IPv4: The End is Near!

The present, the future, the past…

Nikolas Pediaditis | RIPE 79 | 16 October 2019

IPv4 made it to Rotterdam…just!

RIPE NCC IPv4 Pool — Last 36 Months

Legend:
- Millions of IPv4 Addresses Reserved
- Millions of IPv4 Addresses Available Outside 185/8
- Millions of IPv4 Addresses Available in 185/8

Current status

- **On 2 October 2019 we ran out of contiguous /22s**

- **We continue making /22-equivalent allocations made up of /23s and /24s**

- **Once we can no longer allocate the equivalent of a /22, we will announce that we have reached run-out**

When Will We Run Out?

/22-equivalents Left:

751

Consumption Rate (Allocations)	
June	484
July	785
August	776
September	758
October	273

When Will We Run Out?

Final Estimation:

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3rd Week of November!

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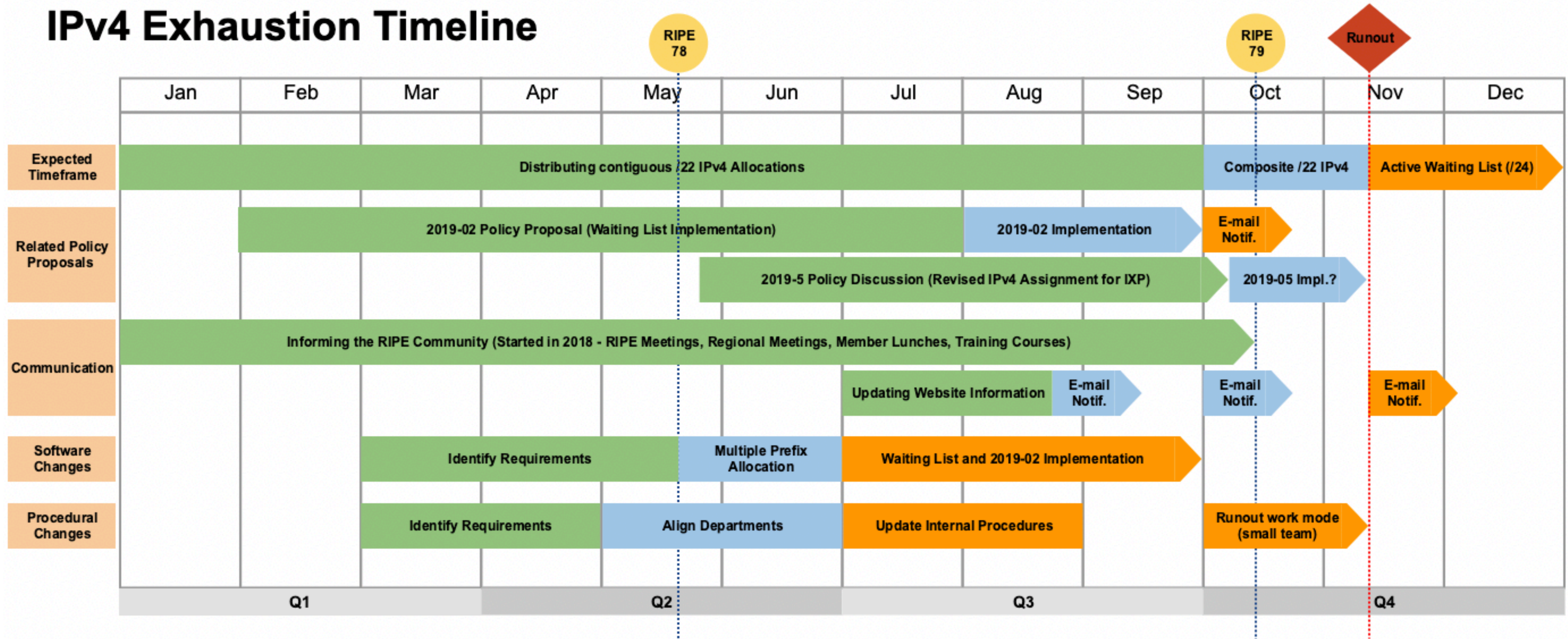± 1 Week

What then?
We have a waiting list

RIPE Policies

- **2019-02, "IPv4 Waiting List Implementation"**

  - Established a waiting list with an allocation size of /24 once our IPv4 pool is exhausted

  - Accepted on 30 July 2019 - Implemented on 19 September 2019

- **2019-05, "Revised IPv4 assignment policy for IXPs"**

  - Accepted on 10 October 2019 - Implementation has started

  - The pool management part has been implemented

  - 185.0.0.0/16 and the IPv4 fragments smaller than /24 have been added to the reserved IPv4 pool for IXPs

  - Approximately two months for full implementation

IPv4 Exhaustion Timeline

How Will It Work?

- Active once we can no longer allocate the equivalent of a /22

- First-come, first-served basis

- Current process for requesting IPv4 remains

- The allocation size is reduced from /22 to /24

- Only for LIRs that have never received an allocation from the RIPE NCC

- Size of the list and "next in line" waiting time, public on ripe.net

- Placement number in the list visible in the LIR Portal

In The Coming Months

- Recovered IP space is quarantined before being redistributed

IPs Out Of Quarantine	
10/2019	3.072
11/2019	7.168
12/2019	66.344
01/2020	56.704
02/2020	215.040
03/2020	18.432

- We will redistribute more than 1,300 /24s in the coming months
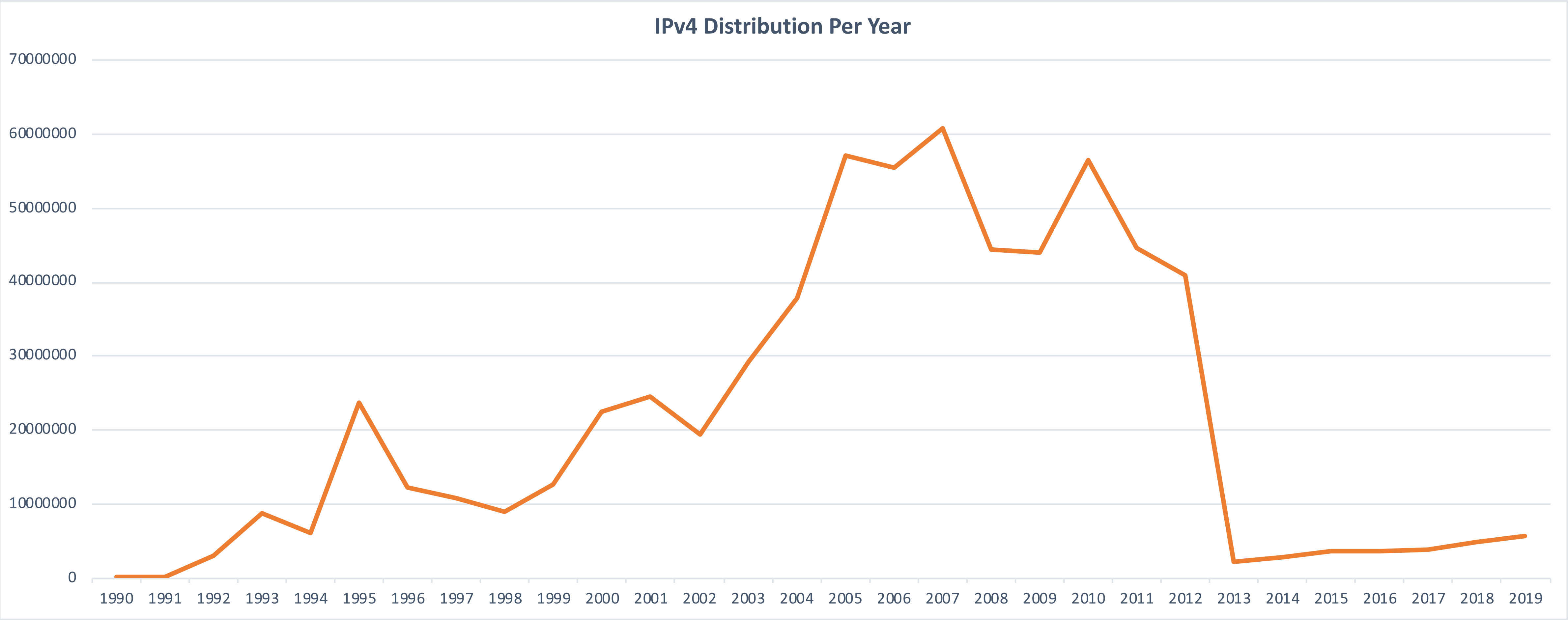
Today

- **We are ready!**

- **We are keeping the community well informed!**

- **Future IPv4 requests of LIRs currently waiting to be activated might end up in the waiting list!**
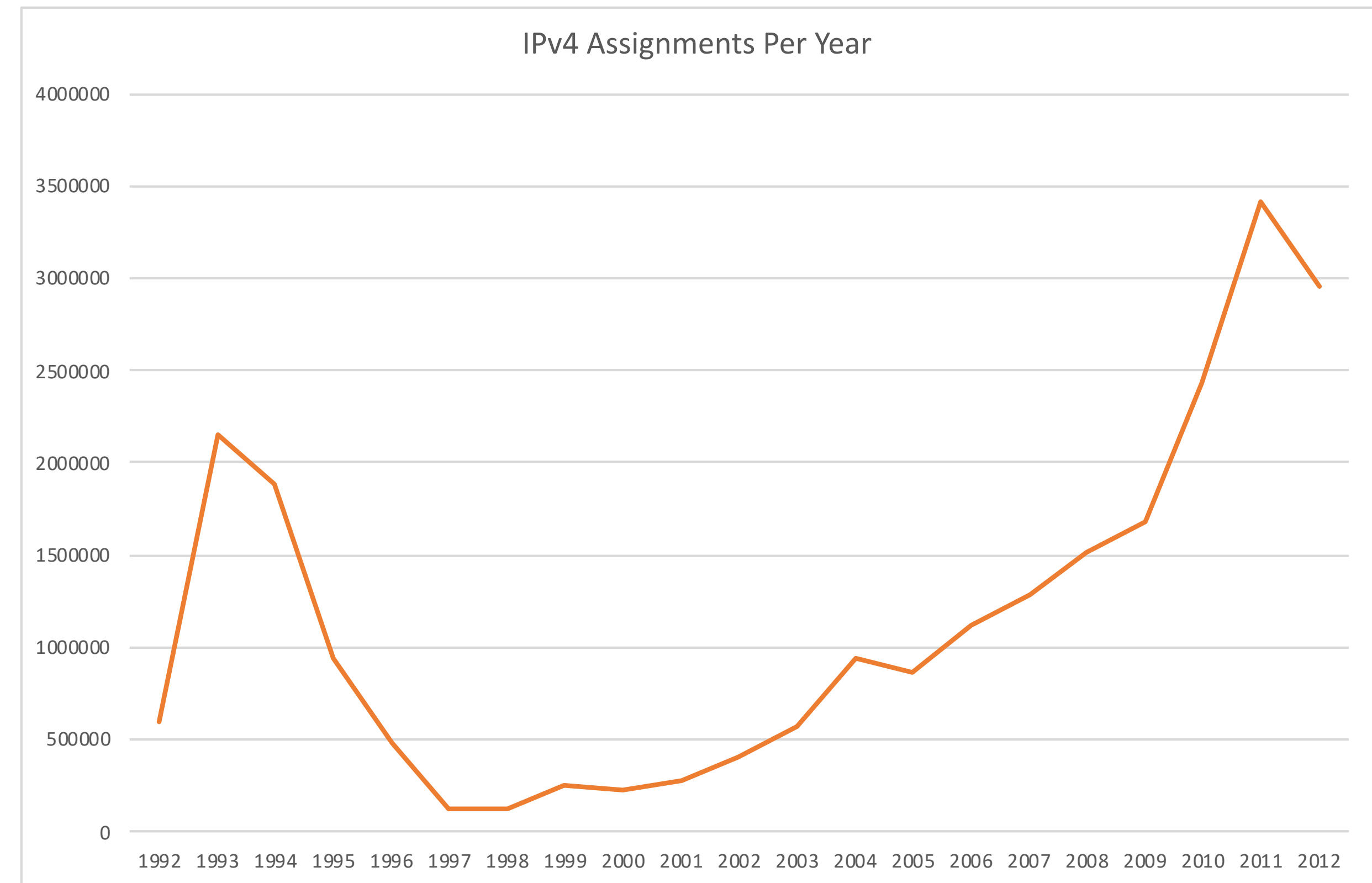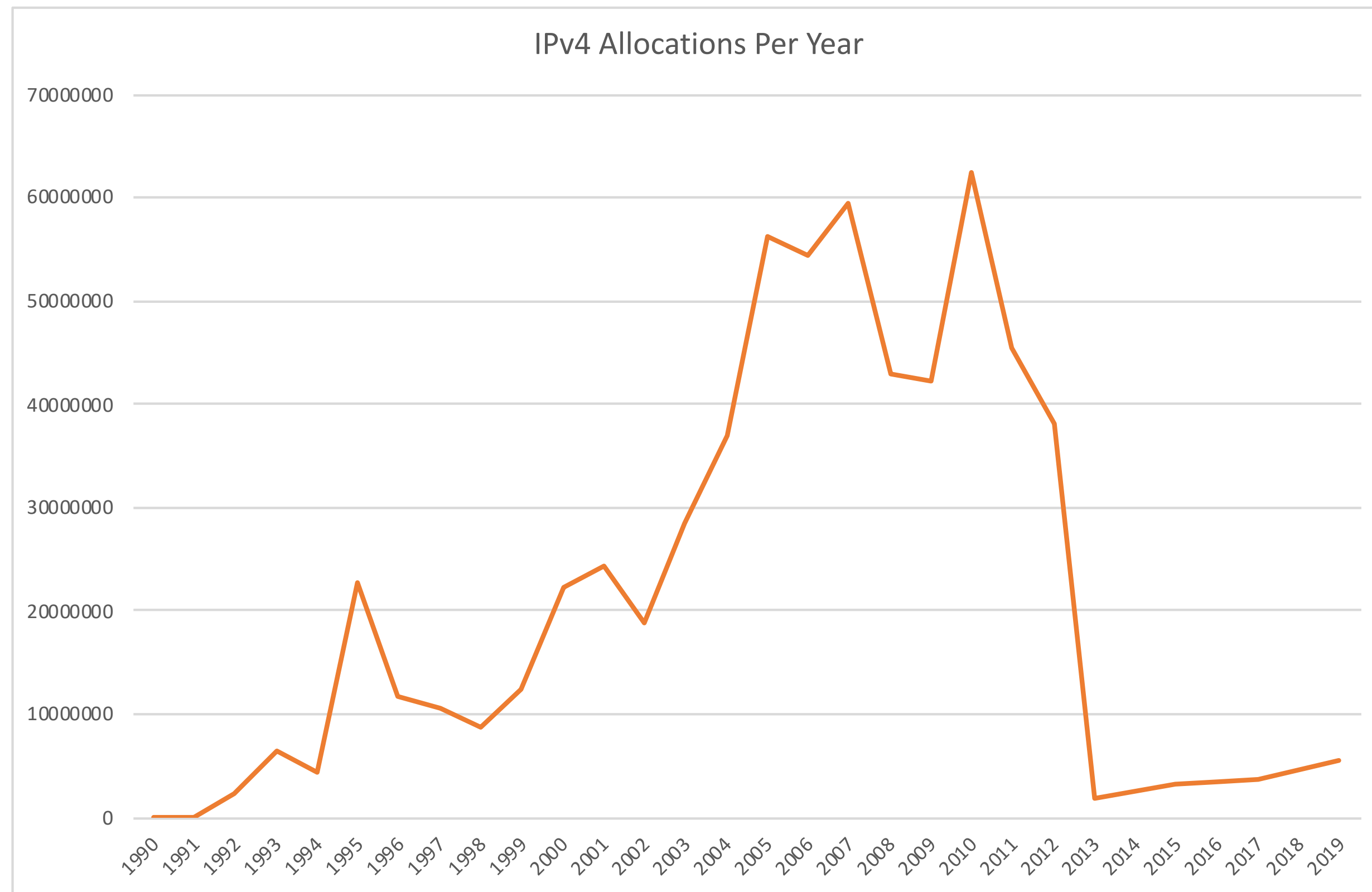
Let's go back in time…

Historical Distribution

IPv4 Distribution Per Year

Allocations vs PI Assignments

IPv4 Allocations Per Year

IPv4 Assignments Per Year
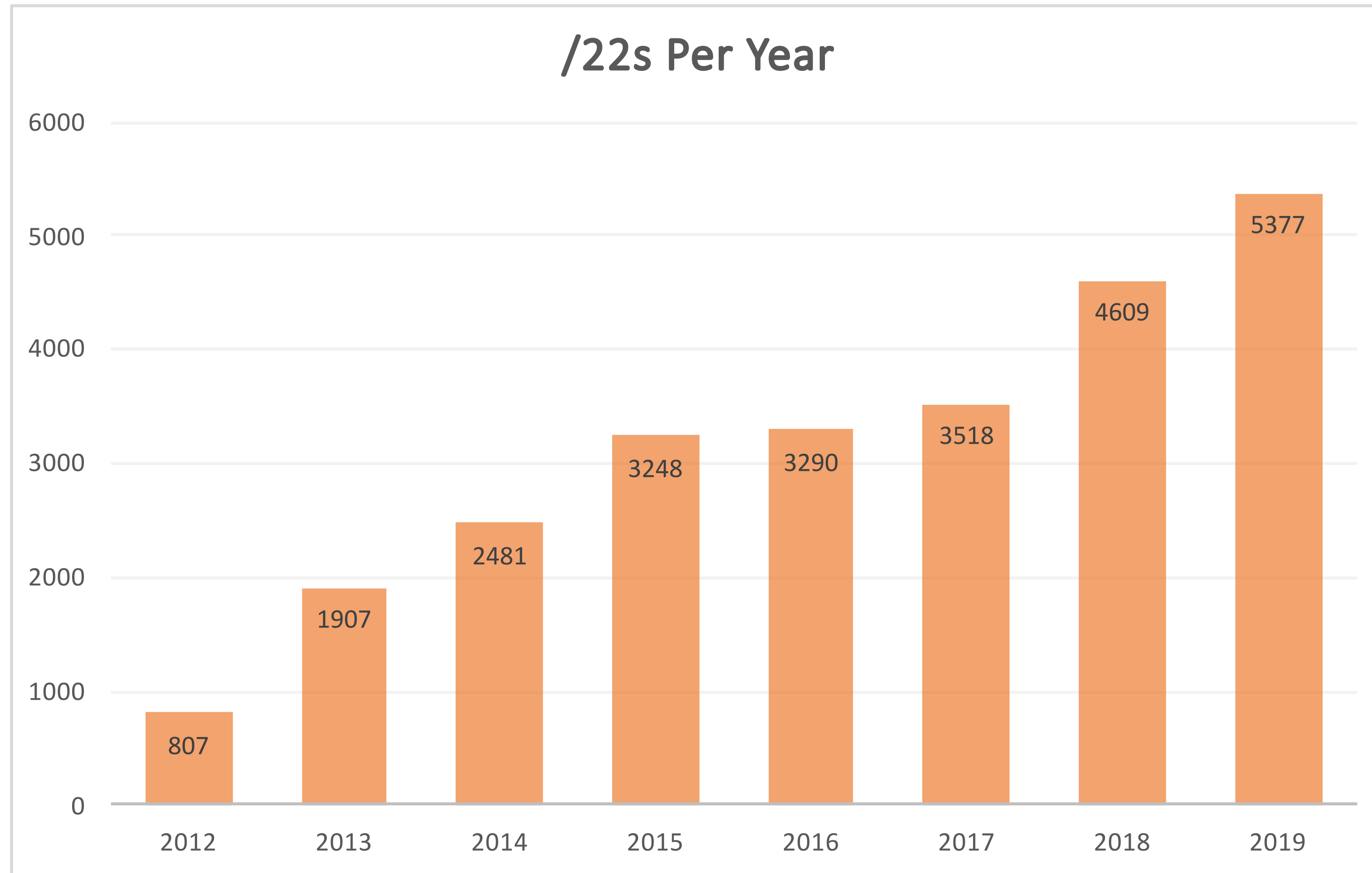
Interesting Facts

- Total of IP addresses distributed by the RIPE NCC: 649,925,248

  - That's 38.7 /8s

- Biggest IPv4 allocation ever: 90.0.0.0/9 in 2006

- Ten /10 allocations to major ISPs from 2004 to 2011

- In 2012:

  - 39,924,056 IPs issued before 15/09/12

  - 997,632 IPs issued after 15/09/12

2012

IPv4 Allocations since 2012

/22s Per Year

Year	/22s
2012	807
2013	1907
2014	2481
2015	3248
2016	3290
2017	3518
2018	4609
2019	5377

IPv4 Transfers

- The first transfer took place in October 2012

- IPv4 Allocations (original blocks): 10,691

- IPv4 Assignments (original blocks): 2,542

- Total IP blocks transferred: 13,233

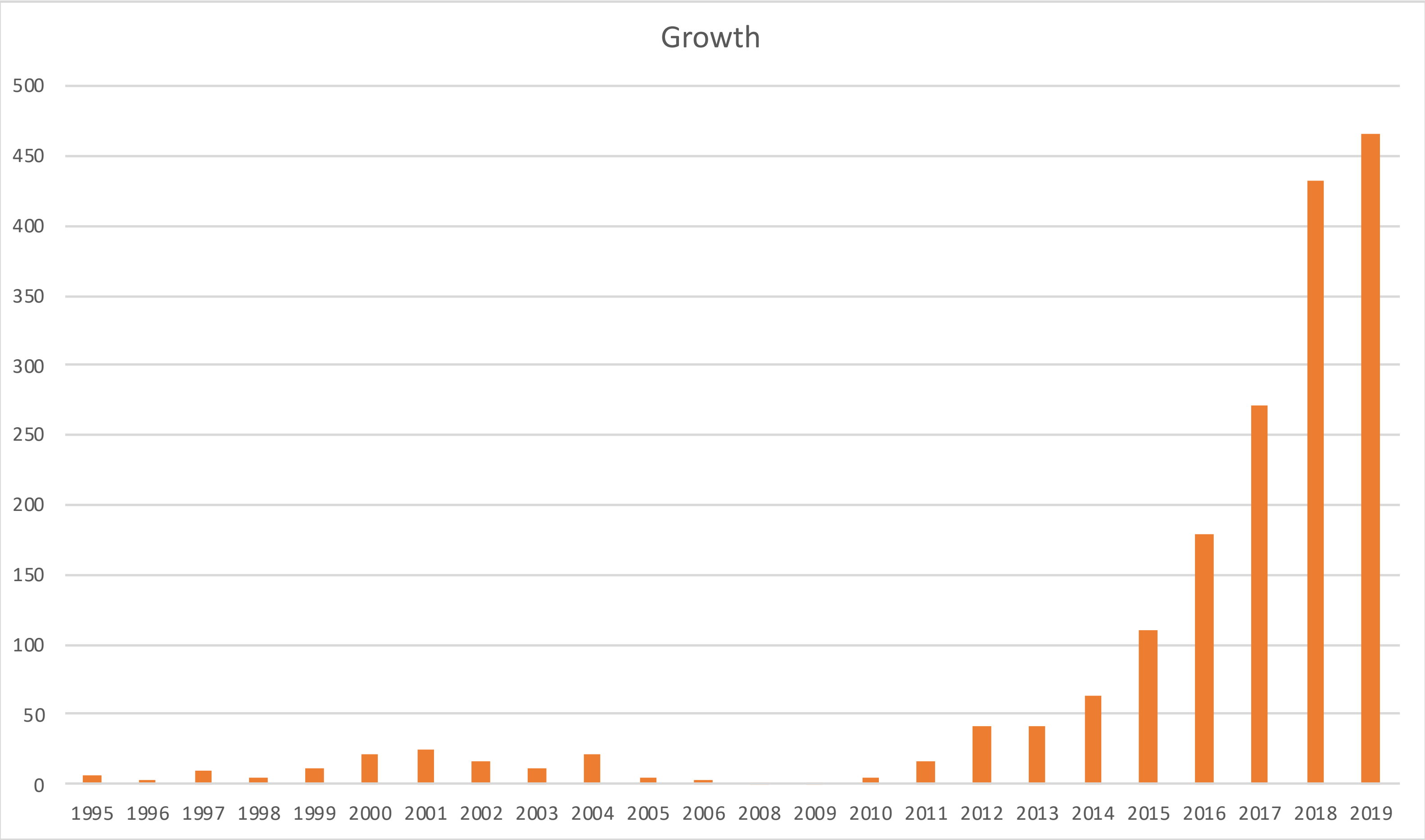- 55 IP blocks from 185/8 have been transferred inter-RIR

Out-of-region use

Out-of-region LIRs

Year	LIRs
1995	6
1996	3
1997	10
1998	4
1999	11
2000	21
2001	25
2002	17
2003	12
2004	22
2005	4
2006	3
2008	2
2009	2
2010	5
2011	17
2012	41
2013	41
2014	63
2015	111
2016	179
2017	271
2018	433
2019	466

Growth

References - Examples

- **ripe-707 (IPv6 Policy):**

*"The primary role of RIRs is to manage and distribute public Internet address space **within their respective regions**."*

- **ripe-730 (IPv4 Policy):**

*"The RIPE NCC is an independent association [...]. **Its service region** incorporates Europe, the Middle East, and Central Asia. The RIPE NCC is responsible for the allocation and assignment of Internet Protocol (IP) address space, Autonomous System Numbers (ASNs) and the management of reverse domain names **within this region**."*

RIPE NCC's Current Practice

- Networks can be global

- An active network element within the RIPE NCC service region is required

- Resources must be used at least partially within our service region

- Legal presence within our service region is not mandatory

Out-of-region use

- Currently 1,246 LIRs out-of-region. Holding:

  - 1,988 IPv4 Allocations (3,223,808 IPs)

  - 768 IPv6 Allocations (5,409 /32s)

- Announced solely by ASNs not managed by the RIPE NCC

  - IPv4 allocations: 1,819 (7,016,704 IPs)

  - IPv4 PI assignments: 238 (195,072 IPs)

  - IPv6 allocations: 1,969 (/32s)

  - IPv6 PI assignments: 13 (/48s)

  - 971 ASNs peering only with ASNs not managed by the RIPE NCC

Status In Other RIRs

- AFRINIC: delegates resources to organisations geographically located and providing services in the AFRINIC service region

- APNIC: delegates resources to organisations which are legally present or have networks located in the APNIC region

- ARIN: requires legal presence and at least a /22 IPv4 or /44 IPv6 used within the ARIN service region

- LACNIC: requires legal presence and resources mainly to be used within the LACNIC service region

Out-of-region LIRs

- There is a growing number of out-of-region LIRs and End Users

- These resource holders have confirmed to have an "active network element within the RIPE NCC service region"

- Due diligence checks have led to termination of memberships & sponsorships

- Sometimes it is later observed that the resources are solely used outside of our region

- It is easy to trick the system

- Is RIR shopping happening? Should we take action?

Questions

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Discussion Topics

- **IPv4 Runout**
  - **Moving Forward**
  - **Lessons Learned?**

- **Out of region use**
  - **Is it an issue?**
  - **Should the RIPE NCC do more?**