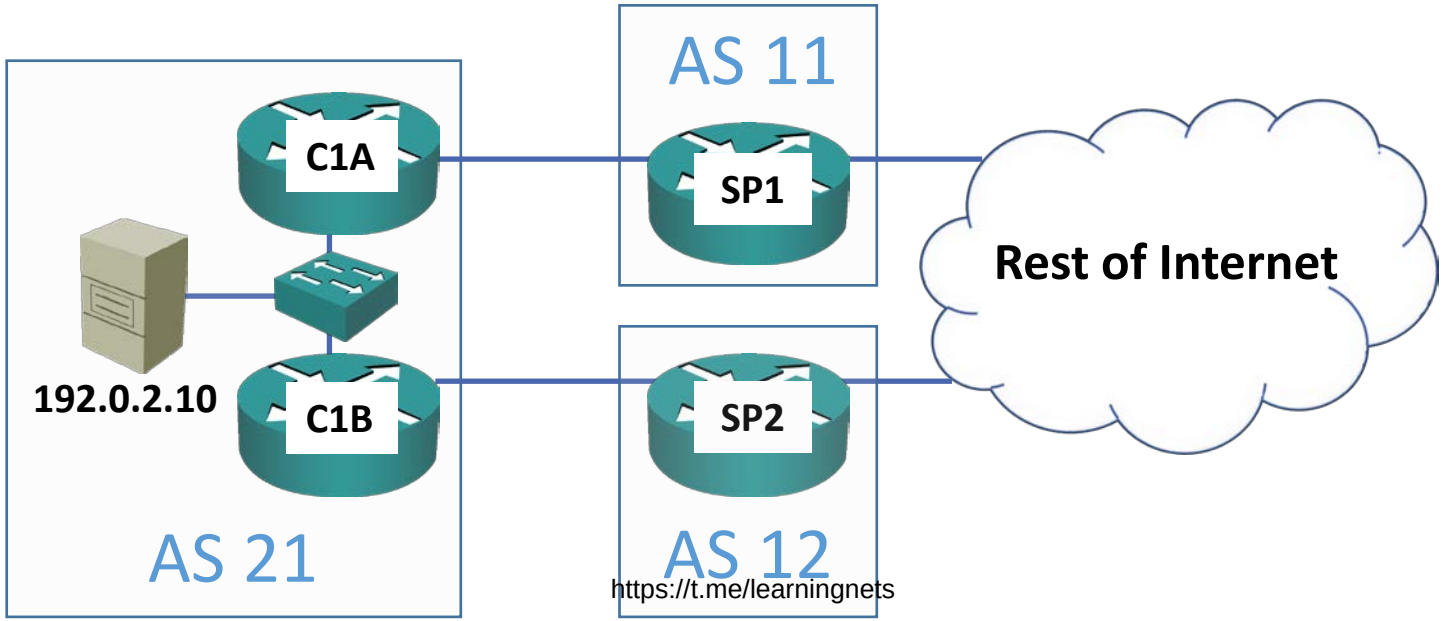
BGP Filtering – Internet Routes Subset

- 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

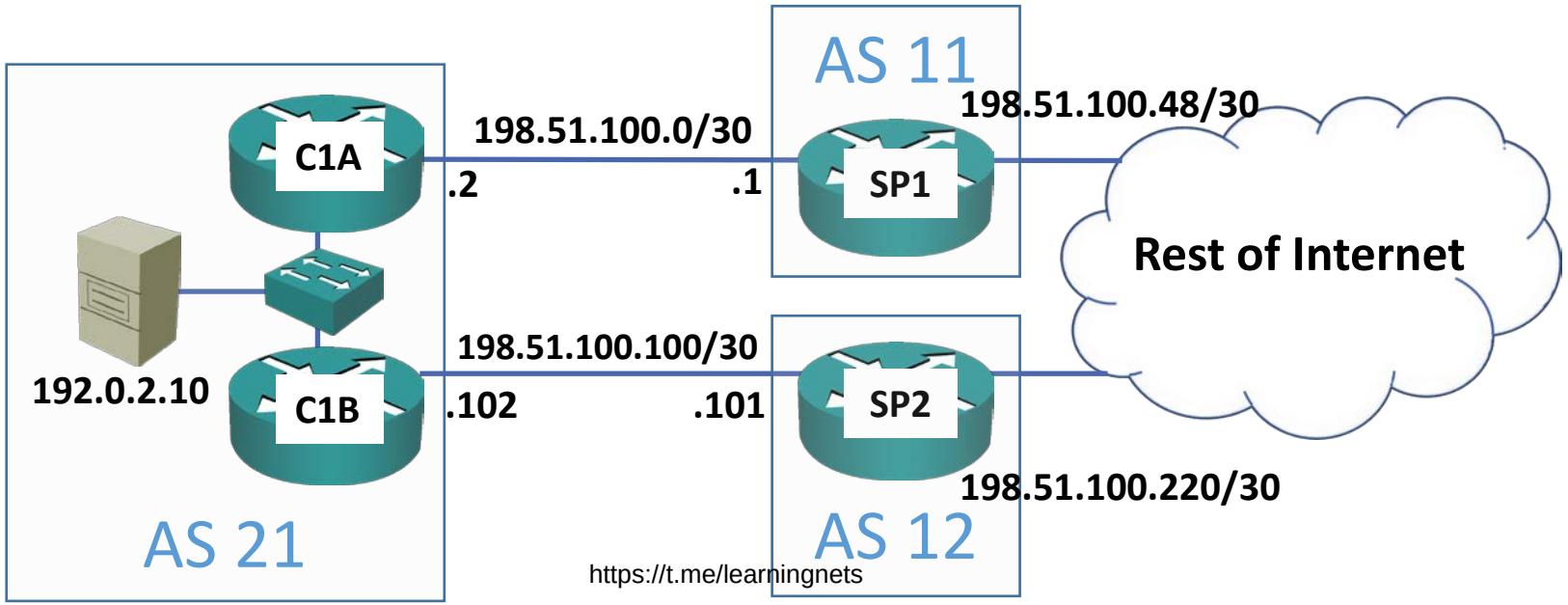
Internet Routes Subset

- 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



Verification – show ip bgp (Before Policy)

```
C1A#show ip bgp
     Network          Next Hop            Metric LocPrf Weight Path
*>   198.51.100.48    198.51.100.1             0             0 11 i
* i                   192.168.0.2                    100      0 12 14 11 i
*>i  198.51.100.220   192.168.0.2              0    100      0 12 i
*                    198.51.100.1                            0 11 14 12 i
! Truncated
```



BGP Default Route

- To send a default route in BGP:

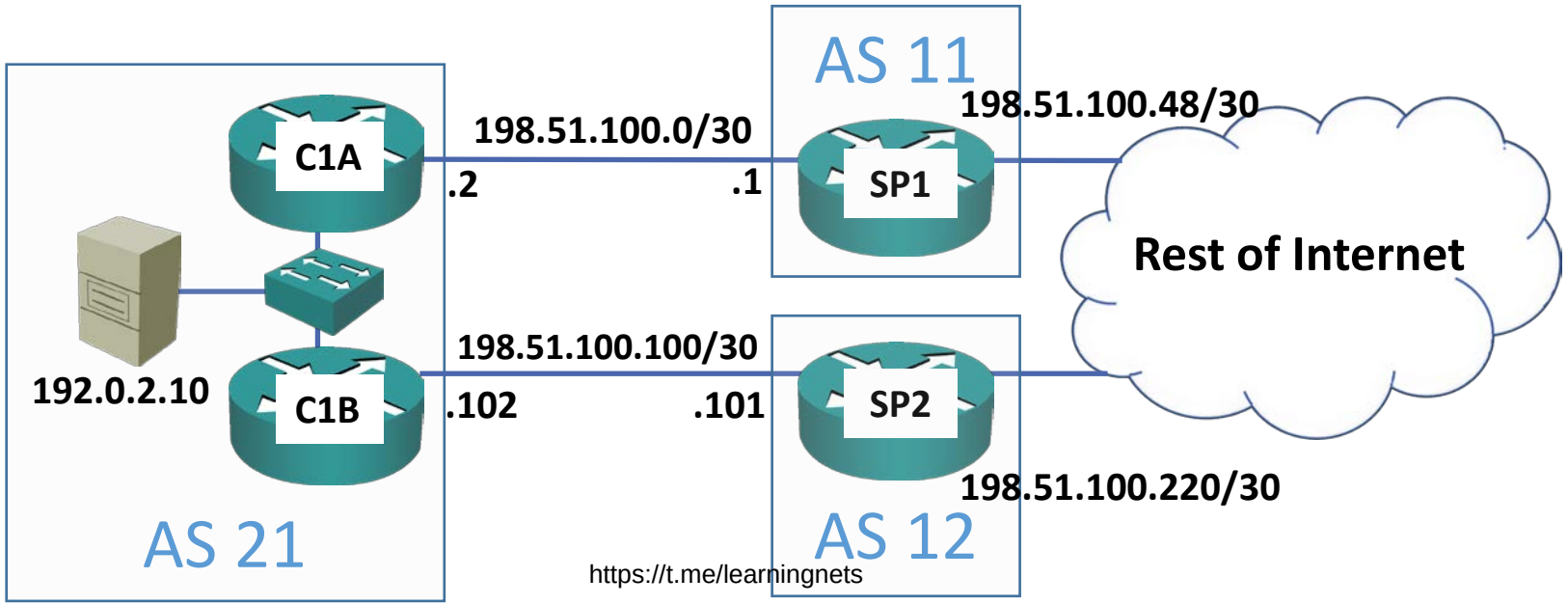
```
SP2(config-router)#neighbor 198.51.100.102 default-originate
```

- A default route does not need to be present in the advertising router's BGP table
- The advertisement bypasses outbound BGP filters on the originating router
- It is propagated by neighbors by default – this should typically be filtered out to prevent transit

Enterprise Inbound Filtering - ACL

```
C1A(config)# access-list 100 permit ip host 198.51.100.48 host 255.255.255.252
C1A(config)# access-list 100 permit ip host 0.0.0.0 host 0.0.0.0
C1A(config)# router bgp 21
C1A(config-router)# neighbor 198.51.100.1 distribute-list 100 in

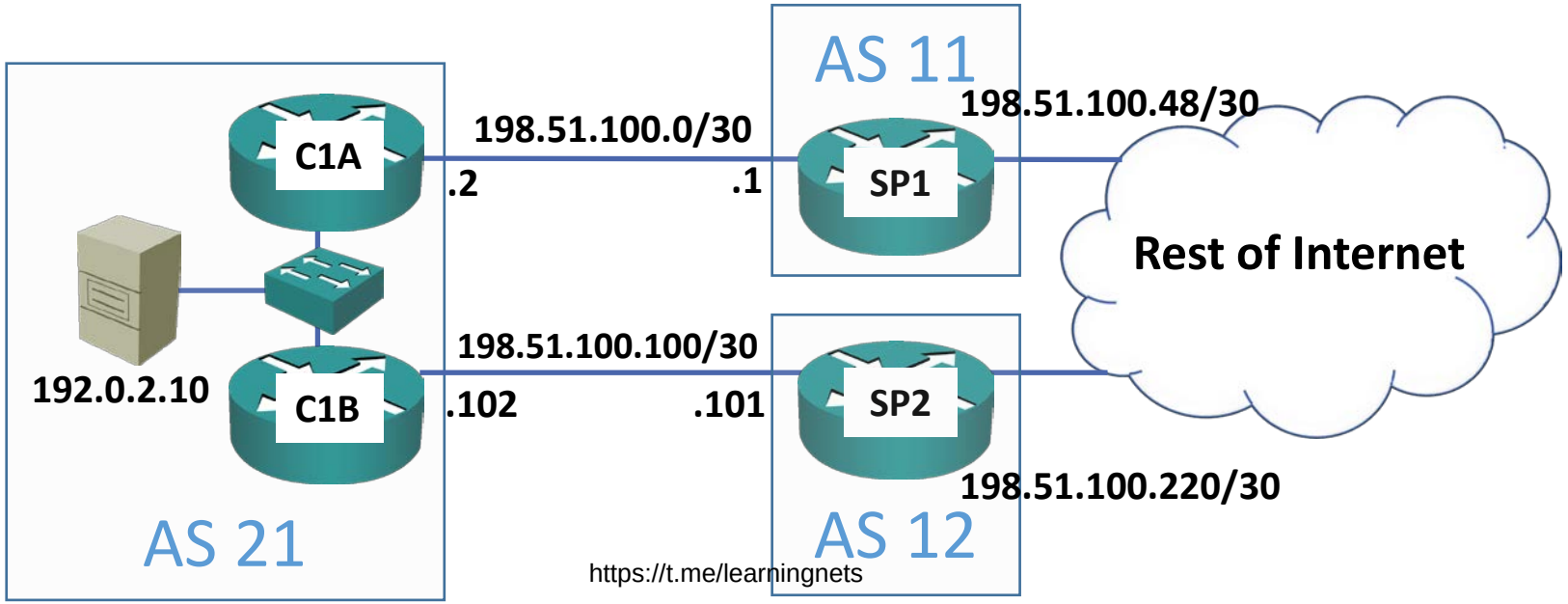
C1B(config)# access-list 100 permit ip host 198.51.100.220 host 255.255.255.252
C1B(config)# access-list 100 permit ip host 0.0.0.0 host 0.0.0.0
C1B(config)# router bgp 21
C1A(config-router)# neighbor 198.51.100.101 distribute-list 100 in
```



Enterprise Inbound Filtering – Prefix List

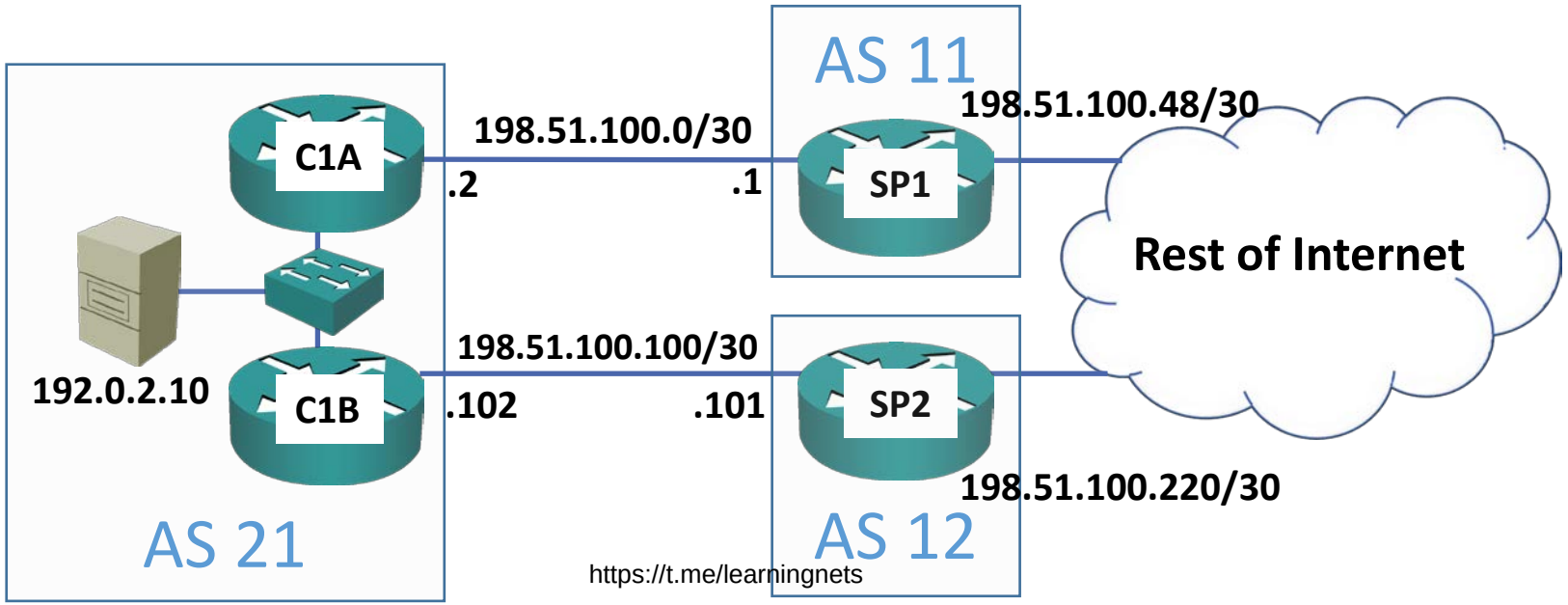
```
C1A(config)# ip prefix-list DEMO permit 198.51.100.48/30
C1A(config)# ip prefix-list DEMO permit 0.0.0.0/0
C1A(config)# router bgp 21
C1A(config-router)# neighbor 198.51.100.1 prefix-list DEMO in

C1B(config)# ip prefix-list DEMO permit 198.51.100.220/30
C1B(config)# ip prefix-list DEMO permit 0.0.0.0/0
C1B(config)# router bgp 21
C1A(config-router)# neighbor 198.51.100.101 prefix-list DEMO in
```



Outbound Route Filtering ORF

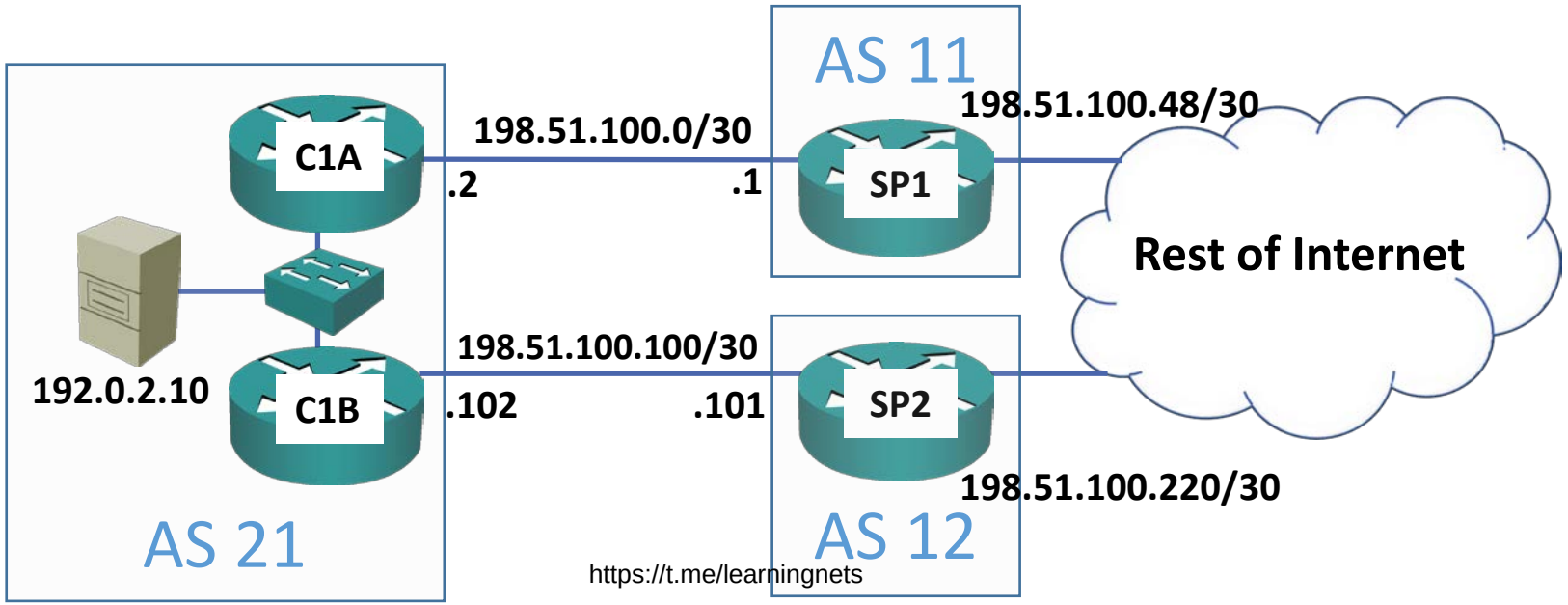
- With inbound filtering, routes are received then filtered out. This takes up processing power on the receiving router
- When the receiving router is using a Prefix List, it can use Outbound Route Filtering (ORF) to signal to the sending router the routes it wants to receive. The routes are then filtered on the sending router



Outbound Route Filtering ORF

```
C1A(config)# router bgp 21
C1A(config-router)# neighbor 198.51.100.1 capability orf prefix-list send

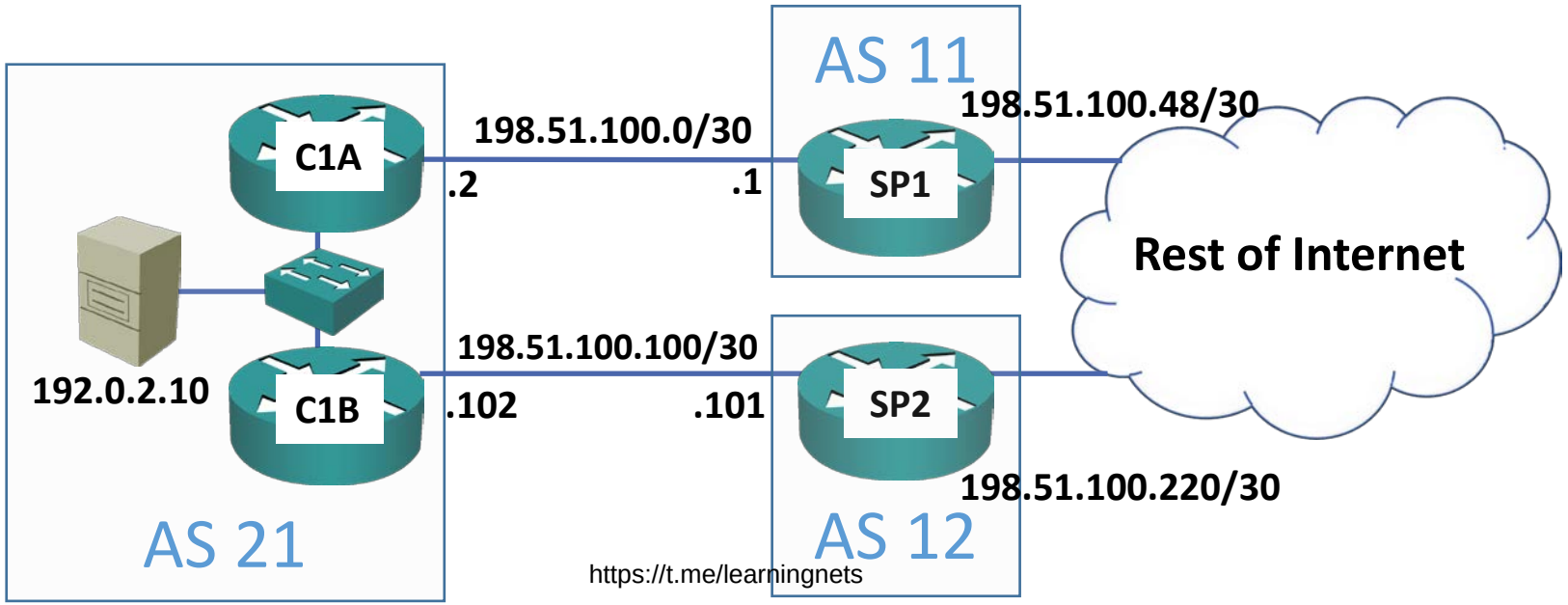
SP1(config)# router bgp 21
SP1(config-router)# neighbor 198.51.100.2 capability orf prefix-list receive
```



Enterprise Inbound Filtering – AS Path Filter

```
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

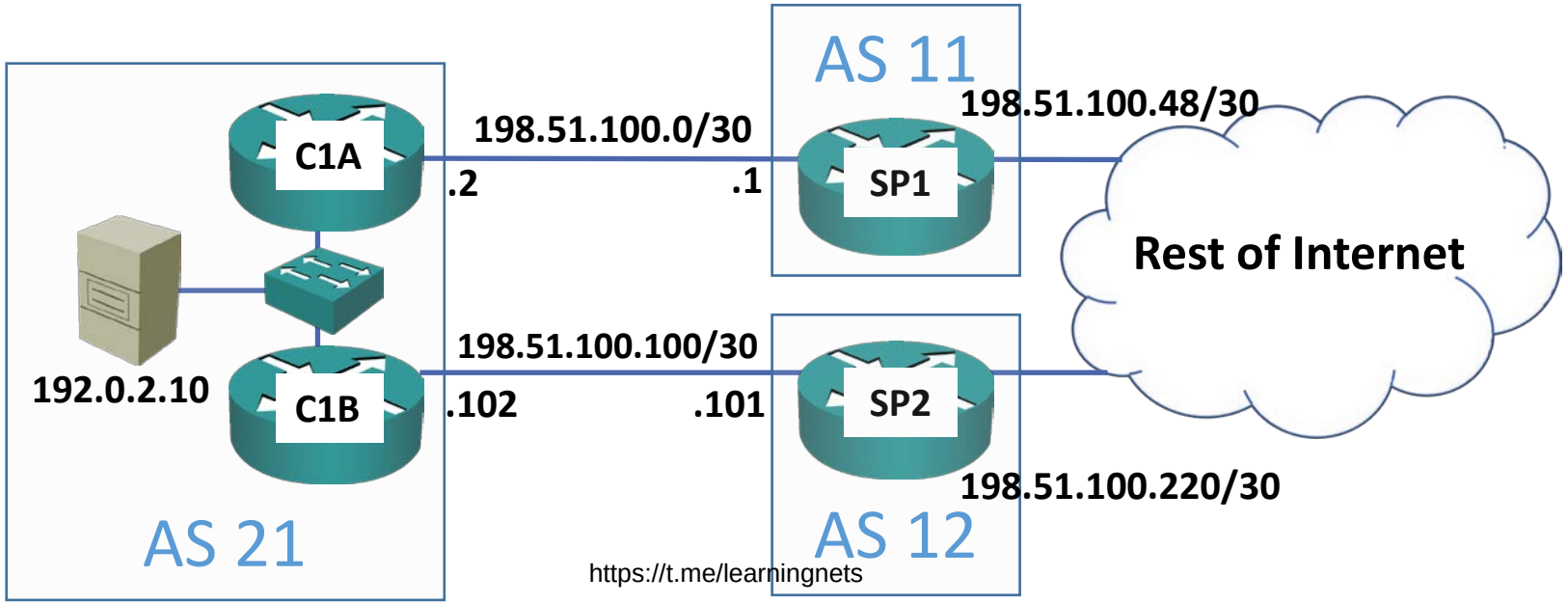
C1B(config)#ip as-path access-list 1 permit ^12$
C1B(config)#router bgp 21
C1B(config-router)#neighbor 198.51.100.101 filter-list 1 in
```



Enterprise Inbound Filtering – Route Map

```
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

C1B(config)#ip as-path access-list 1 permit ^12$
C1B(config)#router bgp 21
C1B(config-router)#neighbor 198.51.100.101 filter-list 1 in
```

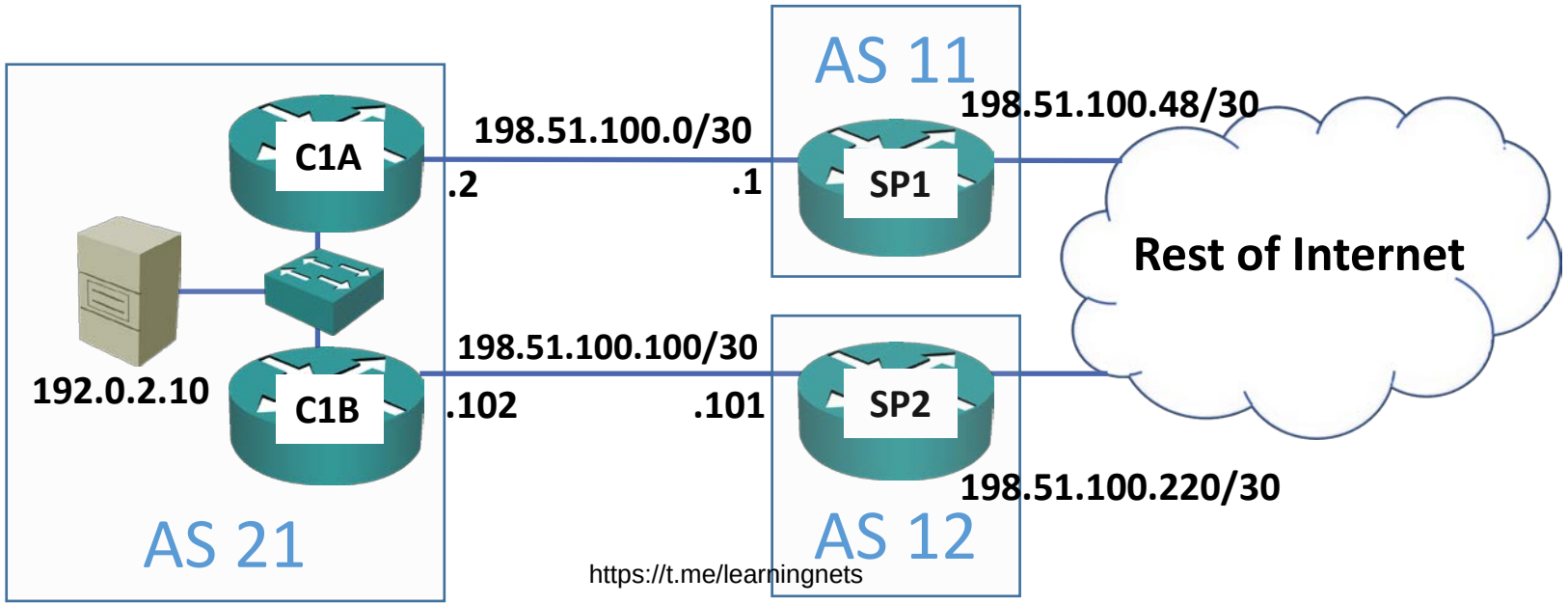


- Default route from AS 11 will be preferred over default route from AS 12

ISP Outbound Filtering - ACL

```
SP1(config)# access-list 100 permit ip host 198.51.100.48 host 255.255.255.252
SP1(config)# access-list 100 permit ip host 0.0.0.0 host 0.0.0.0 ! unneeded - bypassed
SP1(config)# router bgp 11
SP1(config-router)# neighbor 198.51.100.2 default-originate
SP1(config-router)# neighbor 198.51.100.2 distribute-list 100 out

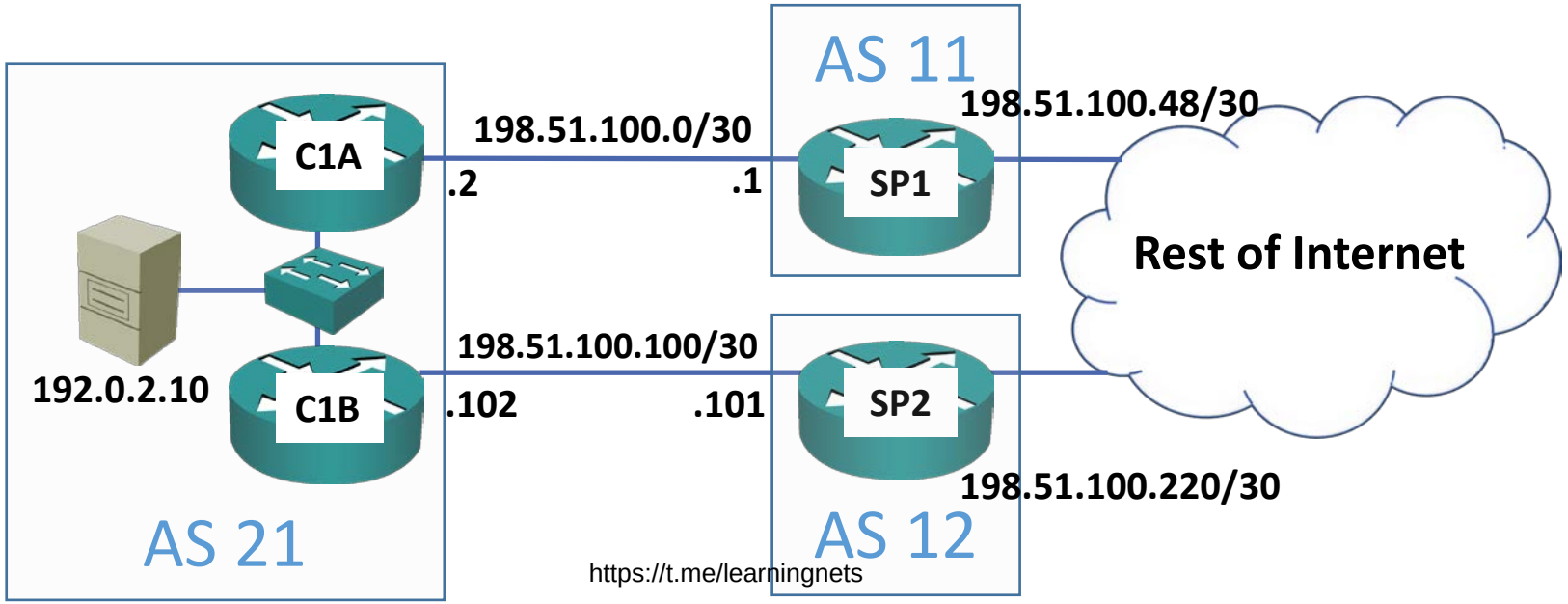
SP2(config)# access-list 100 permit ip host 198.51.100.220 host 255.255.255.252
SP2(config)# router bgp 12
SP2(config-router)# neighbor 198.51.100.102 default-originate
SP2(config-router)# neighbor 198.51.100.102 distribute-list 100 out
```



ISP Outbound Filtering – Prefix List

```
SP1(config)# ip prefix-list DEMO permit 198.51.100.48/30
SP1(config)# ip prefix-list DEMO permit 0.0.0.0/0 ! unneeded - bypassed
SP1(config)# router bgp 11
SP1(config-router)# neighbor 198.51.100.2 default-originate
SP1(config-router)# neighbor 198.51.100.2 prefix-list DEMO out

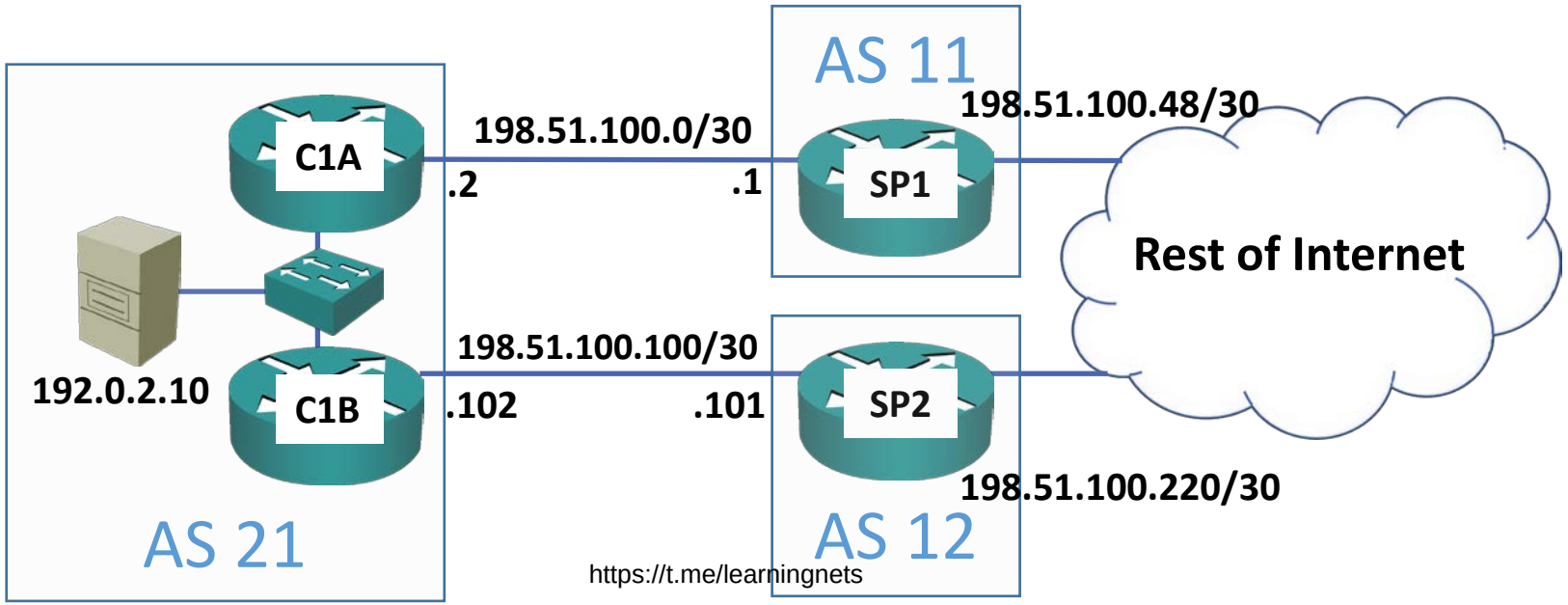
SP2(config)# ip prefix-list DEMO permit 198.51.100.220/30
SP2(config)# router bgp 12
SP2(config-router)# neighbor 198.51.100.102 default-originate
SP2(config-router)# neighbor 198.51.100.102 prefix-list DEMO out
```



ISP Outbound Filtering – AS Path Filter

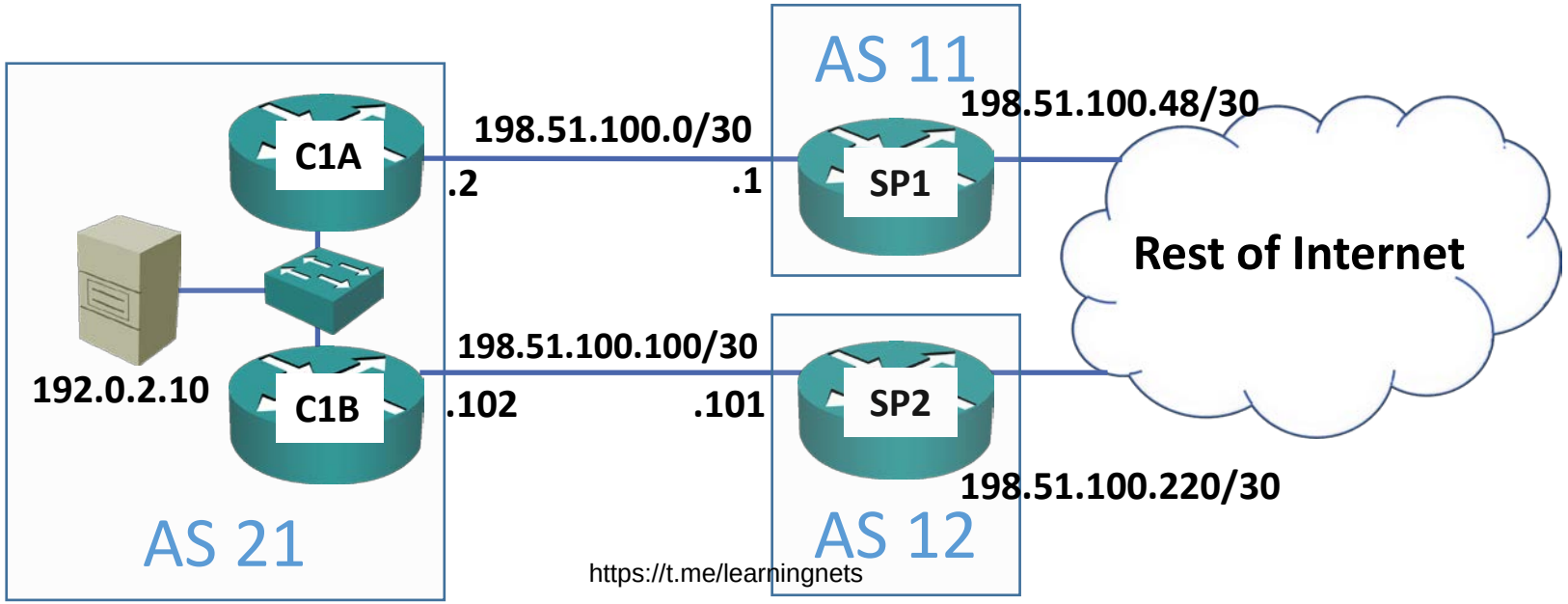
```
SP1(config)#ip as-path access-list 1 permit ^$
SP1(config)#router bgp 11
SP1(config-router)#neighbor 198.51.100.2 filter-list 1 out

SP2(config)#ip as-path access-list 1 permit ^$
SP2(config)#router bgp 12
SP2(config-router)#neighbor 198.51.100.102 filter-list 1 out
```



ISP Outbound Filtering – Route Map

```
SP1(config)# ip as-path access-list 1 permit ^$
SP1(config)# route-map DEMO permit 10
SP1(config-route-map)# match as-path 1
SP1(config-route-map)# set < attribute can be set here >
SP1(config)# router bgp 11
SP1(config-router)# neighbor 198.51.100.2 route-map DEMO out
```



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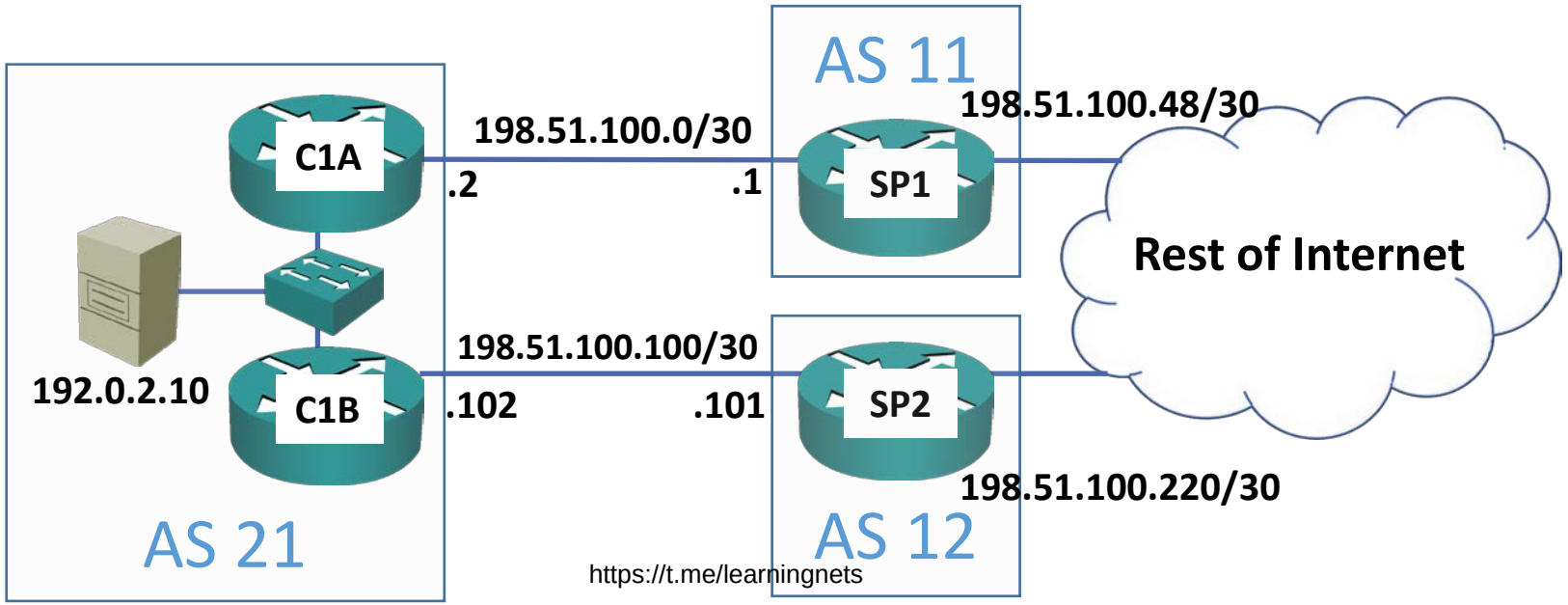
* i                   192.168.0.2                    100      0 12 14 11 i
*>i  198.51.100.220   192.168.0.2              0    100      0 12 i
*                    198.51.100.1                            0 11 14 12 i
! Truncated
```



Verification – show ip bgp (After Policy)

```
C1A#show ip bgp
     Network          Next Hop            Metric LocPrf Weight Path
* i  0.0.0.0          192.168.0.2              0    100      0 12 i
*>   0.0.0.0          198.51.100.1             0             0 11 i
*>   198.51.100.48    198.51.100.1             0             0 11 i
*>i  198.51.100.220   192.168.0.2              0    100      0 12 i
! Truncated
```