

# Hands-on Session: Essentials of BGP, EBGP, IBGP

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## Hands-on Workshop on Networking Topics

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# A Short Overview of BGP

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# BGP – Best Path

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1. Prefer the path with **highest weight** (configured locally; set to 0 (default) for routes not originated by the router)
2. If weights are the same, prefer the path with **highest local preference** (set to 100 by default)
3. If the local preferences are the same, prefer the **path that was originated by BGP running on the router or redistributed from an Interior Gateway Protocol (IGP)**
4. If no route was originated, prefer the path with the **shortest AS\_PATH**
5. If the paths have the same AS\_PATH length, prefer the path with the **lowest origin type** (IGP is lower than Exterior Gateway Protocol (EGP), and EGP is lower than Incomplete)
6. If the origin codes are the same, prefer the path with the **lowest MED attribute** (set to 0 by default)
7. If the paths have the same MED, prefer the **External path (EBGP) over the Internal path (IBGP)**
8. If the paths are still the same, prefer the path through the **closest IGP neighbor (lowest IGP metric)**
9. If both paths are external, prefer the path that was **received first (oldest one)**
10. If the paths are still the same, prefer the path from the **BGP router with the lowest router ID**
11. If the router ID is the same for multiple paths, prefer the path with the **lowest IP address**

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Rick Graziani, "Implementing Cisco IP Routing," Cisco Press, 2015

# BGP – Best Path

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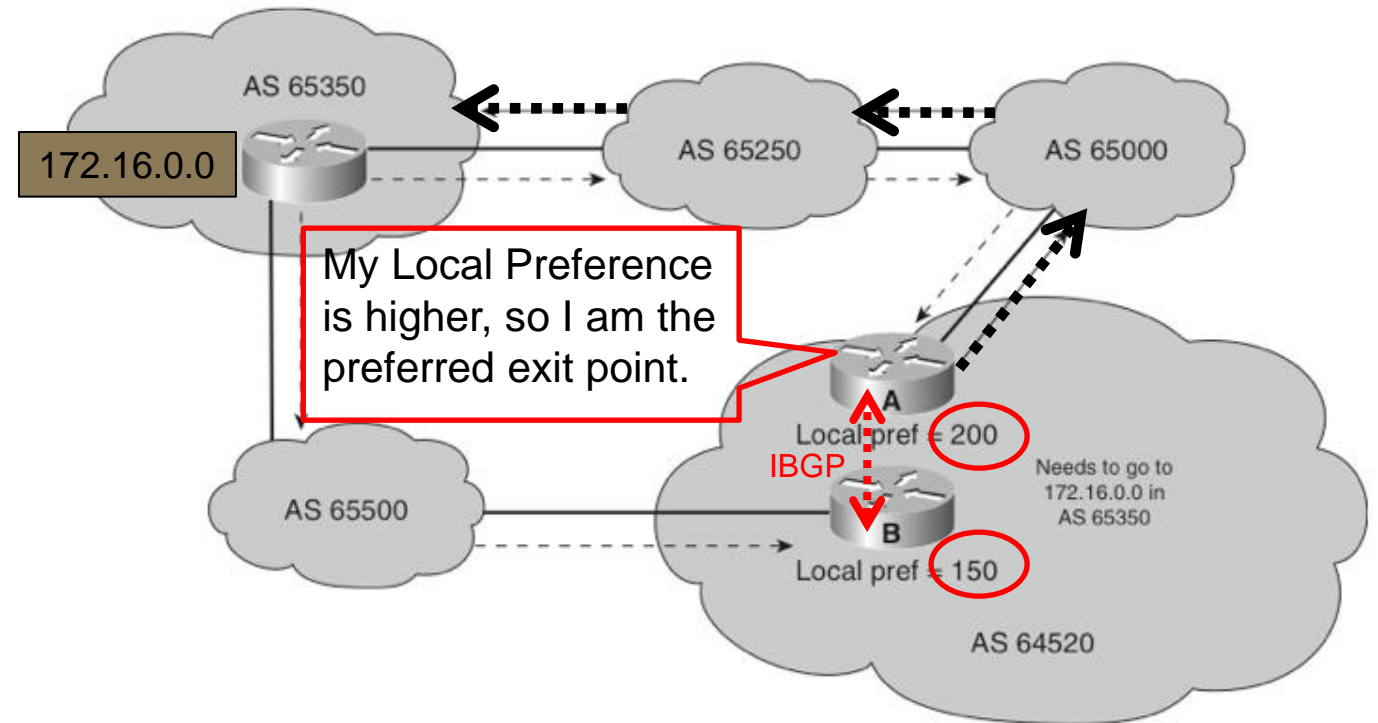
- Without route manipulation, the most common reason for path selection is Step 4
  - If no route was originated, prefer the path with the **shortest AS\_PATH**
- If multiple paths have the same number of autonomous systems to traverse, the second most common decision point is Step 7
  - If the paths have the same MED, prefer **EBGP over IBGP**
- If a network administrator does not like the path with fewest ASes, he/she can manipulate weight or local preference to change which outbound path BGP selects

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Rick Graziani, "Implementing Cisco IP Routing," Cisco Press, 2015

# The Local Preference Attribute

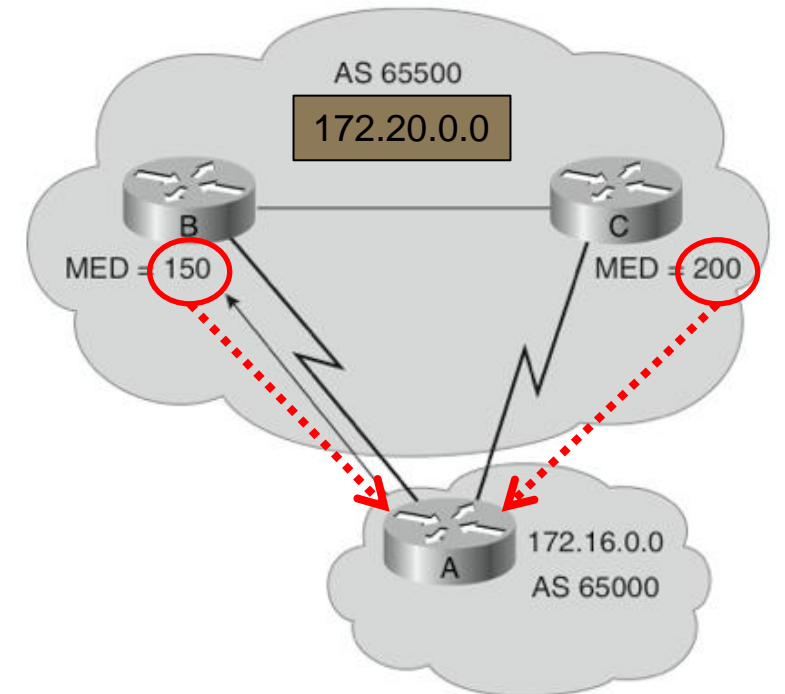
- Indicates to routers in the AS which path is preferred **to exit the AS** (higher is better)
- AS 64520 receives updates about network 172.16.0.0 from two directions:
  - via AS 65500 (65500, 65350)
  - via AS 65000 (65000, 65250, 65350)
- Local preference:
  - On Router A for network 172.16.0.0 is 200
  - On Router B for network 172.16.0.0 is 150
- Local preference information is exchanged within AS 64520 via IBGP
- All traffic in AS 64520 addressed to network 172.16.0.0 is sent to Router A as an exit point from AS 64520



Rick Graziani, "Implementing Cisco IP Routing," Cisco Press, 2015

# The Med Attribute

- Indicates to external neighbors the preferred path *into* an AS
- By default, a router compares the MED only for paths from neighbors in the **same AS**. Lowest Wins!
- MED is sent to EBGP peers:
  - Those routers propagate the MED within their AS
  - But do not pass it on to the next AS



Rick Graziani, "Implementing Cisco IP Routing," Cisco Press, 2015

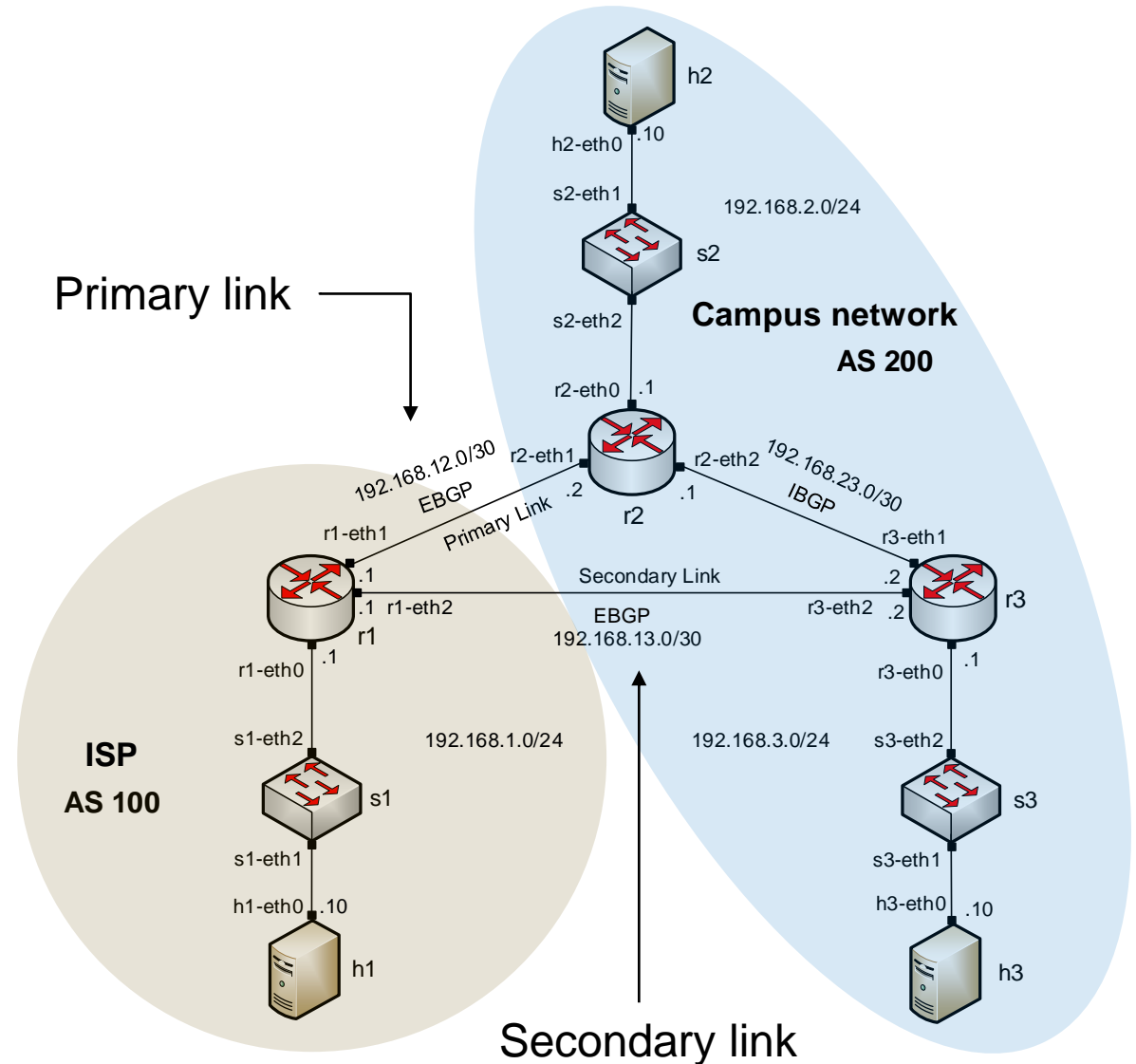
# Configuring IBGP and EBGP Sessions, Local Preference, and MED

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Lab activities are described in Lab 8, BGP Lab Series

# Lab Topology

- Configure IBGP within AS 200
- Configure EBGP between AS 100 and AS 200
- Configure LOCAL\_PREF and MED attributes to favor the primary link over the secondary one



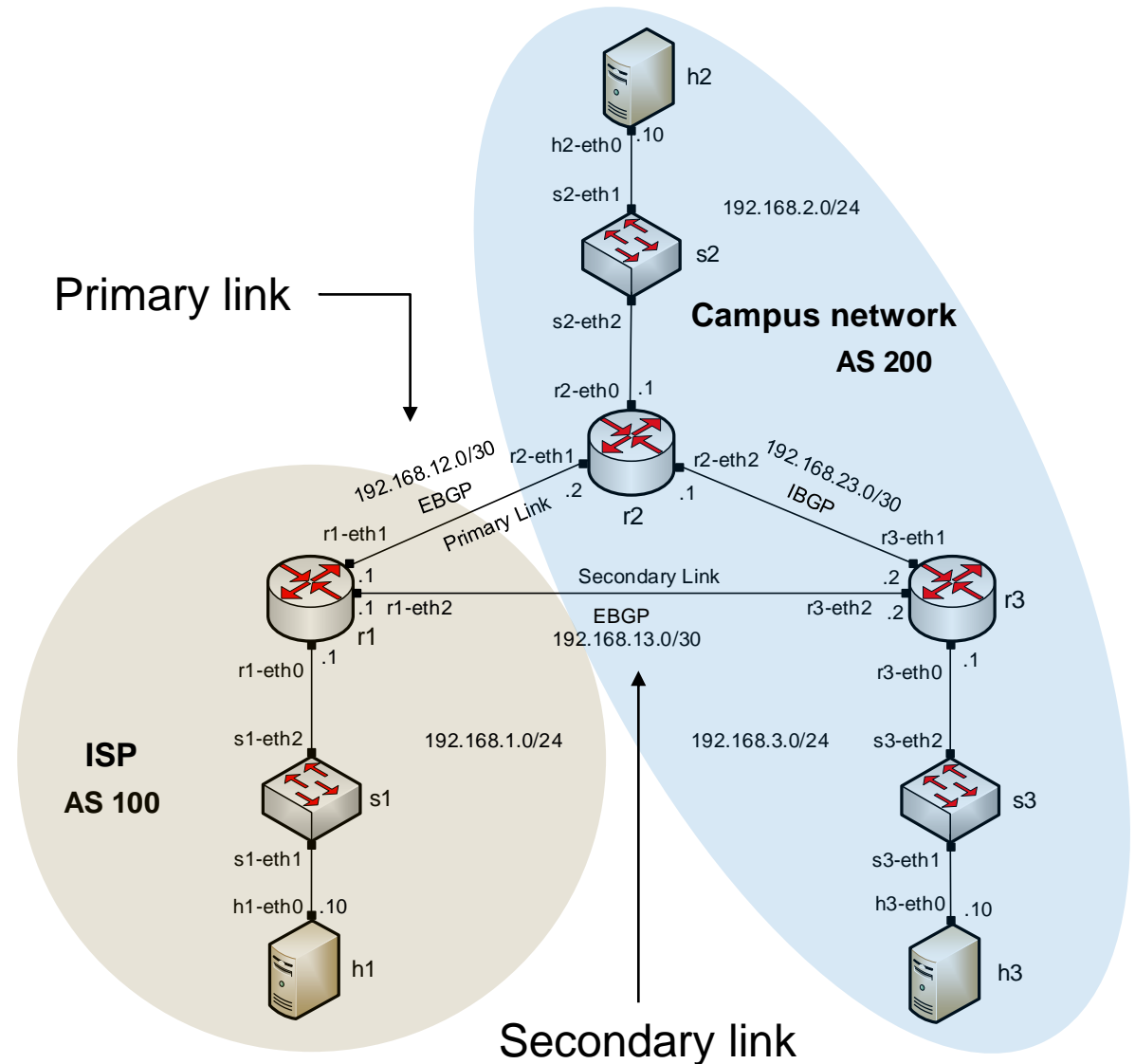


# Lab Topology

- Local\_PREF attribute configuration on routers r2 and r3
  - Configure a route-map
  - Set the LOCAL\_PREF attribute
  - Assign the route-map to the BGP neighbor

```
Host: r2
frr-pc# configure terminal
frr-pc(config)# route-map primary_in permit 10
frr-pc(config-route-map)# set local-preference 150
frr-pc(config-route-map)# exit
frr-pc(config)# router bgp 200
frr-pc(config-router)# neighbor 192.168.12.1 route-map primary_in in
frr-pc(config-router)#
```

```
Host: r3
frr-pc# configure terminal
frr-pc(config)# route-map secondary_in permit 10
frr-pc(config-route-map)# set local-preference 125
frr-pc(config-route-map)# exit
frr-pc(config)# router bgp 200
frr-pc(config-router)# neighbor 192.168.13.1 route-map secondary_in in
frr-pc(config-router)# end
```



# Lab Topology

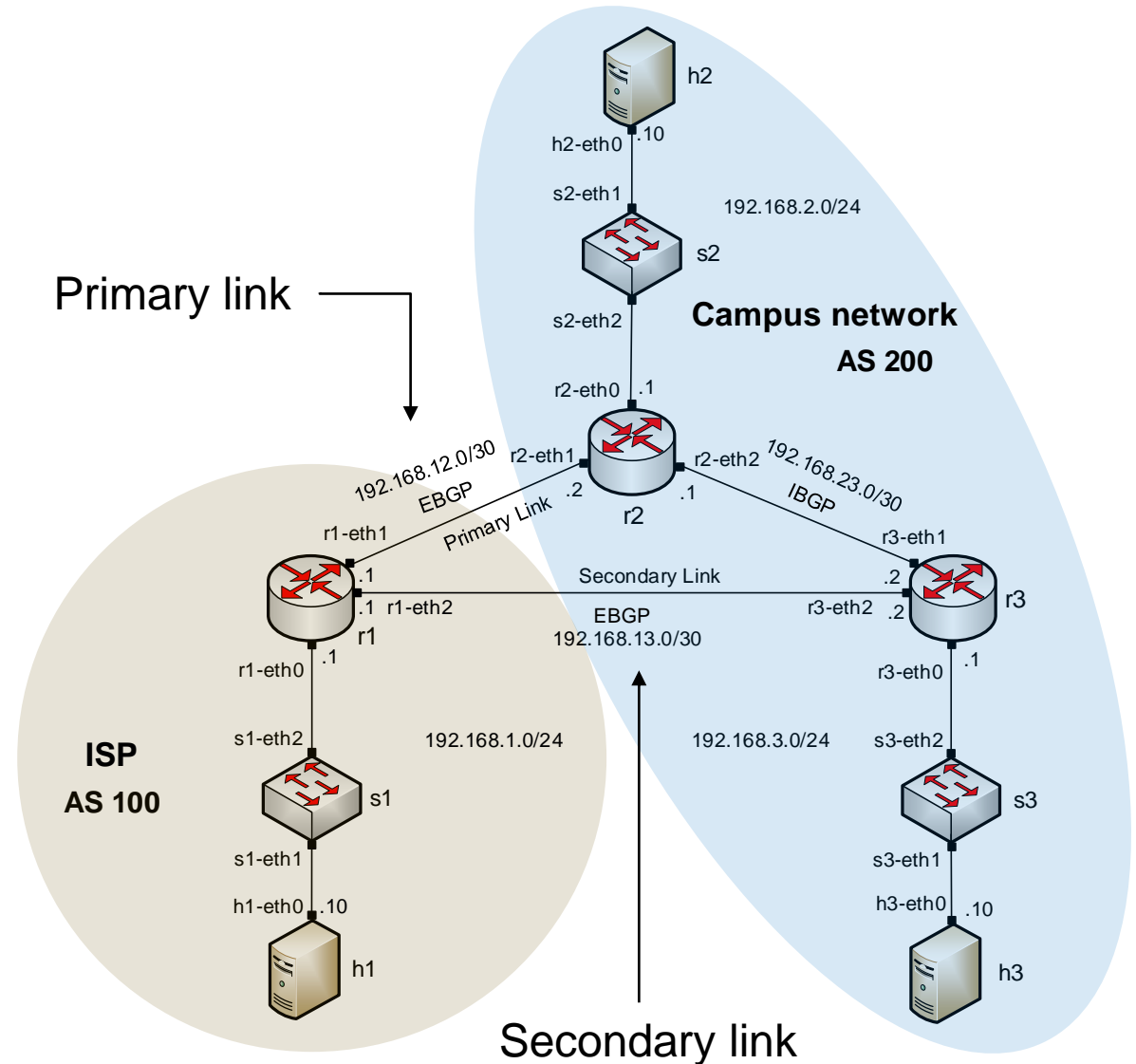
- BGP table of router r3 after configuring the LOCAL\_PREF attribute

```

Host: r3
frr-pc# show ip bgp
BGP table version is 6, local router ID is 3.3.3.3, vrf id 0
Default local pref 100, local AS 200
Status codes: s suppressed, d damped, h history, * valid, > best, = multipath,
               i internal, r RIB-failure, S Stale, R Removed
Nexthop codes: @NNN nexthop's vrf id, < announce-nh-self
Origin codes:  i - IGP, e - EGP, ? - incomplete

Network        Next Hop        Metric LocPrf Weight Path
*>i192.168.1.0/24 192.168.12.1    0      150     0 100 i
*                192.168.13.1    0      125     0 100 i
*>i192.168.2.0/24 192.168.23.1    0      100     0  i
*> 192.168.3.0/24 0.0.0.0         0       0     32768 i
*>i192.168.12.0/30 192.168.23.1    0      100     0  i
*> 192.168.13.0/30 0.0.0.0         0       0     32768 i

Displayed 5 routes and 6 total paths
frr-pc#
  
```

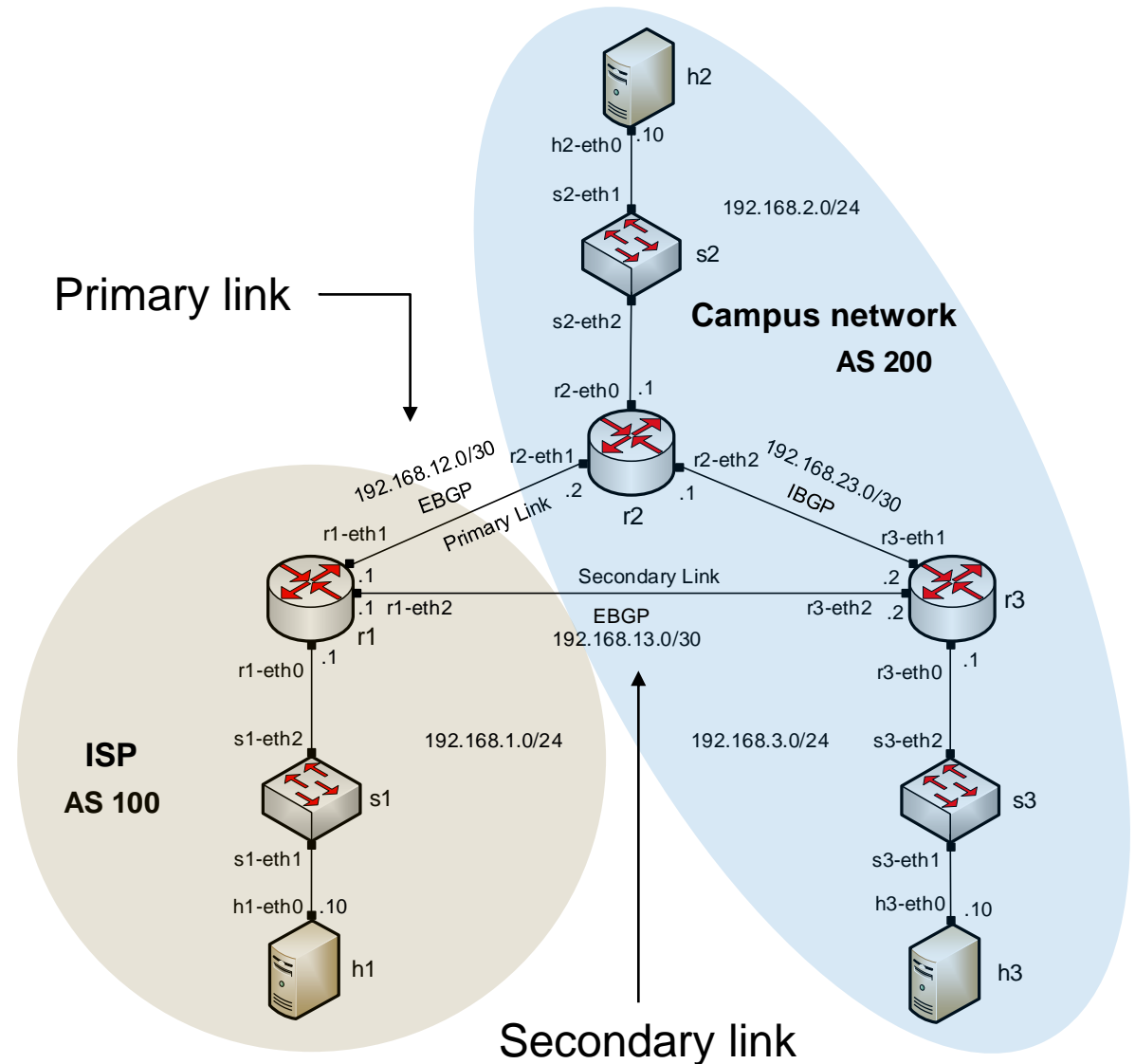


# Lab Topology

- MED attribute configuration on routers r2 and r3
  - Configure a route-map
  - Set the MED attribute
  - Assign the route-map to the BGP neighbor

```
Host: r2
frr-pc# configure terminal
frr-pc(config)# route-map primary_med_out permit 10
frr-pc(config-route-map)# set metric 50
frr-pc(config-route-map)# exit
frr-pc(config)# router bgp 200
frr-pc(config-router)# neighbor 192.168.12.1 route-map primary_med_out out
frr-pc(config-router)#
```

```
Host: r3
frr-pc# configure terminal
frr-pc(config)# route-map secondary_med_out permit 10
frr-pc(config-route-map)# set metric 75
frr-pc(config-route-map)# exit
frr-pc(config)# router bgp 200
frr-pc(config-router)# neighbor 192.168.13.1 route-map secondary_med_out out
frr-pc(config-router)# end
frr-pc#
```



# Lab Topology

- BGP table of router r1 after configuring the MED attribute

```

Host: r1
frr-pc# show ip bgp
BGP table version is 17, local router ID is 1.1.1.1, vrf id 0
Default local pref 100, local AS 100
Status codes: s suppressed, d damped, h history, * valid, > best, = multipath,
               i internal, r RIB-failure, S Stale, R Removed
Nexthop codes: @NNN nexthop's vrf id, < announce-nh-self
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop        Metric LocPrf Weight Path
*> 192.168.1.0/24    0.0.0.0          0         32768 i
* 192.168.2.0/24    192.168.13.2     75         0 200 i
*> 192.168.3.0/24    192.168.12.2     50         0 200 i
*                   192.168.13.2     75         0 200 i
* 192.168.12.0/30   192.168.13.2     75         0 200 i
*>                   192.168.12.2     50         0 200 i
*> 192.168.13.0/30   192.168.12.2     50         0 200 i
*                   192.168.13.2     75         0 200 i

Displayed 5 routes and 9 total paths
frr-pc#
  
```

