

Network | Main course

Session 1

Introduction

Internet protocol

NAT

Utilities & Commands

DNS & DHCP



Maktab
Sharif

by Mohammad Amin H.B. Tehrani

www.maktabsharif.ir

Introduction

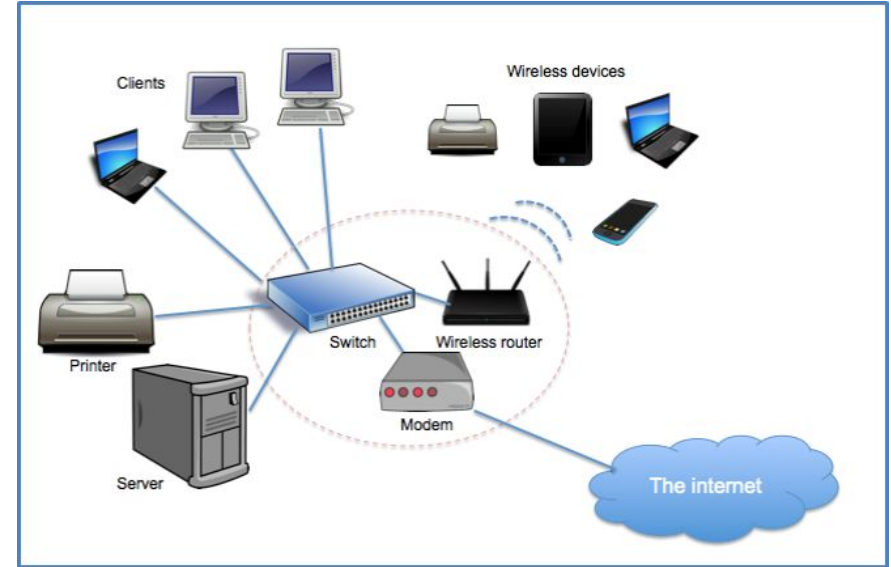


What's Computer network?



What's Computer Network?

A computer network is a group of computers that use a set of common communication protocols over digital interconnections for the purpose of sharing resources located on or provided by the network nodes.



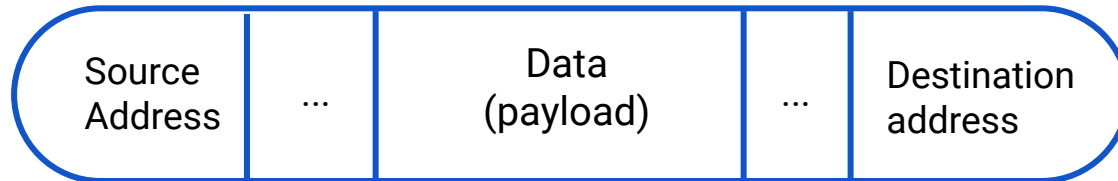
Network packets



Network

In telecommunications and computer networking, a **network packet** is a formatted unit of data carried by a packet-switched network. A packet consists of control information and user data.

Your data is splitting into many packages, then they are sent to the network.



A network packet

Network nodes

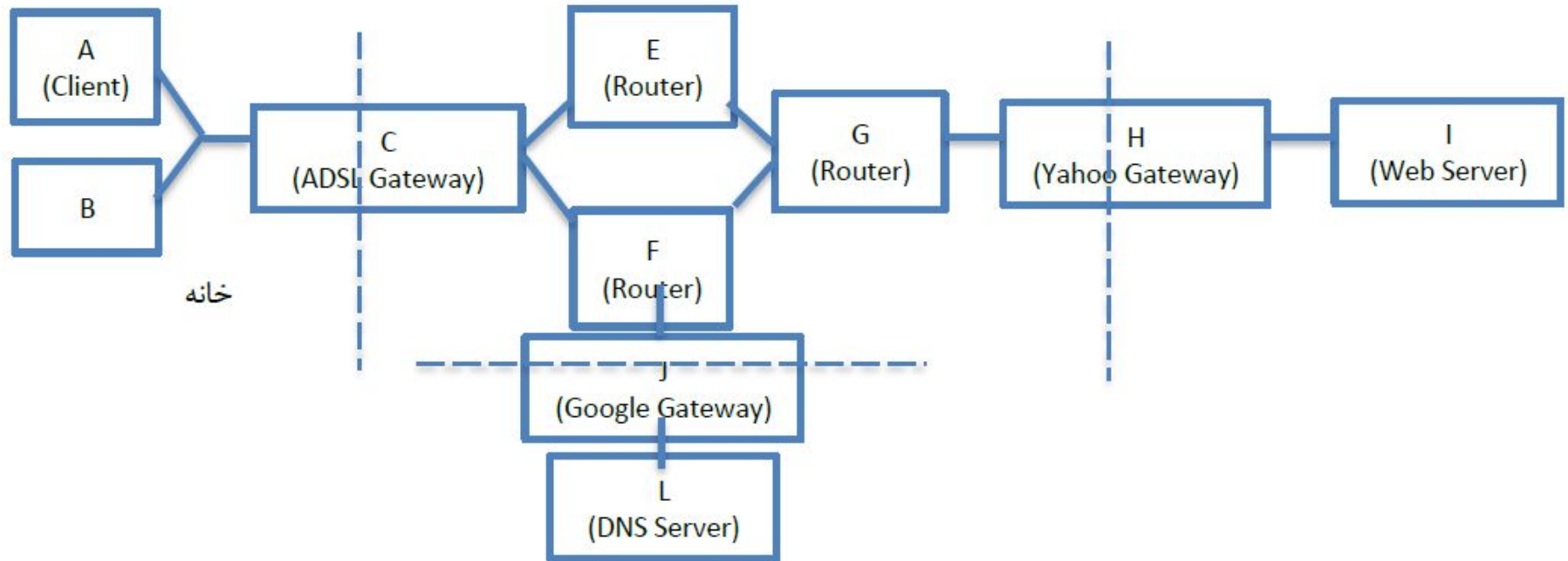


In telecommunications networks, a node is either a redistribution point or a communication endpoint. The definition of a node depends on the network and protocol layer referred to.

Most important nodes:

- Routers
- Hubs
- Switches
- Modems
- ...





Internet protocol



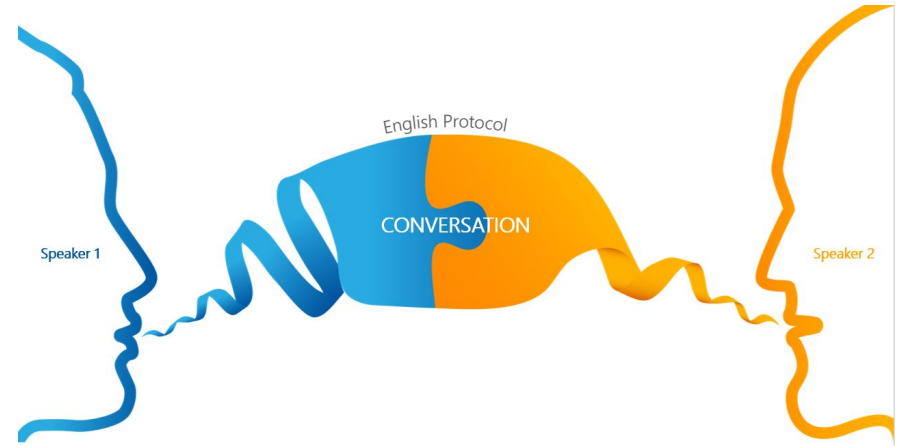


Protocol

In natural and social science research, a protocol is most commonly a predefined procedural method in the design and implementation of an experiment.

Communication protocol

A communication protocol is a system of rules that allows two or more entities of a communications system to transmit information via any kind of variation of a physical quantity. The protocol defines the rules, syntax, semantics and synchronization of communication and possible error recovery methods.



Internet protocols



Internet protocol

The Internet Protocol (IP) is the principal communications protocol in the Internet protocol suite for relaying datagrams across network boundaries. Its routing function enables internetworking, and essentially establishes the Internet.

Versions:

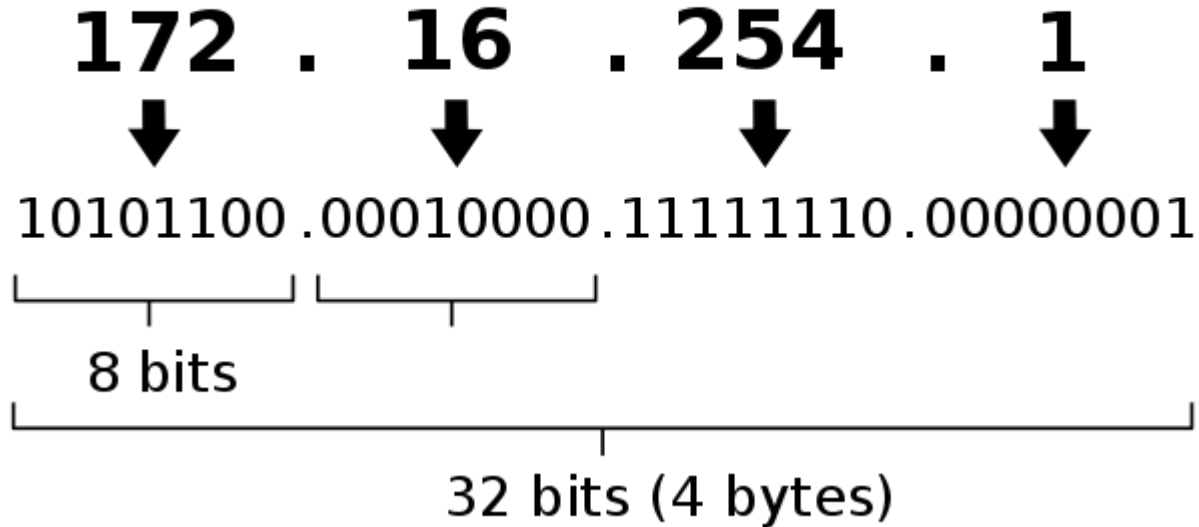
- IPv4
- IPv6

IP Address

An Internet Protocol address is a numerical label assigned to each device connected to a computer network that uses the Internet Protocol for communication. **An IP address serves two main functions: host or network interface identification and location addressing.**



IPv4 address in dotted-decimal notation





An IPv6 address (in hexadecimal)

2001:0DB8:AC10:FE01:0000:0000:0000:0000



2001:0DB8:AC10:FE01:: Zeroes can be omitted



0010000000000001:0000110110111000:101011000010000:1111111000000001:

0000000000000000:0000000000000000:0000000000000000:0000000000000000

IP information



You can find your ip address information simply, by search it on google or related websites like:

- <https://ipgeolocation.io/>
- <https://ipinfo.io/>
- <https://tools.keycdn.com/geo>
- <https://whatismyipaddress.com>
- ...

IP Details For: 2.190.141.255

Decimal: 46042623
Hostname: 2.190.141.255
ASN: 58224
ISP: Information Technology
Company (ITC)
Organization: Iran Telecommunication
Company PJS
Services: None detected
Type: [Broadband](#)
Assignment: [Likely Static IP](#)
Continent: Asia
Country: Iran



Latitude: 35.698 (35° 41' 52.80" N)

Longitude: 51.4115 (51° 24' 41.40" E)

[CLICK TO CHECK BLACKLIST STATUS](#)



Loopback ip (Localhost)

Localhost

In computer networking, **localhost** is a hostname that refers to the current computer used to access it. It is used to access the network services that are running on the host via the loopback network interface.

Loopback ip

The local loopback mechanism may be used to run a network service on a host without requiring a physical network interface, or without making the service accessible from the networks the computer may be connected to.

IPv4 Loopback address:

127.0.0.1

IPv6 Loopback address:

::1

Utilities & Commands



ipconfig (ifconfig)



Ipconfig (or ifconfig)

(standing for "Internet Protocol configuration") is a console application program of some computer operating systems that displays all current TCP/IP network configuration values and refreshes Dynamic Host Configuration Protocol (DHCP) and Domain Name System (DNS) settings.

Commands:

- ipconfig
- ipconfig /all
- ...

(execute **ipconfig /?** for see all options)

```
C:\Users\->ipconfig
```

```
Windows IP Configuration
```

```
Ethernet adapter Ethernet 3:
```

```
Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . :
```

```
Wireless LAN adapter Wi-Fi:
```

```
Connection-specific DNS Suffix . : local
Link-local IPv6 Address . . . . . : fe80::b8bf:1d09:8a4f:cb52%6
IPv4 Address. . . . . : 192.168.1.3
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 192.168.1.1
```

```
Ethernet adapter Bluetooth Network Connection:
```

```
Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . :
```

ping



Ping utility

Ping is a computer network administration software utility used to test the reachability of a host on an Internet Protocol (IP) network.

Commands:

- ping ip_address
- ping url_address

(execute **ping** for see all options)

```
C:\Users\_- >ping google.com
```

```
Pinging google.com [216.58.209.142] with 32 bytes of data:
Reply from 216.58.209.142: bytes=32 time=51ms TTL=52
Reply from 216.58.209.142: bytes=32 time=47ms TTL=52
Reply from 216.58.209.142: bytes=32 time=46ms TTL=52
Reply from 216.58.209.142: bytes=32 time=47ms TTL=52
```

```
Ping statistics for 216.58.209.142:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 46ms, Maximum = 51ms, Average = 47ms
```

```
C:\Users\_- >ping 127.0.0.1
```

```
Pinging 127.0.0.1 with 32 bytes of data:
Reply from 127.0.0.1: bytes=32 time<1ms TTL=128
Reply from 127.0.0.1: bytes=32 time<1ms TTL=128
Reply from 127.0.0.1: bytes=32 time<1ms TTL=128
Reply from 127.0.0.1: bytes=32 time<1ms TTL=128
```

```
Ping statistics for 127.0.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```


Traceroute (tracert)



Trace route

In computing, **traceroute** and **tracert** are computer network diagnostic commands for displaying possible routes and measuring transit delays of packets across an Internet Protocol network.

Commands:

- `tracert ip_address`
- `tracert url_address`
- ...

(execute **tracert** for see all options)

```
C:\Users\_- >tracert google.com
```

```
Tracing route to google.com [216.58.209.142]  
over a maximum of 30 hops:
```

1	2 ms	2 ms	2 ms	192.168.1.1
2	4 ms	4 ms	3 ms	2.190.128.1
3	4 ms	4 ms	5 ms	93.118.125.41
4	18 ms	*	3 ms	10.22.27.41
5	*	*		Request timed out.
6	5 ms	6 ms	4 ms	10.21.252.18
7	4 ms	4 ms	4 ms	10.22.22.225
8	8 ms	8 ms	13 ms	10.202.4.176
9	8 ms	11 ms	5 ms	10.21.21.10
10	6 ms	13 ms	6 ms	10.21.0.11
11	52 ms	50 ms	49 ms	213.202.4.172
12	51 ms	47 ms	48 ms	213.202.5.239
13	51 ms	50 ms	48 ms	216.239.48.133
14	52 ms	52 ms	49 ms	108.170.233.243
15	47 ms	47 ms	49 ms	arn09s05-in-f14.1e100.net

```
[216.58.209.142]
```

```
Trace complete.
```



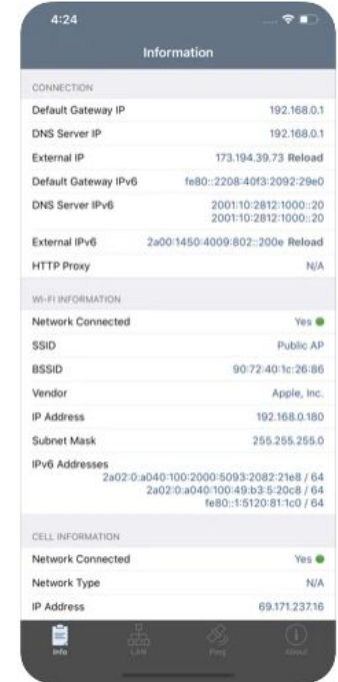
Network analyser app for Android & IOS



Network Analyzer can help you diagnose various problems in your wifi network setup, Internet connectivity, and also detect various issues on remote servers thanks to the wide range of tools it provides.

Features:

- Wifi signal meter
- LAN scanner
- Ping & traceroute
- Whois
- DNS lookup
- Network information



NAT



Public & Private networks

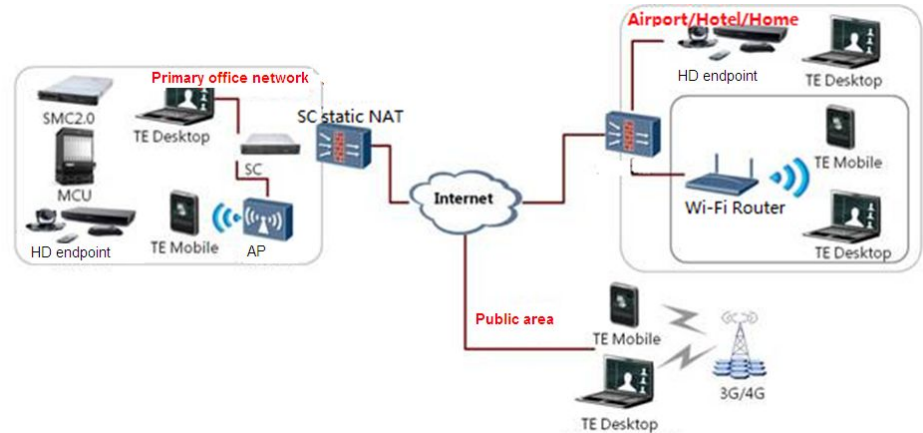


Public network

A public network is a network to which anyone can connect. The best, and perhaps only pure, example of such a network is the Internet.

Private network

A private network is any network to which access is restricted. A corporate network or a network in a school are examples of private networks.

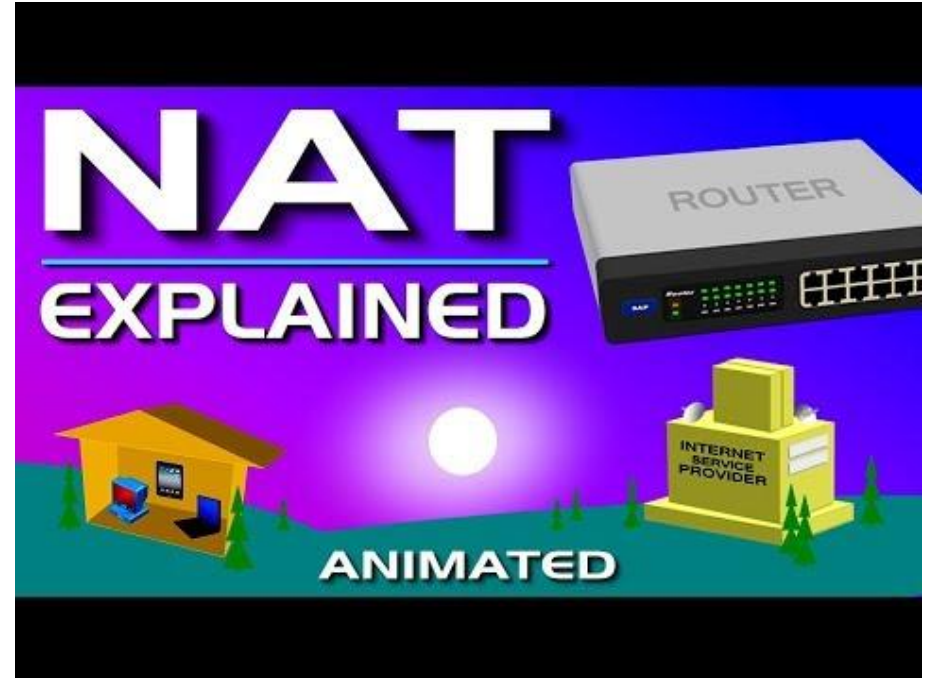


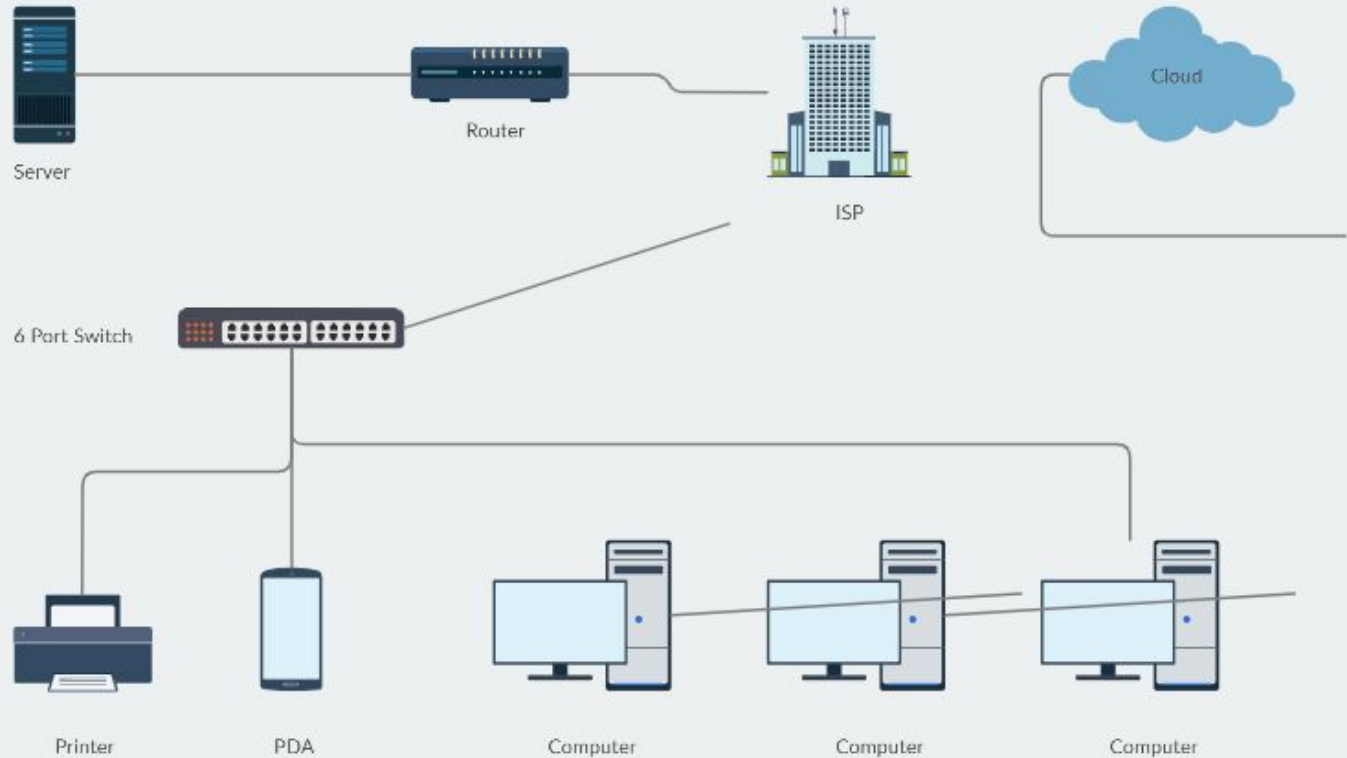
NAT



NAT: Network Address Translator

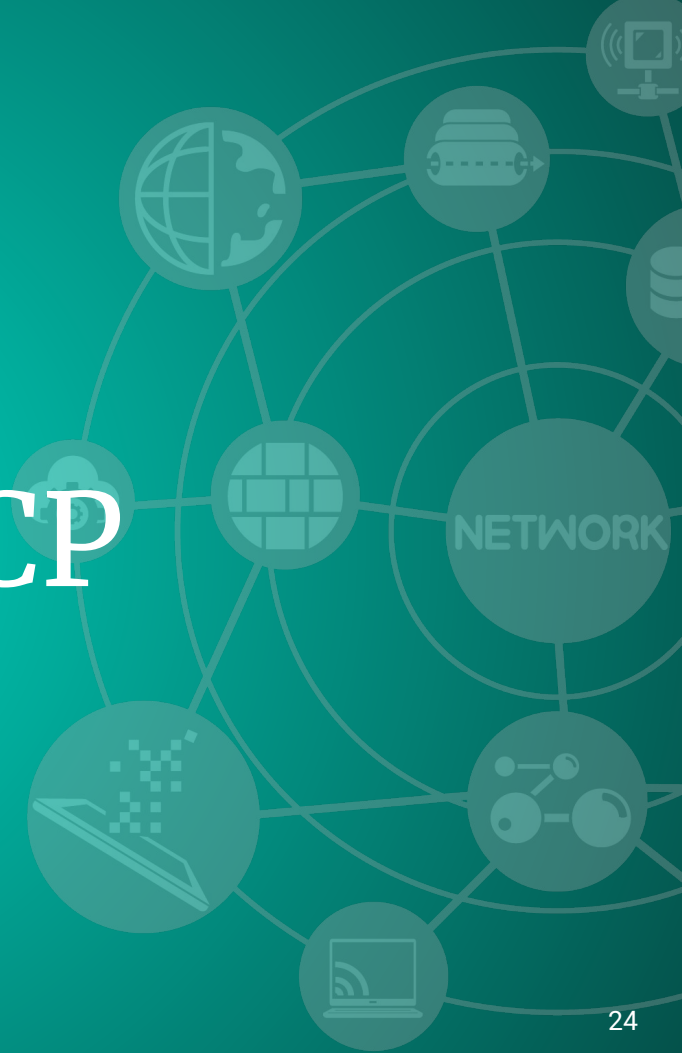
Network address translation is a method of mapping an IP address space into another by modifying network address information in the IP header of packets while they are in transit across a traffic routing device.





Example network diagram

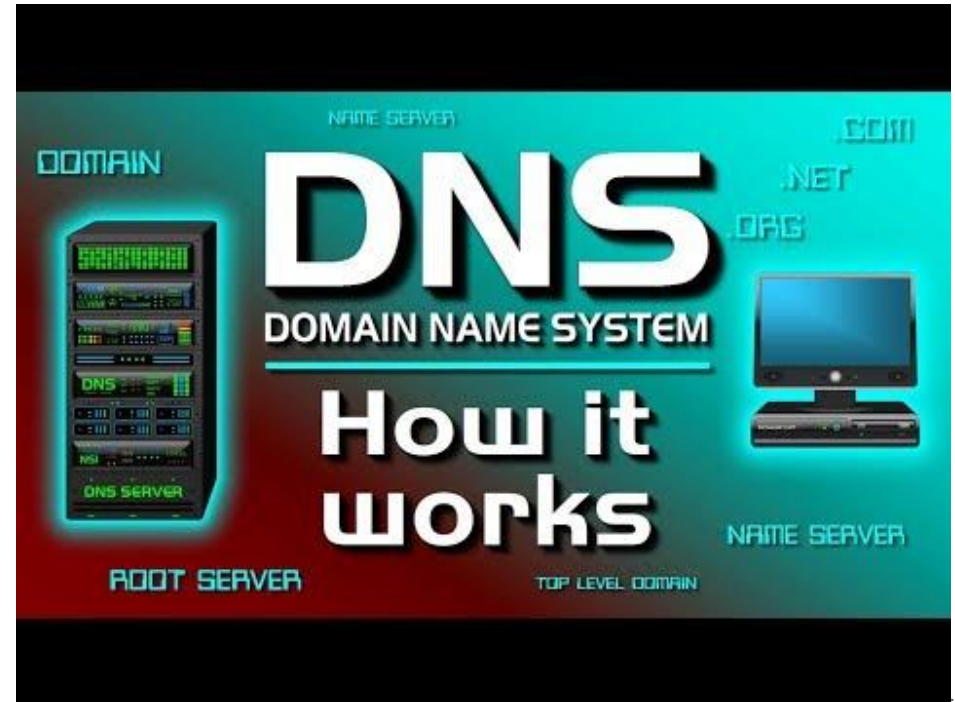
DNS & DHCP



Domain Name System



The **Domain Name System (DNS)** is the phonebook of the Internet. Humans access information online through domain names, like nytimes.com or espn.com. Web browsers interact through Internet Protocol (IP) addresses. DNS translates domain names to IP addresses so browsers can load Internet resources.



Find current dns server



`ipconfig /all`

If you run `ipconfig` command with `/all` (or `-a`) option, you can see more details like DNS server on the result:

```
C:\Users\>ipconfig /all
```

```
Wireless LAN adapter Wi-Fi:
```

```
Connection-specific DNS Suffix  . : local
Description . . . . . : Qualcomm Atheros QCA9377 Wireless Network ...
Physical Address. . . . . : CC-B0-DA-78-13-EB
DHCP Enabled. . . . . : Yes
Autoconfiguration Enabled . . . . : Yes
Link-local IPv6 Address . . . . . : fe80::b8bf:1d09:8a4f:cb52%6(Preferred)
IPv4 Address. . . . . : 192.168.1.3(Preferred)
Subnet Mask . . . . . : 255.255.255.0
Lease Obtained. . . . . : Friday, April 30, 2021 10:13:03 AM
Lease Expires . . . . . : Friday, April 30, 2021 2:13:03 PM
Default Gateway . . . . . : 192.168.1.1
DHCP Server . . . . . : 192.168.1.1
DHCPv6 IAID . . . . . : 80523482
DHCPv6 Client DUID. . . . . : 00-01-00-01-25-E6-AE-78-54-AB-3A-DC-22-57
DNS Servers . . . . . : 192.168.1.1
NetBIOS over Tcpip. . . . . : Enabled
```

nslookup



nslookup

nslookup is a network administration command-line tool for querying the Domain Name System to obtain domain name or IP address mapping, or other DNS records.

Commands:

- nslookup <host>
- nslookup <host> <server>

(execute **nslookup** /? for see all options)

```
C:\Users\ - >nslookup google.com
```

```
Server: UnKnown
```

```
Address: 192.168.1.1
```

```
Non-authoritative answer:
```

```
Name: google.com
```

```
Addresses: 2a00:1450:4018:804::200e  
216.58.209.142
```

```
C:\Users\Mohammad Amin>nslookup google.com 8.8.8.8
```

```
Server: dns.google
```

```
Address: 8.8.8.8
```

```
Non-authoritative answer:
```

```
Name: google.com
```

```
Addresses: 2a00:1450:4018:803::200e  
216.58.209.142
```



Other Public DNS servers

Google Public DNS (8.8.8.8)

Google Public DNS is a **Domain Name System (DNS)** service offered to Internet users worldwide by Google.

It functions as a recursive name server. Google Public DNS was announced on 3 December 2009, in an effort described as "making the web faster and more secure".

one.one.one.one (1.1.1.1) by Cloudflare

1.1.1.1 is a free **Domain Name System (DNS)** service by American company **Cloudflare** in partnership with APNIC. The service functions as a recursive name server providing domain name resolution for any host on the Internet. The service was announced on April 1, 2018.

DNS & DHCP

DHCP



Maktab
Sharif

DHCP

The **Dynamic Host Configuration Protocol** is a network management protocol used on Internet Protocol local area networks. A DHCP server must be present on the network.

How it works

A device connected to the network **requests an IP address** from the DHCP server using the DHCP protocol; **the server assigns a unique address to the device**, identifying it for TCP/IP communication, and supplies other network configuration parameters. In the absence of a DHCP server, a device that needs an IP address must be manually assigned a **static address** by a network administrator



Check your Network DHCP status



```
C:\Users\ - >ipconfig /all
```

```
...
```

```
Wireless LAN adapter Wi-Fi:
```

```
Connection-specific DNS Suffix . : local
Description . . . . . : Qualcomm Atheros QCA9377 Wireless Network ...
Physical Address. . . . . : CC-B0-DA-78-13-EB
DHCP Enabled. . . . . : Yes
Autoconfiguration Enabled . . . . : Yes
Link-local IPv6 Address . . . . . : fe80::b8bf:1d09:8a4f:cb52%6(Preferred)
IPv4 Address. . . . . : 192.168.1.3(Preferred)
Subnet Mask . . . . . : 255.255.255.0
Lease Obtained. . . . . : Friday, April 30, 2021 10:13:03 AM
Lease Expires . . . . . : Friday, April 30, 2021 2:13:03 PM
Default Gateway . . . . . : 192.168.1.1
DHCP Server . . . . . : 192.168.1.1
DHCPv6 IAID . . . . . : 80523482
DHCPv6 Client DUID. . . . . : 00-01-00-01-25-E6-AE-78-54-AB-3A-DC-22-57
DNS Servers . . . . . : 192.168.1.1
NetBIOS over Tcpip. . . . . : Enabled
```

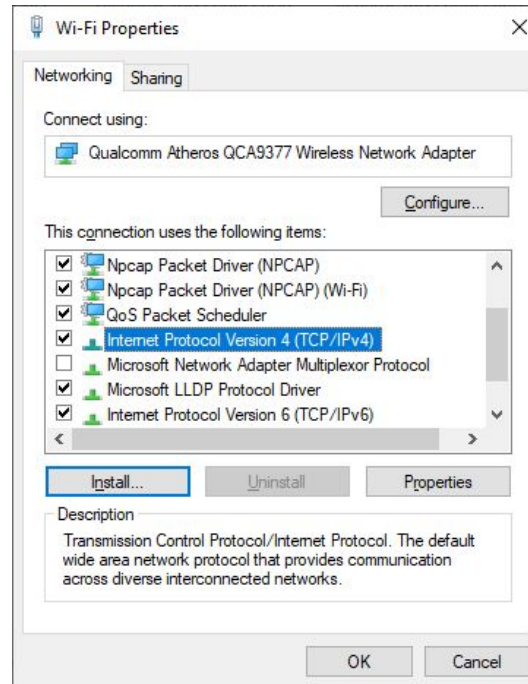
Set Static IP manually (windows)



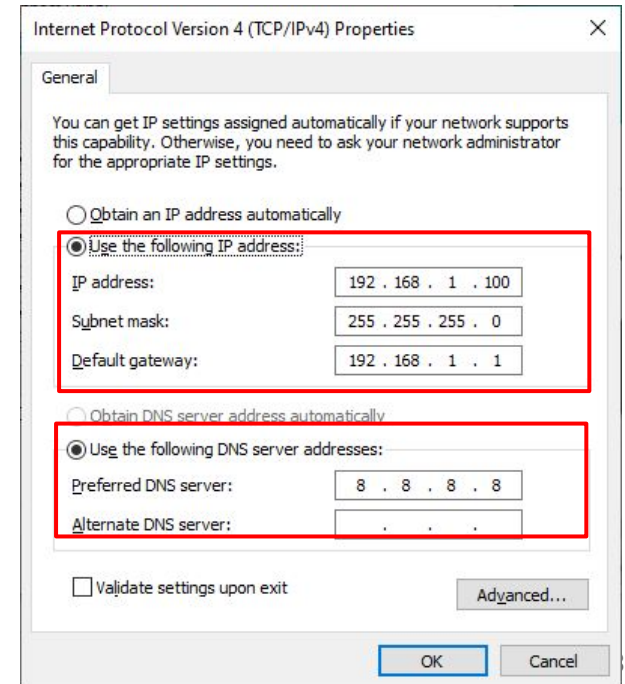
1- Network Connections



2- Properties



3- IPv4 Properties



Pre-reading

Search about:

1. * Port
2. Client-Server model
3. Run server on Linux (Apache)

