# The Road to IPv6

European Commison
Internet Informal Group
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Technical Basics

How to Get IP Adresses

Address Policy History

Where Do We Stand Now


# Technical Basics

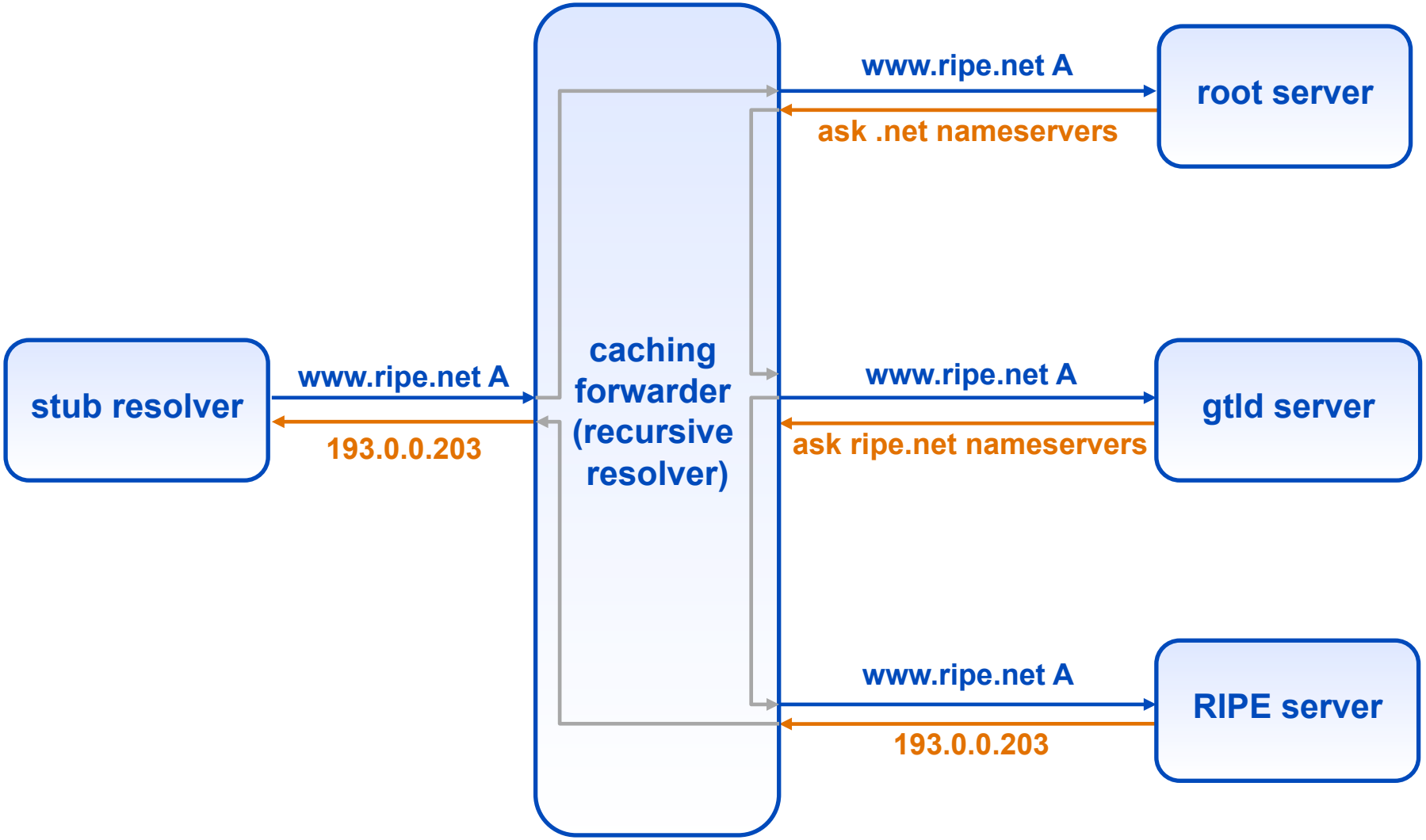
# Names and Numbers

www.ripe.net

193.0.0.203

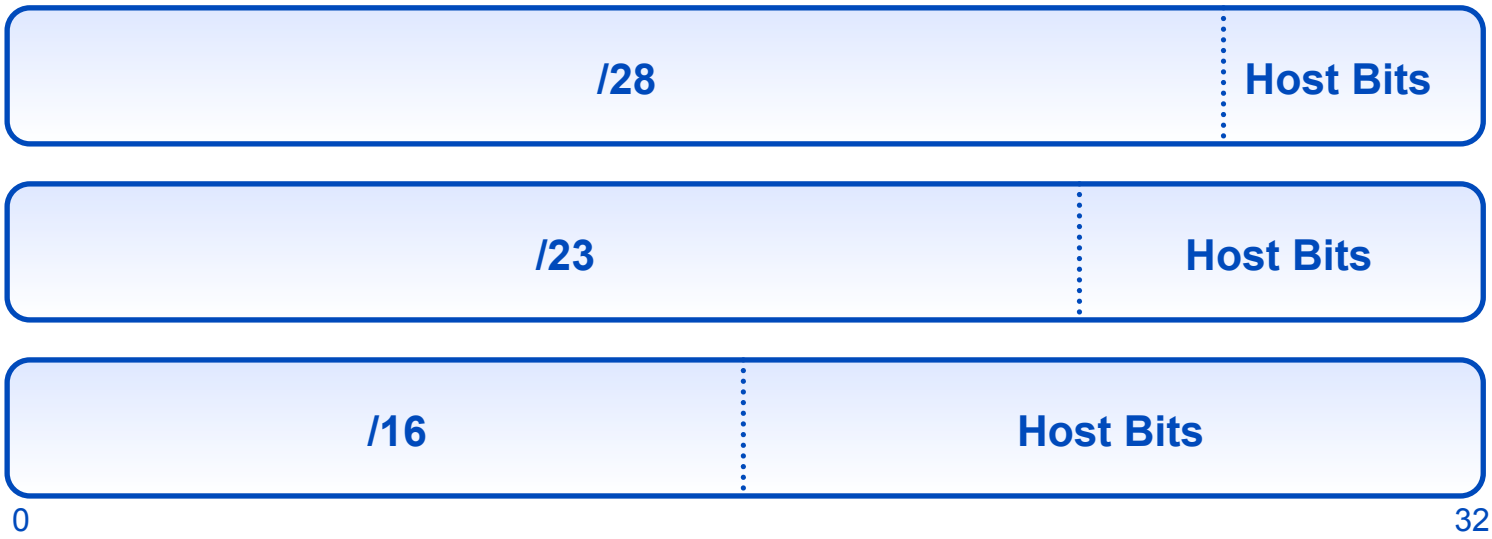
2001:610:240:11::c100:1319

# DNS: Domain Name System

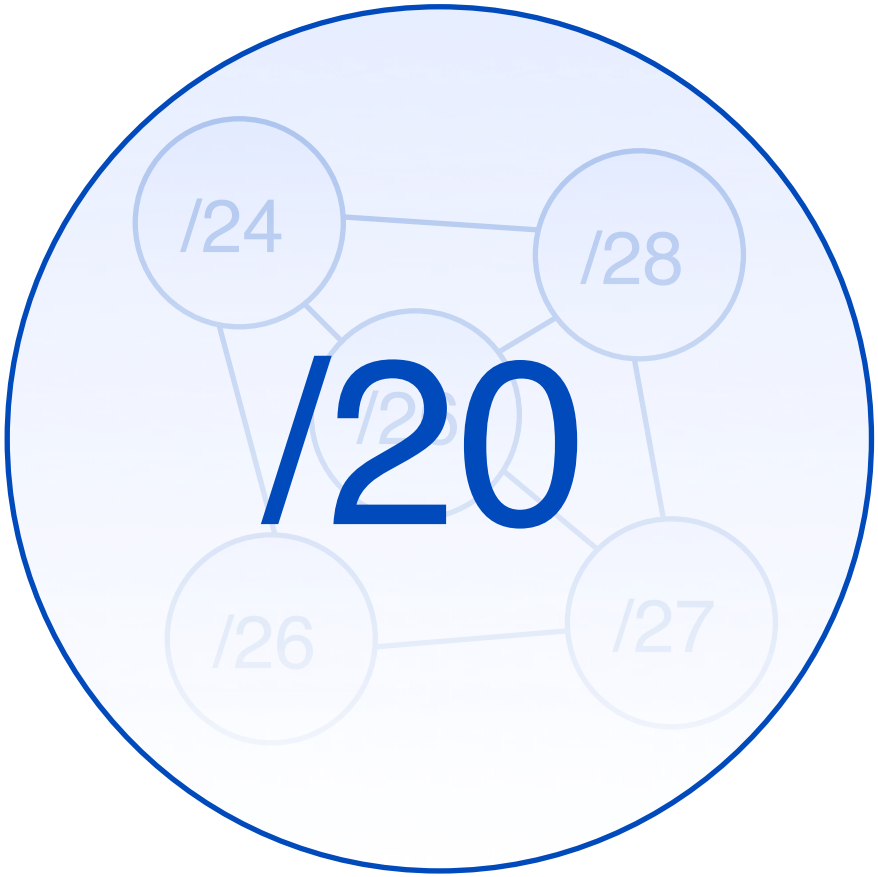


# Network Bits and Host Bits

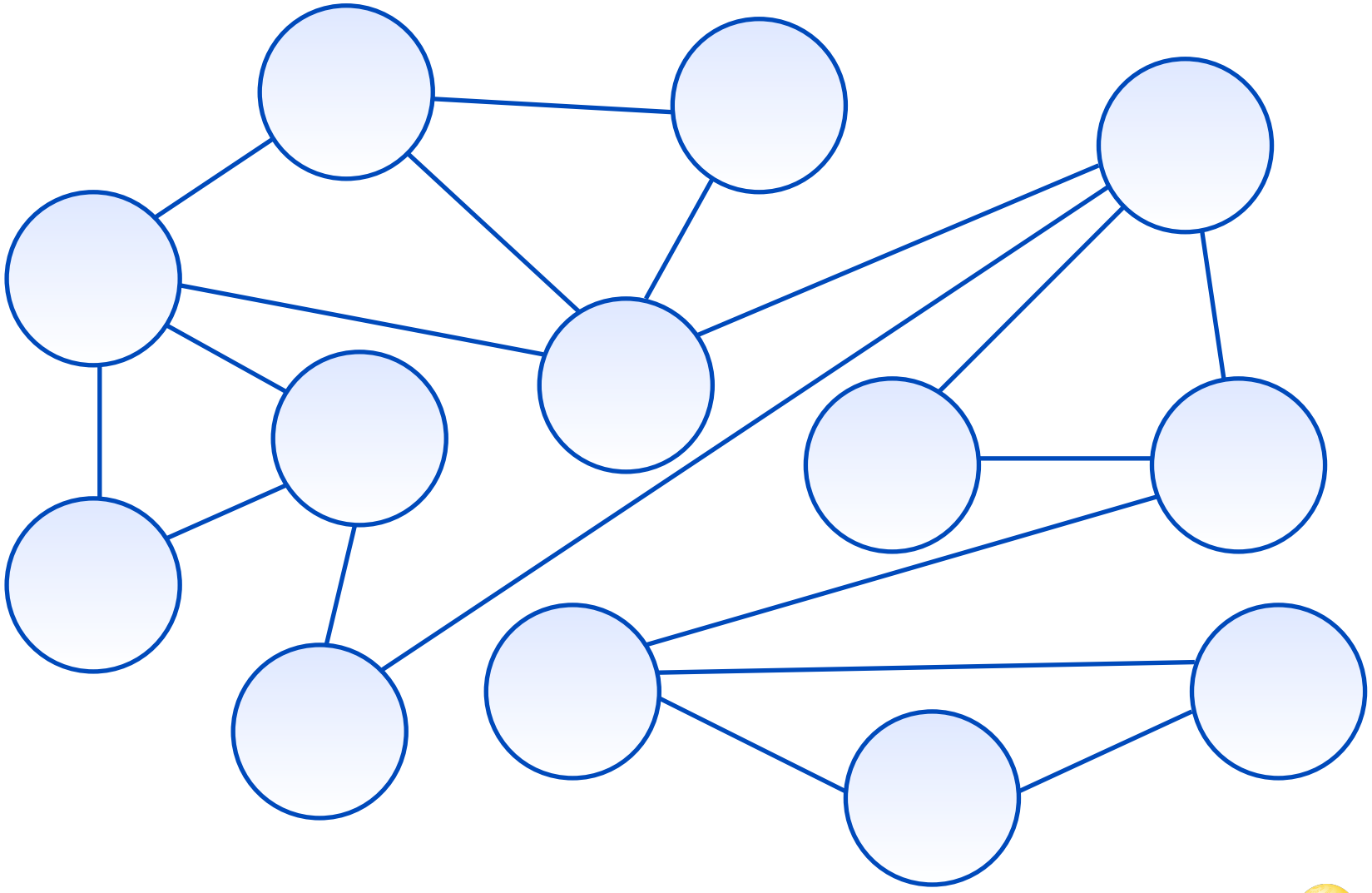

A network is identified in slash notation:



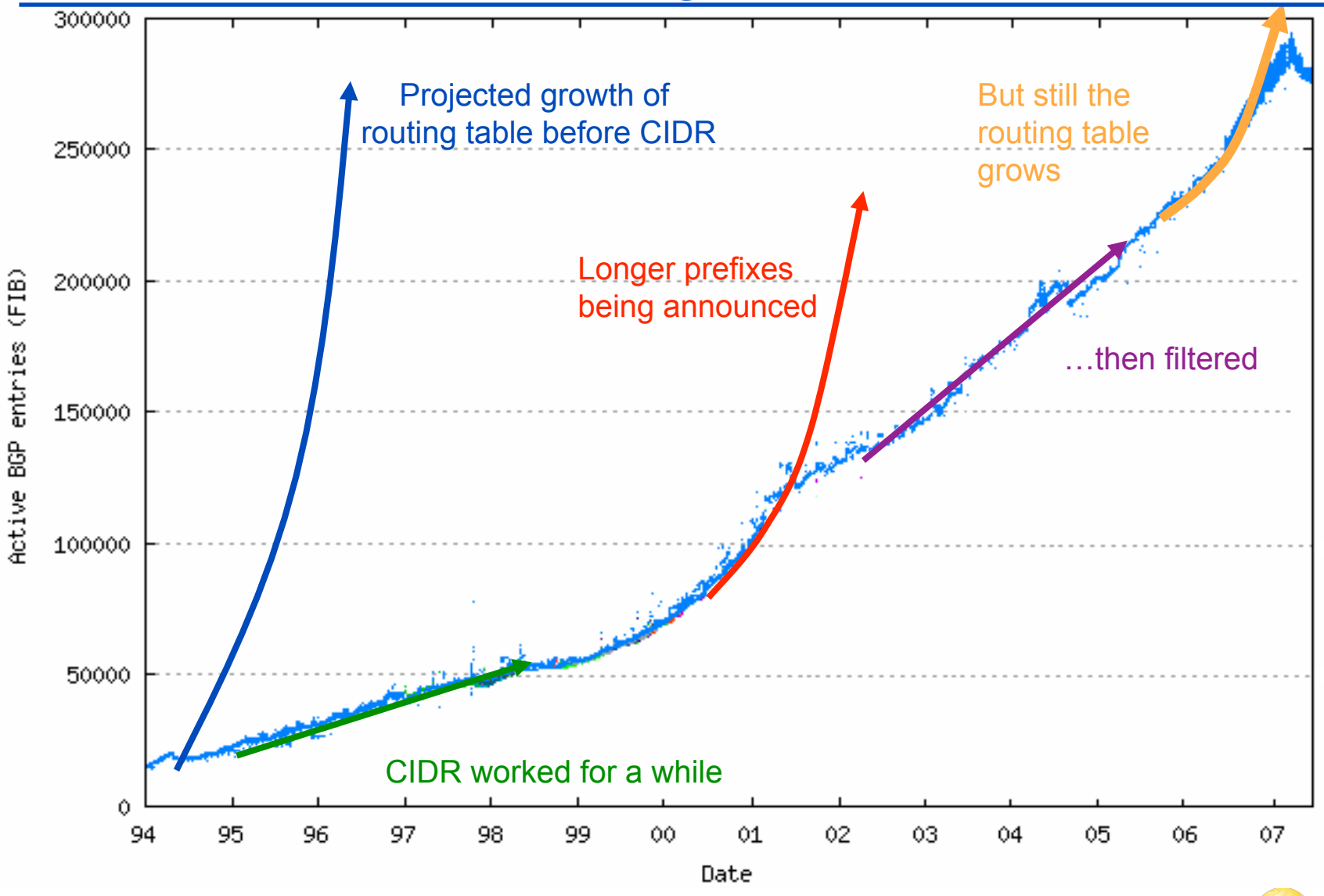
# Internal versus External Routing



# Autonomous Systems



# Growth of the routing table




source: http://potaroo.net

# Autonomous System Numbers

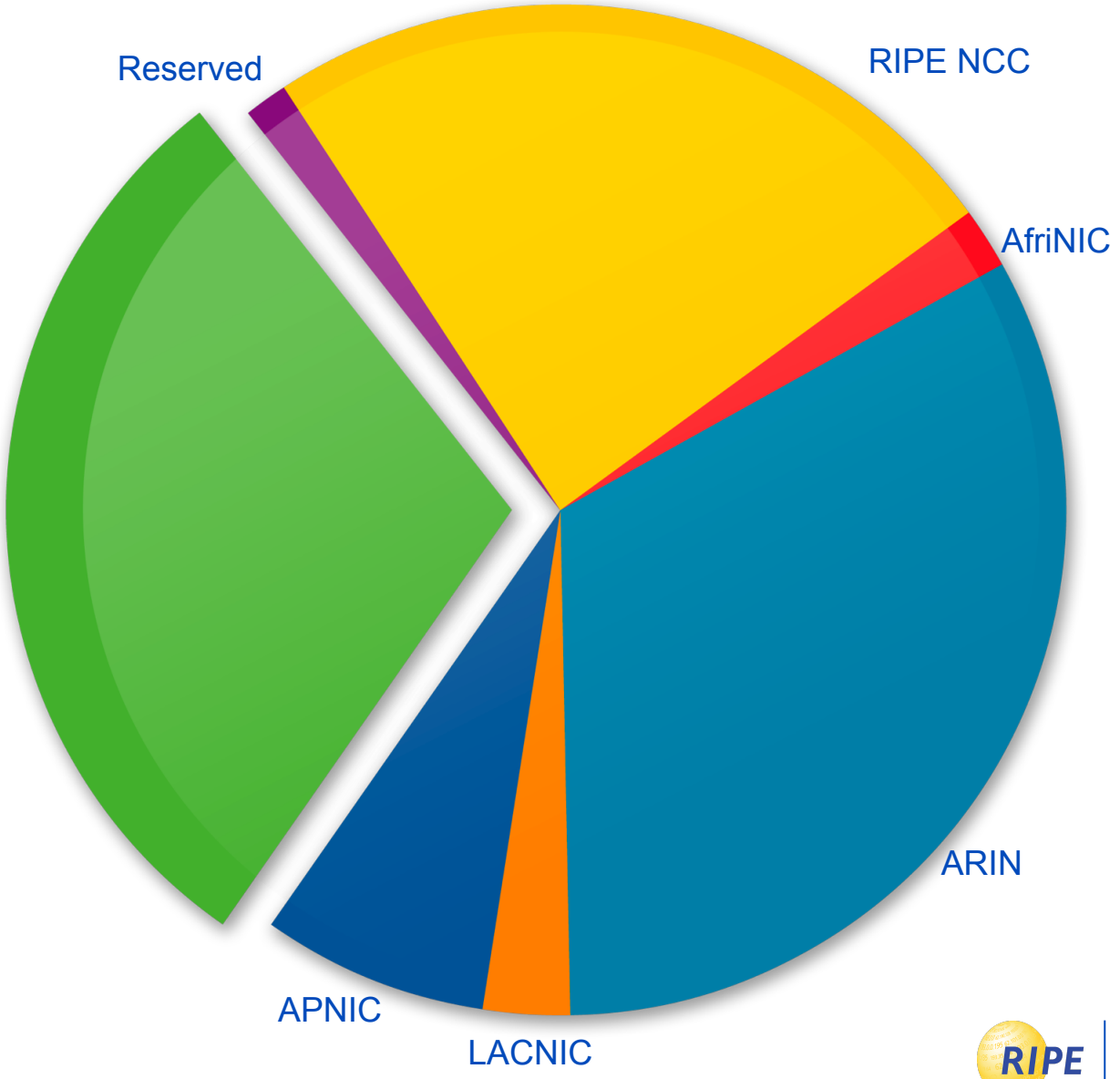
Identify single networks with a single routing policy in BGP

Assignment requirements:

- Address space
- Multihoming
- One AS Number per network

# 16-Bit AS Number pool

28%
available



# IPv4 Basics

IPv4 defined in 1981

IPv4 address: 32 bits

Originally a classful system

- Class A, B and C networks
- Equivalent to todays /8, /16 and /24 networks

CIDR allows flexible routing

# IPv6 Basics

IPv6 address: 128 bits

- 32 bits in IPv4

Huge subnets

Huge allocations

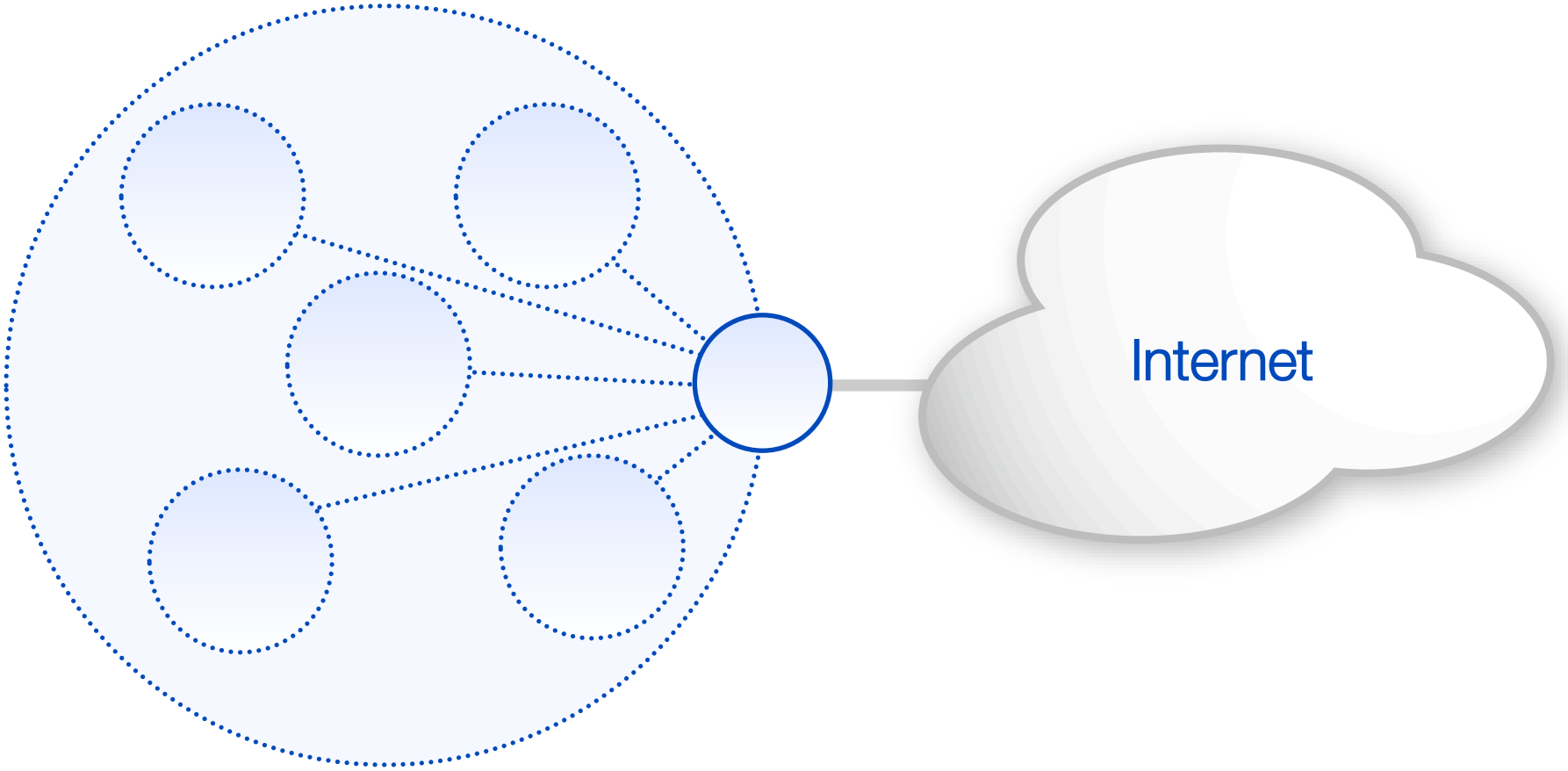
# IPv6 and IPv4 compatibility?

IPv6 is a different protocol from IPv4

IPv6 hosts cannot talk to IPv4 hosts directly

Tools like 6to4 and other tunneling options only let IPv6 hosts talk to eachother

# Network Address Translation



# IPv6 Deployment Challenges

Legacy devices

Firewalls

IPv6/IPv4 priority

# Challenges For Staying With IPv4

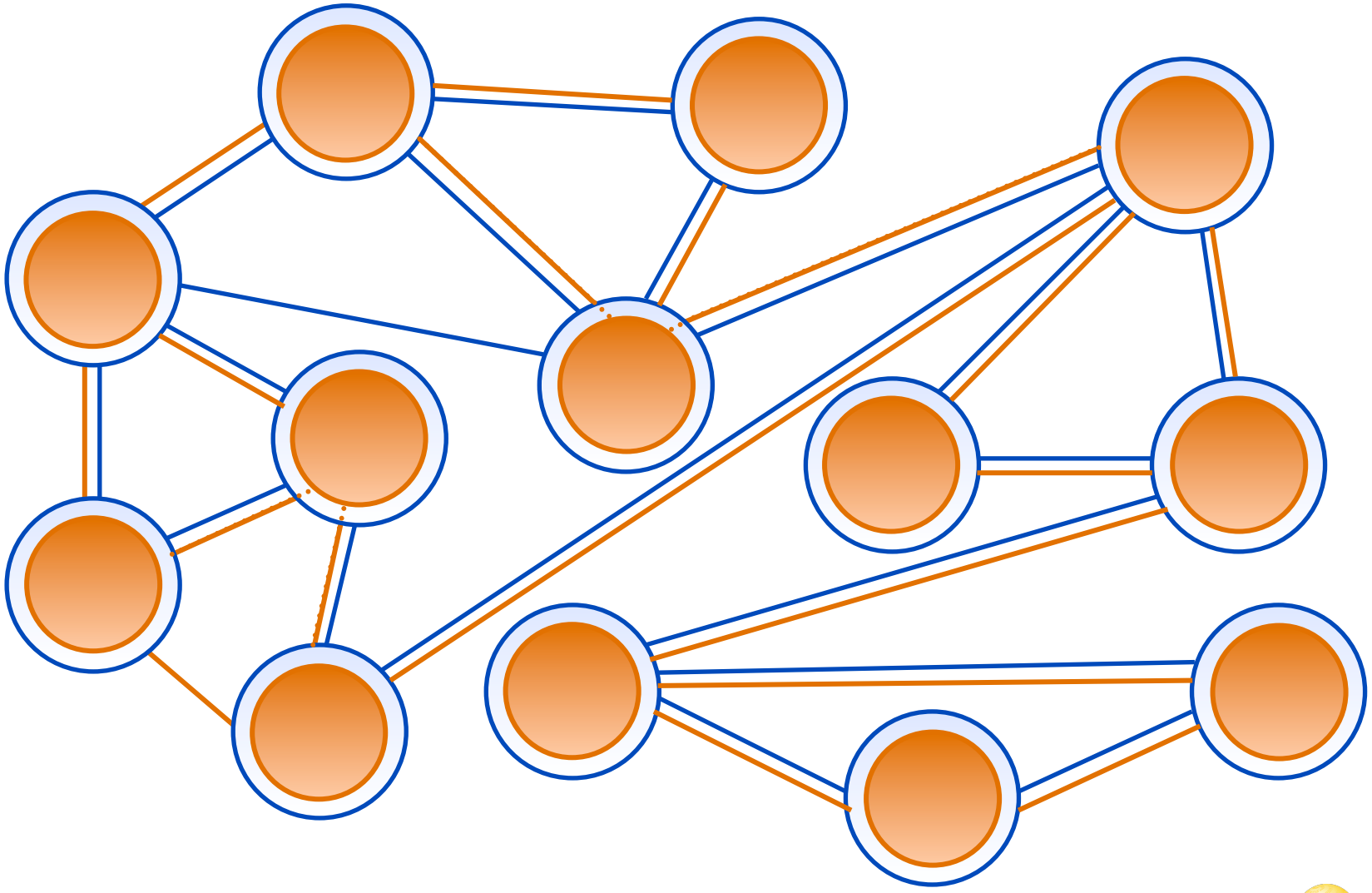
Finding “available” addresses

- redeploying?
- buying?

NAT

- management overhead
- lower class Internet hosts

# IPv6 Transition




# How to Get IP Addresses

RIPE NCC

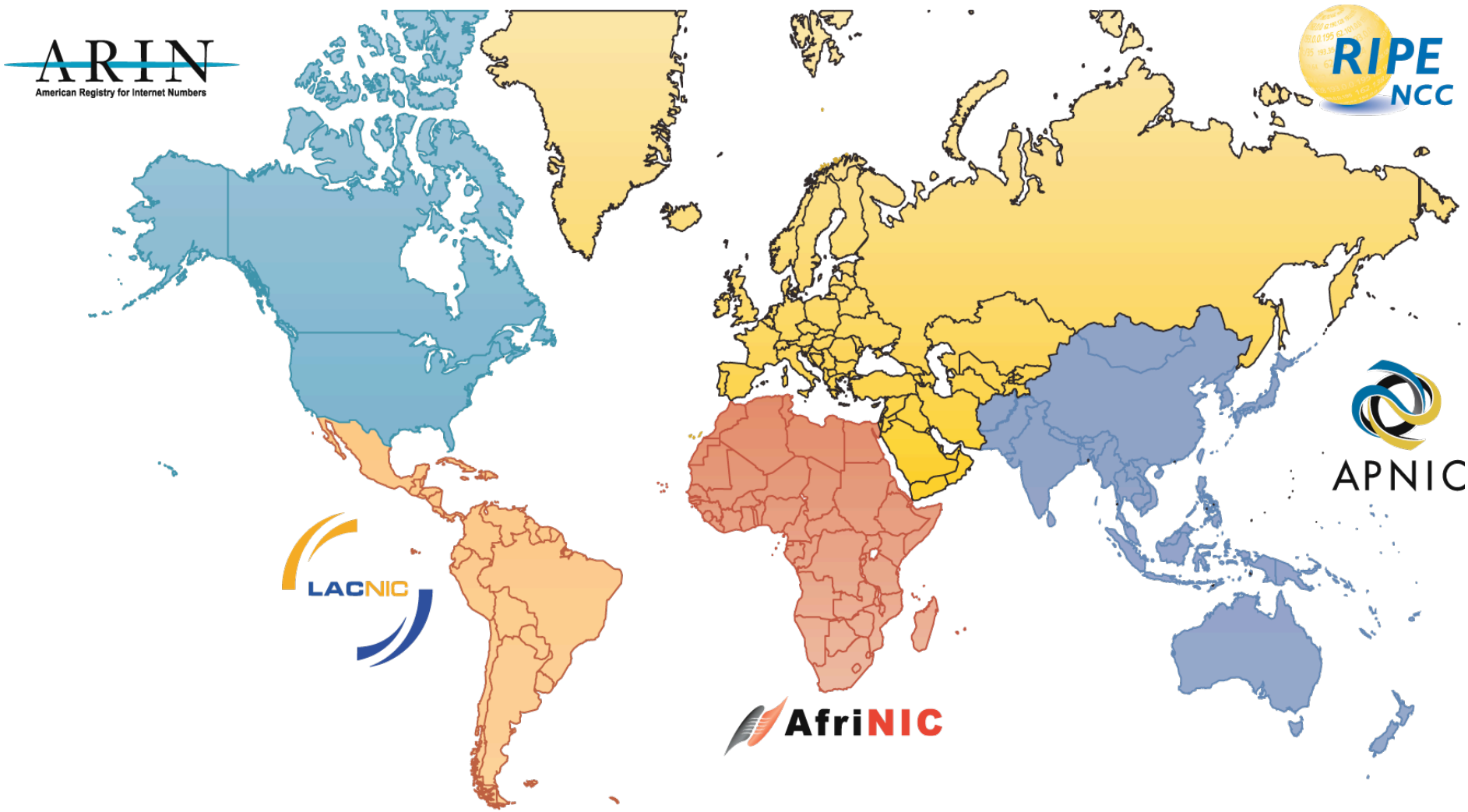
ISOC

IETF

ICANN / IANA

RIRs

# The 5 RIRs


ARIN
American Registry for Internet Numbers
RIPE NCC
APNIC
LACNIC
AfriNIC

# What is RIPE NCC?

RIPE NCC is

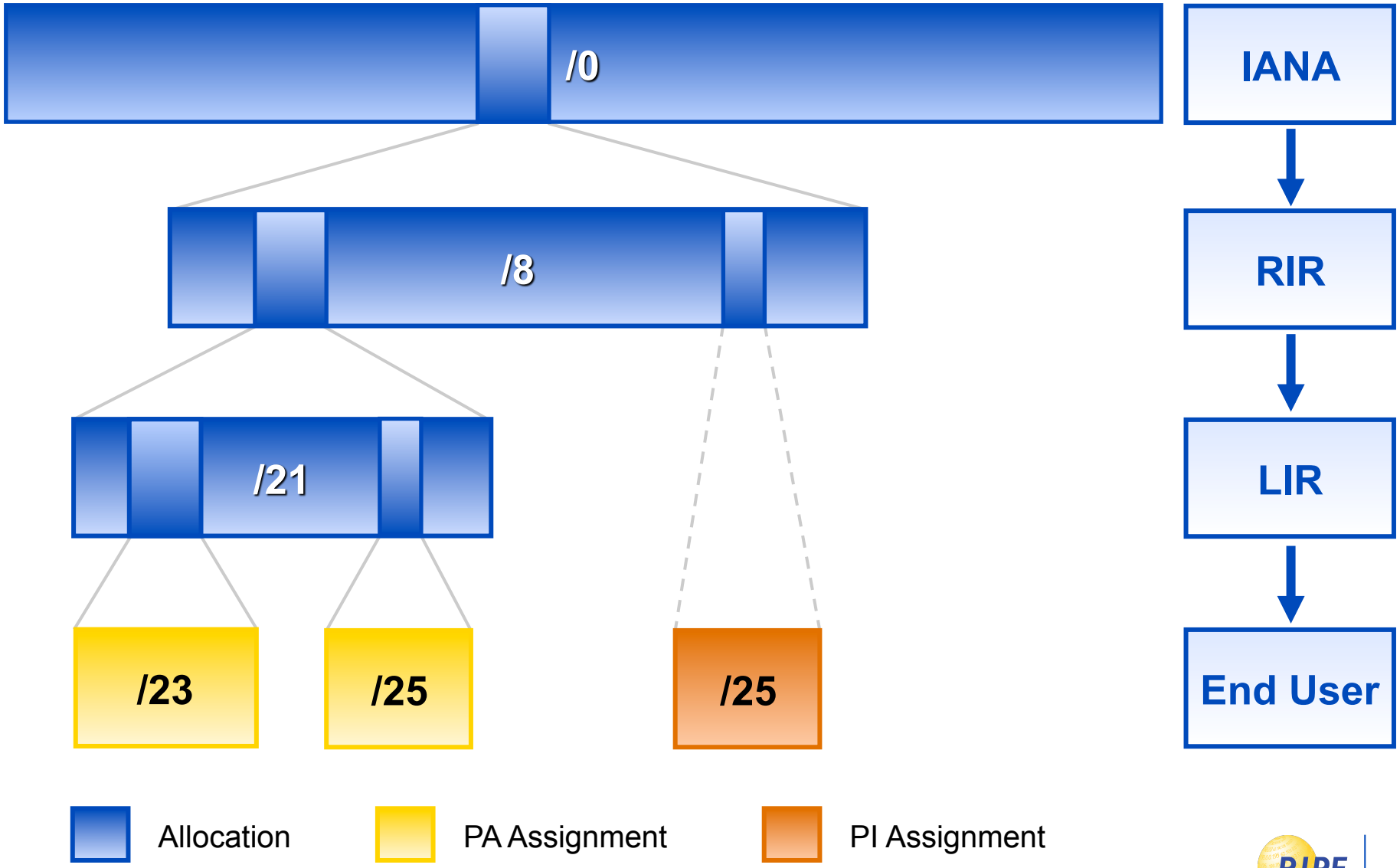
- a Network Coordination Center
- an independent organisation
- a not-for-profit membership association
- one of the 5 Regional Internet Registries

# Registration

# Aggregation

# Conservation

# IP address distribution



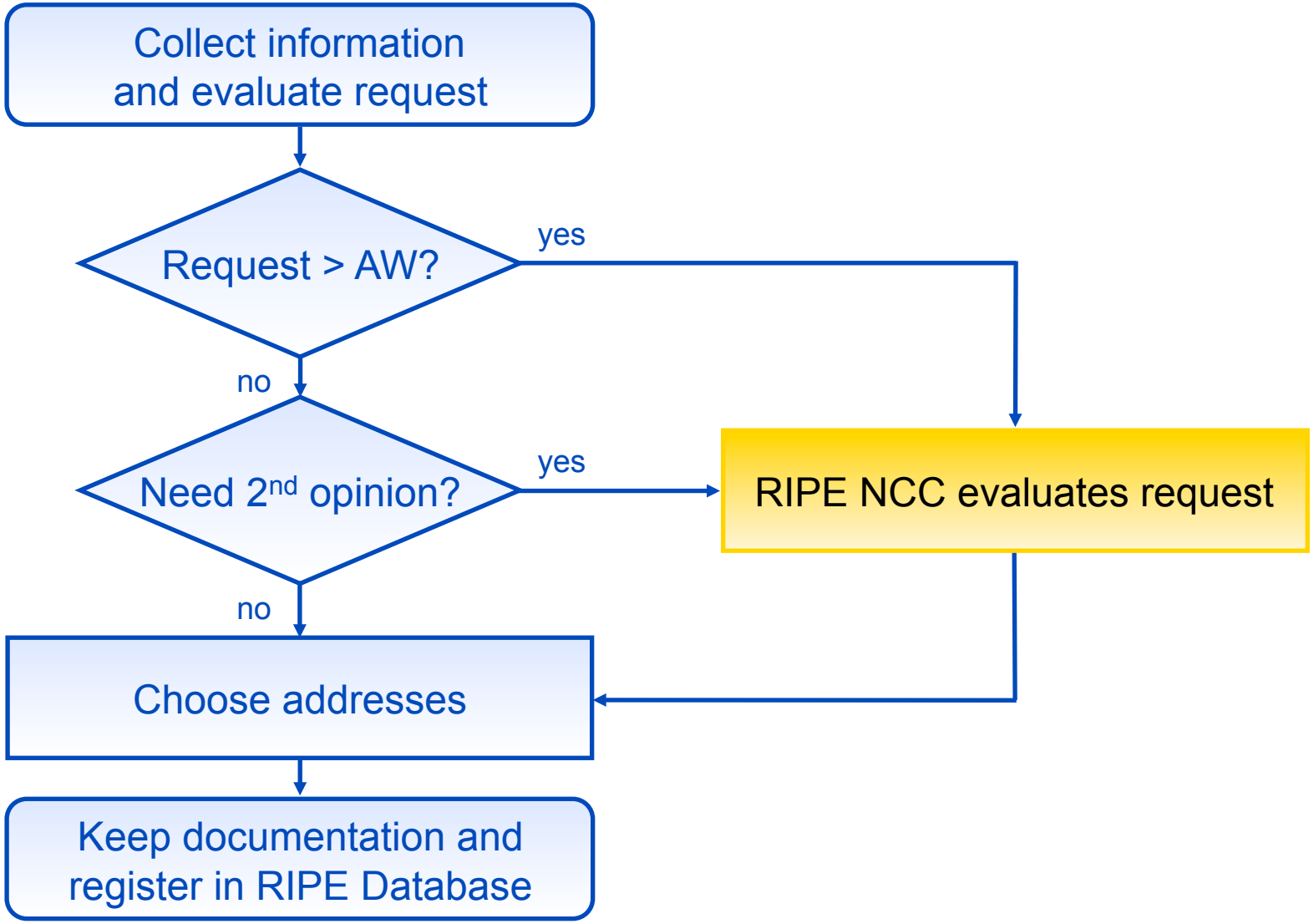
# LIR Set-up Process

Read policy documents

Apply for membership

Sign the contract & pay the fees

# The assignment process



# Getting an IPv4 Allocation

Be an LIR

Want / need independent address space

Size based on estimated usage for one year

Minimum size: /21 (2048 addresses)

# Getting an IPv6 Allocation

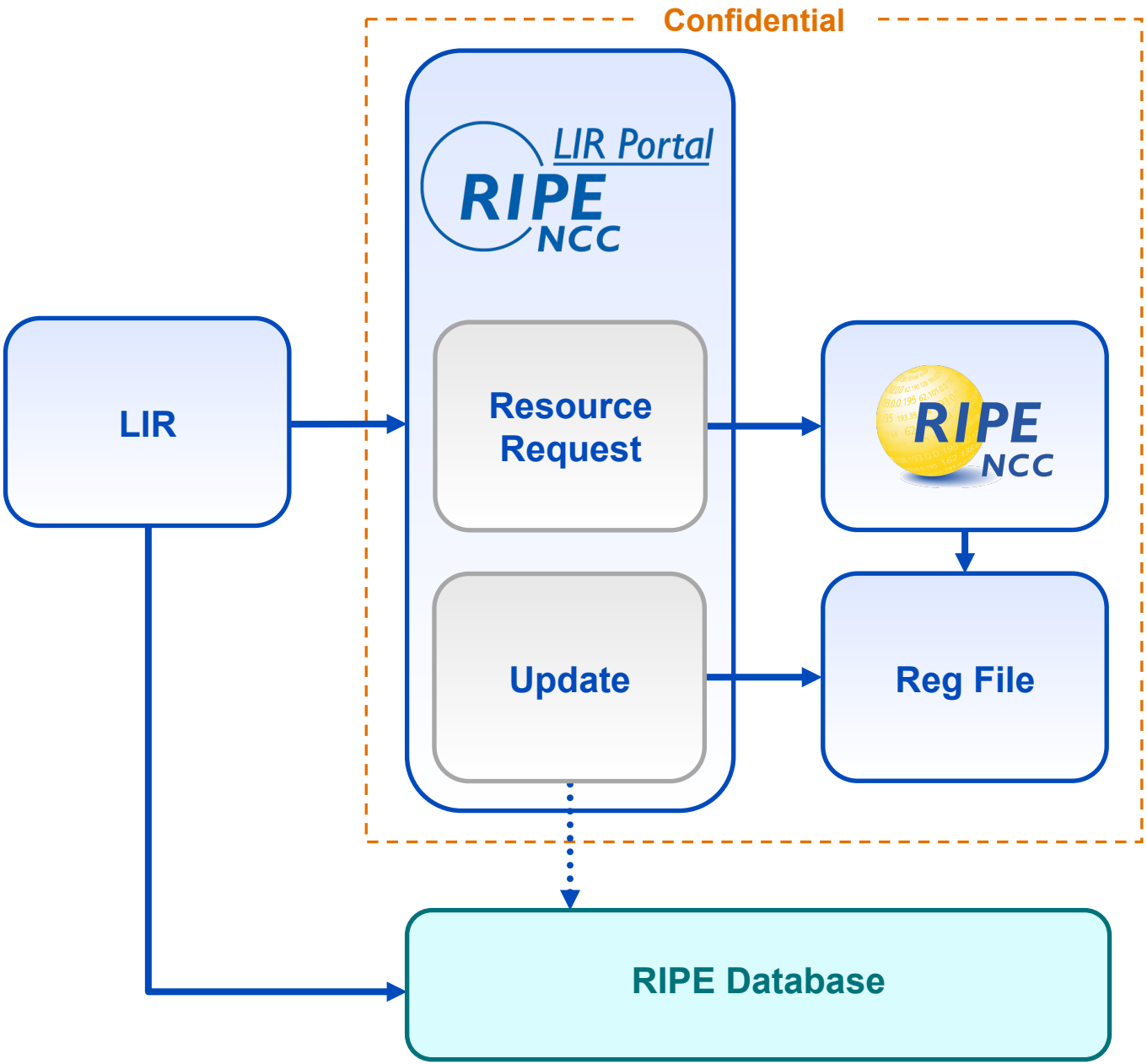
Be an LIR

Advertise the allocation as a single prefix

Have a plan for making assignments within two years

Minimum size: /32

(between 65,536 and 4,294,967,296 assignments)


Confidential
LIR Portal
RIPE NCC
LIR
Resource Request
Update
RIPE NCC
Reg File
RIPE Database


# RIPE Policy Development Process & Address Policy History

# RIPE: The Beginning

Folks in Europe talking about TCP/IP vs OSI

14 of them came together

Started in May 1989

Operational coordination of IP networks

No Standards Development

No Name Assignment

No Network Operation

Terms of Reference: ripe-1

# RIPE

Not a legal entity

No formal membership

No votes *consensus* is the magic word

Has a chairman

Work is done in Working Groups (WGs)

# RIPE Community

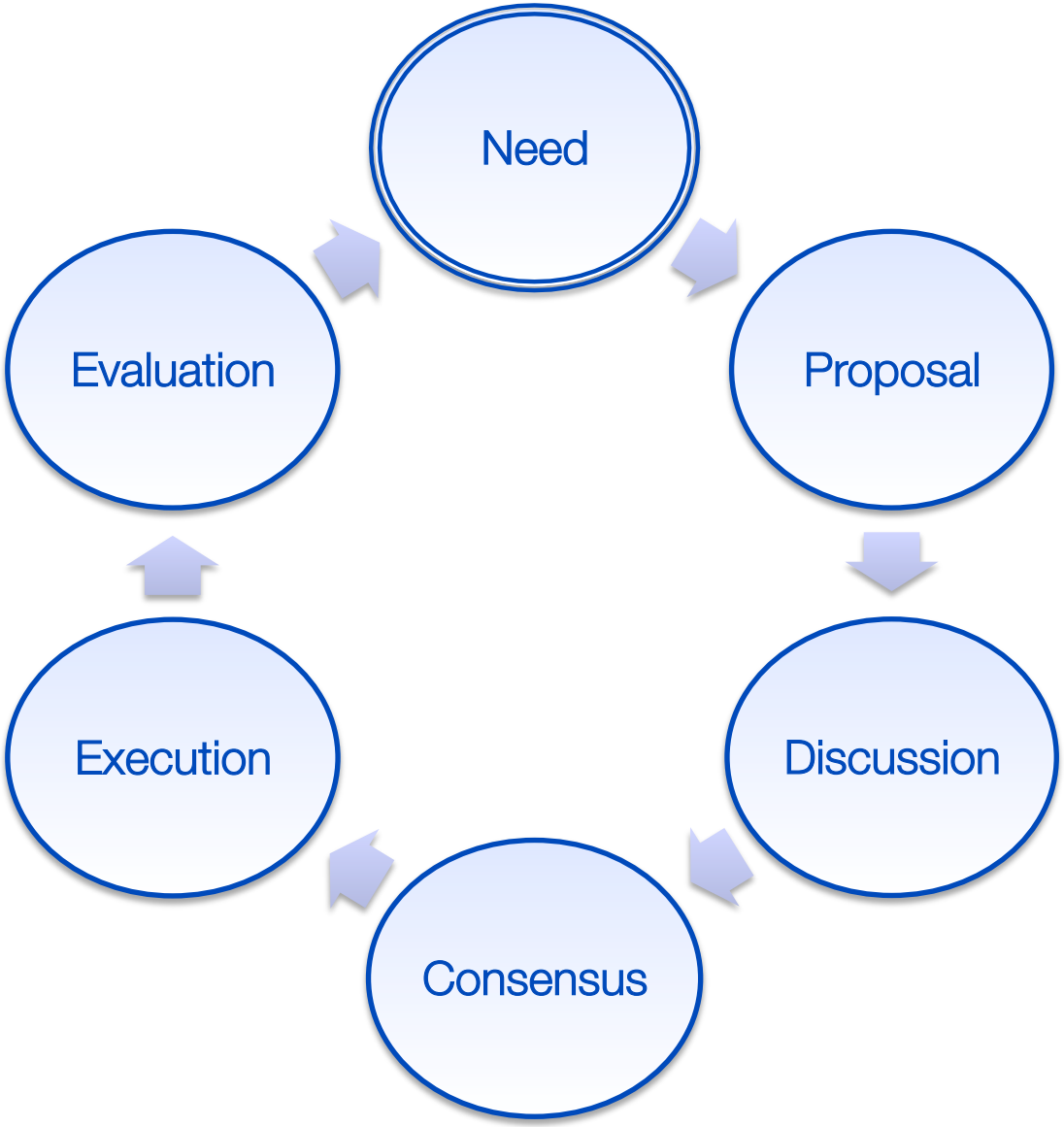
Coming together in RIPE Meetings

Constantly in contact via WG mailing lists

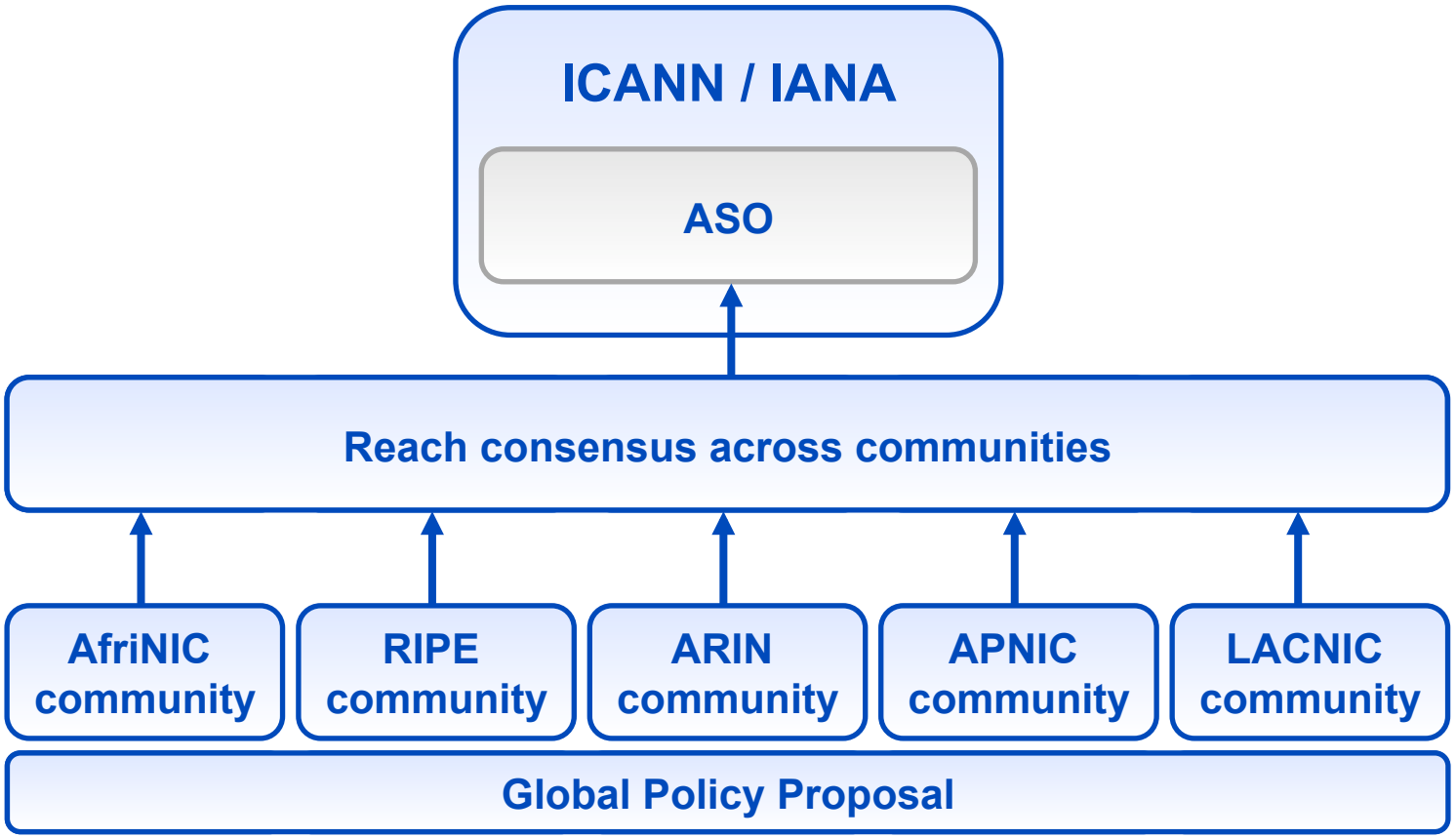
Develop

- Policies
- Best Common Practices (BCPs)
- Recommendations by the Community to the Community

# Policy Development Cycle



# How policy is made



# RIPE PDP Principles

- Open
  - Anyone can participate
  - Policy meetings
  - Mailing lists
- Transparent
  - Malilling lists archived
  - Policy meetings minuted
- Developed Bottom-up
  - By the Internet Community
- Documented
  - Formal Policy Documents
  - Implementation Procedures

# RIPE PDP Formally

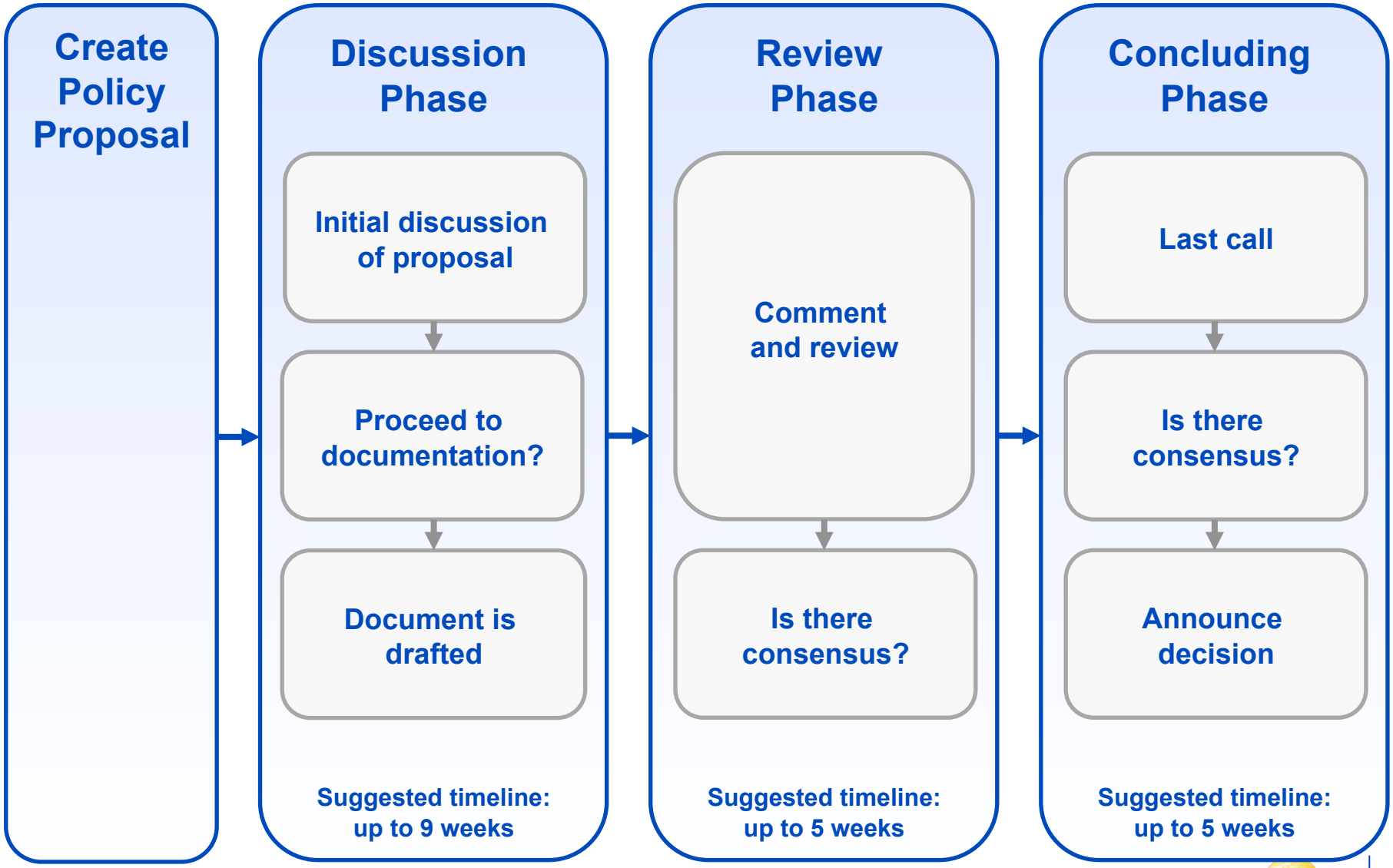
Described in a RIPE document:

http://ripe.net/ripe/docs/pdp.html

4 main Phases:

- Creating Proposal
- Discussion
- Review
- Concluding

# Policy Development Process



# Roles

WG Chairs

- Accepts proposals to their WGs
- Steer and chair the discussions
- Make consensus decision

Community

- Discusses proposals

RIPE NCC

- Acts as the secretariat to support the process
- Publishes the documents
- Maintains the website
- Publishes statistics and analysis to facilitate the discussions

# IPv4 - Allocation Policies

In the beginning (1992-1993)

- RIPE NCC allocating Class Bs and Class Cs
- Procedures document: ripe-65
- September 1993: CIDR is introduced in RFC 1519
- December 1993: ripe-104 is published
  - Minimum allocation size: /16

1996

- ripe-136 is published as a “policy” document
- Maximum allocation size: /16
- Minimum allocation size: /19 (slow start mechanism)
  - Not all network admins are familiar with CIDR yet

1997

- IANA allocates a former Class A block
- Temporary policy agreed in RIPE 26 to have relaxed policies April-December 1997
- To ease the potential problems with this “first-time” address block type
- ripe-155 is published in April outlining this temporary policy
- Further allocation criteria is set to 90% (ripe-159, July)
  - To formalise when an LIR can receive further address space

# IPv4 - Allocation Policies

1998-1999

LIRs find it hard to realise good internal aggregation

- Change 90% criteria to 80% for further allocations
  - Active since October 1998
- Remove maximum allocation size
  - Agreed in 1999

2000-2001

RIPE 36, minimum allocation size changed from /19 to /20

- Stats showing that not all of the /19s are used efficiently within 2 years

RIPE 39, criteria to receive a 1st Allocation is agreed

- Already utilise OR show immediate need for a /22

# IPv4 - Allocation Policies

2003

January, RIPE 44: SUB-ALLOCATIONs are accepted.

December:

- Minimum allocation size changed from a /20 to /21 (2048 IPs)
- Utilisation criteria for 1st allocation is dropped
  - Task Force for Provider Independent Address Space (PI) advised

2004-2005

Minimum allocation size for LIRs in Africa set to /22 (1024 IPs)

- Needs of Africa are different
- To ease the forthcoming transition to AfriNIC

AfriNIC received full recognition in April 2005

- Special policies for Africa are removed

# IPv4 - Allocation Policies

2006-2007

- Proposal to set allocation period to 12 months
- Accepted in March 2007

# IPv4 - Examples of Assignment Policies

Internetworking Experiments

- Researchers need temporary address space
- 2002, Proposed in RIPE 43
- 2003, Reached consensus for all resources

Anycasting DNS

- 2004, Proposed in RIPE 47
- Revised in time
- 2006 September, consensus for a fixed /24

# IPv6 – Bootstrap Policy

1998

Discussions on the Bootstrap Policy in RIPE 30

1999

Common policy for all regions of the time (ARIN, APNIC, RIPE)

General Criteria for an initial /35:

- peerings with 3 other IPv6 networks
- have some space and have assigned 40 customers (/64s) OR
- demonstrate intent to provide services in 12 months

# IPv6 – Bootstrap Policy

Hard to qualify so…

"Bootstrap" Criteria introduced:

- peerings with 3 ASes
- Show plan to provide services in 12 months AND
- Be an IPv4 transit provider and have 40 customers (/48s) OR
- Have 6 months of 6Bone experience

"Bootstrap" to last until 100 allocations made

# IPv6 – Bootstrap to Interim Transition

- Discussions
  - October 1999 set for formal review of ripe-196
  - Call for comments in all 3 regions made
  - Continued until 2002
- In the meanwhile
  - 2001, RIPE 40: IXP assignments reached consensus
    - Documented in ripe-256

# IPv6 – Interim Policy

- 2002
  - RIPE 41
    - /32 to be initial allocation size reached consensus
  - RIPE 42
    - Rest of the topics reached consensus
      - Documented in ripe-246
    - Address for Root Name servers reached consensus too
      - Documented in ripe-233
- 2003
  - Interim Policy published

# IPv6 Policy

Also in 2003

- Assignments for internetworking experiments
- Size = Minimum allocation size of the time

2006

- September: Assignments for Anycasting DNS (/48) reached consensus
- Documented in ripe-388

# Latest Policy

2007

- "200 customers" arbitrary
- End Site definition is exclusive of internal sites

Changed End Site definition

Relaxed Initial allocation Criteria:

- Be an LIR
- Announce the block as a whole (do not deaggregate)
- Plan to make sub-allocations to others or assignments to End Sites

# Latest Policy

2007

Utilisation requirement and unit is changed

For further allocation

- An LIR should reach HD ratio of 0.94
- The unit of measurement is set to a /56

Assignment size decision left to LIRs

- No more fixed sizes

# Global Policy

RIRs received /23s initially

Global policy changed in 2006

- better aggregation
- better address management on RIR level

RIRs now receive /12s

# Autonomous System Numbers

Same policy since the beginning

- Multihoming/unique routing policy

4-Byte AS Numbers since 2007 January

# Some Current Discussions

Direct Assignments from the RIPE NCC

Transfers

Global policy for the remaining IPv4 Blocks

# What did not change?

Principles for Internet registries

Responsible usage of Internet resources

Responsible stewardship of Internet resources

# Conclusion

Industry environment and business requirements change

PDP is there to meet this demand for the changes

So the policies do change

But the principles remain the same

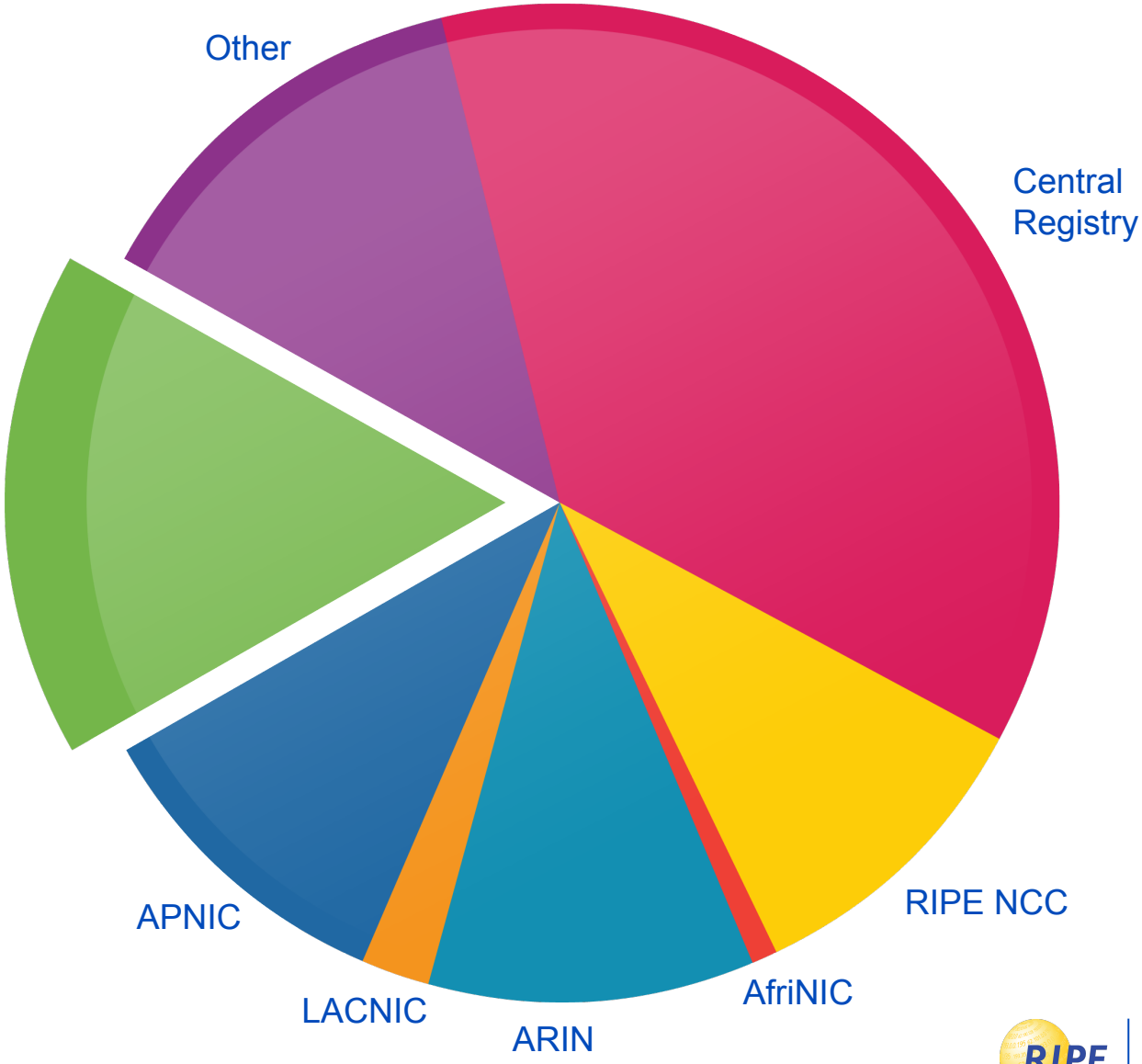
Many policies stayed stable since the beginning


# Where Do We Stand Now

RIPE NCC

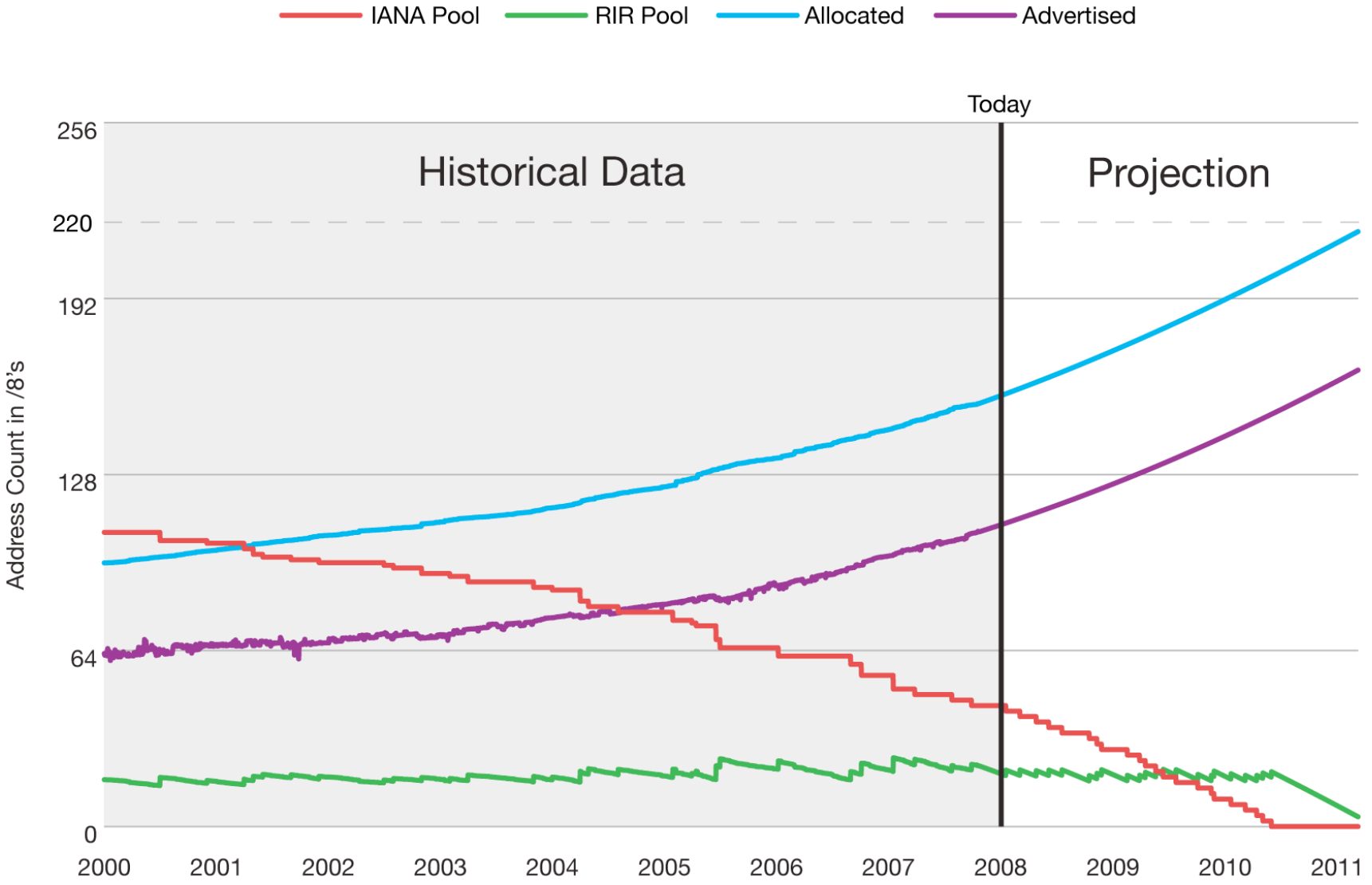
# IPv4 Address Pool - Now

16%
available

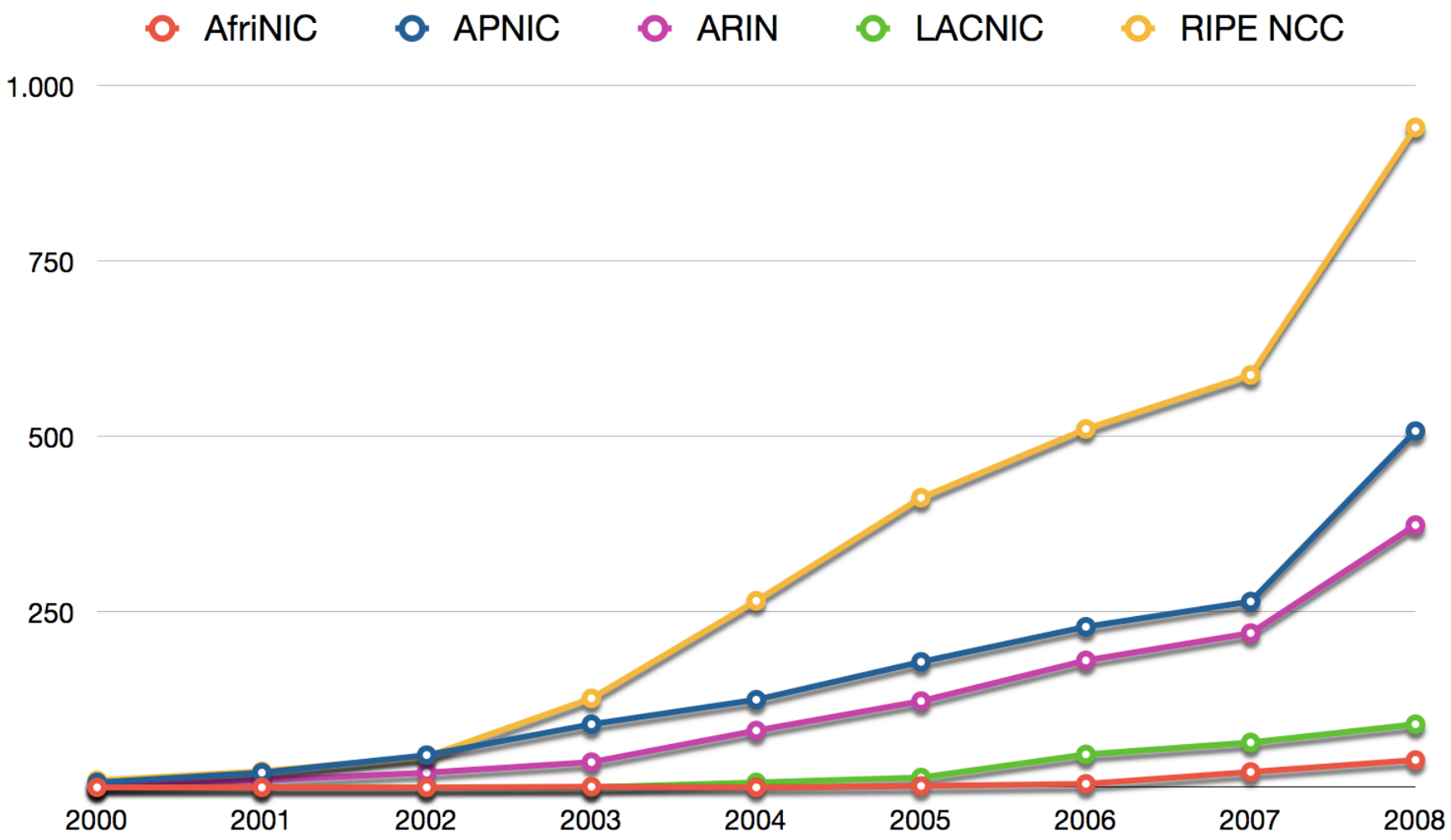



source: http://potaroo.net

# IPv4 Address Pool - The Future



# IPv6 Allocations



# Three Views

Who needs IPv6? We have NAT!

We'll move when staying with IPv4 hurts too much

We'll move before IPv4 runs out, smoothly

# Helping the Transition

Continued community support

Making services available over IPv4 **and** IPv6
"dualstacking"

Certification of resources


More information:

www.ripe.net

RIPE NCC

# References

Mailing list archives

http://www.ripe.net/ripe/maillists/

Meeting Archives

http://www.ripe.net/ripe/meetings/

Working groups

http://www.ripe.net/ripe/wg/

Document Store

http://www.ripe.net/ripe/docs/

RIPE PDP

http://www.ripe.net/ripe/policies/