ARP PROTOKOL

Predmet: Računarske mreže

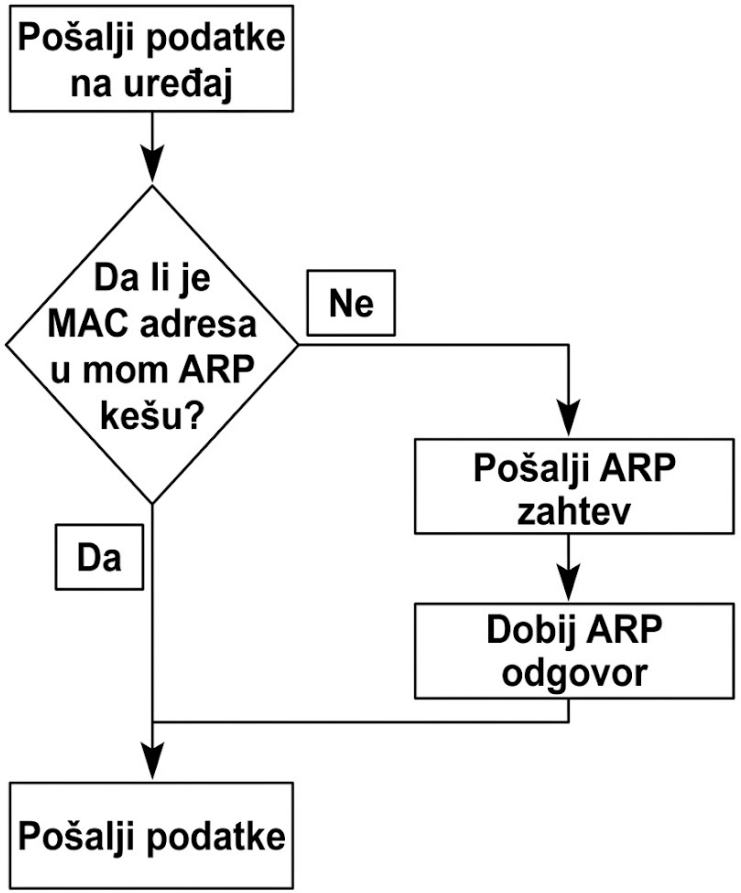
Predavač: dr Dušan Stefanović

ADDRESS RESOLUTION PROTOCOL (ARP)

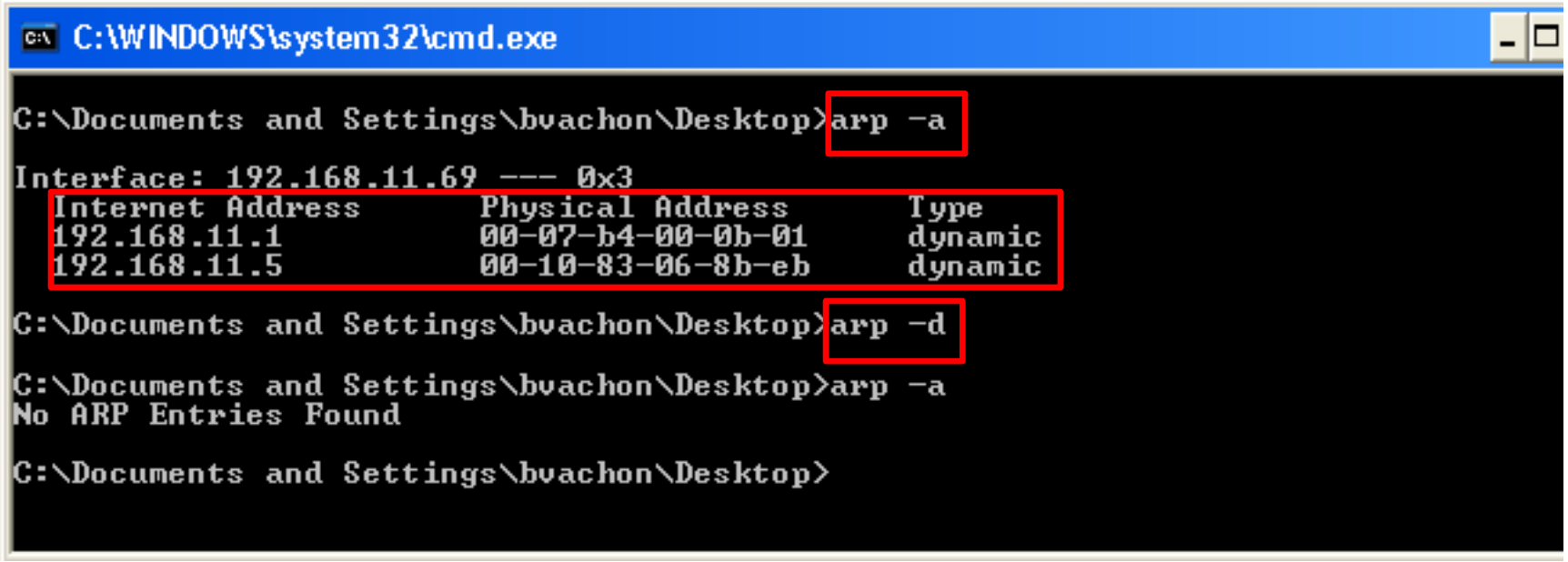
Princip rada ARP-a:

1.Razrešava MAC adrese na osnovu IP adrese

2.Čuva ARP informacije u ARP tabeli (ARP keš)



ARP KEŠ TABELA



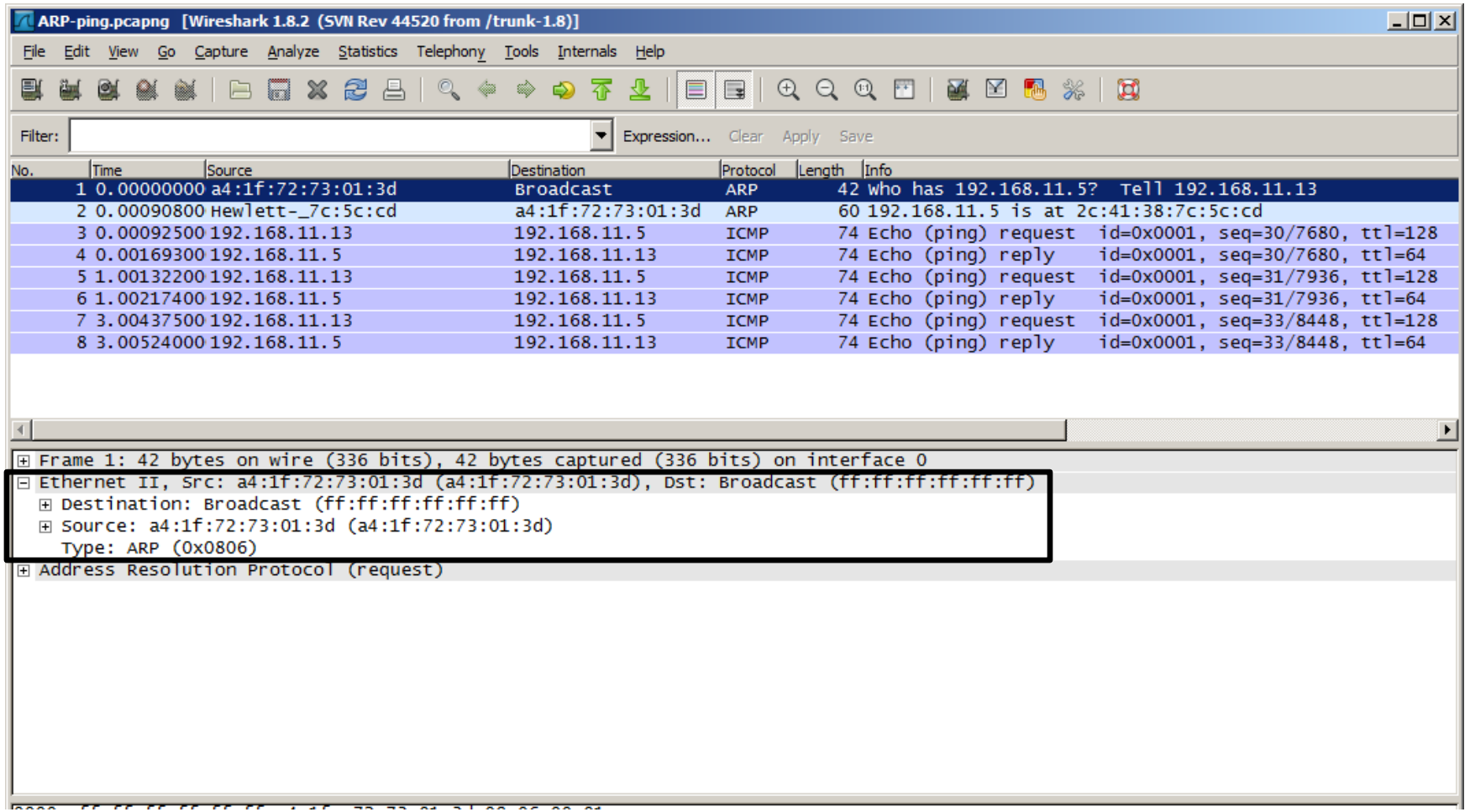
PRIMER RADA ARP PROTOKOLA

```
C:\Users\Dusan> arp -a

Interface: 192.168.11.13 --- 0xb
  Internet Address      Physical Address      Type
  192.168.11.1          00-07-b4-00-0b-01     dynamic

C:\Users\Dusan>
C:\Users\Dusan> ping 192.168.11.5

Pinging 192.168.11.5 with 32 bytes of data:
Reply from 192.168.11.5: bytes=32 time=1ms TTL=64
Reply from 192.168.11.5: bytes=32 time<1ms TTL=64
Reply from 192.168.11.5: bytes=32 time=1ms TTL=64
Reply from 192.168.11.5: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.11.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

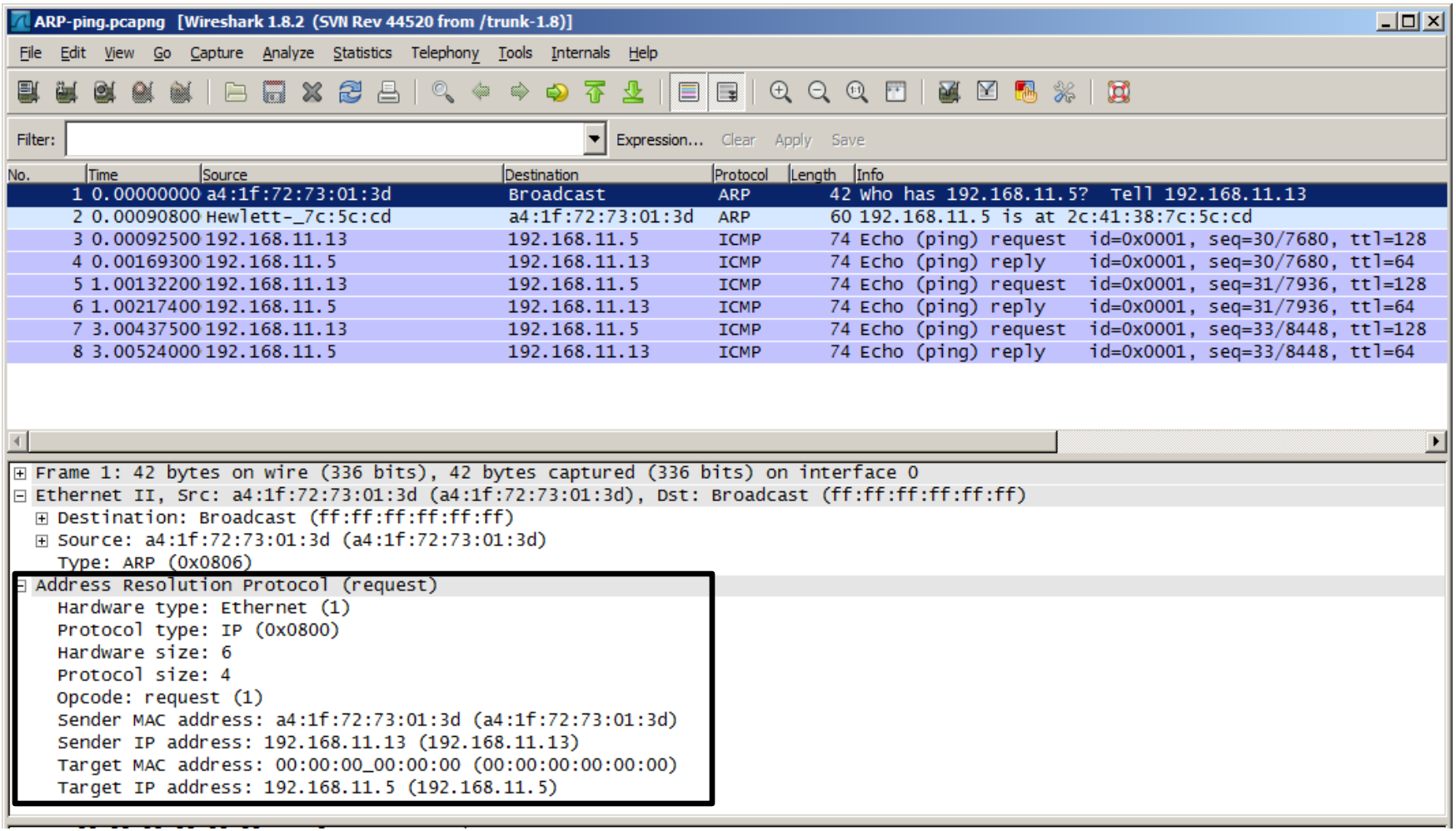
Start Wireshark

Stop Wireshark

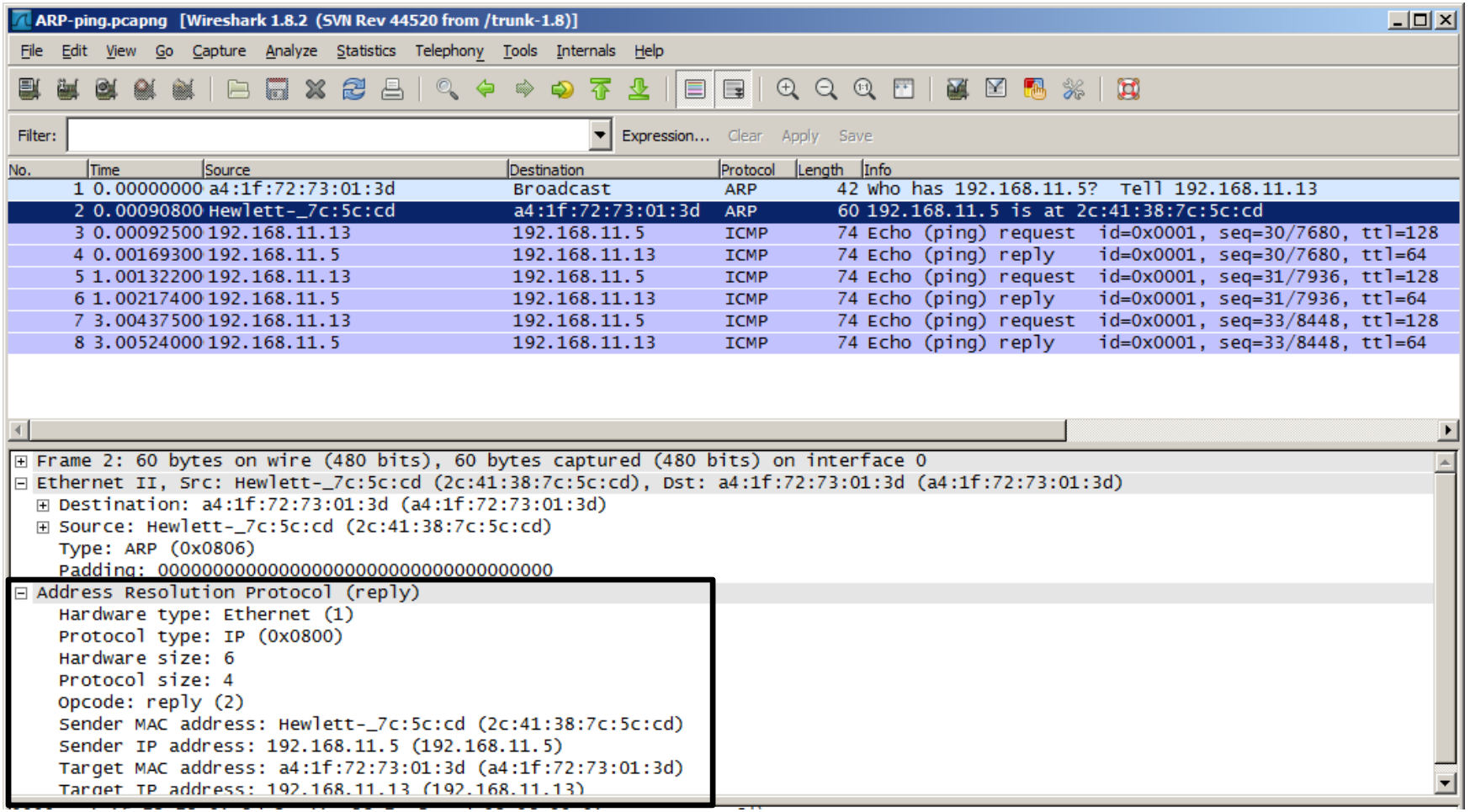
ARP REQUEST PORUKA (PODACI U FREJMU)



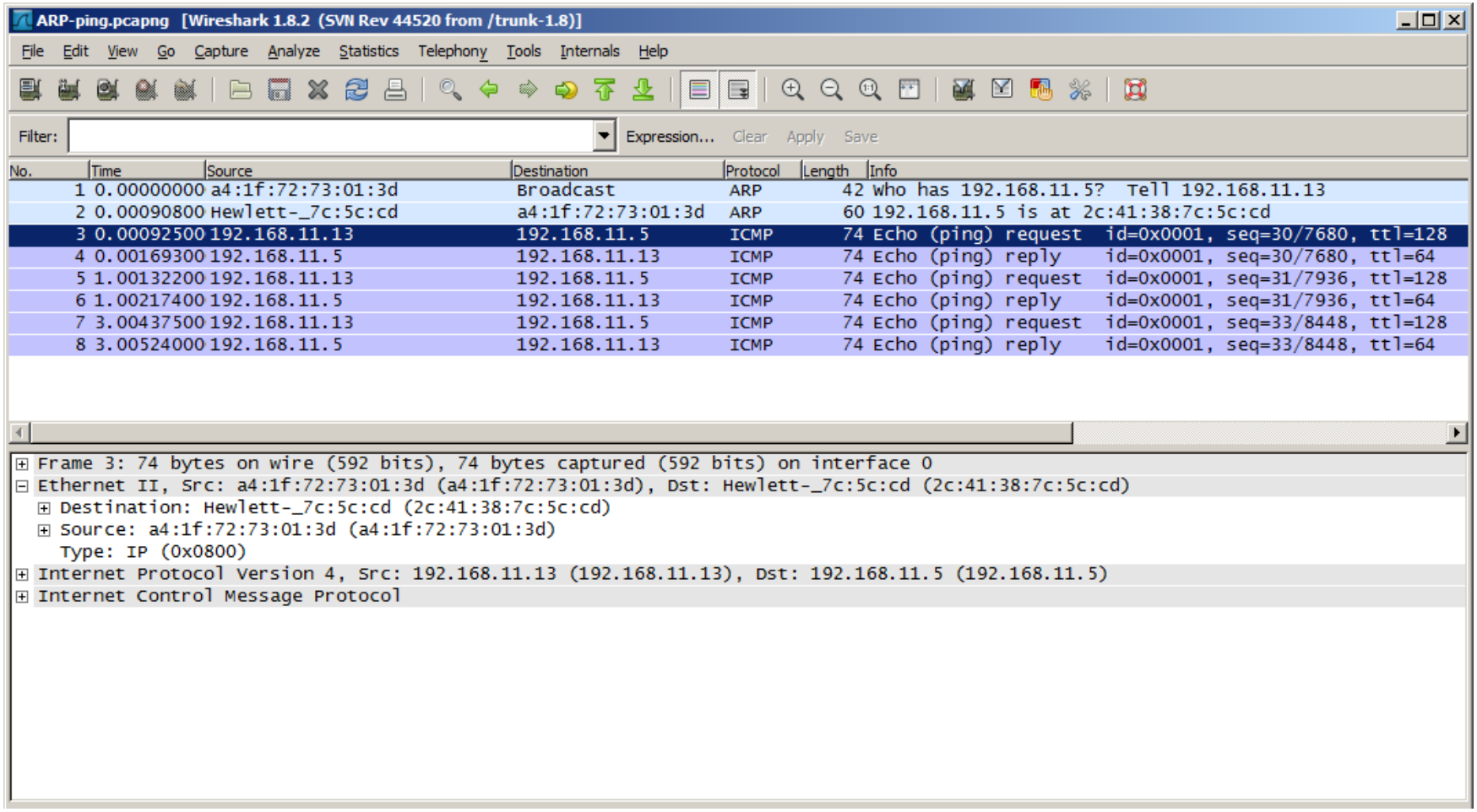
ARP REQUEST PORUKA (PAYLOAD PODACI)



ARP REPLY


ARP-ping.pcapng [Wireshark 1.8.2 (SVN Rev 44520 from /trunk-1.8)]
File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help
Filter: Expression... Clear Apply Save
No. Time Source Destination Protocol Length Info
1 0.00000000 a4:1f:72:73:01:3d Broadcast ARP 42 who has 192.168.11.5? Tell 192.168.11.13
2 0.00090800 Hewlett-_7c:5c:cd a4:1f:72:73:01:3d ARP 60 192.168.11.5 is at 2c:41:38:7c:5c:cd
3 0.00092500 192.168.11.13 192.168.11.5 ICMP 74 Echo (ping) request id=0x0001, seq=30/7680, ttl=128
4 0.00169300 192.168.11.5 192.168.11.13 ICMP 74 Echo (ping) reply id=0x0001, seq=30/7680, ttl=64
5 1.00132200 192.168.11.13 192.168.11.5 ICMP 74 Echo (ping) request id=0x0001, seq=31/7936, ttl=128
6 1.00217400 192.168.11.5 192.168.11.13 ICMP 74 Echo (ping) reply id=0x0001, seq=31/7936, ttl=64
7 3.00437500 192.168.11.13 192.168.11.5 ICMP 74 Echo (ping) request id=0x0001, seq=33/8448, ttl=128
8 3.00524000 192.168.11.5 192.168.11.13 ICMP 74 Echo (ping) reply id=0x0001, seq=33/8448, ttl=64
Frame 2: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface 0
Ethernet II, Src: Hewlett-_7c:5c:cd (2c:41:38:7c:5c:cd), Dst: a4:1f:72:73:01:3d (a4:1f:72:73:01:3d)
Destination: a4:1f:72:73:01:3d (a4:1f:72:73:01:3d)
Source: Hewlett-_7c:5c:cd (2c:41:38:7c:5c:cd)
Type: ARP (0x0806)
Padding: 000000000000000000000000000000000000
Address Resolution Protocol (reply)
Hardware type: Ethernet (1)
Protocol type: IP (0x0800)
Hardware size: 6
Protocol size: 4
Opcode: reply (2)
Sender MAC address: Hewlett-_7c:5c:cd (2c:41:38:7c:5c:cd)
Sender IP address: 192.168.11.5 (192.168.11.5)
Target MAC address: a4:1f:72:73:01:3d (a4:1f:72:73:01:3d)
Target IP address: 192.168.11.13 (192.168.11.13)

SLANJE ICMP PORUKE



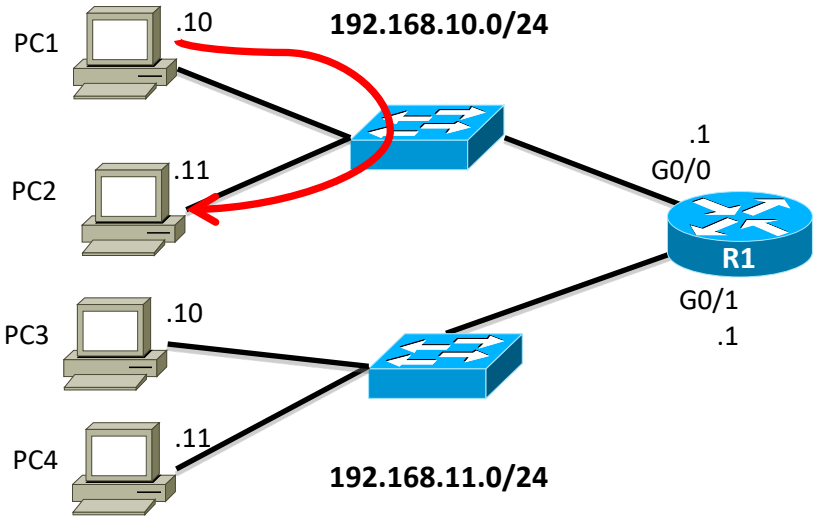
PRIKAZ ARP KEŠ TABELE

```
C:\Users\Dusan> arp -a

Interface: 192.168.11.13 --- 0xb
  Internet Address      Physical Address      Type
  192.168.11.1          00-07-b4-00-0b-01     dynamic
  192.168.11.5          2c-41-38-7c-5c-cd     dynamic

C:\Users\Bob>
```

KOMUNIKACIJA HOSTA U ISTOJ MREŽI

PC1 (**192.168.10**.10 /24) šalje paket PC2 (**192.168.10**.11 /24)

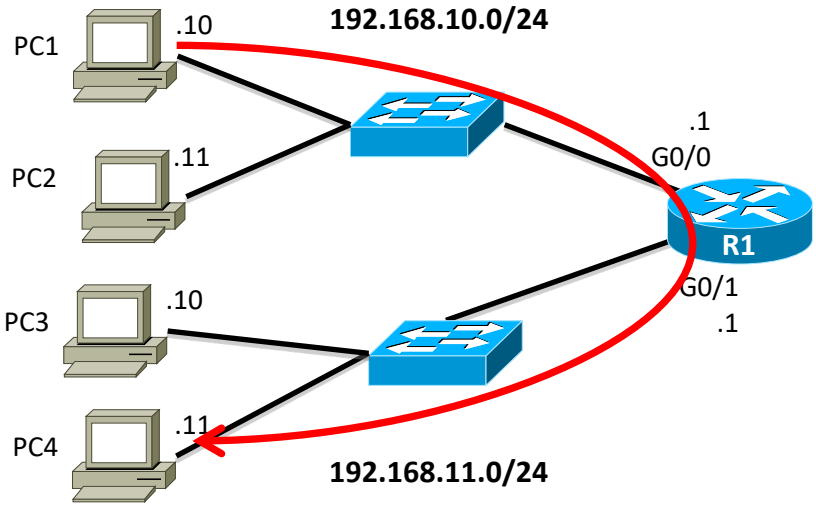
- Pošto se oba hosta nalaze u istoj mreži (**192.168.10**.x /24) usluga mrežnog prolaza (default gateway) nije potrebna



KOMUNIKACIJA HOSTA U RAZLIČITOJ MREŽI

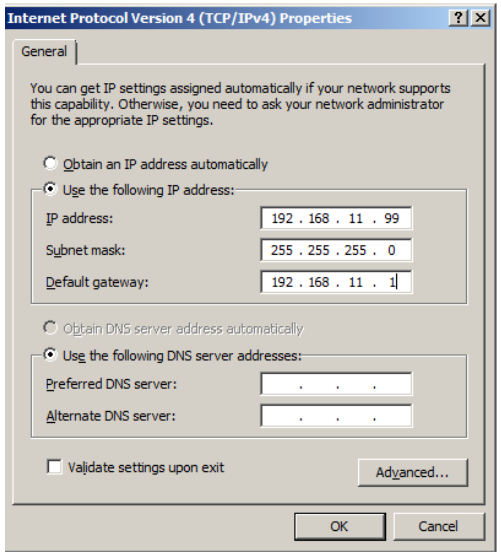
PC1 (192.168.10.10 /24) šalje paket PC4 (192.168.11.11 /24)

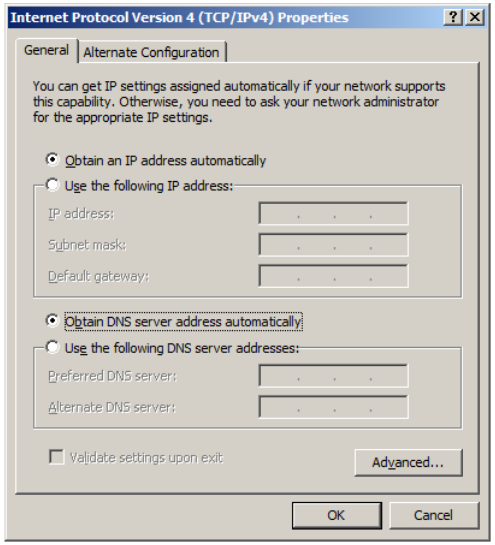
- Pošto se nalaze u različitim mrežama (192.168.**10**.x /24 i 192.168.**11**.x /24) zahteva se usluga mrežnog prolaza.



MREŽNI PROLAZ (DEFAULT GATEWAY)

```
C:\Users\Admin>ipconfig
Windows IP Configuration
Ethernet adapter Local Area Connection:

   Connection-specific DNS Suffix  . : cisco.com
   Link-local IPv6 Address . . . . . : fe80::b572:c6c:f983:cadc%11
   IPv4 Address. . . . . . . . . . . : 192.168.11.99
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : 192.168.11.1
```





RUTING TABELA NA HOSTU

Lista dostupnih mreža na hostu

Lista subnet maski

Lista adresa preko kojih se dolazi do tih mreža. Destinacija koja je direktno dostupna označava se “On-link”.

Lista adresa na fizičkom interfejsu preko koga se šalju paketi

Cena do odredišnih mreža

```
C:\Users\PC1> netstat -r

<Output omitted>

IPv4 Route Table
===========================================================================
Active Routes:
```

Network Destination	Netmask	Gateway	Interface	Metric
0.0.0.0	0.0.0.0	192.168.10.1	192.168.10.10	25
127.0.0.0	255.0.0.0	On-link	127.0.0.1	306
127.0.0.1	255.255.255.255	On-link	127.0.0.1	306
127.255.255.255	255.255.255.255	On-link	127.0.0.1	306
192.168.10.0	255.255.255.0	On-link	192.168.10.10	281
192.168.10.10	255.255.255.255	On-link	192.168.10.10	281
192.168.10.255	255.255.255.255	On-link	192.168.10.10	281
224.0.0.0	240.0.0.0	On-link	127.0.0.1	306
224.0.0.0	240.0.0.0	On-link	192.168.10.10	281
255.255.255.255	255.255.255.255	On-link	127.0.0.1	306
255.255.255.255	255.255.255.255	On-link	192.168.10.10	281

```
===========================================================================
```

RUTING TABELA NA HOSTU

0.0.0.0
- Default ruta i njoj se prosleđuju paketi namenjeni drugim mrežama.
- Default gateway je 192.168.10.1 (R1)

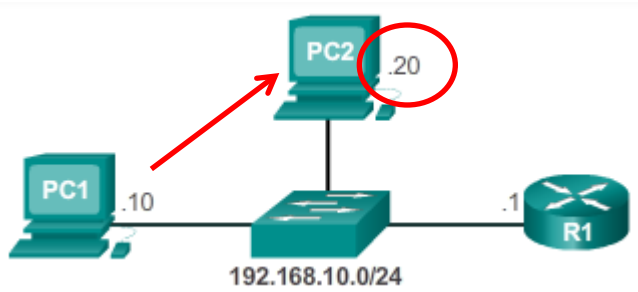
127.0.0.0 – 127.255.255.255
•Ove adrese odnose se na lokalnu konekciju i obezbeđuju servise lokalnom hostu

192.168.10.0 - 192.168.10.255
- Adrese se odnose na host i lokalnu mrežu
- 192.168.10.0 – Ruta do lokalne mreže.
- 192.168.10.10 – Adresa lokalnog hosta.
- 192.168.10.255 – Broadcast adresa.

224.0.0.0
- Specijalne multicast adrese

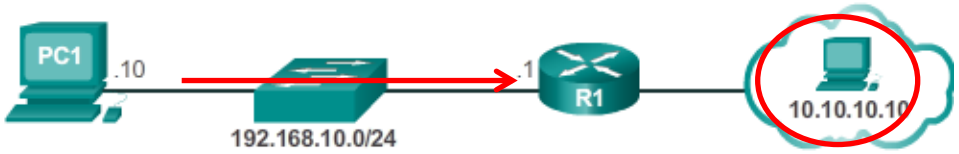
```
C:\Users\PC1> netstat -r

<Output omitted>

IPv4 Route Table
===========================================
Active Routes:
Network Destination        Netmask          Gateway       Interface  Metric
          0.0.0.0          0.0.0.0    192.168.10.1    192.168.10.10      25
        127.0.0.0        255.0.0.0         On-link         127.0.0.1     306
        127.0.0.1  255.255.255.255         On-link         127.0.0.1     306
  127.255.255.255  255.255.255.255         On-link         127.0.0.1     306
      192.168.10.0    255.255.255.0         On-link    192.168.10.10     281
     192.168.10.10  255.255.255.255         On-link    192.168.10.10     281
    192.168.10.255  255.255.255.255         On-link    192.168.10.10     281
        224.0.0.0        240.0.0.0         On-link         127.0.0.1     306
        224.0.0.0        240.0.0.0         On-link    192.168.10.10     281
  255.255.255.255  255.255.255.255         On-link         127.0.0.1     306
  255.255.255.255  255.255.255.255         On-link    192.168.10.10     281
===========================================================================
```

KOMUNIKACIJA PC1 i PC2




```
C:\Users\PC1> netstat -r

<Output omitted>

IPv4 Route Table
===========================================================================
Active Routes:
Network Destination        Netmask          Gateway       Interface  Metric
          0.0.0.0          0.0.0.0    192.168.10.1    192.168.10.10     25
        127.0.0.0        255.0.0.0         On-link         127.0.0.1    306
        127.0.0.1  255.255.255.255         On-link         127.0.0.1    306
  127.255.255.255  255.255.255.255         On-link         127.0.0.1    306
    192.168.10.0    255.255.255.0         On-link    192.168.10.10    281
   192.168.10.10  255.255.255.255         On-link    192.168.10.10    281
  192.168.10.255  255.255.255.255         On-link    192.168.10.10    281
        224.0.0.0        240.0.0.0         On-link         127.0.0.1    306
        224.0.0.0        240.0.0.0         On-link    192.168.10.10    281
  255.255.255.255  255.255.255.255         On-link         127.0.0.1    306
  255.255.255.255  255.255.255.255         On-link    192.168.10.10    281
===========================================================================
```

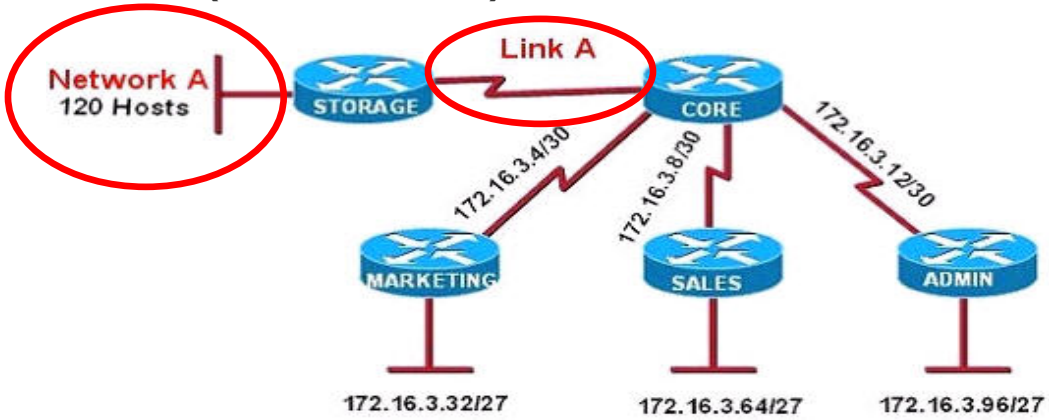
KOMUNIKACIJA
PC1 SA ADRESOM 10.10.10.10




```
C:\Users\PC1> netstat -r

<Output omitted>

IPv4 Route Table
===========================================================================
Active Routes:
Network Destination        Netmask          Gateway       Interface  Metric
          0.0.0.0          0.0.0.0    192.168.10.1    192.168.10.10     25
        127.0.0.0        255.0.0.0         On-link         127.0.0.1    306
        127.0.0.1  255.255.255.255         On-link         127.0.0.1    306
  127.255.255.255  255.255.255.255         On-link         127.0.0.1    306
    192.168.10.0    255.255.255.0         On-link    192.168.10.10    281
   192.168.10.10  255.255.255.255         On-link    192.168.10.10    281
  192.168.10.255  255.255.255.255         On-link    192.168.10.10    281
        224.0.0.0        240.0.0.0         On-link         127.0.0.1    306
        224.0.0.0        240.0.0.0         On-link    192.168.10.10    281
  255.255.255.255  255.255.255.255         On-link         127.0.0.1    306
  255.255.255.255  255.255.255.255         On-link    192.168.10.10    281
===========================================================================
```

ZADATAK

Refer to the exhibit. All of the routers in the network are configured with the ip subnet-zero command. Which network addresses should be used for Link A and Network A? (Choose two)

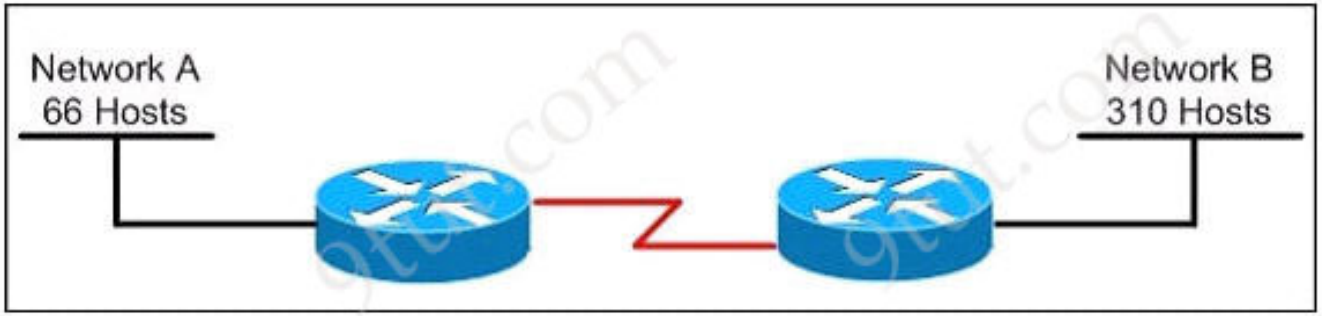


A. Network A – 172.16.3.48/26
B. Network A – 172.16.3.128/25
C. Network A – 172.16.3.192/26
D. Link A – 172.16.3.0/30
E. Link A – 172.16.3.40/30
F. Link A – 172.16.3.112/3

Odgovor B,D

ZADATAK

Refer to the exhibit. Which subnet mask will place all hosts on Network B in the same subnet with the least amount of wasted addresses?



A. 255.255.255.0
B. 255.255.254.0
C. 255.255.252.0
D. 255.255.248.0

Odgovor B

ZADATAK

An administrator must assign static IP addresses to the servers in a network. For network 192.168.20.24/29, the router is assigned the first usable host address while the sales server is given the last usable host address. Which of the following should be entered into the IP properties box for the sales server?

A. IP address: 192.168.20.14
Subnet Mask: 255.255.255.248
Default Gateway: 192.168.20.9

B. IP address: 192.168.20.254
Subnet Mask: 255.255.255.0
Default Gateway: 192.168.20.1

C. IP address: 192.168.20.30
Subnet Mask: 255.255.255.248
Default Gateway: 192.168.20.25

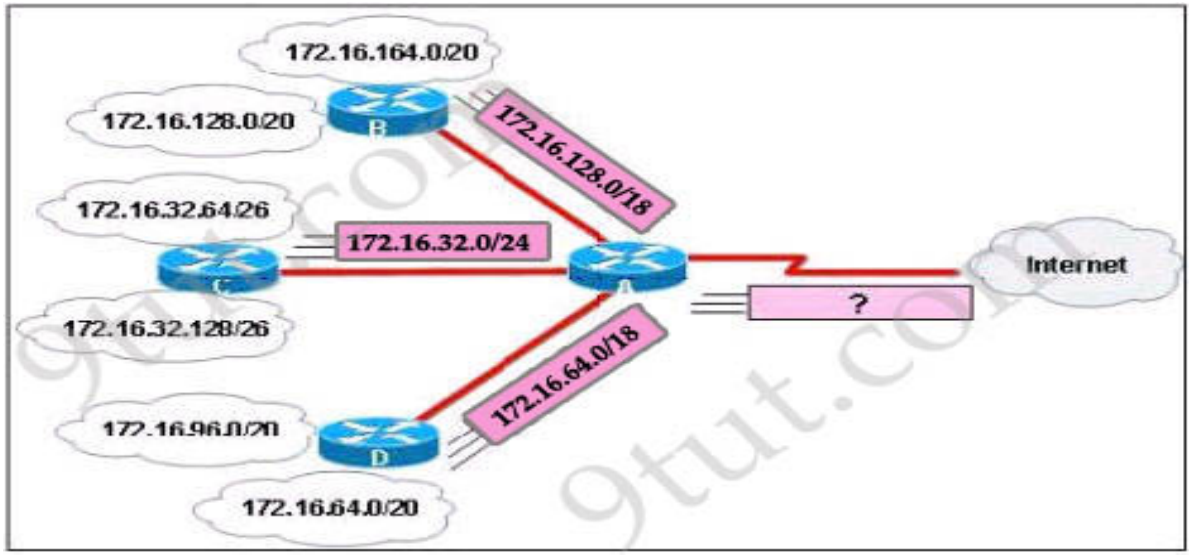
D. IP address: 192.168.20.30
Subnet Mask: 255.255.255.240
Default Gateway: 192.168.20.17

E. IP address: 192.168.20.30
Subnet Mask: 255.255.255.240
Default Gateway: 192.168.20.25

Odgovor C

ZADATAK

Refer to the exhibit. In this VLSM addressing scheme, what summary address would be sent from router A?

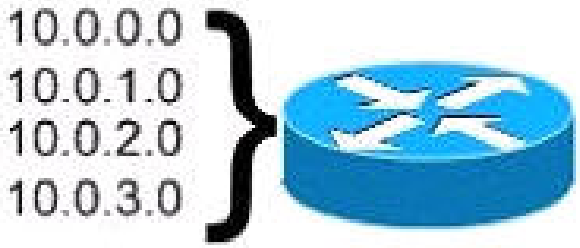


A. 172.16.0.0/16
B. 172.16.0.0/20
C. 172.16.0.0/24
D. 172.32.0.0/16
E. 172.32.0.0/17
F. 172.64.0.0/16

Odgovor A

ZADATAK

Refer to the exhibit. What is the most appropriate summarization for these routes?



A. 10.0.0.0/21
B. 10.0.0.0/22
C. 10.0.0.0/23
D. 10.0.0.0/24

Odgovor B