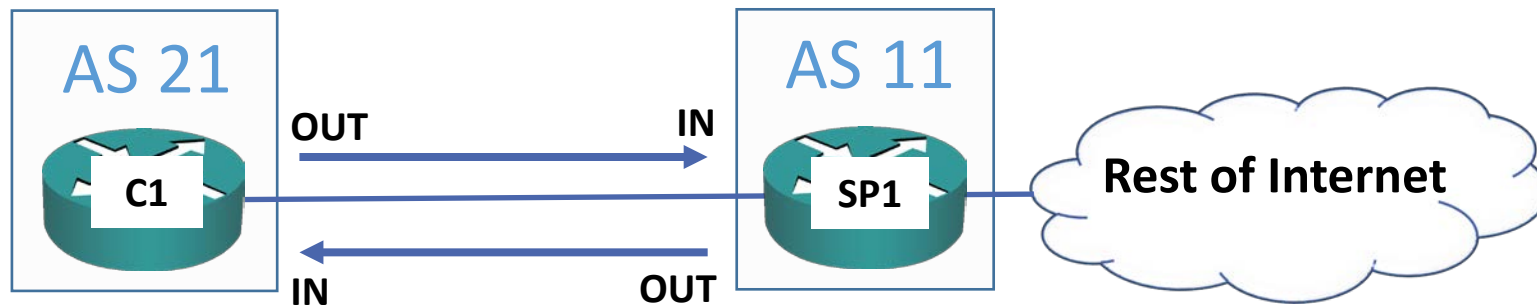


BGP Filtering



- Route filtering allows certain specified routes to not be advertised outbound, or accepted inbound
- It can be implemented on the enterprise and/or ISP side
- It is best to implement it in the outbound direction, saving the receiving router from having to do any filter processing



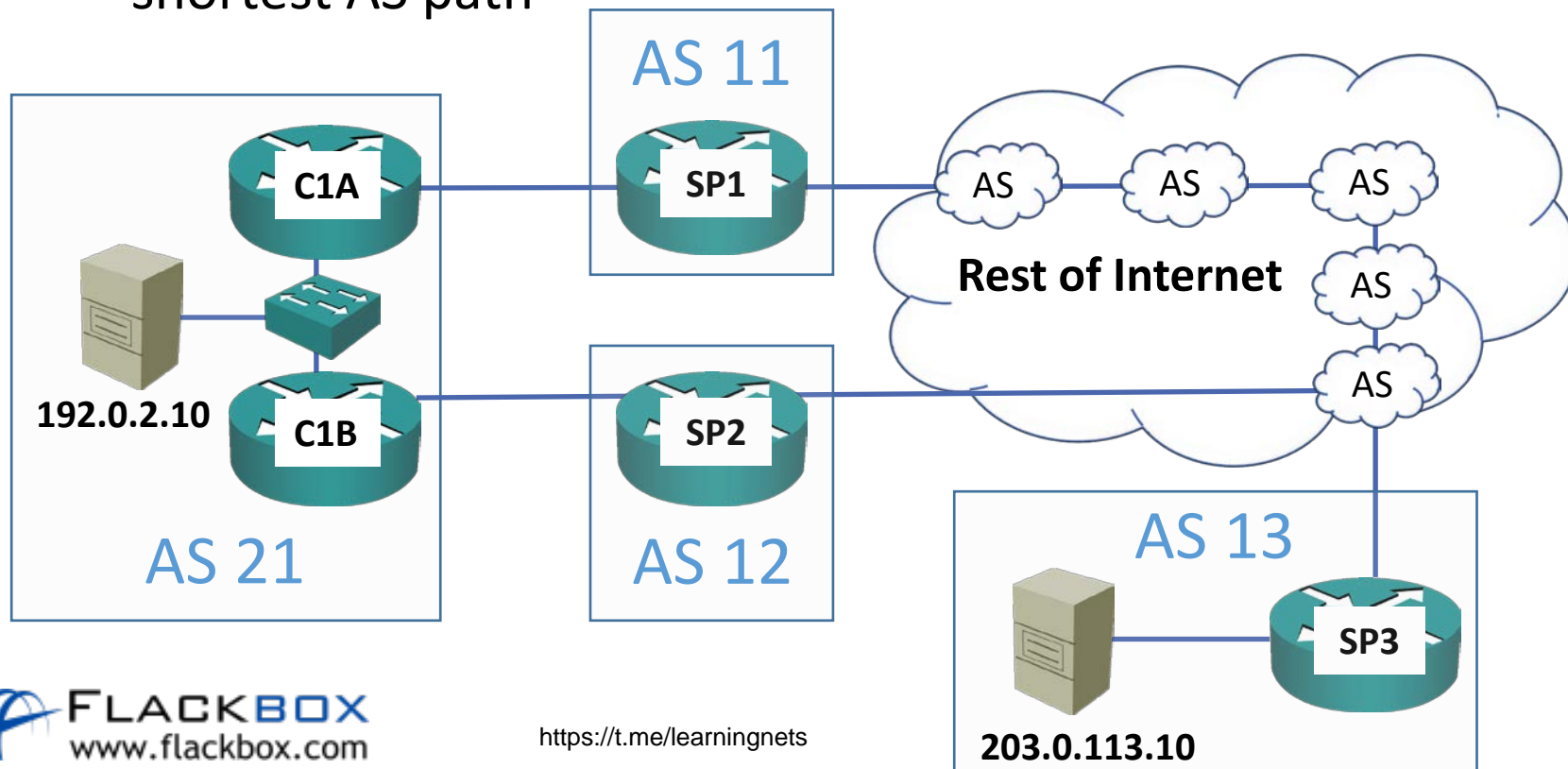
BGP Filtering



- Internet Service Providers implement BGP route filtering to ensure they do not accept improper routes from neighbor ASs
- They filter out bogon networks (unallocated public address space), and addresses which are illegitimate on the Internet such as RFC 1918 private addresses and the loopback address range 127.0.0.0/8
- They will also typically only accept the public networks from an enterprise which are allocated to that enterprise. This ensures that their BGP routing table is correct, and that enterprises do not become transit ASs
- Best practice for enterprises is to also ensure they are only advertising their own public address space

Enterprise Transit Network

- AS 21 should only advertise its own 192.0.2.0/24 network to its ISPs
- If AS 21 advertises Internet routes to its ISPs (the default), it could become a transit AS
- AS 11 will send traffic to 203.0.113.10 via 'C1A > C1B > SP2 > Internet' as that is the shortest AS path



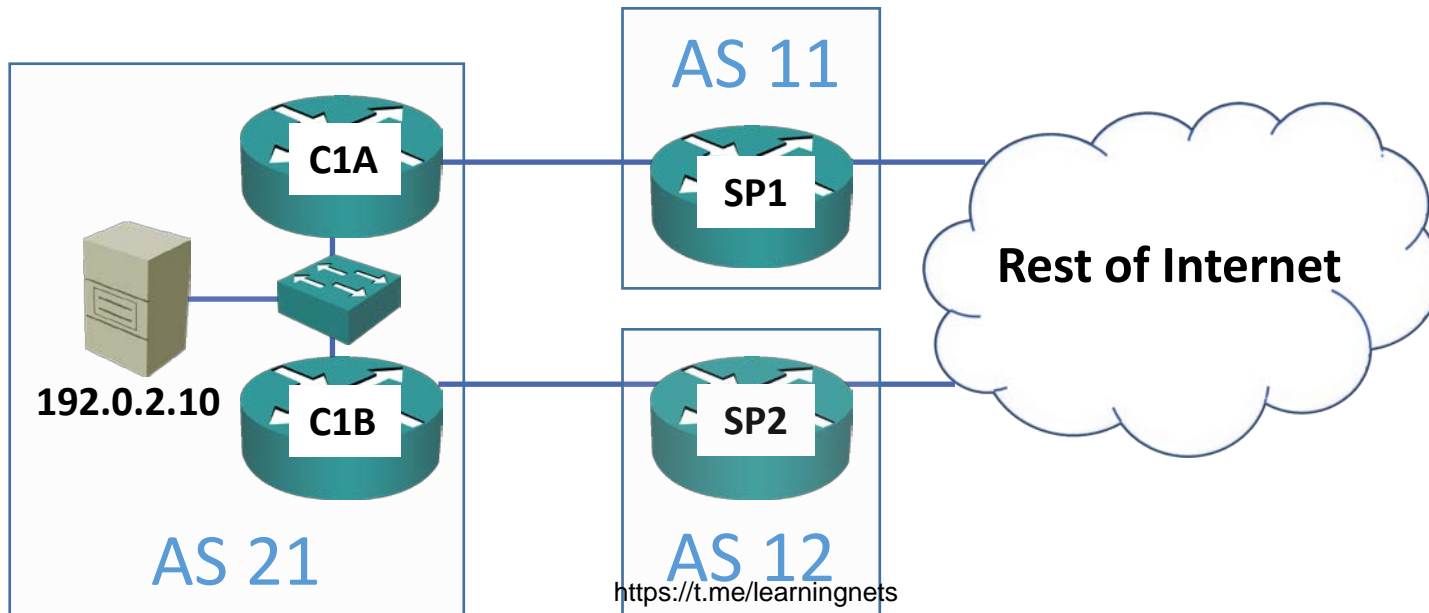
BGP Filtering – Internet Routes Subset

- There are over 700,000 routes in the global Internet routing table
- This can overwhelm many Enterprise class routers
- To limit the amount of routes sent to an enterprise, an ISP can use BGP filtering to only advertise a subset of the entire BGP table (such as routes in the ISP's own AS), and optionally a default route
- This provides for optimal routing where it is most suitable and a default selection for everything else
- The filtering can also occur inbound at the enterprise

Internet Routes Subset



- AS 21 only takes AS 11 routes and a default route from AS11
- AS 21 only takes AS 12 routes and a default route from AS 12
- The size of the BGP tables on AS 21's routers is minimised, while providing optimal routing to networks in AS 11 and AS 12
- Traffic to other ASs is via a default route, not guaranteeing optimal routing



BGP Filtering Methods



- A Distribute List can be applied inbound or outbound globally to all BGP neighbors
- BGP filtering can be applied inbound or outbound for a neighbor using:
 - ACL in Distribute List
 - Prefix List in Distribute List
 - Prefix List
 - AS Path Filter List
 - ACLs, Prefix Lists, AS Path Filter Lists or Communities in Route Map

ACL and Prefix List Route Filter Operation

- **Routes to be filtered** can be specified with an Access Control List or Prefix List
- ACLs and Prefix Lists can optionally be nested inside a Route Map
- The filter is **applied** to the routing protocol with a Distribute List
- Prefix Lists and Route Maps can be applied directly to neighbors in BGP

```
C1A(config)# router bgp 21
C1A(config-router)#?
distribute-list          Filter networks in routing updates (all neighbors)
```

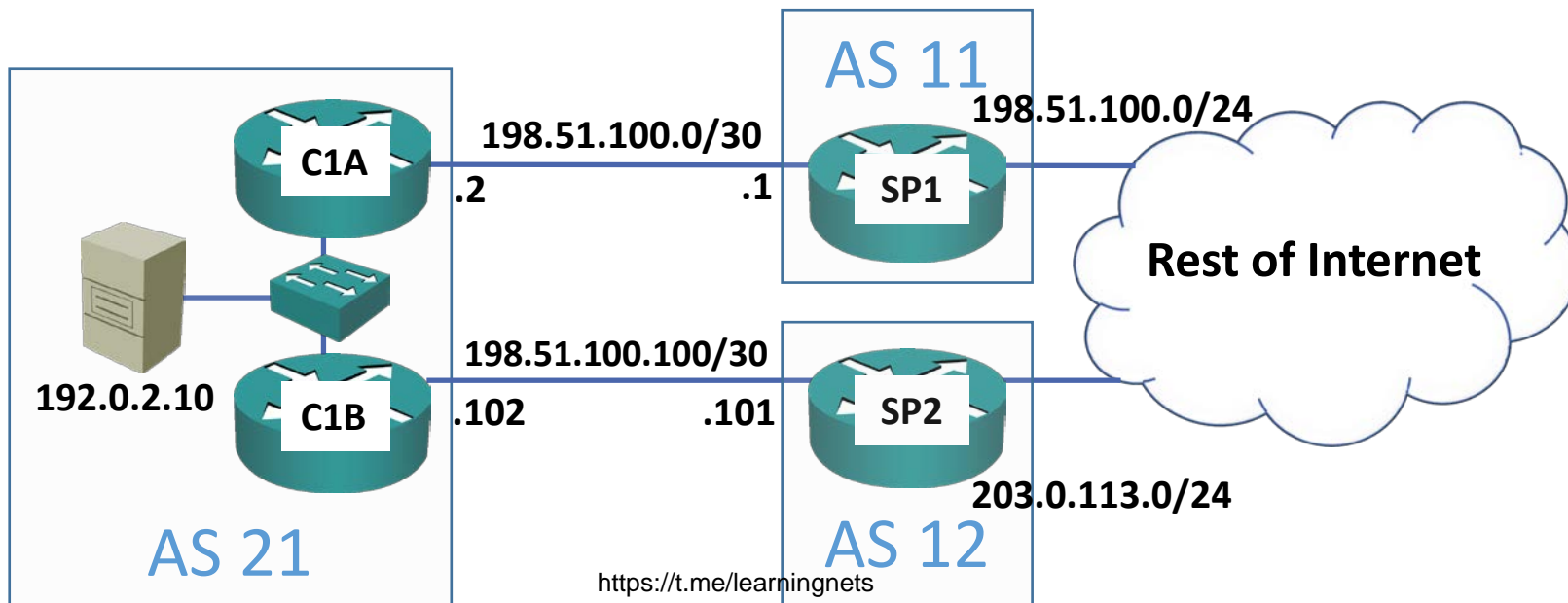
```
C1A(config-router)#neighbor 198.51.100.1 ?
distribute-list          Filter updates to/from this neighbor
prefix-list              Filter updates to/from this neighbor
route-map                Apply route map to neighbor
```

Prefix List Configuration Example – Internet Routes Subset



```
C1A(config)# ip prefix-list DEMO permit 198.51.100.0/24
C1A(config)# ip prefix-list DEMO permit 0.0.0.0/0
C1A(config)# router bgp 21
C1A(config-router)# neighbor 198.51.100.1 prefix-list DEMO in
```

```
C1B(config)# ip prefix-list DEMO permit 203.0.113.0/24
C1B(config)# ip prefix-list DEMO permit 0.0.0.0/0
C1B(config)# router bgp 21
C1B(config-router)# neighbor 198.51.100.101 prefix-list DEMO in
```



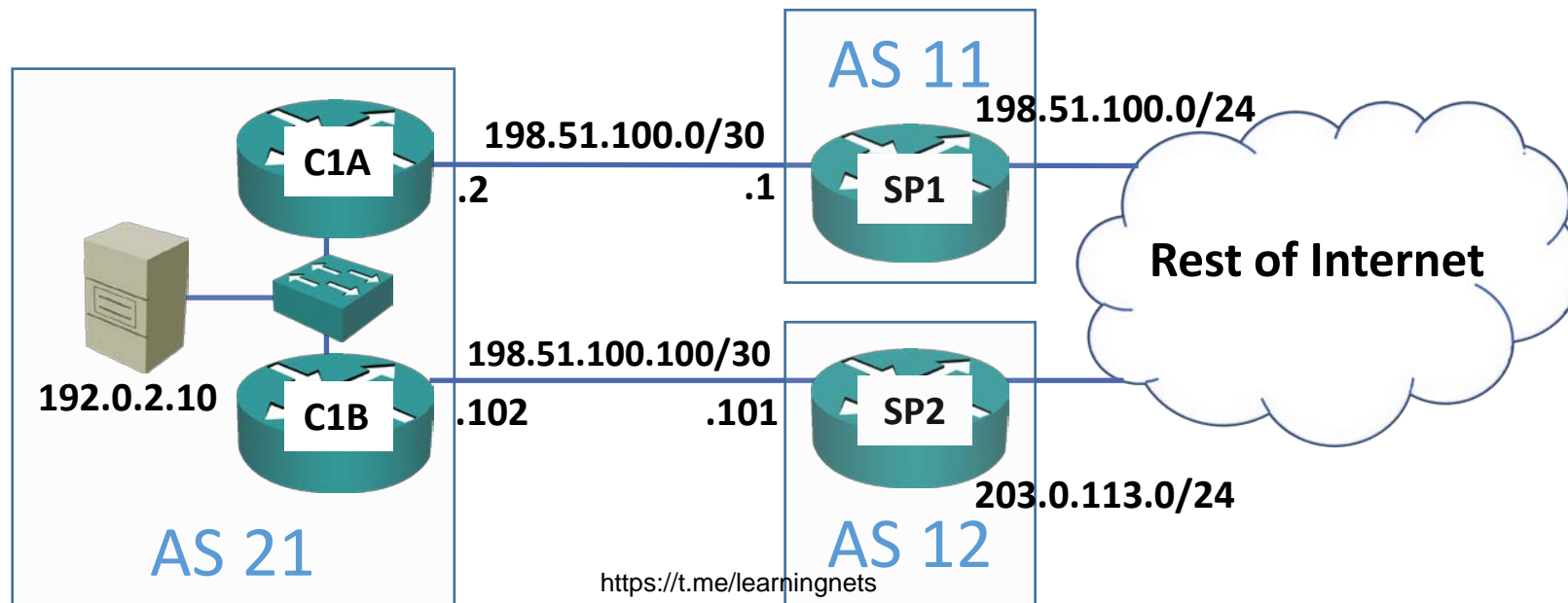
Scalability - AS Path Filtering



- Filtering based on ACLs or Prefix Lists requires a large configuration if there are many IP prefixes, and the configuration needs to be updated whenever prefixes are added or removed to the network
- A more scalable method is AS Path filtering, which filters based on AS numbers in the AS Path
- All the routes originating in or passing through an AS can be referenced together by that AS number
- AS Path info for routes rarely changes
- Either method can be used, or they can both be used at the same time (they are not mutually exclusive)

AS Path Filtering Configuration Example – Internet Routes Subset

```
C1A(config)# ip as-path access-list 1 permit ^11$  
C1A(config)# router bgp 21  
C1A(config-router)# neighbor 198.51.100.1 filter-list 1 in
```



AS Path Filtering Configuration with Route Map

- A Route Map can set attributes on routes as well as filtering them

```
C1A(config)# ip as-path access-list 1 permit ^11$
```

```
C1A(config)# route-map DEMO permit 10
```

```
C1A(config-route-map)# match as-path 1
```

```
C1A(config-route-map)# set local-preference 200
```

```
C1A(config)# router bgp 21
```

```
C1A(config-router)# neighbor 198.51.100.1 route-map DEMO in
```

BGP Communities

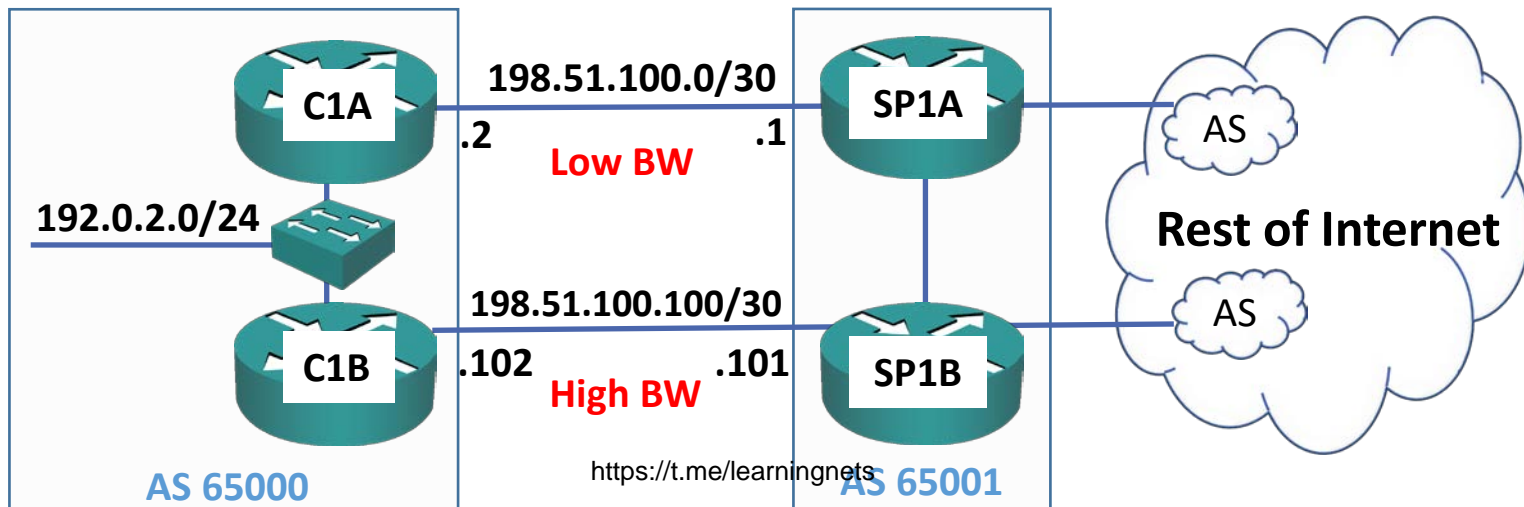


- BGP Communities are a means of tagging routes to ensure consistent filtering or route selection policy
- A Route Map can be used to set a Community value on a group of prefixes to indicate that they should be treated the same way
- A Route Map can be used to filter routes in incoming or outgoing updates or select preferred routes based on communities

Community Configuration Example – Enterprise Side

- The Service Provider has told the Enterprise they set a higher Local Preference on routes received with a community value of 65001:1200

```
C1B(config)# route-map HIGH_BW permit 10
C1B(config-route-map)# set community 65001:1200
C1B(config)# router bgp 21
C1B(config-router)# neighbor 198.51.100.101 send-community
C1B(config-router)# neighbor 198.51.100.101 route-map HIGH_BW out
```



Community Configuration Example – Service Provider Side



```
SP1B(config)#ip community-list 1 permit 65001:1200
```

```
SP1B(config)#route-map LOCAL_PREF permit 10
```

```
SP1B(config-route-map)#match community 1
```

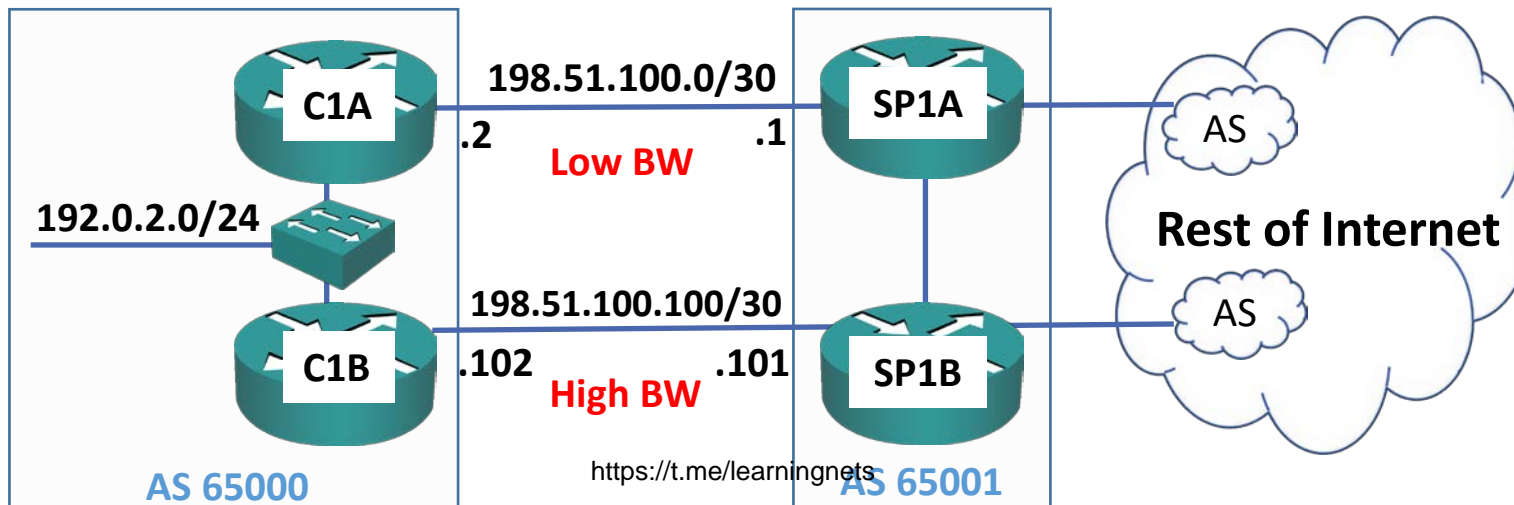
```
SP1B(config-route-map)#set local-preference 200
```

```
SP1B(config-route-map)#route-map LOCAL_PREF permit 20
```

```
SP1B(config)#router bgp 65001
```

```
SP1B(config-router)#neighbor 198.51.100.2 route-map LOCAL_PREF in
```

```
SP1B(config-router)#neighbor 198.51.100.102 route-map LOCAL_PREF in
```



BGP Policy Processing Order



- Multiple BGP policy techniques can be applied to and from the same neighbor
- It is best to use one only in either direction to avoid confusion. If you need to apply a complex configuration you can do it with a single Route Map per direction
- The processing order for inbound updates is:
 1. Filter List
 2. Route Map
 3. Distribute List or Prefix List (cannot both be used on same neighbor)
- For outbound:
 1. Distribute List or Prefix List (cannot both be used on same neighbor)
 2. Prefix List via ORF
 3. Filter List
 4. Route Map