

DINAMIČKI RUTING PROTOKOLI

Predmet: Aktivni mrežni uređaji

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EVOLUCIJA DINAMIČKIH RUTING PROTOKOLA

- Dinamički ruting protokoli se koriste u računarskim mrežama od 1980.
- Novije verzije ruting protokola podržavaju IPv6

Klasifikacija ruting protokola

- Prema mestu implementacije ruting protokoli se mogu klasifikovati u dve grupe
IGP (Interior Gateway Protocols)
EGP (Exterior Gateway Protocols)

	Interior Gateway Protocols				Exterior Gateway Protocols
IPv4	RIPv2	EIGRP	OSPFv2	IS-IS	BGP-4
IPv6	RIPng	EIGRP for IPv6	OSPFv3	IS-IS for IPv6	BGP-MP

EVOLUCIJA DINAMIČKIH RUTING PROTOKOLA

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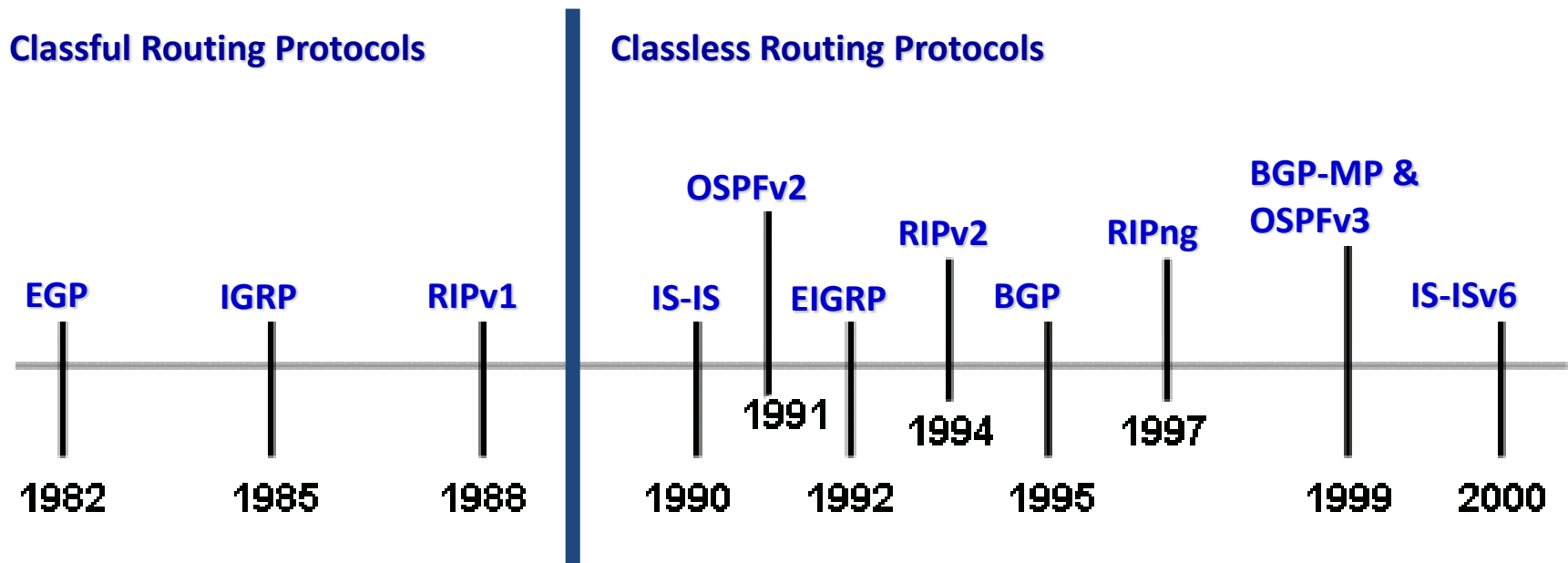
Klasifikacija ruting protokola

- Prema načinu rada ruting protokoli se dele na
 - Distance Vector
 - Link State

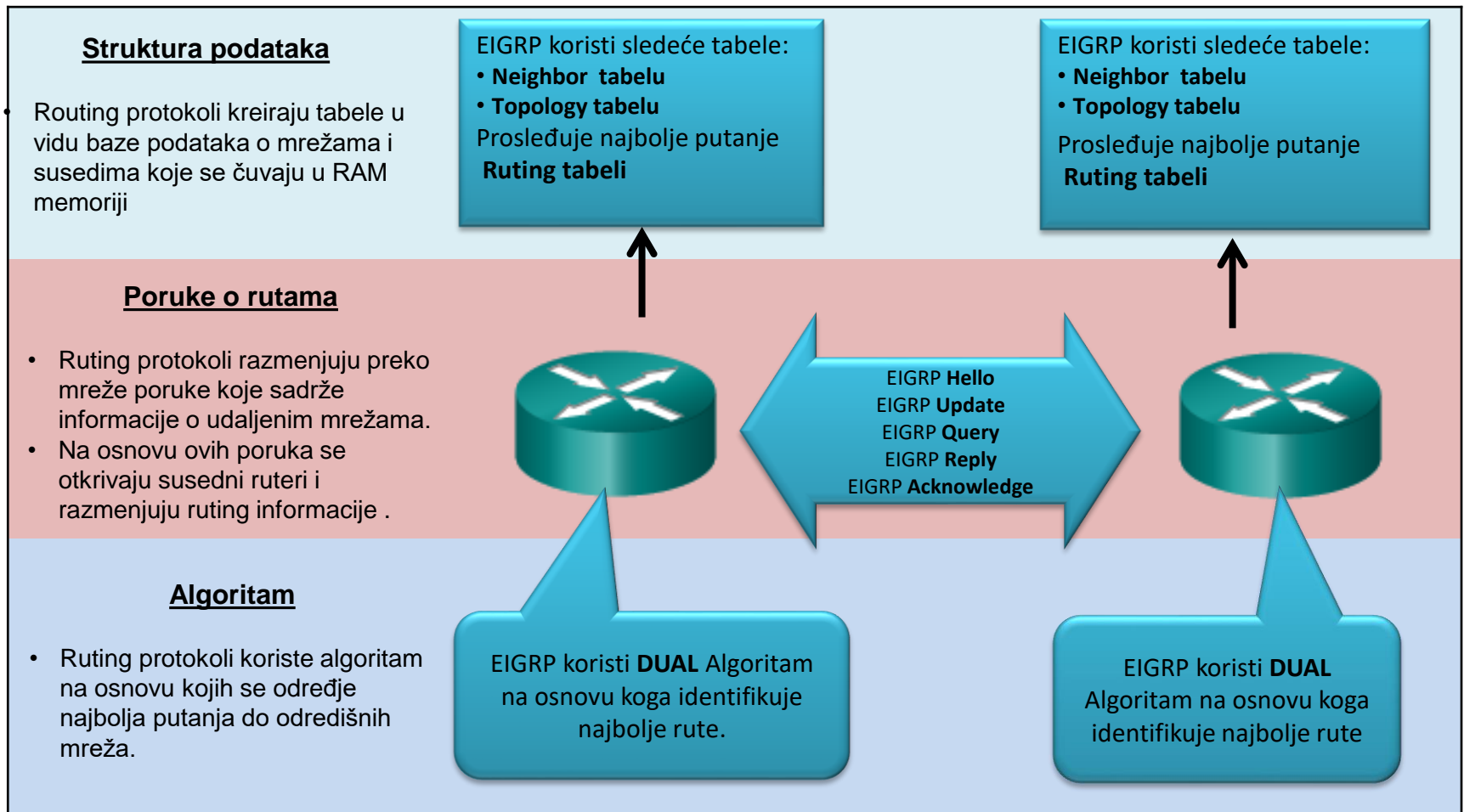
	Distance Vector		Link-State		Path Vector
IPv4	RIPv2	EIGRP	OSPFv2	IS-IS	BGP-4
IPv6	RIPng	EIGRP for IPv6	OSPFv3	IS-IS for IPv6	BGP-MP

EVOLUCIJA DINAMIČKIH RUTING PROTOKOLA

- Klasifikacija rutining protokola prema načinu slanja informacija o mrežnim adresama (routing updates)
 - Klasni (Classful)
 - Bezklasni (Classless)

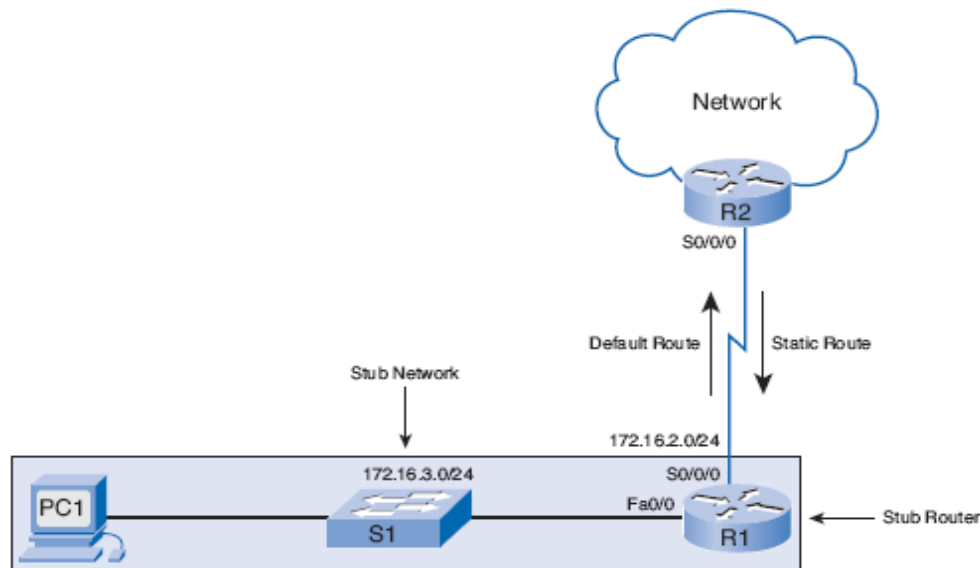


OSNOVNE KOMPONENTE RUTING PROTOKOLA



KADA KORISTITI STATIČKE RUTE

- U malim mrežama za koje se ne očekuje značajno širenje
- Za rutiranje saobraćaja ka i iz *stub* mreže
 - Stub mreža je mreža do koje se dolazi preko samo jedne putanje
 - Stub ruter ima samo jednog *upstream* suseda

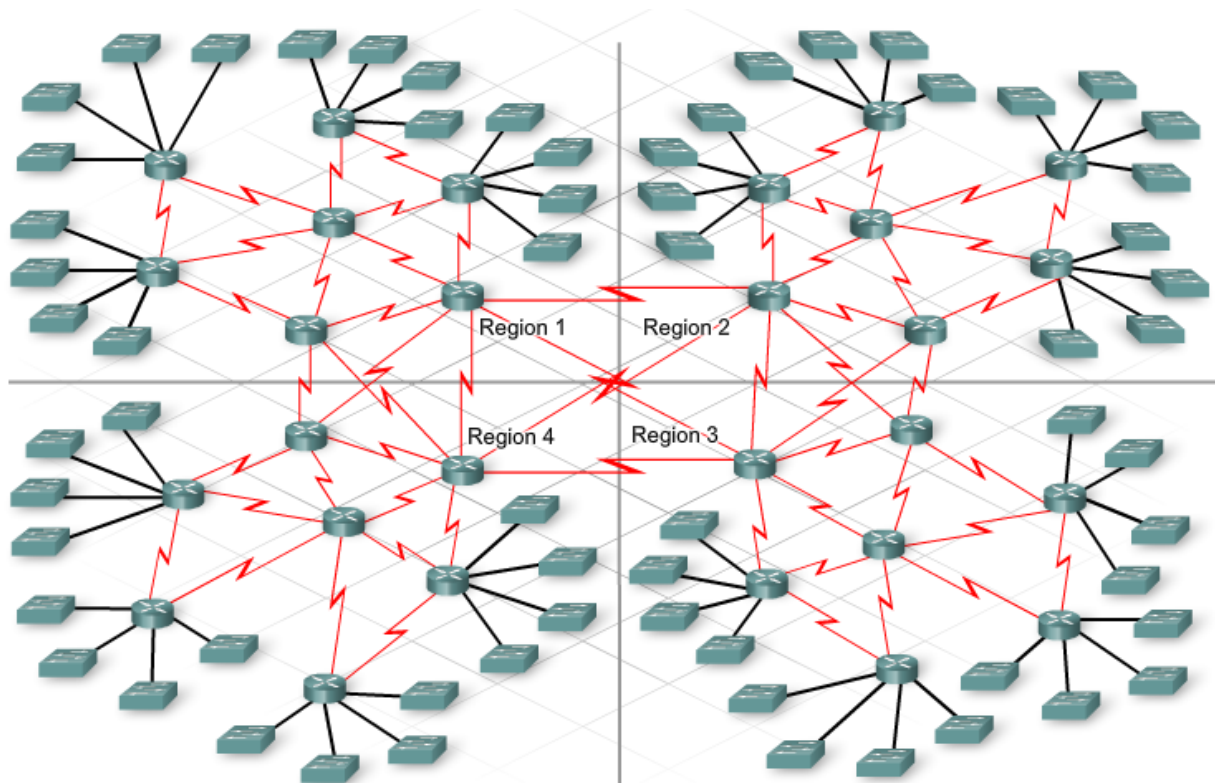


POREĐENJE DINAMIČKIH I STATIČKIH RUTA

	Dinamičko rutiranje	Statičko rutiranje
Složenost konfiguracije		
Promena topologije		
Skaliranje		
Bezbednost		
Upotreba resursa		
Predvidivost		

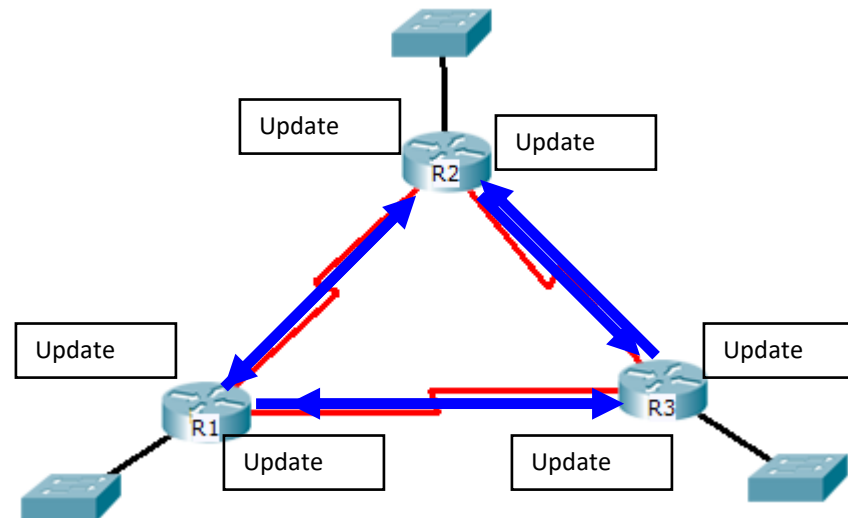
KADA KORISTITI DINAMIČKO RUTIRANJE

- Dinamičko rutiranje je najbolji izbor za velike i složene mrežne topologije



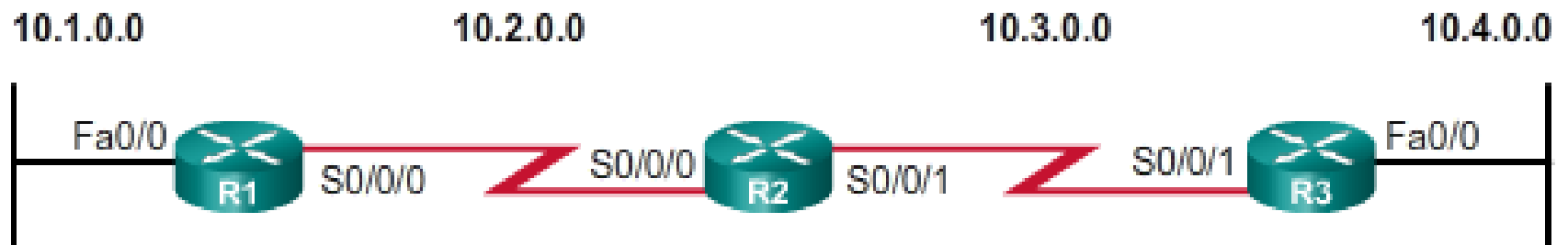
KONCEPT RADA DINAMIČKOG RUTING PROTOKOLA

- Ruter prima i šalje ruting poruke na svojim interfejsima, ka svojim susedima
- Ruteri međusobno razmenjuju ruting informacije sa ostalim ruterima koji koriste isti ruting protokol
- Kada ruter detektuje promenu u topologiji, ruting protokol tu promenu oglašava ostalim ruterima u mreži



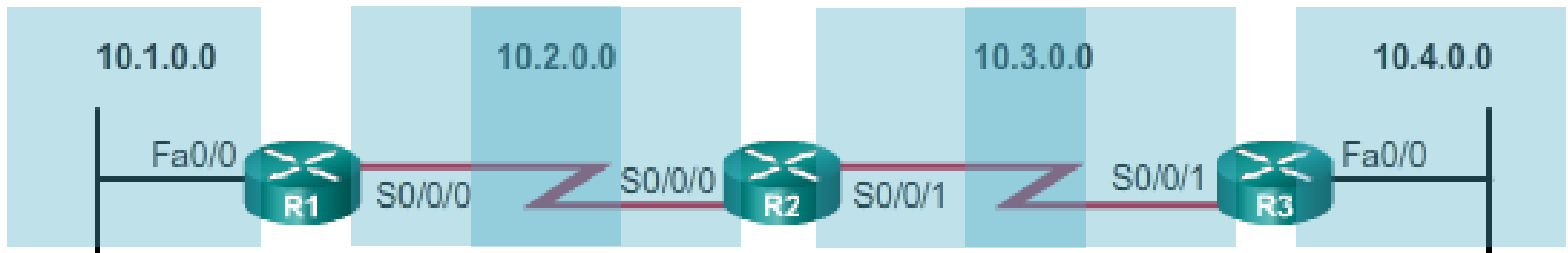
INICIJALIZACIJA – COLD START

- Kada se ruter uključi, on ništa ne zna o mrežnoj topologiji
- Ruter na početku ima informacije samo o svojim direktno povezanim mrežama



DETEKCIJA DIREKTNO POVEZANIH MREŽA

- R1 unosi direktno povezanu mrežu 10.1.0.0 preko interfejsa Fa0/0 i 10.2.0.0 preko interfejsa S0/0/0 u ruting tabelu
- R2 unosi direktno povezanu mrežu 10.2.0.0 preko interfejsa S0/0/0 i 10.3.0.0 preko interfejsa S0/0/1 u ruting tabelu
- R3 na sličan način unosi svoje direktno povezane mreže u ruting tabelu



	Network	Interface	Hop
C	10.1.0.0	Fa0/0	0
C	10.2.0.0	S0/0/0	0

	Network	Interface	Hop
C	10.2.0.0	S0/0/0	0
C	10.3.0.0	S0/0/1	0

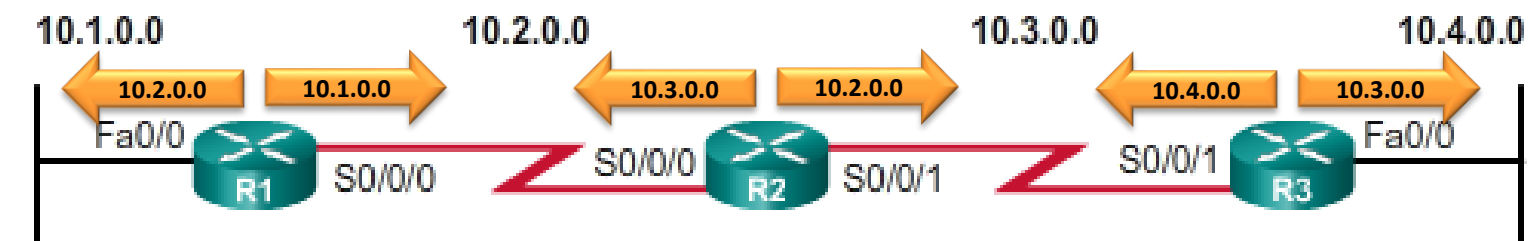
	Network	Interface	Hop
C	10.3.0.0	S0/0/1	0
C	10.4.0.0	Fa0/0	0

OTKRIVANJE MREŽA – INICIJALNA RAZMENA(I KORAK)

R1 šalje update o mreži 10.1.0.0 na Serial0/0/0 intefejs i šalje update o mreži 10.2.0.0 na Fa0/0.

R2 šalje update o mreži 10.3.0.0 na Serial 0/0/0 intefejs i šalje update o mreži 10.2.0.0 na Serial 0/0/1.

R3 šalje update o mreži 10.4.0.0 na Serial 0/0/1 intefejs i šalje update o mreži 10.3.0.0 na FastEthernet0/0.



	Network	Interface	Hop
C	10.1.0.0	Fa0/0	0
C	10.2.0.0	S0/0/0	0

	Network	Interface	Hop
C	10.2.0.0	S0/0/0	0
C	10.3.0.0	S0/0/1	0

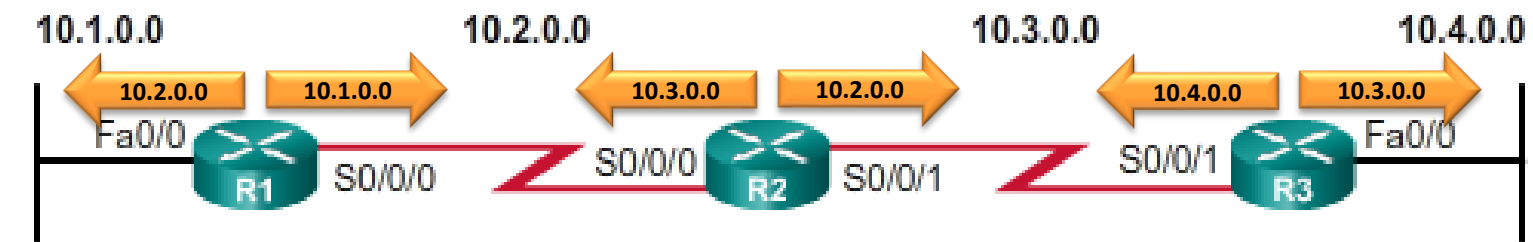
	Network	Interface	Hop
C	10.3.0.0	S0/0/1	0
C	10.4.0.0	Fa0/0	0

OTKRIVANJE MREŽA – SLEDEĆA RAZMENA II KORAK

R1 prima update od R2 o mreži 10.3.0.0 na Serial0/0/0 intefejsu i inkrementira hop count (metrika) za 1 i unosi je u ruting tabelu

R2 prima update od R1 o mreži 10.1.0.0 i update od R3 za mrežu 10.4.0.0, inkrementira hop count za jedan i unosi u ruting tabelu

R3 prima update od R2 o mreži 10.2.0.0 inkrementira hop count za 1 i unosi je u ruting tabelu



	Network	Interface	Hop
C	10.1.0.0	Fa0/0	0
C	10.2.0.0	S0/0/0	0

	Network	Interface	Hop
C	10.2.0.0	S0/0/0	0
C	10.3.0.0	S0/0/1	0

	Network	Interface	Hop
C	10.3.0.0	S0/0/1	0
C	10.4.0.0	Fa0/0	0

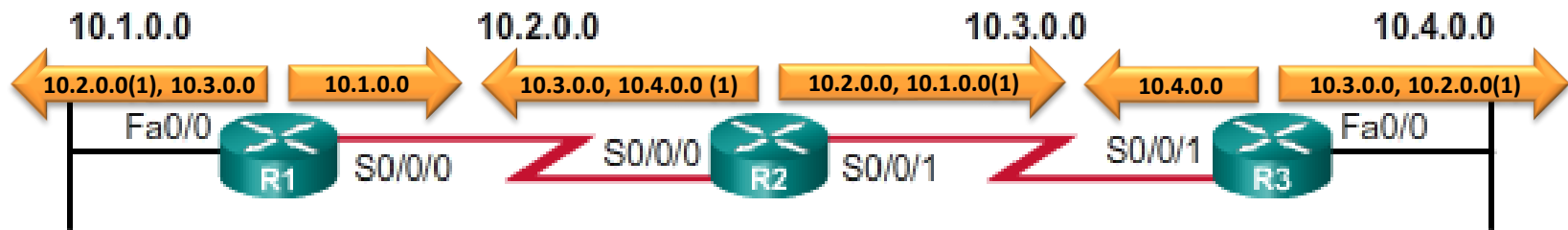
OTKRIVANJE MREŽA – SLEDEĆA RAZMENA(III KORAK)

R1 prima update od R2 o mreži 10.3.0.0 i 10.4.0.0(1) sa metrikom 1.

Osvežava informaciju o mreži 10.3.0.0 koju je dobio u prethodnom koraku.

Metriku za mrežu 10.4.0.0 inkrementira za 1 i unosi je u ruting tabelu.

10.4.0.0 mreža je 1 skok udaljena od R2 a 2 skoka od R1



	Network	Interface	Hop
C	10.1.0.0	Fa0/0	0
C	10.2.0.0	S0/0/0	0
R	10.3.0.0	S0/0/0	1

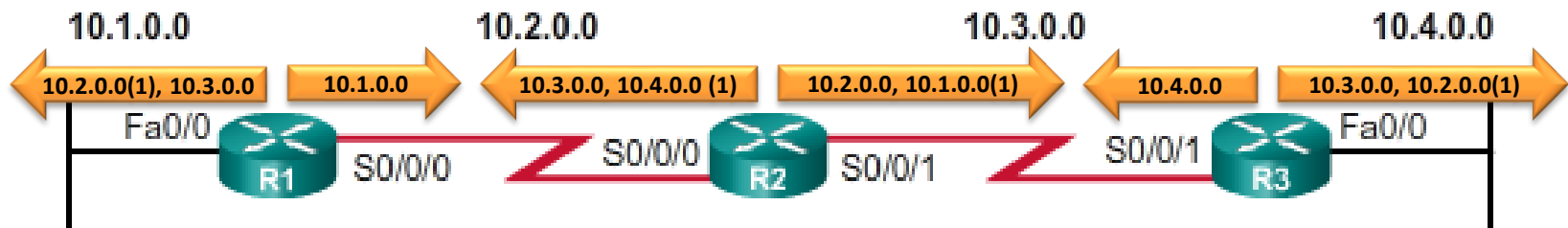
	Network	Interface	Hop
C	10.2.0.0	S0/0/0	0
C	10.3.0.0	S0/0/1	0
R	10.1.0.0	S0/0/0	1

	Network	Interface	Hop
C	10.3.0.0	S0/0/1	0
C	10.4.0.0	Fa0/0	0
R	10.2.0.0	S0/0/1	1

OTKRIVANJE MREŽA – SLEDEĆA RAZMENA(IV KORAK)

R2 prima update od R1 o mreži 10.1.0.0 i od R3 update o mreži 10.4.0.0 kojim se osvežava ruting tabela.

Nema promena u ruting tabeli jer nije naučena nijedna nova mreža kao ni ruta sa boljom metrikom od mreža naučenih u prethodnom koraku



	Network	Interface	Hop
C	10.1.0.0	Fa0/0	0
C	10.2.0.0	S0/0/0	0
R	10.3.0.0	S0/0/0	1
R	10.4.0.0	S0/0/0	2

	Network	Interface	Hop
C	10.2.0.0	S0/0/0	0
C	10.3.0.0	S0/0/1	0
R	10.1.0.0	S0/0/0	1
R	10.4.0.0	S0/0/1	1

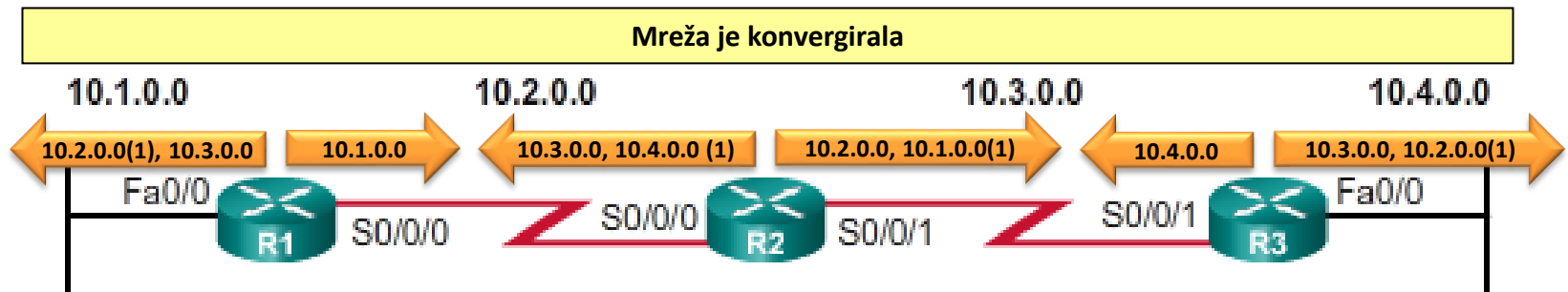
	Network	Interface	Hop
C	10.3.0.0	S0/0/1	0
C	10.4.0.0	Fa0/0	0
R	10.2.0.0	S0/0/1	1

OTKRIVANJE MREŽA – SLEDEĆA RAZMENA(V KORAK)

R3 prima update od R2 o mreži 10.1.0.0(1) i o mreži 10.2.0.0.

Osvežava informaciju o mreži 10.2.0.0 koju je dobio u prethodnom koraku.

Metriku za mrežu 10.1.0.0 inkrementira za 1 i unosi je u ruting tabelu.



	Network	Interface	Hop
C	10.1.0.0	Fa0/0	0
C	10.2.0.0	S0/0/0	0
R	10.3.0.0	S0/0/0	1
R	10.4.0.0	S0/0/0	2

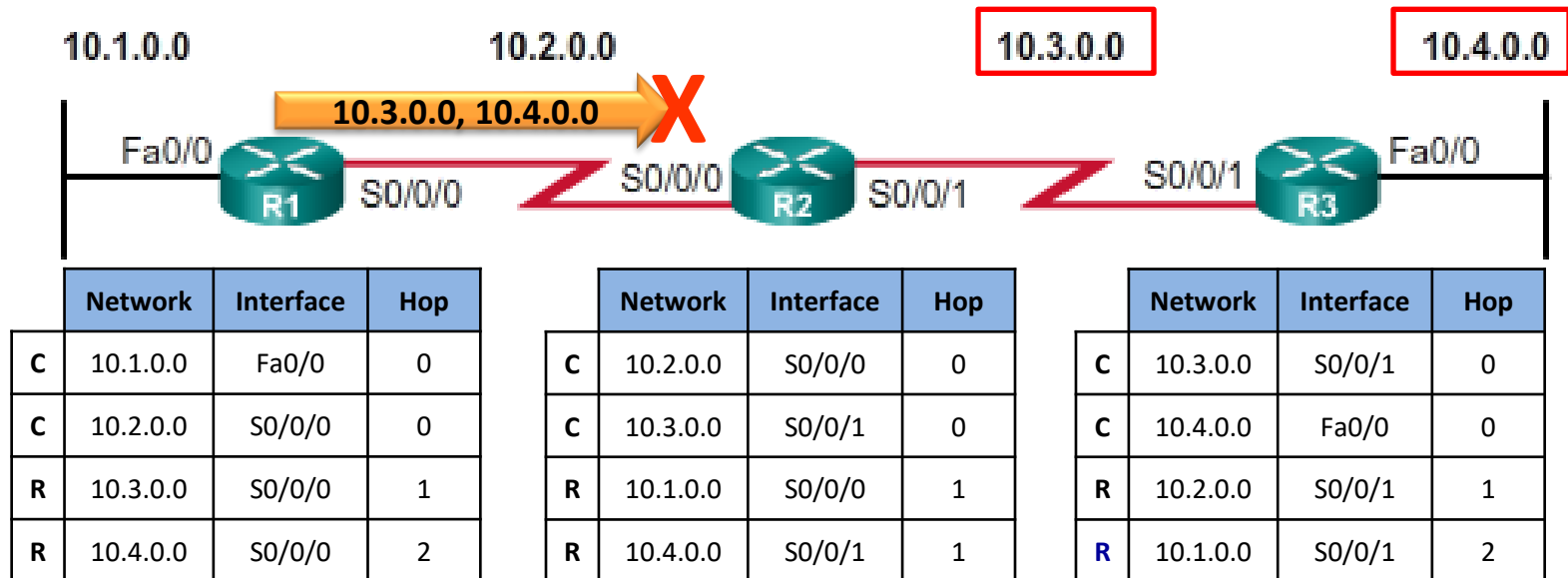
	Network	Interface	Hop
C	10.2.0.0	S0/0/0	0
C	10.3.0.0	S0/0/1	0
R	10.4.0.0	S0/0/1	1

	Network	Interface	Hop
C	10.3.0.0	S0/0/1	0
C	10.4.0.0	Fa0/0	0
R	10.2.0.0	S0/0/1	1

SPLIT HORIZON PRAVILIO

Split horizon pravilo sprečava da ruter oglašava mreže preko onog interfejsa preko koga je naučio te mreže

Ovo pravilo sprečava petlje uzrokovane sporom konvergencijom ruting protokola

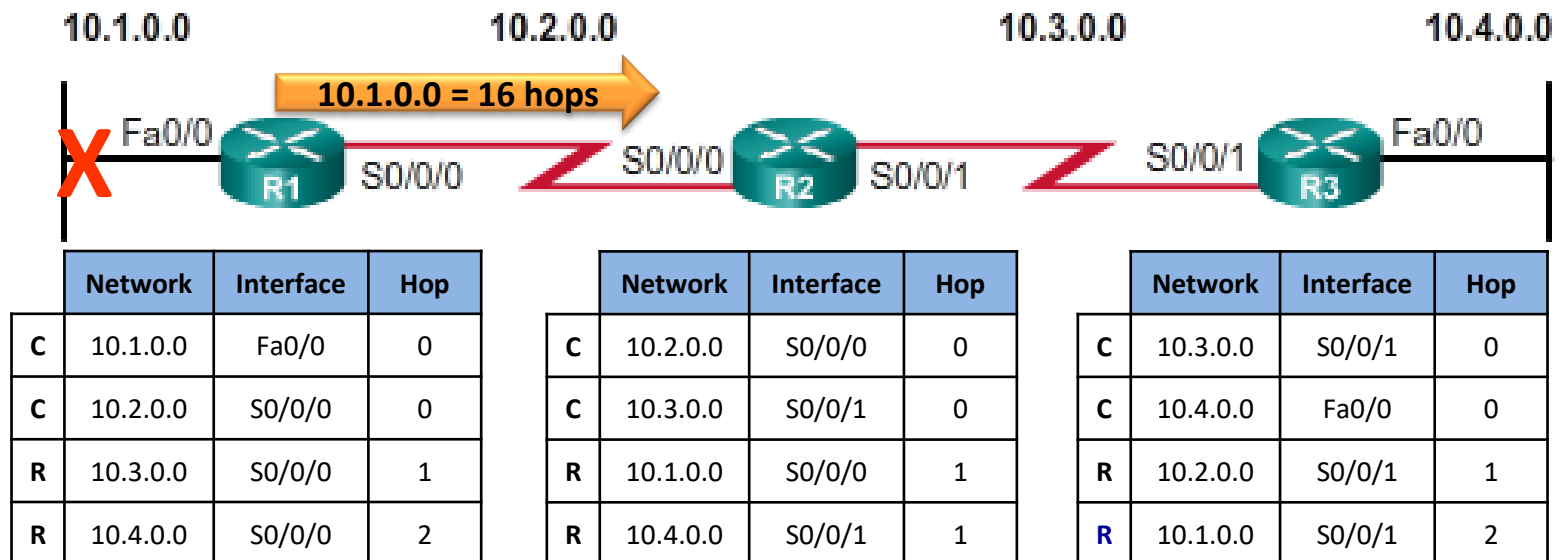


TROVANJE RUTE (ROUTE POISON)

Route Poison je način da rutu markiramo kao nedostupnu prilikom slanja susednim ruterima

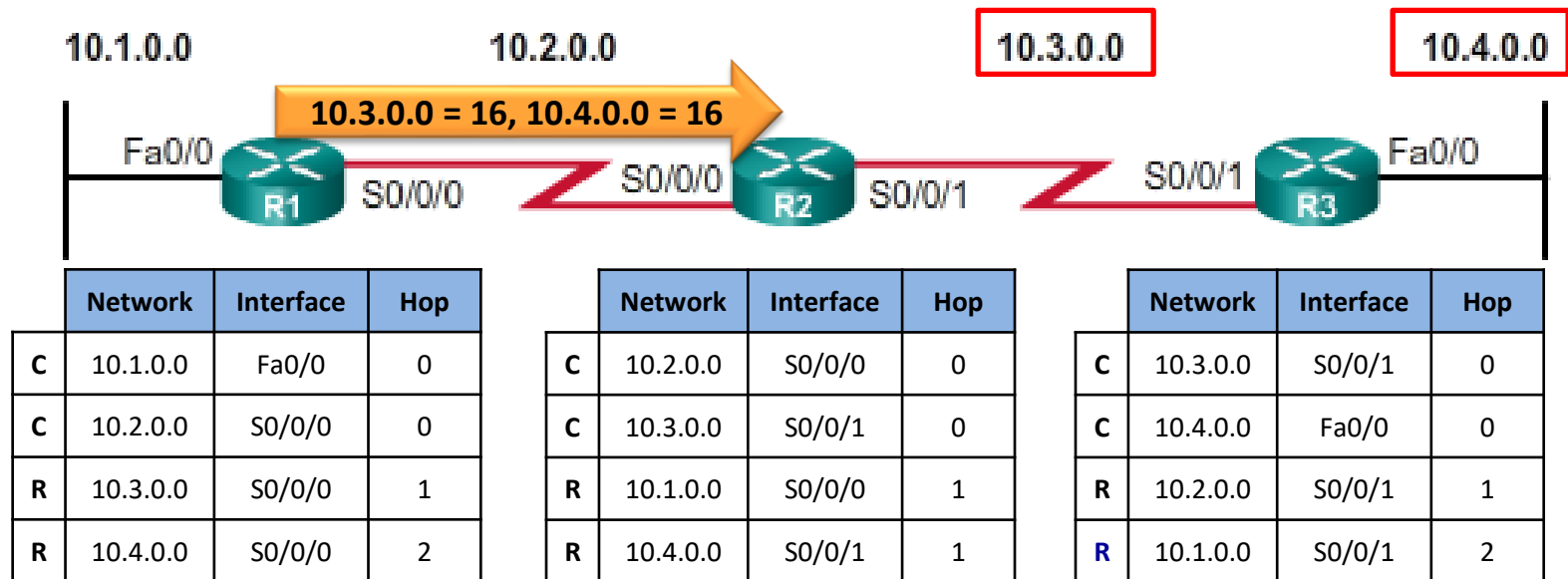
Ruta je nedostupna (unreachable) ukoliko joj se metrika setuje na maksimalnu vrednost. Za RIP ruting protokol maksimalna metrika je 16

Route Poisoning ubrzava proces konvergencije



SPLIT HORIZON - POISON REVERSE

Poison Reverse tehnika zahteva eksplicitno da ruter nedostupnu rutu sa maksimalnom metrikom prosledi kroz interfejs preko kojeg je dobio informaciju o otakzu te rute

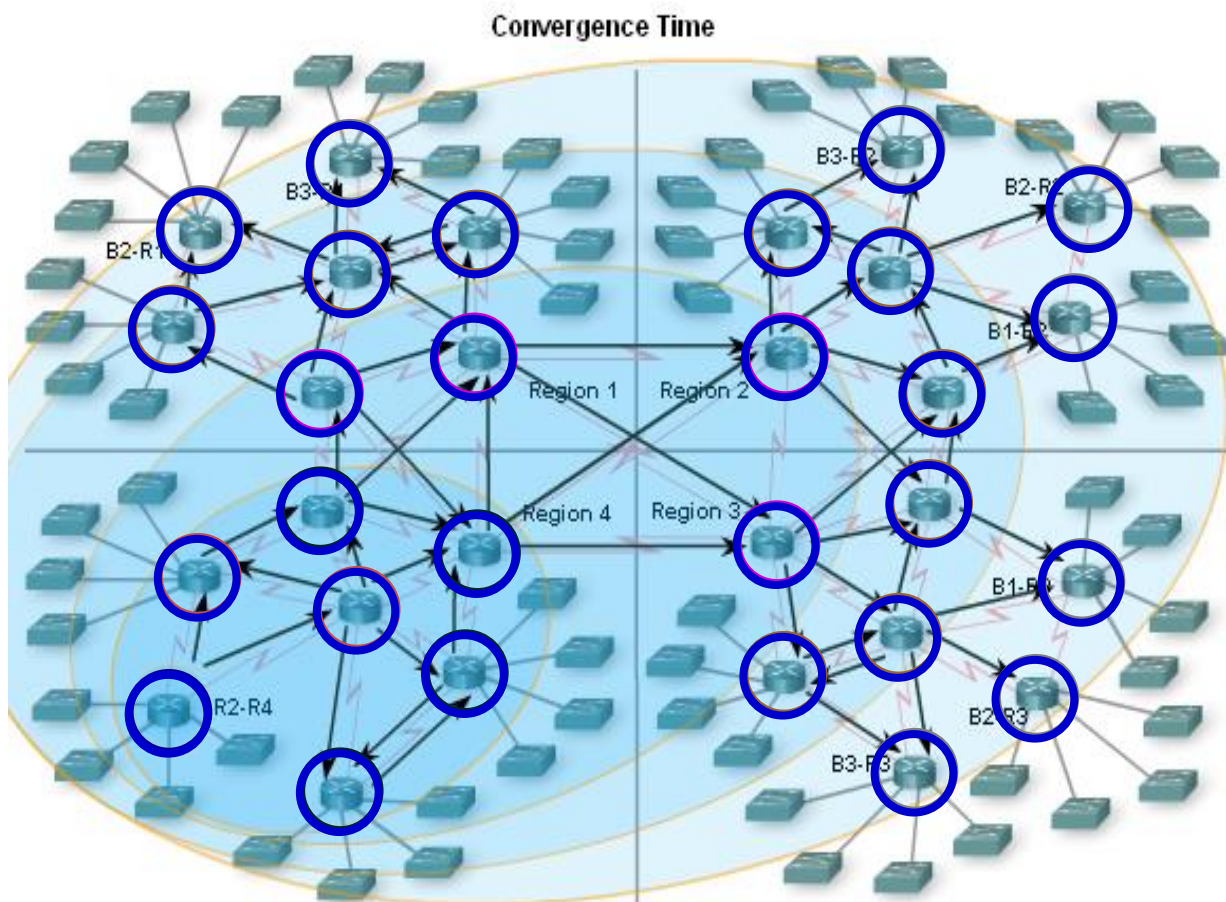


KONVERGENCIJA MREŽE

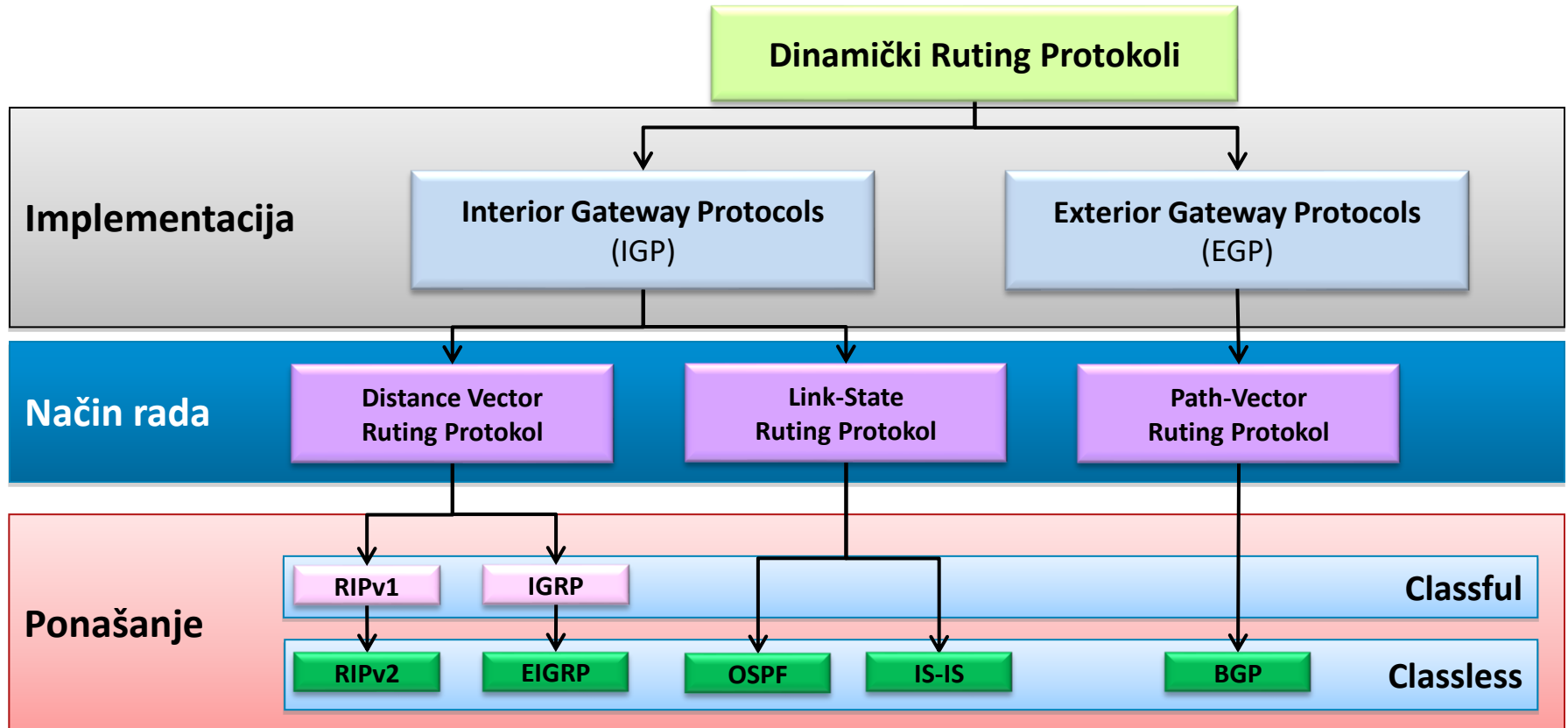
Mreža je konvergentna kada svi ruteri imaju precizne informacije o svim mrežama unutar ruting domena.

Vreme konvergencije je vreme potrebno da svi ruteri imaju informacije o svim mrežama

Mreža ukoliko nije konvergentna nije u potpunosti operativna



PREDISPITNE OBAVEZE



RIPv1 i IGRP su stari protokoli od kojih su se razvili bezklasni ruting protokoli, RIPv2 i EIGRP.

Link-state ruting protokoli su bezklasni po svojoj prirodi.

IGP i EGP KLASIFIKACIJA

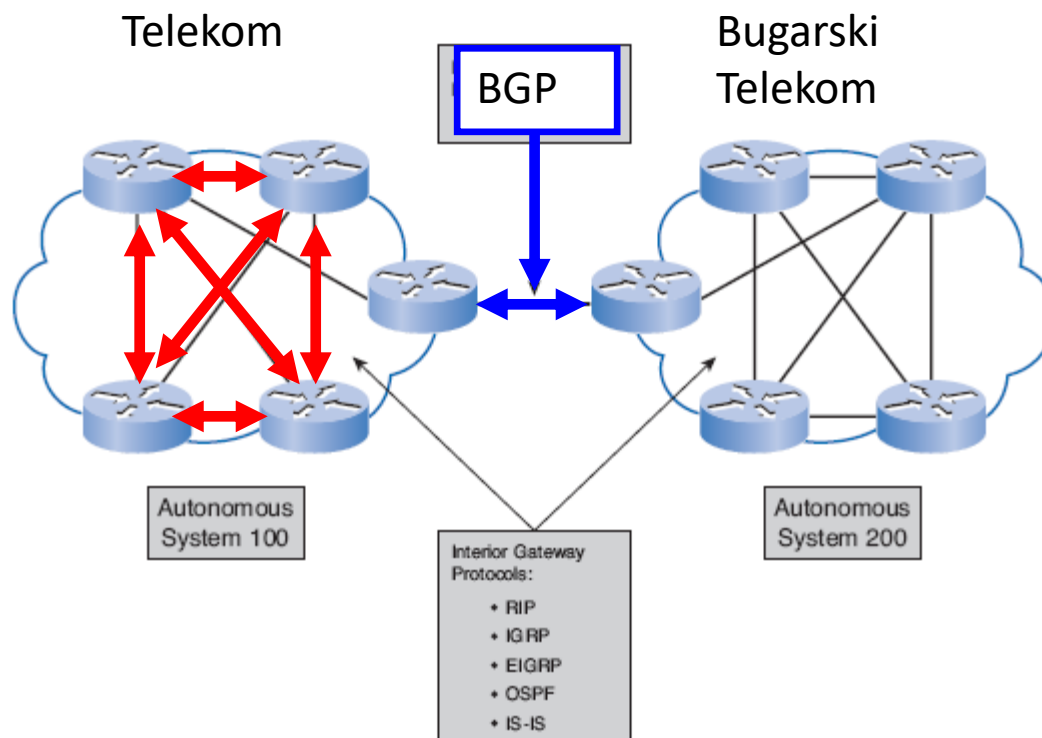
Autonomni sistem (AS) je skup rutera koji su pod kontrolom određene kompanije.

AS je interna mreža kompanije ili mreža Internet provajdera (ISP)

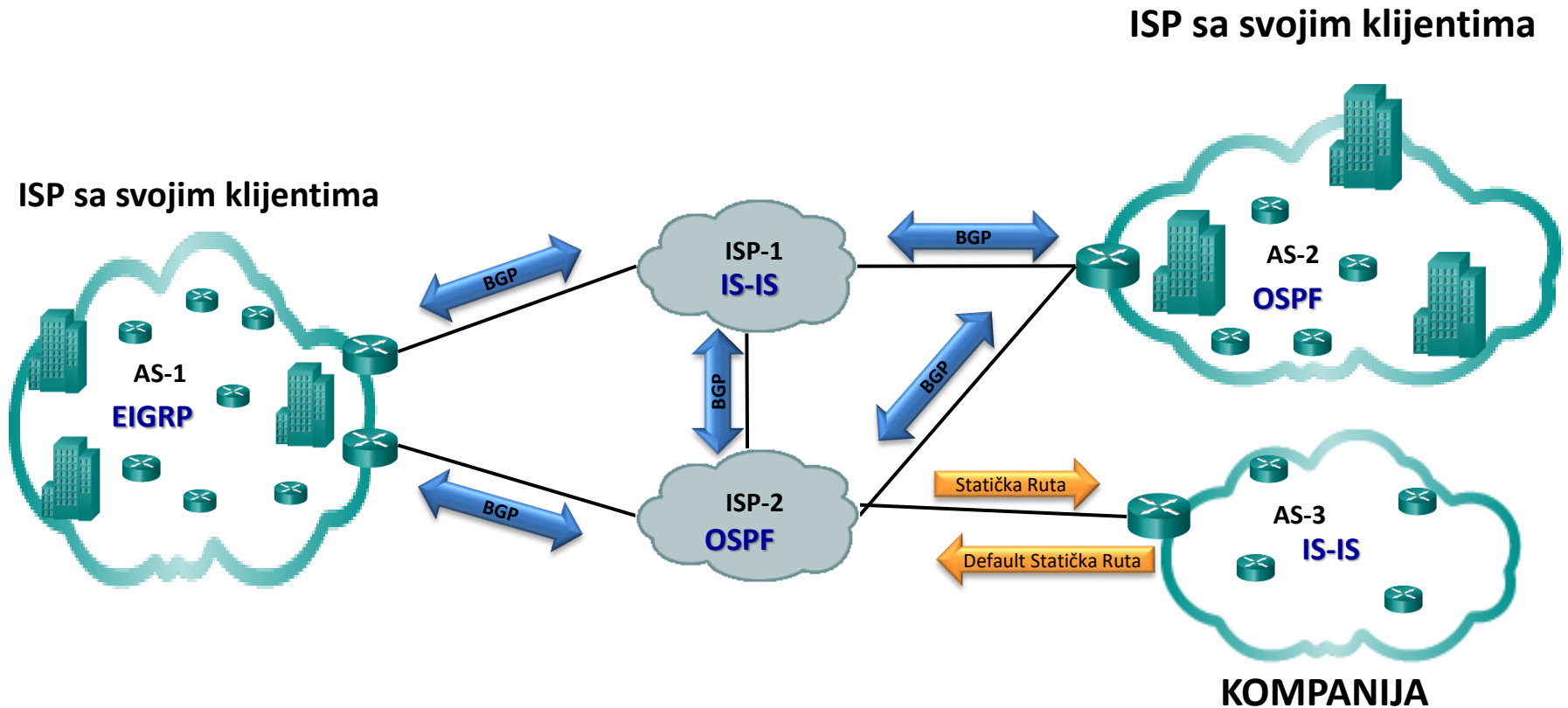
Internet se zasniva na konceptu AS.

Dve vrste rutin protokola se zahtevaju:

- **IGP** – obezbeđuje rutiranje unutar autonomnog sistema
- **EGP** – obezbeđuje rutiranje između autonomnih sistema



IGP i EGP RUTING PROTOKOLI



DISTANCE VECTOR RUTING PROTOKOLI

Svaki putokaz nam saopštava dva podatka:

Rastojanje (koliko je nešto daleko)

Smer (pravac do odredišta)

Distance vector

Rute se oglašavaju kao vektori rastojanja i smera.

Distance je termin koji se odnosi na metriku (rastojanje) kao što je hop count

Direction ili smer je:

Nexthop ruter

ili

Izlazni interfejs

Koristi se **Bellman-Ford algoritam** za održavanje najkraće rute



DISTANCE VECTOR RUTING PROTOKOLI

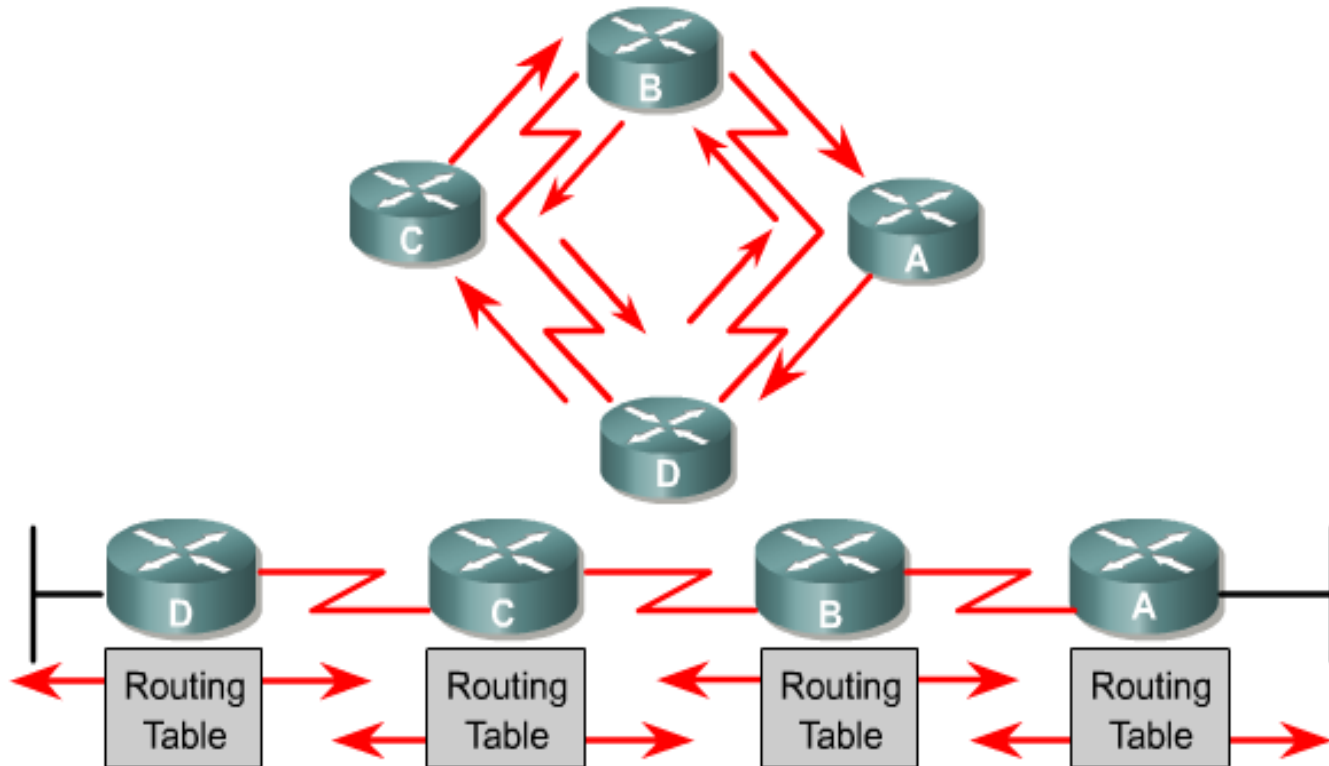
Ruting protokol

- Ne zna topologiju mreže
- Zna samo one informacije koje je dobio od svojih suseda.
- Ne zna da li je druga putanja efikasnija



KONCEPT DISTANCE VECTOR RUTING PROTOKOLA

Distance Vector ruting protokoli periodično šalju kopije svojih tabela svojim susedima



KONCEPT LINK STATE RUTING PROTOKOLA

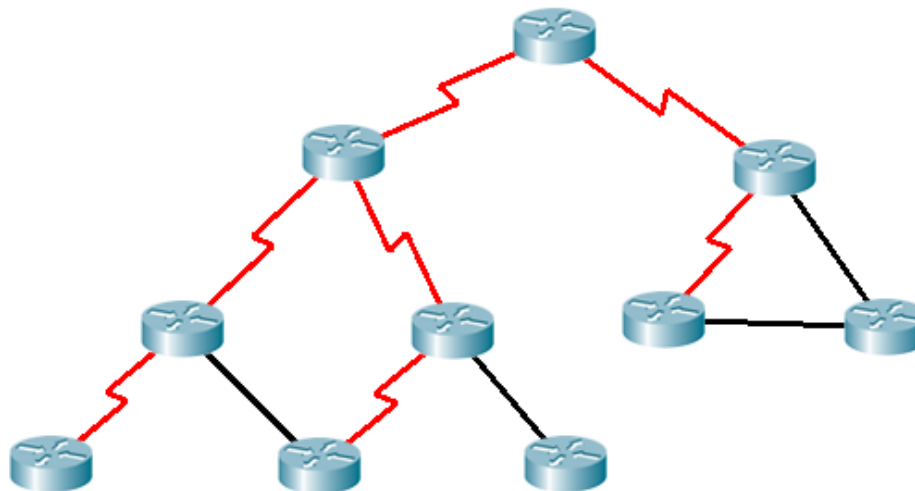
- Ruteri koji koriste link state rutiranje oglašavaju svoje direktno povezane mreže (IP, SM, metriku, stanje linka) do svih rutera u tom rutirajućem domenu.
- Svaki ruter ima kompletnu sliku mrežne topologije na kraju procesa koji se zove plavljenje (flooding)
- Na kraju flooding procesa svi ruteri u tom rutirajućem domenu imaju istu LSDB bazu
- Mreža je konvergirala kada svi ruteri imaju istu LSDB bazu
- LSDB baza je ekvivalentna mapi ili karti određene države
- Svaki ruter samostalno na osnovu LSDB baze kreira najbolje rute do svih mreža



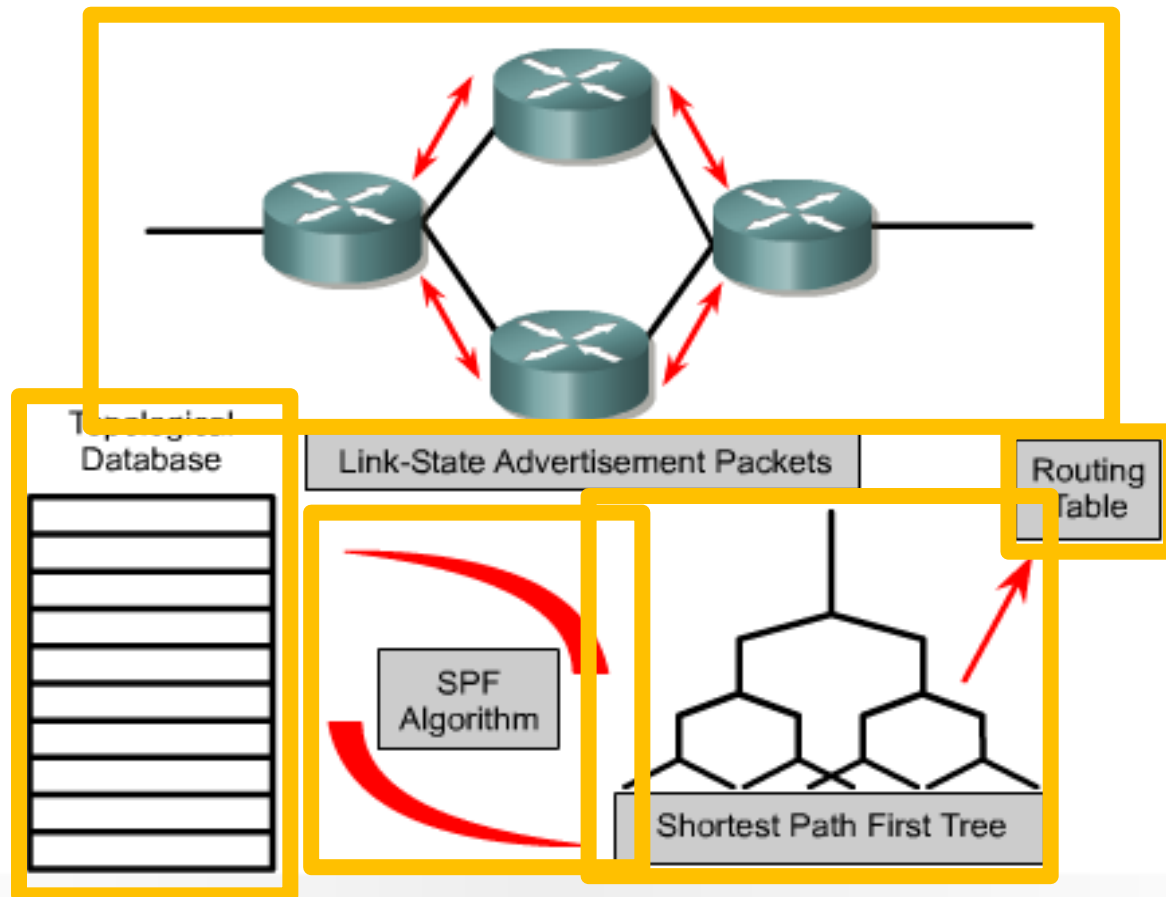
KONCEPT LINK STATE RUTING PROTOKOLA

Link state routing protokol se primenjuje

- ukoliko se zahteva brza konvergencija
- ukoliko se zahteva hijerarhijski dizajn mreže (velike mreže)



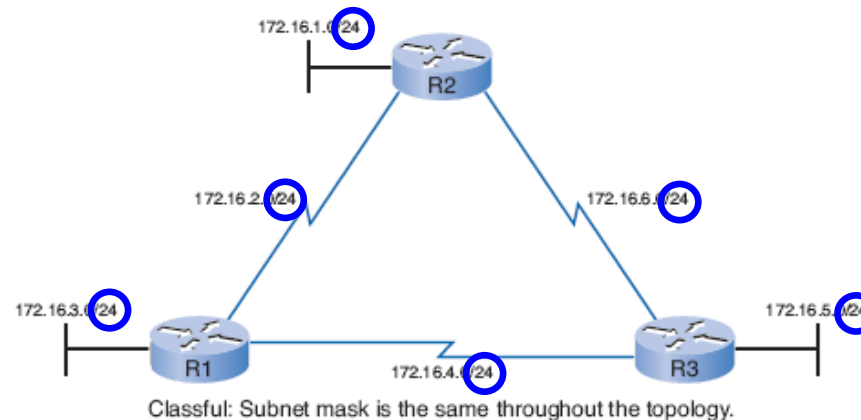
KONCEPT LINK STATE RUTING PROTOKOLA



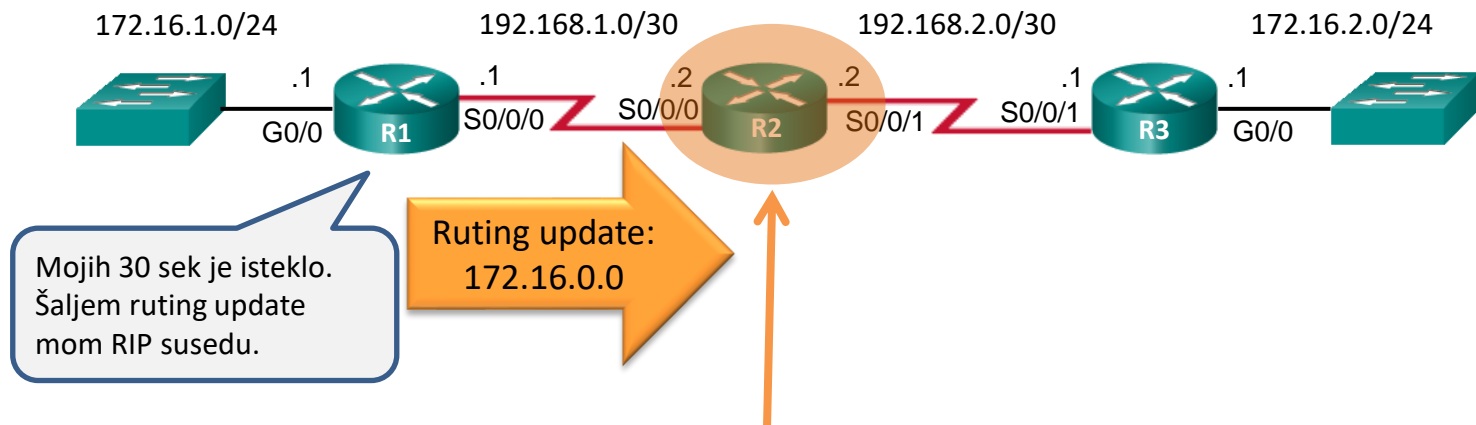
KLASNI RUTING PROTOKOLI

- Klasni rutring protokoli ne šalju u svojim rutring update podmrežnu masku
- IGRP i RIPv1 su klasni rutring protokoli
- Kreirani su kada se koristila klasna šema adresiranja
- Ne podržavaju VLSM i CIDR tehnike adresiranja
- Problem diskontinuitetnih mreža

172.16.0.0/16
Klasna mreža



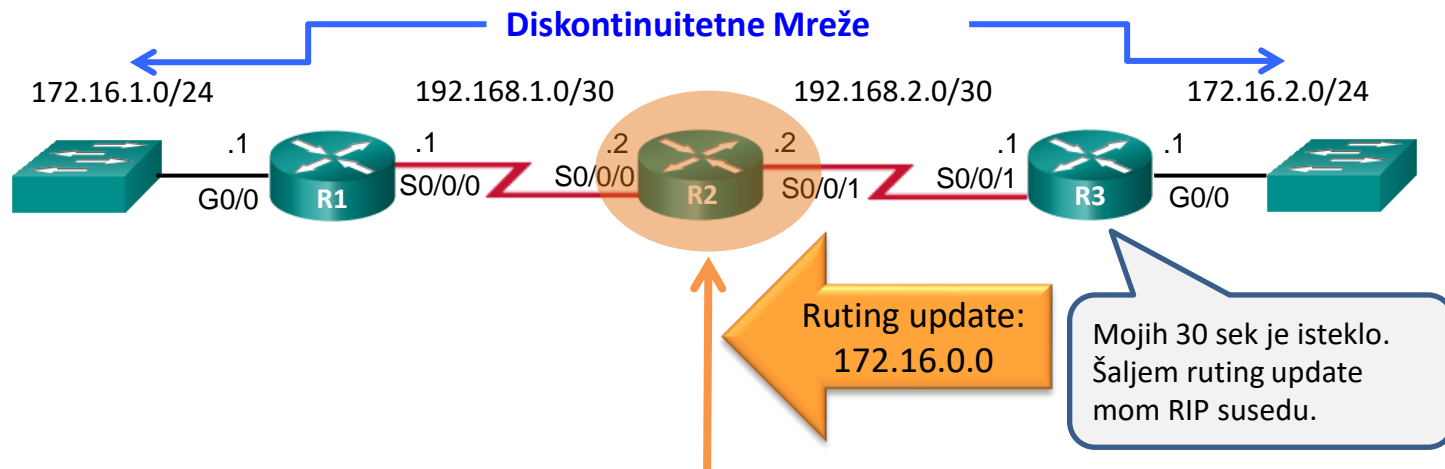
PROBLEM DISKONTINUITETNIH MREŽA



```
R2# show ip route | begin Gateway
Gateway of last resort is not set
```

```
R    172.16.0.0/16 [120/1] via 192.168.1.1, 00:00:11, Serial0/0/0
    192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.1.0/30 is directly connected, Serial0/0/0
L    192.168.1.2/32 is directly connected, Serial0/0/0
    192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.2.0/30 is directly connected, Serial0/0/1
L    192.168.2.2/32 is directly connected, Serial0/0/1
R2#
```

PROBLEM DISKONTINUITETNIH MREŽA



```
R2# show ip route | begin Gateway
```

```
Gateway of last resort is not set
```

```
R    172.16.0.0/16 [120/1] via 192.168.2.1, 00:00:14, Serial0/0/1  
      [120/1] via 192.168.1.1, 00:00:16, Serial0/0/0
```

```
192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
```

```
C    192.168.1.0/30 is directly connected, Serial0/0/0
```

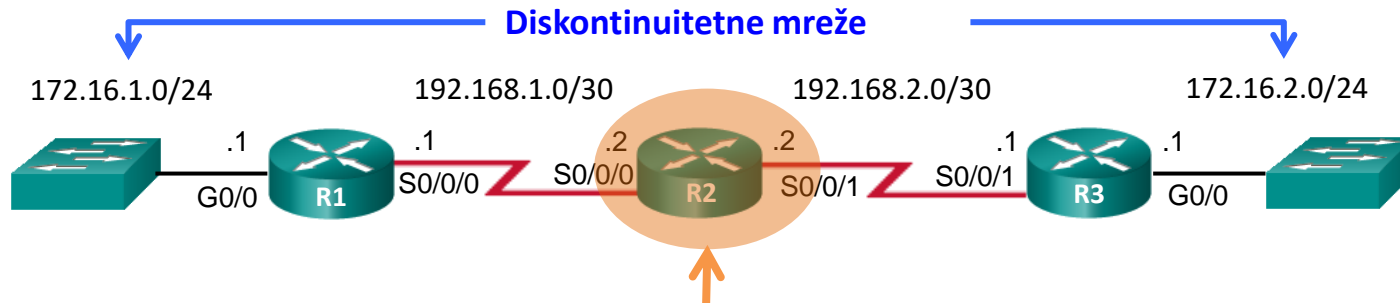
```
L    192.168.1.2/32 is directly connected, Serial0/0/0
```

```
192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
```

```
C    192.168.2.0/30 is directly connected, Serial0/0/1
```

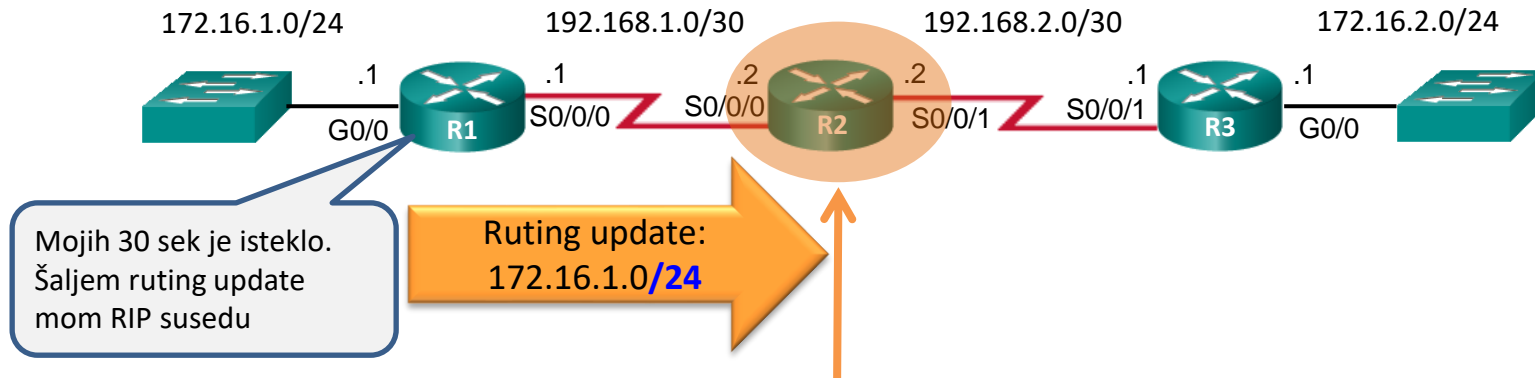
```
L    192.168.2.2/32 is directly connected, Serial0/0/1
```


PROBLEM DISKONTINUITETNIH MREŽA



```
R2# ping 172.16.1.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.1.1, timeout is 2
seconds:
U.U.U
Success rate is 0 percent (0/5)
R2#
R2# traceroute 172.16.1.1
Type escape sequence to abort.
Tracing the route to 172.16.1.1
VRF info: (vrf in name/id, vrf out name/id)
 1 192.168.1.1 4 msec
   192.168.2.1 4 msec
   192.168.1.1 4 msec
```

BEZ KLASNI RUTING PROTOKOLI



```
R2# show ip route | begin Gateway
Gateway of last resort is not set
```

```
172.16.0.0/24 is subnetted, 1 subnets
```

```
R      172.16.1.0 [120/1] via 192.168.1.1, 00:00:06, Serial0/0/0
```

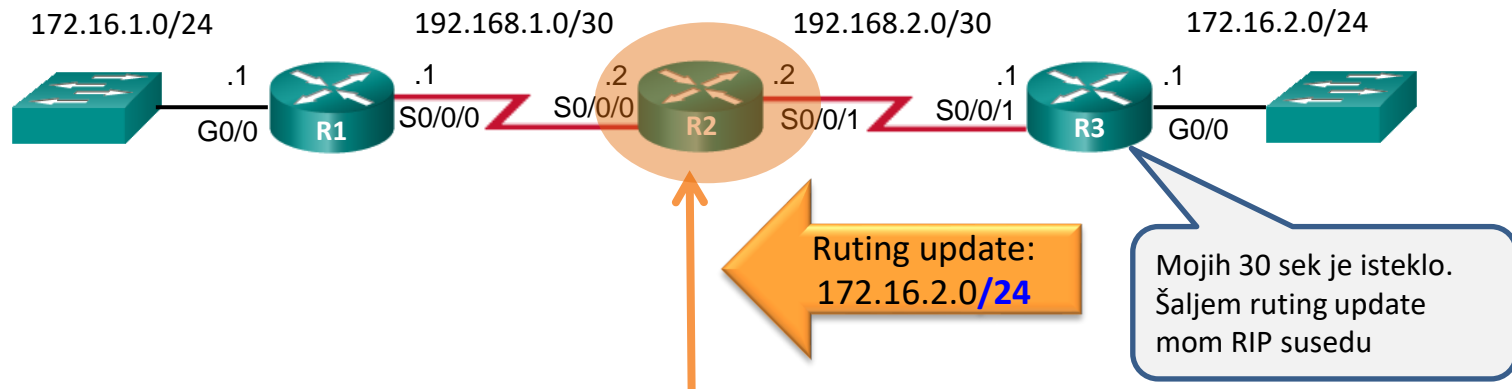
```
192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
```

```
C      192.168.1.0/30 is directly connected, Serial0/0/0
```

```
L      192.168.1.2/32 is directly connected, Serial0/0/0
```

```
R2#
```

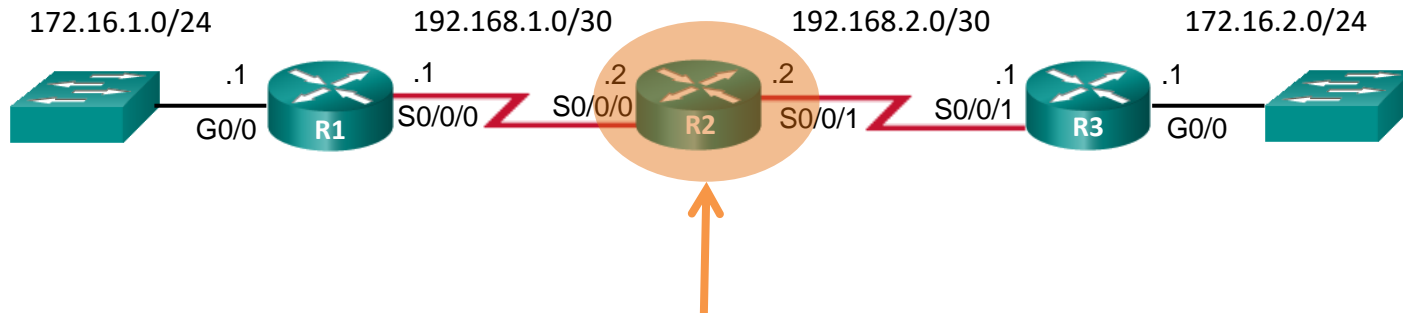
BEZ KLASNI RUTING PROTOKOLI



```
R2# show ip route | begin Gateway
Gateway of last resort is not set

    172.16.0.0/24 is subnetted, 2 subnets
R       172.16.1.0 [120/1] via 192.168.1.1, 00:00:03, Serial0/0/0
R       172.16.2.0 [120/1] via 192.168.2.1, 00:00:03, Serial0/0/1
    192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/30 is directly connected, Serial0/0/0
L       192.168.1.2/32 is directly connected, Serial0/0/0
    192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.2.0/30 is directly connected, Serial0/0/1
L       192.168.2.2/32 is directly connected, Serial0/0/1
```

BEZ KLASNI RUTING PROTOKOLI



```
R2# ping 172.16.1.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 12/14/16 ms
R2#
R2# traceroute 172.16.1.1
Type escape sequence to abort.
Tracing the route to 172.16.1.1
VRF info: (vrf in name/id, vrf out name/id)
 1 192.168.1.1 4 msec 4 msec *
R2#
```

UPOREDNE KARAKTERISTIKE RUTING PROTOKOLA

	Distance Vector				Link State	
	RIPv1	RIPv2	IGRP	EIGRP	OSPF	IS-IS
Speed of Convergence						
Scalability - Size of Network						
Use of VLSM						
Resource Usage						
Implementation and Maintenance						

METRIKA

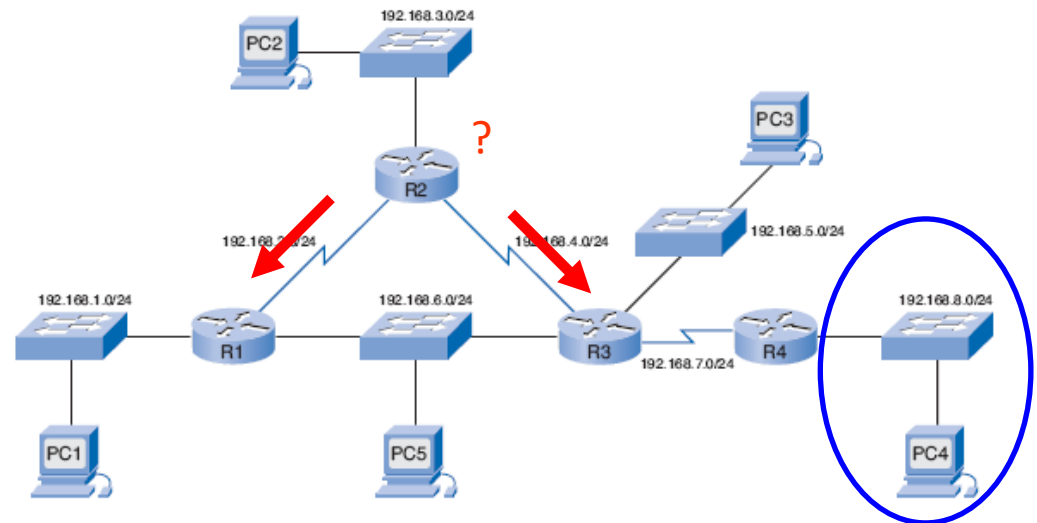
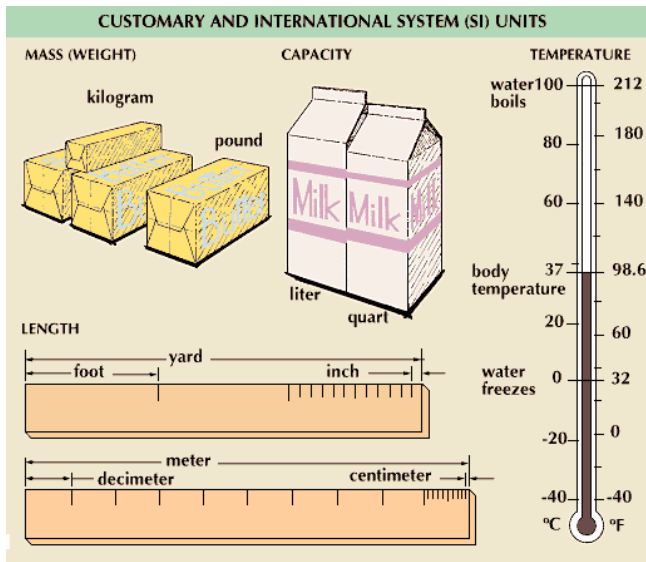
Metrika je način da izmerimo ili uporedimo dve ili više putanje

Određuje najbolju putanju

Ruting protokol može da sadrži više putanja do određene mreže.

Metrika određuje putanju koja je najoptimalnija.

Manja metrika je bolja

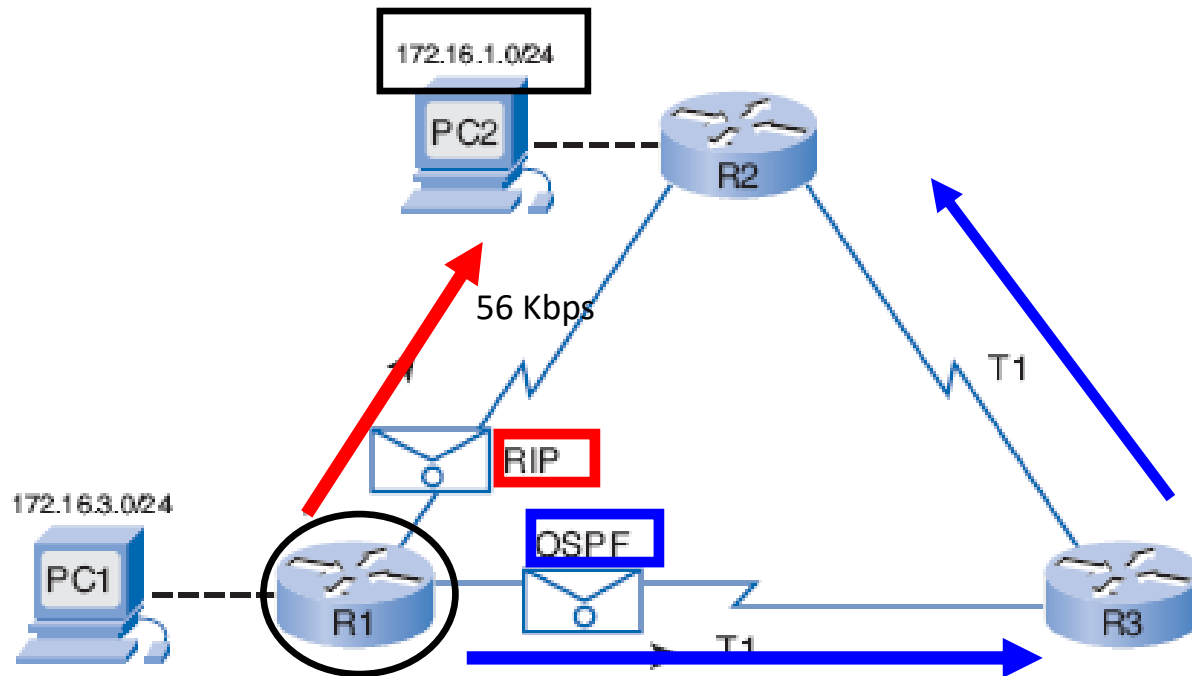


METRIKA

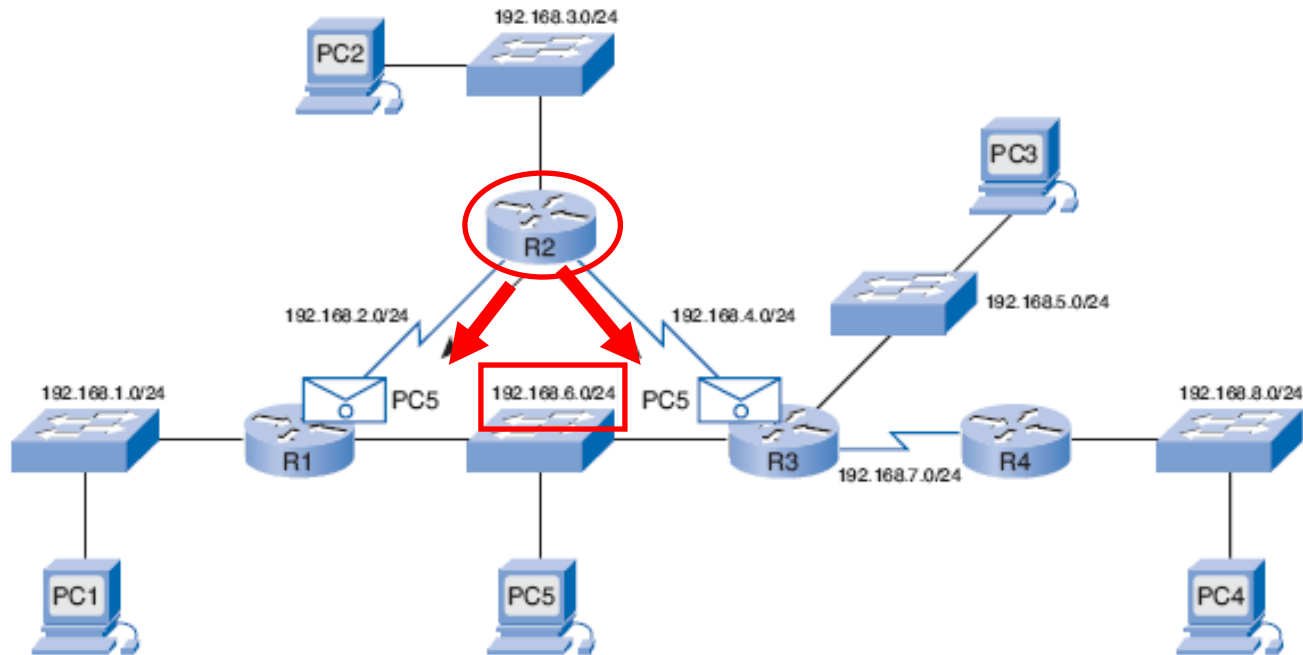
Ruting Protokol	Default Metrika	Opis

METRIKA

- Metrika između rutin protokola ne može da se kombinuje
- Dva različita rutin protokola mogu da izaberu različitu putanju do iste odredišne mreže



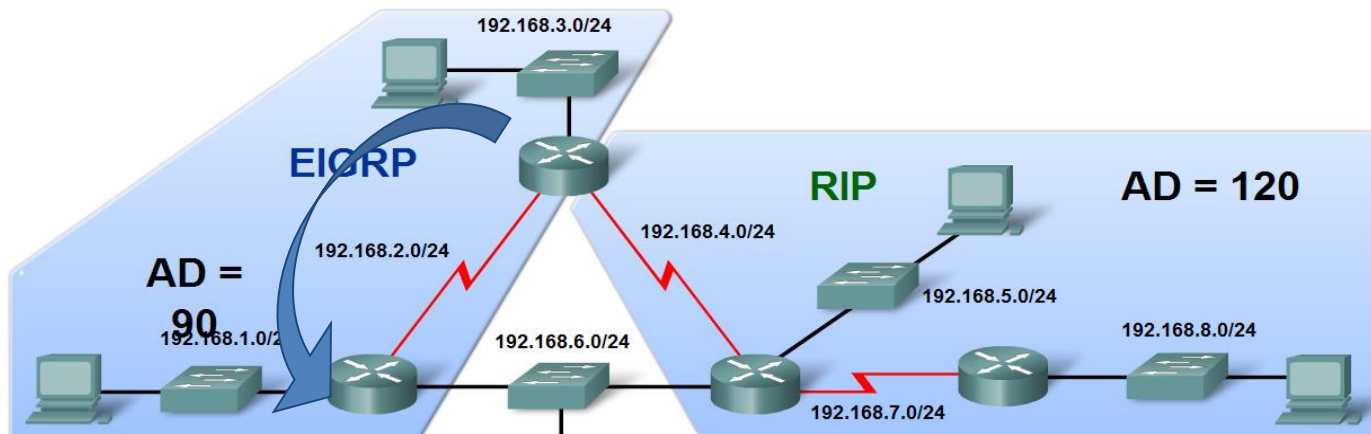
BALANSIRANJE SAOBRAĆAJA(LOAD BALANCING)



```
R2# show ip route  
<output omitted>
```

```
R      192.168.6.0/24 [120/1] via 192.168.2.1, 00:00:24, Serial0/0/0  
      [120/1] via 192.168.4.1, 00:00:26, Serial0/0/1
```

SVRHA ADMINISTRATIVNE DISTANCE

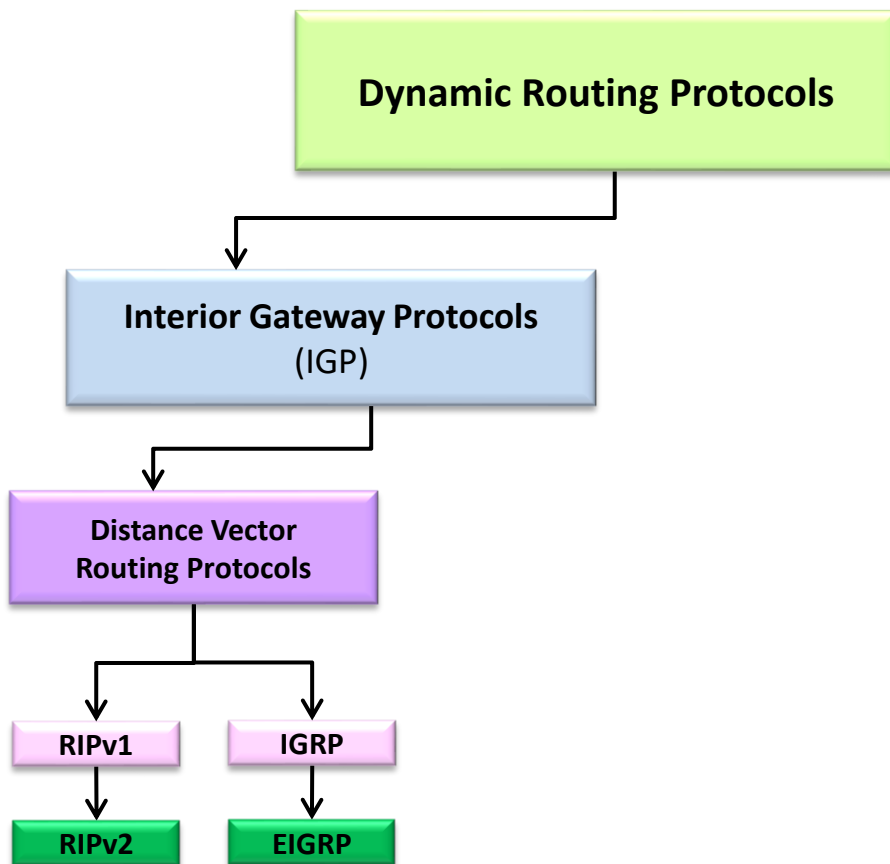


```
R2#show ip route
<output omitted>

Gateway of last resort is not set

D   192.168.1.0/24 [90/2172416] via 192.168.2.1, 00:00:24, Serial0/0/0
C   192.168.2.0/24 is directly connected, Serial0/0/0
C   192.168.3.0/24 is directly connected, FastEthernet0/0
C   192.168.4.0/24 is directly connected, Serial0/0/1
R   192.168.5.0/24 [120/1] via 192.168.4.1, 00:00:08, Serial0/0/1
D   192.168.6.0/24 [90/2172416] via 192.168.2.1, 00:00:24, Serial0/0/0
R   192.168.7.0/24 [120/1] via 192.168.4.1, 00:00:08, Serial0/0/1
R   192.168.8.0/24 [120/2] via 192.168.4.1, 00:00:08, Serial0/0/1
```

DISTANCE VECTOR RUTING PROTOKOLI



- Distance vector routing protokoli:
Razmenjuju update između svojih suseda
- Nisu svesni mrežne topologije
- RIPv1 **periodično šalje broadcast update** na IP 255.255.255.255 čak i ukoliko se topologija nije promenila
- *Update* troše bandwidth i CPU uređaja
- **EIGRP šalje update** samo kada se topologija promeni
- RIPv2 i EIGRP koriste multicast adrese

RIPv1

RIPv1 (RFC 1058) je prvi IPv4 ruting protokol koji se vrlo retko koristi.

Lako se konfiguriše, predstavlja dobar izbor za male mreže.

RIPv1 ima sledeće karakteristike:

Metrika = hop count (manji broj skoka je bolja metrika).

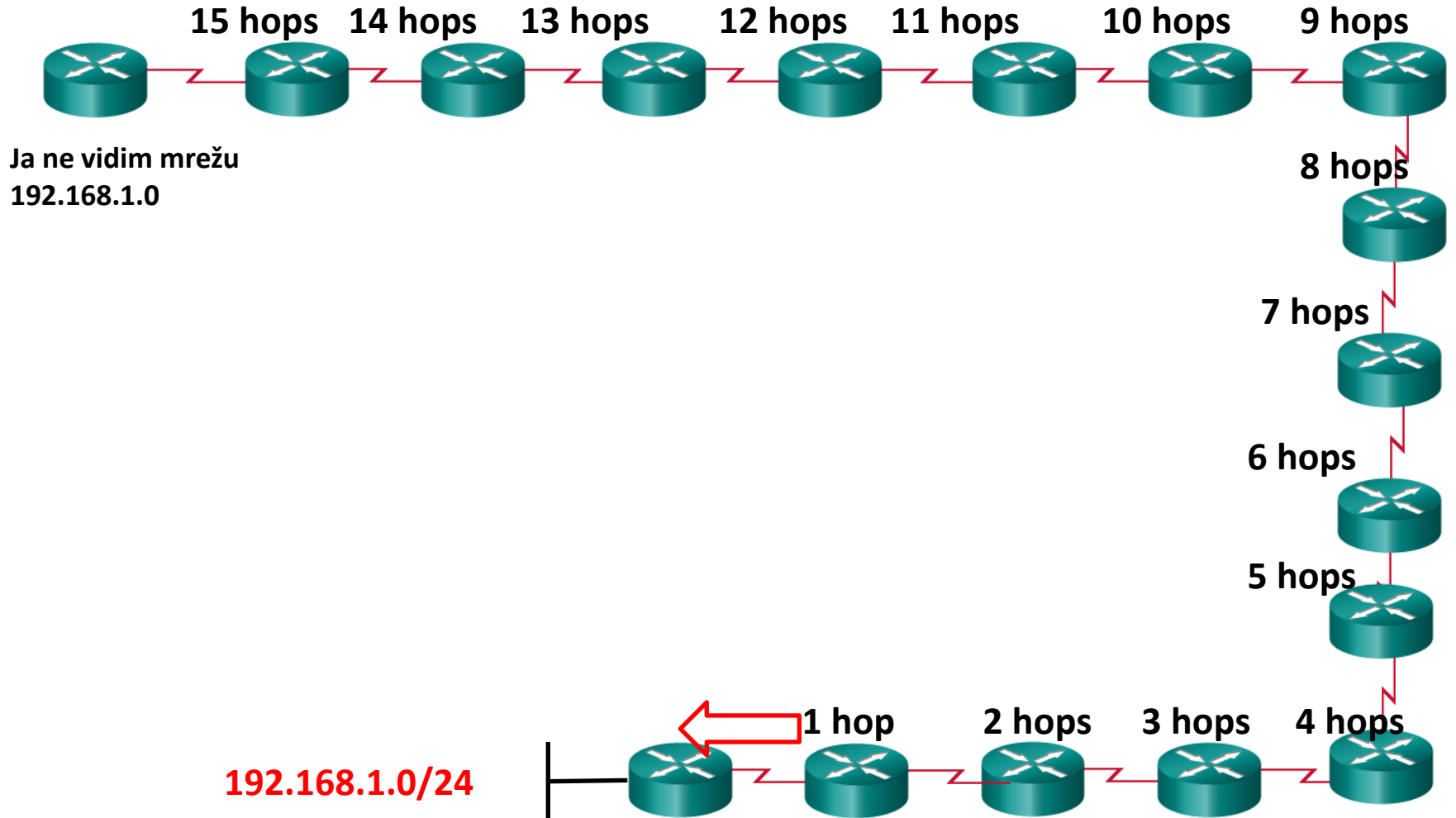
Update šalju se broadcast-om **svakih 30 sekundi na 255.255.255.255**.

Ako je hop count > 15 skoka = ruta se ne šalje dalje.

RIP updates su enkapsulirani u **UDP segment**, gde je source i destination UDP port 520.

Data Link Frame Header	IP Packet Header	UDP Segment Header	RIP Message (512 Bytes: Up to 25 Routes)
------------------------	------------------	--------------------	---

RIPv1



RIPv2

RIPv2 (RFC 1058) je zamenio RIPv1 i uključio sledeća poboljšanja:

- **Classless routing protocol:** Podržava VLSM i CIDR, jer u update je uključena i subnet maska za mrežu.
- **Povećana efikasnost:** Šalje update na multicast adresu 224.0.0.9 umesto na broadcast adresu 255.255.255.255.
- **Smanjen broj ruting unosa:** Podržava ručnu sumarizaciju.
- **Bezbednost:** Podržava autentifikaciju suseda kako bi se osigurala bezbednost ruting *update* između suseda.

KOMPERATIVNE KARAKTERISTIKE RIPv1 i RIPv2

Karakteristike rutin protokola	RIPv1	RIPv2
Metrika		
Adresa slanja update		
Podrška za VLSM		
Podrška za CIDR		
Podrška za SUMARIZACIJU		
Bezbednost		

ZAŠTO RIP?



**Routing
information
protocol**



- RIP se retko koristi u modernim mrežama!
- Koristan je kao osnova za razumevanje rutiranja.

KRATAK PREGLED

	RIPv1	RIPv2
Distance Vector ili Link State?	Distance Vector	Distance Vector
Da li je Classless ruting protokol?	✗	✓
Da li koristi trigerovano slanje update?	✓	✓
Da li koristi split horizon ili split horizon w/poison reverse?	✓	✓
Da li koristi hold-down timer?	✓	✓
Da li je maksimalni hop count = 15?	✓	✓
Da li koristi auto sumarizaciju?	✓	✓
Da li podržava CIDR?	✗	✓
Da li podržava VLSM?	✗	✓
Da li podržava autentikaciju?	✗	✓

RIP KARAKTERISTIKE

Attributes

Type

Algorithm

Admin Distance

Metric

Standard

Protocols

Transport

Authentication

Multicast IP

Terminology

Timer Defaults

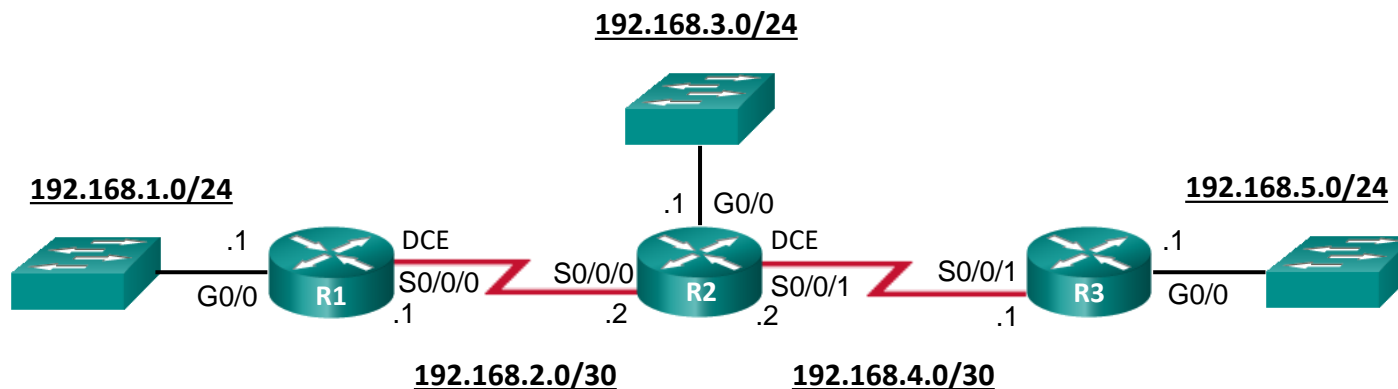
Update

Flush

Invalid

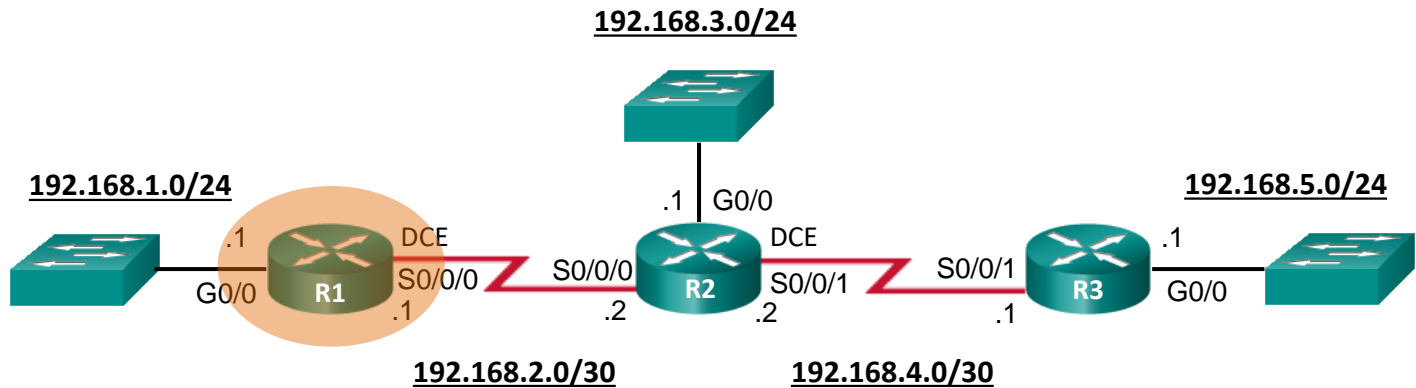
Hold-down

MREŽNA TOPOLOGIJA



Device	Interface	IP Address	Subnet Mask
R1	G0/0	192.168.1.1	255.255.255.0
	S0/0/0	192.168.2.1	255.255.255.0
R2	G0/0	192.168.3.1	255.255.255.0
	S0/0/0	192.168.2.2	255.255.255.0
	S0/0/1	192.168.4.2	255.255.255.0
R3	G0/0	192.168.5.1	255.255.255.0
	S0/0/1	192.168.4.1	255.255.255.0

KONFIGURACIJA RIP RUTING PROTOKOLA



```
R1# conf t  
Enter configuration commands, one per line. End with  
CNTL/Z.  
R1(config)# router rip  
R1(config-router)#
```

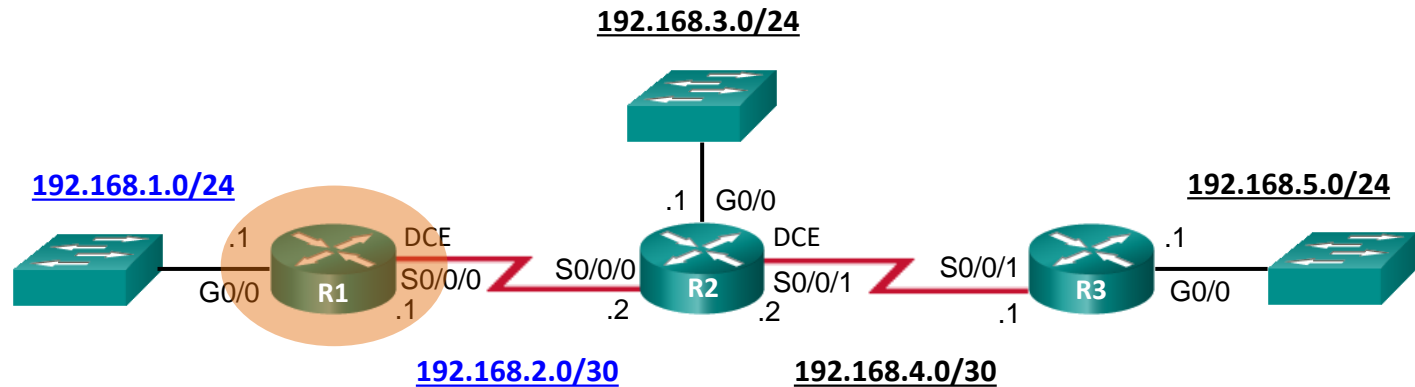
RIP KOMANDE

R1(config-router)# ?

Router configuration commands:

address-family	Enter Address Family command mode
auto-summary	Enable automatic network number summarization
default	Set a command to its defaults
default-information	Control distribution of default information
default-metric	Set metric of redistributed routes
distance	Define an administrative distance
distribute-list	Filter networks in routing updates
exit	Exit from routing protocol configuration mode
flash-update-threshold	Specify flash update threshold in second
help	Description of the interactive help system
input-queue	Specify input queue depth
maximum-paths	Forward packets over multiple paths
neighbor	Specify a neighbor router
network	Enable routing on an IP network
no	Negate a command or set its defaults
offset-list	Add or subtract offset from RIP metrics
output-delay	Interpacket delay for RIP updates
passive-interface	Suppress routing updates on an interface
redistribute	Redistribute information from another routing protocol
timers	Adjust routing timers
traffic-share	How to compute traffic share over alternate paths
validate-update-source	Perform sanity checks against source address of routing updates
version	Set routing protocol version

OGLAŠAVANJE MREŽA



```
R1 (config) # router rip
R1 (config-router) # network 192.168.1.0
R1 (config-router) # network 192.168.2.0
R1 (config-router) #
```

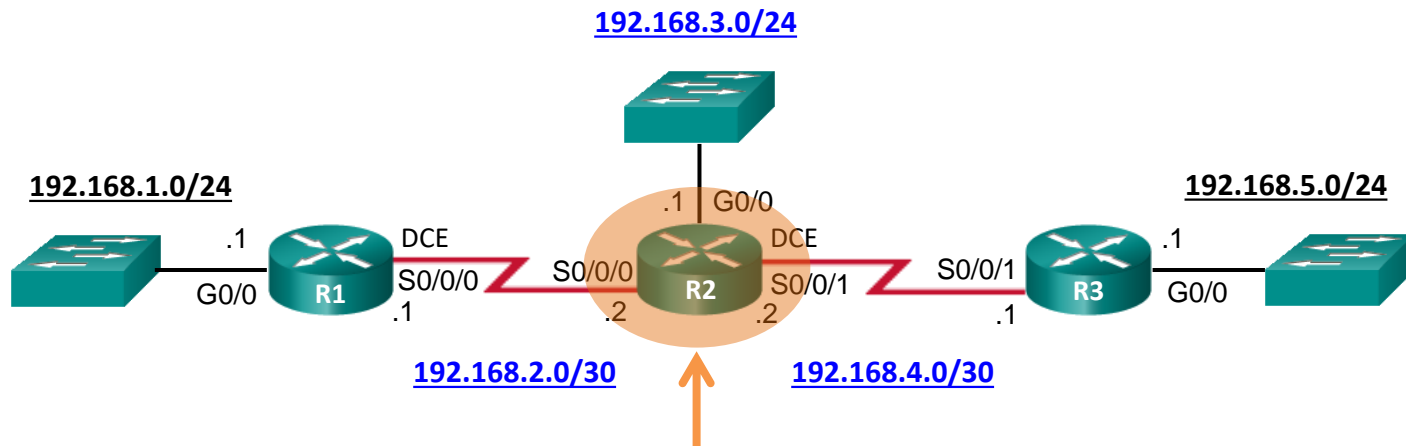
RIP se aktivira komandom **network** *network-address*

Adresu mreže unosimo za svaku **directly connected network**.

Ova komanda omogućava :

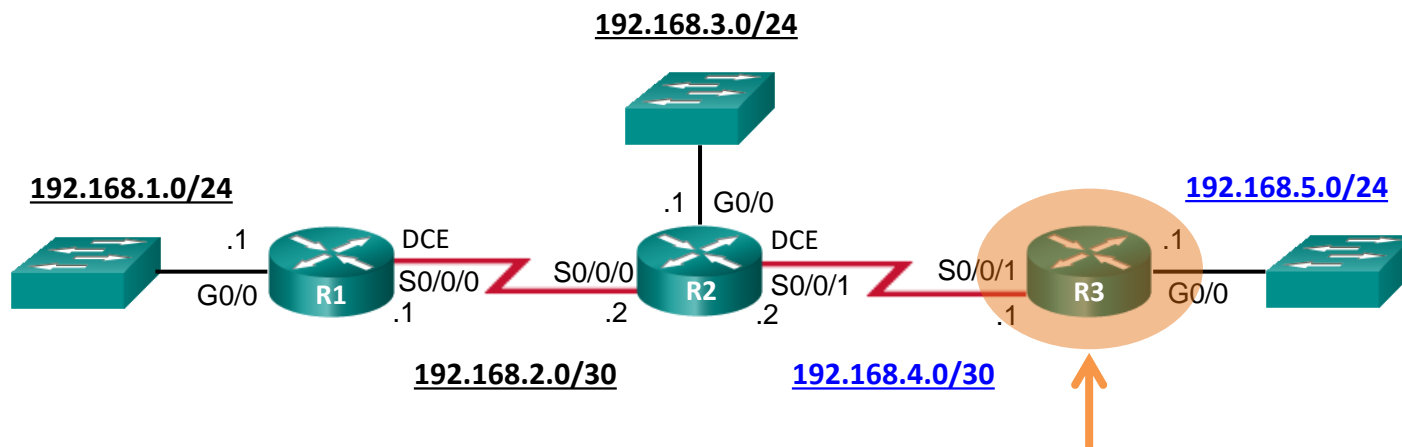
- RIP na svim interfejsima na kojima je uneta adresa u komandi network.
- Interfejsi šalju i primaju RIP update.

OGLAŠAVANJE MREŽA



```
R2 (config)# router rip  
R2 (config-router)# network 192.168.2.0  
R2 (config-router)# network 192.168.3.0  
R2 (config-router)# network 192.168.4.0  
R2 (config-router)#
```

OGLAŠAVANJE MREŽA



```
R3(config)# router rip
R3(config-router)# network 192.168.4.0
R3(config-router)# network 192.168.5.0
R3(config-router)#
```


PROVERA PARAMETRA RIP PROTOKOLA

```
R1# show ip protocols
```

```
Routing Protocol is "rip"
```

```
Outgoing update filter list for all interfaces is not set
```

```
Incoming update filter list for all interfaces is not set
```

```
Sending updates every 30 seconds, next due in 16 seconds
```

```
Invalid after 180 seconds, hold down 180, flushed after 240
```

```
Redistributing: rip
```

```
Default version control: send version 1, receive any version
```

Interface	Send	Recv	Triggered	RIP	Key-chain
GigabitEthernet0/0	1	1	2		
Serial0/0/0	1	1	2		

```
Automatic network summarization is in effect
```

```
Maximum path: 4
```

```
Routing for Networks:
```

```
192.168.1.0
```

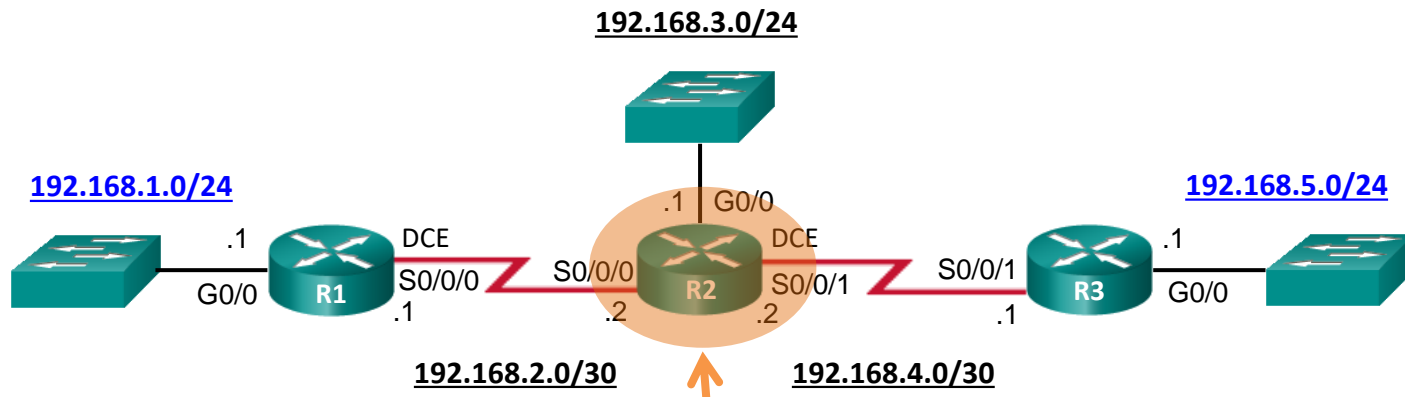
```
192.168.2.0
```

```
Routing Information Sources:
```

Gateway	Distance	Last Update
192.168.2.2	120	00:00:15

```
Distance: (default is 120)
```

PROVERA RUTING TABELE



```
R2# show ip route | begin Gateway
```

```
R 192.168.1.0/24 [120/1] via 192.168.2.1, 00:00:20, Serial0/0/0
```

```
192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
```

```
C 192.168.2.0/24 is directly connected, Serial0/0/0
```

```
L 192.168.2.2/32 is directly connected, Serial0/0/0
```

```
192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
```

```
C 192.168.3.0/24 is directly connected, GigabitEthernet0/0
```

```
L 192.168.3.1/32 is directly connected, GigabitEthernet0/0
```

```
192.168.4.0/24 is variably subnetted, 2 subnets, 2 masks
```

```
C 192.168.4.0/24 is directly connected, Serial0/0/1
```

```
L 192.168.4.2/32 is directly connected, Serial0/0/1
```

```
R 192.168.5.0/24 [120/1] via 192.168.4.1, 00:00:01, Serial0/0/1
```

RIP VERZIJA

```
R1# show ip protocols
```

```
*** IP Routing is NSF aware ***
```

```
Routing Protocol is "rip"
```

```
Outgoing update filter list for all interfaces is not set
```

```
Incoming update filter list for all interfaces is not set
```

```
Sending updates every 30 seconds, next due in 16 seconds
```

```
Invalid after 180 seconds, hold down 180, flushed after 240
```

```
Redistributing: rip
```

```
Default version control: send version 1, receive any version
```

Interface	Send	Recv	Triggered	RIP	Key-chain
GigabitEthernet0/0	1	1	2		
Serial0/0/0	1	1	2		

```
Automatic network summarization is in effect
```

```
Maximum path: 4
```

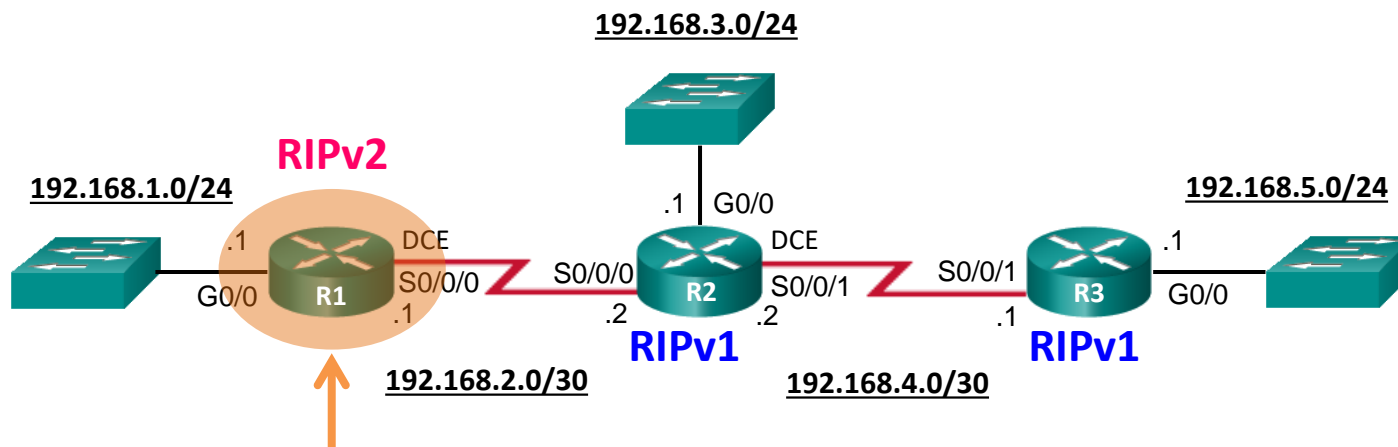
```
Routing for Networks:
```

```
192.168.1.0
```

```
192.168.2.0
```

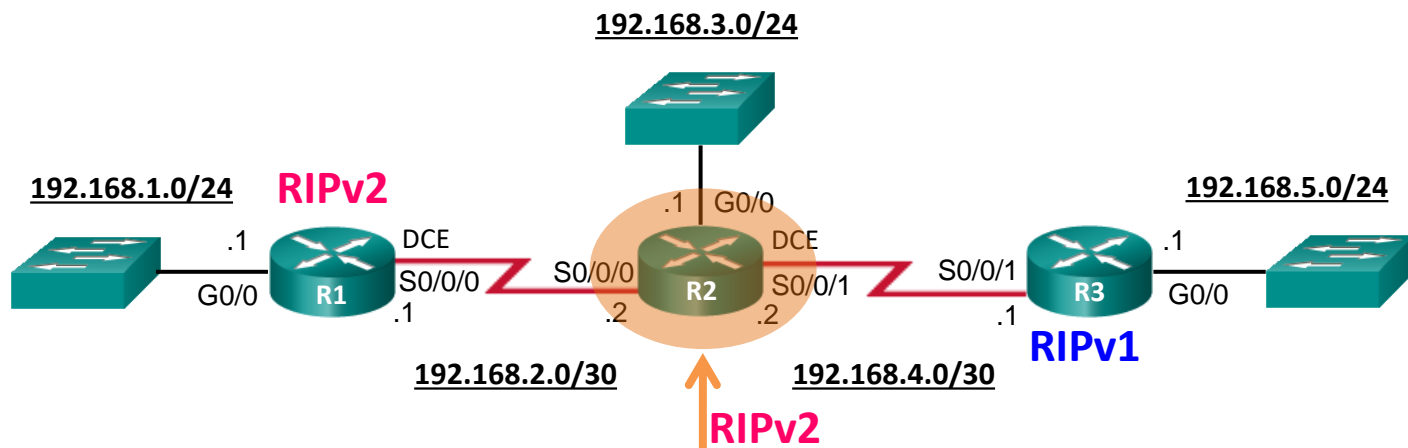
```
<Output omitted>
```

RIPv2 NA RUTERU R1



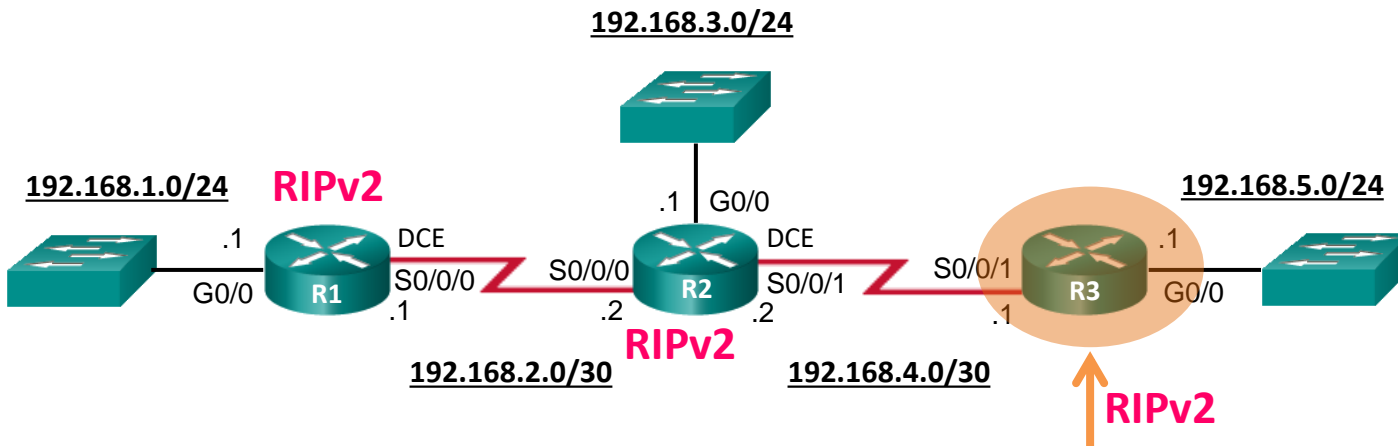
```
R1(config)# router rip
R1(config-router)# version 2
R1(config-router)# ^Z
R1#
R1# show ip protocols | section Default
  Default version control: send version 2, receive version 2
  Interface                Send  Recv  Triggered RIP  Key-chain
  GigabitEthernet0/0       2    2
  Serial0/0/0              2    2
R1#
```

RIPv2 NA RUTERU R2



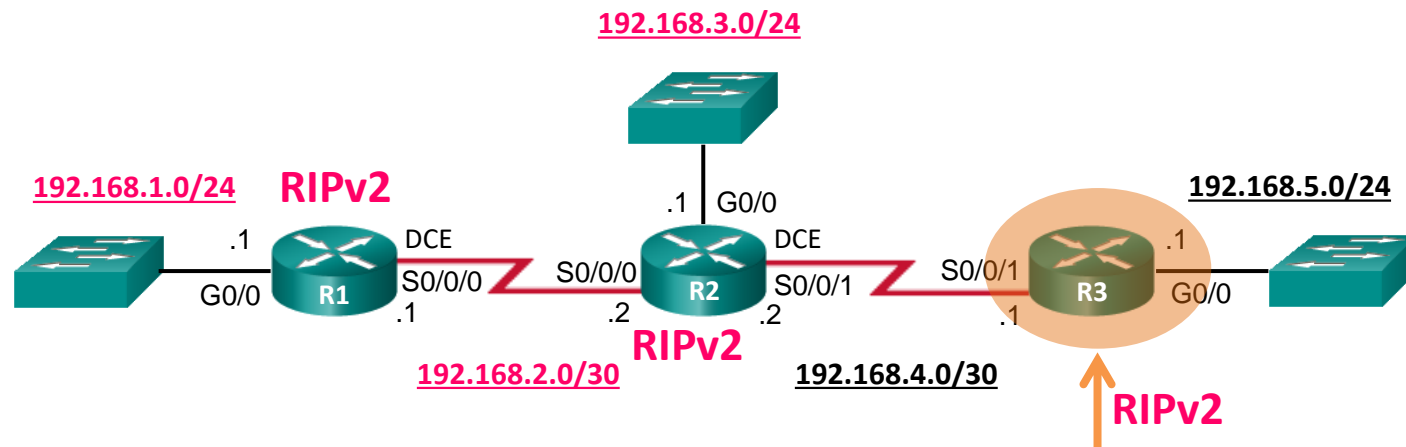
```
R2(config)# router rip
R2(config-router)# version 2
R2(config-router)# end
R2#
R2# show ip protocols | section Default
Default version control: send version 2, receive version 2
  Interface          Send  Recv  Triggered RIP  Key-chain
  GigabitEthernet0/0  2     2
  Serial0/0/0        2     2
  Serial0/0/1        2     2
R2#
```

RIPv2 NA RUTERU R3



```
R3(config)# router rip
R3(config-router)# version 2
R3(config-router)# end
R3#
R3# show ip protocols | section Default
Default version control: send version 2, receive version 2
Interface          Send  Recv  Triggered RIP  Key-chain
GigabitEthernet0/0  2     2
Serial0/0/1        2     2
R3#
```

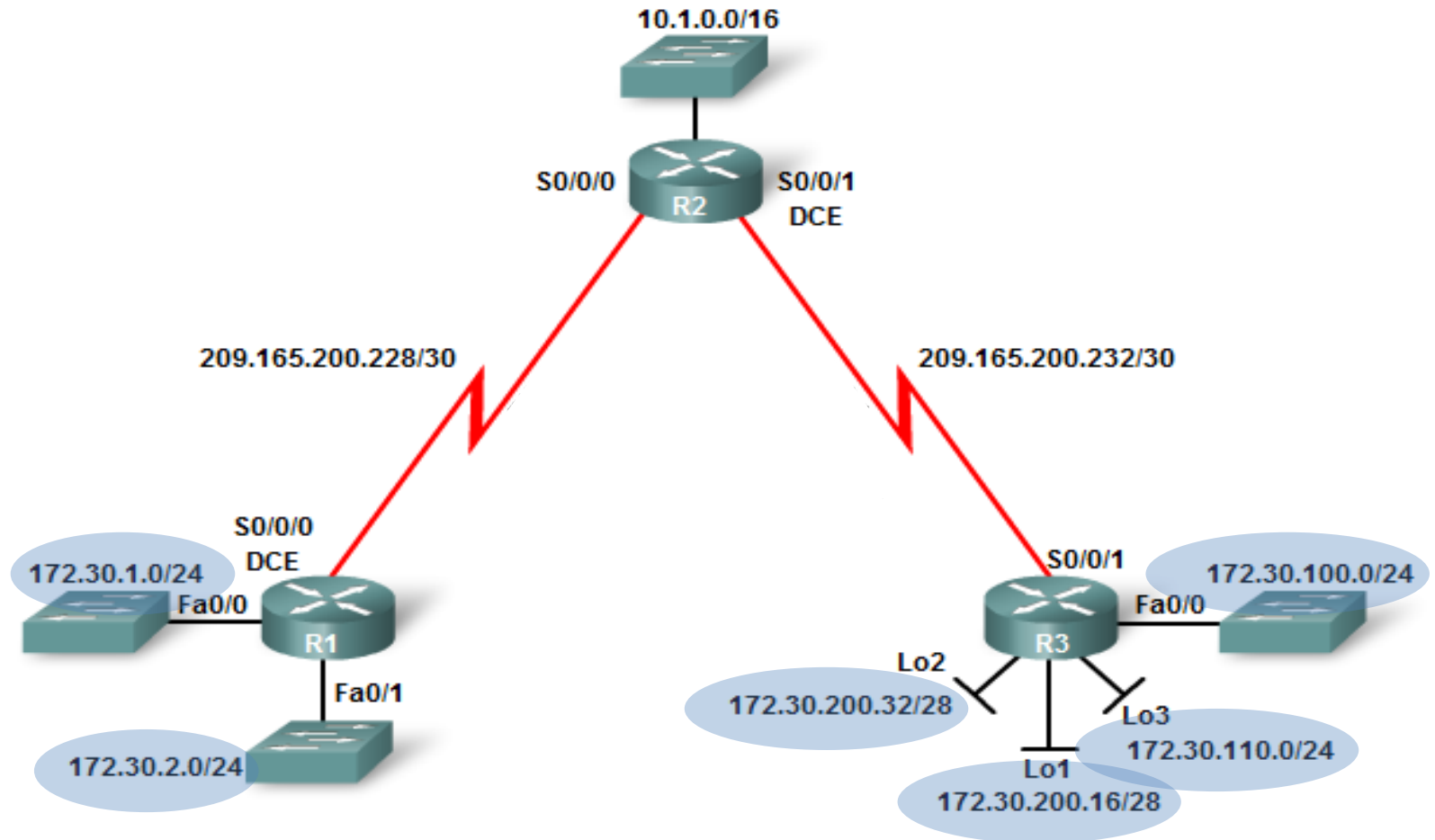
PRIKAZ RUTING TABELE NA RUTERU R3



```
R3# show ip route | begin Gateway
```

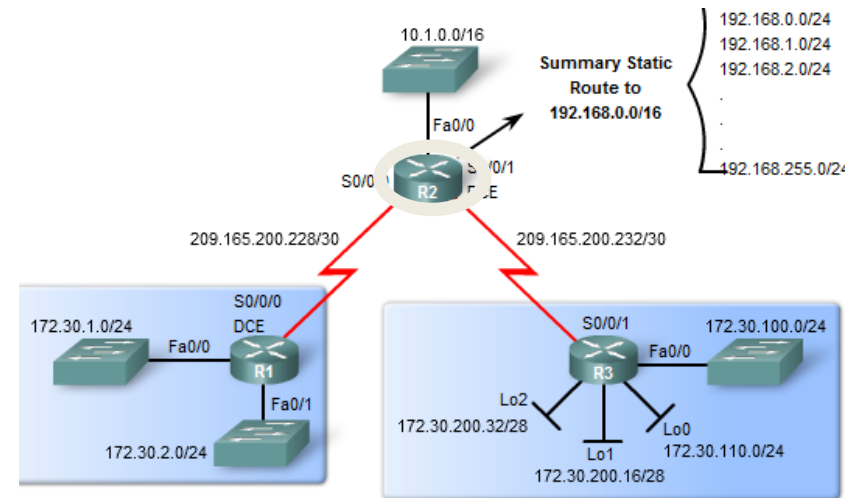
```
R    192.168.1.0/24 [120/2] via 192.168.4.2, 00:00:02, Serial0/0/1
R    192.168.2.0/24 [120/1] via 192.168.4.2, 00:00:02, Serial0/0/1
R    192.168.3.0/24 [120/1] via 192.168.4.2, 00:00:02, Serial0/0/1
    192.168.4.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.4.0/24 is directly connected, Serial0/0/1
L    192.168.4.1/32 is directly connected, Serial0/0/1
    192.168.5.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.5.0/24 is directly connected, GigabitEthernet0/0
L    192.168.5.1/32 is directly connected, GigabitEthernet0/0
```

AUTOMATSKA SUMARIZACIJA



AUTOMATSKA SUMARIZACIJA KOD RIPv2

Šta očekujete da vidite?

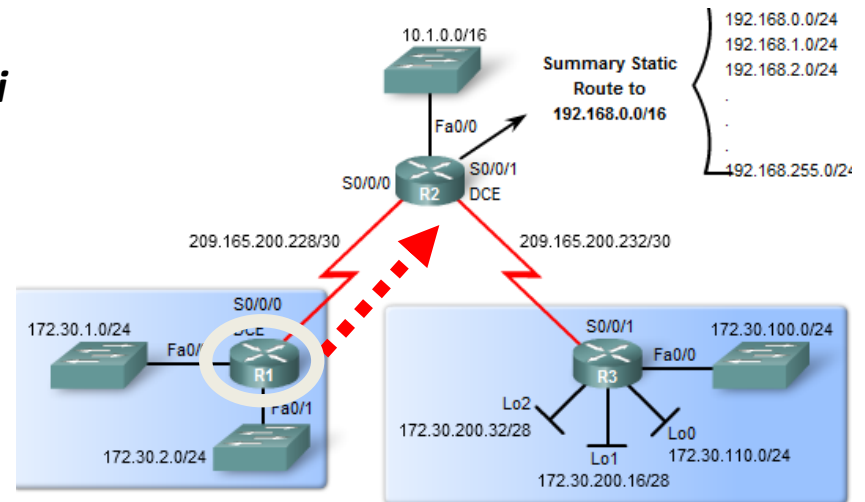


```
R2# show ip route
```

```
R   172.30.0.0/16 [120/1] via 209.165.200.230, 00:00:28, Serial10/0/0
      [120/1] via 209.165.200.234, 00:00:18, Serial10/0/1
209.165.200.0/30 is subnetted, 2 subnets
C     209.165.200.232 is directly connected, Serial10/0/1
C     209.165.200.228 is directly connected, Serial10/0/0
10.0.0.0/16 is subnetted, 1 subnets
C     10.1.0.0 is directly connected, FastEthernet0/0
S    192.168.0.0/16 is directly connected, Null0
```

RIPv2 AUTO SUMARIZACIJA

Podrazumevano RIPv2 automatski sumarizuje mreže na klasnim granicama, kao i RIPv1.



```
R1# show ip protocols
```

```
Routing Protocol is "rip"
```

```
<output omitted>
```

```
Default version control: send version 2, receive version 2
```

Interface	Send	Recv	Triggered RIP Key-chain
FastEthernet0/0	2	2	
FastEthernet0/1	2	2	
Serial0/1/0	2	2	

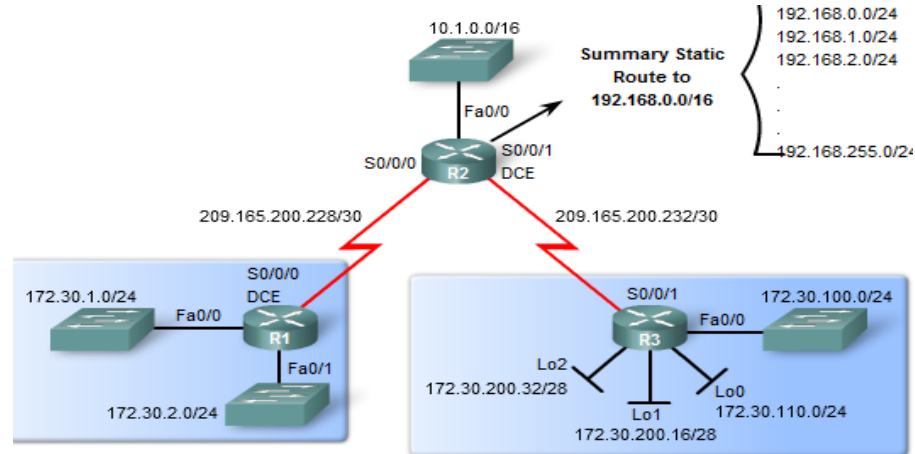
Automatic network summarization is in effect

ISKLUČIVANJE AUTO SUMARIZACIJE KOD RIPv2

```
R2 (config)# router rip  
R2 (config-router)# no auto-summary  
  
R3 (config)# router rip  
R3 (config-router)# no auto-summary  
  
R1 (config)# router rip  
R1 (config-router)# no auto-summary
```

```
R1# show ip protocols  
<output omitted>  
    Automatic network summarization is not in effect  
<output omitted>
```

PRIKAZ RUTING TABELE NAKON ISKLJUČENJA SUMARIZACIJE



```
R2# show ip route
```

```
172.30.0.0/16 is variably subnetted, 6 subnets, 2 masks
```

```
R   172.30.200.32/28 [120/1] via 209.165.200.234, 00:00:09, Serial0/0/1
R   172.30.200.16/28 [120/1] via 209.165.200.234, 00:00:09, Serial0/0/1
R   172.30.2.0/24 [120/1] via 209.165.200.230, 00:00:03, Serial0/0/0
R   172.30.1.0/24 [120/1] via 209.165.200.230, 00:00:03, Serial0/0/0
R   172.30.100.0/24 [120/1] via 209.165.200.234, 00:00:09, Serial0/0/1
R   172.30.110.0/24 [120/1] via 209.165.200.234, 00:00:09, Serial0/0/1
```

```
209.165.200.0/30 is subnetted, 2 subnets
```

```
C   209.165.200.232 is directly connected, Serial0/0/1
C   209.165.200.228 is directly connected, Serial0/0/0
```

```
10.0.0.0/16 is subnetted, 1 subnets
```

```
C   10.1.0.0 is directly connected, FastEthernet0/0
```

```
S 192.168.0.0/16 is directly connected, Null0
```

PROVERA RIP UPDATE U REALNOM VREMENU

R2# **debug ip rip**

RIP: **received v2** update from 209.165.200.234 on Serial0/0/1

172.30.100.0/24 via 0.0.0.0 in 1 hops

172.30.110.0/24 via 0.0.0.0 in 1 hops

172.30.200.16/28 via 0.0.0.0 in 1 hops

172.30.200.32/28 via 0.0.0.0 in 1 hops

RIP: **sending v2** update to 224.0.0.9 via Serial0/0/0 (209.165.200.229)

RIP: build update entries

10.1.0.0/16 via 0.0.0.0, metric 1, tag 0

172.30.100.0/24 via 0.0.0.0, metric 2, tag 0

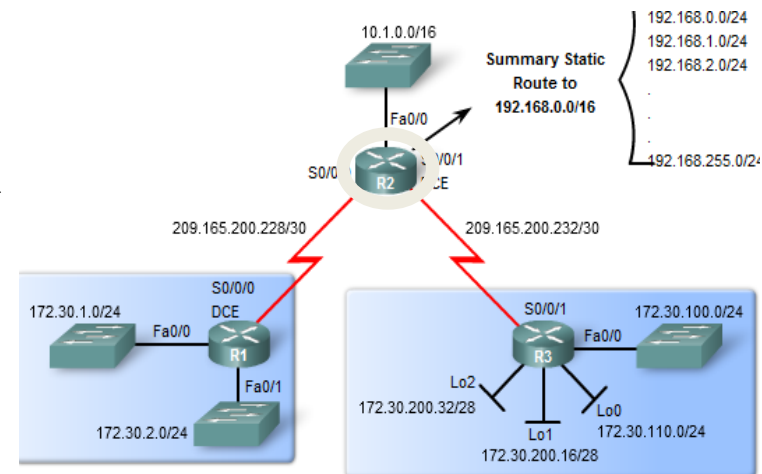
172.30.110.0/24 via 0.0.0.0, metric 2, tag 0

172.30.200.16/28 via 0.0.0.0, metric 2, tag 0

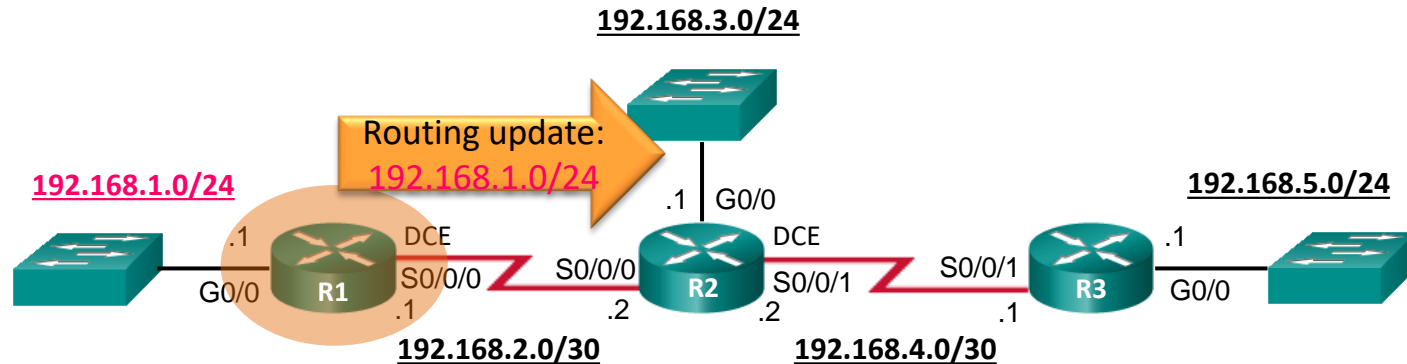
172.30.200.32/28 via 0.0.0.0, metric 2, tag 0

192.168.0.0/16 via 0.0.0.0, metric 1, tag 0

209.165.200.232/30 via 0.0.0.0, metric 1, tag



KONFIGURACIJA PASIVNOG INTERFEJSA NA R1



```
R1(config)# router rip
R1(config-router)# passive-interface g0/0
R1(config-router)# end
R1# show ip protocols | begin Default
```

```
Default version control: send version 2, receive version 2
Interface          Send  Recv  Triggered RIP  Key-chain
Serial0/0/0        2    2
```

Automatic network summarization is not in effect

Maximum path: 4

Routing for Networks:

192.168.1.0

192.168.2.0

Passive Interface(s):

GigabitEthernet0/0

Routing Information Sources:

Gateway	Distance	Last Update
192.168.2.2	120	00:00:06)

KONFIGURACIJA PASIVNOG INTERFEJSA NA R2

```
R2(config)# router rip
R2(config-router)# passive-interface g0/0
R2(config-router)# end
R2#
*Mar 10 16:33:32.391: %SYS-5-CONFIG_I: Configured from console by
console
R2# show ip protocols | begin Default
Default version control: send version 2, receive version 2
  Interface          Send  Recv  Triggered RIP  Key-chain
  Serial0/0/0        2     2
  Serial0/0/1        2     2
Automatic network summarization is not in effect
Maximum path: 4
Routing for Networks:
  192.168.2.0
  192.168.3.0
  192.168.4.0
Passive Interface(s):
  GigabitEthernet0/0
Routing Information Sources:
  Gateway          Distance      Last Update
  192.168.2.1      120          00:00:24
  Gateway          Distance      Last Update
  192.168.4.1      120          00:00:23
Distance: (default is 120)
```


KONFIGURACIJA PASIVNOG INTERFEJSA NA R3

```
R3(config)# router rip
R3(config-router)# passive-interface default
R3(config-router)# no passive-interface s0/0/1
R3(config-router)# end
*Mar 10 16:34:28.899: %SYS-5-CONFIG_I: Configured from console
R3# show ip protocols | begin Default
```

```
Default version control: send version 2, receive version 2
Interface          Send Recv Triggered RIP Key-chain
Serial0/0/1        2     2
```

Automatic network summarization is not in effect

Maximum path: 4

Routing for Networks:

192.168.4.0

192.168.5.0

Passive Interface(s):

Embedded-Service-Engine0/0

GigabitEthernet0/0

GigabitEthernet0/1

GigabitEthernet0/3

Serial0/0/0

Routing Information Sources:

Gateway	Distance	Last Update
192.168.4.2	120	00:00:23

Distance: (default is 120)

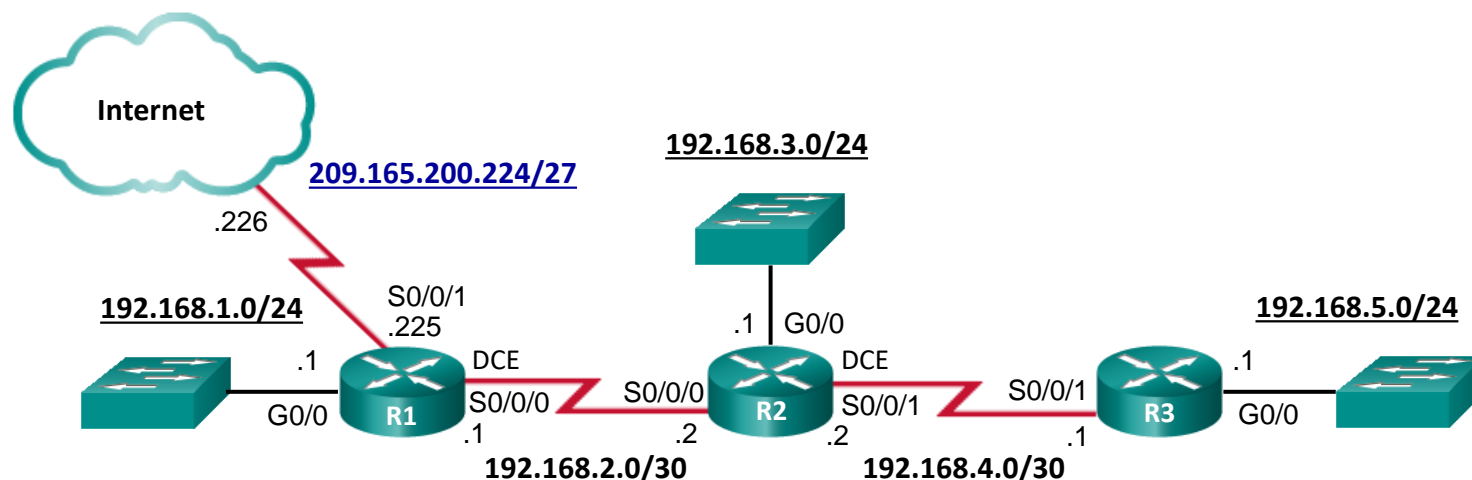
NOTE:

- Kao alternativa, svi interfejsi se mogu konfigurirati kao pasivni komandom **passive-interface default**.
- Za interfejse koji nisu pasivni uneti komandu **no passive-interface**

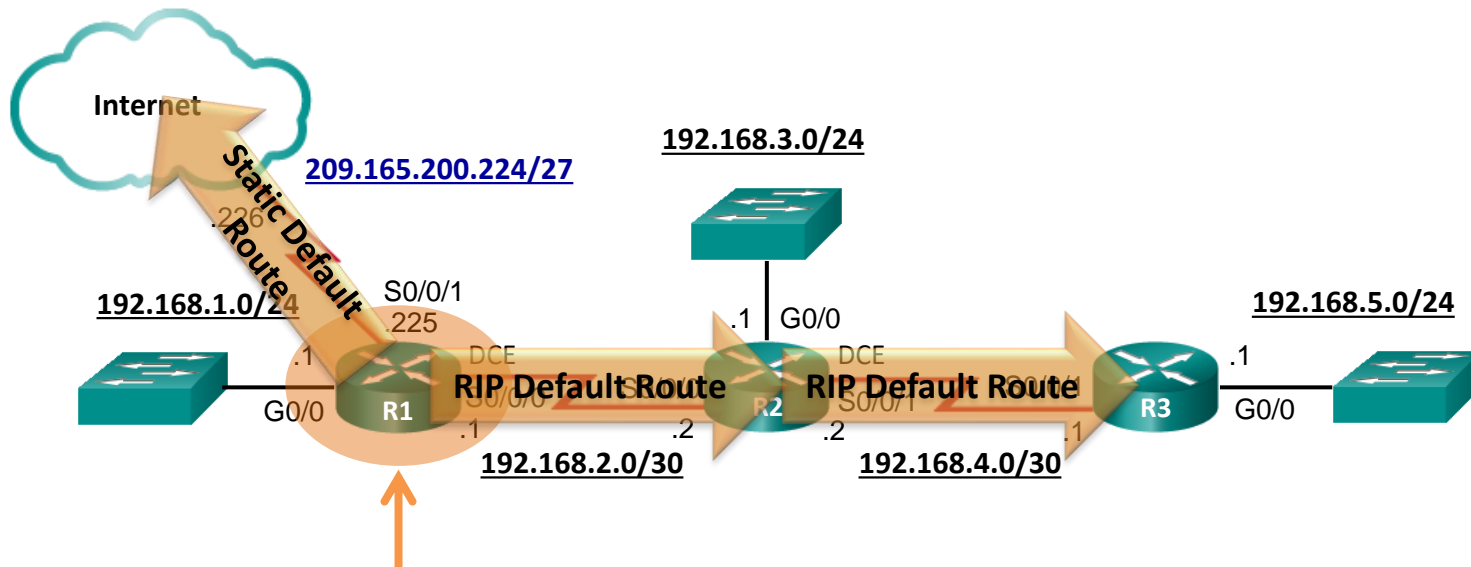
PROPAGACIJA DEFAULT RUTE KROZ RIP RUTING PROTOKOL

Podrazumevana statička ruta se konfigurise na edge ruteru ka ISP-u, a zatim se obično ova ruta propagira kroz RIP ruting protokol do svih RIP rutera

Drugo rešenje je da se podrazumevana statička ruta konfigurise na svim ruterima pojedinačno

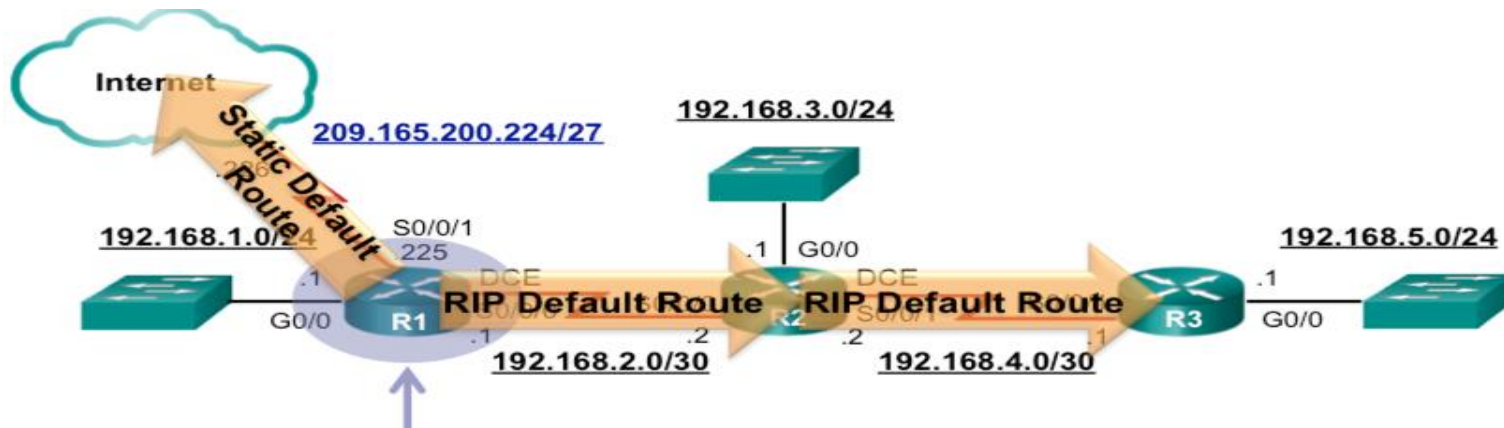


PROPAGACIJA DEFAULT RUTE KROZ RIP RUTING PROTOKOL



```
R1(config)# ip route 0.0.0.0 0.0.0.0 s0/0/1 209.165.200.226
R1(config)# router rip
R1(config-router)# default-information originate
R1(config-router)# ^Z
R1#
*Mar 10 23:33:51.801: %SYS-5-CONFIG_I: Configured from
console by console
```

PRIKAZ RUTING TABELE NA RUTERU R1

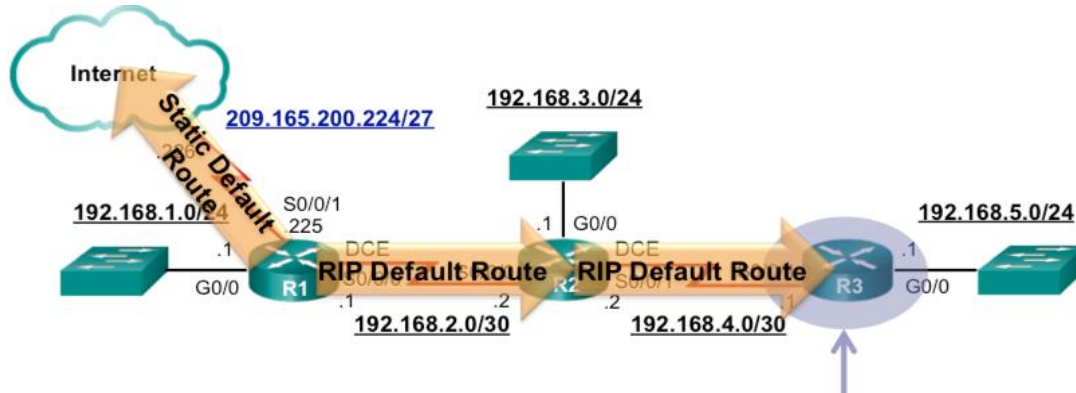


```
R1# show ip route | begin Gateway
```

```
Gateway of last resort is 209.165.200.226 to network 0.0.0.0
```

```
S* 0.0.0.0/0 [1/0] via 209.165.200.226, Serial0/0/1
    192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.1.0/24 is directly connected, GigabitEthernet0/0
L    192.168.1.1/32 is directly connected, GigabitEthernet0/0
    192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.2.0/24 is directly connected, Serial0/0/0
L    192.168.2.1/32 is directly connected, Serial0/0/0
R    192.168.3.0/24 [120/1] via 192.168.2.2, 00:00:08, Serial0/0/0
R    192.168.4.0/24 [120/1] via 192.168.2.2, 00:00:08, Serial0/0/0
R    192.168.5.0/24 [120/2] via 192.168.2.2, 00:00:08, Serial0/0/0
    209.165.200.0/24 is variably subnetted, 2 subnets, 2 masks
C    209.165.200.0/24 is directly connected, Serial0/0/1
```

PRIKAZ RUTING TABELE NA RUTERU R3



```
R3# show ip route | begin Gateway
```

```
Gateway of last resort is 192.168.4.2 to network 0.0.0.0
```

```
R* 0.0.0.0/0 [120/2] via 192.168.4.2, 00:00:00, Serial0/0/1
R 192.168.1.0/24 [120/2] via 192.168.4.2, 00:00:00, Serial0/0/1
R 192.168.2.0/24 [120/1] via 192.168.4.2, 00:00:00, Serial0/0/1
R 192.168.3.0/24 [120/1] via 192.168.4.2, 00:00:00, Serial0/0/1
  192.168.4.0/24 is variably subnetted, 2 subnets, 2 masks
C   192.168.4.0/24 is directly connected, Serial0/0/1
L   192.168.4.1/32 is directly connected, Serial0/0/1
  192.168.5.0/24 is variably subnetted, 2 subnets, 2 masks
C   192.168.5.0/24 is directly connected, GigabitEthernet0/0
L   192.168.5.1/32 is directly connected, GigabitEthernet0/0
```