



## 4.9.4.7 DHCP, NAT & Port Forwarding

### DHCP

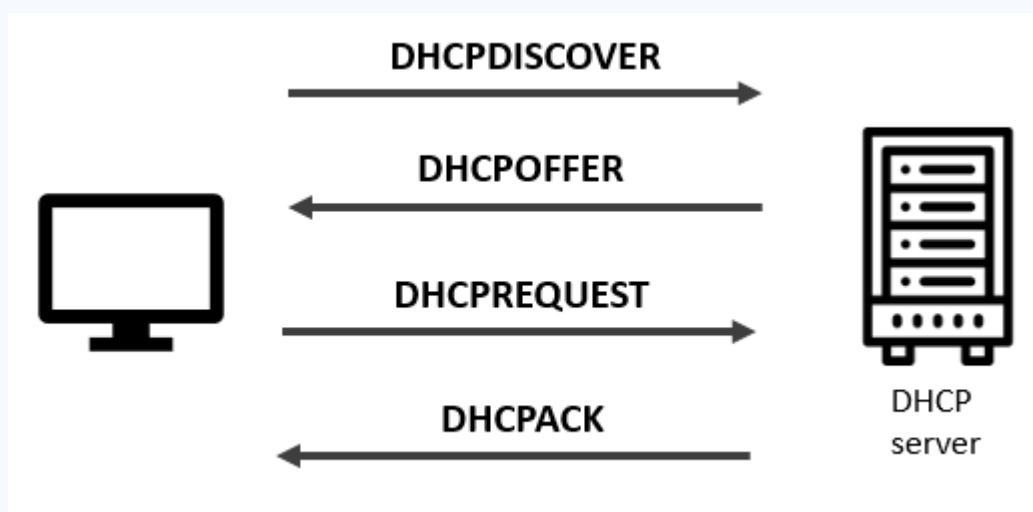
DHCP (Dynamic Host Configuration Protocol) is used to automatically assign IP addresses and other network configuration information to devices joining a network.

Without DHCP, every device would have to manually configure their own IP address, subnet mask, default gateway and DNS server.

This reduces the need for expert knowledge when configuring a host, reduces the time taken, avoids IP duplication errors and facilitates the efficient use of a limited pool of IP addresses.

#### How DHCP works

- **Discover** – A new device joins the network and broadcasts a DHCPDISCOVER message.
- **Offer** – The DHCP server receives the broadcast and replies with a DHCPOFFER which contains the IP address and configuration information.
- **Request** – The device selects an offer (if multiple servers responded) and broadcasts a DHCPREQUEST message to request that IP address.
- **Acknowledge** – The DHCP server sends a DHCPACK to confirm the IP address allocation.





## NAT

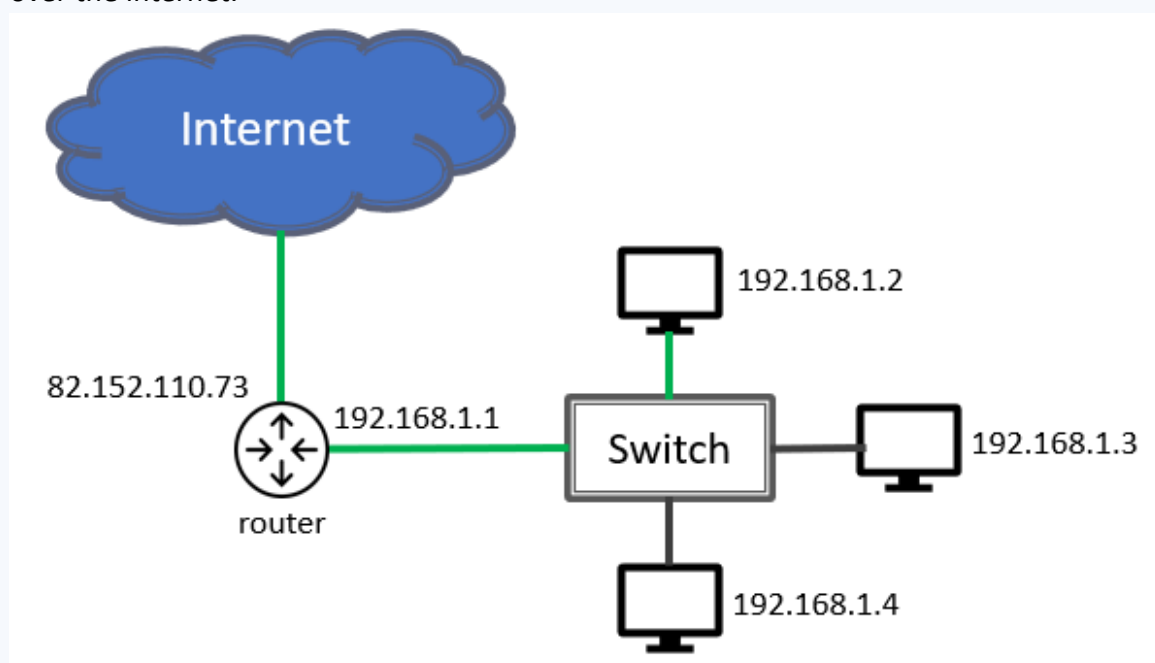
NAT (Network Address Translation) is needed when computers communicate over the internet to translate between private and public IP addresses.

Computers have a private IP address on a LAN and when they communicate on the internet the router translates the private source IP address to its own public IP address when the device communicates over the Internet.

This allows a single public IP address to be shared with many hosts.

The router maintains a NAT table containing the private and public IP addresses and port numbers. When a response returns, the router uses this information to forward it to the correct device

The device with IP 192.168.1.2 wants to communicate with a server with IP 203.0.112.7 over the internet.



The packets are sent to the router, and the router replaces the source's private IP address with its own public IP address. It stores the translation in a NAT table.

| Private IP  | Private Port | Public IP     | Public Port |
|-------------|--------------|---------------|-------------|
| 192.168.1.2 | 50123        | 82.152.110.73 | 40001       |

When a response is received back the router uses the table to replace its IP address with the original devices IP address to forward the packet on.

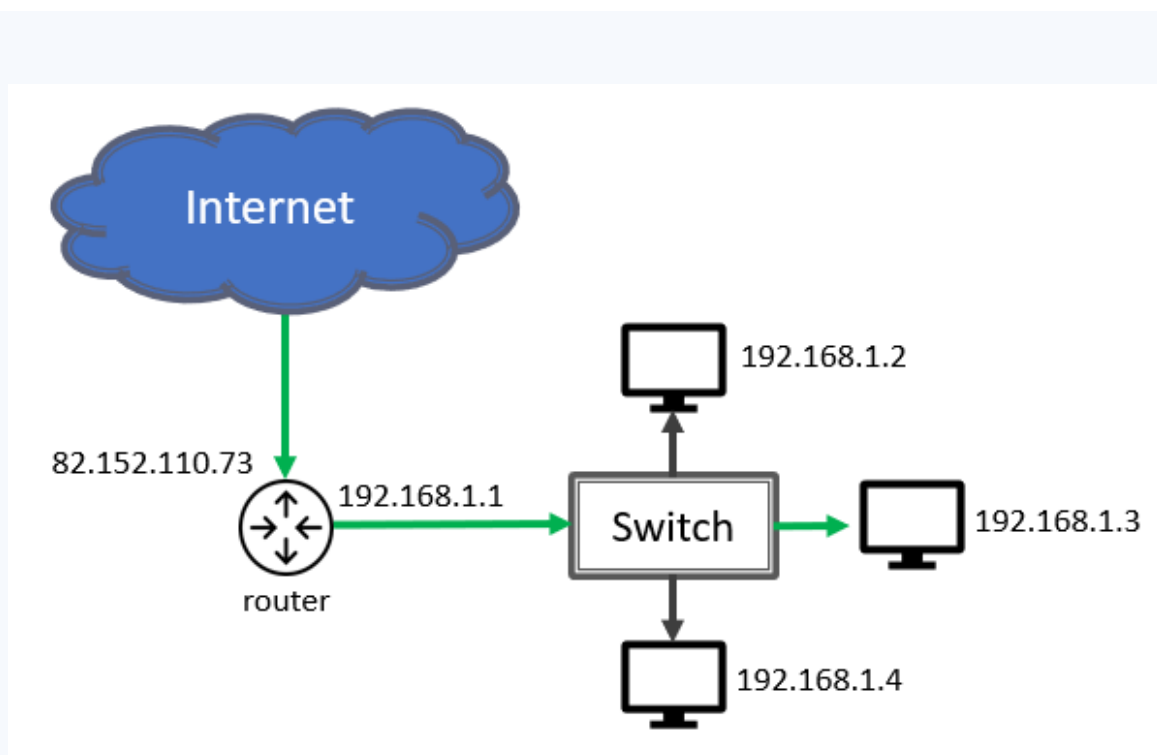




## Port Forwarding

Port forwarding is a technique used by router to allow external devices on the internet to access a specific computer or service inside a private network.

As private IP addresses are not routable they are not normally able to be contacted directly from outside the network. Port forwarding creates a rule that tells the router that if a packet arrives on a certain public port that it should be forwarded on to a particular IP and port number on the network.



A packet arrives at the external router from the internet addressed to port 22000.

A port forwarding rule has been implemented on the router that says to forward packets arriving on this port to 192.168.1.3:31010.

The packet is sent inside the network to the device with 192.168.1.3 on port 31010.

