

The Quality of Internet Address Registration

Daniel Karrenberg
Chief Scientist, RIPE NCC



Who is talking: Daniel Karrenberg

- 1980s: helped build Internet in Europe
 - GUUG, EUUG, EUnet, Ebone, IXes, ...
 - RIPE
- 1990s: helped build RIPE NCC
 - 1st CEO: 1992-2000
- 2000s: Chief Scientist & Public Service
 - Trustee of the Internet Society, IETF, ...
 - Interests: Internet measurements, stability, trust & identity in the Internet, ...

Overview

- Internet Address Space Distribution (Recap)
- LIR Audits
- Return of legacy IPv4 address space
- Registry Data Quality (RDQ) Evaluation

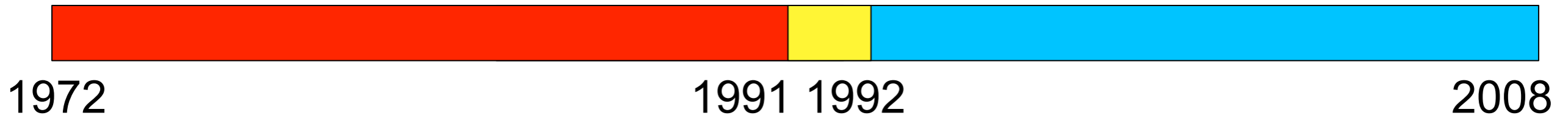


History of IP address registration

Jon Postel
and SRINIC

InterNIC

RIPE NCC



- Responsibility for registering IP addresses has shifted over time:
 - Jon Postel and the Stanford Research Institute Network Information Center (SRINIC) maintained the registry from 1972
 - InterNIC was established in September 1991 to fill this role
 - RIPE NCC established in April 1992, taking responsibility for IP address registration in Europe
- 91 /8s (or more than 1.5 billion addresses) were allocated before the RIRs were established!

The five Regional Internet Registries

ARIN
American Registry for Internet Numbers

RIPE
NCC

APNIC

LACNIC

AfriNIC

RIPE
NCC

Definitions

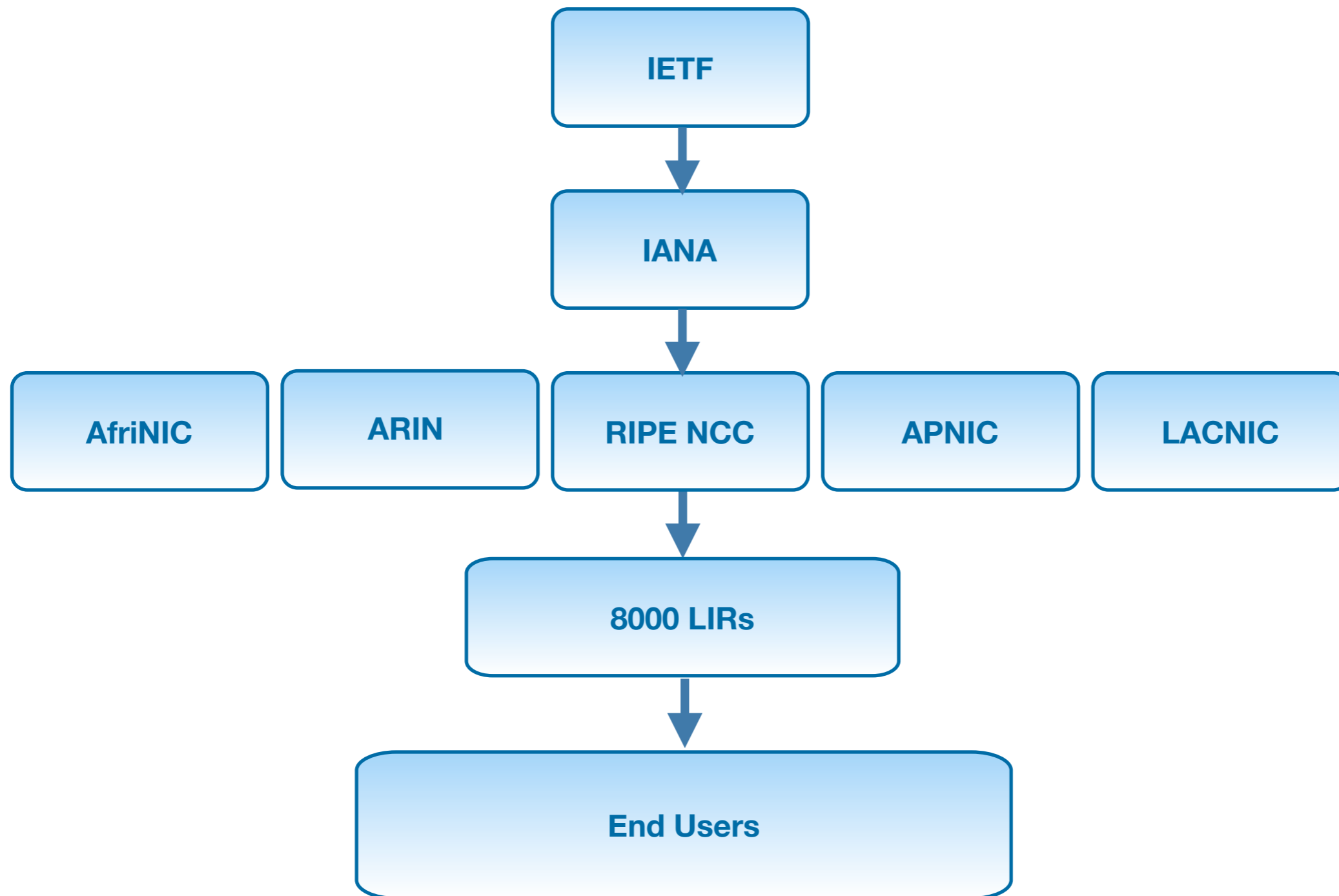
Legacy space

Address space distributed prior to the formation of the RIR system and originally registered in a different registry

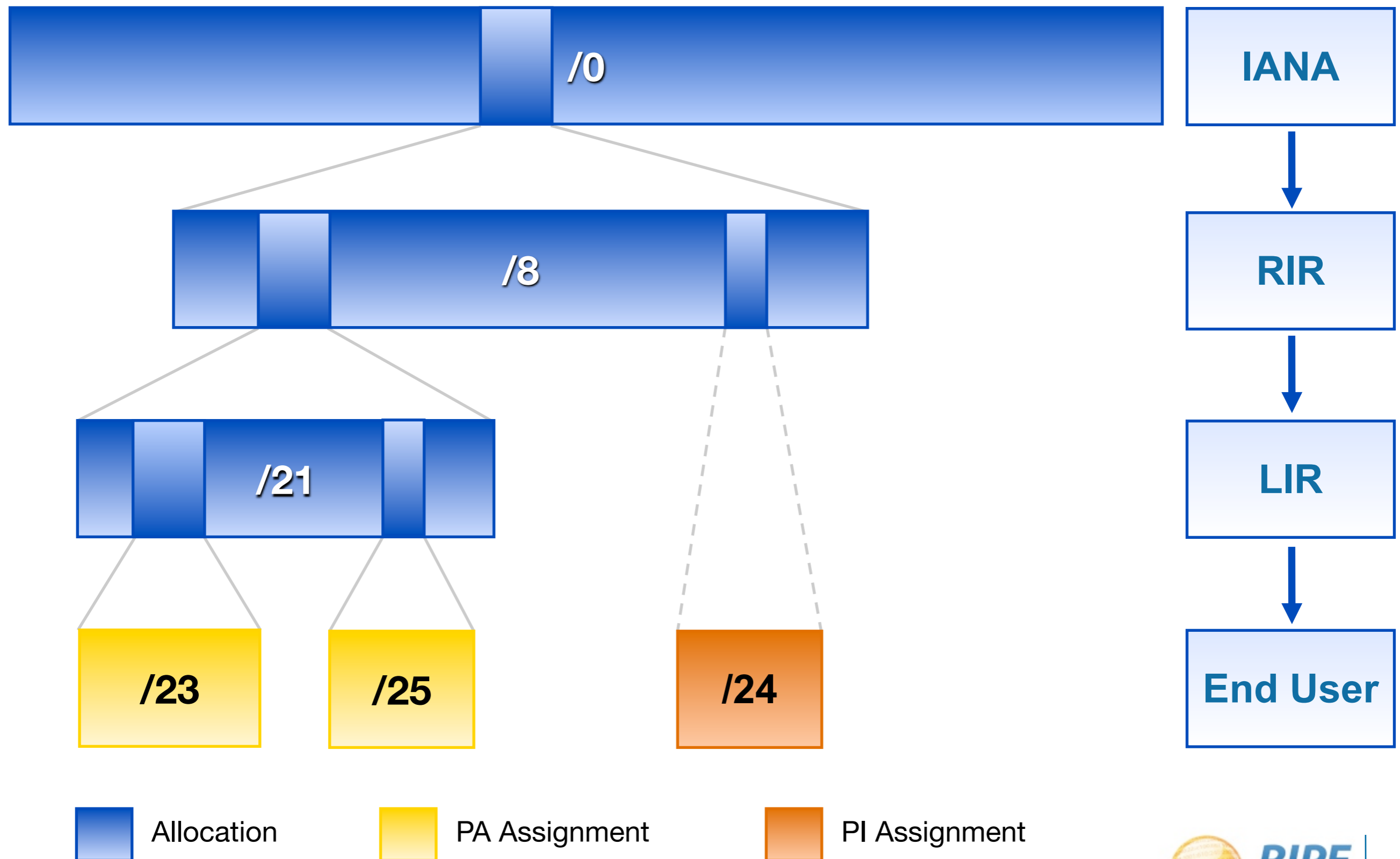
RIPE NCC-distributed space

Address space originally distributed by the RIPE NCC and registered according to RIPE policy

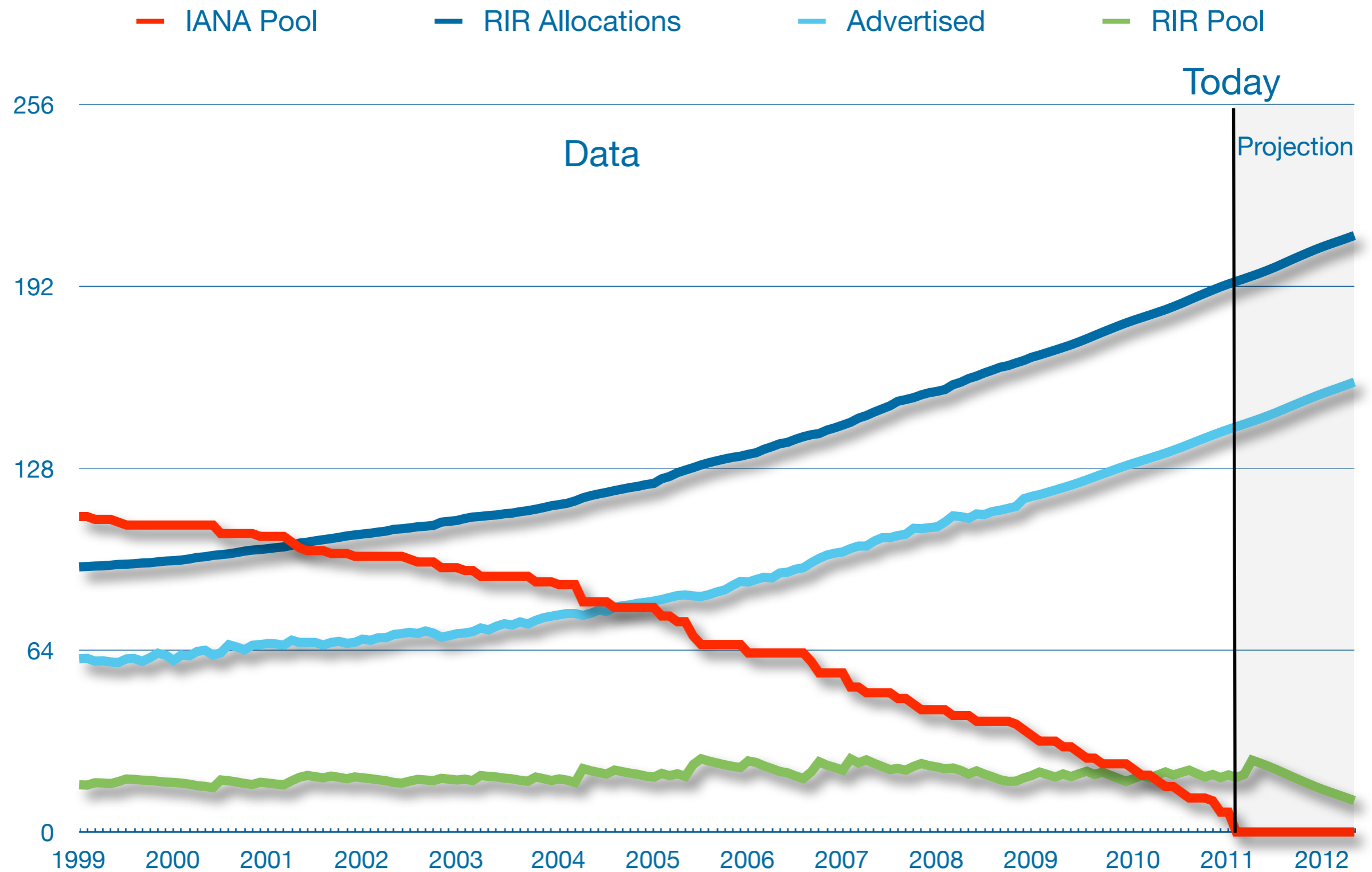
Where do all the addresses come from?



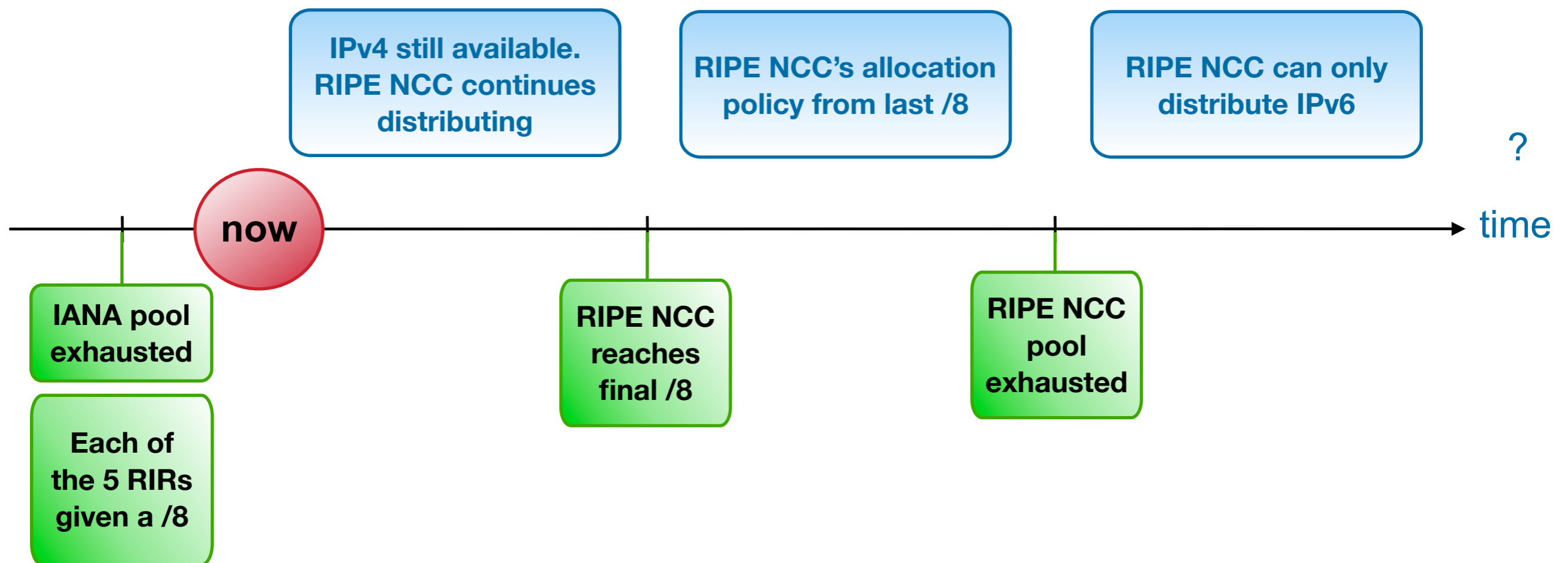
IPv4 address distribution



IPv4 allocation timeline



IPv4 exhaustion phases



Number of addresses (rounded off)

- [illegible]

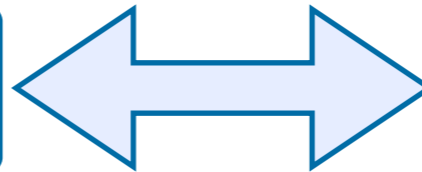
IPv4 vs IPv6 (rounded off)

IPv4

IPv6

addresses

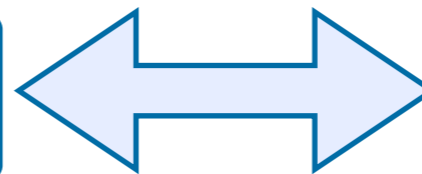
4×10^9



3×10^{38}

allocations
to members

2×10^6

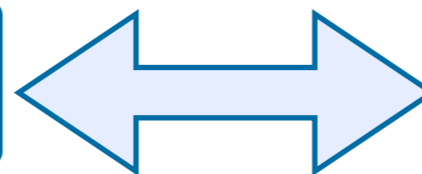


4×10^9

in each:

addresses

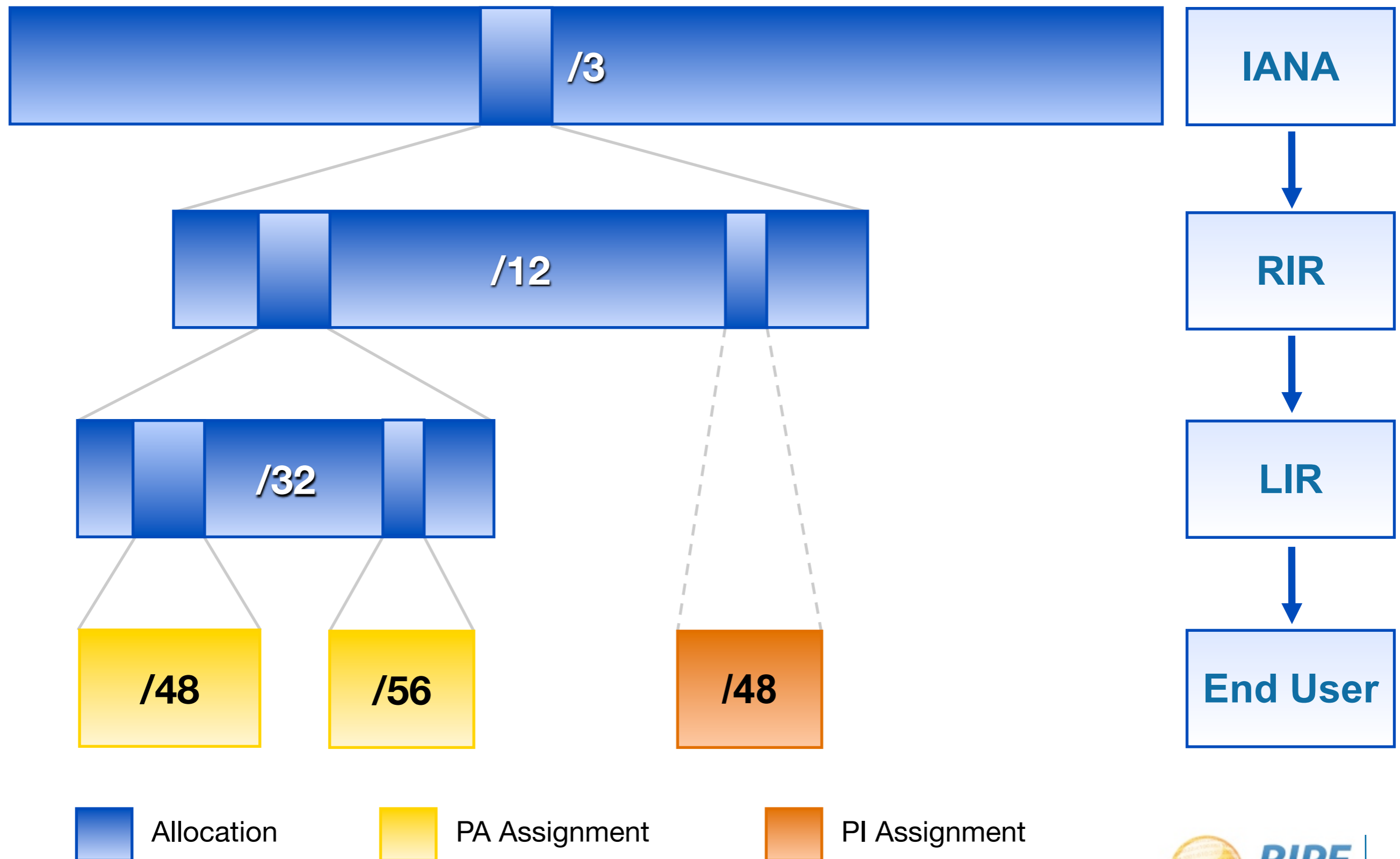
2000



in each:

8×10^{28}

IPv6 address distribution



Questions?



LIR Audits

- RIPE NCC conducts audits on LIRs to ensure fair and neutral application of policies
 - Initiated in 1996
 - LIR Audit Activity
 - 2009: 319 audits, all LIRs were in order or complied with auditors' instructions
 - 2010: 447 audits, seven PI assignments were deregistered
 - 2011 [to date]: 234 audits, 124 are complete, two LIRs closed as a result of audits, two PI assignments deregistered, 110 audits are ongoing

LIR Audits

- As IPv4 exhaustion approaches, the importance of auditing as a RIPE NCC activity will grow
- Aim to audit 50% of membership yearly
- This following guidance from LIRs, RIPE community, Law Enforcement Agencies, ...

Questions?



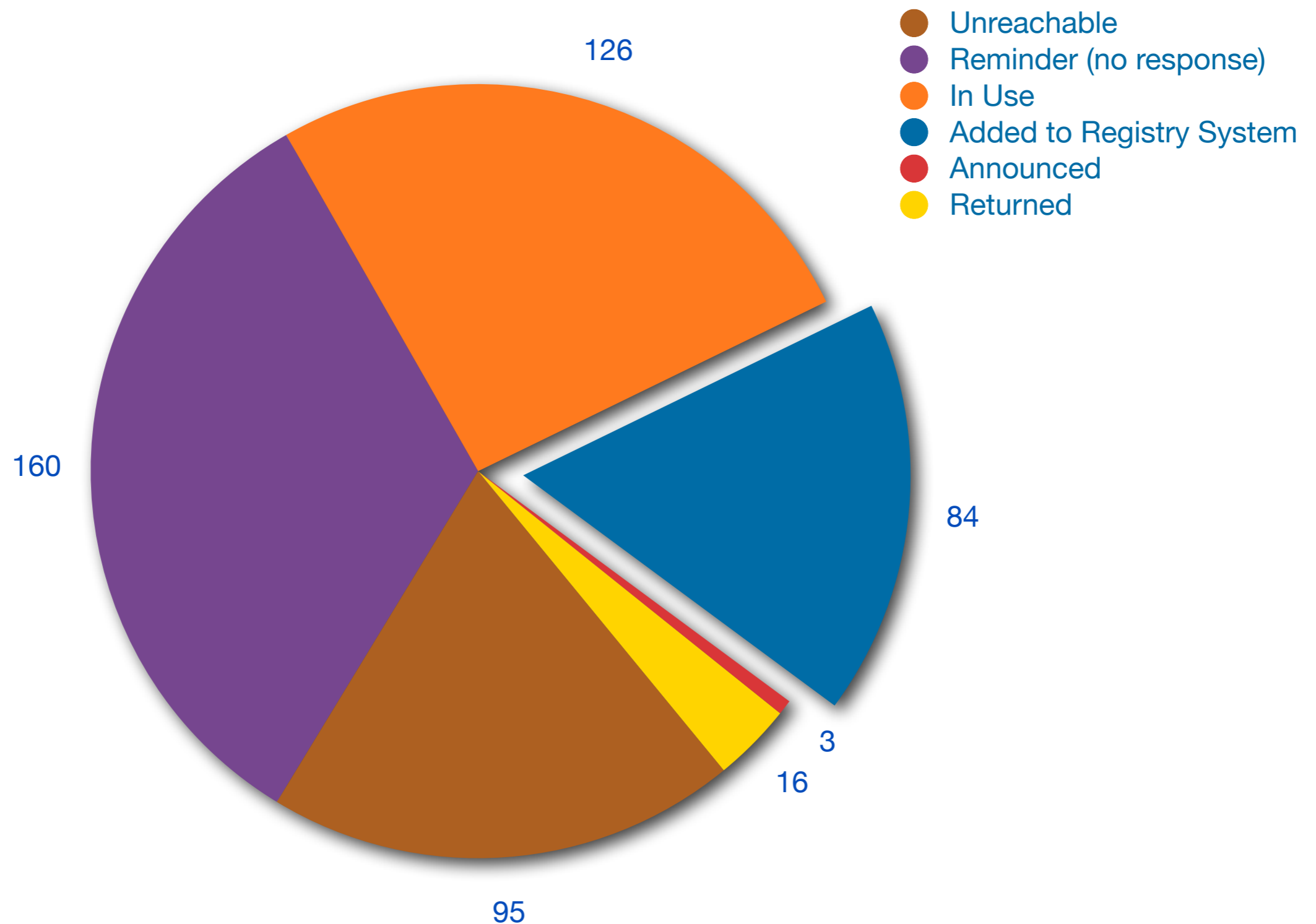
Return of Unused Legacy IPv4 Space

- Large part of legacy space registered in RIPE Database, but not visible on global routing table
- Project launched in 2010 to investigate
 - 730 /16s of IPv4, held by 400 organisations, not visible on the Internet
- RIPE NCC contacted those organisations to ask whether they are willing to hand back their address space

Unannounced Legacy Resources - Results

- 400 emails sent
 - 95 unreachable
 - 126 using internally
 - 3 started announcing prefixes after we contacted them
- 84 moved their resources into the registry system (became an LIR or customer of an LIR)
- 16 returned address space to the RIPE NCC:
 - Total address space returned : ~ 1,300,000 IP addresses

Unannounced Legacy Resources



Next Steps for Legacy Resources

- Contact all legacy holders to become member of RIPE NCC
- Ensure correct and up to date registration data
- **not:** stretch life-time of IPv4

Questions?



Ensuring Registry Data Quality

- Registry Data Quality (RDQ) Evaluation
 - launched 2009
 - Addressing inconsistencies from inter-RIR transfers and procedural changes over time
- Goals:
 - Ensure all resources that the RIPE NCC is responsible for are registered properly
 - Monitor quality of registration data over time
 - Trigger actions if needed

Ensuring Registry Data Quality

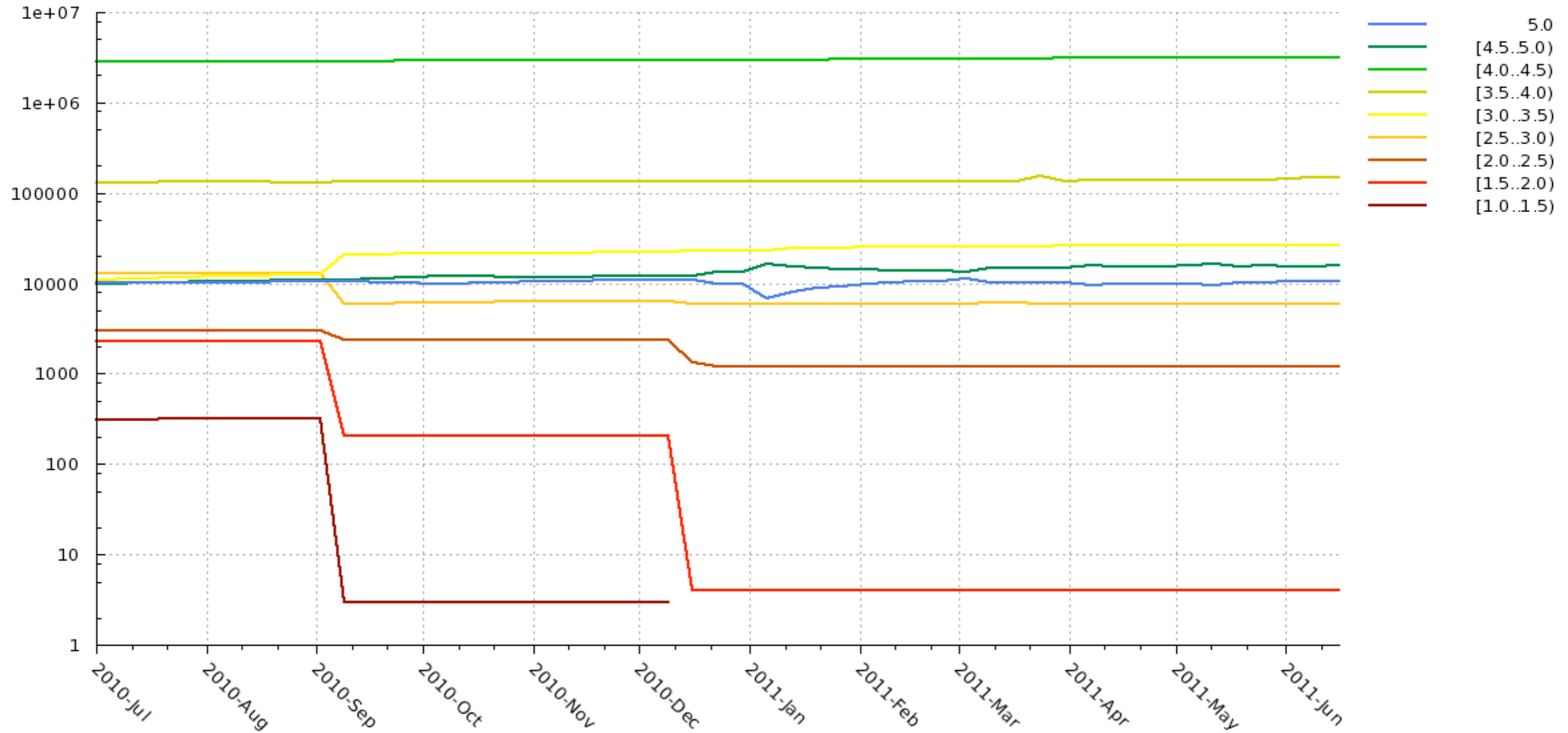
- Methodology for Phase 1 required comparing data from:
 - IANA IP registry
 - RIPE NCC public resource files
 - Other RIR public resource files
 - Various internal data sets
- Now in Phase 2 incorporating data from:
 - RIPE Database
 - Routing Information Service (RIS)

Ensuring Registry Data Quality

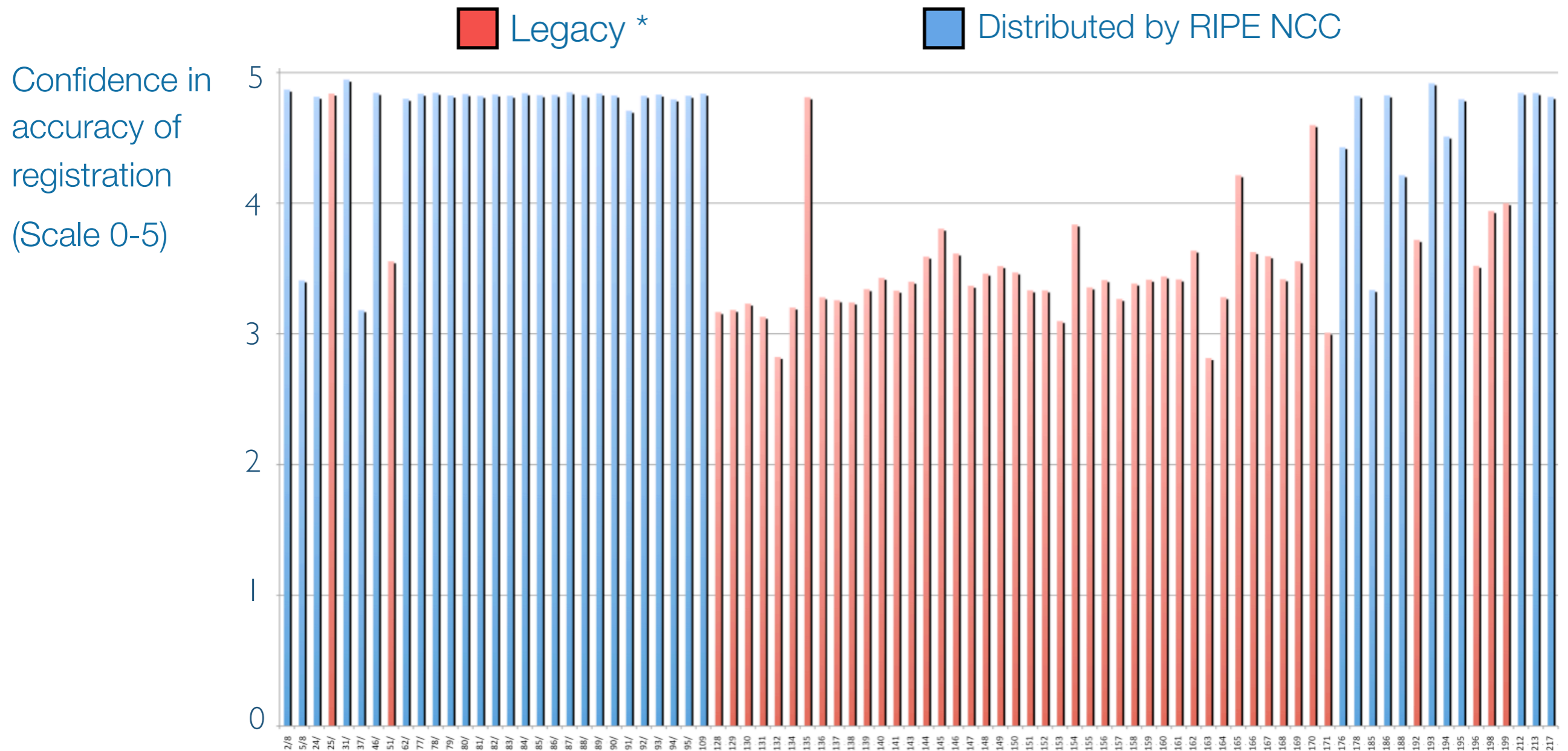
- Results indicate 96% RIPE Database records can be considered accurate with a high level of confidence
- Efforts underway to “clean up” the remaining 4%

Resource Data Quality Over Time

Overall RDQ Score
[Number of RIPE Database Entries]



Registration Data Quality Score per /8



* Legacy /8s may be split between more than one RIR database, and may be only partially registered in the RIPE Database

More information

- RIPE NCC LIR Audits
 - <https://www.ripe.net/lir-services/member-support/audit/quality-audit>
- RIPE NCC governance documentation
 - <https://www.ripe.net/lir-services/ncc/legal>
- Ensuring Registry Data Quality (RDQ)
 - https://labs.ripe.net/Members/xavier/ensuring_registry_data_quality
 - <https://labs.ripe.net/Members/xavier/ensuring-registry-data-quality-phase-2>
- Returned legacy IPv4 address space
 - <https://labs.ripe.net/Members/mirjam/returning-unannounced-legacy-ipv4-address-space>
 - <https://labs.ripe.net/Members/xavier/status-of-legacy-ipv4-address-space>

Questions?

