- The tasks below are considered to be done on your own computer unless explicitly allowed in the task description.
- Wherever appropriate, please provide the exact commands and their output. Better to do this as text, not as screenshots.
- If you prefer screenshots, don't use external links to image sharing services, just put all pictures to the homework results, and ensure they are readable (e.g. not too small).

The (*) sign marks advanced homework.

1. Get the subnet address and the netmask from the network settings of your computer.

We use command ipconfig

```
Windows IP Configuration


Unknown adapter LAN-Verbindung:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::7785:843b:a5d:c9a1%9
   IPv4 Address. . . . . . . . . . . : 10.9.0.130
   Subnet Mask . . . . . . . . . . . : 255.255.255.252
   Default Gateway . . . . . . . . . :

Ethernet adapter Ethernet:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . : fritz.box

Unknown adapter OpenVPN Connect DCO Adapter:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Wireless LAN adapter LAN-Verbindung* 1:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Wireless LAN adapter LAN-Verbindung* 2:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Wireless LAN adapter WLAN:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::bf1c:42dc:8fa5:bae2%8
   IPv4 Address. . . . . . . . . . . : 192.168.0.132
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : 192.168.0.1
```

1.1 For IPv4 Address. . . . . : 192.168.0.132

: Subnet mask 255.255.255.0 and subnet address 192.168.0.0

IPv4 Subnet Calculator

Result

IP Address:	192.168.0.132
Network Address:	192.168.0.0
Usable Host IP Range:	192.168.0.1 - 192.168.0.254
Broadcast Address:	192.168.0.255
Total Number of Hosts:	256
Number of Usable Hosts:	254
Subnet Mask:	255.255.255.0

1.2 For IPv4 Address. . . . . : 10.9.0.130

Subnet Mask . . . . . : 255.255.255.252 and subnet address 10.9.0.128

IPv4 Subnet Calculator

Result

IP Address:	10.9.0.130
Network Address:	10.9.0.128
Usable Host IP Range:	10.9.0.129 - 10.9.0.130
Broadcast Address:	10.9.0.131
Total Number of Hosts:	4
Number of Usable Hosts:	2
Subnet Mask:	255.255.255.252

2. Get the size of it and the IP range with the “ipcalc” tool (in Linux or macOS - may require additional installation) or with online subnet calculators.

2.1 As we can see for 192.168.0.132 ip address:

there are 256 total IP addresses, and 254 of them are usable for hosts.

2.2 and for 10.9.0.130:

Total Number of Hosts: 4

Number of Usable Hosts: 2

3. Find a Linux machine (for students of courses - use any Sandbox server), then:

3.1 Get its routing table using the “ip route list” command and say what sequence of routes will be used to reach the 1.1.1.1 host

```
[ipapara@c7-sandbox ~]$ ip route list
default via 192.168.40.2 dev eth0 proto static metric 100
192.168.40.0/24 dev eth0 proto kernel scope link src 192.168.40.14 metric 100
```

Default route: default via 192.168.40.2 dev eth0 proto static metric 100

Default Route: The default route (default via 192.168.40.2) is used when there is no specific route for the destination. If there is no more specific route for 1.1.1.1, the default route will be used.

Specific Route for 192.168.40.0/24: This route is specific to the 192.168.40.0/24 network. However, the destination 1.1.1.1 is not part of this network.

3.2 Check yourself by the “ip route get” command (see which router will be used to reach out 1.1.1.1) and find out the previously known default gateway

```
[ipapara@c7-sandbox ~]$ ip route get 1.1.1.1
1.1.1.1 via 192.168.40.2 dev eth0 src 192.168.40.14
    cache
```

We can see, that in this case 192.168.40.2 gateway is used as default

4. Use “traceroute” (Linux, macOS) or "tracert" (Windows) tools to

4.1 Get routes to: google.com, amazon.com, microsoft.com

On Linux server from sandbox

4.1..On linux server from sandbox

```
[ipapara@c7-sandbox ~]$ traceroute -I google.com
traceroute to google.com (142.250.74.110), 30 hops max, 60 byte packets
 1  gateway (192.168.40.2)  0.080 ms  0.075 ms  0.074 ms
 2  static.1.193.108.65.clients.your-server.de (65.108.193.1)  0.478 ms  0.669 m
s  0.716 ms
 3  core32.hel1.hetzner.com (213.239.252.53)  0.274 ms  0.276 ms  0.318 ms
 4  core53.sto.hetzner.com (213.239.254.70)  6.959 ms  6.960 ms  6.991 ms
 5  core3.sto.hetzner.com (213.239.252.74)  8.546 ms  8.546 ms  8.585 ms
 6  213-133-121-202.clients.your-server.de (213.133.121.202)  7.988 ms  7.919 ms
  7.908 ms
 7  142.251.67.145 (142.251.67.145)  9.251 ms  9.246 ms  9.331 ms
 8  142.251.48.39 (142.251.48.39)  7.357 ms  7.496 ms  7.466 ms
 9  arn11s10-in-f14.1e100.net (142.250.74.110)  7.012 ms  6.982 ms  6.973 ms
```

```
[ipapara@c7-sandbox ~]$ traceroute -I amazon.com
traceroute to amazon.com (52.94.236.248), 30 hops max, 60 byte packets
 1  gateway (192.168.40.2)  0.089 ms  0.085 ms  0.086 ms
 2  static.1.193.108.65.clients.your-server.de (65.108.193.1)  3.713 ms  3.713 ms  3.729 ms
 3  core32.hel1.hetzner.com (213.239.252.53)  0.302 ms  0.305 ms  0.323 ms
 4  core53.sto.hetzner.com (213.239.254.70)  6.803 ms  6.803 ms  6.844 ms
 5  core3.sto.hetzner.com (213.239.252.74)  6.932 ms  6.958 ms  6.958 ms
 6  ae7-0.sth10.core-backbone.com (80.255.15.125)  6.947 ms  6.764 ms  6.752 ms
 7  ae5-2092.nyk10.core-backbone.com (5.56.18.94)  100.310 ms  100.308 ms  100.324 ms
 8  * * *
 9  * * *
10  * * *
11  * * *
12  * * *
13  * * *
14  * * *
15  * * *
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  52.94.236.248 (52.94.236.248)  102.199 ms  102.203 ms  102.237 ms
```

```
[ipapara@c7-sandbox ~]$ traceroute -I microsoft.com
traceroute to microsoft.com (20.112.250.133), 30 hops max, 60 byte packets
 1  gateway (192.168.40.2)  0.093 ms  0.086 ms  0.085 ms
 2  static.1.193.108.65.clients.your-server.de (65.108.193.1)  18.669 ms  18.701 ms  18.700 ms
 3  core31.hel1.hetzner.com (213.239.252.49)  0.533 ms  0.534 ms  0.567 ms
 4  core9.fra.hetzner.com (213.239.224.166)  20.132 ms  20.134 ms  20.170 ms
 5  core1.fra.hetzner.com (213.239.224.173)  20.441 ms  20.441 ms  20.481 ms
 6  ae74-0.ier01.fra32.ntwk.msn.net (104.44.197.103)  35.694 ms  28.514 ms  28.545 ms
 7  ae31-0.icr01.fra21.ntwk.msn.net (104.44.230.14)  30.933 ms  30.973 ms  31.016 ms
 8  * * *
 9  be-8-0.ibr02.ams30.ntwk.msn.net (104.44.28.123)  145.261 ms  145.142 ms  145.279 ms
10  be-7-0.ibr02.dub07.ntwk.msn.net (104.44.17.58)  145.274 ms  145.148 ms  145.233 ms
11  be-5-0.ibr02.sxl71.ntwk.msn.net (104.44.28.177)  145.092 ms  144.982 ms  145.072 ms
12  be-4-0.ibr02.ewr30.ntwk.msn.net (104.44.17.154)  145.187 ms  145.186 ms  145.284 ms
13  * * *
14  be-11-0.ibr02.ch4.ntwk.msn.net (104.44.29.45)  144.534 ms * *
15  be-7-0.ibr04.dsm05.ntwk.msn.net (104.44.28.222)  145.477 ms  145.522 ms *
16  ae160-0.icr03.dsm05.ntwk.msn.net (104.44.22.206)  143.995 ms  143.912 ms  143.687 ms
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  20.112.250.133 (20.112.250.133)  144.588 ms  144.592 ms  144.624 ms
```

4.2 Determine the common part of these routes - i.e., which hops are common for all aforementioned routes. Specify them if any common hops are found.

1 gateway (192.168.40.2)

2 static.1.193.108.65.clients.your-server.de (65.108.193.1)

On my windows comp

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

Tracing route to google.com [172.217.16.206]
over a maximum of 30 hops:

  1     2 ms     2 ms     2 ms  192.168.0.1
  2     4 ms     2 ms     5 ms  fritz.box [192.168.178.1]
  3    29 ms    31 ms   244 ms  10.141.0.1
  4     *        *        *     Request timed out.
  5    19 ms    36 ms     *     85.232.25.90
  6    36 ms    15 ms    15 ms  SNLEJ-MS01.hlkomm.net [85.232.0.55]
  7    33 ms    36 ms    32 ms  109.104.58.45
  8    39 ms    21 ms    22 ms  109.104.61.60
  9    43 ms    22 ms    18 ms  74.125.32.62
 10    41 ms    23 ms    23 ms  108.170.252.65
 11     *        *       31 ms  142.251.241.77
 12    20 ms    35 ms   112 ms  fra16s08-in-f14.1e100.net [172.217.16.206]
```

5. Open https://showmyip.com in your browser to see your external IP

What is my IP?

85.232.25.89

Please scroll down to see your IPv6 (if found), and the geolocation details (Country, City, ISP, etc...) of your IP address.

Details:

Your IPv4	**85.232.25.89**
Your IPv6	Loading IPv6...
Country	Germany
Region	Saxony
City	Leipzig
ZIP	04129
Timezone	Europe/Berlin
Internet Service Provider (ISP)	HL komm Telekommunikations GmbH
Organization	HL Dtnet
AS number and name	AS16097 HL komm Telekommunikations GmbH
User agent	Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/119.0.0.0 Safari/537.36

6 Get trace to showmyip.com using the “traceroute” (or “tracert” for Windows) tool and try to find your external IP (or the gateway from that subnet) there. Warning: in some cases, the IP address visible via myip.com might not be found in the trace shown by traceroute / tracert.

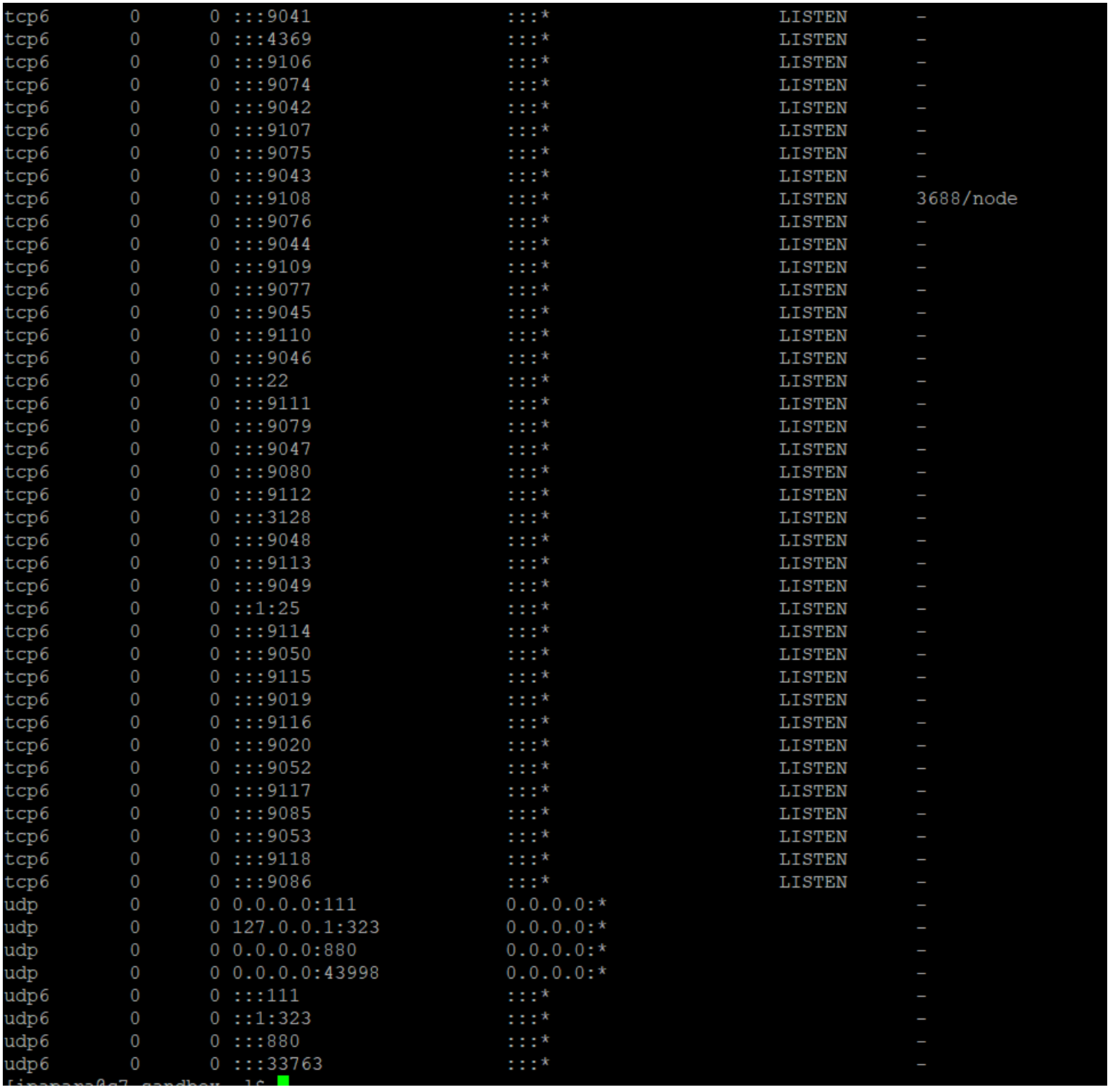
```
C:\Users\irapa>tracert showmyip.com

Tracing route to showmyip.com [172.67.163.127]
over a maximum of 30 hops:

  1     3 ms     3 ms     2 ms  192.168.0.1
  2     4 ms     4 ms     3 ms  fritz.box [192.168.178.1]
  3    31 ms    25 ms    15 ms  10.141.0.1
  4     *        *        *     Request timed out.
  5     *       38 ms    18 ms  85.232.25.90
  6    19 ms    32 ms    16 ms  SNLEJ-MS01.hlkomm.net [85.232.0.55]
  7    20 ms    22 ms    24 ms  109.104.58.37
  8    21 ms    24 ms   235 ms  BYMUC-MC01.hlkomm.net [109.104.60.153]
  9    38 ms    22 ms    31 ms  de-cix-munich.as13335.net [185.1.208.9]
 10    28 ms    20 ms     *     172.67.163.127
 11     *       23 ms    24 ms  172.67.163.127
```

7 Get the list of locally opened ports of your computer or any educational server: the 0.0.0.0, or "*", or ":::", address means that this port is opened in all addresses of your host.

On linux we need

`netstat -vpntul`

```
[ipapara@c7-sandbox ~]$ netstat -vpntul
(Not all processes could be identified, non-owned process info
 will not be shown, you would have to be root to see it all.)
Active Internet connections (only servers)
Proto Recv-Q Send-Q Local Address           Foreign Address         State       PID/Program name
tcp        0      0 0.0.0.0:25672           0.0.0.0:*               LISTEN      -
tcp        0      0 0.0.0.0:111             0.0.0.0:*               LISTEN      -
tcp        0      0 0.0.0.0:4369            0.0.0.0:*               LISTEN      -
tcp        0      0 0.0.0.0:22              0.0.0.0:*               LISTEN      -
tcp        0      0 0.0.0.0:15672           0.0.0.0:*               LISTEN      -
tcp        0      0 127.0.0.1:25            0.0.0.0:*               LISTEN      -
tcp6       0      0 :::9024                 :::*                    LISTEN      -
tcp6       0      0 :::9089                 :::*                    LISTEN      -
tcp6       0      0 :::9057                 :::*                    LISTEN      -
tcp6       0      0 :::9090                 :::*                    LISTEN      -
tcp6       0      0 :::9058                 :::*                    LISTEN      -
tcp6       0      0 :::9026                 :::*                    LISTEN      -
tcp6       0      0 :::9091                 :::*                    LISTEN      -
tcp6       0      0 :::9027                 :::*                    LISTEN      -
tcp6       0      0 :::9060                 :::*                    LISTEN      -
tcp6       0      0 :::9028                 :::*                    LISTEN      -
tcp6       0      0 :::9093                 :::*                    LISTEN      -
tcp6       0      0 :::9061                 :::*                    LISTEN      -
tcp6       0      0 :::9062                 :::*                    LISTEN      -
tcp6       0      0 :::9030                 :::*                    LISTEN      -
tcp6       0      0 :::9095                 :::*                    LISTEN      -
tcp6       0      0 :::9063                 :::*                    LISTEN      -
tcp6       0      0 :::9031                 :::*                    LISTEN      -
tcp6       0      0 :::9000                 :::*                    LISTEN      -
tcp6       0      0 :::9064                 :::*                    LISTEN      -
tcp6       0      0 :::5672                 :::*                    LISTEN      -
tcp6       0      0 :::9001                 :::*                    LISTEN      -
tcp6       0      0 :::9065                 :::*                    LISTEN      -
tcp6       0      0 :::9033                 :::*                    LISTEN      -
tcp6       0      0 :::9002                 :::*                    LISTEN      -
tcp6       0      0 :::9035                 :::*                    LISTEN      -
tcp6       0      0 :::9036                 :::*                    LISTEN      -
tcp6       0      0 :::9037                 :::*                    LISTEN      -
tcp6       0      0 :::9102                 :::*                    LISTEN      -
tcp6       0      0 :::9070                 :::*                    LISTEN      -
tcp6       0      0 :::9103                 :::*                    LISTEN      -
tcp6       0      0 :::9071                 :::*                    LISTEN      -
tcp6       0      0 :::111                  :::*                    LISTEN      -
tcp6       0      0 :::9104                 :::*                    LISTEN      -
tcp6       0      0 :::9072                 :::*                    LISTEN      -
tcp6       0      0 :::9105                 :::*                    LISTEN      -
tcp6       0      0 :::9073                 :::*                    LISTEN      -
```



8 (*) Try to determine the ports available at "localhost" - i.e. those ones listening on all addresses, or explicitly on 127.0.0.1 or on ::1.

As we can see here all ports are available at “localhost”, because some of them are listening on all addresses or explicitly on 127.0.0.1 or on ::1.

Localhost:

::1:323

127.0.0.1:323

127.0.0.1:25

Ports are listening on all addresses:

TCP Ports:

- 0.0.0.0:25672
- 0.0.0.0:111
- 0.0.0.0:4369
- 0.0.0.0:22
- 0.0.0.0:15672
- :::9024
- :::9089
- :::9057
- :::9090
- :::9058
- :::9026
- :::9091
- :::9027
- :::9060
- :::9028
- :::9093
- :::9061
- :::9062
- :::9030
- :::9095
- :::9063
- :::9031
- :::9000
- :::9064
- :::5672
- :::9001
- :::9065
- :::9033
- :::9002
- :::9035
- :::9036
- :::9037
- :::9102
- :::9070
- :::9103
- :::9071
- :::111
- :::9104
- :::9072
- :::9105
- :::9073
- :::9041
- :::4369
- :::9106
- :::9074
- :::9042
- :::9107

- :::9075
- :::9043
- :::9108
- :::9076
- :::9044
- :::9109
- :::9077
- :::9045
- :::9110
- :::9046
- :::22
- :::9111
- :::9079
- :::9047
- :::9080
- :::9112
- :::3128
- :::9048
- :::9113
- :::9049
- :::9114
- :::9050
- :::9115
- :::9019
- :::9116
- :::9020
- :::9052
- :::9117
- :::9085
- :::9053
- :::9118
- :::9086

UDP Ports:

- 0.0.0.0:111
- 0.0.0.0:880
- 0.0.0.0:43998
- :::111
- :::880
- :::33763