UNIVERZITET U SARAJEVU

ELEKTROTEHNIČKI FAKULTET SARAJEVO

DOMAĆA ZADAĆA 3

RAČUNARSKE MREŽE

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Odsjek: Računarstvo i Informatika

Datum:

07.05.2020

Potpis:

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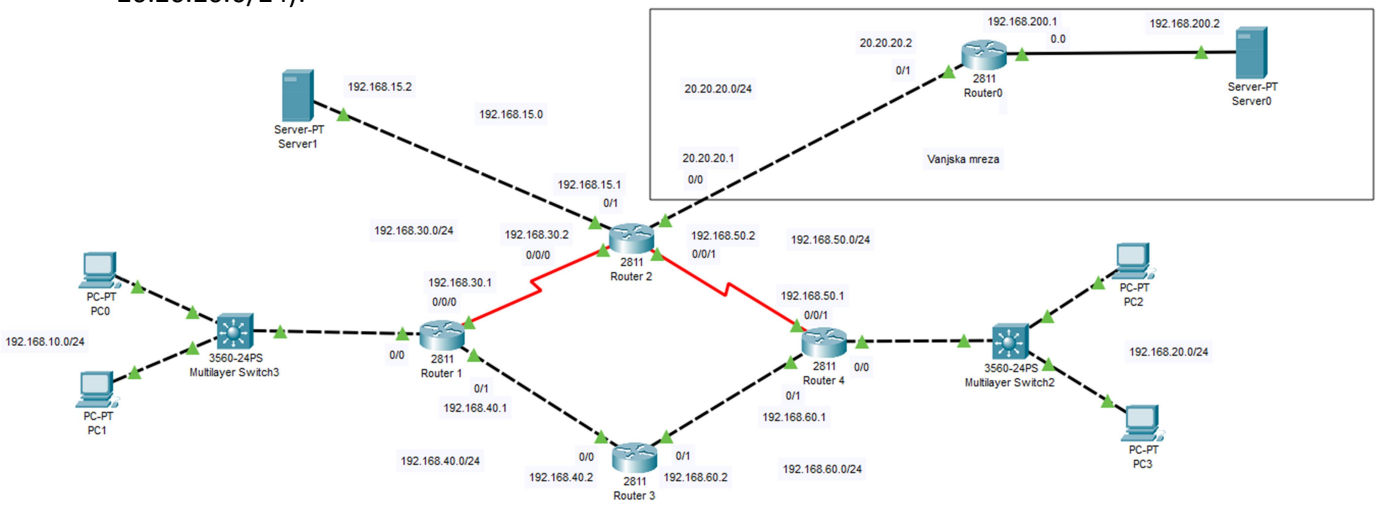
- **Implementirati NAT na graničnom ruteru, pri čemu je dovoljno dozvoliti svim unutrašnjim IP adresama uslugu prevoda. Ovu uslugu testirati pingom prema vanjskom ruteru, na kojem prethodno treba biti omogućena komanda debug ip packet, te snimljene pakete uključiti u izvještaj.**

Na sljedecoj slici je data finalna mreza iskoristena za ovaj zadatak (vanjska mreza je 20.20.20.0/24):



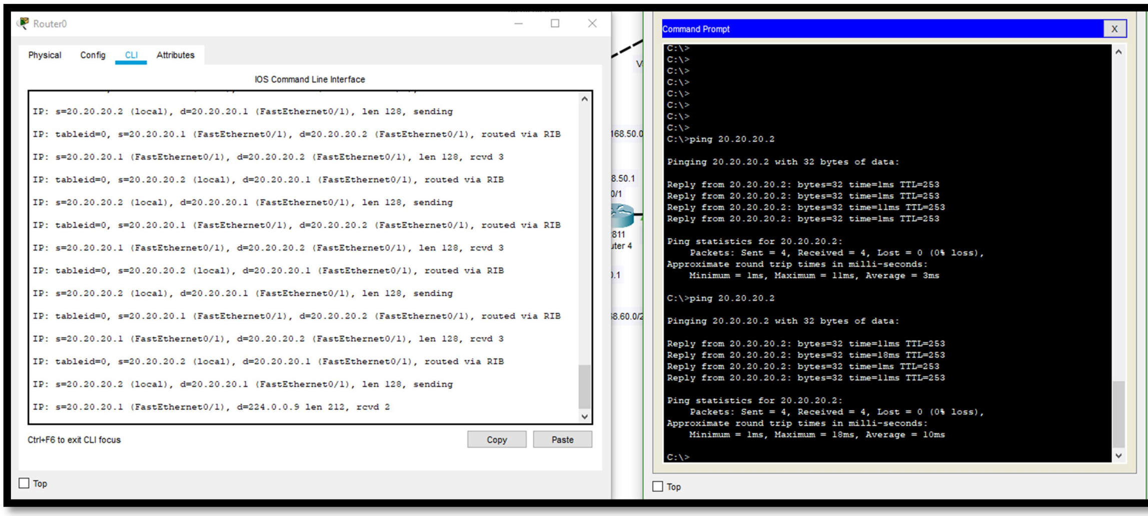
Postavke na granicnom ruteru:

```
!
!
interface FastEthernet0/0
 ip address 20.20.20.1 255.255.255.0
 ip nat outside
 duplex auto
 speed auto
!
interface FastEthernet0/1
 no ip address
 duplex auto
 speed auto
 shutdown
!
interface Serial0/0/0
 ip address 192.168.30.2 255.255.255.0
 ip nat inside
!
interface Serial0/0/1
 ip address 192.168.50.2 255.255.255.0
 ip nat inside
 clock rate 2000000
!
```

Pri cemu je access lista (sve mreze pocinju sa 192.168.a.b):

```
Router#show access-lists
Standard IP access list 1
    10 permit 192.168.0.0 0.0.255.255 (24 match(es))
    20 deny any

Router#
```

I na kraju ping ka interfejsu rutera sa ip adresom 20.20.20.2, sa ukljucenom komandom debug ip:



Vidimo pakete u kojima je source ip adresa jednaka 20.20.20.1, a destination adresa 20.20.20.2.

• Na istom tom graničnom ruteru implementirati i DHCP uslugu, koja treba da poslužuje sve računare u vašoj privatnoj infrastrukturi. U izvještaj uključiti konfiguraciju DHCP-a, kao i moguće dodatne konfiguracije vezane za DHCP na unutrašnjem ruteru.

Konfiguracija DHCP-a na granicnom ruteru (router 2):

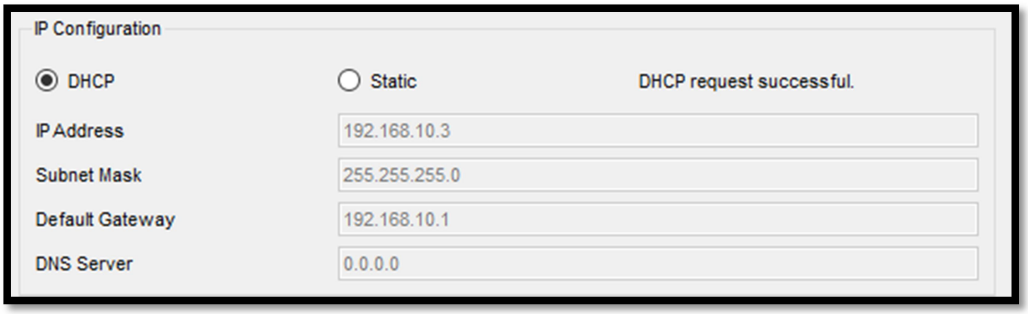
```
ip dhcp pool opseg3
 network 192.168.10.0 255.255.255.0
 default-router 192.168.10.1
ip dhcp pool opseg4
 network 192.168.20.0 255.255.255.0
 default-router 192.168.20.1
!
```

Takodjer, da bi dhcp radio, treba jos dodati defaultne helper ip adrese na unutrasnje rutere 1 i 4. Shodno tome konfiguracije respektivno za unutrasnje rutere 1, 4 za njihove interfejse:

```
!
interface FastEthernet0/0
 ip address 192.168.10.1 255.255.255.0
 ip helper-address 192.168.30.2
 duplex auto
 speed auto
!
```

```
!
interface FastEthernet0/0
 ip address 192.168.20.1 255.255.255.0
 ip helper-address 192.168.50.2
 duplex auto
 speed auto
!
```

Kao primjer ispravnog DHCP requesta:



• Na graničnom ruteru implementirati statičku default rutu. Ovo treba da bude jedina statička ruta na cijeloj mreži. Pobrinuti se da se ona uredno propagira ka vašem unutrašnjem ruteru korištenjem jednog od rađenih ruting protokola. Navesti postavku te rute u izvještaju.

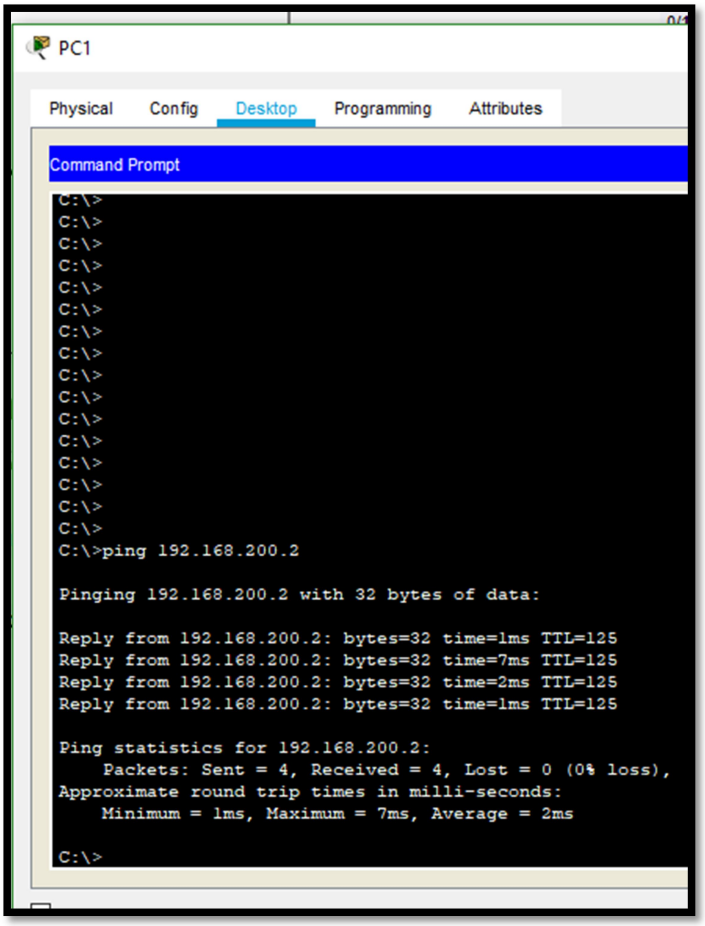
Konfiguracija za postavljanje staticke rute na granicnom ruteru 2:

```
router rip
 version 2
 network 192.168.15.0
 network 192.168.30.0
 network 192.168.50.0
 default-information originate
!
ip nat inside source list 1 interface FastEthernet0/0 overload
ip classless
ip route 0.0.0.0 0.0.0.0 FastEthernet0/0
!
ip flow-export version 9
!
!
access-list 1 permit 192.168.0.0 0.0.255.255
access-list 1 deny any
!
```

Komandom default-information ruteru dajemo mogucnost da oglasava defaultnu staticku rutu ostalim ruterima, a komandom ip route 0.0.0.0 0.0.0.0 fa 0/0 govorimo da interfejs fa 0/0 definisemo za defaultnu rutu. Ukoliko odemo na ruter 3 imamo sljedece rute:

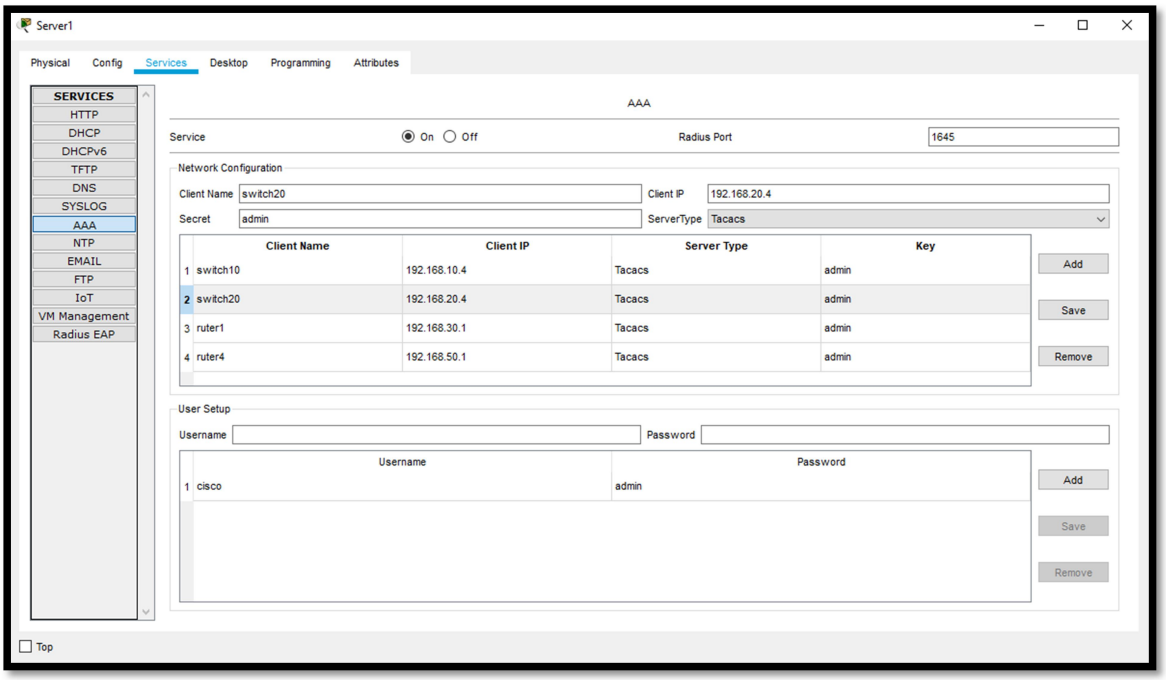
```
Router#sh ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is 192.168.40.1 to network 0.0.0.0

R    192.168.10.0/24 [120/1] via 192.168.40.1, 00:00:17, FastEthernet0/0
R    192.168.15.0/24 [120/2] via 192.168.40.1, 00:00:17, FastEthernet0/0
                     [120/2] via 192.168.60.1, 00:00:04, FastEthernet0/1
R    192.168.20.0/24 [120/1] via 192.168.60.1, 00:00:04, FastEthernet0/1
R    192.168.30.0/24 [120/1] via 192.168.40.1, 00:00:17, FastEthernet0/0
C    192.168.40.0/24 is directly connected, FastEthernet0/0
R    192.168.50.0/24 [120/1] via 192.168.60.1, 00:00:04, FastEthernet0/1
C    192.168.60.0/24 is directly connected, FastEthernet0/1
R*   0.0.0.0/0 [120/2] via 192.168.40.1, 00:00:17, FastEthernet0/0
               [120/2] via 192.168.60.1, 00:00:04, FastEthernet0/1

Router#
```

Vidimo da je defaultna ruta dobijena oglasavanjem rutera 2. Kao primjer uspjesne realizacije proslijedjivanja paketa, imamo ping ka vanjskom serveru na ip adresi 192.168.200.2:



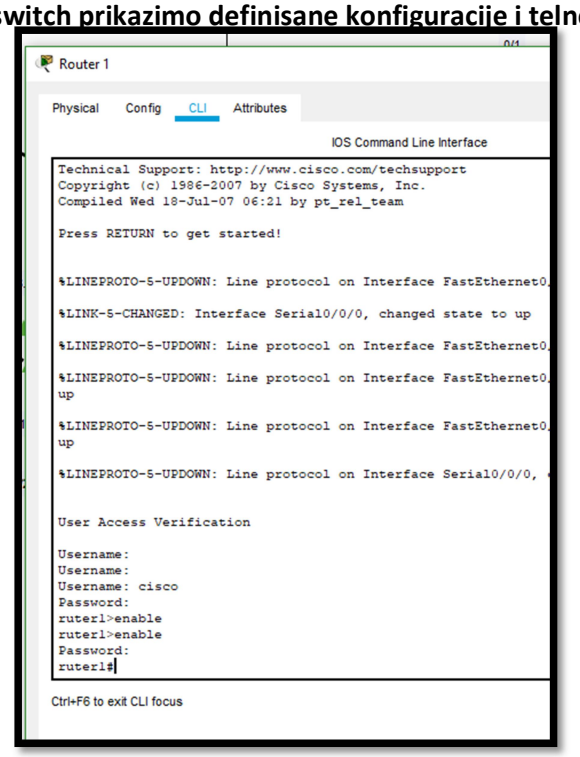
• **Na vašem unutrašnjem serveru implementirati TACACS+. Napraviti korisnika sa proizvoljnim korisničkim imenom i lozinkom. Vaša dva rutera i switch trebaju koristiti TACACS+ za provjeru imena i lozinke, a kao alternativni način nekog lokalnog korisnika (takođe proizvoljan). Treba omogućiti i telnet i SSH pristup. Napraviti screenshot za svaki od ovih pristupa i uključiti ga u izvještaj, zajedno sa relevantnim dijelom konfiguracije.**

Prvo definisimo konfiguraciju parametara unutar tacacs servera:



Sada za svaki ruter i switch prikazimo definisane konfiguracije i telnet i ssh pristup:

- Ruter1

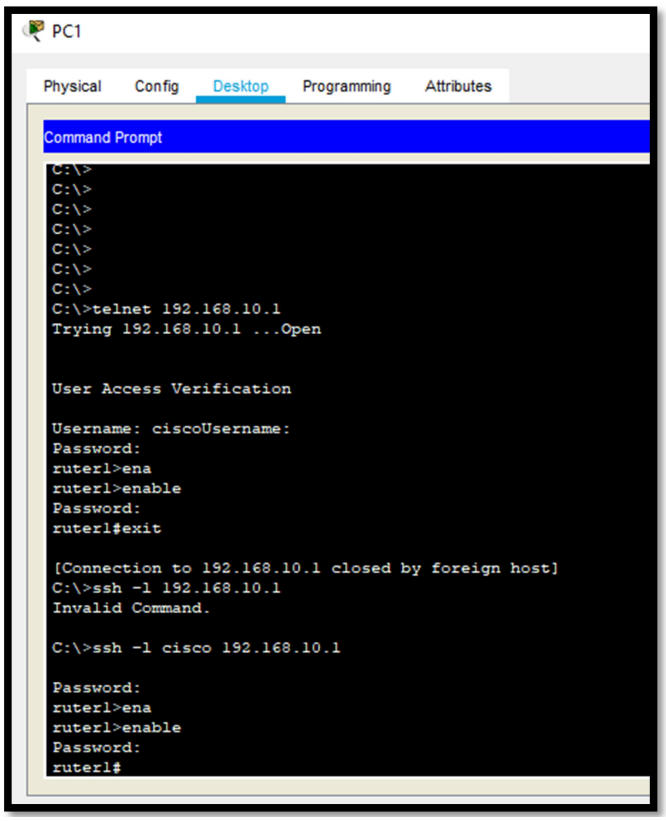


```
!
hostname ruter1
!
!
!
enable secret 5 $1$mERr$vTbHu1lN28cEp81kLqr0f/
!
!
!
!
!
aaa new-model
!
aaa authentication login default group tacacs+ local
!
!
```

```
!
tacacs-server host 192.168.15.2
tacacs-server key admin
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
 login authentication default
line vty 5 15
 login authentication default
!
!
!
```

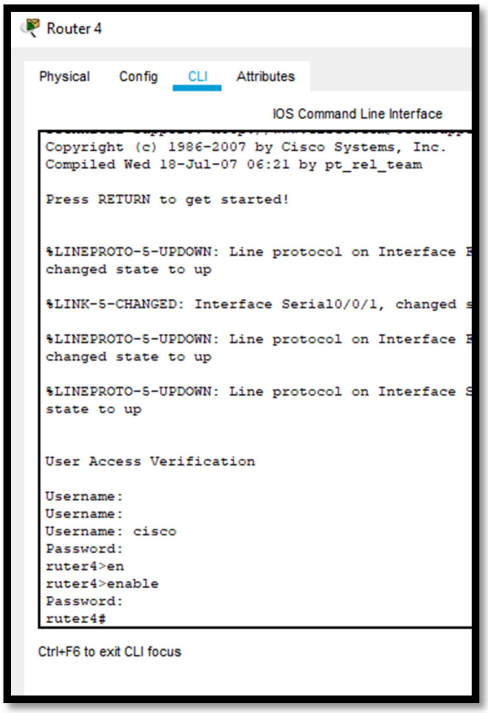
```
!
username admin password 0 admin
!
!
!
!
!
!
!
!
ip domain-name com
!
```

Primjer pristupa telnet i ssh:



U slucaju da ne radi tacacs (admin admin lokalno):

- Ruter4

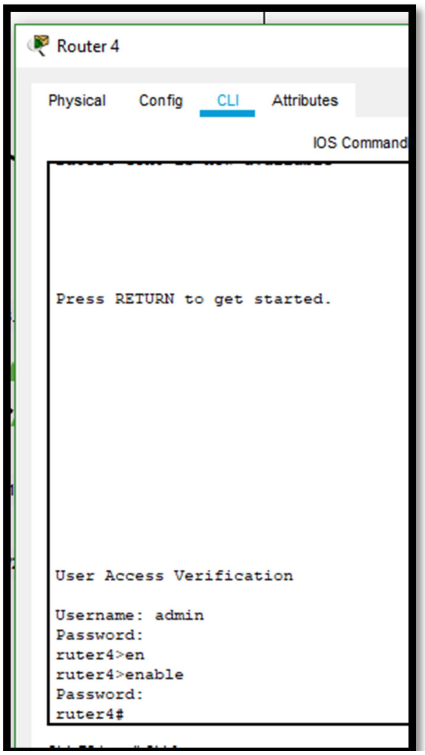


```
!
hostname ruter4
!
!
!
enable secret 5 $1$mERr$vTbHullN28cEp81kLqr0f/
!
!
!
!
!
aaa new-model
!
aaa authentication login default group tacacs+ local
!
```

```
!
!
tacacs-server host 192.168.15.2
tacacs-server key admin
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
 login authentication default
line vty 5 15
 login authentication default
!
!
!
end
```

```
!
username admin password 0 admin
!
!
!
!
!
!
!
!
ip domain-name ba
!
```

U slucaju da ne radi tacacs (admin admin lokalno):



Da bi omogucili oglasavanje ip adrese vlanova na switchovima, moramo omoguciti ip routing i definisati lokalne mreze:

```
!
ip routing
!
```

- Switch2 (192.168.20.0/24)

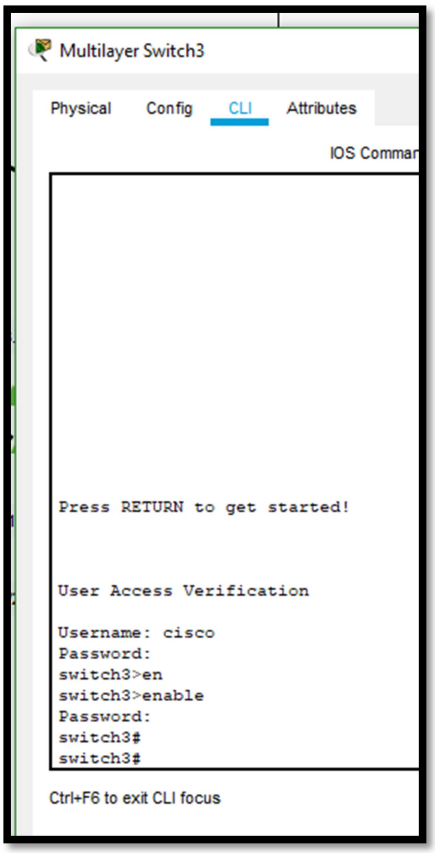

```
!
hostname switch2
!
!
enable secret 5 $1$mERr$vTbHu1lN28cEp8lkLqr0f/
!
!
!
!
!
aaa new-model
!
aaa authentication login default group tacacs+ local
!
```

```
username admin password 0 admin
!
!
!
!
!
!
!
!
!
!
ip domain-name com
!
```

```
!
interface Vlan1
 ip address 192.168.20.4 255.255.255.0
!
router rip
 network 192.168.20.0
!
ip classless
!
ip flow-export version 9
!
!
!
!
tacacs-server host 192.168.15.2
tacacs-server key admin
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
 login authentication default
line vty 5 15
 login authentication default
!
```

U slucaju da ne radi tacacs (admin admin lokalno):

- Switch3 (192.168.10.0/24)

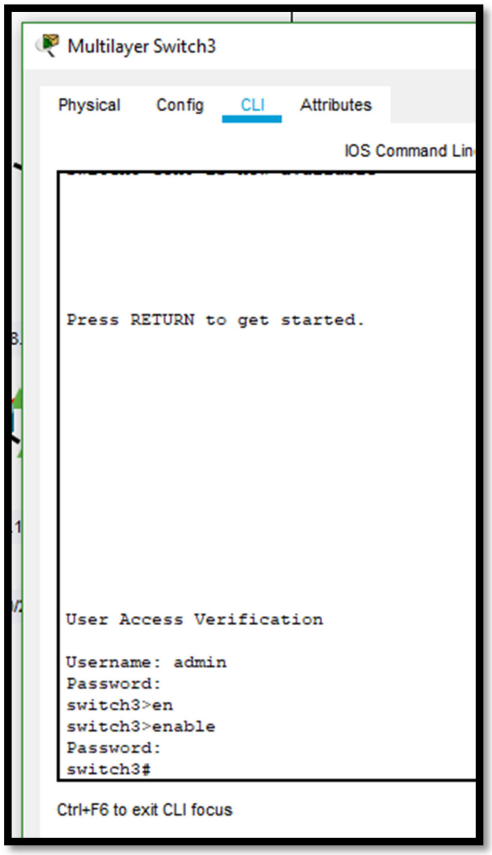



```
!
hostname switch3
!
!
enable secret 5 $1$mERr$vTbHul1N28cEp8lkLqr0f/
!
!
!
!
!
aaa new-model
!
aaa authentication login default group tacacs+ local
!
```

```
!
username admin password 0 admin
!
!
!
!
!
!
!
!
!
!
ip domain-name com
!
```

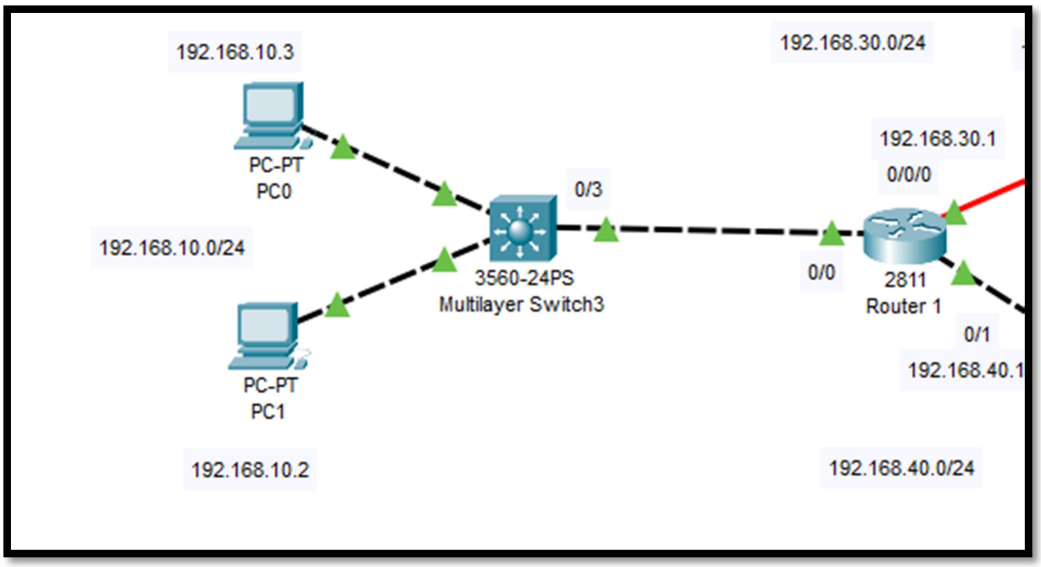
```
interface Vlan1
 ip address 192.168.10.4 255.255.255.0
!
router rip
 network 192.168.10.0
!
ip classless
!
ip flow-export version 9
!
!
!
!
tacacs-server host 192.168.15.2
tacacs-server key admin
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
 login authentication default
line vty 5 15
 login authentication default
!
```

U slucaju da ne radi tacacs (admin admin lokalno):



• Implementirati access listu na jednom od vaših rutera. Ta lista treba da dozvoli jednom vašem korisničkom računaru HTTP pristup vanjskom serveru a da zabrani ping. Za drugi računar treba da radi suprotno, tj. da zabrani HTTP prema vanjskom serveru, a dozvoli ping. TACACS+ serveru treba biti omogućena sva komunikacija. Ne zaboravite u listi dozvoliti sve korištene mrežne protokole (DHCP, rutiranje, TACACS+, telnet, SSH, itd.). Listu uključiti u izvještaj. Testirati pristup sa oba računara, te ispise takođe uključiti u izvještaj.

Za pocetak, ukoliko procitamo ip adrese koje je DHCP dodijelo imamo ovakvu situaciju:

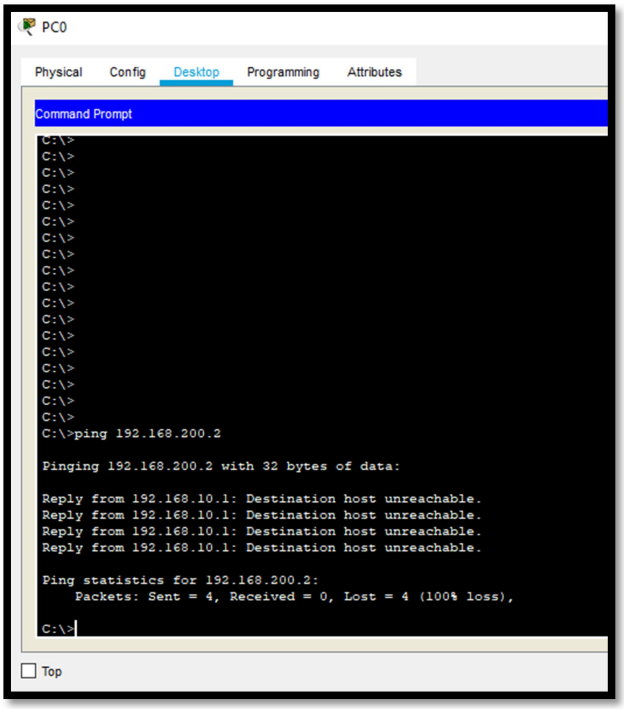


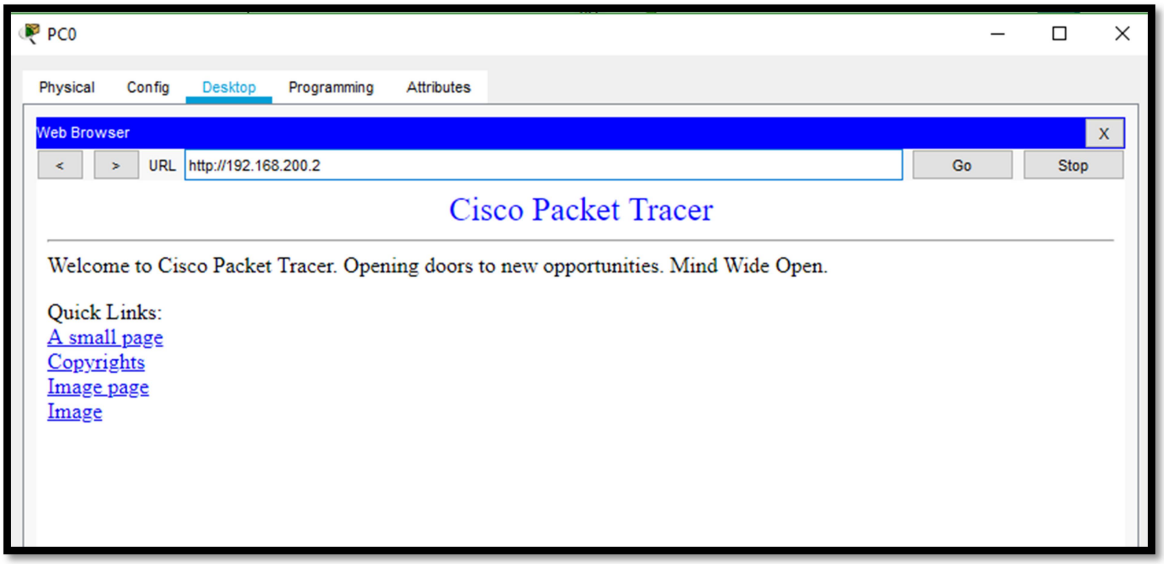
PC0 ce imati HTTP pristup, a nece imati ping mogucnost. Za PC1 ce biti obrnuta situacija. Shodno tome definisana access lista:

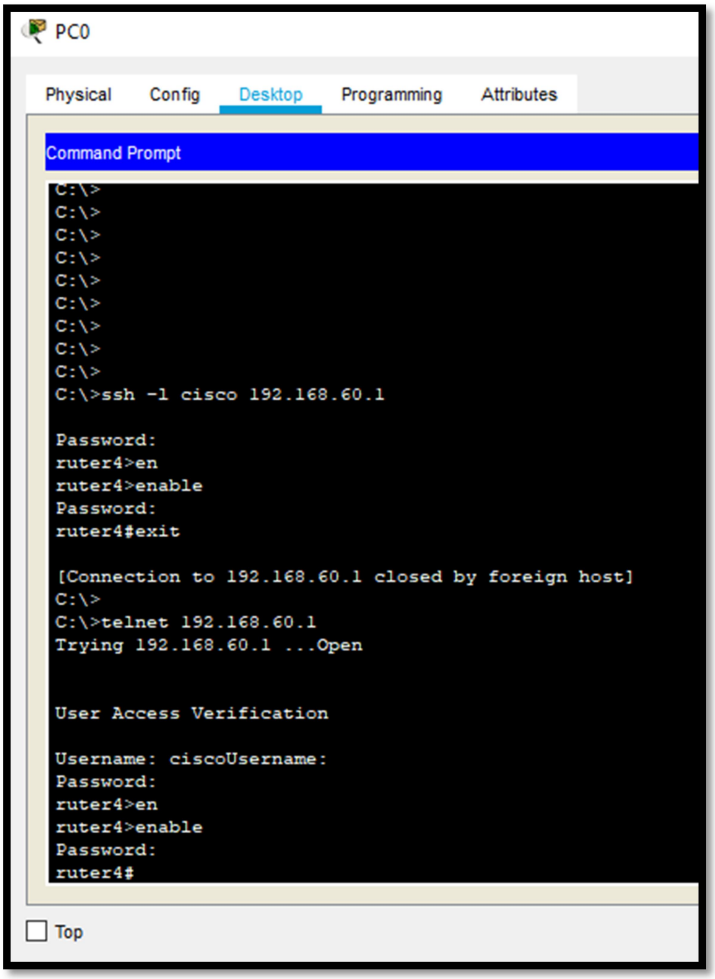
```
ruter1#show access-lists
Extended IP access list 100
    10 deny icmp host 192.168.10.3 any (3 match(es))
    20 permit tcp host 192.168.10.3 host 192.168.200.2 eq www (7 match(es))
    30 deny tcp host 192.168.10.2 host 192.168.200.2 eq www (40 match(es))
    40 permit udp any any (6 match(es))
    50 permit udp any any eq 520
    60 permit tcp any any eq telnet (38 match(es))
    70 permit ip any any (59 match(es))

ruter1#
```

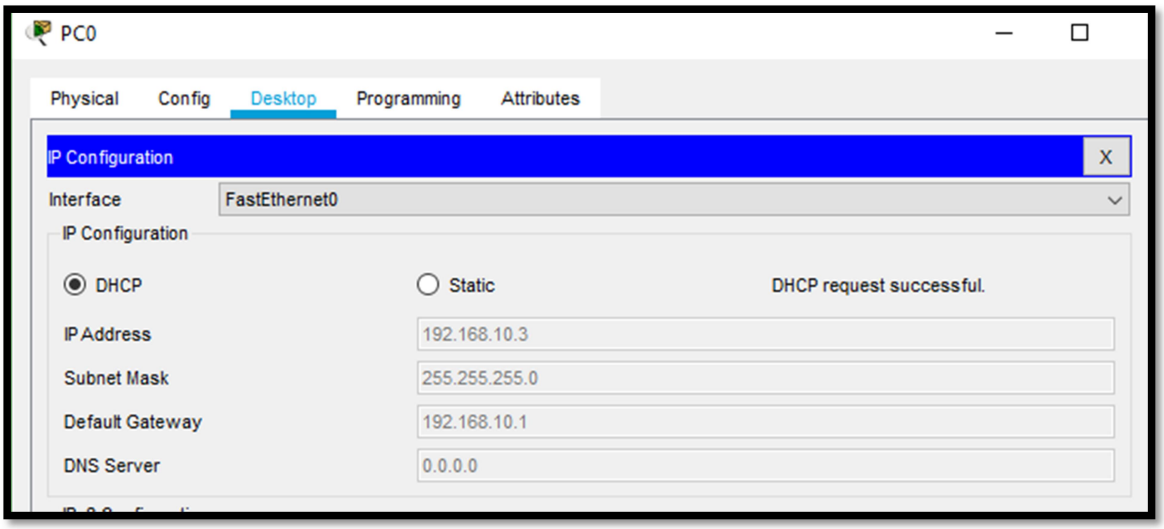
Shodno sa tim, izvrsimo provjere za oba racunara respektivno:

- PC0 (192.168.10.3)

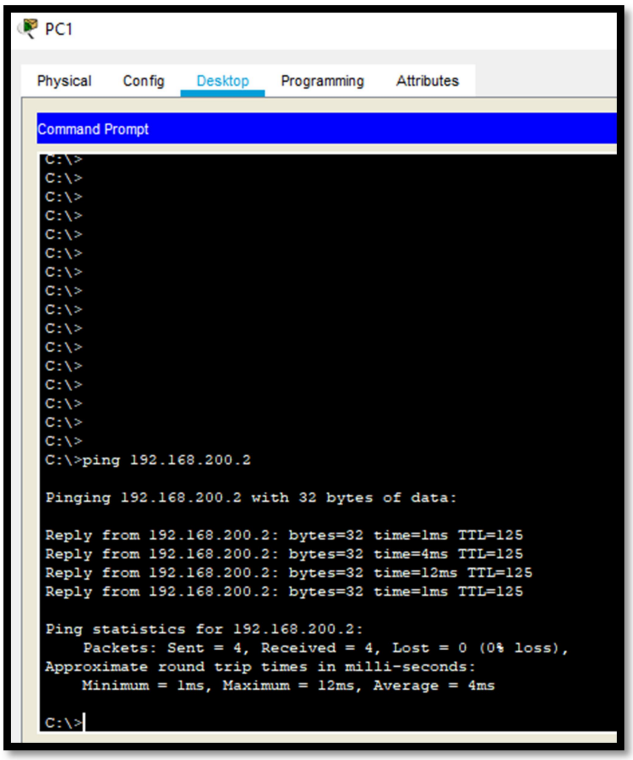




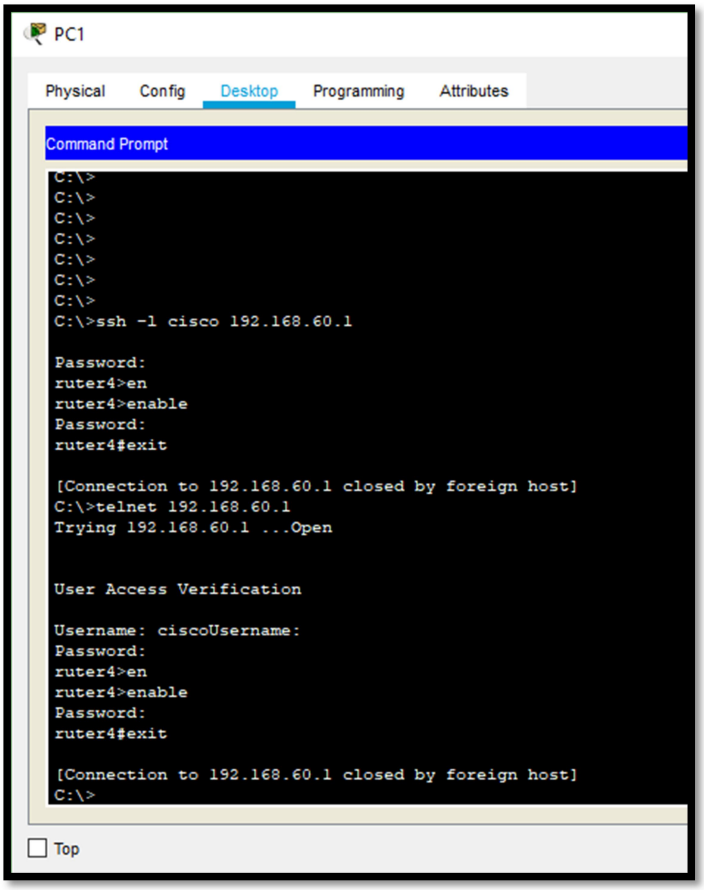

PC0
Physical
Config
Desktop
Programming
Attributes
Command Prompt
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>ssh -l cisco 192.168.60.1
Password:
ruter4>en
ruter4>enable
Password:
ruter4#exit
[Connection to 192.168.60.1 closed by foreign host]
C:\>
C:\>telnet 192.168.60.1
Trying 192.168.60.1 ...Open
User Access Verification
Username: ciscoUsername:
Password:
ruter4>en
ruter4>enable
Password:
ruter4#
Top

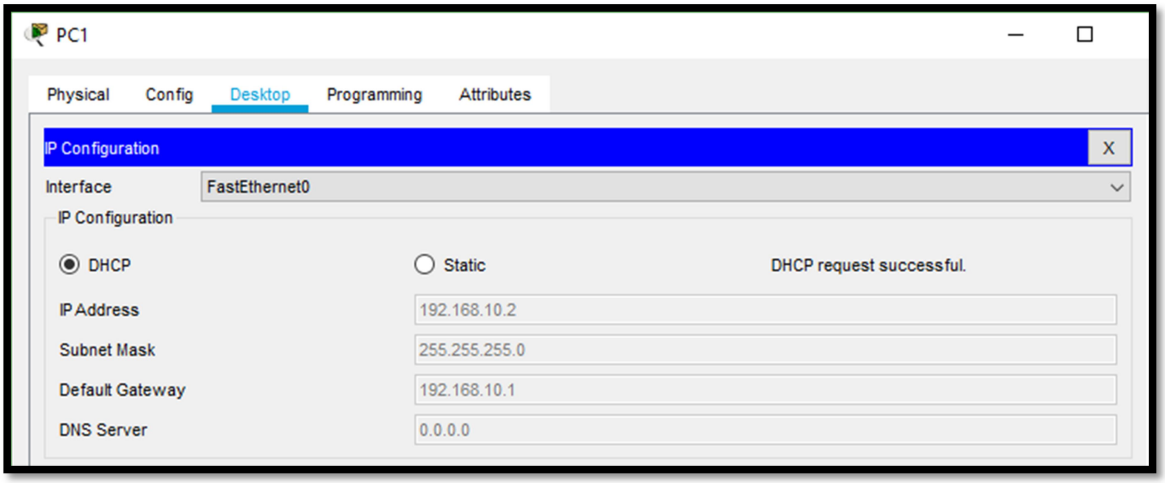

PC0
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
DHCP request successful.
IP Address
192.168.10.3
Subnet Mask
255.255.255.0
Default Gateway
192.168.10.1
DNS Server
0.0.0.0

- PC1 (192.168.10.2)



Stranica se nije loadala, shodno zabranjen je http pristup vanjskom serveru.


PC1
Physical
Config
Desktop
Programming
Attributes
Command Prompt
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>ssh -l cisco 192.168.60.1
Password:
ruter4>en
ruter4>enable
Password:
ruter4#exit
[Connection to 192.168.60.1 closed by foreign host]
C:\>telnet 192.168.60.1
Trying 192.168.60.1 ...Open
User Access Verification
Username: ciscoUsername:
Password:
ruter4>en
ruter4>enable
Password:
ruter4#exit
[Connection to 192.168.60.1 closed by foreign host]
C:\>
Top


PC1
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
DHCP request successful.
IP Address
192.168.10.2
Subnet Mask
255.255.255.0
Default Gateway
192.168.10.1
DNS Server
0.0.0.0