



RIPE NCC
RIPE NETWORK COORDINATION CENTRE

Local Internet Registry

Training Course

November 2015

Schedule



09:00 - 09:30

Coffee, Tea

11:00 - 11:15

Break

13:00 - 14:00

Lunch

15:30 - 15:45

Break

17:30

End

Introductions



- Name
- Number on the list
- Experience with the RIPE NCC
- Goals

Overview



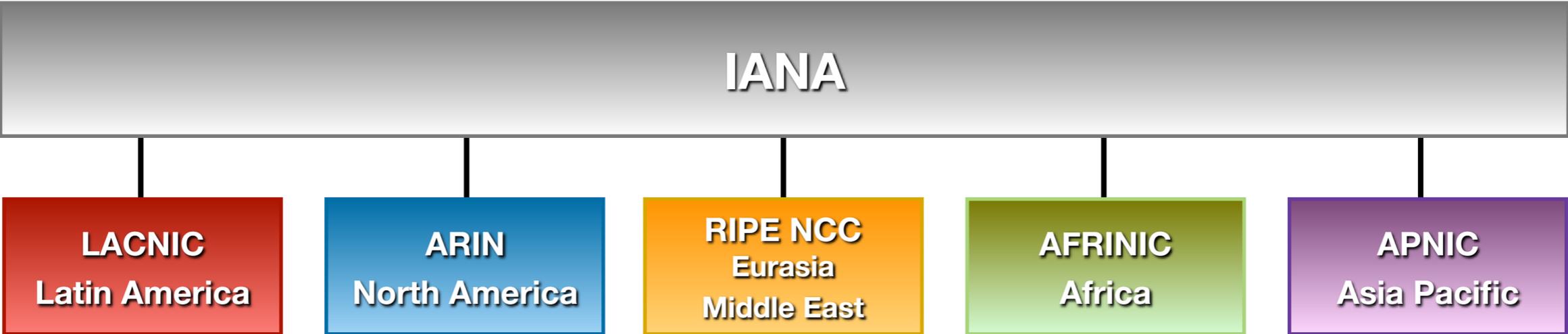
- The Internet Registry (IR) System
- Participating
- Being an LIR
- Exercise: Being an LIR Contact
- The RIPE Database
- Getting Resources
- Transfers
- Distributing Resources
- Exercise: Making Assignments
- Exercise: Registering Assignments
- Managing Resources
- Tips and Tools



The Internet Registry System

Section 1

The Internet Registry System



Regional Internet Registries



- **Five RIRs worldwide**
 - Not-for-profit organisations
 - Funded by membership fees
 - Policies decided by regional communities
 - Neutral, Impartial, Open, Transparent

Goals: Registration



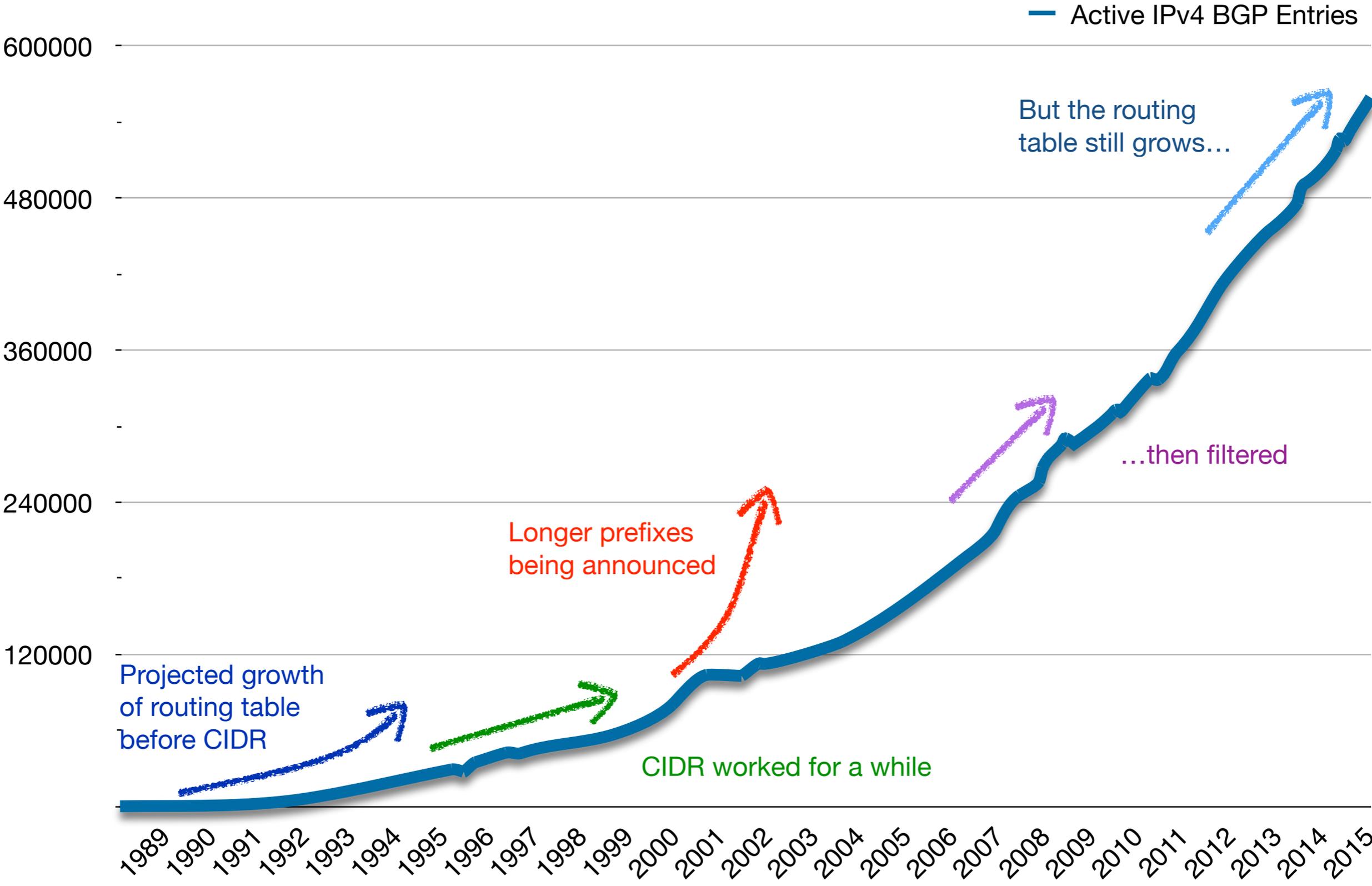
- **Why?**
 - Ensure uniqueness of Internet number resources
 - Provide contact information
- **How?**
 - RIR whois databases
- **Results:**
 - IP address space used only by one organisation
 - Information available on users of Internet number resources

Goals: Aggregation

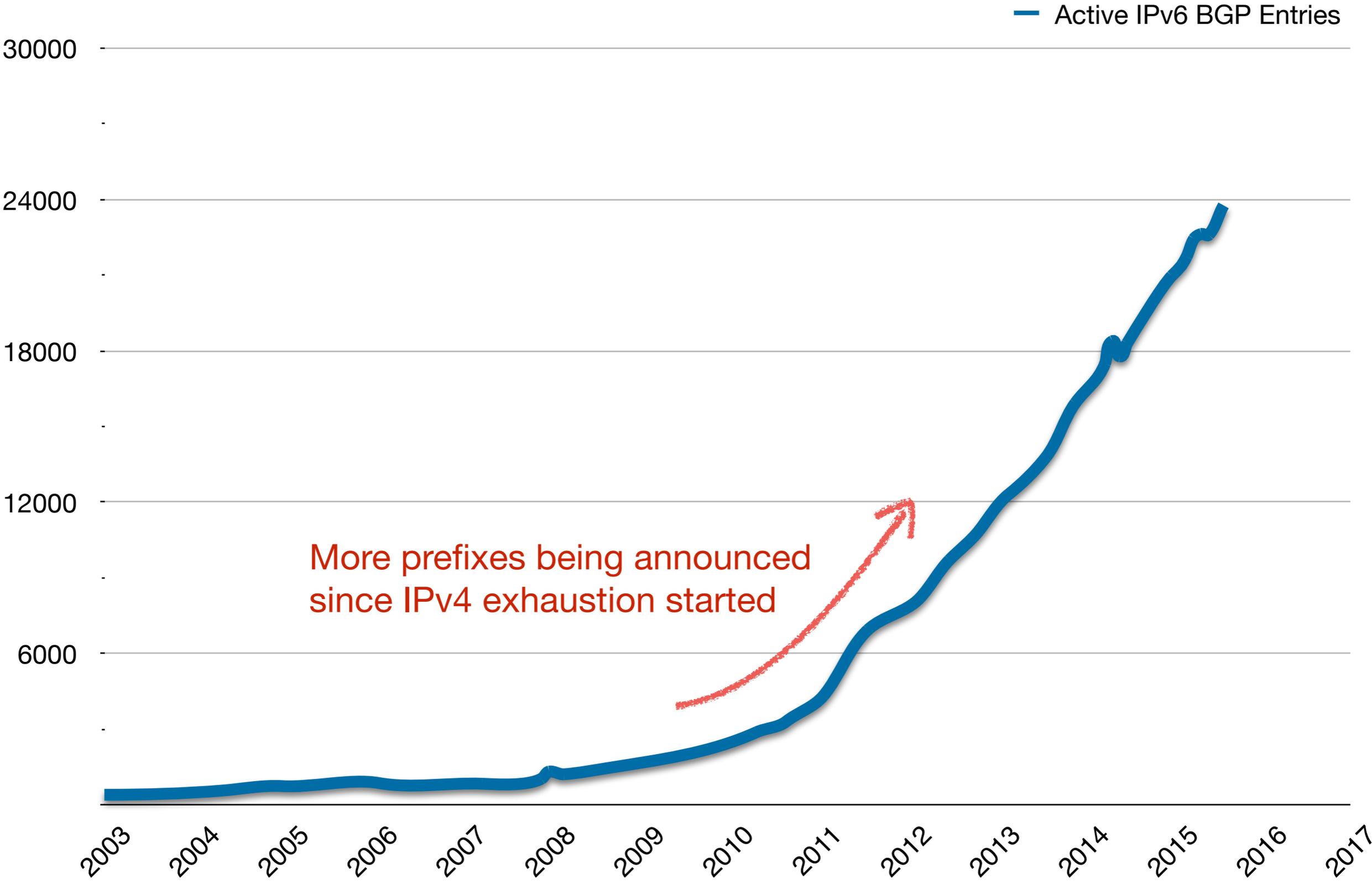


- **Why?**
 - Routing tables growing too fast
 - Provide scalable routing solution for Internet
- **How?**
 - Encourage announcement of whole allocations
 - Introduction of Classless Inter Domain Routing (CIDR)
- **Result:**
 - Growth of routing tables has slowed a bit

Active IPv4 BGP Entries



Active IPv6 BGP Entries

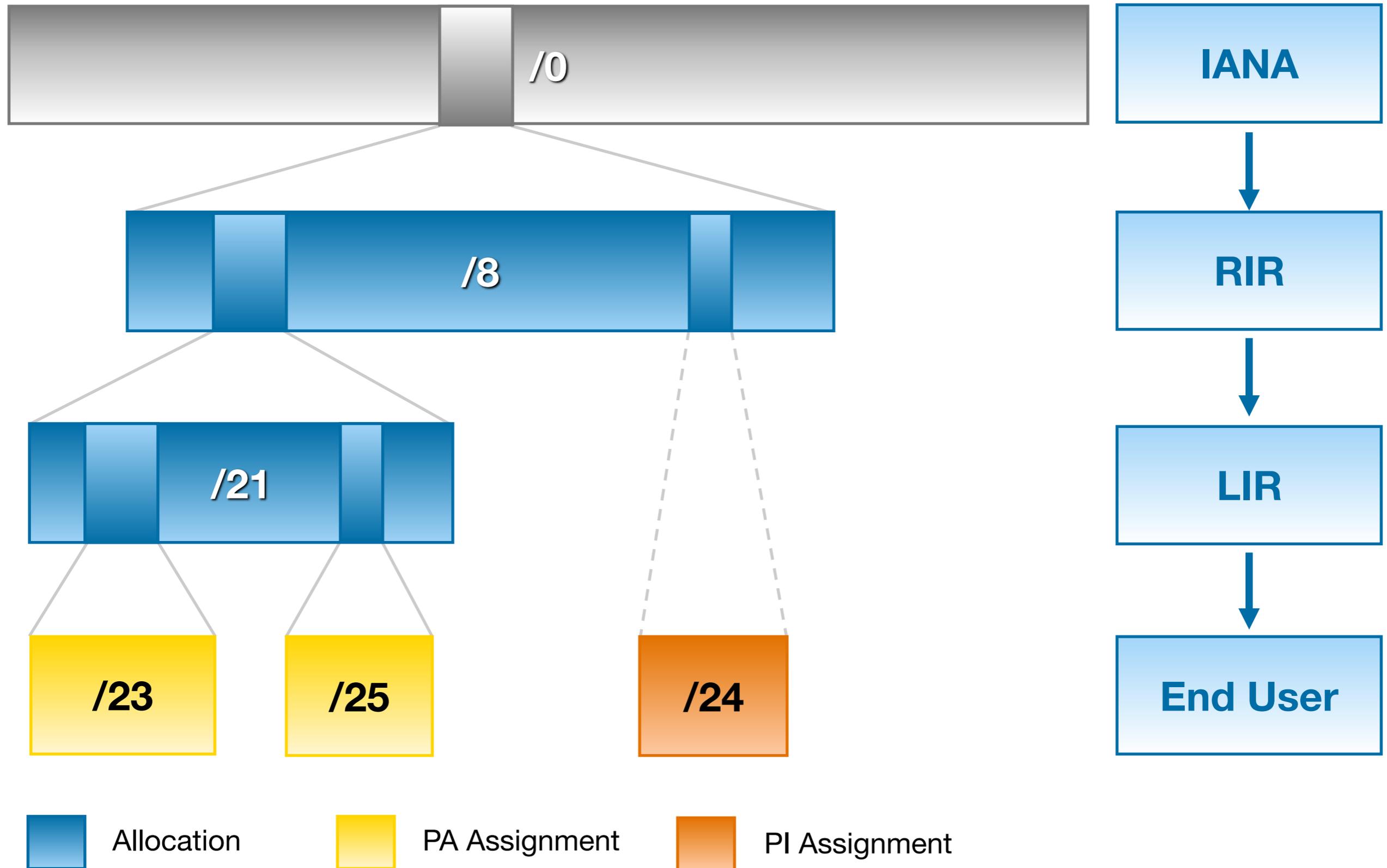


Goals: Conservation

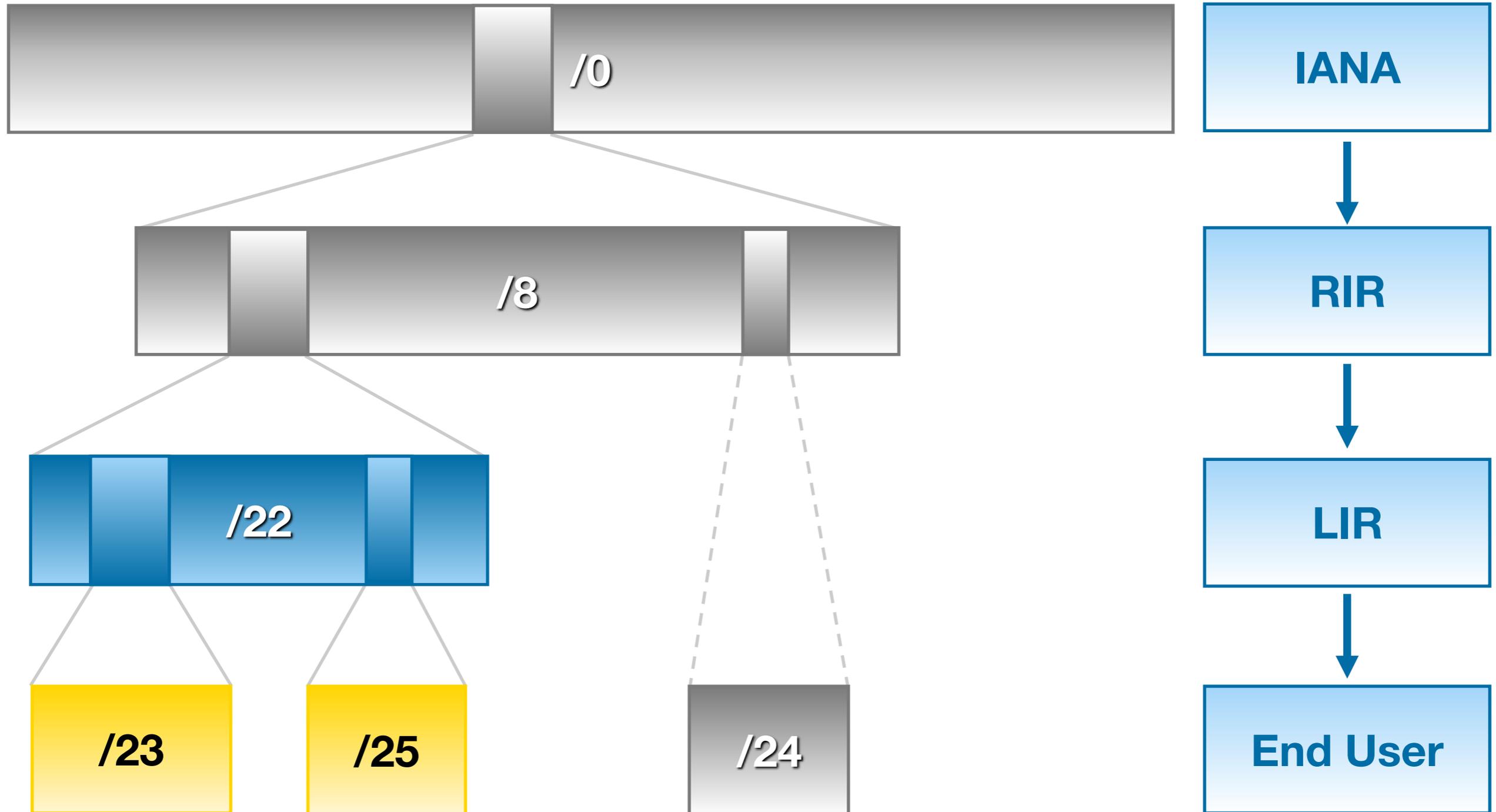


- **Why?**
 - IP addresses and AS Numbers are limited resources
 - These resources were not used efficiently in the past
- **How?**
 - Introduction of CIDR
 - Policies to ensure fair usage
- **Results:**
 - Growth in IP address space usage slowed down
 - Resources were distributed based on need

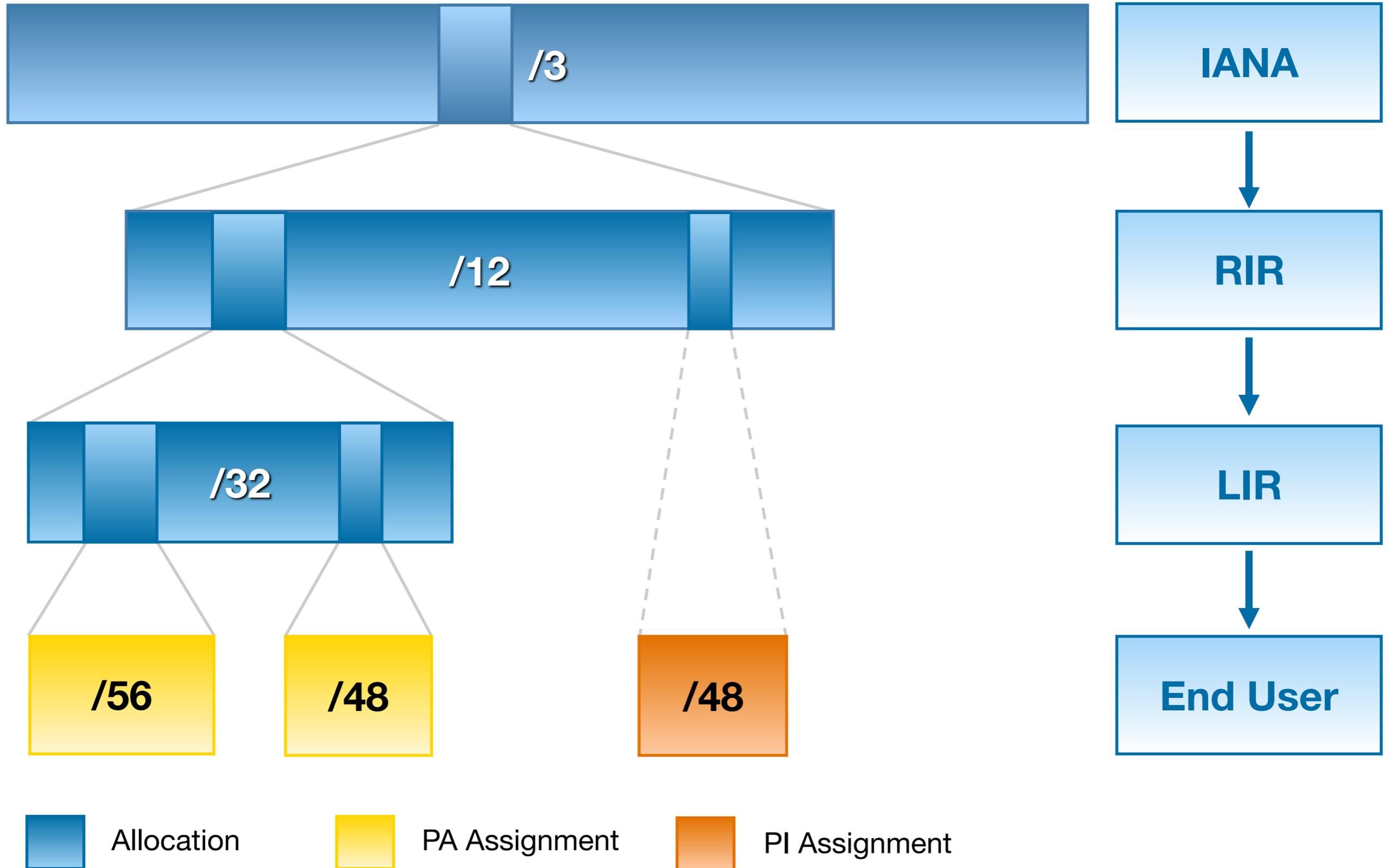
IPv4 Address Distribution - Historical



IPv4 Address Distribution - Current



IPv6 Address Distribution



RIPE NCC



- Began operating in 1992
- Not-for-profit membership organisation
- 12,000+ members (Local Internet Registries)
- Neutral, Impartial, Open, Transparent
- Provides administrative support to RIPE

Réseaux IP Européens (RIPE)



- Started in 1989
- Discussion forum open to all parties interested
- Not a legal entity and no formal membership
- Develops policies
- Work done in Working Groups
- Activities are performed on a voluntary basis
- Decisions formed by consensus

RIPE Community



- 2000+ subscribed to Address Policy Mailing list
- 678 Attendees at RIPE 70, May 2015
- Includes business, government, regulators, law enforcement agencies, civil society, academia, private citizens
- Meets twice a year at the RIPE meetings

RIPE





Participating

Section 2

Does it affect you?



- Listen to the policy proposal
- Hear the pros and the cons
- Does this policy proposal affect your business?
- Are you in favour or against it?

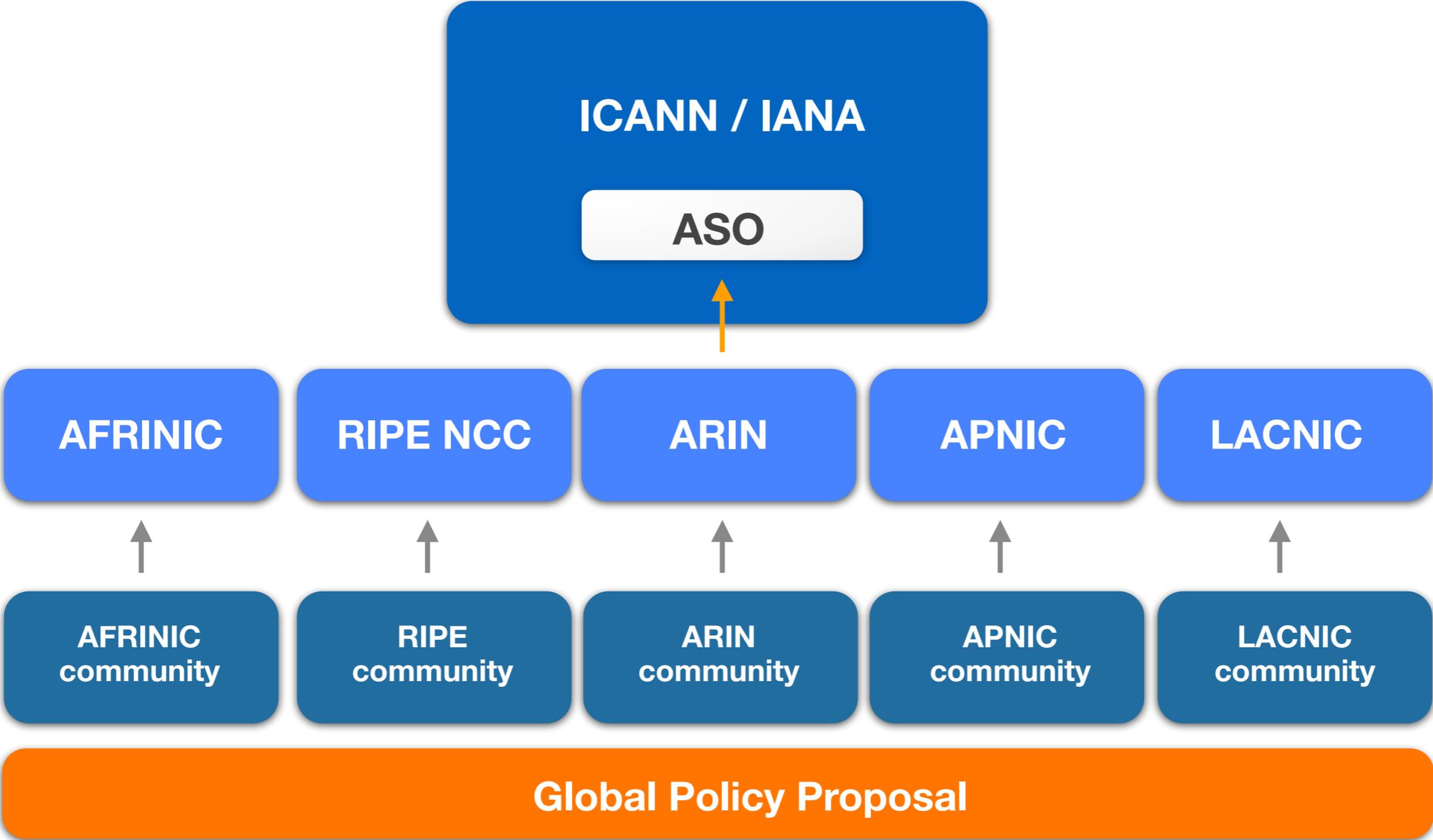


Policy Development Process



- **Open**
 - Anyone can participate
 - On mailing lists and at meetings
- **Transparent**
 - List discussions archived publicly
 - Meetings transcribed
- **Developed bottom-up**
 - **YOU** make the policies
 - The RIPE NCC implements them

Who Makes Policies ?



Who Does What ?



- **The RIPE community**
 - Creates proposals
 - Discusses proposals
 - Seeks consensus
- **Working Group (WG) chairs**
 - Accept proposals
 - Chair the discussions
 - Decide if consensus has been reached

Who Does What ?



- **The RIPE NCC**
 - Acts as the secretariat to support the process
 - Publishes the documents
 - Implements the proposals

Working Groups



- Address Policy
- Routing
- Database
- Anti-abuse
- Cooperation
- IPv6
- RIPE NCC Services
- Connect
- Open Source
- Measurement, Analysis and Tools

Participating in the PDP



- Sign up for the **Policy Development Process Announcements** mailing list
- Join in discussions about policy proposals
- Stay up-to-date with new policies
- Propose a new policy

RIPE NCC General Meeting



- Discuss the RIPE NCC operations and activities
- Give feedback on the Budget and Activity Plan
- Vote on:
 - Charging Scheme, Resolutions
 - Executive Board membership
 - Financial Report





Questions

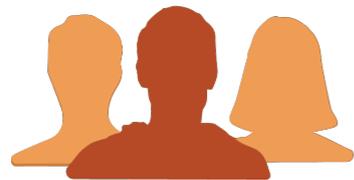




Being an LIR

Section 3

What is in the Local Internet Registry?



Name of the organisation
or person operating the LIR



Contact Information

- Postal address
- Phone numbers
- Email addresses



List of contact persons



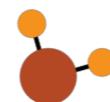
Billing details

- Allocations
- PI assignments



IPv4 & IPv6

- Allocations
- PI assignments



AS Numbers



Preferences

LIR's Responsibilities



- Make assignments
- Register assignments in the RIPE Database
- Keep the registry up-to-date

... following RIPE policies!

RIPE NCC Access



- Our single sign-on system
- To RIPE NCC tools
- Non-LIRs can get an account too
- Use Two-step Verification for added security

<http://access.ripe.net>

LIR Portal



RIPE NCC
Access



LIR Portal

My LIR

- General Information
- Billing Details
- LIR Contacts
- GM Preferences
- Manage Users

Resources

- IPv4 Analyser
- IPv6 Analyser
- IPv4
- IPv6
- ASN
- Request Forms
- Object Editors
- IPv4 Transfer Listing Service

Allocations (42)

Allocation	Usage
62.142.0.0 - 62.142.255.255	62.8%
62.248.128.0 - 62.248.255.255	100%
80.188.0.0 - 80.188.255.255	100%
81.197.0.0 - 81.197.255.255	100%
80.81.160.0 - 80.81.191.255	87.8%
82.103.192.0 - 82.103.255.255	15.3%
82.118.192.0 - 82.118.255.255	33.4%
83.245.128.0 - 83.245.255.255	50%
84.230.0.0 - 84.231.255.255	50%
85.76.0.0 - 85.79.255.255	79%
85.156.0.0 - 85.156.255.255	100%
88.112.0.0 - 88.115.255.255	100%
91.152.0.0 - 91.159.255.255	100%
193.84.0.0 - 193.86.255.255	36.3%
193.94.0.0 - 193.94.255.255	92.4%
193.184.0.0 - 193.185.255.255	92.4%
193.199.0.0 - 193.199.255.255	18.7%
193.229.0.0 - 193.229.255.255	34%
194.86.0.0 - 194.86.255.255	68.5%
194.136.0.0 - 194.136.255.255	40.9%
194.157.0.0 - 194.157.255.255	21.7%
194.188.0.0 - 194.188.255.255	58.2%
194.211.0.0 - 194.211.255.255	72.8%
194.240.0.0 - 194.241.255.255	66.1%

Grand Totals

Total Addresses	Infra	Used	Free
3,088,384	7.0%	69.6%	30.4%

In 42 Allocations: 215,323 Addresses, 2,149,128 Addresses, 939,256 Addresses

Free Space

Want to assign a free block? Select the desired prefix size in the drop-down below for a suggestion.

Size: /23

Using a conservative algorithm the best suggestion is 62.142.34.0/23, this prefix matches one of your free blocks exactly in size.

Notifications

You currently have no notifications.

2a01:9e00::/32 - ALLOCATED_BY_LIR - UK-FAELIX-20110201

Prefix	Assignments
2a01:9e00:4000::/34	1 Assignments of /48
2a01:9e00:7ff::/48	5 Assignments of /64
2a01:9e00:a000::/38	1 Assignments of /56
2a01:9e00:a217::/48	1 Assignments of /64
2a01:9e00:2a3c::/30::/53	5 Assignments of /64
2a01:9e00::/64	4 Assignments of /128

More specific Inetnum

Inetnum	Status	Date	Size	AsgSize	Netname
2a01:9e00:4000::/34	ALLOCATED_BY_LIR	03-02-2011	/34		UK-FAELIX-CUSTOMER
2a01:9e00:a000::/38	ALLOCATED_BY_LIR	04-02-2011	/38		UK-FAELIX-TUNNEL
2a01:9e00:a217::/48	ALLOCATED_BY_LIR	03-02-2011	/48		UK-FAELIX-FAELIX
2a01:9e00:7ff::/48	ALLOCATED_BY_LIR	23-06-2012	/48		UK-FAELIX-CROSSCONNECT

RPKI Dashboard

2 CERTIFIED RESOURCES | NO ALERT EMAIL CONFIGURED

2 BGP Announcements

2 Valid | 0 Invalid | 0 Unknown

2 ROAs

2 OK | 0 Causing problems

BGP Announcements

Origin AS	Prefix	Current Status
AS2121	193.0.24.0/21	VALID
AS2121	2001:57c:54::/48	VALID

Show 25 of 2 items

And more...



LIR Portal

Demonstration

What Should the RIPE NCC Know?



- If any of these change:
 - Company name
 - VAT number
- Company acquisitions and mergers
- Bankruptcy
- Transfer of resources to another organisation

Closing LIRs



- **The RIPE NCC may close an LIR if:**
 - The LIR cannot be contacted by the RIPE NCC for a significant period of time
 - The LIR consistently violates RIPE community's policies
 - The LIR does not pay its fee
- **The RIPE NCC takes on responsibility for address space held by closing LIRs**



Being an LIR contact

Exercise

Exercise: Being an LIR Contact



- **Time**
 - 15 minutes
- **Goal**
 - Understand the tasks of an LIR contact
- **Scenario**
 - It is your first day as an LIR contact. In which order would you complete these tasks?



The RIPE Database

Section 4

RIPE Database



- **Public Internet resource and routing registry database**
 - Resources (IP addresses, AS Numbers)
 - Contact information for resources
 - Reverse DNS delegations
 - Routing policy

RIPE Database Objects



- **Resources**
 - inetnum, inet6num, aut-num
- **Contact**
 - organisation, person, role
- **Routing**
 - route, route6
- **Reverse DNS**
 - domain
- **Security**
 - mntner

Querying the RIPE Database



- Web interface
- Full Text Search
- Command line
- Restful API (XML/JSON)

Search term

Show full object details ?

Do not retrieve related objects ?

You can search up to 5 terms at once in the search box above, separating them with a semicolon.

Sources	Types	Hierarchy Flags	Inverse lookup
<input checked="" type="radio"/> RIPE Database ?			
<input type="radio"/> TEST Database ?			
<input type="radio"/> Global Resource Service (GRS) ?			

By submitting this form you explicitly express your agreement with the [RIPE Database Terms and Conditions](#)

Search



Querying the RIPE Database

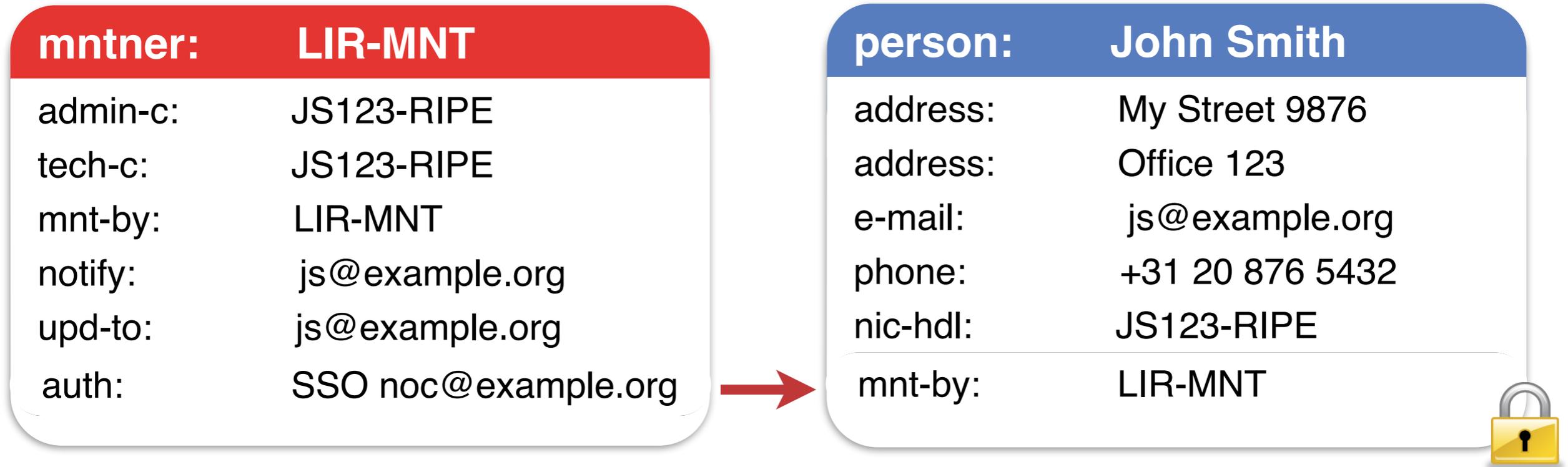
Demonstration

Don't Get Blocked!



- Email addresses are filtered
 - person/role/mntner objects
- Maximum number of queries per day
 - When exceeding, you get **blocked**
- Use “--no-personal” flag to limit the query
- Request to be whitelisted

Protecting Your Objects



Sign in using your RIPE NCC Access account

If you don't have a RIPE NCC Access account, [click here to create one.](#)

Email

Password

Sign in

[Forgot your password?](#)



Creating an object



- Webupdates
- Syncupdates
- Email updates
- Restful API (XML/JSON)

Object type: ?

select a type

Source Database: ?

- RIPE Database
- TEST Database

Operation:

- Create object by individual fields
- Create object in single text area

Create

Creating an object



Create a new inetnum object

inetnum	<input type="text"/>	▼	+	🗑️	?
netname	<input type="text"/>	▼	+	🗑️	?
descr	<input type="text"/>	▼	+	🗑️	?
country	<input type="text"/>	▼	+	🗑️	?
admin-c	<input type="text"/>	▼	+	🗑️	?
tech-c	<input type="text"/>	▼	+	🗑️	?
status	<input type="text"/>	▼	+	🗑️	?
mnt-by	<input type="text"/>	▼	+	🗑️	?
source	RIPE	▼	+	🗑️	?

By submitting this form you explicitly express your agreement with the [RIPE Database Terms and Conditions](#) Cancel Submit



Duplicate the attribute



Add a new attribute



Delete the attribute



Info about the attribute

Creating an inetnum object - IPv4



Object successfully created

inetnum	192.30.0.0 - 192.30.0.255
netname	CUSTOMER-NETWORK-001
descr	The IPv4 network of the customer 001
country	NL
admin-c	TP30-TEST
tech-c	TP30-TEST
status	ASSIGNED PA
mnt-by	CM30-MNT
created	2015-07-14T07:34:11Z
last-modified	2015-07-14T07:34:11Z
source	RIPE

Creating an inet6num object - IPv6



Object successfully created

inet6num	2001:ff30:cafe::/48
netname	CUSTOMER-NETWORK-001
descr	The IPv6 network of the customer 001
country	NL
admin-c	TP30-TEST
tech-c	TP30-TEST
status	ASSIGNED
mnt-by	CM30-MNT
created	2015-07-14T07:36:15Z
last-modified	2015-07-14T07:36:15Z
source	RIPE



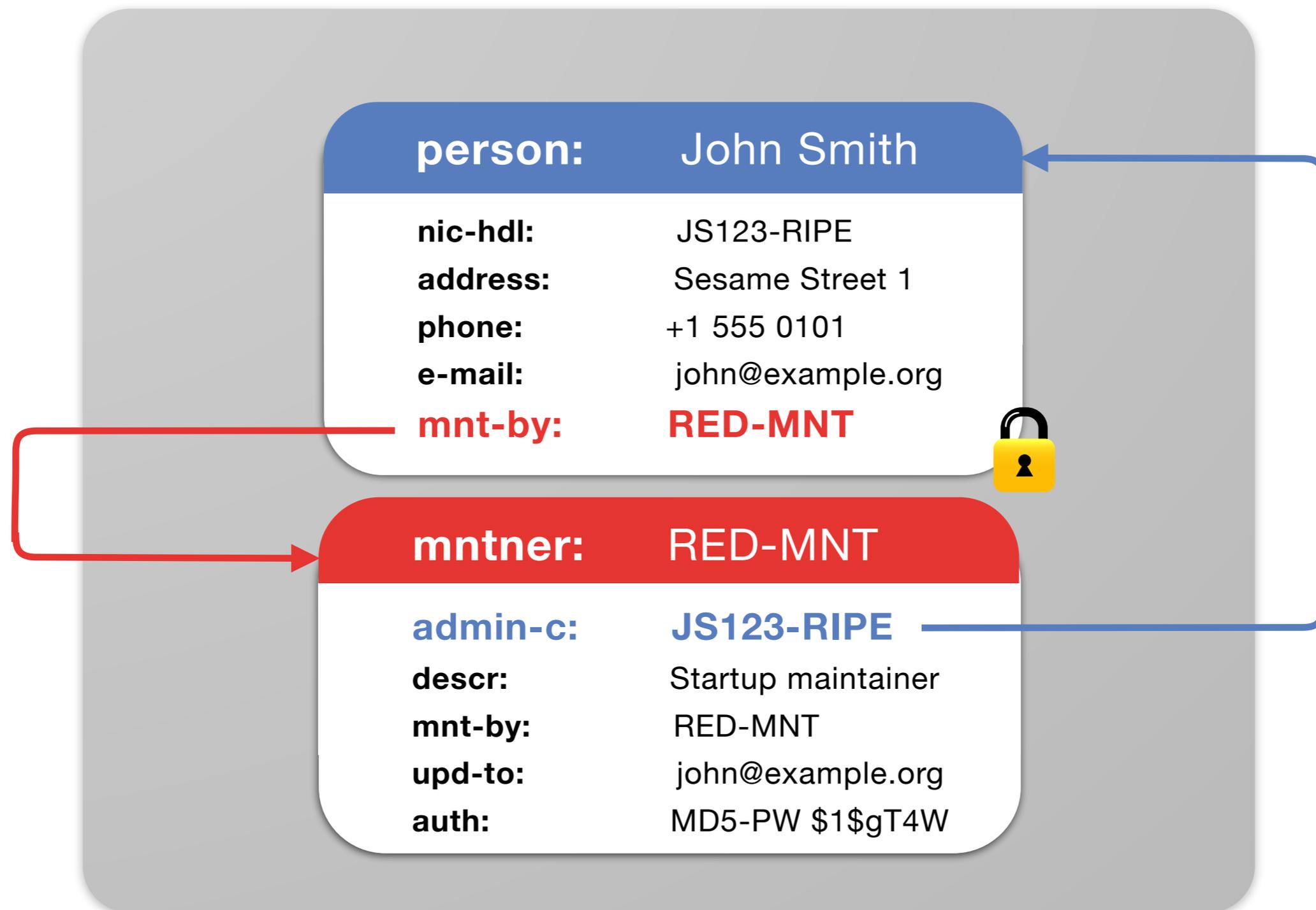
Updating the RIPE Database

Demonstration

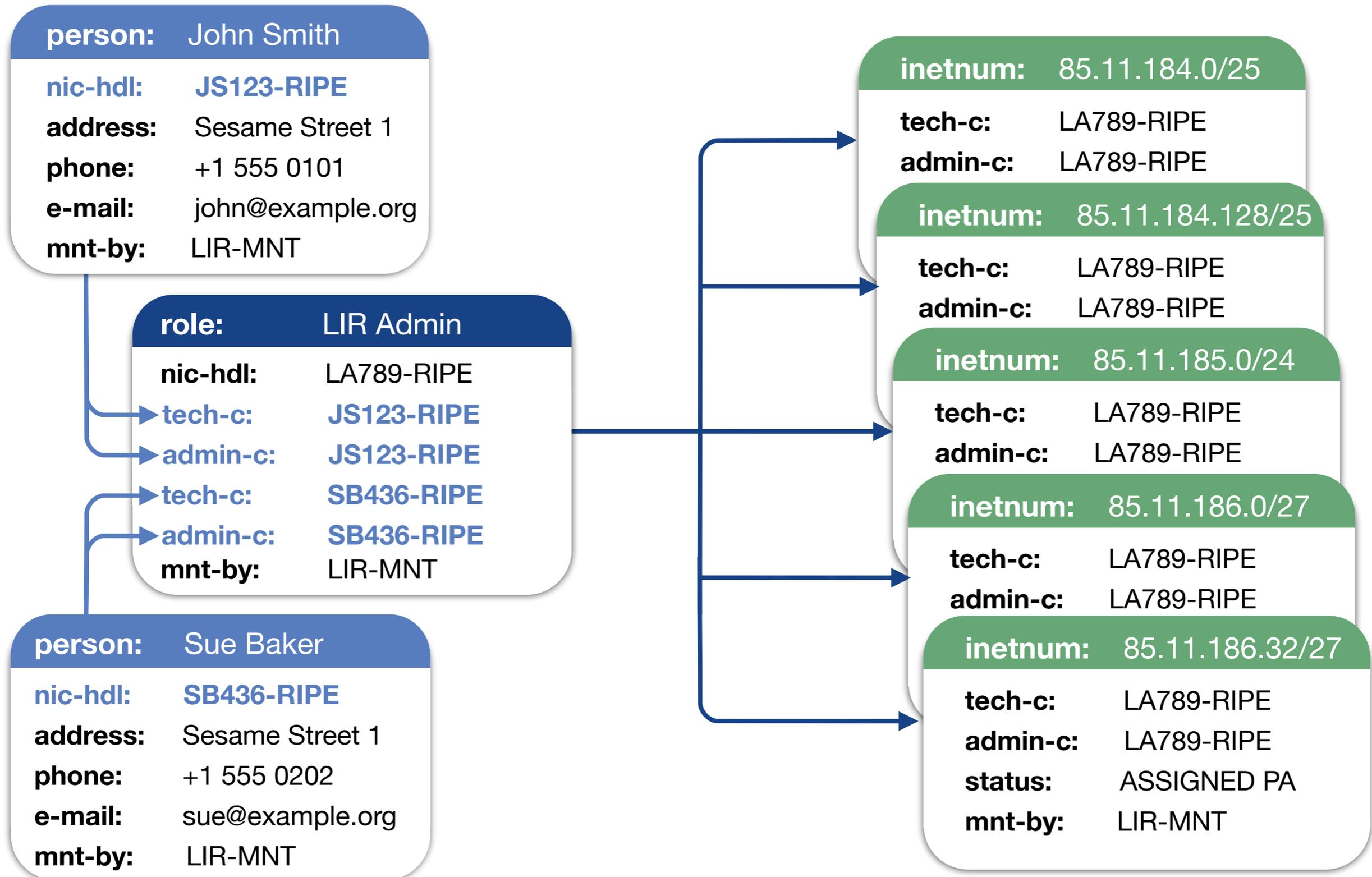
Person object: contact info



- Creation of first **person** - **mntner** object pair



Using a role Object





Questions





Getting Resources

Section 5

Terminology



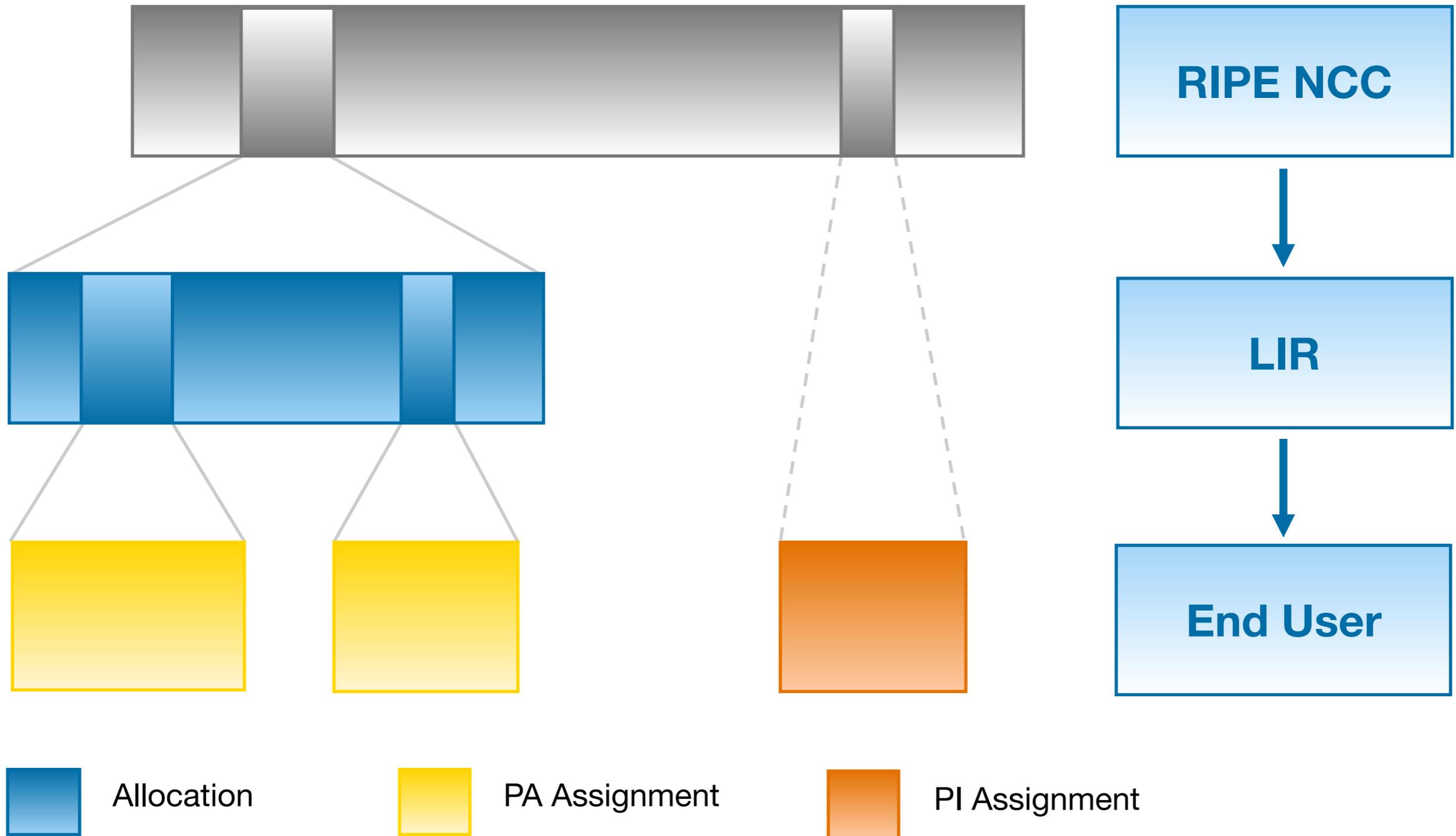
- **Allocation**

- Block of IP addresses reserved for future use

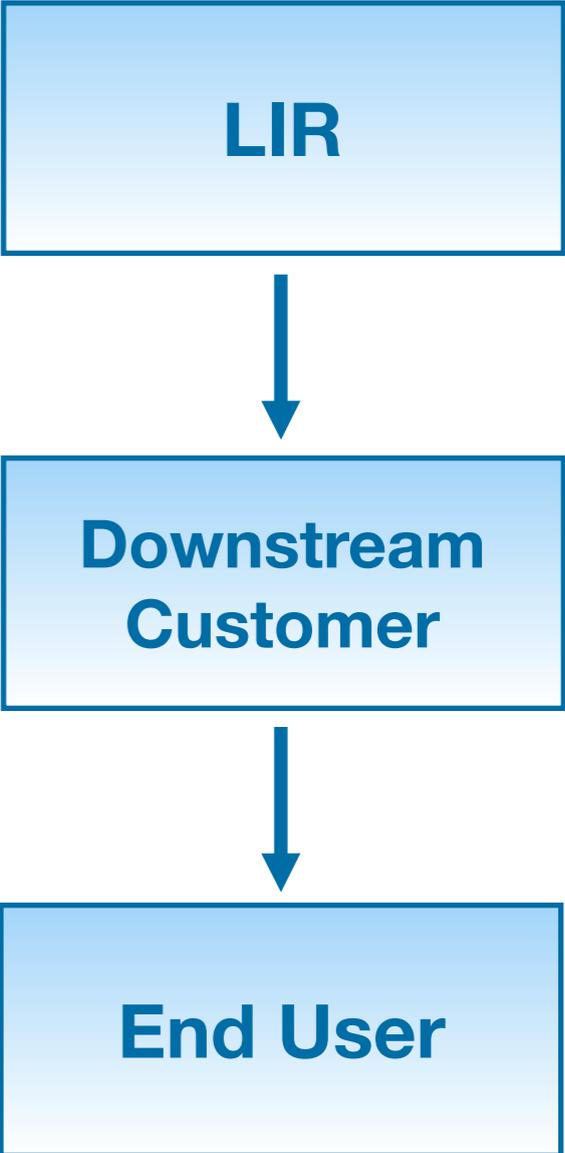
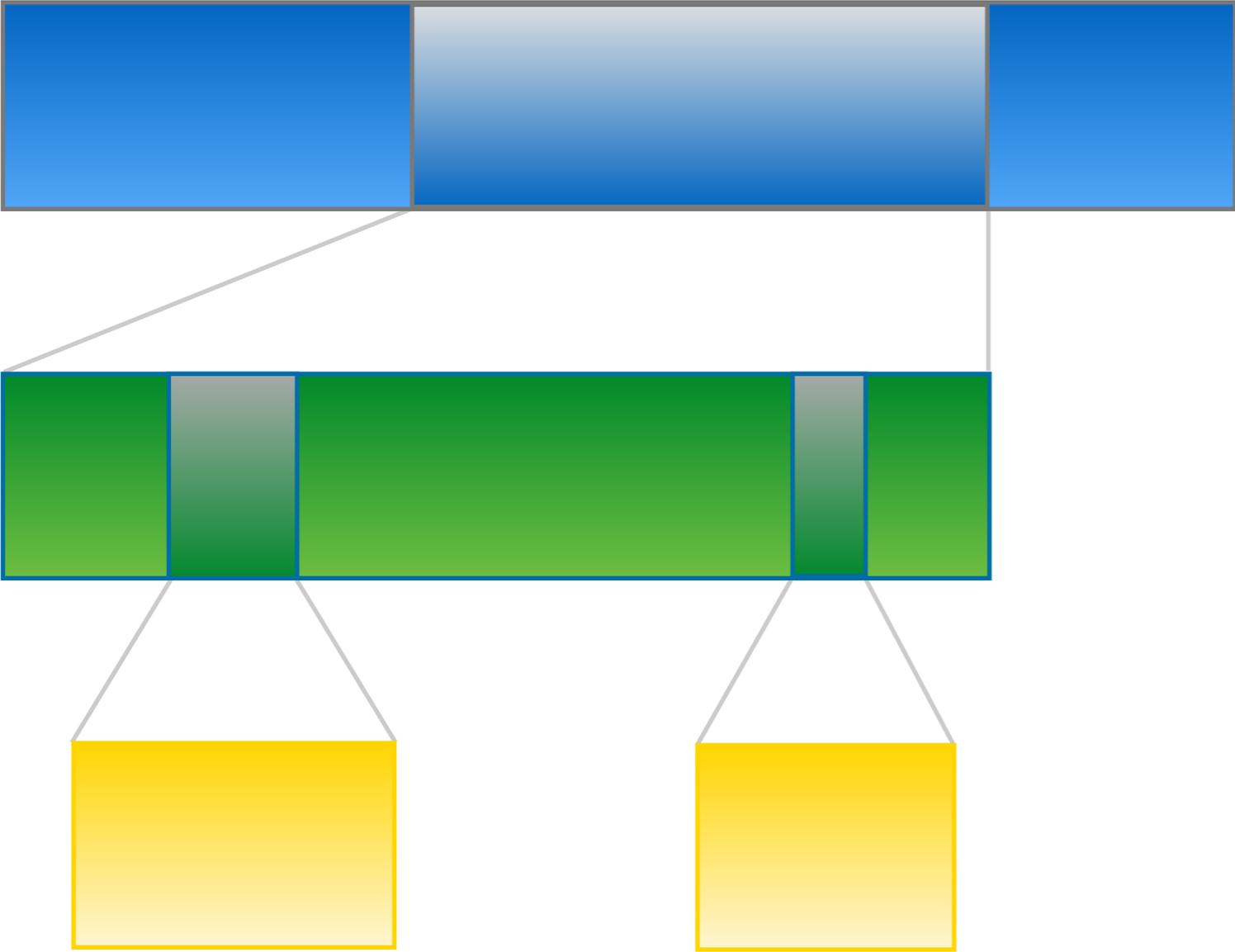
- **Assignment**

- A chunk of addresses from an allocation that is used:
 - in your own infrastructure
 - in an End User network

Allocation and Assignment



Sub-allocations



PA Allocation



PA Sub-allocation



PA Assignment

Types of Address Space



- **Provider Aggregatable (PA)**
 - Assignments made from member's allocation
 - Allocated to LIR / Assigned by LIR
 - Address space remains with LIR
 - Customer has to renumber when changing ISP
- **Provider Independent (PI)**
 - Assignment made directly by the RIPE NCC
 - Assigned to End User
 - End User takes the address space with them

First IPv6 Allocation



- **Create mntner, person and role objects**
 - Use the new organisation startup tool
- **Submit the First IPv6 Allocation Request form**
 - Have a plan for making assignments within two years
- **Minimum allocation size is /32**
 - Up to a /29 without additional justification
 - More if justified by customer numbers and the extent of the infrastructure

Requesting an IPv6 PI Assignment



- Every PI Assignment must have a Sponsoring LIR
- Needs organisation, person and mntner objects
- Minimum size = /48
- Send us:
 - PI Assignment Request Form
 - End User Assignment Agreement
 - Company registration document or picture ID (for a private individual)

IPv6 PI Assignments



- **PI space cannot be used for sub-assignments!**
 - Not even a single address for the connection
 - If you have customers, you cannot use PI for them

inet6num:	2001:db8:1234::/48
descr:	Some PI Assignment
status:	ASSIGNED PI
mnt-by:	RIPE-NCC-END-MNT
mnt-by:	ENDUSER-MNT
mnt-routes:	ENDUSER-MNT
mnt-domains:	ENDUSER-MNT

- **Yearly charges for PI Assignments**
 - See the RIPE NCC Charging Scheme

IPv4 Allocation from the Last /8



- **Submit the IPv4 Allocation Request form**
 - Use the same mntner, person and role objects from the IPv6 allocation
- **Each LIR can get one /22 block**
 - = 1024 IPv4 addresses
- **Cannot be transferred within 24 months after receiving it**

IPv4 PI Assignments



- Since IPv4 exhaustion, no new PI assignments
- No sub-assigning allowed
- Yearly charges for PI Assignments
 - See the RIPE NCC Charging Scheme
- Convert PI assignments into PA allocations

Autonomous System Numbers



- **Assignment requirements**
 - Address space
 - Multihoming
 - One AS Number per network
- **For LIR itself**
- **For End User**
 - Sponsoring LIR requests it for End User
- **32-bit is the default**
 - 16-bit available on request

PI / ASN and Sponsoring LIR



- **Options for End Users holding PI / ASN:**
 - Sign End User Agreement with an LIR
 - Become an LIR themselves
 - Return the resources
- **Sponsoring LIR is published in the RIPE Database**



Getting IPs and ASNs

Demonstration



Transfers

Section 6

Types of Transfers



PA allocations

between RIPE NCC members

Merger or Acquisition

PI assignments

between End Users

From Legacy Space

AS numbers

between End Users

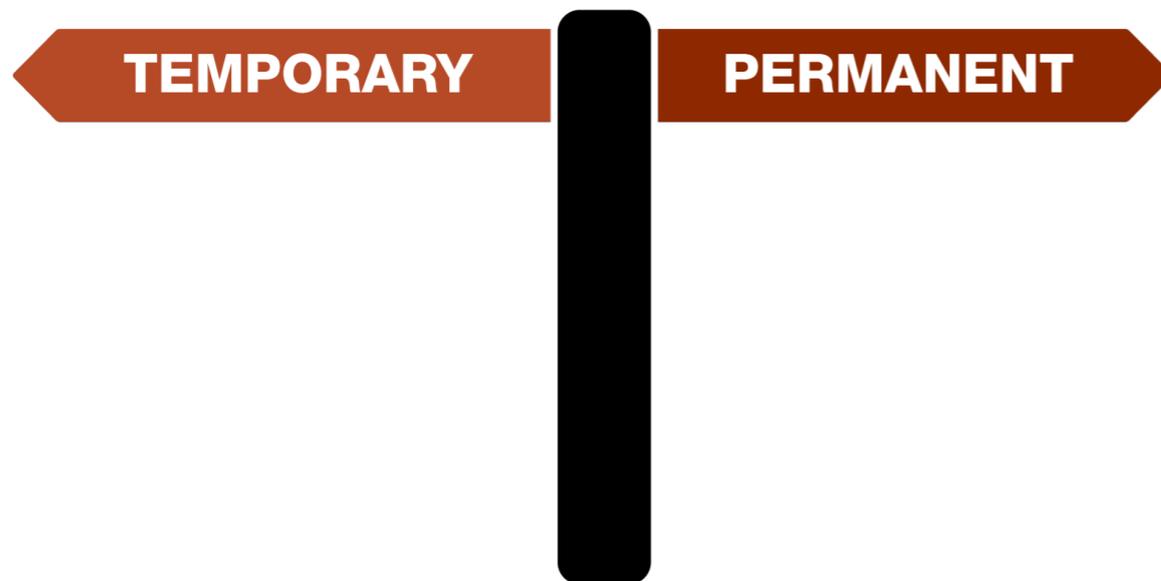
Inter-RIR

**COMING
SOON!**

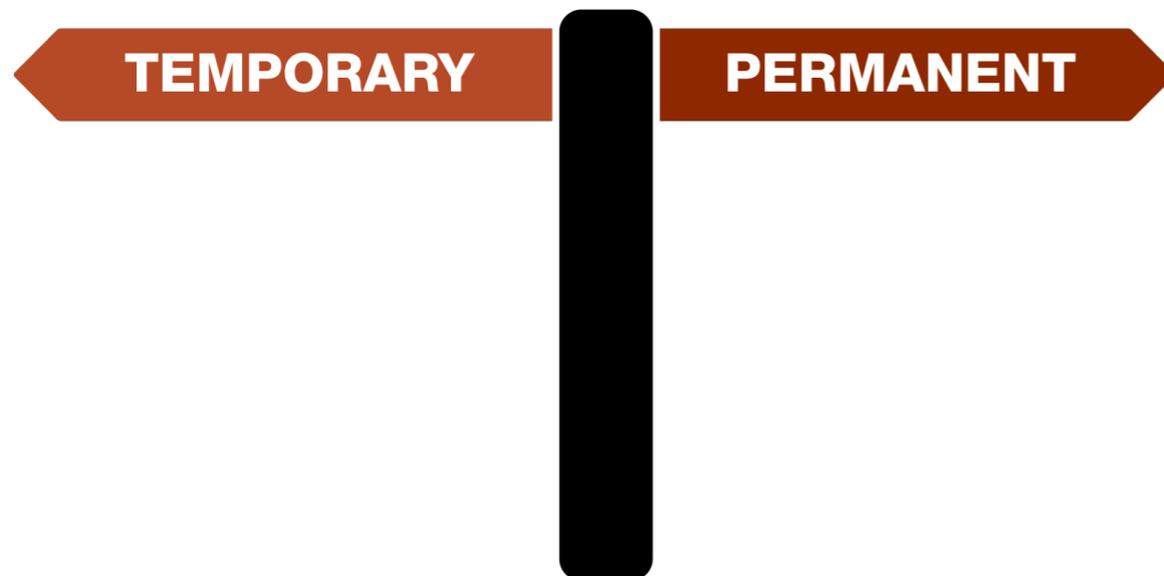
IPv4 Allocation Transfers



LIR → **LIR**



IPv4 PI Assignment Transfers



SPONSORED BY
YOUR LIR

IPv4 Transfers: Where to Look



- **IPv4 Listing Service**

- Accessible from LIR Portal account

- **Brokers**

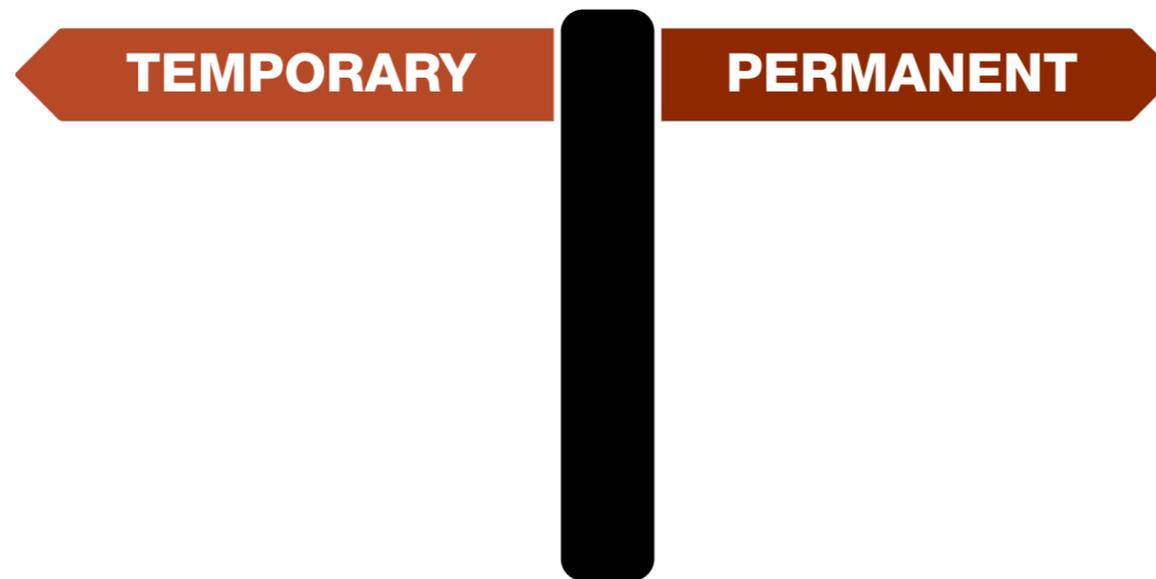
- Listed on RIPE NCC website
- **NOT** endorsed by RIPE NCC
- Signed an agreement to conform to RIPE Policies

IPv6 Allocation Transfers



LIR → **LIR**

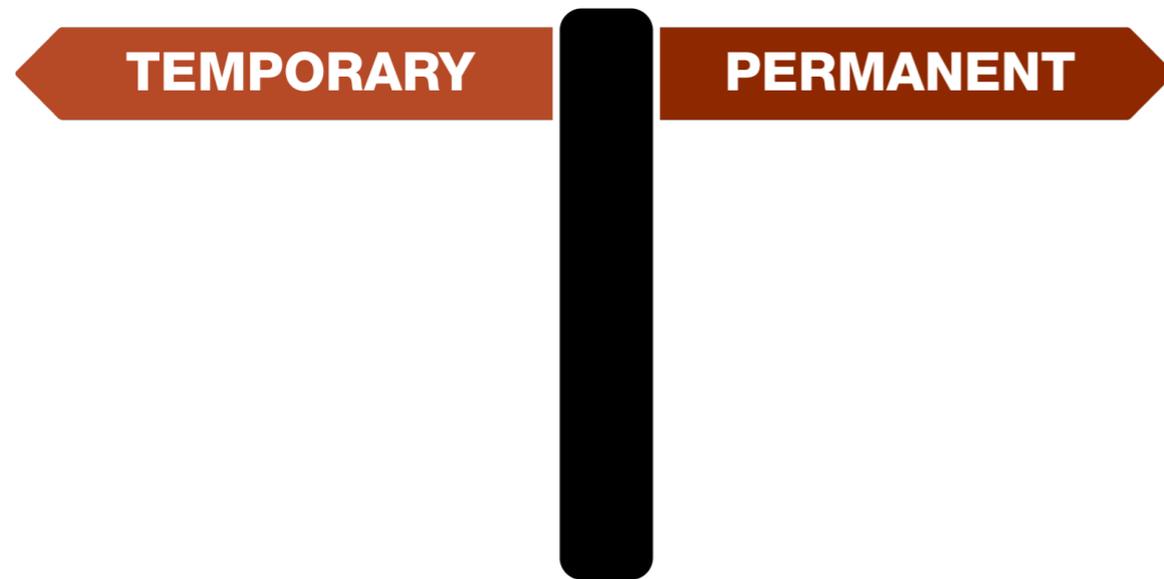
MIN
SIZE
/32



IPv6 PI Assignment Transfers

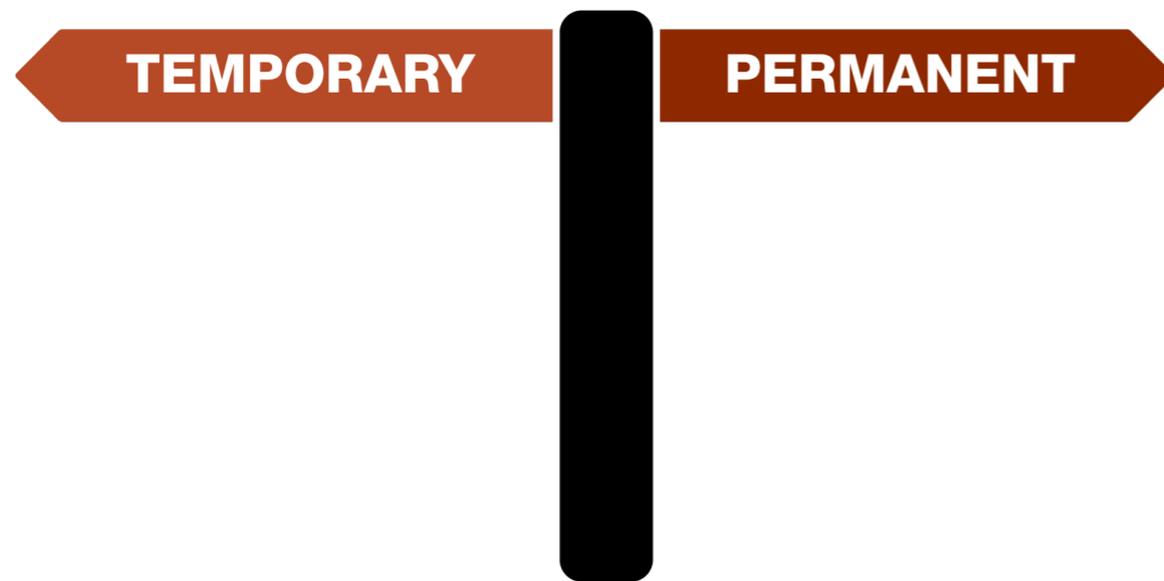
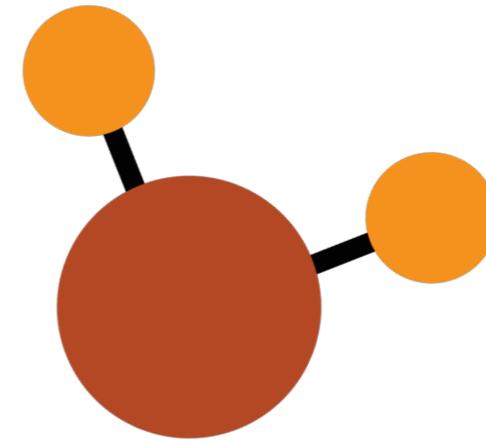


MIN
SIZE
/48



SPONSORED BY
YOUR LIR

AS Number Transfers



SPONSORED BY
YOUR LIR

Transfers: How to Request



- Send an email to lir-help@ripe.net
- Include the following information & documents:
 - IPv4 / IPv6 / ASN being transferred
 - company names and contact details
 - company registration papers
 - Transfer Agreement
 - For PI transfers, sponsoring LIR agreement is needed too



Questions





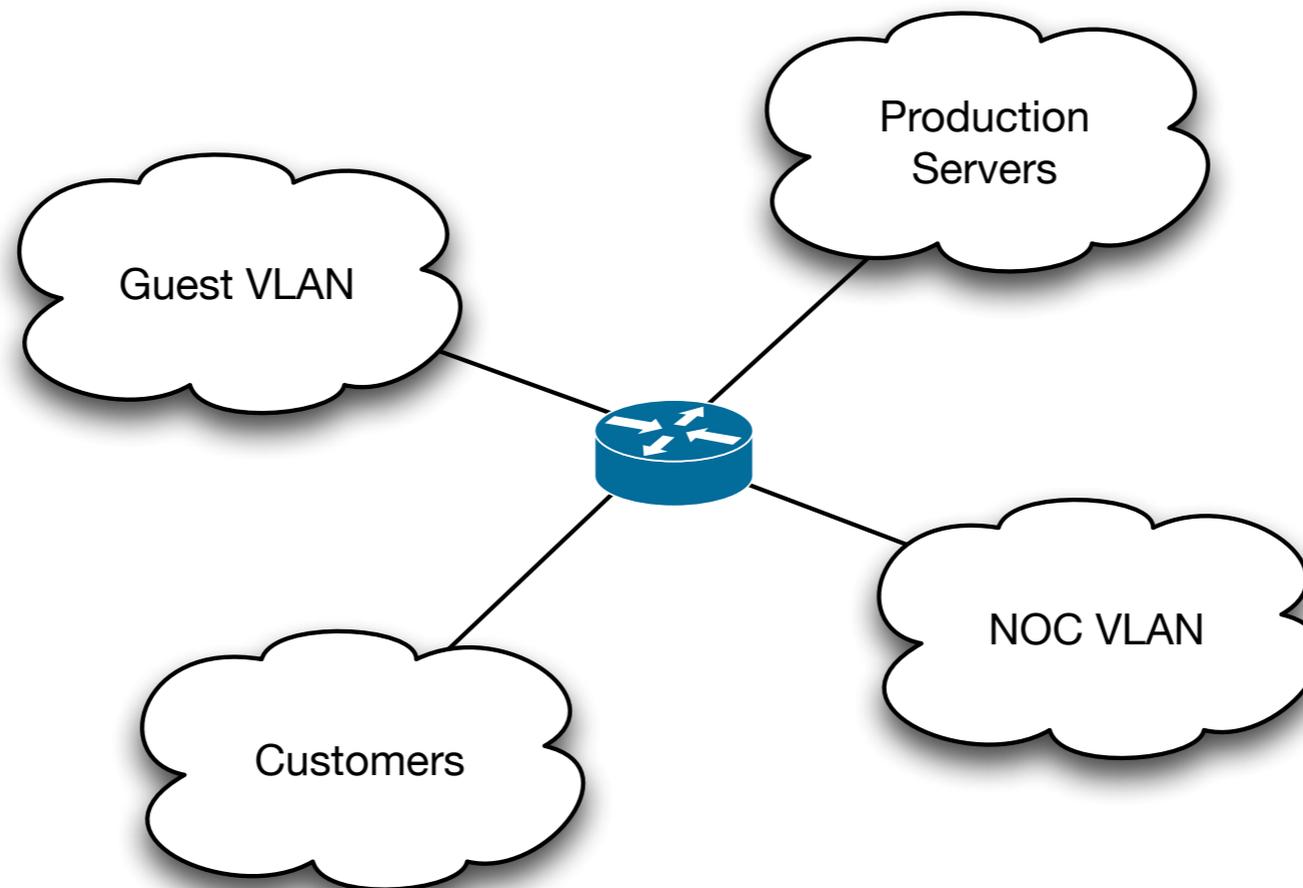
Distributing Resources

Section 7

How Much Address Space?



- Think about how the network will be split up
- Subnets are used to group hosts



- Calculate how much address space you will need!

IPv4 subnets



- 3 IPs required per subnet
 - network
 - broadcast
 - gateway
- Usable IPs = [subnet size] - 3 IPs
 - /24 = 256 IPs = 256 - 3 = 253 usable IPs

IPv6 Subnets



/64 = 1 subnet = 18,446,744,073,709,551,616 IPs

...

/60 = 16 subnets

...

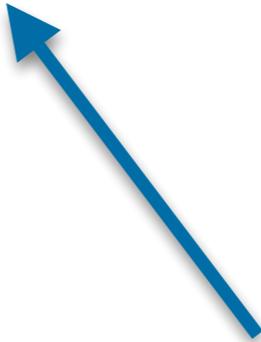
/56 = 256 subnets

...

/52 = 4096 subnets

...

/48 = 65536 subnets



*In IPv6
the amount of hosts
in a subnet is
irrelevant!*



Making Assignments

Exercise

Exercise: Making assignments



- **Time**
 - 30 minutes
- **Goal**
 - Understand and practice the Assignment Process
- **Task**
 - Ask the End User for more information, if needed
 - Decide the assignment sizes

IPv6 Assignments



- Default IPv6 subnet = /64
- Every “end site” can be assigned between /64 and /48 without prior approval of the RIPE NCC
 - For larger assignments, send in request form
- **Assignments for your own infrastructure**
 - /48 per Point of Presence
 - Additional /48 for the core network

IPv6 Registration in the Database



- All assignments and sub-allocations must be registered to make them valid!

inet6num: 2001:db8:aaaa::/48

descr: Customer 321
country: EU
admin-c: LA789-RIPE
tech-c: LA789-RIPE
status: ASSIGNED
mnt-by: LIR-MNT

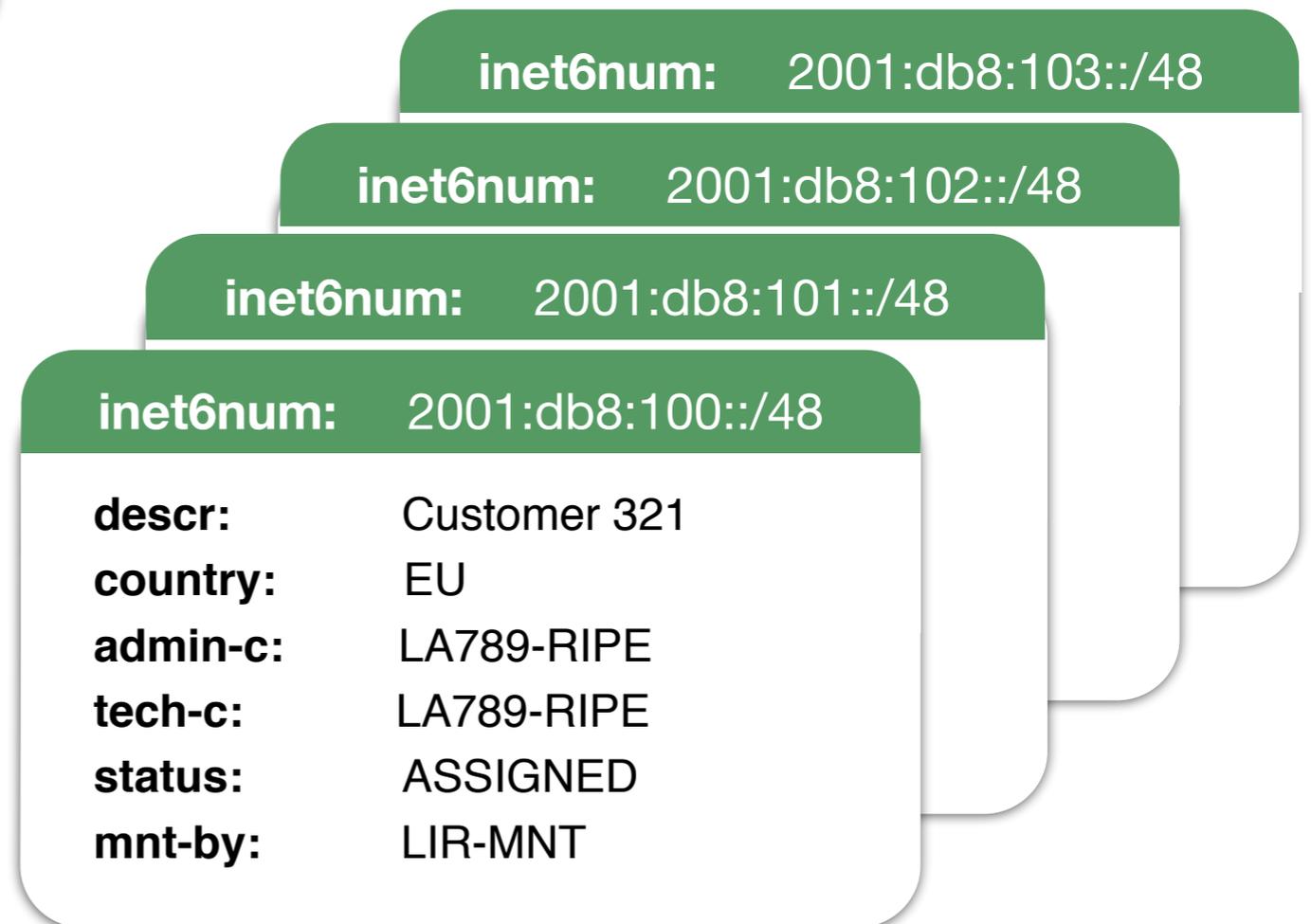
inet6num: 2001:db8:f000::/36

descr: Branch office #1
country: EU
admin-c: LA789-RIPE
tech-c: LA789-RIPE
status: ALLOCATED-BY-LIR
mnt-by: LIR-MNT

Grouping Customer Assignments



inet6num:	2001:db8::/36
descr:	DSL customers
admin-c:	LA789-RIPE
tech-c:	LA789-RIPE
status:	AGGREGATED-BY-LIR
assignment-size:	48
mnt-by:	LIR-MNT



IPv4 Resources



- **LIRs are allocated only one /22**
 - More IPv4 space through transfers
 - Assignment size is limited to total of IPv4 space an LIR holds
- **All assignments must be registered correctly in the RIPE Database**

<http://www.ripe.net/ripe/docs/ipv4-policies.html>

IPv4 Registration in the Database



- All assignments and sub-allocations must be registered to make them valid!

inetnum: 10.0.3.0 - 10.0.3.255

descr: Customer 321
country: EU
admin-c: LA789-RIPE
tech-c: LA789-RIPE
status: ASSIGNED PA
mnt-by: LIR-MNT

inetnum: 10.0.1.0 - 10.0.2.255

descr: Branch office #1
country: EU
admin-c: LA789-RIPE
tech-c: LA789-RIPE
status: SUB-ALLOCATED PA
mnt-by: LIR-MNT

Infrastructure vs. End User



Infrastructure

Blocks for connections to End Users:

- Point of Presence
- Point-to-Point
- Broadband address pools

(Also LIRs own network)

End User

Their equipment, their location

- End User networks
- Offices
- Co-located subnets

Infrastructure vs. End User



Infrastructure

Blocks for connections to End Users:

- Point of Presence
- Point-to-Point
- Broadband address pools

(Also LIRs own network)

Grey Area

Co-location
Server housing
Web hosting
Application Services

End User

Their equipment,
their location

- End User networks
- Offices
- Co-located subnets

When the End User has
a few addresses out of
a larger address block

If the End User has
a separate subnet



Registering the Assignments

Exercise

Exercise: Registering an Assignment



- **Time**
 - 15 minutes
- **Goal**
 - Practice how to register an assignment
- **Task**
 - Use the assignment from the previous exercise
 - Choose the range(s) from your allocation
 - Create the inetnum and inet6num objects in the TEST RIPE Database



Managing Resources

Section 8

Managing IPv6 Address Space



- **Consider your mental health**
 - Use assignments on 4-bit boundary
- **Don't be too conservative**
 - Business customers often get a /48
 - /56 is a popular size for residential customers
- **Use "AGGREGATED-BY-LIR"**
 - to group assignments of the same size

IPv6 Analyser



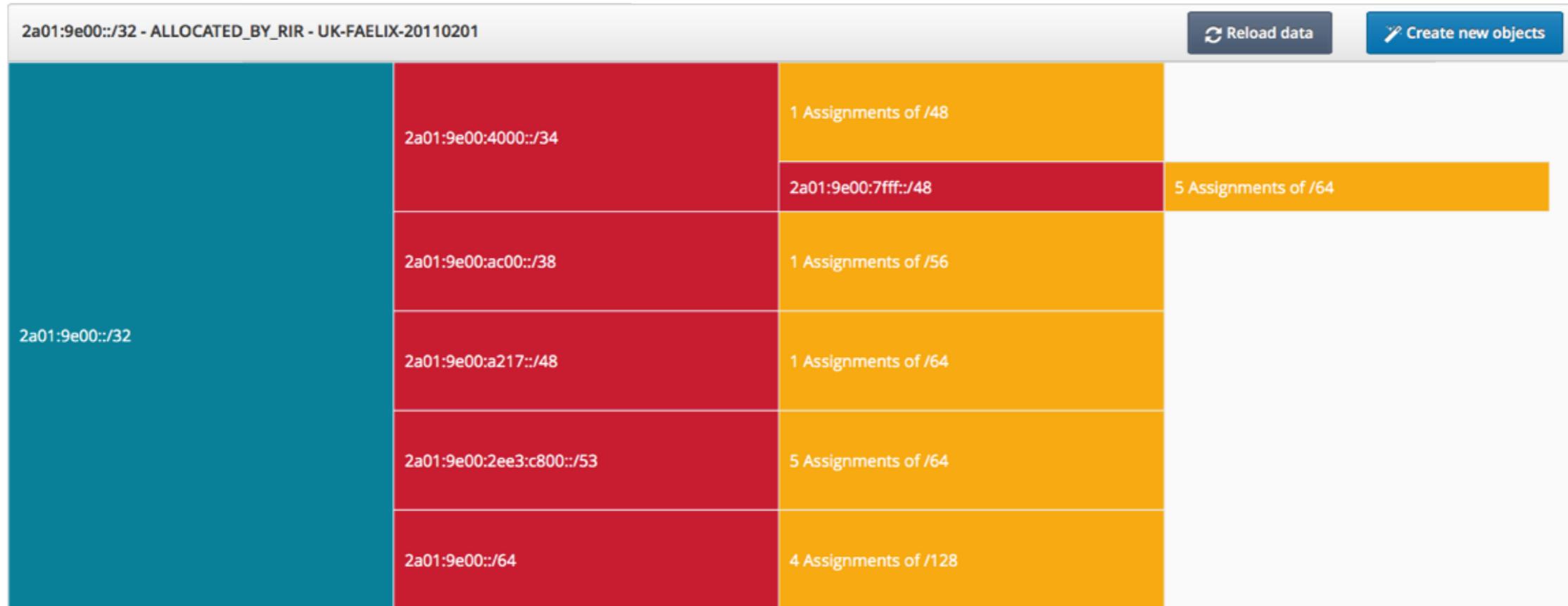
Legend

ALLOCATED-BY-RIR

ALLOCATED-BY-LIR

AGGREGATED-BY-LIR

ASSIGNMENT



More specific inet6nums Filter on range...

inet6num	Status	Date	Size	AsgSize	Netname	
2a01:9e00:4000::/34	ALLOCATED_BY_LIR	03-02-2011	/34		UK-FAELIX-CUSTOMER	⚙
2a01:9e00:ac00::/38	ALLOCATED_BY_LIR	04-02-2011	/38		UK-FAELIX-TUNNEL	⚙
2a01:9e00:a217::/48	ALLOCATED_BY_LIR	03-02-2011	/48		UK-FAELIX-FAELIX	⚙
2a01:9e00:7fff::/48	ALLOCATED_BY_LIR	23-06-2012	/48		UK-FAELIX-CROSSCONNECT	⚙

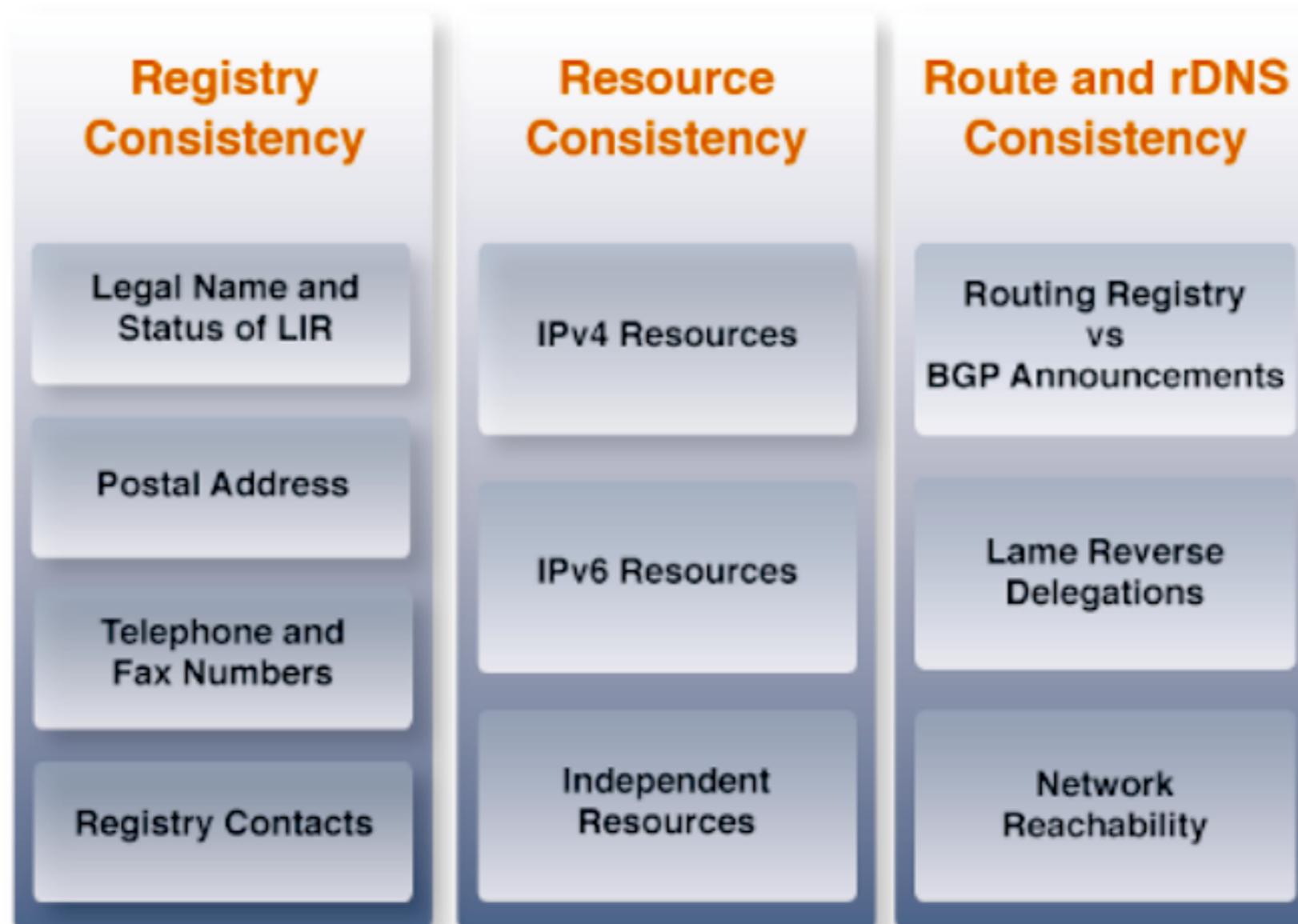
Managing IPv4 Address Space



- LIRs get only one last /22 allocation
 - Make classless assignments
 - inetnum does not have to be CIDR
 - Do not fragment your allocation
- Need is not a criteria for obtaining more IPv4 address space
- Keep the RIPE Database up to date



- Assisted Registry Check



ARC Goals



- Keep registry clean and up to date
- Make you aware of any inconsistencies with the registry data
- Support you with your registration tasks
- Keep in touch with you!

RPKI Digital Resource Certificates



- Issue digital certificates along with the registration of Internet number resources
- Two main purposes:
 - Make the registry more robust
 - Making Internet routing more secure
- Added value comes with validation
 - The possibility to perform BGP Origin Validation



Using Certificates



- **Certification is a free, opt-in service**
 - Your choice to request a certificate
 - Linked to your membership
 - Renewed every 12 months
 - Available in LIR Portal
- **Certificate does not list any identity information**
 - That information is in the RIPE Database
- **Digital proof you are the holder of a resource**
 - and you're authorised to announce it





Questions





Tips and Tools

Section 9

Lost Maintainer Password



- Go to <https://apps.db.ripe.net/change-auth/>
- Automated process
 - Recovery link sent to “**upd-to:**” email address
- Manual process
 - Send statement & registration papers to us
 - After verification, we will send you an email with the recovery link
 - We will add your Access account to the maintainer

Protect Your Resources



- Maintain your contact info in the RIPE database
- Keep your LIR contacts in the LIR Portal up to date
- Know the policies and procedures
- In case of questions, contact

Registration Services

lir-help@ripe.net



RIPE NCC Resource Quality Assistance



- **Address distribution - no claims about routability**
 - Assistance in case of filtering issues:
 - Help to establish a direct communication
 - Provide available contact details
 - Provide information about tools
- **To reduce routability problems, the RIPE NCC:**
 - Announces pilot prefixes of every newly allocated IP address block
 - Quarantines returned IP address space

RIPEstat



- One-stop-shop for viewing all IP-resource related data from RIPE NCC
- Registry data, routing, reverse DNS, measurements & 3rd-party data
- Main interface: web-based widgets
 - also available as: CLI, data API & mobile
 - personalised via RIPE NCC Access

<http://stat.ripe.net>

RIPE Atlas - Active Measurements



- Next generation Internet measurement network
 - Gives a big picture about Internet traffic
- Currently around 8,700 active probes worldwide
- User Defined Measurements available for LIRs
 - ping, traceroute, DNS, SSL
- Set up IPv6 reachability test



<http://atlas.ripe.net>

RIPE Labs



- A place to showcase new and interesting Internet related developments
- Anyone can:
 - Present research
 - Showcase prototype tools
 - Share operational experience
 - Exchange ideas

[**http://labs.ripe.net**](http://labs.ripe.net)



Questions



RIPE NCC Academy



RIPE
NCC ACADEMY

Graduate to the next level!

<http://academy.ripe.net>

Feedback!



<https://www.ripe.net/training/lir/feedback>

Follow us!



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The End!

Край

Y Diwedd

النهاية

Соңы

ჟღერა

Fí

Finis

Ende

Finvezh

Liðugt

Кінець

Konec

Kraj

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Fund

پایان

Lõpp

Beigas

Vége

Son

An Críoch

Kraj

הסוף

Fine

Endir

Sfârșit

Fin

Τέλος

Einde

Конец

Slut

Slutt

დასასრული

Pabaiga

Fim

Amãia

Loppu

Tmíem

Koniec