# Internet Numbers
## Introduction to the RIR System

Chafic Chaya | MEAC-IG Summer School, AUB - Lebanon | August 2016
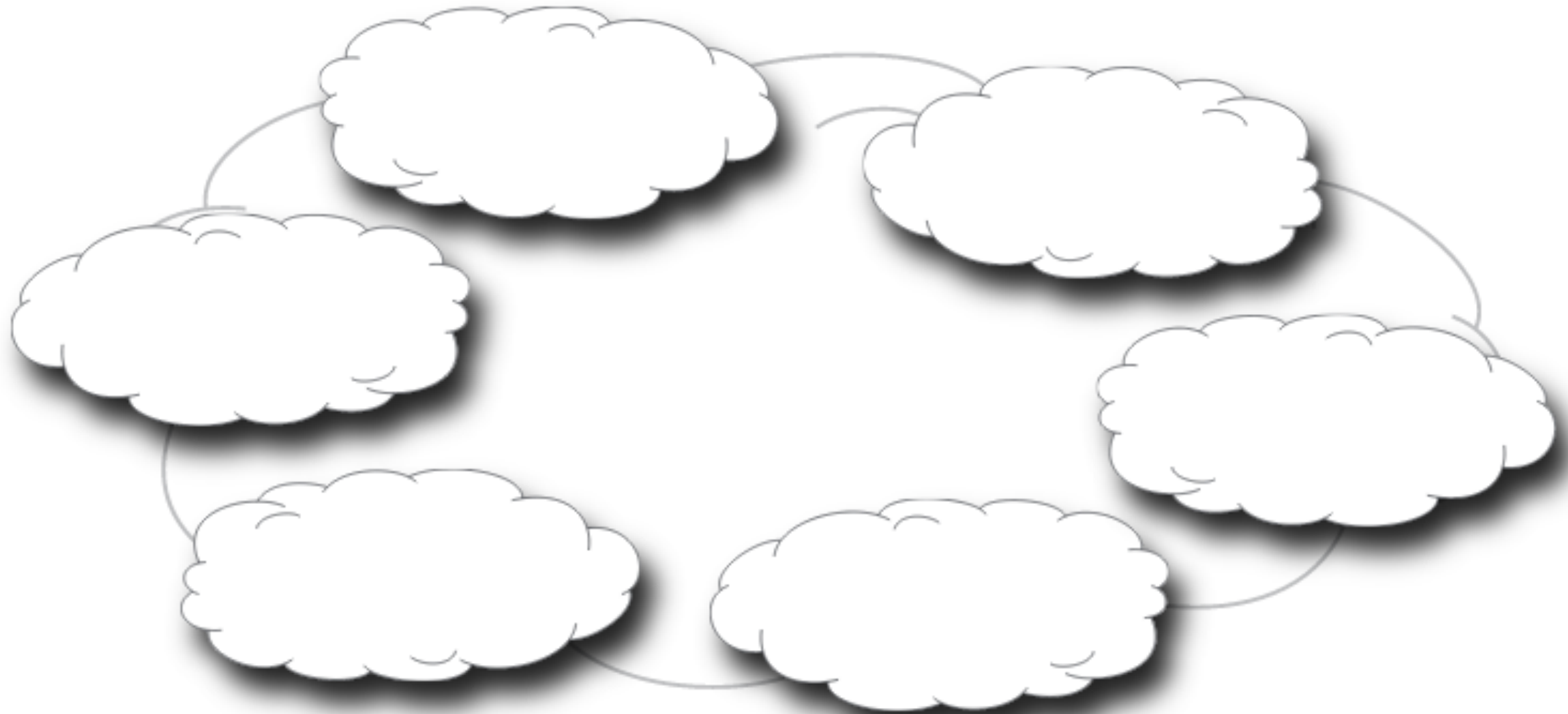
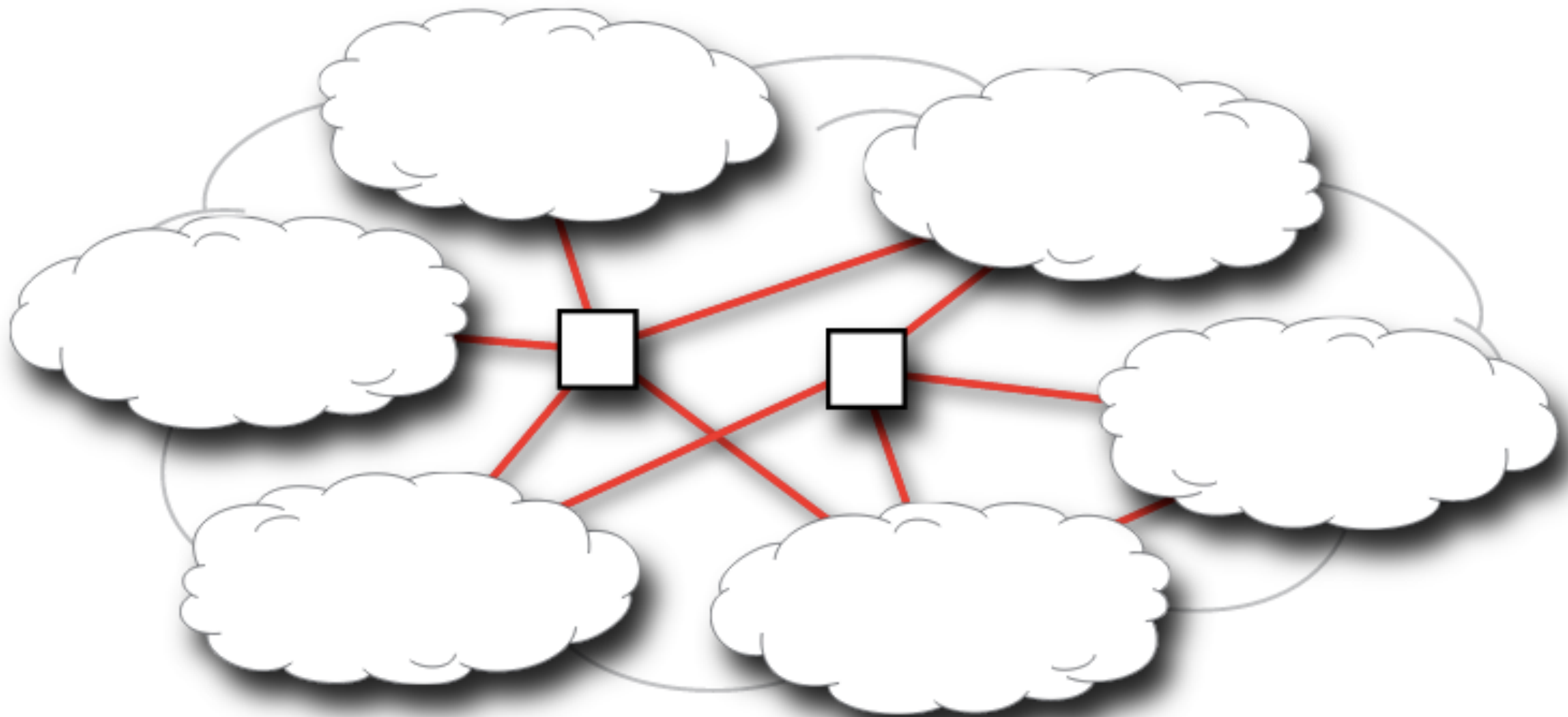# Who Runs the Internet?

The short answer is
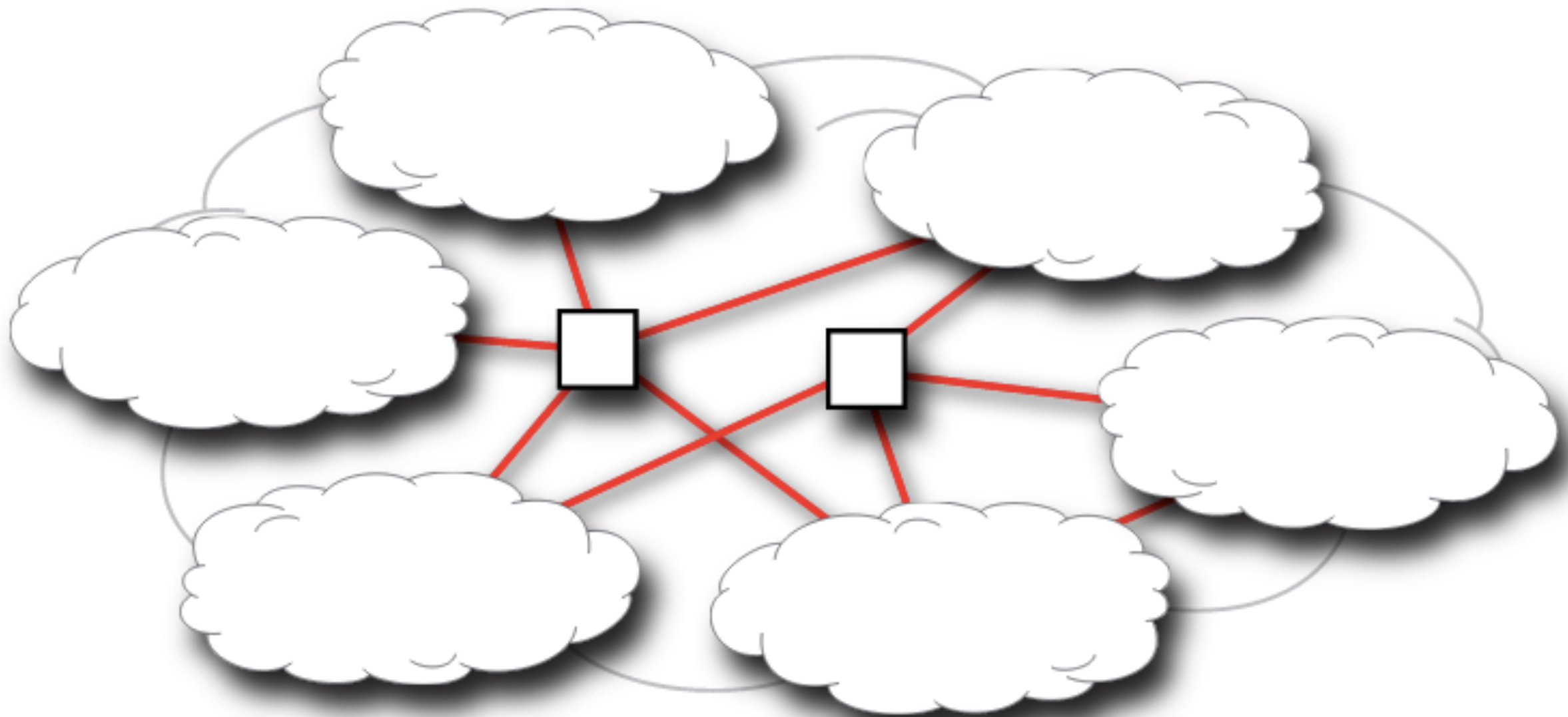
# NO ONE!!!

# What is the Internet?

# What is the Internet?



The Internet is made up of around 55,000 autonomous interconnected networks.

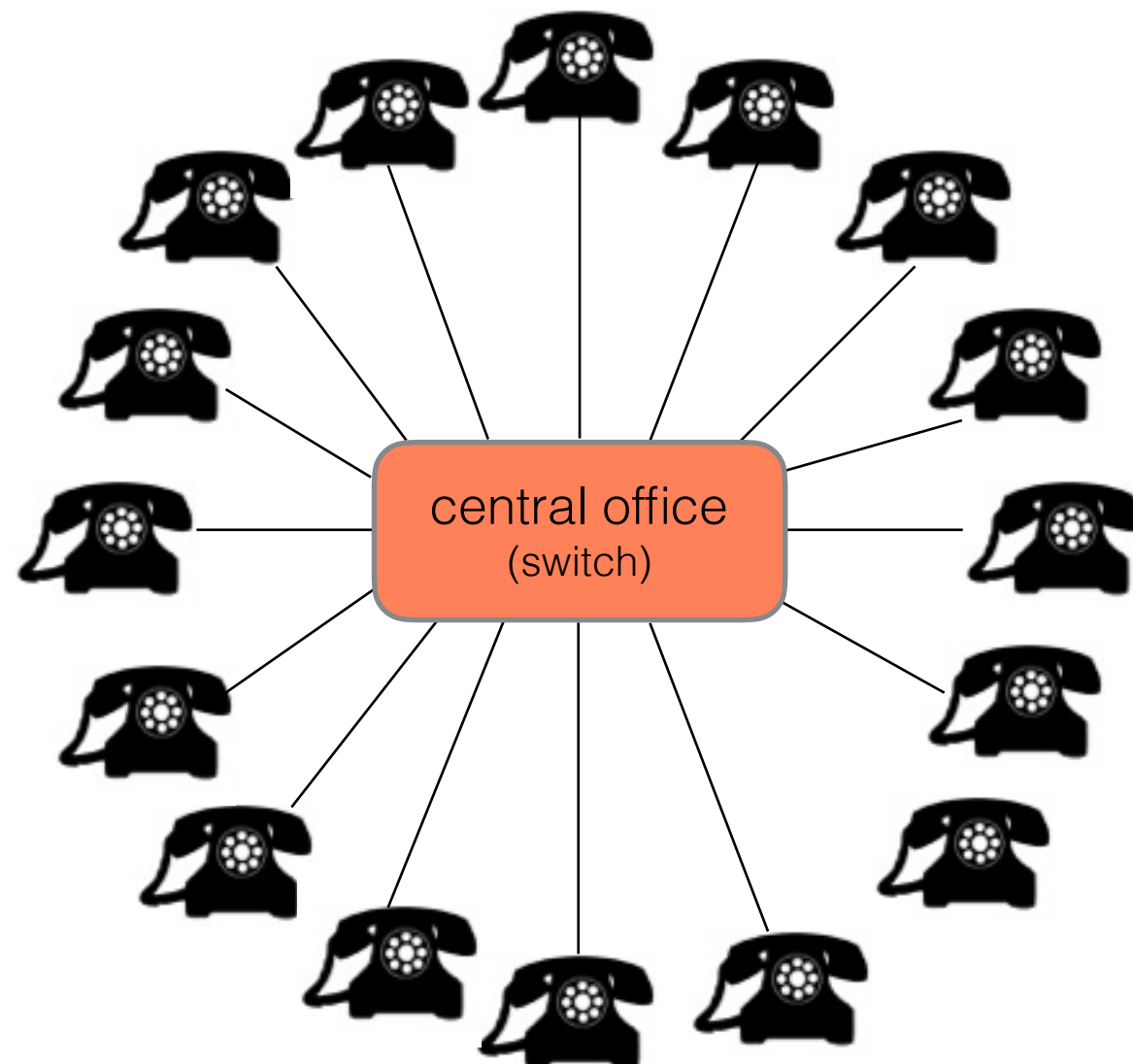# What is the Internet?


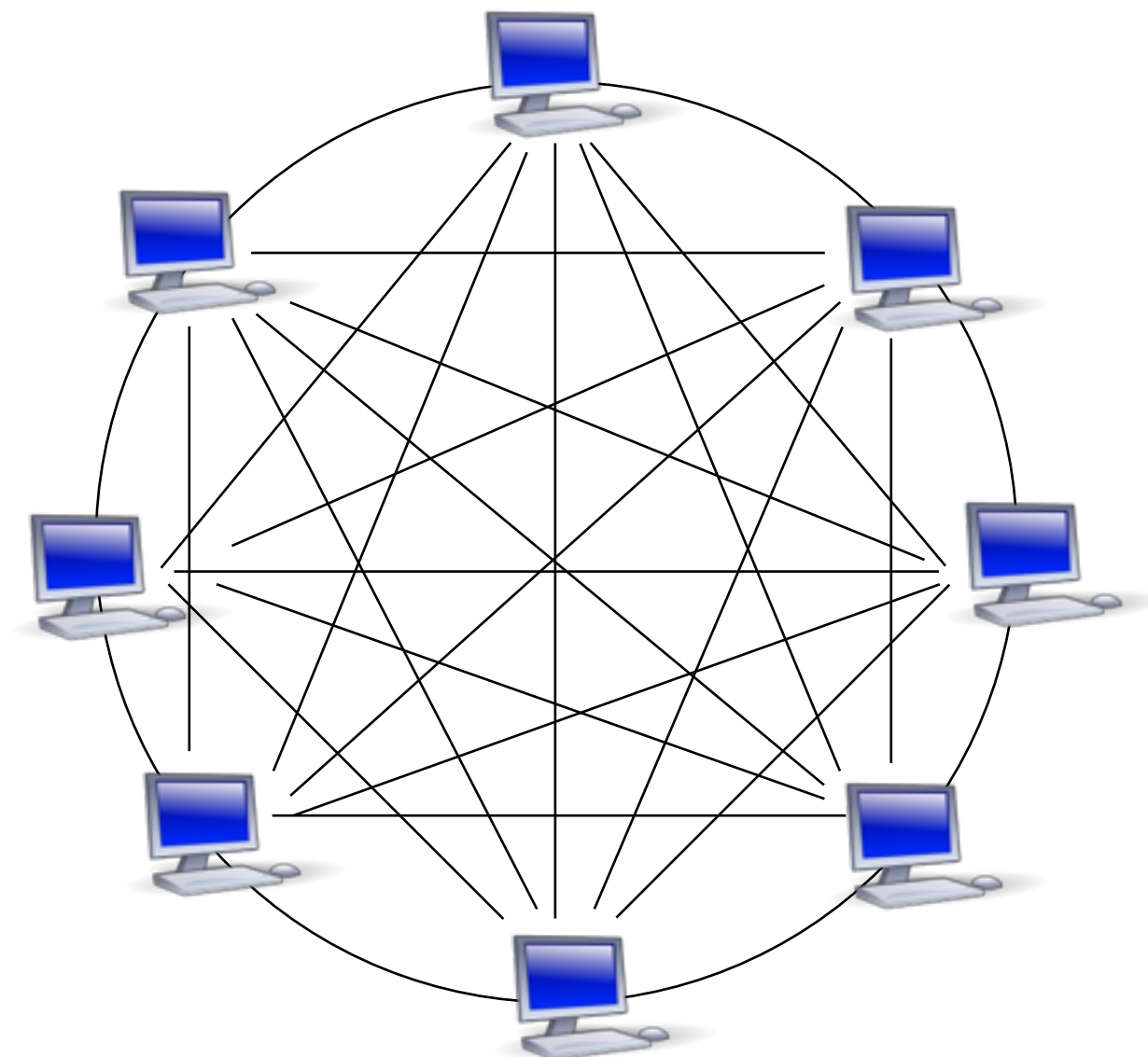
…and more than 3.6 billion users.

# **Standards**

## Rules of Engagement

# Centralised
(telephone system)

# Decentralised
(the Internet)

# Identification

Sender and Receiver Addresses

# Telephone Numbers



ITU          Government          Telco

Country → City → Telco A → Switch A / Switch B

Country → City → Telco B → Switch A / Switch B

Number portability

?
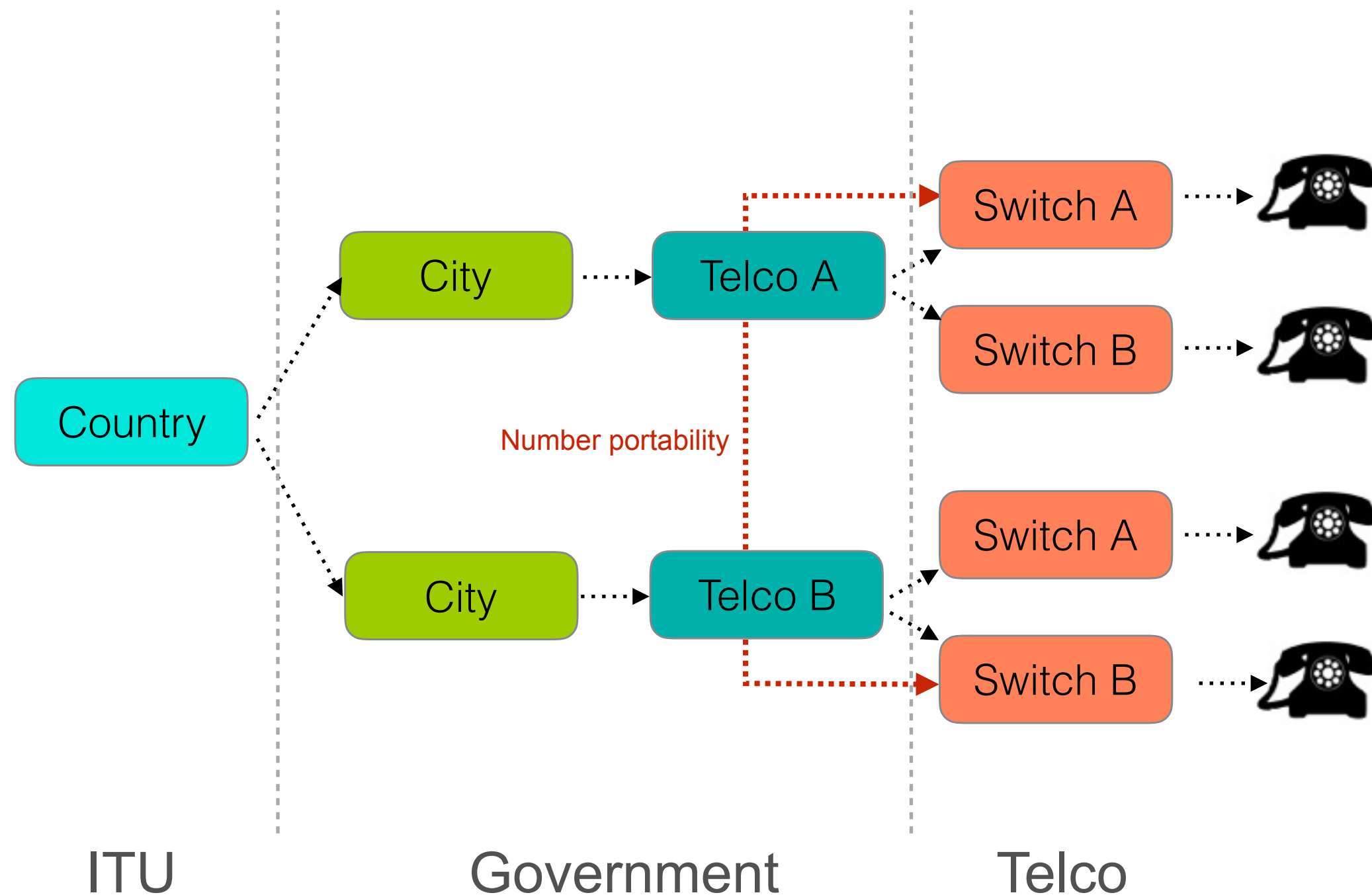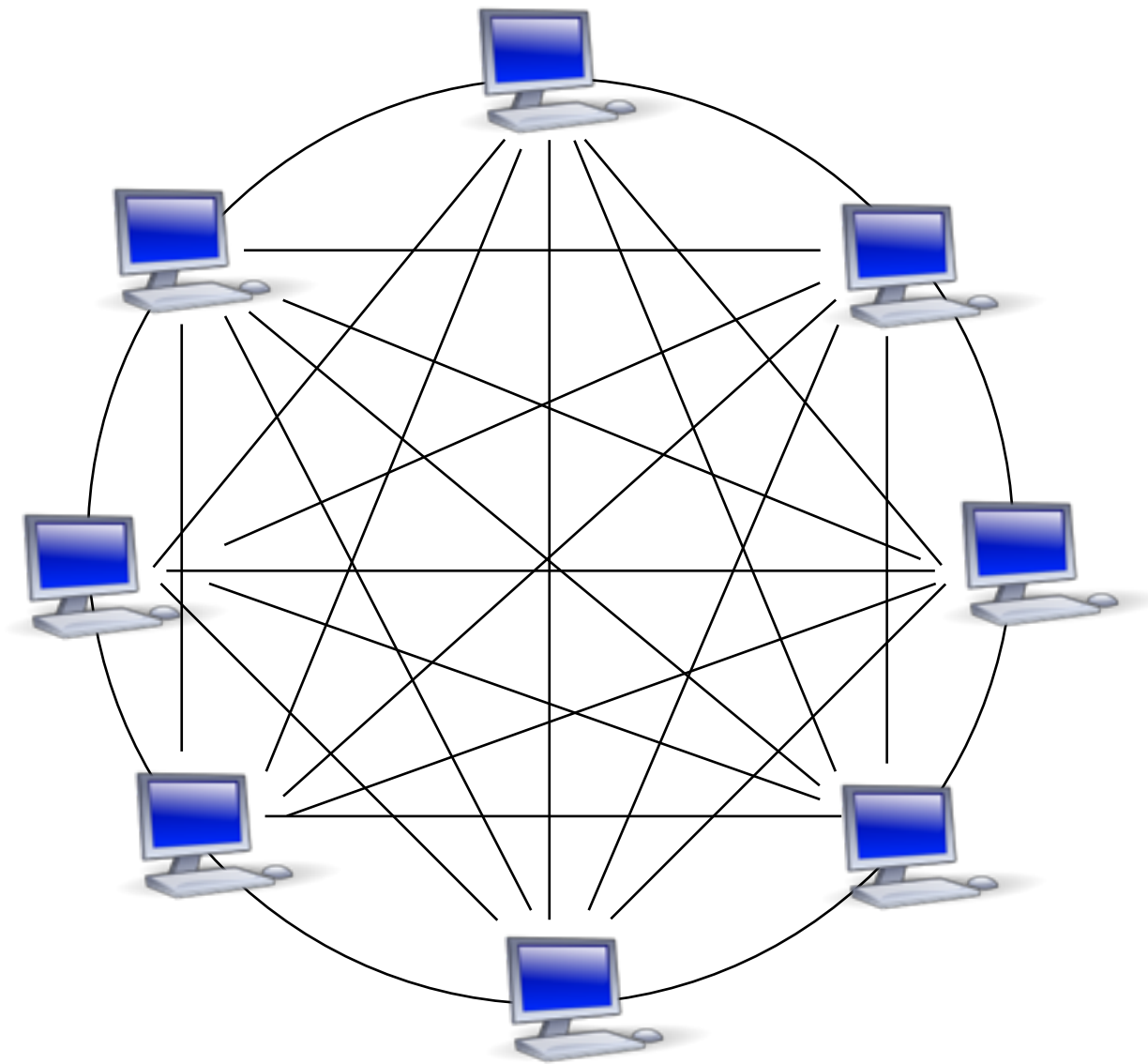
# Standardising Organisations

- The Internet Engineering Task Force

- Develops and promotes voluntary Internet standards

- An open standards organisation, with no formal membership



- The World Wide Web Consortium

- Develops open standards to ensure the long-term growth of the Web

# Internet Number Resources

The Regional Internet Registries

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|Version|  IHL  |Type of Service|          Total Length         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|         Identification        |Flags|      Fragment Offset    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  Time to Live |    Protocol   |         Header Checksum        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                       Source Address                          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                     Destination Address                       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                    Options                    |    Padding     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
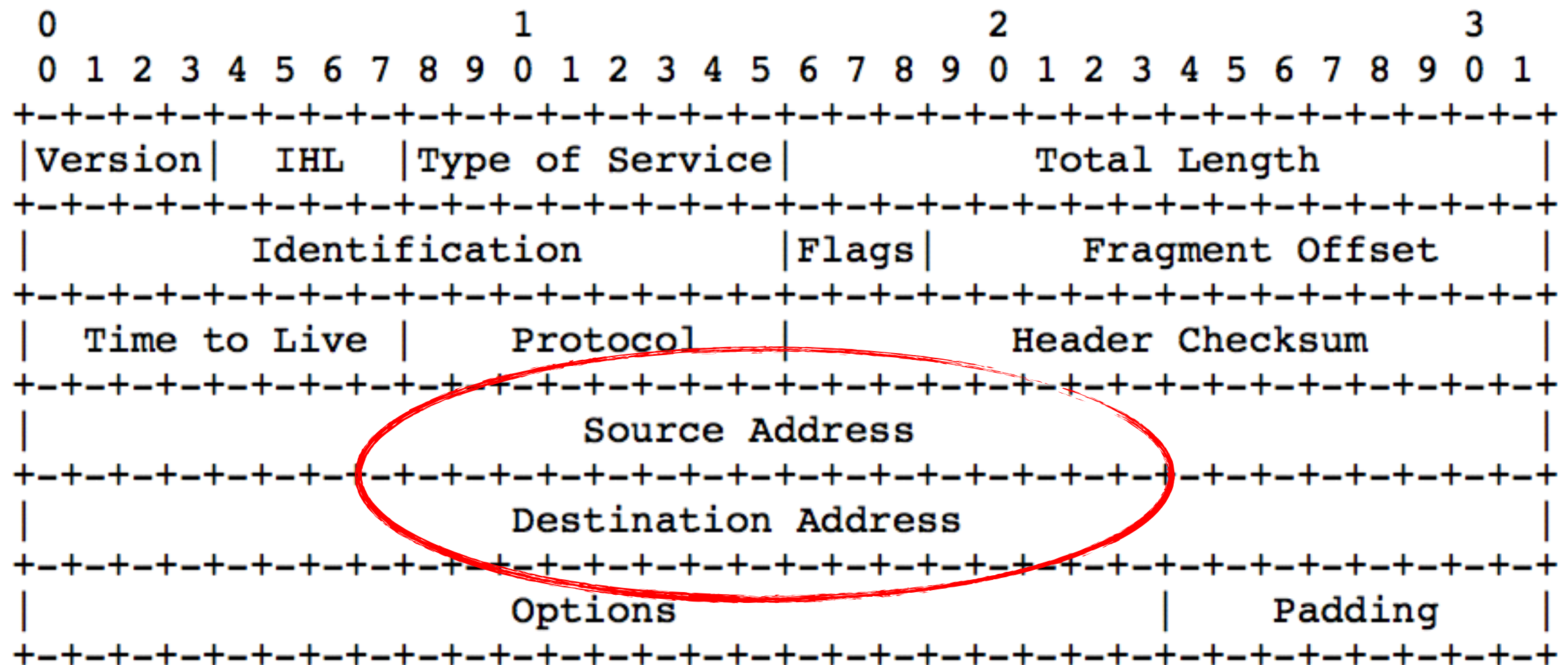
Example Internet Datagram Header
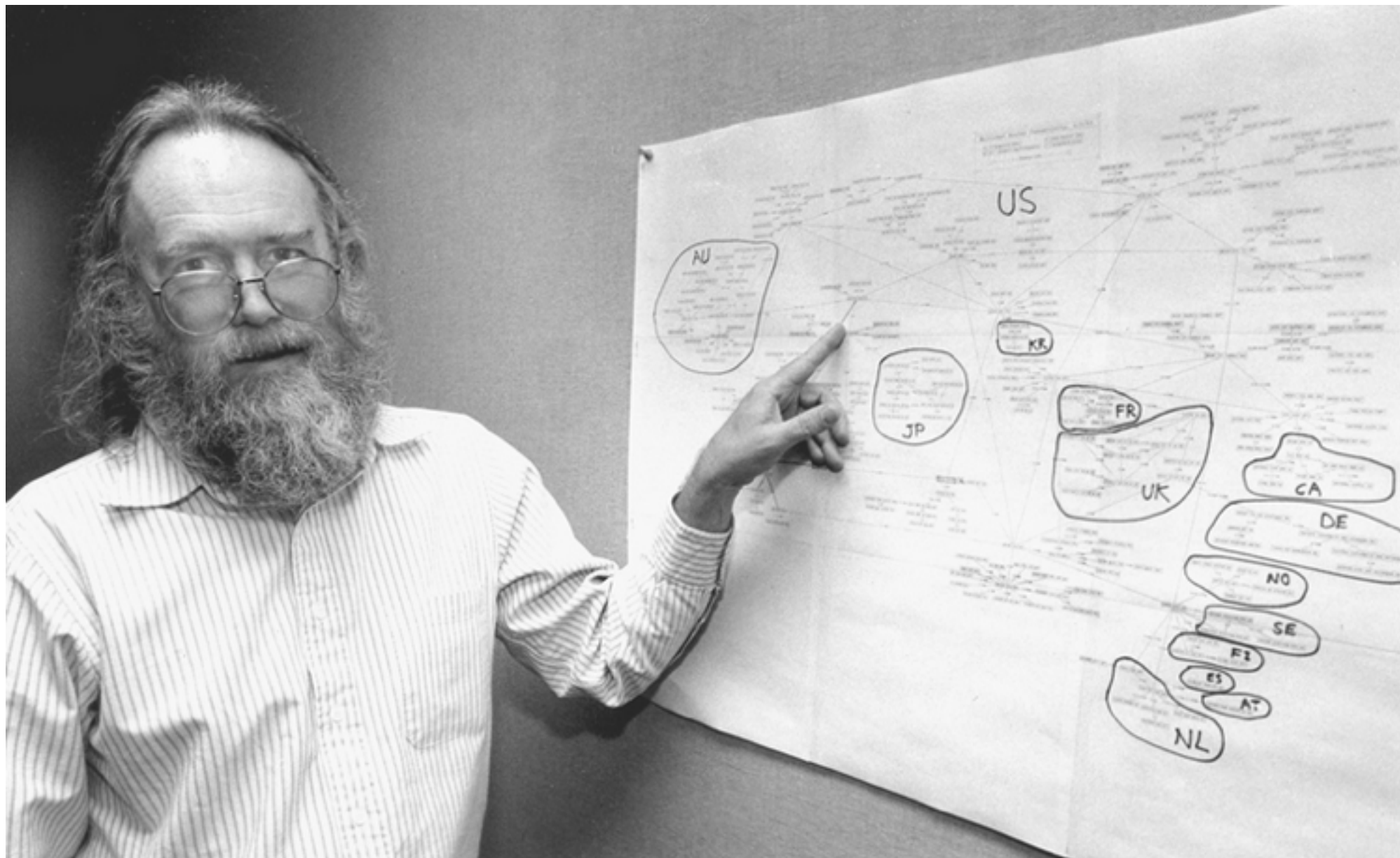
# IP Addresses

- There are two types of IP addresses in active use

- **IP version 4 (IPv4)**

  - Initially deployed: 1 January 1983

  - IPv4 is 32-bit (4.2 billion addresses)

  - Example: 192.0.2.53

  - Still the most commonly used version

- **IP version 6 (IPv6)**

  - Published by the IETF in 1998

  - IPv6 is 128-bit (340 trillion, trillion, trillion addresses)

# IP Addresses

- Need to be globally unique

- It's an address — not an identity

  - Represents a location in a network

  - If you move, your address is likely to change

- Others need to send packets to me

  - The transporting company needs to know where I am

  - It needs some structure

# We Need Someone to Coordinate!



Jon Postel used to manually distribute IP addresses

IANA registry

network A ⟷ network B

193.x.x.x 194.x.x.x
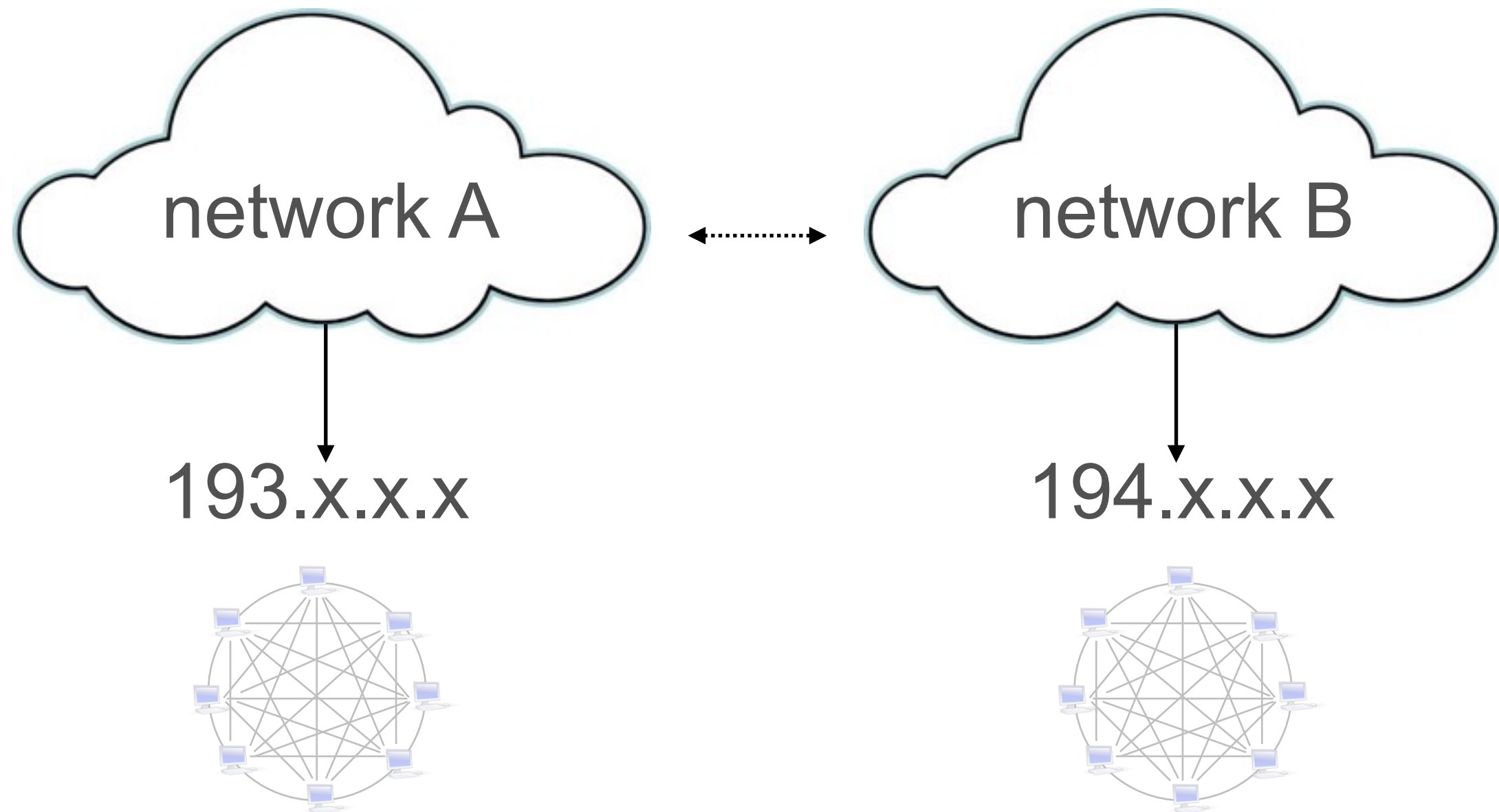
ASSIGNED NETWORK NUMBERS

This list of network numbers is used in the i
is 8 bits in size.

Assigned Network Numbers

| Decimal | Octal | Name | Network |
|---------|-------|--------|---------|
| 0 | 0 | | Reserved |
| 1 | 1 | BBN-PR | BBN Packet Rad |
| 2 | 2 | SF-PR-1 | SF Bay Area P |
| 3 | 3 | BBN-RCC | BBN RCC Netwo |
| 4 | 4 | SATNET | Atlantic Sate |
| 5 | 5 | SILL-PR | Ft. Sill Pack |
| 6 | 6 | SF-PR-2 | SF Bay Area P |
| 7 | 7 | CHAOS | MIT CHAOS Net |

# Internet Number Resource Management
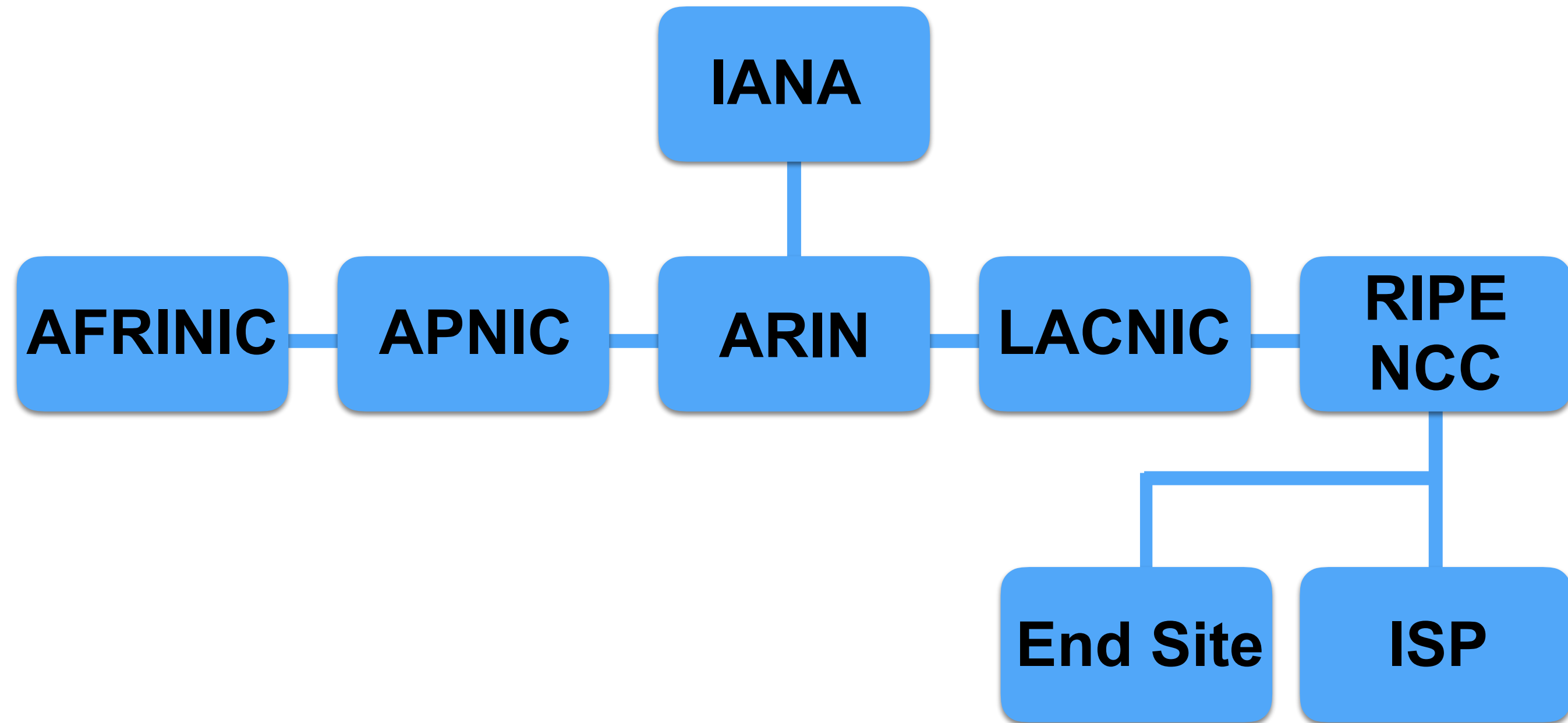
# Regional Internet Registries (RIRs)
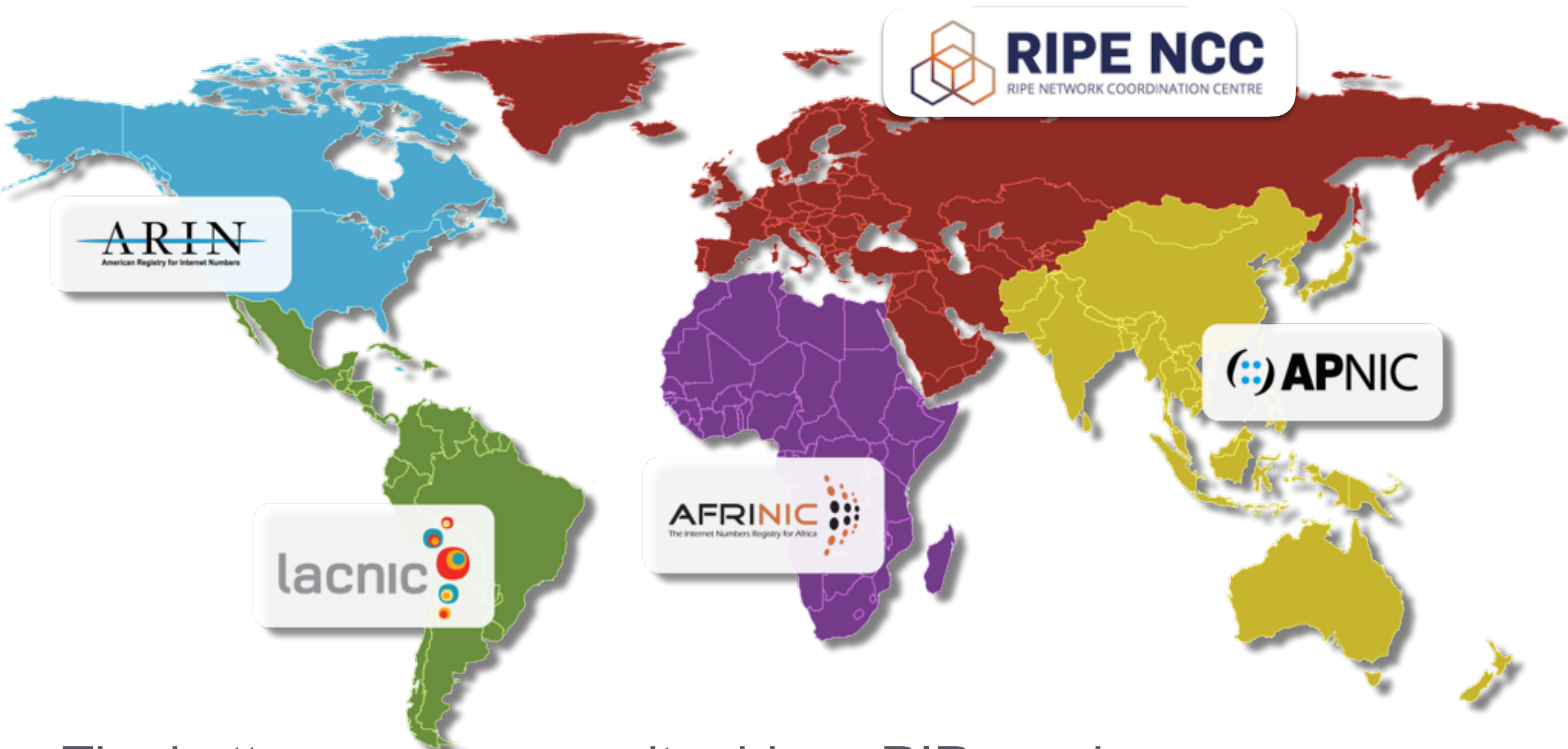


The bottom-up, community-driven RIR number resource management model
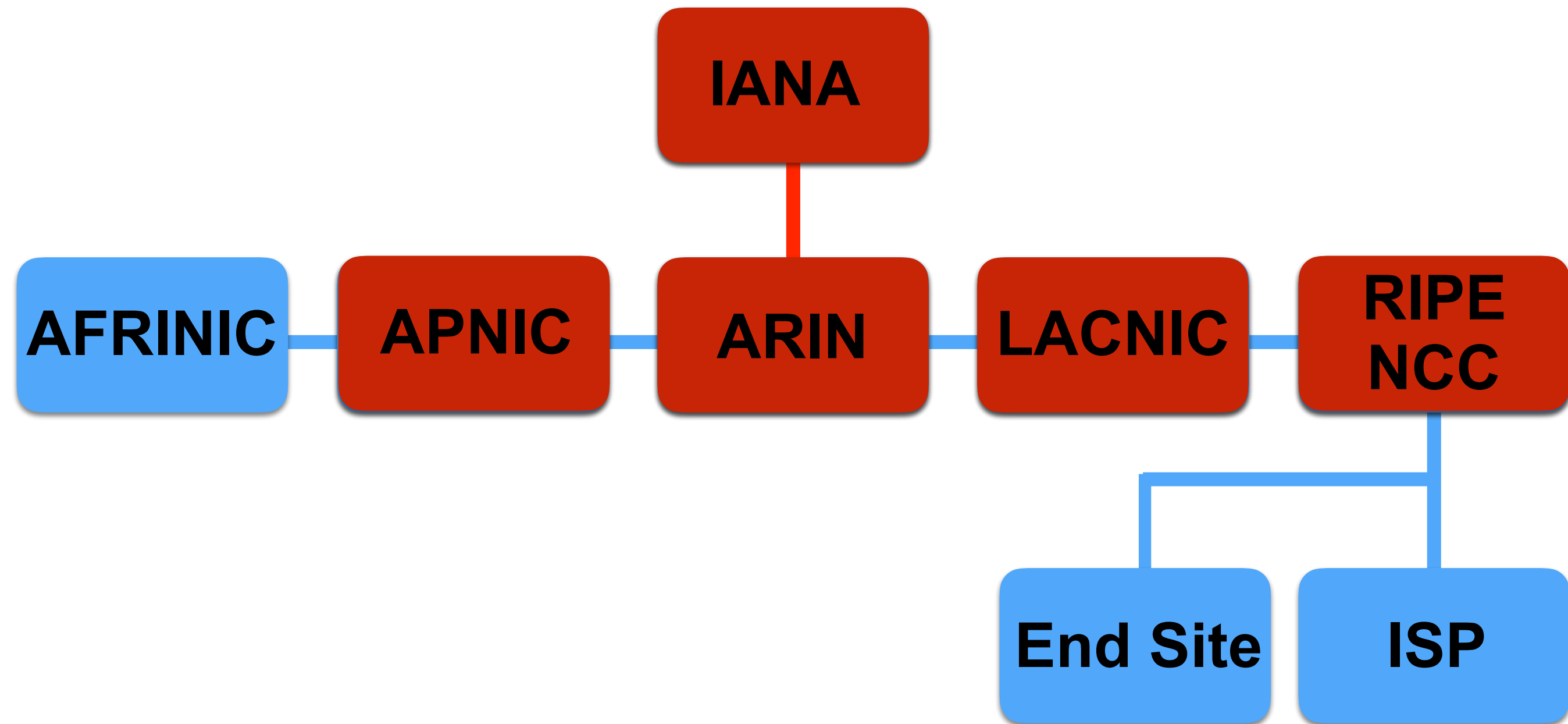
# IPv4 Depletion

# Internet Protocol version 6 (IPv6)

2001:db8:0:0:0:0:0:2:

0010 0000 0000 0001
0000 1101 1011 1000
0000 0000 0000 0000
0000 0000 0000 0000
0000 0000 0000 0000
0000 0000 0000 0000
0000 0000 0000 0000
0000 0000 0000 0010

0010 0000 0000 0001
0000 1101 1011 1000
0000 0000 0000 0000
0000 0000 0000 0000
0000 0000 0000 0000
0000 0000 0000 0000
0000 0000 0000 0000
0000 0000 0000 0001

2001:db8:0:0:0:0:0:1:

# IPv6 Statistics - Google

Native: 10.97% 6to4/Teredo: 0.01% Total IPv6: 10.98% | **Apr 9, 2016**
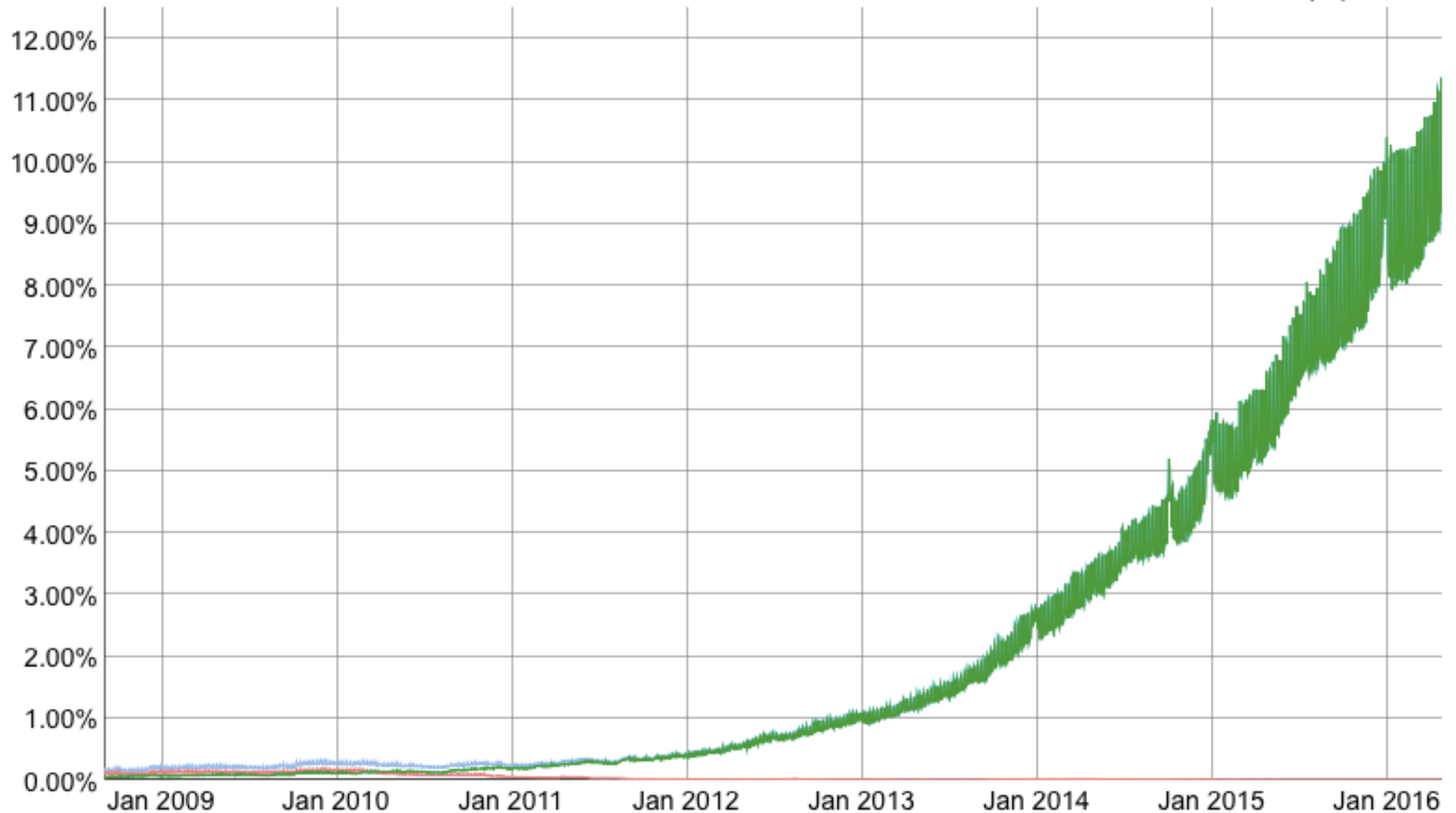


Percentage of IPv6 users that access Google over IPv6
Source: https://www.google.com/intl/en/ipv6/statistics.html#tab=ipv6-adoption&tab=ipv6-adoption

# Internet of Things (IoT)
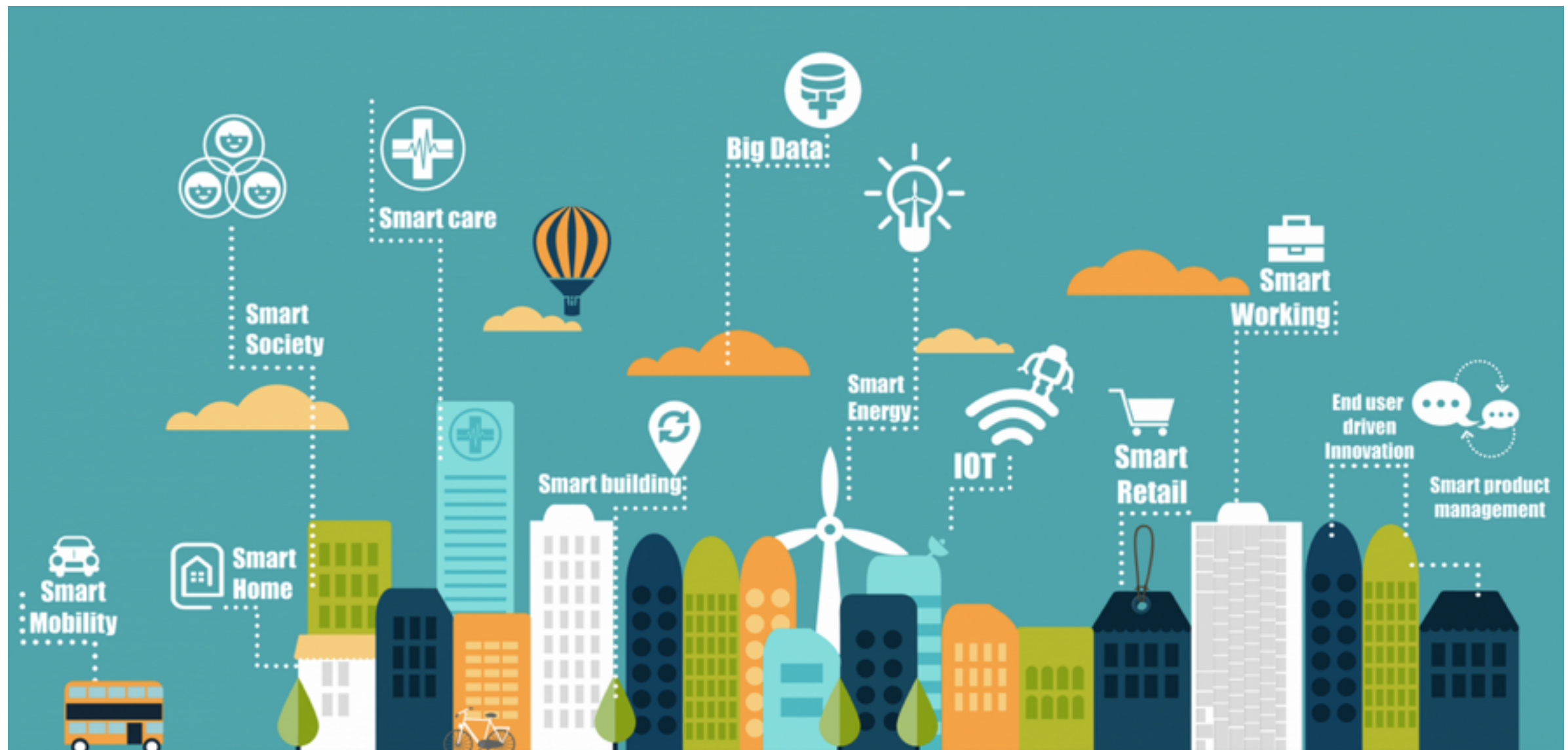


IPv6 is the only way to build a scalable and interoperable future with IoT

# About the RIPE NCC

# About the RIPE NCC

- Secretariat for the RIPE community

- Maintains the RIPE Database

- One of five Regional Internet Registries (RIRs)

  - Serving Europe, the Middle East and parts of Central Asia

  - 76 countries

- Allocate and assign IPv4, IPv6 and ASNs

- Outreach, tools, measurements, training and more!

# About the RIPE NCC

- Independent, not-for-profit, bottom-up membership organisation

- Anyone can become a member

- Incorporated in the Netherlands, governed by Dutch law

- Funded by members, fully autonomous

- Open, transparent, neutral and impartial

- Headquarters in Amsterdam

    - Office in Dubai and Moscow

    - Around 140 staff members

# Growing Membership

**14,000 LIRs**
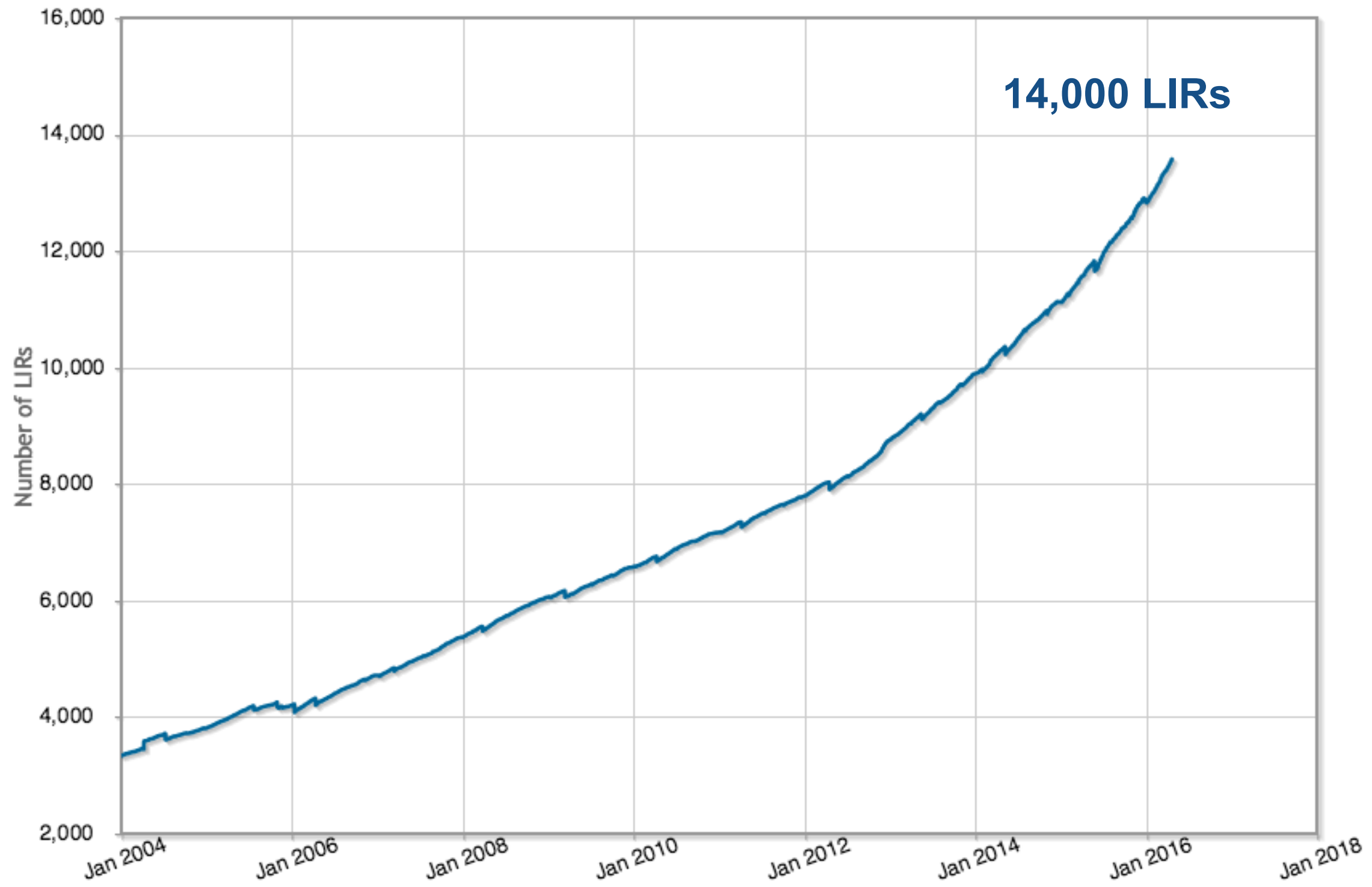
# RIPE NCC Members in Middle East

## Regional Overview

| Country Code | No.of LIRs | IPv4 Allocations | IPv4 Allocated IPs | IPv4 Last /22 Allocations | IPv4 Assignments | ASNs | IPv6 Allocations | IPv6 Allocated /32s | IPv6 Assignments |
|---|---|---|---|---|---|---|---|---|---|
| UAE | 73 | 96 | 3783680 | 49 | 25 | 83 | 36 | 176 | 12 |
| Bahrain | 18 | 48 | 456704 | 8 | 2 | 23 | 15 | 50 | 1 |
| Iraq | 90 | 125 | 641536 | 68 | 3 | 86 | 53 | 236 | 0 |
| Iran | 278 | 956 | 12066560 | 345 | 86 | 500 | 214 | 1210 | 2 |
| Jordan | 37 | 91 | 661504 | 22 | 7 | 33 | 27 | 97 | 0 |
| Kuwait | 35 | 68 | 1719296 | 17 | 36 | 59 | 22 | 85 | 1 |
| Lebanon | 97 | 138 | 539648 | 79 | 17 | 127 | 58 | 268 | 1 |
| Oman | 9 | 28 | 844800 | 5 | 0 | 9 | 6 | 13 | 0 |
| Palestine | 29 | 91 | 590080 | 26 | 15 | 42 | 25 | 67 | 1 |
| Qatar | 13 | 25 | 832512 | 7 | 1 | 14 | 8 | 39 | 0 |
| Saudi Arabia | 94 | 240 | 8578048 | 51 | 83 | 138 | 57 | 232 | 11 |
| Syria | 23 | 82 | 907264 | 21 | 1 | 7 | 15 | 47 | 0 |
| Turkey | 306 | 601 | 15912704 | 225 | 153 | 526 | 231 | 1125 | 18 |
| Yemen | 5 | 16 | 68608 | 5 | 0 | 5 | 5 | 40 | 0 |

# IPv4 Status

- We still have IPv4 addresses left - around one /8 remaining in our available pool

- Every member can get one final /22 (1,024 addresses)

- IPv4 address blocks can be transferred:

  - 2,701 IPv4 transfers in 2015 / 1,165 so-far in 2016

  - Inter-RIR policy was implemented in September 2015

# IPv6 Status

- Over 70% of our members have IPv6 address space

- Providing technical, hands-on IPv6 training courses

- Improving our online IPv6 training and webinars

- IPv6 Roadshows - currently in MENOG region, expansion into ENOG region planned for 2016

# Introducing the RIPE Forum

# RIPE Forum

- Alternative way to participate in discussions about IPv6, RIPE Atlas, anti-abuse, DNS, policies…

- One place to access all RIPE mailing lists

- Completely web-based; no emails in inbox

- Interacts with existing mailing lists
  (post creates email and vice versa)

- Contains threaded view, search function and options to share
  **https://www.ripe.net/participate/mail/forum/**

# RIPE Forum

## RIPE Forum

### Available Lists

| | |
|---|---|
| RIPE Forum Test mailing list | › |
| ACM Task Force | › |
| Address Policy Working Group | › |
| Anti-Abuse Working Group | › |
| Best Current Operational Practices (BCOP) Task Force | › |
| Connect Working Group | › |
| Cooperation Working Group | › |
| Database Working Group | › |
| DNS Working Group | › |

### Recent Posts

**[db-wg] Faked entries in the RIPE db**

Last updated by Ian Dickinson at 2016-05-31 12:44:24

**[ipv6-wg] New on RIPE Labs: How are you Deploying IPv6? Take this Survey**

Last updated by Mirjam Kühne at 2016-05-31 11:40:50

**[dns-wg] New on RIPE Labs: Anycast vs. DDoS - Evaluating the November 2015 Root DNS Event**

Last updated by Mirjam Kühne at 2016-05-31 10:01:52

The RIPE Forum is an additional way to participate in RIPE community mailing list discussions using a web-based interface rather than an email client. Everything you post here goes to the mailing list and everything posted to the mailing list is visible here.

# RIPE Forum

## Address Policy Working Group

Collapse: Off

Threaded: ON

### [address-policy-wg] opposition to 2015-04

**Remco van Mook**
2016-05-25 09:52:55 CET

Share

```
Dear all,

as just mentioned during the address policy session, I'm withdrawing my
objection to 2015-04. While I do think a discussion about policy structure
still needs to be held, I don't think it should hold up this proposal any
longer. This can be fixed after adoption - as long as we're aware.

I do maintain my suggestion to put references in place where chapters about
transfers are removed from other sections of policy.

Kind regards,

Remco
```

Reply

**Aleksey Bulgakov**
2016-05-25 09:57:23 CET

Share

```
Please, go to https://ripe72.ripe.net/live/main/ . There is discussion
about IPv4 proposals now.

2016-05-25 10:52 GMT+03:00 Remco van Mook <remco.vanmook _at_ gmail _dot_
com>:
>
> Dear all,
```
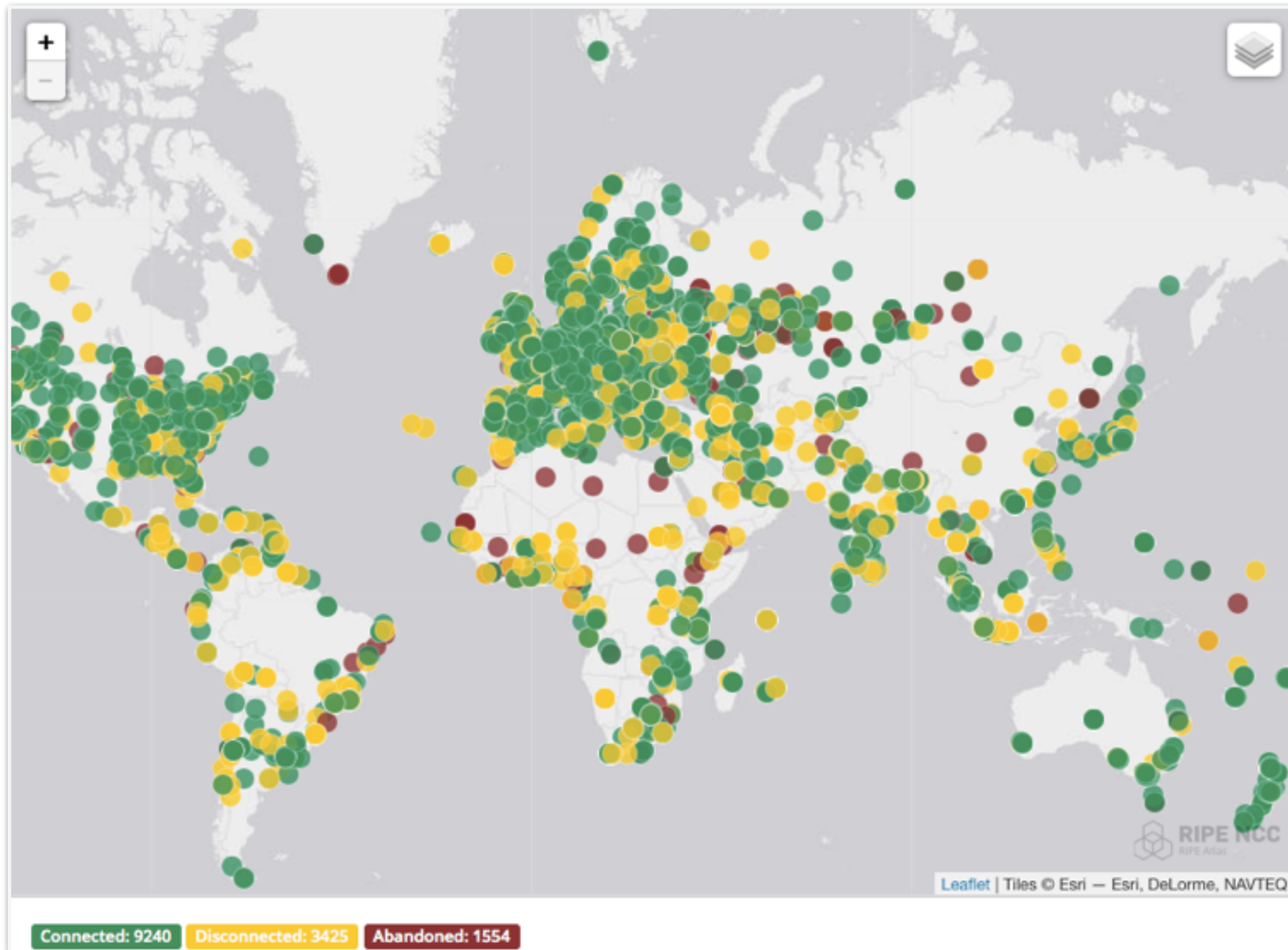
# RIPE Atlas

# RIPE Atlas

- With the help of thousands of volunteers, we're building the world's largest active measurement network

- Perform built-in measurements towards the root name servers

- Participate in user defined measurements (UDM)

- Measurements are done from the probe's perspective

# Network Coverage



Connected: 9240    Disconnected: 3425    Abandoned: 1554

# RIPE Atlas Probes

# RIPE Atlas Anchors

- Anchors can do anything a probe can do

- They participate in Anchoring Measurements

- They can also be a target for a measurement — you can measure towards an anchor

# Probes in the Levant Region

# Routing in the Levant Region

# How can you improve?

- Get more probes connected so more accurate measurements can be performed

- Get an IXP to keep your local traffic local

# RACI

RIPE Academic Cooperation Initiative

# The RACI Story

- A way to connect RIPE and MENOG with the research/academic community

- Gives operators the chance to see what Internet research academics are working on

- Offers academics the chance to present to industry, make connections and get feedback

- RACI presenters receive tickets, travel and accommodation at RIPE & MENOG meetings

- All applicants can publish their work through RIPE Labs (labs.ripe.net)

# **Topics**

- Anything relevant or interesting to the operator community:

    - Network measurements and analyses

    - IPv6 deployment

    - BGP routing

    - Network security

    - Internet governance

    - Peering and interconnectivity

    - Internet of Things

# Get Involved

**ripe.net/raci**

**ripe.net/raci/mailing-list**

**@RACI_RIPE**

**ripe.net/raci/linkedin**

# Questions

cchaya@ripe.net