BGP Route Reflection

Lay Minh (Makito)
CCIE # 47682
MikroTik Certified Trainer, MikroTik Consultant
makito.ogawa@gmail.com

BGP

- BGP routes the Internet.
- 638k+ prefixes in Internet routing table as of November 2016.
  - Reference: http://www.cidr-report.org/2.0/
- External BGP (eBGP) between ASes
- Internal BGP (iBGP) within AS.
- Common ISP practices:
  - IGP carries infrastructure links and loopbacks
  - BGP carries Internet and customer prefixes
  - Redistributing Internet routes into IGP is not realistic

Problems To Be Solved

- iBGP requires full mesh peering.
  - iBGP does not manipulate AS Path, no loop prevention
  - iBGP-learned prefixes won't be re-advertised to iBGP peers
- iBGP full mesh does not scale in big networks
  - Massive iBGP sessions
    - 50 BGP routers require **1,225** sessions
    - 100 BGP routers require **4,950** sessions
    - Formula: **n (n – 1) / 2**, n = Number of routers
  - Management and operational overhead
    - Required configuration changes on all routers whenever a new router added

Solutions

- AS Confederation (RFC 1965, 3065, 5065)
  - Divides AS into multiple sub-ASes.
  - To outside world confederation appears as single AS
  - eBGP between confederation ASes:
    - Loop prevention by AS Path
    - iBGP is required in each sub-AS
  - **Not our main focus in this presentation**

- Route Reflection (RFC 1966, 2796, 4456)
  - Re-advertise iBGP prefixes to avoid full mesh
    - Client to client reflection
    - Client to non-client reflection
  - Loop prevention by Originator ID and Cluster List

How Route Reflection Works?

- **Route Reflector (RR)**
  - Central point of route reflection
  - Defines Route Reflector Client on BGP peering configuration
- **Route Reflector Client (RR Client)**
  - Not self-aware as reflector client, no configuration required
  - Only peers to RR, full mesh between RR Clients is eliminated
- RRs change route advertisement rules:
  - eBGP learned routes…
    - Pass to eBGP peers, RR Clients, and Non-Clients
  - RR Client learned routes…
    - Pass to eBGP peers, RR Clients, and Non-Clients
  - Non-Client learned routes…
    - Pass to eBGP peers & RR Clients

Route Reflection Pros & Cons

- Pros
  - Scalability
  - Reduced Operational Cost
  - Reduced Number of BGP Updates
  - Incremental Deployability
- Cons
  - Robustness
  - Prolonged Routing Convergence
  - Reduced Path Diversity
  - Suboptimal Routes or Potential Loops

Route Reflector Configuration

- Choose a router in the network to run as RR.
  - Redundant RRs are recommended
- Define RR Client on RR.
  - Cisco IOS CLI

```
R1(config)# router bgp 64511
R1(config-router)# bgp router-id 10.255.255.1
R1(config-router)# neighbor 10.255.255.2 remote-as 64511
R1(config-router)# neighbor 10.255.255.2 update-source Loopback0
R1(config-router)# neighbor 10.255.255.2 route-reflector-client
```

  - MikroTik RouterOS

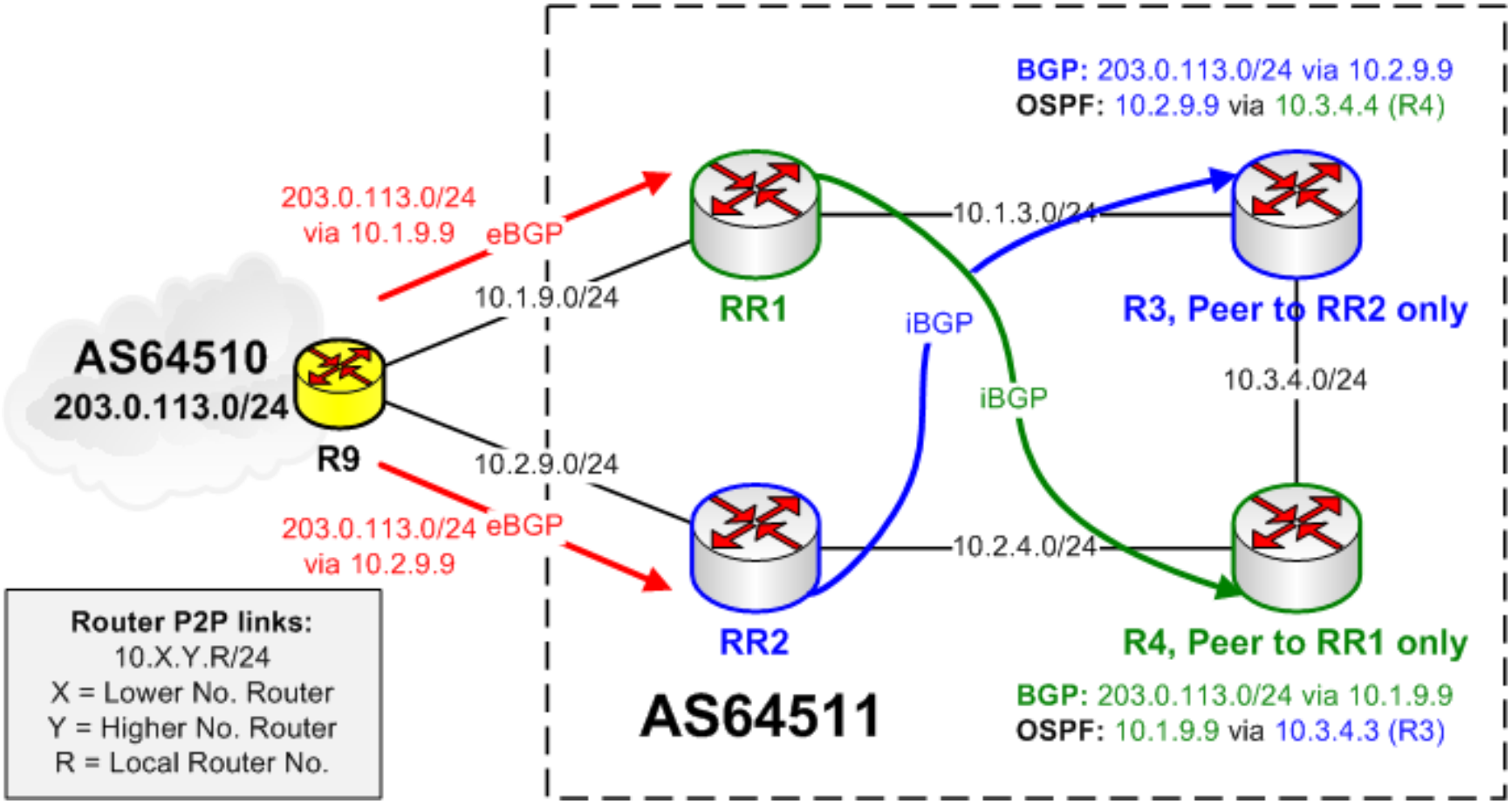
```
# Enable Route Reflector feature
[admin@R1] /routing bgp instance> add name=AS64511 \
    as=64511 router-id=10.255.255.1 \
    client-to-client-reflection=yes

# Configure BGP peer and set as RR Client
[admin@R1] /routing bgp peer> add name=IBGP-R2-IPV4 \
    instance=AS64511 \
    remote-as=64511 remote-address=10.255.255.2 \
    update-source=lo0 route-reflect=yes
```

Route Reflector Design

- By default RR reflects only single best path.
- Placement of RR can be important.
  - RR's best path not necessarily means it is a best path for RR Client's prospective – Introduces Suboptimal Routing
- In-band Route Reflector
  - Common design
  - RR Clients peer to the nearest RR to avoid route deflection
- Out-of-band Route Reflector
  - Works well for MPLS-enabled core
  - Carries VPN prefixes
- Hierarchical Route Reflector
  - Local RR → Regional RR → Continental RR

Route Deflection

- Following setup will cause infinite routing loop between R3 and R4 for destination 203.0.113.0/24.



Questions & Answers

Thank you for your attention!

If you have any questions, please feel free to ask!