CN

Lecture Notes

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Contents

Chapter 1

Intro

1.1 Network Hardware

a network is characterised by two things

- transmission technology
- scale

1.1.1 transmission technology

broadly there are two types of transmiossion technology

- broadcasting : the packets are broadcasted with recepients address and is receieved by every machine but is processed by recipient only
- peer to peer or unicasting

1.2 Network Software

1.2.1 Protocol Hirarchies

to reduce the design complexity most networks are organized as a stack of layers each one built upon the one below it.

- the purpose of each layer is to offer a defined set of services to layer above it.

- a message from highest layer is passed down to lowest layer with each layer adding some information to it and it is the physical medium which actually communicates with the other end.

- each layer seem to be communicating directly to corresponding layer of other end while in reality it is only handing the message over to lower layers

1.2.2 Design isuses for layers

various issus arrising can be solved by

- error detection/correction

- routing (finding routes btn. sender and reciever)

- Protocol layering /addressing / naming (compatibility between different protocols)

- statistical multiplexing (network resource allocation)

- flow of control (the sending and receiving speeds)

- quality of service (eg. in realtime systems)

- integrity (cyber threats)

1.2.3 Connection oriented vs connectionless service

Connection oriented : a Connection is made then message transmited

Connectionless : packets of data with receiver address sent to the system it is upto the system to deliver it correctly

1.2.4 Service premitives

these are operations often system calls of OS to use the network services.

1.3 Open System interconnection(OSI) model

1.3.1 Layers of OSI model

- physical
- Data link
- Network
- Transport
- Session
- Presentation
- Application

Please Do Not Touch Steve's Pet Alligator

1.3.2 Physical Layer

The physical layer is concerned with transmitting raw bits over a communication channel.The design issues largely deal with mechanical, electrical, and timing interfaces, as well as the physical transmission medium, which lies below the physical layer.

1.3.3 Data Link Layer

The main task of data link layer is to mask the errors of transmission line it does this task by having the sender break the data into frames and the reciever to send back an acknoledgment of received data.

in broadcast networks the control acces to shared channel is given to medium access control

1.3.4 Network Layer

The network layer controls the operation of the subnet. A key design issue is determining how packets are routed from source to destination. Routes can be based on static tables that are "wired into" the network and rarely changed, or more often they can be updated automatically to avoid failed components.

1.3.5 Transport Layer

The basic function of the transport layer is to accept data from above it, split it up into smaller units if need be, pass these to the network layer, and ensure that the pieces all arrive correctly at the other end.

1.3.6 Session Layer

The session layer allows users on different machines to establish sessions between them. Sessions offer various services, including dialog control (keeping track of whose turn it is to transmit), token management (preventing two parties from attempting the same critical operation simultaneously), and synchronization (checkpointing long transmissions to allow them to pick up from where they left off in the event of a crash and subsequent recovery).

1.3.7 Presentation Layer

the presentation layer is concerned with the syntax and semantics of the infor- mation transmitted.

1.3.8 Application Layer

The application layer contains a variety of protocols that are commonly needed by users. One widely used application protocol is HTTP (Hyper-Text Transfer Protocol)

1.4 TCP/IP model

as the OSI model itself is necessary to understand different protocols of TCP/IP is necessary too

different layers of TCP/IP model are

1.4.1 Link Layer

The link layer describes what links such as serial lines and classic Eth- ernet must do to meet the needs of this connectionless internet layer.

1.4.2 Internet Layer

Its job is to permit hosts to inject packets into any network and have them travel in- dependently to the destination (potentially on a different network).

The internet layer defines an official packet format and protocol called IP (Internet Protocol), plus a companion protocol called ICMP (Internet Control Message Protocol) that helps it function.

1.4.3 Transport Layer

Its job is simmilar to the transport layer of OSI

Two end-to-end transport protocols have been defined here. The first one, TCP (Transmission Control Protocol), is a reliable connection-oriented protocol that allows a byte stream originating on one machine to be delivered without error on any other machine in the internet. It segments the incoming byte stream into discrete messages and passes each one on to the internet layer. At the destination, the receiving TCP process reassembles the received messages into the output stream. TCP also handles flow control to make sure a fast sender cannot swamp a slow receiver with more messages than it can handle.

The second protocol in this layer, UDP (User Datagram Protocol), is an unreliable, connectionless protocol for applications that do not want TCP's sequencing or flow control and wish to provide their own. It is also widely used for one-shot, client-server-type request-reply queries and applications in which prompt delivery is more important than accurate delivery,1

1.4.4 Application Layer

On top of the transport layer is the application layer. It contains all the high- er-level protocols.

the protocols include the Domain Name System (DNS), for mapping host names onto their net- work addresses, HTTP, the protocol for fetching pages on the World Wide Web, and RTP, the protocol for delivering real-time media such as voice or movies.

Chapter 2

Physical Layer

2.1 Modulation

The process of converting between bits and signals that represent them is called digital modulation

2.2 Multiplexing

sharing the same line to with multiple communication channels.

2.2.1 Frequency Division Multiplexing

the bandwidth is divided between multiple channels

2.2.2 Time Division Multiplexing

Here, the users take turns (in a round-robin fashion), each one periodically getting the entire bandwidth for a little burst of time.

2.2.3 Code division Multiplexing

here each station assigns defferent code (chips) for 1 and 0 using all the available bandwidth thus avoiding interfarences

Chapter 3

Data Link Layer

3.1 Introduction

this layer deals with chunks of data called frames instead bits in physical layer

3.2 Objective of data link layer

- Providing a well-defined service interface to the network layer.
- Dealing with transmission errors.
- Regulating the flow of data so that slow receivers are not swamped by fast senders.

the DLL takes packets from network layer and converts them into frames frames are composed of frame header, frame payload and frame trailer.

3.3 types of protocols

Unacknowledged connectionless service: connection is not established acknoledgement not sent

Acknowledged connectionless service: connection is not established acknoledgement sent **Acknowledged connection-oriented service**:

Each frame sent over the connection is numbered, and the data link layer guarantees that each frame sent is indeed received. Furthermore, it guaran-

tees that each frame is received exactly once and that all frames are received in the right order.

3.4 Framing

The usual approach is for the data link layer to break up the bit stream into discrete frames, compute a short token called a checksum for each frame, and in- clude the checksum in the frame when it is transmitted. (Checksum algorithms will be discussed later in this chapter.) When a frame arrives at the destination, the checksum is recomputed. If the newly computed checksum is different from the one contained in the frame, the data link layer knows that an error has oc- curred and takes steps to deal with it (e.g., discarding the bad frame and possibly also sending back an error report).

3.4.1 Methods of framing

Byte Count: each frame is set a byte count which is then used to partition the byte stream into frames.

Flag bytes with byte stuffing: a special flag byte is inserted at the start and end of the frame thus demarking frames byte stuffing is inserting a special escape sequence before each accidental flag byte which occurs in data itself.

3.5 Error control

in a connection oriented networks it becomes immensly important that the frames arrive at receivers end properly for that the receiver must send a negative or posetive feed back to the sender thus eleminating errors

3.6 Flow Control

when the frames are send at speed greater than the reciver can receive then frames are lost two mechanisms address this issue feedback based flow control and rate based flow control

3.7 Error detection and correction

there are two types of startegy for dealing with errors **Error detecting codes**: just used to detect error and **Error correcting codes**: used to correct errors.

3.8 Elementry DL protocols