What is the Internet?

Networking

Computer networks are complicated in the details, but the basic ideas of how it all works are surprisingly simple. The Internet is like a global phone system for computers: when you call your friend you send a request as a phone call and your friend response accepting this call request, then you say "Alo", then he/she says "Alo", at the end conversation can start. The idea simple and so similar: computers call each other and agree with conditions then transfer information.

| **https://docs.google.com/uc?id=1Kg6Anc45GI19TJ45L54eazx-5bYTmmue** |
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| *Request and Response Model* |

Suppose that your computer is connected to the internet, and you typed "https://clarusway.com" at your browser (like Google Chrome or Safari, etc.). Then your computer first connects the computer of "https://clarusway.com", placing a "call" in effect, and sends a **request** for the main web page. The clarusway.com computer sends back **response** which is the web page and ends the call. Your browser gets back all this data and paints to your screen so you can see images, read the text, etc.

Endpoints

*Endpoints* are remote computing devices that connect to a network and communicates back and forth with the network. Examples of endpoints include:

* Desktops
* Laptops
* Smartphones
* Tablets
* [Servers](https://lms.clarusway.com/mod/lesson/view.php?id=1015)
* Workstations

### Internet

The internet is the network of networks. Thousands of computers and interconnected others are all connected via fiber optic cables, electric cables, radio waves, routers, switches, and hubs. This is **not a centralized system**. Nobody controls the internet. Instead, it’s a fully **distributed, end-to-end communication system**. This means any computer has access to any computer, like the way we call someone by phone lines. In short, the internet is a huge global communication

Everyone has unique phone numbers and web sites have unique IP addresses. For instance Mary Jane's unique phone number is like (555) 555-1234, and Clarusway web site unique address like 54.164.151.235.

Most of the time, the internet is explained with an analogy to Postal Services. When preparing a letter for a friend, we write the text to a paper and put it in an envelope. We write the address on the envelope and give it to the Postal Services. Postal Services take all the letters and groups them according to the addresses written on the envelopes. The letters are loaded on the vehicles and transported to the destination addresses. The Internet is a similar system. But the internet does not ship the letters. It ships the **binary information** which are [bits and bytes](https://lms.clarusway.com/mod/lesson/view.php?id=886). This binary information is transferred to a wide range of areas. The speed is very important for long-distance communication. So the tool for delivering data fast enough to communicate efficiently is the light which is faster than electricity. And the medium for the light is the fiber optic cables. Fiber optic cables travel all around the world, among the continents. And in local areas, electric cables, phone lines, and wi-fi are also used.

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| *Fiber optic cables run along the bottom of earth’s oceans* |

### Ethernet - Local Area Network (LAN)

Local Area Networks (LAN) are small scale networks. LANs are more like one house, one floor or one building. There are two popular LAN; Ethernet and Wi-Fi.

**Ethernet** is a wired LAN. Their wires about as thick as a laptop power cable. Its bandwidth speed measure is Mega/Giga **bits per second** (Mbps/Gbps). **Bandwidth** means the speed of an internet connection. It measured by bits per second. While sending data from one computer to another computer we should use **packets** for data transfer. We will divide to packets and send them, receiver will take these packets and join this packet as one part. Suppose you will send a 40 KB text file. You can't send 40 KB from the wire with one packet (40 KB equal to 40 000 Byte). So you should divide bytes of packets. Assume each packet will be 1000 Bytes. Then text file is divided into about 40 packets. The network transmits one packet at a time.

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| Dividing packets and sending from wire |

Now we will look at the transmission of one 1000 byte packet. We learned that 1 byte consists of 8 bits. So our packet will be 8000 bits in total. Bits corresponding to 1's and 0's. We will send each bit go through left to right and for each 1, put 3 volts on the wire, for each 0, put 0 volt on the wire. The receiver computer will follow along with the pattern of 3 volts / 0 volts coming down the wire, assemble the 0's and 1's in groups of 8 to make each byte. This process called digital transmission (just 1's and 0's)

| **https://docs.google.com/uc?id=1pPXL3uV6bXDxZ7IjCVC50M-raOr5iIuD** |
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| Sending packets from wire, electrical signal illustiration |

Q: What Is LAN?  
A: Local Area Network. A LAN allows users to share [files](https://lms.clarusway.com/mod/lesson/view.php?id=1052) between computers, send e-mail and access the Internet. Most companies use Local Area Networks so that users can access information within or outside the LAN.

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 - Interview Q&A

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### WiFi - Local Area Networks (LAN)

**WiFi** is a wireless LAN. It uses radio channels for data transfer. Every computer has its own address and listens to the shared channel all the time at Local Area Networks.

WiFi **broadcasts** data packets. Broadcasting is the transmission of information by radio channels. Suppose the router has a packet that's supposed to go to computer2. The router broadcasts that packet and it is received by everyone on the LAN. The non-intended recipients are supposed to ignore the packet.

| **https://docs.google.com/uc?id=1hegNGHv-1_WqxJzHrjYojaPoxkJxeQrG** |
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| WiFi Broadcasting data packets |

**Ethernet-Wifi Scenarios**

**Busy LAN**; Radio channel can be busy with many packets (e.g. many users exist on LAN). Radio channel packet size decreases as the number of users increases. But it doesn't break.

**Corruption**; When the packet was corrupted in transit, the receiver will request the re-send of that packet.

**Bad Guy**; Bad guy intercepts packets that are intended for others, for this reason, we are using encryption (we will discuss later).

**Wide Area Network**  
A wide area network (WAN) is a geographically distributed private telecommunications network that interconnects multiple local area networks (LANs).

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| LAN and WAN |

Q: What is WAN?  
A: Wide Area Network (WAN) is more complex than LAN and covers a large span of the area typically a large physical distance. The Internet is the largest WAN which is spread across the world. WAN is not owned by any single organization but it has distributed ownership.

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Protocol means a well-known set of rules and standards for providing communication to computers. TCP/IP stands for **Transmission Control Protocol/Internet Protocol**. Both TCP and IP protocols are separate and individual protocols in the suite of internet protocols. But these two are the fundamental protocols for the internet.

When two people communicate with each other they should obey some rules. For instance, they should talk same language, like people computers have to obey some rules. These rules are protocols, main goal for these protocols is to provide an **end-to-end data transfer model**. And it is based on the **client-server structure**. A computer on one side as a client requests information. The server computer, on the other side, sends back whatever is needed. During this communication, the information passes from one state to another, from one protocol to another.

Q: What Is A Protocol?  
A: A protocol is a method of communication between two devices. You can think of it as the language the devices use to communicate with each other, although it is not the same as a programming language (by which a human programmer controls a computer). Different brands of printers, for example, each use their own protocol (or "language") by which a computer can communicate with the printer. This is why a driver program must be written for each printer.

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A: TCP/IP stands for Transmission control protocol and Internet protocol. It describes how the data will get transmitted and routed from end to end communication.

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### Internet Layer

The internet layer is responsible for finding the best route to the destination address for the data packets. This process is called routing. And it’s controlled by the **routers**. Routing doesn’t mean finding the most direct way. Instead, the best way is found by looking at the **traffic of the requests, political preferences and relationships among the companies (Internet Service Provider (ISP) )** providing the internet service.

The basic protocol type of the internet layer is the IP protocol. This protocol, as the TCP protocol, is one of the fundamental protocols of internet protocols suite. In the IP protocol, every participant computer has a **unique number** known as their IP address. Every data packet going from a computer has two unique address information. One is the source IP address and the other one is the destination IP address. The routers examine the data packets and look for the destination addresses and guide the data packets to their destinations.

IP number system has two versions. One is **IPv4** and the other one is **IPv6**. IPv4 is a 32bit based system which accommodates nearly **4.3 billion unique addresses**. But this is not enough for all the devices running on the internet. Due to the scarcity, a **dynamic IP allocating process** is administered by the **Internet Service Providers** and a new IP version, IPv6, is designed to change the system in the future. IPv6 is based on 128bit number system which gives **340 undecillion (10\*36) unique addresses**.

| **https://docs.google.com/uc?id=1hFjVeqDosEat56Vp_UQm8FTwqAbZzkdD** |
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| Internet Protocol (IP) |

Domain Name System (DNS)

Domain Name Terminology

Every web page has human-readable and computer-readable names. Human readable names are **domain names** and computer-readable names are IP addresses. A domain name is a unique name that identifies a website. Each website has a domain name that serves as an address, which is used to access the website. For example "google.com" is a domain name and 216.58.206.174 is an example of an IP address. When people want to open the Google web site, they should write "google.com" or 216.58.206.174 to the web browser.

Domain names can have **subdomain** for different purposes. For example, google mailing service run on mail.google.com subdomain, Wikipedia uses subdomains for different languages like de.wikipedia.com.

Every domain name has domain suffix such as com, org, gov, net. This domain suffix's name is **Top Level Domain (TLD)**. The TLD helps identify the type of website the domain name represents. For example, ".com" TLD is typically used by the commercial website, while ".org" TLD is often used by non-profit organizations. Some domain names end with a country code, such as ".de" (Germany) or ".fi" (Finland), which helps identify the location and audience of the website.

**Fully Qualified Domain Name (FQDN)** is the most complete domain name  that contain subdomain, domain name and TLD;

The longest web addresses are URLs. **URL** stands for "Uniform Resource Locator." A URL is the address of a specific web page or file on the internet. For example, the URL of the Clarusway website is "https://clarusway.com". The address of the "About Us" page is "https://clarusway.com/about/" and includes the following elements:

1. **https://**: Specifies the protocol used to access web site address
2. **clarusway.com**: Domain name
3. **/about/**: The path to the directory.
4. **www**: Subdomain
5. **com**:Top Level Domain
6. **www.clarusway.com** : Fully Qualified Domain Name

| **https://docs.google.com/uc?id=1kom8-Ejrs70yfkhekESooxZ02TyVRiZZ** |
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| *Domain name terms* |

### Domain Name System

People prefer names but computers prefer numbers for addresses. Typing google.com is easier than typing 216.58.212.46 for each time. For this reason, domain names serve as memorable names for websites and other services on the Internet. However, computers access Internet devices by their IP addresses. With Domain Name System you can visit a website by typing in the domain name rather than the IP address.

A **name server** translates domain names into IP addresses. This makes it possible for a user to access a website by typing in the domain name instead of the website's actual IP address. For example, when you type in "clarusway.com," the request is sent to Clarusway's name server which returns the IP address of the Clarusway website.

**DNS records** are used for translating domain names to IP addresses. They also contain other data, including the domain name's name server and mail server information. We can see DNS records with some terminal commands.

Q: What do you mean by DNS?  
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Let's Practice

We will reach "google.com" domain name's IP address together. Then enter IP address to browser's address bar for open google website.

1. **First you should open your terminal/command prompt**

* Windows Users: Open the Run dialog using Windows+R hotkeys, enter cmd and tap OK. After that, you will get the command prompt window and execute command lines.

| **https://docs.google.com/uc?id=1ofF5quXdcDUf4P77GwjFMjzUPgRC4TPT** |
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| *Opening command prompt from windows* |

* Mac Users: Open Finder,

1. Click Go > Utilities from the menu bar.
2. In the Utilities folder that opens, double-click Terminal.

| **https://docs.google.com/uc?id=12zh1Wbao7EVDnUp2AFQ1LPWDGKTglAa9** |
| --- |
| *Mac User opening terminal from finder* |

* Ubuntu Users: Just click Ctrl+Alt+T

1. **Second write to the command prompt: ping google.com**

Every second your command prompt will send requests to google.com, you can see google's IP address every line on the command line.

| **https://docs.google.com/uc?id=1FtWINFNWdkJmJlT6w-N4PvH_yN_i8eVR** |
| --- |
| *After Ping command, you can see 216.58.213.100 which is one of the IP address of google.com* |

1. **Now you obtained IP address of google.com, go to your browser's address bar and type IP address then press enter**

The browser should re-directs to google.com. If it happens you achieved! By the way, you don't have to scare, you are not hacking google.com :) not yet ;)