

Task.Networking.1

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1) Create virtual machines connection according to figure 1:

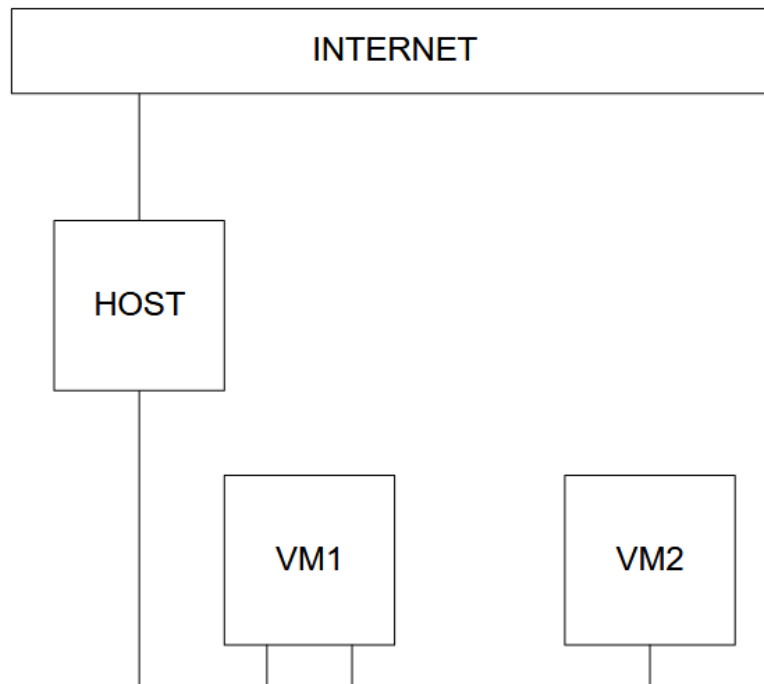
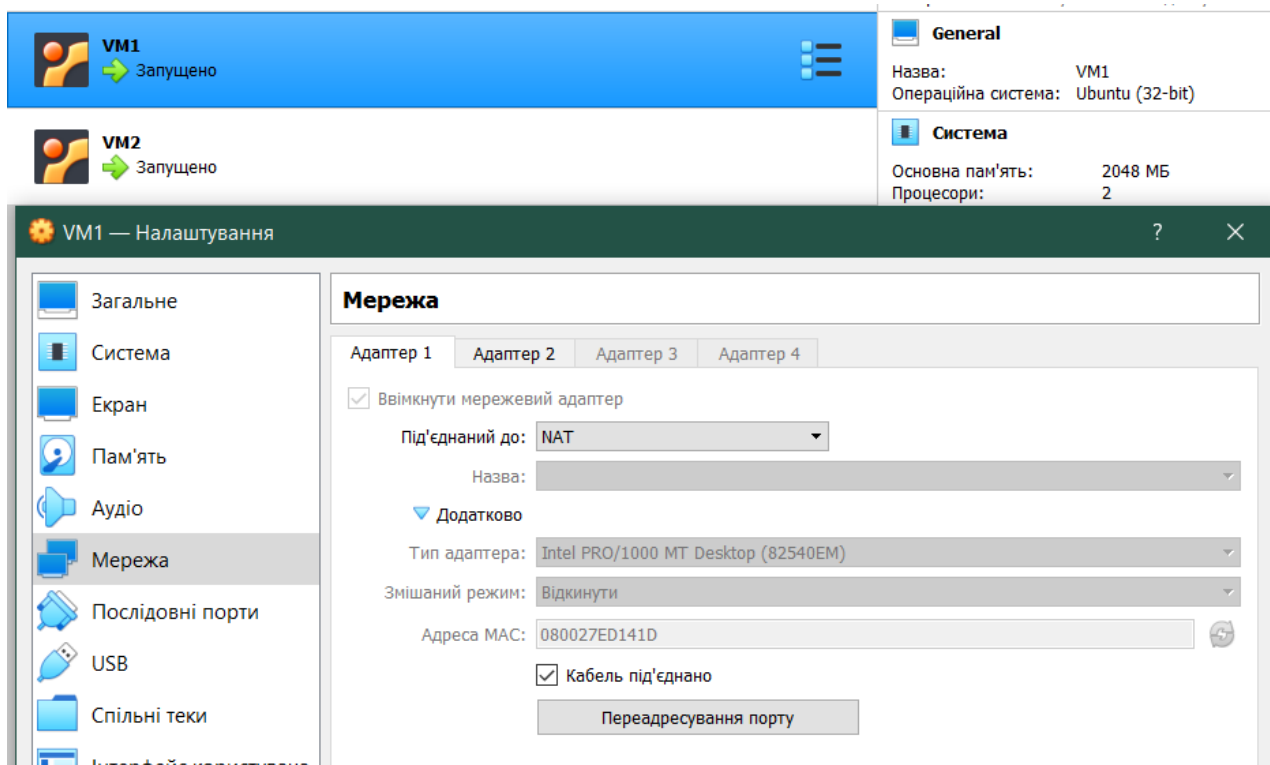
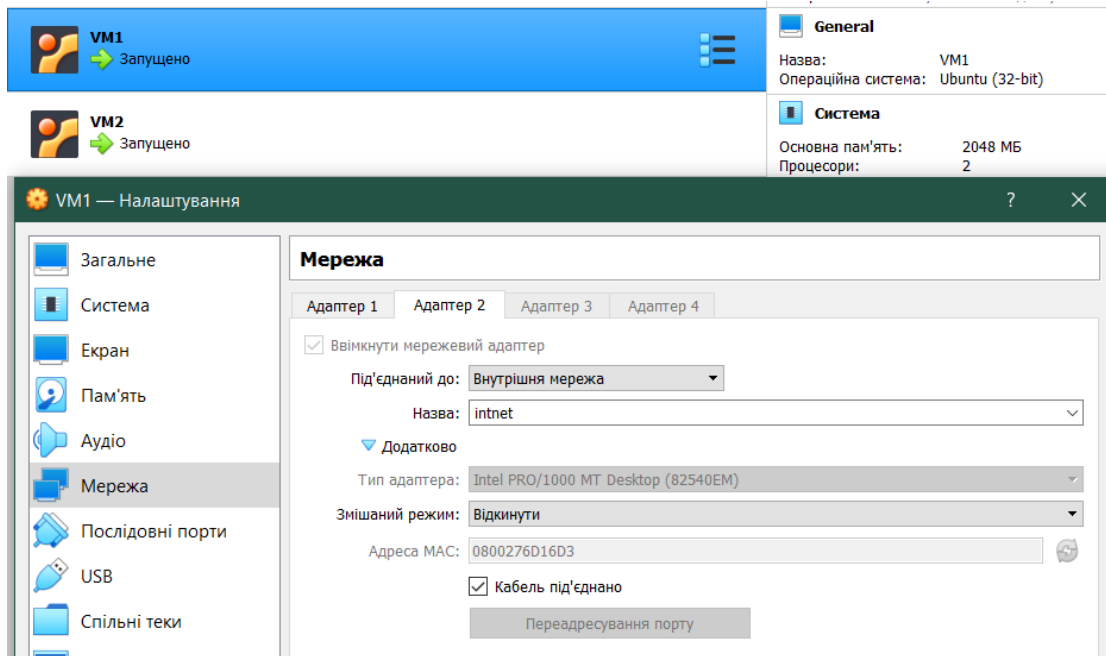


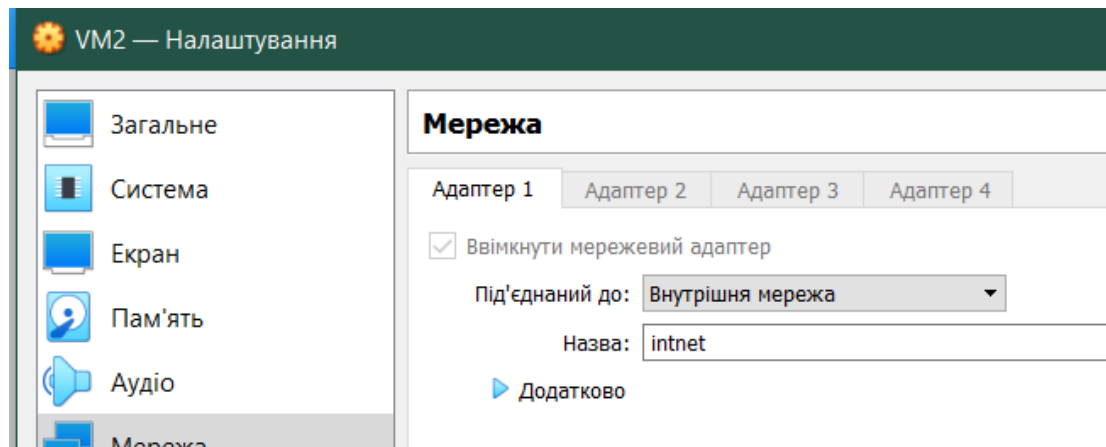
Figure 1 – VMs connection

Network interfaces on **VM1**:





Network interface on **VM2**:



2) VM2 has one interface (internal), VM1 has 2 interfaces (NAT and internal). Configure all network interfaces in order to make VM2 have access to the Internet (iptables, forward, masquerade).

Accessing **VM1** to setup internal interface in */etc/network/interfaces*:

```

VM1 [Запущено] - Oracle VM VirtualBox
Файл  Машина  Перегляд  Введення  Пристрої  Довідка

# This file describes the network interfaces available on your system
# and how to activate them. For more information, see interfaces(5).

# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface
auto eth0
iface eth0 inet dhcp

# internal network interface
auto eth1
iface eth1 inet static
address 10.10.10.1
netmask 255.255.255.0
broadcast 10.10.10.255

```

```
VM1 [Запущено] - Oracle VM VirtualBox
Файл  Машина  Перегляд  Введення  Пристрої  Довідка
root@CsnKhai:/home/student# ifup eth1
root@CsnKhai:/home/student# ifconfig
eth0      Link encap:Ethernet  HWaddr 08:00:27:ed:14:1d
          inet addr:10.0.2.15  Bcast:10.0.2.255  Mask:255.255.255.0
          inet6 addr: fe80::a00:27ff:feed:141d/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:79 errors:0 dropped:0 overruns:0 frame:0
          TX packets:86 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:14184 (14.1 KB)  TX bytes:8054 (8.0 KB)

eth1      Link encap:Ethernet  HWaddr 08:00:27:6d:16:d3
          inet addr:10.10.10.1  Bcast:10.10.10.255  Mask:255.255.255.0
          inet6 addr: fe80::a00:27ff:fe6d:16d3/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:59 errors:0 dropped:0 overruns:0 frame:0
          TX packets:8 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:20178 (20.1 KB)  TX bytes:648 (648.0 B)
```

Accessing *VM2* to set static IP and VM1 as default gateway in */etc/network/interfaces*:

```
VM2 [Запущено] - Oracle VM VirtualBox
Файл  Машина  Перегляд  Введення  Пристрої  Довідка
# This file describes the network interfaces available on your system
# and how to activate them. For more information, see interfaces(5).

# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface
auto eth0
iface eth0 inet static
address 10.10.10.2
netmask 255.255.255.0
broadcast 10.10.10.255
gateway 10.10.10.1
```

```
VM2 [Запущено] - Oracle VM VirtualBox
Файл  Машина  Перегляд  Введення  Пристрої  Довідка
root@CsnKhai:/home/student# ifdown eth0
root@CsnKhai:/home/student# ifup eth0
root@CsnKhai:/home/student# ifconfig
eth0      Link encap:Ethernet  HWaddr 08:00:27:ed:14:1d
          inet addr:10.10.10.2  Bcast:10.10.10.255  Mask:255.255.255.0
          inet6 addr: fe80::a00:27ff:feed:141d/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:85 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:23350 (23.3 KB)
```

Uncommenting line in */etc/sysctl.conf* on *VM1*:

```
# Uncomment the next line to enable packet forwarding for IPv4  
net.ipv4.ip_forward=1
```

Creating file named *iptables.sh* on *VM1*, that will contain *iptables* instructions to execute on system startup (to avoid losing result after reboot):

```
VM1 [Запущено] - Oracle VM VirtualBox  
Файл  Машина  Перегляд  Введення  Пристрої  Довідка  
student@CsnKhai:~$ touch iptables.sh  
student@CsnKhai:~$ sudo chmod u+x iptables.sh  
[sudo] password for student:  
student@CsnKhai:~$ ls -l  
total 0  
-rwxrwx-r-- 1 student student 0 Aug 19 16:55 iptables.sh  
student@CsnKhai:~$
```

```
VM1 [Запущено] - Oracle VM VirtualBox  
Файл  Машина  Перегляд  Введення  Пристрої  Довідка  
#!/bin/sh  
  
sysctl -w net.ipv4.ip_forward=1  
  
iptables -F  
iptables -t nat -A POSTROUTING -o eth0 -j MASQUERADE  
iptables -A FORWARD -i eth1 -o eth0 -j ACCEPT  
iptables -L  
~
```

Adding *iptables.sh* execution line to */etc/rc.d/rc.local* (this file executes on startup):

```
VM1 [Запущено] - Oracle VM VirtualBox  
Файл  Машина  Перегляд  Введення  Пристрої  Довідка  
#!/bin/sh -e  
#  
# rc.local  
#  
# This script is executed at the end of each multiuser runlevel.  
# Make sure that the script will "exit 0" on success or any other  
# value on error.  
#  
# In order to enable or disable this script just change the execution  
# bits.  
#  
# By default this script does nothing.  
sh /home/student/iptables.sh  
exit 0  
~
```

iptables rules automatically saved after system restart:

```
VM1 [Запущено] - Oracle VM VirtualBox
Файл  Машина  Перегляд  Введення  Пристрої  Довідка

Ubuntu 14.04.3 LTS CsnKhai tty1

CsnKhai login: student
Password:
Last login: Sat Aug 19 16:45:32 UTC 2023 from 10.0.2.2 on pts/0
Welcome to Ubuntu 14.04.3 LTS (GNU/Linux 3.13.0-63-generic i686)

 * Documentation:  https://help.ubuntu.com/
New release '16.04.7 LTS' available.
Run 'do-release-upgrade' to upgrade to it.

student@CsnKhai:~$ sudo iptables -L
[sudo] password for student:
Chain INPUT (policy ACCEPT)
target     prot opt source                destination

Chain FORWARD (policy ACCEPT)
target     prot opt source                destination
ACCEPT     all  --  anywhere              anywhere

Chain OUTPUT (policy ACCEPT)
target     prot opt source                destination
student@CsnKhai:~$ _
```

3) Check the route from VM2 to Host.

```
VM2 [Запущено] - Oracle VM VirtualBox
Файл  Машина  Перегляд  Введення  Пристрої  Довідка

root@CsnKhai:/home/student# traceroute 192.168.0.108
traceroute to 192.168.0.108 (192.168.0.108), 30 hops max, 60 byte packets
 1  10.10.10.1 (10.10.10.1)  0.782 ms  1.780 ms  1.652 ms
 2  10.0.2.2 (10.0.2.2)  1.558 ms  1.396 ms  1.580 ms
 3  10.0.2.2 (10.0.2.2)  4.964 ms  4.689 ms  4.552 ms
root@CsnKhai:/home/student#
```

4) Check the access to the Internet, (just ping, for example, 8.8.8.8).

```
VM2 [Запущено] - Oracle VM VirtualBox
Файл  Машина  Перегляд  Введення  Пристрої  Довідка

root@CsnKhai:/home/student# ping -c 4 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=115 time=83.6 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=115 time=33.4 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=115 time=34.6 ms
64 bytes from 8.8.8.8: icmp_seq=4 ttl=115 time=29.5 ms

--- 8.8.8.8 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3022ms
rtt min/avg/max/mdev = 29.509/45.322/83.678/22.226 ms
root@CsnKhai:/home/student# _
```

5) Determine, which resource has an IP address 8.8.8.8.

whois 8.8.8.8 command output:

```
# start
NetRange:      8.8.8.0 - 8.8.8.255
CIDR:          8.8.8.0/24
NetName:       LVLT-GOGL-8-8-8
NetHandle:     NET-8-8-8-0-1
Parent:        LVLT-ORG-8-8 (NET-8-0-0-0-1)
NetType:       Reallocated
OriginAS:
Organization:  Google LLC (GOGL)
RegDate:       2014-03-14
Updated:       2014-03-14
Ref:           https://rdap.arin.net/registry/ip/8.8.8.0

OrgName:       Google LLC
OrgId:         GOGL
Address:       1600 Amphitheatre Parkway
City:          Mountain View
StateProv:     CA
PostalCode:    94043
Country:       US
RegDate:       2000-03-30
Updated:       2019-10-31
Comment:       Please note that the recommended way to file abuse complaints are located in the following links.
Comment:
Comment:       To report abuse and illegal activity: https://www.google.com/contact/
Comment:
Comment:       For legal requests: http://support.google.com/legal
Comment:
Comment:       Regards,
Comment:       The Google Team
Ref:           https://rdap.arin.net/registry/entity/GOGL
```

6) Determine, which IP address belongs to resource epam.com.

```
student@CsnKhai:~$ dig epam.com

; <>> DiG 9.9.5-3ubuntu0.5-Ubuntu <>> epam.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<- opcode: QUERY, status: NOERROR, id: 4552
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1232
;; QUESTION SECTION:
;epam.com.                IN      A

;; ANSWER SECTION:
epam.com.                  2989    IN      A      3.214.134.159

;; Query time: 21 msec
;; SERVER: 192.168.0.1#53(192.168.0.1)
;; WHEN: Sat Aug 19 18:07:43 UTC 2023
;; MSG SIZE rcvd: 53
```

7) Determine the default gateway for your HOST and display routing table.

Default gateway of my *Windows HOST* from *CMD*:

```
Command Prompt
Microsoft Windows [Version 10.0.19045.3208]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Win10>ipconfig | findstr /i "Gateway"
    Default Gateway . . . . . : 192.168.0.1
    Default Gateway . . . . . :
    Default Gateway . . . . . :
    Default Gateway . . . . . :
    Default Gateway . . . . . :
    Default Gateway . . . . . :

C:\Users\Win10>
```

Using *WSL*:

```
Select max@DESKTOP-JT48RV1: ~
max@DESKTOP-JT48RV1:~$ route
Kernel IP routing table
Destination      Gateway          Genmask         Flags Metric Ref    Use Iface
0.0.0.0          192.168.0.1     255.255.255.255 U        0      0        0 eth0
192.168.0.0      0.0.0.0         255.255.255.0   U        256    0        0 eth0
192.168.0.108    0.0.0.0         255.255.255.255 U        256    0        0 eth0
192.168.0.255    0.0.0.0         255.255.255.255 U        256    0        0 eth0
224.0.0.0        0.0.0.0         240.0.0.0       U        256    0        0 eth0
255.255.255.255  0.0.0.0         255.255.255.255 U        256    0        0 eth0
192.168.157.0    0.0.0.0         255.255.255.0   U        256    0        0 eth1
192.168.157.1    0.0.0.0         255.255.255.255 U        256    0        0 eth1
192.168.157.255  0.0.0.0         255.255.255.255 U        256    0        0 eth1
224.0.0.0        0.0.0.0         240.0.0.0       U        256    0        0 eth1
255.255.255.255  0.0.0.0         255.255.255.255 U        256    0        0 eth1
172.17.32.0      0.0.0.0         255.255.240.0   U        256    0        0 eth2
172.17.32.1      0.0.0.0         255.255.255.255 U        256    0        0 eth2
172.17.47.255    0.0.0.0         255.255.255.255 U        256    0        0 eth2
224.0.0.0        0.0.0.0         240.0.0.0       U        256    0        0 eth2
255.255.255.255  0.0.0.0         255.255.255.255 U        256    0        0 eth2
172.25.48.0      0.0.0.0         255.255.240.0   U        256    0        0 eth3
172.25.48.1      0.0.0.0         255.255.255.255 U        256    0        0 eth3
```

Displaying *routing table* with *CMD*:

```
C:\Users\Win10>route print
```


IPv4 Route Table

Active Routes:

Network	Destination	Netmask	Gateway	Interface	Metric
	0.0.0.0	0.0.0.0	192.168.0.1	192.168.0.108	35
	127.0.0.0	255.0.0.0	On-link	127.0.0.1	331
	127.0.0.1	255.255.255.255	On-link	127.0.0.1	331
127.255.255.255	255.255.255.255		On-link	127.0.0.1	331
	172.17.32.0	255.255.240.0	On-link	172.17.32.1	5256
	172.17.32.1	255.255.255.255	On-link	172.17.32.1	5256
	172.17.47.255	255.255.255.255	On-link	172.17.32.1	5256
	172.25.48.0	255.255.240.0	On-link	172.25.48.1	5256
	172.25.48.1	255.255.255.255	On-link	172.25.48.1	5256
	172.25.63.255	255.255.255.255	On-link	172.25.48.1	5256
	172.26.80.0	255.255.240.0	On-link	172.26.80.1	5256
	172.26.80.1	255.255.255.255	On-link	172.26.80.1	5256
	172.26.95.255	255.255.255.255	On-link	172.26.80.1	5256
	172.31.16.0	255.255.240.0	On-link	172.31.16.1	5256
	172.31.16.1	255.255.255.255	On-link	172.31.16.1	5256
	172.31.31.255	255.255.255.255	On-link	172.31.16.1	5256
	192.168.0.0	255.255.255.0	On-link	192.168.0.108	291
	192.168.0.108	255.255.255.255	On-link	192.168.0.108	291
	192.168.0.255	255.255.255.255	On-link	192.168.0.108	291
	192.168.157.0	255.255.255.0	On-link	192.168.157.1	291
	192.168.157.1	255.255.255.255	On-link	192.168.157.1	291
192.168.157.255	255.255.255.255		On-link	192.168.157.1	291
	224.0.0.0	240.0.0.0	On-link	127.0.0.1	331
	224.0.0.0	240.0.0.0	On-link	192.168.0.108	291
	224.0.0.0	240.0.0.0	On-link	172.17.32.1	5256
	224.0.0.0	240.0.0.0	On-link	172.25.48.1	5256
	224.0.0.0	240.0.0.0	On-link	172.26.80.1	5256
	224.0.0.0	240.0.0.0	On-link	192.168.157.1	291
	224.0.0.0	240.0.0.0	On-link	172.31.16.1	5256
255.255.255.255	255.255.255.255		On-link	127.0.0.1	331
255.255.255.255	255.255.255.255		On-link	192.168.0.108	291
255.255.255.255	255.255.255.255		On-link	172.17.32.1	5256
255.255.255.255	255.255.255.255		On-link	172.25.48.1	5256
255.255.255.255	255.255.255.255		On-link	172.26.80.1	5256
255.255.255.255	255.255.255.255		On-link	192.168.157.1	291
255.255.255.255	255.255.255.255		On-link	172.31.16.1	5256

8) Trace the route to google.com.

```
C:\Users\Win10>tracert google.com
```

```
Tracing route to google.com [142.250.203.206]
over a maximum of 30 hops:
```

```
 1  <1 ms  <1 ms  <1 ms  192.168.0.1
 2    5 ms    5 ms    5 ms  77.88.248.147.p2p.datagroup.ua [77.88.248.147]
 3    5 ms    5 ms    5 ms  77.88.248.146.p2p.datagroup.ua [77.88.248.146]
 4   13 ms   13 ms   13 ms  et-4-3-0.2.at.mx10.iev1.core.as3326.net [88.81.245.160]
 5   13 ms   13 ms   13 ms  192.178.68.164
 6   14 ms   14 ms   14 ms  142.250.238.57
 7   13 ms   13 ms   16 ms  108.170.248.138
 8   28 ms   27 ms   26 ms  142.251.242.35
 9   27 ms   27 ms   27 ms  142.250.46.55
10   28 ms   28 ms   28 ms  108.170.250.209
11   26 ms   26 ms   26 ms  209.85.252.109
12   27 ms   27 ms   27 ms  waw02s22-in-f14.1e100.net [142.250.203.206]
```

```
Trace complete.
```