Motivation

» Boost acceptance and usage of RPKI-based prefix origin validation
  » Support legacy hardware

» Increase the security of the Internet routing system
  » Prefix Hijacking

» Increase peering quality through IXP’s route servers
  » Route Leaks
IXP – Route Server Architecture
IXP – Prefix Origin Validation Support

Prefix Origin Validation

Prefix Origin Validation

Prefix Origin Validation

IXP

eBGP

Route Server

Prefix Validation
IXP – Prefix Origin Validation Support
IXP – Prefix Origin Validation Support

How to signal prefix origin validation results to peers?
How to signal prefix origin validation results to peers?

ietf-sidr-origin-validation-signaling: defines extended communities for signaling (iBGP)
Prefix Origin Validation

IXP

eBGP & ietf-sidr-origin-validation-signaling

Route Server

Prefix Origin Validation

Prefix Origin Validation

Prefix Origin Validation

Prefix Origin Validation
IETF - Internet Draft

» DE-CIX, AMS-IX, France-IX, and other IXPs discussed (during Euro-IX meetings) the idea of enabling route servers for prefix origin validation and signalling results to peers

» ”Internet Draft” version 01 submitted to the IETF SIDR working group
  » Signalling RPKI Validation Results from a route servers to Peers

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  » France-IX: Arnaud Fenioux
  » DE-CIX: Thomas King & Daniel Kopp
RPKI Global

8.3% of advertised IPv4 space
## RPKI at RIRs

<table>
<thead>
<tr>
<th>RIR</th>
<th>Percentage on IPv4 space</th>
<th>Adv. coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arin</td>
<td>0.4549</td>
<td>0.6800</td>
</tr>
<tr>
<td>Apnic</td>
<td>0.2381</td>
<td>0.8600</td>
</tr>
<tr>
<td>Ripe</td>
<td>0.2225</td>
<td>0.8600</td>
</tr>
<tr>
<td>Lacnic</td>
<td>0.0517</td>
<td>0.8800</td>
</tr>
<tr>
<td>Afrinic</td>
<td>0.0329</td>
<td>0.6900</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RIR</th>
<th>RPKI coverage on total</th>
<th>RPKI coverage on adv.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arin</td>
<td>0.0200</td>
<td>0.0294</td>
</tr>
<tr>
<td>Apnic</td>
<td>0.0082</td>
<td>0.0095</td>
</tr>
<tr>
<td>Ripe</td>
<td>0.1957</td>
<td>0.2279</td>
</tr>
<tr>
<td>Lacnic</td>
<td>0.1352</td>
<td>0.1537</td>
</tr>
<tr>
<td>Afrinic</td>
<td>0.0357</td>
<td>0.0516</td>
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</table>
# RPKI Covered Prefixes at DE-CIX

<table>
<thead>
<tr>
<th>IXP</th>
<th>Prefix Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dubai</td>
<td>705</td>
</tr>
<tr>
<td>Frankfurt</td>
<td>160,000</td>
</tr>
<tr>
<td>Hamburg</td>
<td>2,191</td>
</tr>
<tr>
<td>Munich</td>
<td>1,587</td>
</tr>
<tr>
<td>New York</td>
<td>60,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IXP</th>
<th>Valid Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dubai</td>
<td>0.3773</td>
</tr>
<tr>
<td>Frankfurt</td>
<td>0.0735</td>
</tr>
<tr>
<td>Hamburg</td>
<td>0.1447</td>
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<tr>
<td>Munich</td>
<td>0.1676</td>
</tr>
<tr>
<td>New York</td>
<td>0.0370</td>
</tr>
</tbody>
</table>
RPKI Covered Prefixes at DE-CIX

- Dubai: 705
- Frankfurt: 2.191
- Hamburg: 1.587
- Munich: 1.587
- New York: 0.011348

Invalid ratios:
- Dubai: 0.007530
- Frankfurt: 0.002282
- Hamburg: 0.003151
- Munich: 0.003630
- New York: 0.003630
## RPKI Covered Prefixes at DE-CIX

<table>
<thead>
<tr>
<th>IXP</th>
<th>Not found</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dubai</td>
<td>0.6113</td>
</tr>
<tr>
<td>Frankfurt</td>
<td>0.9190</td>
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<tr>
<td>Hamburg</td>
<td>0.8530</td>
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<tr>
<td>Munich</td>
<td>0.8292</td>
</tr>
<tr>
<td>New York</td>
<td>0.9593</td>
</tr>
</tbody>
</table>

**IXP**

- Dubai: 705
- Frankfurt: 2.191
- Hamburg: 1.587
- Munich: New York
RPKI – Prefixes vs. Data Volume

- Not Found: 91.90% Prefixes, 86.70% Data volume
- Invalid: 0.75% Prefixes, 0.53% Data volume
- Valid: 7.35% Prefixes, 12.78% Data volume
RPKI Invalid – Prefixes vs. Data Volume

- Unauthorized AS
  - Prefixes: 65.43%
  - Data volume: 8.55%

- Too specific
  - Prefixes: 34.57%
  - Data volume: 91.45%
Conclusion

» Advantages
  » Supporting legacy hardware
  » Added value for customers
  » More resilient and secure Internet

» Challenges
  » Adoption of RS feature by peers
  » Adoption of RPKI by ASes
  » ARIN's Relying Party Agreement

» Ongoing work
  » Internet draft under development
  » Observation of RPKI status
  » Planning to implement RPKI at DE-CIX
Thank you.