Network Models: TCP/IP

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Questions on Previous Lecture

- Who originally gave the idea for packet switching Network?
  - Paul Baran
- What is ARPA?
  - Advanced Research Project Agency
- Why internet is called **Internet**, not **ARPANET?**
- What is **IMP?**
  - Interface Message Processor
- What is subnet software?
- TCP/ IP is .....?
- What is **PROTOCOL**?

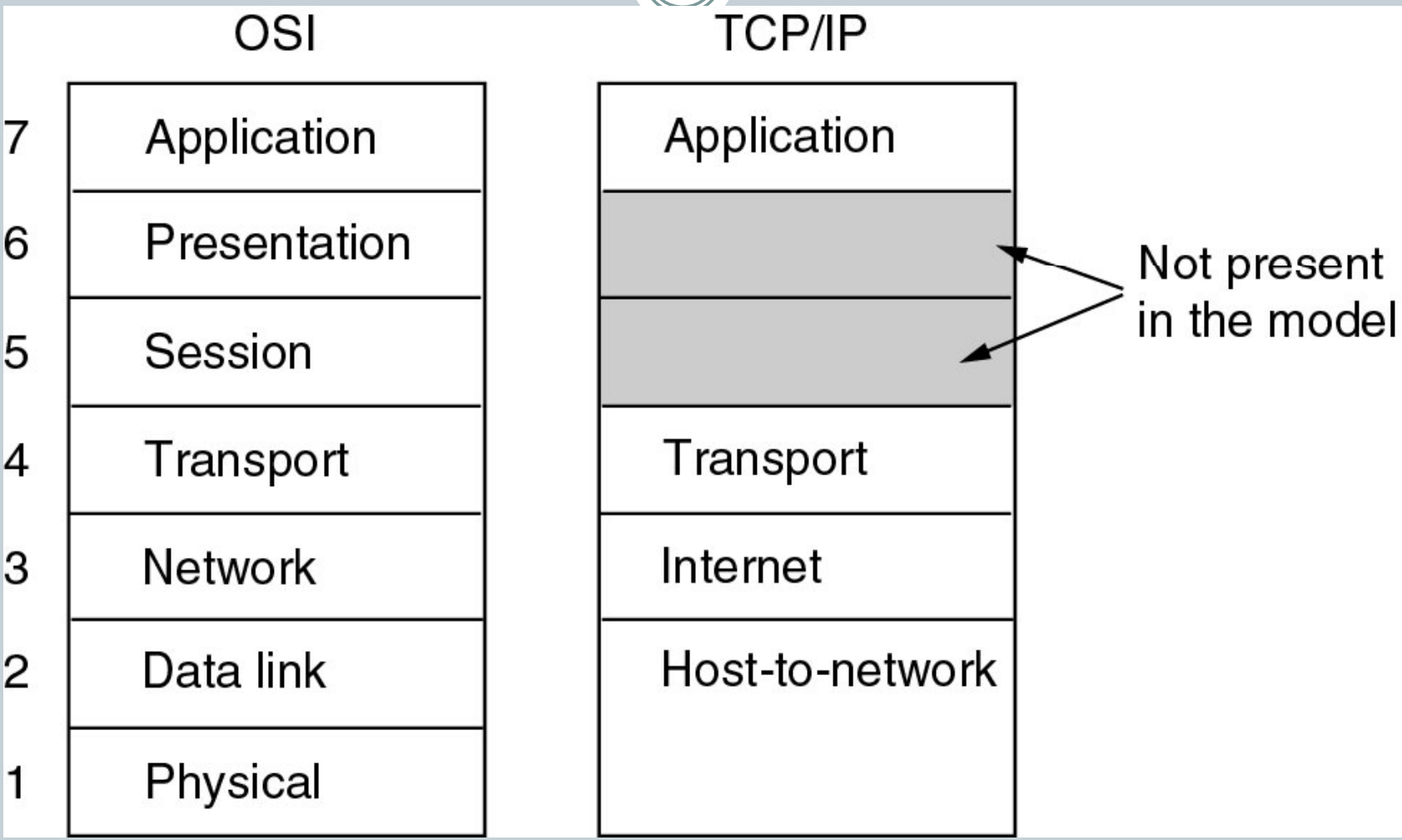
HISTORY

- The TCP/IP model is a description framework for computer network protocols created in the 1970s by DARPA, an agency of the United States Department of Defense.
- It evolved from ARPANET, which was the world's first wide area network and a predecessor of the Internet.
- The TCP/IP Model is sometimes called the Internet Model or the DoD Model.

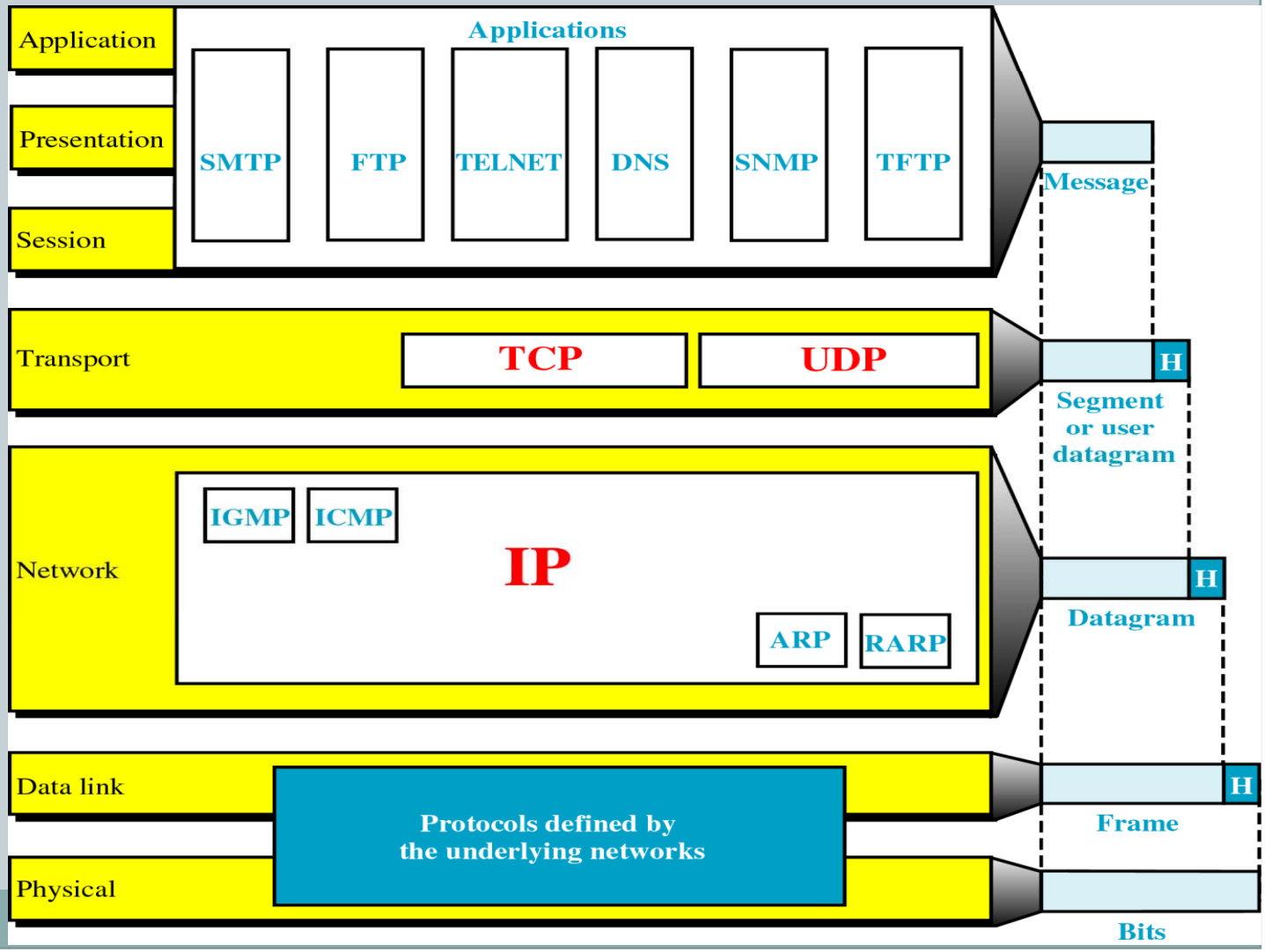
INTRODUCTION

- The TCP/IP model, or Internet Protocol Suite, describes a set of general design guidelines and implementations of specific networking protocols to enable computers to communicate over a network.
- TCP/IP provides end-to-end connectivity specifying how data should be formatted, addressed, transmitted, routed and received at the destination.
- Protocols exist for a variety of different types of communication services between computers.
- TCP/IP, sometimes referred to as the Internet model, has four abstraction layers .
- The TCP/IP model and related protocols are maintained by the Internet Engineering Task Force (IETF)

OSI vs. TCP/IP


OSI
TCP/IP
7
Application
6
Presentation
5
Session
4
Transport
3
Network
2
Data link
1
Physical
Application
Transport
Internet
Host-to-network
Not present
in the model

PROTOCOLS IN DIFFERENT LAYERS



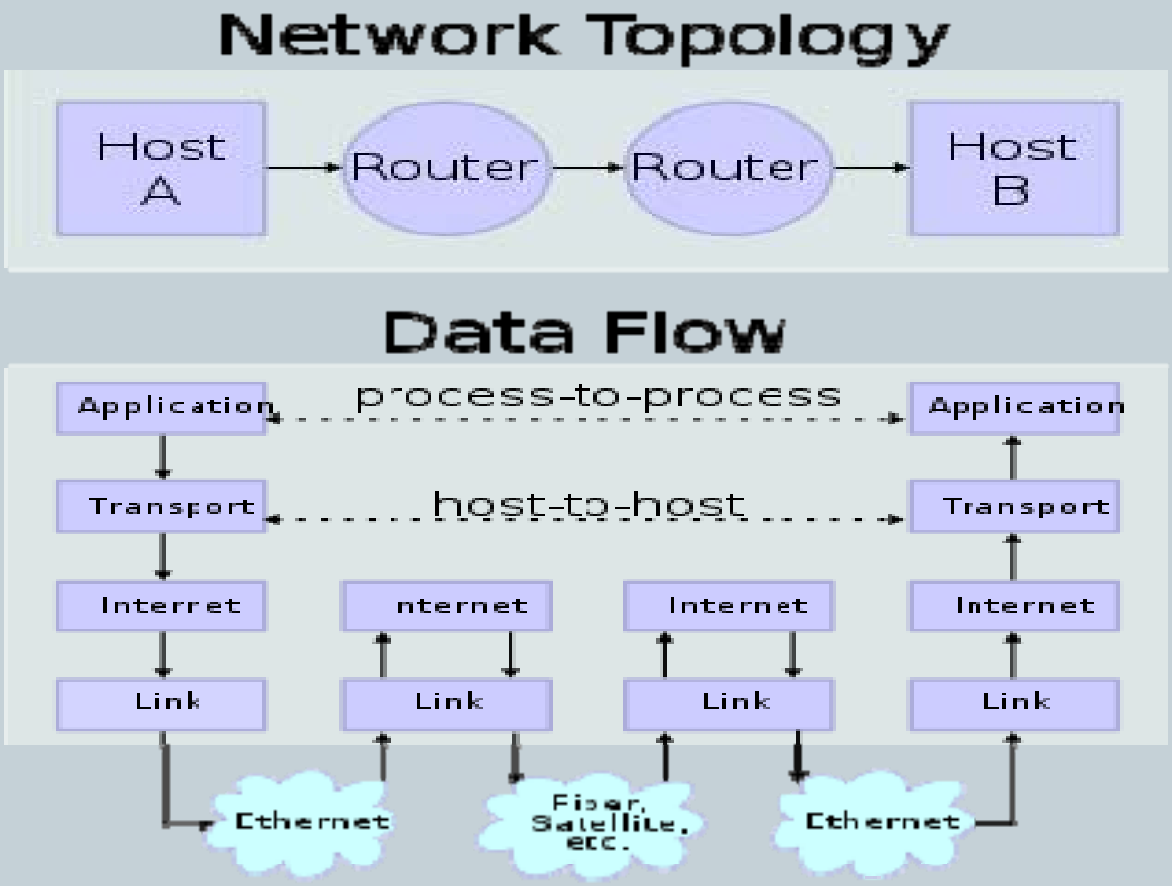
The Host-to-Network Layer/ LINK LAYER

- This is the **lowest component layer** of the Internet protocols, as TCP/IP is designed to be **hardware independent**. As a result TCP/IP is able to be implemented on top of virtually any hardware networking technology.
- This layer deals with how a host is attached to the local network connection using a **LINK** and some **protocol** so that it can send IP packets .
- The Link Layer is used to move packets between the Internet Layer interfaces of two different hosts on the same link.

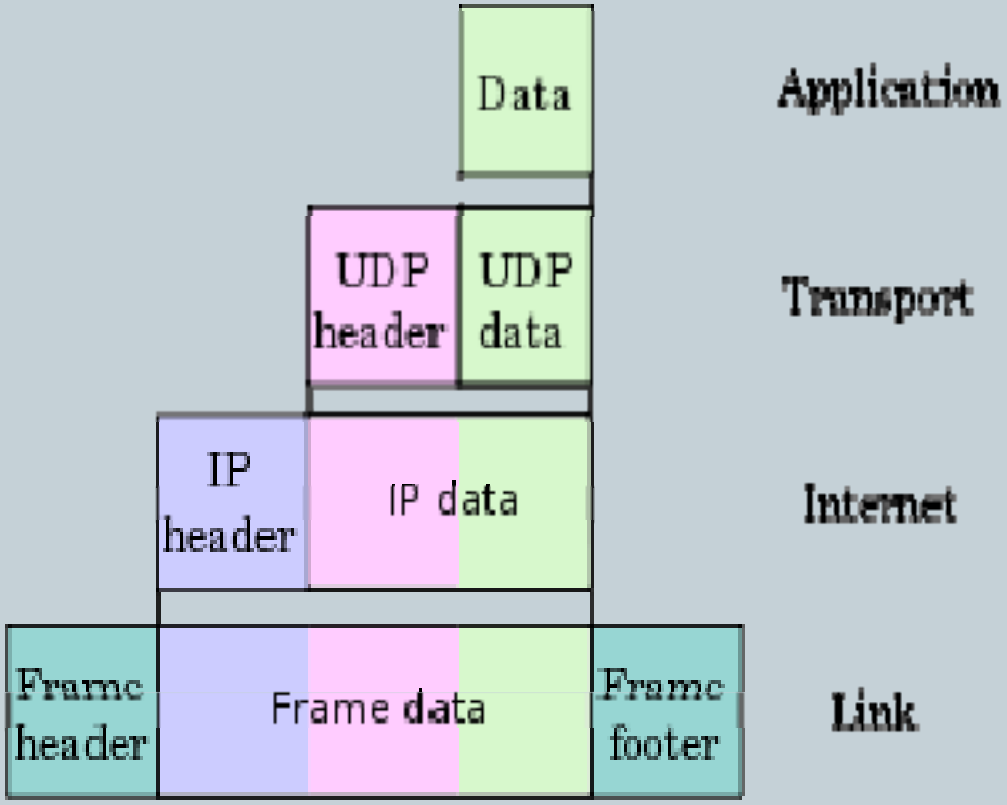
The Host-to-Network Layer/ LINK LAYER

- The processes of transmitting and receiving packets on a given link can be controlled both in the software device driver for the network card, as well as on firmware or specialized chipsets.
- These will perform data link functions such as adding a packet header to prepare it for transmission, then actually transmit the frame over a physical medium.
- The TCP/IP model includes specifications of translating the network addressing methods used in the Internet Protocol to data link addressing, such as Media Access Control (MAC), however all other aspects below that level are implicitly assumed to exist in the Link Layer, but are not explicitly defined.

Hosts connected via two routers



DATA FORMATS AT DIFFERENT LAYERS



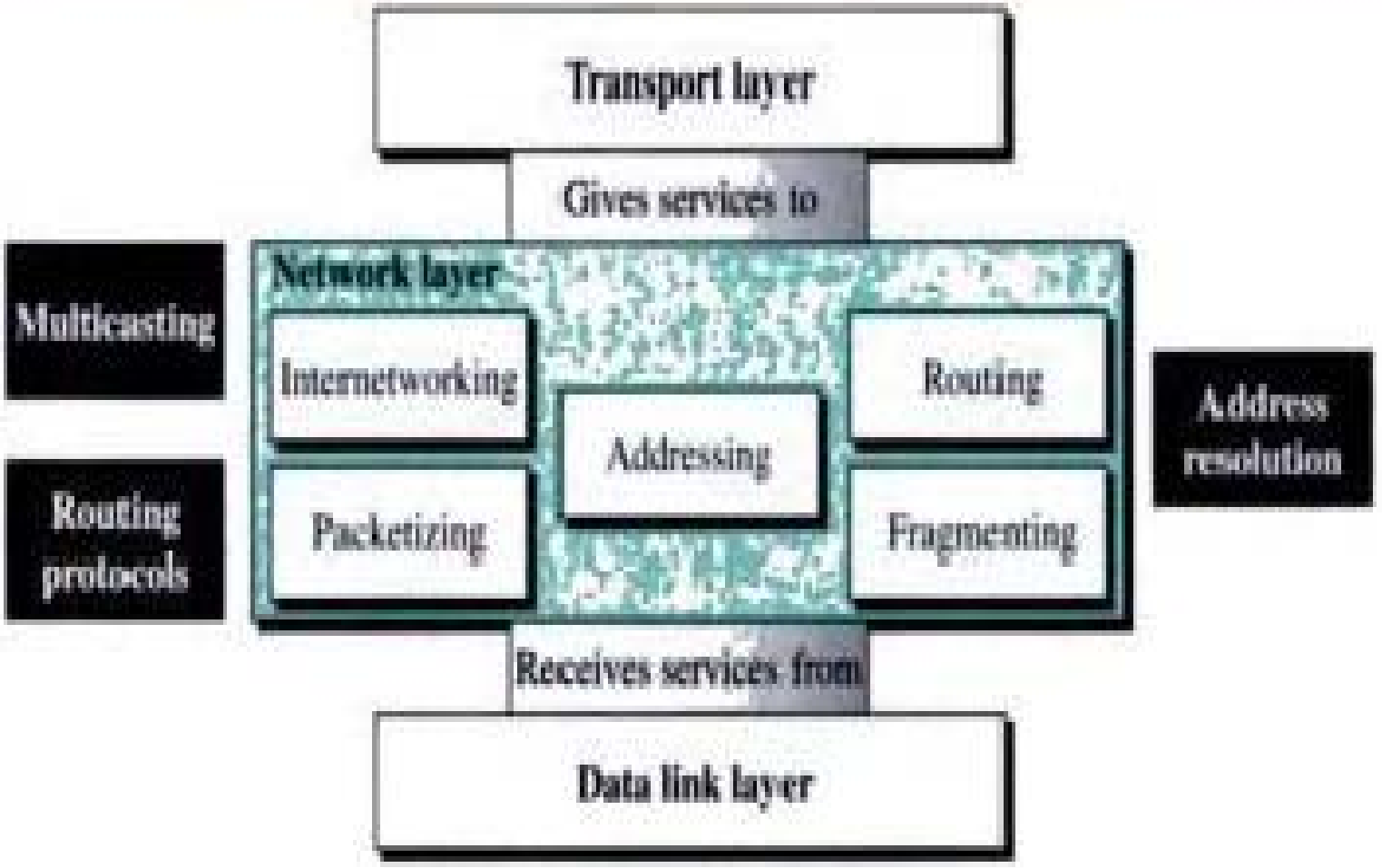
INTERNET LAYER

- The Internet Layer solves the problem of sending packets across one or more networks. Internetworking requires sending data from the source network to the destination network. This process is called routing.
- TCP/IP internet layer is very similar in functionality to the OSI network layer
- TCP/IP supports the internetworking protocol (IP). IP in turn uses 4 supporting protocols: ARP, RARP, ICMP, IGMP

MAIN TASKS OF INTERNET LAYER

- **Host addressing and identification**
  - This is accomplished with a hierarchical addressing system.
- **Packet routing**
  - This is the basic task of getting packets of data (datagrams) from source to destination by sending them to the next network node (router) closer to the final destination.

SERVICES BY INTERNET LAYER



TRANSPORT LAYER

- The Transport Layer's responsibilities include end-to-end message transfer capabilities independent of the underlying network.
- End to end message transmission or connecting applications at the transport layer can be categorized as :
  - connection-oriented, implemented in Transmission Control Protocol (TCP)
  - connectionless, implemented in User Datagram Protocol (UDP).
- The Transport Layer can be thought of as a transport mechanism,
  - e.g., a vehicle with the responsibility to make sure that its contents (passengers/goods) reach their destination safely and soundly, unless another protocol layer is responsible for safe delivery.
- The Transport Layer provides this service of connecting applications through the use of service ports

MAIN TASKS OF TRANSPORT LAYER

- Error control,
- Segmentation,
- Flow control,
- Congestion control
- Application addressing (port numbers).

TCP vs. UDP

RELIABLE	**UNRELIABLE**
ORDERED	**NOT ORDERED**
HAEVY WEIGHT	**LIGHT WEIGHT**
STREAMING	**DATAGRAMS**

APPLICATION LAYER

- The application layer enables the user to access the network.
- The application layer is responsible for providing services to the user.
- It provides user interfaces and support for services such as
  - electronic mail,
  - file access and transfer,
  - access to system resources
  - surfing the world wide web
  - network management.

APPLICATION LAYER

- The Application Layer refers to the higher-level protocols used by most applications for network communication.
- Examples of application layer protocols include the File Transfer Protocol (FTP) and the Simple Mail Transfer Protocol (SMTP)
- Tasks related with session and Presentation layer of OSI model are also done by Application layer of TCP/IP.

TCP/IP VS. OSI

- It is a basic communication language or protocol of the internet developed by U.S. Dept. of Defense, ARPANET for 'transporting application data over local and wide area networks'.

- It is a standard developed by the ISO for 'how messages should be transmitted b/w any 2 points in a telecommunication n/w.

TCP/IP VS. OSI

- It doesn't clearly distinguish b/w service, interface & protocol.
- The protocols aren't hidden

- It distinguish the service, interface and protocols at different layers.
- Protocols are better hidden than in TCP/IP model and can be changed/replaced as the technology changes.

TCP/IP VS. OSI

- These are specific models where protocol come first and model is just a description of the existing protocol.
- TCP/IP model has 4 layers

- It was designed before the protocol were invented. This means the model was biased towards any specific protocol or a set of protocols.
- OSI model has 7 layers.

TCP/IP VS. OSI

- TCP/IP model has only one mode in the network layer (connectionless), but supports both modes in the transport layer, giving the users a choice.
- OSI model supports both connectionless and connection oriented communication in the network layer, but only connection oriented communication in the transport layer, where it counts.

Applications

- TCP/IP model is the practically used model for data communication over networks
- TCP/IP model is also applicable in wireless networks
- Latest IP protocol IPv6 is having such a strength that it can connect all the electronics devices supporting TCP/IP over network not only mobile , laptops, desktops or PDA's. A number of different devices can now support TCP/IP communication.

Scope of Research

- Mobility support in TCP/IP
- Adhoc networks
- Security in IPv6

Assignment 5

- What is TCP/IP : a model or a protocol suite?
- When did TCP/IP model came into existence? What is the history behind?
- At which layer of TCP/IP, sessions are managed?

By: Tamanna Sehgal