APOGEE LABS

TECHNICAL WHITE PAPER

"Reliable" UDP (RUDP) Time Estimates in TMoIP Networking Products

RUDP Overview

In computer networking, the Reliable User Datagram Protocol (RUDP) is a transport layer protocol designed at Bell Labs and now utilized by a number of large technology companies, including Microsoft and Cisco. RUDP aims to provide a solution where UDP is too primitive because guaranteed-ordered packet delivery is desirable, but Transmission Control Protocol (TCP) adds too much complexity/overhead. In order to achieve a higher quality of service, RUDP implements features that are similar to TCP, but with less overhead. Specifically, in order to ensure quality, RUDP extends UDP by means of adding the following features:

1. Acknowledgment of received packets
2. Windowing and flow control
3. Retransmission of lost packets
4. Over buffering (Faster than real-time streaming)

Overview of Customer Application Problem

As mentioned above, utilization of TCP introduces congestion/overhead to the network, rendering it a sub-optimal protocol, as demonstrated by the following telemetry application overview.

Application Overview

- In the application, the monitoring system deemed any data stale if the overall system latency exceeded 500 ms (and prevented the user from seeing the data).
- Due to network congestion, the customer observed data rates drop to 13-14 Mbps for multiple seconds, which increased latency by 1-2 Mb per second (or 66-133 ms per second). Therefore, when the rate dropped to 13 Mbps for 4 seconds, the maximum network latency was realized.
- Requirements included SatCom-type BER (or approximately 10e-9 or less BER) and the customer's network was modified to transmit the data over a VPN and the IP packets were given a DSCP priority of Expedited Forwarding. This reduced the network rtt from 30 ms to 15 ms with <1 ms of jitter, but the system still dropped packets.
- Consequently, when using UDP under these conditions, packets were dropped and, during a typical 24-hour period, the BER was approximately 10e-8, which ruled out UDP as an optimal transport protocol.

The Apogee RUDP Solution

Cisco, Microsoft, and other technology companies have created RUDP that re-transmit dropped packets. However, the implementation of the RUDP still uses congestion windows and multiple types of flow control that lead to reduced bit rates under a congested network and larger latency, similar to the outcome with TCP.

Consequently, the Apogee solution was to enable an application-specific RUDP that allows for a single request for a dropped packet from the sender. In the design, if the re-transmitted packet arrives before it is sent to the serial output, the output buffer is filled with the predefined packet stuffing byte. The output stream does not wait until the re-transmitted packet arrives (as in TCP) and, therefore, the stream will not incur an increase in latency.

The second key element of the design is the allowance for a single flow control device that does not change the rate at which our TMoIP Input Product transmits its data (to ensure a constant latency), but our TMoIP Output Product will stop requesting re-transmitted packets. This is accomplished by monitoring the dropped packets on the TMoIP Output Product.

The Outcome

Prior to implementation of the Apogee RUDP solution, the drops on our customer's network were monitored at a rate of approximately 4.5 drops per hour. Our RUPD handled these network dropouts without any errors on the output. Errors still occurred during times of significant network congestion, which was observed by the Network Group during the nighttime, but the errors did not have an adverse effect on latency.

Summary

Reliable User Datagram Protocol (RUDP) facilitates a higher level of service Transmission Control Protocol (TCP) by ensuring guaranteed-ordered packet delivery and overcoming the challenges associated with TCP adding excessive complexity/overhead.

Want To Learn More?
Contact us today to speak with one of our Technical Team Members to learn more about RUDP, our TMoIP (and other) Networking Products, request a demo, and learn how we can apply our extensive telemetry experience and value added engineering services to satisfy your needs... on budget and on time. To review our comprehensive and growing line of TMoIP Networking Products, visit us on the web at www.ApogeeLabs.com and click on the TMoIP Solutions link.