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**Report for Reliable Data transfer protocol**

**Protocol used** - The data is transferred over UDP and the process is made reliable by using the below parameters.

1) Acknowledgment
2) Sequence number
3) Finish bit.

Custom Protocol Header :

| SourceAddress | DestinationAddress | SequenceNo | Ack (flag) |
|---|---|---|---|
| 4 bytes | 4 bytes | 1 byte | 1 byte |

Total Protocol Length - 10 Bytes.
Total Data length(removing the protocol length) - 946 bytes.

**Source Address** - Stores the sender's address in the custom protocol.
**Destination Address** - Stores the final destination address in the custom protocol.
**SequenceNo** - starts with the 1 and will increment the sequence no with each other unique packet sent.
**Ack flag** - Will be set to 1 , when the acknowledgement is set.

**Design Implementation**:

1) There are 11 rovers with one being the sender and one being the destination. We will first find the route from sender to destination using RIP protocol, the packet forwarded will be a UDP over the route identified by RIP protocol.

2) Not every router in the process needs to know about all the routes from the sender to destination. Each router checks its routing table to find the nexthop for the final destination address and forwards the packet to the nexthop address.

3) The RIP Protocol and will be continuously receiving updates on the routes to other routers and will keep updating its routing table.

4) So every time a router wants to send a packet , it checks for the nexthop corresponding to the destination address to forward the packet.

5) There are 4 classes, RIP sender, RIP receiver, UDP data transfer, UDP data receiver. RIP sender and RIP receiver will always start and will never be stopped. The rover which will be the sender will start the UDP sender thread and Receiver thread will be started for all the other rovers.

6) The sender will check its routing table to lookup for the next hop address for the destination. If yet there is no info in routing table it will wait for the routing table to get updated (by the background running RIP processes) and will again try to send the packet.

7) At the receiver's end, it will check if it's the destination, in that case it will sending the acknowledgement by switching the source and destination address in the protocol header and will lookup the next hop address corresponding to the sender's address.

8) If the receiver is not the final destination, it will simply forward the same packet to the nexthop address by looking up the destination table in routing table.

9) Before sending any further packet, the sender will wait for the acknowledgment for the previous packet, if in a certain specified timeout, it doesn't receive an acknowledgement, it will resend the same packet with same sequence number.

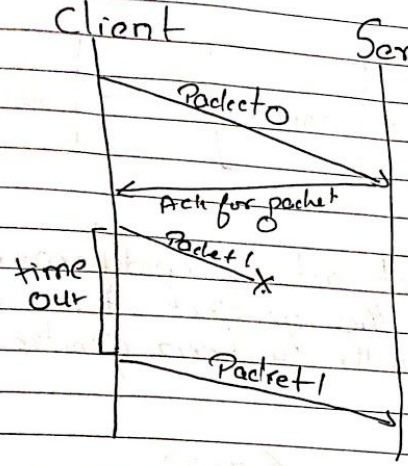
10) At receiver's end if it receives the duplicate packet (It will sense the duplicate packet by looking for the sequence number , if it's the same sequence number as per the previous packet), it will simply not print the message of the packet but will send the acknowledgement again for the packet. To know for duplicate packets, we have a variable ExpectedSequencenumber at receivers end , which will be incremented for all unique packets, if the received packet's Sequence number is greater than 2 or more with the expected sequence number, we will not increment the value of expected sequence number , also if the sequence number for received packet is less than expected sequence number, we know that this is the copy of the packet previously sent, hence we will not increment the expected sequence number and will simply send the acknowledgement with the same sequence number.

11) Finally, once a receiver has received all the contents of the text file from the sender it will send the acknowledgement for the last packet with finish bit set to 1 .

12) Once a sender has received the acknowledgement of the last packet with finish bit set to 1, it will send an acknowledgement to the sender the receiver and will inform that it is stopping sending packets to receiver.

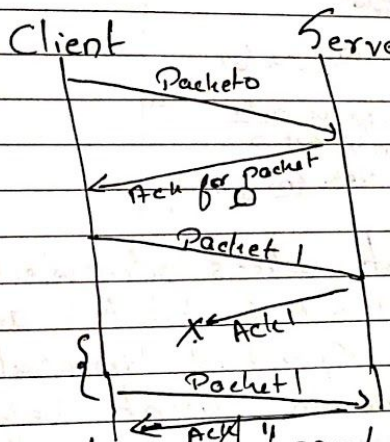
13) The receiver after sending the last packet acknowledgement , will wait for specified duration time for senders acknowledgement and on time out or receipt of ack will stop receiving.

1)




In case of packet 1 loss, the client will resend the packet after a certain time out period time.

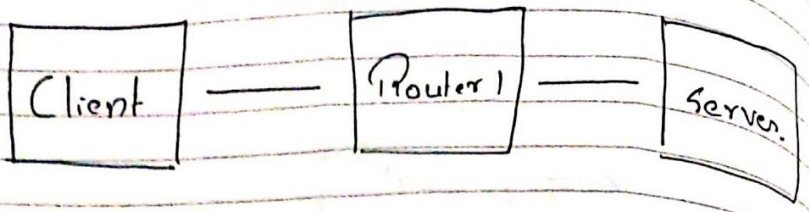
2)




In case, where Acknowledgement is lost for packet 1, client will resend the packet 1 after a specified time out.

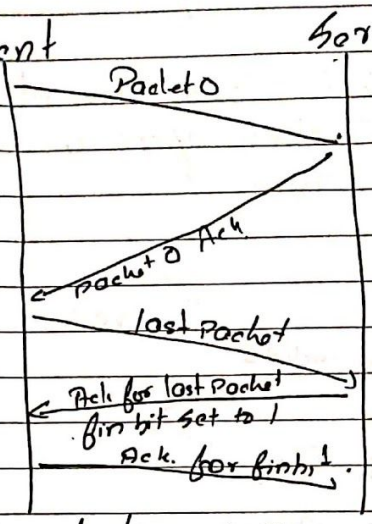
At the receiver End, receiver will never print the contents of the file but will again send the Acknowledgement for packet 1.

3)




Router 1 will just act as middleman and will forward the packet received from client with custom protocol until.

4)




→ for the last packet's acknowledgement. Server will set fin bit to 1 and will wait for a specified timeout of for the client acknowledgement before shutting down receiver