LAB EXERCISE – EGP ROUTING - BGP

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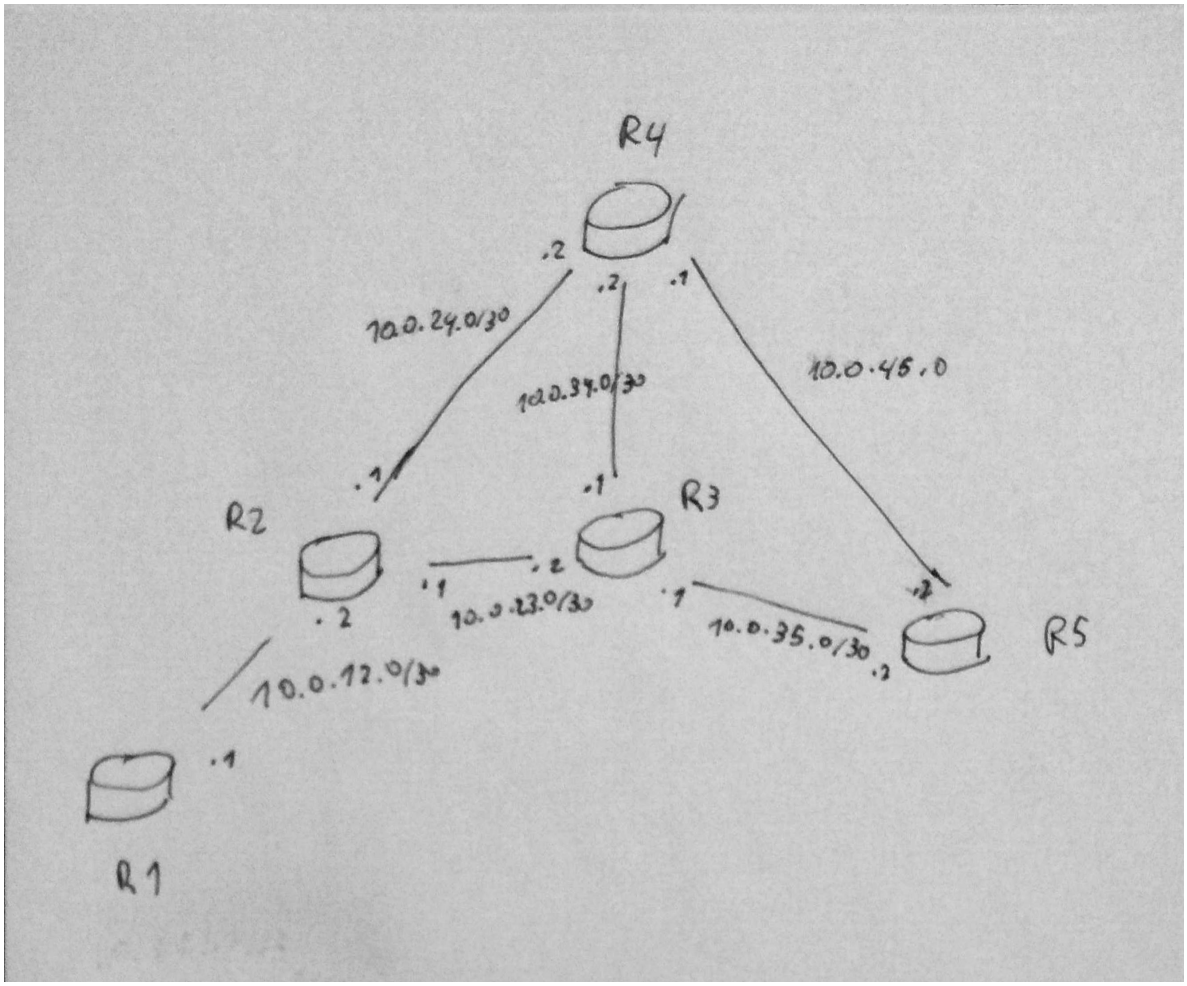
Exercise A



Exercise B

```
R2#show ip protocols
Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 192.168.21.1
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    2.2.2.2 0.0.0.0 area 0
    10.0.23.0 0.0.0.3 area 0
```

```
 Reference bandwidth unit is 100 mbps
  Routing Information Sources:
    Gateway         Distance      Last Update
    192.168.31.1         110      00:09:26
  Distance: (default is 110)
```

```
R3#show ip prot
Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 192.168.31.1
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    3.3.3.3 0.0.0.0 area 0
    10.0.23.0 0.0.0.3 area 0
 Reference bandwidth unit is 100 mbps
  Routing Information Sources:
    Gateway         Distance      Last Update
    192.168.21.1         110      00:13:08
  Distance: (default is 110)
```

```
R2#ping 3.3.3.3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 3.3.3.3, timeout is 2 seconds:
```

Exercise C

Task C1

Your first task is to configure the iBGP session between routers R2 and R

In R2:

```
R2(config)#router bgp 230
R2(config-router)#neighbor 3.3.3.3 remote-as 230
```

In R3:

```
R3(config)#router bgp 230
R3(config-router)#neighbor 2.2.2.2 remote-as 230
```

```
R2#show ip bgp neighbors
...
```

```
R2(config-router)#neighbor 3.3.3.3 update-source l0
R2(config-router)#
*Mar  1 04:06:01.926: %BGP-5-ADJCHANGE: neighbor 3.3.3.3 Up
```

```
R2#show ip bgp neighbors
...
  BGP state = Established, up for 00:01:13
...
```

Task C2

Configure eBGP session between routers R1 and R2

```
R1(config)#router bgp 100
R1(config-router)#ne 10.0.12.2 remote-as 230
```

```
R1#show ip bgp summary
BGP router identifier 192.168.11.1, local AS number 100
BGP table version is 1, main routing table version 1

Neighbor        V    AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
10.0.12.2       4   230       0       0        0    0    0 never    Active
```

```
R1#show ip bgp neighbors
BGP neighbor is 10.0.12.2,  remote AS 230, external link
  BGP version 4, remote router ID 0.0.0.0
  BGP state = Active
  Last read 00:03:42, last write 00:03:42, hold time is 180, keepalive interval
is 60 seconds
  Message statistics:
    InQ depth is 0
    OutQ depth is 0
                         Sent       Rcvd
    Opens:                  0          0
    Notifications:          0          0
    Updates:                0          0
    Keepalives:             0          0
    Route Refresh:          0          0
    Total:                  0          0
  Default minimum time between advertisement runs is 30 seconds

 For address family: IPv4 Unicast
  BGP table version 1, neighbor version 0/0
 Output queue size : 0
  Index 1, Offset 0, Mask 0x2
  1 update-group member
                               Sent       Rcvd
  Prefix activity:             ----       ----
    Prefixes Current:             0          0
    Prefixes Total:               0          0
    Implicit Withdraw:            0          0
    Explicit Withdraw:            0          0
    Used as bestpath:           n/a          0
    Used as multipath:          n/a          0
```

```
                                 Outbound    Inbound
  Local Policy Denied Prefixes:  --------    -------
    Total:                               0          0
  Number of NLRIs in the update sent: max 0, min 0

  Connections established 0; dropped 0
  Last reset never
  No active TCP connection
```

```
R2#show ip bgp summary
BGP router identifier 192.168.21.1, local AS number 230
BGP table version is 1, main routing table version 1

Neighbor        V    AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
3.3.3.3         4   230      21      21        1    0    0 00:18:56        0
```

```
R2#show ip bgp summary
BGP router identifier 192.168.21.1, local AS number 230
BGP table version is 1, main routing table version 1

Neighbor        V    AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
3.3.3.3         4   230      21      21        1    0    0 00:18:56        0
R2#show ip bgp neighbors
BGP neighbor is 3.3.3.3,  remote AS 230, internal link
  BGP version 4, remote router ID 192.168.31.1
  BGP state = Established, up for 00:19:27
  Last read 00:00:28, last write 00:00:28, hold time is 180, keepalive interval
is 60 seconds
  Neighbor capabilities:
    Route refresh: advertised and received(old & new)
    Address family IPv4 Unicast: advertised and received
  Message statistics:
    InQ depth is 0
    OutQ depth is 0
                         Sent       Rcvd
    Opens:                  1          1
    Notifications:          0          0
    Updates:                0          0
    Keepalives:            21         21
    Route Refresh:          0          0
    Total:                 22         22
  Default minimum time between advertisement runs is 0 seconds

 For address family: IPv4 Unicast
  BGP table version 1, neighbor version 1/0
 Output queue size : 0
  Index 1, Offset 0, Mask 0x2
  1 update-group member
                               Sent       Rcvd
  Prefix activity:             ----       ----
    Prefixes Current:             0          0
    Prefixes Total:               0          0
    Implicit Withdraw:            0          0
    Explicit Withdraw:            0          0
    Used as bestpath:           n/a          0
```

```
    Used as multipath:            n/a          0

                                   Outbound    Inbound
  Local Policy Denied Prefixes:    --------    -------
    Total:                                0          0
  Number of NLRIs in the update sent: max 0, min 0

  Connections established 1; dropped 0
  Last reset never
Connection state is ESTAB, I/O status: 1, unread input bytes: 0
Connection is ECN Disabled, Mininum incoming TTL 0, Outgoing TTL 255
Local host: 2.2.2.2, Local port: 27835
Foreign host: 3.3.3.3, Foreign port: 179

Enqueued packets for retransmit: 0, input: 0  mis-ordered: 0 (0 bytes)

Event Timers (current time is 0xF31F84):
Timer          Starts    Wakeups            Next
Retrans            23          0             0x0
TimeWait            0          0             0x0
AckHold            21          2             0x0
SendWnd             0          0             0x0
KeepAlive           0          0             0x0
GiveUp              0          0             0x0
PmtuAger            0          0             0x0
DeadWait            0          0             0x0

iss: 2507525237  snduna: 2507525682  sndnxt: 2507525682     sndwnd:  15940
irs: 3190860763  rcvnxt: 3190861208  rcvwnd:      15940  delrcvwnd:    444

SRTT: 306 ms, RTTO: 364 ms, RTV: 58 ms, KRTT: 0 ms
minRTT: 200 ms, maxRTT: 1000 ms, ACK hold: 200 ms
Flags: active open, nagle
IP Precedence value : 6

Datagrams (max data segment is 536 bytes):
Rcvd: 44 (out of order: 0), with data: 21, total data bytes: 444
Sent: 27 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion:
0), with data: 22, total data bytes: 444
```

Task C3

Add network represented by the R1 loopback 1 interface to the BGP protocol

In R1:

```
R1(config)#router bgp 100
R1(config-router)#network 192.168.11.0 mask 255.255.255.0
```

In 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

     2.0.0.0/32 is subnetted, 1 subnets
C       2.2.2.2 is directly connected, Loopback0
     3.0.0.0/32 is subnetted, 1 subnets
O       3.3.3.3 [110/11] via 10.0.23.2, 03:18:40, Ethernet0/2
C    192.168.21.0/24 is directly connected, Loopback1
     10.0.0.0/30 is subnetted, 3 subnets
C       10.0.12.0 is directly connected, Ethernet0/0
C       10.0.24.0 is directly connected, Ethernet0/1
C       10.0.23.0 is directly connected, Ethernet0/2
```

```
R2#show ip bgp
```

In 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

     2.0.0.0/32 is subnetted, 1 subnets
O       2.2.2.2 [110/11] via 10.0.23.1, 03:17:30, Ethernet0/2
C    192.168.31.0/24 is directly connected, Loopback1
     3.0.0.0/32 is subnetted, 1 subnets
C       3.3.3.3 is directly connected, Loopback0
     10.0.0.0/30 is subnetted, 3 subnets
C       10.0.23.0 is directly connected, Ethernet0/2
C       10.0.34.0 is directly connected, Ethernet0/3
C       10.0.35.0 is directly connected, Ethernet0/0
```

```
R3#show ip bgp
```

`show ip bgp` should show an output but I haven't been able to find why it doesn't

Configure router R2 to override the next hop in the iBGP advertisements with its own address

```
R2(config-router)#neighbor 3.3.3.3 next-hop-self
```

```
R3#ping 1.1.1.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.1, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)
```

Task C4

Configure all remaining eBGP sessions between Autonomous Systems in the lab setup (using addresses of interfaces connecting the relevant peers – not loopback interfaces).

To connect R4 to R2

```
R4(config)#router bgp 400
R4(config-router)#neighbor 10.0.24.1 remote-as 230
```

To connect R4 to R3

```
R4(config-router)#neighbor 10.0.34.1 remote-as 230
```

To connect R4 to R5

```
R4(config-router)#ne 10.0.45.2 remote-as 500
```

To connect R3 and R5:

```
R5(config)#router bgp 500
R5(config-router)#neighbor 10.0.35.1 remote-as 230
```

```
R3(config)#router bgp 230
R3(config-router)#neighbor 10.0.35.2 remote-as 500
```

```
show ip bgp neighbors
BGP neighbor is 2.2.2.2,  remote AS 230, internal link
  BGP version 4, remote router ID 192.168.21.1
  BGP state = Established, up for 03:42:16
  Last read 00:00:17, last write 00:00:17, hold time is 180, keepalive interval
is 60 seconds
  Neighbor capabilities:
    Route refresh: advertised and received(old & new)
    Address family IPv4 Unicast: advertised and received
  Message statistics:
    InQ depth is 0
    OutQ depth is 0
                         Sent       Rcvd
    Opens:                  1          1
    Notifications:          0          0
    Updates:                0          0
    Keepalives:           224        224
    Route Refresh:          0          0
    Total:                225        225
  Default minimum time between advertisement runs is 0 seconds
```

```
 For address family: IPv4 Unicast
  BGP table version 1, neighbor version 1/0
 Output queue size : 0
  Index 1, Offset 0, Mask 0x2
  1 update-group member
                                 Sent       Rcvd
  Prefix activity:               ----       ----
    Prefixes Current:               0          0
    Prefixes Total:                 0          0
    Implicit Withdraw:              0          0
    Explicit Withdraw:              0          0
    Used as bestpath:             n/a          0
    Used as multipath:            n/a          0

                                   Outbound    Inbound
  Local Policy Denied Prefixes:    --------    -------
    Total:                                0          0
  Number of NLRIs in the update sent: max 0, min 0

  Connections established 1; dropped 0
  Last reset never
Connection state is ESTAB, I/O status: 1, unread input bytes: 0
Connection is ECN Disabled, Mininum incoming TTL 0, Outgoing TTL 255
Local host: 3.3.3.3, Local port: 179
Foreign host: 2.2.2.2, Foreign port: 27835

Enqueued packets for retransmit: 0, input: 0  mis-ordered: 0 (0 bytes)

Event Timers (current time is 0x1AC8304):
Timer          Starts    Wakeups            Next
Retrans           226          1             0x0
TimeWait            0          0             0x0
AckHold           225        217             0x0
SendWnd             0          0             0x0
KeepAlive           0          0             0x0
GiveUp              0          0             0x0
PmtuAger            0          0             0x0
DeadWait            0          0             0x0

iss: 3190860763  snduna: 3190865065  sndnxt: 3190865065     sndwnd:  15928
irs: 2507525237  rcvnxt: 2507529539  rcvwnd:      15928  delrcvwnd:    456

SRTT: 300 ms, RTTO: 303 ms, RTV: 3 ms, KRTT: 0 ms
minRTT: 0 ms, maxRTT: 1288 ms, ACK hold: 200 ms
Flags: passive open, nagle, gen tcbs
IP Precedence value : 6

Datagrams (max data segment is 536 bytes):
Rcvd: 237 (out of order: 0), with data: 225, total data bytes: 4301
Sent: 449 (retransmit: 1, fastretransmit: 0, partialack: 0, Second Congestion:
0), with data: 224, total data bytes: 4301

BGP neighbor is 10.0.35.2,  remote AS 500, external link
  BGP version 4, remote router ID 192.168.51.1
  BGP state = Established, up for 00:01:04
  Last read 00:00:04, last write 00:00:04, hold time is 180, keepalive interval
is 60 seconds
```

```
  Neighbor capabilities:
    Route refresh: advertised and received(old & new)
    Address family IPv4 Unicast: advertised and received
  Message statistics:
    InQ depth is 0
    OutQ depth is 0
                         Sent       Rcvd
    Opens:                  1          1
    Notifications:          0          0
    Updates:                0          0
    Keepalives:             4          4
    Route Refresh:          0          0
    Total:                  5          5
  Default minimum time between advertisement runs is 30 seconds

 For address family: IPv4 Unicast
  BGP table version 1, neighbor version 1/0
 Output queue size : 0
  Index 2, Offset 0, Mask 0x4
  2 update-group member
                                 Sent       Rcvd
  Prefix activity:               ----       ----
    Prefixes Current:               0          0
    Prefixes Total:                 0          0
    Implicit Withdraw:              0          0
    Explicit Withdraw:              0          0
    Used as bestpath:             n/a          0
    Used as multipath:            n/a          0

                                   Outbound    Inbound
  Local Policy Denied Prefixes:    --------    -------
    Total:                                0          0
  Number of NLRIs in the update sent: max 0, min 0

  Connections established 1; dropped 0
  Last reset never
Connection state is ESTAB, I/O status: 1, unread input bytes: 0
Connection is ECN Disabled, Mininum incoming TTL 0, Outgoing TTL 1
Local host: 10.0.35.1, Local port: 179
Foreign host: 10.0.35.2, Foreign port: 22732

Enqueued packets for retransmit: 0, input: 0  mis-ordered: 0 (0 bytes)

Event Timers (current time is 0x1ACA4B8):
Timer          Starts    Wakeups            Next
Retrans             4          0             0x0
TimeWait            0          0             0x0
AckHold             4          1             0x0
SendWnd             0          0             0x0
KeepAlive           0          0             0x0
GiveUp              0          0             0x0
PmtuAger            0          0             0x0
DeadWait            0          0             0x0

iss: 3662440517  snduna: 3662440639  sndnxt: 3662440639     sndwnd:  16263
irs: 3070467878  rcvnxt: 3070468000  rcvwnd:      16263  delrcvwnd:    121

SRTT: 124 ms, RTTO: 1405 ms, RTV: 1281 ms, KRTT: 0 ms
```

```
minRTT: 60 ms, maxRTT: 300 ms, ACK hold: 200 ms
Flags: passive open, nagle, gen tcbs
IP Precedence value : 6

Datagrams (max data segment is 1460 bytes):
Rcvd: 7 (out of order: 0), with data: 4, total data bytes: 121
Sent: 5 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 0),
with data: 3, total data bytes: 121
```

Task C5

Advertise all remaining L1, L2 (where applicable) and L3 (where applicable) router addresses via the BG

In R4:

```
R4(config)#router bgp 400
R4(config-router)#network 192.168.41.0 mask 255.255.255.0
```

In R5:

```
R5(config)#router bgp 500
R5(config-router)#network 192.168.51.0 mask 255.255.255.0
```

Task C6

On router R1, check the connectivity to the advertised R5 loopback 1 interface using the ping command

```
R1#ping 192.168.51.0 source 192.168.11.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.51.0, timeout is 2 seconds:
Packet sent with a source address of 192.168.11.1
.....
Success rate is 0 percent (0/5)
```

Configure router R3 to override the next hop in the BGP advertisements with its own address

```
R1#traceroute 192.168.51.1 source 192.168.11.1

Type escape sequence to abort.
Tracing the route to 192.168.51.1

  1  *  *  *
  2  *  *  *
.
.
.
 29  *  *  *
 30  *  *  *
```

Again there's an error in the connections, but I haven't been able to find the reason.

D. ADVANCED BGP CONFIGURATION

TASK D1 (LOCAL PREFERENCE)

Execute the traceroute command from router R1 to R4 loopback 1 interface, setting R1 loopback 1 interface as a source.

```
R1#traceroute 192.168.41.1 source l1

Type escape sequence to abort.
Tracing the route to 192.168.41.1

  1  *  *  *
  2  *  *  *
 .
 .
 .
 29  *  *  *
 30  *  *  *
```

Next, configure the local preference to force the outbound traffic from AS2 to AS4 to be routed through the interface f0/0 of router R3.

```
R3#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#route-map ROUTE-MAP permit 10
R3(config-route-map)#set local-preference 1000
R3(config-route-map)#ex
R3(config)#router bgp 230
R3(config-router)#neighbor 10.0.34.2 route-map ROUTE-MAP in
```

```
R1#traceroute 192.168.41.1 source l1

Type escape sequence to abort.
Tracing the route to 192.168.41.1

  1  *  *  *
  2  *  *  *
 .
 .
 .
 29  *  *  *
 30  *  *  *
```

TASK D2 (MED – MULTI-EXIT DISCRIMINATOR)

```
R4#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R4(config)#router bgp 400
R4(config-router)#network 192.168.41.0 mask 255.255.255.0
R4(config-router)#ex
R4(config)#interface l2
R4(config-if)#ip address 192.168.42.1 255.255.255.0
R4(config-if)#ex
R4(config)#int l3
R4(config-if)#ip address 192.168.43.1 255.255.255.0
R4(config-if)#ex
R4(config)#router bgp 400
R4(config-router)#network 192.168.42.0 mask 255.255.255.0
R4(config-router)#network 192.168.43.0 mask 255.255.255.0
R4(config-router)#ex
R4(config)#int l2
R4(config-if)#ex
R4(config)#in e0/3
R4(config-if)#
R4(config-if)#access-list 12 permit 192.168.42.0 0.0.0.255
R4(config)#in e0/1
R4(config-if)#access-list 13 permit 192.168.43.0 0.0.0.255
R4(config)#route-map med permit 20
R4(config-route-map)#set metric 500
R4(config-route-map)#match ip address 12
R4(config-route-map)#ex
R4(config)#route-map med2 permit 40
R4(config-route-map)#set metric 500
R4(config-route-map)#match ip address 13
R4(config-route-map)#ex
R4(config)#router bgp 400
R4(config-router)# neighbor 10.0.24.1 route-map med2 out
R4(config-router)#neighbor 10.0.34.1 route-map med out
```

```
R1#traceroute 192.168.42.1 source l1

Type escape sequence to abort.
Tracing the route to 192.168.42.1

  1  *  *  *
  2  *  *  *
  3  *
R1#traceroute 192.168.43.1 source l1

Type escape sequence to abort.
Tracing the route to 192.168.43.1

  1  *  *  *
  2  *  *  *
  3  *  *
```

None of the traceroutes works but I'm unable to find the reason