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Address Supporting Organization

How It Works

The Regional Internet Registry System

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The Internet

The Internet is a network of networks.

Every device that is directly connected to the Internet requires **a unique IP address**.

Data travels in packets between these IP addresses. It is crucial that these IP addresses remain unique for the Internet to keep working.

The Core Principles Behind the Internet

The Internet is built on two core principles:

- **Open standards** that ensure devices can communicate seamlessly across networks with different underlying technologies worldwide, to guarantee interoperability.
- Registration of global Internet identifiers (names, numbers and ports), coordinated openly and without commercial control, **to guarantee global uniqueness**.

Together, they make the Internet a permissionless, global platform for innovation and communication.

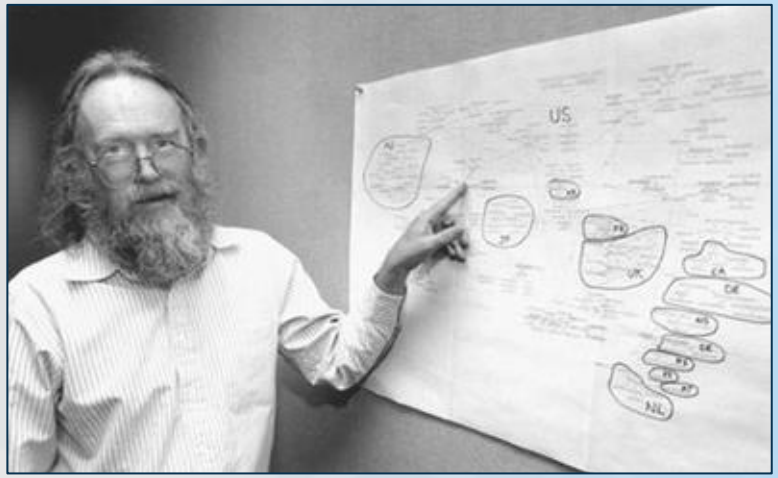
A Short History (1980s to 1990s)

The US Department of Defence contracted administration of names, numbers and protocols to the University of Southern California's ISI

Run by **Jon Postel**, the function was called Internet Assigned Numbers Authority (**IANA**)

The **RIR system** was formed in the early 1990s, starting with the RIPE NCC in 1992, APNIC in 1993 and ARIN in 1997

Internet number resource administration split from the Domain Name System (DNS)



Jon Postel

Early Registrations

Early IP address space referred to as "legacy space"

Internet number resources allocated liberally

Organizations made simple request; no contract required

The Internet rapidly expanded, distribution could not be managed this way

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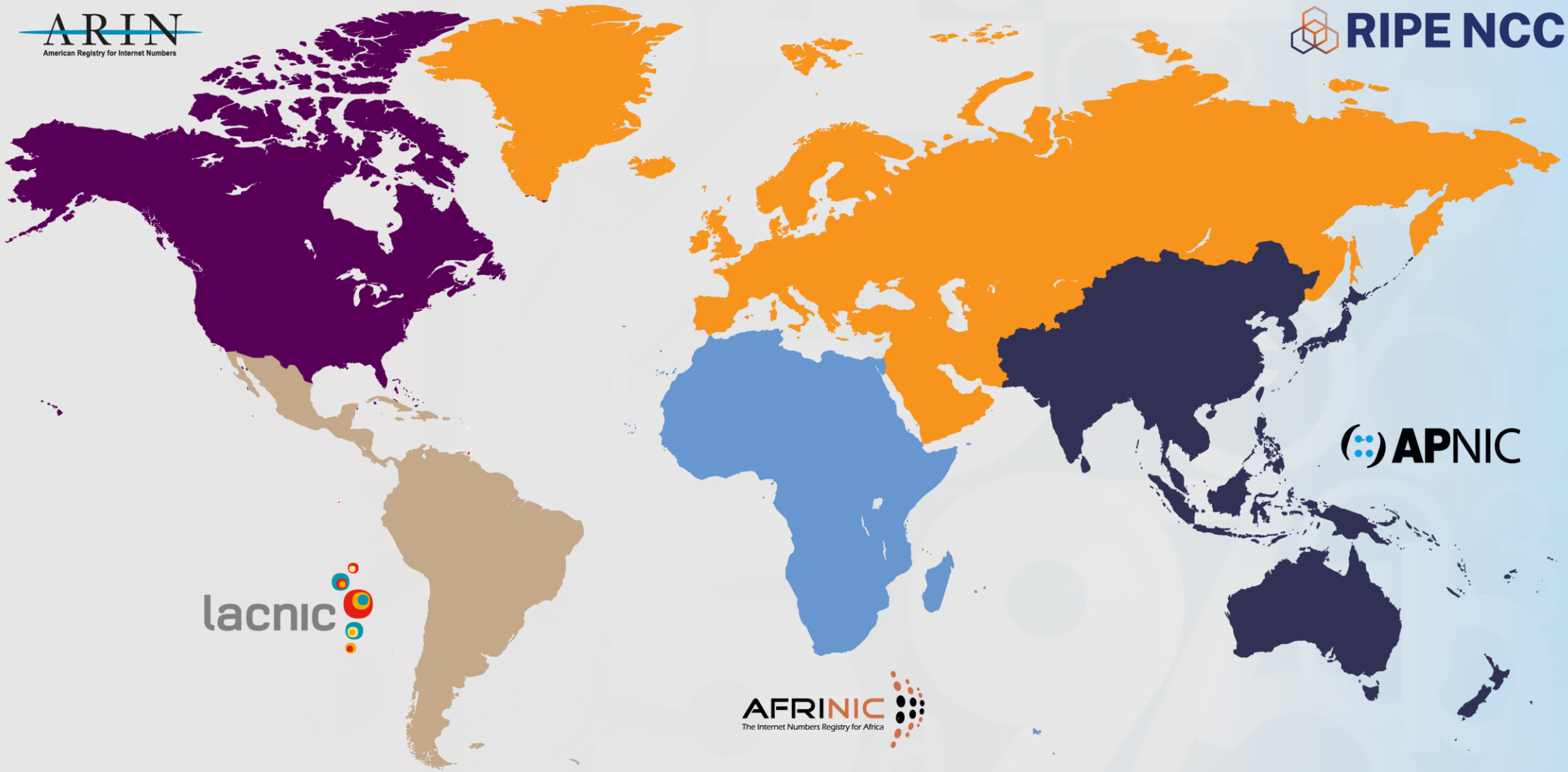
Regional Internet Registry

Manages the allocation, administration and registration of Internet number resources in a specific region of the world.

To ensure the accurate registration of IP address allocations.

To ensure the uniqueness of IP addresses so that the Internet continues to function.

The Regional Internet Registries



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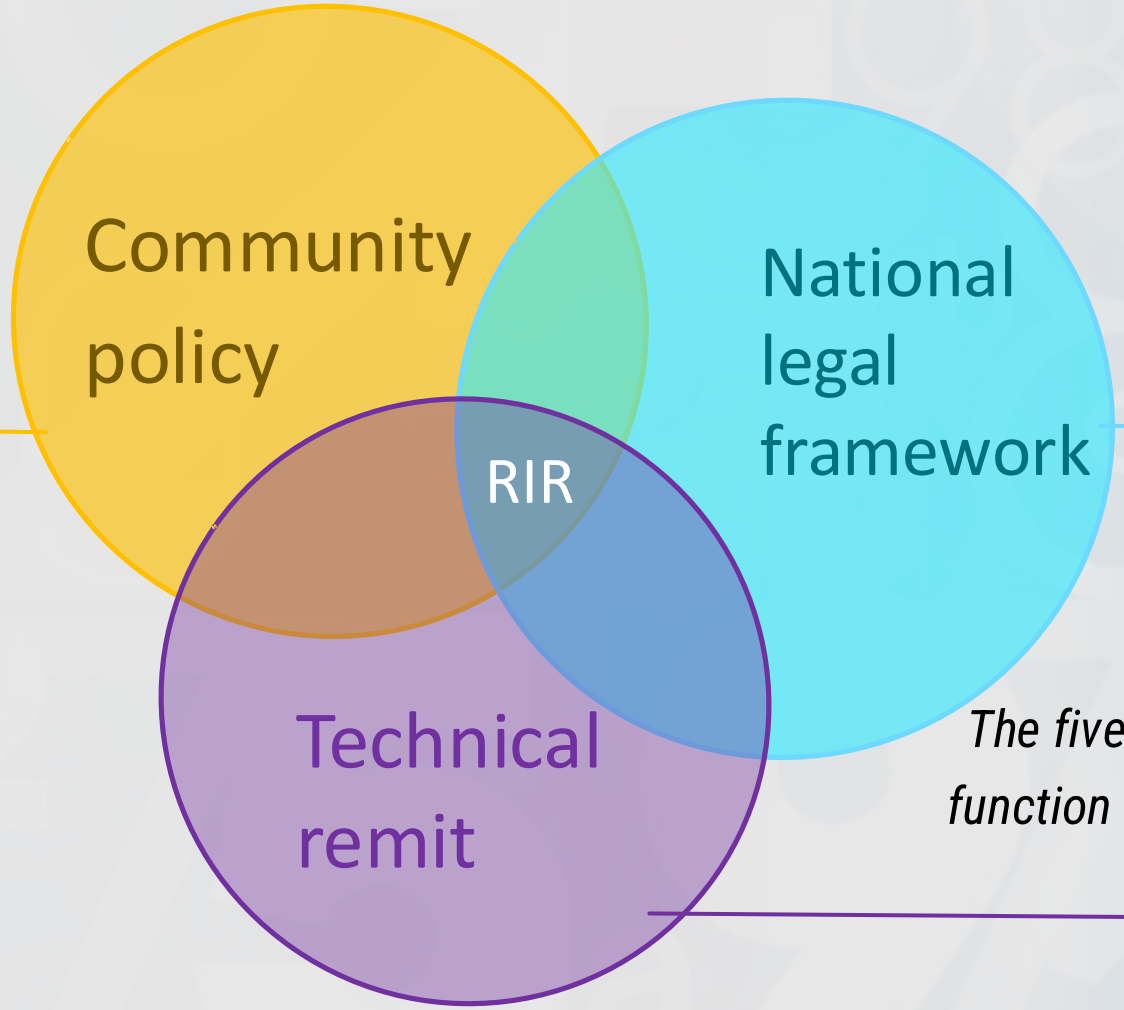
The RIRs are:

- **Independent:** Not governmental bodies or entities
- **Membership-based:** Open to Internet number resource holders in the regions (ISPs, NRENs, governments etc.)
- **Not-for-profit:** Funded by membership fees
- **Community-driven:** Policies are set by the community

RIR Governance

Each RIR community sets the policies by which that RIR registers and distributes resources



Each RIR is established under the legal framework of a specific country

The five RIRs fulfil a specific function in the global Internet governance system

Functions of an RIR

Manage and distribute Internet number resources:

- IPv4 and IPv6 addresses
- Autonomous System numbers (ASNs)

Maintain directory services including:

- Whois, Whowas, and routing registries
- Provide reverse DNS

Support Internet infrastructure through:

- Technical coordination
- Community-driven policy process
- Training and capacity building

Supporting the Internet

- **Scalability:** By promoting the use of IPv6
- **Security:** Providing RPKI to protect against route hijacks and misconfigurations
- **Capacity building:** Supporting network operators and communities through training and education
- **Policy development:** Takes place through open, bottom-up, multistakeholder processes

- Number resource management
- IPv6 deployment
- RPKI and routing security
- DNS and reverse DNS
- Internet governance
- Policy development

- Self-paced and online
- Webinars
- Instructor-led (in-person and regional events

Policy Development

Multistakeholder Approach

Policy Development Process

Inclusive

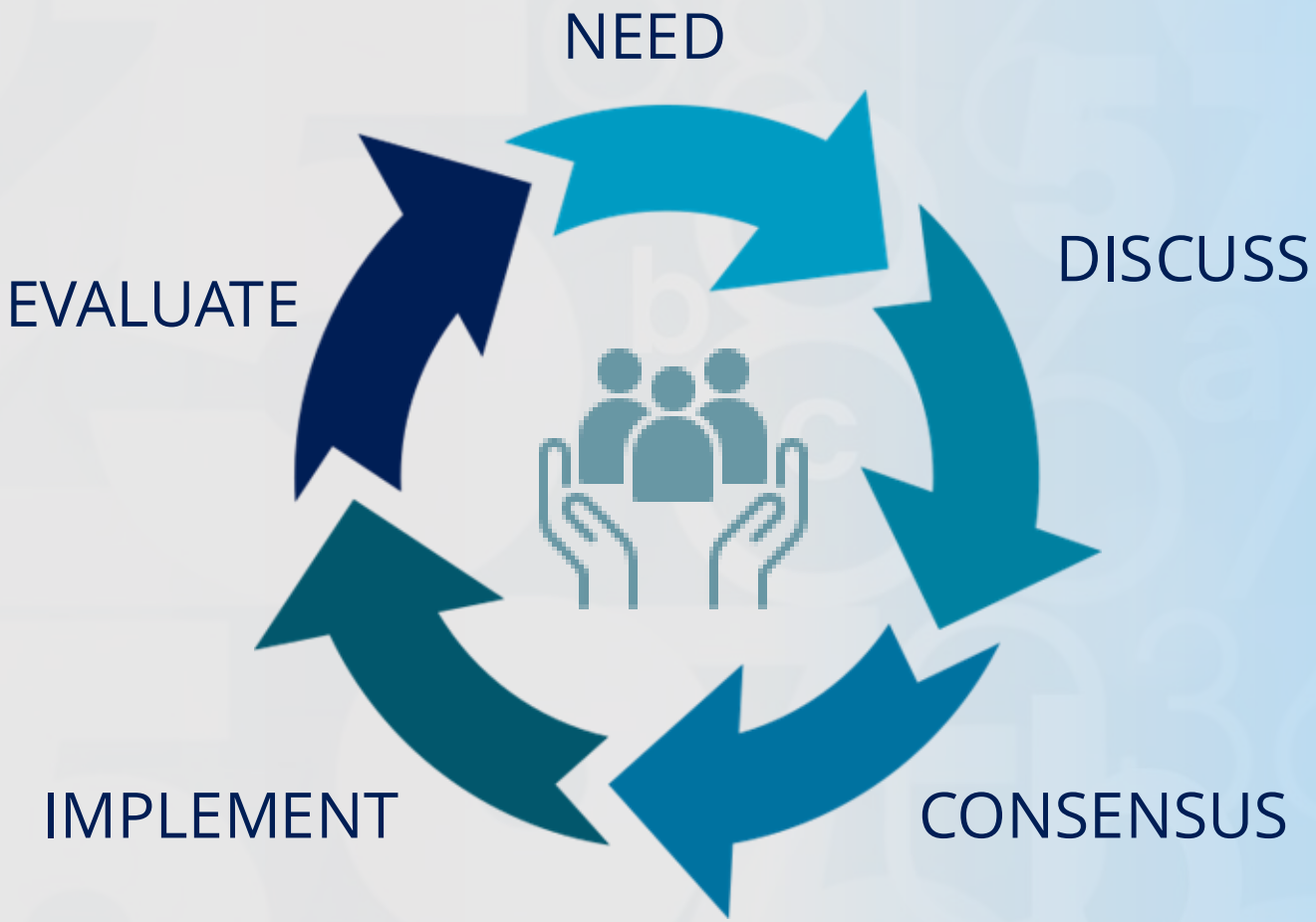
Anyone can participate

Bottom Up

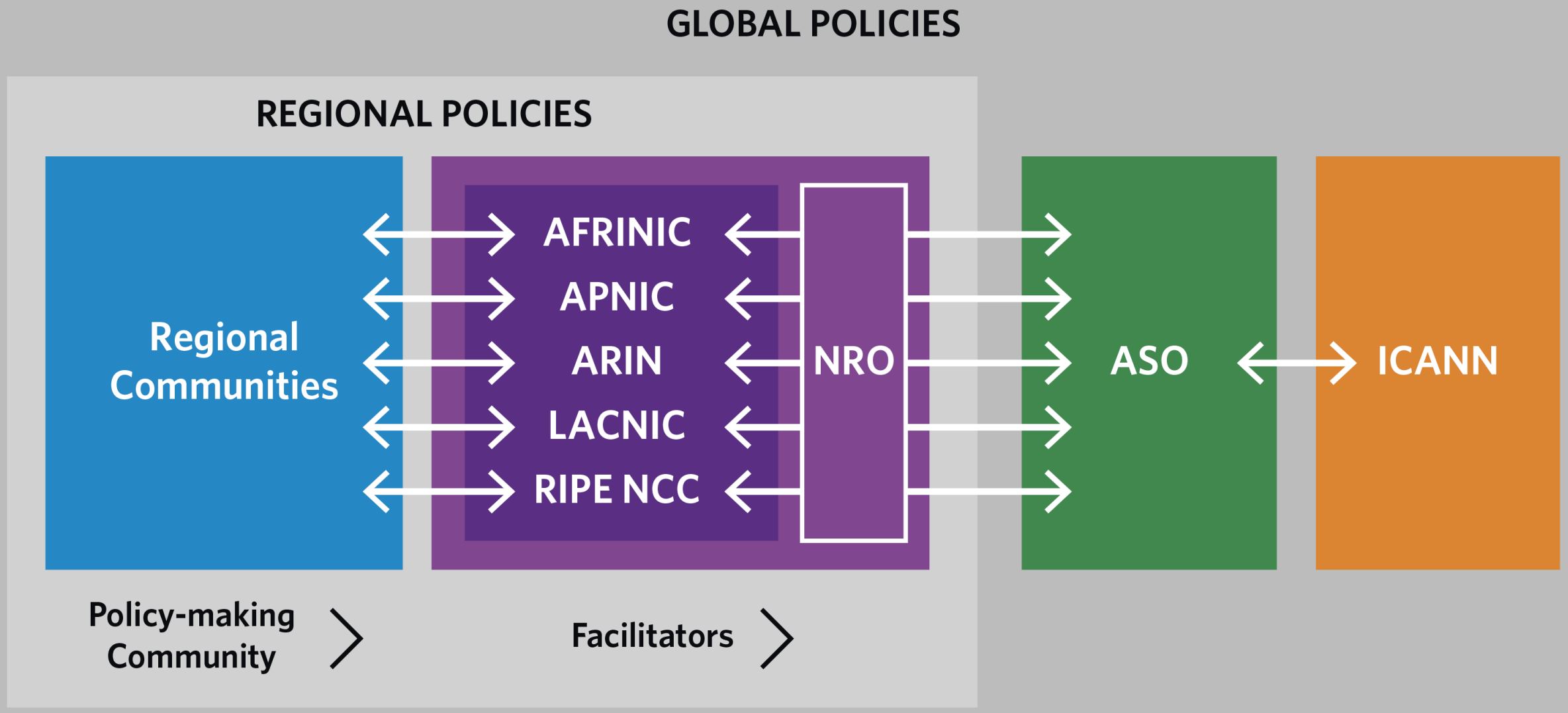
The Internet community proposes and approves policies

Transparent

Policies and decisions are documented and publicly available



The Global Policy Development Process



The NRO and the ASO

The Number Resource Organization

- The Number Resource Organization (NRO) is the coordinating body for the five **RIRs.**
- It serves as the Address Supporting Organization at ICANN.
- Part of the Supporting Organizations (SO) since 1999.
- Charged with reviewing and developing recommendations on Internet Protocol (IP) address policy and advises the ICANN Board on policy issues relating to the operation, assignment, and management of IP addresses.

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NRO Mission

NRO

To actively contribute to an **open**, **stable**, and **secure Internet** by:

- Providing and promoting a coordinated Internet number registry system
- Being an authoritative voice on the multistakeholder model and bottom-up policy process in Internet governance
- Coordinating and supporting joint activities of the RIRs

ICANN Policy Stakeholders

Supporting Organisations

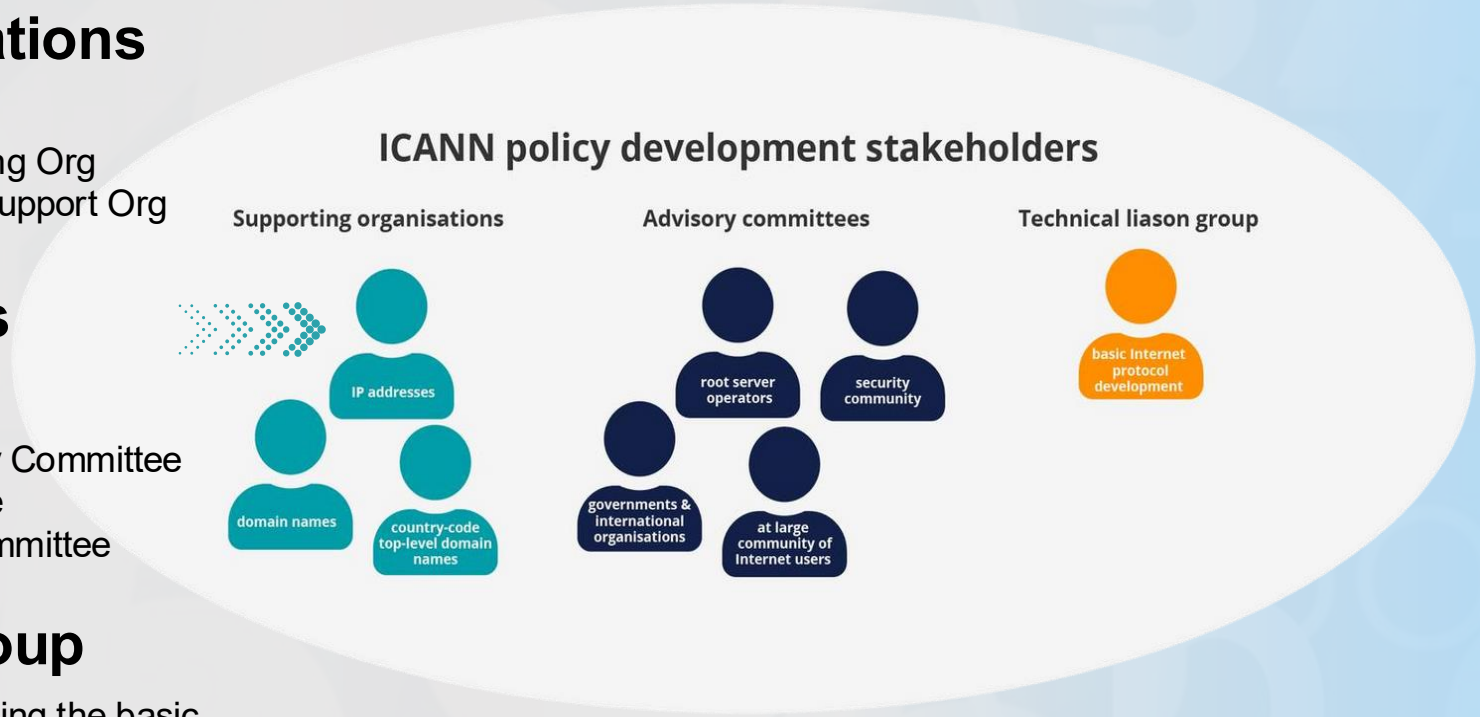
- **ASO: Address Supporting Org**
- GNSO: Generic Names Supporting Org
- CCNSO: Country Code Names Support Org

Advisory Committees

- At Large Advisory Committee
- DNS Root Server System Advisory Committee
- Governmental Advisory Committee
- Security and Stability Advisory Committee

Technical Liaison Group

Works with the organisations developing the basic Internet protocols



https://www.icann.org/community

ICANN ASO AC (Address Council)

Who is it:	**NRO Number Council**
What is it?	Number Resource Advisory Council
How is it organised?	• 15 Members [3 from each region] • 2 elected-at -large • 1 appointed by RIR Board • RIR and ICANN observers
Term of office	Different for every RIR
What does it do?	• Advise ICANN Board on Internet Numbers • Overseeing the Global Policy Development Process • Appoint ICANN Board Members (2) • Appoint member to ICANN NomCom (1)

Internet Number Resources

IPv4, IPv6, and Autonomous System Numbers (ASNs)

IPv4 and IPv6

Unique IPv4 addresses

4,294,967,296 or roughly 4.2 billion unique addresses

Unique IPv6 addresses

340,282,366,920,938,463,463,374,607,431,768,211,456
or 340 undecillion unique addresses

Or more IPv6 addresses than grains of sand on the Earth...

Internet Protocol (IP) Addresses

IP address – unique numerical address assigned to every device connected to a TCP/IP network that facilitates moving data across the network

- IPv4:
  - 32-bit addresses; written in dotted decimal
  - 2^32= ~4.2 billion
  - For example: 205.150.58.7
- IPv6:
  - 128-bit addresses; written in hexadecimal
  - 28= ~50 octillion for each of the roughly 6.5 billion people alive
  - For example: 2001:0503:0C27:0000:0000:0000:0000:0000

IP Addresses are *Not* Domain Names

IP address

[Identifier]

e.g. 2001:0db8:85a3:0000:0000:8a2e:0370:7334

- Computers recognize **numbers**
- Identifies a device on the Internet
- Used for routing (moves information across an inter-network from a source to a destination)
- Every device directly connected to the Internet requires a unique IP address

DNS name

[Reference]

e.g. www.nro.net

- People recognize **names**
- Maps host name to unique IP address
- A means of storing and retrieving information about hostnames and IP addresses in a distributed database

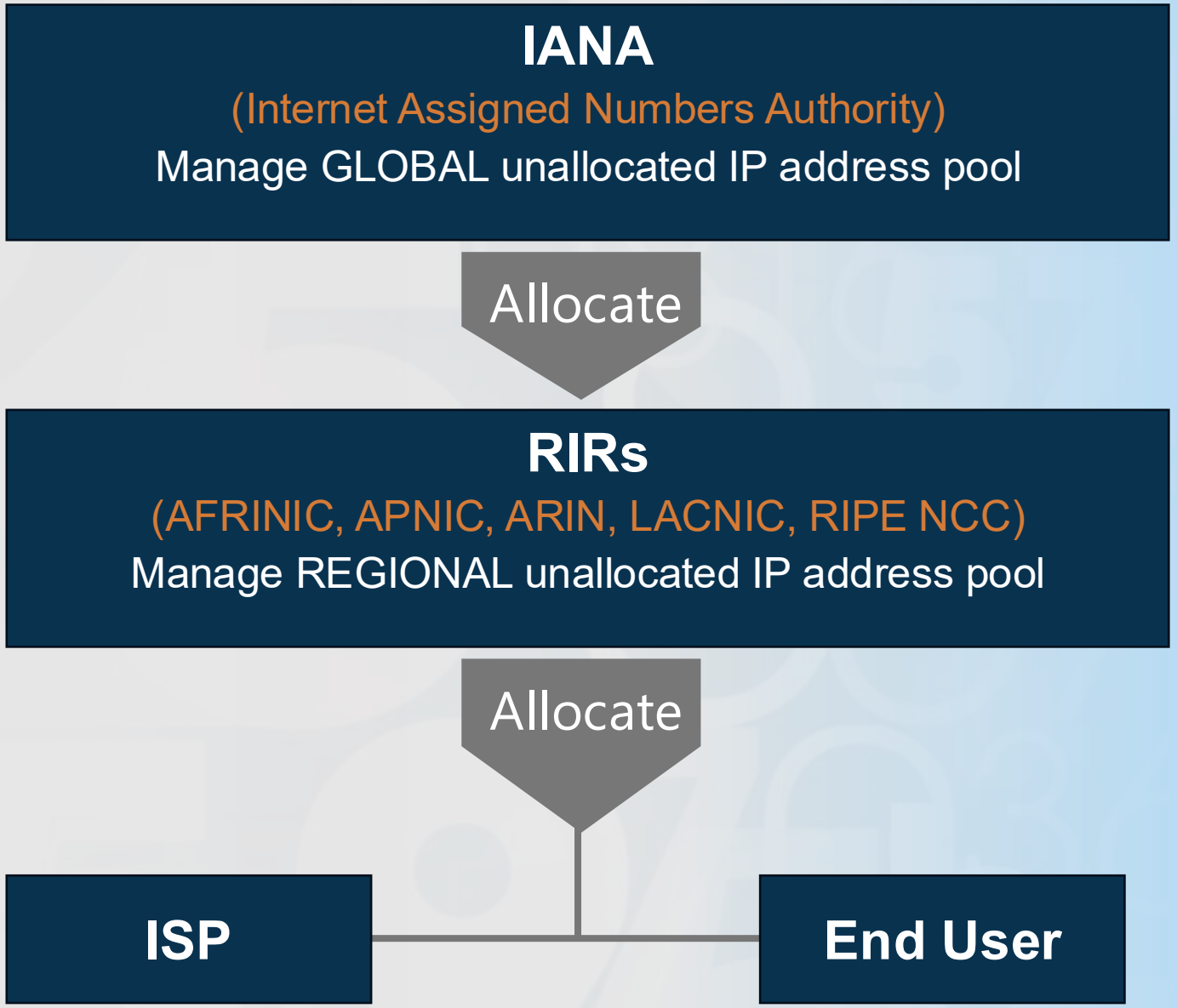
Autonomous System Numbers (ASNs)

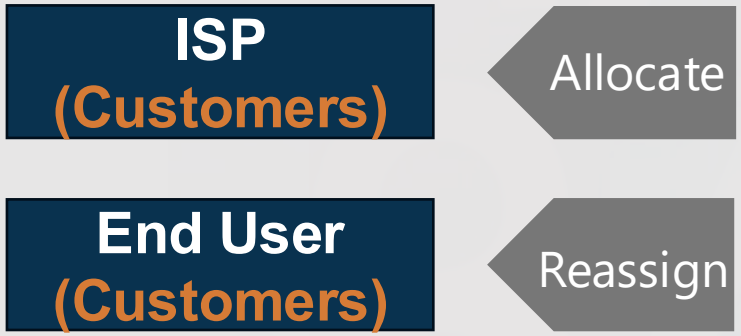
Globally unique numbers used to exchange routing information with neighbouring Autonomous Systems

Group of IP networks administered under the umbrella of a single entity

Network operators must have an ASN to control routing within their network and to exchange routing information with other Internet Service Providers

How IP addresses are issued





Routing

How Data Moves

Core Internet Functions: DNS & Routing

The Internet relies on two critical systems:

- **DNS** - translates domain names to IP addresses (forward lookup) and IP addresses to domain names (reverse lookup)
- **Routing** – forwards IP data packets across the network from source to destination

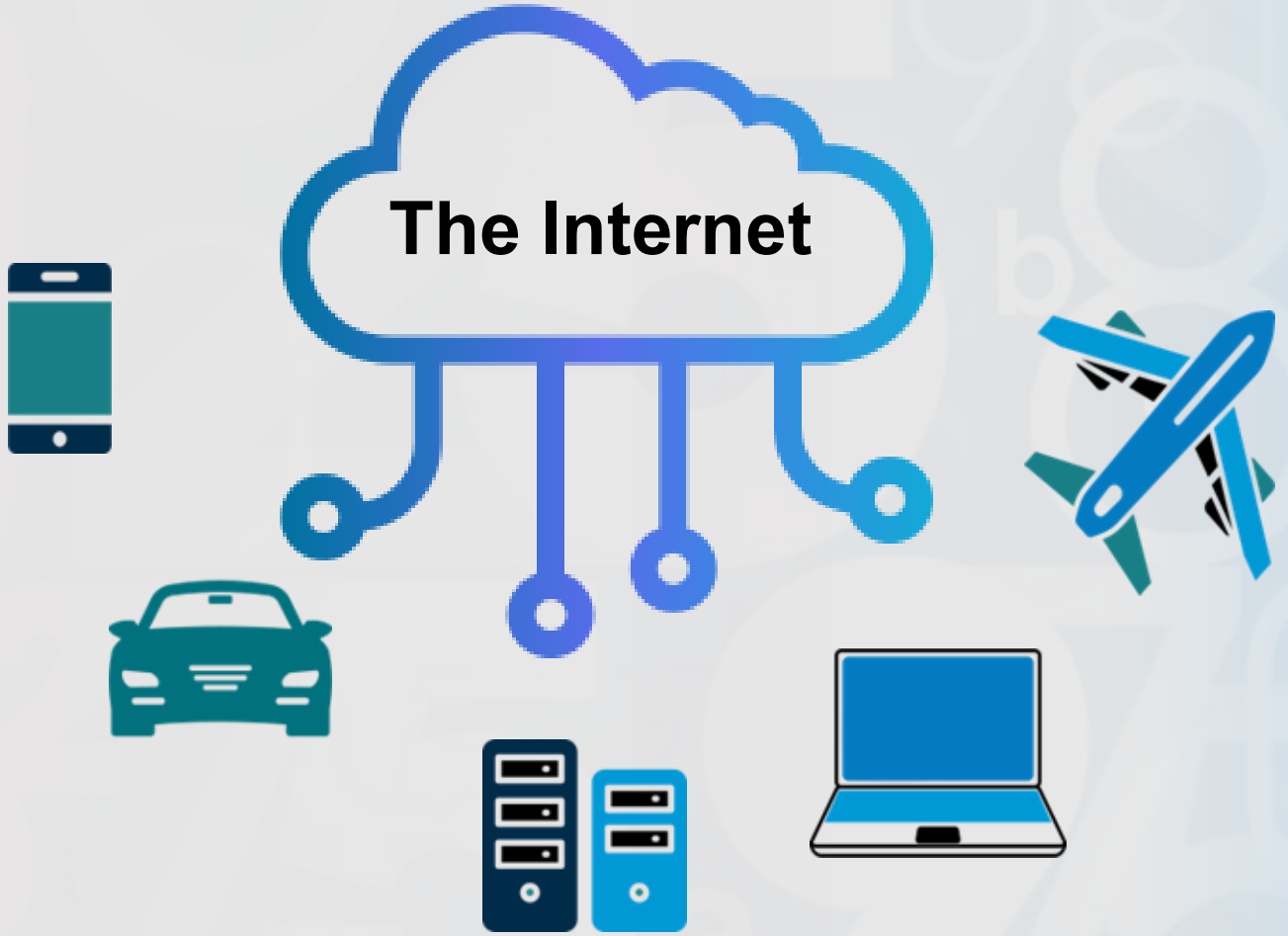
These critical systems are not inherently secure

- Subject to misconfigurations and nefarious activity

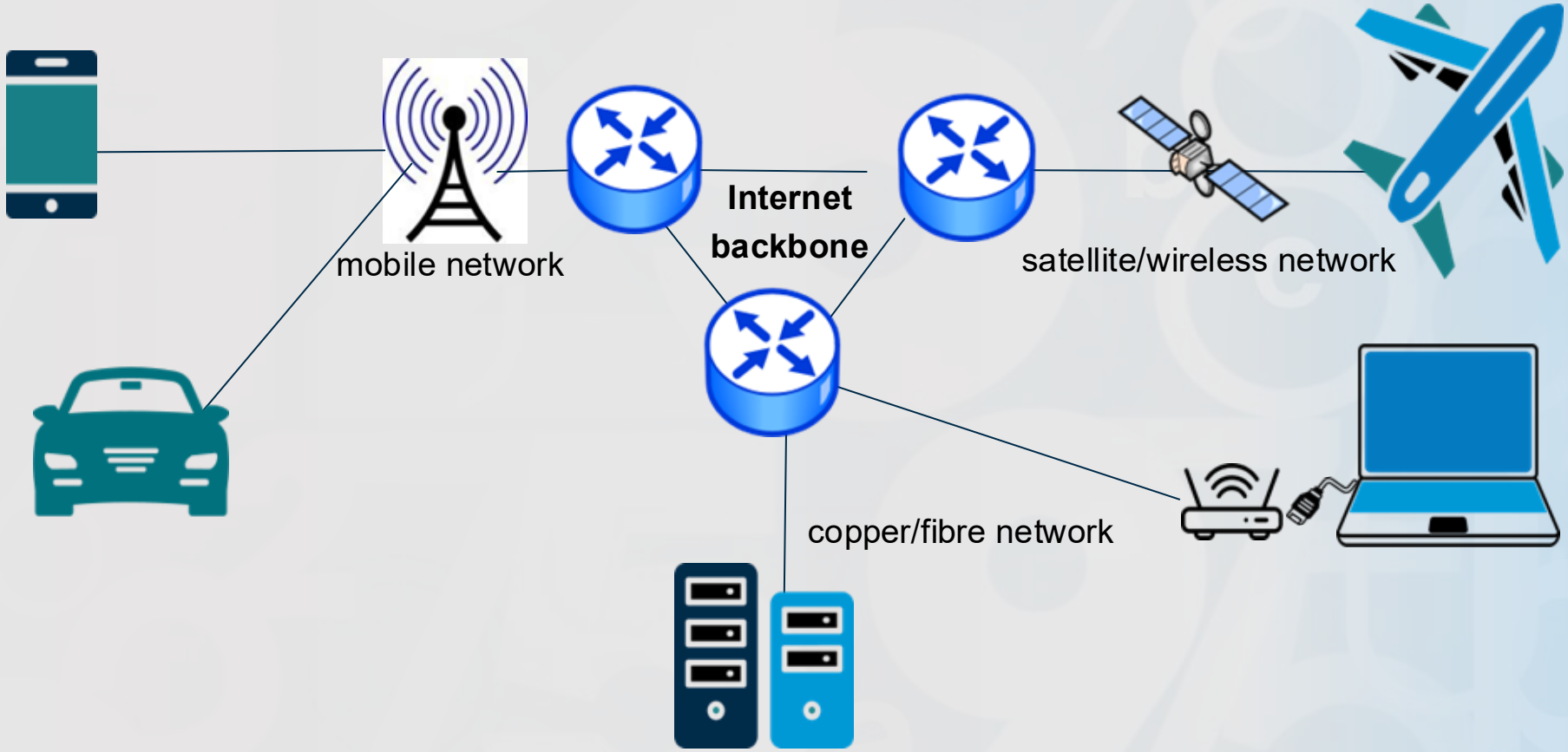
Traditional options for verifying routing

- Internet Routing Registry (IRR)
- Letters of Authority (LOAs)
- Seems ‘legit’ (informal arrangement between ISPs)

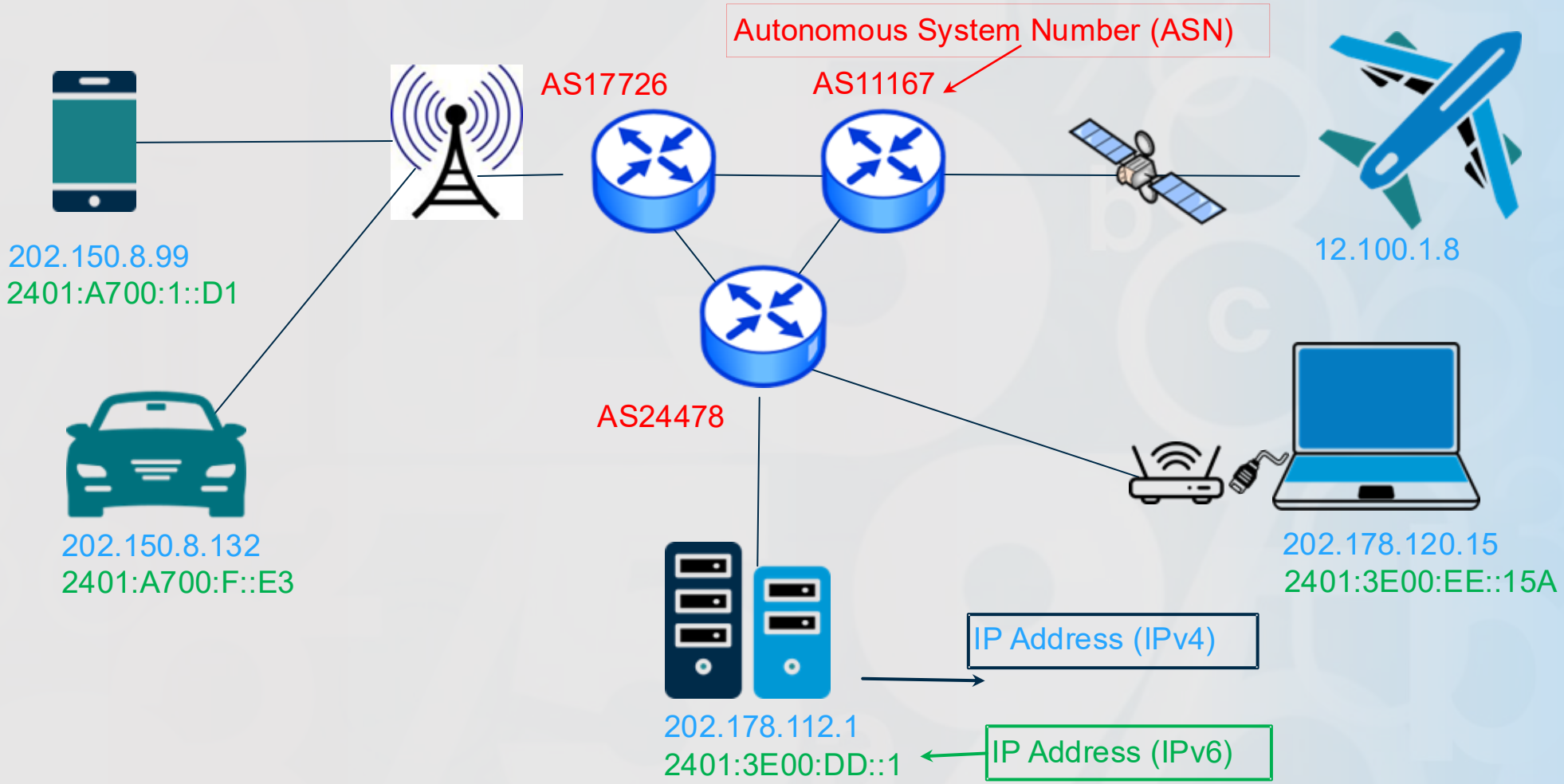
The Internet is…



A Network of Networks



Networks That Use Standard Protocols



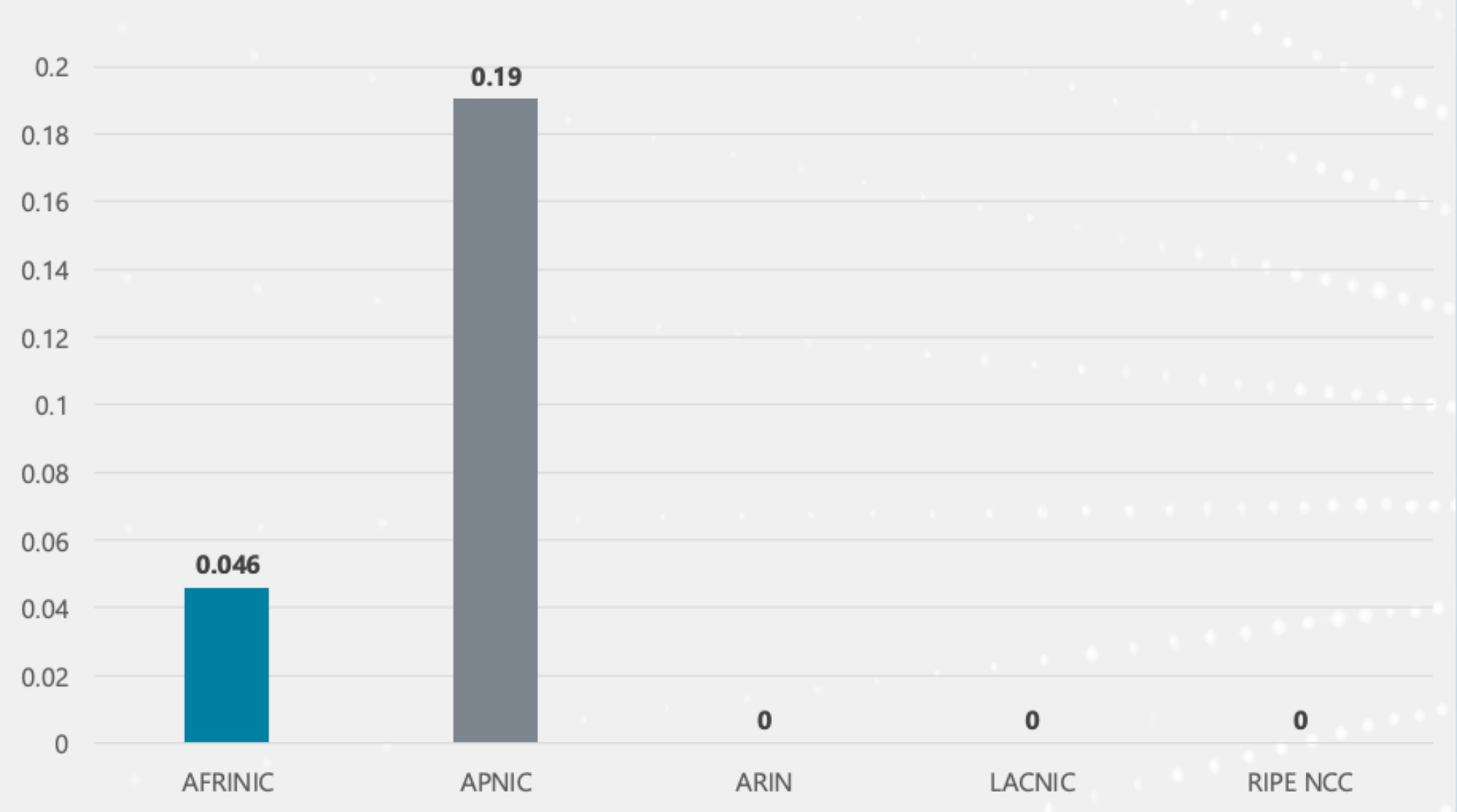
Noteworthy Developments

Global IPv4 Depletion at IANA

Each RIR received its last /8 IPv4 address block from IANA on 3 February 2011

Available IPv4 Space in each RIR

In terms of /8s



IPv6 Deployment

- As per ISOC, the rate of IPv6 deployment is at 50% worldwide

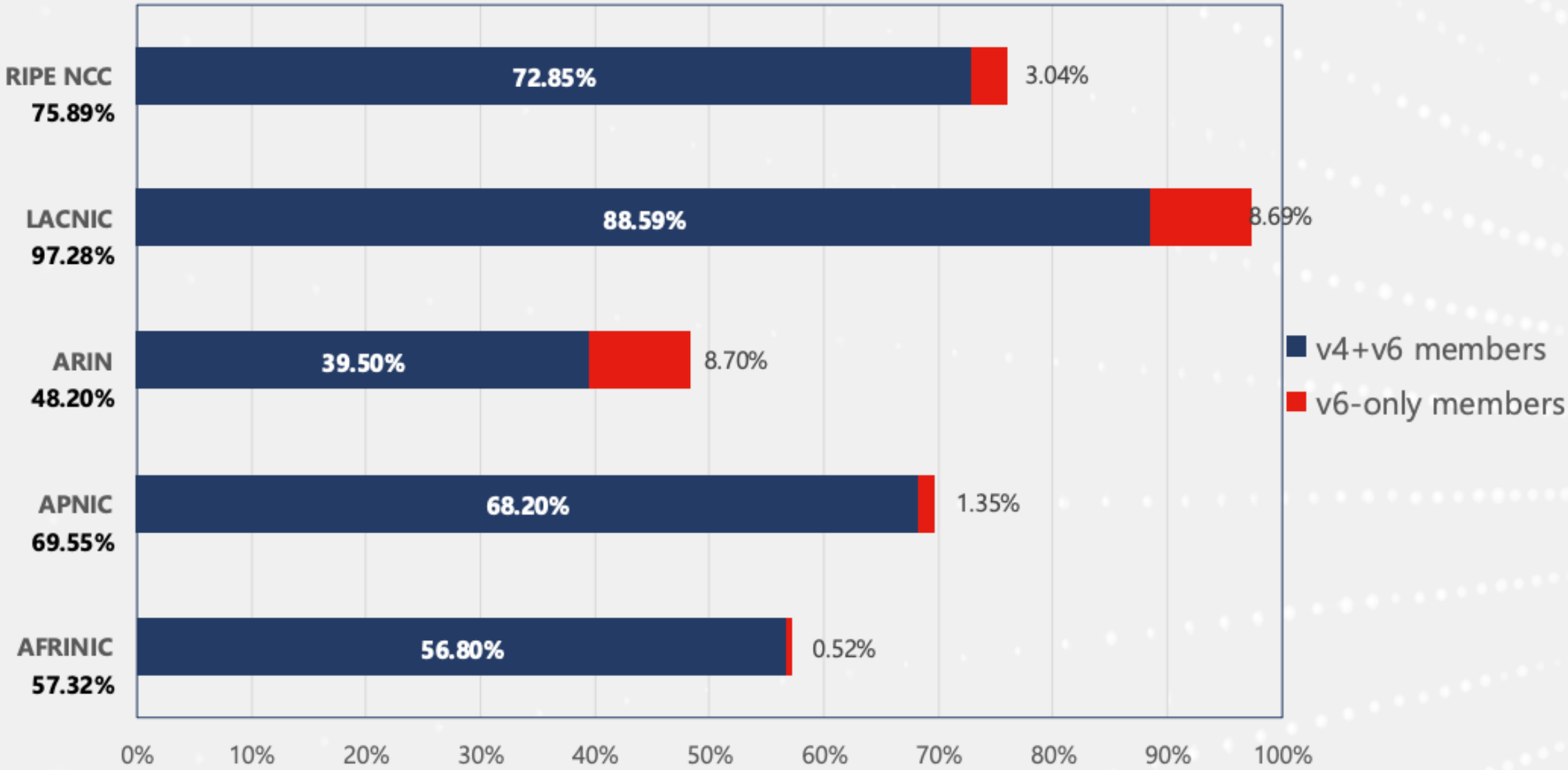
  Source: https://pulse.internetsociety.org/en/technologies/

- Google IPv6 statistics show ~47% of global Internet traffic is over IPv6

  Source: https://www.google.com/intl/en/ipv6/statistics.html

As of March 2026

Percentage of Members with IPv6 in each RIR



As of March 2026

IPv6 Deployment

Movement to IPv6 has been steady

- ISPs rolling out IPv6
- Steady increase in IPv6 traffic
- Increase in IPv6 requests

There is still a demand for IPv4

- All RIRs are still receiving a significant number of IPv4 requests
- Customers are increasingly turning to the secondary IPv4 transfer market for address space

IPv4 Transfers

Developed due to ongoing demand for rapidly depleting IPv4 addresses

Choices were:

- Facilitate IPv4 markets transfers through RIR policies
- Watch a black market emerge with no registry interactions

Needs-based IPv4 market transfer policies developed by communities

- Allowed IPv4 holders to transfer space to qualified recipients

RIR's role

- Ensure compliance with needs-based policies
- Maintain the accuracy of the registry
- RIRs are not privy to any financial data regarding transactions between parties

RIR Services and Tools

Whois

Public directory service

Used to query databases that store registered users of an Internet resource

Differs in usage or content depending on the type of registry

- Number resource registries
- Domain name registries and registrars
- Routing registries

RIR's Whois registry is publicly accessible

RIR Whois Information

Publicly displayed registration data including:

- IP number resources issued by RIRs or predecessor registry ("legacy" space)
- Organizations and their contact info (mailing addresses, emails, phone numbers)
- Original registration date and last updated date
- Customer reassignment information (ISP customers)
- Referential information to authoritative RIRs

Routing Security Tools

The RIRs have deployed two technologies to help secure Internet routing:

Resource Public Key Infrastructure (RPKI)

- Security framework designed to improve/secure the Internet's routing infrastructure
- Verifies association between resource holders and their number resources

Validated Internet Routing Registry (IRR)

- Validation mechanisms added to IRR that guarantee routing announcements are published only by an authorized network

A third technology – **ASPA** (AS Provider Authorisations) is in development

RPKI

- Public key infrastructure framework designed to secure the Internet's BGP routing infrastructure
- Cryptographically certifies network resources (AS numbers and IP address prefixes) and route announcements
- Route Origin Authorisations (ROAs) define which AS is authorised to originate a prefix
- Provides stronger validation than existing technologies such as:
  - Internet Routing Registry (IRR)
  - Letters of Authority (LOA)
- Five RIRs (NRO) collaborating on this cross-RIR project

Why is RPKI important?

Establishes a **level of trust** that the RPKI information is authentic and is confirmed coming from the authorized holder of the resources

The RPKI gives network operators a **method to make better judgments** on which is the valid source (origin) of a route announcement

RPKI can **limit the impact** of a configuration mistake or nefarious activity of a bad actor

RPKI Adoption Rate in Each Region

% of IP address space covered by RPKI certificates

REGION	IPv4 ADOPTION	IPv6 ADOPTION
AFRINIC	51.25	47.42
APNIC	38.43	18.19
ARIN	41.65	63.87
LACNIC	57.29	58.16
RIPE NCC	75.56	43.39

https://ftp.ripe.net/pub/stats/ripencc/nro-adoption/latest/rir-adoption.txt

As of March 2026

NRO RPKI Program:
Securing the Internet routing system, together

Purpose: "To provide a more consistent and uniformly secure, resilient and reliable RPKI service"

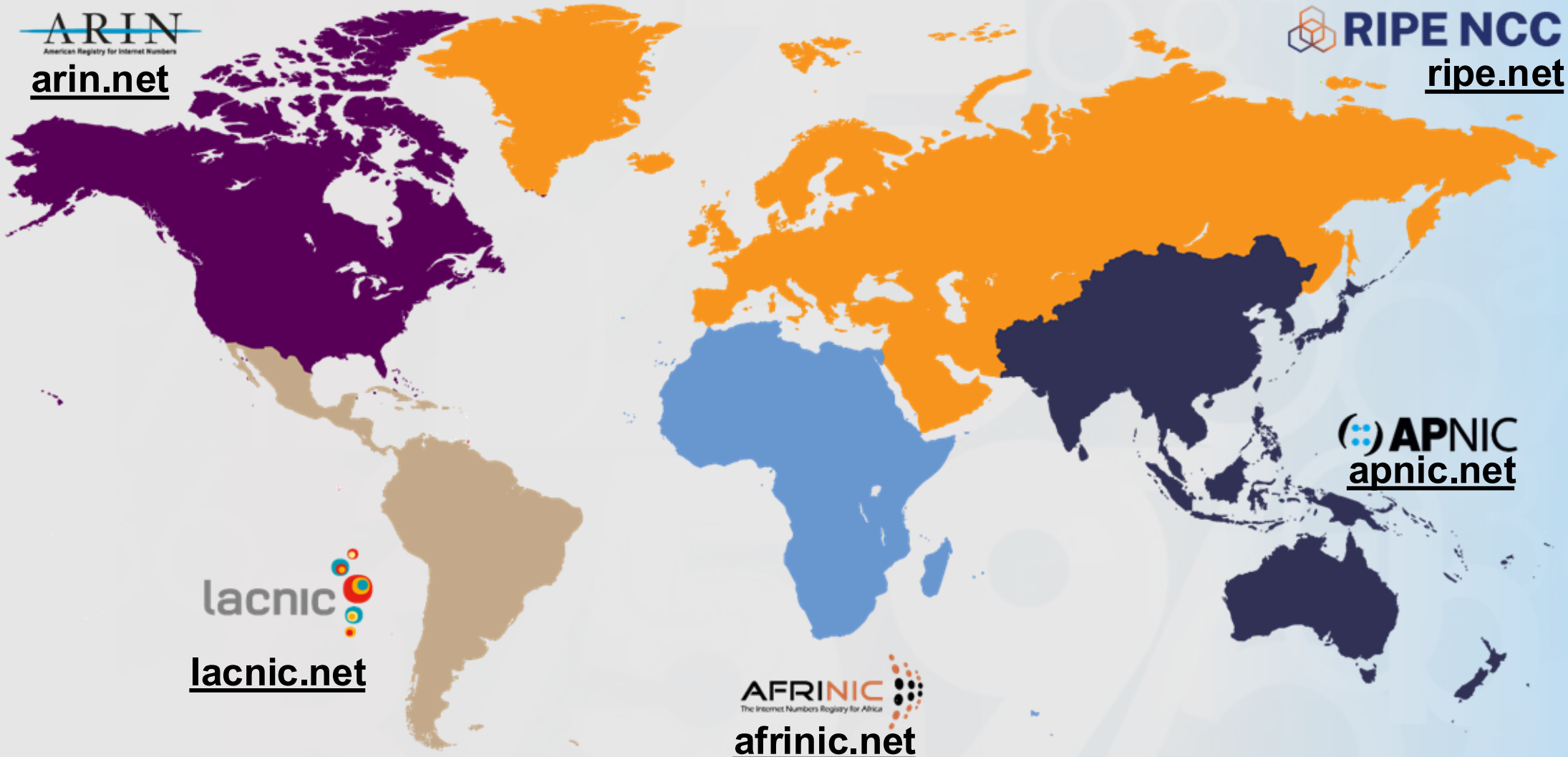
Why is it important?

1. It creates a space for structured **coordination and collaboration** on RPKI among the RIRs
2. Current **diversity/inconsistency** among RIRs' RPKI implementations
3. Some RPKI challenges/concerns need to be addressed by the five RIRs **in alignment**

NRO Publications

- **Global Internet Number Statistics**
  - Internet Number Resources Status Report (updated quarterly)
  - Global stats on IPv4, IPv6, ASN (updated daily)
  - RPKI Adoption Reports by IPv4, IPv6, economy (updated daily)
  - https://www.nro.net/statistics
- **Comparative Policy Overview**
  - Updated quarterly
  - Information on RIRs Membership policies (access to delegation and registration services)
  - https://www.nro.net/rir-comparative-policy-overview

Stay Informed



Any Questions?

Thank You

secretariat@nro.net

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