RIPE NCC
RIPE NETWORK COORDINATION CENTRE

IP Blocklisting Basics

1 hour

Webinar

RIPE NCC Learning & Development

This session is being recorded

Goals

- Explain **why** an IP address can get blocklisted
- **Prevent** IP address blocks from being blocklisted
- **Remove** IP addresses from blocklists using specific techniques
- Implement **best practices** for preventing IP addresses from being blocklisted

Agenda

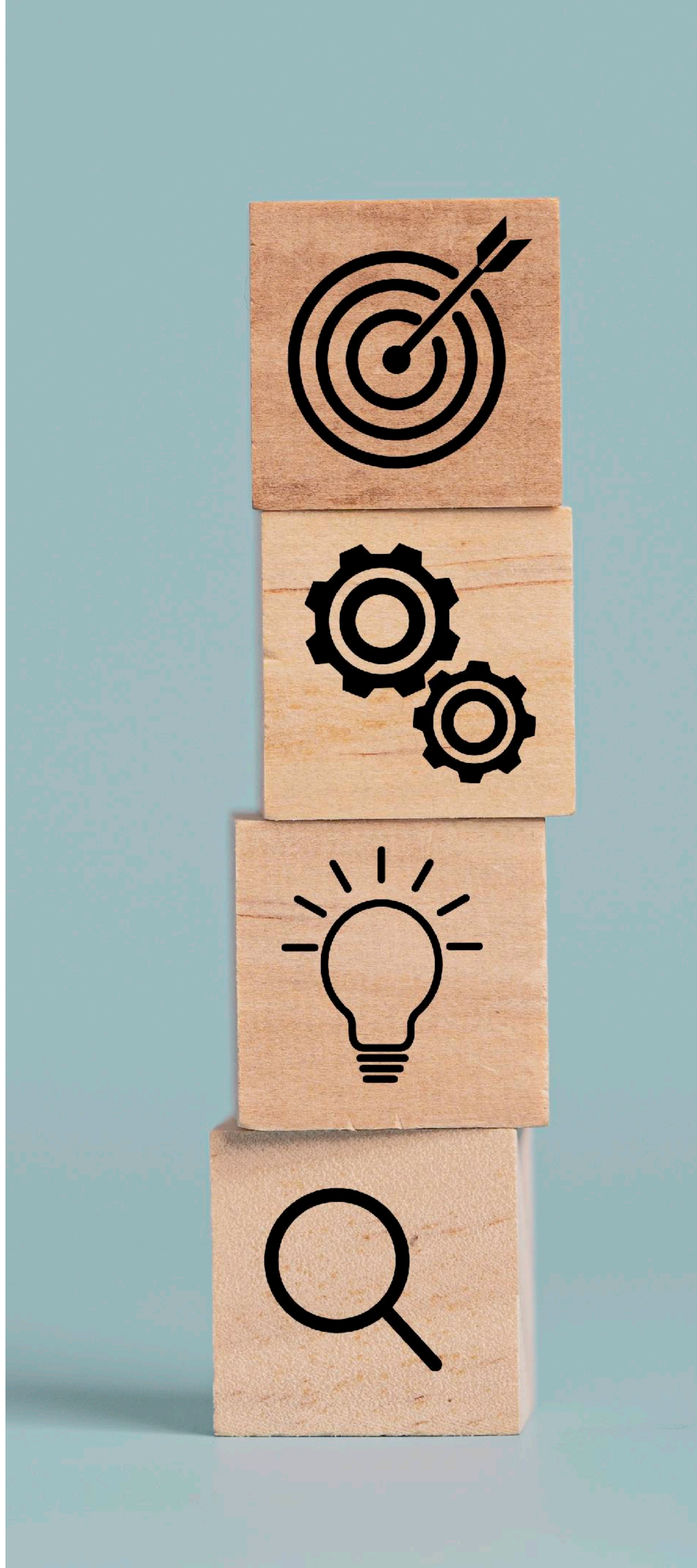
1. Internet, IPs, ASNs, Routing, etc.

2. IP and ASN Blocklists

3-7. How and why an IP prefix or ASN can be blocklisted

8-9. Best Practices:

- How to prevent IPs and ASNs from being blocklisted
- How to remove IPs and ASNs from blocklists



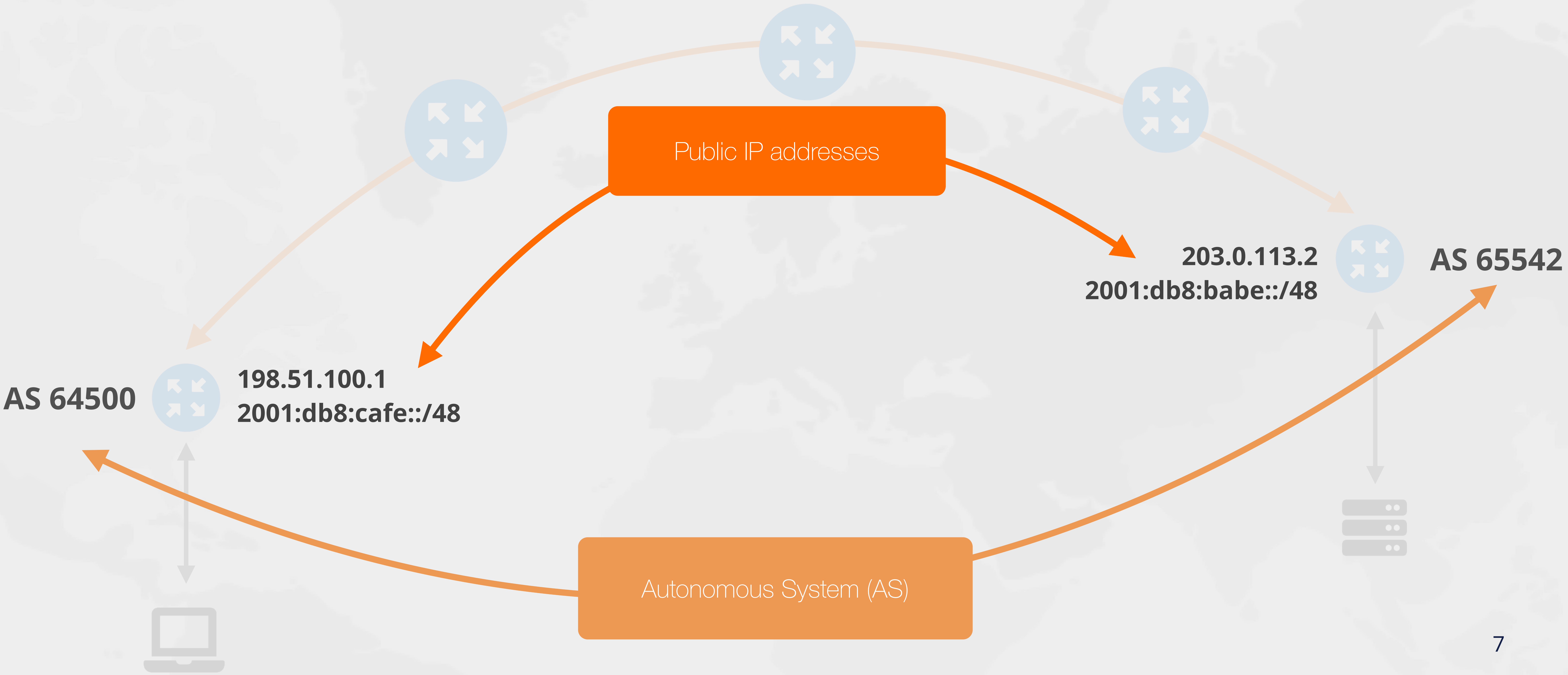
Internet, IPs, ASNs, etc.

Section 1 of 9

How do we address nodes on the Internet?

AS 64500
198.51.100.1
2001:db8:cafe::/48
203.0.113.2
2001:db8:babe::/48
AS 65542

Focus on these numbers:



Public IP addresses

Autonomous System (AS)

What can go wrong?

How can somebody **abuse** or **misuse** resources on the Internet?

Choose all possible situations in the poll, and tell us your experience in the chat window.

1 min.

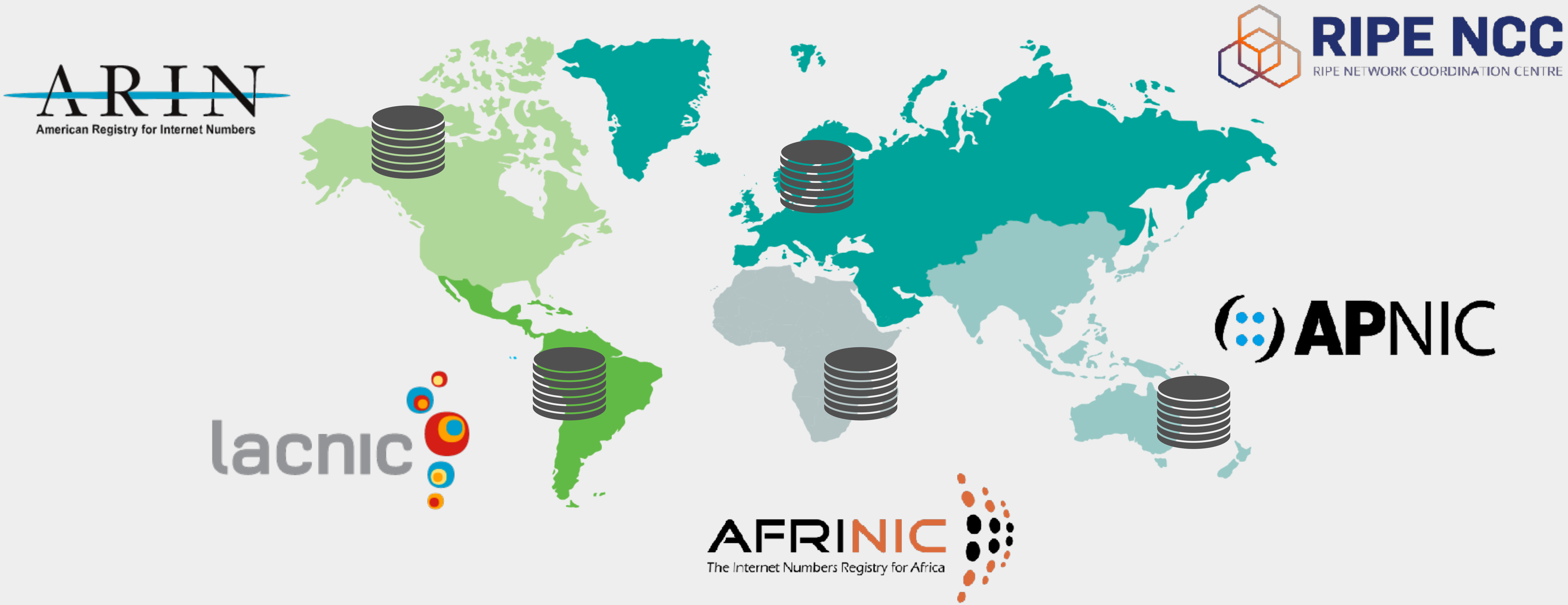
Answers

How can somebody **abuse** or **misuse** resources on the Internet?

+ An AS announces somebody else's IPs and hijacks their traffic
+ An AS announces a bigger prefix than they have, by mistake
+ Somebody spoofs their originating IP address and causes a spike of useless traffic to the forged IP

1 min.

IANA and the 5 Regional Internet Registries (RIRs)


ARIN
American Registry for Internet Numbers
RIPE NCC
RIPE NETWORK COORDINATION CENTRE
APNIC
lacnic
AFRINIC
The Internet Numbers Registry for Africa

The RIPE NCC and its 20k+ LIRs

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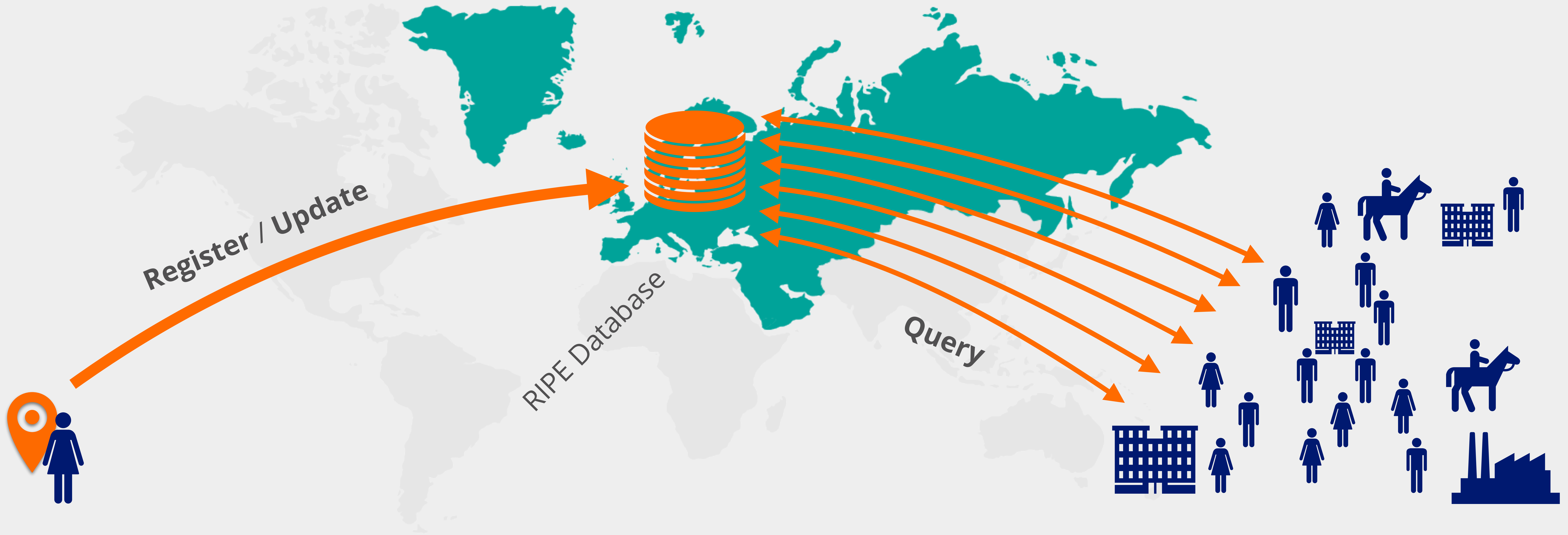
Local Internet Registries (LIRs) are responsible for:

- Distributing Internet Number resources (IP addresses and ASNs) **to End Users**
- Registering them in the **RIPE Database**
- Keeping the registry up-to-date

The Big Picture



The legitimate holder
(the RIPE NCC, LIR, etc.) registers their assignments, (sub)-allocations, and ASNs.

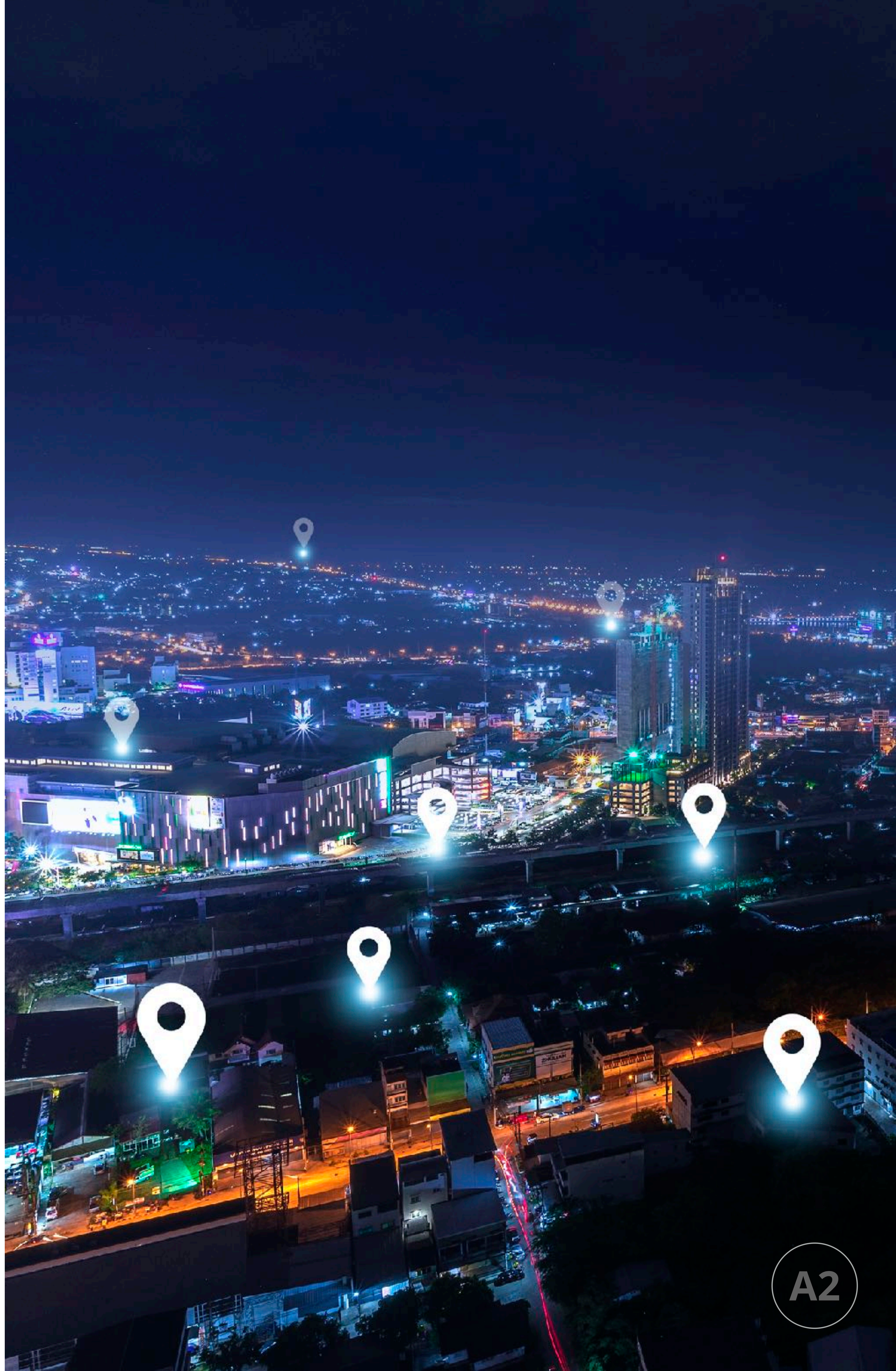
Other Internet users or ISPs
can query who is the legitimate holder of a resource.

Can AS 3333 announce 193.0.0.0/24?

- **AS 3333** is assigned to the ORG-RIEN1-RIPE
- **193.0.0.0/24** is also assigned to ORG-RIEN1-RIPE

Please choose the correct answer.

⏱ 1 min.

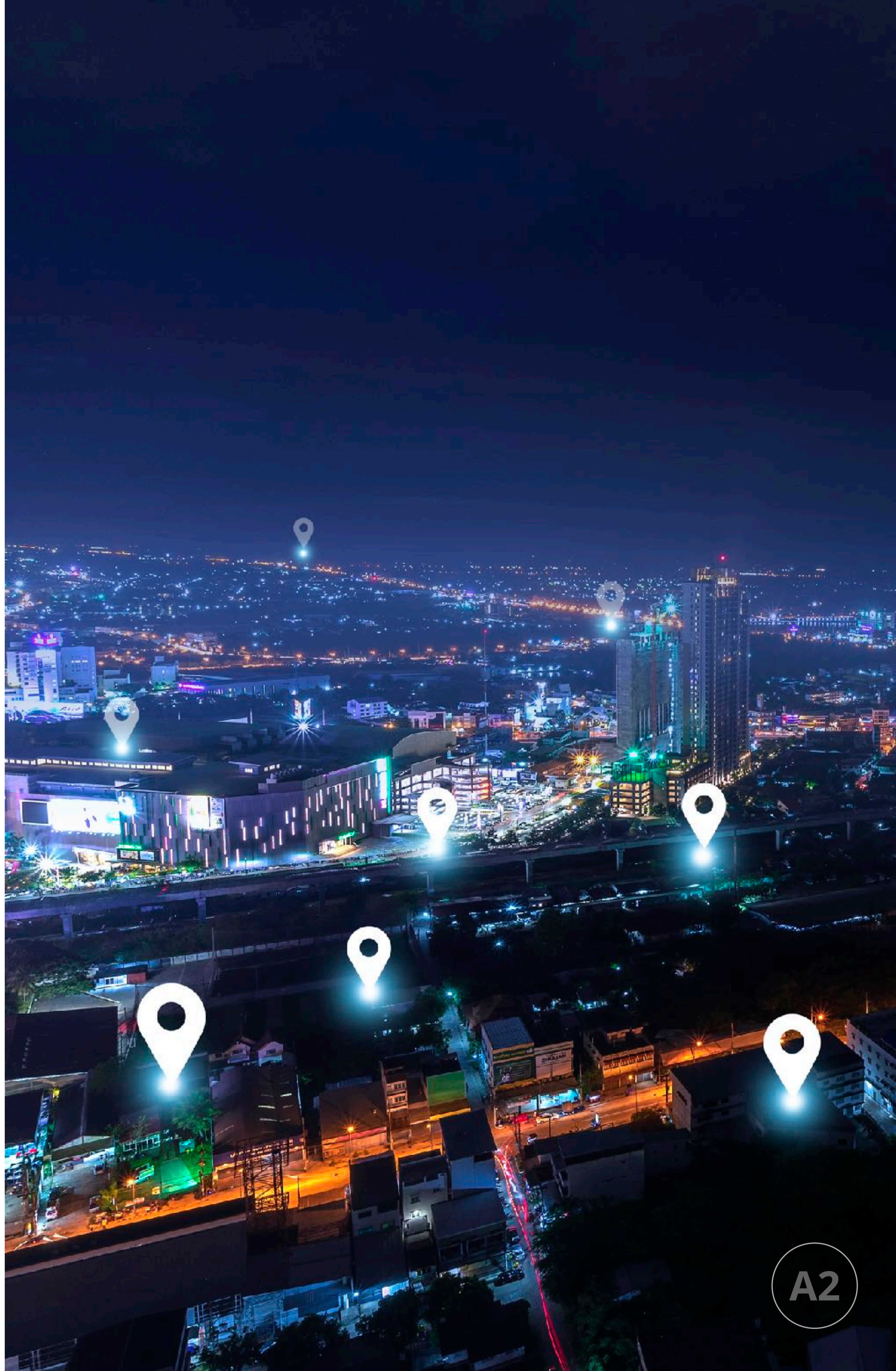


Answer

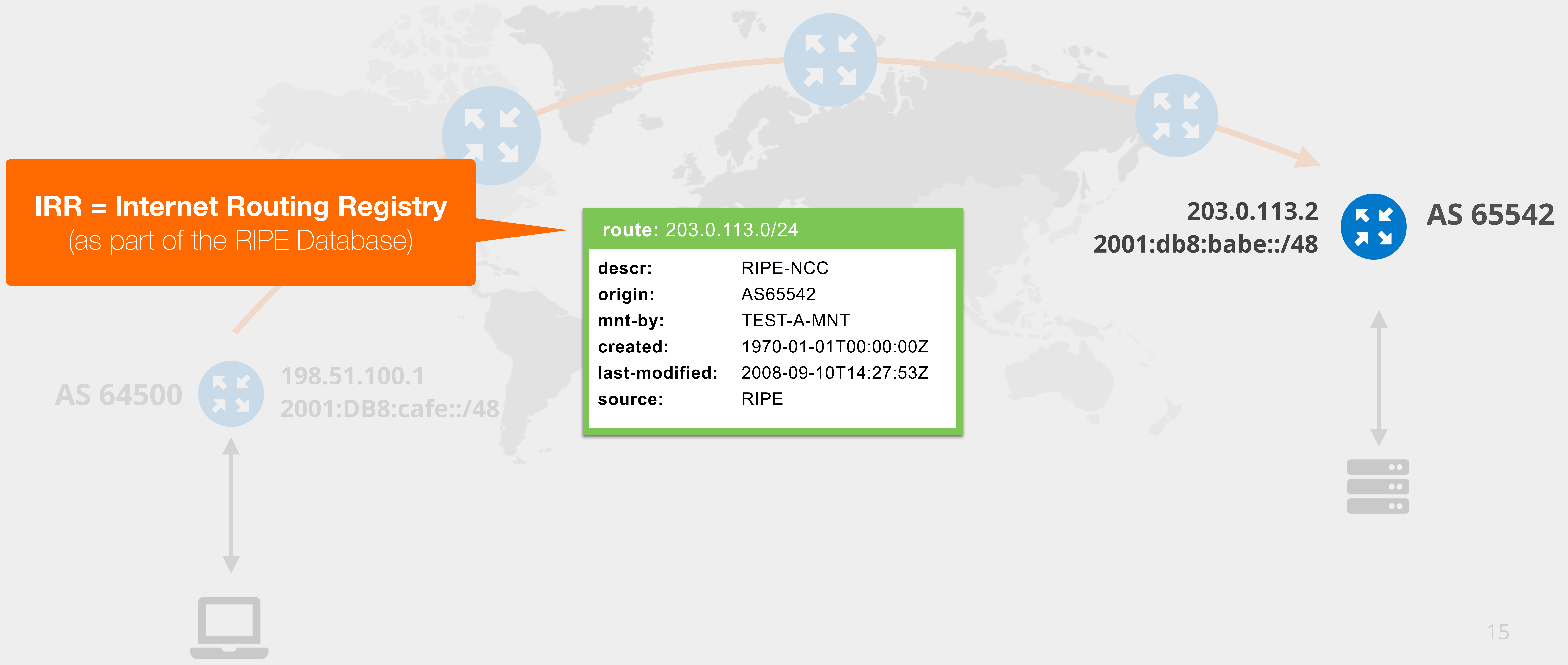
Can AS 3333 announce 193.0.0.0/24?

+ Yes, any AS can announce any prefix

1 min.



The prefix holder can create a ROUTE object!



IRR = Internet Routing Registry
(as part of the RIPE Database)

```
route: 203.0.113.0/24
descr:          RIPE-NCC
origin:         AS65542
mnt-by:         TEST-A-MNT
created:        1970-01-01T00:00:00Z
last-modified:  2008-09-10T14:27:53Z
source:         RIPE
```

AS 64500

198.51.100.1
2001:DB8:cafe::/48

203.0.113.2
2001:db8:babe::/48

AS 65542

For legitimate prefix holders...

Why is registering ROUTE objects **important** for the stability of the Internet?

Hint: which AS is allowed to announce **2001:67c:64::/48**?

Please choose your answer, and type in the answer for BONUS in the chat window.

1 min.

A3

Answers

Why is registering ROUTE objects **important** for the stability of the Internet?

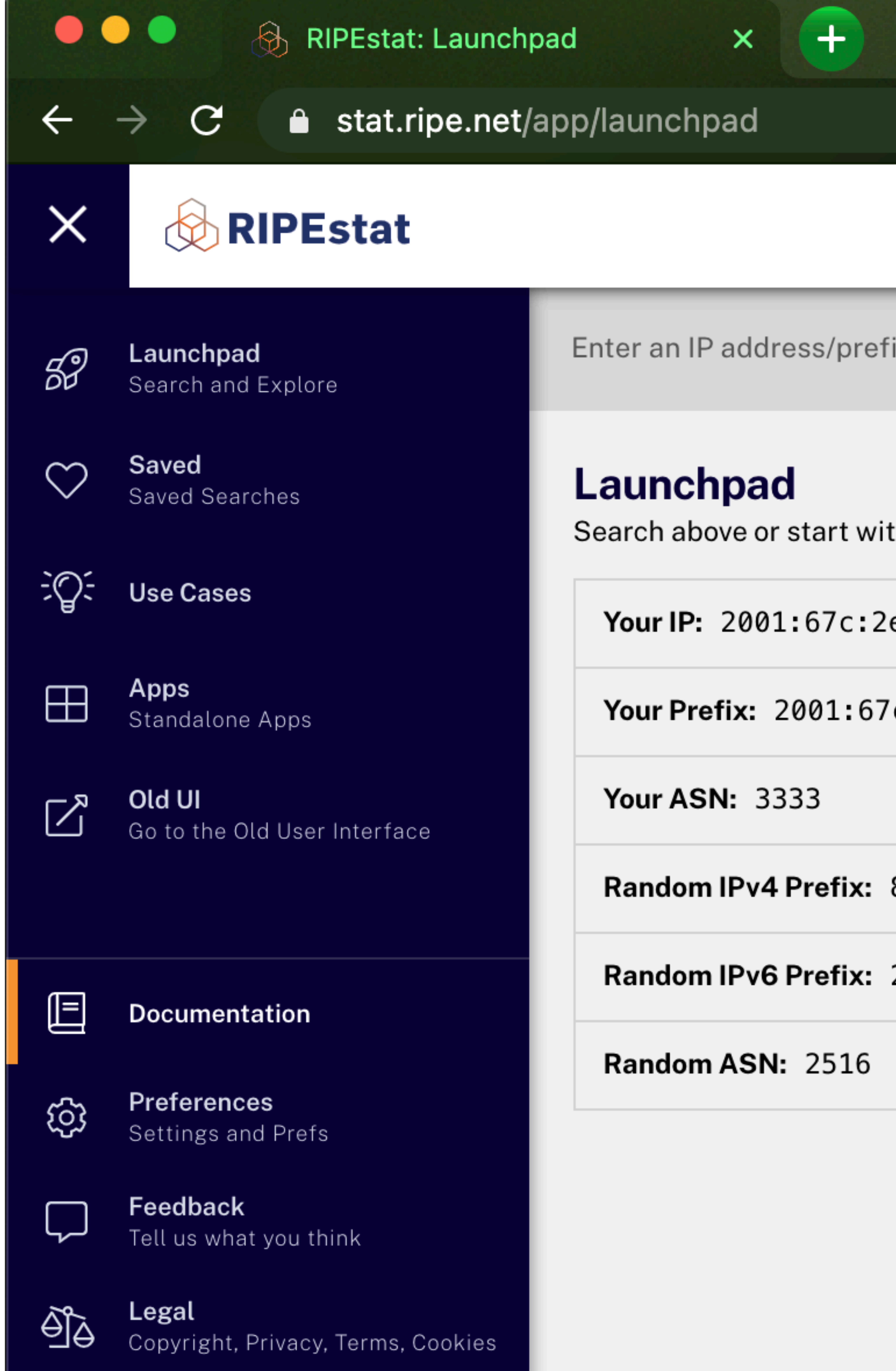
+ Prevent prefix hijacking: the legitimate holder of the prefix can state which AS can announce the prefix
+ Other IRRs (incl. commercial) mirror IRR-related data from the RIPE Database

⏱ 1 min.

Let’s investigate a prefix

Which network shall we investigate?

Demo



Launchpad

Search above or start wit

Your IP: 2001:67c:2e

Your Prefix: 2001:67

Your ASN: 3333

Random IPv4 Prefix: 8

Random IPv6 Prefix: 2

Random ASN: 2516

Our Focus: Blocklisting

Section 2 of 9

IP Blocklisting in Action

Is 203.0.113.222 **blocklisted**?

Yes ✗

No ✅

198.51.100.1

Public blocklists

203.0.113.0/24

The server at 203.0.113.222

A user connecting to 203.0.113.222

IP Blocklisting in Action

Is 198.51.100.1
blocklisted?
Yes
❌
No
✅
203.0.113.0/24
198.51.100.1
Public blocklists
The server at
203.0.113.222
A user connecting
to 203.0.113.222

Tell us your experience

Have you ever **blocklisted anybody**, or were blocklisted **yourself**?

Please choose your answer, or type it in the chat window

1 min.

A4

Blocklists can be private and public

1. Administrators have full control over a **private blocklist** (e.g. ACLs)
2. **Public blocklists** have different policies for how IPs/ASNs are added and removed

We're going to focus on **PUBLIC** blocklists

SPAMHAUS

spamcop.net

invaluement

CBL COMPOSITE BLOCKING LIST

SBL Advisory

XBL Advisory

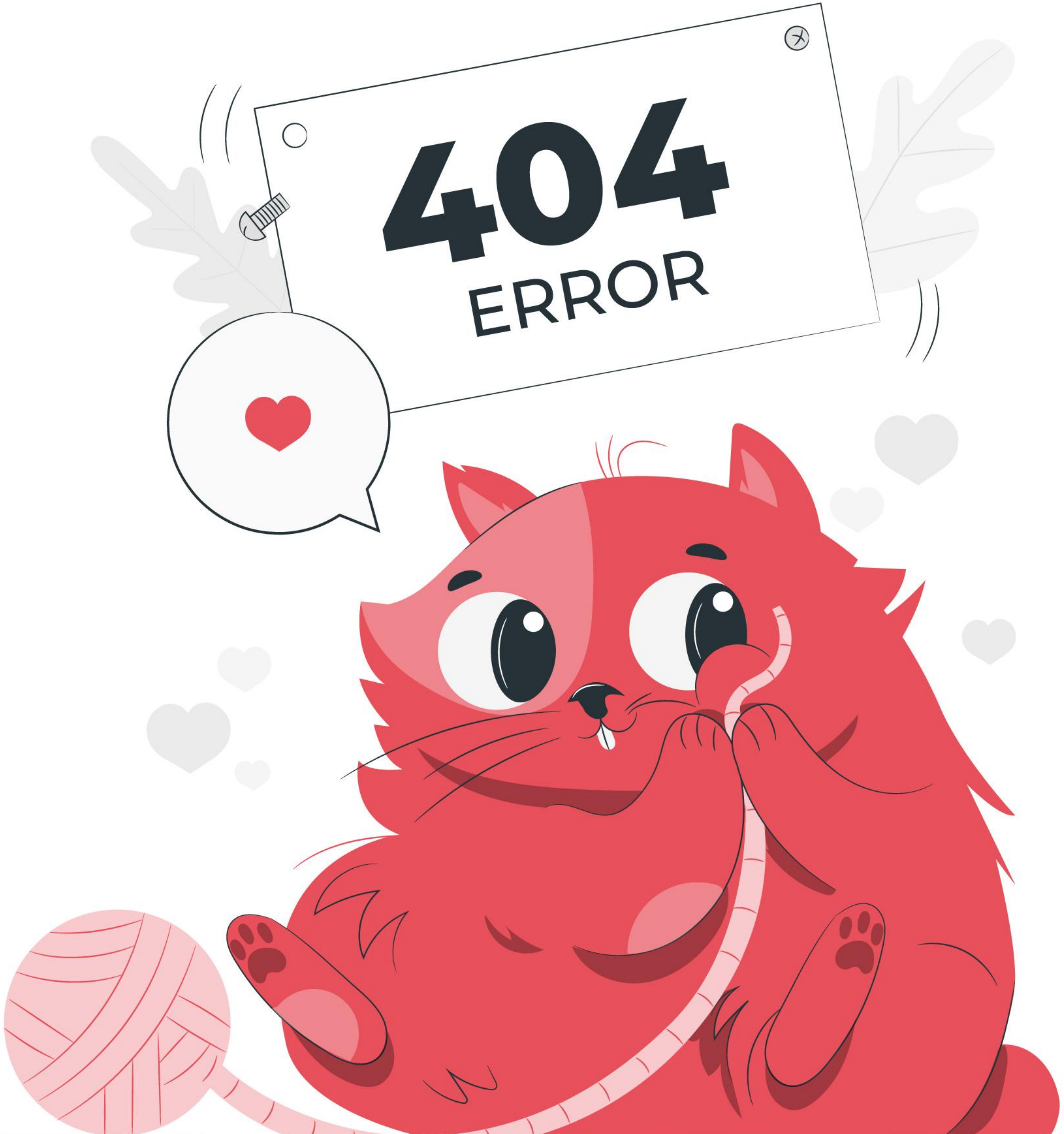
Return Path

Barracuda

Passive Spam Block List (**PSBL**)

.. and many more

So… How somebody might end up on a blocklist?



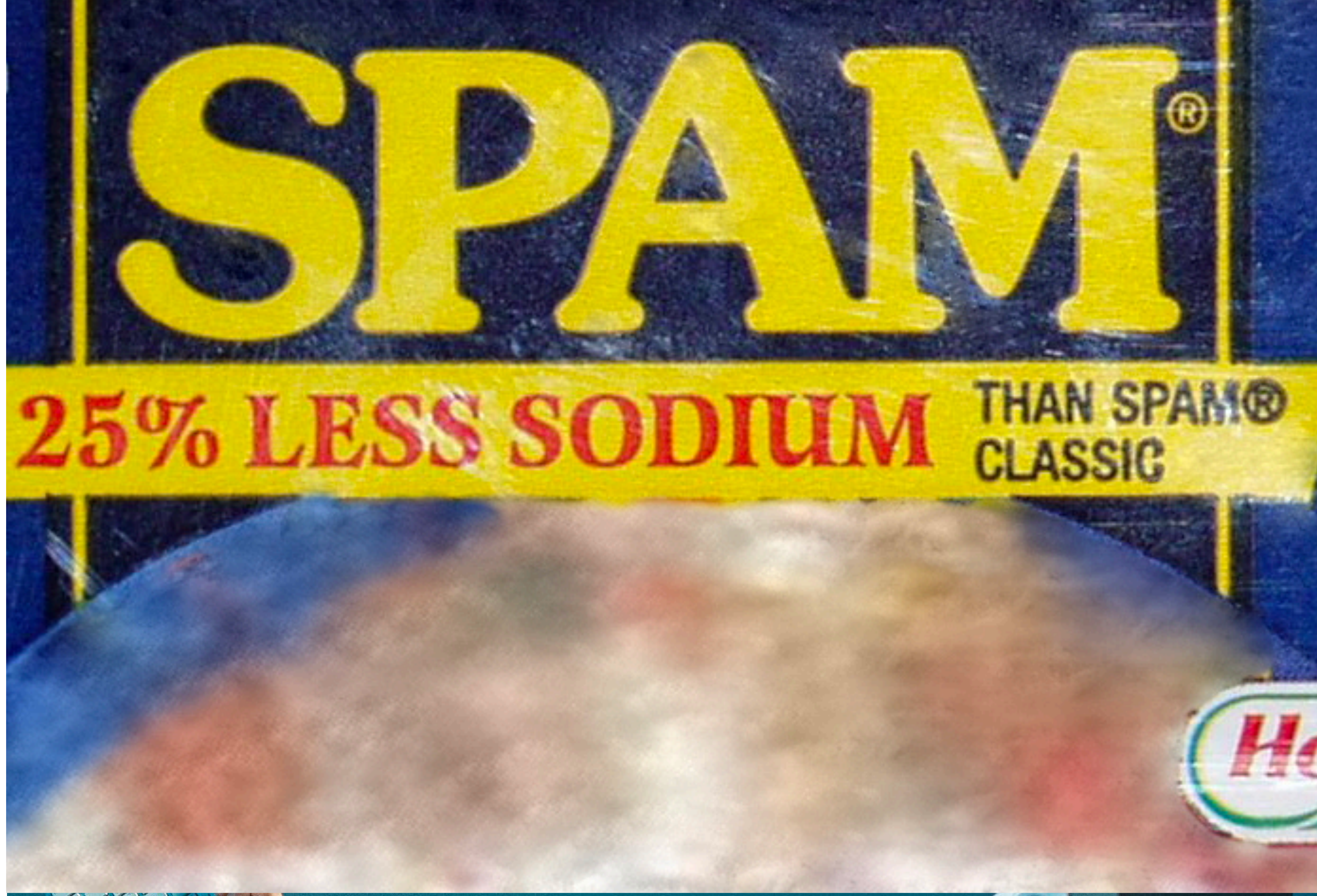
Reason #1: Spam

Section 3 of 9

What is Spam?

There are many names for **unsolicited** messages sent **in bulk by email**:

- Email **spam**
- **Junk** emails
- **UBE** = Unsolicited Bulk Email



Why spamming is unacceptable

- **Interferes** with the operation of the Internet
- Creates **unwanted traffic** for the recipients
- Creates **support overhead** for ISPs

There is no global framework regulating spamming.

What would you do?

You’re a system administrator of a small company with no extra budget to spend on IT.

One day, your colleagues start receiving **dozens of weird emails** from a foreign prince asking you for help to retrieve his fortune.

What would you do?

Please choose your answers, or type them in the chat window

1 min.

A5

But the prince might have spoofed the sender’s IP address…

How would you check who is the **legitimate holder** of an IP address?

Please choose the correct options.

1 min.

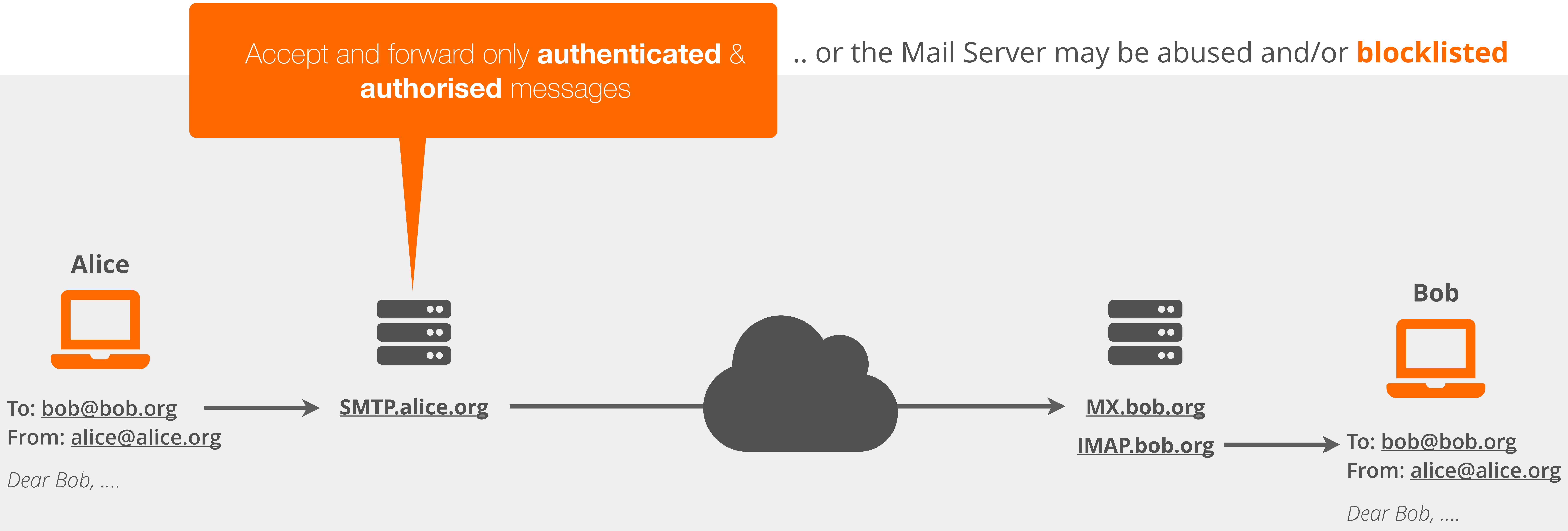
Reason #2: Misconfigurations

Section 4 of 9

Can wrongdoing be unintentional?

Open Mail Relay: anybody can abuse it!

- Open Mail Relays are NOT recommended by RFC 5321 (which defines SMTP)



Accept and forward only **authenticated** & **authorised** messages

.. or the Mail Server may be abused and/or **blocklisted**

Alice

To: bob@bob.org
From: alice@alice.org

Dear Bob, ….

SMTP.alice.org

MX.bob.org

IMAP.bob.org

Bob

To: bob@bob.org
From: alice@alice.org

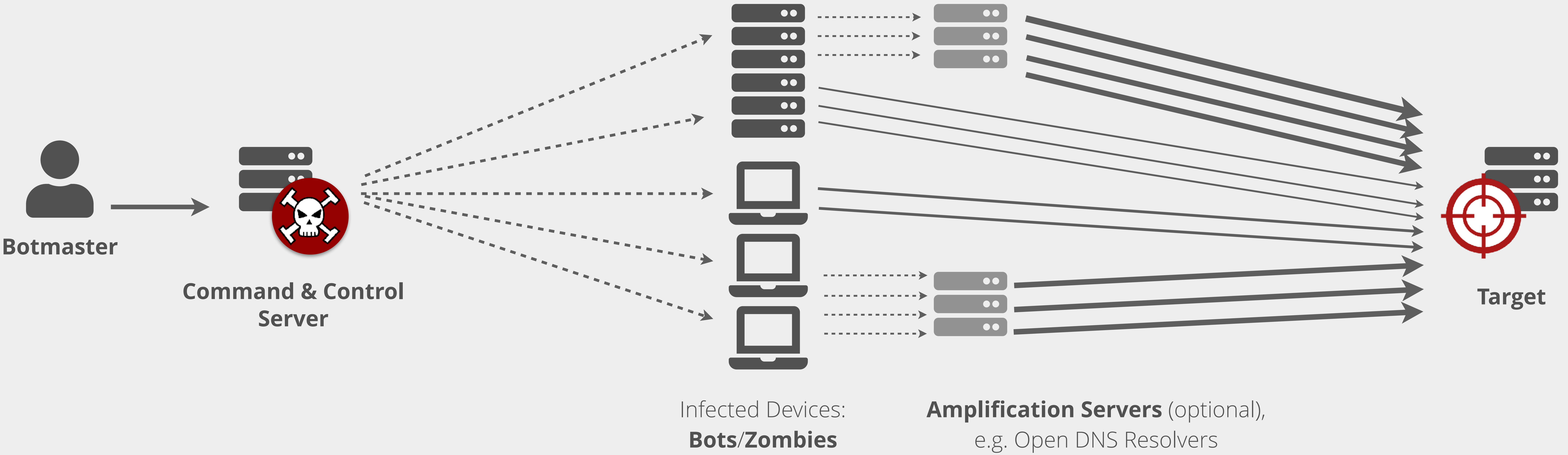
Dear Bob, ….

Reason #3: Malware and Botnets

Section 5 of 9

What is a botnet?

Botnet can use spoofed IPs
(which can then be blocklisted)



Botmaster

Command & Control Server

Infected Devices:
Bots/Zombies

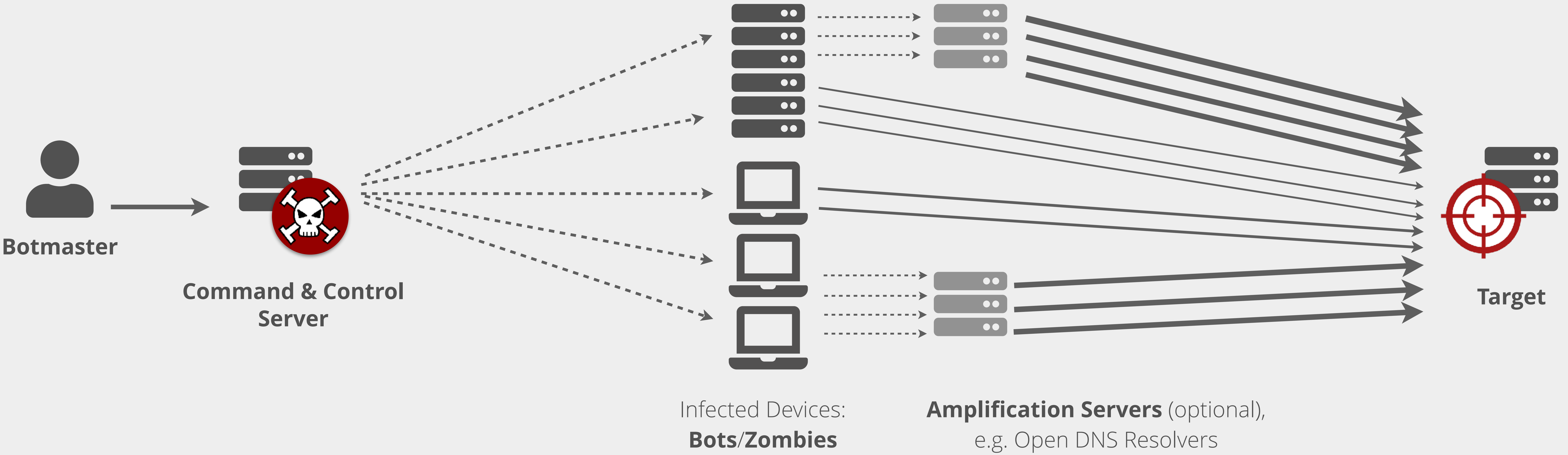
Amplification Servers (optional),
e.g. Open DNS Resolvers

Target

How to avoid being blocklisted?

Protect your network against malware

Make sure nobody in your network is running a service which can be abused by others (you might not be **aware of it**)

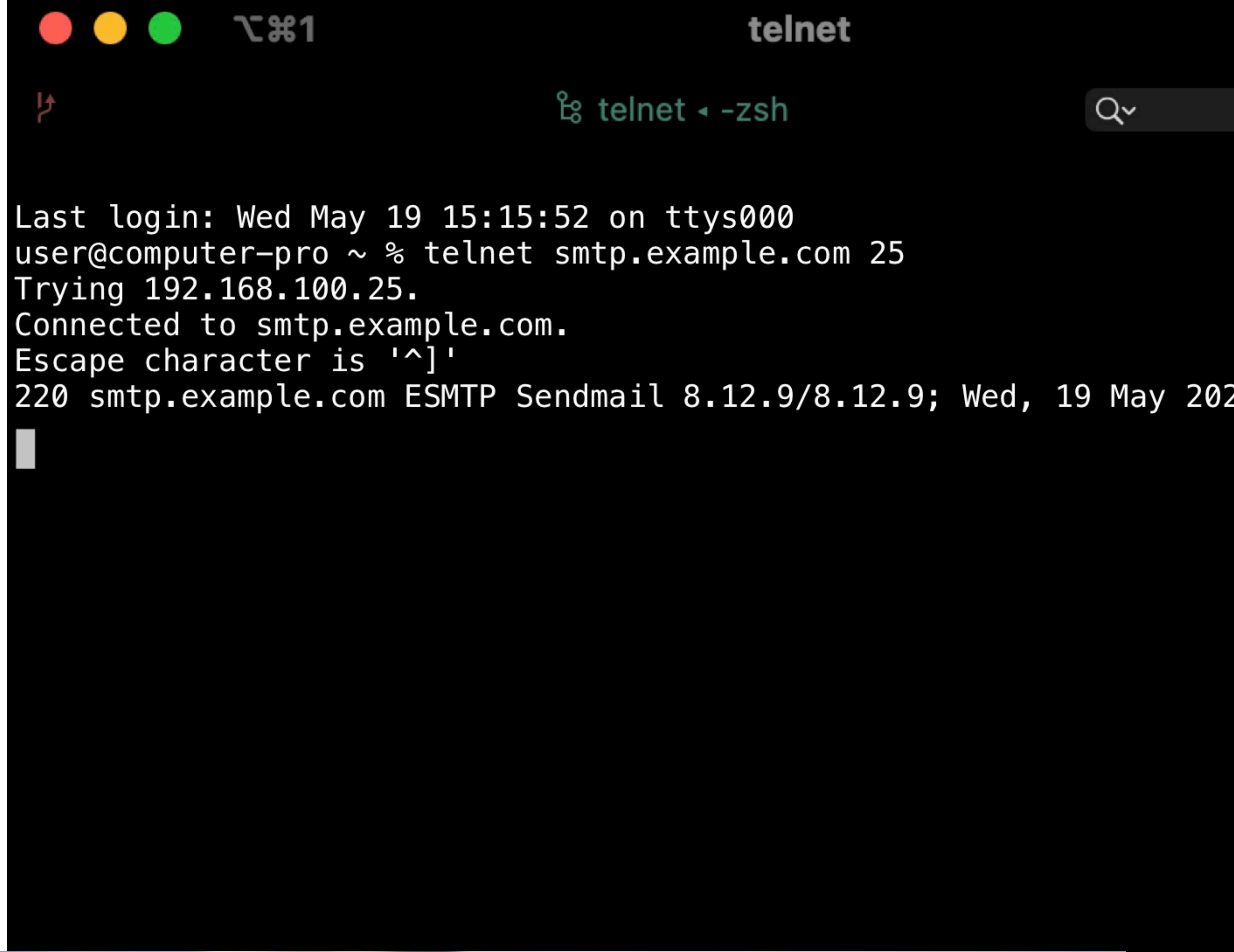


What would you do..

.. if you were an ISP, and one of your customers insisted on running a service that could be **abused** by others?

Please choose your answer, or type in your answer in the chat widow

1 min.



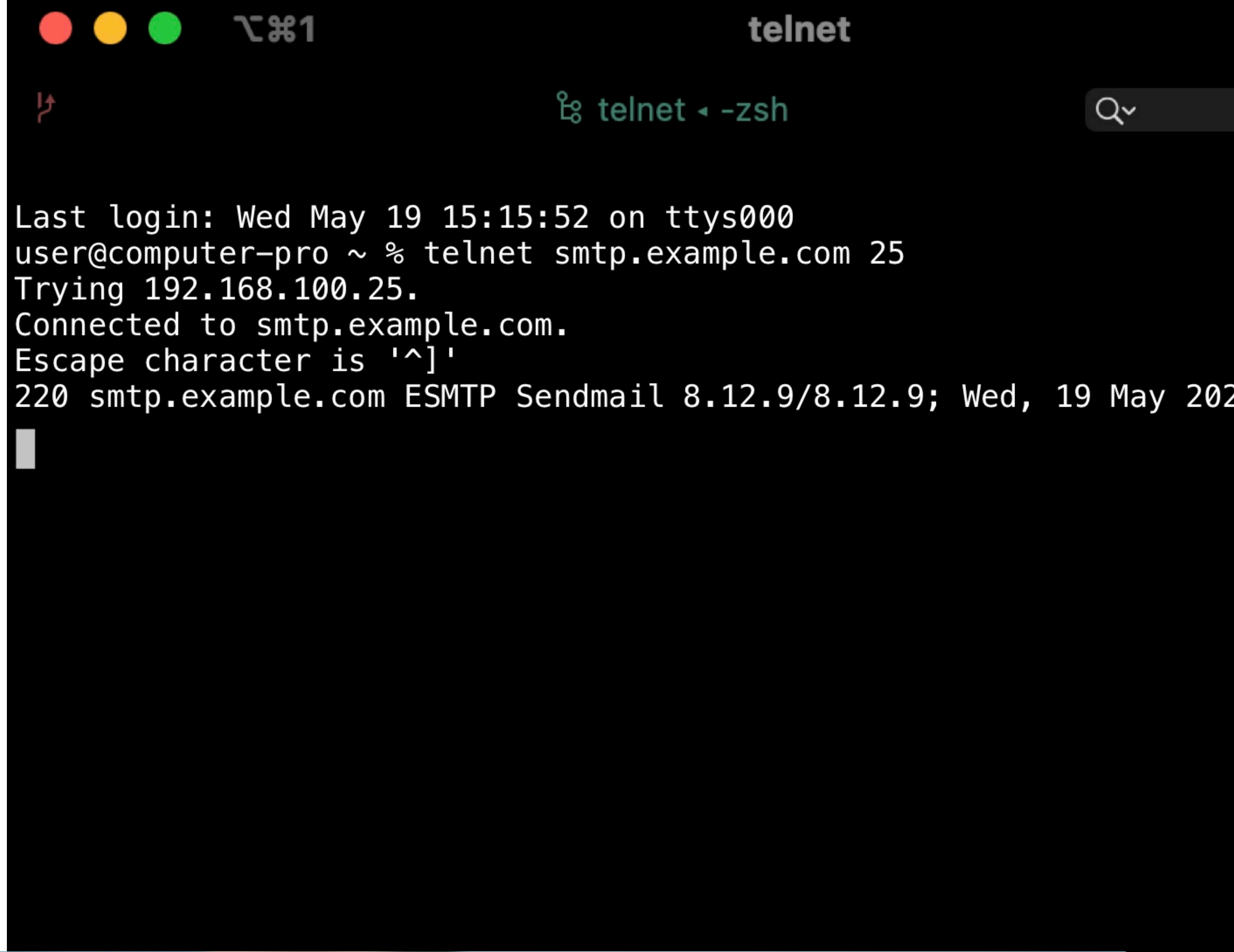
```
Last login: Wed May 19 15:15:52 on ttys000
user@computer-pro ~ % telnet smtp.example.com 25
Trying 192.168.100.25.
Connected to smtp.example.com.
Escape character is '^]'
220 smtp.example.com ESMTP Sendmail 8.12.9/8.12.9; Wed, 19 May 202
▌
```

Answers

What would you do if you were an ISP, and one of your customers insisted on running a service that could be **abused** by others?

+ Terminate the contract (if possible)
+ Create separate ASSIGNMENTS for them in the RIPE Database
+ Make sure they’re not sharing IP with other customers

1 min.



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220 smtp.example.com ESMTP Sendmail 8.12.9/8.12.9; Wed, 19 May 202
```

A7

Reason #4: Unwanted content, service or software

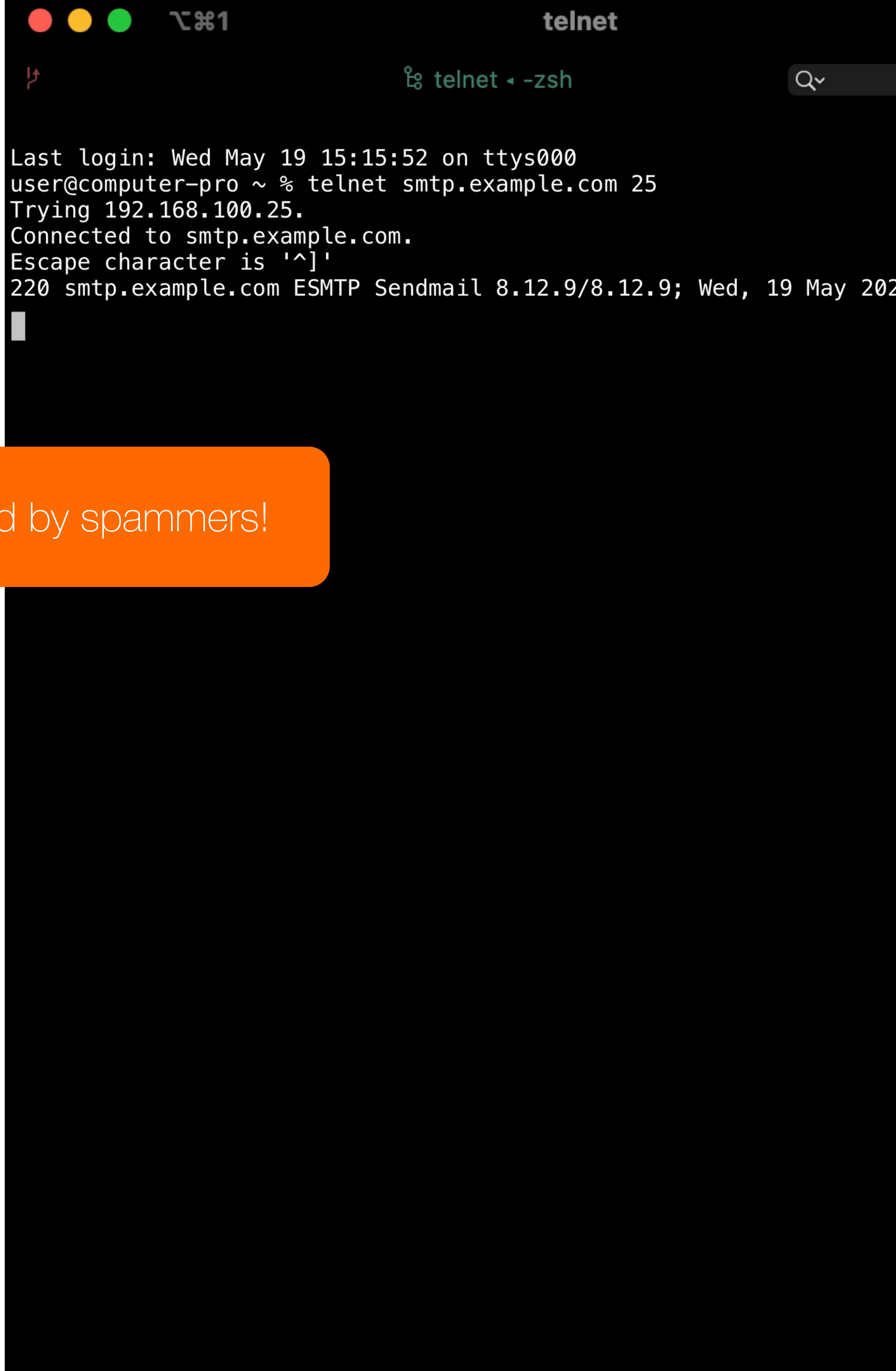
Section 6 of 9

Example: Open Mail Relay

- .. is an SMTP server which allows **anybody** on the Internet to send emails through it

Can be abused by spammers!

- NOT recommended by RFC 5321 (defines SMTP)
- .. a valid reason for the server to be **blocklisted**



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Connected to smtp.example.com.
Escape character is '^]'
220 smtp.example.com ESMTP Sendmail 8.12.9/8.12.9; Wed, 19 May 202
```
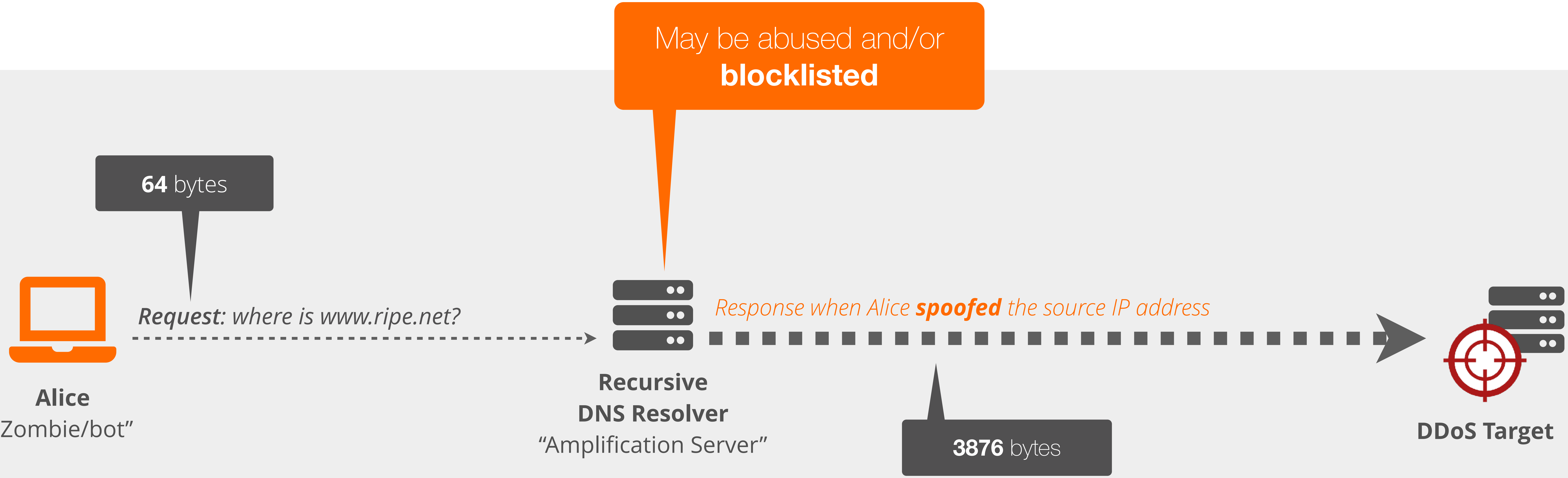

Example: Open Recursive DNS Resolver

- Can be used in a DNS amplification attack
- There are some public DNS servers: **1.1.1.1**, **8.8.8.8**, **2001:4860:4860::8888**

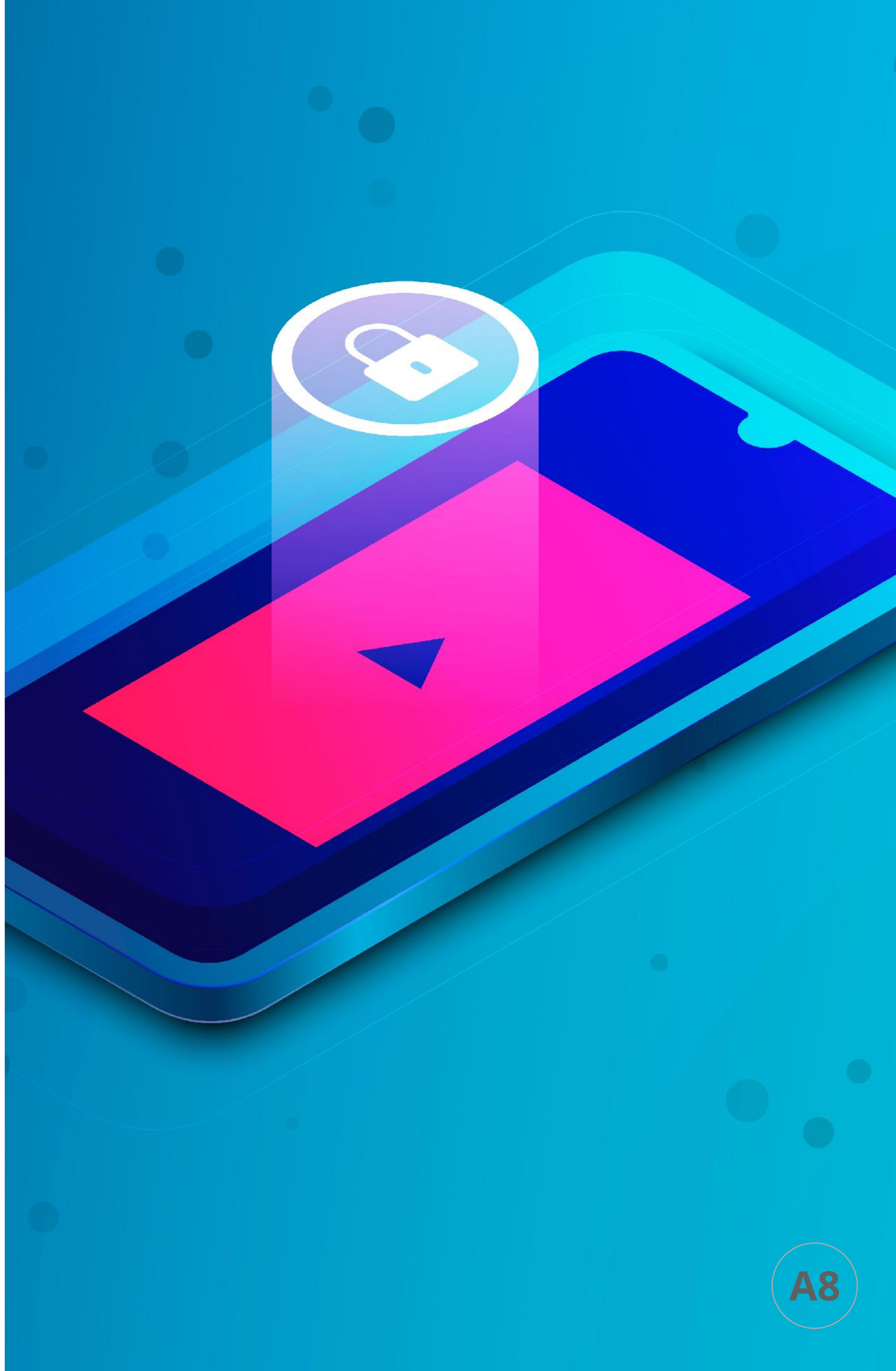


May be abused and/or **blocklisted**
64 bytes
Request: *where is www.ripe.net?*
Response when Alice ***spoofed*** *the source IP address*
Alice
"Zombie/bot"
Recursive DNS Resolver
"Amplification Server"
3876 bytes
DDoS Target

What can an ISP/LIR do...

.. to prevent IPs from being **blocklisted** due to undesirable content or services?

Please choose your answer, and share with us your experience in the chat window.



3 min.

Reason #5: IP prefix’s history

Section 7 of 9

You received a prefix …. there’re 2 options:

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… all IPv4 prefixes come from **recycled** space

or

Or from **another region**
(member of another RIR)

RIPE NCC
Member

… as a receiving LIR you might want to **investigate the prefix** before signing off the transfer

Previous holder’s actions may lead to your IP’s being **blocklisted**

How IP addresses are quarantined at the RIPE NCC

Step 1: **De-registration** → all related RIPE Database objects deleted, ROAs cleared

Step 2: **Quarantine** → for six months or as long as the space is globally routed

Step 3: **Allocation to a new LIR**

What exactly the RIPE NCC is doing during de-registration:
https://www.ripe.net/manage-ips-and-asns/resource-management/quarantine-for-returned-internet-number-resources

Resource Quality Assurance before re-allocating IP prefixes:
https://www.ripe.net/manage-ips-and-asns/resource-management/ripe-ncc-resource-quality-assistance

Use RIPEstat for transfers

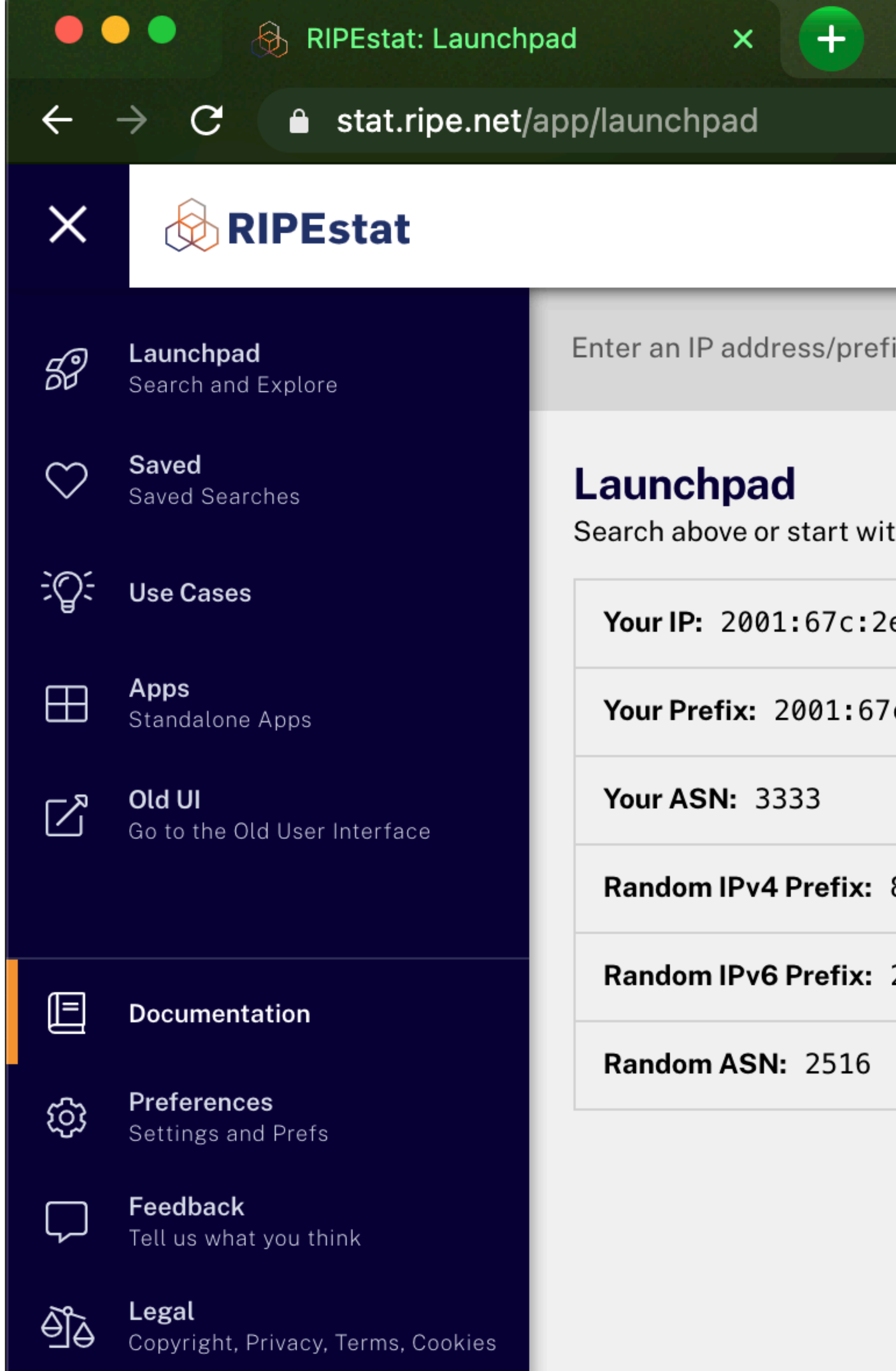
One of the services to use when investigating **the previous usage** of a prefix or ASN:

- Who was the legitimate holder in the past?
- Who was announcing the prefix in the past?

…

But there is **NO GUARANTEE** that no changes will be detected after the transfer, or after you just finished investigating

Demo



Your IP: 2001:67c:2e

Your Prefix: 2001:67

Your ASN: 3333

Random IPv4 Prefix: 8

Random IPv6 Prefix: 2

Random ASN: 2516

Questions ?

How to prevent IPs and ASNs from being blocklisted

Section 8 of 9

1. Know your infrastructure and customers

- Separate prefixes used for different services/networks/customers
- Separate the LIR’s prefix from the customer’s resources

LIR Admin
RIPE Database
&
RPKI
LIR’s Infrastructure
LIR’s Customers

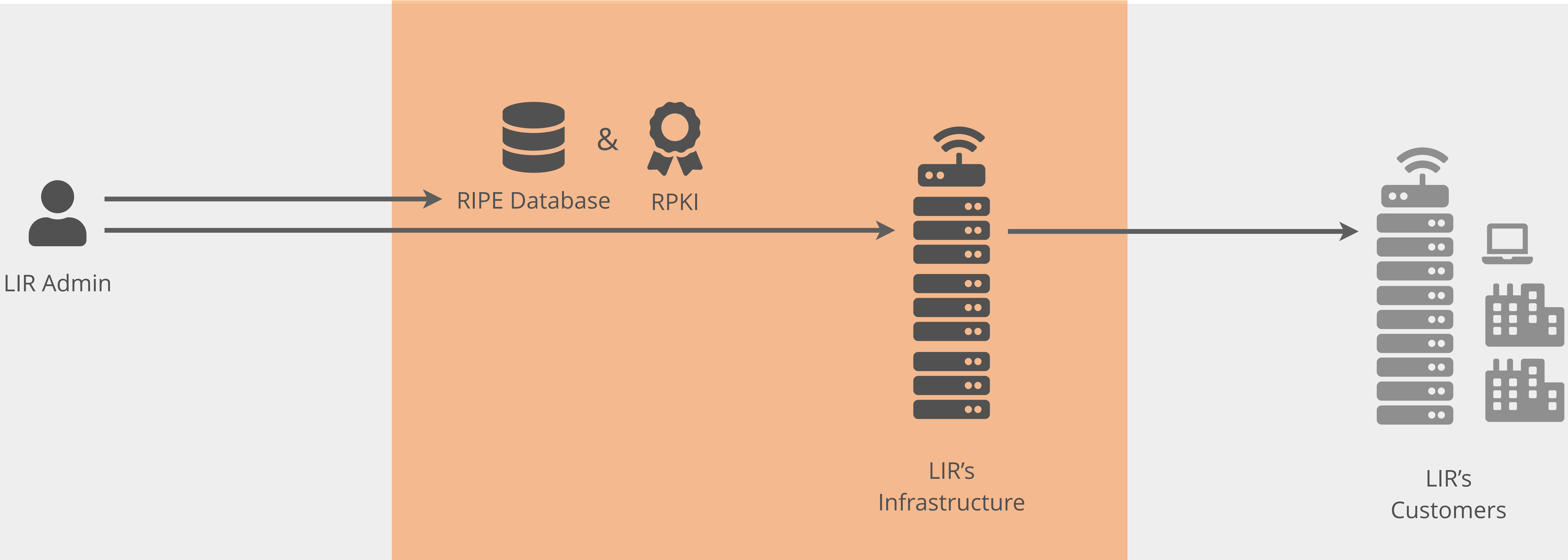
2. Implement proper security measures

- Follow RFC 5321 for mail servers
- Do not operate open DNS resolvers if possible
- Implement measures against amplification attacks, e.g. response rate-limiting

RIPE Database
&
RPKI
LIR Admin
LIR's
Infrastructure
LIR's
Customers

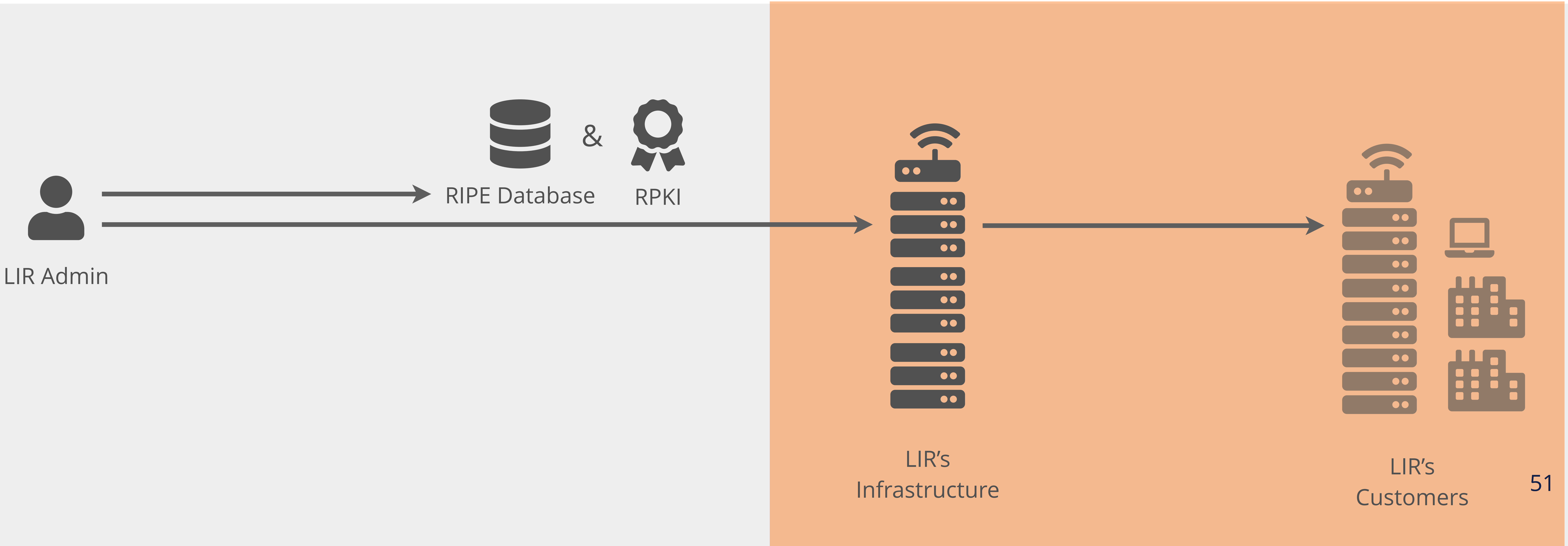
3. Prevent address space hijacking

- Maintain RIPE Database objects and keep them **up-to-date**
- Create **ROAs** for your prefixes
- Detect spoofed IP addresses in the ingress traffic: implement **BCP-38**



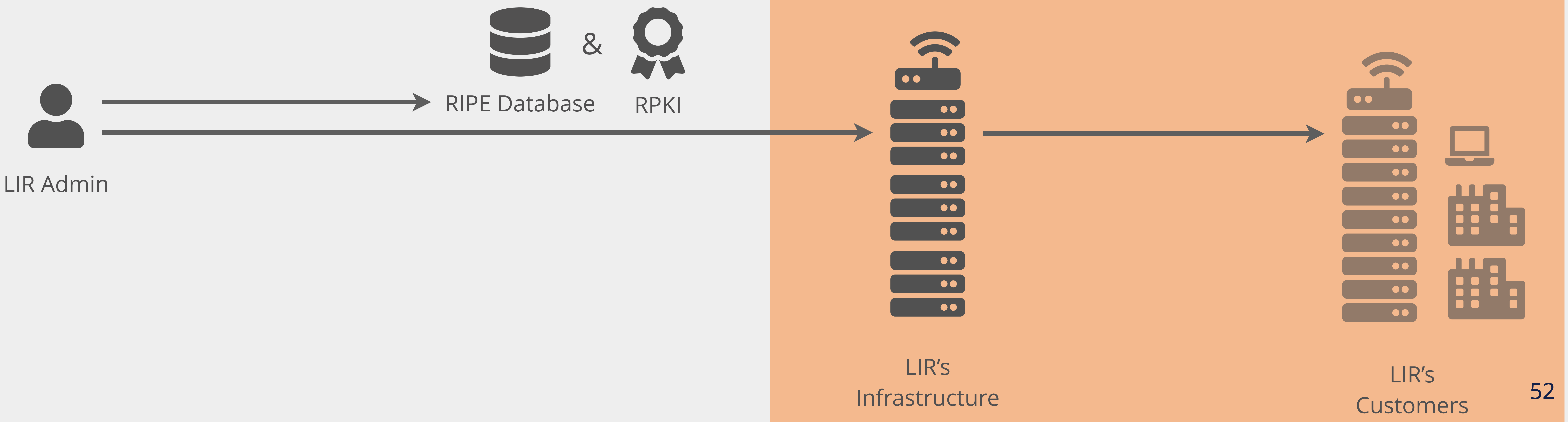
4. Investigate the prefix

- Investigate how the prefix was used in the past before assigning it to a critical service



5. Monitor your reputation

- **Monitor** how your prefixes are used
- Look for **abnormalities** in the traffic



How to **prevent** your IPs from being blocklisted:

What is **the most important** measure?

Please choose an option or type in your answer in the chat window.

⏱ 1 min.

Answers

How to prevent your IPs from being blocklisted:

- Know your infrastructure and customers
- Implement proper security measures
- Prevent address space hijacking
- Investigate the prefix
- Monitor your reputation

1 min.

How to remove IPs and ASNs from blocklists

Section 9 of 9

1. Don’t panic, investigate first

Find out **where** you’re blocklisted, and **for what**.

— Check security measures

— Check traffic logs

— Scan for vulnerabilities

…

2. Take care of the reasons and contact blocklists

Remove malware, fix misconfiguration, etc, and **explain** to blocklists what was done.

How to **remove** your IPs from public blocklists:

What is **the most challenging** thing to do?

Please choose an option or type in your answer in the chat window.

⏱ 1 min.

A10

Wrap-Up

1. Stay **up-to-date**: sign up for mailing lists
2. **Know** the services you and your customers are providing
3. Implement **security measures** for infrastructure and services
4. Create and update assignments in the **RIPE Database**
5. Prevent address space hijacking: use BGP security measures for your prefixes

Questions ?

We want your feedback!

What did you think about this session? Take our survey at:

https://www.ripe.net/feedback/blocklisting

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Associate
RIPE NCC Certified Professionals
IPv6 Security
Expert

https://getcertified.ripe.net/

Ënn Соңы An Críoch پایان Ende Y Diwedd

Vége Endir Koniec

Son დასასრული Finvezh վերջ Кінець

הסוף Tmiem Liðugt Finis

Lõpp Amaia Loppu Крај

Slutt

Kraj Sfârşit النهاية Конец Konec Fund

Fine Fin Einde Fí Край Beigas Τέλος

Fim Slut

Pabaiga

Fighting Spam

Good Practice In Minimising Email Abuse: https://www.ripe.net/publications/docs/ripe-409

The History of Spam: https://www.internetsociety.org/wp-content/uploads/2017/08/History20of20Spam.pdf

Combating Spam: Policy, Technical and Industry Approaches:
https://www.internetsociety.org/resources/doc/2012/combating-spam-policy-technical-and-industry-approaches/

Anti-Spam Recommendations for SMTP MTAs: https://datatracker.ietf.org/doc/html/rfc2505

Email Submission Operations: Access and Accountability Requirements (BCP-134):
https://datatracker.ietf.org/doc/html/rfc5068

Botnets Prevention

Botnet Remediation Overview & Practices:
https://www.internetsociety.org/wp-content/uploads/2017/10/ota_2013_botnet_remediation_best_practices.pdf

Preventing Use of Recursive Nameservers in Reflector Attacks (BCP-140): https://www.ietf.org/rfc/rfc5358.txt

Prevent hijacking

Maintain the RIPE DB objects up-to-date: https://apps.db.ripe.net/db-web-ui/myresources/overview

Create ROAs: https://my.ripe.net/#/rpki

Network Ingress Filtering: Defeating Denial of Service Attacks which employ IP Source Address Spoofing (BCP-38): https://www.rfc-editor.org/info/bcp38

Join the MANRS: https://www.manrs.org/isps/

RIPE NCC procedures

Reusing Recovered Internet Number Resources:
https://www.ripe.net/manage-ips-and-asns/resource-management/quarantine-for-returned-internet-number-resources

Resource Quality Assurance before re-allocating IP prefixes:
https://www.ripe.net/manage-ips-and-asns/resource-management/ripe-ncc-resource-quality-assistance

Useful tools for investigation

RIPEstat Historical Whois: https://stat.ripe.net/widget/historical-whois

RIPEstat Allocation History: https://stat.ripe.net/widget/allocation-history

RIPEstat Routing History: https://stat.ripe.net/widget/routing-history

Transfer Statistics: https://www.ripe.net/manage-ips-and-asns/resource-transfers-and-mergers/transfer-statistics

Anti-Abuse Working Group (WG): https://www.ripe.net/participate/ripe/wg/active-wg/anti-abuse

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