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Links visited during the webinar

→ RFCs:
  • RFC7454 - BGP Operations and Security (if you only read one, read this one)
  • RFC2385 - TCP MD5 Protection
  • RFC5925 - TCP Authentication Option
  • RFC5082 - Generalized TTL Security Mechanism
  • RFC1918 - IPv4 prefixes for private networks
  • RFC5737 - IPv4 prefixes for documentation
  • RFC3849 - IPv6 prefix for documentation
  • RFC5398 - AS numbers reserved for documentation
  • RFC6996 - AS numbers reserved for private use
  • RFC7300 - Last AS reservation
  • RFC6480 - RPKI Introduction

→ Other links:
  • IANA IPv4 Special Registry
  • IANA IPv6 Address Space
  • IANA Special-Purpose Autonomous System Numbers
  • RIPE NCC - RPKI Documentation
  • MANRS - Mutually Agreed Norms for Routing Security

→ Tools:
  • Regular Expression Tester
  • Numerical Regular Expression Generator
  • RPKI Validator

→ More DE-CIX Academy
  • Visit our website for recorded webinars and more:
    • https://www.de-cix.net/en/about-de-cix/academy/videos-and-webinars
    • https://www.de-cix.net/en/about-de-cix/academy/white-papers
Security Measures presented in the webinar

Measures in **bold** are **highly recommended**

→ Simple measures
  - Set a reasonable high maximum prefix on each eBGP session
  - Implement MD5 password protection on most important sessions
  - Enable TTL Security

→ Prefix filtering (IPv4 and IPv6)
  - filter against private networks
  - filter against reserved networks
  - filter against IXP peering LANs
  - filter against your own prefixes
  - filter against your customers prefixes (caution if customers are multi-homed)

→ AS path filtering
  - filter against private AS numbers in the path (anywhere)
  - filter against reserved AS numbers in the path (anywhere)
  - filter against other reserved AS numbers
    - A list to be filtered can be found [here](#) (except AS112, you should allow that one)
**Configuration Example (Cisco)**

Prefix-list for unwanted prefixes:

```
ip prefix-list ipv4-unwanted permit 192.168.0.0/16 le 32
ip prefix-list ipv4-unwanted permit 172.16.0.0/12 le 32
ip prefix-list ipv4-unwanted permit 10.0.0.0/8 le 32
ip prefix-list ipv4-unwanted permit 224.0.0.0/4 le 32
ip prefix-list ipv4-unwanted permit 240.0.0.0/4 le 32
```

```
ipv6 prefix-list ipv6-unwanted deny 2000::/3 le 48
ipv6 prefix-list ipv6-unwanted permit ::/0 ge 128
```

Prefix-list for too large and too small prefixes:

```
ip prefix-list ipv4-unwanted permit 0.0.0.0/0 ge 25
ip prefix-list ipv4-unwanted permit 0.0.0.0/0 ge 1 le 7
```

```
ipv6 prefix-list ipv6-unwanted permit ::/0 ge 49
ipv6 prefix-list ipv6-unwanted permit ::/0 ge 1 le 19
```

Prefix-list for IXP LANs (Example: Peering LAN DE-CIX Frankfurt (a /21)):

```
ip prefix-list ipv4-unwanted permit 80.81.192.0/21 le 32
ipv6 prefix-list ipv6-unwanted permit 2001:7f8::/64 le 128
```

Route-map, using above prefix-list

```
route-map peering-in deny 50
  match ip address prefix-list ipv4-unwanted
  match ipv6 address prefix-list ipv6-unwanted
```

If you use the same route-map for IPv4 and IPv6 you must have two match statements (one for v6 and one for v6) in the same entry.
AS-Path filter list for unwanted ASes in the path:

We do not want:

- AS64496 - AS64511 (Documentation ASes)
- AS64512 - AS65534 (Private ASes)
- AS65535 (Reserved)
- AS65536 - AS65551 (Documentation ASes)
  - You can summarize this with AS64496 - AS65551
  - And split up again in
    - 64496 - 64499
    - 64500 - 64999
    - 65000 - 65499
    - 65500 - 65549
    - 65550 - 65551
  - And convert these into regular expressions:
    - _6449[6-9]_
    - _64[5-9][0-9][0-9]_
    - _65[0-4][0-9][0-9]_
    - _655[0-4][0-9]_
    - _6555[01]_

- So the config looks like:

  ip as-path access-list 99 permit _6449[6-9]_
  ip as-path access-list 99 permit _64[5-9][0-9][0-9]_
  ip as-path access-list 99 permit _65[0-4][0-9][0-9]_
  ip as-path access-list 99 permit _655[0-4][0-9]_
  ip as-path access-list 99 permit _6555[01]_

route-map peering-in deny 60
  match as-path 99