Development in Routing Security

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Who We Are

- We manage IP and ASN allocations in Europe, the Middle East and parts of Central Asia
  - Ensure unique holdership
  - Document holdership in the RIPE Database (whois)
  - Enable operators to document use of their address spaces
Routing Security is in Our DNA

• In 1994, RIPE-181 was the first document published that used a common language to describe routing policies
• We co-developed standards for IRR and RPKI
• We are one of the five RPKI Trust Anchors
• Our Validator tool was, until recently, the only production-grade tool to do Origin Validation
Routing on the Internet

“A: “I have 193.x.x.x”

B: “I have 194.x.x.x”

Routing table 194.x.x.x = B

Routing table 193.x.x.x = A

Can I trust B?

Is A correct?

“BGP protocol”
How to Secure Routing?

“Internet Routing Registry”

RIPE Database
A = 193.x.x.x
B = 194.x.x.x

Can I trust B?

B: “I have 194.x.x.x”

A: “I have 193.x.x.x”

Is A correct?
Internet Routing

• Border Gateway Protocol
  - BGPv4, 1994

• The problem remains
  - No built-in security in BGP Protocol
Accidents Happen

- **Fat Fingers**
  - 2 and 3 are really close on our keyboards…

- **Policy violations (leaks)**
  - Oops, we did not want this to go to the public Internet
  - Infamous incident with Pakistan Telecom and YouTube
Or Worse…

- April 2018
  - BGP and DNS hijack
  - Targeting MyEtherWallet
  - Unnoticed for 2 hours
Incidents Are Common

- 2017 Routing Security Review by the Internet Society
  - 14k incidents
  - 10% of all ASNs affected
  - 3k ASNs victims of at least one incident
  - 1.5k ASNs caused at least one incident

Internet Routing Registry

• Many exist, most widely used
  - RIPE Database
  - RADB

• Verification of holdership over resources
  - RIPE Database for RIPE region resources only
  - RADB allows paying customers to create any object
  - Lots of the other IRRs do not formally verify holdership
Accuracy - RIPE IRR

Accuracy - Valid announcements / covered announcements
Accuracy - RADB IRR

Accuracy - Valid announcements / covered announcements
Resource Public Key Infrastructure

• RPKI
  - Ties IP addresses and ASNs to public keys
  - Follows the hierarchy of the registry

• Authorised statements from resource holders
  - ASN X is authorised to announce my IP Prefix Y
  - Signed, holder of Y
Resource Public Key Infrastructure

• Operated since 2008 by all RIRs
  - Community-driven standardisation (IETF)
  - IRR was not sufficient (incomplete, incorrect)

• Adds crypto-security to Internet Number Resources
Operators Are In Control

• We show member announcements
  - Member chooses to authorise or not
  - Does not need to worry about the crypto
  - It is there, but let the machines handle it…

• APNIC and Lacnic also have easy-to-use portals
  - Uptake and quality of data is a function of the interface
Certificates

This graph shows the total number of resource certificates created under the RIR Trust Anchor. One certificate is generated per LIR, listing all eligible Internet number resources.
Coverage - RPKI (all RIRs)
Accuracy - RPKI (all RIRs)

IPv4 addresses in valid announcements / covered announcements
## RPKI in some European countries

<table>
<thead>
<tr>
<th>Country</th>
<th>% Addresses</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE</td>
<td>78%</td>
<td>100,0%</td>
</tr>
<tr>
<td>SI</td>
<td>54%</td>
<td>100,0%</td>
</tr>
<tr>
<td>NL</td>
<td>53%</td>
<td>99,9%</td>
</tr>
<tr>
<td>DE</td>
<td>48%</td>
<td>99,9%</td>
</tr>
<tr>
<td>IE</td>
<td>52%</td>
<td>99,9%</td>
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<td>26%</td>
<td>99,8%</td>
</tr>
<tr>
<td>GR</td>
<td>72%</td>
<td>99,8%</td>
</tr>
<tr>
<td>ES</td>
<td>2%</td>
<td>99,7%</td>
</tr>
<tr>
<td>IT</td>
<td>3%</td>
<td>99,0%</td>
</tr>
</tbody>
</table>

source: [https://lirportal.ripe.net/certification/content/static/statistics/world-roas.html](https://lirportal.ripe.net/certification/content/static/statistics/world-roas.html)
The Road Ahead

- Ensure resiliency and stability of RPKI core
- Provide information and statistics
- Keep the focus on usability
- Policy work on improving IRR data
Making the Difference

- Is routing security on your agenda?
- Initiate the conversation with providers
- Are you leading by example?
Questions

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