1η ΕΡΓΑΣΙΑ ΕΡΓΑΣΤΗΡΙΟΥ ΔΙΚΤΥΩΝ

Όνομα: Γεώργιος

Επώνυμο: Βέργος

Αριθμός Μητρώου: 1072604

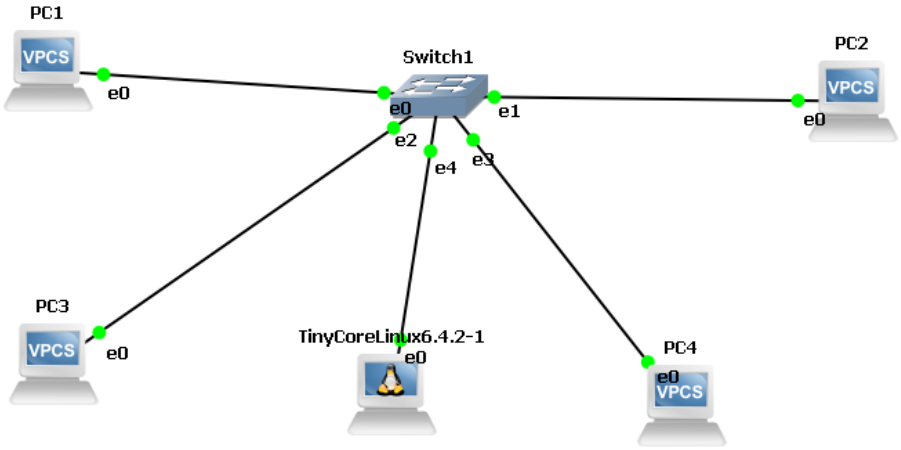
Εξάμηνο: 6ο

Ημερομηνία: 29/3/2022

Password Mikrotik:helibonis

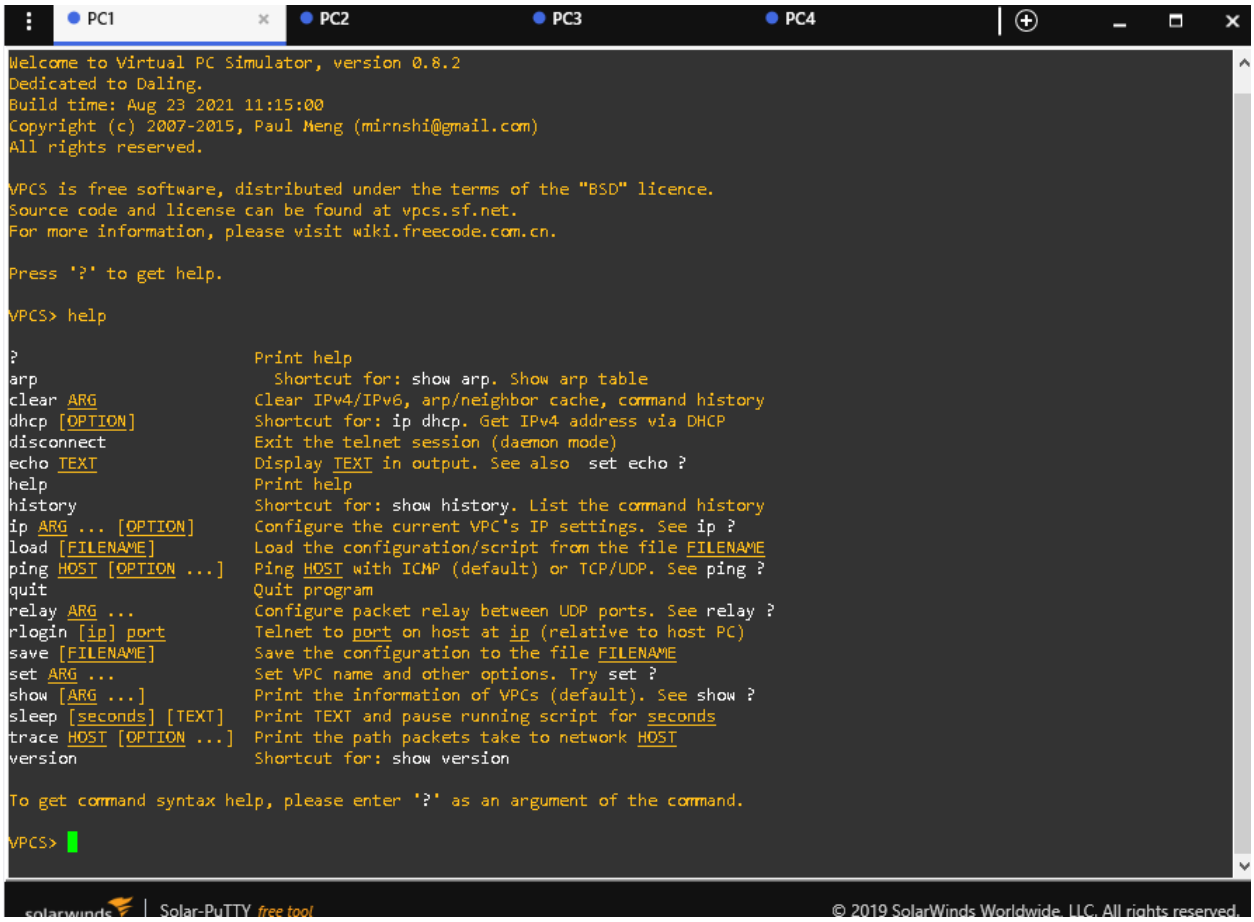
Άσκηση 1

Για τη πρώτη άσκηση υλοποιούμε την τοπολογία της παρακάτω εικόνας:



Ερωτήματα:

1) Εκτελώντας την εντολή help στο PC1 μπορούμε να δούμε τη λίστα όλων των υποστηριζόμενων εντολών:



2) Εκτελώντας την εντολή ip στο PC2 βλέπουμε τις παραμέτρους που χρειάζεται για να εκτελεστεί:

3)

Αναθέτουμε τις εξής ip διευθύνσεις σε κάθε PC όπου θα έχουμε: Ip(PC1)=192.168.1.1 , ip(PC2)=192.168.1.2 , ip(PC3)=192.168.1.3 , ip(PC4)=192.168.1.4. Αυτό φαίνεται αναλυτικά στις παρακάτω εικόνες:


PC1
PC2
PC3
PC4
All rights reserved.
VPCS is free software, distributed under the terms of the "BSD" licence.
Source code and license can be found at vpcs.sf.net.
For more information, please visit wiki.freecode.com.cn.
Press '?' to get help.
VPCS> help
? Print help
arp Shortcut for: show arp. Show arp table
clear ARG Clear IPv4/IPv6, arp/neighbor cache, command history
dhcp [OPTION] Shortcut for: ip dhcp. Get IPv4 address via DHCP
disconnect Exit the telnet session (daemon mode)
echo TEXT Display TEXT in output. See also set echo ?
help Print help
history Shortcut for: show history. List the command history
ip ARG ... [OPTION] Configure the current VPC's IP settings. See ip ?
load [FILENAME] Load the configuration/script from the file FILENAME
ping HOST [OPTION ...] Ping HOST with ICMP (default) or TCP/UDP. See ping ?
quit Quit program
relay ARG ... Configure packet relay between UDP ports. See relay ?
rlogin [ip] port Telnet to port on host at ip (relative to host PC)
save [FILENAME] Save the configuration to the file FILENAME
set ARG ... Set VPC name and other options. Try set ?
show [ARG ...] Print the information of VPCs (default). See show ?
sleep [seconds] [TEXT] Print TEXT and pause running script for seconds
trace HOST [OPTION ...] Print the path packets take to network HOST
version Shortcut for: show version
To get command syntax help, please enter '?' as an argument of the command.
VPCS> ip 192.168.1.1 255.255.255.0
Checking for duplicate address...
VPCS : 192.168.1.1 255.255.255.0
VPCS>
solarwinds | Solar-PuTTY free tool
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PC1
PC2
PC3
PC4
VPCS is free software, distributed under the terms of the "BSD" licence.
Source code and license can be found at vpcs.sf.net.
For more information, please visit wiki.freecode.com.cn.
Press '?' to get help.
VPCS> ip
ip ARG ... [OPTION]
Configure the current VPC's IP settings
ARG ...:
address [mask] [gateway]
address [gateway] [mask]
Set the VPC's ip, default gateway ip and network mask
Default IPv4 mask is /24, IPv6 is /64. Example:
ip 10.1.1.70/26 10.1.1.65 set the VPC's ip to 10.1.1.70,
the gateway to 10.1.1.65, the netmask to 255.255.255.192.
In tap mode, the ip of the tapx is the maximum host ID
of the subnet. In the example above the tapx ip would be
10.1.1.126
mask may be written as /26, 26 or 255.255.255.192
auto Attempt to obtain IPv6 address, mask and gateway using SLAAC
dhcp [OPTION] Attempt to obtain IPv4 address, mask, gateway, DNS via DHCP
-d Show DHCP packet decode
-r Renew DHCP lease
-x Release DHCP lease
dns ip Set DNS server ip, delete if ip is '0'
dns6 ipv6 Set DNS server ipv6, delete if ipv6 is '0'
domain NAME Set local domain name to NAME
VPCS> 192.168.1.2 255.255.255.0
Bad command: "192.168.1.2 255.255.255.0". Use ? for help.
VPCS> ip 192.168.1.2 255.255.255.0
Checking for duplicate address...
VPCS : 192.168.1.2 255.255.255.0
VPCS>
solarwinds
Solar-PuTTY free tool
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PC1
PC2
PC3
PC4
Welcome to Virtual PC Simulator, version 0.8.2
Dedicated to Daling.
Build time: Aug 23 2021 11:15:00
Copyright (c) 2007-2015, Paul Meng (mirnshi@gmail.com)
All rights reserved.
VPCS is free software, distributed under the terms of the "BSD" licence.
Source code and license can be found at vpcs.sf.net.
For more information, please visit wiki.freecode.com.cn.
Press '?' to get help.
VPCS> ip 192.168.1.3 255.255.255.0
Checking for duplicate address...
VPCS : 192.168.1.3 255.255.255.0
VPCS> show ip
NAME : VPCS[1]
IP/MASK : 192.168.1.3/24
GATEWAY : 255.255.255.0
DNS :
MAC : 00:50:79:66:68:02
LPORT : 20010
RHOST:PORT : 127.0.0.1:20011
MTU : 1500
VPCS>
solarwinds
Solar-PuTTY free tool
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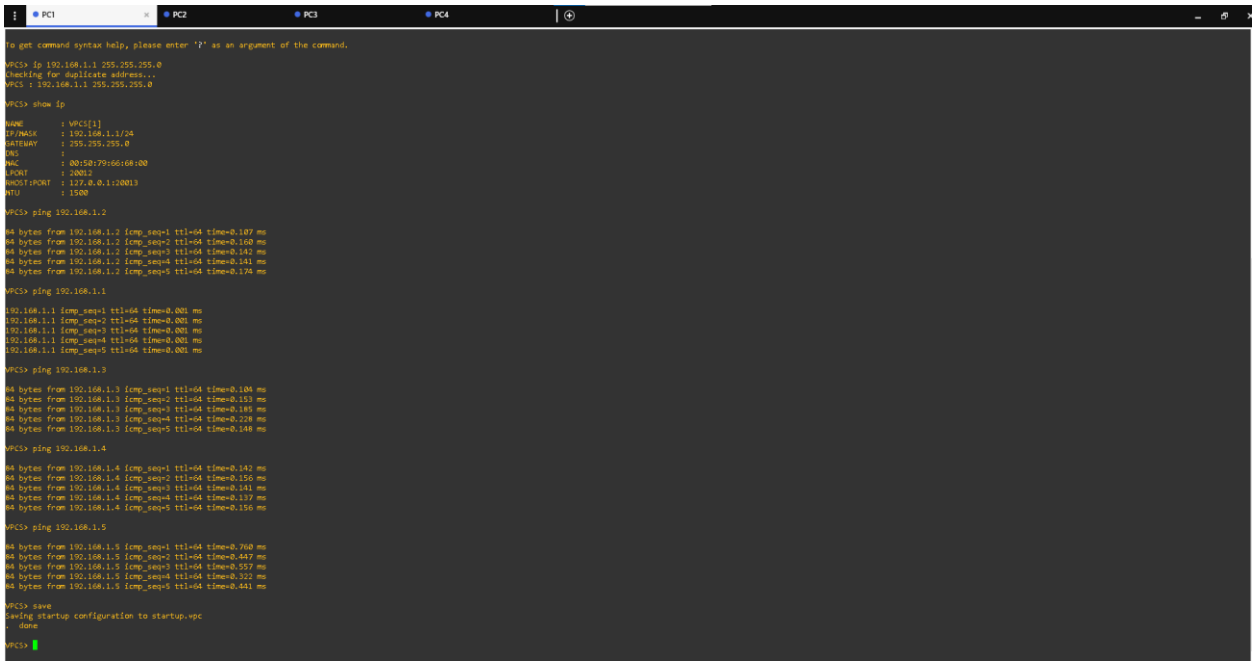
4) Αναθέτουμε στη TinyCore μηχανή την ip=192.168.1.5 . Αυτό φαίνεται στη παρακάτω εικόνα:

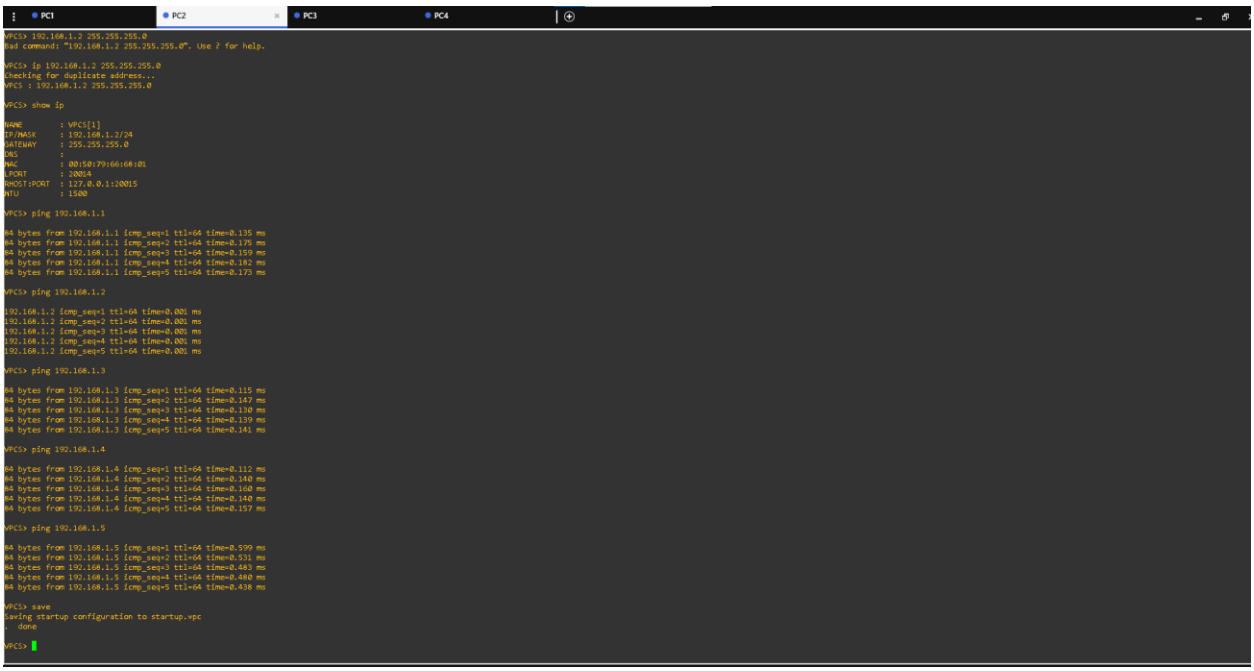
```
gns3@box:~$ sudo ifconfig eth0 192.168.1.5 netmask 255.255.255.0
gns3@box:~$ ifconfig
eth0      Link encap:Ethernet  HWaddr 0C:0F:3C:D5:00:00
          inet addr:192.168.1.5  Bcast:192.168.1.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:24 errors:0 dropped:0 overruns:0 frame:0
          TX packets:157 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1940 (1.8 KiB)  TX bytes:50202 (49.0 KiB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

gns3@box:~$
```

5) Εκτελούμε σε κάθε μηχανή την εντολή ping προς όλους τους υπόλοιπους υπολογιστές στο δίκτυο. Αυτό φαίνεται στις παρακάτω εικόνες:

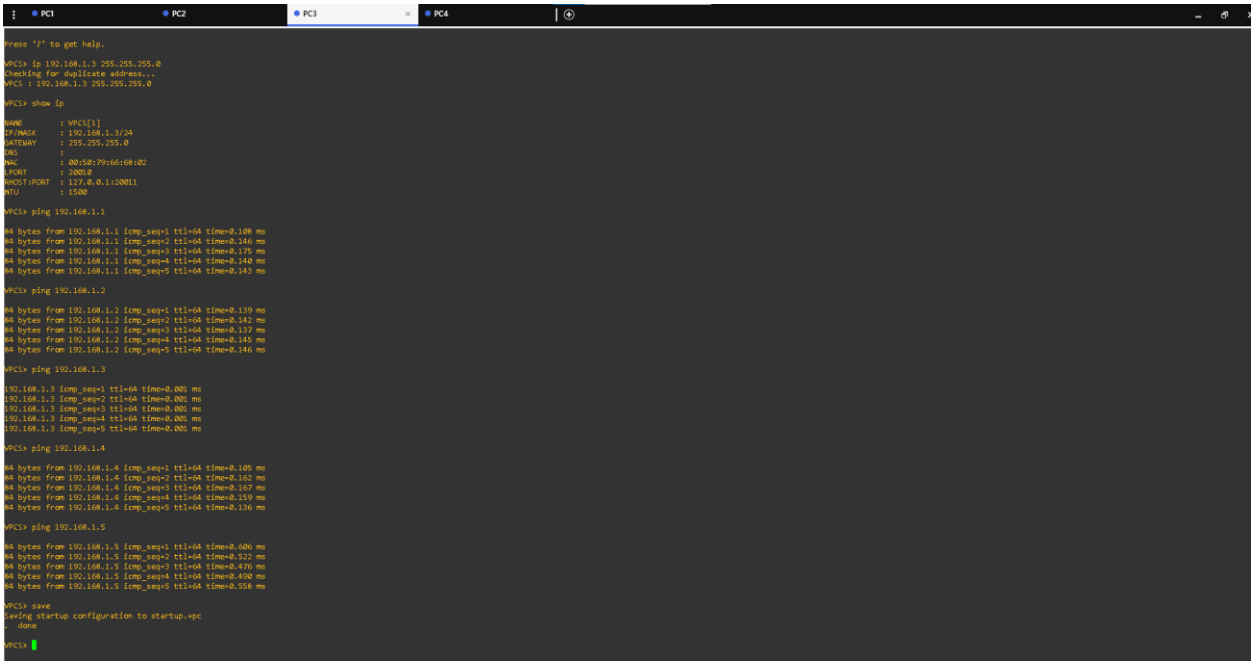
PC1:


PC1
PC2
PC3
PC4
To get command syntax help, please enter '?' as an argument of the command.
VPCS> ip 192.168.1.1 255.255.255.0
Checking for duplicate address...
VPCS : 192.168.1.1 255.255.255.0
VPCS> show ip
NAME : VPCS[1]
IP/MASK : 192.168.1.1/24
GATEWAY : 255.255.255.0
DNS :
MAC : 00:50:79:66:68:00
LPORT : 20012
RHOST:PORT : 127.0.0.1:20013
MTU : 1500
VPCS> ping 192.168.1.2
84 bytes from 192.168.1.2 icmp_seq=1 ttl=64 time=0.107 ms
84 bytes from 192.168.1.2 icmp_seq=2 ttl=64 time=0.160 ms
84 bytes from 192.168.1.2 icmp_seq=3 ttl=64 time=0.142 ms
84 bytes from 192.168.1.2 icmp_seq=4 ttl=64 time=0.141 ms
84 bytes from 192.168.1.2 icmp_seq=5 ttl=64 time=0.174 ms
VPCS> ping 192.168.1.1
192.168.1.1 icmp_seq=1 ttl=64 time=0.001 ms
192.168.1.1 icmp_seq=2 ttl=64 time=0.001 ms
192.168.1.1 icmp_seq=3 ttl=64 time=0.001 ms
192.168.1.1 icmp_seq=4 ttl=64 time=0.001 ms
192.168.1.1 icmp_seq=5 ttl=64 time=0.001 ms
VPCS> ping 192.168.1.3
84 bytes from 192.168.1.3 icmp_seq=1 ttl=64 time=0.104 ms
84 bytes from 192.168.1.3 icmp_seq=2 ttl=64 time=0.153 ms
84 bytes from 192.168.1.3 icmp_seq=3 ttl=64 time=0.185 ms
84 bytes from 192.168.1.3 icmp_seq=4 ttl=64 time=0.228 ms
84 bytes from 192.168.1.3 icmp_seq=5 ttl=64 time=0.140 ms
VPCS> ping 192.168.1.4
84 bytes from 192.168.1.4 icmp_seq=1 ttl=64 time=0.142 ms
84 bytes from 192.168.1.4 icmp_seq=2 ttl=64 time=0.156 ms
84 bytes from 192.168.1.4 icmp_seq=3 ttl=64 time=0.141 ms
84 bytes from 192.168.1.4 icmp_seq=4 ttl=64 time=0.137 ms
84 bytes from 192.168.1.4 icmp_seq=5 ttl=64 time=0.156 ms
VPCS> ping 192.168.1.5
84 bytes from 192.168.1.5 icmp_seq=1 ttl=64 time=0.760 ms
84 bytes from 192.168.1.5 icmp_seq=2 ttl=64 time=0.447 ms
84 bytes from 192.168.1.5 icmp_seq=3 ttl=64 time=0.557 ms
84 bytes from 192.168.1.5 icmp_seq=4 ttl=64 time=0.322 ms
84 bytes from 192.168.1.5 icmp_seq=5 ttl=64 time=0.441 ms
VPCS> save
Saving startup configuration to startup.vpc
. done
VPCS>

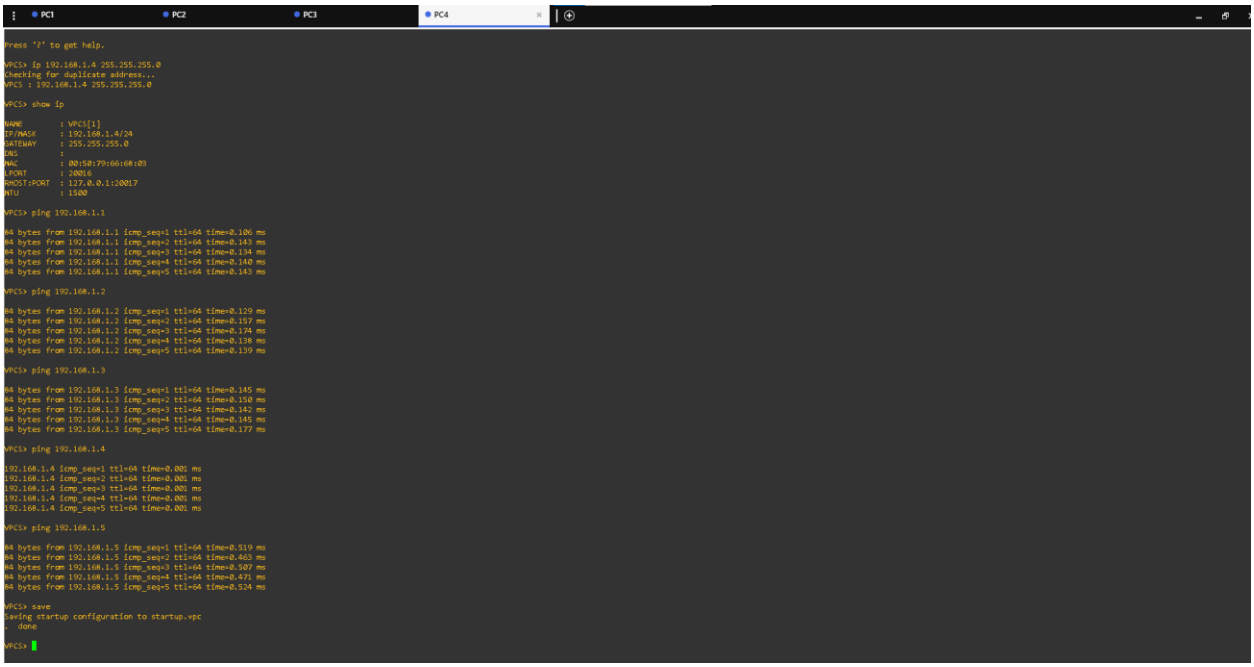
PC2:


PC1
PC2
PC3
PC4
VPCS> 192.168.1.2 255.255.255.0
Bad command: "192.168.1.2 255.255.255.0". Use ? for help.
VPCS> ip 192.168.1.2 255.255.255.0
Checking for duplicate address...
VPCS : 192.168.1.2 255.255.255.0
VPCS> show ip
NAME : VPCS[1]
IP/MASK : 192.168.1.2/24
GATEWAY : 255.255.255.0
DNS :
MAC : 00:50:79:66:68:01
LPORT : 20014
RHOST:PORT : 127.0.0.1:20015
MTU : 1500
VPCS> ping 192.168.1.1
84 bytes from 192.168.1.1 icmp_seq=1 ttl=64 time=0.135 ms
84 bytes from 192.168.1.1 icmp_seq=2 ttl=64 time=0.175 ms
84 bytes from 192.168.1.1 icmp_seq=3 ttl=64 time=0.159 ms
84 bytes from 192.168.1.1 icmp_seq=4 ttl=64 time=0.182 ms
84 bytes from 192.168.1.1 icmp_seq=5 ttl=64 time=0.173 ms
VPCS> ping 192.168.1.2
192.168.1.2 icmp_seq=1 ttl=64 time=0.001 ms
192.168.1.2 icmp_seq=2 ttl=64 time=0.001 ms
192.168.1.2 icmp_seq=3 ttl=64 time=0.001 ms
192.168.1.2 icmp_seq=4 ttl=64 time=0.001 ms
192.168.1.2 icmp_seq=5 ttl=64 time=0.001 ms
VPCS> ping 192.168.1.3
84 bytes from 192.168.1.3 icmp_seq=1 ttl=64 time=0.115 ms
84 bytes from 192.168.1.3 icmp_seq=2 ttl=64 time=0.147 ms
84 bytes from 192.168.1.3 icmp_seq=3 ttl=64 time=0.130 ms
84 bytes from 192.168.1.3 icmp_seq=4 ttl=64 time=0.139 ms
84 bytes from 192.168.1.3 icmp_seq=5 ttl=64 time=0.141 ms
VPCS> ping 192.168.1.4
84 bytes from 192.168.1.4 icmp_seq=1 ttl=64 time=0.112 ms
84 bytes from 192.168.1.4 icmp_seq=2 ttl=64 time=0.140 ms
84 bytes from 192.168.1.4 icmp_seq=3 ttl=64 time=0.160 ms
84 bytes from 192.168.1.4 icmp_seq=4 ttl=64 time=0.140 ms
84 bytes from 192.168.1.4 icmp_seq=5 ttl=64 time=0.157 ms
VPCS> ping 192.168.1.5
84 bytes from 192.168.1.5 icmp_seq=1 ttl=64 time=0.599 ms
84 bytes from 192.168.1.5 icmp_seq=2 ttl=64 time=0.531 ms
84 bytes from 192.168.1.5 icmp_seq=3 ttl=64 time=0.483 ms
84 bytes from 192.168.1.5 icmp_seq=4 ttl=64 time=0.480 ms
84 bytes from 192.168.1.5 icmp_seq=5 ttl=64 time=0.438 ms
VPCS> save
Saving startup configuration to startup.vpc
. done
VPCS>

PC3:



PC4:

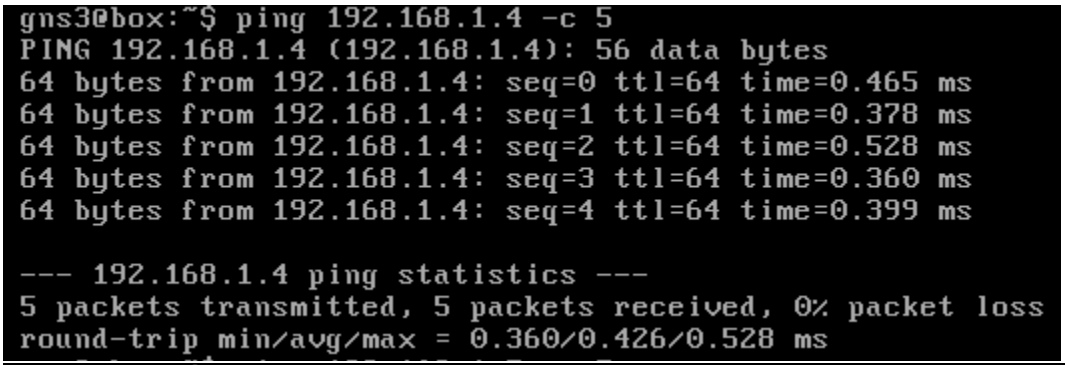


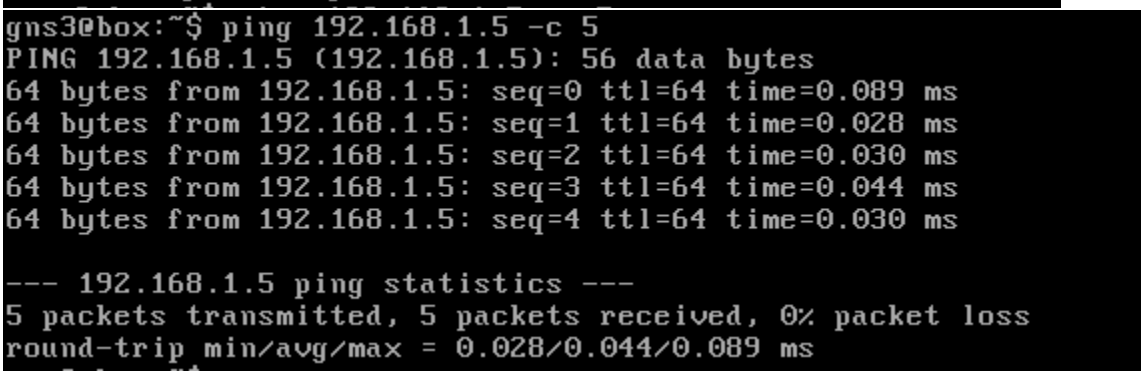
TinyCore:

```
gns3@box:~$ ping 192.168.1.1 -c 5
PING 192.168.1.1 (192.168.1.1): 56 data bytes
64 bytes from 192.168.1.1: seq=0 ttl=64 time=0.877 ms
64 bytes from 192.168.1.1: seq=1 ttl=64 time=0.640 ms
64 bytes from 192.168.1.1: seq=2 ttl=64 time=0.544 ms
64 bytes from 192.168.1.1: seq=3 ttl=64 time=0.546 ms
64 bytes from 192.168.1.1: seq=4 ttl=64 time=0.568 ms

--- 192.168.1.1 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max = 0.544/0.635/0.877 ms
```

```
gns3@box:~$ ping 192.168.1.2 -c 5
PING 192.168.1.2 (192.168.1.2): 56 data bytes
64 bytes from 192.168.1.2: seq=0 ttl=64 time=0.784 ms
64 bytes from 192.168.1.2: seq=1 ttl=64 time=0.875 ms
64 bytes from 192.168.1.2: seq=2 ttl=64 time=0.516 ms
64 bytes from 192.168.1.2: seq=3 ttl=64 time=0.671 ms
64 bytes from 192.168.1.2: seq=4 ttl=64 time=0.553 ms

--- 192.168.1.2 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max = 0.516/0.679/0.875 ms
```

```
gns3@box:~$ ping 192.168.1.3 -c 5
PING 192.168.1.3 (192.168.1.3): 56 data bytes
64 bytes from 192.168.1.3: seq=0 ttl=64 time=0.487 ms
64 bytes from 192.168.1.3: seq=1 ttl=64 time=0.579 ms
64 bytes from 192.168.1.3: seq=2 ttl=64 time=1.017 ms
64 bytes from 192.168.1.3: seq=3 ttl=64 time=0.514 ms
64 bytes from 192.168.1.3: seq=4 ttl=64 time=0.553 ms

--- 192.168.1.3 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max = 0.487/0.630/1.017 ms
```





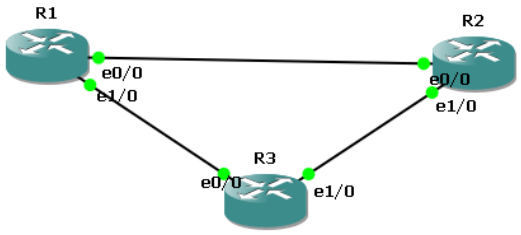
Παρατηρούμε πως όλοι οι υπολογιστές στο δίκτυο επικοινωνούν μεταξύ τους. Στις παραπάνω εικόνες φαίνεται και η εντολή save ώστε να σώσουμε τις ρυθμίσεις που περάσαμε. Για το tinycore linux :

Σώζουμε το αρχείο και έπειτα στο τερματικό γράφουμε:

Filetool.sh -b κάνοντας back-up το Filetool.sh. Κάνουμε sudo-reboot για να επανεκκινήσουμε τη μηχανή. Εάν εκτελέσουμε πάλι ifconfig στη μηχανή βλέπουμε πως οι ρυθμίσεις μας είναι σωσμένες.

Άσκηση 2

Για τη δεύτερη άσκηση υλοποιούμε την τοπολογία της παρακάτω εικόνας:



Ερωτήματα:

1)

Για κάθε δρομολογητή αναθέτουμε ip διευθύνσεις στα απαιτούμενα interfaces τους.

Για τον R1:

```
R1#sh ip int br
Interface                  IP-Address      OK? Method Status                Protocol
Ethernet0/0                unassigned      YES unset  administratively down down
Serial0/0                  unassigned      YES unset  administratively down down
Serial0/1                  unassigned      YES unset  administratively down down
Serial0/2                  unassigned      YES unset  administratively down down
Ethernet1/0                unassigned      YES unset  administratively down down
Ethernet1/1                unassigned      YES unset  administratively down down
Ethernet1/2                unassigned      YES unset  administratively down down
Ethernet1/3                unassigned      YES unset  administratively down down
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#int e0/0
R1(config-if)#ip add 192.168.1.2
% Incomplete command.

R1(config-if)#ip add 192.168.1.2 255.255.255.0
R1(config-if)#no shut
R1(config-if)#
*Mar  1 00:02:41.604: %LINK-3-UPDOWN: Interface Ethernet0/0, changed state to up
R1(config-if)#
*Mar  1 00:02:42.606: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet0/0, changed state to up
R1(config-if)#int e1/0
R1(config-if)#ip add 192.168.2.2
% Incomplete command.

R1(config-if)#ip add 192.168.2.2 255.255.255.0
R1(config-if)#no shut
R1(config-if)#end
*Mar  1 00:04:55.484: %LINK-3-UPDOWN: Interface Ethernet1/0, changed state to up
R1(config-if)#end
*Mar  1 00:04:56.486: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/0, changed state to up
R1(config-if)#end
R1#sh ip int br
*Mar  1 00:04:57.808: %SYS-5-CONFIG_I: Configured from console by console
R1#sh ip int br
Interface                  IP-Address      OK? Method Status                Protocol
Ethernet0/0                192.168.1.2     YES manual up                    up
Serial0/0                  unassigned      YES unset  administratively down down
Serial0/1                  unassigned      YES unset  administratively down down
Serial0/2                  unassigned      YES unset  administratively down down
Ethernet1/0                192.168.2.2     YES manual up                    up
Ethernet1/1                unassigned      YES unset  administratively down down
Ethernet1/2                unassigned      YES unset  administratively down down
Ethernet1/3                unassigned      YES unset  administratively down down
R1#sh ip int br
Interface                  IP-Address      OK? Method Status                Protocol
Ethernet0/0                192.168.1.2     YES manual up                    up
Serial0/0                  unassigned      YES unset  administratively down down
Serial0/1                  unassigned      YES unset  administratively down down
Serial0/2                  unassigned      YES unset  administratively down down
Ethernet1/0                192.168.2.2     YES manual up                    up
Ethernet1/1                unassigned      YES unset  administratively down down
Ethernet1/2                unassigned      YES unset  administratively down down
Ethernet1/3                unassigned      YES unset  administratively down down
R1#ping 192.168.1.3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.3, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 16/31/64 ms
R1#ping 192.168.1.3
```

Για τον R2:

```
*Mar  1 00:00:14.816: %CRYPTO-6-GDOI_ON_OFF: GDOI is OFF
R2#sh ip int br
Interface                  IP-Address      OK? Method Status                Protocol
Ethernet0/0                unassigned      YES unset  administratively down down
Serial0/0                  unassigned      YES unset  administratively down down
Serial0/1                  unassigned      YES unset  administratively down down
Serial0/2                  unassigned      YES unset  administratively down down
Ethernet1/0                unassigned      YES unset  administratively down down
Ethernet1/1                unassigned      YES unset  administratively down down
Ethernet1/2                unassigned      YES unset  administratively down down
Ethernet1/3                unassigned      YES unset  administratively down down
R2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#int e0/0
R2(config-if)#ip add 192.168.1.3 255.255.255.0
R2(config-if)#no shut
R2(config-if)#
*Mar  1 00:06:43.958: %LINK-3-UPDOWN: Interface Ethernet0/0, changed state to up
R2(config-if)#
*Mar  1 00:06:44.959: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet0/0, changed state to up
R2(config-if)#int e1/0
R2(config-if)#ip add 192.168.3.3 255.255.255.0
R2(config-if)#no shut
R2(config-if)#end
R2#sh ip int br
*Mar  1 00:08:49.812: %SYS-5-CONFIG_I: Configured from console by console
R2#sh ip int br
Interface                  IP-Address      OK? Method Status                Protocol
Ethernet0/0                192.168.1.3     YES manual up                    up
Serial0/0                  unassigned      YES unset  administratively down down
Serial0/1                  unassigned      YES unset  administratively down down
Serial0/2                  unassigned      YES unset  administratively down down
Ethernet1/0                192.168.3.3     YES manual up                    up
Ethernet1/1                unassigned      YES unset  administratively down down
Ethernet1/2                unassigned      YES unset  administratively down down
Ethernet1/3                unassigned      YES unset  administratively down down
R2#
*Mar  1 00:08:50.709: %LINK-3-UPDOWN: Interface Ethernet1/0, changed state to up
*Mar  1 00:08:51.711: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/0, changed state to up
R2#sh ip int br
Interface                  IP-Address      OK? Method Status                Protocol
Ethernet0/0                192.168.1.3     YES manual up                    up
Serial0/0                  unassigned      YES unset  administratively down down
Serial0/1                  unassigned      YES unset  administratively down down
Serial0/2                  unassigned      YES unset  administratively down down
Ethernet1/0                192.168.3.3     YES manual up                    up
Ethernet1/1                unassigned      YES unset  administratively down down
Ethernet1/2                unassigned      YES unset  administratively down down
Ethernet1/3                unassigned      YES unset  administratively down down
R2#ping 192.168.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 16/33/60 ms
R2#ping 192.168.3.4

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.3.4, timeout is 2 seconds:
!!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 8/13/20 ms
R2#ping 192.168.3.4
```

Για τον R3:

```
R3#sh ip int br
Interface                  IP-Address      OK? Method Status                Protocol
Ethernet0/0                unassigned      YES unset  administratively down down
Serial0/0                  unassigned      YES unset  administratively down down
Serial0/1                  unassigned      YES unset  administratively down down
Serial0/2                  unassigned      YES unset  administratively down down
Ethernet1/0                unassigned      YES unset  administratively down down
Ethernet1/1                unassigned      YES unset  administratively down down
Ethernet1/2                unassigned      YES unset  administratively down down
Ethernet1/3                unassigned      YES unset  administratively down down
R3#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#int e0/0
R3(config-if)#ip add 192.168.2.3 255.255.255.0
R3(config-if)#no shut
R3(config-if)#ip
*Mar  1 00:13:19.895: %LINK-3-UPDOWN: Interface Ethernet0/0, changed state to up
*Mar  1 00:13:20.896: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet0/0, changed state to up
R3(config-if)#int e1/0
R3(config-if)#ip add 192.168.3.4 255.255.255.0
R3(config-if)#no shut
R3(config-if)#end
R3#sh ip int br
*Mar  1 00:14:42.122: %SYS-5-CONFIG_I: Configured from console by console
R3#sh ip int br
Interface                  IP-Address      OK? Method Status                Protocol
Ethernet0/0                192.168.2.3     YES manual up                    up
Serial0/0                  unassigned      YES unset  administratively down down
Serial0/1                  unassigned      YES unset  administratively down down
Serial0/2                  unassigned      YES unset  administratively down down
Ethernet1/0                192.168.3.4     YES manual up                    up
Ethernet1/1                unassigned      YES unset  administratively down down
Ethernet1/2                unassigned      YES unset  administratively down down
Ethernet1/3                unassigned      YES unset  administratively down down
R3#
*Mar  1 00:14:43.055: %LINK-3-UPDOWN: Interface Ethernet1/0, changed state to up
R3#
*Mar  1 00:14:44.057: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/0, changed state to up
R3#ping 192.168.2.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.2.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 16/31/56 ms
R3#ping 192.168.3.3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.3.3, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 12/16/20 ms
R3#opsf
Translating "opsf"

Translating "opsf"

% Unknown command or computer name, or unable to find computer address
R3#ospf
Translating "ospf"

Translating "ospf"
```

2)

Εκτελούμε την εντολή ping στο δρομολογητή R1 για τις αντικριστές συνδέσεις:

```
R1#ping 192.168.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 8/8/8 ms
R1#ping 192.168.1.3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.3, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 16/33/60 ms
R1#ping 192.168.1.3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.3, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 16/20/24 ms
R1#ping 192.168.2.3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.2.3, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 8/16/20 ms
R1#ping 192.168.2.3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.2.3, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 8/19/28 ms
R1#
```

Εκτελούμε την εντολή ping στον R2 για τις αντικριστές συνδέσεις:

```
R2#ping 192.168.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 16/19/21 ms
R2#ping 192.168.3.4

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.3.4, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 8/37/80 ms
R2#ping 192.168.3.4

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.3.4, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 8/12/24 ms
R2#
```

Εκτελούμε την εντολή ping στον R3 για τις αντικριστές συνδέσεις:

```
R3#ping 192.168.2.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.2.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/12/24 ms
R3#ping 192.168.3.3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.3.3, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/15/24 ms
R3#
```

Όμως εάν πάμε και κάνουμε ping μη αντικριστές συνδέσεις θα συμβεί αυτό που φαίνεται στη παρακάτω εικόνα:

Για τον R1:

```
R1#ping 192.168.3.3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.3.3, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)
R1#ping 192.168.3.4

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.3.4, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)
R1#
```

Για τον R2:

```
R2#ping 192.168.2.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.2.2, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)
R2#ping 192.168.2.3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.2.3, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)
R2#
```

Για τον R3:

```
R3#ping 192.168.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.2, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)
R3#ping 192.168.1.3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.3, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)
R3#
```

Γεγονός το οποίο ήταν αναμενόμενο αφού οι δρομολογητές δεν έχουν ενημερωθεί για όλα τα διαθέσιμα μονοπάτια.

3)

Ενεργοποιούμε το πρωτόκολλο ospf ώστε οι δρομολογητές να ενημερωθούν για όλα τα διαθέσιμα μονοπάτια. Θα έχουμε για τον R1:

```
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#router ospf 1
R1(config-router)#network 192.168.1.0 0.0.0.255 area 0
R1(config-router)#network 192.168.2.0 0.0.0.255 area 0
R1(config-router)#end
R1#
*Mar  1 01:41:20.591: %SYS-5-CONFIG_I: Configured from console by console
R1#
*Mar  1 01:43:08.412: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.3.3 on Ethernet0/0 from LOADING to FULL, Loading Done
R1#
*Mar  1 01:45:14.330: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.3.4 on Ethernet1/0 from LOADING to FULL, Loading Done
```

Για τον R2:

```
R2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#router ospf 1
R2(config-router)#network 192.168.1.0 0.0.0.255 area 0
R2(config-router)#n
*Mar  1 01:43:08.140: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.2.2 on Ethernet0/0 from LOADING to FULL, Loading Done
R2(config-router)#network 192.168.3.0 0.0.0.255 area 0
R2(config-router)#end
R2#
*Mar  1 01:43:55.345: %SYS-5-CONFIG_I: Configured from console by console
R2#
*Mar  1 01:45:35.453: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.3.4 on Ethernet1/0 from LOADING to FULL, Loading Done
```

Για τον R3:

```
R3#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#router ospf 1
R3(config-router)#network 192.168.2.0 0.0.0.255 area 0
R3(config-router)#
*Mar  1 01:45:15.400: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.2.2 on Ethernet0/0 from LOADING to FULL, Loading Done
R3(config-router)#network 192.168.3.0 0.0.0.255 area 0
R3(config-router)#
*Mar  1 01:45:36.771: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.3.3 on Ethernet1/0 from LOADING to FULL, Loading Done
R3(config-router)#end
R3#
*Mar  1 01:45:42.208: %SYS-5-CONFIG_I: Configured from console by console
```

4)

Κάνοντας ping αυτή τη φορά όχι για τις αντικριστές συνδέσεις δηλαδή οι παραπάνω από τις οποίες δεν πέρναμε απάντηση, έχοντας:

Για τον R1:

```
R1#ping 192.168.3.3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.3.3, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 16/20/28 ms
R1#ping 192.168.3.4

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.3.4, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 16/23/28 ms
```

Για τον R2:

```
R2#ping 192.168.2.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.2.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 8/21/32 ms
R2#ping 192.168.2.3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.2.3, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 12/25/33 ms
```

Για τον R3:

```
R3#ping 192.168.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 16/27/32 ms
R3#ping 192.168.1.3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.3, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 36/40/48 ms
R3#
```

5)

Τα μονοπάτια δρομολόγησης για κάθε δρομολογητή θα είναι:

Για τον R1:

```
R1#show ip route
Codes: C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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 not set

C    192.168.1.0/24 is directly connected, Ethernet0/0
C    192.168.2.0/24 is directly connected, Ethernet1/0
O    192.168.3.0/24 [110/20] via 192.168.2.3, 00:09:05, Ethernet1/0
                    [110/20] via 192.168.1.3, 00:10:47, Ethernet0/0
R1#
```

Για τον R2:

```
R2#show ip route
Codes: C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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 not set

C    192.168.1.0/24 is directly connected, Ethernet0/0
O    192.168.2.0/24 [110/20] via 192.168.3.4, 00:12:01, Ethernet1/0
                    [110/20] via 192.168.1.2, 00:14:29, Ethernet0/0
C    192.168.3.0/24 is directly connected, Ethernet1/0
R2#
```

Για τον R3:

```
R3#show ip route
Codes: C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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 not set

O    192.168.1.0/24 [110/20] via 192.168.3.3, 00:13:22, Ethernet1/0
                    [110/20] via 192.168.2.2, 00:13:44, Ethernet0/0
C    192.168.2.0/24 is directly connected, Ethernet0/0
C    192.168.3.0/24 is directly connected, Ethernet1/0
R3#
```

6)

Στις παραπάνω εικόνες φαίνοντα και τα μηνύματα των δρομολογητών όταν ‘’ανακαλύπτουν’’ τους γείτονες τους.

Κάνουμε save τις ρυθμίσεις μας:

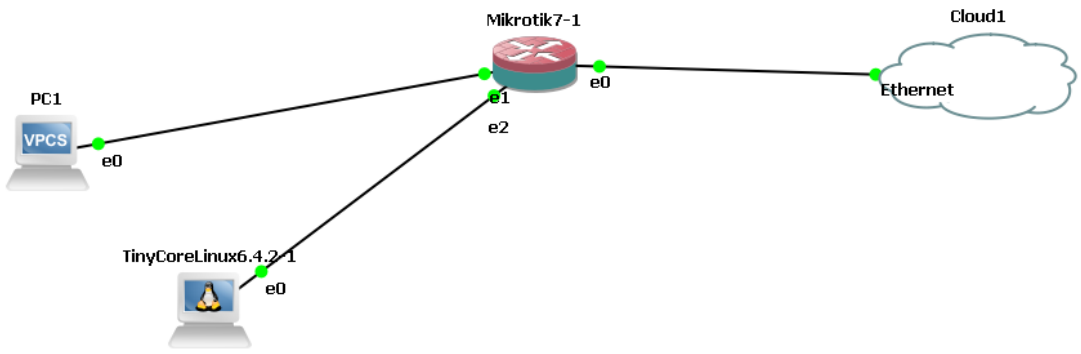
```
R1#copy running-config startup-config
Destination filename [startup-config]?
Warning: Attempting to overwrite an NVRAM configuration previously written
by a different version of the system image.
Overwrite the previous NVRAM configuration?[confirm]
Building configuration...
[OK]
R1#
```

```
R2#copy running-config startup-config
Destination filename [startup-config]?
Warning: Attempting to overwrite an NVRAM configuration previously written
by a different version of the system image.
Overwrite the previous NVRAM configuration?[confirm]
Building configuration...
[OK]
R2#
```

```
R3#copy running-config startup-config
Destination filename [startup-config]?
Warning: Attempting to overwrite an NVRAM configuration previously written
by a different version of the system image.
Overwrite the previous NVRAM configuration?[confirm]
Building configuration...
[OK]
R3#
```

Άσκηση 3

Υλοποιήθηκε η εξής τοπολογία:



Υλοποιούμε στο router της mikrotik τα εξής βήματα:

1)

Αναθέτω στις ether2 και ether3 τις εξής διευθύνσεις αφού ο ΑΜ είναι 1072604:

Ether2=10.72.60.4/24 και ether3=10.72.61.4/24. Αυτό φαίνεται και στη παρακάτω εικόνα:

2-3)

Υλοποιούμε NAT στη διεπαφή ether1 για όλη την κίνηση εξόδου από το εσωτερικό δίκτυο στο εξωτερικό διαδίκτυο. Αυτό φαίνεται στη παρακάτω εικόνα:

```
[admin@MikroTik] > ip address print
Flags: D - DYNAMIC
Columns: ADDRESS, NETWORK, INTERFACE
#   ADDRESS            NETWORK       INTERFACE
0   10.72.60.4/24      10.72.60.0    ether2
1   10.72.61.4/24      10.72.61.0    ether3
2 D 192.168.86.129/24  192.168.86.0  ether1
[admin@MikroTik] > ip dhcp-client print detail
Flags: X - disabled, I - invalid, D - dynamic
 0   interface=ether1 add-default-route=yes default-route-distance=1 use-peer-dns=yes use-peer-ntp=yes
     dhcp-options=hostname,clientid status=bound address=192.168.86.129/24 gateway=192.168.86.2
     dhcp-server=192.168.86.254 primary-dns=192.168.86.2 expires-after=29m42s
[admin@MikroTik] > ip firewall nat add chain=srcnat action=masquerade out-interface=ether1
[admin@MikroTik] >
[admin@MikroTik] > ip dhcp-client print detail
Flags: X - disabled, I - invalid, D - dynamic
 0   interface=ether1 add-default-route=yes default-route-distance=1 use-peer-dns=yes use-peer-ntp=yes
     dhcp-options=hostname,clientid status=bound address=192.168.86.129/24 gateway=192.168.86.2
     dhcp-server=192.168.86.254 primary-dns=192.168.86.2 expires-after=23m26s
[admin@MikroTik] > /ip dhcp-server setup
Select interface to run DHCP server on

dhcp server interface: ether2
Select network for DHCP addresses

dhcp address space: 10.72.60.0/24
Select gateway for given network

gateway for dhcp network: 10.72.60.4
Select pool of ip addresses given out by DHCP server

addresses to give out: 10.72.60.1-10.72.60.3,10.72.60.5-10.72.60.254
Select DNS servers

dns servers: 192.168.86.2
Select lease time

lease time: 10m
```

Επίσης όπως φαίνεται στη παρακάτω εικόνα έχει υλοποιηθεί dhcp server στο interface ether2 ώστε να μπορεί να δώσει δυναμικά διεύθυνση στη συσκευή που είναι συνδεδεμένη σε αυτό. Για τον ίδιο λόγο υλοποιούμε dhcp server στο interface ether3 πράγμα που φαίνεται στη παρακάτω εικόνα:

```
[admin@MikroTik] > /ip dhcp-server setup
Select interface to run DHCP server on

dhcp server interface: ether3
Select network for DHCP addresses

dhcp address space: 10.72.61.0/24
Select gateway for given network

gateway for dhcp network: 10.72.61.4
Select pool of ip addresses given out by DHCP server

addresses to give out: 10.72.61.1-10.72.61.3,10.72.61.5-10.72.61.254
Select DNS servers

dns servers: 192.168.86.2
Select lease time

lease time: 10m
[admin@MikroTik] > ip dhcp-client print detail
Flags: X - disabled, I - invalid, D - dynamic
 0   interface=ether1 add-default-route=yes default-route-distance=1 use-peer-dns=yes use-peer-ntp=yes
     dhcp-options=hostname,clientid status=bound address=192.168.86.129/24 gateway=192.168.86.2
     dhcp-server=192.168.86.254 primary-dns=192.168.86.2 expires-after=15m55s
[admin@MikroTik] >
```

DHCP client υπάρχει στο interface ether1 το οποίο πρέπει να πάρει δυναμικά διεύθυνση από τον υπολογιστή μου.

4)Εκτελούμε την εντολή ip dhcp στο PC1 ώστε να πάρει αυτόματα διεύθυνση. Θα έχουμε:

```
PC1> ip dhcp
DORA IP 10.72.60.3/24 GW 10.72.60.4
```

5)Και τέλος εκτελώντας ifconfig στο tinycore linux βλέπουμε στη συνδεδεμένη με το router διεπαφή(ether0=eth0) να έχει πάρει αυτόματα ip:

```
gns3@box:~$ ifconfig
eth0      Link encap:Ethernet  HWaddr 0C:45:8C:5A:00:00
          inet addr:10.72.61.3  Bcast:10.72.61.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:16 errors:0 dropped:0 overruns:0 frame:0
          TX packets:64 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:2654 (2.5 KiB)  TX bytes:21052 (20.5 KiB)
```

Ερωτήματα:

1)

Συνδεδεμένος στο PC1 τρέχω την εντολή ping 8.8.8.8 και έχω το εξής αποτέλεσμα:

```
PC1> ping 8.8.8.8

84 bytes from 8.8.8.8 icmp_seq=1 ttl=127 time=57.152 ms
84 bytes from 8.8.8.8 icmp_seq=2 ttl=127 time=57.705 ms
84 bytes from 8.8.8.8 icmp_seq=3 ttl=127 time=57.187 ms
84 bytes from 8.8.8.8 icmp_seq=4 ttl=127 time=57.624 ms
84 bytes from 8.8.8.8 icmp_seq=5 ttl=127 time=58.513 ms

PC1>
```

Στέλνω 5 πακέτα στην 8.8.8.8 και επειδή έχω πετύχει σύνδεση με το internet και η 8.8.8.8 είναι online μπορώ και παίρνω απάντηση από αυτή.

Τρέχοντας την εντολή trace 8.8.8.8 -P 1 -m 15

```
PC1> trace 8.8.8.8 -P 1 -m 15
trace to 8.8.8.8, 15 hops max (ICMP), press Ctrl+C to stop
 1   10.72.60.4   3.709 ms  1.200 ms  0.797 ms
 2   192.168.86.2   1.430 ms  0.878 ms  0.867 ms
 3     *  *  *
 4     *  *  *
 5     *  *  *
 6     *  *  *
 7     *  *  *
 8     *  *  *
 9     *  *  *
10     *  *  *
11     *  *  *
12     *  *  *
13     *  *  *
14     *  *  *
15   8.8.8.8   58.793 ms  57.973 ms  62.393 ms
```

Παρατηρούμε δηλαδή ότι φτάνοντας στο gateway έχουμε timeout (δεν δείχνει τους ενδιάμεσους υπολογιστές μεταξύ του PC1 και της 8.8.8.8. Σε αυτό πιθανότατα οφείλεται κάποια ρύθμιση του isp που μπλουκάρει το traceroute. Τρέχοντας ping ? και trace ? βλέπουμε τα πιθανά ορίσματα που μπορούμε να προσθέσουμε στις δύο αυτές εντολές:

```
PC1> ping ?

ping HOST [OPTION ...]
  Ping the network HOST. HOST can be an ip address or name
    Options:
     -1              ICMP mode, default
     -2              UDP mode
     -3              TCP mode
     -c count        Packet count, default 5
     -D              Set the Don't Fragment bit
     -f FLAG         Tcp header FLAG |C|E|U|A|P|R|S|F|
                                bits |7 6 5 4 3 2 1 0|
     -i ms           Wait ms milliseconds between sending each packet
     -l size         Data size
     -P protocol     Use IP protocol in ping packets
                       1 - ICMP (default), 17 - UDP, 6 - TCP
     -p port         Destination port
     -s port         Source port
     -T ttl          Set ttl, default 64
     -t              Send packets until interrupted by Ctrl+C
     -w ms           Wait ms milliseconds to receive the response

  Notes: 1. Using names requires DNS to be set.
         2. Use Ctrl+C to stop the command.
```

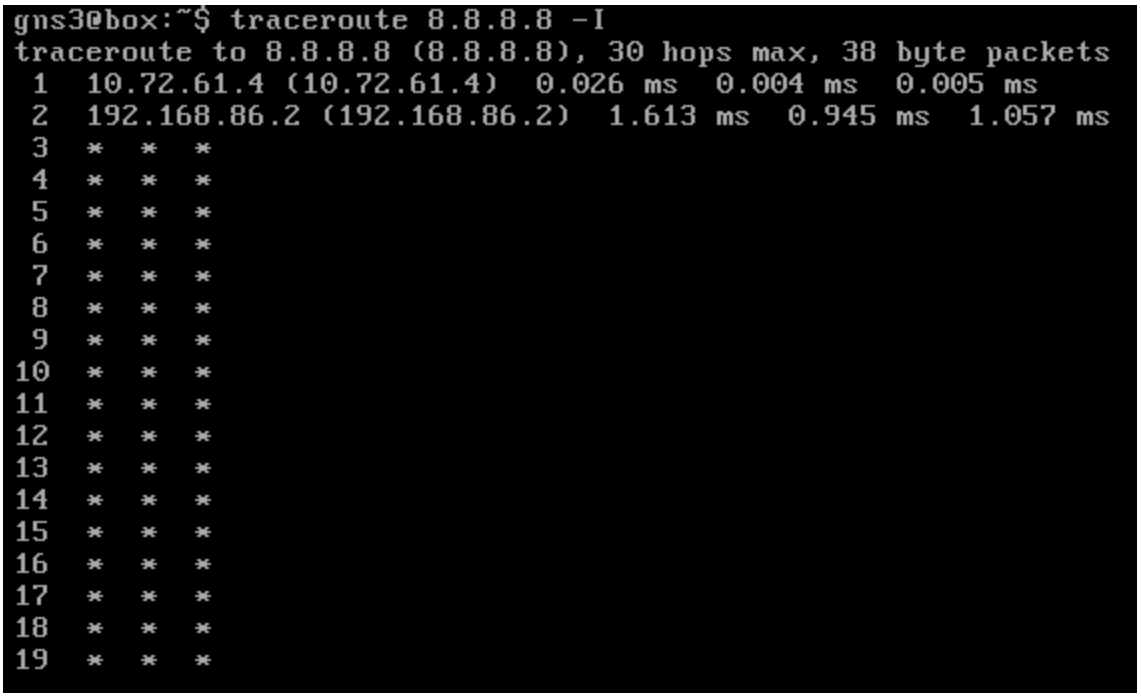
```
PC1> trace ?

trace HOST [OPTION ...]
  Print the path packets take to the network HOST. HOST can be an ip address or
  name.
    Options:
      -P protocol     Use IP protocol in trace packets
                        1 - icmp, 17 - udp (default), 6 - tcp
      -m ttl          Maximum ttl, default 8

  Notes: 1. Using names requires DNS to be set.
         2. Use Ctrl+C to stop the command.
```

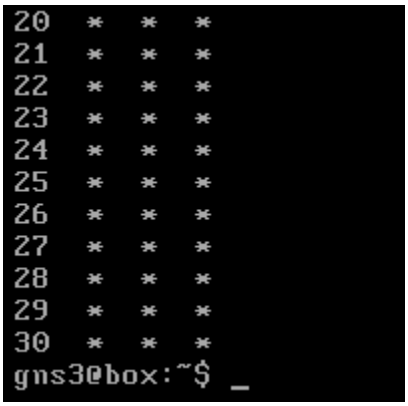
2)

Κάνοντας ping την 8.8.8.8 έχουμε το εξής αποτέλεσμα:

```
gns3@box:~$ ping 8.8.8.8 -c 10
PING 8.8.8.8 (8.8.8.8): 56 data bytes
64 bytes from 8.8.8.8: seq=0 ttl=127 time=56.401 ms
64 bytes from 8.8.8.8: seq=1 ttl=127 time=56.663 ms
64 bytes from 8.8.8.8: seq=2 ttl=127 time=56.595 ms
64 bytes from 8.8.8.8: seq=3 ttl=127 time=56.601 ms
64 bytes from 8.8.8.8: seq=4 ttl=127 time=60.479 ms
64 bytes from 8.8.8.8: seq=5 ttl=127 time=58.766 ms
64 bytes from 8.8.8.8: seq=6 ttl=127 time=59.040 ms
64 bytes from 8.8.8.8: seq=7 ttl=127 time=58.643 ms
64 bytes from 8.8.8.8: seq=8 ttl=127 time=61.377 ms
64 bytes from 8.8.8.8: seq=9 ttl=127 time=59.222 ms

--- 8.8.8.8 ping statistics ---
10 packets transmitted, 10 packets received, 0% packet loss
round-trip min/avg/max = 56.401/58.378/61.377 ms
gns3@box:~$ _
```

Όπως και με το PC1 ο server της google μας απαντά θετικά στην ύπαρξη του δηλαδή έχουμε συνδεσιμότητα με το διαδίκτυο. Τρέχοντας traceroute 8.8.8.8 -I παίρνω:

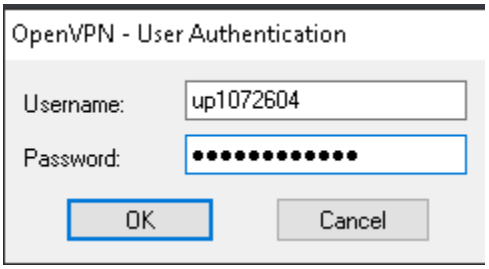




Σε αυτό πιθανότατα οφείλεται κάποια ρύθμιση του isp που μπλουκάρει το traceroute. Τρέχοντας traceroute -help έχουμε:

```
BusyBox v1.23.1 (2015-02-22 15:33:33 UTC) multi-call binary.

Usage: traceroute [-FIldnrv] [-f 1ST_TTL] [-m MAXTTL] [-p PORT] [-q PROBES]
        [-s SRC_IP] [-t TOS] [-w WAIT_SEC] [-g GATEWAY] [-i IFACE]
        [-z PAUSE_MSEC] HOST [BYTES]

Trace the route to HOST

        -F      Set the don't fragment bit
        -I      Use ICMP ECHO instead of UDP datagrams
        -l      Display the TTL value of the returned packet
        -d      Set SO_DEBUG options to socket
        -n      Print numeric addresses
        -r      Bypass routing tables, send directly to HOST
        -v      Verbose
        -m      Max time-to-live (max number of hops)
        -p      Base UDP port number used in probes
                (default 33434)
        -q      Number of probes per TTL (default 3)
        -s      IP address to use as the source address
        -t      Type-of-service in probe packets (default 0)
        -w      Time in seconds to wait for a response (default 3)
        -g      Loose source route gateway (8 max)

gns3@box:~$ D_
```

3) Συνδέομαι στο vpn του πανεπιστημίου και έχω:



```
OpenVPN Connection (UPatras)
Current State: Connected
Wed Mar 30 01:35:38 2022 OpenVPN 2.3.10 x86_64-w64-mingw32 [SSL (OpenSSL)] [LZO] [PKCS11] [IPv6] built on Jan  4 2016
Wed Mar 30 01:35:38 2022 Windows version 6.2 (Windows 8 or greater)
Wed Mar 30 01:35:38 2022 library versions: OpenSSL 1.0.1q 3 Dec 2015, LZO 2.09
Wed Mar 30 01:35:38 2022 MANAGEMENT: TCP Socket listening on [AF_INET]127.0.0.1:25340
Wed Mar 30 01:35:38 2022 Need hold release from management interface, waiting...
Wed Mar 30 01:35:38 2022 MANAGEMENT: Client connected from [AF_INET]127.0.0.1:25340
Wed Mar 30 01:35:38 2022 MANAGEMENT: CMD 'state on'
Wed Mar 30 01:35:38 2022 MANAGEMENT: CMD 'log all on'
Wed Mar 30 01:35:38 2022 MANAGEMENT: CMD 'hold off'
Wed Mar 30 01:35:38 2022 MANAGEMENT: CMD 'hold release'
Wed Mar 30 01:35:59 2022 MANAGEMENT: CMD 'username "Auth" ''up1072604'''
Wed Mar 30 01:35:59 2022 MANAGEMENT: CMD 'password [...]'
Wed Mar 30 01:36:00 2022 Socket Buffers: R=[65536->65536] S=[65536->65536]
Wed Mar 30 01:36:00 2022 MANAGEMENT: >STATE:1648593360,RESOLVE,,,
Wed Mar 30 01:36:00 2022 UDPv4 link local: [undef]
Wed Mar 30 01:36:00 2022 UDPv4 link remote: [AF_INET]150.140.128.117:1194
Wed Mar 30 01:36:00 2022 MANAGEMENT: >STATE:1648593360,WAIT,,,
Wed Mar 30 01:36:00 2022 MANAGEMENT: >STATE:1648593360,AUTH,,,
Wed Mar 30 01:36:00 2022 TLS: Initial packet from [AF_INET]150.140.128.117:1194, sid=54cad7e5 8fcd1f0a
Wed Mar 30 01:36:00 2022 WARNING: this configuration may cache passwords in memory -- use the auth-nocache option to prevent this
Wed Mar 30 01:36:00 2022 VERIFY OK: depth=1, C=GR, ST=Achaia, L=Patras, O=Upatras, OU=Upnet, CN=estero.upatras.gr, name=openvpn ca, emailAddress=postmaster@upnet.gr
Wed Mar 30 01:36:00 2022 Validating certificate key usage
Wed Mar 30 01:36:00 2022 ++ Certificate has key usage  00a0, expects 00a0
Wed Mar 30 01:36:00 2022 VERIFY KU OK
Wed Mar 30 01:36:00 2022 Validating certificate extended key usage
Wed Mar 30 01:36:00 2022 ++ Certificate has EKU (str) TLS Web Server Authentication, expects TLS Web Server Authentication
Wed Mar 30 01:36:00 2022 VERIFY EKU OK
Wed Mar 30 01:36:00 2022 VERIFY OK: depth=0, C=GR, ST=Achaia, L=Patras, O=Upatras, OU=Upnet, CN=estero.upnet.gr, name=openvpn server, emailAddress=postmaster@upnet.gr
Wed Mar 30 01:36:00 2022 Data Channel Encrypt: Cipher 'BF-CBC' initialized with 128 bit key
Wed Mar 30 01:36:00 2022 Data Channel Encrypt: Using 160 bit message hash 'SHA1' for HMAC authentication
Wed Mar 30 01:36:00 2022 Data Channel Decrypt: Cipher 'BF-CBC' initialized with 128 bit key
Wed Mar 30 01:36:00 2022 Data Channel Decrypt: Using 160 bit message hash 'SHA1' for HMAC authentication
Wed Mar 30 01:36:00 2022 Control Channel: TLSv1.2, cipher TLSv1/SSLv3 ECDHE-RSA-AES256-GCM-SHA384, 1024 bit RSA
Wed Mar 30 01:36:00 2022 [estero.upnet.gr] Peer Connection Initiated with [AF_INET]150.140.128.117:1194
Wed Mar 30 01:36:01 2022 MANAGEMENT: >STATE:1648593361,GET_CONFIG,,,
Wed Mar 30 01:36:02 2022 SENT CONTROL [estero.upnet.gr]: 'PUSH_REQUEST' (status=1)
Wed Mar 30 01:36:02 2022 PUSH: Received control message: 'PUSH_REPLY,redirect-gateway def1,dhcp-option DNS 150.140.129.30,dhcp-option DNS 150.140.129.130,route 150.140.254.1,topology net30,ping 20,ping-restart 120,ifconfig 150.140.254.214 150.140.254.213,peer-id 8'
Wed Mar 30 01:36:02 2022 OPTIONS IMPORT: timers and/or timeouts modified
Wed Mar 30 01:36:02 2022 OPTIONS IMPORT: --ifconfig/up options modified
Wed Mar 30 01:36:02 2022 OPTIONS IMPORT: route options modified
Wed Mar 30 01:36:02 2022 OPTIONS IMPORT: --ip-win32 and/or --dhcp-option options modified
Wed Mar 30 01:36:02 2022 OPTIONS IMPORT: peer-id set
Wed Mar 30 01:36:02 2022 OPTIONS IMPORT: adjusting link_mtu to 1577
Wed Mar 30 01:36:02 2022 ROUTE_GATEWAY 192.168.1.1/255.255.255.0 I=13 HWADDR=00:d8:61:51:b8:a7
Wed Mar 30 01:36:02 2022 do_ifconfig, tt->ipv6=0, tt->did_ifconfig_ipv6_setup=0
Wed Mar 30 01:36:02 2022 MANAGEMENT: >STATE:1648593362,ASSIGN_IP,,150.140.254.214,
Wed Mar 30 01:36:02 2022 open_tun, tt->ipv6=0
Wed Mar 30 01:36:02 2022 TAP-WIN32 device [Ethernet 2] opened: \\.\Global\{A39531F6-7A25-4CAD-A9AA-4C80A231D157}.tap
Wed Mar 30 01:36:02 2022 TAP-Windows Driver Version 9.21
Wed Mar 30 01:36:02 2022 Notified TAP-Windows driver to set a DHCP IP/netmask of 150.140.254.214/255.255.255.252 on interface {A39531F6-7A25-4CAD-A9AA-4C80A231D157} [DHCP-serv: 150.140.254.213, lease-time: 31536000]
Wed Mar 30 01:36:02 2022 Successful ARP Flush on interface [18] {A39531F6-7A25-4CAD-A9AA-4C80A231D157}
Wed Mar 30 01:36:04 2022 TEST ROUTES: 2/2 succeeded len=1 ret=1 a=0 u/d=up
Wed Mar 30 01:36:04 2022 C:\Windows\system32\route.exe ADD 150.140.128.117 MASK 255.255.255.255 192.168.1.1
Wed Mar 30 01:36:04 2022 env_block: add PATH=C:\Windows\System32;C:\Windows;C:\Windows\System32\Wbem
Wed Mar 30 01:36:04 2022 C:\Windows\system32\route.exe ADD 0.0.0.0 MASK 128.0.0.0 150.140.254.213
Wed Mar 30 01:36:04 2022 env_block: add PATH=C:\Windows\System32;C:\Windows;C:\Windows\System32\Wbem
Wed Mar 30 01:36:04 2022 C:\Windows\system32\route.exe ADD 128.0.0.0 MASK 128.0.0.0 150.140.254.213
Wed Mar 30 01:36:04 2022 env_block: add PATH=C:\Windows\System32;C:\Windows;C:\Windows\System32\Wbem
Wed Mar 30 01:36:04 2022 MANAGEMENT: >STATE:1648593364,ADD_ROUTES,,,
Wed Mar 30 01:36:04 2022 C:\Windows\system32\route.exe ADD 150.140.254.1 MASK 255.255.255.255 150.140.254.213
Wed Mar 30 01:36:04 2022 env_block: add PATH=C:\Windows\System32;C:\Windows;C:\Windows\System32\Wbem
Wed Mar 30 01:36:04 2022 Initialization Sequence Completed
Wed Mar 30 01:36:04 2022 MANAGEMENT: >STATE:1648593364,CONNECTED,SUCCESS,150.140.254.214,150.140.128.117
```

Στο PC1 τρέχω την εντολή ping 150.140.139.250 -P 6 -p 22 :

Pingάρω την ip 150.140.139.250 κάνοντας χρήση του TCP πρωτόκολλου με θύρα προορισμού 22.

```
PC1> ping 150.140.139.250 -P 6 -p 22

Connect   22@150.140.139.250 seq=1 ttl=127 time=27.483 ms
SendData  22@150.140.139.250 seq=1 ttl=127 time=1.250 ms
Close     22@150.140.139.250 timeout(2.658ms)
Connect   22@150.140.139.250 seq=2 ttl=127 time=28.462 ms
SendData  22@150.140.139.250 seq=2 ttl=127 time=2.494 ms
Close     22@150.140.139.250 timeout(2008.593ms)
Connect   22@150.140.139.250 seq=3 ttl=127 time=26.481 ms
SendData  22@150.140.139.250 seq=3 ttl=127 time=2.531 ms
Close     22@150.140.139.250 timeout(6.776ms)
Connect   22@150.140.139.250 seq=4 ttl=127 time=25.372 ms
SendData  22@150.140.139.250 seq=4 ttl=127 time=2.390 ms
Close     22@150.140.139.250 timeout(4.963ms)
Connect   22@150.140.139.250 seq=5 ttl=127 time=26.137 ms
SendData  22@150.140.139.250 seq=5 ttl=127 time=2.608 ms
Close     22@150.140.139.250 timeout(11.560ms)

PC1>
```

Μπορούμε να συνδεθούμε και να στείλουμε δεδομένα. Η εξωτερική IP διεύθυνση που μου έχει δωθεί είναι :

```
Assigned IP: 150.140.254.214
```

4)

Κλείνω το vpn και τρέχω πάλι την ίδια εντολή:

```
PC1> ping 150.140.139.250 -P 6 -p 22

Connect   22@150.140.139.250 seq=1 ttl=127 time=27.483 ms
SendData  22@150.140.139.250 seq=1 ttl=127 time=1.250 ms
Close     22@150.140.139.250 timeout(2.658ms)
Connect   22@150.140.139.250 seq=2 ttl=127 time=28.462 ms
SendData  22@150.140.139.250 seq=2 ttl=127 time=2.494 ms
Close     22@150.140.139.250 timeout(2008.593ms)
Connect   22@150.140.139.250 seq=3 ttl=127 time=26.481 ms
SendData  22@150.140.139.250 seq=3 ttl=127 time=2.531 ms
Close     22@150.140.139.250 timeout(6.776ms)
Connect   22@150.140.139.250 seq=4 ttl=127 time=25.372 ms
SendData  22@150.140.139.250 seq=4 ttl=127 time=2.390 ms
Close     22@150.140.139.250 timeout(4.963ms)
Connect   22@150.140.139.250 seq=5 ttl=127 time=26.137 ms
SendData  22@150.140.139.250 seq=5 ttl=127 time=2.608 ms
Close     22@150.140.139.250 timeout(11.560ms)

PC1> ping 150.140.139.250 -P 6 -p 22

Connect   22@150.140.139.250 timeout
Connect   22@150.140.139.250 timeout
Connect   22@150.140.139.250 timeout
Connect   22@150.140.139.250 timeout
Connect   22@150.140.139.250 timeout

PC1>
```

Δε συνδέεται στον εξυπηρετητή του εργαστηρίου αφού δεν είμαι συνδεδεμένος στο υποδίκτυο του πανεπιστημίου.

5)

Τρέχοντας την εντολή nc -u 150.140.139.250 9000 από το tinycore linux έχουμε:

```
gns3@box:~$ sudo nc -u 150.140.139.250 9000
1072604 82.198.53.124
```

Με την εντολή nc τρέχουμε το netcat και με το όρισμα -u χρησιμοποιούμε το πρωτόκολλο UDP αντί του προεπιλεγμένου TCP. Με την netcat μπορούμε να στείλουμε ‘’ωμά’’ δεδομένα μέσω ενός δικτύου μέσω της θύρας 9000.