Public Network-Frame Relay-architecture, ATM Architecture

X.25

X.25 was a standard suite of protocols used for packet-switched communications over a wide area network—a WAN. A protocol is an agreed-upon set of procedures and rules. Two devices that follow the same protocols can understand each other and exchange data.

X.25 was developed in the 1970s to carry voice over analog telephone lines—dial-up networks—and is one of the **oldest packet-switched services**.

Typical applications of X.25 included automatic teller machine networks and credit card verification networks. X.25 also supported a variety of mainframe terminal and server applications. The 1980s were the heydays of X-25 technology when it was used by public data networks Compuserve, Tymnet, Telenet, and others. In the early '90s, many X.25 networks were replaced by Frame Relay in the U.S. Some older public networks outside the U.S. continued to use X.25 until recently. Most networks that once required X.25 now use the less complex Internet Protocol. X-25 is still used in some ATMs and credit card verification networks.

X.25

X-25 Structure

Each X.25 packet contained up to 128 bytes of data. The X.25 network handled packet assembly at the source device, the delivery, and the reassembly at the destination. X.25 packet delivery technology included not only switching and network-layer routing but also error checking and retransmission logic should a delivery failure occur.

X.25 supported multiple simultaneous conversations by multiplexing packets and using virtual communication channels.

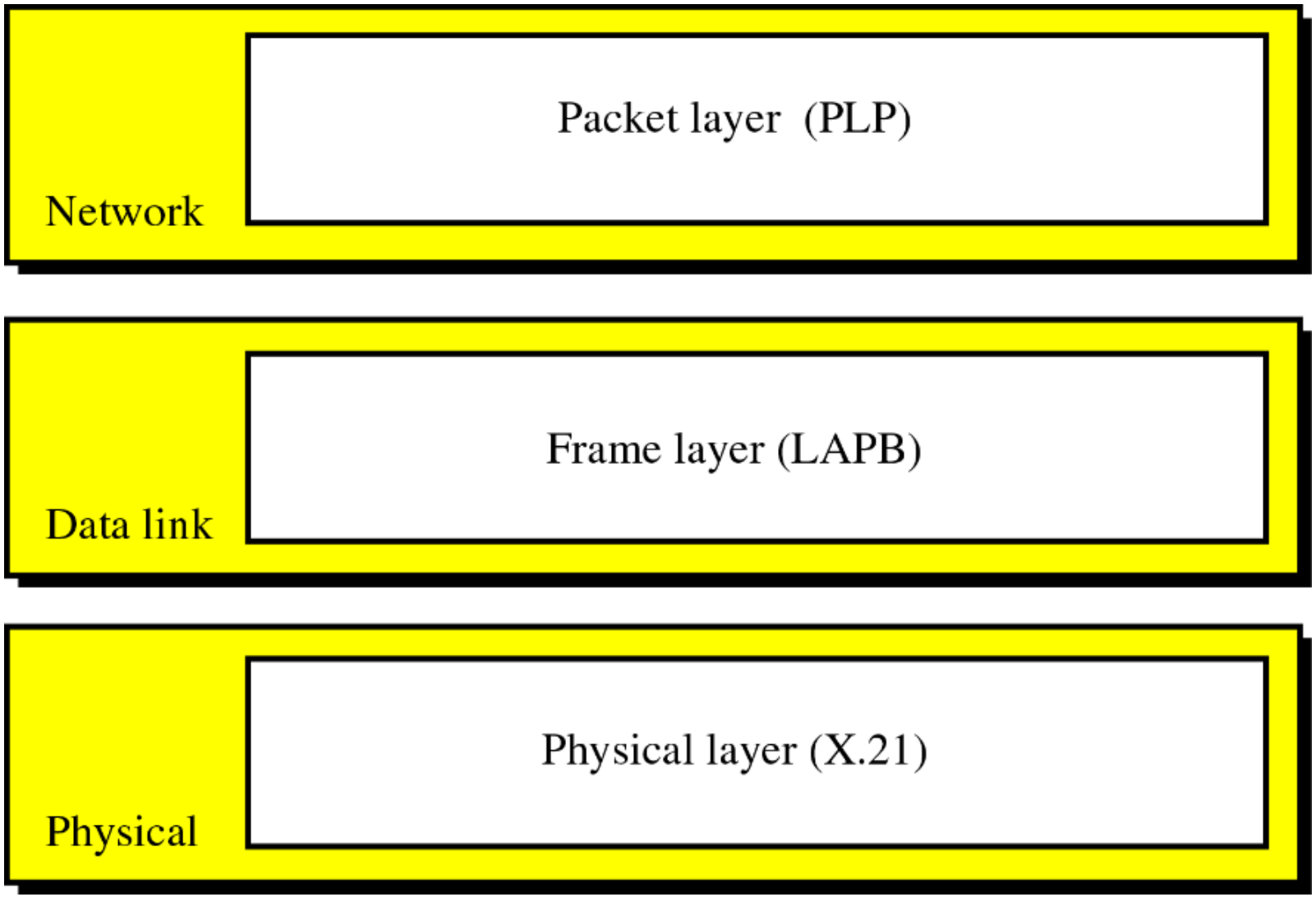
X-25 offered three basic layers of protocols:

1. Physical layer
2. Data link layer
3. Packet layer

X-25 comes before the OSI Reference Model, but the X-25 layers are analogous to the physical layer, data link layer and network layer of the standard OSI model.

With the widespread acceptance of Internet Protocol (IP) as a standard for corporate networks, X.25 applications migrated to cheaper solutions using IP as the network layer protocol and replacing the lower layers of X.25 with Ethernet or with new ATM hardware.

X.25 Layers in Relation to the OSI Layers



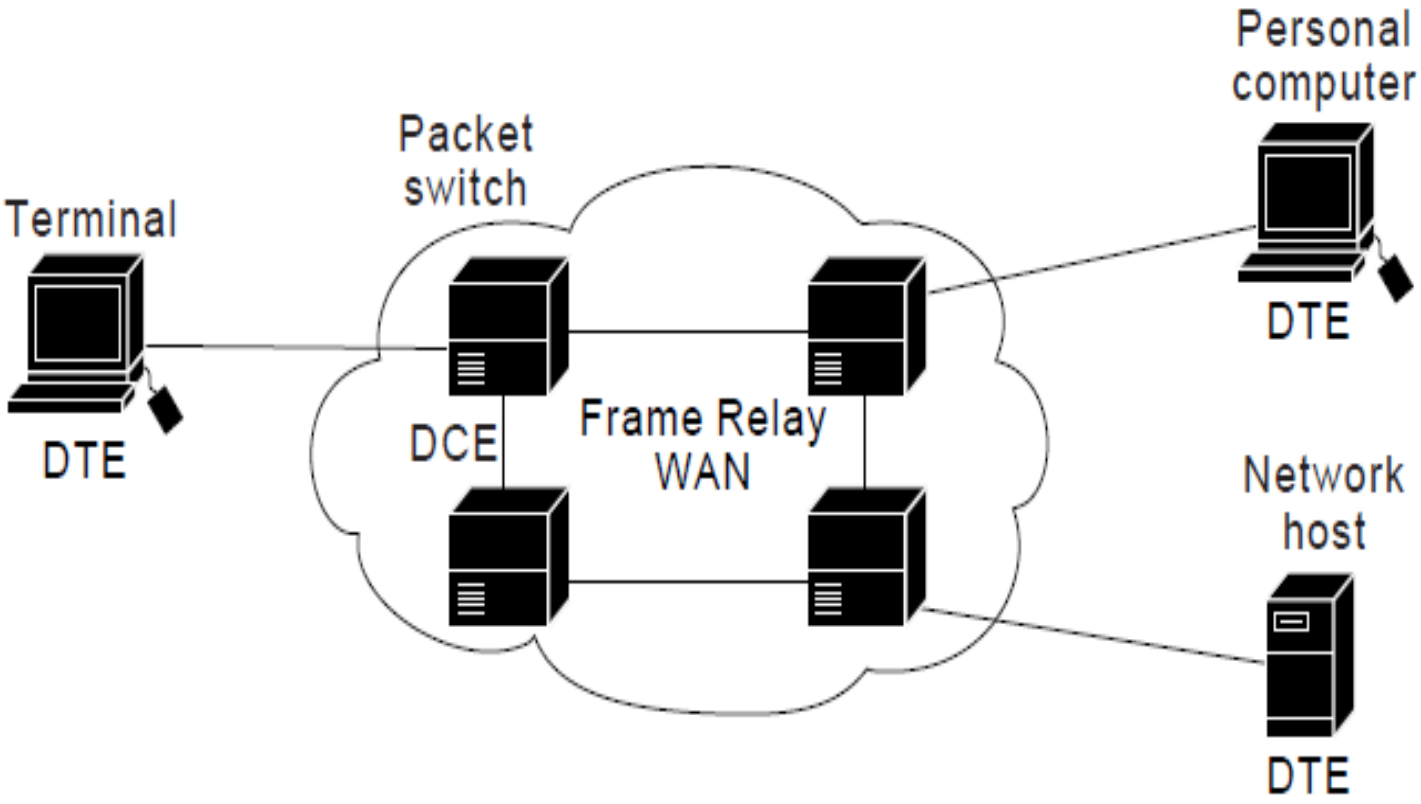
Frame Relay

Frame relay is a packet-switching telecommunication service designed for cost-efficient data transmission for intermittent traffic between local area networks (LANs) and between endpoints in wide area networks (WANs). The service, once widely available and implemented, is in the process of being discontinued by major Internet service providers. Sprint ended its frame relay service in 2007, while Verizon said it plans to phase out the service in 2015. AT&T stopped offering frame relay in 2012 but said it would support existing customers until 2016

Frame relay puts data in a variable-size unit called a *frame* and leaves any necessary error correction (retransmission of data) up to the endpoints, which speeds up overall data transmission. For most services, the network provides a permanent virtual circuit (PVC), which means that the customer sees a continuous, dedicated connection without having to pay for a full-time leased line, while the service provider figures out the route each frame travels to its destination and can charge based on usage. Switched virtual circuits (SVC), by contrast, are temporary connections that are destroyed after a specific data transfer is completed.

An enterprise can select a level of service quality, prioritizing some frames and making others less important. A number of service providers, including AT&T, offer frame relay, and it's available on fractional T-1 or full T-carrier system carriers. Frame relay complements and provides a mid-range service between ISDN, which offers bandwidth at 128 Kbps, and Asynchronous Transfer Mode (ATM), which operates in somewhat similar fashion to frame relay but at speeds of 155.520 Mbps or 622.080 Mbps.

Frame Relay



DTE Data Terminal Equipment
DCE Data Circuit-Terminating Equipment

ATM Protocol

- **ATM is an acronym for Asynchronous Transfer Mode.** It's a high-speed networking standard designed to support voice, video and data communications, and to improve utilization and quality of service (QoS) on high-traffic networks.

- ATM is normally utilized by internet service providers on their private long-distance networks. ATM operates at the data link layer (Layer 2 in the OSI model) over either fiber or twisted-pair cable.

- Although it's fading in favor of the NGN (next generation network), this protocol is critical to the SONET/SDH backbone, the PSTN (public switched telephone network) and ISDN (Integrated Services Digital Network).

How ATM Networks Work

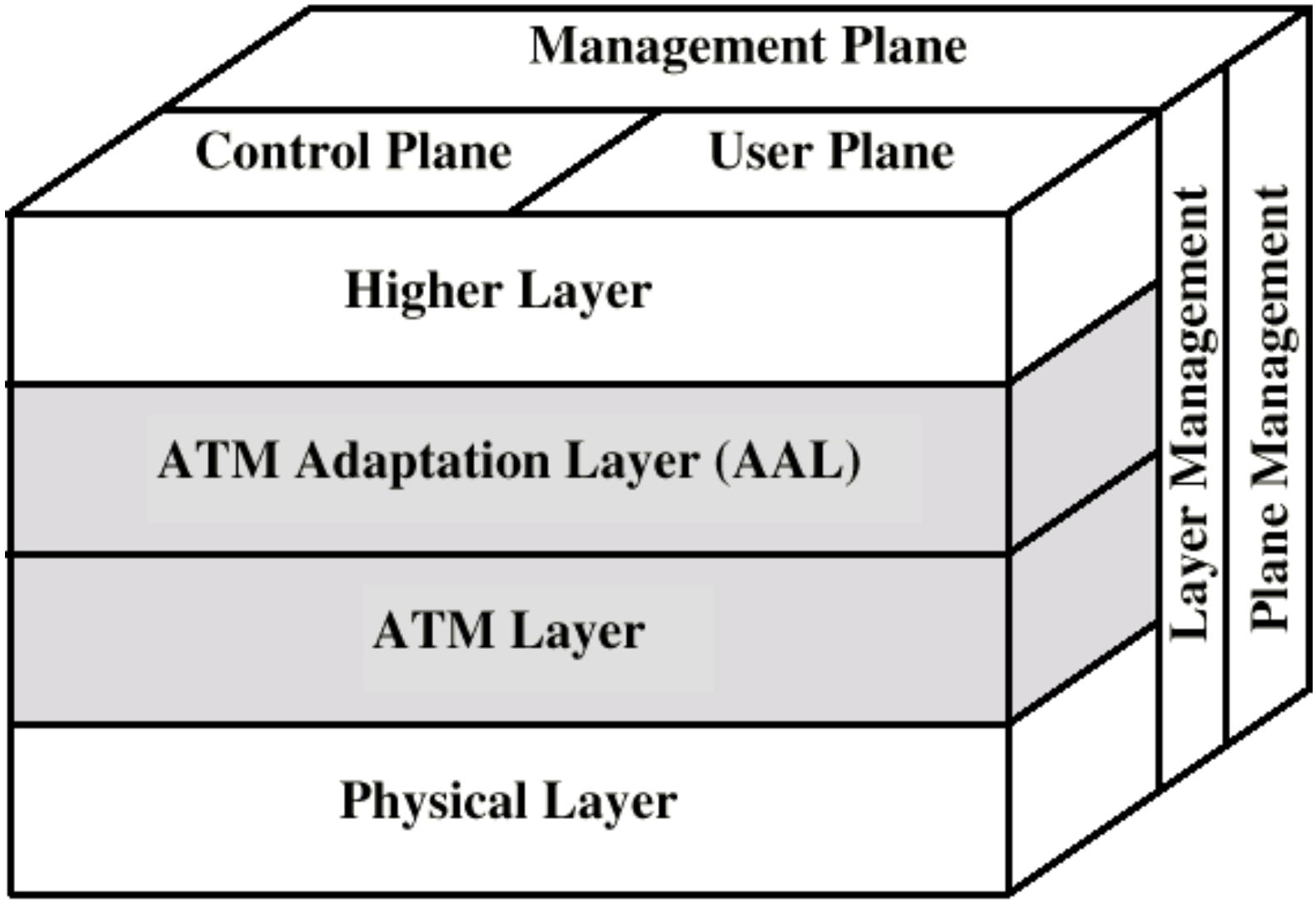
ATM differs from more common data link technologies like Ethernet in several ways.
For one, ATM uses zero routing. Instead of using software, dedicated hardware devices known as ATM switches establish point-to-point connections between endpoints and data flows directly from source to destination.

Additionally, instead of using variable-length packets like Ethernet and Internet Protocol does, ATM utilizes fixed-sized cells to encode data. These ATM cells are 53 bytes in length, that include 48 bytes of data and five bytes of header information.

Each cell is processed at their own time. When one is finished, the procedure then calls for the next cell to process. This is why it's called asynchronous; none of them go off at the same time relative to the other cells. The connection can be preconfigured by the service provider to make a dedicated/permanent circuit or be switched/set up on demand and then terminated at the end of its use. Four data bit rates are usually available for ATM services: Available Bit Rate, Constant Bit Rate, Unspecified Bit Rate and Variable Bit Rate (VBR).

Without routing and with fixed-size cells, networks can much more easily manage bandwidth under ATM than other technologies like Ethernet. The high cost of ATM relative to Ethernet is one factor that has limited its adoption to the backbone and other high-performance, specialized networks.

ATM Protocol Architecture



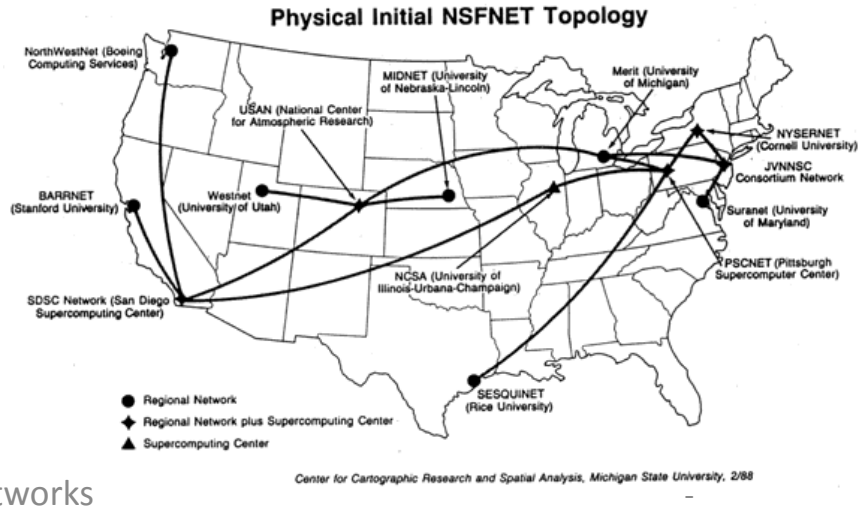
Example Networks

National Science Foundation Network (NSFNet)

The National Science Foundation Network (NSFNet) is a wide area network that was developed by the National Science Foundation to replace ARPANET as the main network linking government and research facilities.

NSFNet was a major force in the development of computing infrastructure and enhanced network services. By making high-speed networking available to national computer centers and inter-linked regional networks, NSFNet created a network of networks, which laid the foundation for today's Internet.

NSFNet was dismantled in 1995 and replaced with a commercial Internet backbone.



Example Networks

USENET

Usenet is a worldwide system for Internet discussion that consists of a set of newsgroups that are organized by subject. Users post articles or messages to these newsgroups. The articles are then broadcast to other computer systems, most of which now connect via the Internet. Usenet was conceived in 1979, making it one of the oldest network communications systems still in use today. It is also the predecessor of many of the forums online today.

Usenet got its name from Unix-to-Unix Copy (UUCP), a protocol suite for sending data, usually over a dial-up network. Initially, this was the dominant mode of transmission for Usenet, but it has since come to rely on the Internet.

Some newsgroups are moderated, which means that posts are sent to a moderator for approval before being distributed to the group. Usenet users exchange articles by tagging them with universally recognized labels. Many Internet service providers and Internet sites provide news servers, which allow their users to handle Usenet articles. Although Usenet is still used, it has become less important in the face of online forums, blogs and mailing lists.

Example Networks

NICNET

NICNET(National Informatics Centre NETwork – NIC network)

- Conceived in 1973 & commissioned in 1977
- NIC (National Informatics Centre) is an organization set up by the Govt. of India in 1977
- NIC has set up a satellite-based nation-wide computer-communication network, called NICNET
- The world's largest Satellite based Computer communication network.
- Providing information exchange services – b/w Government and Corporate sector organizations,
- NICNET services include File Transfer, Electronic Mail, Remote Database Access, Data broadcast and EDI
- NICNET has served as the basic message communication facility in the calamity-affected areas

Example Networks

ERNET

ERNET (Education and Research NETwork)

Initiated in **1986** by the Department of Electronics (**DoE**)

With funding support from the **Government of India** and United Nations Development Program **(UNDP)**

Involving eight premier institutions as participating agencies

-- **NCST** (National Centre for Software Technology) Bombay,

-- **IISc** (Indian Institute of Science) Bangalore,

-- **IITs** (Indian Institutes of Technology)

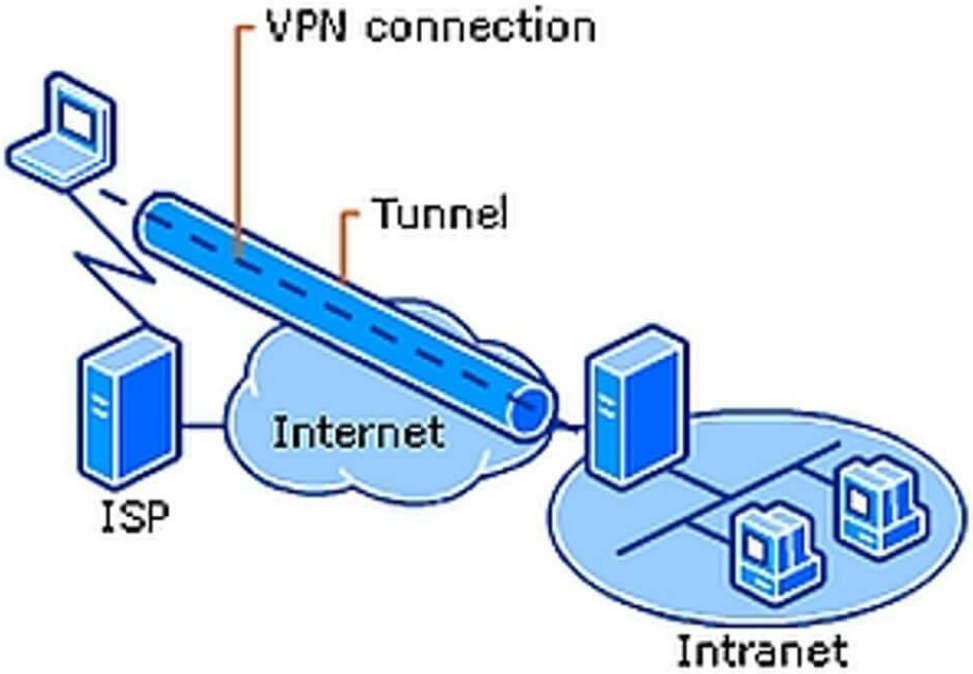
-- and the **DoE**, New Delhi

Objective: The objective was to create expertise R&D and education in the country in the area of networking and Internet in the country"

ERNET India in partnership with University Grants Commission is setting up UGC-Info net.

MOU with AICTE to provide connectivity to AICTE Recognized Colleges and Regional Centers..

Indian Council for Agriculture Research-Net



REFERENCE ONLY

A [VPN (Virtual Private Network)] is a service that creates a private, secure network over a public one – like the one you're using right now, for instance.

Once you connect through a VPN, **all your traffic becomes encrypted** and your IP (Internet Protocol) address gets replaced with the address of the VPN server. Basically, nobody will manage to **track your online traffic.**

As a result, your personal information and online activities remain private and secure. Plus, **using a VPN also means that:**

- You can **overcome geo-restrictions**
- You can **enjoy true online anonymity**
- You can **freely speak your mind** online