**Reliable UDP**

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Reliable UDP provides reliability, flow control and congestion control on top of UDP. We built a header rUDPHeader that includes the following elements

rUDPHeader{

unsigned int SeqNumber;

unsigned int ackNumber;

unsigned int FIN;

unsigned int finalOffset;

}

seqNumber and ackNumber represent the sequence number of the sending packet and sequence number of the packet acknowledged respectively. We used a FIN flag and finalOffset to indicate the last packet of the transmission and the offset into the packet being read. We pad the last packet with ‘@’ if there is not enough data left to fill the packet. Subsequently, the last packet is only read till the offset value at the client side too.

We implemented Sliding Window protocol for reliability. Duplicate acknowledgements and timeouts invoke retransmissions. We maintain LFS(Last Frame Sent), LAR (Last Acknowledgement Received) at the server side and LFR(Last Frame Received) and LAF( Largest Acceptable Frame ) at the client side. The Advertised window is a fixed parameter and has a size of SEGMENTSIZE\*4 bytes.

Select() is used for the checking of timeout expiration. fcntl() is used for blocking and non-blocking.

Jacobson/Karel’s algorithm has been used for timeout calculation and adaptive retransmission.

Congestion control has been provided in the form of Slowstart /Additive Increase Multiplicative Decrease (AIMD).

We are maintaining a structure struct sendingBuffer that stores the start and end times of a packet transmitted, the packet header and data, the deviation, estimated RTT, sample RTT and difference that are useful in the Jacobson/Karel’s timeout estimation and a flag that indicates whether the ack for this packet is successfully received.

**References:**

1) http://www.cplusplus.com/reference/clibrary

2) TCP/IP Sockets in C: Practical Guide for Programmers by M. Donahoo, K. Calvert

3) Computer Networks: A System’s Approach by Larry Peterson and Bruce Davie

**Usage**

./rUDPClient <Server Address> <Filename> <Port> <Simulation>

./rUDPServer <port>