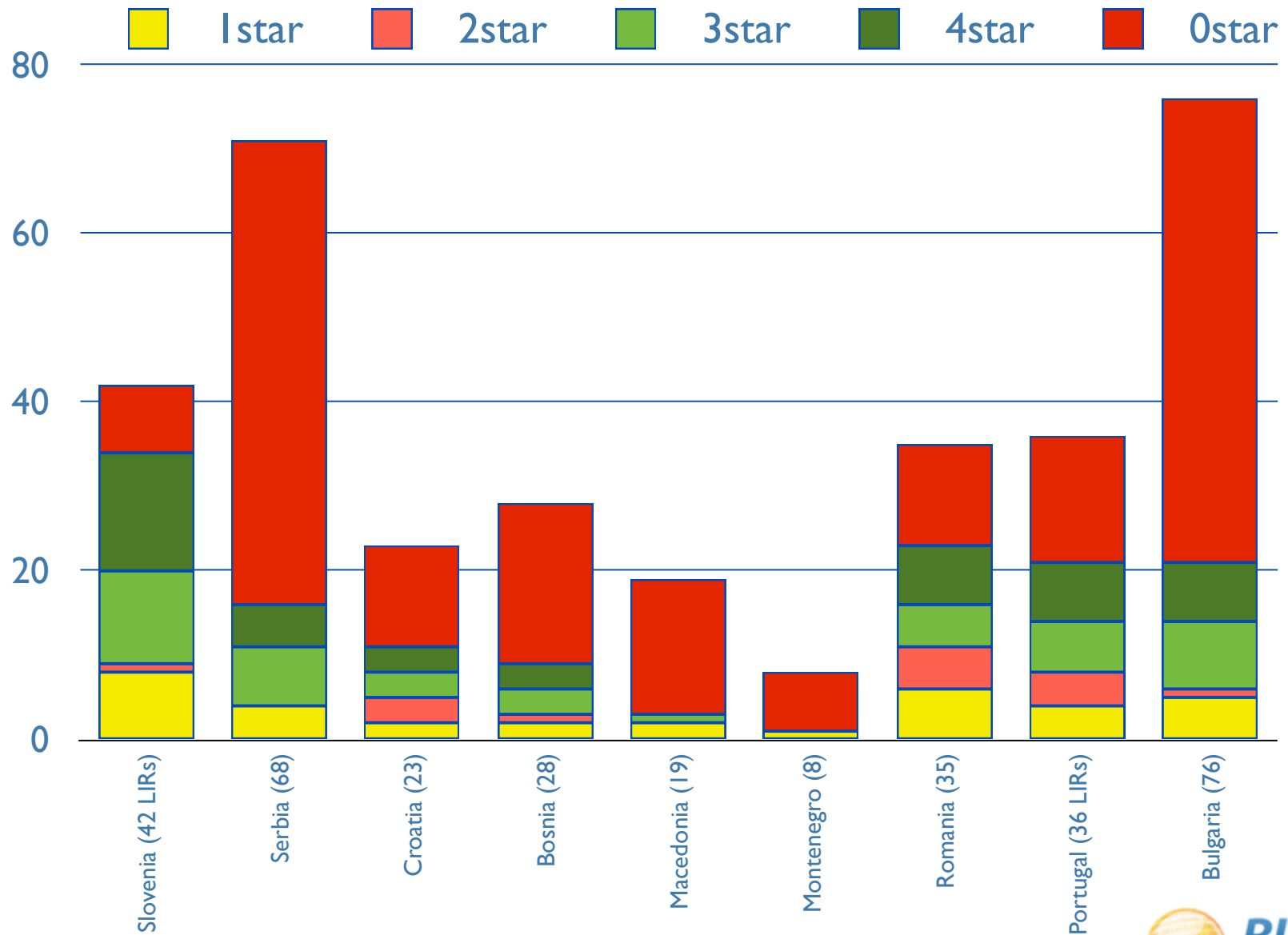
IPv6 Ripeness

- 1* = IPv6 allocation or PI assignment
- More stars:
 - visible in RIS
 - route6 object
 - reverse DNS
- All 4* = IPv6 “ripe”
- Zero stars - no IPv6
- Total number of LIRs per country
 - in brackets next to country name on X axes

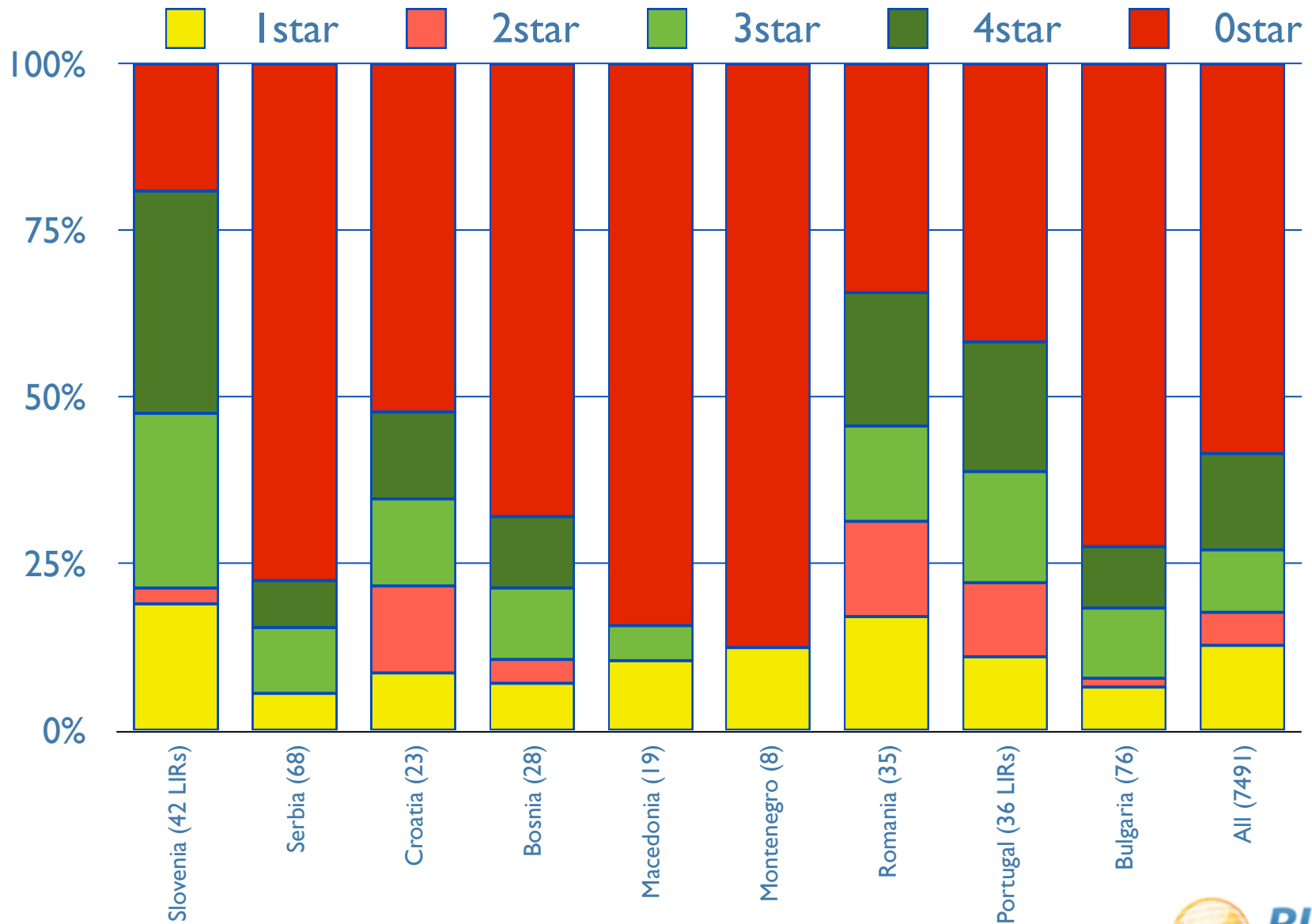
IPv6 RIPv6ness: 7491 LIRs (24 May 2011)



IPv6 RIPEness – countries (24 May 2011)



IPv6 RIPv6ness – relative (24 May 2011)



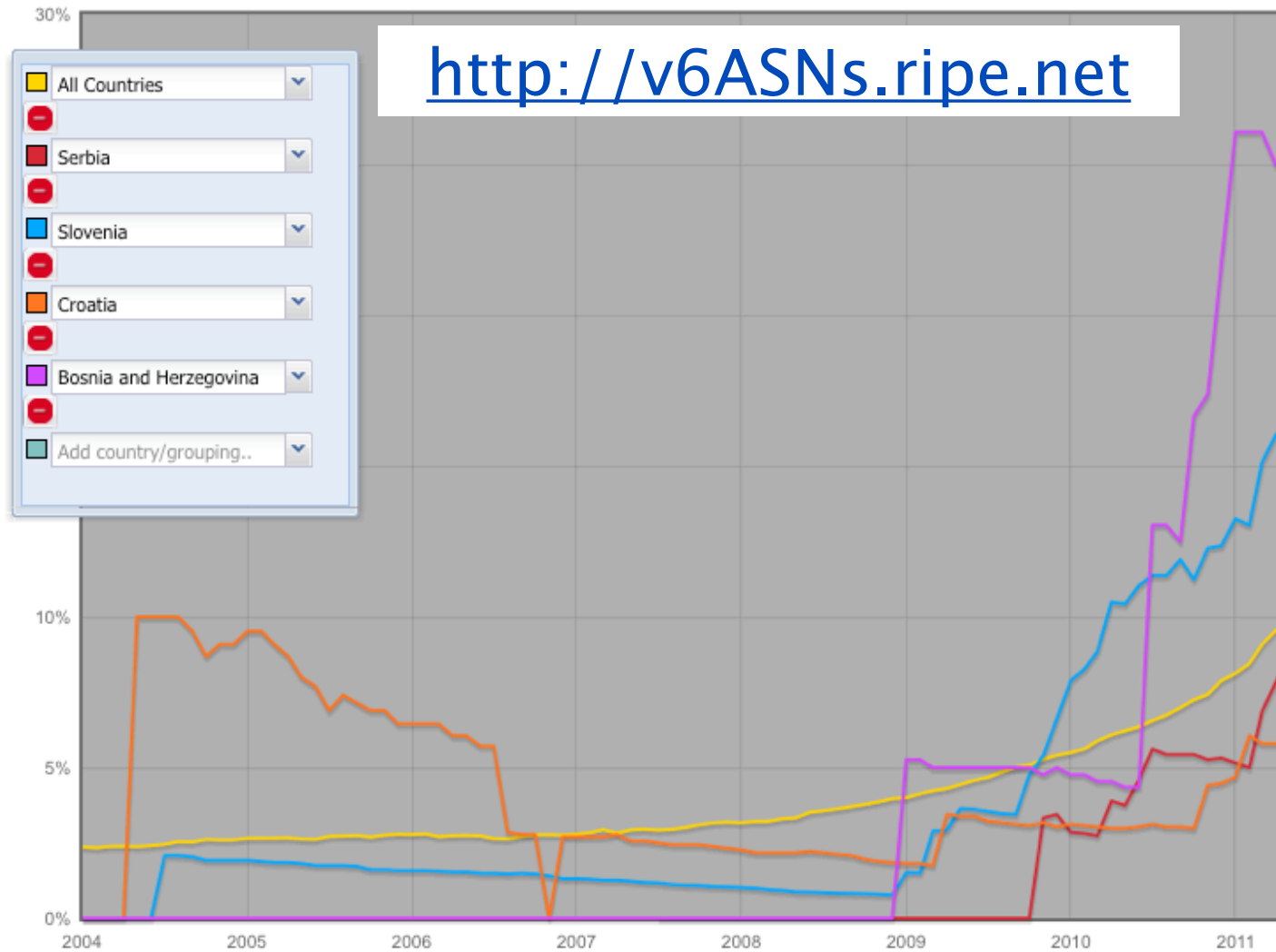
IPv6 enabled ASes in global routing



IPv6 Enabled Networks

permalink: http://v6asns.ripe.net/v/6.csv?s=_ALL;s=RS;s=SI;s=HR;s=BA

This graph shows the percentage of networks (ASes) that announce an IPv6 prefix for a specified list of countries or groups of countries



Top-5 IPv6 deployment challenges

Top-5 IPv6 deployment challenges

1. IPv4 and IPv6 are incompatible
2. The equipment is not IPv6 ready
3. There is no customer demand yet
4. There is no IPv6 content yet
5. There is still time to wait and do it later...

Problem: IPv4 and IPv6 are incompatible

- Solutions:
- While you can, build **dual-stack** networks
- Many translation and tunneling mechanisms exist
 - NAT64 / NAT-PT
 - 6in4, 6to4, Teredo, 6RD, TSP, A+P, 4RD...

Problem: The equipment is not IPv6 ready

- Solutions:

- demand IPv6 feature-parity from your vendors
- Requirements For IPv6 in ICT Equipment: RIPE-501
- list & review of home-routers that support IPv6:
 - <https://labs.ripe.net/Members/mirjam/ipv6-cpe-surveys/>
- “IPv6 Ready” program: <http://www.ipv6ready.org/>

Problems: no customers / no content

- Solutions:
 - customer education
 - killer-app?

- Use “World IPv6 Day” for testing!

There is still time to wait and do it later...

- Problems:
 - There is no business case
 - It costs money to implement changes
- Temporary solutions:
 - “We will use more NAT”: CGN, LSN, NAT444...
- Solution: think ahead! Make future-proof decisions!

World IPv6 Day



World IPv6 Day

- 8 June 2011
- Initiated by ISOC
- 0:00 GMT - 23:59 GMT
- Top 500 websites
 - Google, Facebook, Yahoo...
 - and you?
- Great test opportunity



RIPE NCC and World IPv6 Day

- RIPE NCC Measurements

- Measuring connectivity to World IPv6 Day participants
- Testing connectivity and performance using TTM
- Monitor performance of 6to4 versus native IPv6
- <http://ipv6eyechart.ripe.net>

- Coordinated events

- Amsterdam
- Moscow



- Live reports on <http://www.ripe.net/worldipv6day>

Useful IPv6 links

Websites:

- <http://IPv6ActNow.org>
- <http://www.getipv6.info>
- <http://datatracker.ietf.org/wg/v6ops/>
- <http://www.ripe.net/ripe/docs/ripe-501.html>

Mailing lists:

- <http://lists.cluenet.de/mailman/listinfo/ipv6-ops>
- <http://www.ripe.net/mailman/listinfo/ipv6-wg>

Implications of IPv4 / IPv6 transition for Internet Governance

IPv4, IPv6 & Internet Governance?

- IPv4 addresses trading?
- Creating a new digital divide?
- Governments and regulators involvement in encouraging / demanding IPv6 deployment?
- Consumer choice?
- RPKI / SIDR: resource certification & secure routing
- **Please, take part in RIPE Policy Development Process and IETF standards development!**

IPv4/IPv6 in S.E.E. region: 6-9.9. Dubrovnik

- RIPE NCC Regional Meeting:
 - <http://ripe.net/dubrovnik-2011>
- Tutorials & hands-on workshops, presentations...
 - IPv4/IPv6 Transition Mechanisms
 - IPv6 in Microsoft Environment
 - Basic & advanced BGP routing for IPv6
 - IPv6 basics
- Hosted by CarNET
- **Free of charge!**