

## Design of Reliable Communication Protocol Based on Emergency Satellite Communications Ground Station

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**Abstract**—According to the characteristics of satellite emergency communication, combined with the UDP protocol and the TCP protocol of the advantages and disadvantages, the article puts forward an improved expanded with reissue of double reliable D - RCUDP protocol. This paper mainly introduces the improved D-RCUDP protocol application background, the hierarchical structure, the core mechanism, application platform and experimental results.

**Keywords**-UDP; Satellite Emergency Communication; Reliability

### I. INTRODUCTION

When a sudden disaster occurs, conventional terrestrial communications equipment or systems will have been seriously damaged, so here is the use of the satellite emergency communication system (Figure 1). Satellite user ground stations use the UDP protocol, but it can not guarantee the reliable transmission of data. Therefore, this paper mainly design according to the satellite emergency communication characteristics of based on UDP the application level of the reliable data transfer protocol, and used for the rapid configuration user satellite ground station, so as to ensure the critical information of timely transmission.

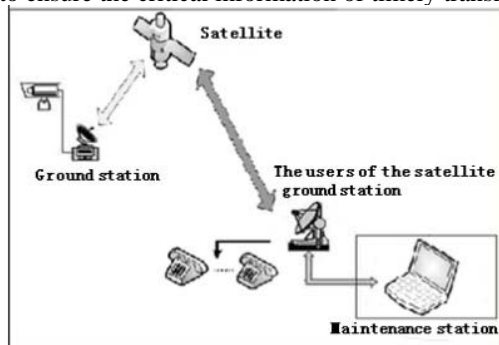


Figure 1. Satellite emergency communication system.

### II. BASED ON THE UDP PROTOCOL OF EXPANDED WITH REISSUE OF DOUBLE RELIABLE D - RCUDP PROTOCOL OF THE DESIGN

#### A. Basic principle

The article mainly studies the reliable data transfer protocol for satellite emergency communication, which has a requirement of speed and reliability, but in the data transmission of process, the contradiction between the speed and reliability can not be eliminated. In other words, high-speed simple transport protocol often has poor reliability; on the contrary the high reliability protocol of transport speed is usually not ideal. Although in the communication process, adding some reliable mechanisms like serial mechanism, CRC check, identify mechanisms, dual-thread mechanism, and keep-alive mechanism, stopping to wait mechanism, retransmission mechanism, discarded errors and duplication package, to ensure its reliability [1]. But stopping to wait mechanism and retransmission mechanism will reduce the transmission speed, and simply discarding the received packet will bring a heavy workload to the retransmission. Sliding window mechanism in TCP protocol is very good, but a bit complicated. So it was suggested that the idea of replacement pointer, although the mere reissue operation efficiency is high, but if the receiving end is not enough processing capacity, or the reissued queue is too long, it will take up a lot of the memory, and affect other operations. So combined with this mechanism, to improve stopping to wait mechanism and retransmission mechanism, and add the queue of the out-of-order queue. This will not only ensure the reliability, but also improve efficiency, and reduce the sending time-consuming, and not simply discard the packet received.

#### B. Protocol hierarchy

D-RCUDP protocol based on message is a reliable data transfer protocol, with UDP protocol as the underlying

support protocol [2], the D-RCUDP protocol hierarchy as shown in Figure 2.

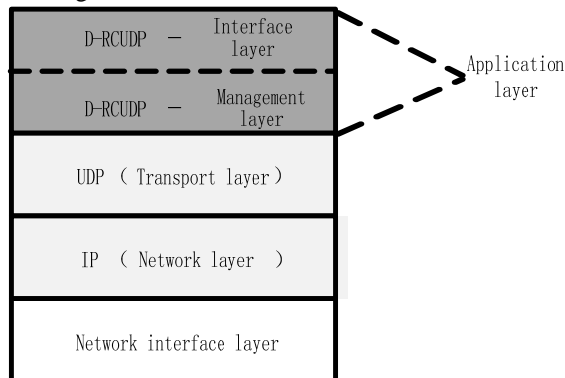


Figure 2. D-RCUDP hierarchical structure diagram.

D-RCUDP - the interface layer is responsible for sending and receiving, and passes the data to management layer analysis. D-RCUDP - the management layer main for the protocol content of analysis and processing, for example: recognition analysis, reliable data processing analysis and maintaining links keep-alive message processing.

### C. Protocol basic

The D-RCUDP protocol uses the means of communication should be in conformity with the relevant provisions. This protocol adapted to communicate both IP address on the same subnet, is not restricted to specific IP address. The underlying transport protocol using UDP protocol, maintenance monitor as a server (CON), satellite ground station as a user client (PUS).

### D. Internal core mechanism

#### 1) with patulous and reissue of double reliable mechanism.

In the maintenance station initial configuration of the satellite users ground stations, in order to make the fast into the work of the state, will be normal to send, reproduction and expanding reissue for a kind of new combination operation, that is to say in normal send uninterrupted cases to join repeat and expanded reissue combining the mechanism, and based on not simple give up the data packets of principle, add out-of-order mechanism. Because the stop wait mechanism and retransmission mechanism can make the transmission speed is reduced, and the received packet simply discarded, to repeat great workload. Also because of simple replacement operation efficiency is high, but if the receiver processing capacity is not enough, or the replacement queue is too long will take up a lot of memory, but affect other operations. Therefore, through the analysis of two mechanism the malpractice, stopped waiting mechanism and retransmission mechanism is improved, and joined the out-of-order queue, so can have assure reliable basis, improve efficiency, reduce the transmission time consuming, not simply abandon the received packet. Specific design as shown in figure 3 below:

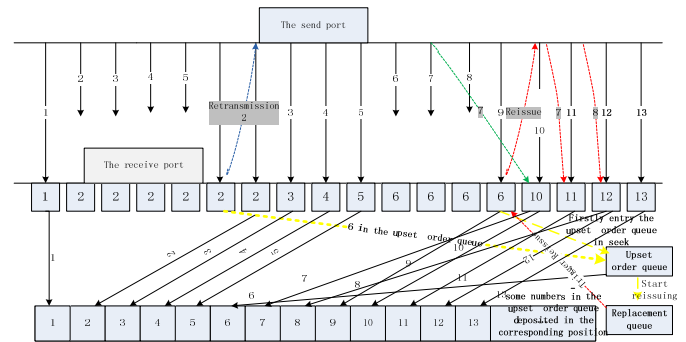


Figure 3. With the development of a reliable mechanism for double.

When received data packet number and required number difference is greater than K (Take  $K = 3$ ), trigger retransmission mechanism, as shown in figure 4, 1 packets of normal and deposited into the corresponding position, after should receive 2 pack, but received 6 packet, and the required number of difference for 4. This shows that 2, 3, 4, 5 received packets are not normal, then start the retransmission mechanism, the pointer to rescheduled for 2 packets, and to send the correct number, meanwhile will received receive 6 out-of-order packets into local out-of-order data buffer queue, and set out-of-order sequence data counter. When the receiving end more than threshold clear out-of-order queue, in order to avoid take up a lot of memory which affect transmission efficiency. The sending end received in a retransmission request according to the correct number repositioning transmits the location, from the current package began retransmitting data.

Continue above the transmission process, from the 6 package began, when packet's number with the desired data number difference is greater than 0, but less than or equal to K, trigger expanded with reissue mechanism. As shown in Figure 3, the receiving end receives the pass over the data packets through the analytically derived number is 9, but need the number is 6, the difference between the two is 3. Then do not need to send again, only in the normal transmission on the basis of turn on the expanded with reissue mechanism, and the number of offset storage, save to correspond to the number 9 position. At the same time in out-of-order queue search need 6, 7, 8 pack, if the search to the need pack is stored to a specified location, without triggering the extended reissue pointer. If there is no need to bag, then sends expanded reissue request to the sending end, the sending end after receipt of a request does not change the original position is transmitted, but through expanded reissue mechanism proceed expand reissue package fast positioning and replacement treatment, namely open two threads. After searching out-of-order queue exist 6 pack, the 6 pack save to the corresponding position, but no search to 7, 8 bag. Now that enabled the two threads, a thread in a sending normal package No.10 while another thread send expanded reissue request required 7, 8 pack.

When parsing a number with the desired number difference is less than 0, the message is expanded reissue



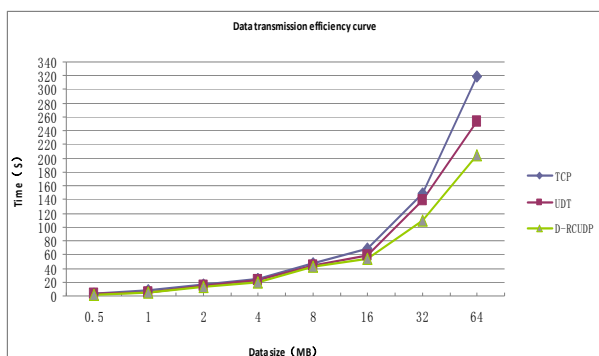


Figure 5. Data transmission efficiency curve.

At the same time in the laboratory simulation tests, the frame rate of the D-RCUDP agreement loss is zero when it is under in 16, 64, 128 byte frame. In the actual emergency communication process, the frame loss rate is less than 2%, related to the actual link quality and transmission interference, but it is able to resolve this problem through dual reliably expand reissue.

## V. CONCLUSION

With emergency satellite communication technology matures, the study of large-capacity high-speed interactive communication necessary to data reception has also been a new development. In emergency communication process In above the udp protocol to join the double reliable communication protocol D - RCUDP, makes the reliability

and efficiency have been give attention to two or morethings, so that the reliability is assured, without reducing the transmission efficiency also. With further research, the out-of-order queue threshold settings problem further highlighted. If too short, it will not achieve a big role. If too long, it is a burden for memory. Therefore, research and optimization this problem to ensure satellite communications and ground data receiving and distribution system more perfect and practical is the next task.

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