Beyond Numbers:

Navigating the "end-user" part of the AS Ecosystem

Radu Anghel / RIPE 88

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Autonomous System Numbers

- **4.294.967.295** maximum uint32 ASNs (for simplicity, incl. reserved)

- **116.965** currently [assigned by RIRs](#)

- **75.770** (64.78%) visible in the v4 GRT ([APNIC](#))

- The **41.195** (35.22%) not visible in the GRT could be

  - v6 only networks approx. **7.000** (6%)

  - IXPs, Route Collectors (???%)

  - Private networks that require unique numbering (???%)

  - Abandoned (???%)

- Around 20% of RIPENCC assigned ASNs are [not routed at all](#)

- Are they a scarce resource today? **NO**

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Regional Internet Registries

- Monthly avg. assignments ([IANA](#))

  - **RIPENCC: 192**

  - **APNIC: 119**

  - ARIN: 111

  - LACNIC: 52

  - AFRINIC: 12

- Will focus next on **RIPENCC** and **APNIC**

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Regional Internet Registries

- **RFC1930** Guidelines for [...] registration of an AS (1996 –28yo)

  - Is mentioned in various documents by all the five RIRs

- Eligibility for an ASN in **APNIC** is evaluated based on **RFC1930**

  - **"**Requests for ASNs under these criteria will be evaluated using the guidelines described in RFC1930**"**

- **RIPE-679** ASN Assignment policies - "see **RFC1930**"

  - Policy is not clear if a request can be rejected for "**RFC1930** reasons"

  - "In order to help decrease global routing complexity, a new AS Number should be used only if a new external routing policy is required, see RFC1930."

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RFC1930 sec. 5 – do I need an AS?

- Need to exchange routing info (**BGP**) (important)

- Have multiple prefixes (less important)

- Have a **unique routing policy** (important)

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Where do I get an ASN from? * if needed

- Regional Internet Registries

  - From the (main) **region** the network operates in

  - One network can operate in multiple regions (ex. 174)

- **RIR** shopping is possible to some degree

  - Choosing the cheapest/easiest to deal with

  - This translates to "**out-of-region**" assignments

- **RIPENCC!**

RIPE, both NCC and the Community recap

- At RIPE 86, the out-of-region issue was [presented](#)

- **Maintenance fee** for ASNs was [proposed](#)

  a. Recover **abandoned** ASNs (db accuracy)

  b. **Financial incentive** to double check if you(r customers) need an ASN

  c. Proportional **financial contribution** to the RIPENCC budget based on usage

- Maintenance fee was [rejected](#) at the GM in 2023

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RIPE, the NCC

- Growing number of ASN requests coming from end-users

  - 2020: **50%**

  - 2021: **48,3%**

  - 2022: **55,1%**

  - 2023: **64,4%**

  - End-users can be natural or juridical persons

  - End-users have no contractual relationship with RIPENCC, only LIRs

  - >50% of requests [come from natural persons](#)

  - Registration Services are not happy

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RIPE, the NCC

- The number of unsuccessful requests is also increasing

  - 2020: **11,8%**

  - 2021: **11,4%**

  - 2022: **13,5%**

  - 2023: **14,6%**

- Unsuccessful requests = rejected or silently dropping (not providing required documents)

- Unsuccessful requests = wasted RIPE NCC resources

  - Receiving the requests

  - Checking the documents

  - Asking for more documents

- RIPENCC resources = € paid by the members (LIRs)

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The five RIRs

- ASNs visible in the v4 GRT (APNIC):

  - RIPENCC: 28621 (**12116**)* only one prefix announced

  - ARIN: 19162 (**6970**)

  - APNIC: 14135 (**4298**)

  - LACNIC: 11081 (**2615**)

  - AFRINIC: 1844 (**658**)

  - RIPENCC wins with almost double 1-prefix ASNs vs ARIN

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ASNs are

- 16 bit numbers **YES**

- 32 bit numbers **YES**

- BSNs (AHV/Personnumer/NIN/CHI/CNP/SSN) **NO**
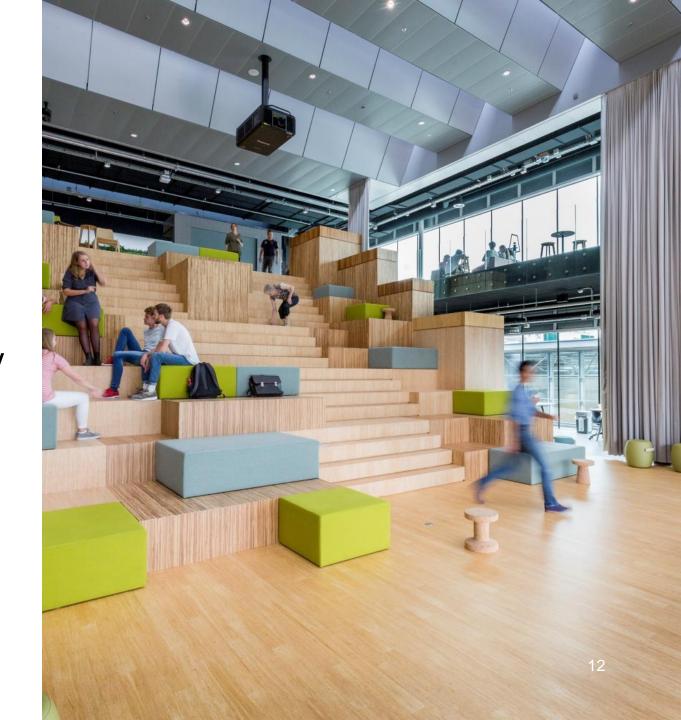
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What are "Personal ASNs"?

- Different opinions:

  - 2021: "Research networks" with double quotes (DENOG13)

  - 2022: A way of getting new networkers interested

On a previous slide: **ASNs are not a scarce resource today**

- World population July 2023: **8.045.311.447**

- uint32: **4.294.967.295**

  - Only 53.4% of world pop. has ASNs available

  - 1 in 2 potential network engineers would have to find a different career

Reconsider scarcity?

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Personal ASNs

Do I need an ASN if I like computer networks? NO

Do I need an ASN if I want to be a net. eng.? NO

- Some professions require the person to have some type of license: doctors

- When a doctor changes workplaces the license follows

- **This is not the case with net. eng. and ASNs**

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Personal ASNs

- **Do I need an ASN if I want to learn BGP? NO**

  - You don't need a personal train operated on the (inter)national railway to learn to be a train driver

  - Courses are organized and trains are provided (no BYOT)

  - dn42 or similar networks

- **Do I need an ASN if I research BGP things? NO**

  - Trains are provided by NRENs and/or Universities, Schools, etc

  - Temporary assignments for academic research

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ASNs

- Operating a public ASN on the Internet has global effects

  - It grants access to tools, databases otherwise not available

  - It also comes with responsibilities towards the community for keeping these functional

- Responsibilities are easily overlooked

  - There is no Internet Police

  - Spiderman philosophy

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User-generated content: PeeringDB

- Self-reported by confirmed ASN contacts

- Information is used for automating things

- Network types: not free text; some options provided

  - **Educational/Research** frequently chosen by personal ASN holders

  - What does it mean? NRENs? Universities?

  - Natural persons?

- # of prefixes:

  - "Recommended max # of routes/prefixes for peering with this ASN"

- 2024: PeeringDB Feature Request: [Add new network type "Personal"](#)

PeeringDB

- Assume that I am running the **NVTR-IX*** with a TMB* cert. for privacy

    - I magically build my configs from PeeringDB data

    - I suddenly have very high prefix limits because some of my **Educational** customers announcing 1 prefix put in PDB >10.000 prefixes

- Should I not use PeeringDB anymore as it's not trustworthy?

- Is **IRR** info still trustworthy?

* **Not Virtual Totally Real Internet Exchange**

* **Trust Me Bro**

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User-generated content: Geofeeds

- **RFC 8805**
  - Standardized format for geofeed CSVs
  - 3.3 Verification of Accuracy -> err. threshold -> admin review
- RIPE DB:
  - Can add as remarks:
  - Can add as geofeed:

User-generated content: Geofeeds

- Assume I'm a serious person working for a nice bank

  - I start seeing penguins accessing banking services

  - I immediately call the person handling the security feed with geolocation data

  - They notice some geofeeds are wrong (admin review)

- RFC 8805 is almost 4 years old and already not usable/trustworthy

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(whois) Internet Graffiti

- "I want to change my geofeed so I can watch *flix in countryX"

- "I want to change my geofeed to see if large companies take me seriously"

  - Not valid reasons for obtaining IPs/ASNs

- Incorrect/Incomplete info

- Some *really* not operational info

- Graffiti can be art or vandalism

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RIPE, the NCC, and the GDPR

- Number resources

  - ASNs

  - IP addresses

  - Phone numbers (oops, these are not assigned by RIPENCC!)

- GDPR Legitimate interest

  - "Your company/organisation has a legitimate interest when the processing takes place within a client relationship [...] to prevent fraud or to ensure the network and information security of your IT systems."

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RIPE, the NCC

- bgp.tools (manually) maintains a list of personal ASNs

  - **1390** ASNs marked as personal

  - **1291** of them are assigned by RIPENCC (NRO combined stats)

  - 2022 numbers by Evan Pratten and Emile Aben (aprox. 135 difference in a few months)

- Some natural persons have **more than one** ASN assigned

- Currently racing towards 2% of visible ASNs

- Top 5 sponsoring-org: for personal ASNs:

  - ORG-ZHL2-RIPE: 134 (299 all time)

  - ORG-SA4302-RIPE: 99 (278)

  - ORG-OG36-RIPE: 87 (186)

  - ORG-ICL64-RIPE: 75 (210)

  - ORG-CR158-RIPE: 52 (133)

Big sponsoring-org: Business

- Business model:

  - ASN request from RIPENCC has no costs, they one time handle paperwork

  - No worries about DB accuracy

  - Additional must-have services (BGP VMs, …)

  - Even paid "export your routes to RIS"

- Additional services are cheap

  - Affordable

  - Less complaints for small amounts

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How does this affect us?

- Directly

  - Costs of operating Registration Services translate to membership fees (**LIRs**)

- Indirectly

  - DB accuracy (**RIPENCC**, **everybody**)

  - Operational issues (**everybody**)

  - Data quality for actual research (**researchers**)

What can we do to fix it?

- Easy

  - Enforce existing policies (**RIPENCC**)

  - Cleanup some of the graffiti (**ASN contacts, RIPENCC**)

  - Alternative ways of creating interest in networking (**everybody**)

- Hard

  - Adapt policies (**RIPE Community**)

  - Attach maintenance fees to ASNs at least similar to PI space (**LIRs**)

  - Alternative ways of creating interest in networking (DUP!)

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Feedback / Questions

- And, if this was not torture enough, we are looking for:

  - ASN operators (both "traditional" and "personal")

  - LIR representatives

  - RIR people

- … to fill in a short [survey](#)

- You can also contact me at r.anghel@tudelft.nl

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