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# Network Address Translation

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## Overview

Network Address Translation (NAT) is a service which translates between IP address from a private network and ones which can be used to communicate across the Internet.

## Why use NAT

There are a finite number of IPv4 addresses available to be used at a time, and with more and more people connecting to the Internet, we are running out. Originally, NAT was designed to free up some of these addresses so that we don't run out.

## Local Area Network

A Local Area Network (LAN) is a small group of nodes which are contained within a small geographical area, usually controlled by a single source.

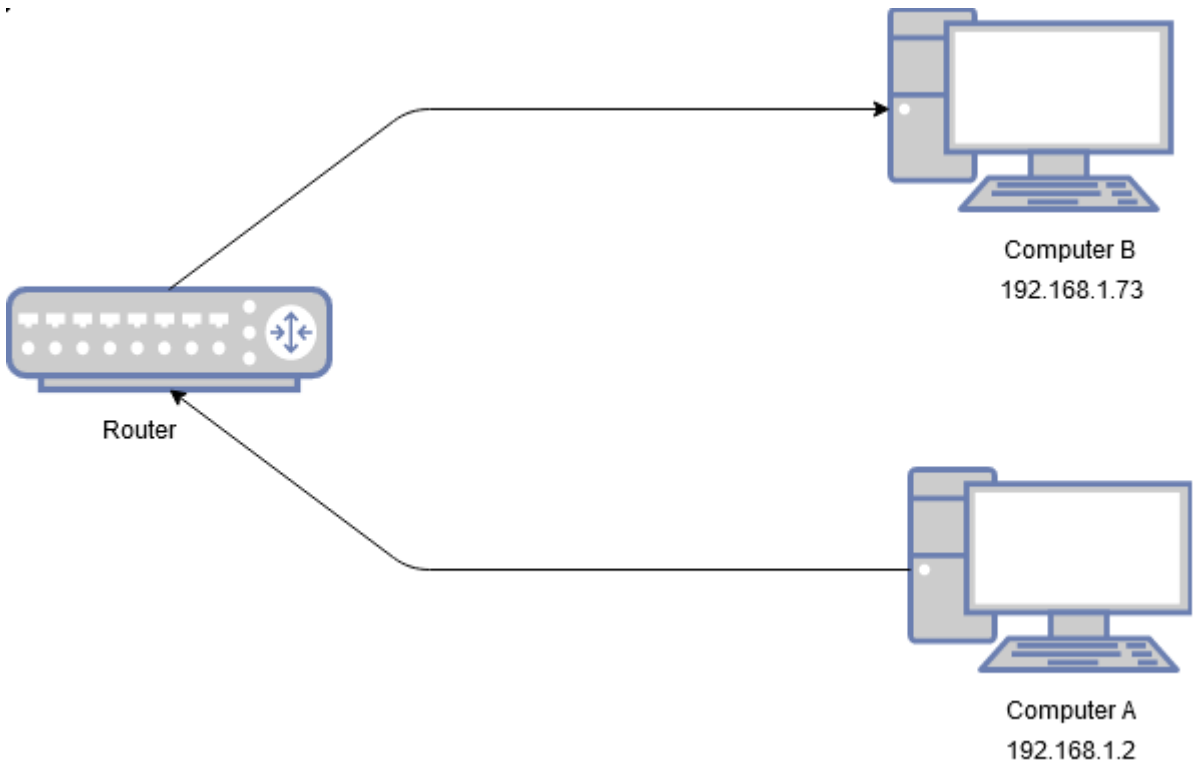
In a LAN, such as your home or work network, each node will have it's own **private IP** address. This address is used to communicate with other nodes in the same LAN only, as a result, the same **private IP** can be used in multiple LANs.

## Communication

When computer A, with a private IP address of **192.168.1.2**, tries to communicate with computer B, which has a private IP address of **192.168.1.73**, it sends a packet of data which contains both the **source IP** and the **destination IP**.

This packet of data is usually sent via a **router**; the router knows which node has the destination IP and redirects the packet to the correct place.

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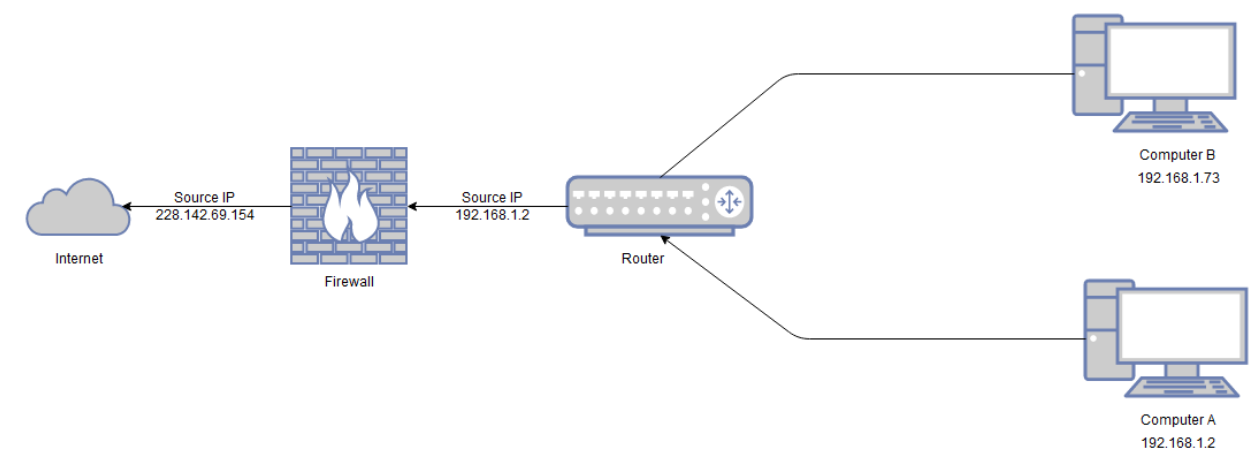
## How NAT works

When computer A tries to communicate with a node via the Internet, it sends a packet which contains the **source IP** and the **destination IP**.

When the **router** received this packet, it recognises that the destination IP is not in the LAN and redirects it to the **firewall**.

The firewall takes this request, and sends a copy of it to the destination IP address, via the Internet, with its own **external IP** addresses as the source IP.

When a response is received, it is sent back to the computer inside the LAN with using the **private IP**.



## Web Servers

As nodes in a private network do not have an external IP address by default, nodes from outside the network cannot instigate a connection to them.

To let other devices connect to a node from via the Internet, we use NAT to assigned a separate external IP to the node. This way, the firewall knows exactly which machine to redirect packets to when a device tries to connect.

Since the connection must come through the firewall, we can set up further **firewall rules** to help keep out private network secure.

## Tutorial

Using the terminal on our machines, we're going to look at the private IP configurations of our machine.

## Windows

Open up **powershell**. This can be done by pressing the **windows key** and **R** at the same time, and then typing in **powershell**.

Once you have opened powershell, type the following and press **Enter**

```
ipconfig
```

Make a note of your IPv4 address.

## Linux/macOS

Open up a **terminal**.

This can be done by searching your applications for the word **terminal**.

Once you have opened a terminal, type the following and press **Enter**

```
ifconfig
```

Make a note of your IPv4 address, you can find it next to the label **inet**.

## External IP

Now, we want to compare the private IP of our machine, to the external IP (also known as public IP).

Go to [google](#), and search for

```
what is my ip
```

Compare this to the private IP you found earlier, you should see that these are different.

Since Google is running on another node which must be accessed via the internet, the private IP of your machine has been translated to a public IP, using NAT, when you connected to it.

## Exercises

There are no exercises for this module.