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**Welcome  
To  
Network for you  
NAT AND PAT**



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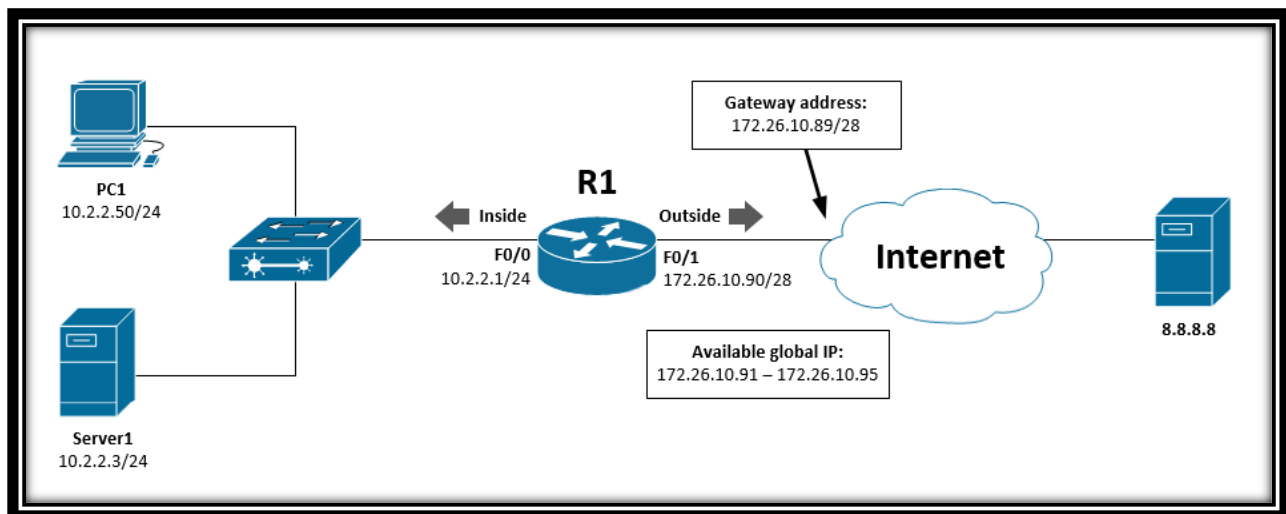
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## NAT (Network Address Translation):

- NAT stand for Network Address Translation.
- What NAT do? It translates Private IP Address into Public IP address.
- In order to communicate with internet we need to have public IP address.
- So one host need to have 1 Public IP address that mean if we have 15 devices then want to go to internet same time then we need to take 15 public IP address from ISP it is very expensive if we do this.
- To Overcome with this issues we use NAT.
- Because NAT is going to take private IP and Translate to Public IP address.



## Network Address translation was originally developed to solve two problems:

- To handle a shortage of IPv4 addresses
- Hide network addressing schemes.

## Types of NAT:

- Static NAT
- Dynamic NAT
- PAT

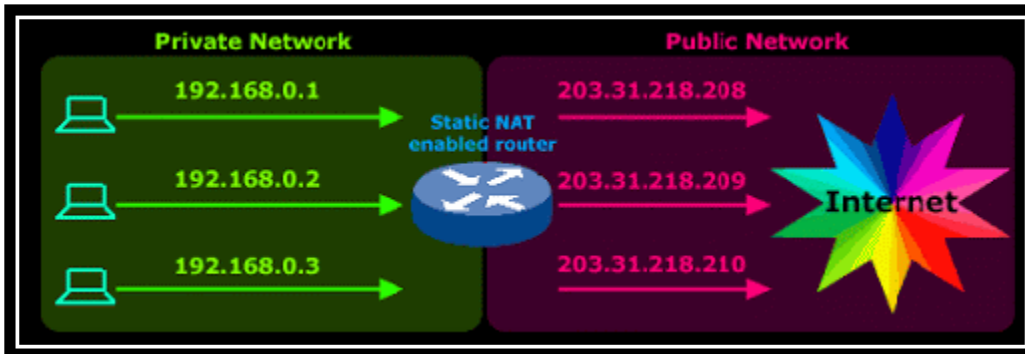
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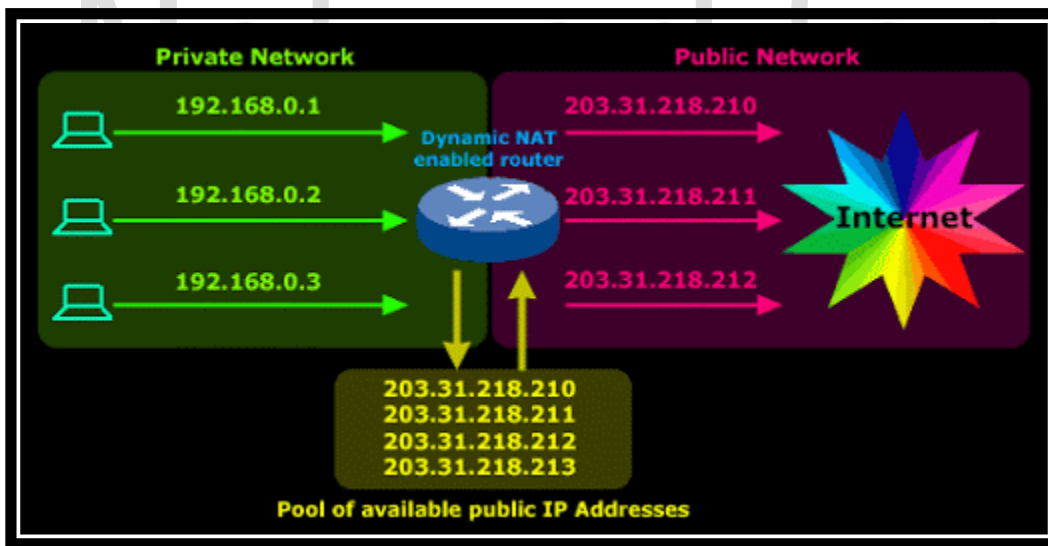


## Static NAT:



- This type of NAT is designed to allow one-to-one mapping between local and global address.
- Static NAT Translation is bidirectional whether the internal host or the external host send the first packet, it would pass through the static NAT.
- Static NAT also allows connections from an outside host to an inside host.

## Dynamic NAT:



- A Dynamic NAT sometime referred to as a One-to-Many.
- Dynamic NAT is used when we have a “pool” of public IP address that you want to assign to your internal hosts dynamically.

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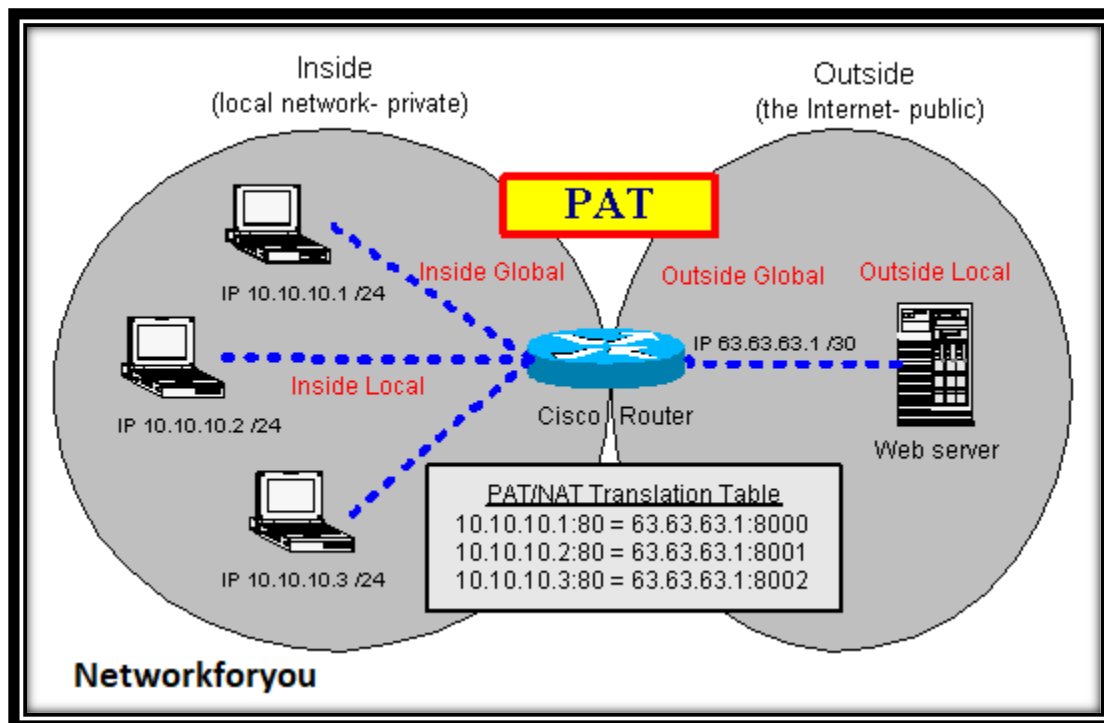
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## PAT (Port Address Translation):

- PAT is another type of dynamic NAT, which can map multiple private IP address to a single public IP address by using a technology known as Port Address Translation.
- When any PC (Client) from inside network communicates to a host in the Internet, the router changes the source port number with another port number.
- These port mappings are kept in a table. When the router received data packet from Internet, it will refer the table, which keep the port mappings and forward the data packet to the original sender.



## Inside Local Address:

- Inside local address is an IP address assigned to a workstation inside our network.
- Inside local address are typically private IP addresses, which stay inside our network.

## Inside Global Address:

- Inside Global address are typically public IP addresses which are assigned to our end internet facing router to be used as the IP address for communicating with other devices in the Internet.
- The Inside Local IP addresses are removed at the NAT router and translated with inside Global address.

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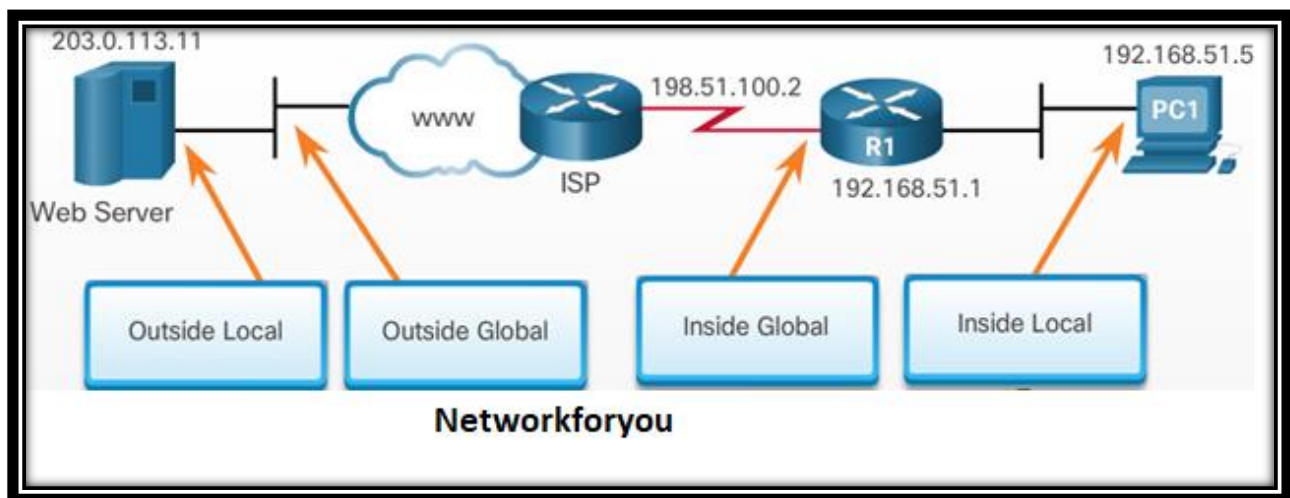


## Outside Global Address:

- Outside Global address is the public IP address assigned to the end device on the other network to communicate other devices in the Internet.
- Outside Global addresses are public IP addresses which are routable.

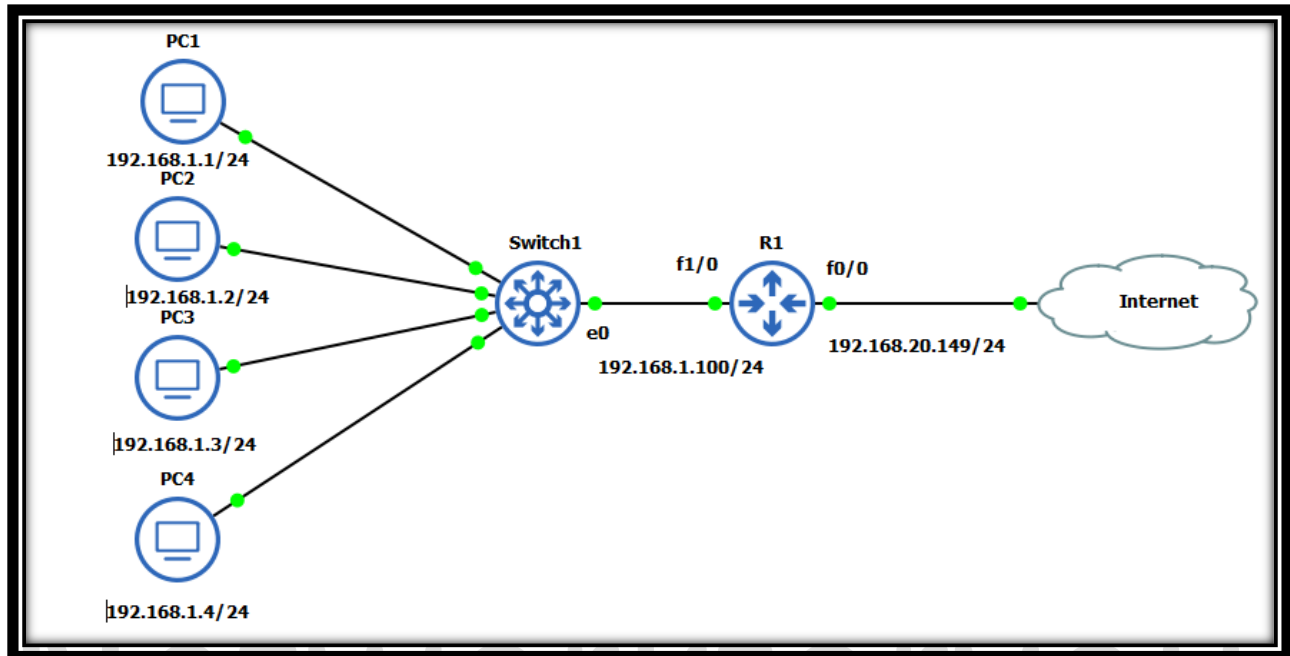
## Outside Local Address:

- Outside local address is the real IP address of the end device at other network.
- Outside local address are typically private IP addresses assigned to the computers in the other private network.
- We cannot know the Outside local addresses because in a NAT enable network we use the destination IP address as Outside Global address.





## Lab Time:



### R1 Basic Configuration

<pre>en confi t hostname R1 int f0/0 ip add dhcp no sh</pre>	<pre>int f1/0 ip add 192.168.1.100 255.255.255.0 no sh exit ip domain-lookup ip name-server 8.8.8.8</pre>
--	---

### Static NAT Configuration on R1

```
ip nat inside source static 192.168.1.1 192.168.20.150
ip nat inside source static 192.168.1.2 192.168.20.151
ip nat inside source static 192.168.1.3 192.168.20.152

int f0/0
ip nat outside
int f1/0
ip nat inside
```

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```
R1#sh ip nat translations
Pro Inside global      Inside local      Outside local      Outside global
--- 192.168.20.150     192.168.1.1      ---                ---
--- 192.168.20.151     192.168.1.2      ---                ---
--- 192.168.20.152     192.168.1.3      ---                ---
```

After sending the traffic from 192.168.1.1 it is translated and send the traffic outside.

```
R1#sh ip nat translations
Pro Inside global      Inside local      Outside local      Outside global
tcp 192.168.20.150:35358 192.168.1.1:35358 157.240.196.14:443 157.240.196.14:443
tcp 192.168.20.150:40002 192.168.1.1:40002 31.13.86.36:443 31.13.86.36:443
tcp 192.168.20.150:40004 192.168.1.1:40004 31.13.86.36:443 31.13.86.36:443
tcp 192.168.20.150:40006 192.168.1.1:40006 31.13.86.36:443 31.13.86.36:443
udp 192.168.20.150:41976 192.168.1.1:41976 8.8.8.8:53 8.8.8.8:53
tcp 192.168.20.150:44652 192.168.1.1:44652 157.240.196.15:443 157.240.196.15:443
tcp 192.168.20.150:44654 192.168.1.1:44654 157.240.196.15:443 157.240.196.15:443
tcp 192.168.20.150:44656 192.168.1.1:44656 157.240.196.15:443 157.240.196.15:443
tcp 192.168.20.150:44658 192.168.1.1:44658 157.240.196.15:443 157.240.196.15:443
tcp 192.168.20.150:44660 192.168.1.1:44660 157.240.196.15:443 157.240.196.15:443
tcp 192.168.20.150:44662 192.168.1.1:44662 157.240.196.15:443 157.240.196.15:443
tcp 192.168.20.150:44666 192.168.1.1:44666 157.240.196.15:443 157.240.196.15:443
udp 192.168.20.150:46878 192.168.1.1:46878 8.8.8.8:53 8.8.8.8:53
udp 192.168.20.150:53662 192.168.1.1:53662 8.8.8.8:53 8.8.8.8:53
udp 192.168.20.150:53781 192.168.1.1:53781 8.8.8.8:53 8.8.8.8:53
tcp 192.168.20.150:55484 192.168.1.1:55484 157.240.196.35:443 157.240.196.35:443
udp 192.168.20.150:58150 192.168.1.1:58150 8.8.8.8:53 8.8.8.8:53
tcp 192.168.20.150:59348 192.168.1.1:59348 93.184.220.29:80 93.184.220.29:80
tcp 192.168.20.150:59350 192.168.1.1:59350 93.184.220.29:80 93.184.220.29:80
tcp 192.168.20.150:59352 192.168.1.1:59352 93.184.220.29:80 93.184.220.29:80
udp 192.168.20.150:59547 192.168.1.1:59547 8.8.8.8:53 8.8.8.8:53
--- 192.168.20.150     192.168.1.1      ---                ---
--- 192.168.20.151     192.168.1.2      ---                ---
--- 192.168.20.152     192.168.1.3      ---                ---
```

### Dynamic NAT Configuration on R1

```
access-list 1 permit 192.168.1.0 0.0.0.255
ip nat pool abc 192.168.20.150 192.168.20.152 netmask 255.255.255.0
ip nat inside source list 1 pool abc
Int f0/0
ip nat outside

Int f1/0
ip nat inside
```

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```
R1#sh ip nat translations
Pro Inside global      Inside local      Outside local      Outside global
tcp 192.168.20.150:35208 192.168.1.1:35208 216.58.207.14:443 216.58.207.14:443
tcp 192.168.20.150:36204 192.168.1.1:36204 172.217.19.170:443 172.217.19.170:443
udp 192.168.20.150:39353 192.168.1.1:39353 8.8.8.8:53 8.8.8.8:53
tcp 192.168.20.150:39596 192.168.1.1:39596 172.217.21.33:443 172.217.21.33:443
udp 192.168.20.150:42248 192.168.1.1:42248 8.8.8.8:53 8.8.8.8:53
tcp 192.168.20.150:47398 192.168.1.1:47398 216.58.208.234:443 216.58.208.234:443
tcp 192.168.20.150:53756 192.168.1.1:53756 34.107.221.82:80 34.107.221.82:80
tcp 192.168.20.150:56248 192.168.1.1:56248 172.217.21.45:443 172.217.21.45:443
tcp 192.168.20.150:57066 192.168.1.1:57066 172.217.21.34:443 172.217.21.34:443
tcp 192.168.20.150:58476 192.168.1.1:58476 216.58.207.99:80 216.58.207.99:80
tcp 192.168.20.150:59902 192.168.1.1:59902 172.217.21.36:443 172.217.21.36:443
tcp 192.168.20.150:59978 192.168.1.1:59978 216.58.208.227:443 216.58.208.227:443
tcp 192.168.20.150:60002 192.168.1.1:60002 216.58.208.227:443 216.58.208.227:443
tcp 192.168.20.150:60710 192.168.1.1:60710 172.217.19.182:443 172.217.19.182:443
--- 192.168.20.150 192.168.1.1 ---
tcp 192.168.20.151:38368 192.168.1.2:38368 157.240.196.15:443 157.240.196.15:443
tcp 192.168.20.151:38376 192.168.1.2:38376 157.240.196.15:443 157.240.196.15:443
tcp 192.168.20.151:39634 192.168.1.2:39634 157.240.196.35:443 157.240.196.35:443
tcp 192.168.20.151:48712 192.168.1.2:48712 157.240.196.14:443 157.240.196.14:443
udp 192.168.20.151:59991 192.168.1.2:59991 8.8.8.8:53 8.8.8.8:53
--- 192.168.20.151 192.168.1.2 ---
udp 192.168.20.152:34245 192.168.1.3:34245 8.8.8.8:53 8.8.8.8:53
tcp 192.168.20.152:36644 192.168.1.3:36644 13.226.118.21:443 13.226.118.21:443
tcp 192.168.20.152:41514 192.168.1.3:41514 13.226.118.36:443 13.226.118.36:443
udp 192.168.20.152:44513 192.168.1.3:44513 8.8.8.8:53 8.8.8.8:53
tcp 192.168.20.152:44594 192.168.1.3:44594 152.199.21.141:443 152.199.21.141:443
tcp 192.168.20.152:44596 192.168.1.3:44596 152.199.21.141:443 152.199.21.141:443
tcp 192.168.20.152:46328 192.168.1.3:46328 104.244.42.66:443 104.244.42.66:443
tcp 192.168.20.152:46350 192.168.1.3:46350 104.244.42.66:443 104.244.42.66:443
udp 192.168.20.152:48914 192.168.1.3:48914 8.8.8.8:53 8.8.8.8:53
tcp 192.168.20.152:53780 192.168.1.3:53780 104.244.42.193:443 104.244.42.193:443
tcp 192.168.20.152:54964 192.168.1.3:54964 93.184.220.70:443 93.184.220.70:443
tcp 192.168.20.152:57192 192.168.1.3:57192 172.217.21.46:443 172.217.21.46:443
udp 192.168.20.152:59218 192.168.1.3:59218 8.8.8.8:53 8.8.8.8:53
--More--
```

### PAT Configuration on R1

```
access-list 1 permit 192.168.1.0 0.0.0.255
ip nat pool abc 192.168.20.150 192.168.20.150 netmask 255.255.255.0
ip nat inside source list 1 pool abc overload
int f0/0
ip nat outside
int f1/0
ip nat inside
```

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```
R1#sh ip nat translations
Pro Inside global      Inside local      Outside local      Outside global
tcp 192.168.20.150:36132 192.168.1.1:36132 172.217.19.161:443 172.217.19.161:443
tcp 192.168.20.150:36258 192.168.1.1:36258 172.217.19.170:443 172.217.19.170:443
tcp 192.168.20.150:40278 192.168.1.1:40278 172.217.19.174:443 172.217.19.174:443
tcp 192.168.20.150:42142 192.168.1.1:42142 172.217.19.163:80 172.217.19.163:80
tcp 192.168.20.150:47464 192.168.1.1:47464 172.217.19.3:443 172.217.19.3:443
tcp 192.168.20.150:53926 192.168.1.1:53926 34.107.221.82:80 34.107.221.82:80
tcp 192.168.20.150:57794 192.168.1.1:57794 172.217.19.162:443 172.217.19.162:443
tcp 192.168.20.150:58040 192.168.1.1:58040 216.58.207.4:443 216.58.207.4:443
tcp 192.168.20.150:58632 192.168.1.1:58632 172.217.21.35:443 172.217.21.35:443
tcp 192.168.20.150:58646 192.168.1.1:58646 172.217.21.35:443 172.217.21.35:443
tcp 192.168.20.150:39270 192.168.1.2:39270 172.217.19.162:443 172.217.19.162:443
tcp 192.168.20.150:44730 192.168.1.2:44730 172.217.19.163:443 172.217.19.163:443
tcp 192.168.20.150:45288 192.168.1.2:45288 172.217.19.4:443 172.217.19.4:443
tcp 192.168.20.150:45560 192.168.1.2:45560 216.58.208.246:443 216.58.208.246:443
tcp 192.168.20.150:48666 192.168.1.2:48666 34.107.221.82:80 34.107.221.82:80
tcp 192.168.20.150:50934 192.168.1.2:50934 172.217.19.174:443 172.217.19.174:443
tcp 192.168.20.150:54016 192.168.1.2:54016 216.58.208.237:443 216.58.208.237:443
tcp 192.168.20.150:56582 192.168.1.2:56582 172.217.19.170:443 172.217.19.170:443
tcp 192.168.20.150:59934 192.168.1.2:59934 172.217.19.161:443 172.217.19.161:443
tcp 192.168.20.150:60346 192.168.1.2:60346 172.217.21.35:443 172.217.21.35:443
tcp 192.168.20.150:60358 192.168.1.2:60358 172.217.21.35:443 172.217.21.35:443
tcp 192.168.20.150:34482 192.168.1.3:34482 216.58.207.99:443 216.58.207.99:443
tcp 192.168.20.150:35124 192.168.1.3:35124 172.217.19.164:443 172.217.19.164:443
tcp 192.168.20.150:37480 192.168.1.3:37480 172.217.19.3:443 172.217.19.3:443
udp 192.168.20.150:38114 192.168.1.3:38114 8.8.8.8:53 8.8.8.8:53
tcp 192.168.20.150:41260 192.168.1.3:41260 216.58.208.226:443 216.58.208.226:443
tcp 192.168.20.150:41824 192.168.1.3:41824 13.226.118.125:443 13.226.118.125:443
tcp 192.168.20.150:43870 192.168.1.3:43870 91.228.74.134:443 91.228.74.134:443
udp 192.168.20.150:44304 192.168.1.3:44304 8.8.8.8:53 8.8.8.8:53
tcp 192.168.20.150:44348 192.168.1.3:44348 172.217.19.162:443 172.217.19.162:443
tcp 192.168.20.150:45880 192.168.1.3:45880 35.244.245.222:443 35.244.245.222:443
tcp 192.168.20.150:48104 192.168.1.3:48104 151.101.1.140:443 151.101.1.140:443
tcp 192.168.20.150:48124 192.168.1.3:48124 151.101.1.140:443 151.101.1.140:443
tcp 192.168.20.150:48130 192.168.1.3:48130 151.101.1.140:443 151.101.1.140:443
tcp 192.168.20.150:48140 192.168.1.3:48140 151.101.1.140:443 151.101.1.140:443
tcp 192.168.20.150:48162 192.168.1.3:48162 151.101.1.140:443 151.101.1.140:443
tcp 192.168.20.150:48186 192.168.1.3:48186 151.101.1.140:443 151.101.1.140:443
tcp 192.168.20.150:48198 192.168.1.3:48198 151.101.1.140:443 151.101.1.140:443
udp 192.168.20.150:49784 192.168.1.3:49784 8.8.8.8:53 8.8.8.8:53
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