COMPUTER NETWORKS AND INTERNET

Principles of network applications
- Network applications are based on communication between clients and servers through specific protocols.

- APIs give you the ability to connect between networks and applications.

Client-server model
- The client requests services and the server provides them.
  Example: HTTPS for the web.

- Post is when I send data. Post and get are API methods.

Peer-to-peer (P2P) model
- The nodes act as clients and servers simultaneously.
  Example: The Pirate Bay.

Application protocols
- Some common protocols include HTTPS, FTP, SMTP, DNS, among others.

What is the internet?
- The Internet is a global network of interconnected computers that use the TCP/IP protocol for communication.

History of the internet
- The Internet emerged from Arpanet in the 1960s and has evolved into today's global infrastructure.

Internet components
- It includes ISPs, servers, routers, access networks, and end users.

Internet Design Principles
- Key principles include scalability, interoperability, decentralization and reliability.

Layered architecture
- The design of the Internet follows a modular approach with layers such as application, transport, network, link and physics.

The core of the network
- The core of the network is made up of routers and links that route data traffic efficiently.

Routing and switching
- Packets travel through the network using routers that determine the best route.

Time and efficiency in packet switching networks
- Factors such as latency, bandwidth, jitter and packet loss are analyzed.

  - <mark>Latency:</mark> It is the time it takes for data to travel from the source to the destination or, in other words, the delay time experienced by the transmission of information through the network. It is measured in units of time, such as milliseconds.

  - <mark>Bandwidth:</mark> It is the maximum amount of data that can be transmitted through an Internet connection in a given time. It is normally represented in the number of bits, kilobits, megabits or gigabits that can be transmitted in 1 second.

  - <mark>Jitter:</mark> is a variation or delay in the delivery of data packets over a network, that is, a delay between the time a signal is transmitted and received. Delay/jitter/change in time is an interruption in the ordinary sequence of sending data packets and is measured in milliseconds (ms).

  - <mark>Packet loss:</mark> It is a communication error that occurs when one or more packets do not travel between the router and the device, that is, the data packets do not reach their destination.

Internet structure and exchange points
- The Internet is organized into ISPS, Internet Exchange Points (IXPS), and backbone networks.

ISP (Internet Service Provider)
- It is an internet service provider that allows users and companies to connect to the global network.

- They offer different types of connections such as: optical fiber, ADSL, cable, satellite and mobile networks (4G-5G).

- Types of ISP:

  - ==Access ISPS:== provides connection to end users (e.g. TELMEX, AT&T, TOTALPLAY).

  - ==Hosting ISPS:== They offer services such as web hosting and mail servers.

  - ==Transit ISPS:== transport data between different ISPS and manage large network infrastructures.

Backbone networks

- They are the main communication infrastructures on the Internet. These high-capacity networks interconnect different smaller networks such as ISPs and data centers.

- Features:
  - **High speed and bandwidth:** They use technologies such as *optical fiber* and *high capacity* links (10GBPS or more).

  - **Global Interconnection:** They connect large data centers, ISPS and Internet Exchange Points *(IXPS)*.

  - **Redundancy and reliability:** It has multiple routes and backup systems to guarantee service continuity.

  - **Use of advanced protocols:** they use protocols such as *BGP (Border Gateway Protocol)* for efficient traffic routing.

Internet Exchange Points (IXPS)

- IXPS enables efficient interconnection of multiple ISPS to improve performance and reduce costs.

- How do IXPS work?
  - **Connection of local networks:** several ISPS and other entities connect to an IXP through *optical fiber* links.

  - **Use of high-performance switches:** a *central switch* in the IXP allows the interconnection of multiple networks without the need for intermediaries.

- ○ **Routing via BGP (Border Gateway Protocol):** networks agree how to exchange traffic with each other using *peering agreements*, optimizing data flow.

Content Delivery Networks (CDNS)
- ICDNS optimize content delivery by storing data on distributed servers.