

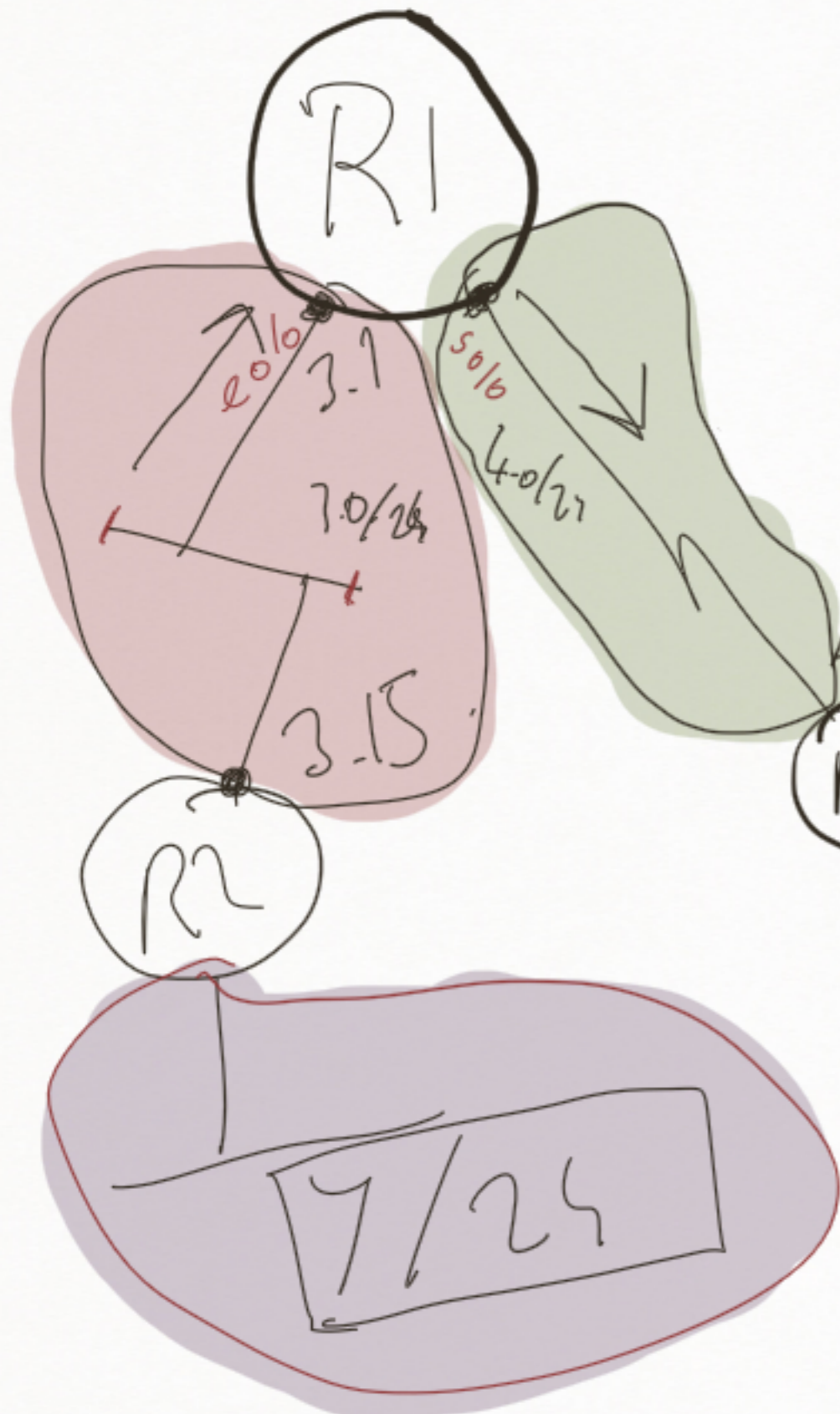
Routing -6-
Switching -4-
Performance -3-

Huawei

HCNP

26-03-2018

R1 Routing Table



X/24	S	S0/0
7/24	O	192.168.3.15
192.168.3.0/24	C	e0/0
192.168.4.0/24	C	S0/0

→ Fiber interface;
 → Next Hop
 → Directly Connected

> Connected

> Static Manual

> Dynamic

RIPv1
RIPv2
RIPng
IGRP
EIGRP
EIGRPv6
OSPFv2
OSPFv3
IS-IS

EIGRP
iBGP
eBGP
MP-BGP
PIM-DM
PIM-SM
DVMRP

Dynamic Routing
Protocols

IP Summarization
stet gesamt

- 92.168.0.0/24
- 92.168.1.0/24
- 92.168.2.0/24
- 92.168.3.0/24
- 92.168.4.0/24
- 92.168.5.0/24
- 92.168.6.0/24
- 92.168.7.0/24



91.0.0.0/8 (auto summary)
92.168.0.0/21



92.168.0.0/22
92.168.4.0/23 (Manual Summary)
92.168.6.0/24

$$8 = 2^x$$
$$x = 3$$
$$25 - 3 = 21$$

0.0.0.0
any (herhangi bir)

Default route

Default gateway

Quad

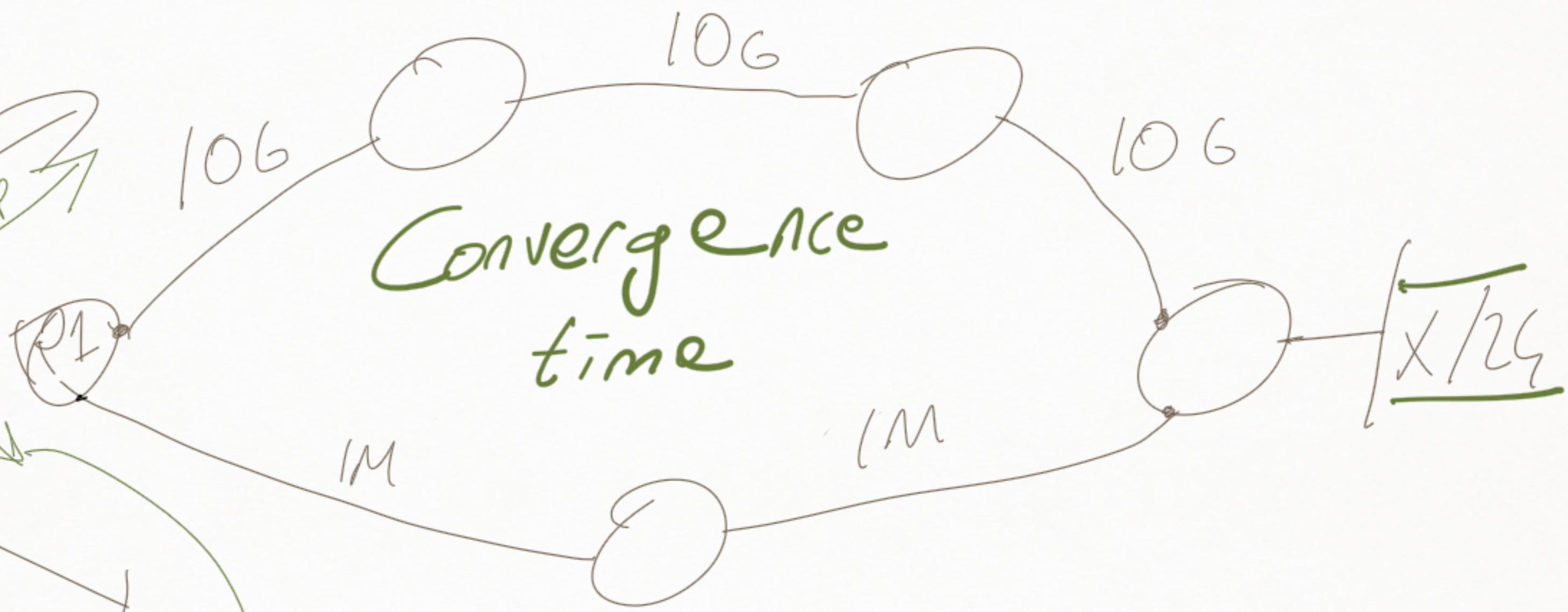
zero

IS-IS
OSPF

BIGRP

EIGRP

RIP
3
2



Convergence
time

X/24

Unequal Cost Path Load Balance

[Bellman-Ford]

Distance Vector Alg

RIP v1/v2

RIPng

BGP ←

EIGRP ←

IGRP

1970 ARPA-BBN

[P, Extra]

Link-State

OSPF

1979 ARPA-BBN

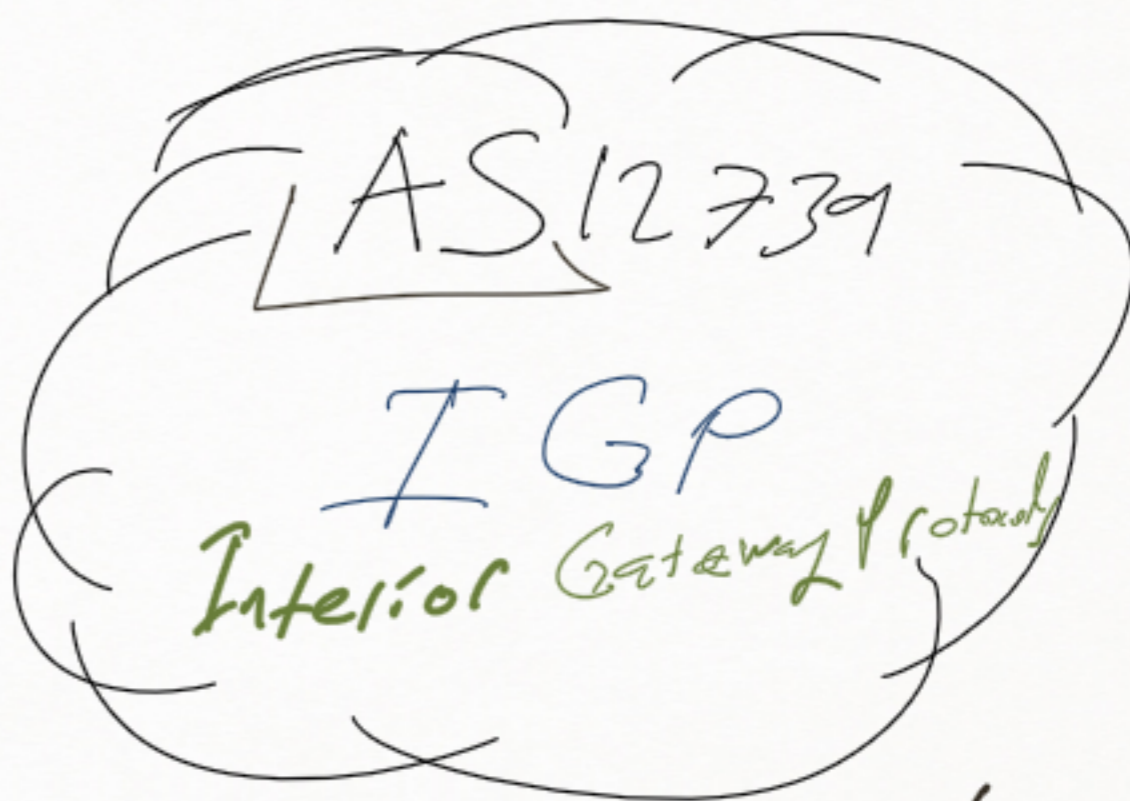
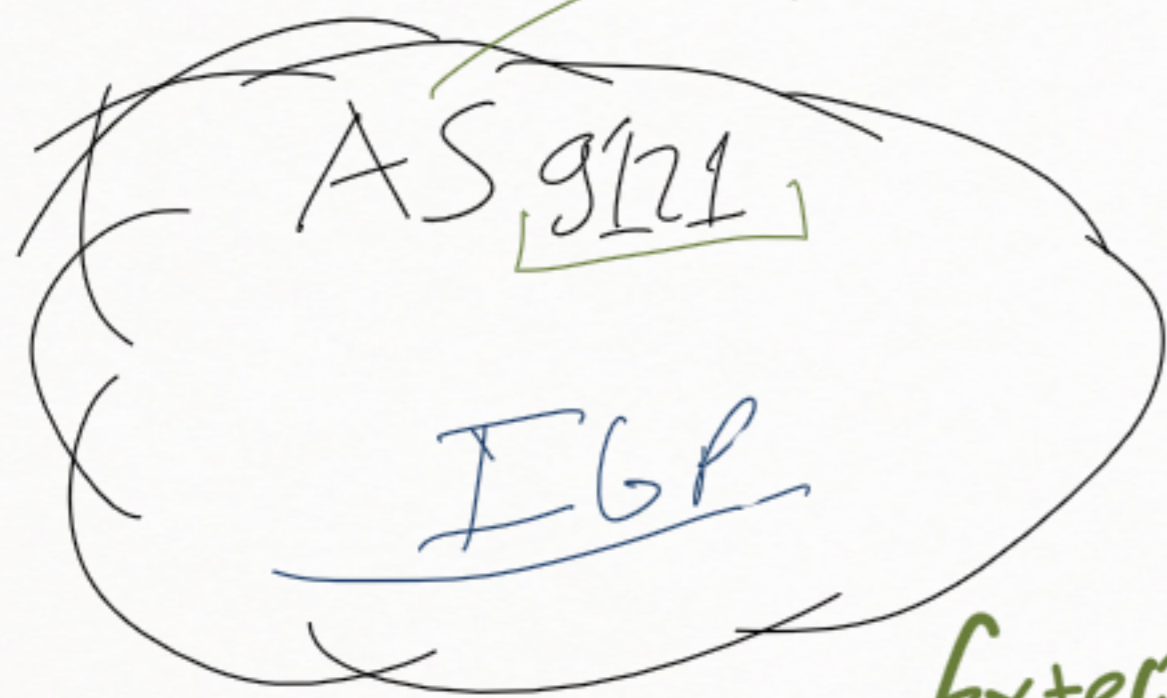
IS-IS

~~Distance Vector Alg~~
[DHAL]

Diffusing Update Algorithm

EIGRP

ISP (Türk Telekom)



Exterior Gateway Protocols

Autonomous System

Dehili

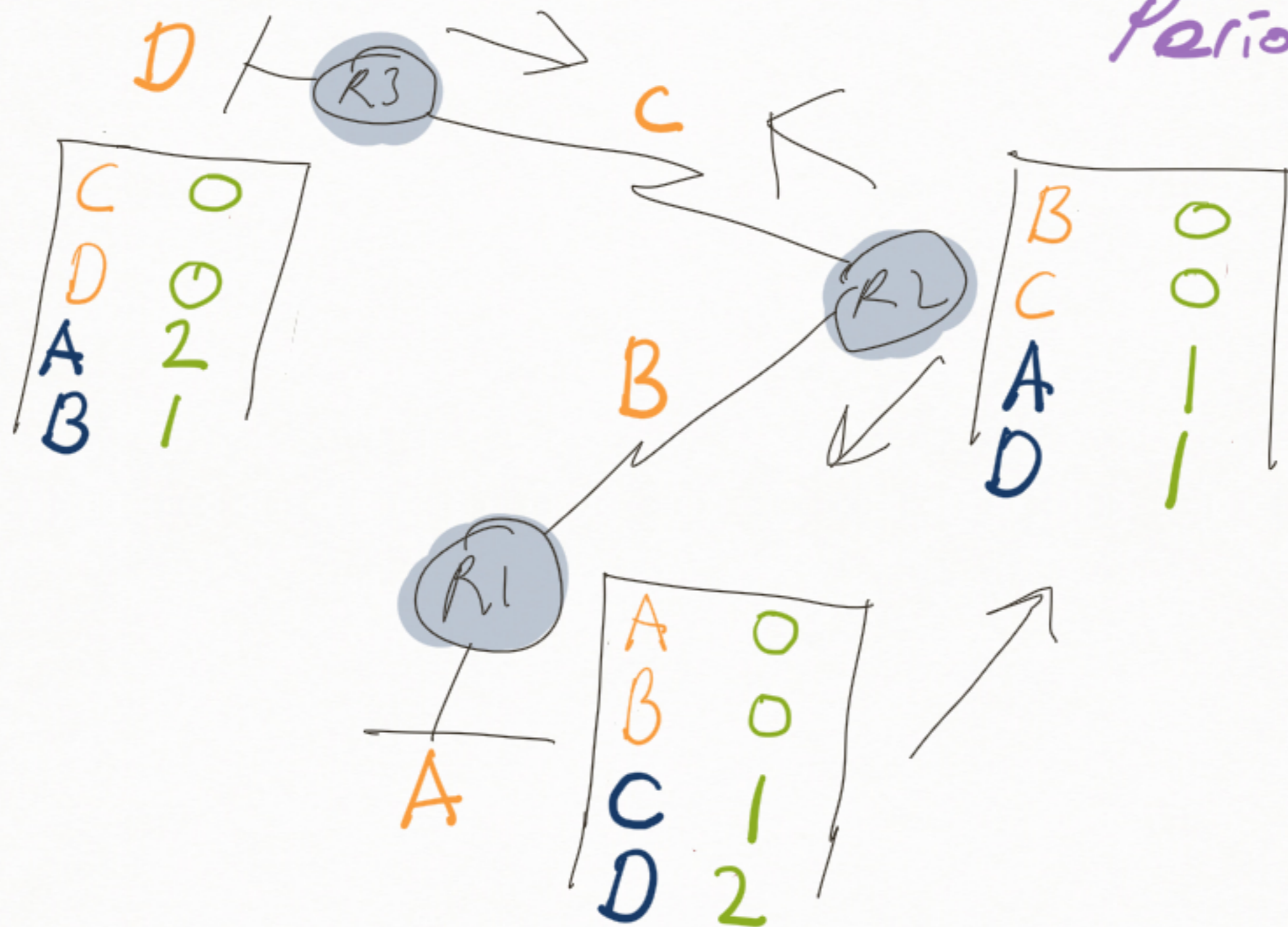
- IS-IS
- OSPF
- RIP
- EIGRP
- iBGP

- EIGRP
- RIP
- OSPF
- IS-IS
- iBGP

Dehili

ROUTING LOOP

Distance Vector
Periodic Update



ROUTING LOOP

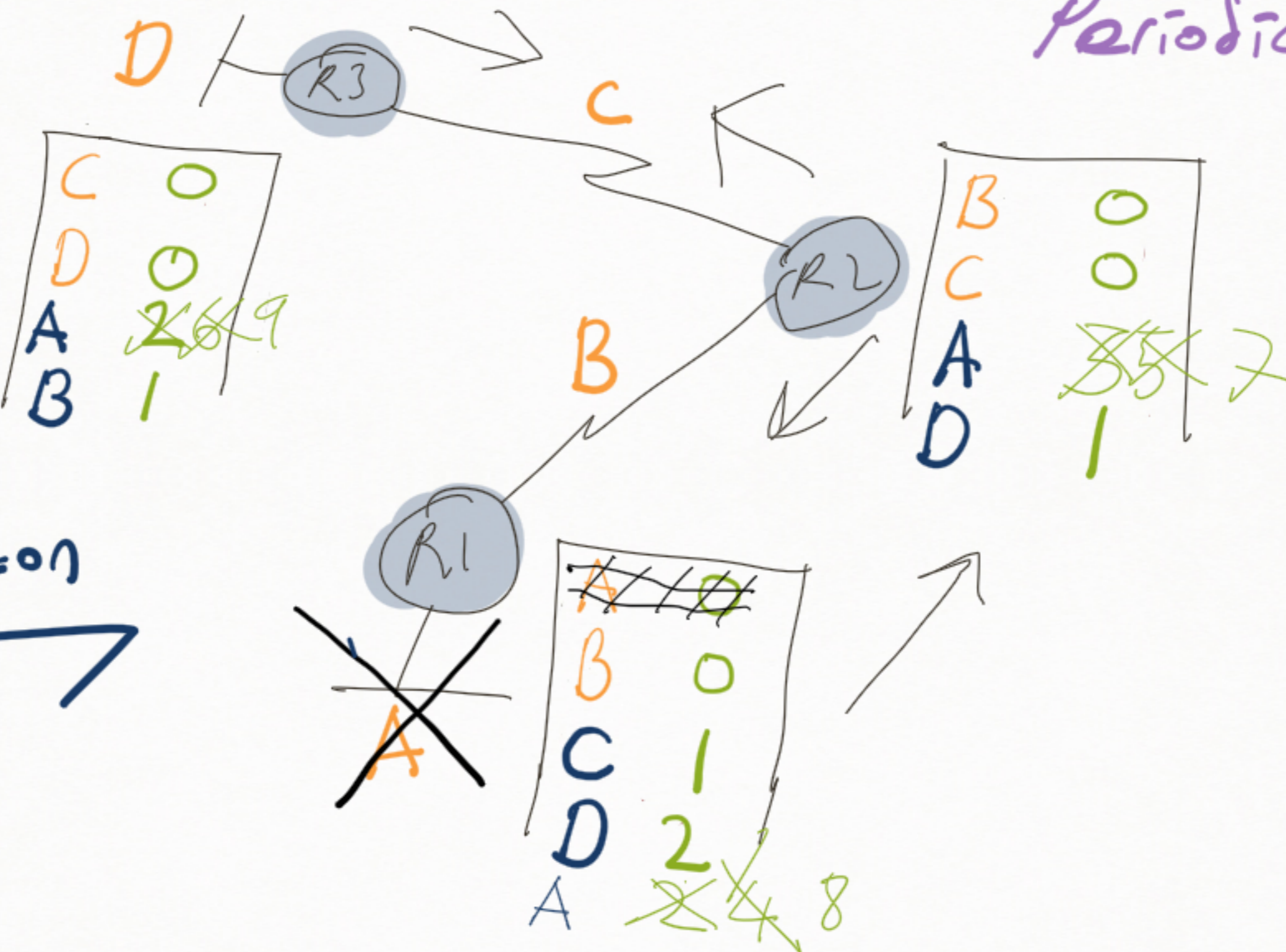
Timer

Triggered Update

Poison-Reverse

Split-Horizon

Distance Vector
Periodic Update



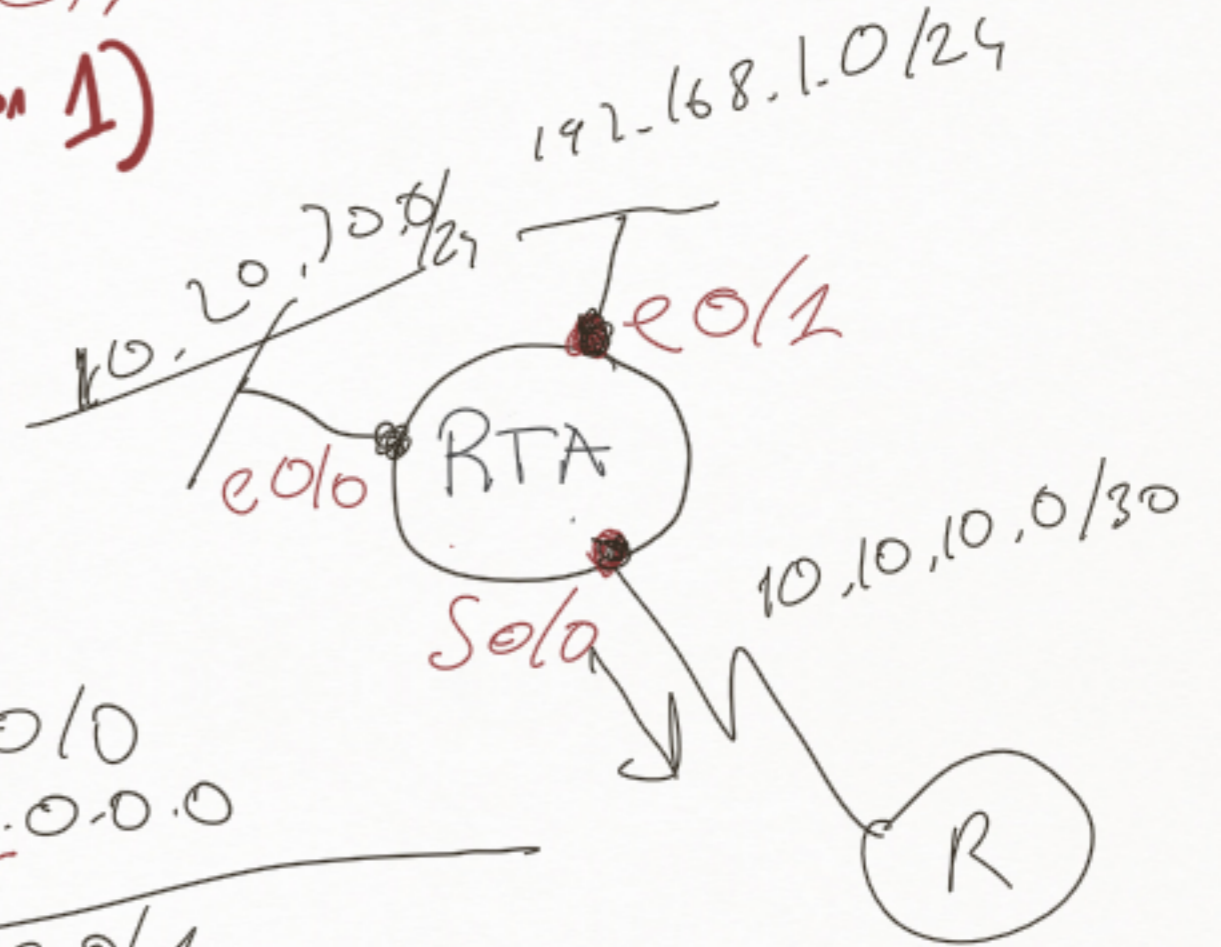
MAX
Hop
Count
"16"

① Routing Process; enable etmek

② Interface'leri process'e dahil etmek

Optional (default version 1)

```
[RTA]rip  
[RTA-rip-1]version 2  
[RTA-rip-1]network 10.0.0.0
```



Undo Summary

no auto-summary

“ is co 'da " var
" auto summary
kapatilmali.

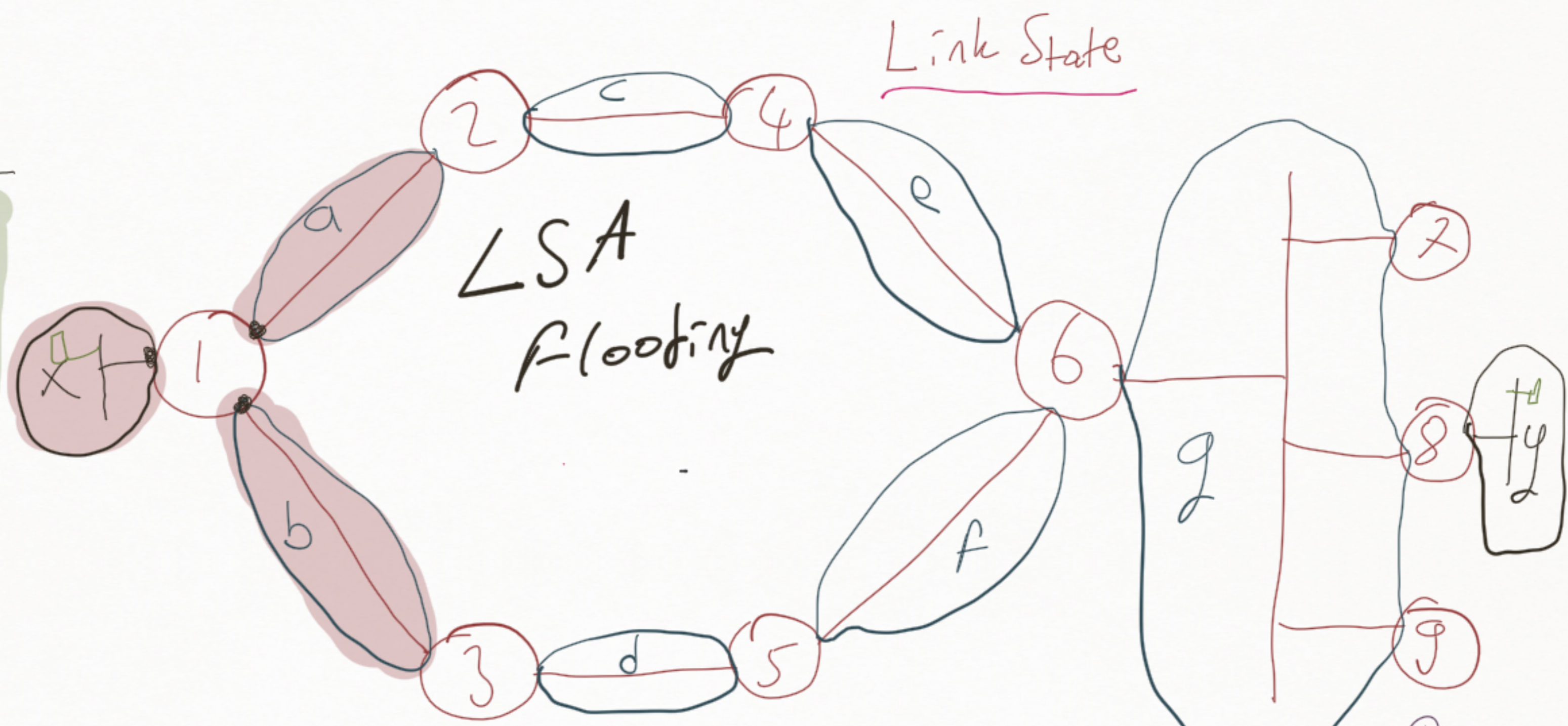
Network Solo
Network 10.0.0.0

Network e0/1
Network 192.168.1.0

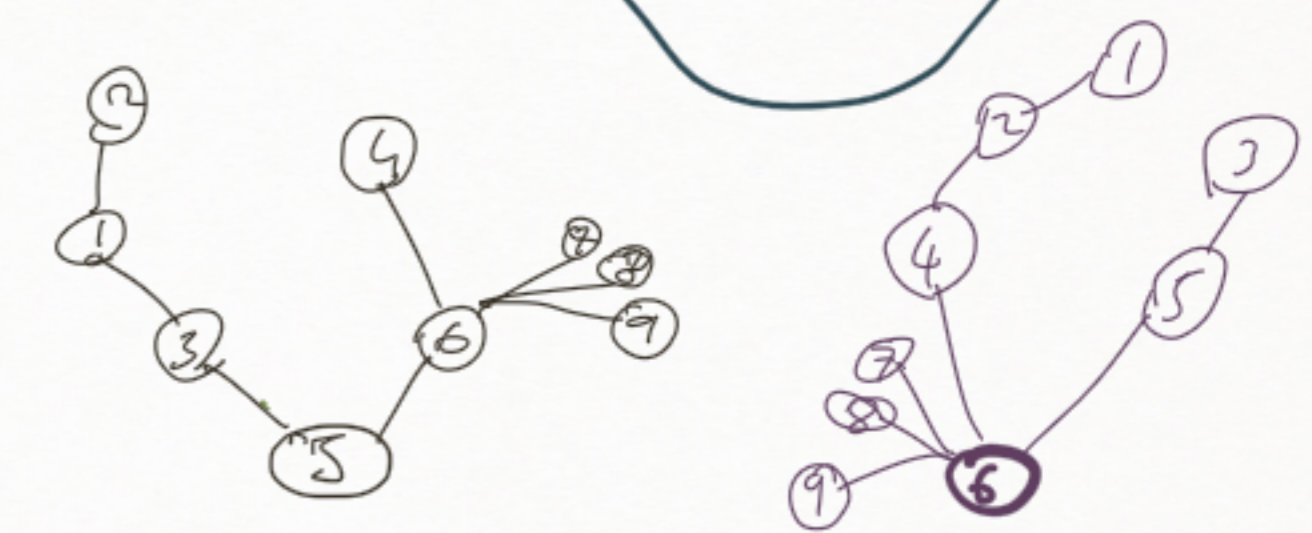
Network 0.0.0.0

LSDB

- > Link a
- > Link b
- > Link x
- Link c
- Link d
- Link e
- Link f
- Link g
- Link y



LSDB > SPF

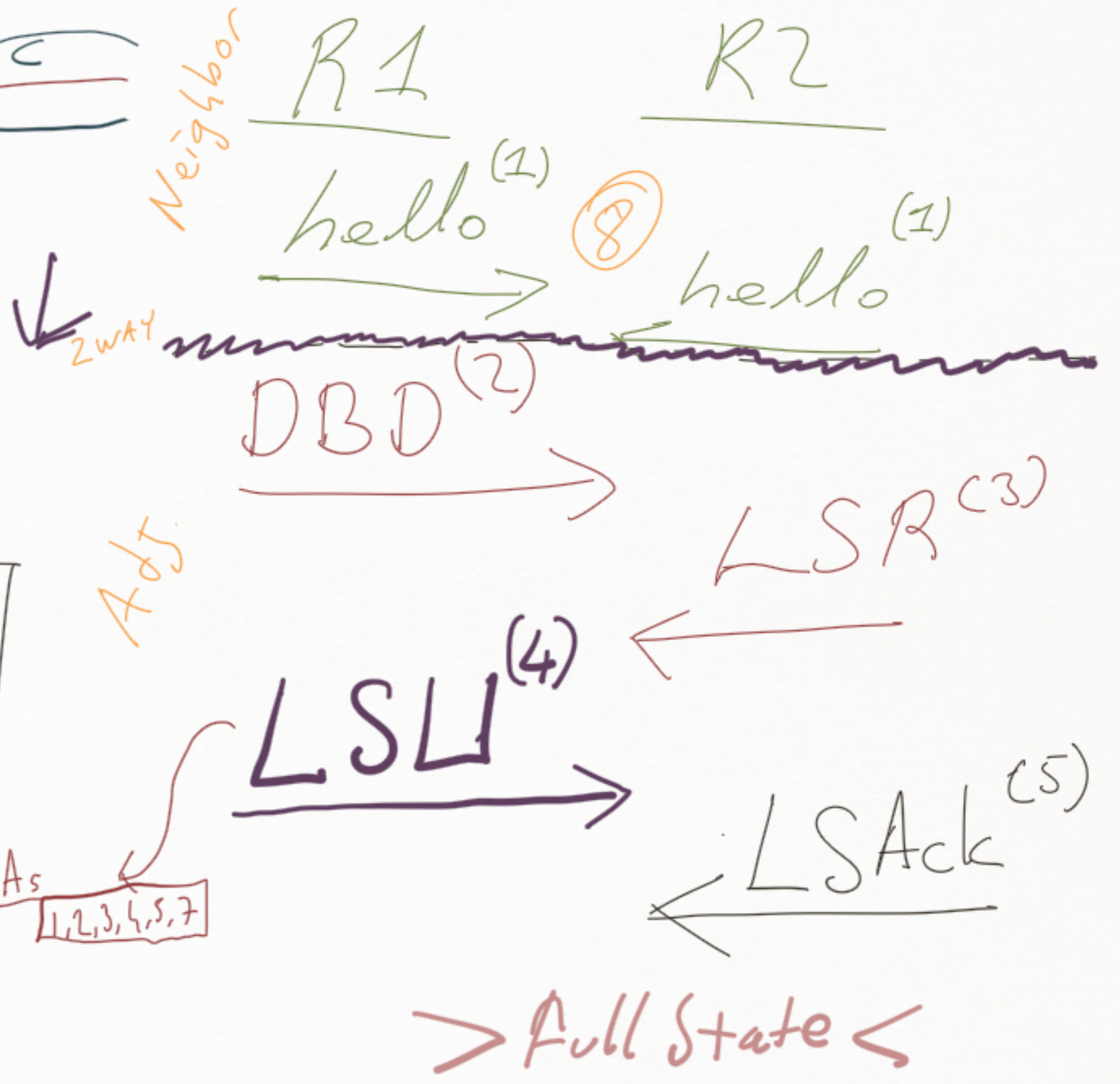
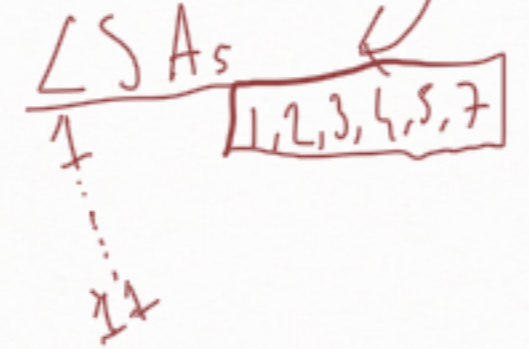


224.0.0.5 01:00:5e:00:00:05
224.0.0.6 01:00:5e:00:00:06



[Same Topological Database
 Unique Routing Table]

Neighbor adjacency

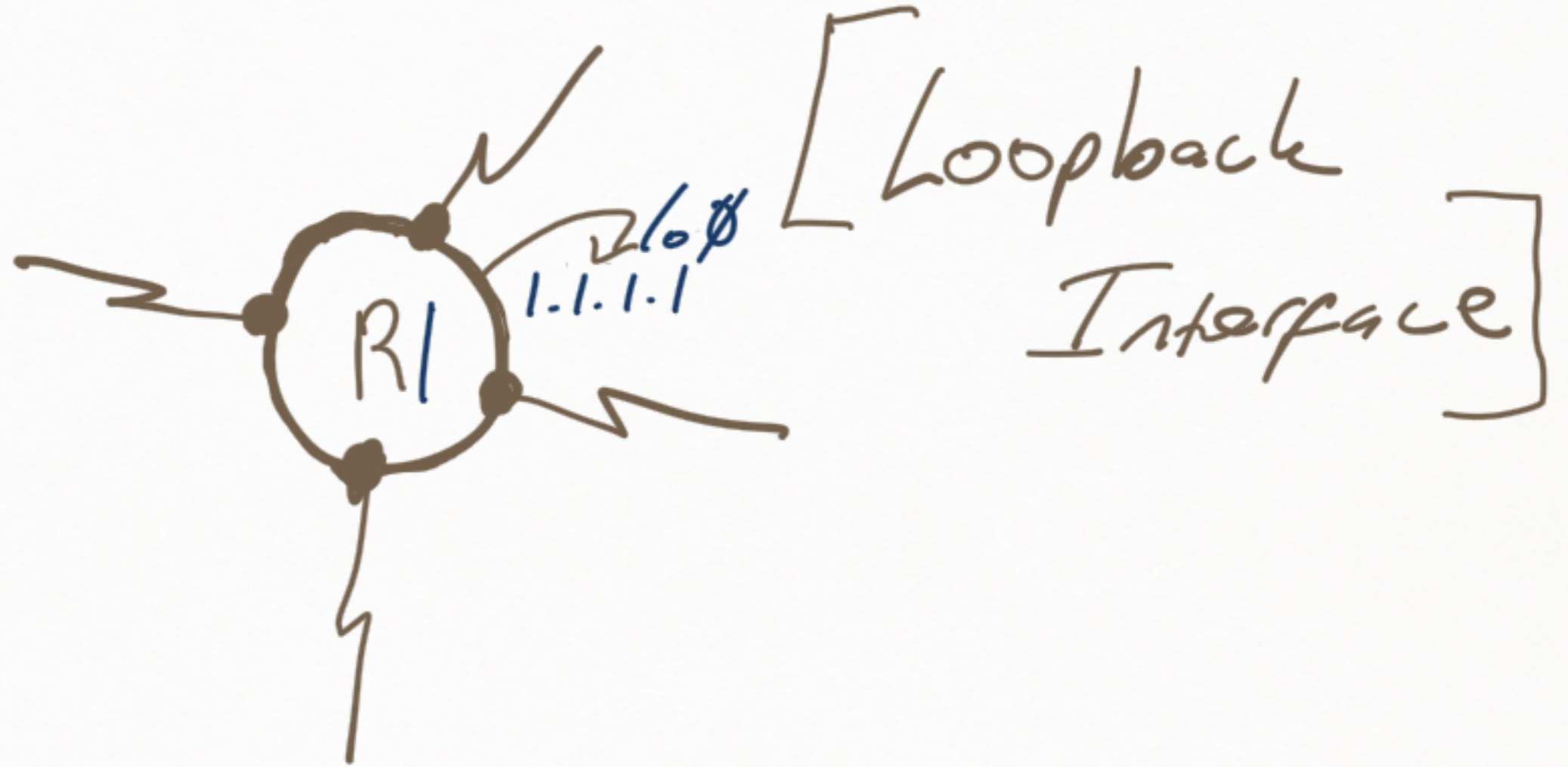


Router-ID

Novel 0.0.0.3

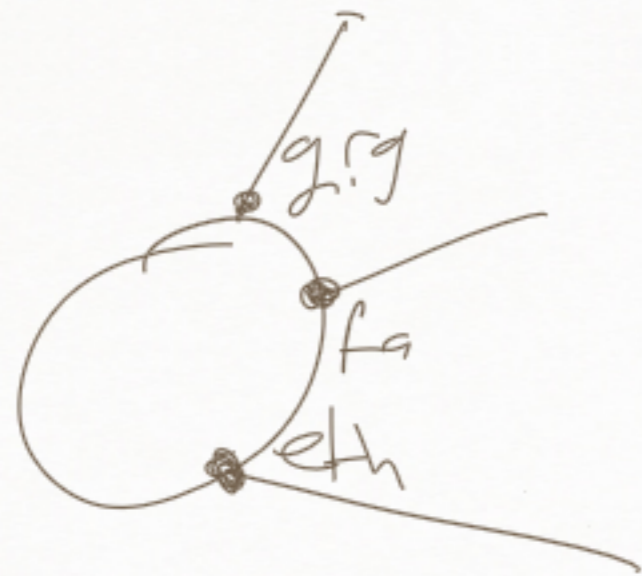
1.0.0.0

32-bit (4 x Octet)



OSPF Metric

$$\text{Cost} = \frac{\text{Ref BW} = (10 \text{ mbps})}{\text{int BW}}$$



$$\text{Cost} = \frac{100.000}{1.000.000} = 1$$

$$\text{Cost} = \frac{100.000}{100.000} = 1$$

$$\text{Cost} = \frac{100.000}{10.000} = 10$$

- ① Ref. BW: default value, high degree.
- ② int BW: default value, high degree.
- ③ Cost degree, manual calculation = link cost

Area 1

LSDB

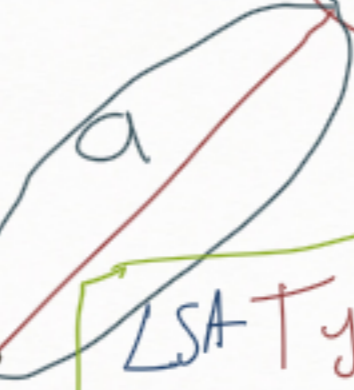
Link a

Link b

Link c

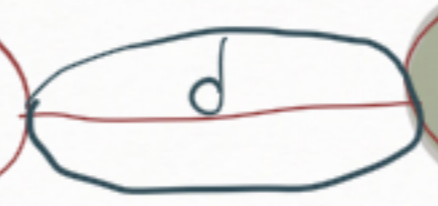
Link d

Link e



LSA Type 1
LSA Type 2

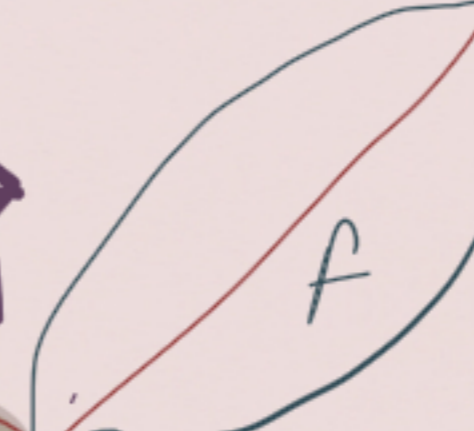
Type 3



ABR



Area 0



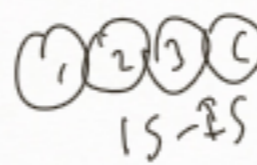
ABR

Area 2



ASBR

Z

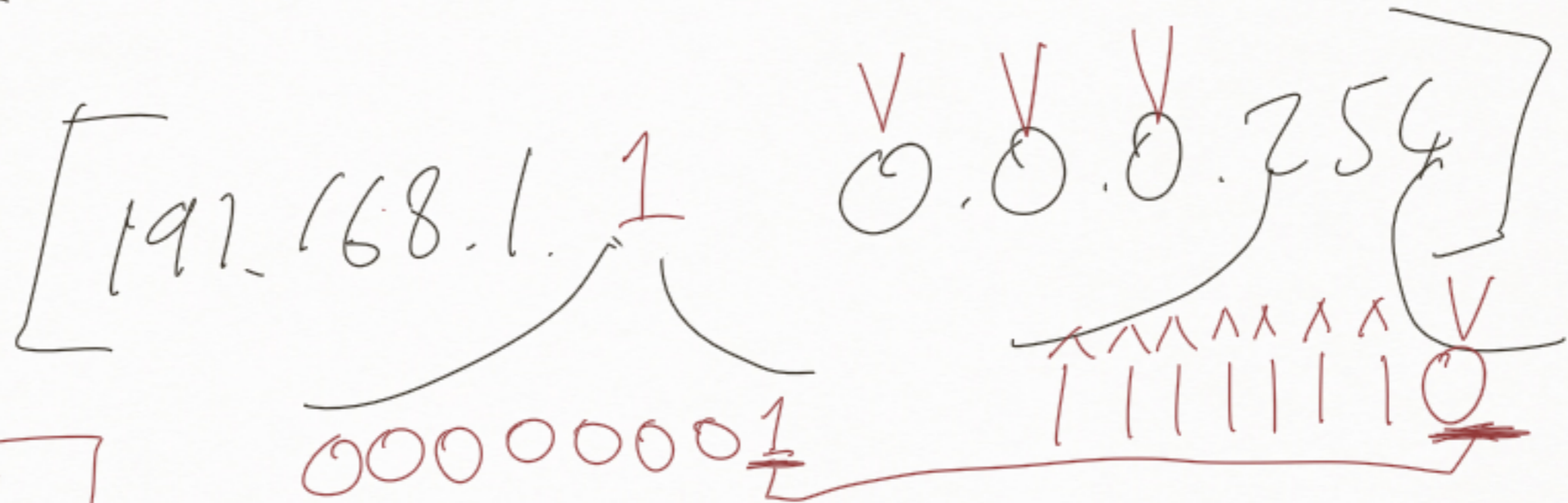


WorldCard Mast

255.255.255.255

S.M. 255.255.255.240

W.M. 0.0.0.15



192.168.1.15

0.255.0.255

<exact> <any> <exact> <any>

192.XXX.1.XXX

192.168.1.0

255
254
253
252
251
250
249
248
247
246
245
244
243
242
241
240
239
238
237
236
235
234
233
232
231
230
229
228
227
226
225
224
223
222
221
220
219
218
217
216
215
214
213
212
211
210
209
208
207
206
205
204
203
202
201
200
199
198
197
196
195
194
193
192

S.M. = 255.255.255.0

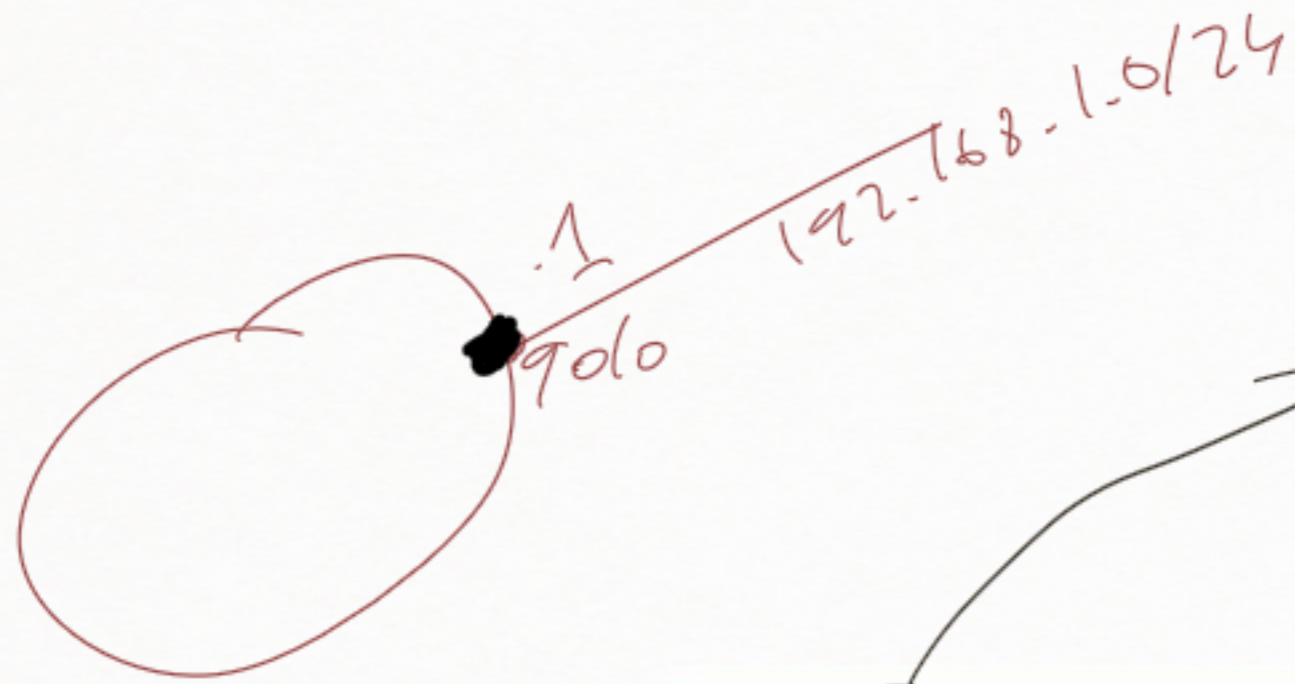
1 = exact

0 = any

W.M. = 0.0.0.255

1 = any

0 = exact



enable process

optional

area 0 konfigurasi

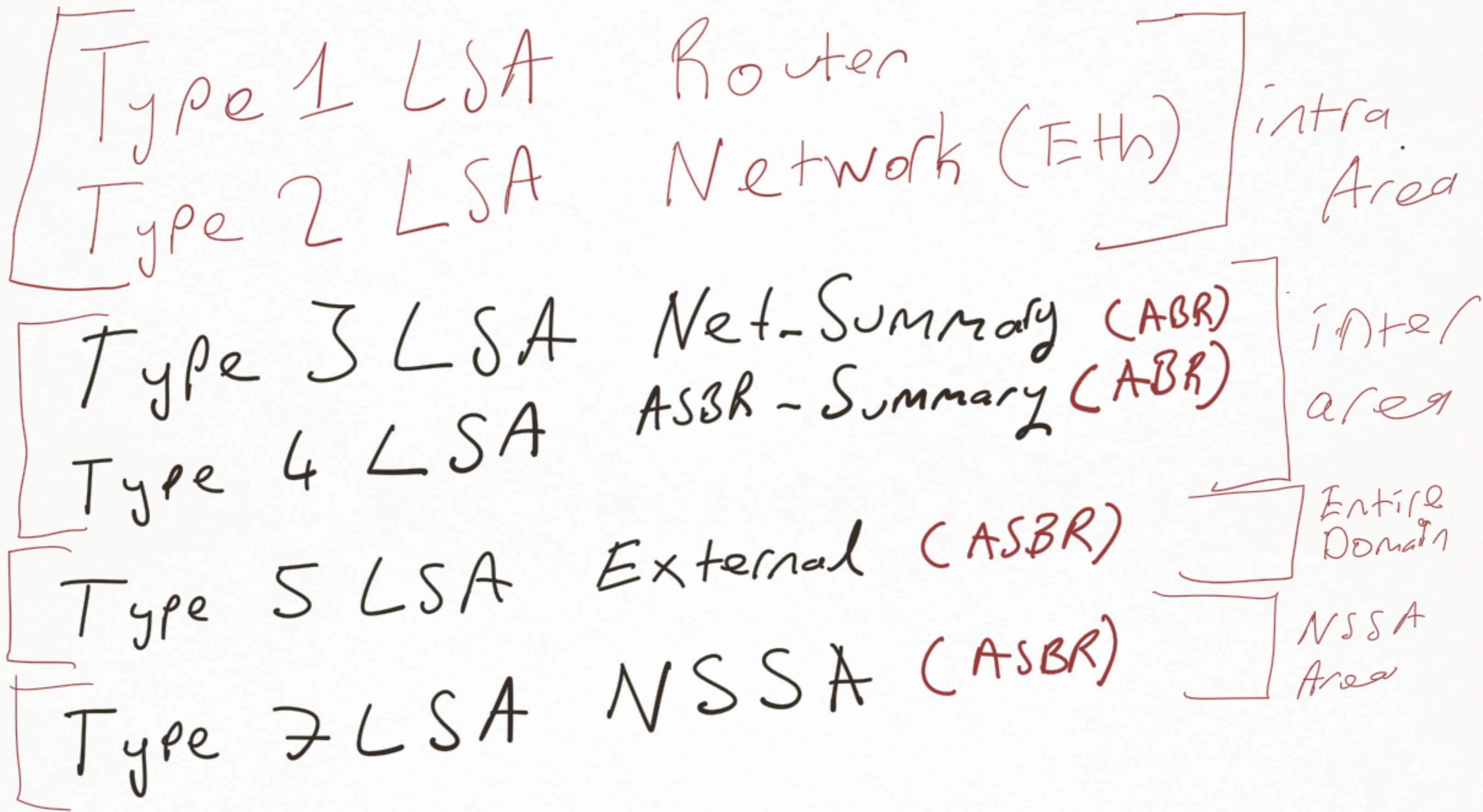
interface!-
process'e dahil
eder.

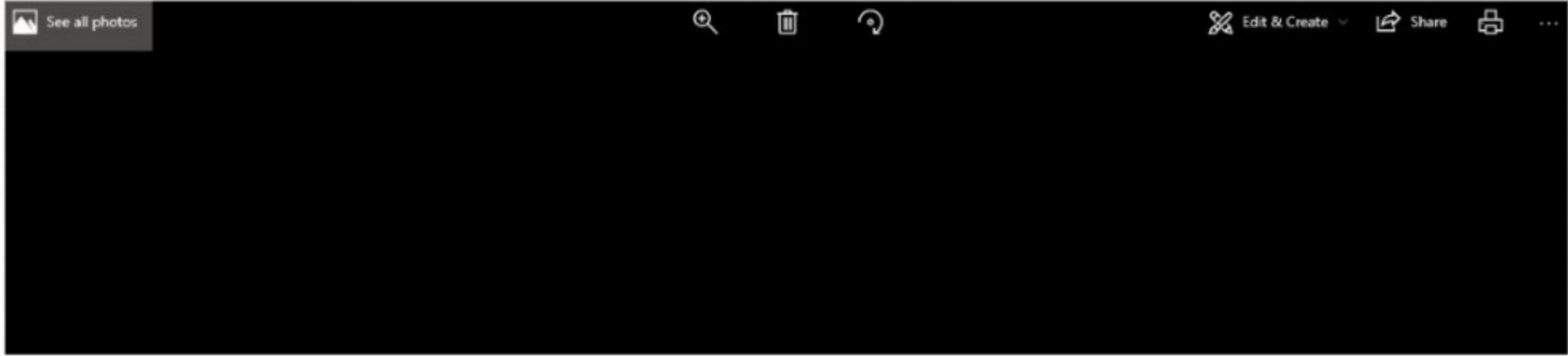
```
[RTA]ospf 1 router-id 1.1.1.1
[RTA-ospf-1]area 0
[RTA-ospf-1-area-0.0.0.0]network 192.168.1.0 0.0.0.255
```

Network 9.9 0/0

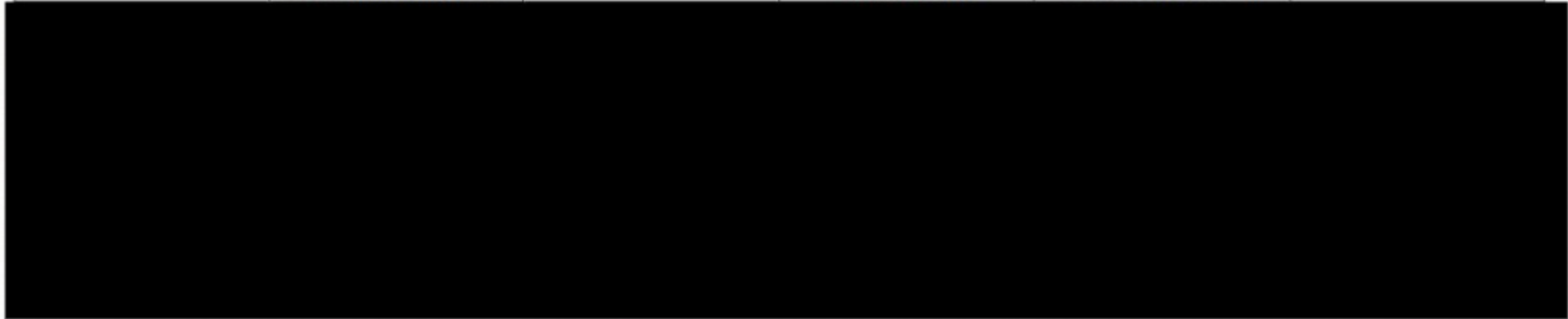
Network 192.168.1.1 0.0.0.0

Network 0.0.0.0 255.255.255.255
v v v v





	LSA1 Paketinde	LSA2 Paketinde	LSA3 Paketinde	LSA4 Paketinde	LSA5 Paketinde
Link ID	Aynı areadaki komşu router'ların router-ID'si	DR'ın Router-ID'si	Diğer arealardaki subnetler	ASBR'ın Router-ID'si	OSPF dışındaki subnetler
ADV Router	Aynı areadaki komşu router'ların router-ID'si	DR'ın Router-ID'si	Areadaki ABR'ların Router-ID'leri	ASBR'ı öğrendiğimiz ABR'ın Router-ID'si	ASBR'ın Router-ID'si



	Type 1	Type 2	Type 3	Type 4	Type 5	Type 7
Stub Area	✓	✓	✓	Default route	Default route	N/A
Totally Stub Area	✓	✓	Default route	Default route	Default route	N/A
NSSA	✓	✓	✓	Default route	Default route	✓
Totally NSSA	✓	✓	Default route	Default route	Default route	✓
Regular Area	✓	✓	✓	✓	✓	N/A

Stub Area

Totally Stub Area

NSSA

Totally NSSA

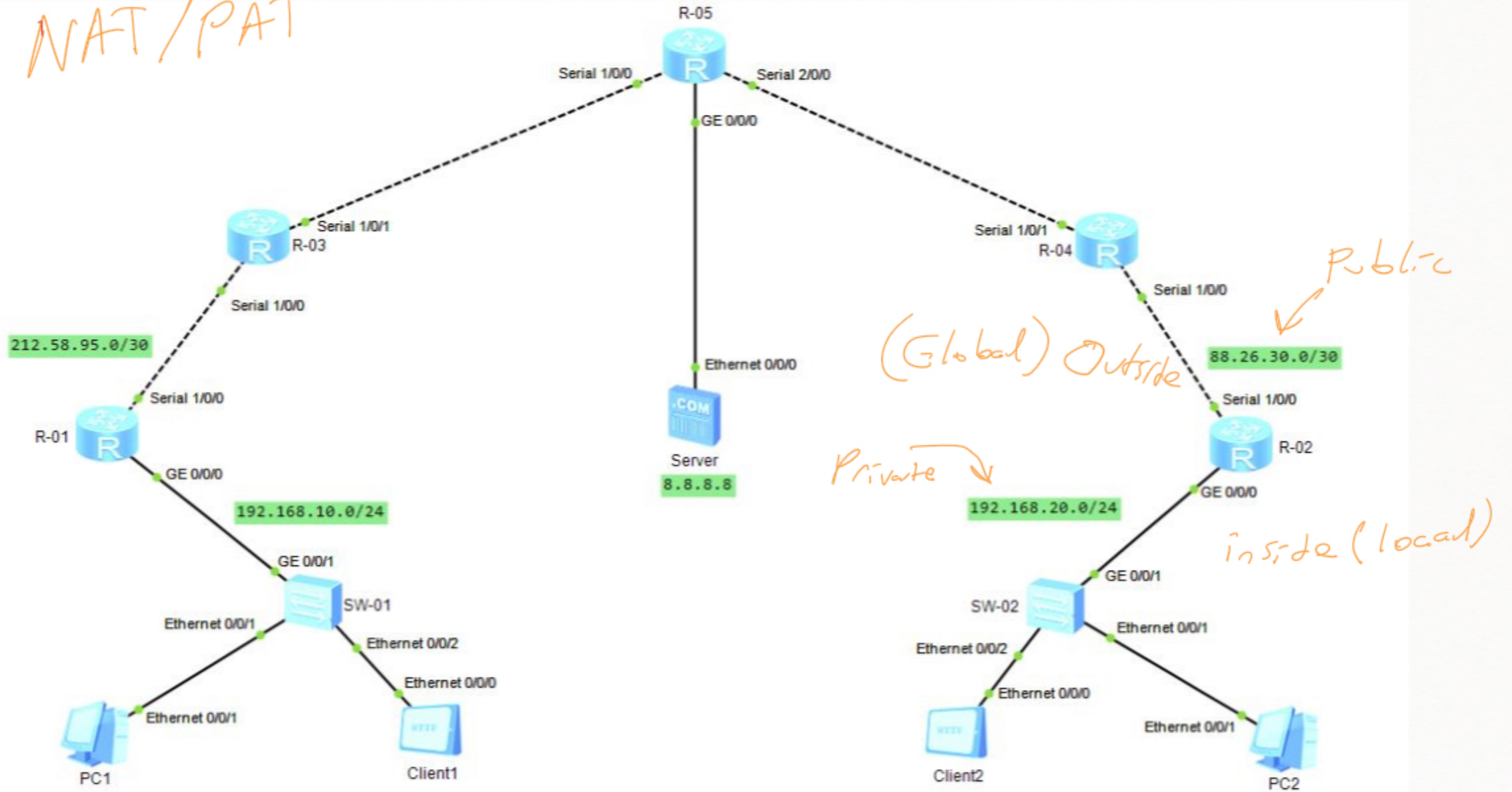
Regular Area

192.168.0.0 / 16
172.16.0.0 / 12
10.0.0.0 / 8

Private
Address

Public
Address

NAT/PAT





TTNET

TCCELL

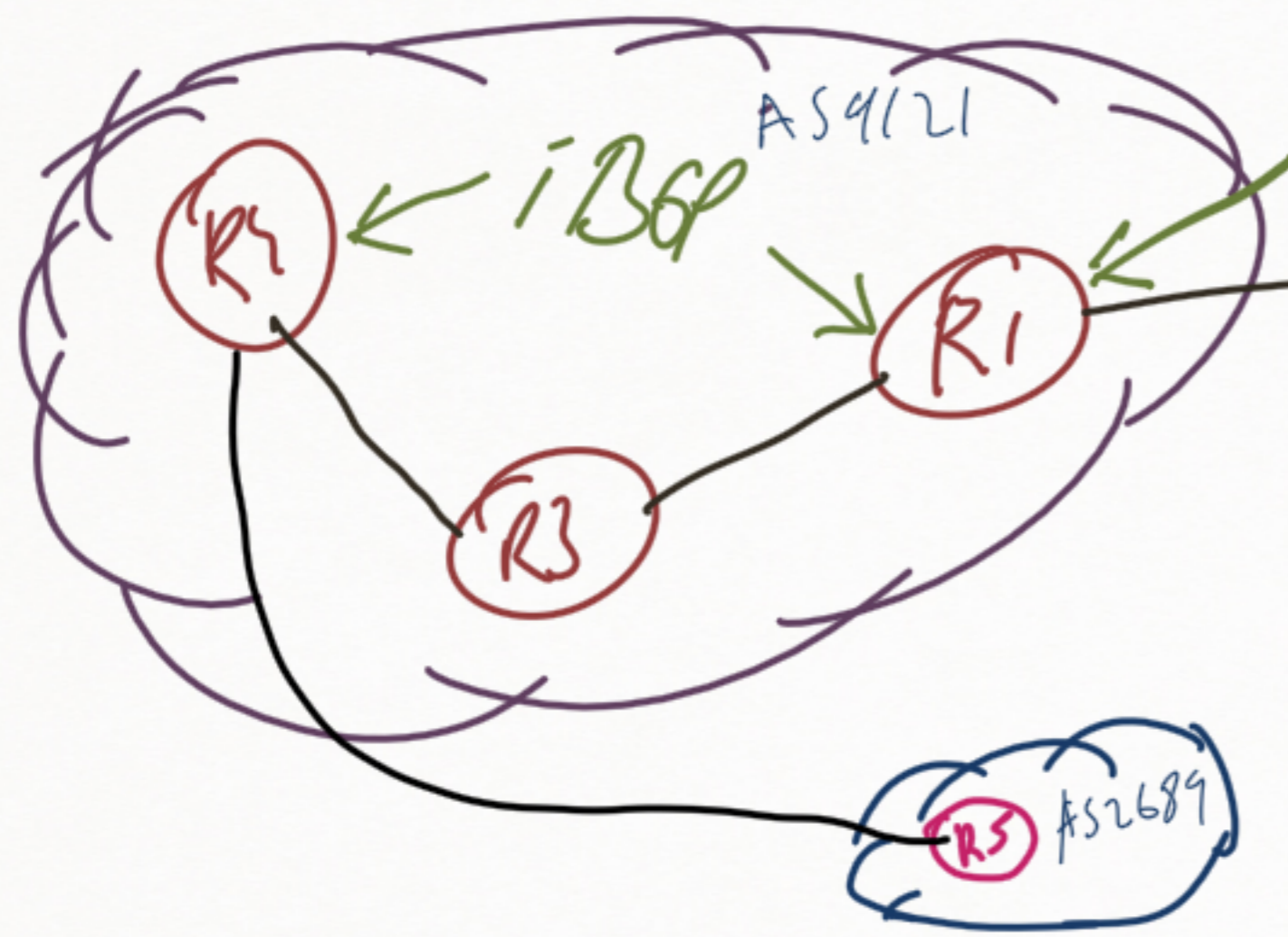
193.110.209.0/24

AS 3486
XXXXX

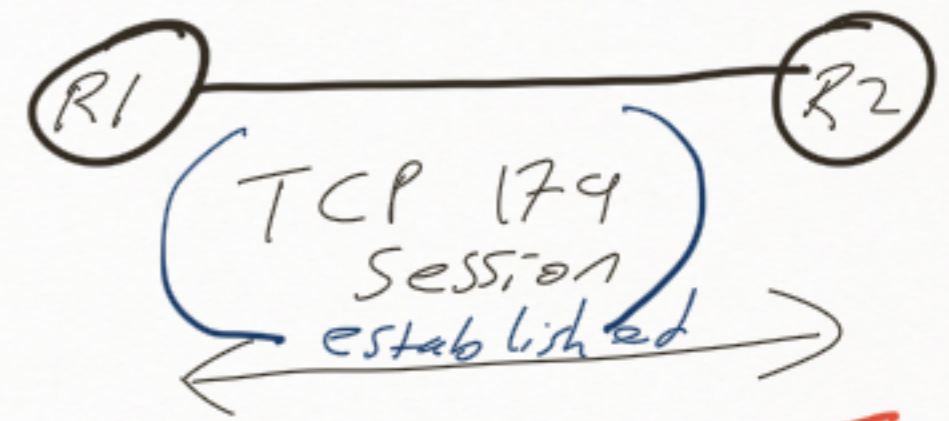
BGP (Distance-Vector)

eBGP \Rightarrow TTL (1)!

iBGP \Rightarrow TTL (255)



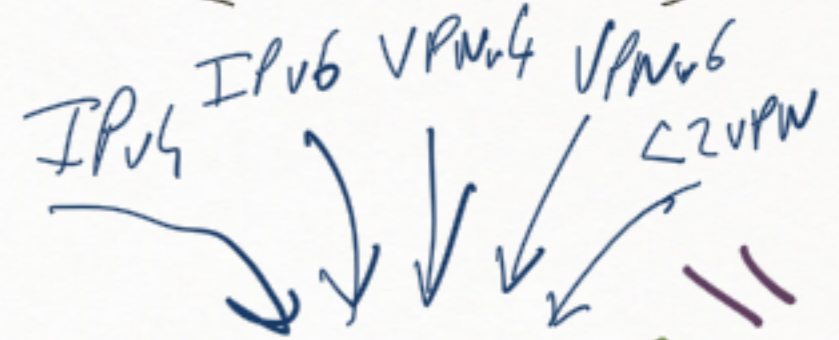
eBGP



OPEN

Notification

Keepalive

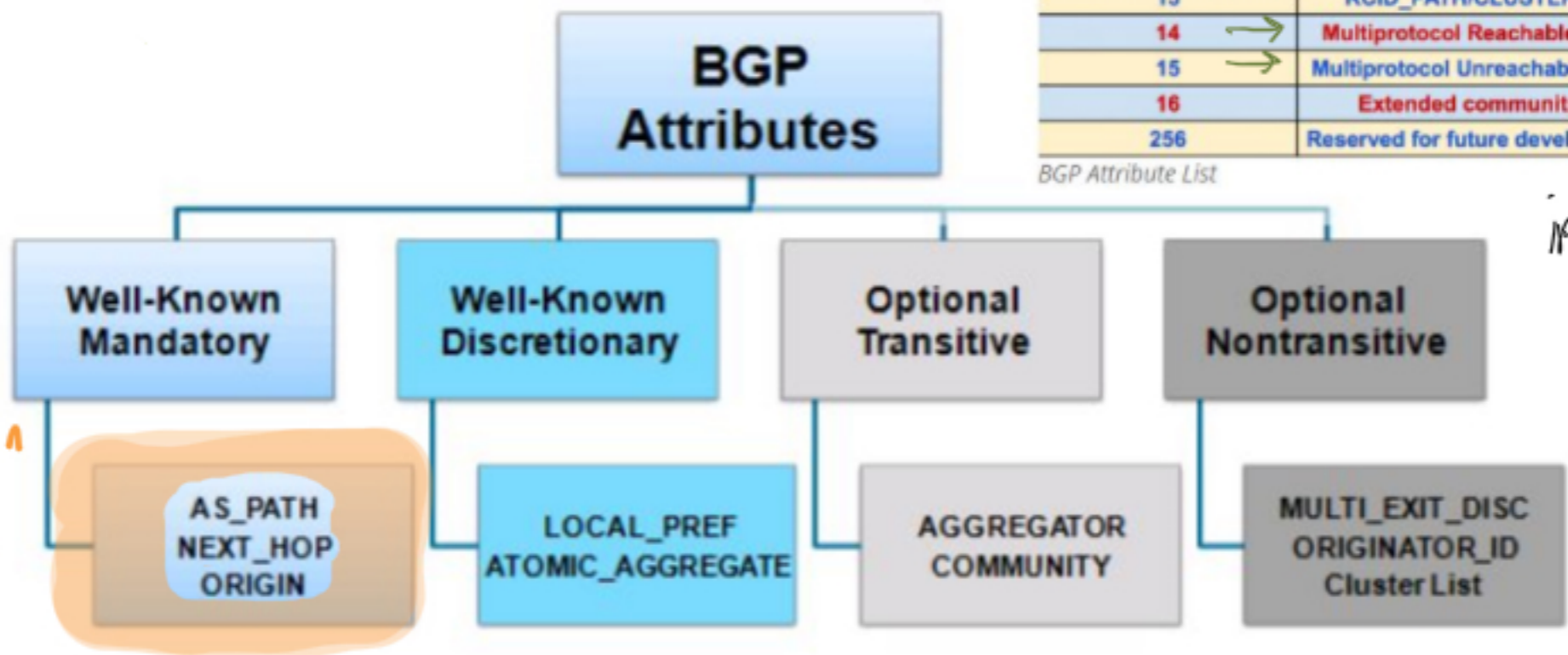


Origin
 AS-PATH
 Next-Hop (cihet)
 Weight
 Local Pref (i)
 MED (e)
 Community



Type Code	value	Attribute Name	Category
1		ORIGIN	Well-known mandatory
2		AS_PATH	Well-known mandatory
3		NEXT_HOP	Well-known mandatory
4		MULTI_EXIT_DISC (MED)	Optional non-transitive
5		LOCAL_PREF	Well-known discretionary
6		ATOMIC_AGGREGATE	Well-known discretionary
7		AGGREGATOR	Optional transitive
8		COMMUNITY	Optional transitive
9		ORIGINATOR_ID	Optional non-transitive
10		Cluster List	Optional non-transitive
11		DPA	Designation Point Attribute
12		Advertiser	BGP/IDRP Route Server
13		RCID_PATH/CLUSTER_ID	BGP/IDRP Route Server
14		Multiprotocol Reachable NLRI	Optional non-transitive
15		Multiprotocol Unreachable NLRI	Optional non-transitive
16		Extended communities	
256		Reserved for future development	

BGP Attribute List



Her Update'in
 Tqinde Mecluri
 bulunur.

ip bgp-community new-format

- Standard Community
- 16bit = 16bit
- Extended Community
- 32bit = 32bit

// Origin // BGP'ye prefix nasıl
girdi?

I GP
i

en iyi
network
aggregate

<

E GP
e

Orta
E GP'den

<

Incomplete
?
en kötü
Redistribution

AS-PATH

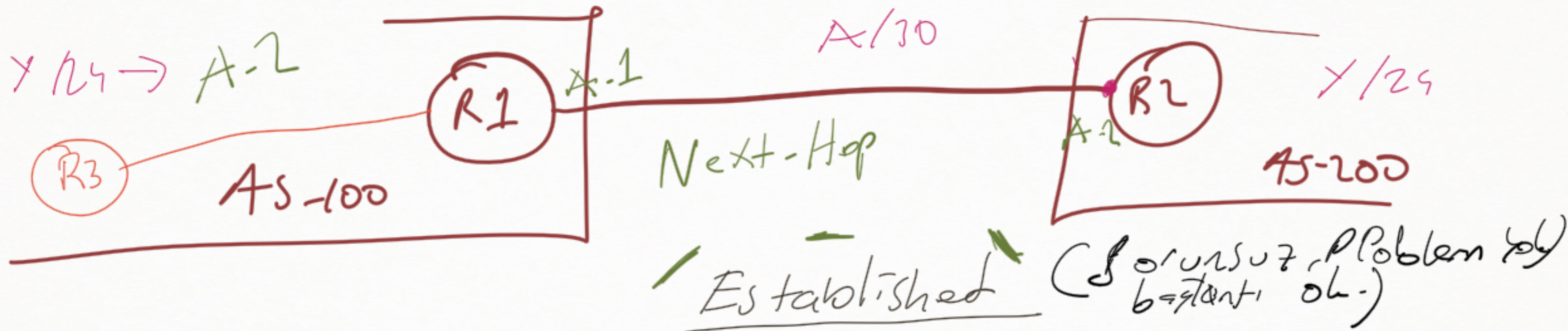
4-hop

82.26.20.0/24

38706 2995 3590 3052 ?

AS-PATH Attribute





Established (Sorunsuz, Problem yok)
 (başlangıçta olur.)

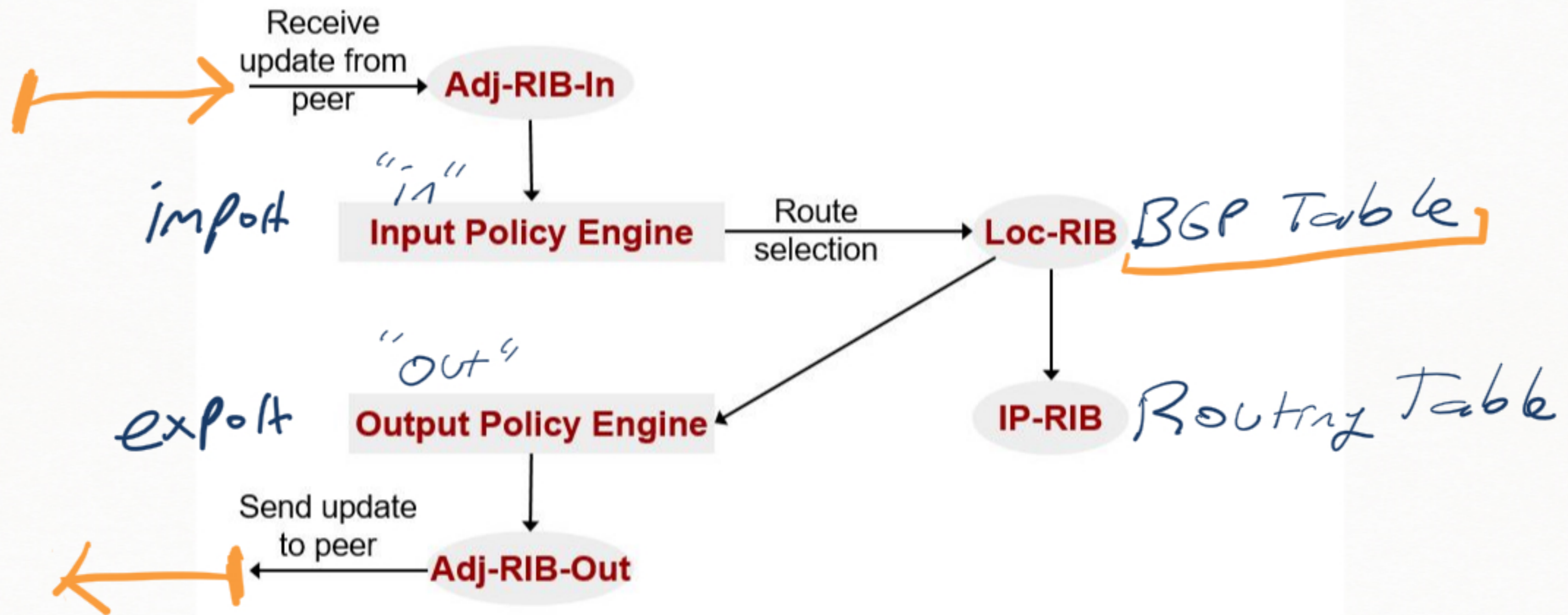
- L1
- L2
- L3
- L4

Hiz erişimlerinin L1, L2, L3, L4 sorun olabilir.

Active (Problem)

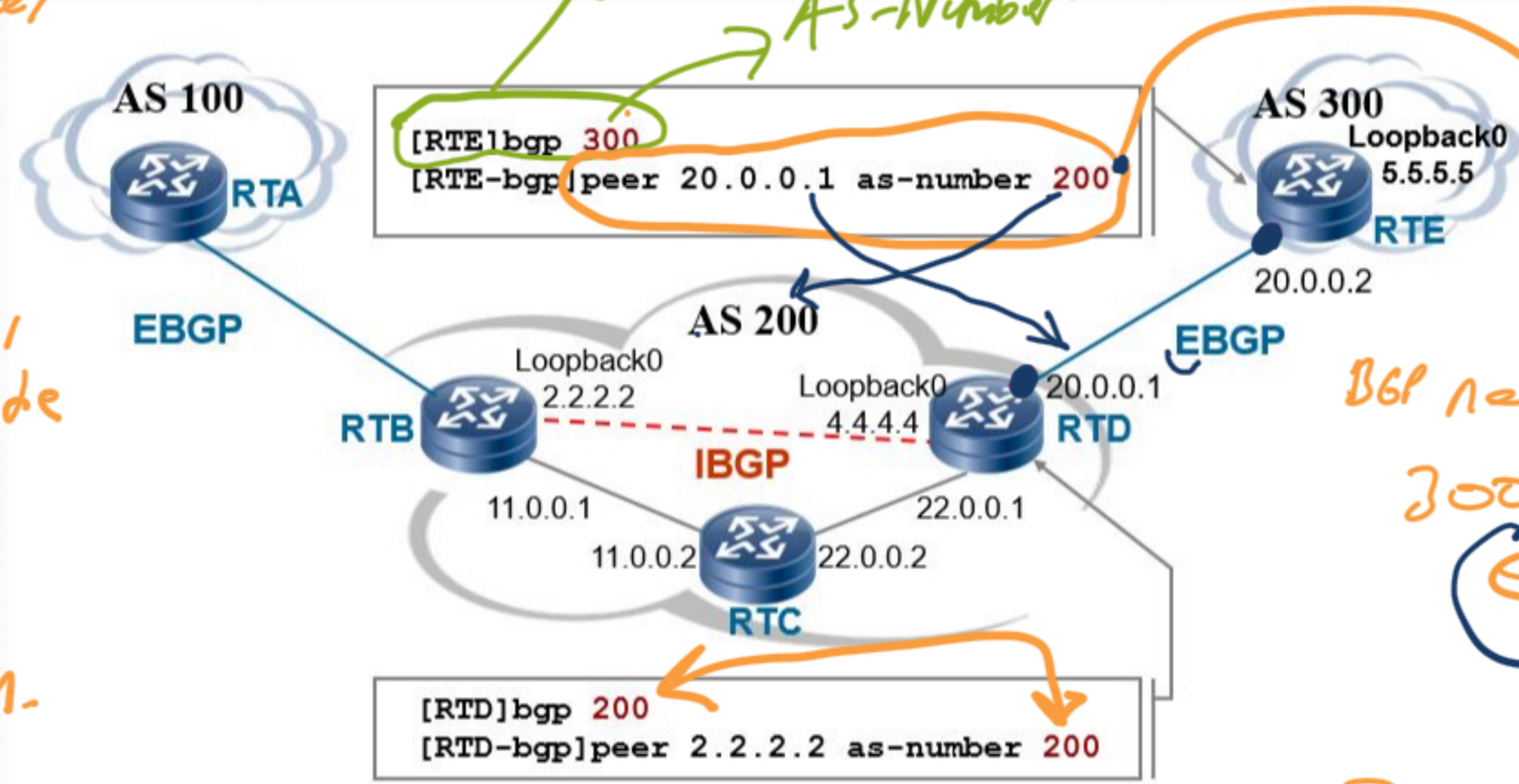
- (L7)

İnsan hatası, yanlış Config
 Idle (Problem)



BGP'de Peer'ing Türü
 direkt bağlantıdır!

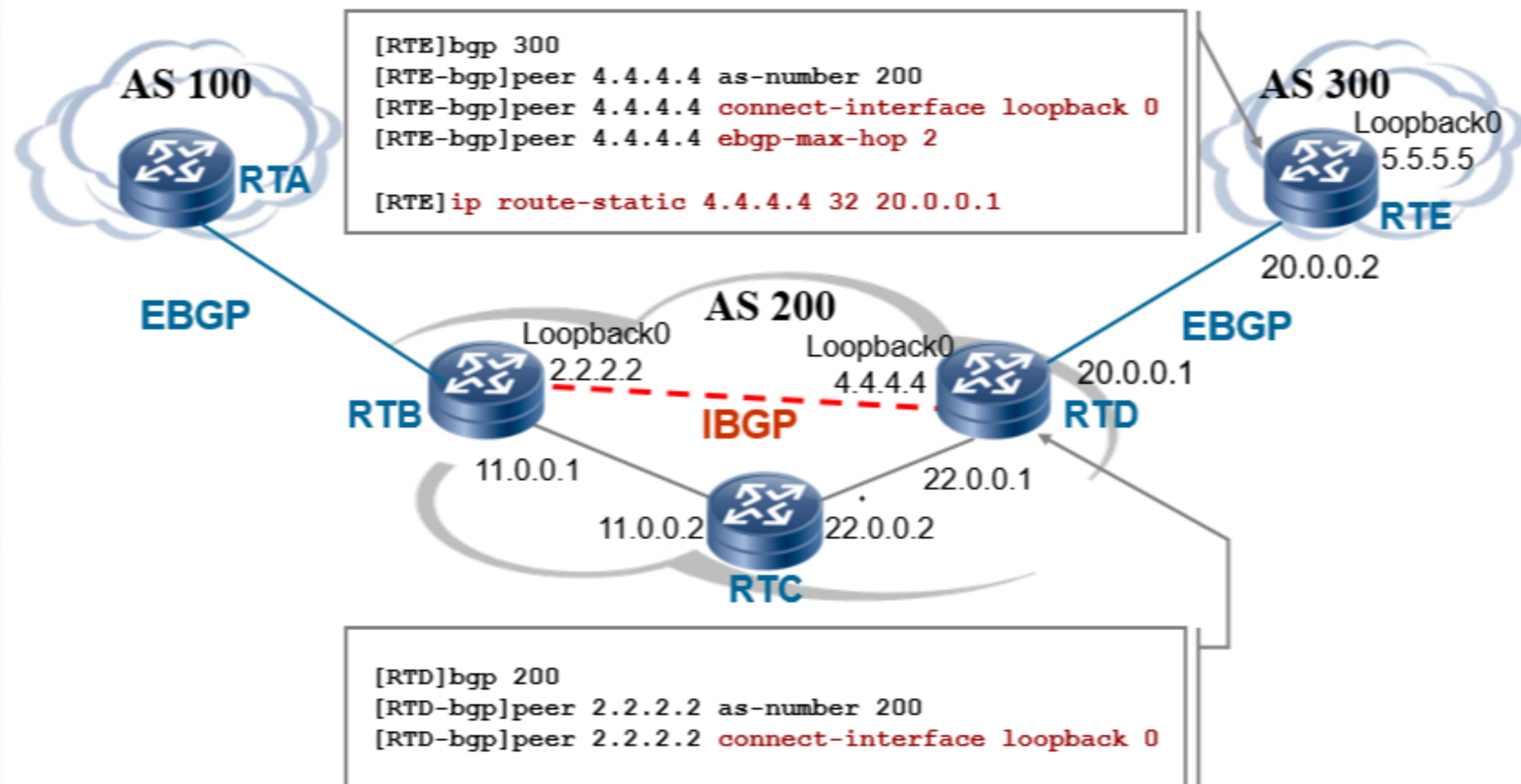
enable bgp process
 AS-Number



eBGP'de
 TTL=1
 olduğuna
 vakti mayn.
 iBGP'de
 TTL=255

BGP Neighbor Config
 300 ↔ 200
 eBGP
 200 ↔ 200
 iBGP

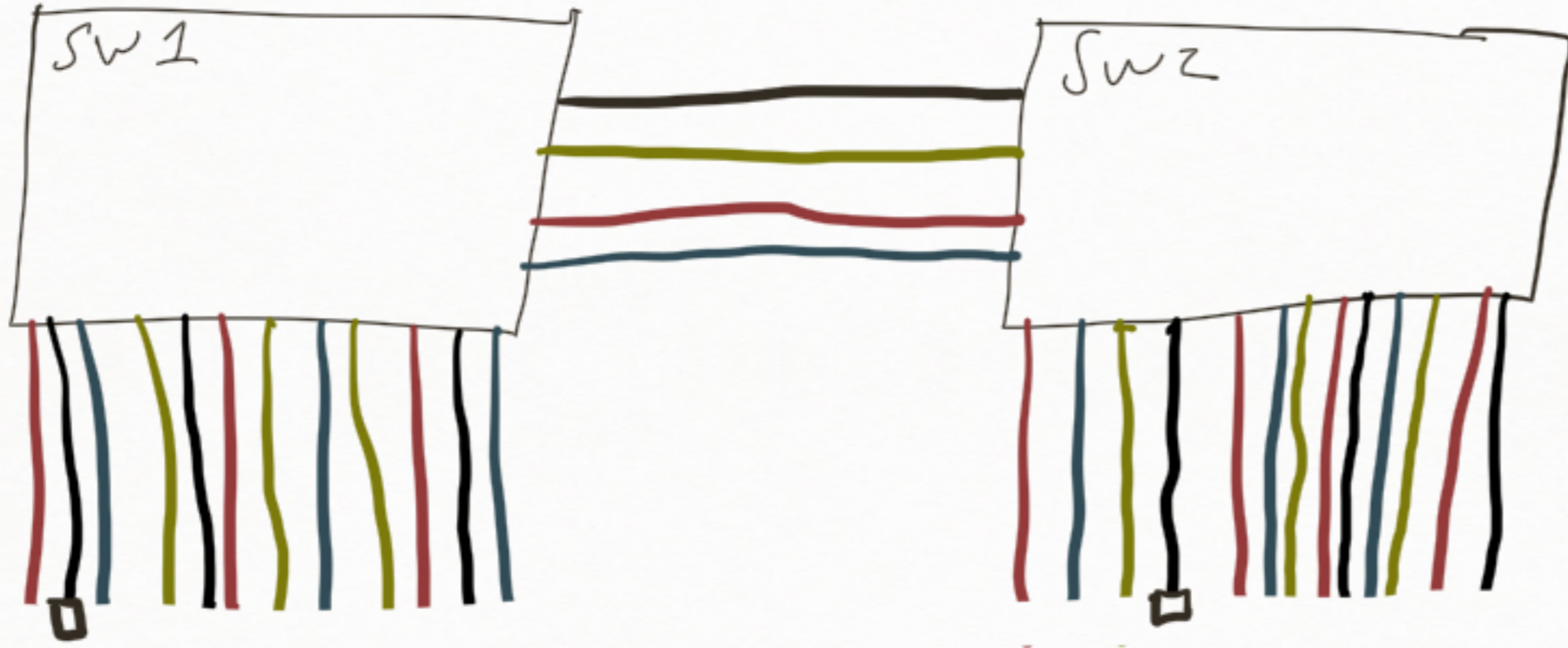
EBGP Multi-hop and specify the update source



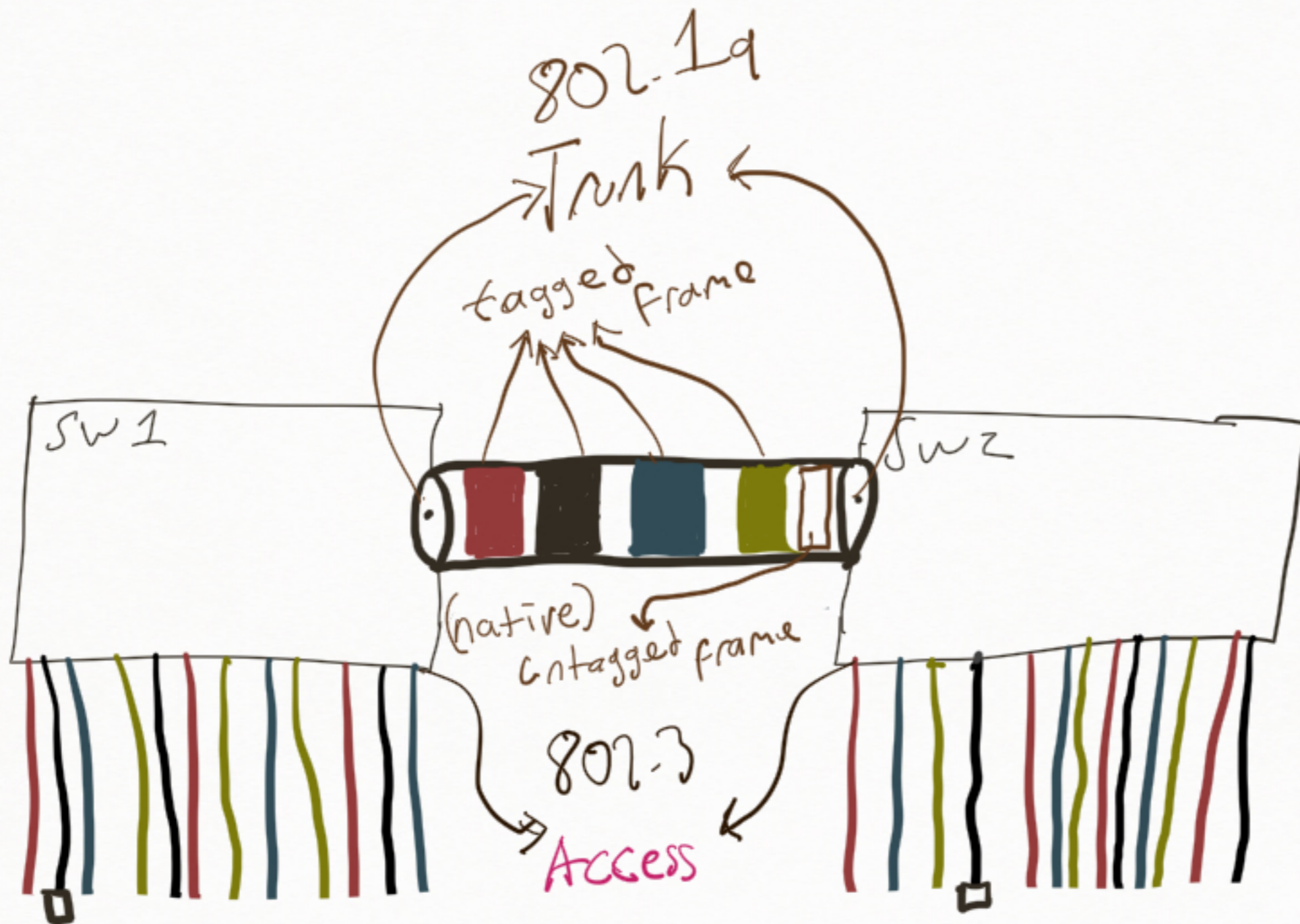
V-LAN

Virtual obrazy

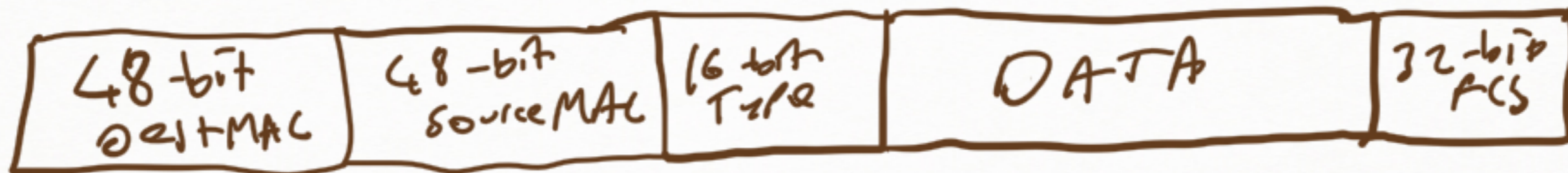




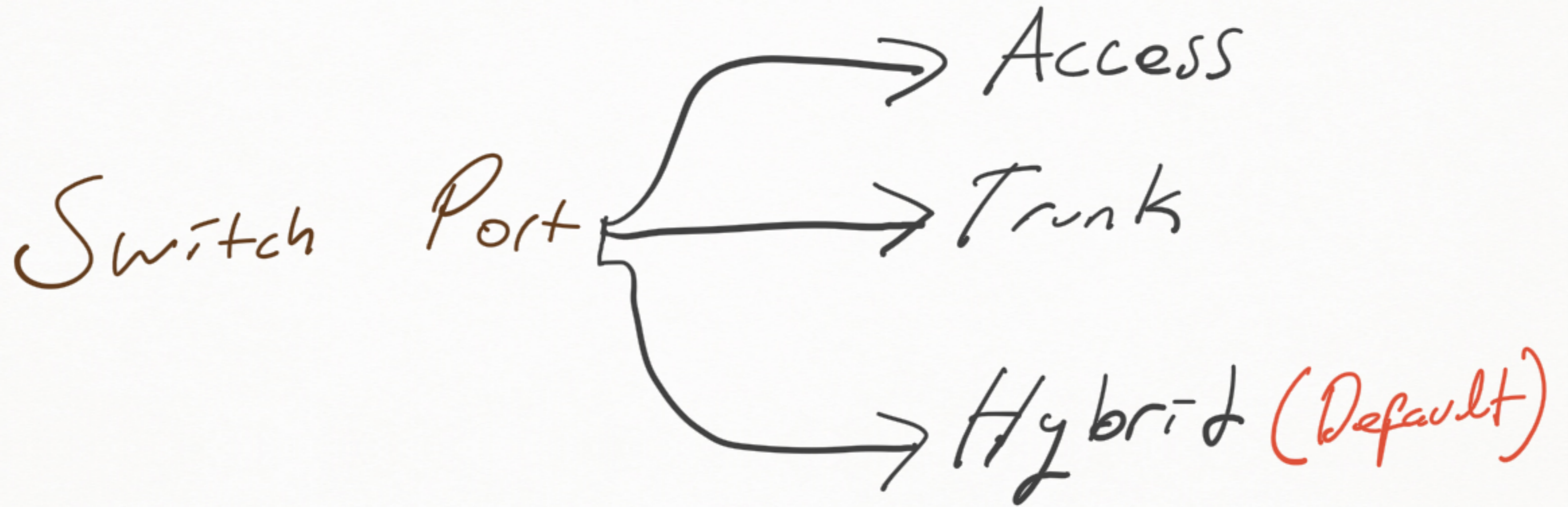
- Vlan 10
- Vlan 20
- Vlan 30
- Vlan 40



- Vlan 10
- Vlan 20
- Vlan 30
- Vlan 40

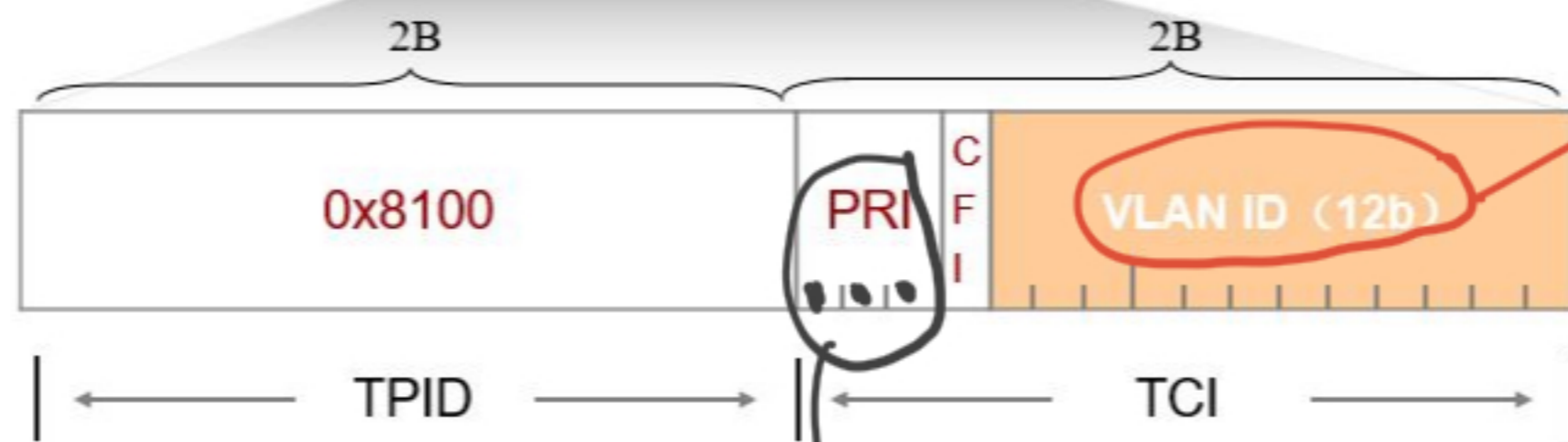
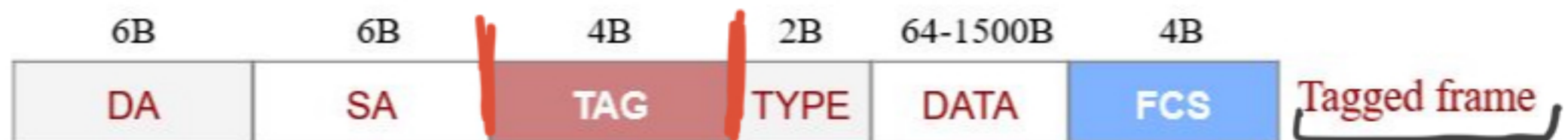


802.3 Ethernet frame



802.3

802.1q



$2^{12} = 4096$

802.1p (Cos)
Priority bits.

Access Port'ü VLAN'a üye yapma =

Port'ü
Access
yapıyor

Access Port VLAN Attribute

```
[Quidway-2-GigabitEthernet2/0/2]display this  
#  
interface GigabitEthernet2/0/2  
port link-type access  
port default vlan 2  
#  
return
```

Access Port, used to connect to host

The default VLAN is 2, untagged frames will be forwarded after tag is added

Port'ü
Vlan
üye yapılıyor.

Trunk port VLAN Attribute

```
[Quidway-GigabitEthernet2/0/3]display this
#
interface GigabitEthernet2/0/3
port link-type trunk
port trunk pvid vlan 3
port trunk allow-pass vlan 5 100
undo negotiation auto
speed 100
#
return
```

Define trunk port

After receiving untagged frame
Add PVID 3 and forward it

Permit multiple
VLANs to pass

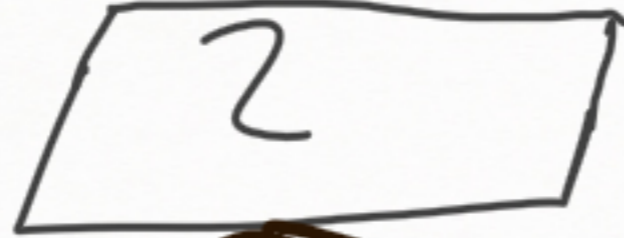
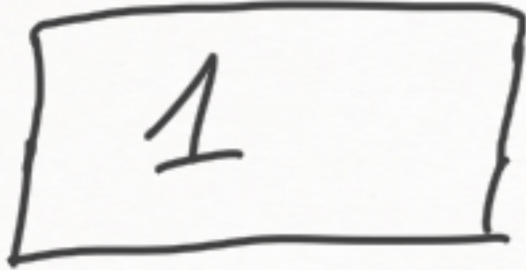
Portlu trunk yapmak
vlan 3'in untagged olmasını sağlar.

Mecbur

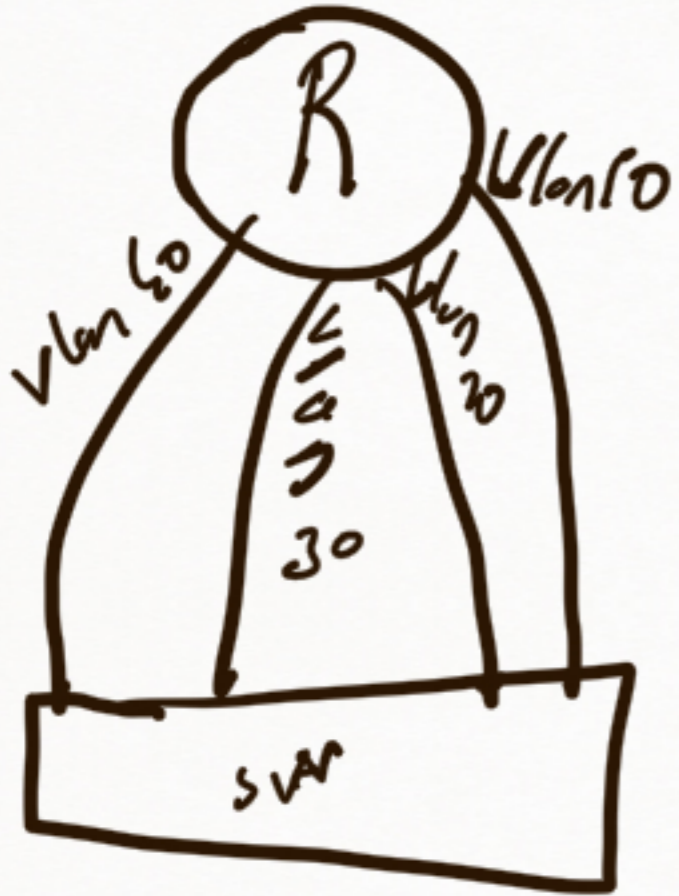
Opsiyonel

Bu trunk porttan sadece vlan 5'e ve vlan 100'e ait frame'ler tag'lenip gönderilecek. Vlan 3'e ait olan taglenmeden gidecek. Geri kalan VLANların frame'leri Deney!!!

Inter-VLAN Routing

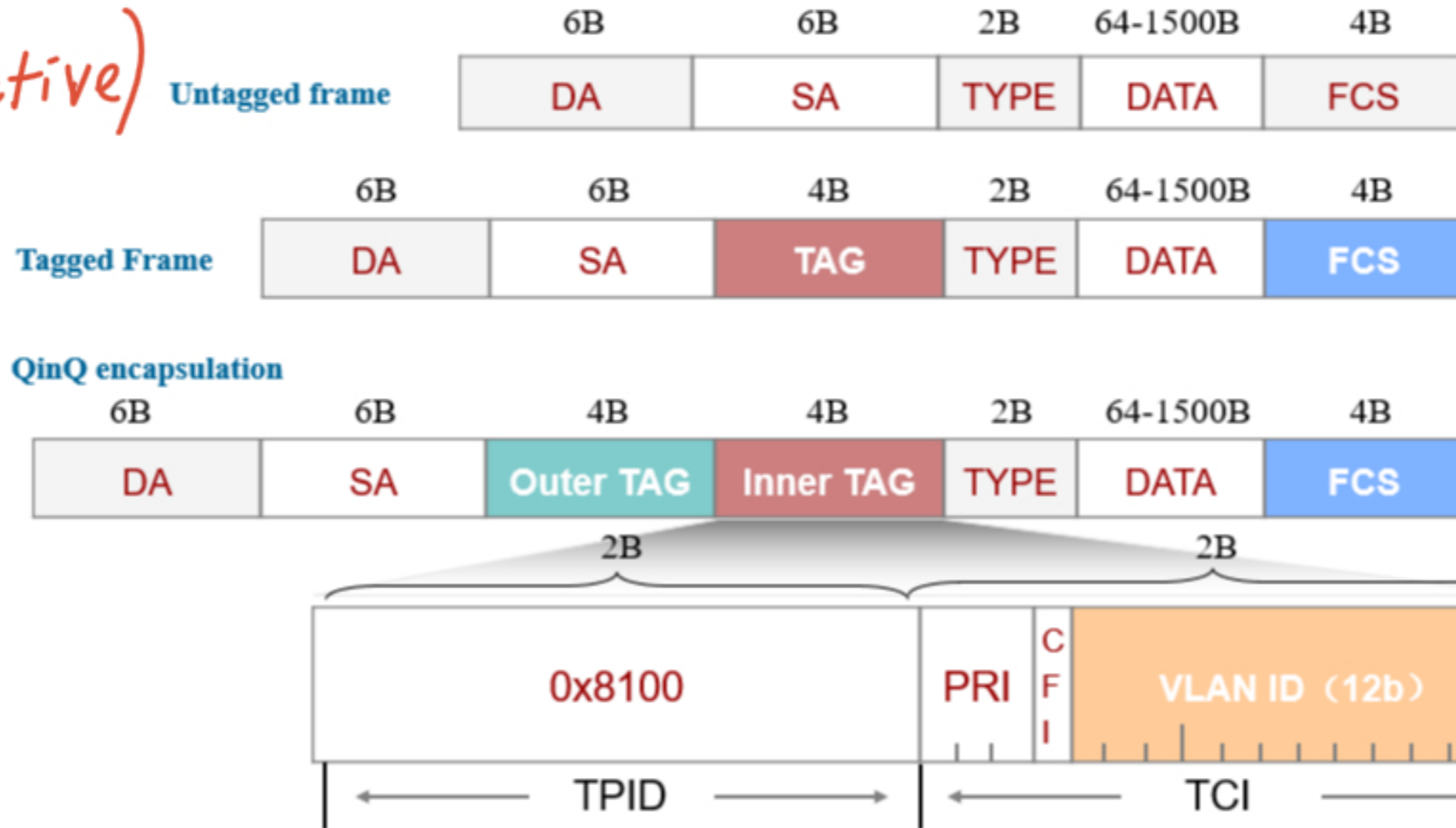


Layer 3 switch



QinQ Encapsulation

(Native)



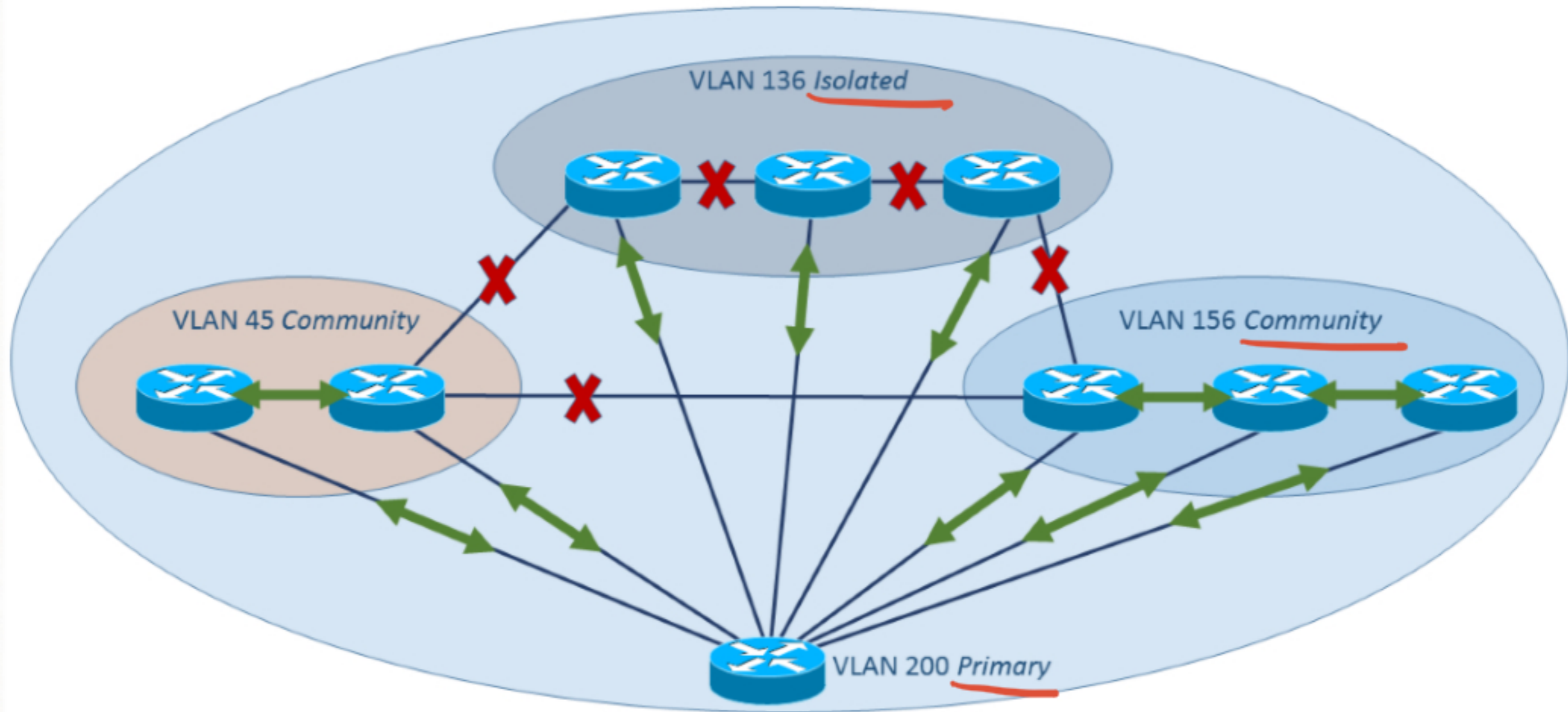
802.3

802.1q

802.1ad

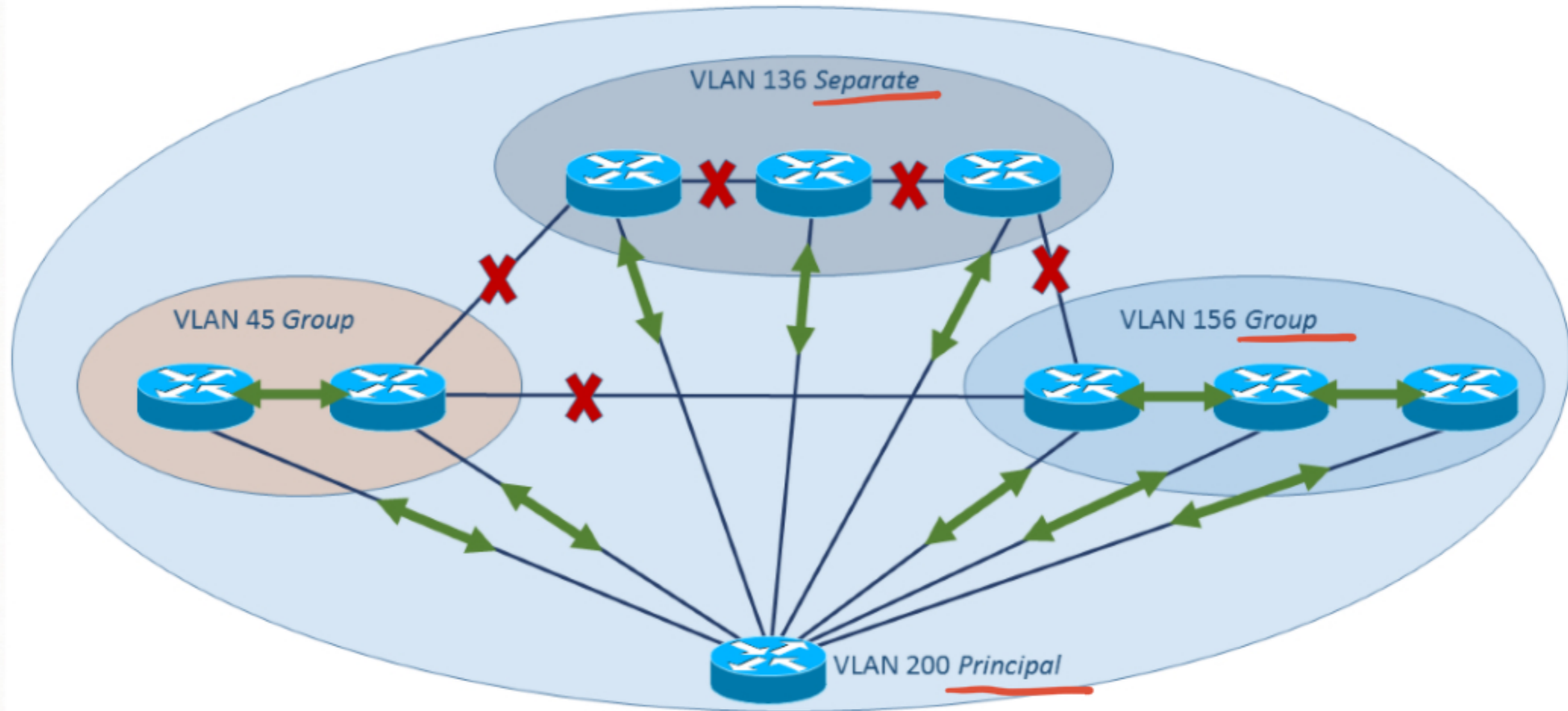
Cisco Private VLANs

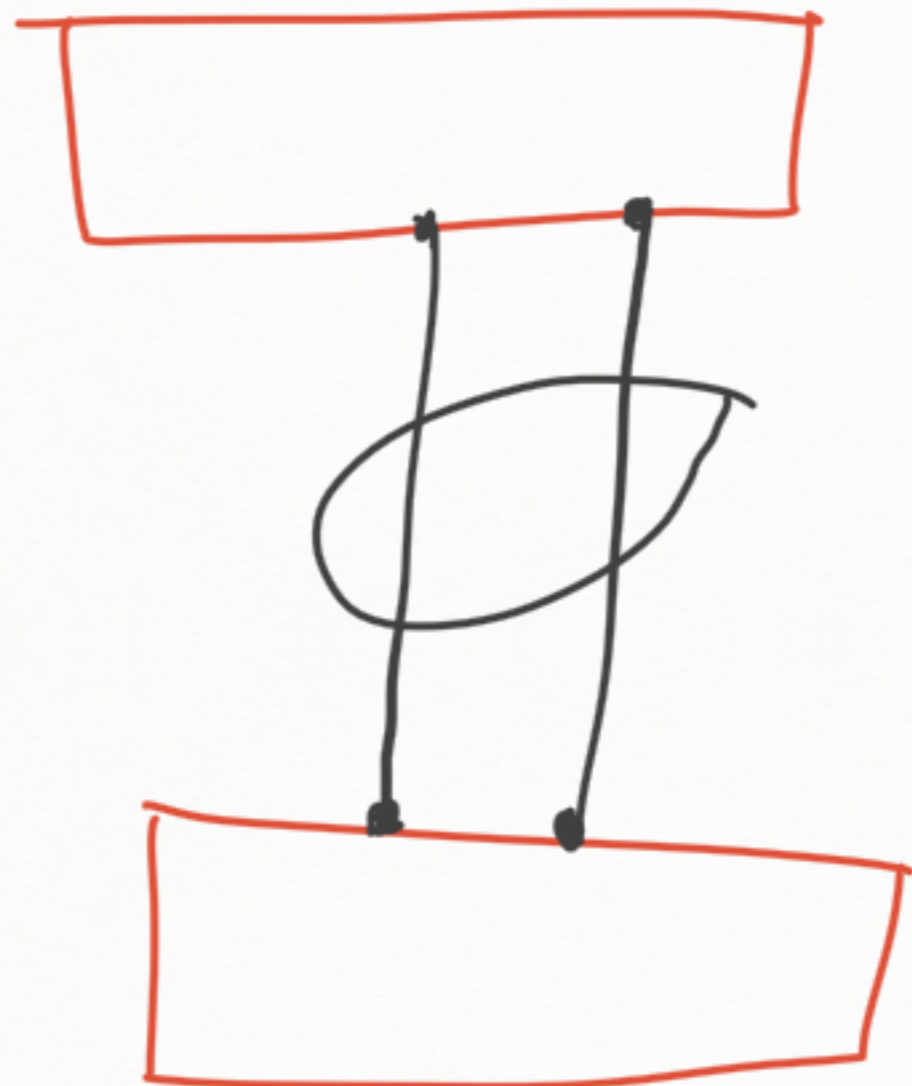
SWITCH



Mux VLANs Huawei

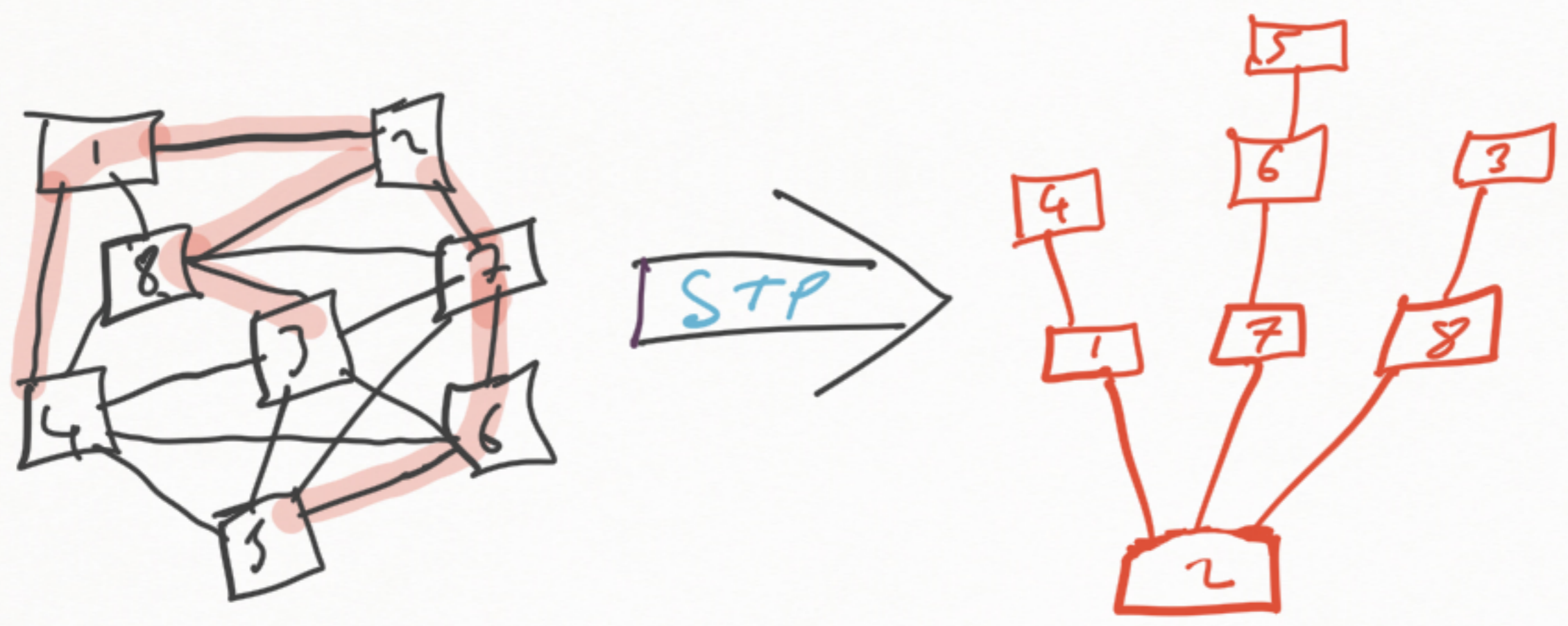
SWITCH





Eth-Trunk
Ether-Channel

STP	802.1D	≠	PVST
R STP	802.1W	≠	Rapid-PVST
MSTP	802.1S	=	MST



BPD4

← 2sa →

Content of Configuration BPDU

1	2 Bytes	Protocol Identifier
2	1 Bytes	Protocol Version Identifier
3	1 Bytes	BPDU Type
4	1 Bytes	Flags
5	8 Bytes	Root Identifier
6	4 Bytes	Root Path Cost •
7	8 Bytes	Bridge Identifier •
8	2 Bytes	Port Identifier •
9	2 Bytes	Message Age
10	2 Bytes	Max Age
11	2 Bytes	Hello Time
12	2 Bytes	Forward Delay

Root Bridge?
Root Port?
Seçimler yapılıken
kullanılır.

BPD4 - FLAG

STP

RSTP

IEEE 802.1D

7	6	5	4	3	2	1	0
---	---	---	---	---	---	---	---



TC ←

Bit	Function
7	Topology Change (TC)
6	Unused
5	Unused
4	Unused
3	Unused
2	Unused
1	Unused
0	Topology Change Ack (TCA)

TCA ←

IEEE 802.1w

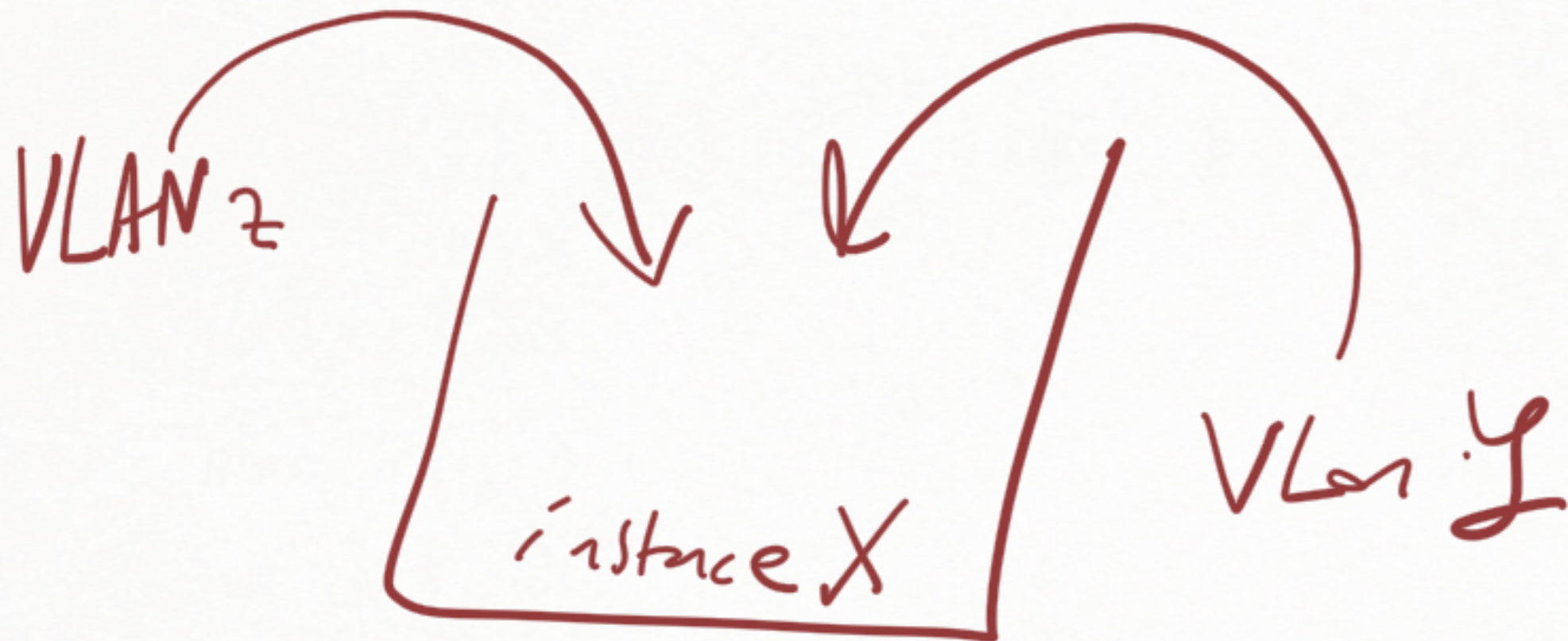
7	6	5	4	3	2	1	0
---	---	---	---	---	---	---	---



Bit	Function
7	Topology Change (TC)
6	Proposal
5	Port Role:
	00 - Unknown
	01 - Alternate Port
4	10 - Root Port
	11 - Designated Port
3	Learning
2	Forwarding
1	Agreement
0	Topology Change Ack (TCA)

Instance 1
Vlan 5, Vlan 7

Instance 8
Vlan 10, Vlan 11
Vlan 12, Vlan 13



1. Create a VLAN on the switch and add interfaces to the VLAN.

Create a VLAN.

```
<Quidway> system-view  
[Quidway] sysname Switch  
[Switch] vlan 10  
[Switch-vlan10] quit
```

Add GE1/0/1 to VLAN 10. The configurations of GE1/0/2 and GE1/0/3 are similar to the configuration of GE1/0/1, and are not mentioned here.

```
[Switch] interface gigabitethernet 1/0/1  
[Switch-GigabitEthernet1/0/1] port link-type access  
[Switch-GigabitEthernet1/0/1] port default vlan 10  
[Switch-GigabitEthernet1/0/1] quit
```

2. Configure port security of **GE1/0/1**.

Enable the sticky MAC function and set the maximum number of MAC addresses. The configurations of GE1/0/2 and GE1/0/3 are similar to the configuration of GE1/0/1, and are not mentioned here.

```
[Switch] interface gigabitethernet 1/0/1  
[Switch-GigabitEthernet1/0/1] port-security enable  
[Switch-GigabitEthernet1/0/1] port-security mac-address sticky  
[Switch-GigabitEthernet1/0/1] port-security max-mac-num 1
```

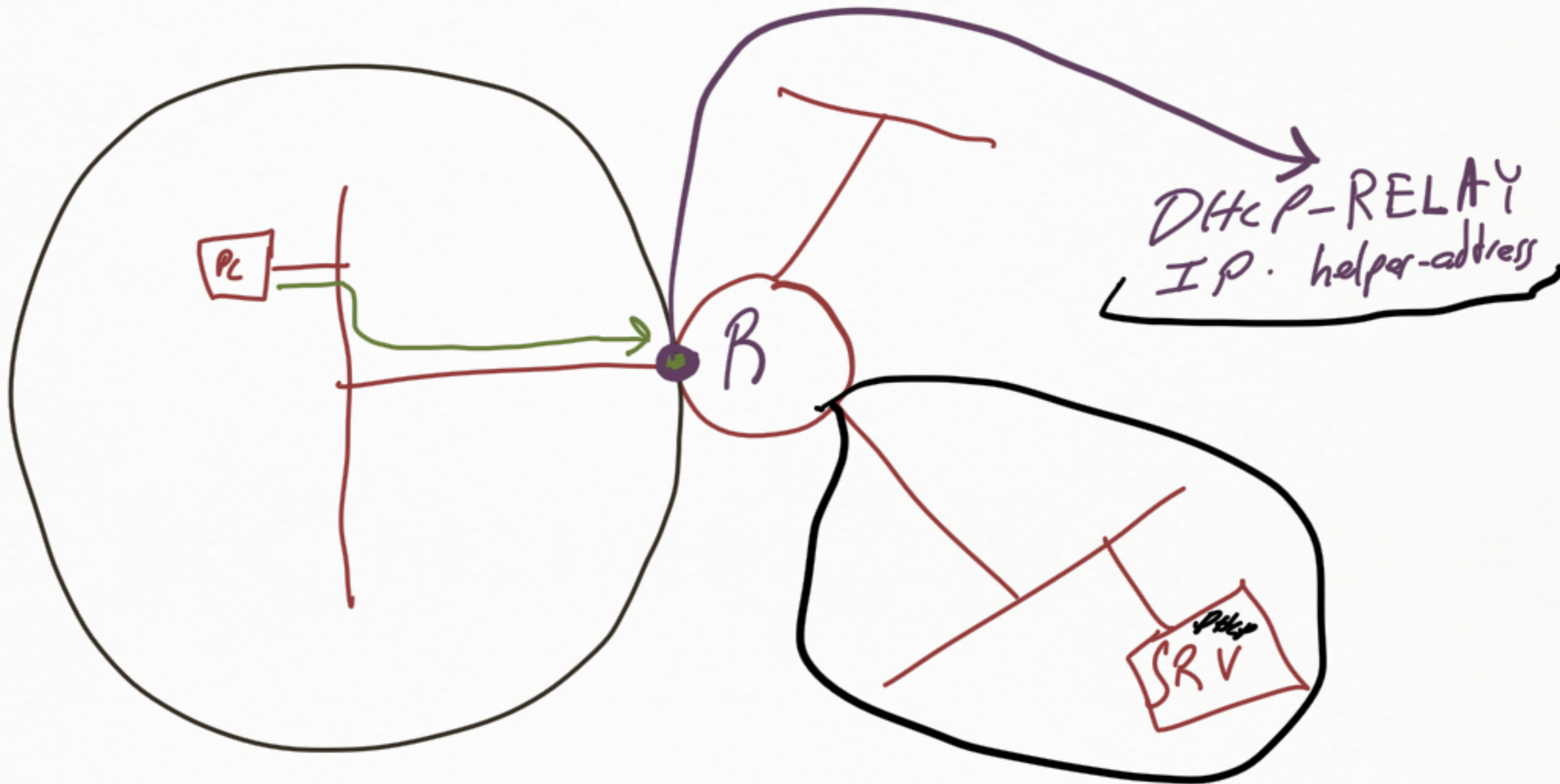
Sadece "1" adet
MAC öğrenilecek

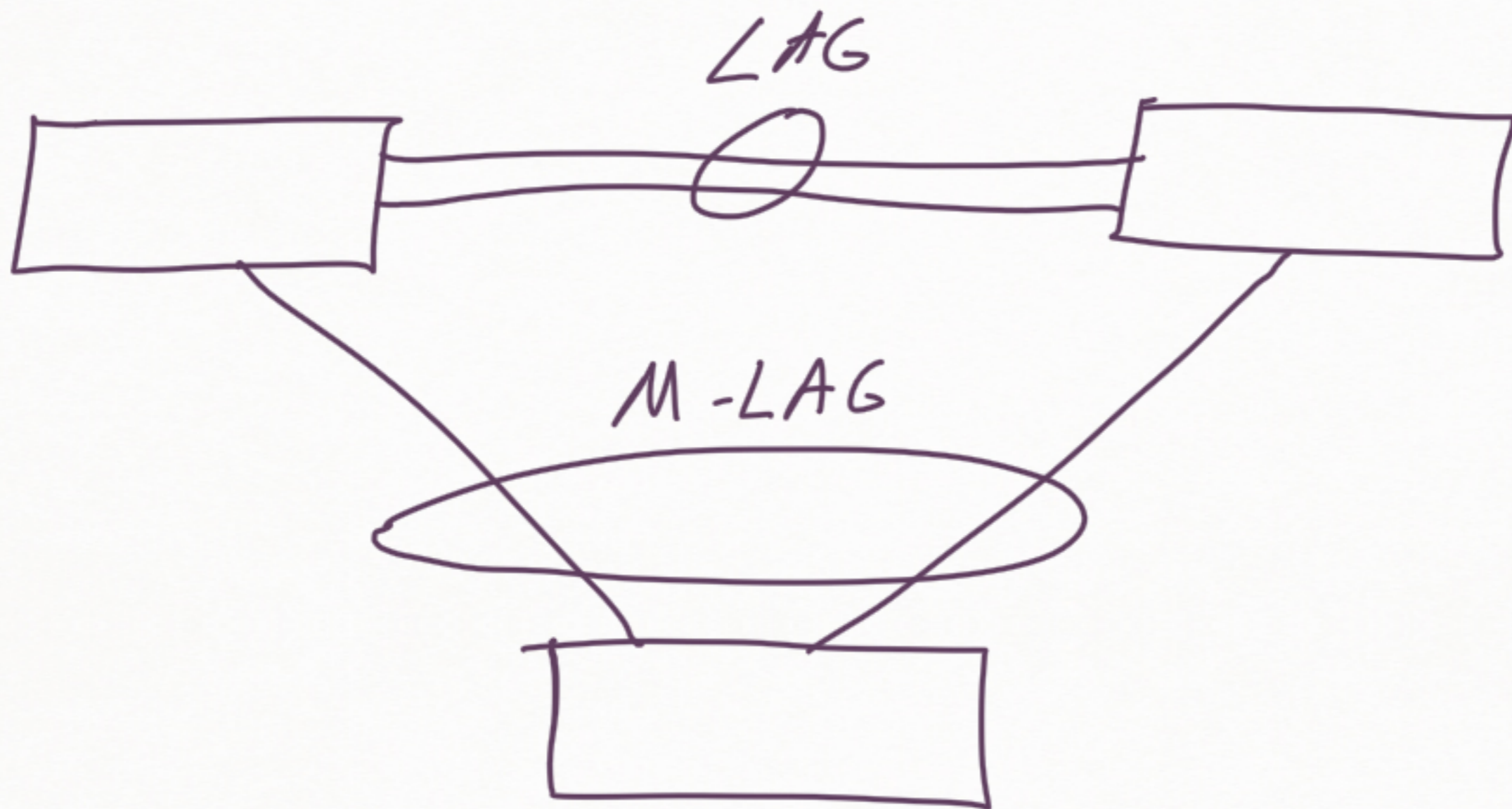
mevcut
kaynak
Sadece
MAC
Adresi

Configuration Files

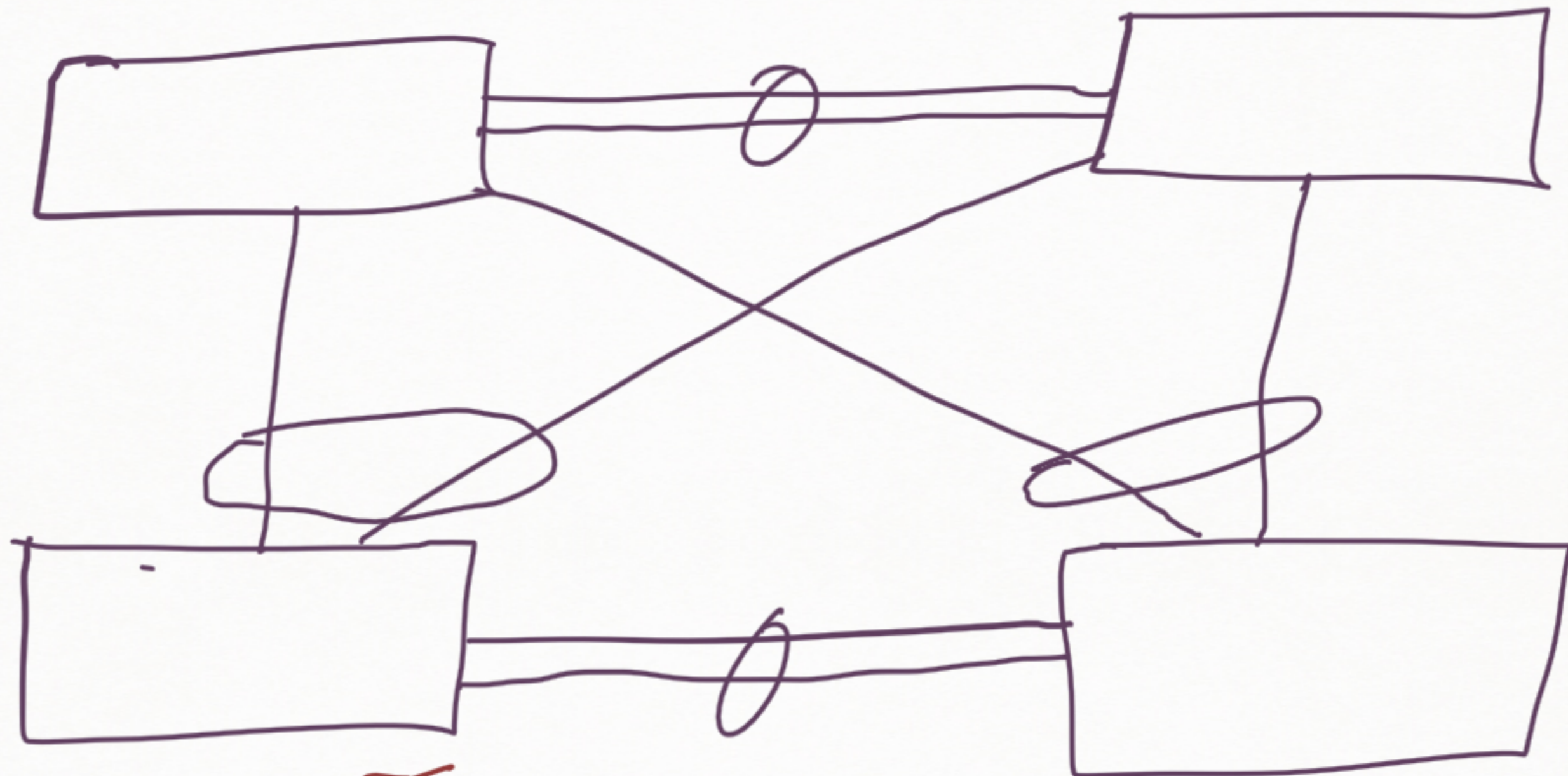
Switch configuration file

```
#
sysname Switch
#
vlan batch 10
#
interface GigabitEthernet1/0/1
 port link-type access
 port default vlan 10
 port-security enable
 port-security mac-address sticky
#
interface GigabitEthernet1/0/2
 port link-type access
 port default vlan 10
 port-security enable
 port-security mac-address sticky
#
interface GigabitEthernet1/0/3
 port link-type access
 port default vlan 10
 port-security enable
 port-security mac-address sticky
#
return
```





Trill, fabricpath, Qfabric, SPB, ...



[BGP - EvPN ve VXLAN]

A-class 1.0.0.0 - 126.255.255.255
B-class 128.0.0.0 - 191.255.255.255
C-class 192.0.0.0 - 223.255.255.255
D-class 224.0.0.0 - 239.255.255.255 Multicast
E-class 240.0.0.0 - 255.255.255.255

fixed

00000001

L1 Address

224.1.1.1
23 bit

L2 address

01:00:5E:0
24 bit 1 bit 23 bit

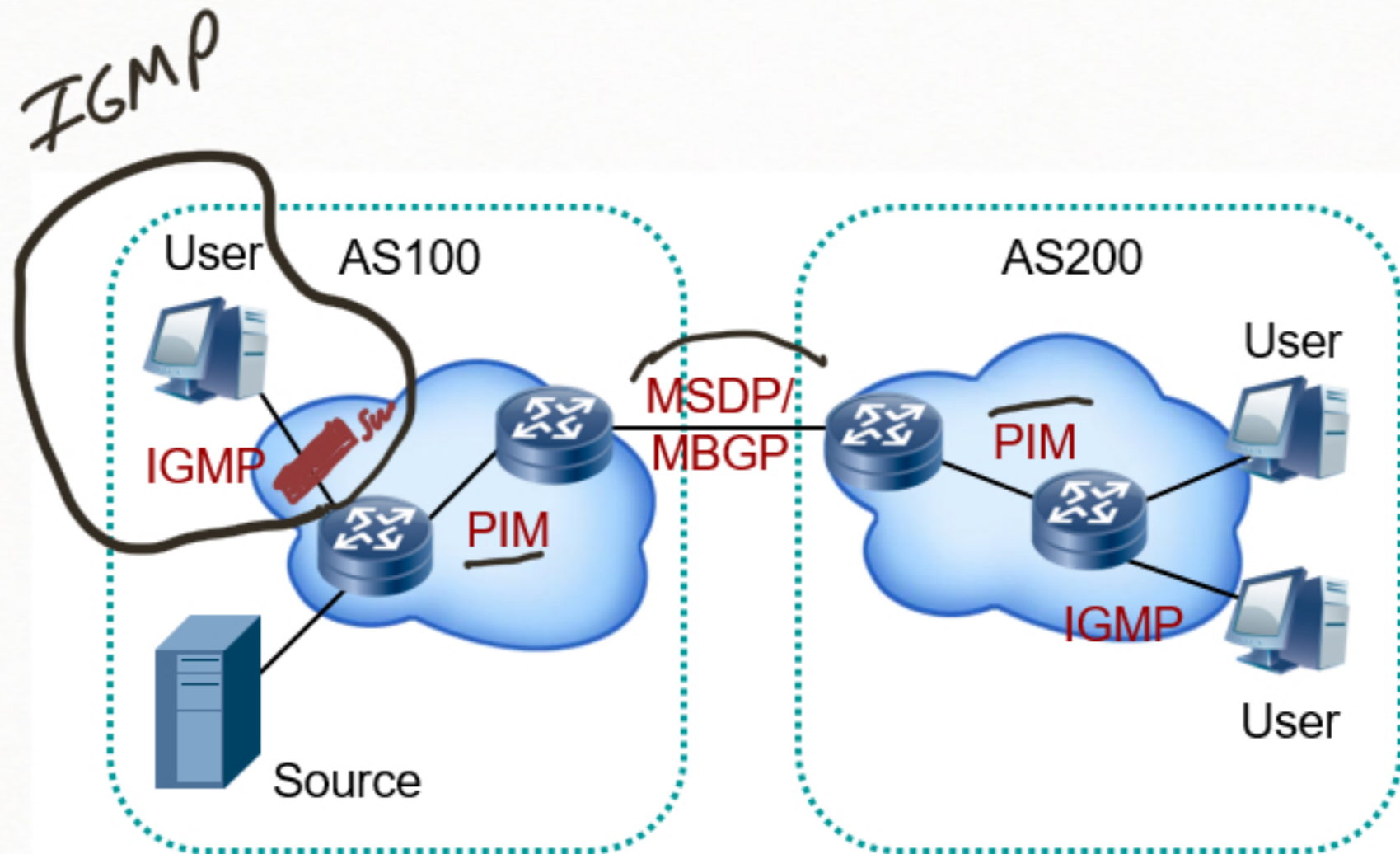
$$\frac{2^4}{2^5} = 2^{19}$$

224.1.1.1
225-229.1.1.1
228.1.1.1
223-229.1.1.1

01:00:5E:01:01:01

IGMP

Sw



Protocol Independent
Multicast

PIM-SM
PIM-DM
PIM-BIDR

R

IGMP Snooping

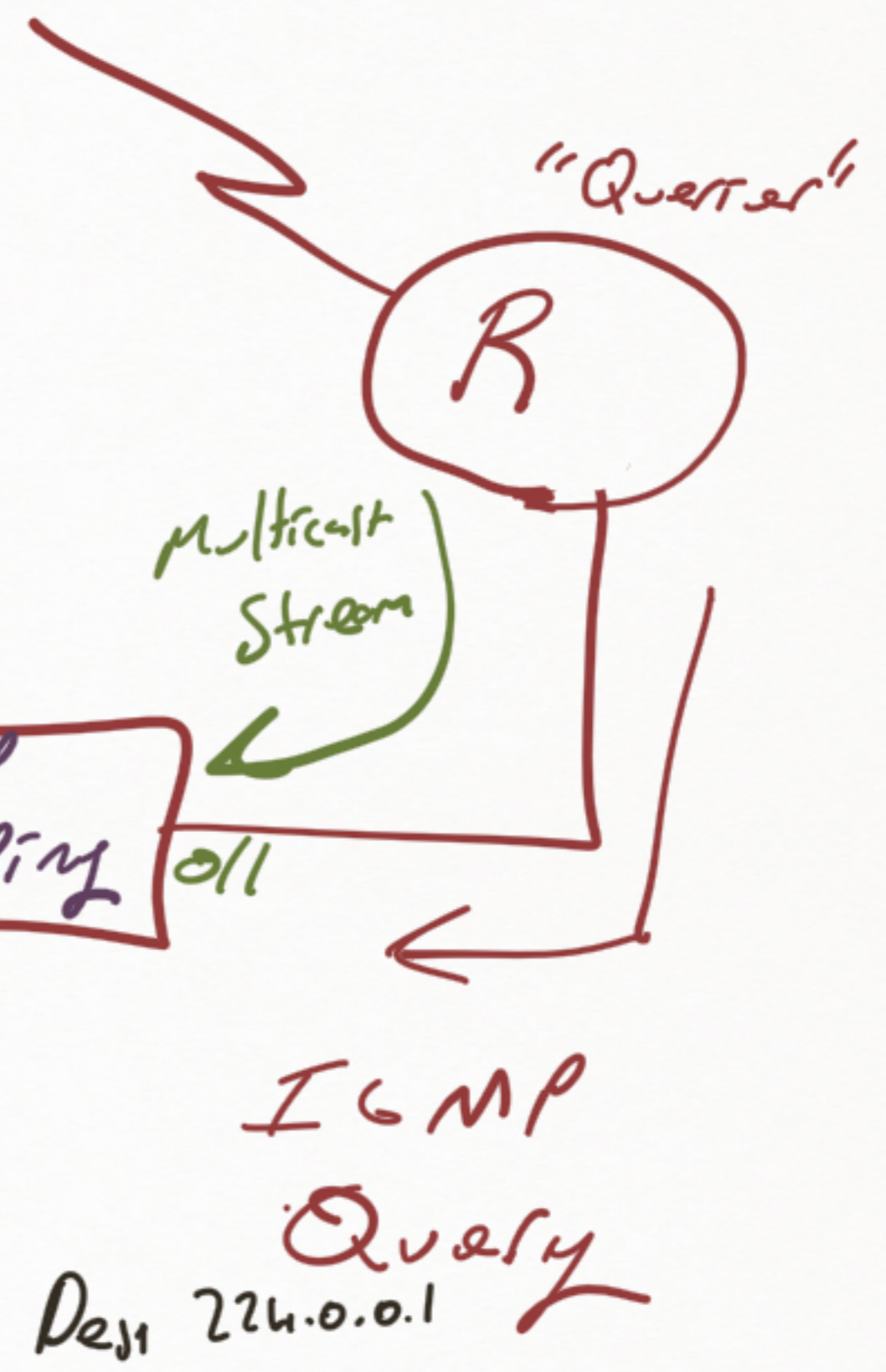
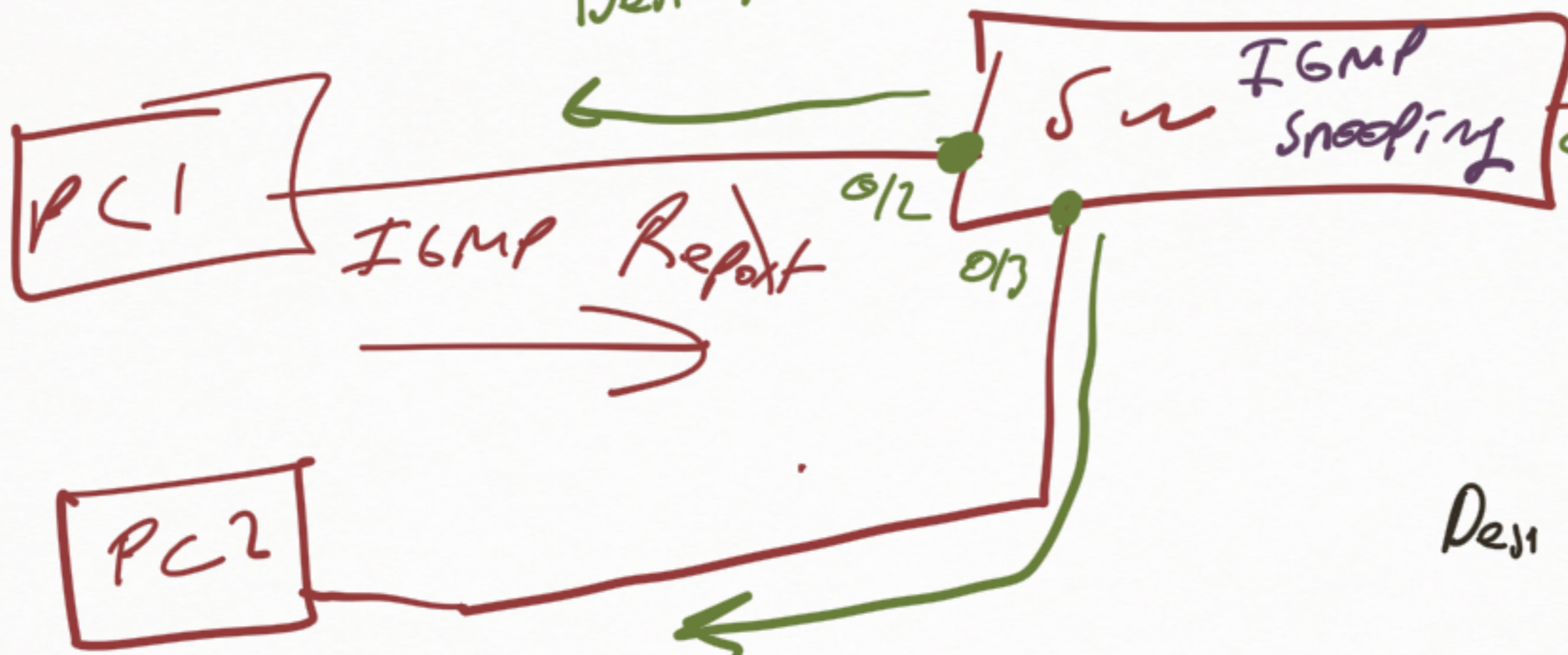
Switchler "in" yönünde gelen frame'lerin Source MAC adreslerini giriş yapılan port ile eşleştirip "MAC Address Table'a" yazar.



IGMP Report (Join)

Dest IP = 226.16.16.16

Dest MAC = "01:00:5E:10:10:60"
Dest 226.16.16.16

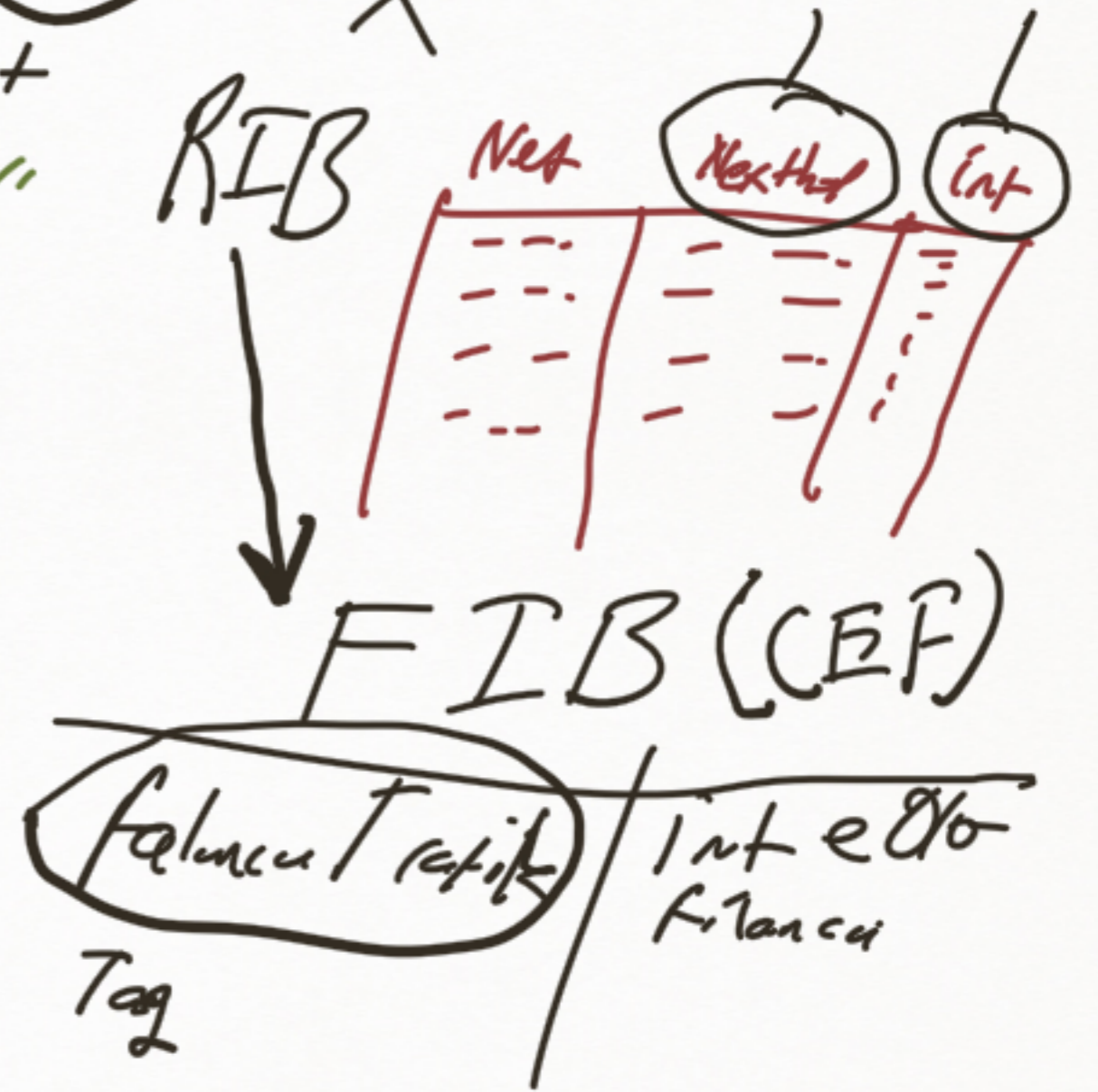
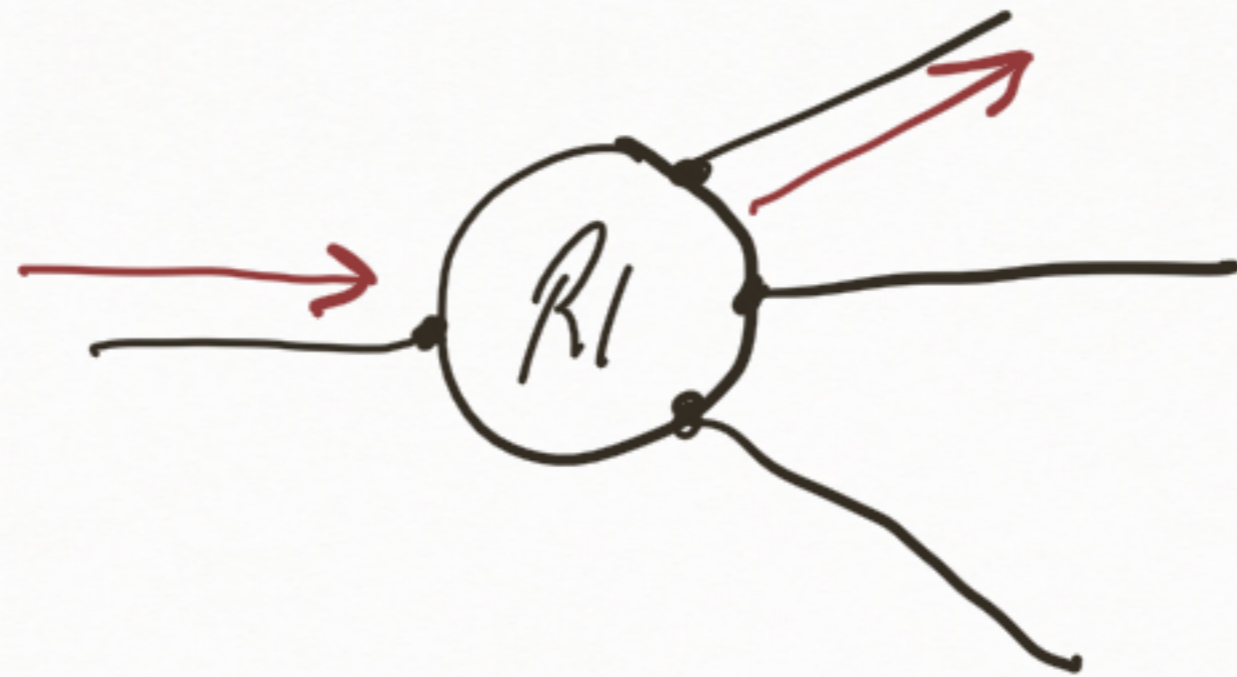


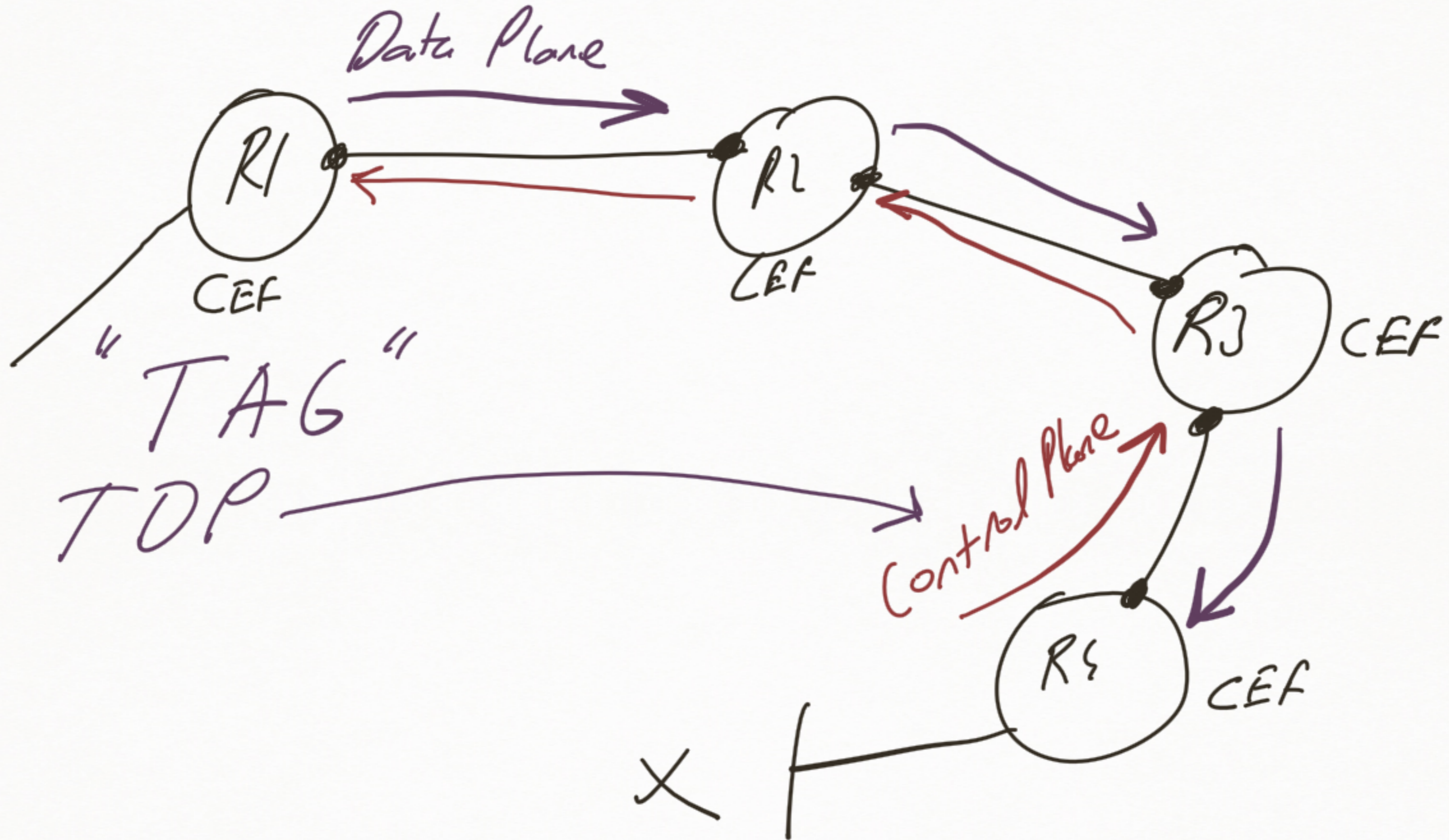
MAC	Port
01:00:5E:10:10:10	gig 0/2, gig 0/3, gig 0/16

① Traditional IP forwarding 

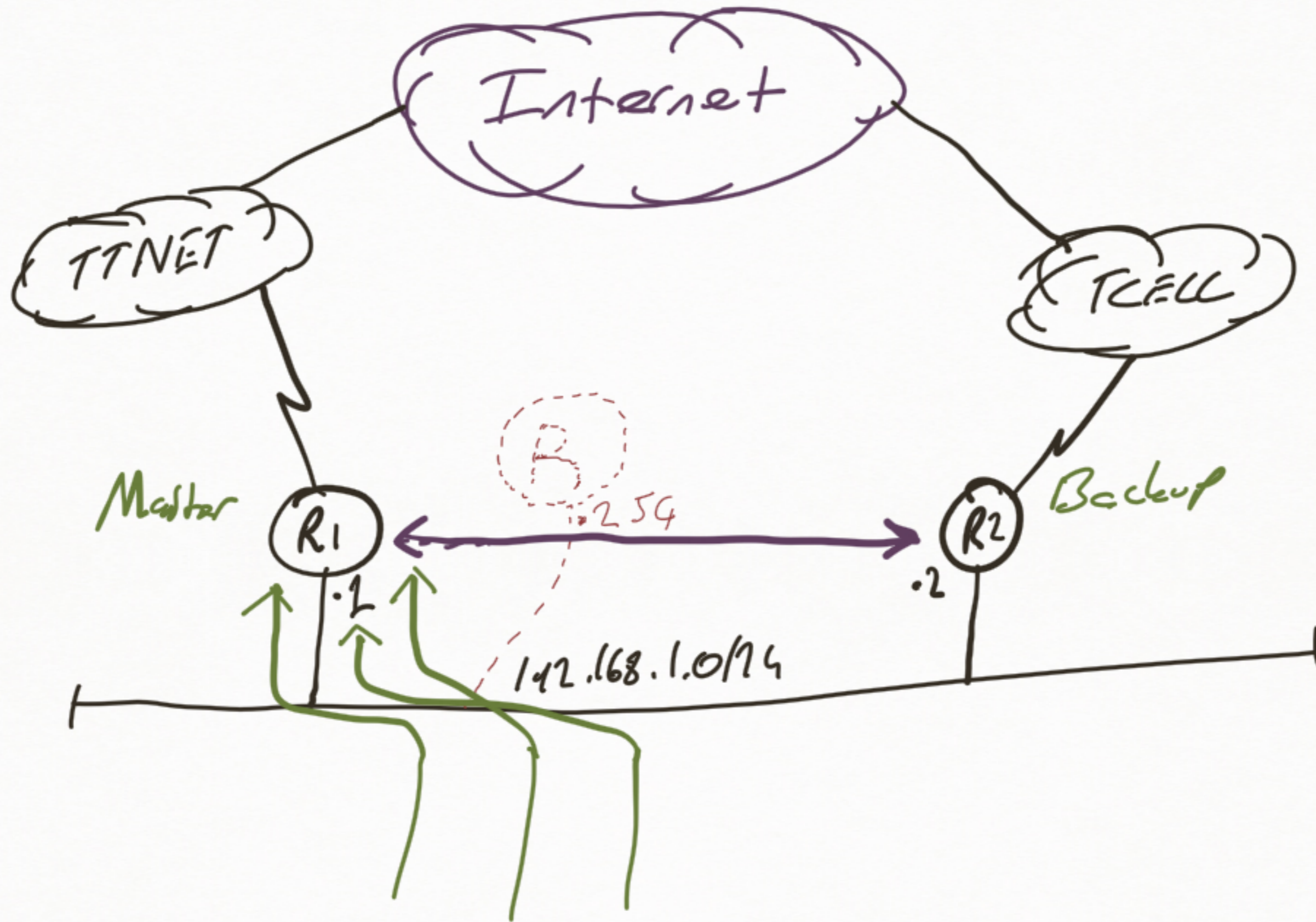
② Fast Switching 

③ Cisco Express Forwarding "CEF"





TAG \cong LABEL
TDP \cong LDP
CEF \cong FIB
TAG Switching \cong MPLS
Multi-Protocol Label Switching



HSRP
VRRP

Master

Backup

254

192.168.1.0/24

.1

.2



Vlan 10 ⇒ vrrp vrid 10

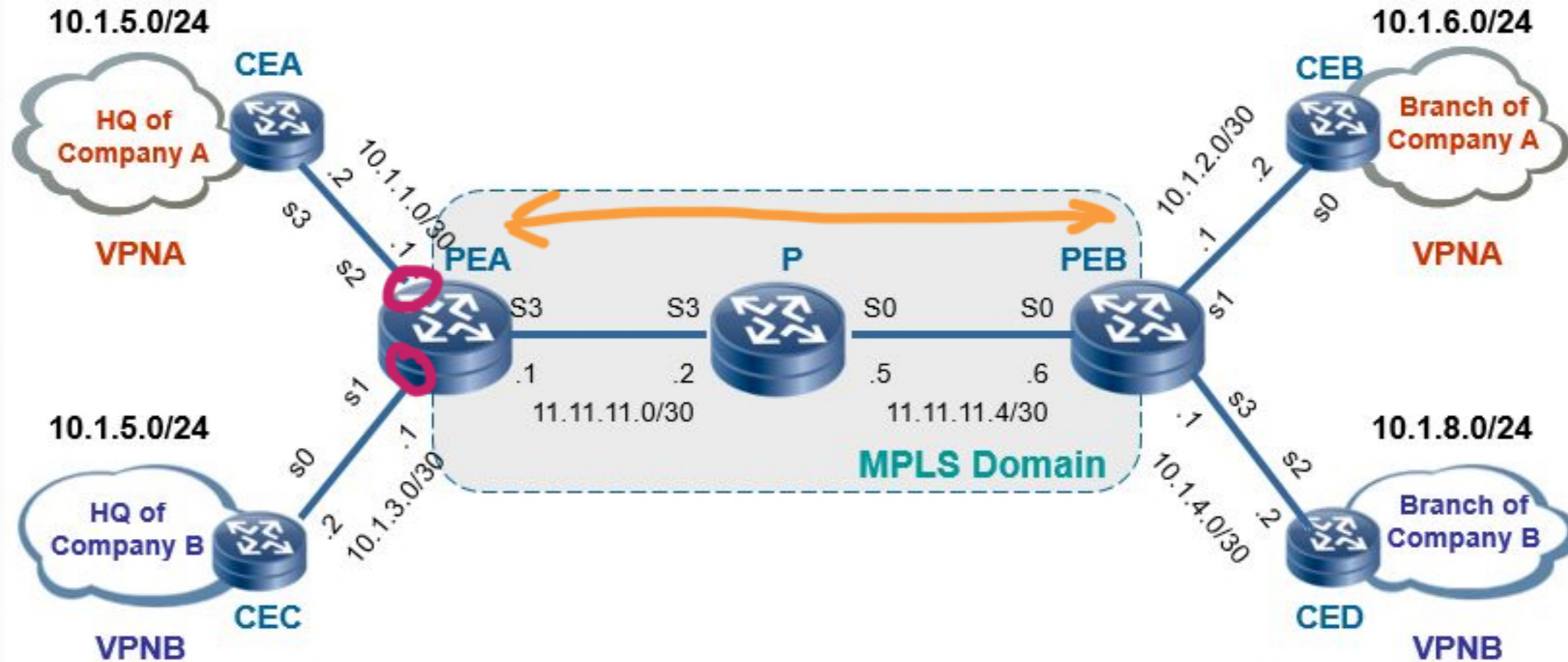
VPN-Instance

VPNs with Overlapping Address Spaces

- HQ of Company A and Company B attached to PEA have overlapping address spaces

10.1.5.0/24 ↗
↘

VRF



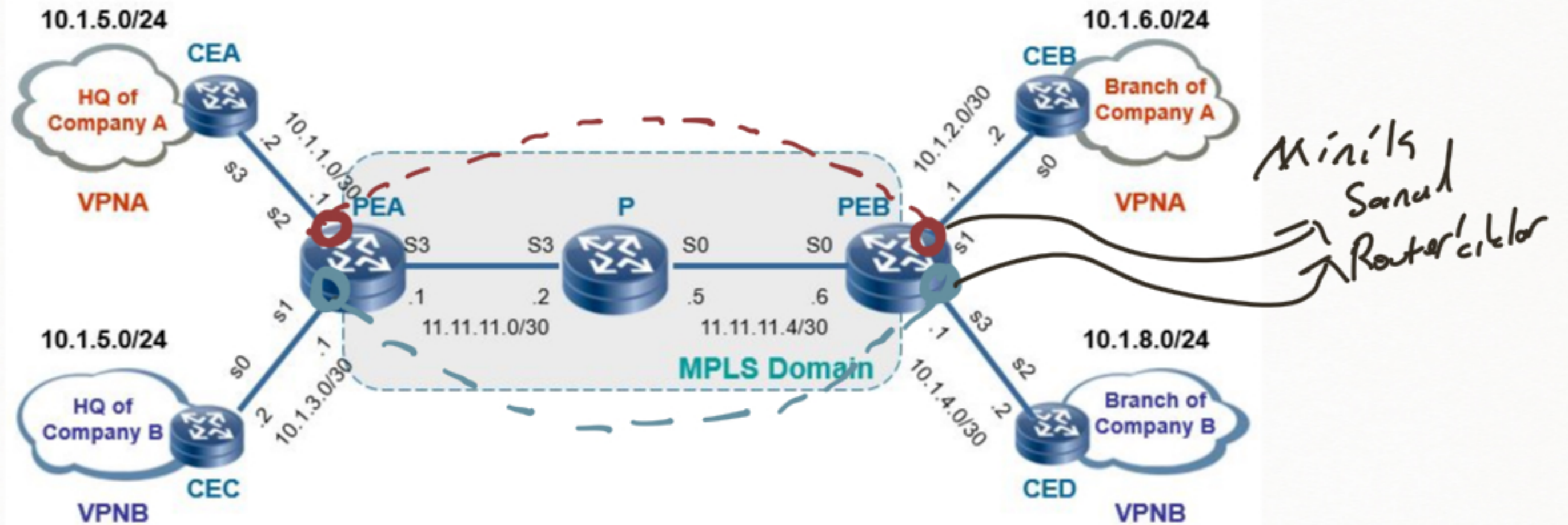
oper

shell

GP vs MPLS

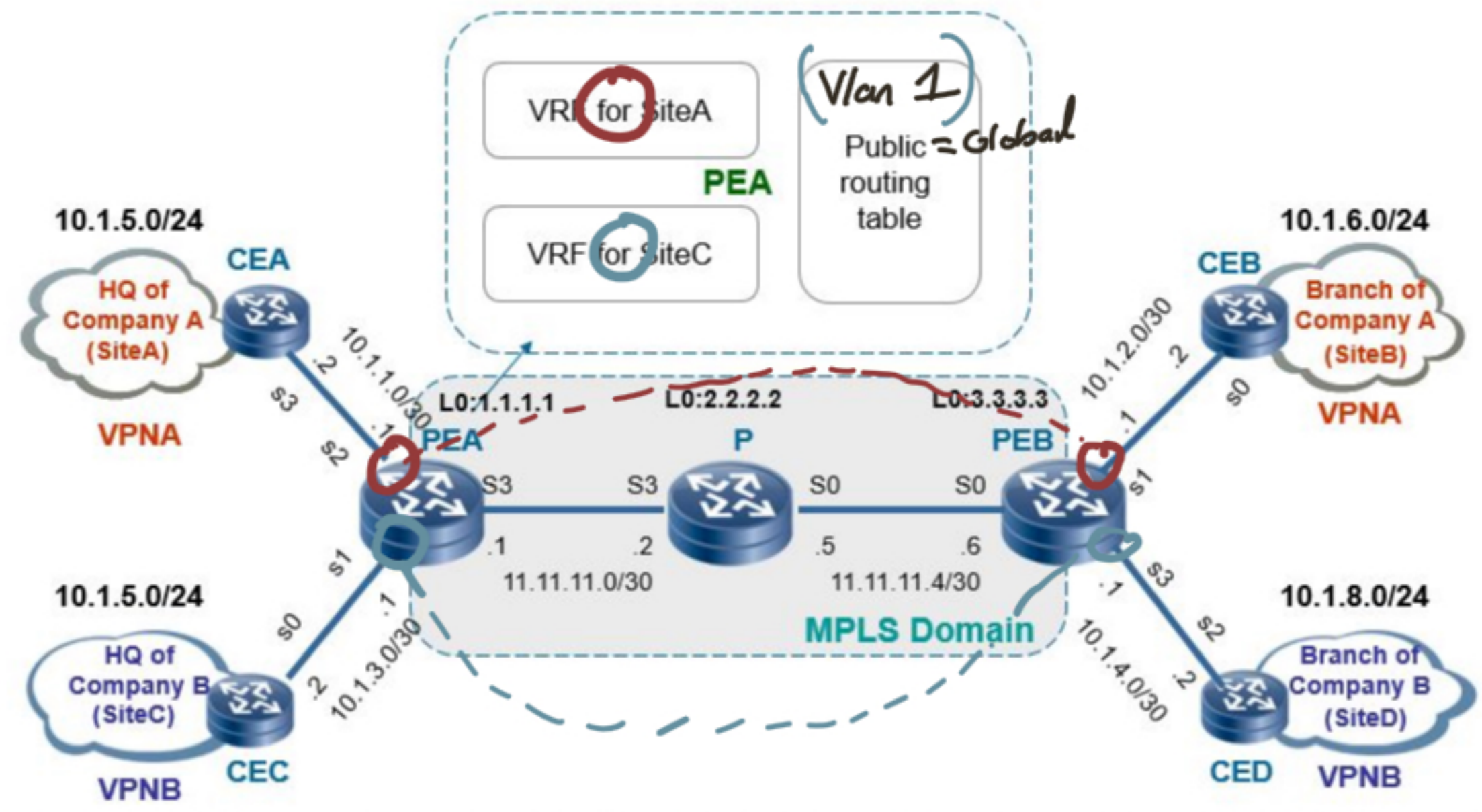
VPNs with Overlapping Address Spaces

- HQ of Company A and Company B attached to PEA have overlapping address spaces



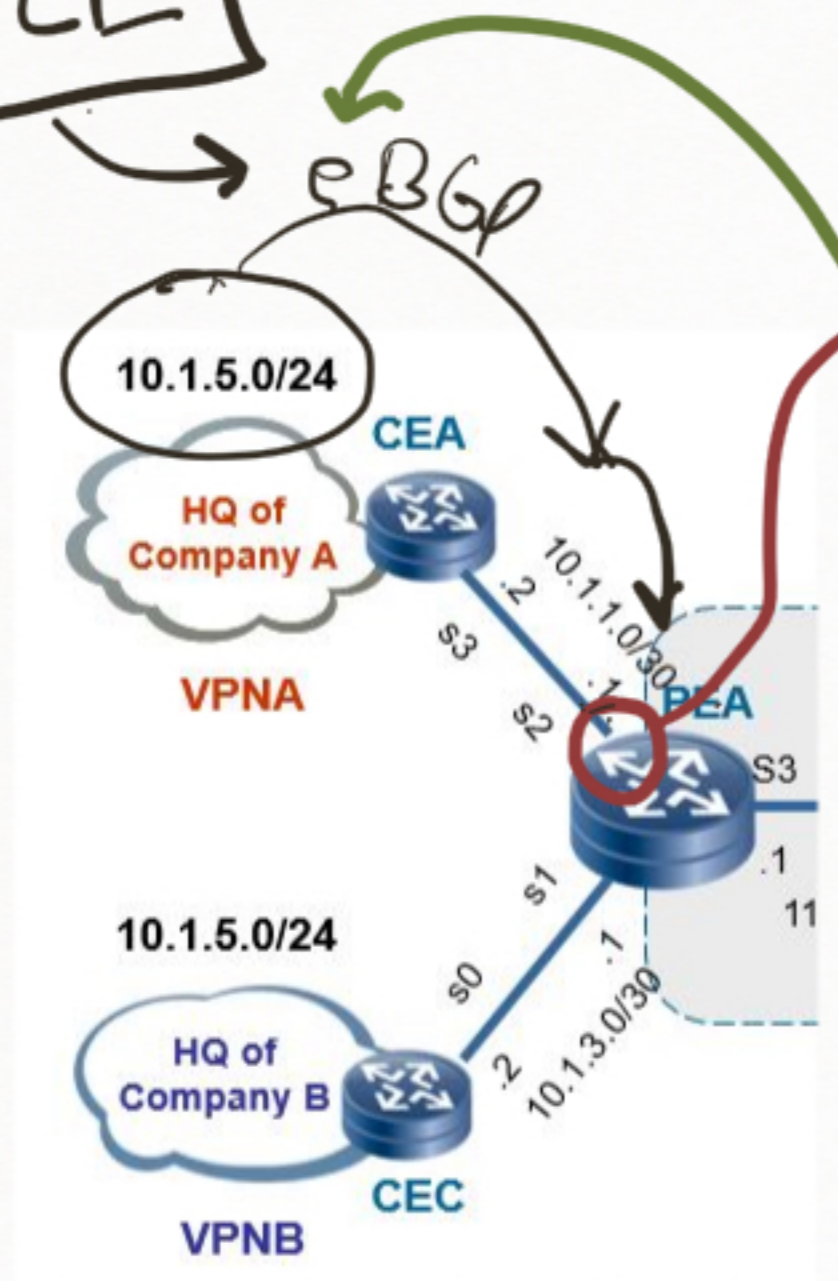
Virtual

VRF: VPN Routing and Forwarding table



Show it route vif vpna

PE-LE



PEA VRF for SiteA (HQ of Company A)

```
[PEA]display ip routing-table vpn-instance vpna
```

Routing Tables: vpna

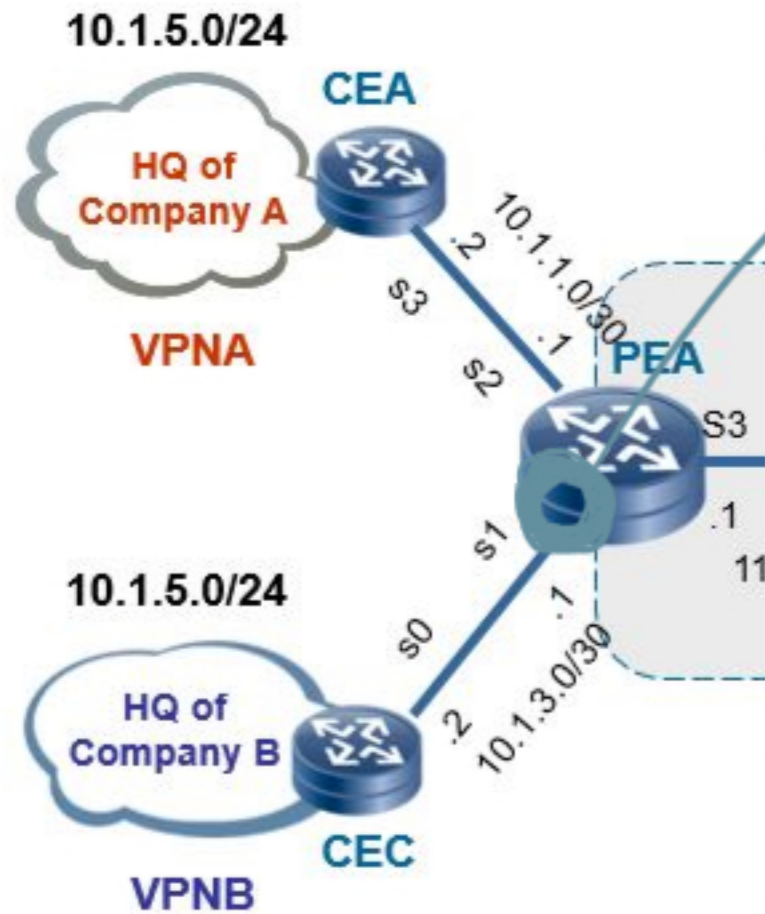
Destinations : 7 Routes : 7

Destination/Mask	Proto	Pre	Cost	NextHop	Interface
10.1.1.0/30	Direct	0	0	10.1.1.1	Serial2
10.1.1.1/32	Direct	0	0	127.0.0.1	InLoopBack0
10.1.1.2/32	Direct	0	0	10.1.1.2	Serial2
10.1.2.0/30	BGP	255	0	3.3.3.3	----- VRF LABEL
10.1.2.2/32	BGP	255	0	3.3.3.3	----- VRF LABEL
10.1.5.0/24	BGP	255	0	10.1.1.2	Serial2
10.1.6.0/24	BGP	255	0	3.3.3.3	----- VRF LABEL

----- VRF LABEL
----- VRF LABEL
----- VRF LABEL

PEB

PEA VRF for SiteC (HQ of Company B)



```
[PEA]display ip routing-table vpn-instance vpnb
Routing Tables: vpnb
Destinations : 7          Routes : 7
```

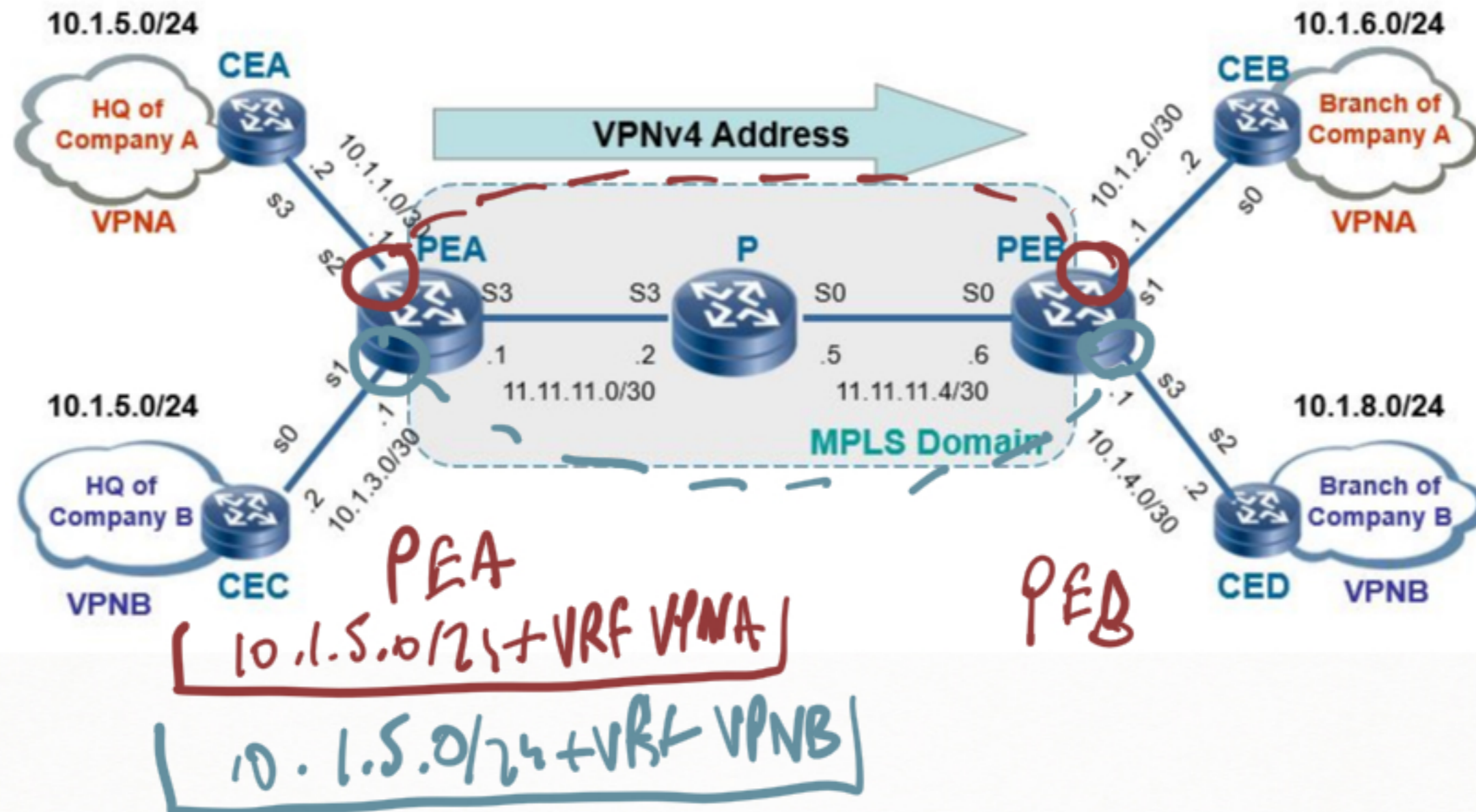
Destination/Mask	Proto	Pre	Cost	NextHop	Interface
10.1.3.0/30	Direct	0	0	10.1.3.1	Serial1
10.1.3.1/32	Direct	0	0	127.0.0.1	InLoopBack0
10.1.3.2/32	Direct	0	0	10.1.3.2	Serial1
10.1.4.0/30	BGP	255	0	3.3.3.3	----- VRF L
10.1.4.2/32	BGP	255	0	3.3.3.3	----- VRF L
10.1.5.0/24	BGP	255	0	10.1.3.2	Serial1
10.1.8.0/24	BGP	255	0	3.3.3.3	----- VRF L

Shell

PEB

VPN Route Distribution via BGP

- PE routers use MP-BGP to distribute VPN routes to each other



10.1.5.0/24 + VPN A

VPN Route Distribution via BGP

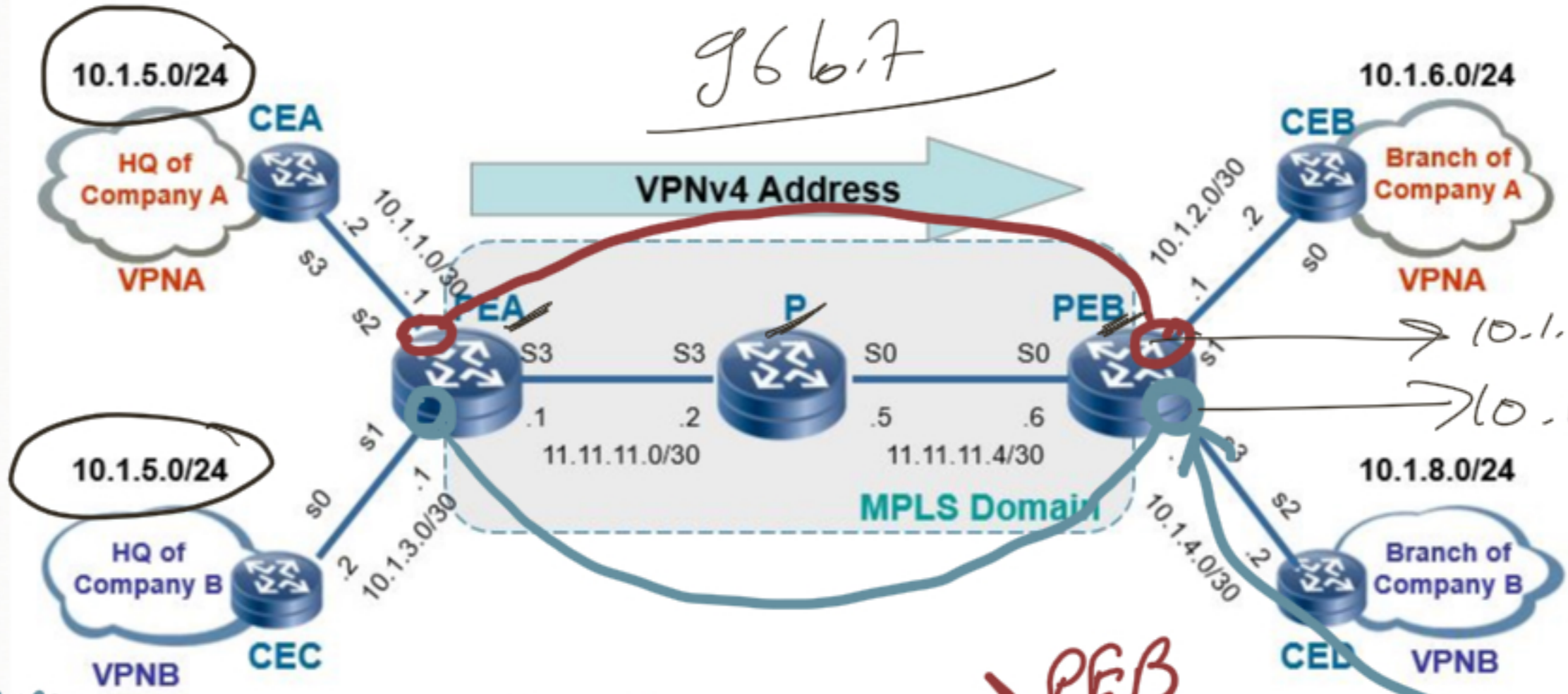
32 bit

Route Distinguisher (64 bit)

- PE routers use MP-BGP to distribute VPN routes to each other

VPN v4
96-bit

96 bit



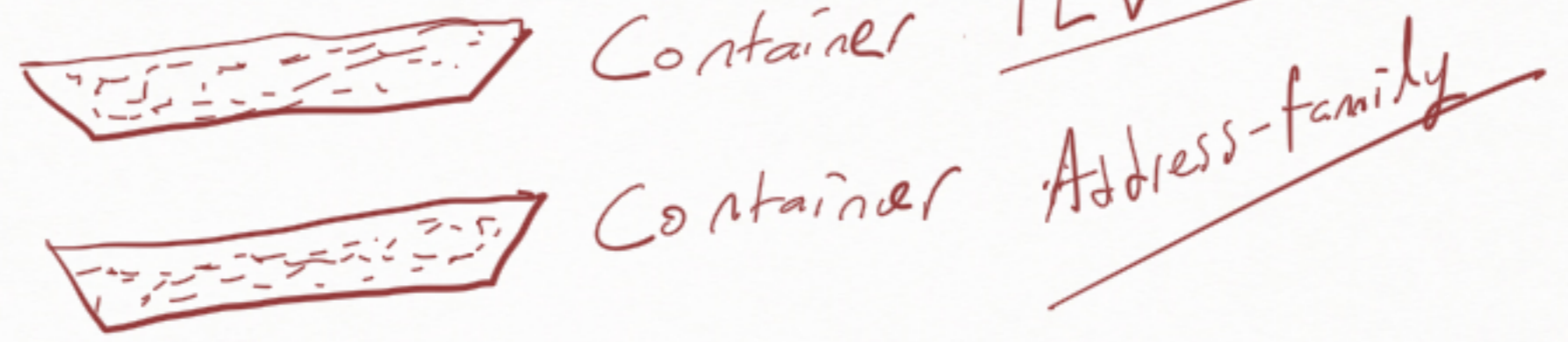
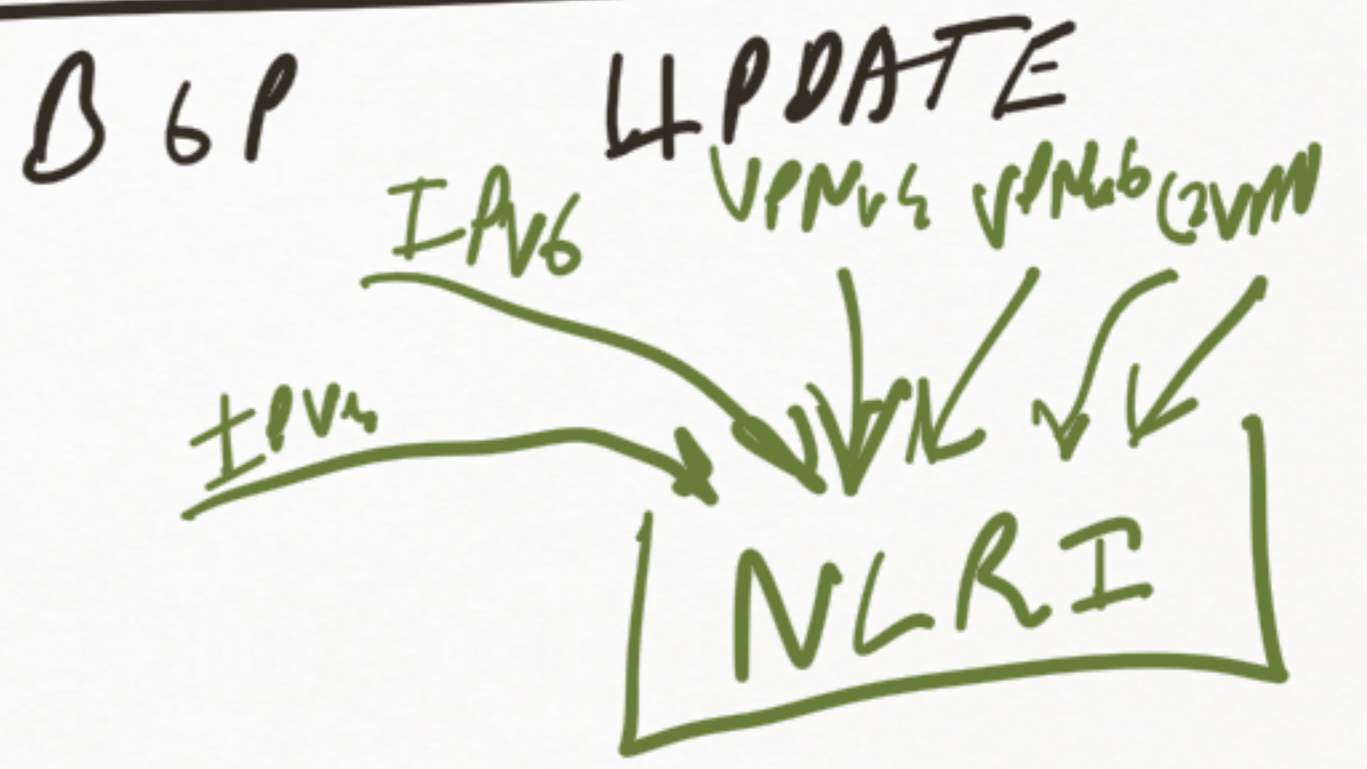
10.1.5.0/24
10.1.5.0/24

10.1.5.0/24 + VPN B

PEA ← iBGP → PEB

RIPv1
 RIPv2
 RIPv2
 OSPFv2
 OSPFv3
 EIGRP (2016)
 IS-IS
 MP-BGPv4

IPv4
 IPv4
 IPv6
 IPv4
 IPv4, IPv6
 IPv4, IPv6



16bit = 32bit
32bit = 16bit

65312 : 100

172.16.20.15 : 100

BGP

RD : Route Distinguisher = Community Attribute

- RD: Route Distinguisher

⇒ 64bits prefix

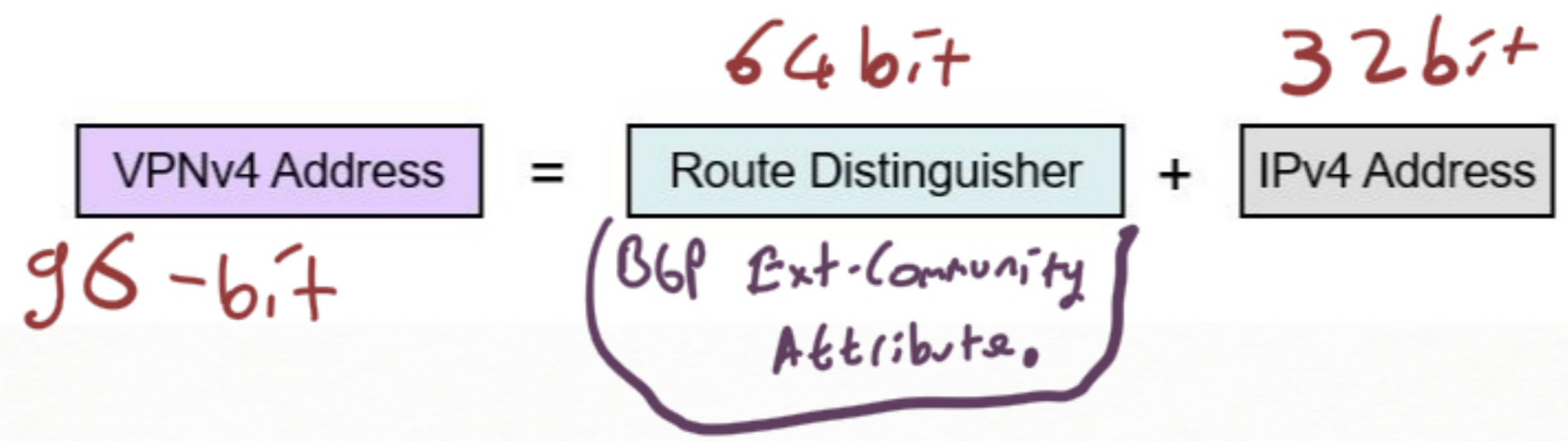
- VPNv4 Address

⇒ Consist of a 64-bit RD followed by a 32-bit IPv4 address

⇒ RD unique makes VPNv4 address distinct

Standard
32bit

Extended
64bit

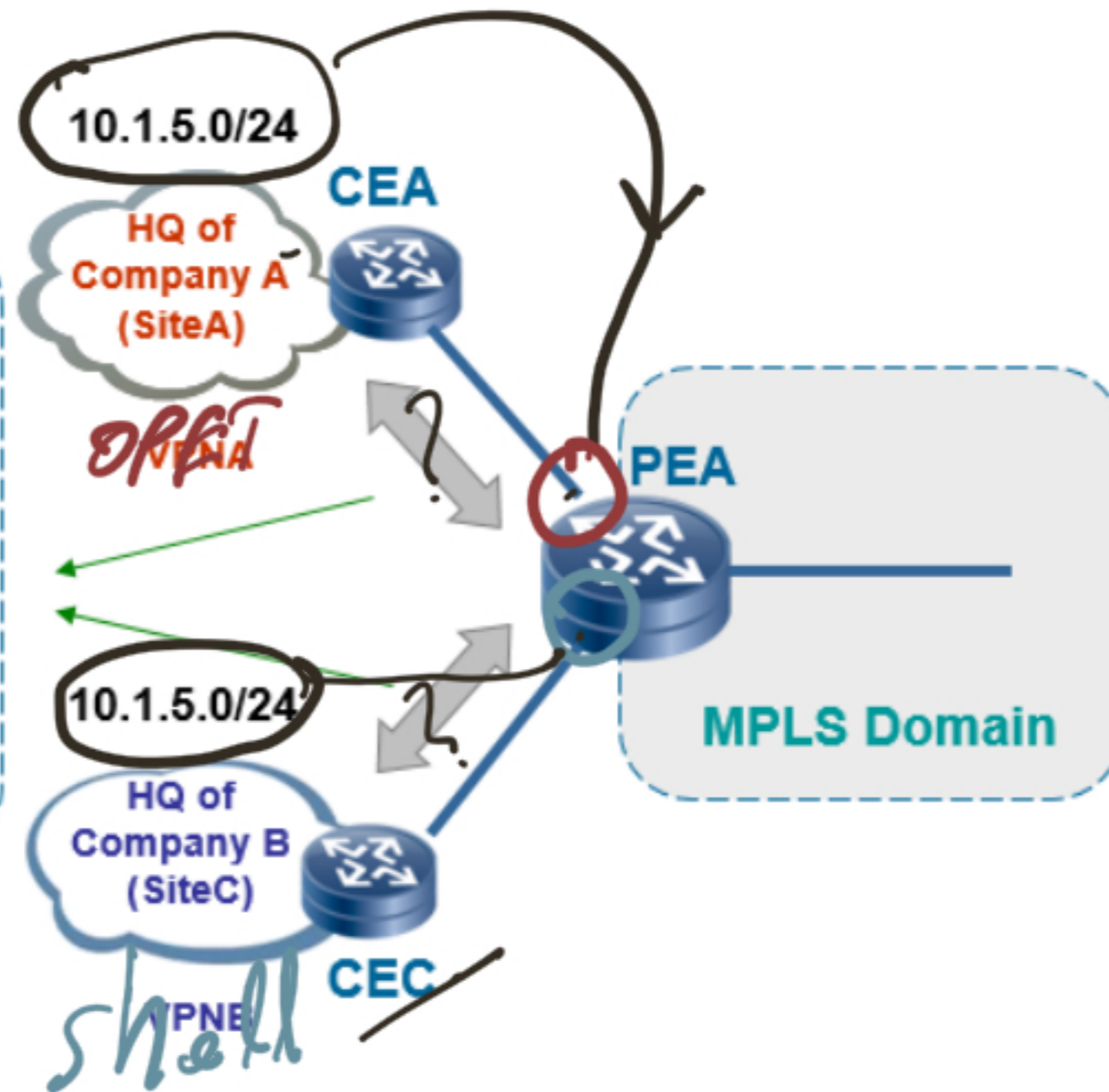


How PEs Learn Routes from CEs

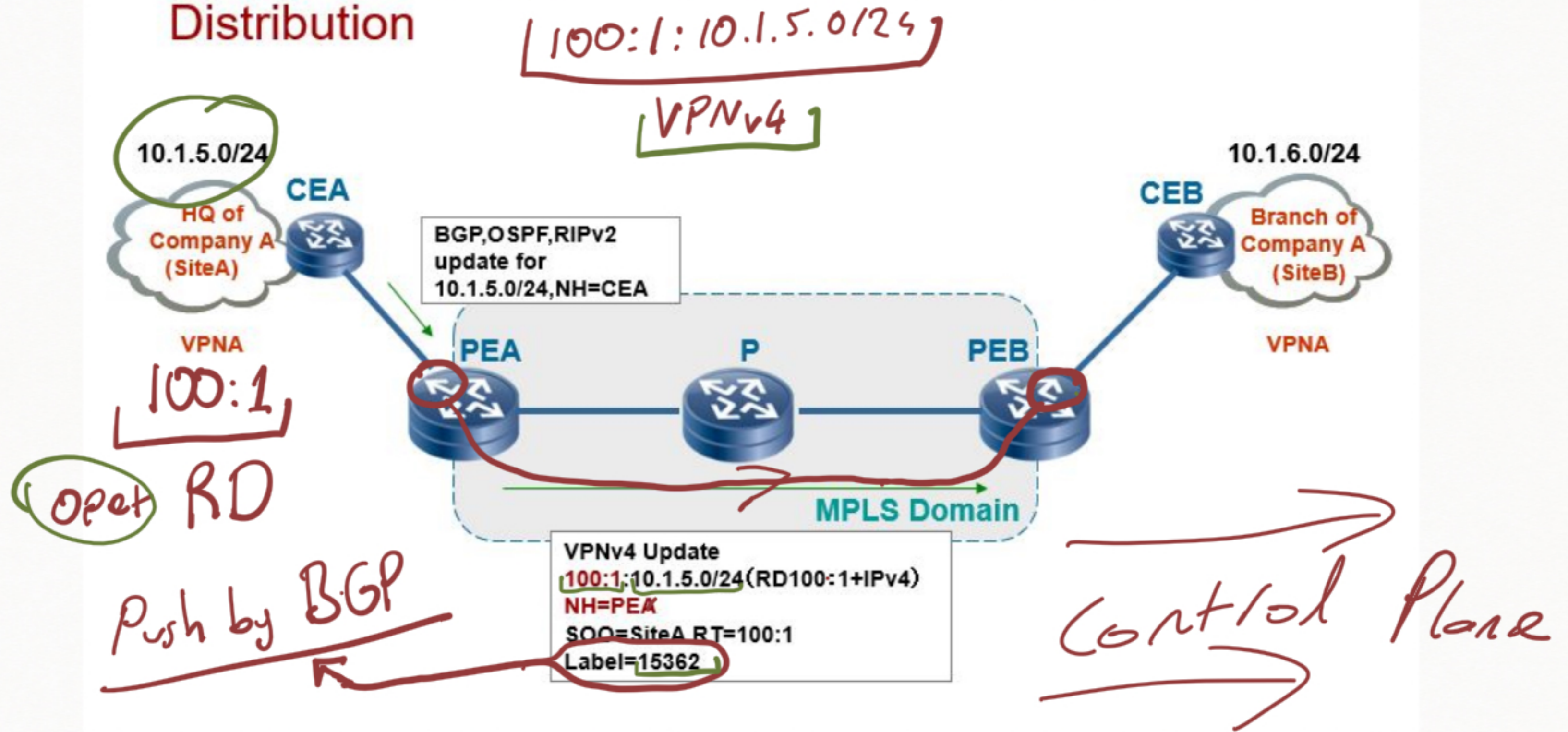
The possible PE/CE distribution techniques

are:

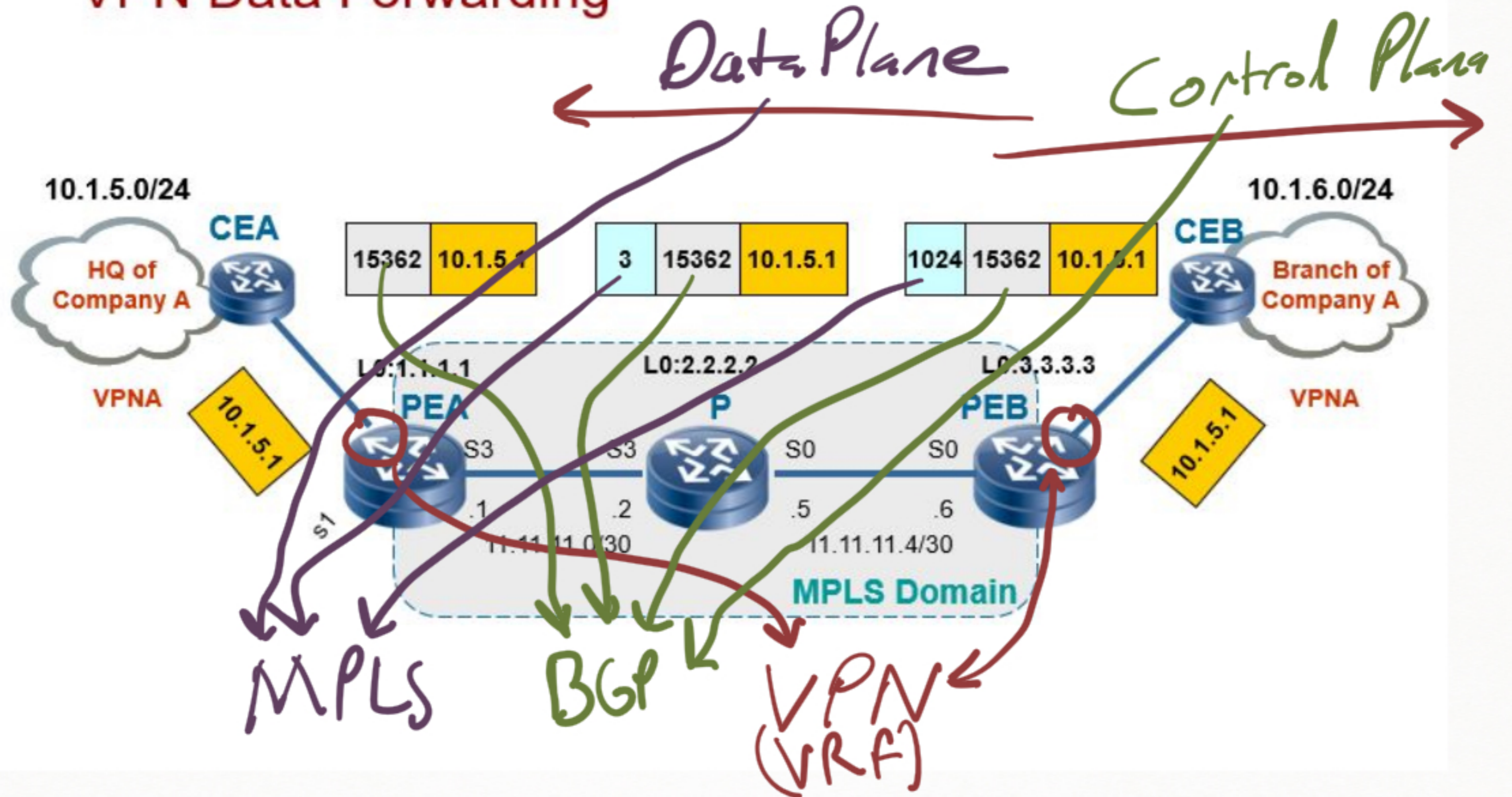
- ~~BGP~~
- OSPF
- IS-IS
- RIPv2
- Static



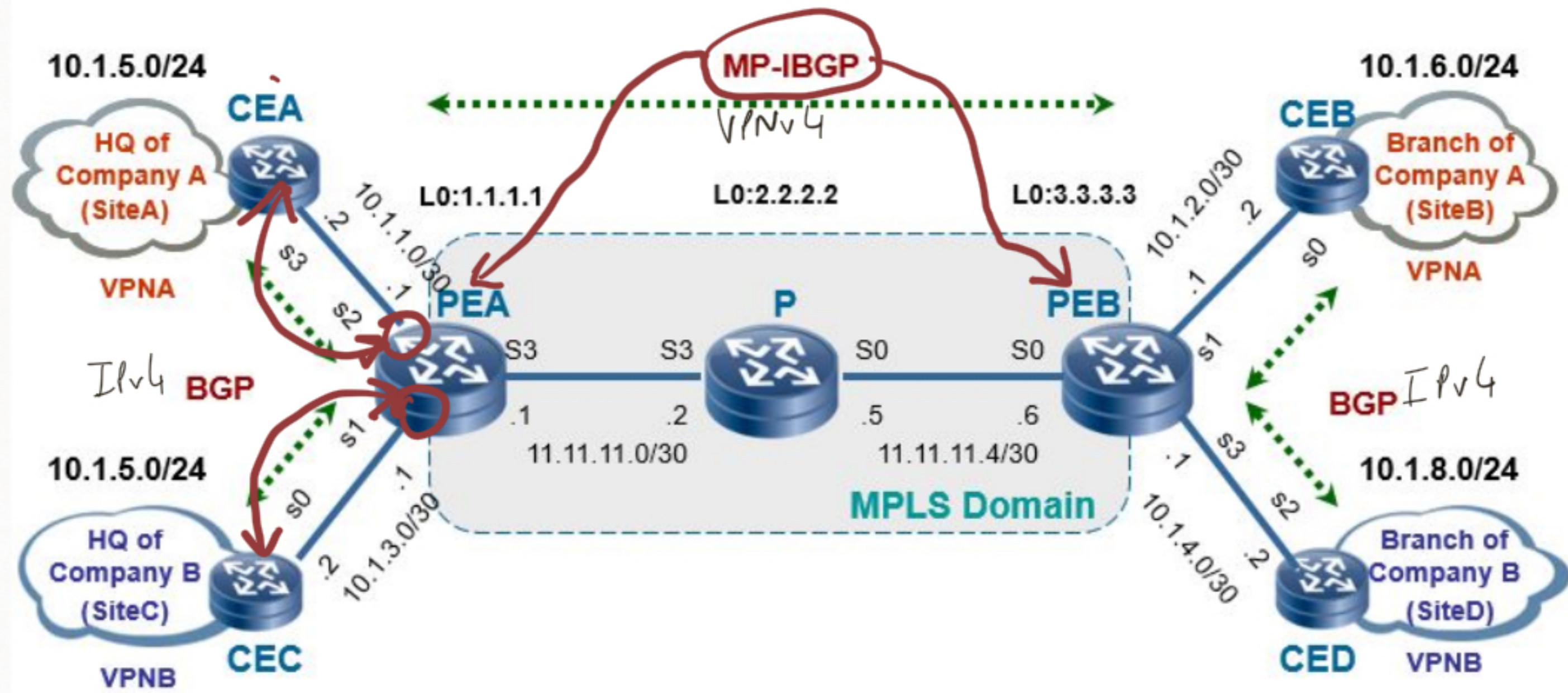
Route Distribution by MP-BGP & VPN Route Label Distribution



VPN Data Forwarding



MPLS BGP VPN Basic Configuration



Configuration Steps

1. Configure VPN-instance *VRF oluşturma*
2. Configure BGP between CE and PE *(PE-CE routing) müştairden bilgi alması.*
3. Configure IGP in the MPLS backbone *OSPF, IS-IS*
4. Configure MPLS LDP to establish LSP *LDP*
5. Configure MP-IBGP between PEs *PE ↔ PE
[VPNv4]*



65 098 : 1

VRF olusturma

Configure VPN-instance

```
[PEA]ip vpn-instance OPET  
[PEA-vpn-instance-vpna]route-distinguisher 100:1  
[PEA-vpn-instance-vpna]vpn-target 100:1
```

64 bit

```
[PEA]interface s2  
[PEA-Serial2]ip binding vpn-instance vpna  
! All IPv4 related configurations on this interface are removed  
[PEA-Serial2]ip address 10.1.1.1 30
```


2

Configure BGP between CE and PE

```
[PEA]bgp 100
[PEA-bgp]ipv4-family vpn-instance vpna
[PEA-bgp-vpna]peer 10.1.1.2 as-number 65410
[PEA-bgp-vpna]import-route direct
```

PE-CE
Routing

```
[CEA]bgp 65410
[CEA-bgp]peer 10.1.1.1 as-number 100
[CEA-bgp]network 10.1.5.0 255.255.255.0
```

3
ISP
inside
OSPF

```
[PEA-Serial3]display bgp vpnv4  vpn-instance vpna peer
BGP local router ID : 1.1.1.1
Local AS number : 100
Total number of peers : 1                Peers in established state : 1
```

Peer	V	AS	MsgRcvd	MsgSent	OutQ	Up/Down	State	PrefRcv
10.1.1.2	4	65410	7056	7369	0	0094h02m	Established	1

4
ISP
inside
LDP

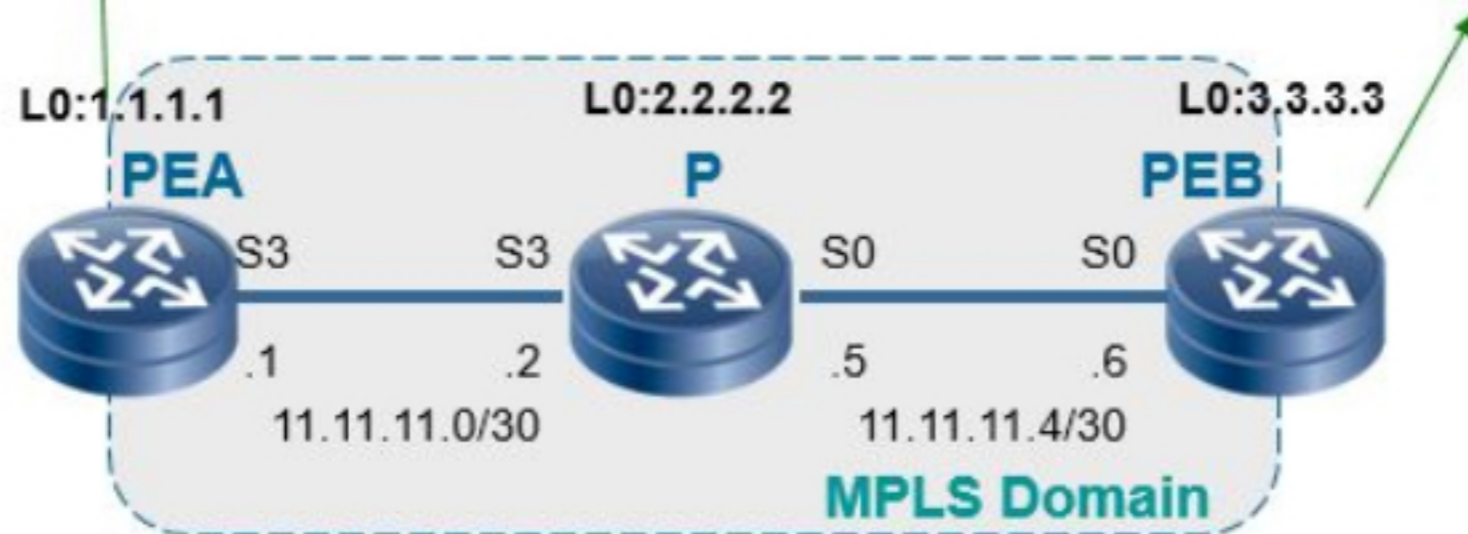
5

Configure MP-IBGP between PEs

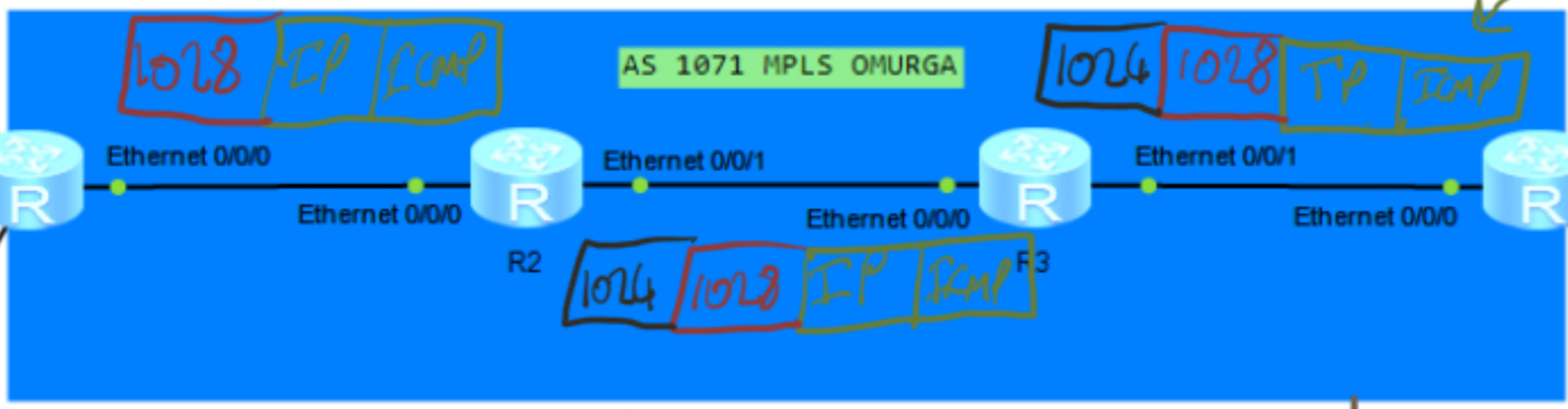
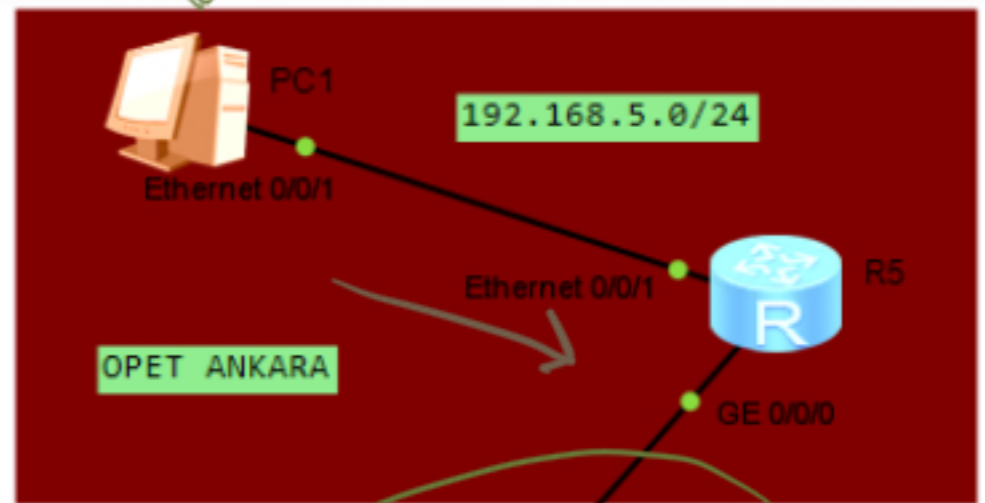
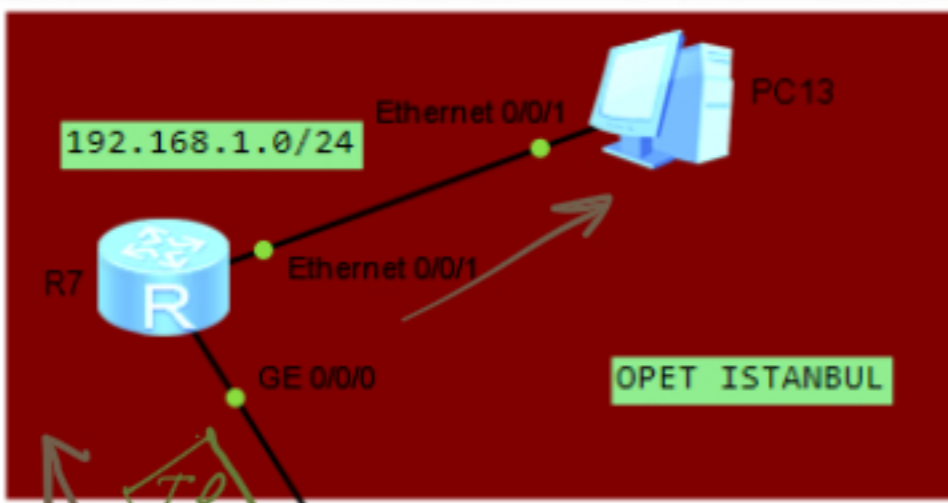
```
[PEA]bgp 100
[PEA-bgp]peer 3.3.3.3 as-number 100
[PEA-bgp]peer 3.3.3.3 connect-interface LoopBack0
[PEA-bgp]ipv4-family vpnv4
[PEA-bgp-af-vpnv4]peer 3.3.3.3 enable
```

*PE to PE
VPNv4 neighborhood*

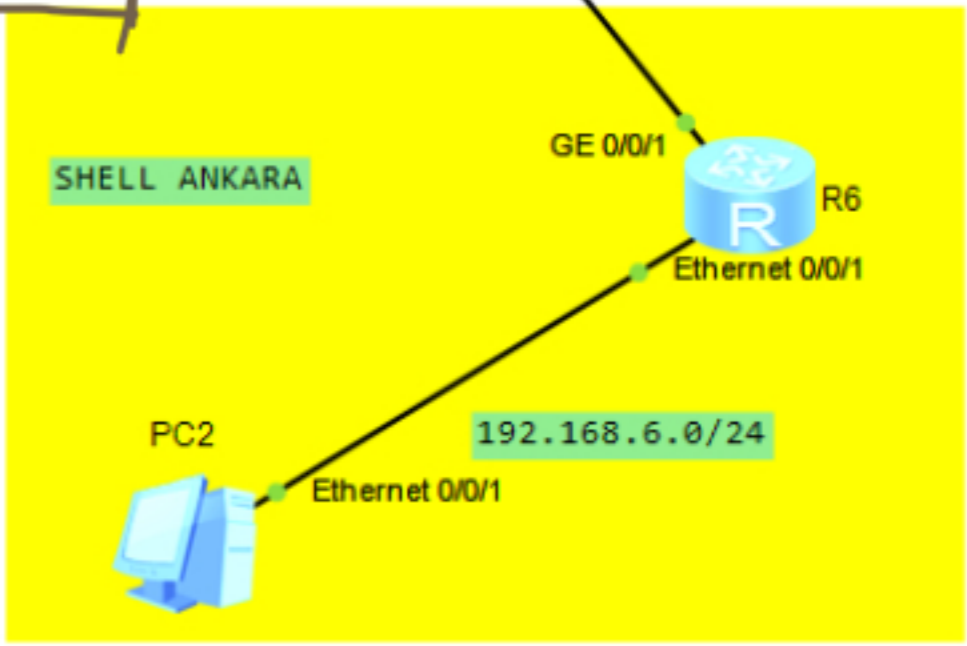
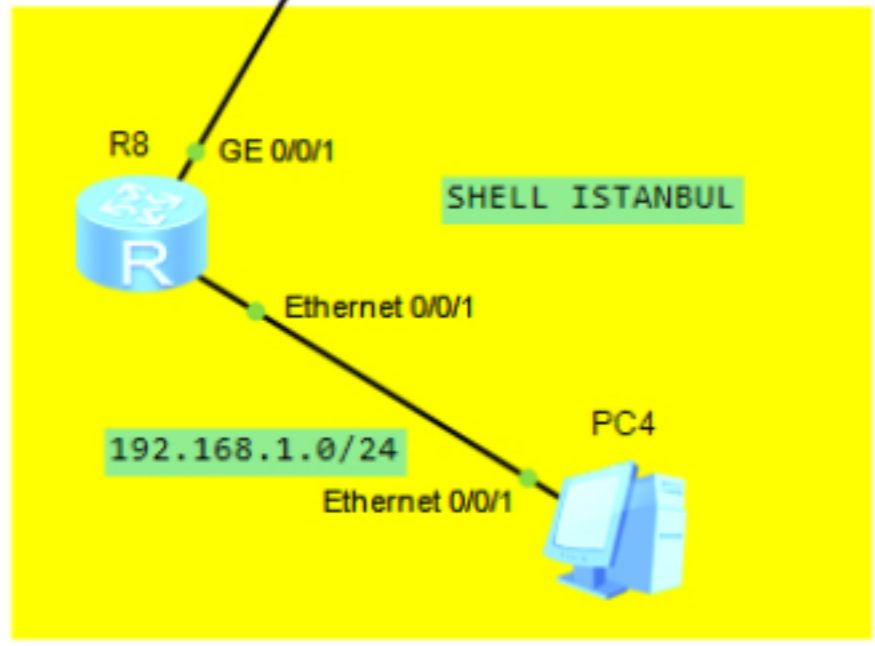
```
[PEB]bgp 100
[PEB-bgp]peer 1.1.1.1 as-number 100
[PEB-bgp]peer 1.1.1.1 connect-interface LoopBack0
[PEB-bgp]ipv4-family vpnv4
[PEB-bgp-af-vpnv4]peer 1.1.1.1 enable
```

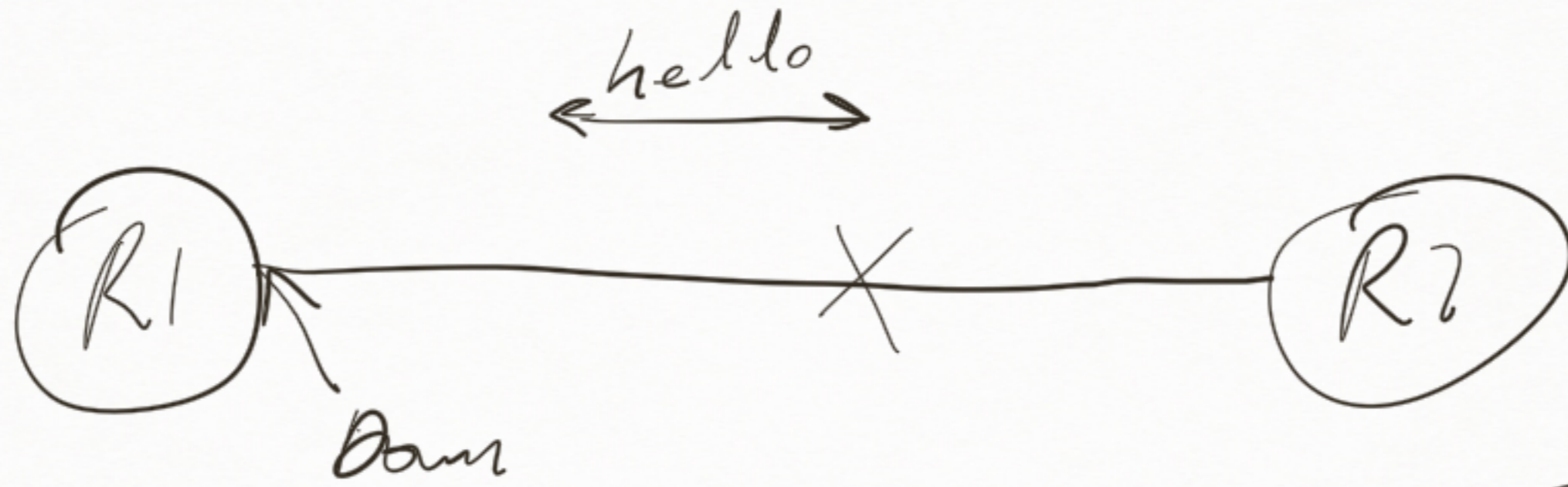


Ping PC13

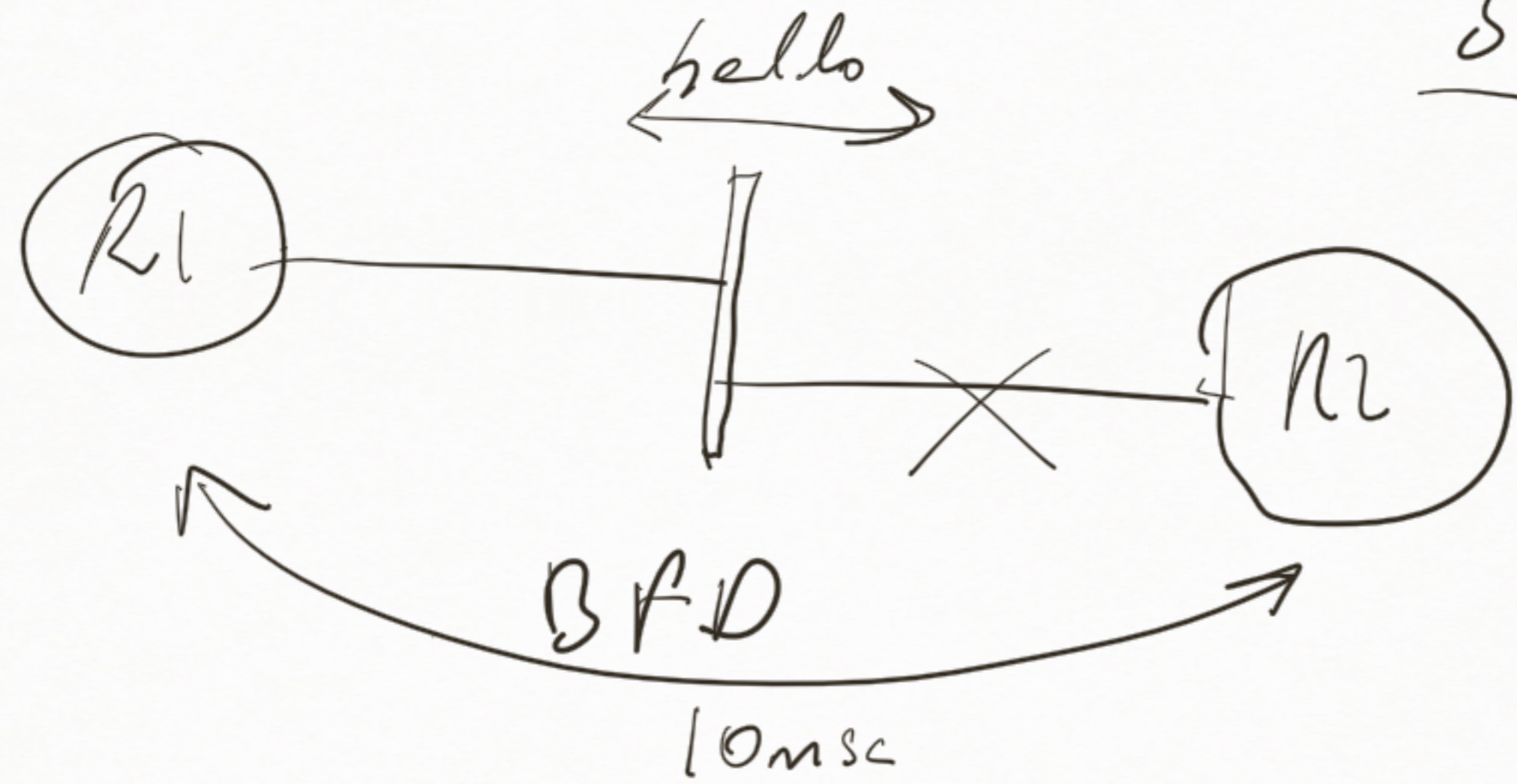


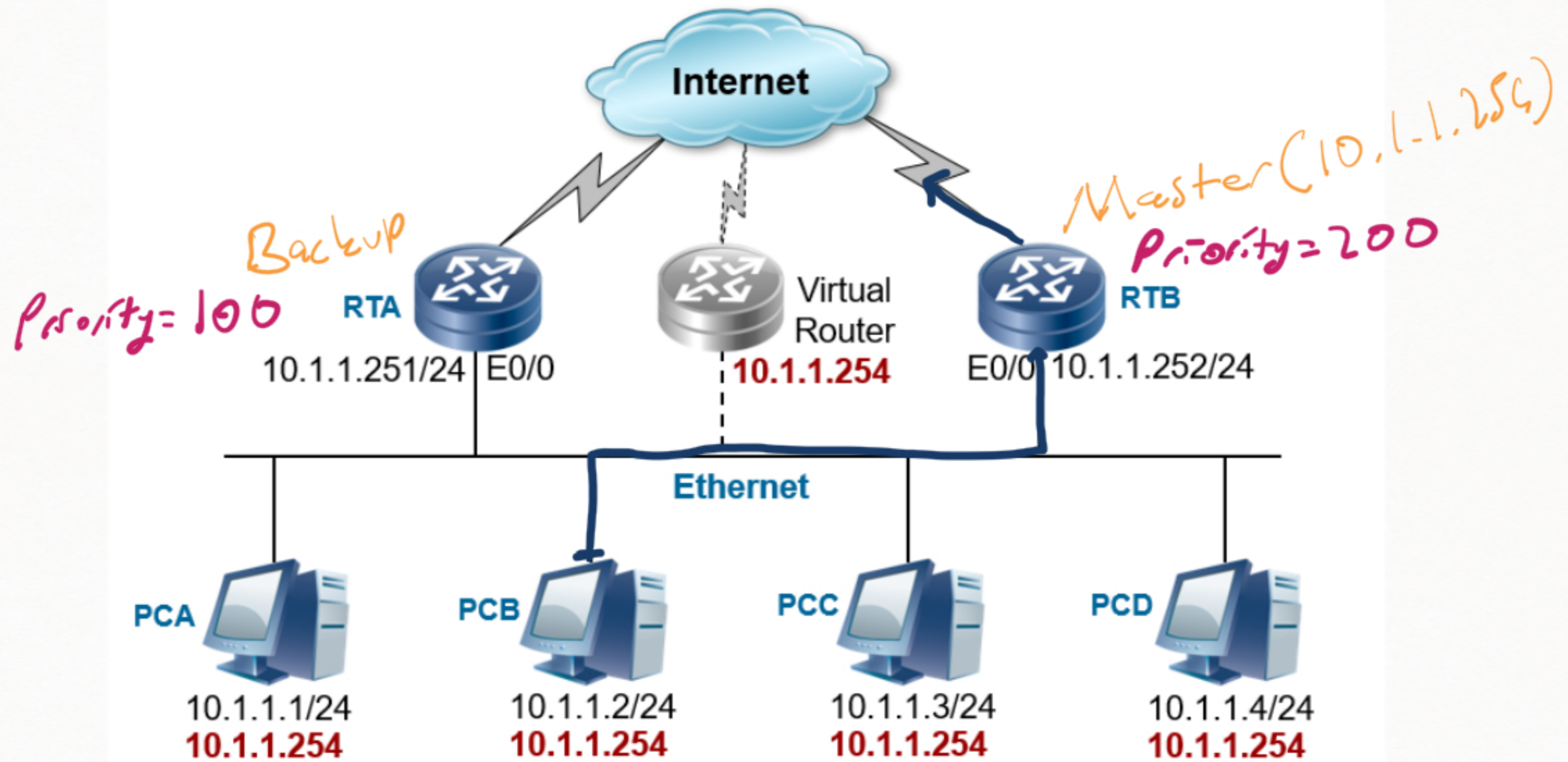
Das PC13 IP
Sor PC1 TP
ICMP
L) IP





30msec Sn





```
<Quidway>system-view
```

```
[Quidway]sysname RTA
```

```
[RTA]
```

```
[RTA]interface Ethernet 0/0
```

```
[RTA-Ethernet0/0]ip address 10.1.1.251 24
```

```
[RTA-Ethernet0/0]
```

```
[RTA-Ethernet0/0]vrrp vrid 1 virtual-ip 10.1.1.254
```

```
[RTA-Ethernet0/0]quit
```

```
[RTA]
```

Configure the physical IP address of the interface

00:00:5E:00:01:01

vrid ⇒ 10
00:00:5E:00:01:0A

Create a Virtual Router: VRID is 1,
Virtual IP Address is 10.1.1.254

```
<Quidway>system-view
```

```
[Quidway]sysname RTB
```

```
[RTB]
```

```
[RTB]interface Ethernet 0/0
```

```
[RTB-Ethernet0/0]ip address 10.1.1.252 24
```

```
[RTB-Ethernet0/0]
```

```
[RTB-Ethernet0/0]vrrp vrid 1 virtual-ip 10.1.1.254
```

```
[RTB-Ethernet0/0]
```

```
[RTB-Ethernet0/0]vrrp vrid 1 priority 200
```

```
[RTB-Ethernet0/0]quit
```

```
[RTB]
```

The same VRID and
Virtual IP Address as
RTA

Configuring the Priority of
Virtual Router 1 as 200

QoS

Best Effort
FIFO

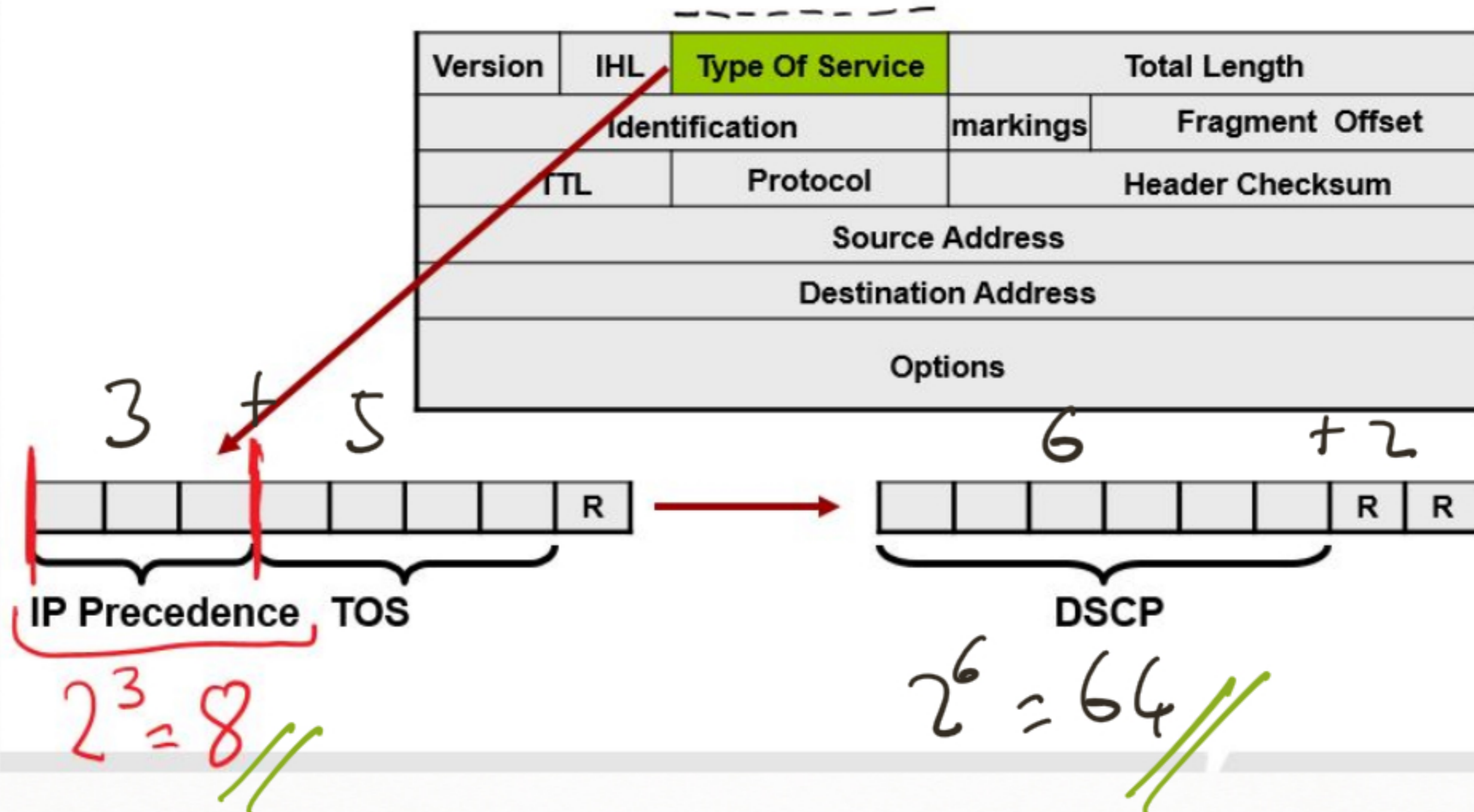
> L3 ToS (8) Precedence (3+5) DSCP (6+2)

> L2,5 Exp (3)

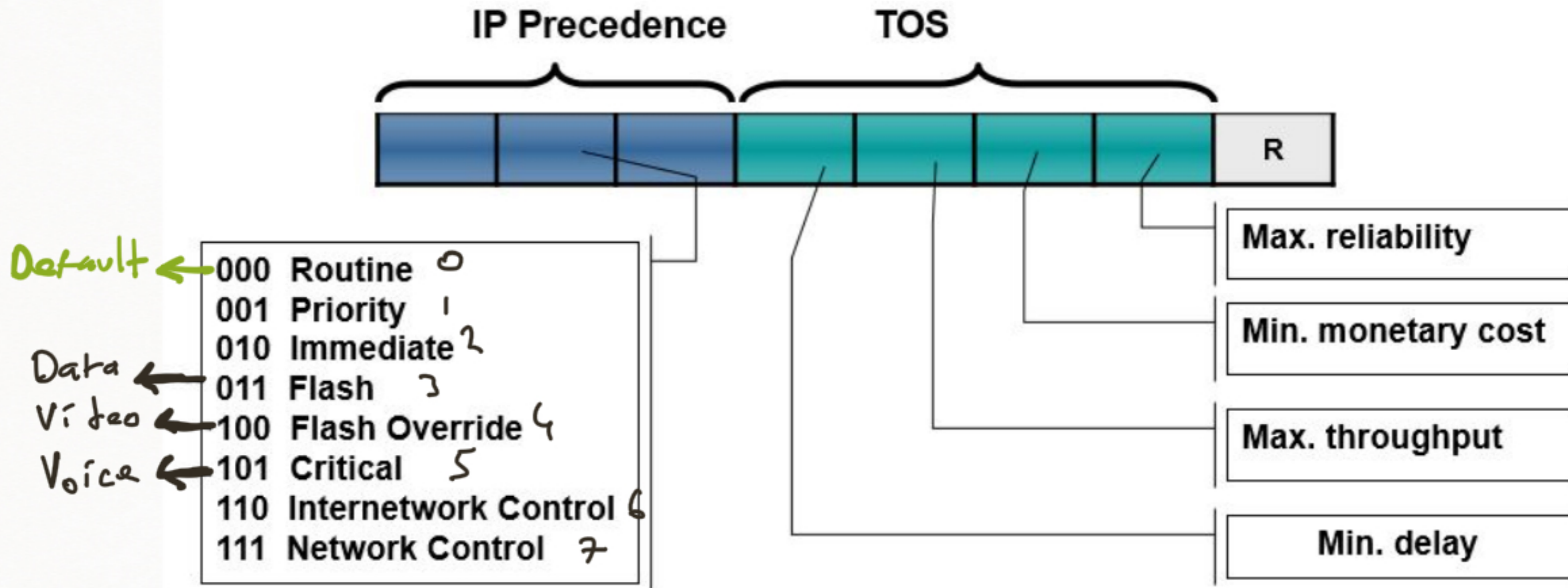
> L2 Cos (3)

802.1q → 802.1p

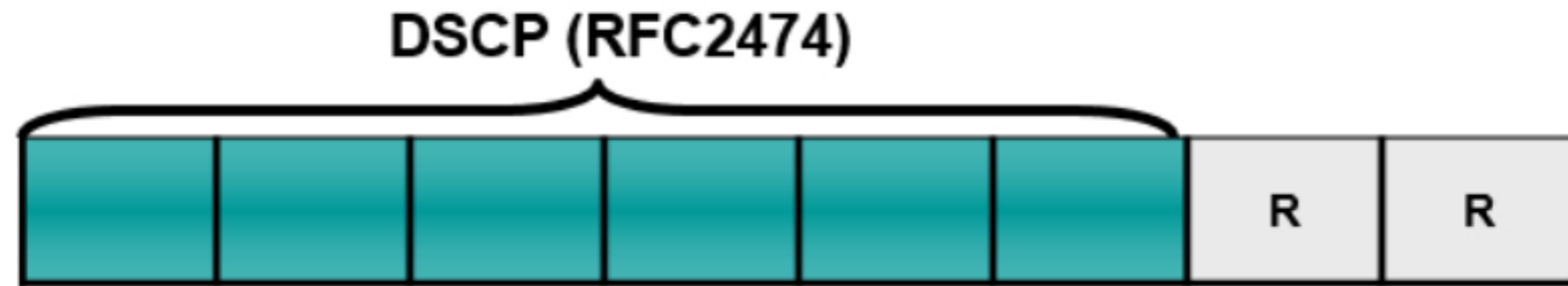
Marking Field



IP Precedence and TOS



DSCP: DiffServ Code Point



CS 0 0
⋮
CS 7 7

- Default PHB

CS 0 - ... CS 7
• Class Selector (IP Precedence) PHB

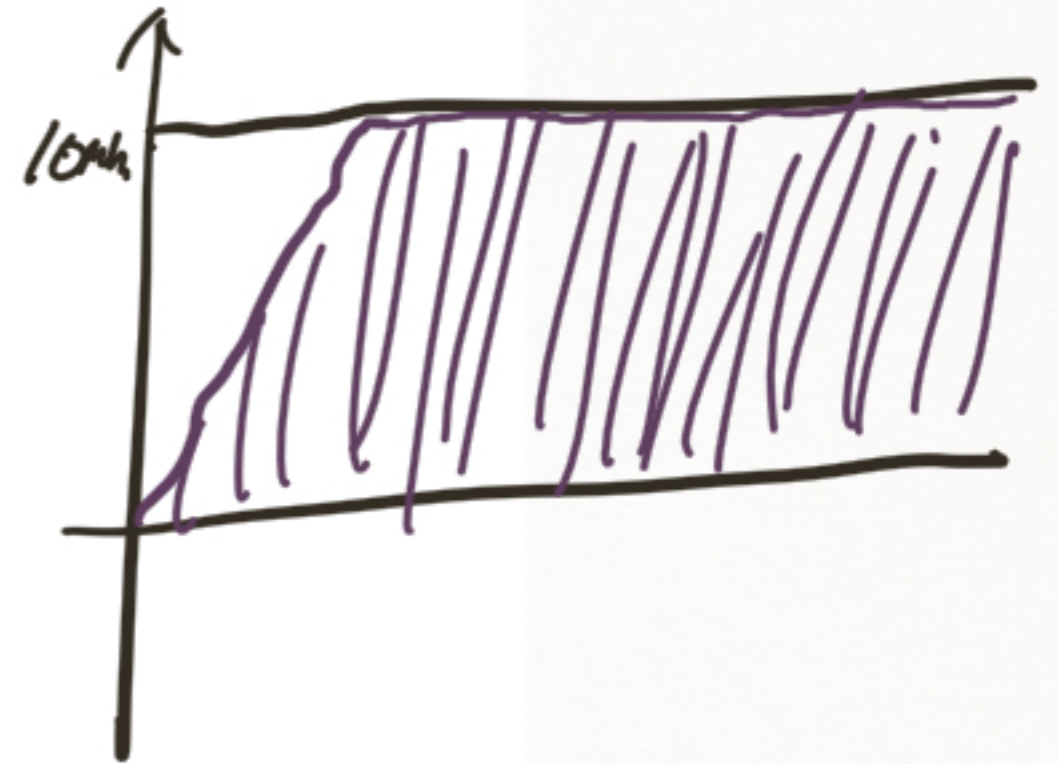
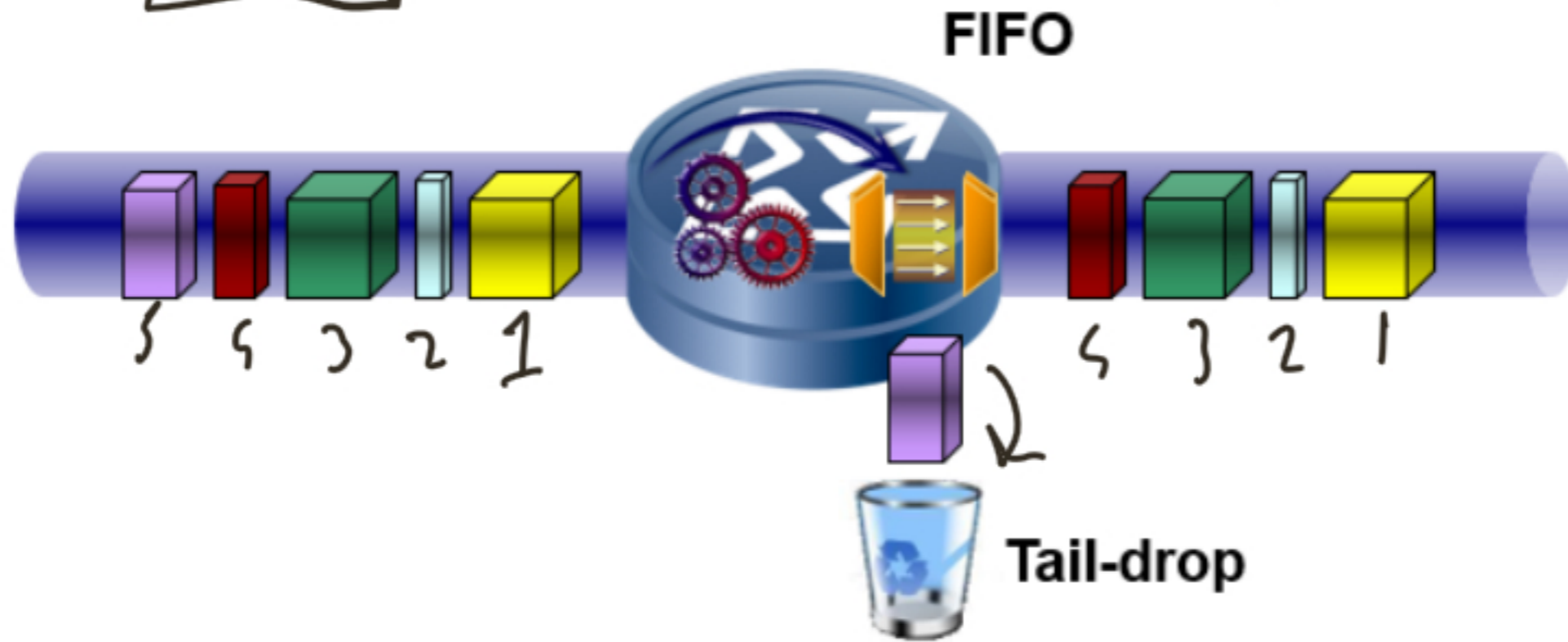
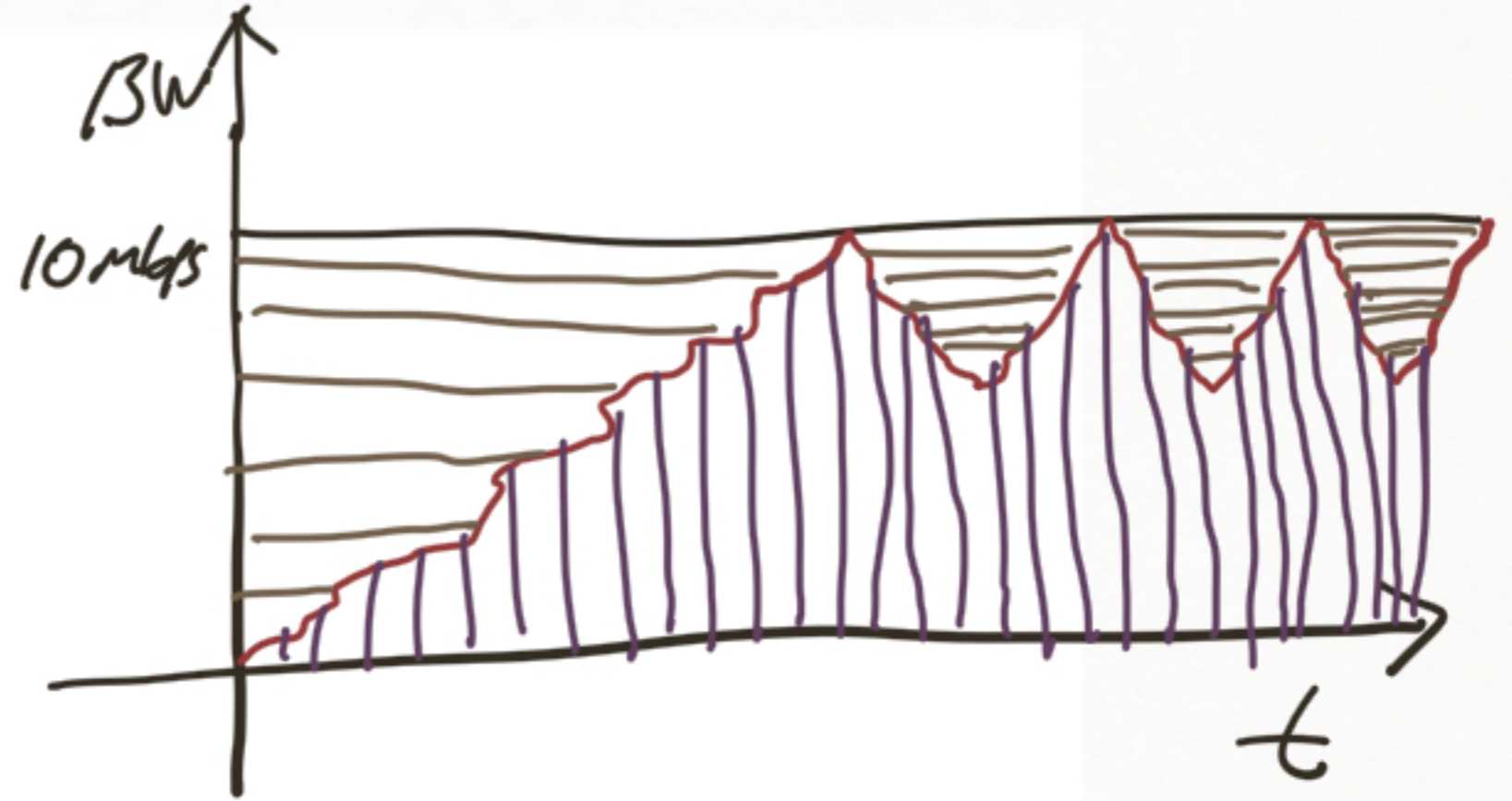
⓪ Expedited Forwarding (EF) PHB

⓪ Assured Forwarding (AF) PHB

- Each DSCP value maps a BA.
- Each BA is assigned a PHB.
- Each PHB is implemented by a group of QoS mechanisms.

Default PHB

- Default DSCP: 000000 (CS0)
- Default PHB
 - ⇒ FIFO, first in first out
 - ⇒ Tail-drop



IP Precedence

CS PHB

- Ensures the compatibility with the nodes not supporting DSCP.
- The three high-order bit maps the IP precedence value

- 8 -

CS Class	DSCP Value	Precedence Value	Precedence Class
CS0 Default	000 <u>000</u>	0	Routine
CS1	001 <u>000</u>	1	Priority
CS2	010 <u>000</u>	2	Immediate
CS3	011 <u>000</u>	3	Flash
CS4	100 <u>000</u>	4	Override Flash
CS5	101 <u>000</u>	5	Critical
CS6	110 <u>000</u>	6	Internetwork Control
CS7	111 <u>000</u>	7	Network Control

AF PHB

- Guarantees certain bandwidth.
- Permits occupation of idle bandwidth.

Assured Forwarding (AF) behavior group

	Class 1	Class 2	Class 3	Class 4
Low drop probability	AF11 (DSCP 10)	AF21 (DSCP 18)	AF31 (DSCP 26)	AF41 (DSCP 34)
Med drop probability	AF12 (DSCP 12)	AF22 (DSCP 20)	AF32 (DSCP 28)	AF42 (DSCP 36)
High drop probability	AF13 (DSCP 14)	AF23 (DSCP 22)	AF33 (DSCP 30)	AF43 (DSCP 38)

AF1x < AF2x < AF3x < AF4x



Class

Drop probability

	Class1	Class2	Class3	Class4
Low drop precedence	001010	010010	011010	100010
Medium drop precedence	001100	010100	011100	100100
High drop precedence	001110	010110	011110	100110

Expedited Forwarding

"Ismi" EF = 101110 DSCP

101 Precedence

"5" Cos, EXP

"184" TOS

$$CIR = \frac{B_c}{T_c}$$

$$\frac{1,125,000 \text{ bit}}{0.125 \text{ s}} = 10,000,000 \text{ bit/s}$$

$$EIR = \frac{B_e}{T_c}$$

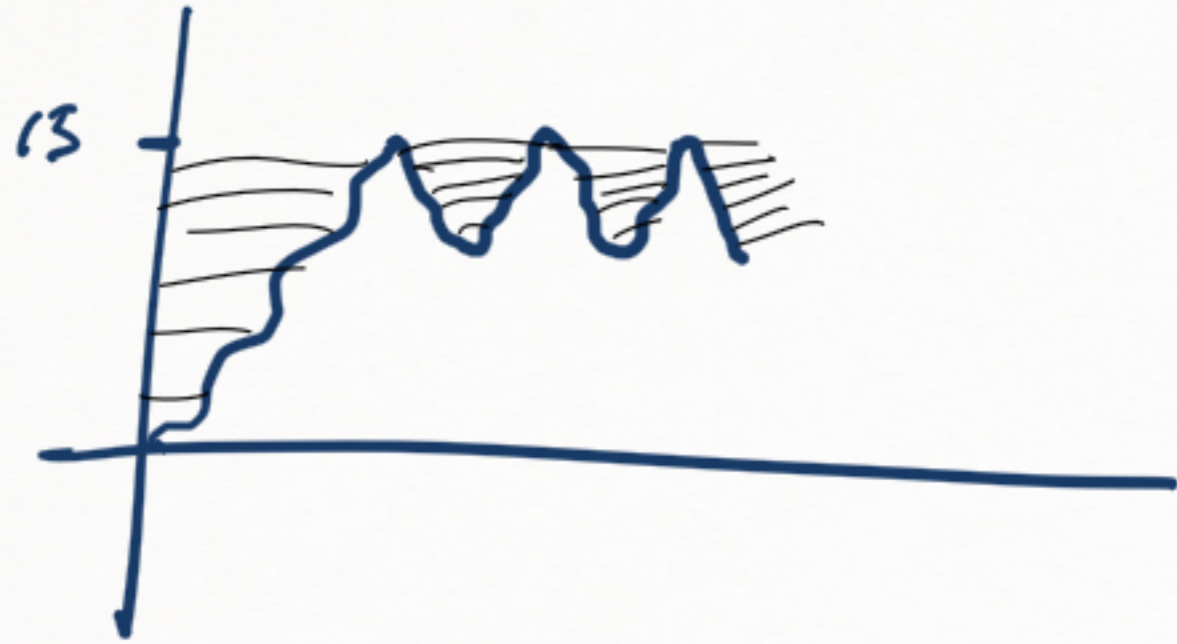
$$\frac{1,125 \text{ bit}}{0.125 \text{ s}} = 1,000,000 \text{ bit/s}$$

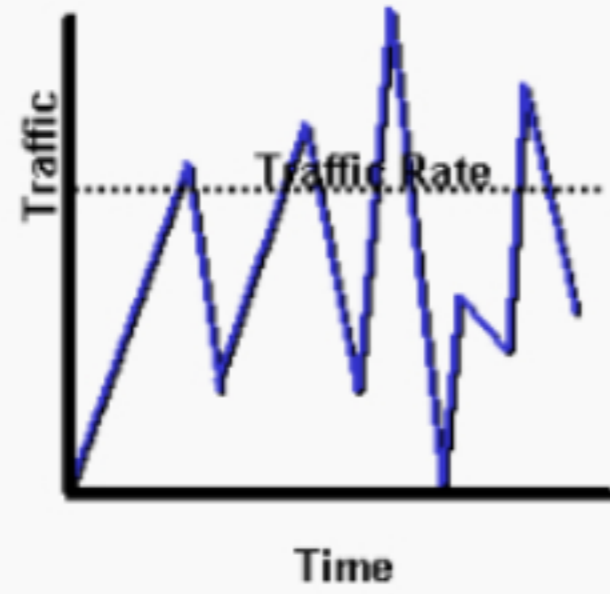
$$CIR + EIR = PIR$$

CIR = 15 mbps
PIR = 16 mbps
MIR = 100

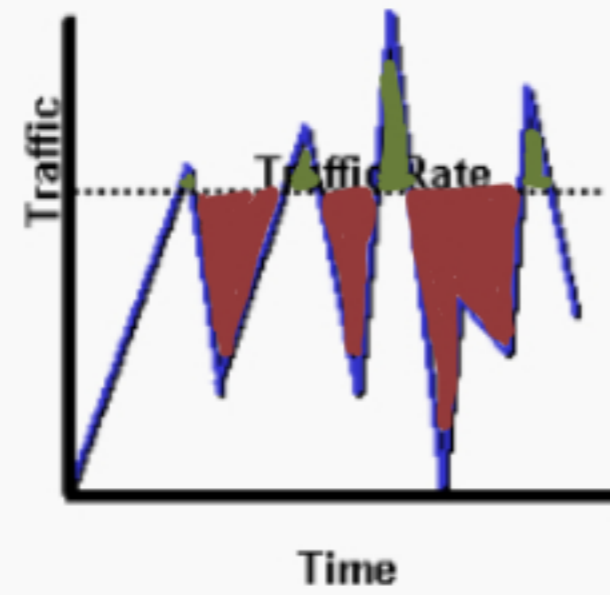
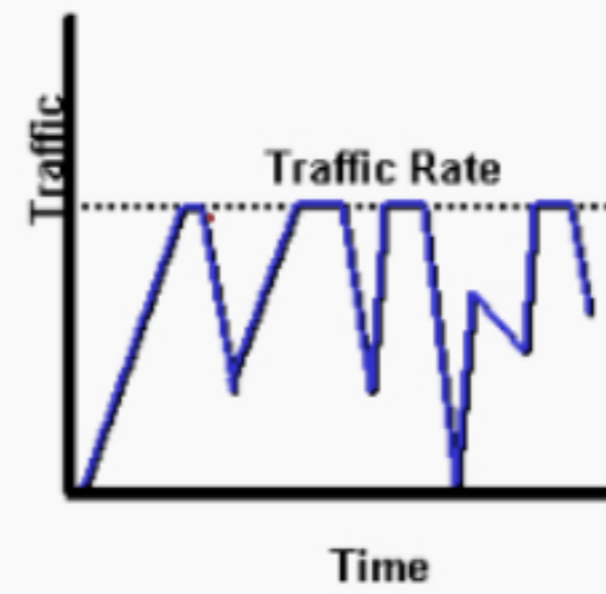
"out" Shaping

mbps (Access Rate)





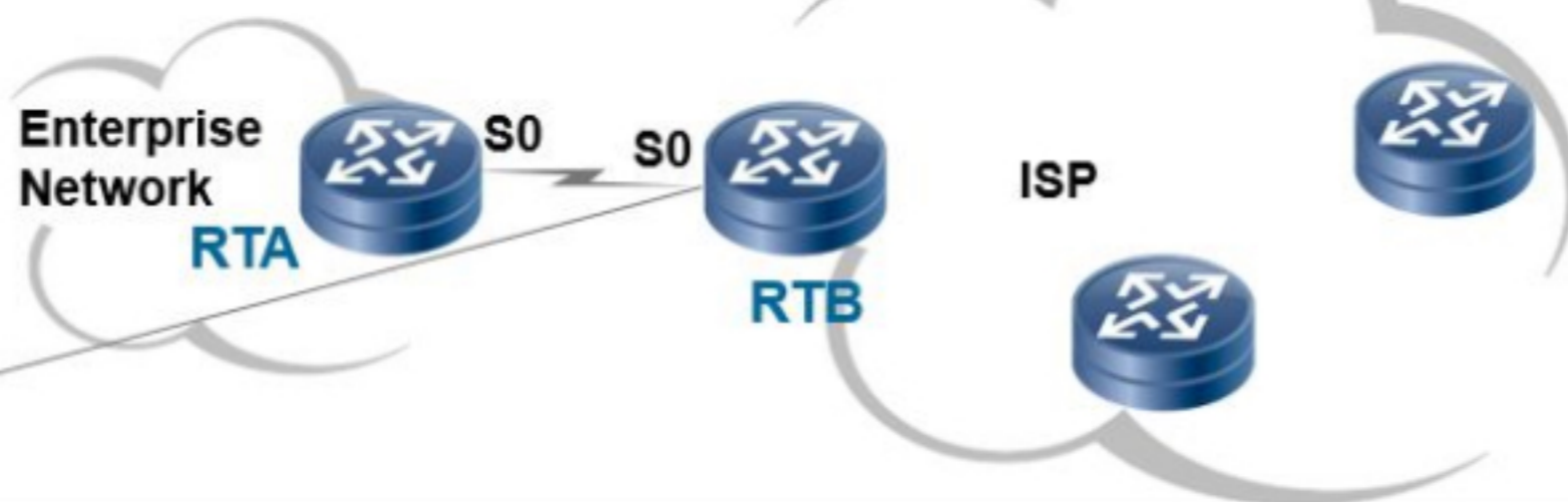
Policing
"in"




Shaping
"out"



Configure Traffic Policing



```
qos carl 1 precedence 4 5
acl number 2001
 rule 0 permit source 1.1.1.0 0.0.0.255
acl number 2002
 rule 0 permit source 1.1.2.0 0.0.0.255
interface Serial0
 qos car inbound acl 2001 cir 8000 cbs 15000000 ebs 0 green pass red drop
 qos car inbound acl 2002 cir 8000 cbs 15000000 ebs 100000 green remark-prec-pass 0 red drop
 qos car inbound carl 1 cir 8000 cbs 15000000 ebs 0 green remark-prec-pass 3 redremark-prec-pass 0
```

Umarım faydalı bir  çalışma olmuştur.
Soru ve yorumlarınız için,
aliaydemir80@gmail.com