

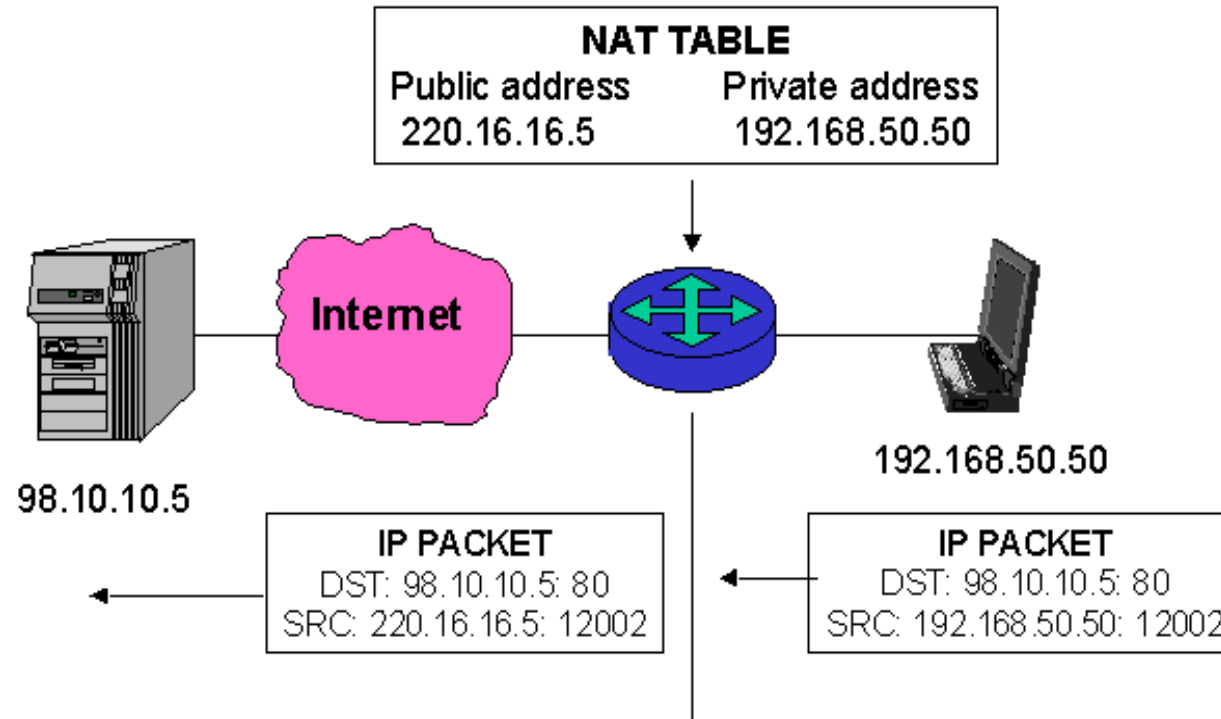
CSC 361 Lab Session 8

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Summer 2016

Network Address Translation (NAT)



non-Routable addresses

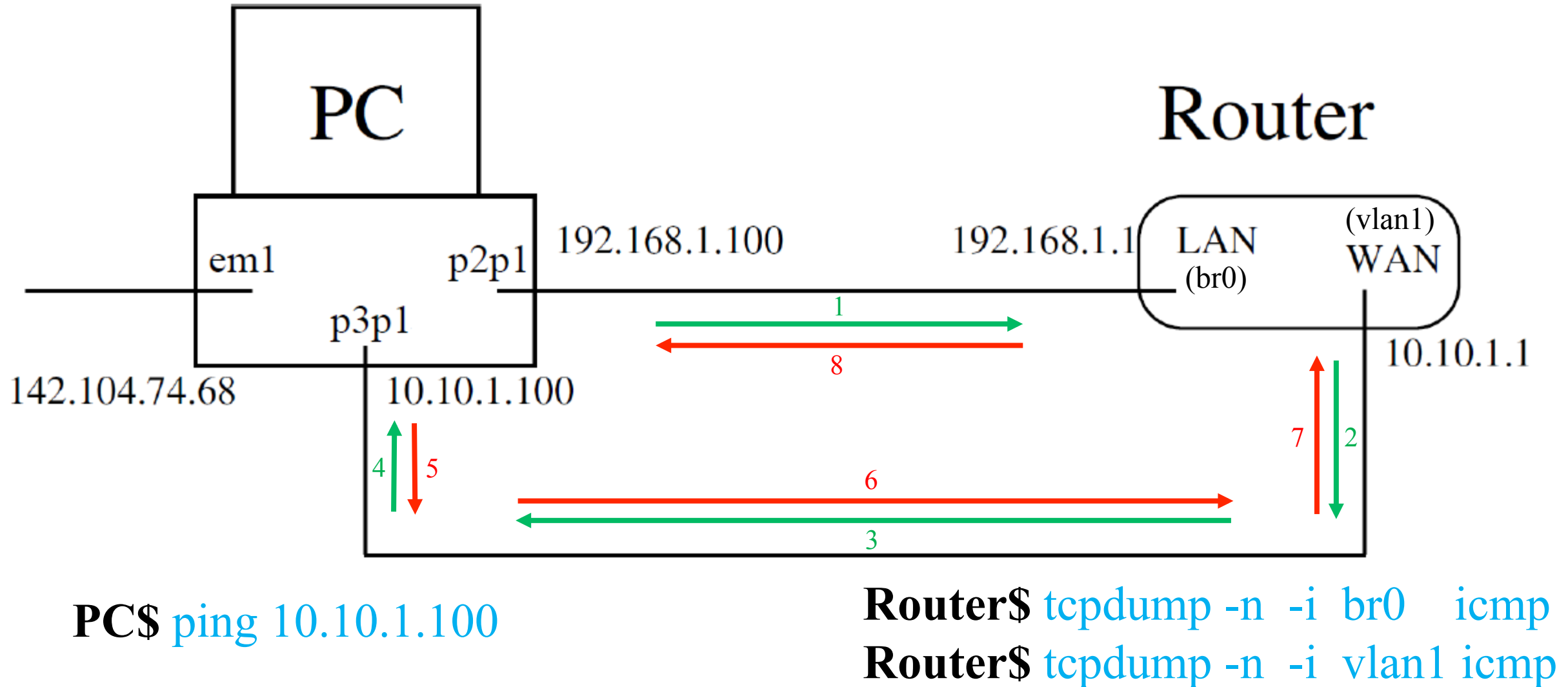
10.0.0.0 – 10.255.255.255

172.16.0.0 – 172.31.255.255

192.168.0.0 – 192.168.255.255

- NAT device has address translation table

Network Address Translation (NAT)



Network Address Translation (NAT)

Please download trace files: [nat-int.cap](#), [nat-ext.cap](#)

Experiment settings

Internal network address: 192.168.1.0/24

External network address: 10.10.1.1/32

Traffic generator: ping

Outgoing packets

Out from PC: 192.168.1.100 -> 10.10.1.100 (ICMP Echo Request)

After NAT: 10.10.1.1 -> 10.10.1.100 (ICMP Echo Request)

Incoming packets

Out from pc: 10.10.1.100 -> 10.10.1.1 (ICMP Echo Reply)

After NAT: 10.10.1.100 -> 192.168.1.100 (ICMP Echo Reply)

Static Routing

Show the routing configuration on the router

- *ip* route command:

Command

```
ip route list
```

Static Routing

- A host specific route:
192.168.1.100 → 192.168.1.1 → 10.10.1.1 → 10.10.1.100
- Show the static routing on the router:

Command

```
ip route list
```

- Add a static route:

Command

```
ip route add 10.10.2.0/24 via 10.10.1.100 dev vlan1
```

- Delete a static route:

Command

```
ip route del 10.10.2.0/24 via 10.10.1.100 dev vlan1
```

Default route

Static Routing

- Add a default route:

Command

```
ip route add default via 10.10.1.100 dev vlan1
```

- Alternative way to add default route:

Command

```
ip route add 0/0 via 10.10.1.100 dev vlan1
```

- Delete the default route:

Command

```
ip route del default
```

Assignment 3

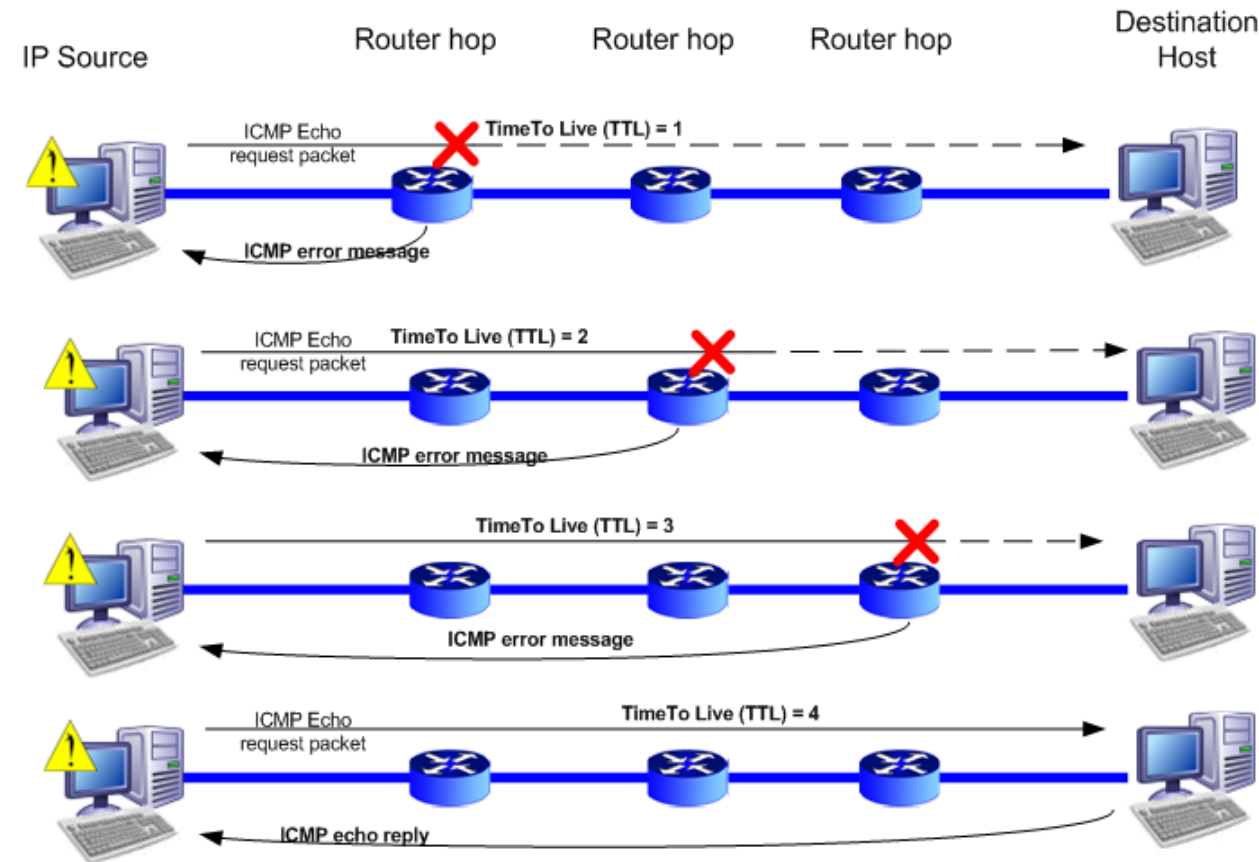
PC\$ `tracert google.com`

```
tracert to google.com (216.58.216.142), 30 hops max, 60 byte packets
 1  n-gateway.csc.uvic.ca (142.104.74.65)  0.321 ms  0.470 ms  0.555 ms
 2  192.168.9.5 (192.168.9.5)  0.165 ms  0.142 ms  0.149 ms
 3  192.168.10.1 (192.168.10.1)  0.786 ms  0.772 ms  0.540 ms
 4  192.168.8.6 (192.168.8.6)  0.648 ms  0.633 ms  0.619 ms
 5  csc1cled050.bb.uvic.ca (142.104.252.37)  0.871 ms  0.756 ms  0.750 ms
 6  emc1cled050.bb.uvic.ca (142.104.252.246)  1.299 ms  1.320 ms  1.323 ms
 7  IX-UVic-cr1.VICTX1.BC.net (207.23.244.242)  1.299 ms  1.265 ms  48.958 ms
 8  206.12.3.17 (206.12.3.17)  3.109 ms  3.080 ms  3.565 ms
 9  vncv1rtr2.canarie.ca (199.212.24.64)  2.959 ms  3.579 ms  3.539 ms
10  google-1-lo-std-707.sttlwa.pacificwave.net (207.231.242.20)  6.389 ms  6.780 ms  6.944 ms
11  209.85.249.32 (209.85.249.32)  6.935 ms  6.617 ms  6.581 ms
12  216.239.51.159 (216.239.51.159)  6.545 ms  6.487 ms  7.090 ms
13  sea15s01-in-f14.1e100.net (216.58.216.142)  6.290 ms  6.858 ms  6.897 ms
```

Traceroute sends **Datagram** Packets to the destination.
It uses Time-To-Live (**TTL**) field of the IP header.

If the **TTL** reaches **0**, the router returns an ICMP message (type 11 **ICMP TTL-exceeded**) to the sender.

The sender that runs **tracert** can learn the identities of the intermediate routers (between itself and the destination) by looking at the source IP addresses in the datagrams containing the **ICMP TTL-exceeded** messages



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Assignment 3 (sample output)

The IP address of the source node: 192.168.1.12

The IP address of ultimate destination node: 10.216.216.2

The IP addresses of the intermediate destination nodes:

router 1: 24.218.01.102,

router 2: 24.221.10.103,

router 3: 10.215.118.1.

The values in the protocol field of IP headers:

1: ICMP

17: UDP

The number of fragments created from the original datagram is: 3

The offset of the last fragment is: 3680

The avg RRT between 192.168.1.12 and 24.218.01.102 is: 50 ms, the s.d. is: 5 ms

The avg RRT between 192.168.1.12 and 24.221.10.103 is: 100 ms, the s.d. is: 6 ms

The avg RRT between 192.168.1.12 and 10.215.118.1 is: 150 ms, the s.d. is: 5 ms

The avg RRT between 192.168.1.12 and 10.216.216.2 is: 200 ms, the s.d. is: 15 ms