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## COMPUTER NETWORKS

# TUTORIAL 01

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### A BRIEF HISTORY OF THE INTERNET

The Internet started in the 1960s as a way for the US government researchers to share information. Computers in the '60s were large and immobile and in order to make use of information stored in any one computer, one had to either travel to the site of the computer or have magnetic computer tapes sent through the conventional postal system.

The Soviet Union's launch of the Sputnik satellite spurred the U.S. Defense Department to consider ways information could still be disseminated even after a nuclear attack. This eventually led to the formation of the ARPANET (Advanced Research Projects Agency Network), the network that ultimately evolved into what we now know as the Internet.

A new communications protocol was established called Transfer Control Protocol/Internetwork Protocol (TCP/IP). This allowed different kinds of computers on different networks to "talk" to each other. All networks could now be connected by a universal language.

There were some ground rules :

- Each distinct network would have to stand on its own and no internal changes could be required to any such network to connect it to the Internet.
- Communications would be on a best effort basis. If a packet didn't make it to the final destination, it would shortly be retransmitted from the source.
- Controlling devices would be used to connect the networks, which would later be called gateways and routers. There would be no information retained by the gateways about the individual flows of packets passing through them, thereby keeping them simple and avoiding complicated adaptation and recovery from various failure modes.
- There would be no global control.
- Communication between two processes would logically consist of a very long stream of **bytes** (data that can be represented in eight binary digits). The position of any byte in the stream would be used to identify it.

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- Flow control would be done by using sliding windows and acknowledgments (acks). The destination could select when to acknowledge and each ack returned would be cumulative for all packets received to that point.
  - It was left open as to exactly how the source and destination would agree on the parameters of the windowing to be used. Defaults were used initially.

Widespread development of **Local Area Networks (LANs)**, **Personal Computers (PCs)**, and workstations in the 1980s allowed the Internet to flourish. Later, the large number of LANs led to the invention of **DNS**(Domain Name System).

The free and open-access to the basic documents and protocols led to the huge growth of the internet. **RFC** (Request For Comments) were established which were accessed by **FTP** (File Transfer Protocol). Now the **www** (World Wide Web) is in the play.

Internet Engineering Task Force (**IETF**) began to hold meetings 3 to 4 times a year which were attended by the vendors involved in the commercialisation of the internet technology.

Tim Berners Lee coined 3 fundamental technologies for the world wide web :

- **HTML: HyperText Markup Language**: The markup (formatting) language for the Web.
- **URI: Uniform Resource Identifier**: A kind of “address” that is unique and used to identify each resource on the Web. It is also commonly called a **URL**.
- **HTTP: Hypertext Transfer Protocol**: Allows for the retrieval of linked resources from across the Web.

The early Web community produced some revolutionary ideas that are now spreading far beyond the technology sector:

- **Decentralization**: No permission is needed from a central authority to post anything on the Web, there is no central controlling node, and so no single point of failure ... and no “kill switch”! This also implies freedom from indiscriminate censorship and surveillance.
- **Non-discrimination**: If I pay to connect to the Internet with a certain quality of service, and you pay to connect with that or a greater quality of service, then we can both communicate at the same level. This principle of equity is also known as **Net Neutrality**.
- **Bottom-up design**: Instead of code being written and controlled by a small group of experts, it was developed in full view of everyone, encouraging maximum participation and experimentation.

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- **Universality:** For anyone to be able to publish anything on the Web, all the computers involved have to speak the same languages to each other, no matter what different hardware people are using; where they live; or what cultural and political beliefs they have. In this way, the Web breaks down silos while still allowing diversity to flourish.
  - **Consensus:** For universal standards to work, everyone had to agree to use them. Berners-Lee and others achieved this consensus by giving everyone a say in creating the standards, through a transparent, participatory process at the **World-Wide Web Consortium (W3C)**.