

ICANN | ASO

Address Supporting Organization

How It Works

The Regional Internet Registry System



True or False?

The **World Wide Web** and **the Internet**
are the same thing.

The correct answer is **False**

The Internet and the Web are two different things.

The **Internet** is a foundational network of networks.

The **World Wide Web** is one of many applications that run on the Internet.



Sir Tim Berners-Lee and Vint Cerf - fathers of the Web and the Internet, respectively - at the World Wide Web Consortium's 20th Anniversary

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.

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

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



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



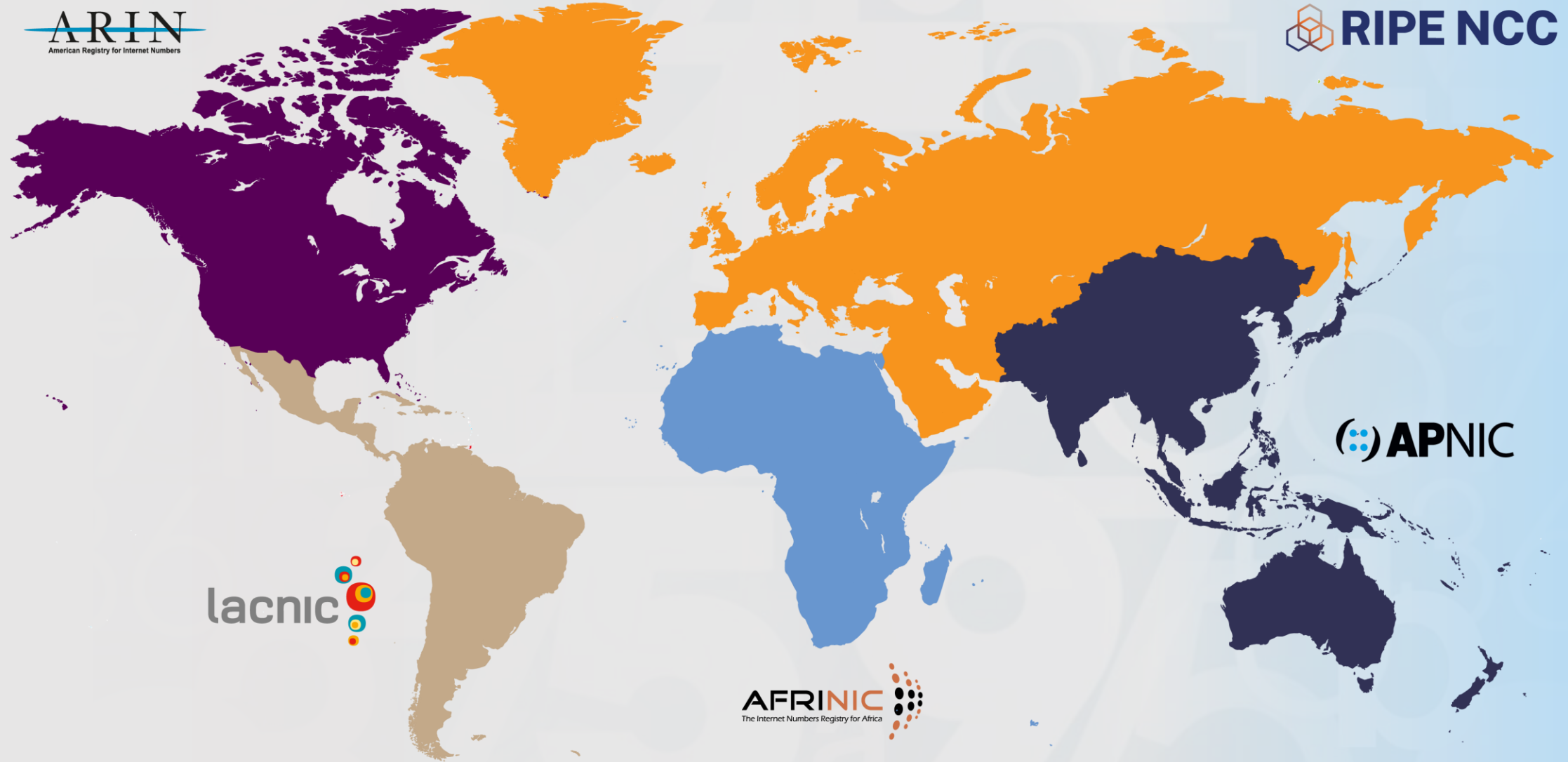
RIR

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

This is why RIRs exist

- Regional Internet Registries (RIRs) were set up to ensure the accurate registration of IP address allocations.
- The goal is to ensure the uniqueness of IP addresses so that the Internet continues to function.

The Regional Internet Registries



Functions of an RIR



Manage and distribute
Internet Number
Resources:

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



Maintain directory
services including:
Whois, Whoas, 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
- **Policy Development:** Takes place through bottom-up, multistakeholder processes
- **Capacity Building:** Supporting network operators and communities through training and education

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

Community
policy

RIR

National
legal
framework

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

Technical
remit

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

The NRO and the ASO



The Number Resource Organization



- The Number Resource Organization (NRO) is the coordinating body for the five **Regional Internet Registries (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.

ICANN | ASO

Address Supporting Organization

NRO Mission



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

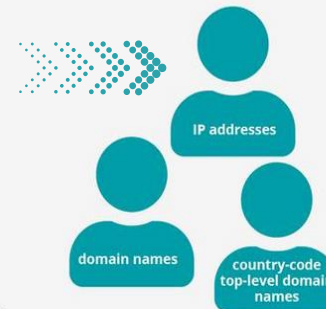


Technical Liaison Group

Works with the organisations developing the basic Internet protocols.

ICANN policy development stakeholders

Supporting organisations



Advisory committees



Technical liaison group



<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 Organized?	15 Members [3 From Each Region] – 2 Elected at Large – 1 Appointed by RIR Board • RIR & 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)

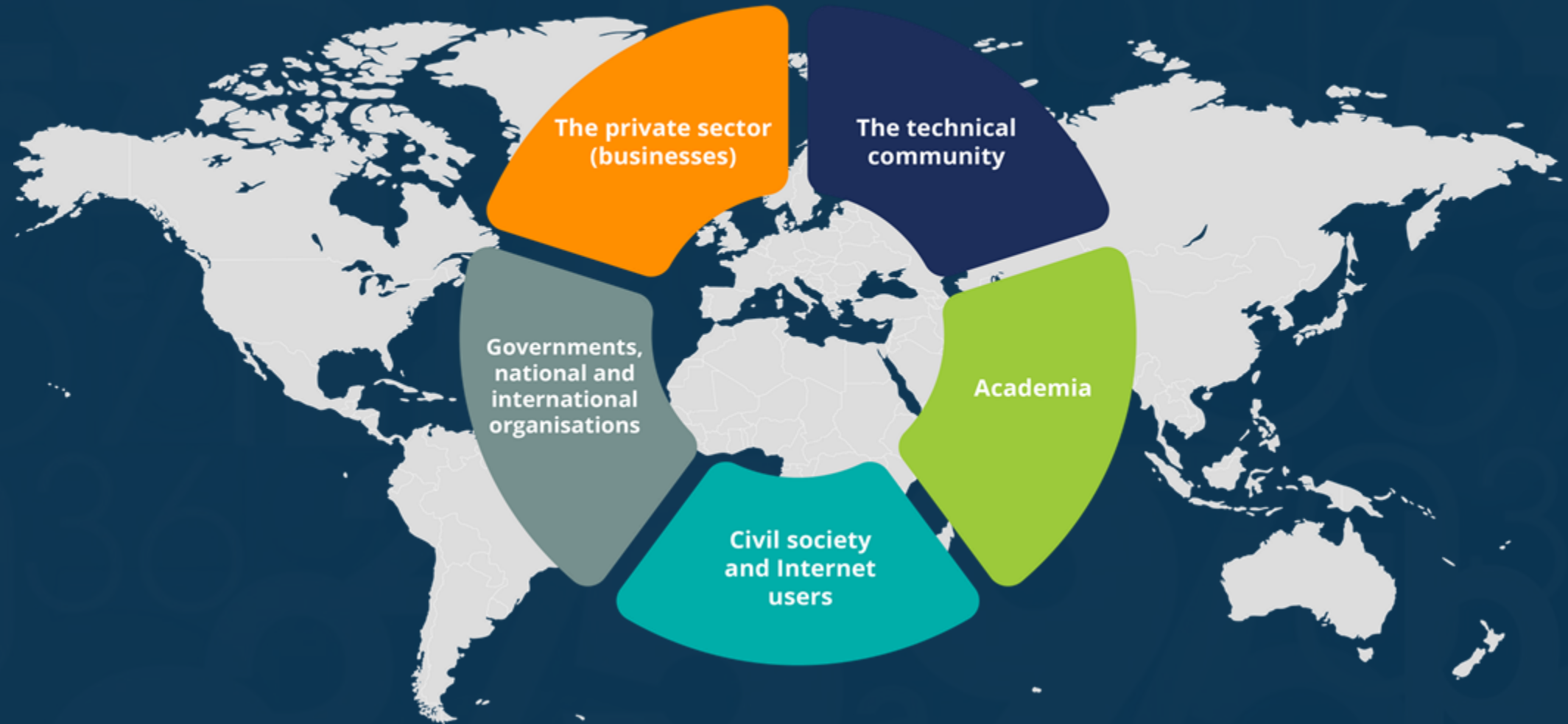
Policy Development



True or False?

You can participate in policy development
in a Regional Internet Registry.

Multistakeholder Approach



Policy Development Process



Inclusive

Anyone can participate



Bottom Up

The Internet community proposes and approves policies

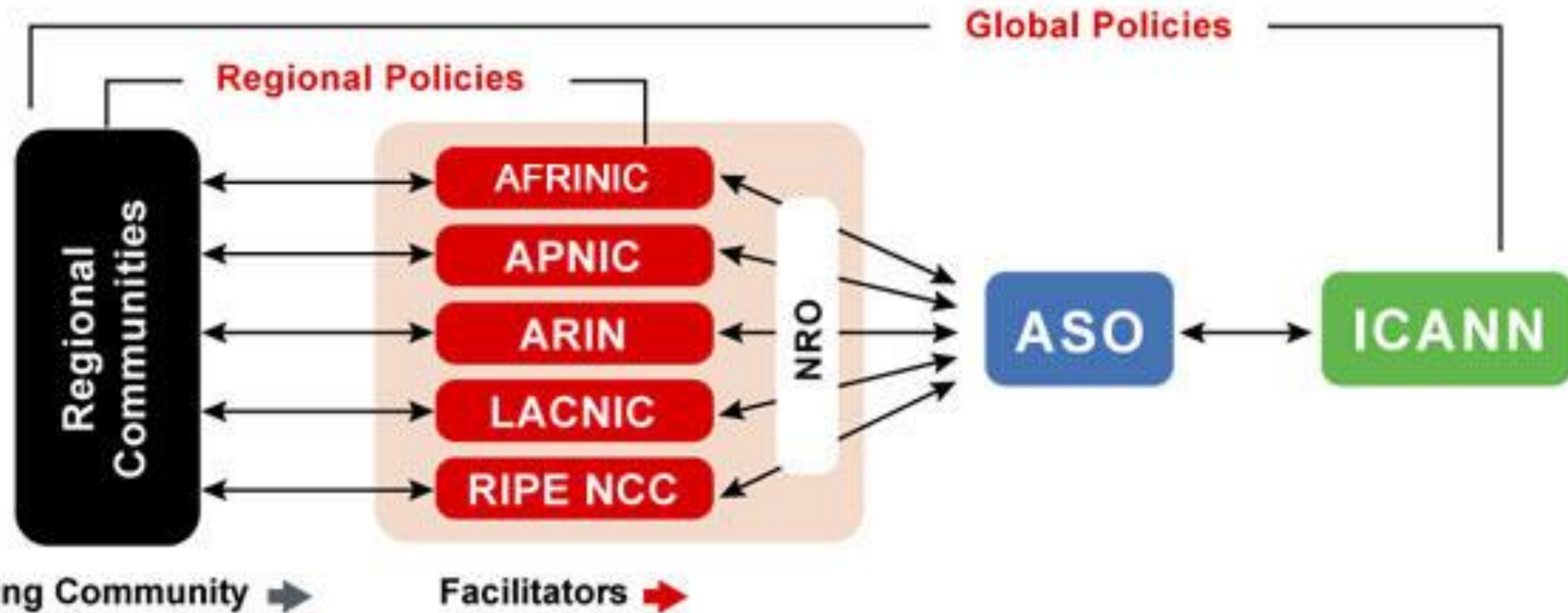


Transparent

Policies and decisions are documented and publicly available



The Global Policy Development Process



Internet Number Resources

IPv4, IPv6, and Autonomous System
Numbers (ASNs)



True or False?

There are more IPv6 addresses than grains of sand on the Earth.

The correct answer is **True**

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
- $2^{32} = \sim 4.2$ billion
- e.g. 205.150.58.7

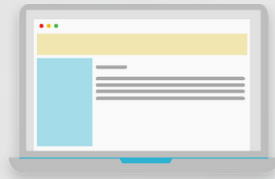
- **IPv6**

- 128-bit addresses; written in hexadecimal
- $2^{128} = \sim 50$ octillion for each of the roughly 6.5 billion people alive
- e.g. 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

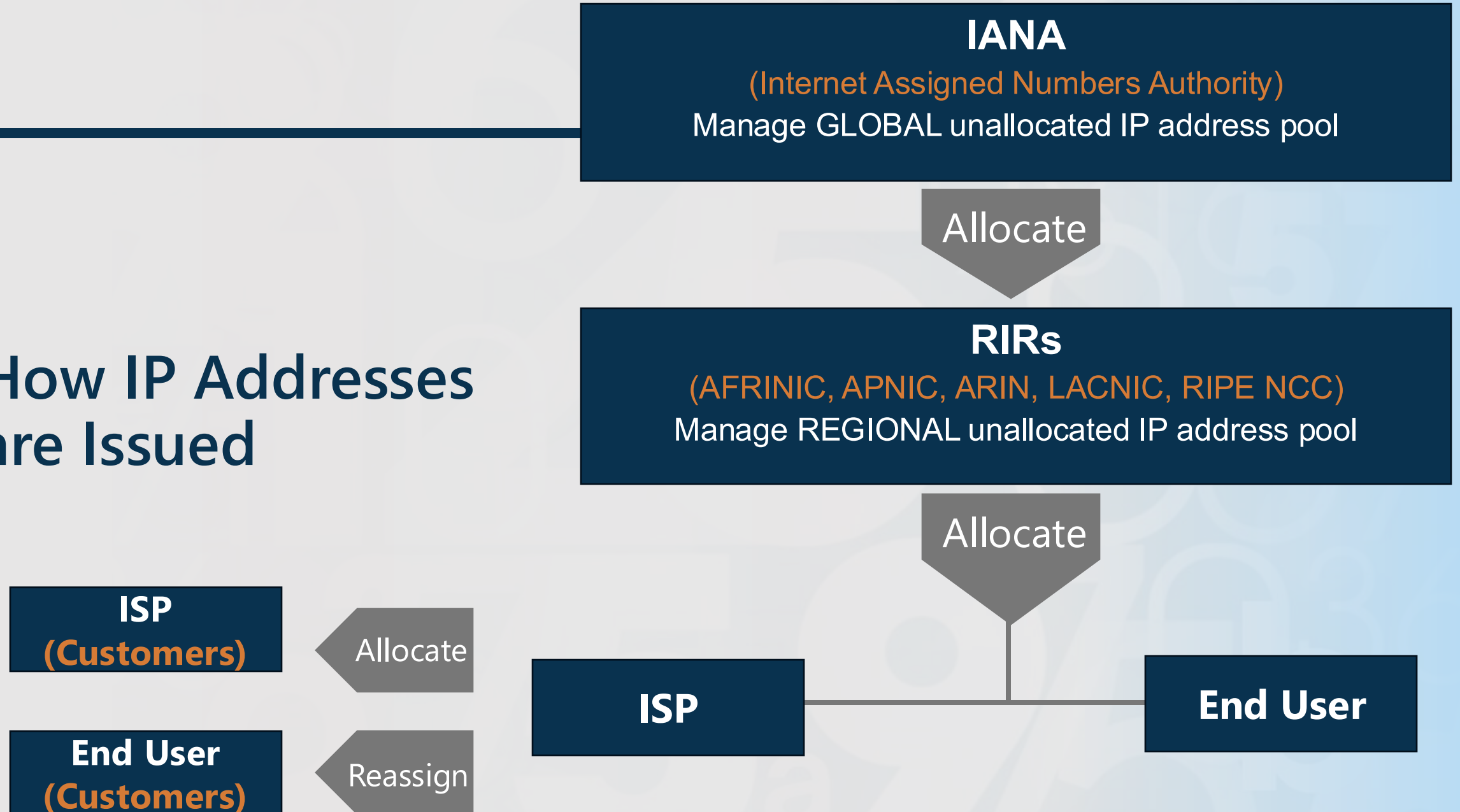
Autonomous System Numbers (ASNs)

Globally unique numbers used to exchange routing information with neighboring 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

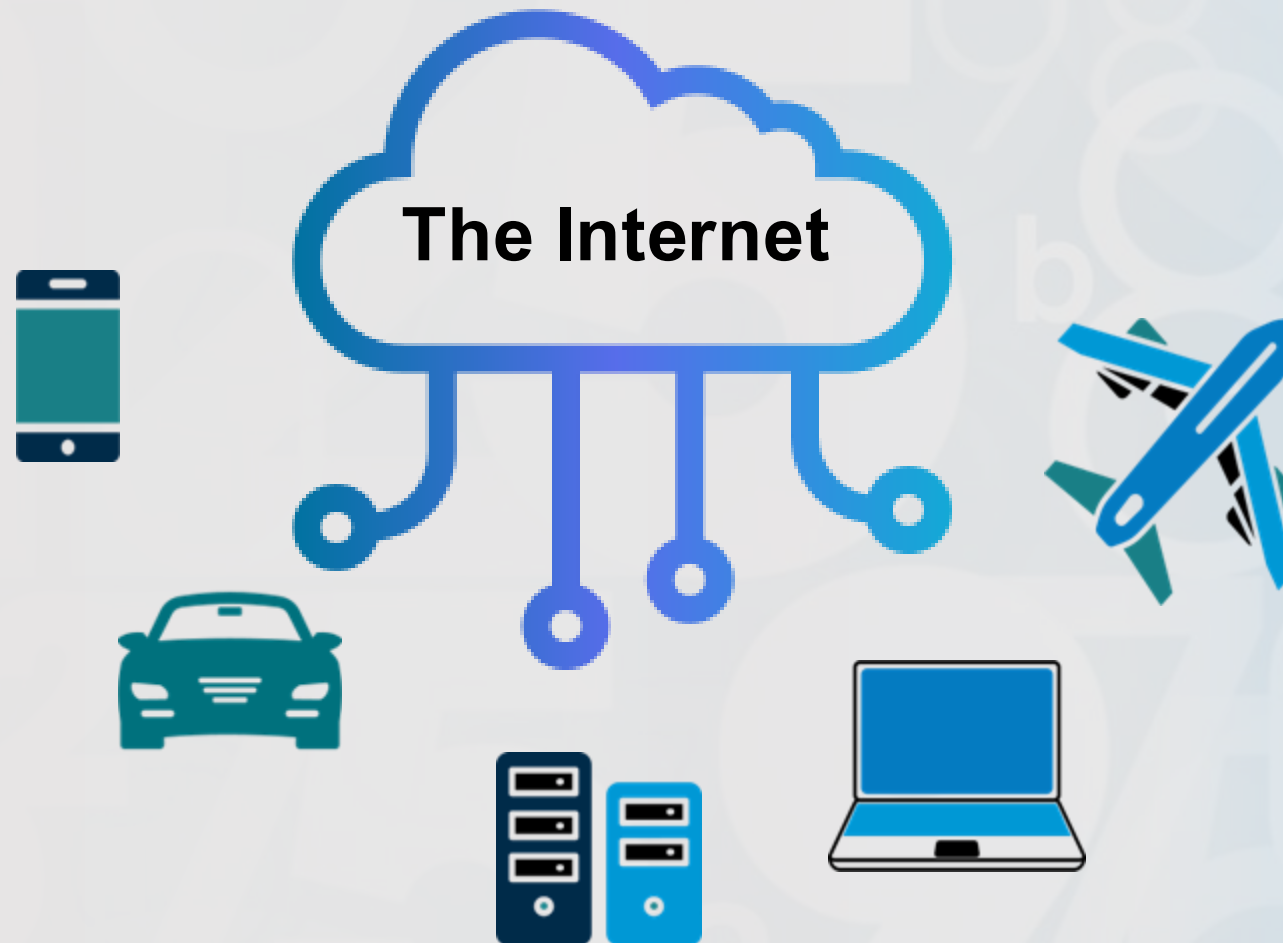
These critical systems are not inherently secure

- Subject to misconfigurations and nefarious activity

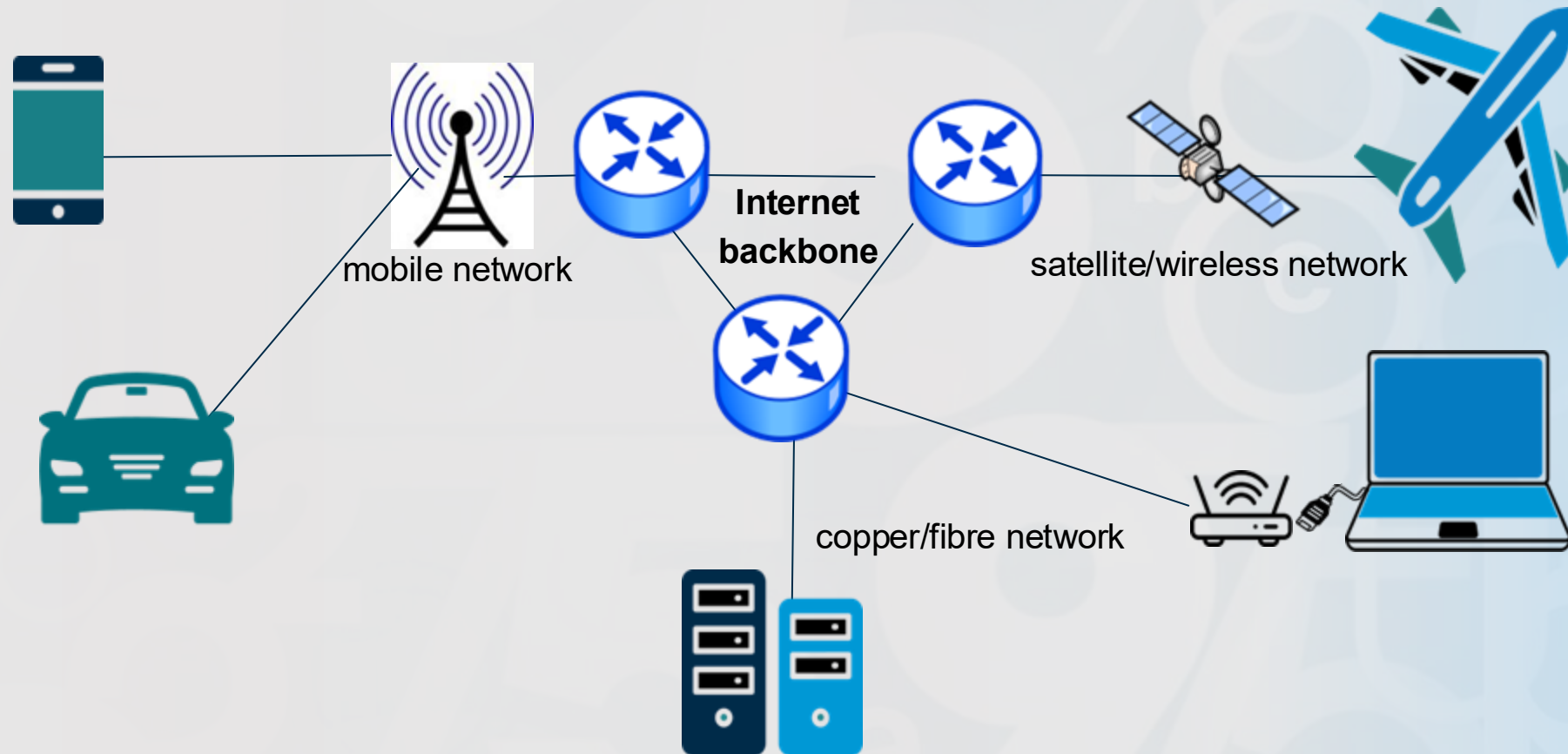
Traditional options for verifying routing

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

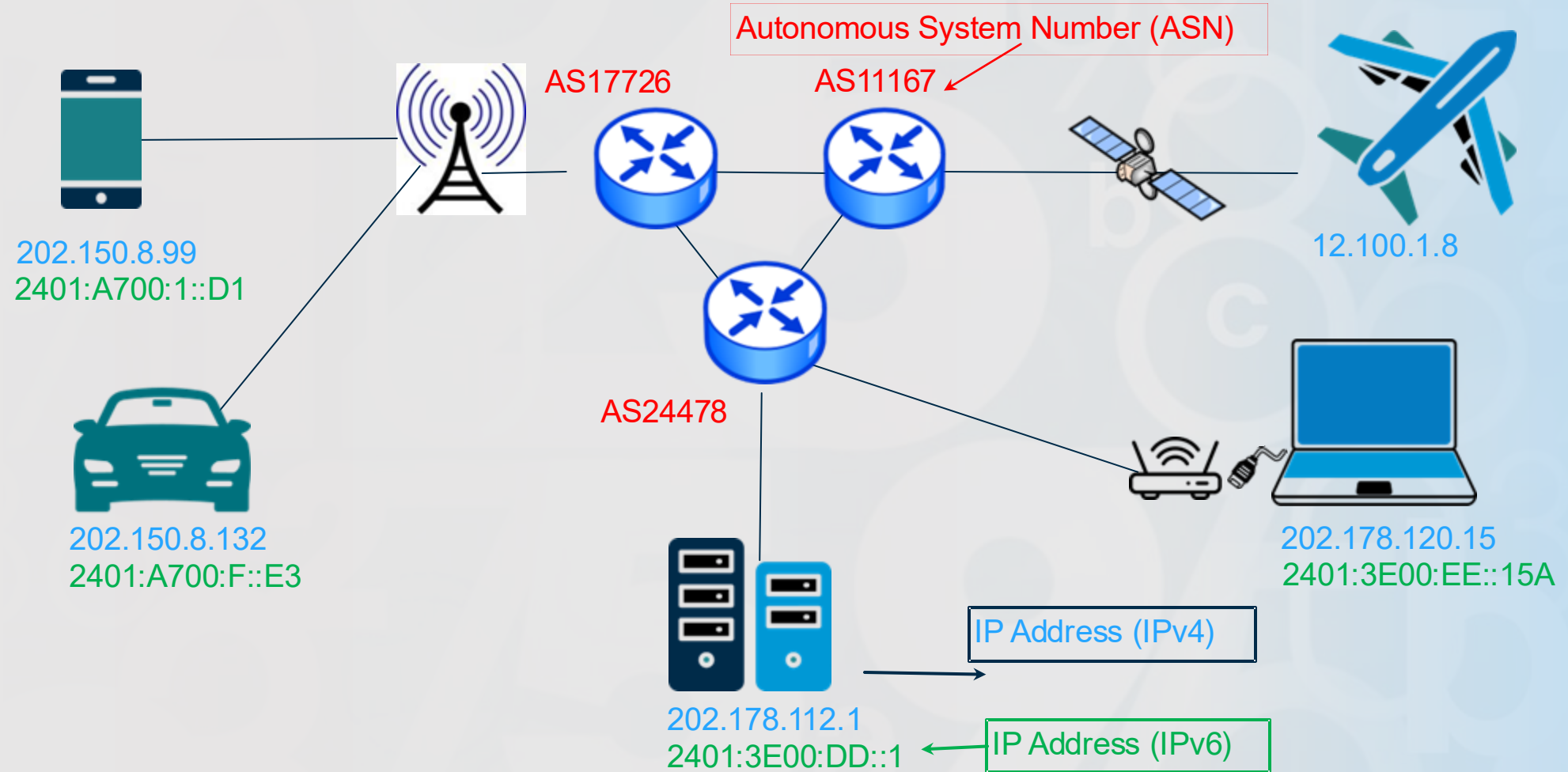
The Internet is...



A Network of Networks



Networks That Use Standard Protocols



Noteworthy Developments



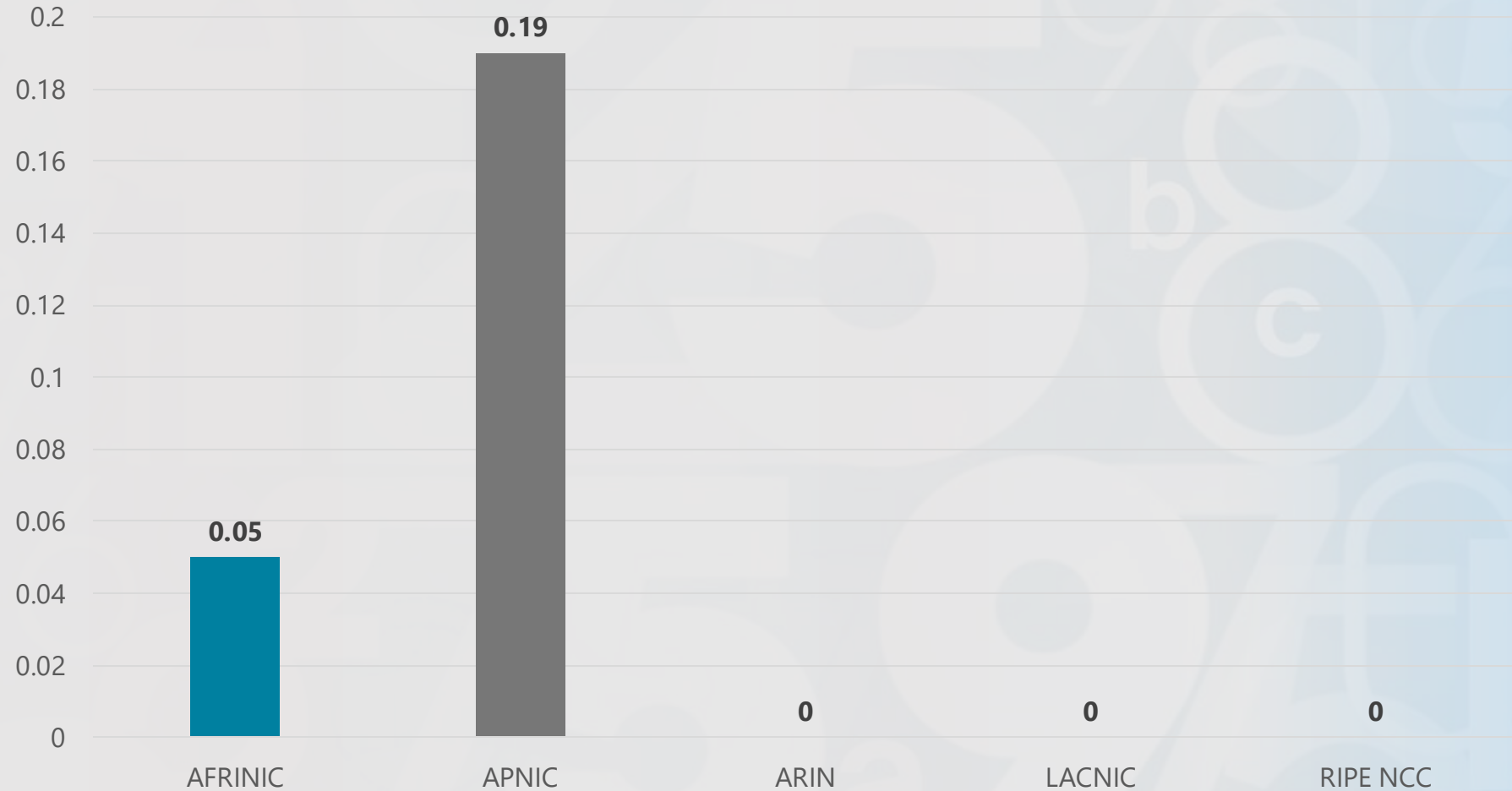
Global IPv4 Depletion at IANA

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

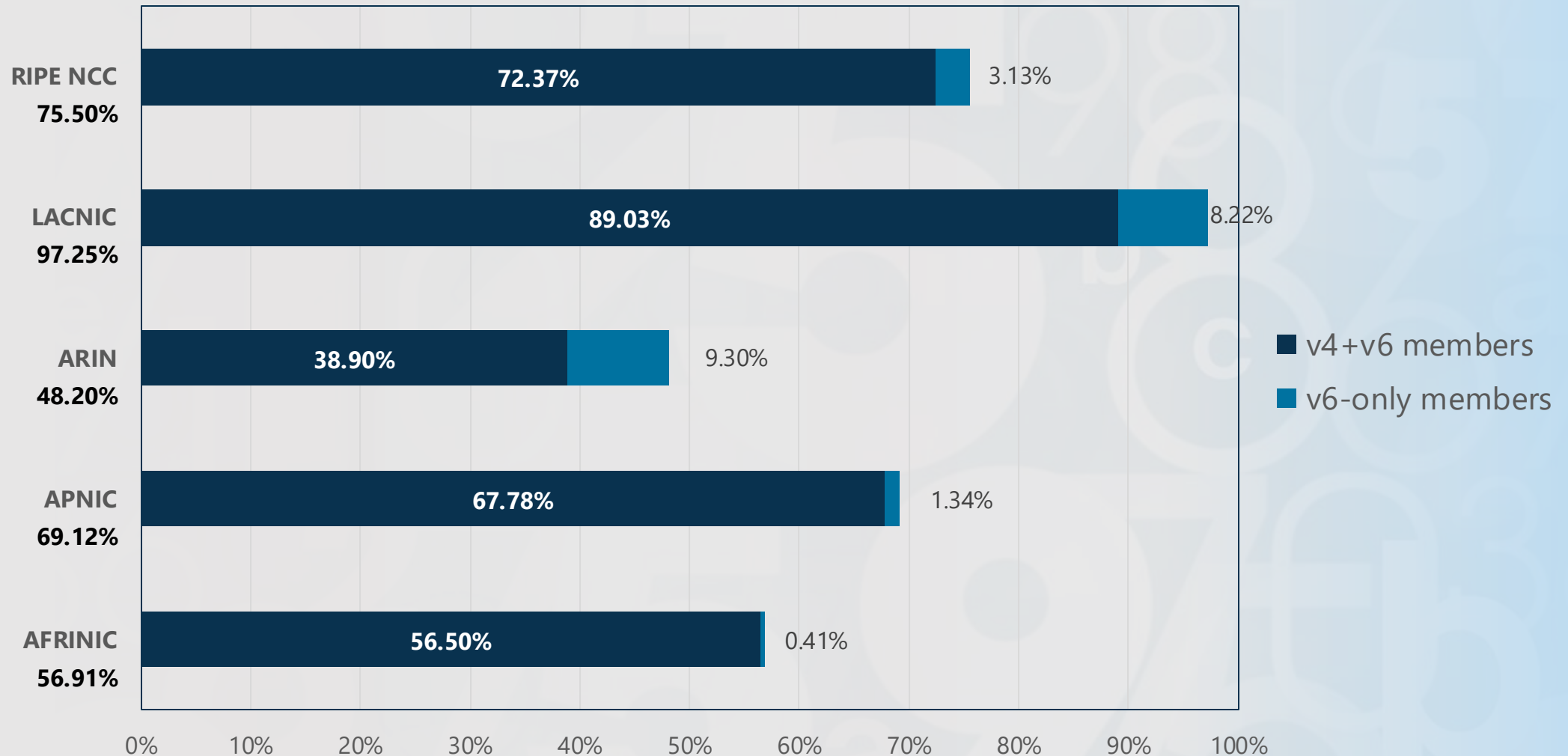


IPv6 Deployment

- 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 October 2025

Percentage of Members with IPv6 in each RIR



Post-IPv4 Depletion

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 significant number of IPv4 requests
- Customers increasingly turning to the secondary IPv4 transfer market for address space
- Increase in fraudulent requests for IPv4 space
 - Submitting falsified business records, personal ID documents, etc.

IPv4 Transfers

Developed due to on-going demand for rapidly depleting IPv4 addresses.

Choices were:

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

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

Inter-RIR IPv4 Transfers

Number of
transfers

Number
addresses
transferred

Recipient RIR

Source RIR

	AFRINIC	APNIC	ARIN	LACNIC	RIPE NCC
AFRINIC		0	0	0	0
APNIC	0		248 2.379M	19 .02202M	665 3.984M
ARIN	0	418 20.460M		32 .17831M	758 34.751M
LACNIC	0	6 .01170M	33 7.1890M		45 .1025M
RIPE NCC	0	157 2.7299M	323 9.3379M	18 .01535M	

RIR Service 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

Resource Public Key Infrastructure (RPKI)

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

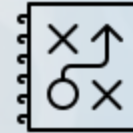
Why is RPKI important?



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 as of 27 October 2025

REGION	IPv4 ADOPTION	IPv6 ADOPTION
AFRINIC	31.15	11.06
APNIC	37.94	18.09
ARIN	40.91	63.71
LACNIC	56.93	57.74
RIPE NCC	74.35	41.64

<https://ftp.ripe.net/pub/stats/ripenncc/nro-adoption/latest/rir-adoption.txt>

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**

RPKI NRO Program Objectives

Progress towards improved transparency, robustness, and security of the RPKI system

- Building on 2024 work:
 - Key aspects of robustness documented
 - TA configuration problem statement and potential solutions

Increased consistency of the RPKI system user experience

- Building on 2024 work:
 - Documentation of baseline for RPKI services/features offered by each RIR
 - User research with users interacting with multiple RIRs

The technical community is kept informed and engaged throughout the program.

- RPKI Program updates presented at relevant events
- Blog articles in RIR blogs
- Etc.

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

ARIN
American Registry for Internet Numbers
arin.net

 **RIPE NCC**
ripe.net

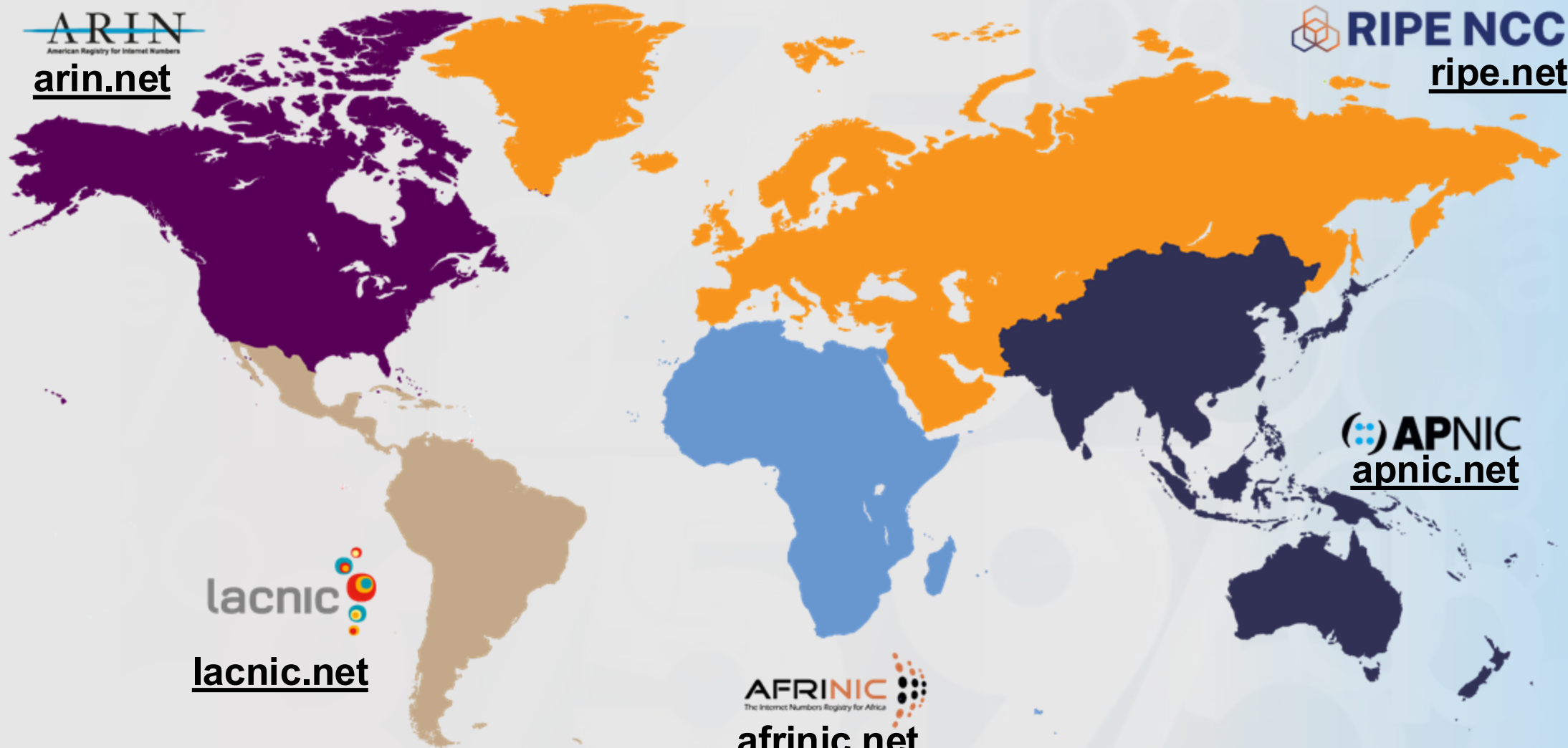
 **APNIC**
apnic.net

lacnic

lacnic.net

AFRINIC
The Internet Numbers Registry for Africa

afrinic.net





Any Questions?

Thank You

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