

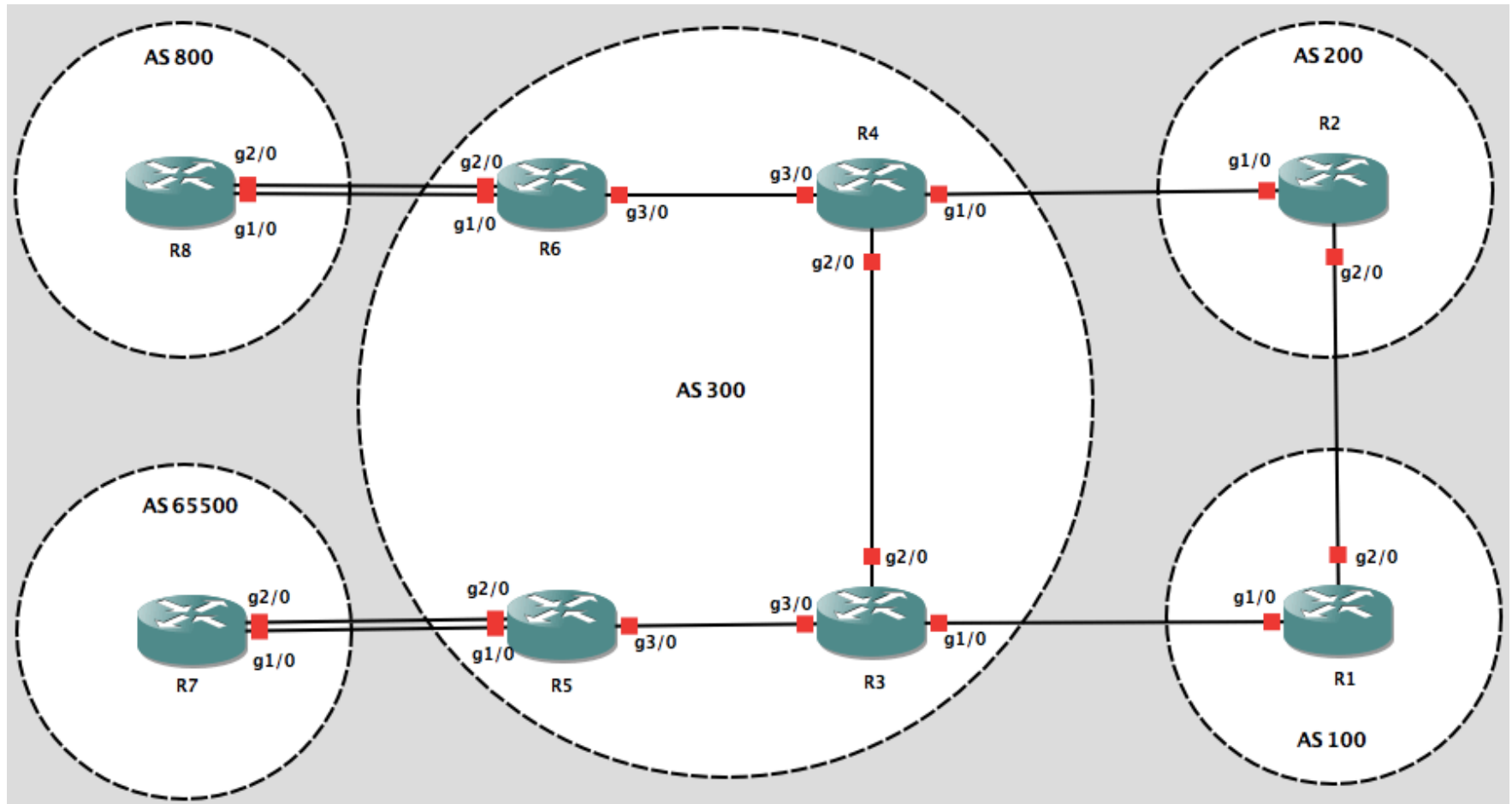
BGP

Lab Activity



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Topology



Network and IP Plan

- All Routers
 - Loopback 10: 10.10.10.X/32
 - Peering: 100.100.XY.X(Y)/24
- R3 – R6
 - Client prefix: 20.20.X.X/24
 - OSPF Process ID: 1
 - OSPF Router ID: X.X.X.X
 - OSPF Area: 0
- Between R5 – R7 and R6 – R8
 - Peering IP 1: 100.100.XY.X(Y)/24
 - Peering IP 1: 100.100.YX.X(Y)/24

Task 0: Troubleshooting Basics

BGP Concept

- Why full mesh network is required for iBGP
- Synchronization rule
- BGP table exchange behavior (best routes)
- iBGP and eBGP route propagation towards neighbor
- iBGP and eBGP next-hop behavior
- Update source for iBGP
- Interpreting BGP table
- Finding the attributes of a route
- Route Reflector
- Route-map operation
- BGP soft and hard reset

Verification

- show ip bgp summary
- show ip bgp neighbors
- show ip protocols
- show ip bgp
- show ip route bgp
- show ip bgp neighbors <neighbor IP> advertised-routes
- show ip bgp neighbors <neighbor IP> routes
- clear ip bgp <AS> / * <soft> <in/out>

Task 1: Basic Configuration

Task 1: Basic Configuration

- Configure all routers
 - Loopback
 - Interface IP

Example: R3

```
interface Loopback 10  
  ip address 10.10.10.3 255.255.255.255
```

```
interface GigabitEthernet1/0  
  description Connected to R1 Gi1/0  
  ip address 100.100.13.3 255.255.255.0  
  no shutdown
```

```
interface GigabitEthernet2/0  
  description Connected to R4 Gi2/0  
  ip address 100.100.34.3 255.255.255.0  
  no shutdown
```

```
interface GigabitEthernet3/0  
  description Connected to R5 Gi3/0  
  ip address 100.100.35.3 255.255.255.0  
  no shutdown
```

Task 2: IGP Configuration

Task 2: IGP Configuration

- Configure OSPF in R3 – R6
 - Router ID
 - Interface with OSPF 1 and area 0
- Check OSPF neighbors
- Ping loopback of R6 from R5
 - Check routing table

Example: R3

```
router ospf 1
  router-id 3.3.3.3

interface Loopback 10
  ip ospf 1 area 0

interface GigabitEthernet2/0
  ip ospf 1 area 0

interface GigabitEthernet3/0
  ip ospf 1 area 0
```

Task 3: iBGP Configuration

Task 3: iBGP Configuration

- Configure R3 as iBGP RR and R4-R6 as RR Client
 - Peer-group in R3
 - Update source loopback
 - Next-hop-self
 - Re-check routing table of R3 – R6
 - Check **Cluster-ID** and **Originator-ID**

Example: R3

```
router bgp 300
  address-family ipv4
    neighbor IBGP-PEER peer-group
    neighbor IBGP-PEER remote-as 300
    neighbor IBGP-PEER update-source Loopback10
    neighbor IBGP-PEER route-reflector-client
    neighbor IBGP-PEER next-hop-self
  neighbor 10.10.10.4 peer-group IBGP-PEER
  neighbor 10.10.10.4 description iBGP with R4
  neighbor 10.10.10.5 peer-group IBGP-PEER
  neighbor 10.10.10.5 description iBGP with R5
  neighbor 10.10.10.6 peer-group IBGP-PEER
  neighbor 10.10.10.6 description iBGP with R6
```

Example: R4

```
router bgp 300
  neighbor 10.10.10.3 remote-as 300
  neighbor 10.10.10.3 description iBGP with R3
  neighbor 10.10.10.3 update-source Loopback10
  neighbor 10.10.10.3 next-hop-self
```


Task 4: eBGP Configuration

Task 4: eBGP Configuration

- Configure all EBGP peering
 - Announce Network
 - Check eBGP neighbor
 - Check routing table
 - Check BGP Table

Example: R1

```
router bgp 100
  neighbor 100.100.12.2 remote-as 200
  neighbor 100.100.12.2 description eBGP with R2
  neighbor 100.100.13.3 remote-as 300
  neighbor 100.100.13.3 description eBGP with R3

address-family ipv4
  network 10.10.10.1 mask 255.255.255.255
```

Task 5: Multiple eBGP Peering

Task 5: Multiple eBGP Peering

- Configure eBGP in loopback between R5 and R7
 - One eBGP peering using multihop option
 - Static route to reach the loopbacks
 - Update source
 - Check BGP neighbors
- Configure eBGP between R6 and R8
 - Two eBGP peering for two physical link
 - Check BGP neighbors

Example: R5

```
router bgp 300
  neighbor 10.10.10.7 remote-as 65500
  neighbor 10.10.10.7 ebgp-multihop 2
  neighbor 10.10.10.7 update-source Loopback10

ip route 10.10.10.7 255.255.255.255 100.100.57.7
ip route 10.10.10.7 255.255.255.255 100.100.75.7
```

Example: R6

```
router bgp 300
  neighbor 100.100.68.8 remote-as 800
  neighbor 100.100.68.8 description eBGP-Pri with R8
  neighbor 100.100.86.8 remote-as 800
  neighbor 100.100.86.8 description eBGP-Sec with R8
```

Task 6: Originate Prefix

Task 6: Originate Prefix

- Originate prefix in R3-R6
 - **network** command
 - Pull up route

Example: R4

```
router bgp 300
  address-family ipv4
    network 10.10.10.4 mask 255.255.255.255
    network 20.20.4.0 mask 255.255.255.0

ip route 10.10.10.4 255.255.255.255 null 0
ip route 20.20.4.0 255.255.255.0 null 0
```

Example: R1

```
router bgp 100  
  address-family ipv4  
    network 10.10.10.1 mask 255.255.255.255
```

```
ip route 10.10.10.1 255.255.255.255 null 0
```

Task 7: BGP Authentication

Task 7: BGP Authentication

- Configure MD5 between R1 and R2
 - Configure R1 and wait for message/log
 - Configure different password in R2
 - Fix the problem with correct password
- Check bgp table

Example: R1

```
router bgp 100  
  neighbor 100.100.12.2 password BGPLAB
```

Task 8: Remove Private AS

Task 8: Remove Private AS

- Check bgp table from R1 for R7's loopback
 - Is the private AS present in the AS path?
- Remove private AS in R3 towards R1
 - Configure remove-private-as in bgp with R1
 - Soft clear bgp table
- Re-check R1's bgp table for private AS

Example: R3

```
router bgp 300  
  address-family ipv4  
    neighbor 100.100.13.1 remove-private-as
```

Task 9: Default Route

Task 9: Default Route

- Configure default route in R1 towards R3
 - Soft clear bgp neighbor
 - Check bgp table from R1, R2, R3 and R7

Example: R1

```
router bgp 100  
  neighbor 100.100.13.3 default-originate
```

Task 10: Summary Route

Task 10: Summary Route

- Configure summarization in R3 for 20.20.0.0/16
 - Aggregate address in R3 without and with summary-only
 - Check bgp and routing table from R1
 - Aggregate address in R3 without and with as-set
 - Check bgp and routing table from R1 and R4
- Remove the summary route configuration
- <http://www.cisco.com/c/en/us/support/docs/ip/border-gateway-protocol-bgp/5441-aggregation.html>

Example: R3

```
router bgp 300  
  aggregate-address 20.20.0.0 255.255.0.0 [summary-only]  
  aggregate-address 10.10.10.0 255.255.255.0 [as-set]
```

Task 11: Weight

Task 11: Weight

- Option 1: Configure weight in BGP peering
 - Check routing table and BGP table in R6 and R8
 - Check the next-hop for R6's loopback 10 from R8
 - Configure weight for both link so that secondary link becomes best route for R6's loopback 10 from R8
 - Soft clear bgp
 - Check BGP table and routing table for best path
 - Check weight attribute from R8
 - Check weight attribute from R6
 - Revert to previous configuration
- Option 2: Configure weight using route-map

Example: R8

```
router bgp 800
  neighbor 100.100.68.6 remote-as 300
  neighbor 100.100.68.6 weight 100
  neighbor 100.100.86.6 remote-as 300
  neighbor 100.100.86.6 weight 200

clear ip bgp <neighbor IP>/* in/out/soft
```

Task 12: Local Preference

Task 12: Local Preference

- Option 1: Configure default local preference
bgp default local-preference *[value]*
- Option 2: Configure local preference in route-map
- Configure local preference in R3 so that R1 becomes next hop for R2's loopback 10
 - Check BGP table for R2's loopback in R1
 - Configure prefix-list
 - Configure route-map
 - Match prefix-list
 - Set higher local-preference
 - Assign the route-map on neighbor command with R1
 - Soft clear bgp table
- Re-check the next hop
- Remove the local preference configuration

Example: R3

```
ip prefix-list LPREF seq 10 permit 10.10.10.2/32
```

```
route-map UPLOAD permit 10  
  match ip address prefix-list LPREF  
  set local-preference 200
```

```
!
```

```
route-map UPLOAD permit 20
```

```
router bgp 300  
  neighbor 100.100.13.1 route-map UPLOAD in
```

Task 13: Multi Exit Discriminator

Task 13: Multi Exit Discriminator

- Option 1: Configure default metric
`default metric [value]`
- Option 2: Configure metric in route-map
- Configure MED so that secondary path wins to reach R8's Loopback 10 from R6
 - Check bgp table of R8 and R6
 - Reset BGP peering with 100.100.86.8 (sec), now next hop for R8's loopback from R6 should be 100.100.68.8 (pri)
 - Configure prefix-list
 - Configure route-map to set MED
 - Assign route-map to neighbor
 - Soft clear bgp
 - Check metric in R8, R6, R3 and R1
- Re-check the bgp table
- Remove the MED configuration

Example: R8

```
ip prefix-list MED seq 10 permit 10.10.10.8/32
```

```
route-map MED-P permit 10  
  match ip address prefix-list MED  
  set metric 100  
route-map MED-P permit 20  
  set metric 200
```

DO SIMILAR CONFIGS FOR THE BACKUP PATH

```
router bgp 800  
  neighbor 100.100.86.6 route-map MED-P out  
  neighbor 100.100.68.6 route-map MED-B out
```


Task 14: AS Path Prepend

Task 14: AS Path Prepend

- Check the bgp table in R1 for R5's loopback
- Configure as path prepend to make R2 as the next hop from R1 to reach R5
 - Configure prefix list
 - Configure route-map
 - Match prefix list
 - Set as path prepending
 - Assign in bgp neighbor
 - Soft clear bgp
- Recheck bgp table of R1
- Remove the AS path prepend configuration

Example: R3

```
ip prefix-list AS-PATH seq 10 permit 10.10.10.5/32
ip prefix-list AS-PATH seq 20 permit 20.20.5.0/24
```

```
route-map AS-PREP permit 10
  match ip address prefix-list AS-PATH
  set as-path prepend 300 300
```

!

```
route-map AS-PREP permit 20
```

```
router bgp 300
  neighbor 100.100.13.1 route-map AS-PREP out
```

Task 15: Prefix List

Task 15: Prefix List

- Check R4's advertised routes towards R2
- Check R2's received routes from R4
- Configure prefix-list in R4 to send only loopback 20 prefixes of AS 300 to R2
 - Create prefix-list and permit the prefix
 - Use no le/ge logic i.e 20.20.0.0/16
 - Re-check advertise (from R4)/received (from R2) routes
 - Permit 20.20.0.0/16 le 24
 - Re-check advertise (from R4)/received (from R2) routes
- Remove the prefix list configuration

Example: R4

```
ip prefix-list PREFIX seq 10 permit 20.20.0.0/16  
[le] [ge] <prefix length>
```

```
router bgp 300
```

```
neighbor 100.100.24.2 prefix-list PREFIX out
```

Task 16: Filter List

Task 16: Filter List

- Check R7's received routes from AS 300
- Create filter list in R7
 - Permit prefixes generated from AS 300 only
 - Apply the filter list to bgp neighbor
 - Soft clear bgp
 - Re-check R5's advertised routes and R7's received routes
 - Remove the filter-list command
- Create route map and match the filter list
 - Apply the route map to bgp neighbor
 - Soft clear bgp
 - Re-check R5's advertised routes and R7's received routes

Example: R7

```
ip as-path access-list 10 permit ^300$
```

```
router bgp 65500
```

```
neighbor 10.10.10.5 filter-list 10 in
```

OR

```
route-map AS-SET permit 10
```

```
match as-path 10
```

```
route-map AS-SET permit 20
```

```
router bgp 65500
```

```
neighbor 10.10.10.5 route-map AS-SET in
```

Task 17: BGP Community

Task 17: BGP Community

- In R3
 - Set BGP Community 300:11 for default route received from R1
 - Set BGP Community 300:12 for the rest of the routes
- In R4
 - Set BGP Community 300:2 for the routes received from R2
- In R5
 - Set BGP Community 300:7 for the routes received from R7
- In R6
 - Permit default route towards R8 via secondary path using community
 - Permit full routes towards R8 via primary path using community

Example: R3

```
ip bgp-community new-format
```

```
ip prefix-list DEFAULT seq 10 permit 0.0.0.0/0
```

```
route-map BGP-COMM-IN permit 10  
  match ip address prefix-list DEFAULT  
  set community 300:11 additive  
route-map BGP-COMM-IN permit 20  
  set community 300:12 additive
```

```
router bgp 300  
  neighbor 100.100.13.1 route-map BGP-COMM-IN in  
  neighbor IBGP-PEER send-community
```

Example: R4

```
ip bgp-community new-format
```

```
route-map BGP-COMM-IN permit 10  
  set community 300:2 additive
```

```
router bgp 300  
  neighbor 100.100.24.2 route-map BGP-COMM-IN in  
  neighbor 10.10.10.3 send-community
```

Example: R6

```
ip bgp-community new-format
```

```
ip community-list 1 permit 300:11
```

```
ip community-list 2 permit 300:11
```

```
ip community-list 2 permit 300:12
```

```
ip community-list 2 permit 300:2
```

```
ip community-list 2 permit 300:7
```

```
route-map BGP-COMM-PRI-OUT permit 10
```

```
match community 2
```

```
route-map BGP-COMM-SEC-OUT permit 10
```

```
match community 1
```

```
router bgp 300
```

```
neighbor 100.100.68.8 route-map BGP-COMM-PRI-OUT out
```

```
neighbor 100.100.86.8 route-map BGP-COMM-SEC-OUT out
```

Question?