BGP (new) Webinars Overview

- 01 - Prefixes and AS numbers
- 02 - BGP Introduction
- 03a - Setting up iBGP
- 03b - Setting up eBGP
- 04 - Becoming multi-homed
- 05 - BGP Best Path Selection
- 06 - BGP Communities
- ...

Where networks meet
What we already know about BGP (1)

- We already learned about prefixes
  - IPv4 and IPv6
- BGP is about announcing prefixes
- We also introduced the Autonomous System
  - An Autonomous System groups prefixes together
  - And has a common routing policy
  - And has an Autonomous System Number (ASN, AS-Number)
What we already know about BGP (2)

- We configured iBGP
  - iBGP is BGP within an AS
- We configured eBGP
  - eBGP is BGP to another AS
  - like an upstream provider
- Today we will do more with eBGP
  - add a second upstream provider
  - and add peering connections to other ASes
Why do we do this?

<table>
<thead>
<tr>
<th></th>
<th>With multiple Upstreams and Peering</th>
<th>Without an AS or with just one upstream</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Redundancy</strong></td>
<td>In case of a problem with one upstream you have a second one</td>
<td>If your upstream has a problem, you have a problem</td>
</tr>
<tr>
<td><strong>Control</strong></td>
<td>You have full control over your outgoing traffic</td>
<td>Your upstream ISP controls your traffic</td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td>You can optimize your traffic for cost</td>
<td>You just pay your one upstream ISP</td>
</tr>
<tr>
<td><strong>Peering</strong></td>
<td>You can setup your own peering policy and have full control</td>
<td>Your upstream ISP makes all decisions</td>
</tr>
</tbody>
</table>
Example Network

AS64500

AS64511

iBGP

eBGP

AS64496

AS64497

Provides Transit Service

Provides Transit Service

Peering at DE-CIX

Customer
Let's simplify that a bit

AS64500

iBGP

eBGP

AS64496

eBGP

AS64494
Let's get started.... with two upstreams

AS64500 — eBGP — AS64496 — eBGP — AS64497
Let's get started.... with two upstreams

AS64500

AS64496

AS64497
Let's get started.... with two upstreams

- AS64500
  - 10.3.8.0/22
  - 64496 286 517

- AS64497
  - 10.3.8.0/22
  - 64497 517

- AS64496
  - AS-Path Length: 3
  - eBGP

- AS517
  - AS286

AS-Path Length: 2
Better
### BGP Best Path Selection

<table>
<thead>
<tr>
<th></th>
<th>NextHop reachable?</th>
<th>Continue if &quot;yes&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
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<td></td>
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<tr>
<td>10</td>
<td></td>
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</tr>
</tbody>
</table>

- AS-Path Length: 3
- AS-Path Length: 2

Better
Let's continue...

AS64500

AS64496

AS6995 (route server)

AS64497
Let's add peering

AS64500

10.3.8.0/22 64496 286 517

10.3.8.0/22 64497 517

AS64496

10.3.8.0/22 286 517

AS64497

10.3.8.0/22 517
Let's add peering

AS64496

AS64500

AS64497

10.3.8.0/22

64496 286 517

10.3.8.0/22

64497 517

AS64496

AS286

AS517

361x322

361x271

eBGP

eBGP

AS-Path Length: 2

AS-Path Length: 2

10.3.8.0/22

286 517
The BGP Routing Algorithm

<table>
<thead>
<tr>
<th>Step</th>
<th>Criteria</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NextHop reachable?</td>
<td>Continue if &quot;yes&quot;</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>AS Path Length</td>
<td>shorter wins</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
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AS-Path Length: 2
**Local Preference**

- Higher wins
- Integer value (32bit, 0-4294967295)
- Propagated via iBGP inside an Autonomous System
- Usually set using rules when receiving prefixes
- Typical values:
  - Customer prefixes: 10000
  - Peering prefixes: 1000
  - Upstream prefixes: 100

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<tbody>
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<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Local Preference</td>
<td>higher wins</td>
</tr>
<tr>
<td>3</td>
<td>AS Path Length</td>
<td>shorter wins</td>
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Local Preference - how to set

→ High level:

if (prefix received from customer)
   then set local-preference of prefix = 10000
else if (prefix received from peer)
   then set local-preference of prefix = 1000
else
   set local-preference of prefix = 100

→ Cisco IOS or FRRouting:

route-map peering-in permit 10
   set local-preference 1000
router bgp 64500
   neighbor peering route-map peering-in in
Before we go to our experiment part....

The Interconnection Database


PeeringDB is a freely available, user-maintained, database of networks, and the go-to location for interconnection data. The database facilitates the global interconnection of networks at Internet Exchange Points (IXPs), data centers, and other interconnection facilities, and is the first stop in making interconnection decisions.

The database is a non-profit, community-driven initiative run and promoted by volunteers. It is a public tool for the growth and good of the Internet. Join the community and support the continued development of the Internet.

https://docs.peeringdb.com/
Experiment: Setup eBGP

experiment 02b + ./2a-solution-ipv4 + ./2a-solution-ipv6
Thank you!

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Links and further reading

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Links visited during the webinar

- RFCs
  RFCs are Internet standards issued by the Internet Engineering Task Force (IETF)
  - RFC 4271 - A Border Gateway Protocol 4 (BGP-4)
    - see 5.1.5 for a definition of Local Preference
    - see 9.1 for the BGP best path selection algorithm

- BGP Best Path Selection by vendor
  - Cisco
  - Juniper
  - Mikrotik
  - Nokia
  - BIRD
  - FRRouting

- If you peering at any Internet Exchange - please use PeeringDB

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