Internet Exchanges and BGP Route Servers

Limelight Networks
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Interconnection
Internet Exchange

AS1

Switch Park

AS2

AS3

AS4

AS5
Internet Exchanges

• Layer-2 platform for peers to interconnect

• 121 IXPs in Europe

• Examples: AMS-IX in Amsterdam, LINX in London, DE-CIX in Frankfurt, Espanix in Madrid, Equinix in various locations, ...

• Different structure in different parts of the world:
  • Commercial vs. non-for-profit
  • Independent vs. tied into other services
eBGP - Full Mesh

$n^*(n-1)/2$
eBGP Sessions
eBGP - Full Mesh

- Administrative overhead
- Initial resources when connecting to IX

\[ n*(n-1)/2 \]

eBGP Sessions
eBGP - Full Mesh with RS

eBGP Sessions

n
Route Server

• Receive routing information from all client routers
• Compute best paths
• Distribute routing information among all client routers
Route Server

AS1
BGP Router
P
AS2
BGP Router
P
Loc-RIB
P
AS4
BGP Router
P
AS5
BGP Router
P
Route Server Implementations

• Open source implementations:
  • Quagga, OpenBGPD, BIRD

• Implementation differences, no document to describe what a route server is

• More implementations to come:
  • Cisco IOS, JunOS

• draft-jasinska-ix-bgp-route-server-02
Attribute Transparency

- BGP RS implementation:
  - MUST NOT change NEXT_HOP
  - SHOULD NOT insert ASN into AS_PATH
  - SHOULD NOT modify, process or remove MULTI_EXIT_DISC
  - SHOULD NOT modify, process or remove Communities
eBGP - Partial Mesh

AS1

AS2

AS3

IX

AS4

AS5

BGP Router

BGP Router

BGP Router

BGP Router

BGP Router

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eBGP - Partial Mesh with RS

AS1

BGP Router

IX

AS2

BGP Router

RS

BGP Router

AS3

IX

AS4

BGP Router

AS5

BGP Router

!AS2
Prefix Hiding

AS1

BGP Router

AS5

BGP Router

AS2

BGP Router

AS4

BGP Router

Loc-RIB

>*>
P

*>P

P

AS2

>AS2
Multiple RIBs
Add-paths

• Another approach to provide policy routing on a route server

• Add-paths on eBGP

• Second-best path sent to route server client in case policy applies (or third, or fourth, etc.)
Thanks!