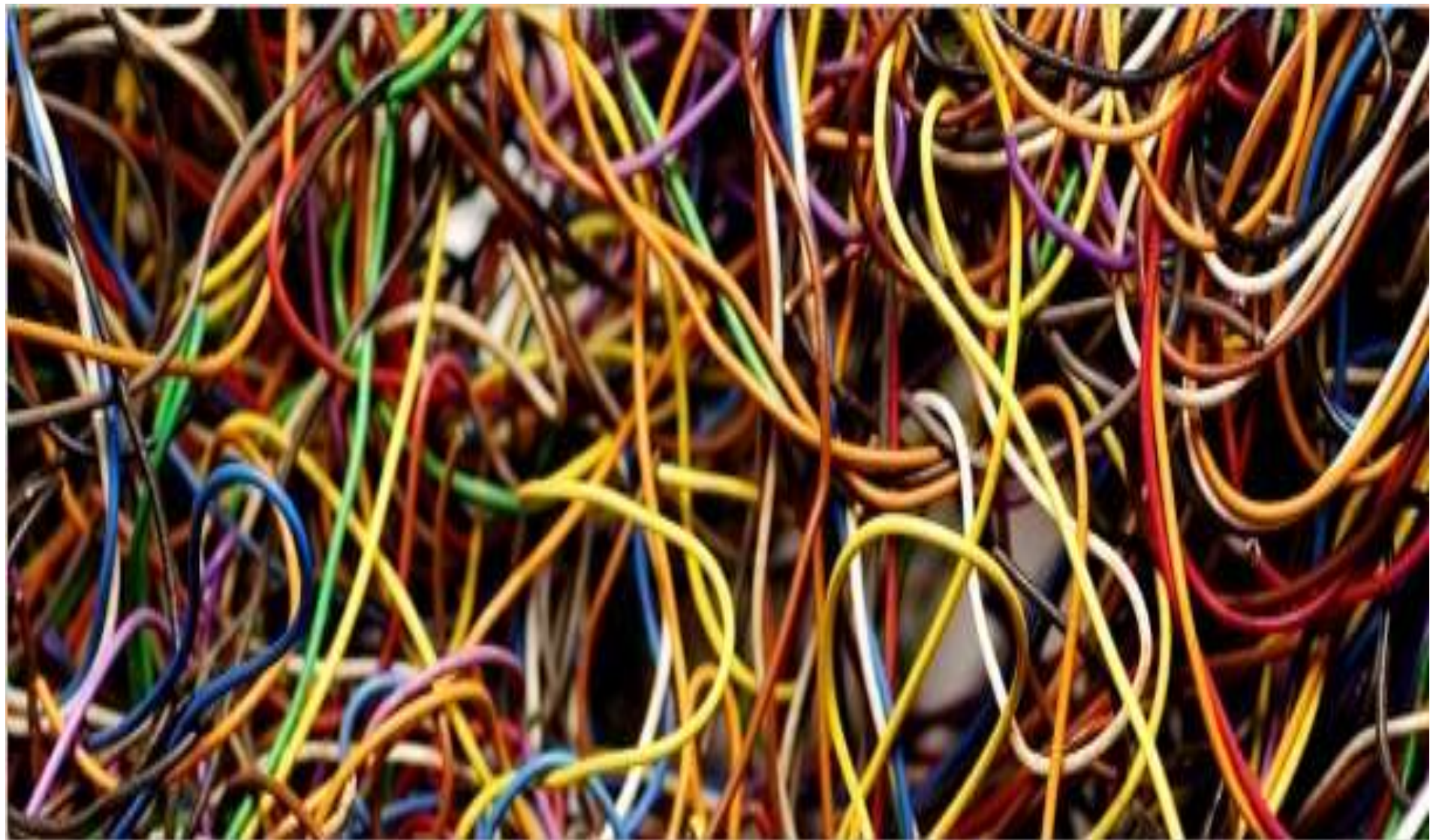# Introduction to Regional Internet Registries (RIRs)

Pakistan School on Internet Governance (pkSIG) 2018

Ihtisham Khalid

You should feel like this ?
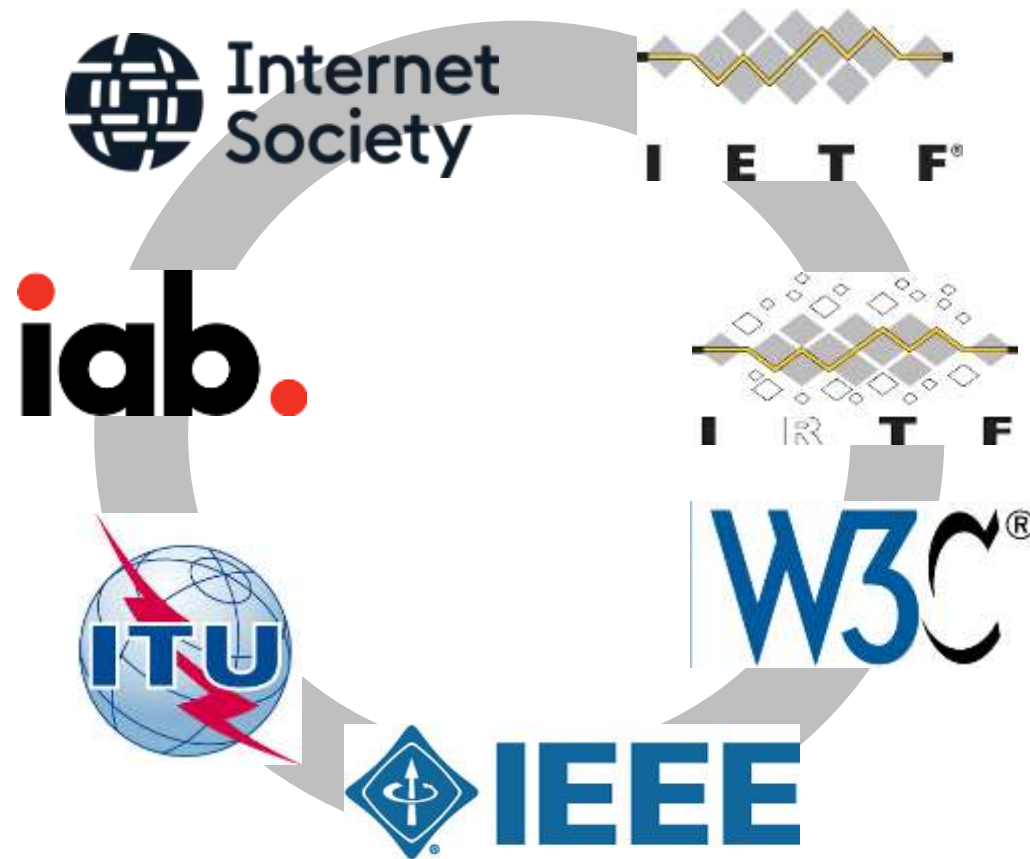
My background in IG

- **ICANN**
  - NextGen Fellow
  - NextGen Ambassador
  - Root Server System Advisory Committee (RSSAC) – Caucus member
  - Meeting attended: ICANN 55 (Marrakech), ICANN 57 (Hyderabad), ICANN 61 (San Juan, Puerto Rico)
- **ISOC**
  - Expert course moderator
    - Building Wireless Community Networks
    - Shaping the internet: History & Futures
  - Train the Trainers Program
    - Mutually Agreed Norms for Routing Security
- **IEEE**
  - 802.11 WIFI Working Group – Voting Member
- **Summer Schools on IG**
  - PKSIG, APIGA, APSIG, INSIG

What is this ?

Birthplace of the Internet

Birthplace of the Internet

- 1969 -

3420

INTERFACE MESSAGE PROCESSOR

Developed for the Advanced Research Projects Agency by Bolt Beranek and Newman Inc.

bbn

POWER   SENSE   REGISTER   OPERATION

IEEE MILESTONE IN ELECTRICAL ENGINEERING AND COMPUTING

Birthplace of the Internet, 1969

At 10:30 p.m., 29 October 1969, the first ARPANET message was sent from this UCLA site to the Stanford Research Institute. Based on packet switching and dynamic resource allocation, the sharing of information digitally from this first node of ARPANET launched the Internet revolution.

October 2009

IEEE

[Open] standards development

Internet of Rights Fellow – Team Digital

"Protecting Freedom of Expression in Internet Governance Bodies"

National Endowment for Democracy, USA

Focus organizations:

What is an RIR ?

What is an RIR ?

A Regional Internet Registry (RIR) manages the allocation and registration of Internet number resources in a particular region of the world and maintains a unique registry of all IP numbers issued.

Number resources include IP addresses (Ipv4 and IPv6) and autonomous system (AS) numbers

The Internet Registry System

1992 **RIPE** NCC

1993 ⸬ **AP**NIC

1997 ARIN

1999 lacnic

2005 AFRINIC
The Internet Numbers Registry for Africa

THE REGIONAL
INTERNET REGISTRIES

The RIR system allocates addresses
according to policies developed in
open, transparent, bottom-up,
multistakeholder processes

On the Internet, you are nothing but an IP address!

# On the Internet, you are nothing but an IP address!

196.216.2.1

193.0.0.131

202.12.29.20

192.0.34.163

202.12.29.142

192.149.252.7

206.131.253.68

200.160.2.15

192.0.0.214
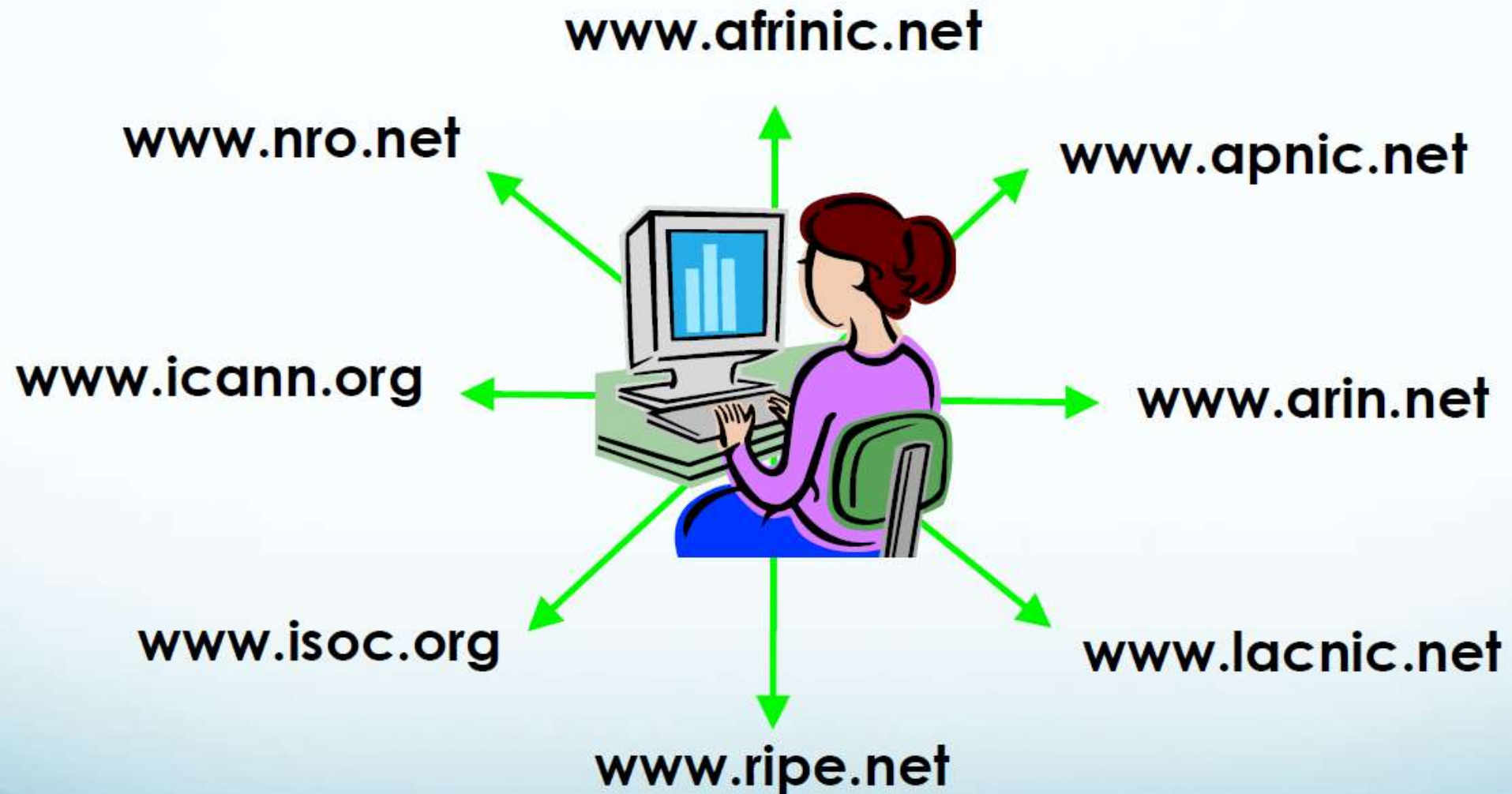
What is an IP Address ?

- Unique identifier for a computer or device on a TCP/IP network that facilitates moving data between networks

- Every device directly connected to the Internet needs a unique IP address

IP Addresses are Not Domain Names

- **IP Address [Identifier]**
  - "Computer-friendly"
  - Unique number identifies computer on Internet
  - Used for routing (moving information across an internetwork from a source to a destination)

- **Domain Name [Reference]**
  - "People-Friendly"
  - Maps host name to unique IP address
  - A means of storing and retrieving information about hostnames and IP addresses in a distributed data base

Resource Allocation Path
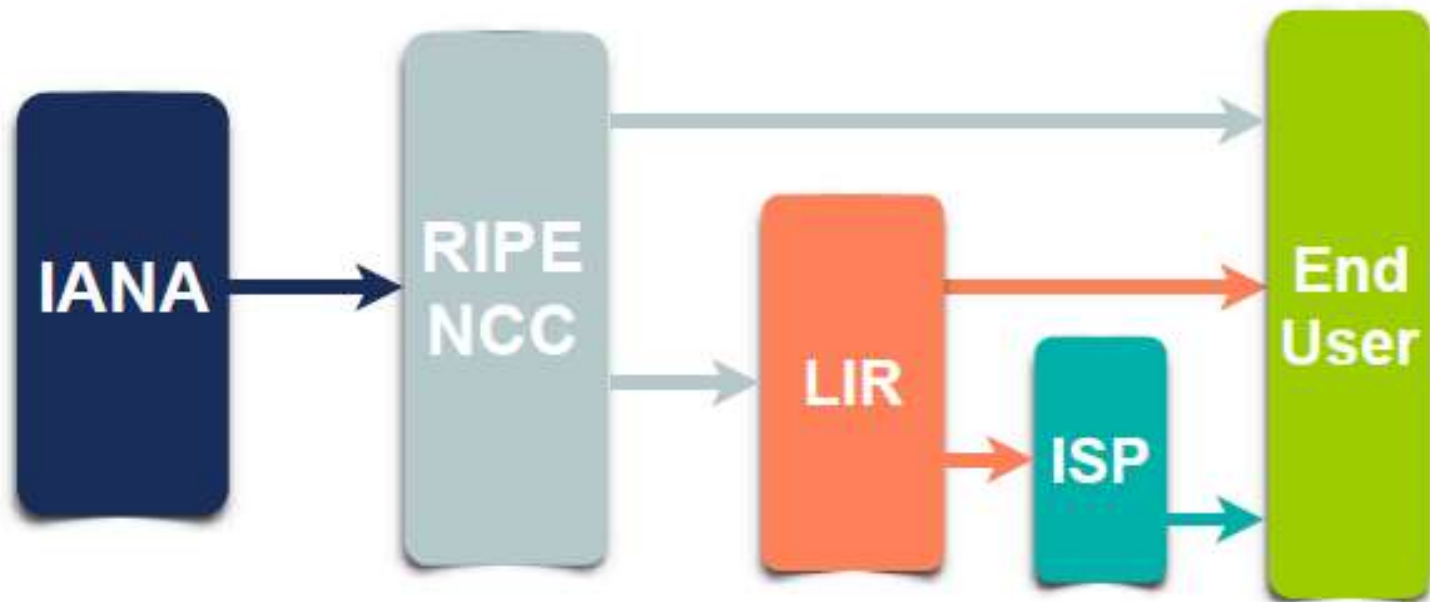
Regional Internet Registries

- Five RIRs Worldwide
  - Not-for-profit organizations
  - Funded by membership fees
  - Policies decided by regional communities
  - Neutral, Impartial, Open, Transparent

- RIR Goals: Registration, Aggregation, Conservation

Goals: Registration

- Why?
  - Ensure uniqueness of internet number resources
  - Provide contact information

- How?
  - RIR whois database

- Result:
  - IP address space used only by one organization
  - Information available on users of internet number resources

Goals: Aggregation

- Why?
  - Routing tables growing too fast
  - Provide scalable routing solution for internet

- How?
  - Encourage announcement of whole allocation
  - Introduction of Classless Inter Domain Routing (CIDR)

- Result:
  - Growth of routing tables has slowed a bit

Goals: Conservation

- Why?
  - IP addresses and AS number are limited resources
  - These resources were not used efficiently in the past

- How?
  - Introduction of CIDR
  - Policies to ensure fair usage

- Result:
  - Growth in IP address space usage slowed down
  - Resources were distributed based on need

RIR Bottom-up Model
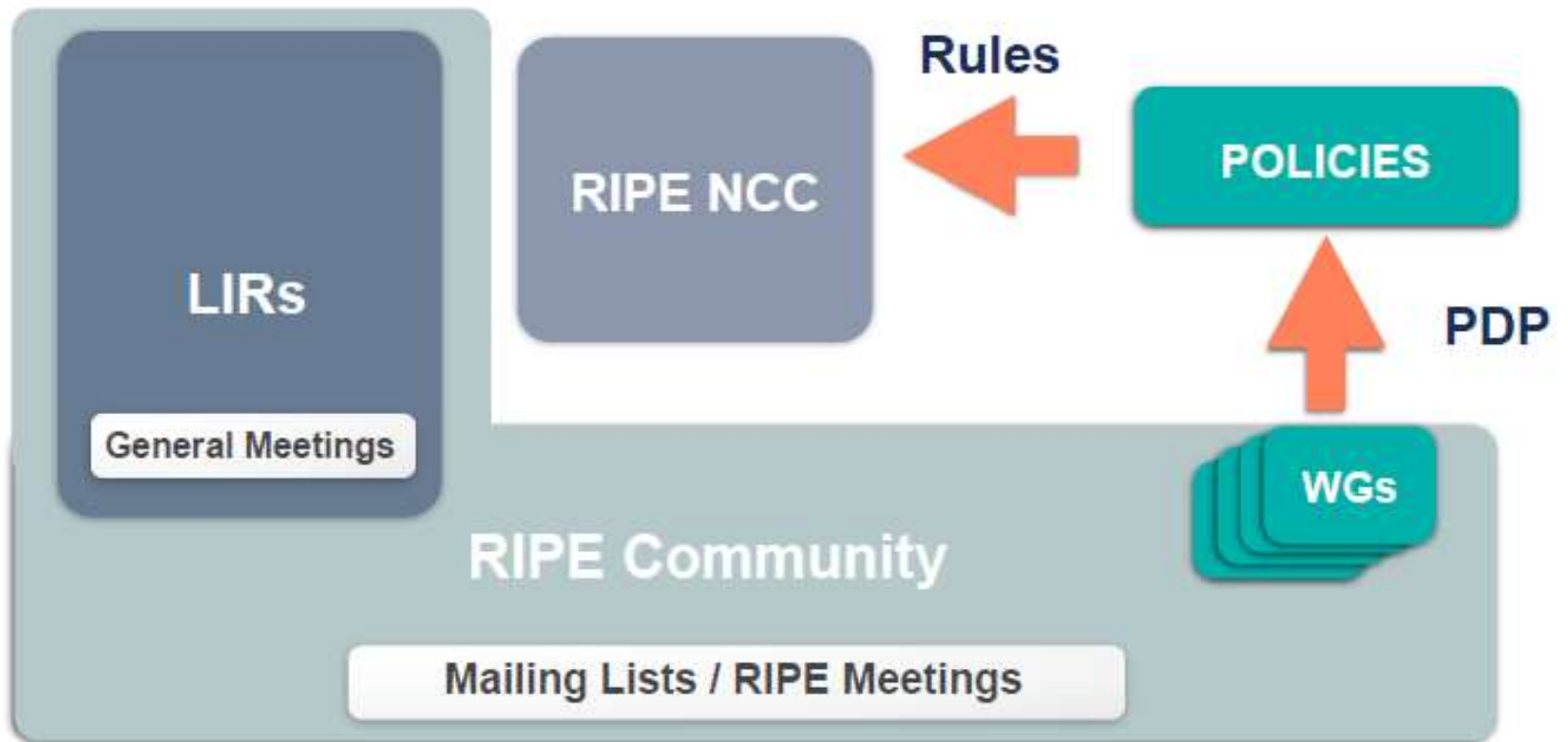
Terminology

- Allocation
  - Block of IP addresses reserved for future use

- Assignment
  - A chunk of addresses from an allocation that is used:
    - In your own infrastructure
    - In an end user network

Types of Address Space

- PA = Provider Aggregatable
  - Blocks given to LIRs
  - Distributed further to other users
  - When customers change ISP, the IPs go back to LIR

- PI = Provider Independent
  - Blocks given directly to a user for their own network
  - User takes IPs with them if they change ISP

PA versus PI
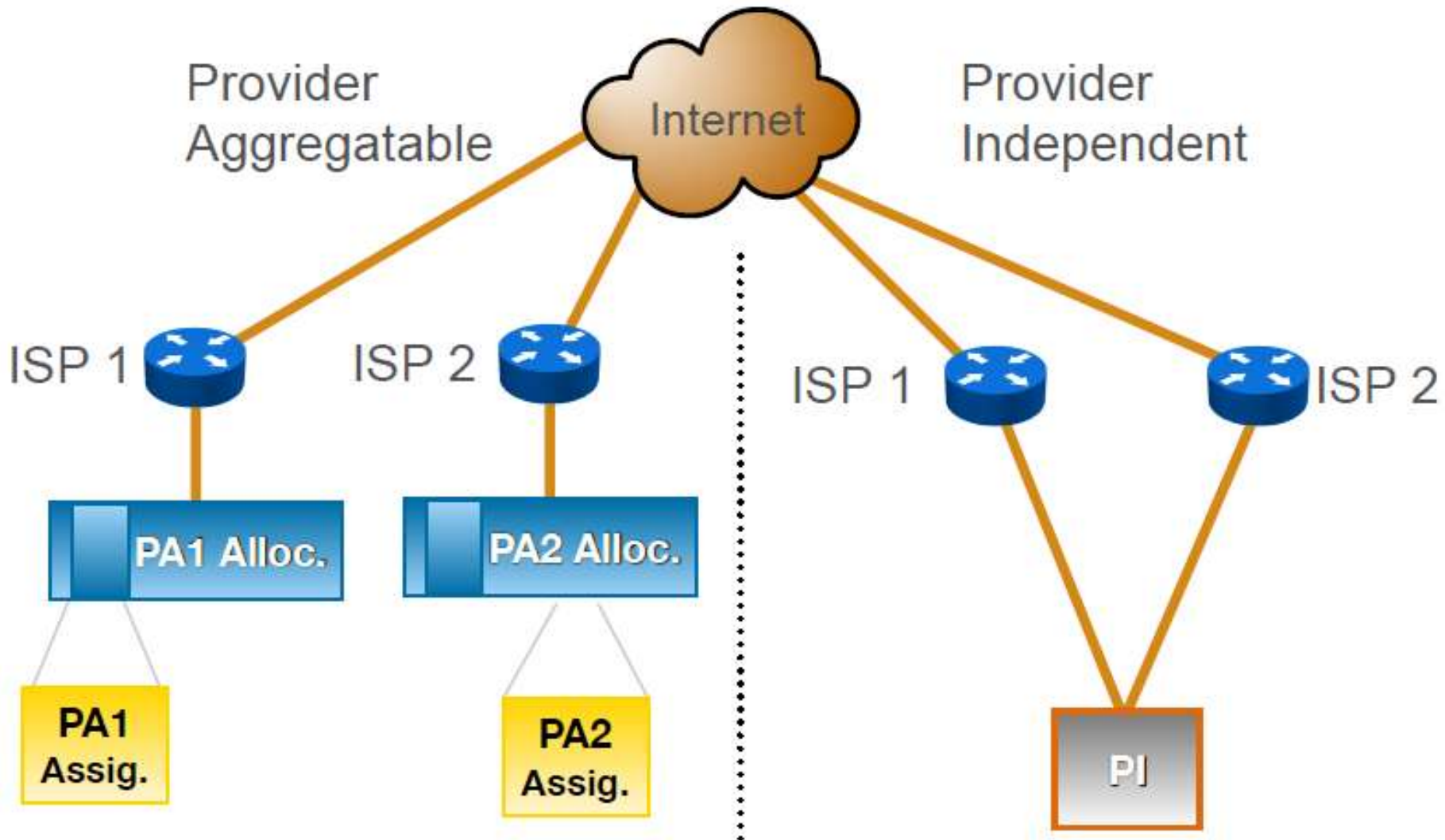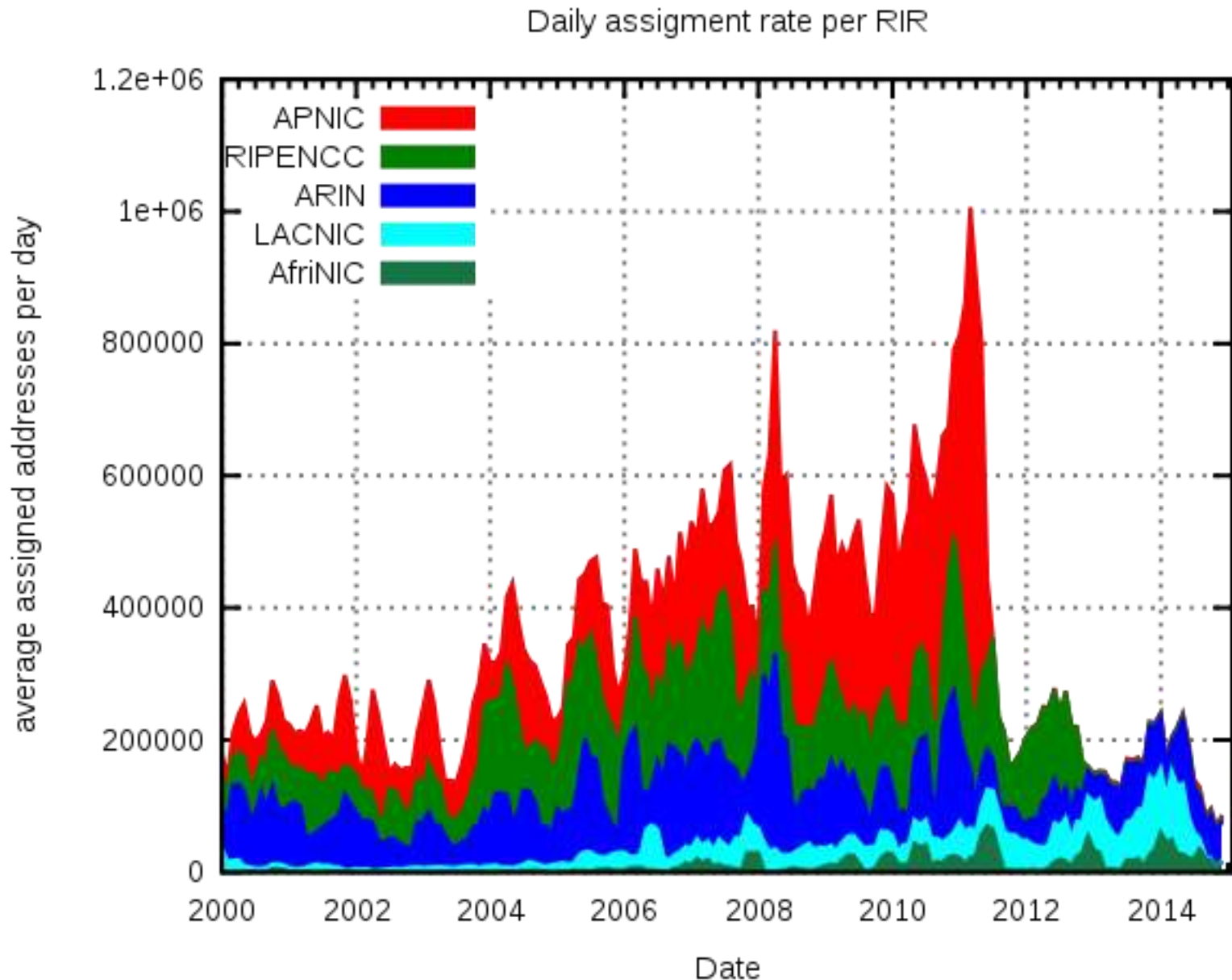
IPv4 Address Distribution
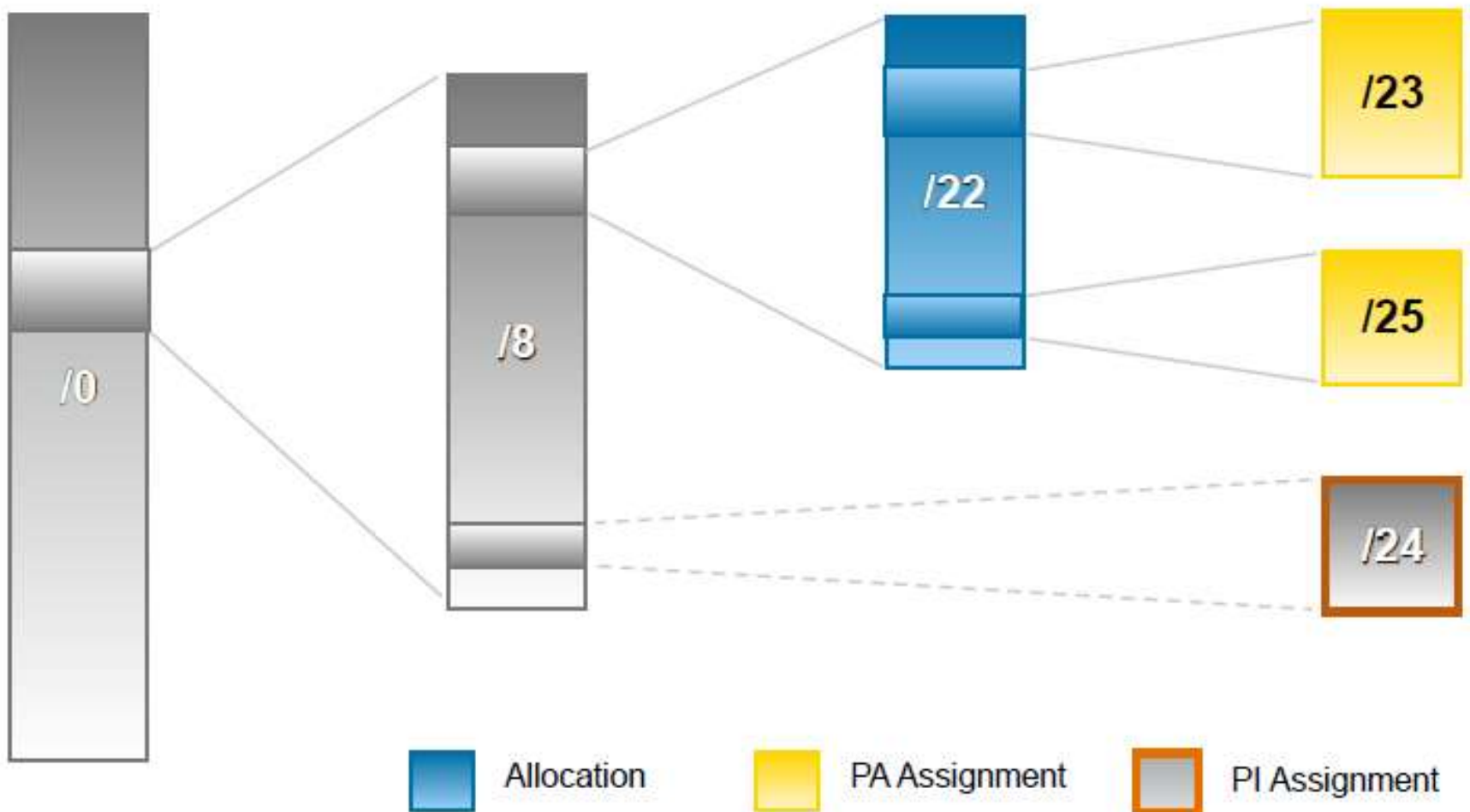
IPv6 Address Distribution
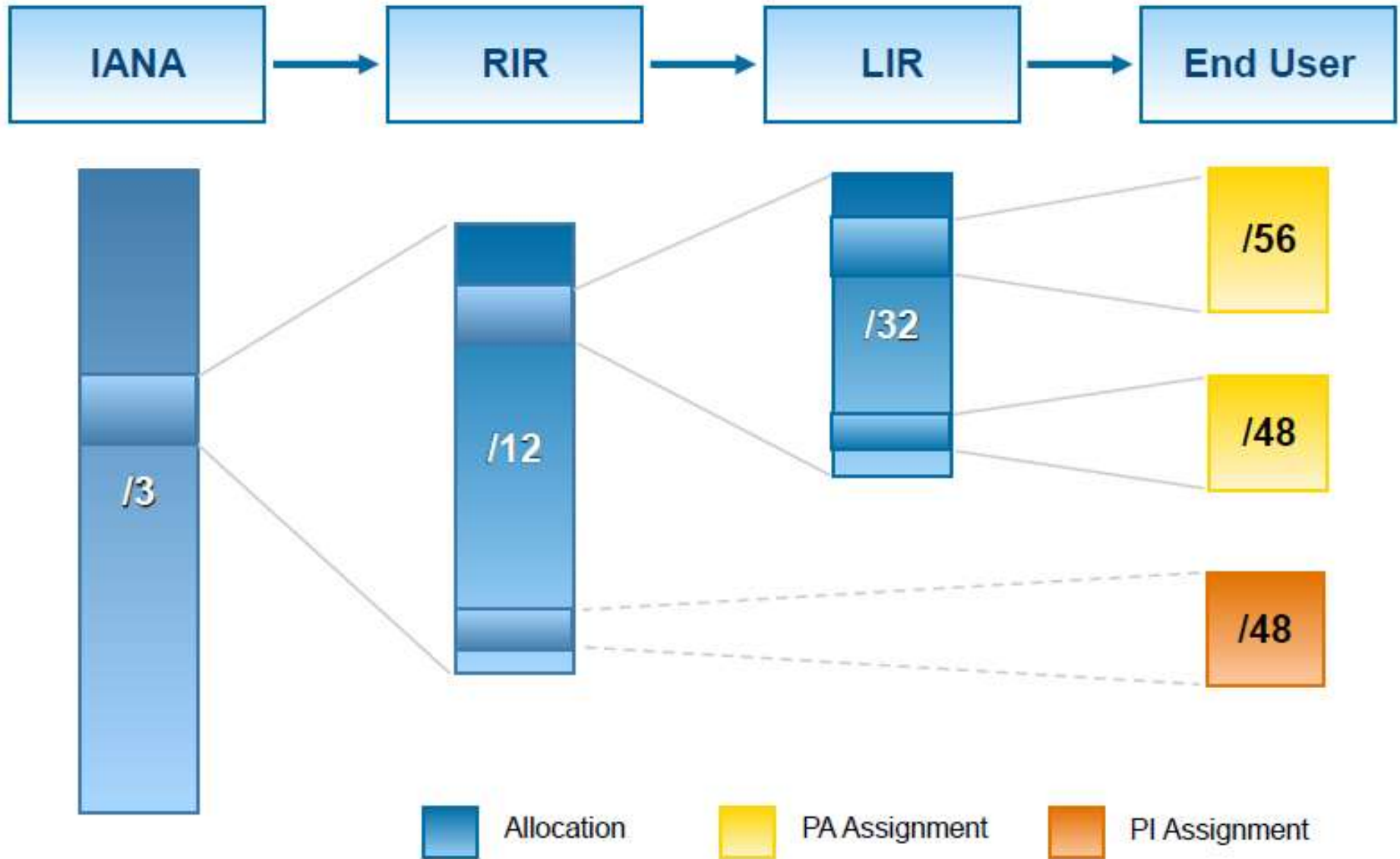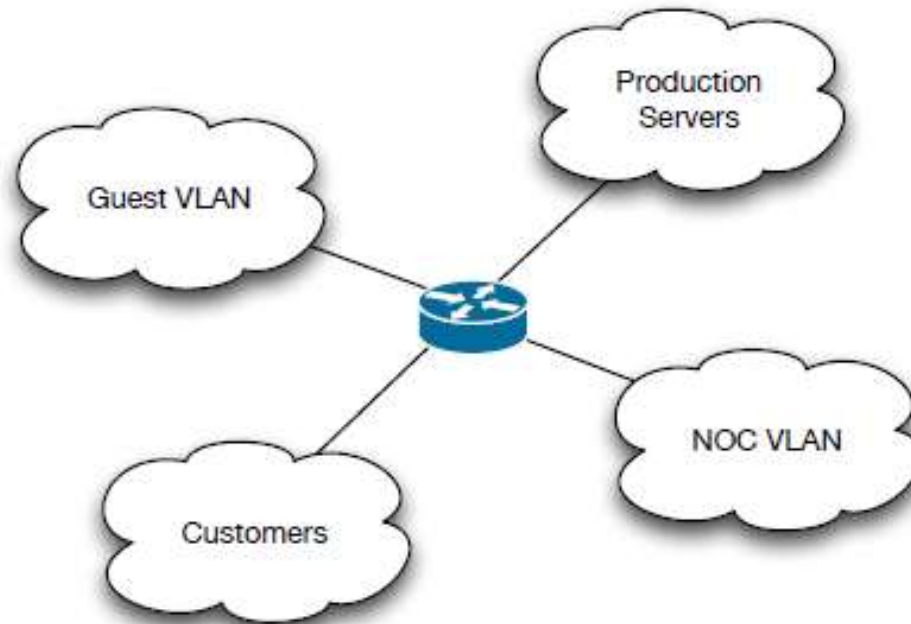
Exhaustion on IPv4 addresses since 1995

Free /8
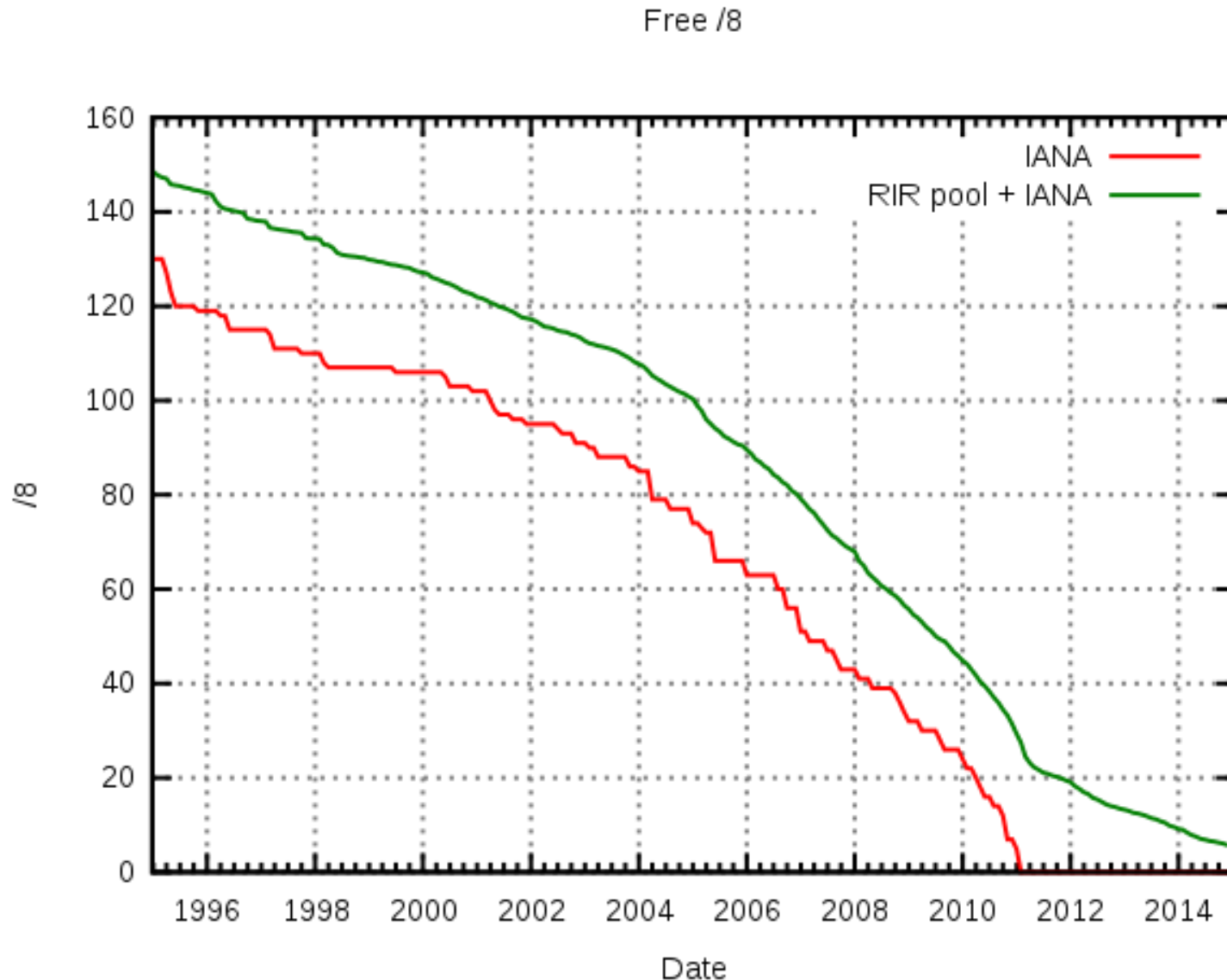
IPv4 addresses allocation rate per RIR

Daily assigment rate per RIR

How Much Address Space?

- Think about how the network will be split up

- Subnets are used to group hosts

- Calculate how much address space you will need!

IPv4 Subnets

- 3 IPs required for each subnet

  - network

  - broadcast

  - gateway

- Usable IPs = [subnet size] - 3 IPs

  - /24 = 256 IPs = 256 - 3 = 253 usable IPs

IPv6 Subnets

/64 = 1 subnet = 18,446,744,073,709,551,616 IPs

...

/60 = 16 subnets

...

/56 = 256 subnets

...

/52 = 4096 subnets

...

/48 = 65536 subnets

In IPv6 the amount of hosts in a subnet is irrelevant!

35%
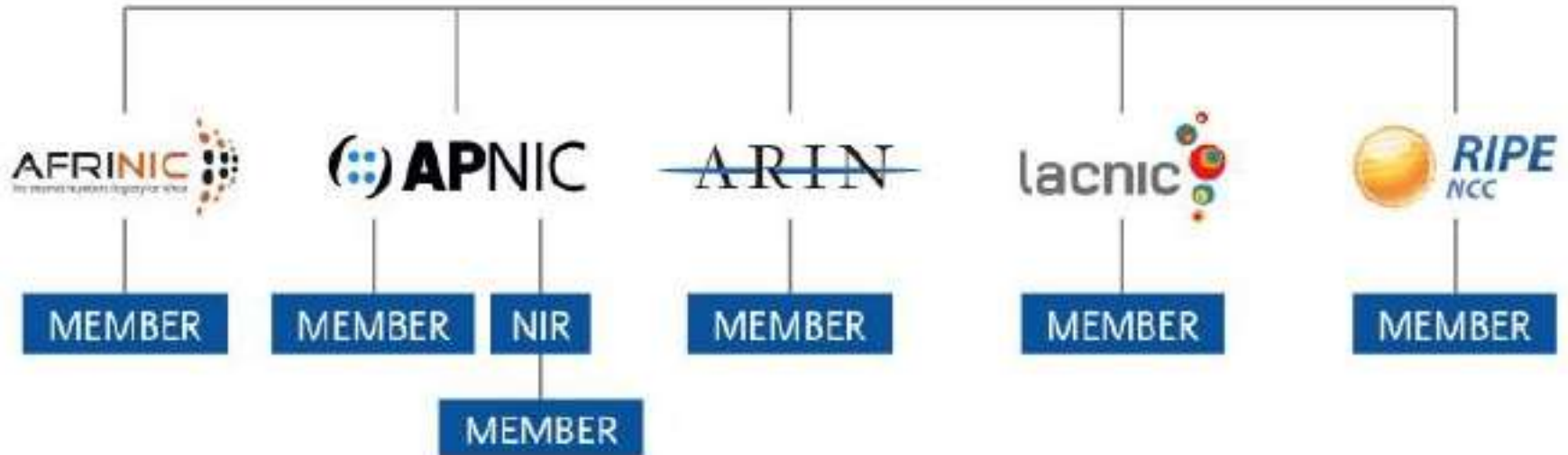IPv4 SPACE
ALLOCATED

1992

65%
IPv4 SPACE
AVAILABLE

Expanding the Internet

THE RIR SYSTEM ESTABLISHED
FOR SUSTAINABLE ADDRESS ALLOCATION

Internet Registry Structure

APNIC

- Asia-Pacific Network Information Centre

- One of five Regional Internet Registry (RIRs) charged with ensuring the fair **distribution and responsible management of IP addresses and related resources**

- A membership-based, not-for-profit organization

- Industry self-regulatory body
  - Open
  - Consensus-based
  - Transparent

Where is the APNIC Region ?

APNIC - Services

- Resource distribution
  - IP addresses
  - AS numbers
- Registration services
  - Reverse DNS
  - Internet routing registry
 - Resource certification
  - Whois registry

APNIC – Support in region

- Capacity building
  - Training
  - Workshops
  - Conferences
  - Fellowships
  - Grants
- Infrastructure
  - Root servers
  - IXPs
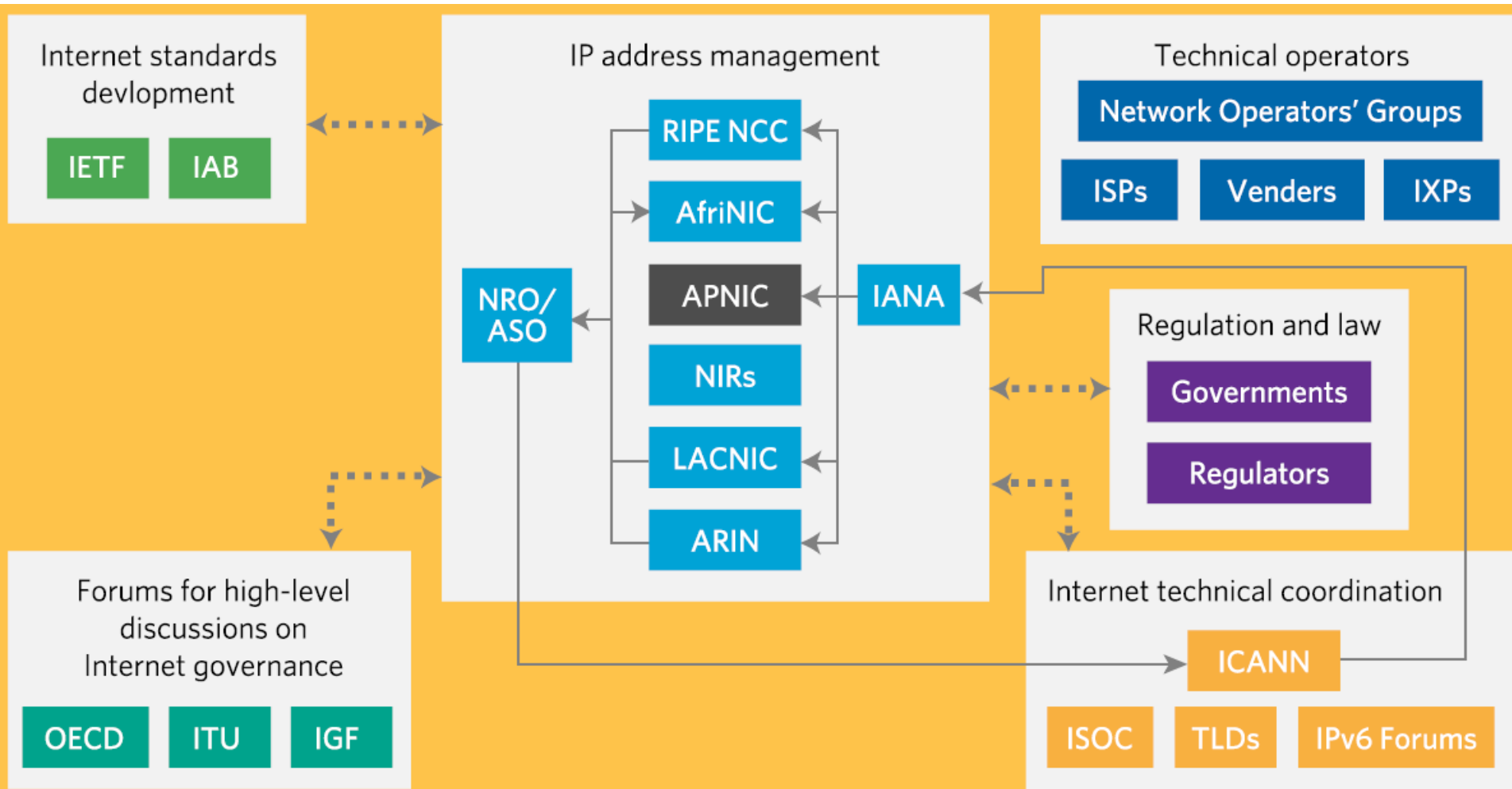 - Engineering assistance

APNIC – Collaboration with community

- Original research
- Data collection & measurement
- Publications
- Local/regional/global events
- Government outreach
- Intergovernmental & technical orgs collaboration
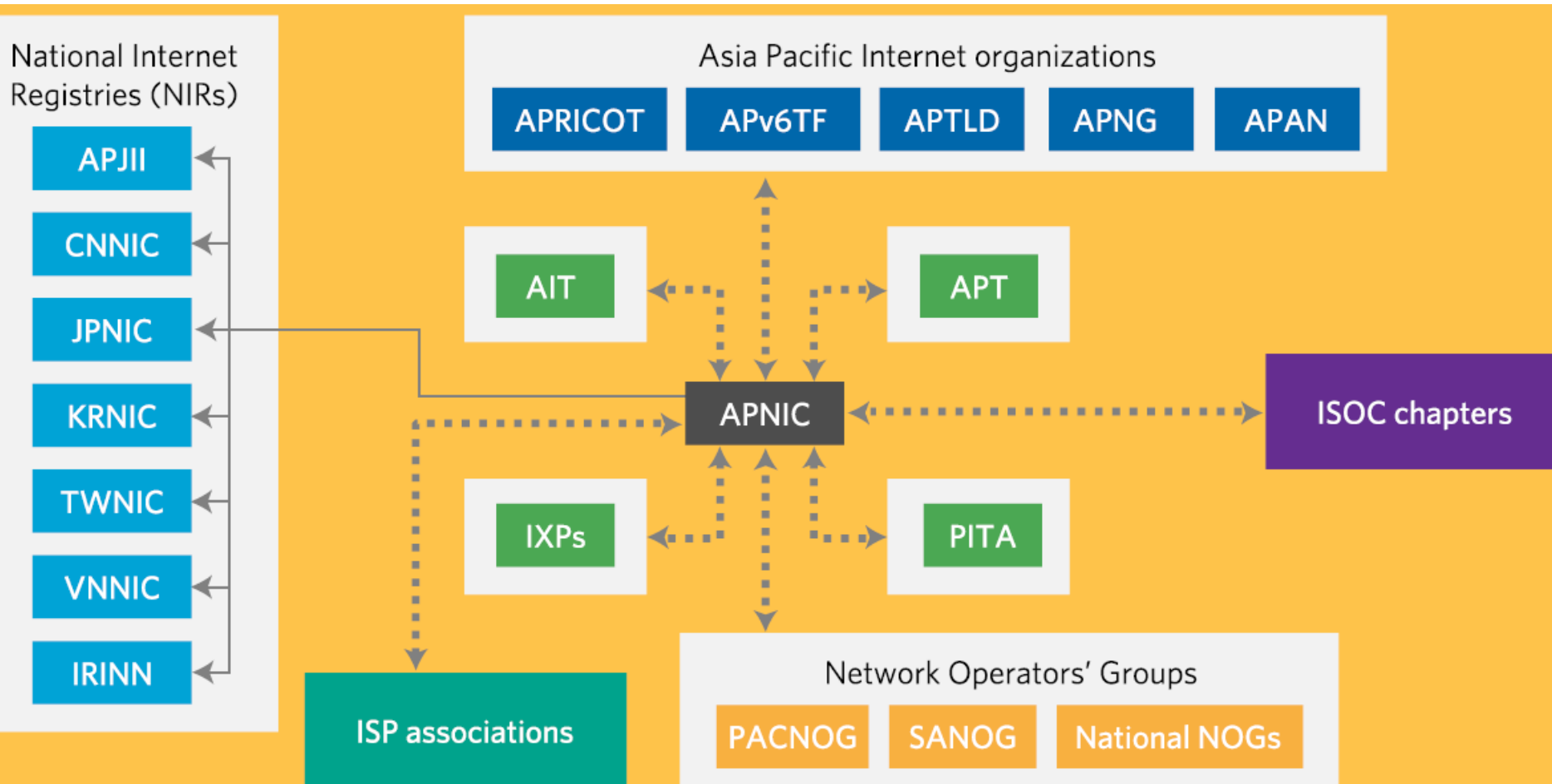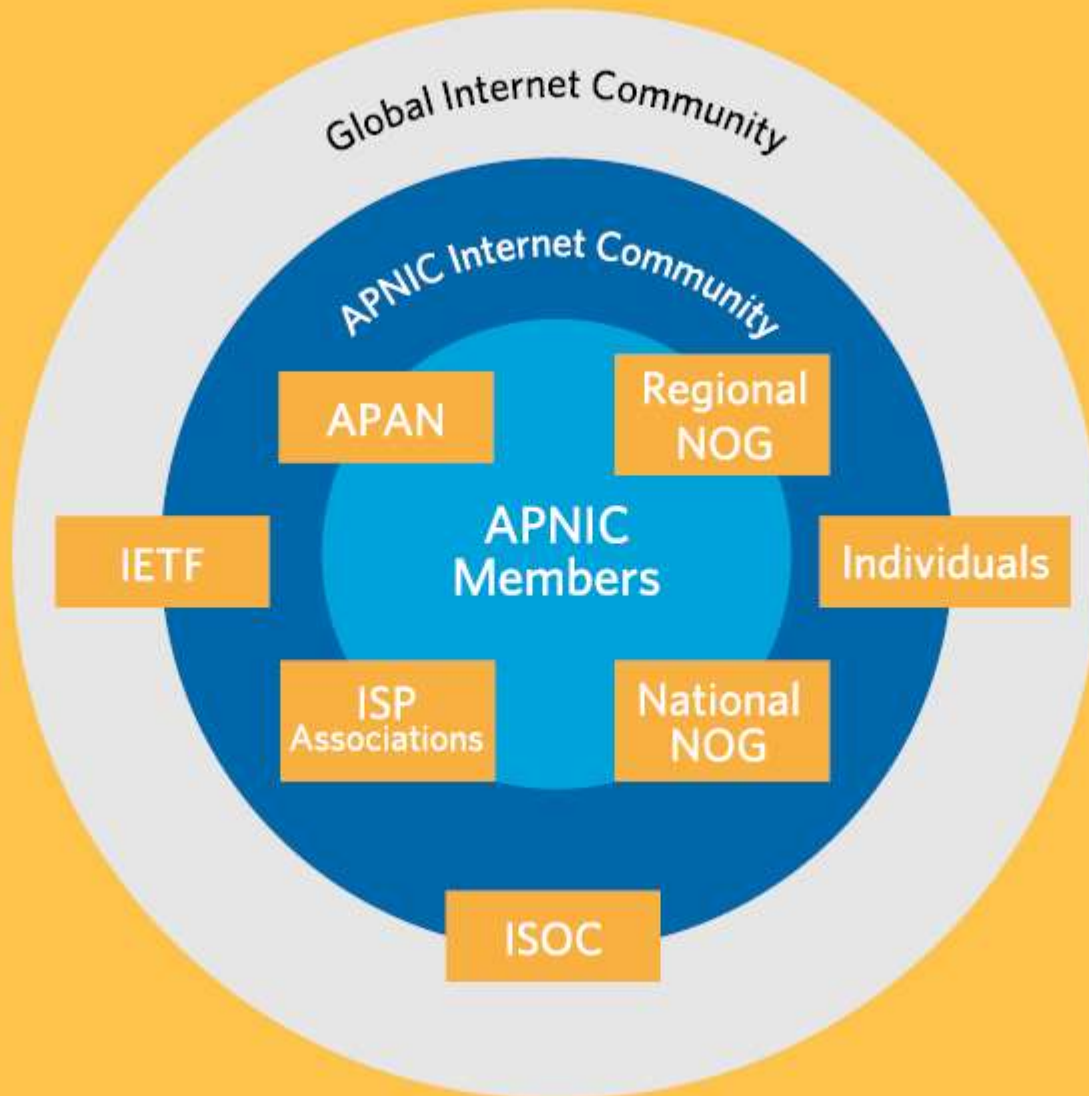- Internet security

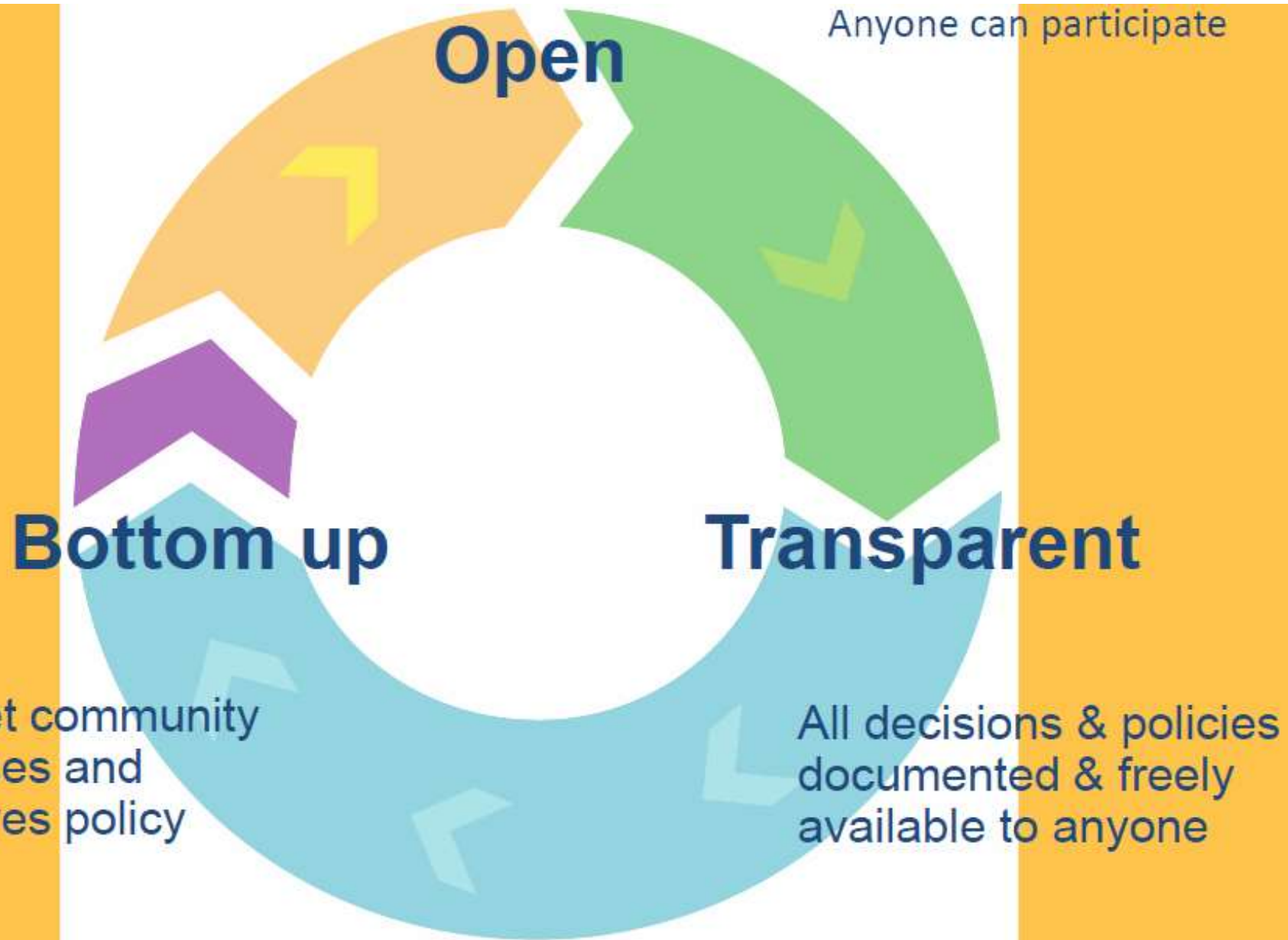# APNIC Membership
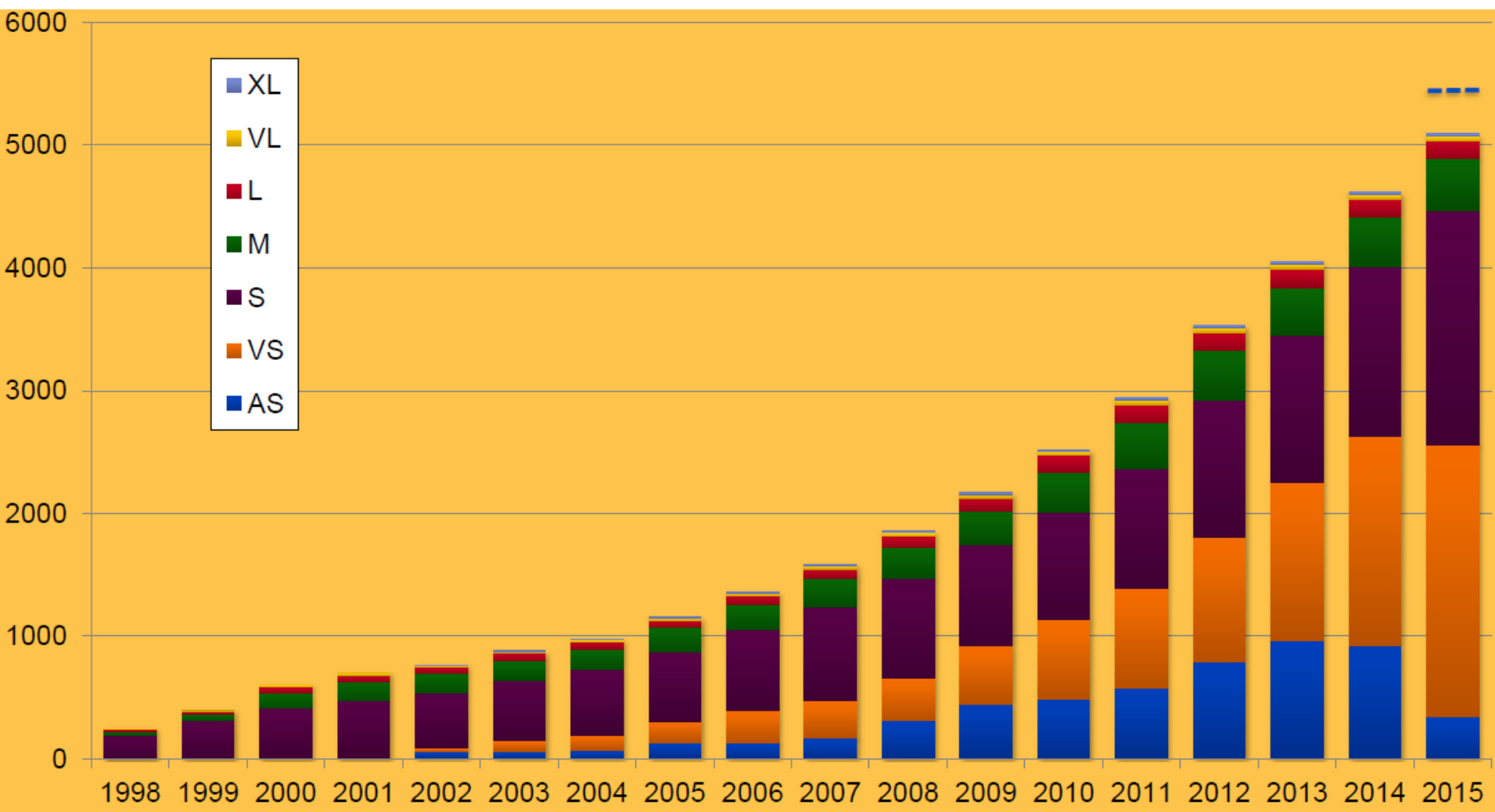
APNIC from a Global Perspective
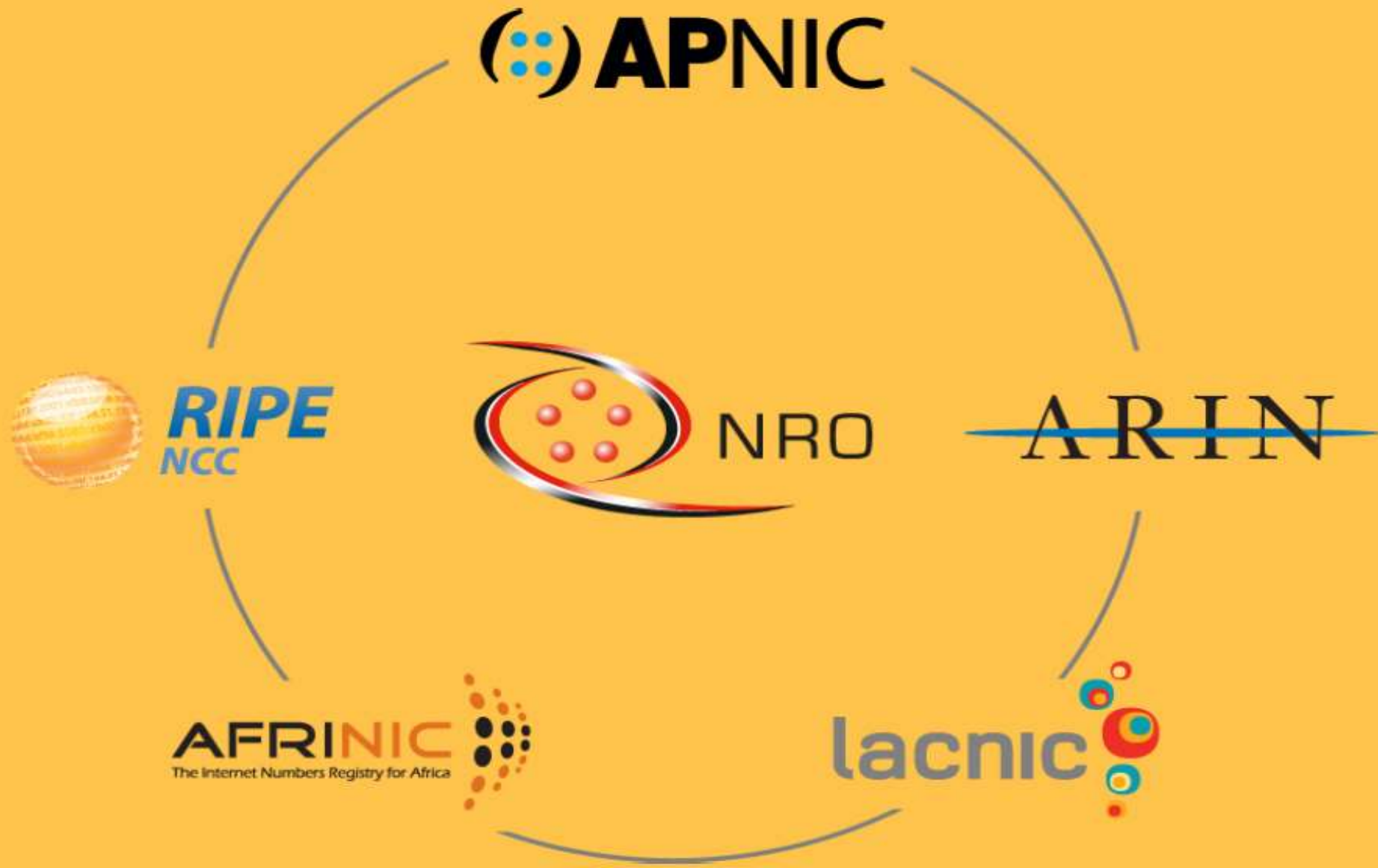
APNIC in the Asia Pacific

Participate!

Policy Development Process

Policy Development Process

Global Policy Coordination

IPv4 ADDRESS SPACE

STATUS OF 256 /8s IPv4 ADDRESS SPACE

CENTRAL REGISTRY 91

NOT AVAILABLE 35

EXPERIMENTAL 16
LOCAL IDENTIFICATION 1
LOOPBACK 1
PRIVATE USE 1
MULTICAST 16

TOTAL IPv4 SPACE

RIRs 130

IANA RESERVED 0

APNIC 45

ARIN 36
AFRINIC 5
LACNIC 9
RIPE NCC 35
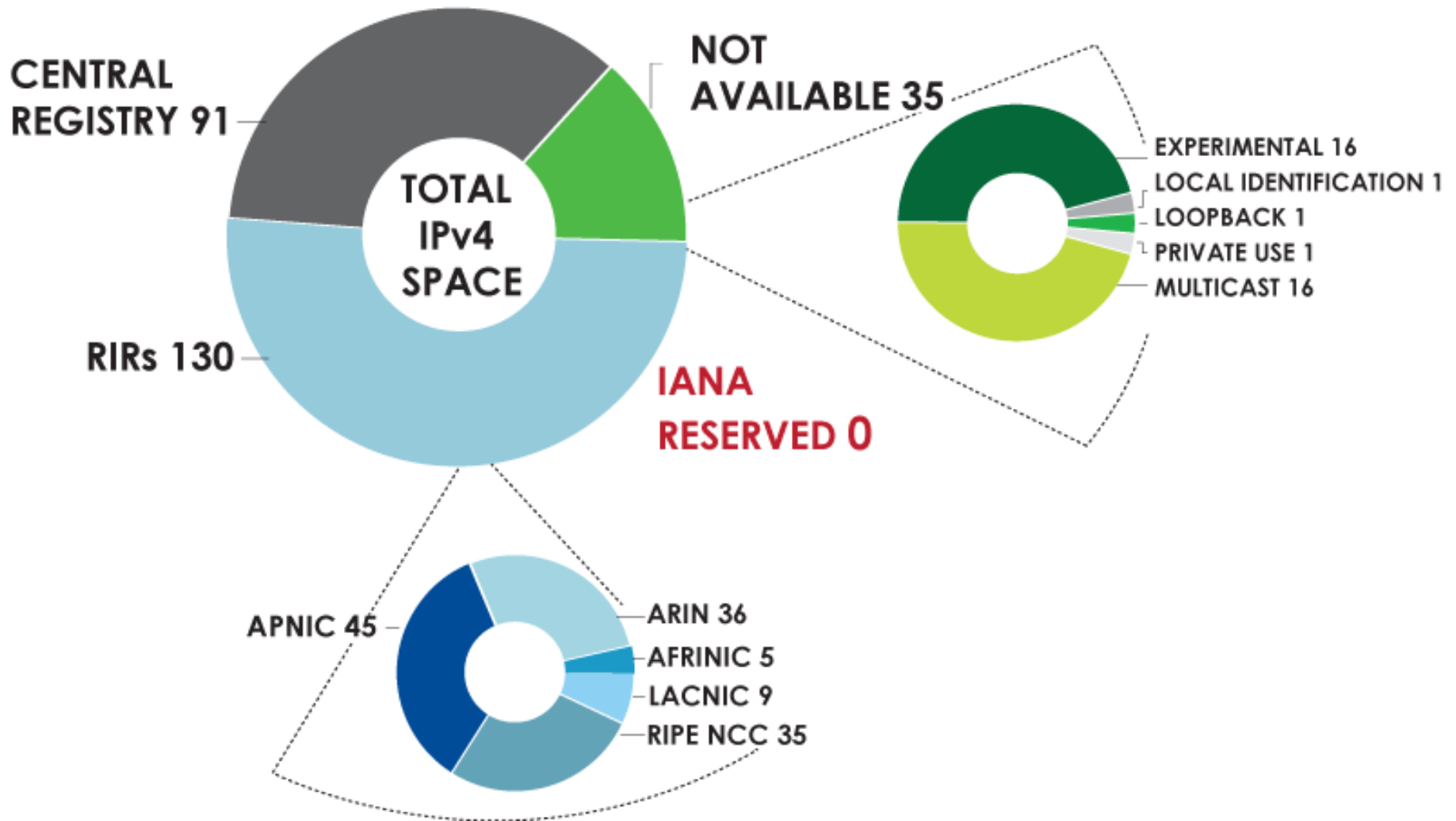
IPv6 ADDRESS SPACE
How much has been allocated to the RIRs?

ALL IPv6 SPACE

/0

/3

GLOBAL
UNICAST

IANA RESERVE
506 /12s

Miscellaneous
1 /12

RIRs 5 /12s (October 2006)

RIR	IPv6 ADDRESS
AFRINIC	2C00:0000::/12
APNIC	2400:0000::/12
ARIN	2600:0000::/12
LACNIC	2800:0000::/12
RIPE NCC	2A00:0000::/12
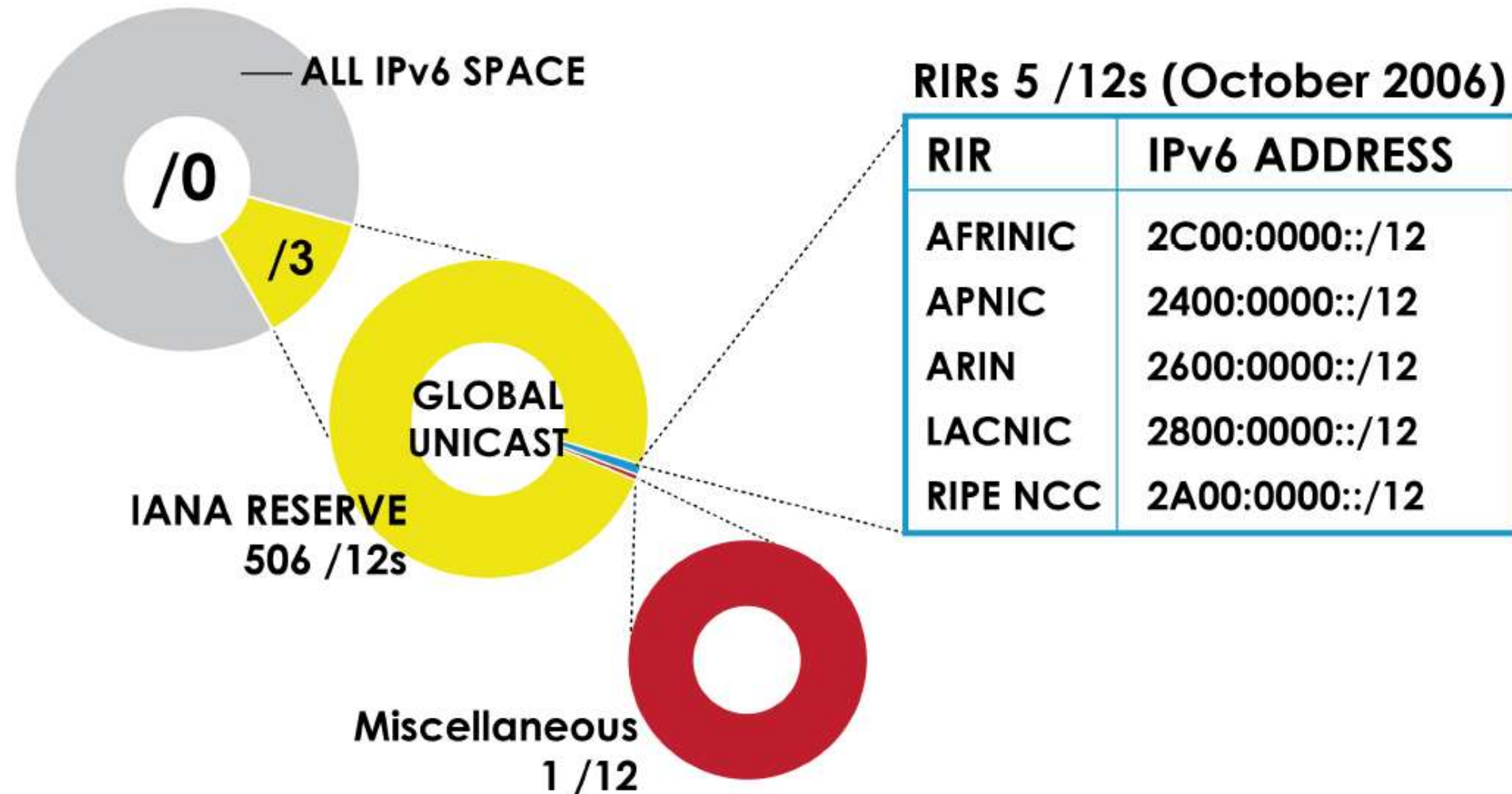
Links to RIR Statistics

- **RIR Stats:**
  - www.nro.net/statistics
- **Raw Data/Historical RIR Allocations:**
  - www.iana.org/assignments/ipv4-address-space
  - www.iana.org/assignments/as-numbers
  - www.iana.org/assignments/ipv6-unicast-address-assignments

References

- https://www.ripe.net/support/training/material/lir-training-course/lir-slides.pdf

- https://www.nro.net/wp-content/uploads/NRO_Q1_2018.pptx

Question?

Thank you

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ihtisham@article19.org