Introduction to IP Addressing and Regional Internet Registries

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Content

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  - Who we are and what we do
- The Regional Internet Registry System
  - How IP addresses are distributed
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The RIPE NCC

RIPE NCC

About the RIPE NCC

- Established in 1992 by the RIPE community
  - Initially part of the academic network association
  - Since 1997 a membership association under Dutch law
  - Not for profit, independent, neutral, open
  - Main offices in Amsterdam; staff in Dubai and Moscow
- Funded by the membership
  - 11,500 members from 76 countries
  - Initially mostly ISPs and universities
  - Now also traditional industries, small Internet companies
- One of five Regional Internet Registries

RIPE NCC Activities

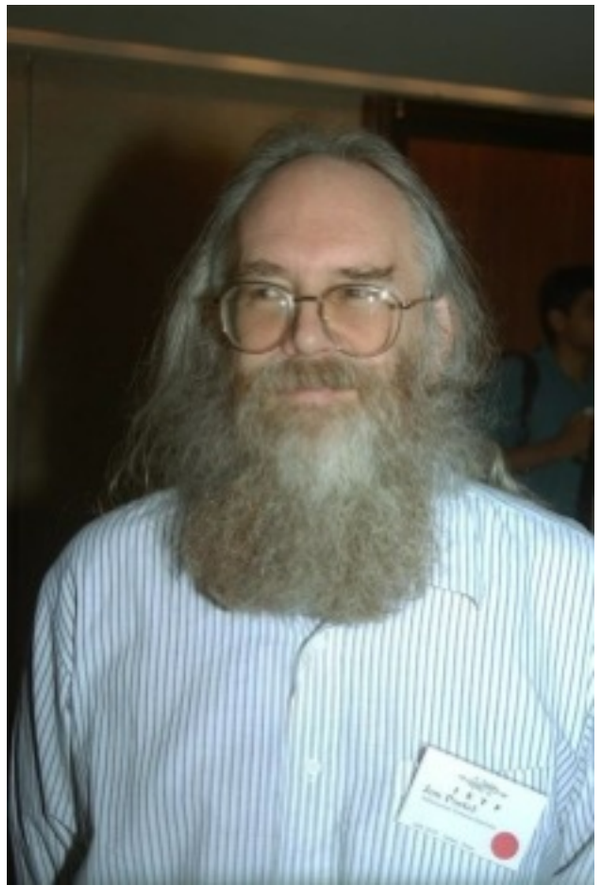
- Member services
  - Resource distribution (IPv4, IPv6, ASNs)
  - Resource certification
  - Trainings
- Public services
  - RIPE Database
  - Reverse DNS
  - Operating K-root server
  - Operator tools
  - Data sharing
  - Open meetings

The Internet Registry System

RIPE NCC

How it all Started: The IETF

- Internet Engineering Task Force
  - Not-for-profit, open to anybody
  - Builds technical Internet standards and protocols
    - BGP, DNS, traceroute, IP, SIP, DNSSEC, IPSEC, ..
- Standards are defined in RFC documents
- The IETF standardised TCP/IP
  - As part of that, need for registration arose
  - Therefore IETF standardised registration model
  - Defined in RFC1466 in May 1993



Jon Postel

(1943-1998)

“The Internet Assigned Numbers Authority”

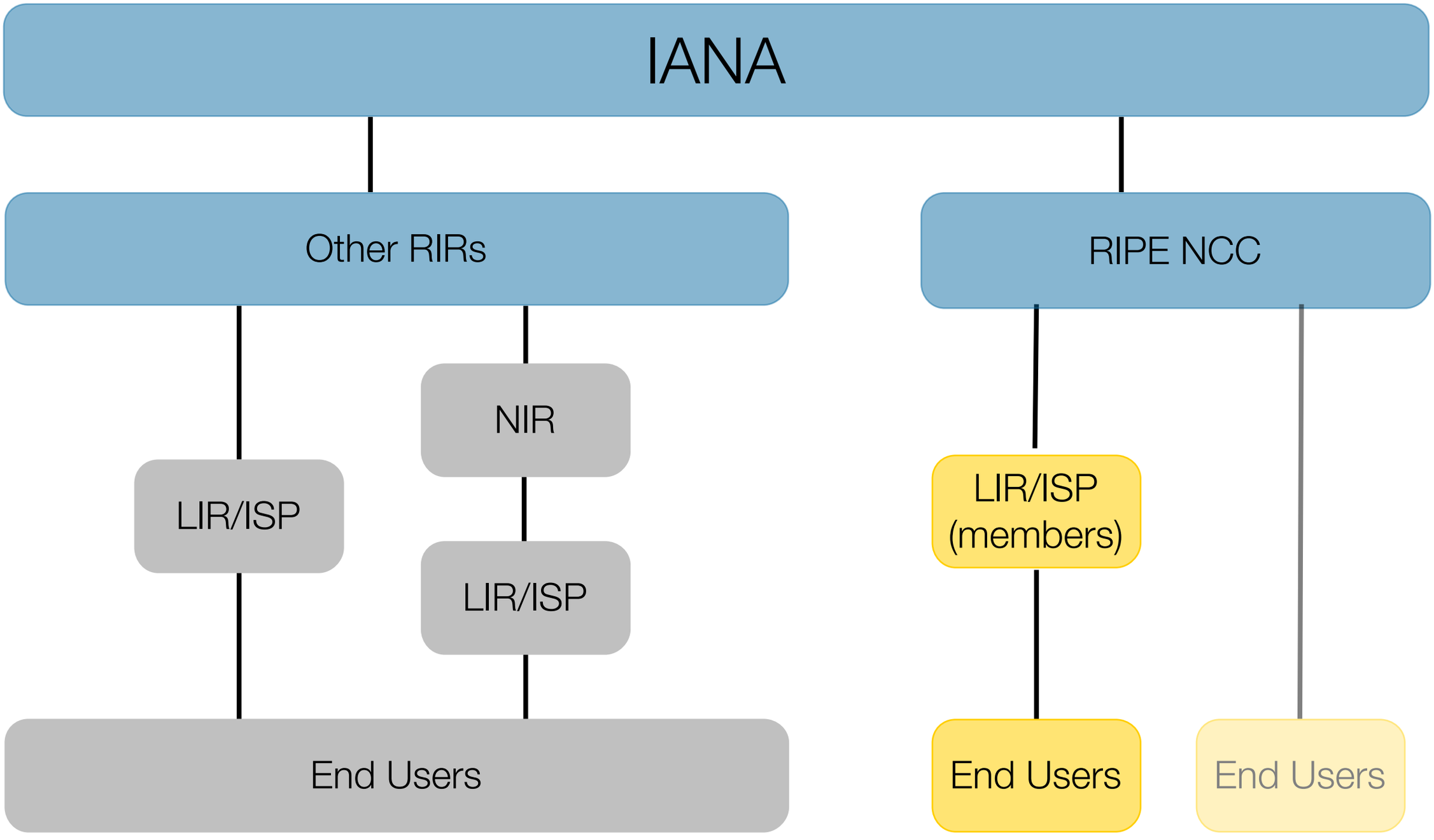
The IANA IPv4 Registry

Prefix	Designation	Date	WHOIS	RDAP	Status [1]	Note
000/8	IANA - Local Identification	1981-09			RESERVED	[2]
001/8	APNIC	2010-01	whois.apnic.net		ALLOCATED	
002/8	RIPE NCC	2009-09	whois.ripe.net		ALLOCATED	
003/8	General Electric Company	1994-05	whois.arin.net		LEGACY	
004/8	Level 3 Communications, Inc.	1992-12	whois.arin.net		LEGACY	
005/8	RIPE NCC	2010-11	whois.ripe.net		ALLOCATED	
006/8	Army Information Systems Center	1994-02	whois.arin.net		LEGACY	

088/8	RIPE NCC	2004-04	whois.ripe.net	ALLOCATED
089/8	RIPE NCC	2005-06	whois.ripe.net	ALLOCATED
090/8	RIPE NCC	2005-06	whois.ripe.net	ALLOCATED
091/8	RIPE NCC	2005-06	whois.ripe.net	ALLOCATED
092/8	RIPE NCC	2007-03	whois.ripe.net	ALLOCATED
093/8	RIPE NCC	2007-03	whois.ripe.net	ALLOCATED
094/8	RIPE NCC	2007-07	whois.ripe.net	ALLOCATED
095/8	RIPE NCC	2007-07	whois.ripe.net	ALLOCATED
096/8	ARIN	2006-10	whois.arin.net	ALLOCATED
097/8	ARIN	2006-10	whois.arin.net	ALLOCATED

253/8	Future use	1981-09	RESERVED
254/8	Future use	1981-09	RESERVED
255/8	Future use	1981-09	RESERVED

IP Address Distribution



Regional Internet Registries

The Regional Internet Registries (RIRs)

- All five RIRs are not-for-profit associations
- Funded by the membership
- Responsible for allocation and assignment of Internet Number Resources in their service regions
  - IPv4 addresses
  - IPv6 addresses
  - Autonomous System Numbers (ASN)
- Each RIR operates a whois database as a registry for these numbers

Public Registry Data

- Information in the registries is publicly available
  - Which entity uses a particular resource
  - How you can contact them
- Each of the RIRs operates a ‘whois database’
  - Commonly accessible via website or whois protocol
  - Use whois.iana.org to find the responsible registry
- Note: IPv4 and IPv6 are distributed in ranges
  - Operators can further distribute them to customers
  - Level of detail on these customer assignments may vary

Registration of Internet Number Resources

- Ensures global uniqueness of IPs and ASNs
- Provides contact details for network operators
  - In case you need to troubleshoot or arrange connectivity
- Function originally performed by John Postel
  - Became known as the “Internet Assigned Numbers Authority” (IANA)
- IANA functions are now operated by ICANN
  - Under a contract with NTIA (US Government)
  - Maintains the global pool of Internet Number Resources

Regional Address Policies

- Each RIR has its own Policy Development Process
- Regional community decides on regional policies for address allocation, assignment and registration
- Communities are open to everyone to participate
  - You don't have to live in a specific service region
  - You don't have to be a member of an RIR
- Decisions are made by rough consensus
  - No voting
- RIRs implement policy and operate accordingly

RIPE Region Specific

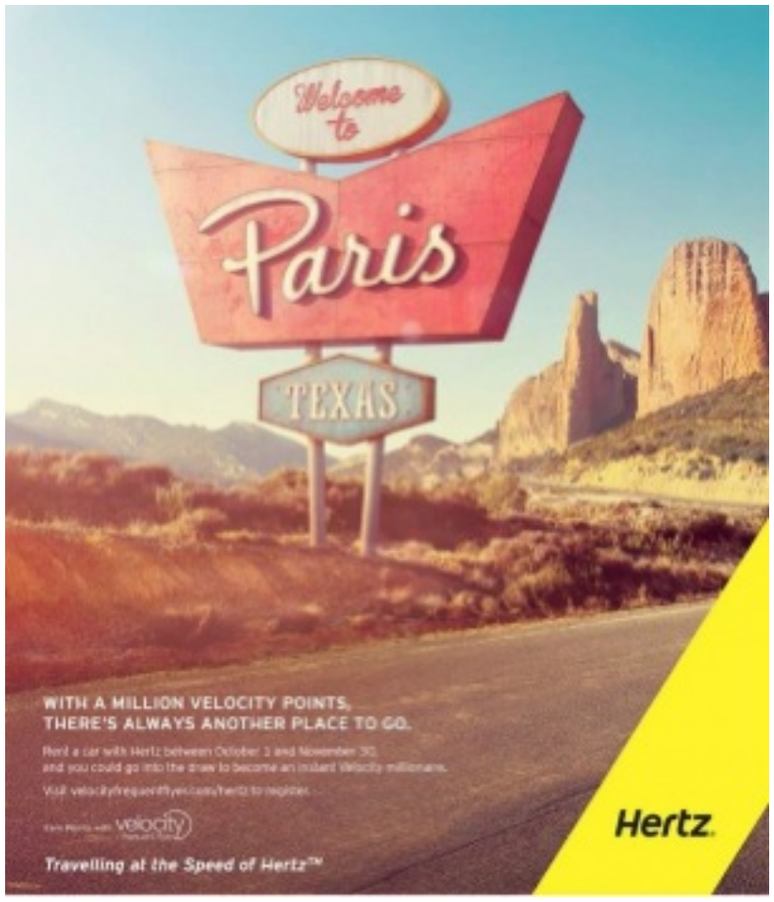
- Réseaux IP Européens was formed in 1989 by a small group of academics in Europe
- Goal was to promote IP
- Not a legal entity
- Two RIPE Meetings per year with WGs
- Open RIPE mailing Lists
- RIPE set up RIPE NCC as a secretariat
- Only later RIPE NCC became RIR

IPv4 & IPv6

RIPE NCC

(IP) Address Properties

- Every entity handling packets needs to be able to read and understand the address
  - Fixed format
  - Machine readable
- The address has to be unambiguous
  - Globally unique

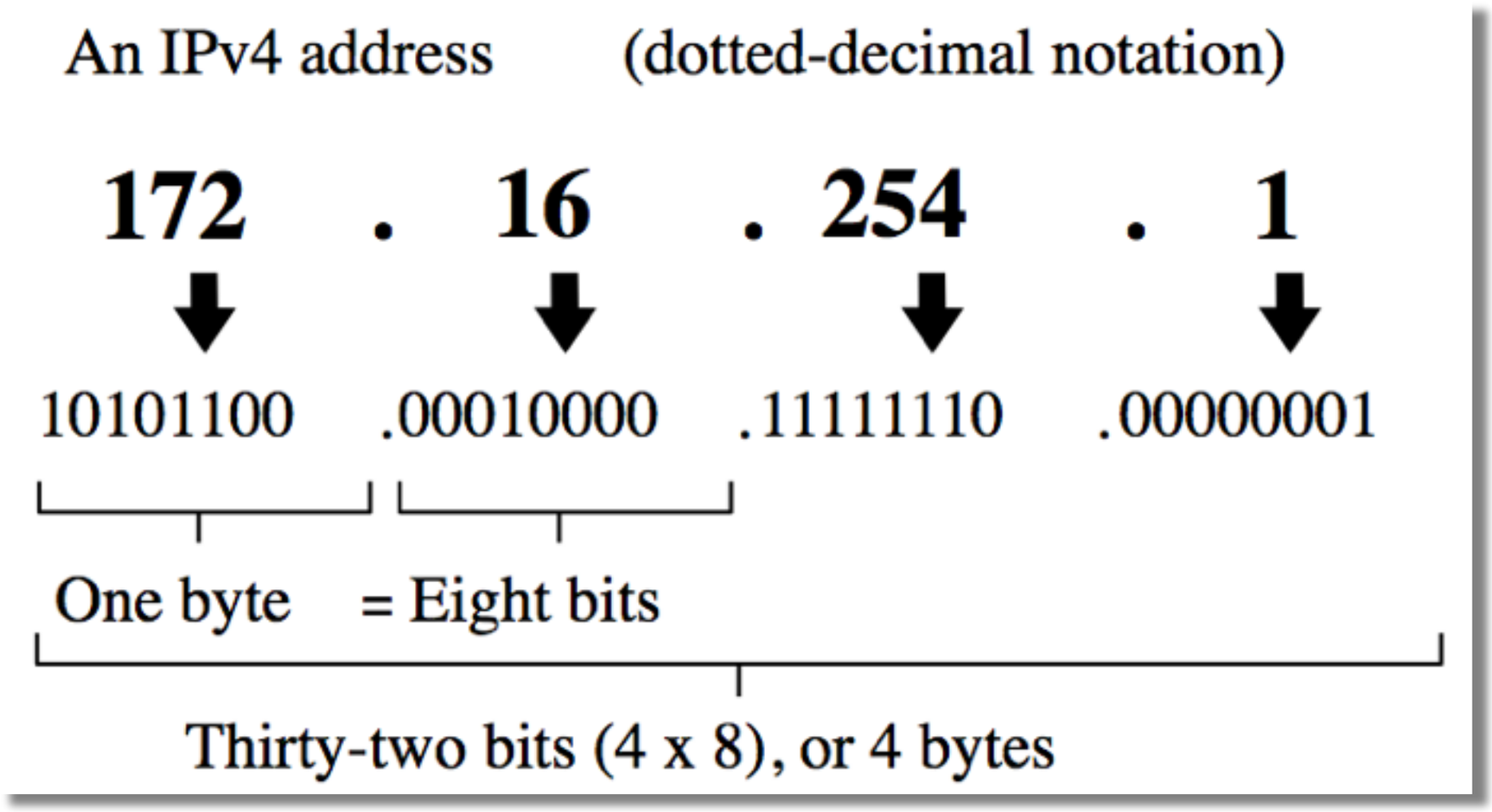


Dual Function

- Addresses can be used for two things:
  - Identify the sender and recipient
  - Tells where the packet needs to go
- IP address
  - **One single number for both functions**
- IP address changes when you change network

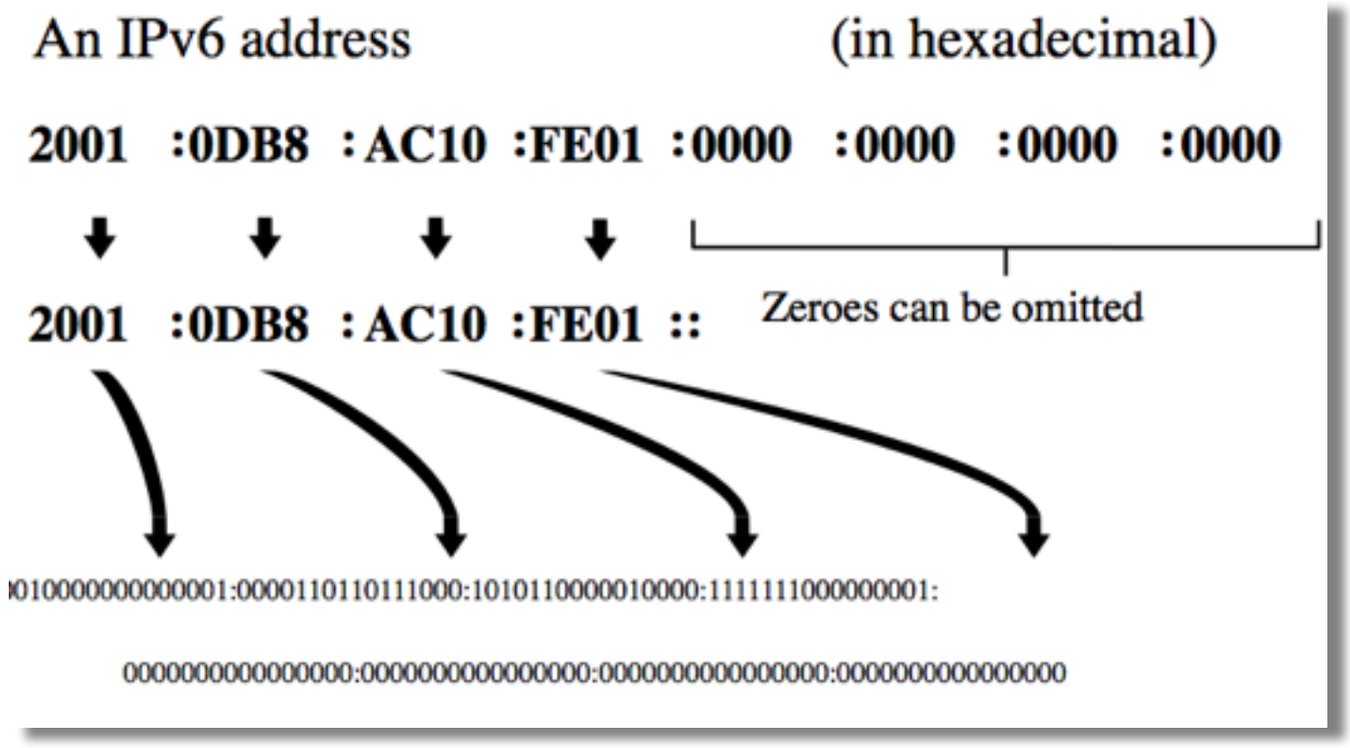
IPv4 Protocol Basics

- IPv4 address is 32 bits long
  - In total 2^32 addresses (4,294,967,296)
  - But some needed for network structure



IPv6 Protocol Basics

- Functionally the same as IPv4, just more addresses
- IPv6 address is 128 bits long
  - 2^128 addresses available
    - 340282366920938463463374607431768211456 options
- Incompatible with IPv4 (design decision)



Deploying IPv6: The Plan

- Standard work on IPv6 finished in 1998
- IPv6 and IPv4 are not compatible
  - You can use both protocols at the same time on the same network without interference
  - You can “retrofit” IPv6 onto existing networks
- Computers which have both can choose wether to use IPv4 or IPv6
  - Depending on the peers capability
- When both are available: use IPv6
  - This will gradually phase out IPv4

Chickens and Eggs

- IPv6 suffers from a classic bootstrapping problem

- For applications to support IPv6 you need the network to deliver packets
  - Networks don't supply IPv6 connectivity because there are not that many applications that support it
- Content and Services need to adopt IPv6, but there are no users who can access using IPv6
  - There are no users, because there is no content

RIRs and IPv6

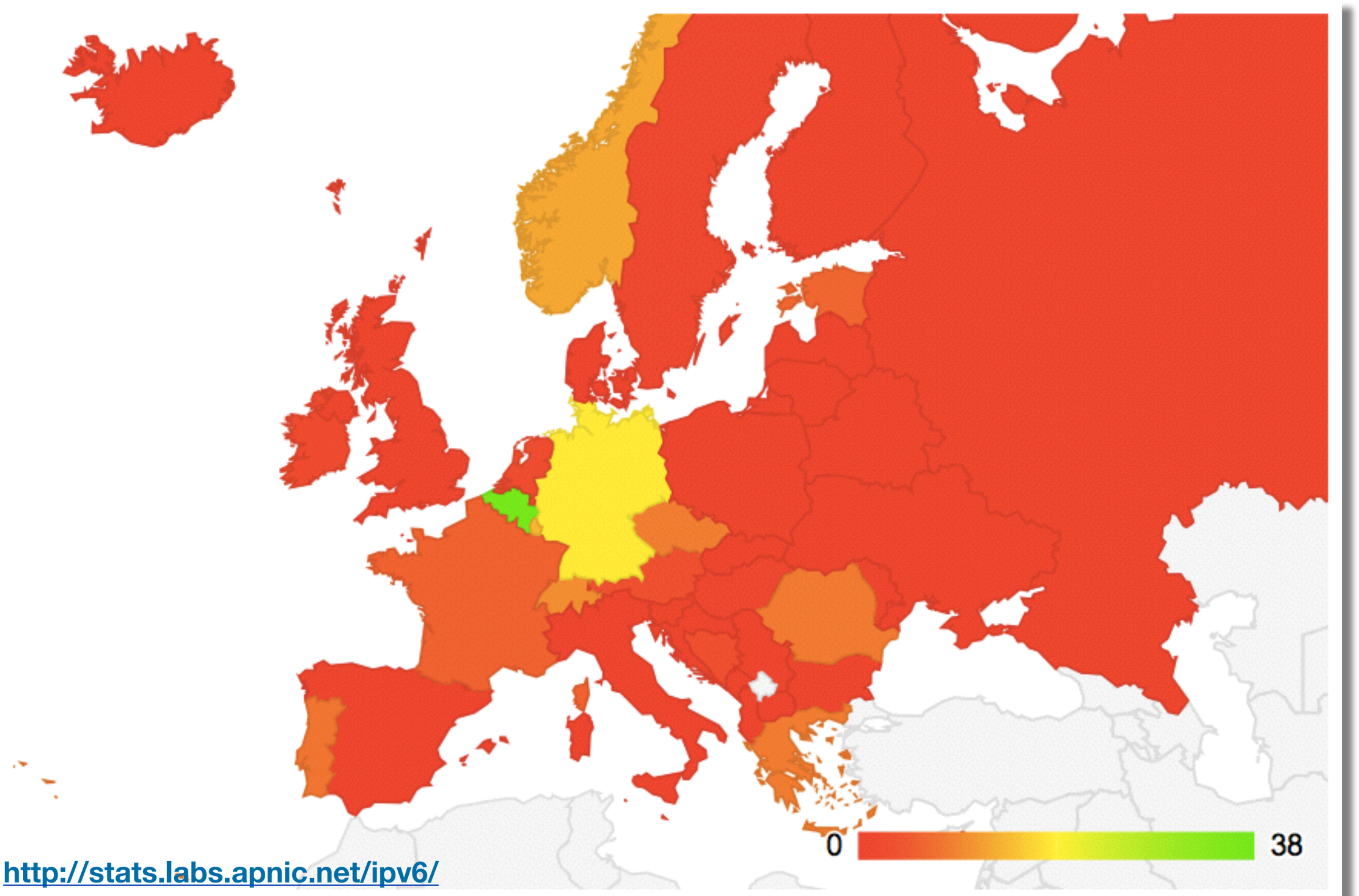
- Encouraging the adoption of IPv6 for over 10 years
  - IPv6 resource allocation started late nineties
- Capacity building at different levels
  - High level information for decision makers
  - Hands-on training for engineers
  - Online, in situ, brochures, webinairs, conferences
- Cooperation with ISOC, IETF, ICANN, ITU-D, industry and governments

IPv6 is Taking Off

- APNIC, LACNIC and RIPE NCC have exhausted their pools of IPv4 addresses (starting in 2012)
  - ARIN has 0.29 of a /8 left (4,5 million addresses)

- Networks now have to deploy IPv6 to grow
  - Sustaining IPv4 becomes expensive

IPv6 Deployment in Europe



http://stats.labs.apnic.net/ipv6/

Questions?

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http://www.ripe.net

http://www.nro.net

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