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days

1) Pseudo code of one bit bidirectional sliding window protocol:

→ Piggybacks acks on reverse data frames for ~~acc~~ efficiency

→ Handles transmission errors, flow control, early ~~frames~~ times.

/* must be 1 for protocol 4 */

▷ Each node is sender and receiver : (P4)

```
#define MAX_SEQ 1
typedef enum (frame arrival,
  chksum_err, timeout) event type;
# include "protocol.h"

void protocol4 (void) {

    seq nr next frame to send;
    seq nr frame expected;
    from r, s;
    packet bf buffer;
    event type event;
    next frame to send = 0;
    frame expected = 0;
    from network layer (&buffer);
    s.info = buffer;              // Prepare first frame
    s.seq = next frame to send;
    s.ack = 1 - frame expected;
    to physical layers (&s);
    start timer( s.seq );         // Launch and set timer

    while (true) {                // wait for a frame or timeout
        wait for event (&event);
        if (event == frame arrival) {
            from physical layer (&r);
            if ( r.seq == from expected) {
                to network layer ( &r.info);
                inc (frame expected);
            }
```

If a frame with a new data, then deliever it if ack for the last frame; then prepare for the next data frame

```
if (r.ack == next frame to send) {
    stop timer (r.ack);
    from network layer (&buffer);
    inc (next frame to send);
}
}
```

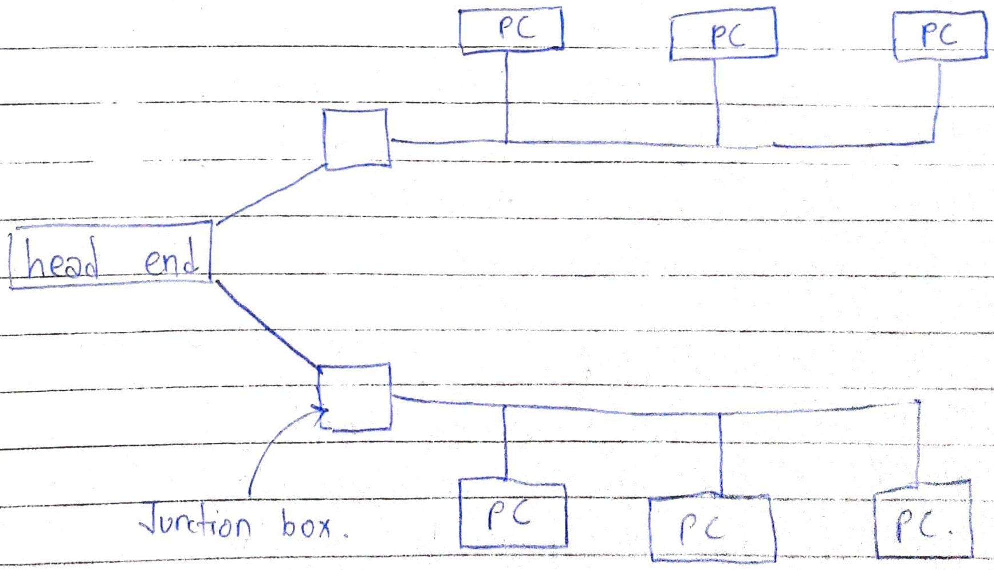
(Otherwise it was a timeout)

```
s.info = buffer;
s.seq = next frame to send;
s.ack = 1 - frame expected;
to physical layer (&s);
start timer (s.seq);
```

send next data frame or retransmit the older one; ack the last data received }

}

2.) Local Area Nework (LAN).



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layers

2nd continue.

i) Network topology: here common bus topology will be used in which nodes are directly connected to a common bus (half duplex link). here every station will receive ~~traffic~~ all network traffic, and the traffic generated by each station has equal transmission priority.

ii) Communication medium: wired communication,
→ So, wire will be medium for communication.

iii) ~~Transpor~~ Encoding method: checksum method.

iv.) here we will use TCP/IP protocol so there ~~will~~ will be mainly four layers.

Application
Transport
Internet
Link

All the pc and head ends contains all the four layers.
But Junction box will only have link layer.

v.) function of each layers is described below:

1.) Application layer: It is used ~~as~~ in end layers application in is on this layer & end uses also interacts with this layer only.

2.) transport layer: transport layer simply transfers the data by encrypting to lower layer or by decrypting to upper layer.

3.) Network: Network layer passes the data in form of frames to link layer. or decapsulate frames to bit to transfer it to ~~free~~ transport layer.

4.) Link layer: link layer does have two works
1.) where data is to be send is decided by this layer.
2.) It will actually transfer the data through wired medium and receives it.

5.) for online meeting one users from any pc will interact with application layer of that PC & send signal to appropriat data to transport layer.

~~to~~ transport layer will intreprit the information and will add header & trailor for appropriate data transfer according to need.

Network layer will encapsulate this data in ~~few~~ form of packets and send it to link layer.

▷ link layer will interprit the formation about host & destination corresponds by address field guided by with dester.
▷ Now link layers will send this ~~layer~~ data to recivers through wire (coaxial cables or ethernet cabel)
▷ Receivers will decode all the information and reliable transmission will be done.
▷ Thus communication (of meeting) b/w two users will ~~be~~ occur.

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3.) Protocol = stop and wait protocol
data (carried by each packet) = 1000 bits
data to be sent : 1 million bits = 10,000,00 bits.
Distance b/w sender and receiver = 2500 km
$= 2500 \times 10^3$ m.

Propogation speed : $2 * 10^8$ m

⇒ Packet size = 1000 bits. = 10^3 bits.
Total data to be transmitted = 10^6 bits

∴ Number of packets to be transmitted $= \frac{10^6}{10^3} = 1000$

$= 10^3$

⇒ Propogation delay for one packet $= \frac{\text{distance}}{\text{propagation speed}}$

$= \frac{25 \times 10^5}{2 \times 10^8}$

$= 0.0125$ s

⇒ Propogation delay for one ACK $= \frac{\text{Distance}}{\text{Propagation speed}}$

$= \frac{25 \times 10^5}{2 \times 10^8}$

$= 0.0125$ s

here transmission delay is 0.

∴ So, total time to transmit one packet and receive ~~A~~ its ACK $= 2 * 0.0125 = 0.025$ s

∴ Therefore, total time to transmit 1000 packets
$= 1000 * 0.025 = 25$ s.

∴ To send 1 million bits of data, it will take 25 seconds.

4.) here, window size : 256 frames
frame size = 500 bits
protocol : Go back N sliding window protocol
Transmission speed : 5×10^3 bits/s
distance = 2.5 Km = 2.5×10^3 m
Speed = 2×10^8 m/s.
Time out = $1.2 \times$ RTT

▷ Propogating time = $\frac{\text{distance}}{\text{speed}}$

$= \frac{2.5 \times 10^3}{2 \times 10^8} = \cancel{1.25}\ 1.25 \times 10^{-5}$ s

$= 12.5$ µs.

▷ here, RTT = 25 µs.
bandwidth = 5×10^3 bits/s.

∴ a frame takes, $\frac{500}{5000} = 0.1$ s to arrive.

by not considering any acknoledgement delay here,
$1.2 \times$ RTT > the time a frame takes.

Hence, only one frame would have been sent after the error.

~~The~~ Thus, only two frames needs to be resent if error occurs.

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Q-5 The advantages over the use of packet switching instead of circuit switching in computer networks:

1.) Data packets are able to find the destination without the use of a dedicated channel

2.) Reduces lost data packets because packets switching allows for resending of packets

3.) More efficient than circuit switching

4.) More cost-effective since there is no need for dedicated channel for voice or data traffic.

So, packet switching works well for data communication, transmitting digital data directly to its destination. Data transmission are generally in high quality in a packet switched network because such a network employs error detection and checks data distribution with the goal of error free transmission.

6.) bandwidth of line = 1 Mbps
Round trip time = 30 ms.
Packet size = 1000 bits :
Link utilization for stop & wait protocol = ?

→ Calculating transmission delay :
Transmission delay $(T_t) = \frac{\text{Packet size}}{\text{Bandwidth}}$

$= \frac{1000 \text{ bits}}{1 \times 10^6 \text{ bits per sec}}$

$= 10^{-3}$ sec

$\Rightarrow$ ~~sec~~ = 1 ms

→ Calculating propagation delay:
Propagation delay (T_p) = Round Trip Time / 2

$= \frac{30 \text{ ms}}{2}$

= 15 ms

→ Calculating value of 'a' :
$a = T_p / T_t = \frac{15}{1} = 15$

$= \frac{1 \text{ ms}}{15 \text{ ms}} = \cancel{\frac{1}{15}} = \cancel{0.067}$

→ Calculating link utilization :

Link utilization or efficiency (η)

$= \frac{1}{1+2a} = \frac{1}{[1 + 2 \times (15)]} = \frac{1}{1+30}$

$= \cancel{\frac{1}{1.134}} = \cancel{0.882} = \frac{1}{31} = 0.0323$

∴ Link Utilization = 0.0323

= 3.23%