COMPUTER COMMUNICATION NETWORKS

M Rajasekar

Department of Electronics and Communication Engineering

COMPUTER COMMUNICATION NETWORKS

DHCP & NAT

M Rajasekar
Department of Electronics and Communication Engineering

DHCP - Dynamic Host Configuration Protocol

- DHCP allows a host to obtain IP address automatically.
- DHCP provides **dynamic allocation of IP addresses**
- In addition to host IP address assignment, DHCP also gives additional information, such as
  - Its subnet mask,
  - The address of its first-hop router
  - The address of its local DNS server.
- It is often referred to as a **plug-and-play protocol**

DHCP - Dynamic Host Configuration Protocol (Contd..)

- DHCP uses client – server model for obtaining the IP address.
- Server listens for **UDP** messages on port **67**
- ***For a newly arriving host, the DHCP protocol is a four – step process***
  - Host communicates initially using broadcast address
  - Broadcast address: 255.255.255.255
  - Host sends a DHCP discovery message
  - DHCP servers replies with DHCP offer messages
  - Host replies with DHCP request
  - DHCP server acknowledges with the assigned IP address

DHCP

DHCP Client – Server Scenario

- **DHCP Server Discovery (C → S):**
- The first task of a newly arriving host is to find a DHCP server with which to interact done using a DHCP discover message which a **client** from port **68** sends within a UDP packet to **server** port **67**.
- DHCP client creates an IP datagram containing its DHCP discover message along with the broadcast destination IP address of 255.255.255.255 and a "this host" source IP address of 0.0.0.0.
- The DHCP client passes the IP datagram to the link layer

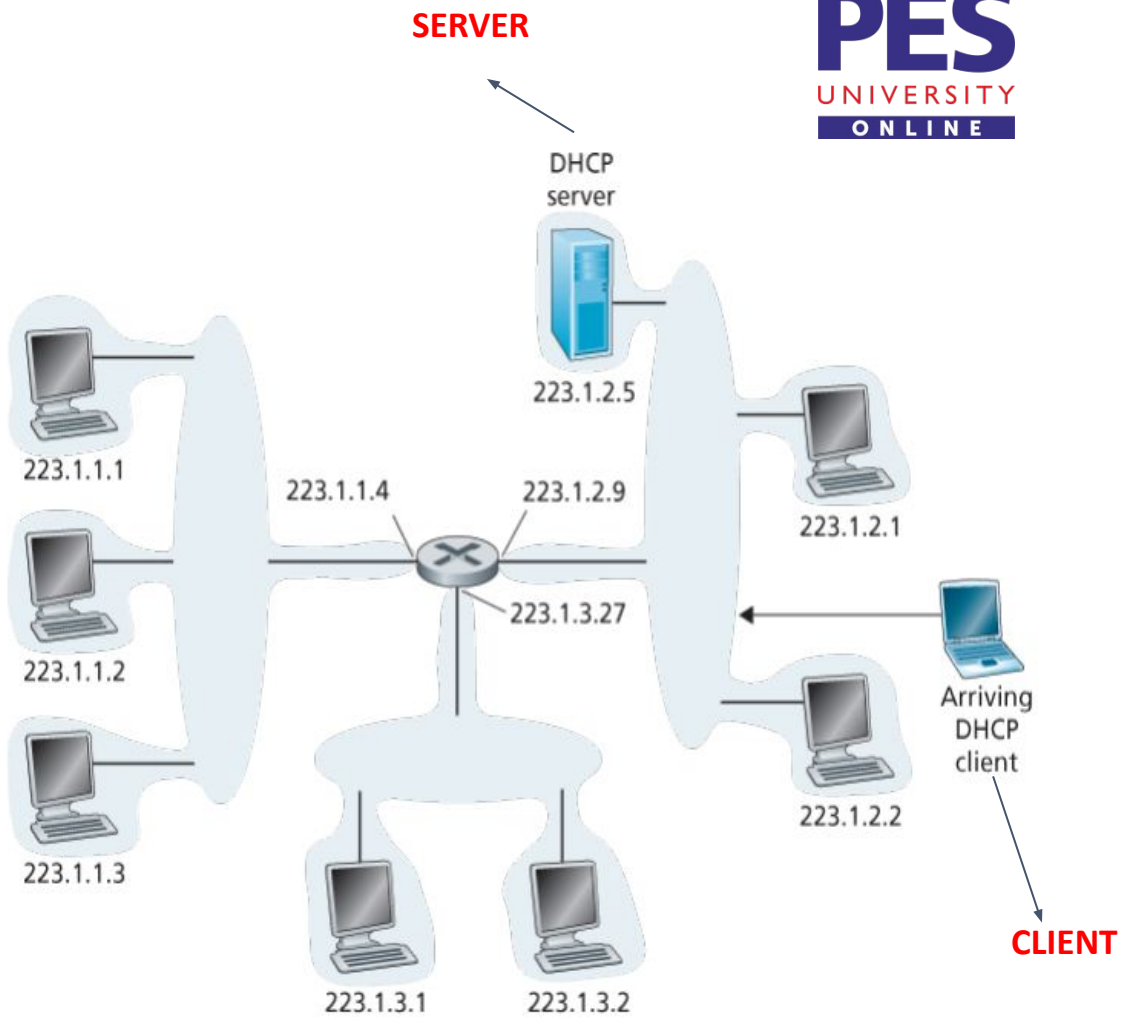


Figure 4.23 DHCP client and server

DHCP Client – Server Scenario

- **DHCP Server Offer (S → C):**
- A DHCP responds to the client with a DHCP offer message that is broadcast to all nodes again using the IP broadcast address of 255.255.255.255.
- Each server offer message contains
  - The transaction ID of the received discover message,
  - The proposed IP address for the client, the network mask, and
  - An IP address lease time—the amount of time for which the IP address will be valid.

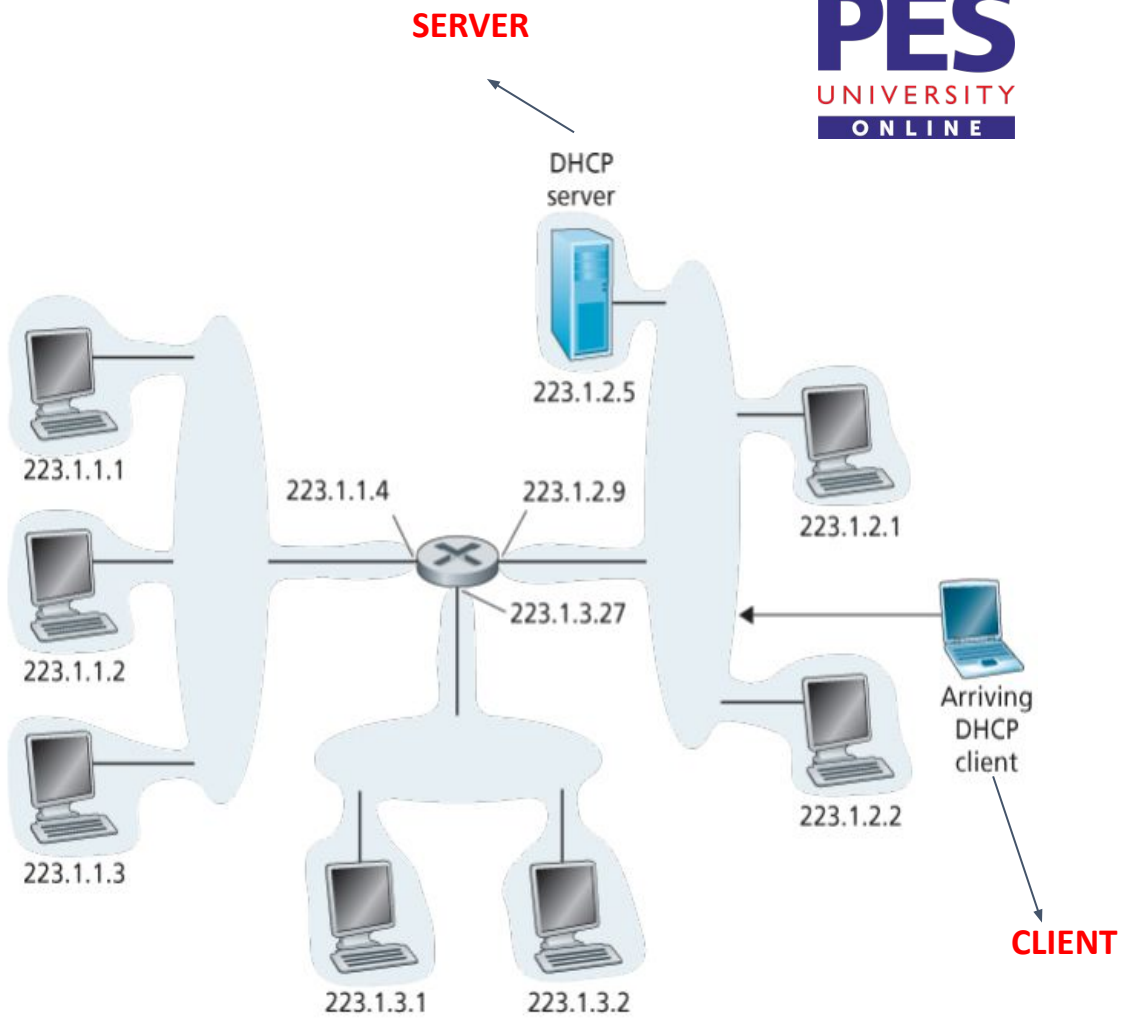


Figure 4.23 DHCP client and server

DHCP

DHCP Client – Server Scenario

- **DHCP Request (C → S):**

The client will choose from among one or more server offers and respond to its selected offer with a DHCP request message echoing back the configuration parameters.

- **DHCP ACK (S → C):**

The server responds to the DHCP request message with a **DHCP ACK message, confirming the requested parameters**.

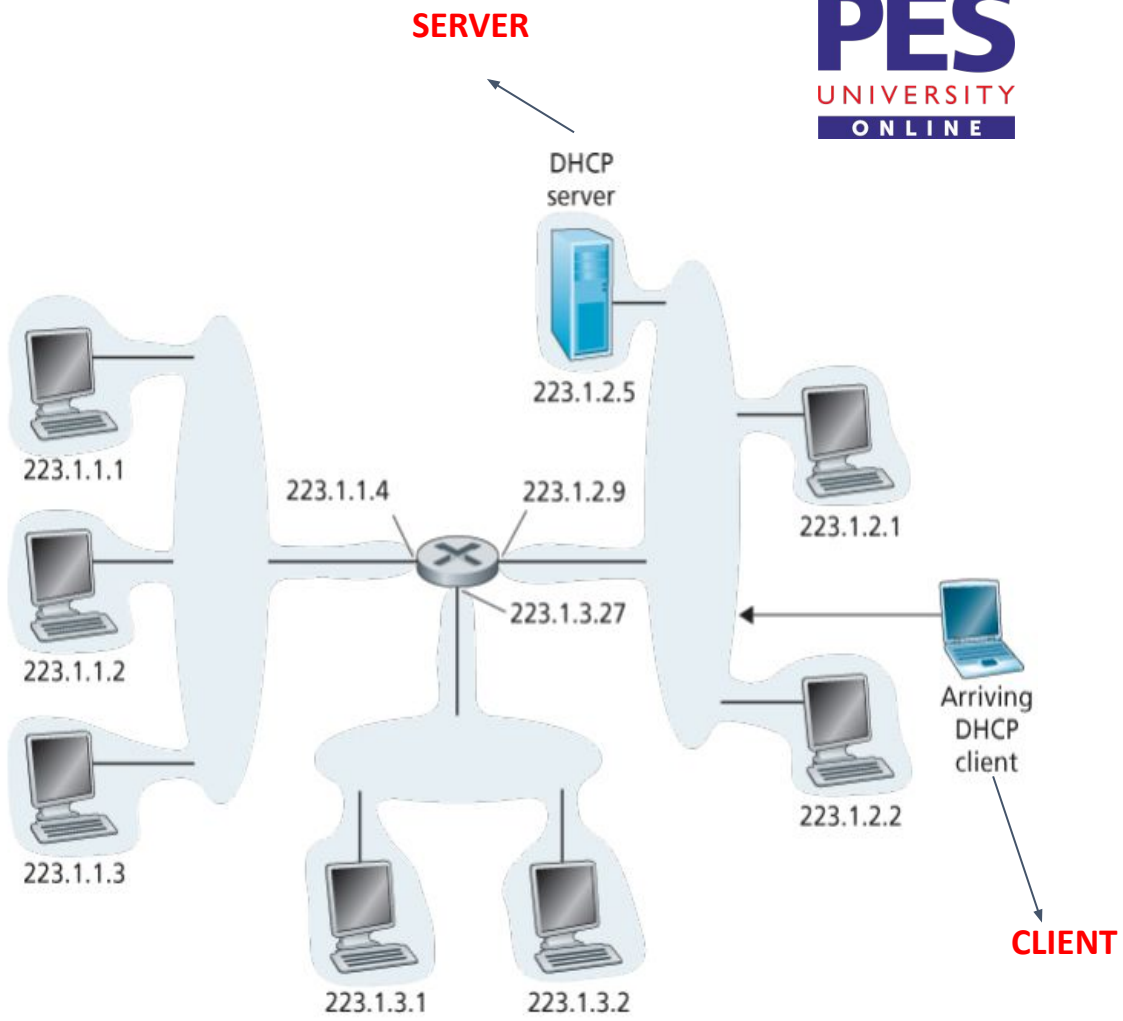
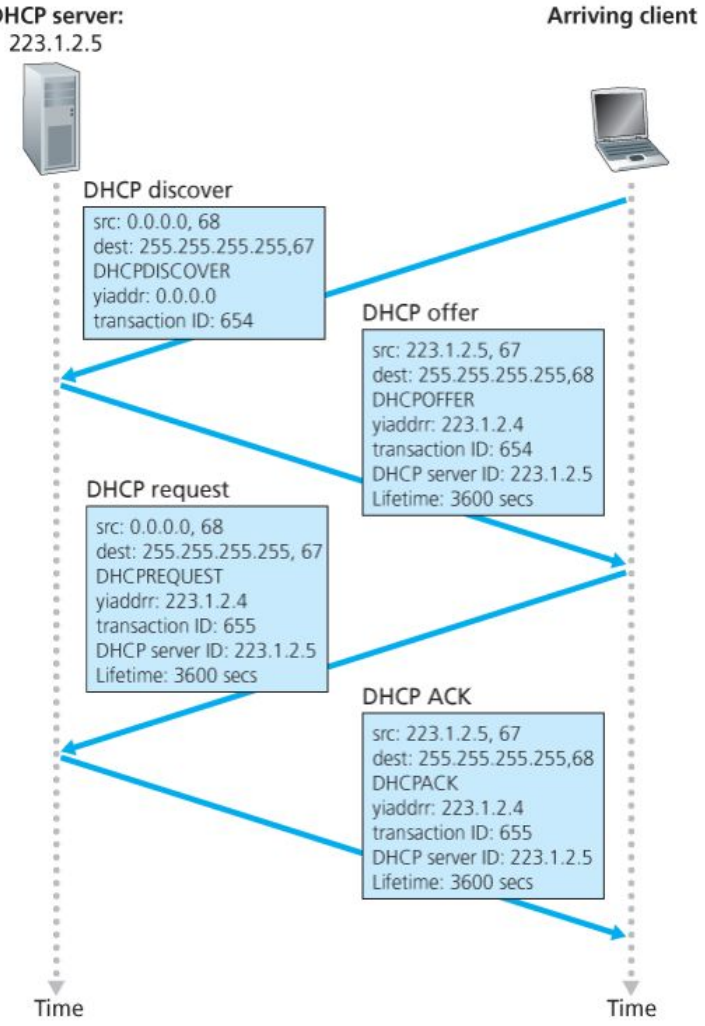


Figure 4.23 DHCP client and server

DHCP Client – Server Interaction



DHCP

Numerical 1:

Suppose the DHCP server has the IP address of 192.168.1.1. Suppose a host wants to join the network. Answer the following.

i. What is the transport layer protocol used by the client?
ii. What are the port numbers used by the client and the server?
iii. What are the source and destination IP address in a DHCP discovery message?
iv. What are the source and destination IP address in a DHCP offer message?
v. What are the last two messages exchanged by the client and the DHCP server?

DHCP

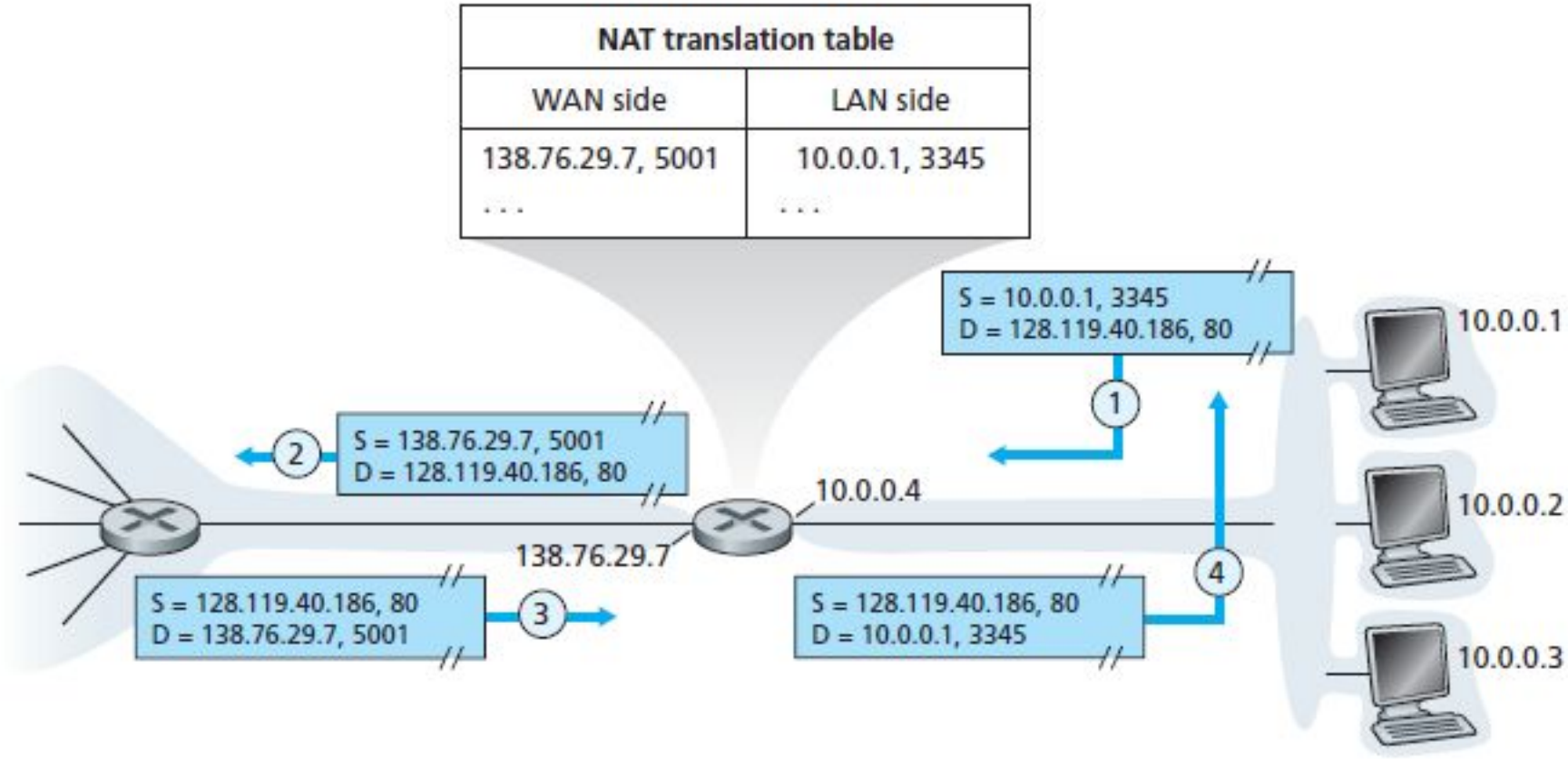
Solution:

i. UDP
ii. Client and server port numbers are 68 and 67 respectively
iii. DHCP discovery message source and destination IP addresses are 0.0.0.0 and 255.255.255.255
iv. DHCP offer message source and destination IP addresses are 192.168.1.1 and 255.255.255.255
v. The last two messages exchanged by the client and DHCP server are DHCP request and DHCP acknowledgement.

Network address translation (NAT)

- Private IP address are assigned
- Private hosts can access the public internet using NAT
- NAT maps the private hosts to the public IP address
- NAT table maintains such mapping

Network address translation (NAT) (Contd.):



Network address translation (NAT): Objections by purists

- Ports used for addressing processes not hosts
- Routers should perform only level 3 functions
- Violates end to end principle
- Slowing down adoption of IPv6

UNIVERSAL PLUG AND PLAY(UPnP)

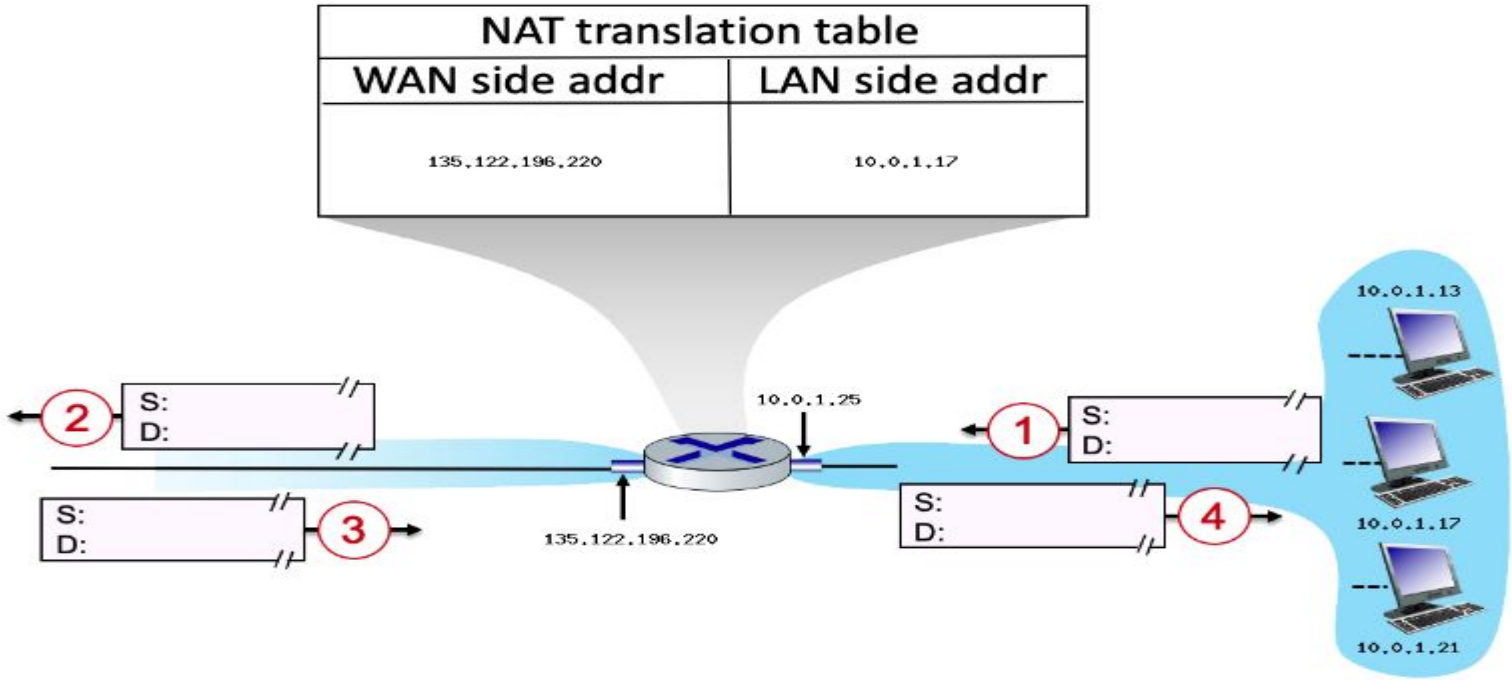
- NAT traversal is increasingly provided by Universal Plug and Play (UPnP), which is a protocol that allows a host to discover and configure a nearby NAT.
- With UPnP, an application running in a host can request a NAT mapping between its (private IP address, private port number) and the (public IP address, public port number)

UNIVERSAL PLUG AND PLAY(Contd):

- If the NAT accepts the request and creates the mapping, then nodes from the outside can initiate TCP connections to (public IP address, public port number)..
- UPnP allows external hosts to initiate communication sessions to NATed hosts, using either TCP or UDP.

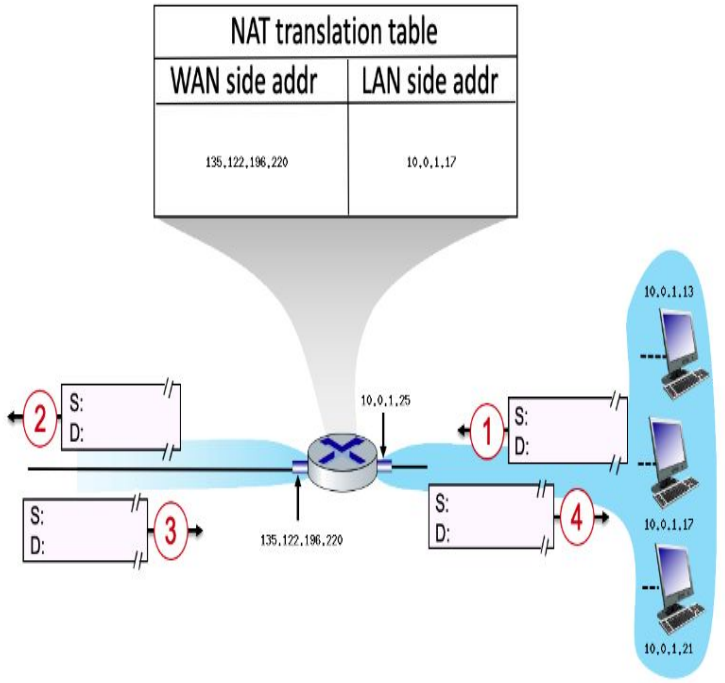
COMPUTER COMMUNICATION NETWORKS
NAT, NAT Traversal, UPnP

Consider the scenario below in which three hosts, with private IP addresses 10.0.1.13, 10.0.1.17, 10.0.1.21 are in a local network behind a NAT'd router that sits between these three hosts and the larger Internet. IP datagrams being sent from, or destined to, these three hosts must pass through this NAT router. The router's interface on the LAN side has IP address 10.0.1.25, while the router's address on the Internet side has IP address 135.122.196.220. Suppose that the host with IP address 10.0.1.17 sends an IP datagram destined to host 128.119.170.182. The source port is 3452, and the destination port is 80.



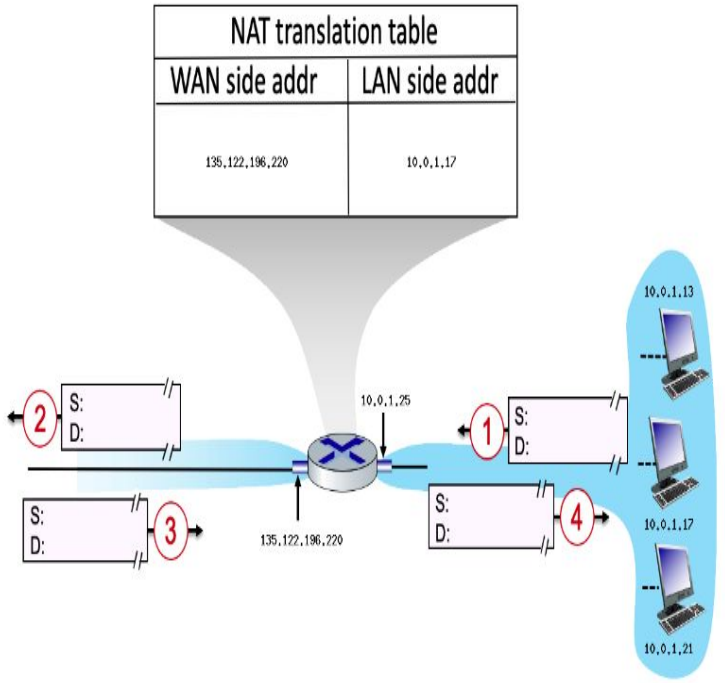
Questions:

1. Consider the datagram at step 1, after it has been sent by the host but before it has reached the router. What is the source IP address for this datagram?
2. At step 1, what is the destination IP address?
3. Now consider the datagram at step 2, after it has been transmitted by the router. What is the source IP address for this datagram?
4. At step 2, what is the destination IP address for this datagram?
5. Will the source port have changed? Yes or No.
6. Now consider the datagram at step 3, just before it is received by the router. What is the source IP address for this datagram?
7. At step 3, what is the destination IP address for this datagram?
8. Last, consider the datagram at step 4, after it has been transmitted by the router but before it has been received by the host. What is the source IP address for this datagram?
9. At step 4, what is the destination IP address for this datagram



Solution

1. The source address will be the local host's IP, which is 10.0.1.17
2. The destination address will be the remote machine's IP, which is 128.119.170.182
3. The source address will be the router's public IP, which is 135.122.196.220
4. The destination address will be the remote machine's IP, which is 128.119.170.182
5. Yes, the NAT will change the source port.
6. The source address will be the remote machine's IP, which is 128.119.170.182
7. The destination address will be the router's public IP, which is 135.122.196.220
8. The source address will be the remote machine's IP, which is 128.119.170.182
9. The destination address will be the local host's IP, which is 10.0.1.17



THANK YOU

M Rajasekar
Department of Electronics and Communication Engineering
rajasekarmohan@pes.edu