RIPE NCC
RIPE NETWORK COORDINATION CENTRE

Annual Report 2016

RIPE NCC Service Region
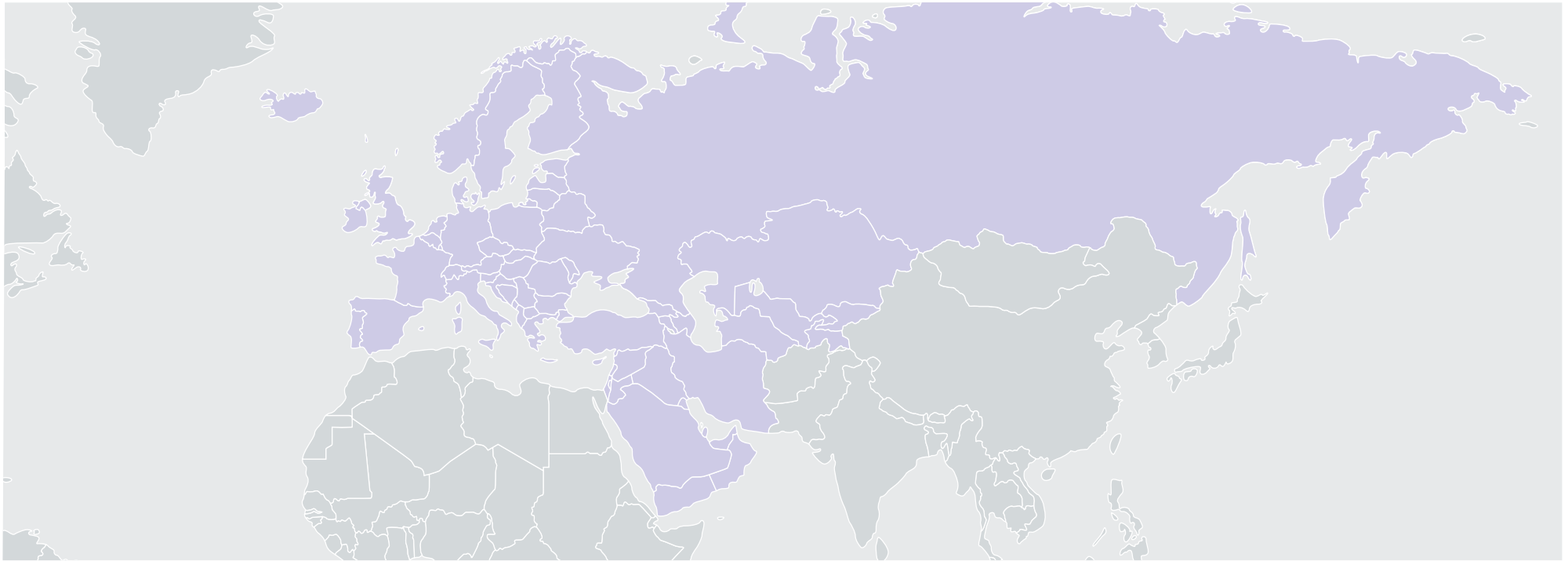
2016 in Numbers

76	Countries	**1**	Roundtable Meeting	**856**	Executive Board Votes
15,008	Members	**5**	Outreach Meetings	**2,500**	ARC Reviews Completed
2,178	New Members	**102**	Training Courses	**3,291**	IPv4 Allocations
2	RIPE Meetings	**33**	Webinars	**1,878**	IPv6 Allocations
5	Regional Meetings	**9,200**	Active RIPE Atlas Probes	**2,602**	ASN Assignments
17	Member Lunches	**247**	RIPE Atlas Anchors Online	**10b**	RIPE Database Queries

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Nigel Titley

Introduction by the Chairman of the Executive Board

Welcome to the RIPE NCC's Annual Report for 2016. This is where we report on the RIPE NCC's performance of the activities that were documented in the Activity Plan and Budget 2016. Every year we send out the Activity Plan to tell you what we plan to do and the Budget to tell you how we plan to finance it. By doing this we ensure that you, the members, have a complete view of how the association is carrying out your wishes.

With a membership that passed the 15,000 LIR mark in December, a major focus of the Executive Board has been on making sure that the RIPE NCC continues to provide a high level of service and value. We have encouraged improvements in RIPE NCC operational efficiency and have supported communications with you to increase your participation in the RIPE community.

Ongoing discussions in a range of different Internet governance forums continue to hold the potential to impact the RIPE community and the activities of the RIPE NCC. We have told the RIPE NCC to continue to contribute as fully as possible to these discussions so the RIPE community is properly represented and so that our views are heard by governments and regulators alike.

Several important proposals were discussed by the membership in 2016, two of which were related to ongoing abuse of the final /8 block of IPv4 addresses that the RIPE community has reserved for new entrants. The board and the RIPE NCC supported the RIPE community in making policy changes to address this issue, and together we can continue with the real work of supporting IPv6 deployment.

Axel Pawlik

Introduction by the RIPE NCC Managing Director

A notable milestone for the global Internet community in 2016 was the successful completion of the IANA stewardship transition in October. Oversight of the IANA is now the responsibility of the Names, Number and Protocol Parameters communities that rely on its services. On behalf of the RIPE NCC, I would like to thank everyone from the RIPE community who contributed towards making this transition a success.

In 2016, we focused on simplifying our processes for members by addressing areas of improvement in the RIPE Database and overhauling the user experience in certain areas of the LIR Portal. This has led to a drop in customer service requests and gives an indication of how we can make further improvements.

The results of the RIPE NCC Survey 2016 are also a valuable source of feedback from our members and other interested stakeholders. We noted a great deal of support for the current direction of the RIPE NCC alongside a variety of suggestions for improvement or additional support. A distillation of the results into 40 key findings is now available on our website.

A lot of effort went into the preparation of the new RIPE NCC office for 2016. We expect the investment to pay dividends in terms of greater internal collaboration between departments, more efficiency, and better information sharing.
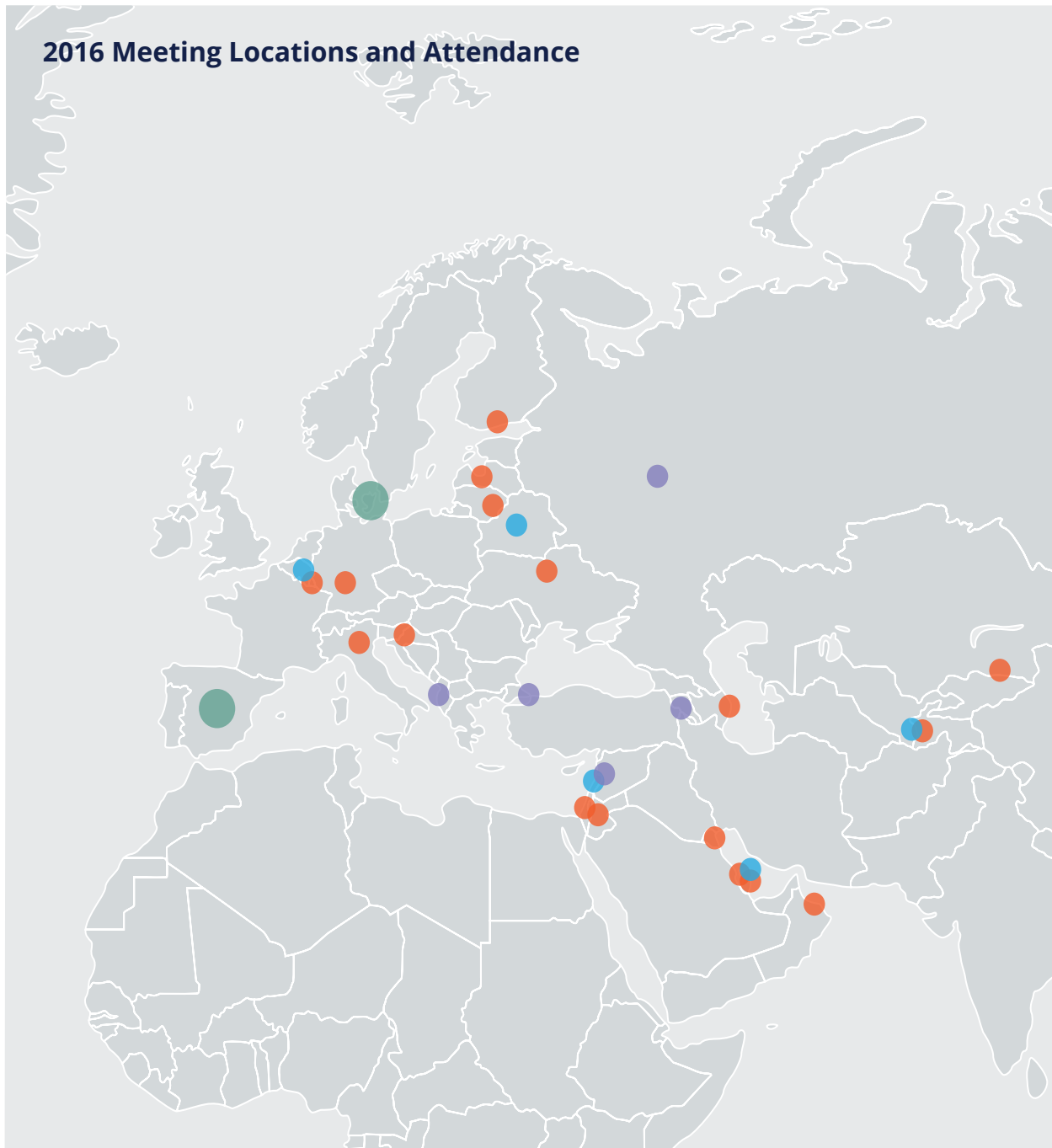
2016 Meeting Locations and Attendance

RIPE Meetings (Total attendees: 1,306)
RIPE 72, Copenhagen, Denmark: **675**
RIPE 73, Madrid, Spain: **631**

Outreach Meetings (Total attendees: 211)
Government Roundtable Meeting, Brussels, Belgium: **57**
IPv6 Coordination Meeting, Beirut, Lebanon: **56**
Financial Sector Engagement Meeting, Beirut, Lebanon: **23**
Financial Sector Engagement Meeting, Manama, Bahrain: **25**
IPv6 Roundtables, Dushanbe, Tajikistan: **25**
IPv6 Roundtables, Minsk, Belarus: **25**

Regional Meetings (Total attendees: 1,230)
SEE 5, Tirana, Albania: **136**
MENOG 16, Istanbul, Turkey: **150**
RIPE NCC Levant Meeting, Beirut, Lebanon: **140**
ENOG 11, Moscow, Russia: **553**
ENOG 12, Yerevan, Armenia: **251**

Member Lunches (Total attendees: 237)
Manama, Bahrain: **12**
Tel Aviv, Israel: **16**
Kuwait City, Kuwait: **12**
Vilnius, Lithuania: **12**
Riga, Latvia: **6**
Helsinki, Finland: **8**
Doha, Qatar: **13**
Dushanbe, Tajikistan: **25**
Milan, Italy: **11**
Muscat, Oman: **15**
Luxembourg City, Luxembourg: **14**
Frankfurt, Germany: **17**
Zagreb, Croatia: **7**
Kiev, Ukraine: **20**
Amman, Jordan: **19**
Almaty, Kazakhstan: **20**
Baku, Azerbaijan: **10**

About the RIPE NCC

The Réseaux IP Européens Network Coordination Centre (RIPE NCC) is an independent, not-for-profit membership organisation. It supports the operation and development of the Internet through technical coordination and operates one of the world's five Regional Internet Registries (RIRs).

The RIPE NCC's most prominent tasks include:
• Registering and distributing Internet number resources
• Operating the RIPE Database
• Operating K-root, one of the world's 13 root name server clusters
• Facilitating RIPE community activities
• Developing the RIPE Atlas network
• Providing high-quality measurement information services

The RIPE NCC is an open and transparent organisation with a broad and varied membership.

The RIPE NCC is based in Amsterdam, the Netherlands, and had 139 full-time equivalents (FTEs) in 2016.

As with the other four RIRs, the RIPE NCC operates as a community-driven, bottom-up and self-governing organisation. The policies that govern the way the RIPE NCC operates are proposed, discussed and accepted by the RIPE community. The activities performed by the RIPE NCC and the services it provides are approved each year by the RIPE NCC Executive Board following feedback from the members.

Annual Membership Growth

Year	Total	Growth
2010	7,167	584
2011	7,795	628
2012	8,760	965
2013	9,899	1,139
2014	11,115	1,216
2015	12,830	1,715
2016	15,008	2,178

■ Existing Members ■ Growth

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Members by Country

869	1,493	919	510	1,733	726	394	1,351	473	850	5,690		

NL | DE | FR | CH | UK | ES | SE | RU | PL | IT | Other
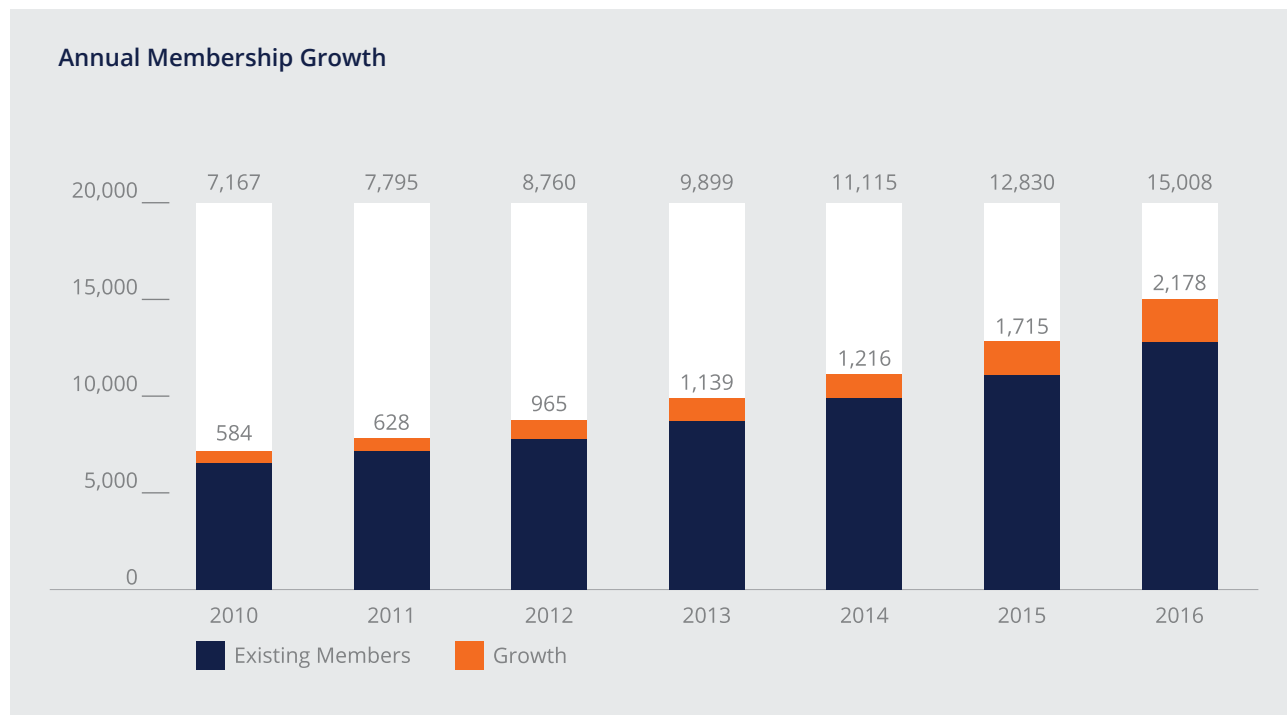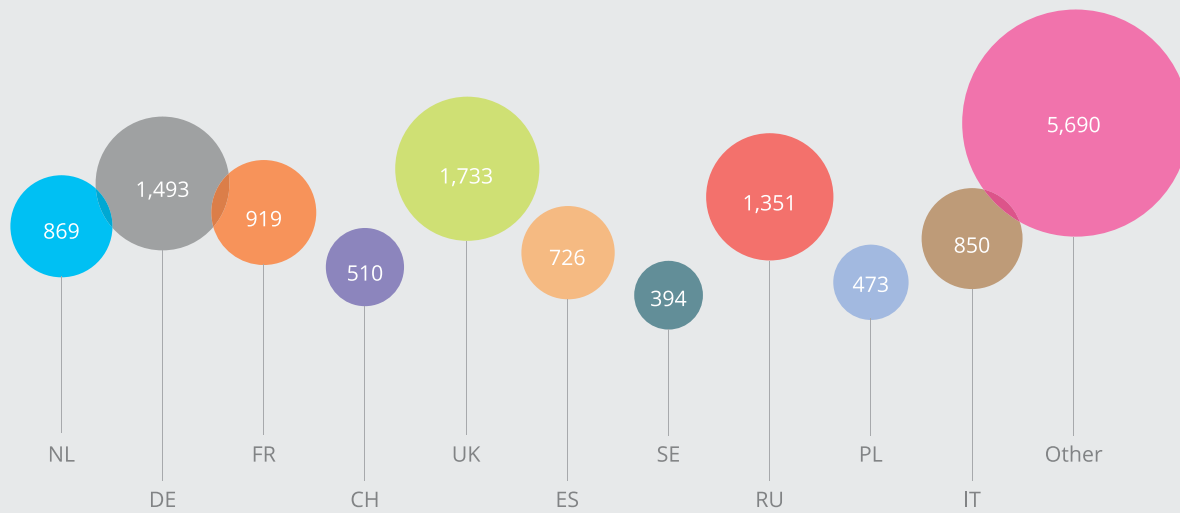
New Member Applications by Country

170	255	191	147	353	184	167	237	95	146	1,225	

NL | DE | FR | US | UK | ES | IR | RU | PL | IT | Other
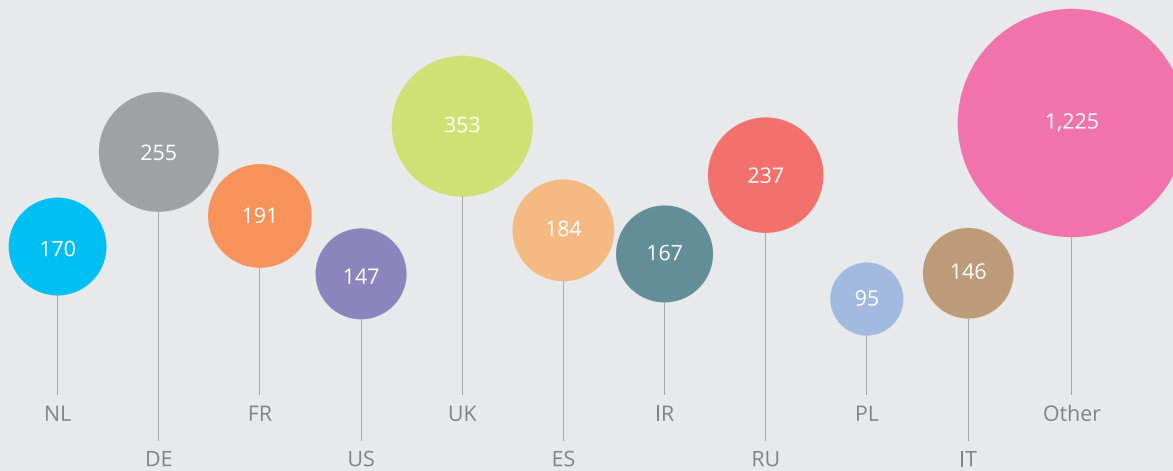
The RIPE NCC and the RIPE Community

The RIPE NCC and RIPE are separate but highly interdependent entities. RIPE was founded in 1989 and is a collaborative forum open to all parties with an interest in the technical development of the Internet. The RIPE community develops policies for the technical Internet community and ensures the administrative and technical coordination necessary for the operation of the Internet.

The term "RIPE community" is used to describe individuals or organisations, whether members of the RIPE NCC or not, with an interest in the technical coordination of the Internet and the way the Internet is structured and governed. This includes the RIPE NCC membership, government and regulatory bodies, academic institutions, as well as other organisations and individuals with an interest in technical and Internet governance issues.

Valuable input from the Internet industry, governments and regulators comes to the RIPE NCC from the RIPE community. There are no formal requirements for participation. The RIPE NCC provides administrative support to RIPE, the RIPE Working Groups, RIPE Task Forces and the RIPE Programme Committee, including the facilitation of RIPE Meetings and maintenance of the RIPE Document Store and publicly archived mailing lists.

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Remco van Mook   Christian Kaufmann   János Zsakó   Salam Yamout   Maria Häll   Dmitry Burkov   Nigel Titley

The RIPE NCC Executive Board

The Executive Board exists to:
- Represent the interests of the membership
- Appoint and provide guidance to the RIPE NCC Managing Director
- Be responsible for the overall financial position of the RIPE NCC and for keeping records that allow the current financial situation to be evaluated at any time
- Present the RIPE NCC Financial Report and the Charging Scheme for members to vote on
- Approve the RIPE NCC Activity Plan and Budget
- Call RIPE NCC General Meetings
- Provide financial and legal representation to the RIPE NCC as an organisation

The activities of the RIPE NCC are financed and guided by its members, who elect the RIPE NCC Executive Board to represent their interests.

RIPE NCC General Meetings

All RIPE NCC members are encouraged to attend RIPE NCC General Meetings either in person or remotely. These meetings are held twice each year.

At General Meetings, members have the opportunity to give feedback directly to the Executive Board on the RIPE NCC's activities and services. In 2016, RIPE NCC General Meetings took place alongside RIPE 72 in Copenhagen and RIPE 73 in Madrid.

At the May General Meeting, the membership adopted the Charging Scheme for the following year and approved the ability of RIPE NCC members to create additional LIR accounts. An election was held for two seats on the RIPE NCC Executive Board. There were four candidates and the seats were taken by Nigel Titley and Remco van Mook, the previous incumbents.

At the October General Meeting, members voted to adopt amendments to the RIPE NCC Charging Scheme 2016 and RIPE NCC Charging Scheme 2017, redistribute the 2016 surplus to the membership in 2017, and adopt amendments to the RIPE NCC Conflict Arbitration Procedure.

Executive Board Election Votes

Year	Votes
2010	204
2011	315
2012	303
2013	316
2014	535
2015	433
2016	856
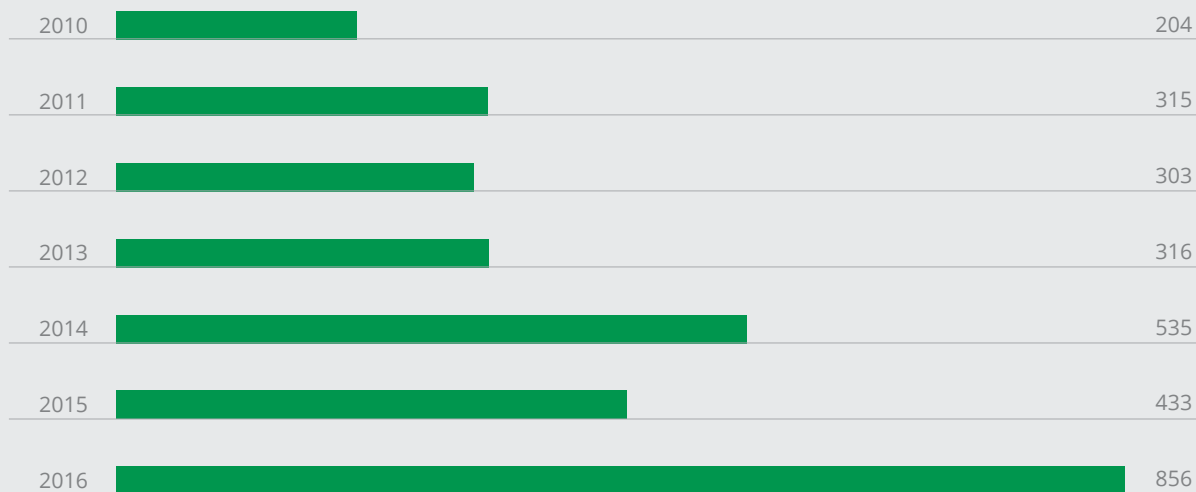
Arbitration

A neutral and objective Arbiters Panel exists to settle disputes and evaluate requests for Internet number resources by the RIPE NCC. Arbiters are appointed by the RIPE NCC Executive Board and approved by the RIPE NCC General Meeting. Currently, the Arbiters Panel consists of ten Arbiters. The Arbiters held an official meeting in May in Copenhagen. At the General Meeting in October, an updated conflict arbitration procedure was approved by the RIPE NCC membership.

In 2016, five disputes were settled through the arbitration procedure.

The first two disputes were between RIPE NCC members regarding the transfer of Internet number resources. After reviewing the information submitted by the parties, the Arbiters in both disputes rejected the requests to revert the transfer of the Internet number resources.

The other three arbitration requests were submitted by three members against the RIPE NCC following its decision to terminate their RIPE NCC Standard Service Agreements due to the provision of falsified information. The initiating parties decided to discontinue the dispute, confirming that the documents they had provided to the RIPE NCC were falsified.

www.ripe.net/lir-services/ncc/legal/arbitration

Articles of Association

The rights and obligations of the RIPE NCC are detailed in the Articles of Association (AoA).

www.ripe.net/publications/docs/ripe-602

Legal Framework

In 2016, the RIPE NCC fortified its corporate governance by updating and producing a series of documents that describe RIPE NCC procedures in a clear and transparent way.

The following RIPE NCC procedural documents were updated:

- "Due Diligence for the Quality of the RIPE NCC Registration Data"
- "Transfer of Internet Number Resources and Change of a Member's Official Legal Name"
- "Independent Internet Number Resources – Contractual Relationship Changes Between Sponsoring LIR and End User"
- "RIPE NCC Billing Procedure and Fee Schedule Document"

The RIPE NCC also created the "RIPE NCC LIR Account Agreement", which stipulates the terms for the operation of an LIR account and the "RIPE NCC Secondary DNS Service Terms and Conditions", which describes the Terms and Conditions under which the RIPE NCC offers its secondary DNS service.

In 2016, the RIPE NCC was involved in an intellectual property rights infringement case before a Russian court as a defendant. The accusations against the RIPE NCC were dropped.

The RIPE NCC also submitted a request for appeal before the Russian Court of Cassation against a court decision that ruled against the RIPE NCC on an intellectual property rights infringement case in 2015. The request was rejected.

www.ripe.net/about-us/legal

Governance Matrix and Accountability Document

The RIPE NCC maintains two documents in coordination with the other RIRs that demonstrate their transparency and accountability:

- The RIR Governance Matrix provides a structured view of various aspects of RIR governance, with links to source documents on the relevant RIR's website
- The RIR Accountability Questions and Answers document responds to questions of accountability as they relate to the RIRs

www.nro.net/about-the-nro/rir-governance-matrix
www.nro.net/about-the-nro/rir-accountability

Law Enforcement Agency Requests

The RIPE NCC receives information requests from Law Enforcement Agencies (LEAs) and tries to facilitate the provision of any required publicly available information. The RIPE NCC does not provide any confidential or private information to LEAs without a court order or other legally enforceable order or request under Dutch law.

In 2016, the RIPE NCC received four information requests from LEAs. None of these requests were accompanied by a Dutch court order; two were accompanied by non-Dutch subpoenas. Overall, the number of requests decreased by 50% compared to 2015. LEAs now appear to understand the RIPE NCC's role as a Regional Internet Registry, the information it possesses, and what it will and will not share. LEAs seem to acknowledge the RIPE NCC's procedures and will try to consult with the RIPE NCC before making an official request.

More detail about these requests is available in the 2016 report on Law Enforcement Agency requests:

https://www.ripe.net/publications/docs/ripe-678/

Law Enforcement Agency Requests

	2012	2013	2014	2015	2016
For information not related to the RIPE NCC	2	1	0	0	0
For information the RIPE NCC does not have	17	9	5	3	3
On whether the RIPE NCC can share non-public information	0	0	1	2	1
For publicly available information	2	1	1	3	0
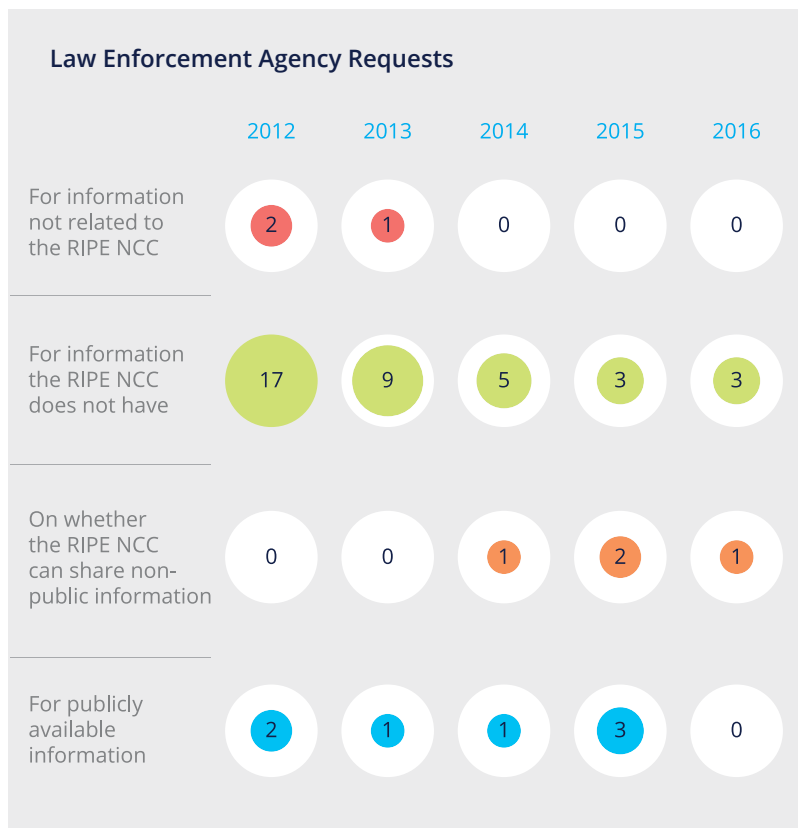
RIPE NCC Activity Plan and Budget

The activities that the RIPE NCC performs and the services that it provides are defined, discussed and evaluated by RIPE NCC members and the RIPE community. All proposals, plans and discussions are publicly documented.

The activities that the RIPE NCC proposes to perform in the coming year are detailed in the annual Activity Plan and Budget. Input and feedback on activities are collected from members and the RIPE community via RIPE Working Groups, RIPE mailing lists, RIPE NCC Regional Meetings, RIPE NCC surveys and at the members-only General Meetings. The RIPE NCC Executive Board approves the Activity Plan and Budget.

In 2015, the RIPE NCC published an Activity Plan and Budget based on recommendations from the membership. The document laid out the RIPE NCC's planned activities and services along with their associated costs for 2016 in a user-friendly and transparent way.

www.ripe.net/publications/docs/ripe-662

Activity Overview 2016

Total activity costs were over budget, while the total RIPE NCC expenses were below budget due to lower depreciation costs in 2016.

The shift between the main categories of resources from The Registry towards Coordination Activities and Services continued in 2016. Costs relating to The Registry were lower than budgeted due to ongoing process improvements and less software development than expected.

Costs for Services were higher than expected. Training Services expanded in 2016 with the growth of the RIPE NCC Academy and the provision of more webinars and training sessions. RIPE Atlas costs were higher than planned for: more back-end costs and resources were allocated to RIPE Atlas than budgeted. Other services were higher due to software development efforts, not attributable to other activities and Customer Services work that is not related to The Registry.

Coordination Activities costs were over budget as a result of greater Member Outreach and External Relations efforts. In 2016, the RIPE NCC increased activities in this area to strengthen our presence throughout our service region. RIPE Meeting costs were on budget.
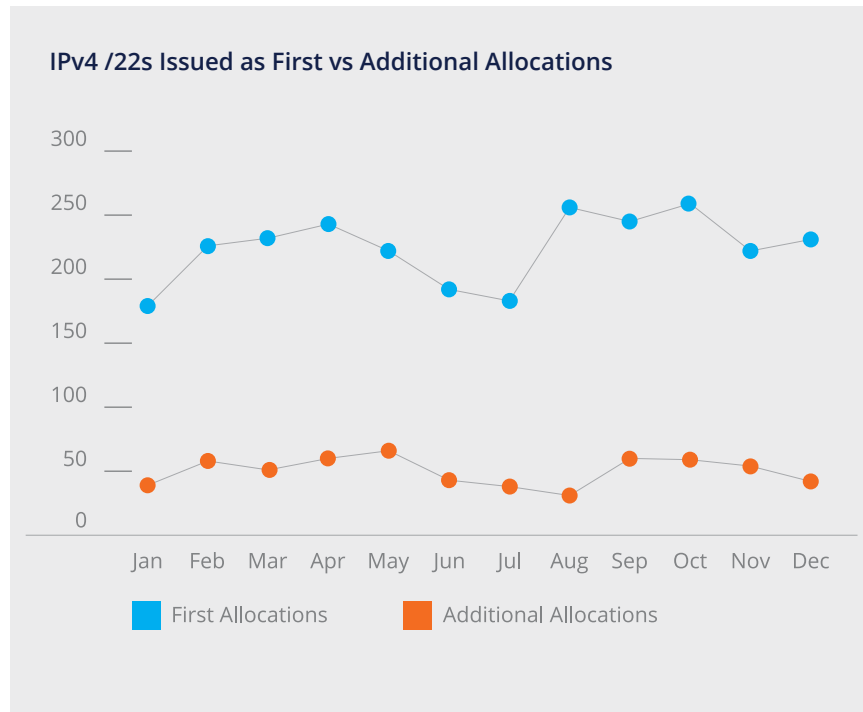
Internal costs were above budget. This was caused by internal changes that required additional interim management support. Facilities costs were lower than expected. This was a result of additional investments (CAPEX) made to reduce our Operational Expenses.

Budget 2016 vs Actuals 2016 (in kEUR)

	Budget Operational Expenses 2016	Actual Operational Expenses 2016	Variation
Registry Maintenance	3,096	2,919	-177
RIPE Database	908	793	-115
Certification	157	92	-65
LIR Portal	425	371	-54
The Registry	**4,586**	**4,175**	**-411**
Training	1,019	1,119	100
RIPEstat	699	452	-247
RIPE Atlas	943	1,283	340
Other Services	385	724	339
Services	**3,046**	**3,578**	**532**
DNS & K-root Operations	504	526	22
Data Analysis and Scientific Support	339	416	77
RIPE Labs	266	209	-57
External Relations	1,830	2,203	373
Member Outreach	1,286	1,224	-62
IPv6 Support	153	158	5
RIPE Meetings	1,599	1,589	-10
RIPE Policy and Community Support	220	116	-104
ICANN/IETFs/NOGs	1,141	1,171	30
Coordination Activities	**7,338**	**7,612**	**274**
IT	2,138	2,187	49
Facilities (Rent and Utilities)	1,730	1,621	-109
Management and HR	2,253	2,393	140
Finance & Administration	756	763	7
Specialist Support	145	254	109
Organisational Activities	323	230	-93
Internal	**7,345**	**7,448**	**103**
RIPE NCC	**22,315**	**22,813**	**498**

Note: Operational expenses do not include depreciation and bad debts.

These figures are not part of the Financial Report and as such have not been audited by an external third party. They are indications based on an internal time registration methodology that is executed on a monthly basis. These figures serve only as indications of the costs relating to these activities.

IPv4 /22s Issued as First vs Additional Allocations

First Allocations
Additional Allocations

Allocations and Assignments

IPv4 /22 Allocations	IPv6 Allocations	IPv6 Allocation Extensions	IPv6 PI Assignments	IPv6 Anycast Assignments
3,291	1,878	174	255	1,738
20	17	16	4	3 / 864
IXP Assignments IPv4	IXP Assignments IPv6	Temporary Assignments IPv4	Temporary Assignments IPv6	ASN Assignments 16-bit / ASN Assignments 32-bit

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Internet Resource Lifecycle Management

As a Regional Internet Registry (RIR), the RIPE NCC's core activity is to distribute and register IPv4 and IPv6 addresses and Autonomous System (AS) Numbers in its service region. The RIPE NCC allocates and assigns IP addresses to its members and End Users in accordance with policies developed by the RIPE community.

In 2016, the RIPE NCC continued to allocate IPv4 address space according to the last /8 policy, which entitles each LIR to one final /22 allocation (1,024 addresses). The exhaustion of the regular IPv4 address pool had initially triggered exponential growth in the number of IPv4 transfers within the RIPE NCC service region, which stabilised in 2016.

Starting in 2013 and continuing into 2016, the RIPE NCC witnessed a significant increase in attempts to hijack IPv4 address space records. Indications are that this is also caused by the exhaustion of the regular IPv4 address pool.

Ticket volume did not grow in 2016 but requests became more complex. While we have gained efficiency by automating some steps in the evaluation process, human intervention remains a crucial element. Performing thorough due diligence checks identifies trends that can help us to provide better service and support, and also uncovers efforts to exploit loopholes in the current policies and procedures.

Requests for Internet Number Resources and Assistance

In 2016, the RIPE NCC received a total of 13,824 requests for resources and related assistance, a 10.6% decrease compared to 2015. There were fewer resource requests compared to 2015 and requests for assistance also reduced by roughly 21% in 2016. The number of allocations and assignments of Internet number resources made by the RIPE NCC remained the same.

Requests for resources and assistance in 2016 included:

- Provider Aggregatable (PA) assignments
- Provider Independent (PI) IPv6 assignments
- IPv4 and IPv6 allocations, and IPv6 extensions
- Autonomous System Number (ASN) assignments
- IPv4 allocation and assignment transfers
- Anycast assignments
- Assignments for Internet exchange points (IXPs)
- Temporary assignments
- Issues related to existing resources and members (assistance), including Live Chat sessions
- Issues related to legacy resources

In 2016, the RIPE NCC made a total 8,260 allocations and assignments of Internet number resources. These are accounted for in the Allocations and Assignments graph on page 13.

IPv4 allocations increased by 1% compared to the previous year. The majority of /22s issued in 2016 went to new LIRs (2,690 from a total of 3,291 allocations).

By the end of 2016, 11,237 LIRs held an IPv6 allocation, which corresponded to 74.8% of the RIPE NCC membership, compared to 75.4% at the end of 2015.

Autonomous System Number (ASN) assignments in 2016 were 2.3% higher compared to 2015. The RIPE NCC has assigned 32-bit (or four-byte) ASNs by default since 2009. This has encouraged adoption of the new format. In 2016, 66.8% of the ASNs assigned in the RIPE NCC service region were 32-bit, compared to 63.6% in 2015.

Resource Transfers

RIPE Policy allows the transfer of Internet number resources between networks in the RIPE NCC service region and those in other RIR service regions with reciprocal policies.

In 2016, the RIPE NCC processed 2,180 IPv4 transfers within its service region, containing a total of 7,833,344 IP addresses. Of these, 1,635 were PA allocations (7,254,016 IP addresses) and 545 were PI assignments (579,328 IP

addresses). In 2016, both the number of transfers and the overall number of IP addresses transferred were lower than in 2015.

In 2016, the RIPE NCC processed 190 IPv6 transfers. Of these, 170 were allocations (714 /32s) and 20 were PI assignments (20 /48s).

In 2016, the RIPE NCC processed 418 ASN transfers.

Note: Transfers that were due to a change in company structure, such as a merger or acquisition, are not included in the statistics in this section.

Autonomous System Number (ASN) Assignments

16-bit —— 864

1,738 —— 32-bit

Inter-RIR Transfers in 2016

In 2016, the RIPE NCC processed 126 IPv4 inter-RIR transfers, containing a total of 1,753,344 IP addresses. Of these, 77 were PA allocations (1,055,488 IP addresses), 45 were legacy resources (691,456 IP addresses), and four were PI assignments (6,400 IP addresses).

Out of the 126 transfers, 14 came from APNIC to the RIPE NCC and 100 came from ARIN to the RIPE NCC; three went from the RIPE NCC to APNIC and nine went from the RIPE NCC to ARIN.
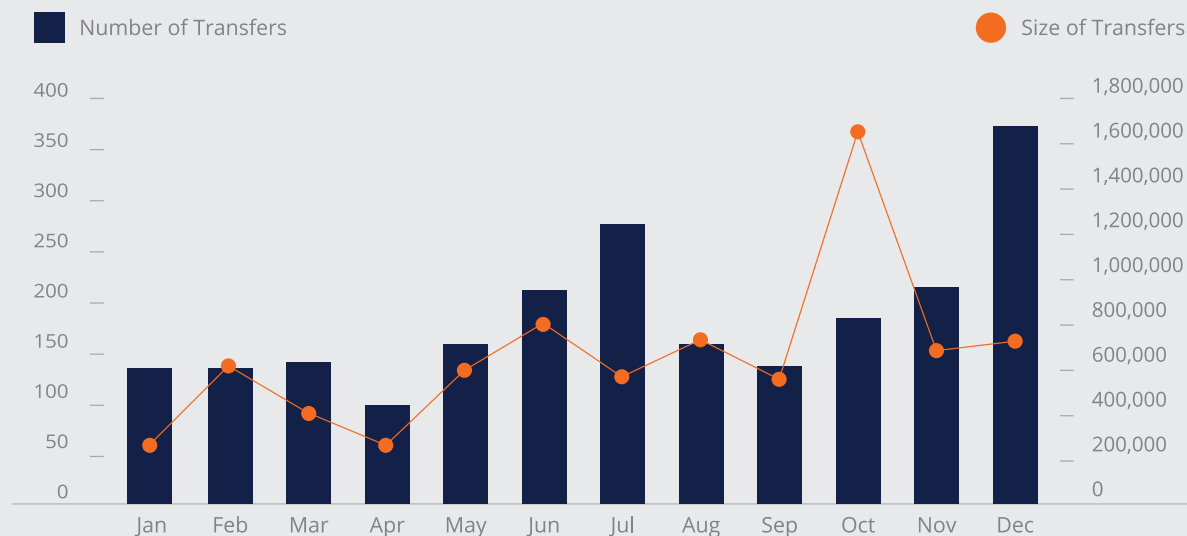
There were no inter-RIR IPv6 or ASN transfers in 2016.
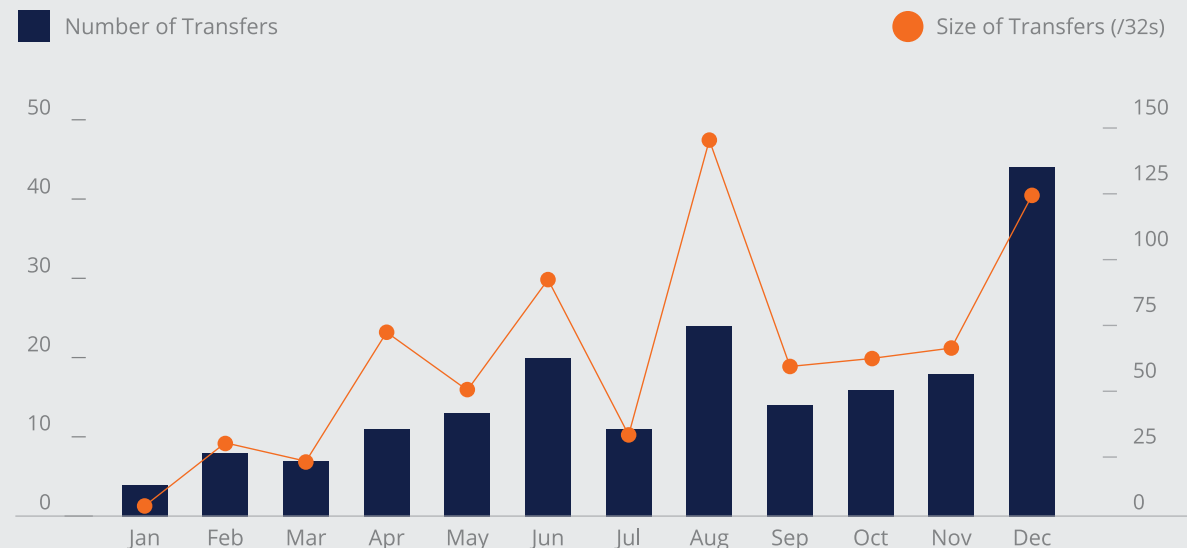
Resources Received from IANA

In 2016, IANA allocated 147,456 IPv4 addresses to the RIPE NCC from its pool of recovered IPv4 addresses according to "Global Policy for Post Exhaustion IPv4 Allocation Mechanisms by the IANA".

IANA allocated 100 16-bit ASNs and 2,972 32-bit ASNs to the RIPE NCC in 2016. In August 2016, IANA announced that it had exhausted its pool of 16-bit ASNs and that future allocations would be made solely from its 32-bit ASN pool.
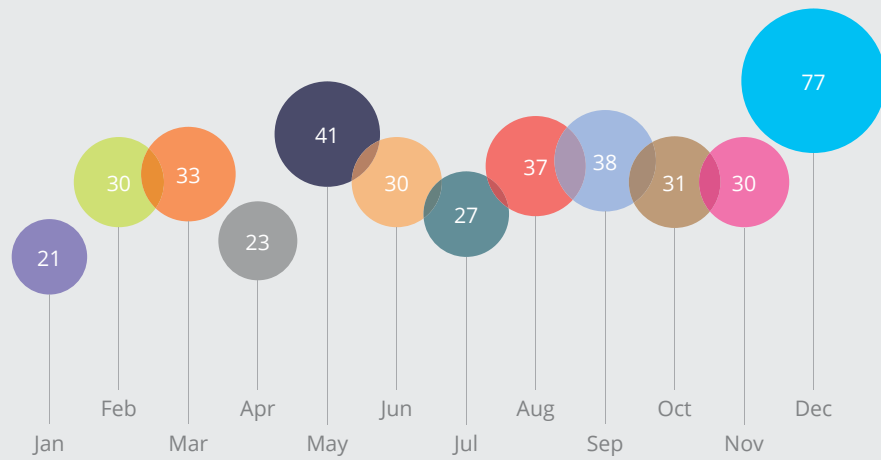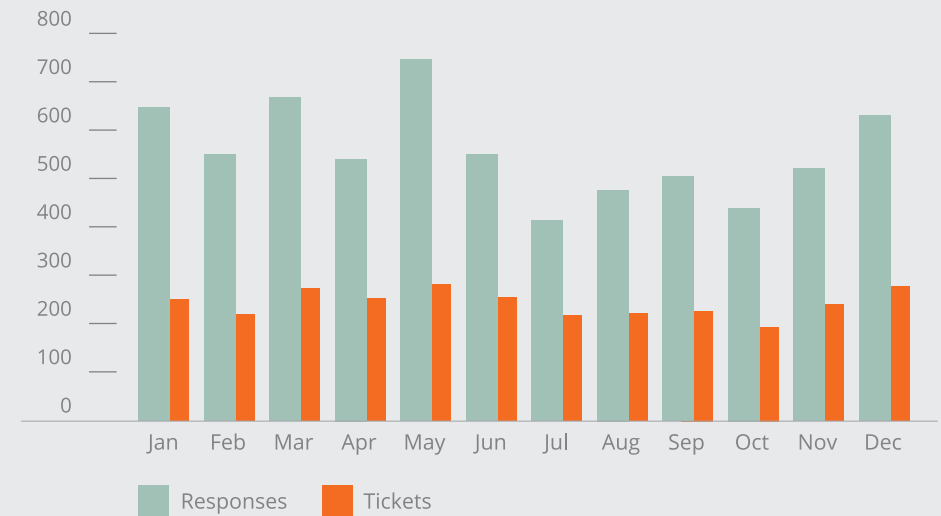
IPv4 Prefixes Transferred vs Transfer Size

- Number of Transfers
- Size of Transfers

IPv6 Prefixes Transferred vs Transfer Size

- Number of Transfers
- Size of Transfers (/32s)

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ASN Transfers

Jan 21
Feb 30
Mar 33
Apr 23
May 41
Jun 30
Jul 27
Aug 37
Sep 38
Oct 31
Nov 30
Dec 77

Contractual Relationship Changes Processed in 2016

Responses   Tickets

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Maintenance of Independent Resources and Contractual Relationship

According to ripe-637, "Contractual Requirements for Provider Independent Resource Holders in the RIPE NCC Service Region", a contractual relationship must exist between an End User and a sponsoring LIR or the RIPE NCC. Since this policy was accepted, the RIPE NCC has been processing changes to these contractual relationships. These include changes to the sponsoring LIR, returned address space and name changes due to takeovers.
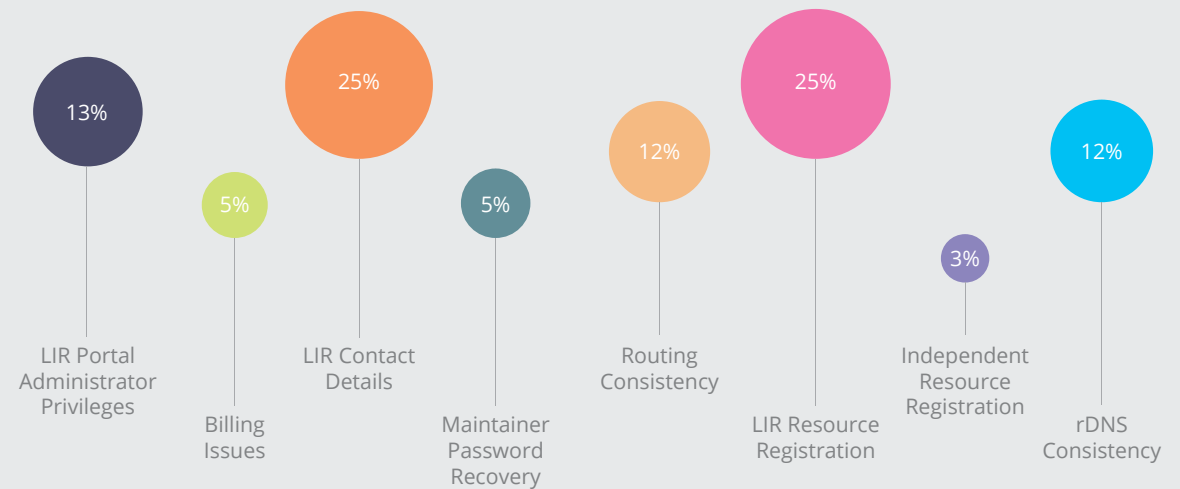
Assisted Registry Check

Maintaining the accuracy of RIPE Registry data is a key strategic focus of the RIPE NCC. One of the ways we support this is by directly contacting our members to check that their registry data is up-to-date. The Assisted Registry Check (ARC) provides LIRs with personalised support that can include help creating RIPE Database objects to improve contact data, granting access rights to authorised personnel, removing inconsistent resource records and offering clarification on RIPE Policies.

In 2016, almost 3,000 ARC tickets were opened and more than 2,500 were completed. On average, LIRs spent around 15 minutes discussing the ARC during the initial telephone call and more than 93% of all registry checks resulted in remedial action being taken.

The RIPE NCC offers ARC reviews to members attending RIPE Meetings. During RIPE 72 and RIPE 73, ARCs were completed for 85 LIR accounts, which represents an increase of 25% from 2015. Members found that the face-to-face format enabled them to efficiently complete ARCs for several registries in a single appointment.

www.ripe.net/lir-services/resource-management/assisted-registry-check

ARC Review Actions Taken in 2016

Category	Percentage
LIR Portal Administrator Privileges	13%
Billing Issues	5%
LIR Contact Details	25%
Maintainer Password Recovery	5%
Routing Consistency	12%
LIR Resource Registration	25%
Independent Resource Registration	3%
rDNS Consistency	12%

Areas Covered by ARC Review

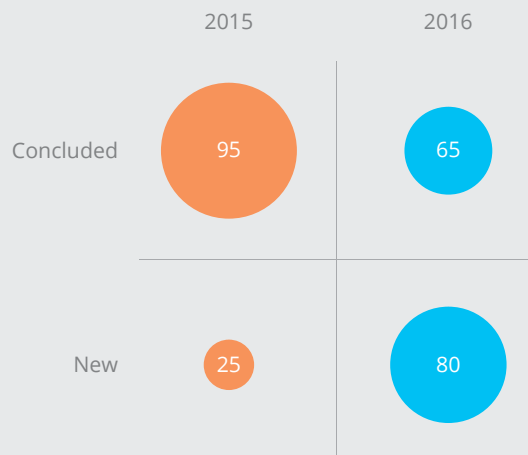| Registry Consistency	Resource Consistency	Route and rDNS Consistency
Legal Name and Status of LIR	IPv4 Resources	Routing Registry vs BGP Announcements
Postal Address	IPv6 Resources	Lame Reverse Delegations
Telephone and Fax Numbers	Independent Resources	Network Reachability
Registry Contacts		

Address Hijacking

The RIPE NCC remains committed to investigating suspected attempts to hijack address space. In 2016, the RIPE NCC uncovered numerous attempts to fraudulently gain control of specific Internet number resources as well as entire LIR accounts. As in previous years, there were more cases of Provider Independent resources (IP addresses and Autonomous System Numbers) being targeted for hijack via fraudulent sponsorships. This resulted in four official warnings being issued to experienced RIPE NCC members that, wilfully or not, provided falsified documentation. Several newer LIRs had their RIPE NCC Standard Service Agreement (SSA) terminated for submitting falsified registration papers, three of which initiated the RIPE NCC Conflict Arbitration Procedure to dispute the closure of their accounts. In all three instances, the respective LIRs dropped

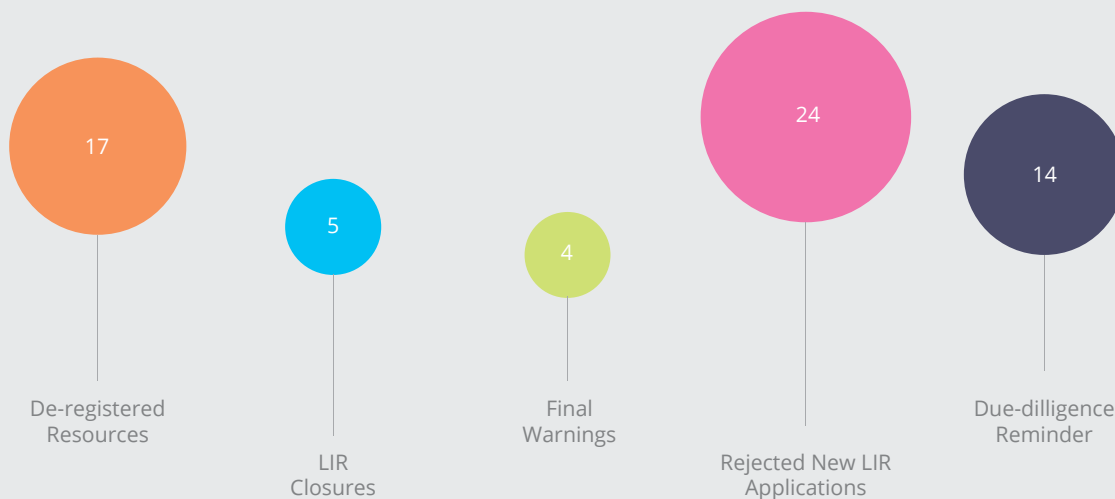the case after admitting to the arbiter that the documents they had submitted were indeed fraudulent.

2016 also saw the continuation of existing disputes over the holdership of transferred resources, including several cases being reviewed via arbitration and in national courts. The RIPE NCC endeavours to offer appropriate and neutral advice to the parties involved. An increased level of due diligence, initiated by the Executive Board, has helped to prevent unauthorised transfers, some of which involved well-known organisations. However, despite this higher level of verification checks, there were still some transfers that were disputed and the RIPE NCC is investigating further. Legacy resources remain susceptible to hijacks using fraudulently provided statements and several cases are under active investigation. In one concluded case, the changes made to the registration were reverted.

The RIPE NCC is using every opportunity to remind LIRs to diligently maintain the information held in their accounts. This helps to safeguard their resources against hijacking.

18

Hijacking Case Numbers

	2015	2016
Concluded	95	65
New	25	80

Hijacking Case Outcomes

- De-registered Resources — 17
- LIR Closures — 5
- Final Warnings — 4
- Rejected New LIR Applications — 24
- Due-dilligence Reminder — 14

Abuse Reports

The RIPE NCC Report Form makes it easier to file a complaint and ensures that all the information needed to follow up is included in the report.

The RIPE NCC received 556 reports via the report form in 2016. Of these, 374 were relevant to the RIPE NCC, while the remaining 182 concerned issues such as spamming or hacking.

Of the reports that were investigated:

- 305 reported incorrect data in the RIPE Database; 204 of these required further investigation by the RIPE NCC
- 59 reports concerned policy violations or untruthful information. 50 of these were found not to be policy violations, one could not be followed up due to lack of information, and eight resulted in further inquiries
- 10 reports did not fall under the scope of normal abuse reports, but were investigated nonetheless

www.ripe.net/report-form

Assignment and Allocation Policies Implemented in 2016

All of the policies that govern how the RIPE NCC allocates and assigns Internet number resources are proposed, discussed and accepted or rejected by the RIPE community. Once a RIPE Policy is accepted, the RIPE NCC implements it into its operations and procedures.

In 2016, no policy proposals were implemented as none reached consensus.

RIPE NCC Services to Legacy Internet Resource Holders

In 2014, the RIPE community reached consensus on "RIPE NCC Services to Legacy Internet Resource Holders", which outlined how the RIPE NCC would provide registry services to legacy holders. The RIPE NCC has contacted legacy resource holders to ask if they would like to establish a relationship with the RIPE NCC according to the options in the policy.

By the end of 2016, 48% of overall legacy resources were registered in an LIR. Out of these, 79% were moved into the legacy holder's LIR account and 21% were registered with a Sponsoring LIR.

In 2016, the RIPE NCC handled 627 requests related to legacy resources. 83% of these requests were related to an update of the registration of legacy resources. 98 updates were completed following a change in holdership.

Membership Lifecycle Management

The RIPE NCC manages the complete lifecycle of RIPE NCC memberships and of those wishing to take advantage of RIPE NCC services (e.g. legacy resource holders). Support and advice is given throughout the contractual relationship, including queries from potential members, applications, administrative and contractual changes, billing enquiries and account closure.

New LIR Accounts

In 2016, the RIPE NCC activated 2,700 new LIR accounts - an increase of about 9% compared to 2015. 203 of these were additional LIR accounts for existing members. Only a handful of these new LIR accounts were closed during the year, resulting in an effective growth of about 21%.

Year	New LIR accounts	Closed new LIR accounts
2016	2,700	40
2015	2,472	360

On 11 February 2016, the RIPE NCC Executive Board decided to temporarily suspend the ability of RIPE NCC members to open additional LIR accounts. During the RIPE NCC General Meeting on 25 May 2016, the following resolution was approved by the membership: "The General Meeting approves the ability of RIPE NCC members to create additional LIR accounts."

LIR accounts were approved and processed as per 20 June 2016 under the following stipulations:

1. The transfer of resources between LIR accounts of the same member will fall under the transfer policy.
2. Only one application will be processed at a time.
3. An LIR Account Agreement needs to be signed by the member for an additional LIR account.
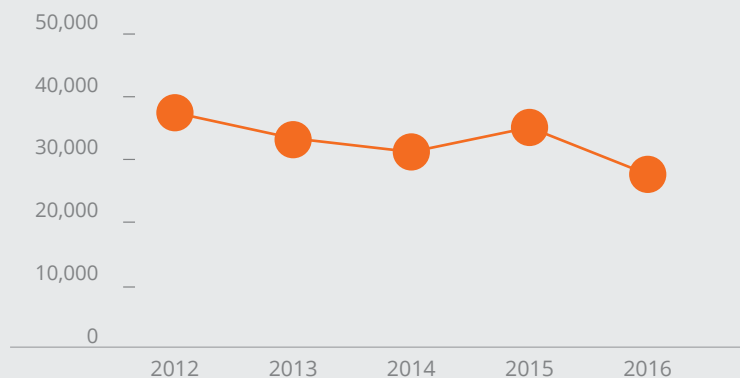
Membership Updates

The RIPE NCC processes membership updates and transfers due to company mergers or acquisitions. On 14 April 2016, the Executive Board announced that mergers, acquisitions, bank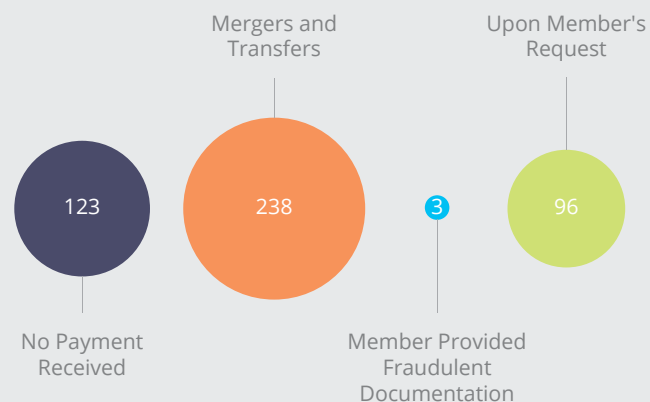ruptcies and liquidations must be supported by official documentation issued by national authorities (e.g. Chamber of Commerce). If a National Authority document cannot be provided, the transfer of Internet resources held by a RIPE NCC member automatically falls under the transfer policy supported by a transfer agreement signed by both parties.

In 2016, the RIPE NCC closed 460 LIR accounts in total due to the reasons illustrated below.

Amount of Tickets

Closure of LIR Accounts

Mergers and Transfers: 238
Upon Member's Request: 96
No Payment Received: 123
Member Provided Fraudulent Documentation: 3

The RIPE Database

The RIPE Database is operated and maintained by the RIPE NCC. It contains IPv4 and IPv6 allocations and assignments and Autonomous System Number (ASN) assignments within the RIPE NCC service region, as well as related information about organisations, contacts and reverse Domain Name System (rDNS) delegations.

The RIPE Database is open for anyone to query and RIPE NCC members use it to provide information about their Internet number resource allocations and assignments. In 2016, around 10 billion queries were served.

Key improvements requested by the community in 2016 include:

- Prevent the use of RIPE-NCC-RPSL-MNT on "mnt-by:"
- Clean-up "descr:" or RIPE NCC allocated/assigned resource objects
- Fixed an automated process to clean up unreferenced personal data
- Highlight RIPE NCC managed data in RIPE NCC allocated/assigned resource objects

RIPE NCC LIR Portal object editors were decommissioned: LIRs can now update their organisation and RIPE NCC allocated/assigned resource objects directly in the RIPE Database. Business rules ensure that RIPE NCC managed attributes can only be modified by the RIPE NCC.

We also significantly improved the set-up of reverse DNS through domain objects. By providing a wizard that helps verifying the basic set-up of DNS servers early in the process, the success rate of setting up rDNS has been improved and the error rate has dropped by two thirds.

The LIR Portal

We improved the functionality and performance of the LIR Portal to make resource management easier for RIPE NCC members. Highlights in 2016 included:

- Better functionality to manage resource registration information, including resource transfers, inter-RIR transfers, and changes resulting from mergers and acquisitions
- Improved functionality of contact management
- Refined online payment system

Resource Certification (RPKI)

RPKI adoption continues to increase: over 4,000 resource holders have requested a certificate and secured over ten /8 blocks of IPv4 address space in total. The service focused on stability, scalability and robustness. After presenting a business case to the RIPE community, the RIPE NCC got support to develop a new version of the RPKI Validator that better caters to the needs of network operators.

Training Course Locations in 2016

Training Course Highlights

Webinars

Total Webinars
33

Participants
622

RIPE NCC Academy

Certificates Issued
702

Enrolled Users
3,363

Training Courses

Number of Courses

1-day Courses: **73**

2-day Courses: **19**

IPv6 Roadshows: **8**

LEA Training Courses: **2**

Total Training Courses
102

Total Participants
1,828

Participants by Course

LIR: **388**

Basic IPv6: **506**

Advanced IPv6: **177**

BGP: **140**

RIPE Database: **313**

DNSSEC: **170**

IPv6 Roadshow: **134**

Training Services

The RIPE NCC provides training services to its members in order to:

- Assist members with the correct registration and administration of Internet number resources
- Teach other technical skills that will improve their operational work
- Improve their understanding of RIPE NCC procedures and tools

IPv6 Roadshows

The RIPE NCC runs IPv6 Roadshows as a joint initiative between the Middle East Network Operators Group (MENOG), the RIPE NCC and APNIC. Eight IPv6 Roadshows were held in 2016.

RIPE NCC Academy

The RIPE NCC Academy is a virtual learning environment where members can access online courses offered by the RIPE NCC through an interactive portal. Members can also test and certify their knowledge and interact with RIPE NCC trainers and each other, to share experiences and best current practices.
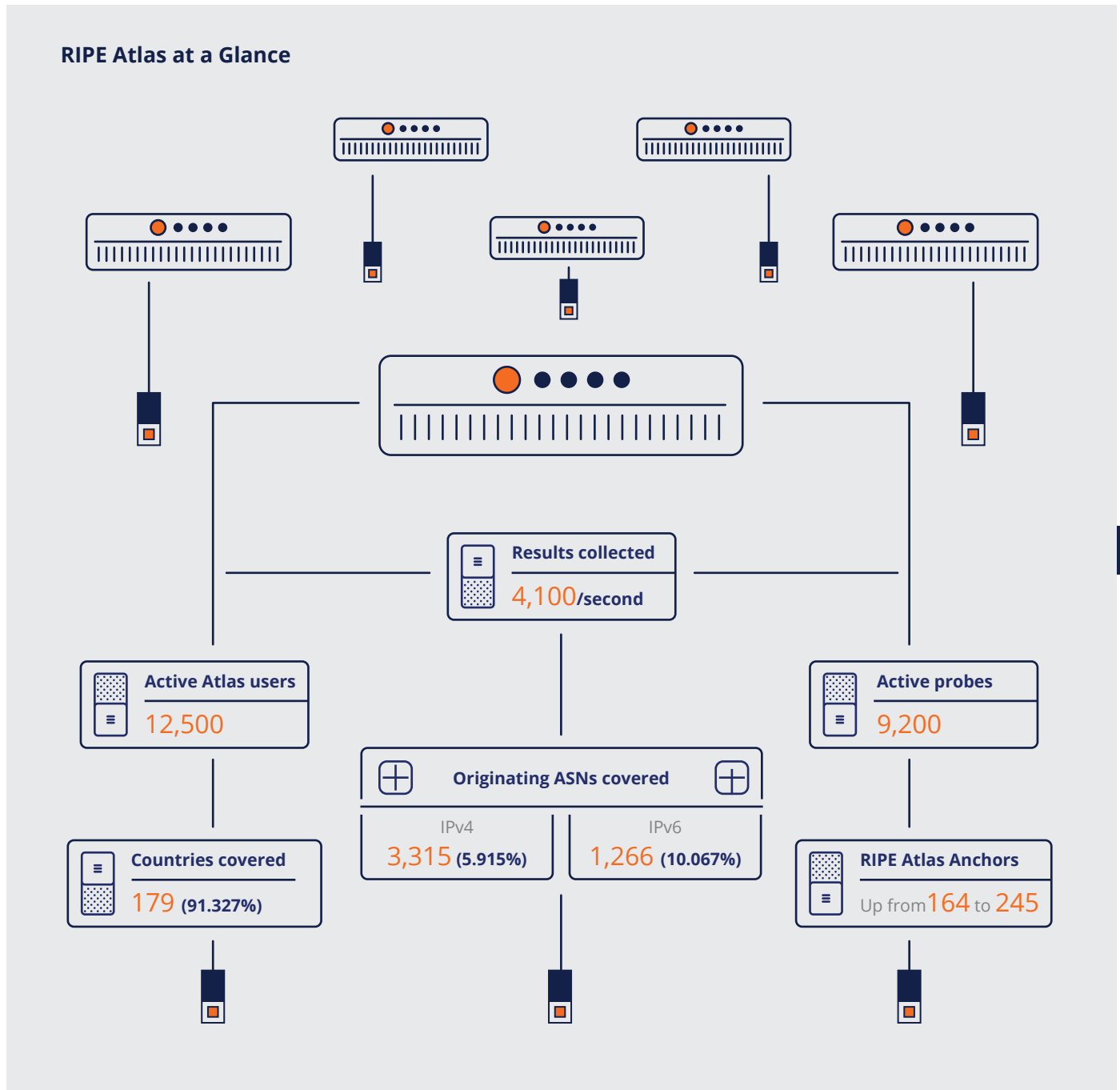
We now offer three courses via the RIPE NCC Academy:

- LIR Training Course
- RIPE Database Expert
- Introduction to IPv6

https://academy.ripe.net

RIPE Atlas

RIPE Atlas is a global network of probes that perform active measurements about the reachability and connectivity of the Internet, including ping, traceroute, DNS and SSL certificate measurements. RIPE Atlas probes are hosted by volunteers around the world who benefit from being able to perform their own customised measurements using the entire RIPE Atlas network. The collected data is available to anyone, and is used to create visualisations and analyses that describe the Internet in real time.

RIPE Atlas at a Glance

Results collected
4,100/second

Active Atlas users
12,500

Active probes
9,200

Originating ASNs covered

IPv4	IPv6
3,315 (5.915%)	1,266 (10.067%)

Countries covered
179 (91.327%)

RIPE Atlas Anchors
Up from 164 to 245

RIPE Atlas Anchor Locations

Anchors Added		+69	+64	+81
Timeline	2013	→ 2014	→ 2015	→ 2016
Active Anchors	31	100	164	245
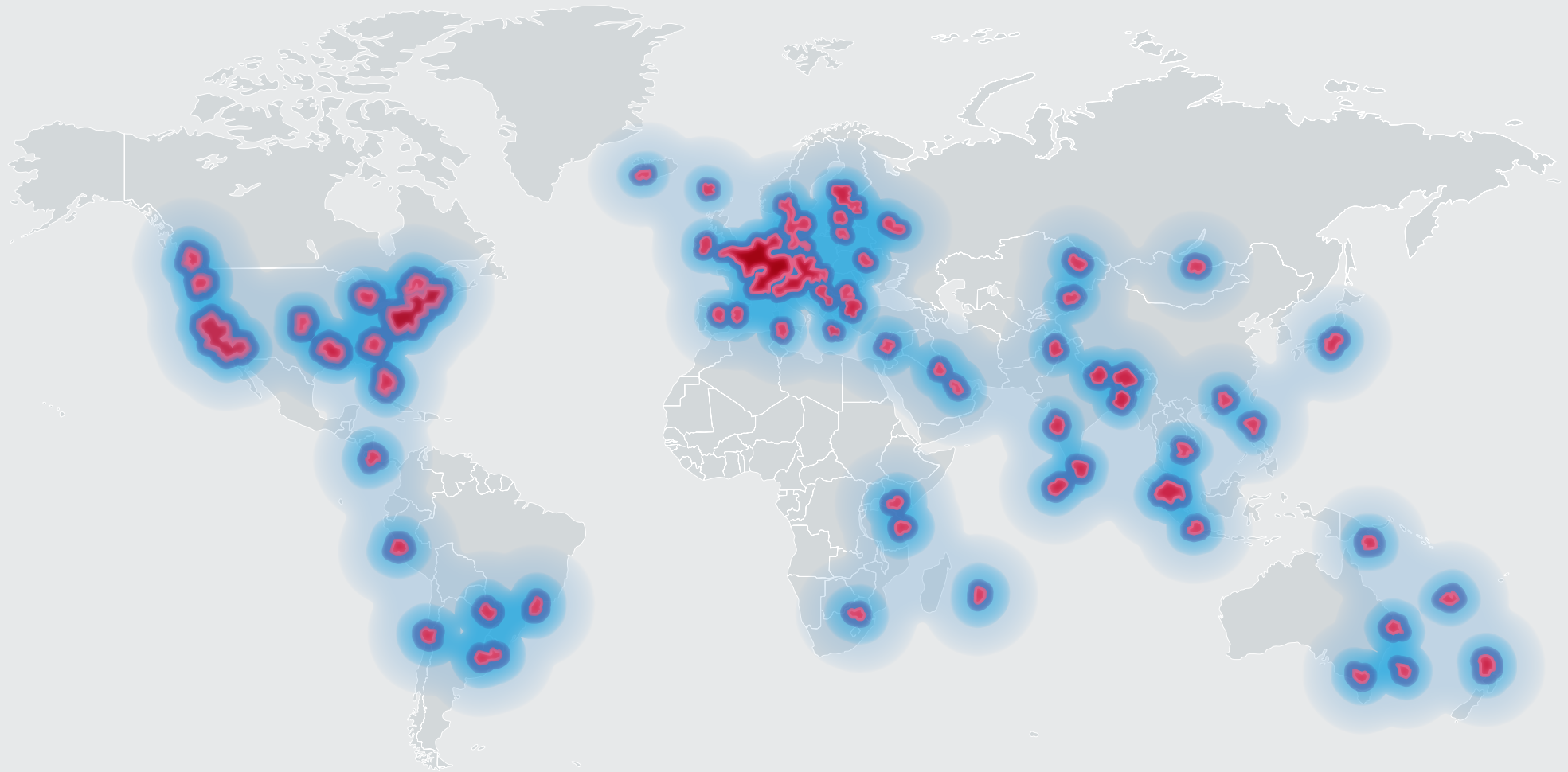
RIPE NCC K-root Node and RIS Collector Locations
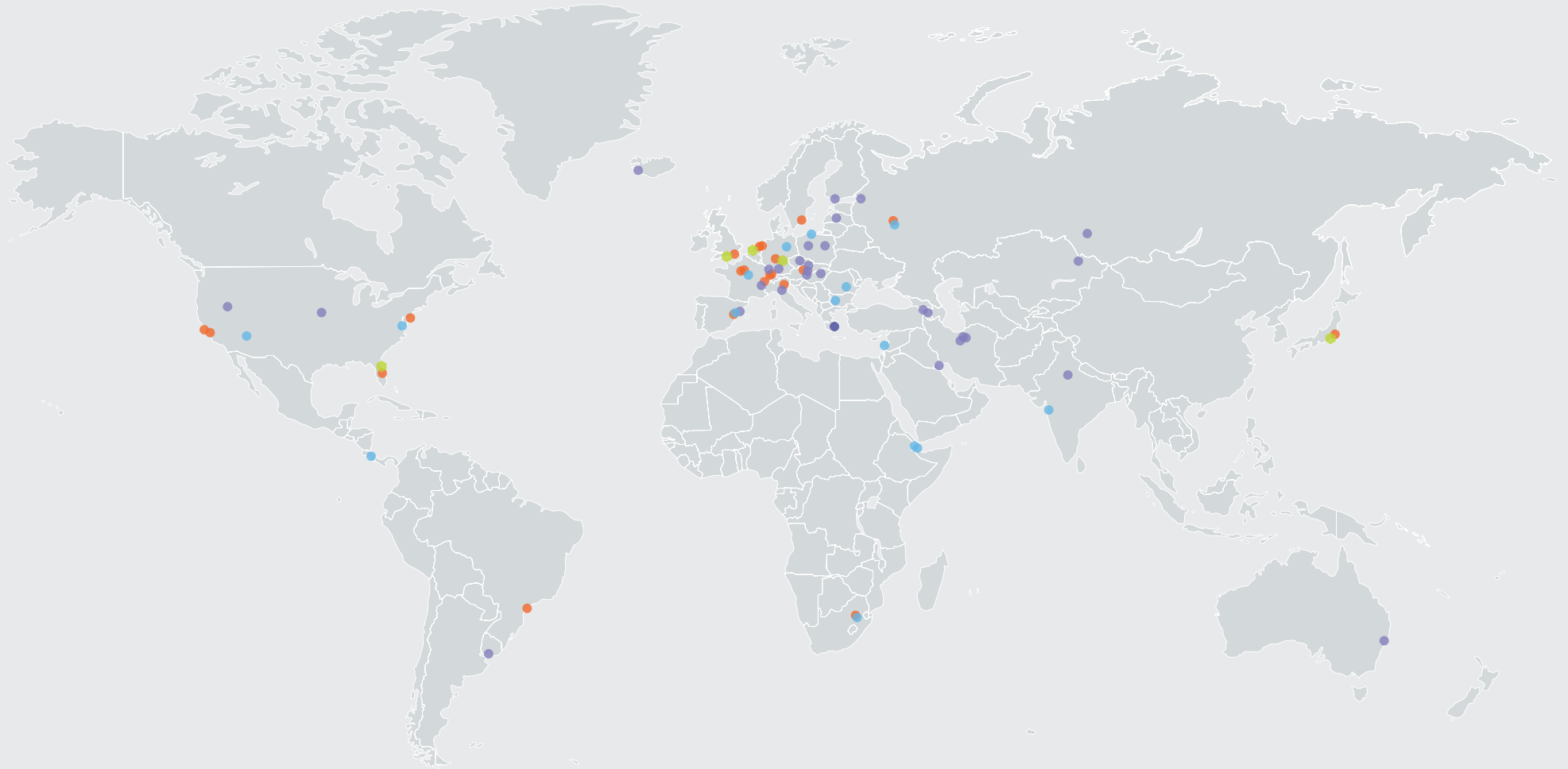
K-root Core Node   RIS Collector   K-root Hosted Node   K-root Hosted Node Added in 2016

26

Routing Information Service (RIS)

RIS keeps track of changes in the global Internet routing system by collecting and storing Border Gateway Protocol (BGP) routing information using 19 Remote Route Collectors (RRCs) located at major Internet exchanges around the world. During 2016, we added the first RIS collector in Africa, hosted by NAPAfrica and Workonline Communications at the NAPAfrica Johannesburg Internet Exchange.

RIS holds a complete routing history of the Internet for the past decade. This data is made available in RIPEstat via several different widgets, and is also available as a raw data download.

Domain Name System (DNS) Services

The RIPE NCC DNS service is run from a cluster of servers in three locations: Amsterdam, London and Stockholm. Zones served from this cluster include reverse delegations for RIPE NCC member allocations, country code Top-Level Domains (ccTLD) secondary services and RIPE NCC authoritative zones. We decided to further improve the resiliency of our authoritative DNS services by procuring secondary DNS services for the RIPE NCC's own zones from a third party. The open tender process was finalised in October when we announced our decision to contract Verisign for the period of one year, with the intention to reassess and renew yearly.

The RIPE NCC also runs the Tier-0 registry and the DNS service for the e164.arpa domain to support ENUM.

Reverse Delegation

As part of its technical support for allocated address space, the RIPE NCC provides primary and secondary Domain Name System (DNS) services for reverse domains.

RIPE NCC members maintain their own reverse delegations by updating their information in the RIPE Database, the authoritative source for reverse zones in the RIPE NCC service region.

Secondary DNS

The RIPE NCC's secondary DNS service contributes to the reliability and robustness of the global DNS. The RIPE NCC provides a secondary DNS service for other Regional Internet Registries' reverse zones and for some ccTLD organisations, mainly in developing countries or those who have difficulty obtaining and paying for commercial DNS services.

As requested by the community, in 2016 we started a process to evaluate all ccTLDs for eligibility for this service as defined in ripe-663. This process, which has led to a reduced number of ccTLDs receiving this service from the RIPE NCC, will conclude in 2017. At the end of the year, we were still providing service for 53 ccTLDs. Five of these also have IDN ccTLDs, bringing the overall total to 58.

For any zones maintained by the RIPE NCC, full DNS Security (DNSSEC) support, including zone signing and support for secure delegations, is provided.

K-root and Anycast

The K-root anycast service continued to expand in 2016, increasing from 35 nodes in 25 countries to 50 nodes in 31 countries. Page 26 shows the expansion of K-root, comparing existing nodes with nodes added in 2016.
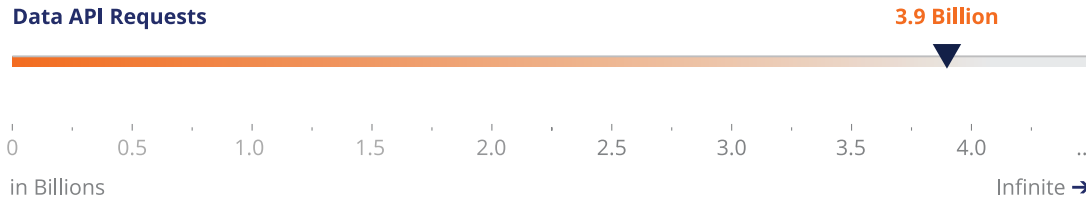
Upgrading Core Nodes

In view of the continuing increase of incidents with traffic overloads towards the K-root infrastructure, we started a process of upgrading our K-root core nodes to support 10GB connectivity. At the end of 2016, the architecture was defined and tested and a plan was defined to expand the K-root core nodes, which will be implemented throughout 2017.
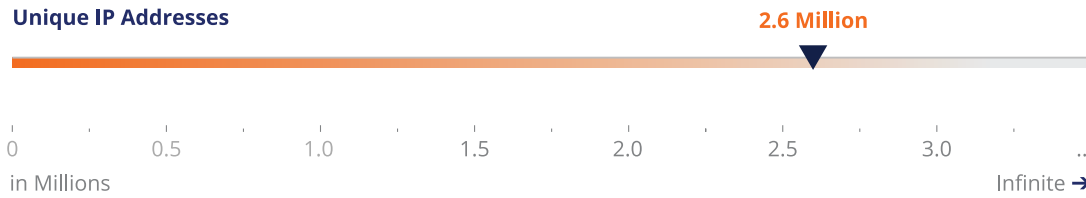
RIPEstat

RIPEstat is a web-based interface that provides everything you ever wanted to know about IP address space and routing data, DNS data, geographical information, abuse contacts and more in the form of widgets that can be embedded on any web page. RIPEstat also provides an API to access the raw data for use in advanced applications.
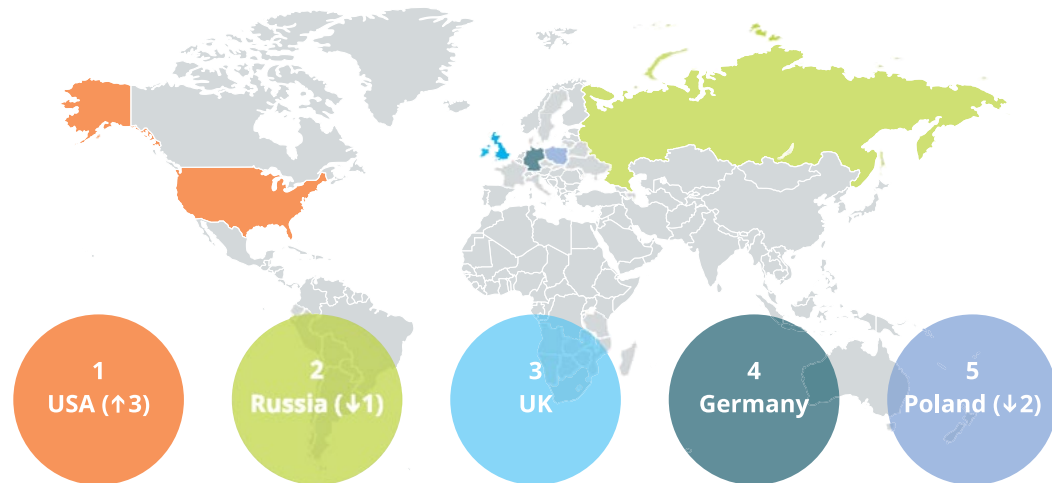
Peak Usage

Data API Requests

3.9 Billion

0   0.5   1.0   1.5   2.0   2.5   3.0   3.5   4.0   ...

in Billions

Infinite ➜

Unique IP Addresses

2.6 Million

0   0.5   1.0   1.5   2.0   2.5   3.0   ...

in Millions

Infinite ➜

Infinite ➜

1.3 Million
Requests/Hour

Top Five Countries Using RIPEstat

1	2	3	4	5
USA (↑3)	Russia (↓1)	UK	Germany	Poland (↓2)

Top 5 Data Calls	1	Network-Info
	2	GEOLOC
	3	Abuse-Contact-Finder
	4	Address-Space-Hierarchy
	5	WHOIS

Top Five Widgets	1	BGPLAY
	2	ASN Neighbours
	3	Looking Glass
	4	Routing History
	5	Routing Status

Information Security

In 2016, the RIPE NCC Information Security team was expanded by one FTE. This expansion was necessary to cope with the increase of security activities in general. Projects were initiated to further increase and automate monitoring of security incidents and reporting.

The RIPE NCC CSIRT (Computer Security Incident Response Team) received 74 security reports in 2015. Of these, five contained minor security issues that required action. The other 69 reports (including generic spam and unrelated requests) did not require action. There were no major security incidents in 2016.
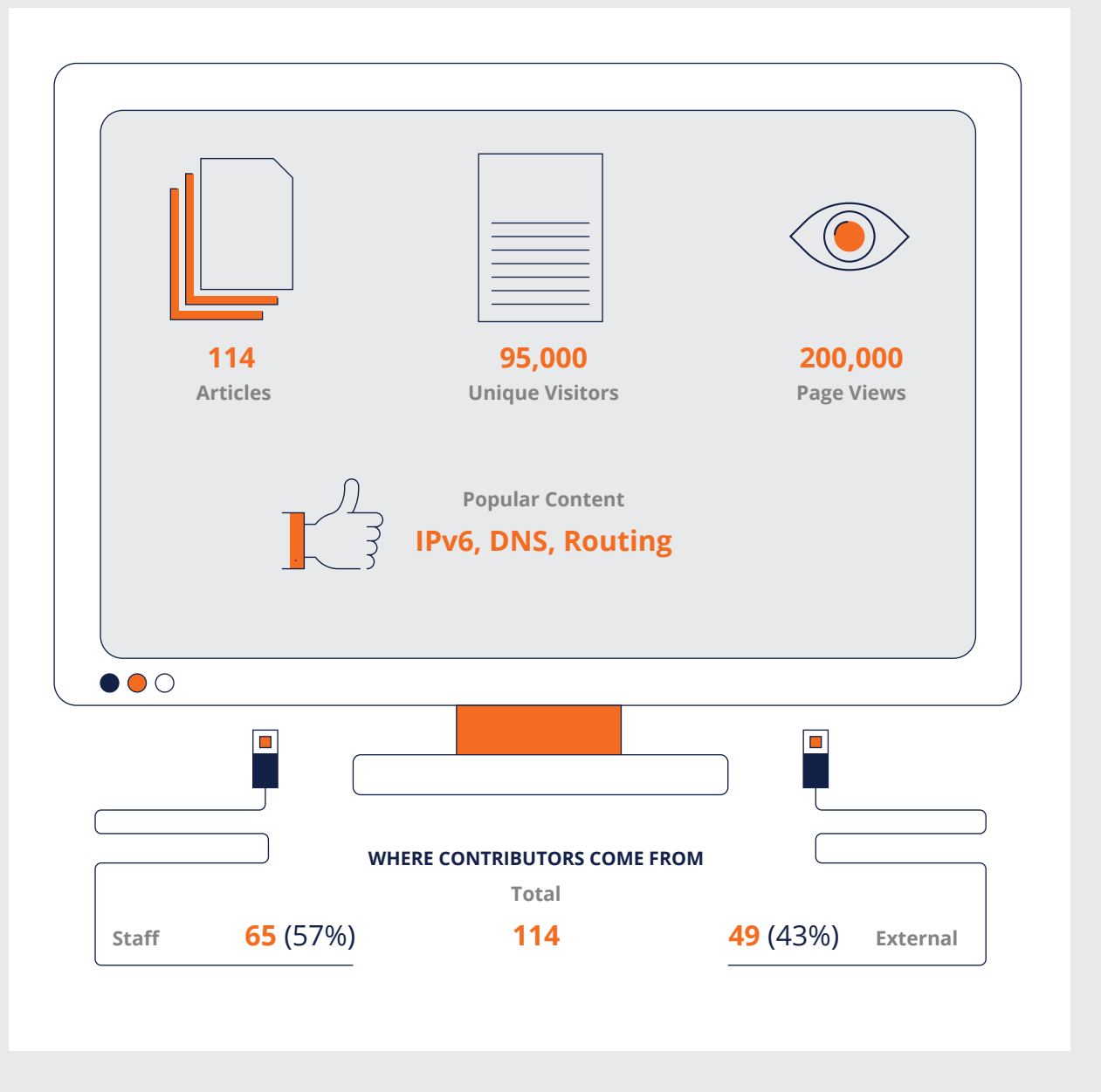
The RIPE NCC continues to interact frequently with the security community, and is an active participant in the TF-CSIRT community.

RIPE Labs

The underlying premise of RIPE Labs is one of engagement, collaboration and openness. RIPE Labs hosts research, content or tools that other organisations or individuals would like to share with the wider community. We also exchange content with other RIRs and we always welcome feedback and requests for specific information.

In 2016, we moved the Statistics Dashboard to a more prominent place on our website and made the mobile version of RIPE Labs more user-friendly. Statistics were again the most popular content on RIPE Labs in 2016, followed by articles related to IPv6, routing, the DNS and RIPE Atlas. RIPE Labs also showcased more academic pieces in 2016, often as a result of collaboration between RIPE NCC staff and external researchers, including RIPE Academic Cooperation Initiative (RACI) Fellows.

RIPE Labs Statistics

114
Articles

95,000
Unique Visitors

200,000
Page Views

Popular Content

IPv6, DNS, Routing

WHERE CONTRIBUTORS COME FROM

Total

Staff **65** (57%)   **114**   **49** (43%) External

External Relations

The strategy behind the RIPE NCC's external relations efforts is outlined in the Activity Plan and Budget 2016:

https://www.ripe.net/publications/docs/ripe-662

Regional and Stakeholder Engagement

In addition to supporting regional events, we organised and participated in numerous local events for governments and regulators, law enforcement agencies, academics and other stakeholders. We formalised our member lunch outreach in 2016, holding 17 member lunches in various locations across our service region.

Strengthening Relationships

We began an ongoing effort to formalise our existing relationships with organisations including Euro-IX and Europol. The Memoranda of Understanding established in 2016 will enhance the cooperation between the RIPE NCC and external organisations, to the benefit of the RIPE NCC membership and RIPE community.

Internet Governance

The successful IANA stewardship transition was a major highlight in 2016. Oversight of the IANA functions is now the responsibility of the Names, Number and Protocol Parameters communities that rely on these functions.

The RIPE NCC also continued to contribute to other Internet governance discussions via the Internet Governance Forum (IGF) and regional/national events such as EuroDIG and the Central Asian IGF.

Accountability

The accountability of all actors in the area of Internet policymaking has continued to be a major focus of Internet governance discussions. Interested members of the RIPE community formed a new Accountability Task Force at RIPE 73 in October. This group, with support from the RIPE NCC, will review the RIPE community's current processes, documentation and structure.

RIPE Academic Cooperation Initiative (RACI)

RACI brings the academic research and RIPE communities closer together. In addition to their strong presence at RIPE 72 and RIPE 73, RACI participants were involved in each of the MENOG, ENOG and SEE events in 2016.

The Number Resource Organization (NRO) and the Address Supporting Organization (ASO)

RIPE NCC Managing Director Axel Pawlik served as a member of the NRO Executive Council in 2016.

The NRO Number Council (NC) performs the function of the ASO Address Council (AC). In 2016, the NRO NC representatives from the RIPE NCC's service region were:

Nurani Nimpuno
Wilfried Woeber
Filiz Yilmaz

At the RIPE 73 Meeting in October 2016, Filiz Yilmaz was re-elected to the NRO NC to serve another three-year term.

RIPE Working Groups

RIPE Working Groups discuss technical or service issues and policy proposals via publicly archived mailing lists and the RIPE Forum. They also meet twice a year in dedicated sessions during RIPE Meetings. Working groups can be formed or disbanded as necessary by the RIPE community.

RIPE Meetings

The RIPE NCC supports and facilitates RIPE Meetings. These five-day events are held twice a year and registration is open to everyone. RIPE Meetings bring together key industry players, network operators, governments, regulators and individuals to discuss the technical, administrative and policy issues surrounding IP networking. Relevant tutorials, training and demonstrations are also provided.

The RIPE NCC facilitates remote participation and feedback mechanisms during RIPE Meetings for those who are unable to take part in person. All sessions are webcast, and remote participants can contribute to discussions during the meeting sessions using Internet Relay Chat (IRC). Live transcripts of the sessions are also provided for attendees.

In 2016, RIPE 72 was held in Copenhagen in May and RIPE 73 was held in Madrid in October.
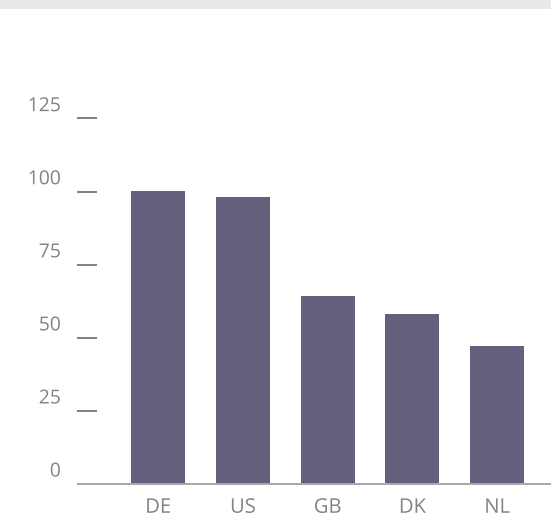
RIPE NCC Regional Meetings and Support

In 2016, the frequency of MENOG meetings dropped from two to one per year. This expands the opportunity for the RIPE NCC to facilitate other regional and national meetings in order to provide more focused support.

The RIPE NCC continues to provide sponsorship and expertise to national events across the RIPE NCC service region.
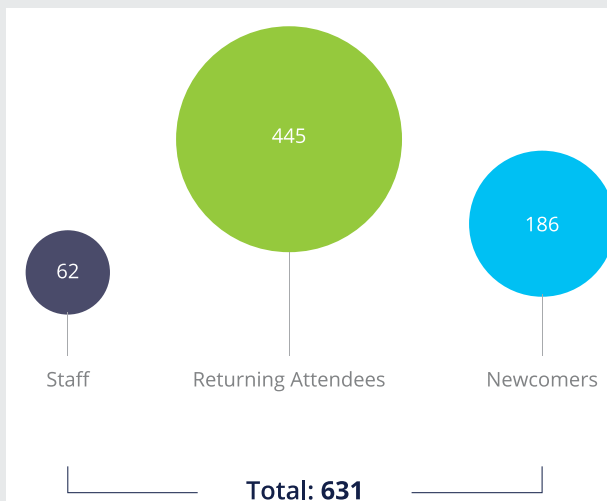
RIPE 72 Attendees
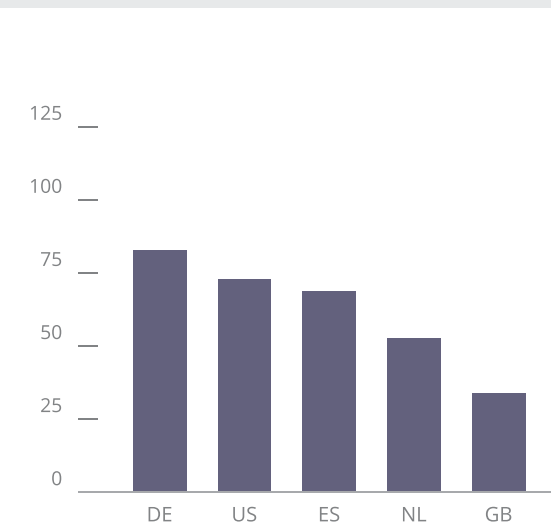
Staff: 57
Returning Attendees: 447
Newcomers: 171

Total: **675**
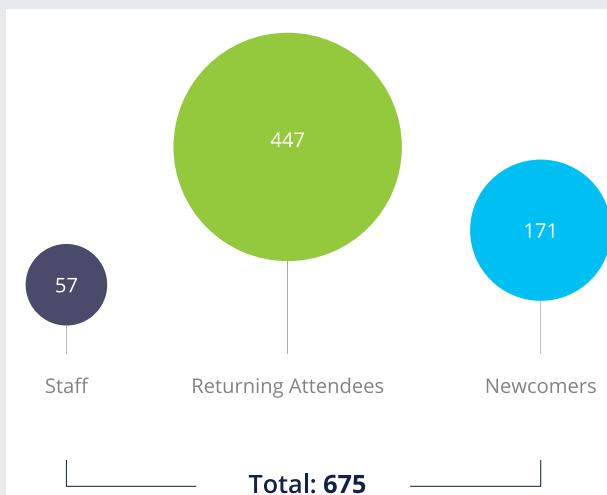
RIPE 72 Attendees - Top 5 Countries

RIPE 73 Attendees

Staff: 62
Returning Attendees: 445
Newcomers: 186

Total: **631**

RIPE 73 Attendees - Top 5 Countries

31

The RIPE Policy Development Process (PDP)

Action	Policy Proposal Made	Discussion Phase		Review Phase	Last Call	Proposal Accepted
		Discussion	Documentation			

Weeks					
	0	9	14	19	
		Continue?	Consensus?	Consensus?	

32
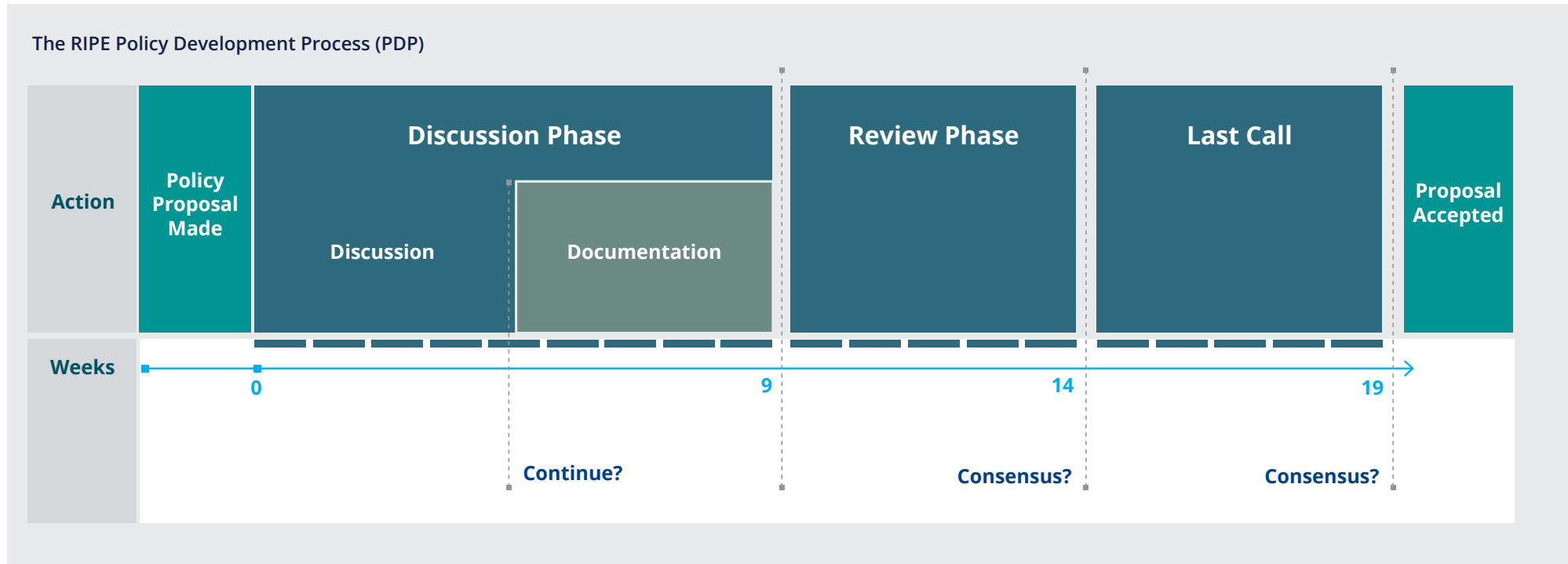
The RIPE Policy Development Process (PDP)

The RIPE PDP is a bottom-up process of discussion and consensus-based decision-making. It is open to anyone who would like to suggest a new policy or a change to an existing one.

In order to be accepted, a policy proposal must pass through the Discussion, Review and Last Call phases of the PDP. After a proposal has made its way through all three phases, and if the relevant RIPE Working Group Chair determines there is consensus in the RIPE community, it completes the PDP and consensus is declared. The RIPE NCC then implements the policy into its working procedures.

The RIPE NCC has no role in accepting or rejecting policies. Instead, it provides administrative support to the PDP. Part of this involves publishing an impact analysis when a proposal enters the Review Phase, which helps the RIPE community to understand the likely effects the proposal would have if it were to be implemented.

Regular activities such as multilingual policy updates, training and presentations help to increase the awareness of and participation in the PDP. In 2016, the RIPE Forum - a web-based interface integrated with all RIPE mailing lists - was introduced to allow participation via a web browser.

Policy Proposals in 2016

The RIPE community discussed seven proposals in 2016: two were still under discussion from the previous year and five new proposals entered into the PDP. About 170 people from 30 different countries actively contributed to RIPE Policy discussions in three different working groups.

In January, the proposal **2016-01, "Include Legacy Internet Resource Holders in the Abuse-c Policy"**, was presented to the Anti-Abuse Working Group. This proposal aimed for a mandatory abuse contact for legacy Internet resource holders in the RIPE Database. In July, the proposal was withdrawn as no consensus could be achieved.

In April, the proposal **2016-02, "Resource Authentication Key (RAK) code for third party authentication"**, was published in the RIPE NCC Services Working Group. This proposal aimed to allow all number resources to be authenticated via an API-key. The proposal was withdrawn in September.

Also in April, the proposal **2016-03, "Locking Down the Final /8 Policy"**, was discussed in the Address Policy Working Group. This proposal aimed to ban transfers of /22 IPv4 allocations made under the last /8 policy. After an intense discussion, the proposal was withdrawn in November as no consensus was in sight.

In June, an ongoing proposal from the previous year, **2015-05, "Last /8 Allocation Criteria Revision"**, was withdrawn. This proposal was discussed in the Address Policy Working Group and aimed to allow LIRs to request an additional /22 IPv4 allocation from the RIPE NCC every 18 months.

In October, the proposal **2016-04, "IPv6 PI Sub-assignment Clarification"**, was published in the Address Policy Working Group. The goal of this proposal is to define sub-assignments in IPv6 PI assignments as subnets of /64 and shorter.

In November, the proposal **2016-05, "Synchronising the Initial and Subsequent IPv6 Allocation Policies"**, was published, also in the Address Policy Working Group. This proposal aims to match the subsequent IPv6 allocation requirements with the initial allocation requirements. This and the above IPv6 sub-assignment proposal were still under discussion at the end of 2016.

Also still under discussion was **2015-04, "RIPE Resource Transfer Policies"**, which was published for the first time in 2015 and went through several iterations. This proposal aims to create a single transfer policy with all relevant information on the transfer of Internet number resources, replacing text in several RIPE Policies. The proposal also introduces a 24-month holding period for IPv4 addresses and 16-bit ASNs after any change of holdership.