Analysis of the Impact of Buffers of Baseband Equipment on Transmission Data

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Abstract. In the high-rate FM baseband equipment test, there is a packet loss in the telemetry data sent by the central unit to the center. Combined with the previous high-rate FM baseband equipment transmission data, preliminary analysis, the buffer size of the baseband equipment affects the time gap between the central machine and the telemetry data sent to the center, resulting in the phenomenon of packet loss. This paper mainly studies the influence of different buffer sizes on the transmission data gap and data volume, and then calculates the optimal baseband device buffer size without affecting the central machine transmission data, which provides a reference for practical engineering.

1. Introduction
The measurement ship needs to bear the high-speed data transmission service such as the original source code of the arrow. Considering the influence of the buffer size on the transmission data, the central machine sends the telemetry data to the center during use, and the Ping packet is lost. This paper mainly studies the influence of different buffer sizes on the transmission data gap and data volume, and then calculates the optimal baseband device buffer size without affecting the central machine transmission data, which provides a reference for practical engineering.

2. Basic transmission data mechanism
(a) High-rate FM baseband device transmission data mechanism
The high-rate FM baseband device opens up a “ring buffer” for telemetry data interaction between the underlying board and the host computer network sending program. The new baseband device buffer size is 30ms, and the integrated baseband device buffer size is 10ms.

The data interaction between the two and the buffer contains two threads: "data collection thread" and "data sending thread".

After the telemetry frame synchronization of the FM baseband device, the data acquisition thread is responsible for collecting the telemetry data demodulated by the underlying board and writing it to the ring buffer, and the data head pointer (data producer maintenance pointer) is correspondingly increased.

The data sending thread is responsible for reading the telemetry data from the ring buffer, and packaging the data frame according to the parameter setting, and the data tail pointer (data user maintenance pointer) is adjusted accordingly.

The data sending thread processing flow is as follows:

After the baseband device turns on the transmission data switch, the data transmission thread first determines whether the telemetry demodulation parameter is reloaded. If the demodulation parameter is reloaded, the buffer "data head pointer" is aligned with the "data tail pointer" and then the new data is
read and packaged for transmission. If the demodulation parameter is not reloaded, the telemetry data between the "data tail pointer" and the "head pointer" is continuously packaged and sent in a format. The calculation can be obtained, the buffer of 30ms size can store 76.8 frames of data.

(b) Analysis of telemetry packets sent by the central unit to the center

Each packet of telemetry data sent by the central unit to the center contains telemetry data sent by the baseband equipment to the central unit (that is, contains 64 frames of telemetry data), that is, the telemetry original code data packet, the packet length is 15876 bytes, and is encapsulated by the UDP protocol. The telemetry data packet is 15916Byte, of which the telemetry data packet is 15876Byte, the PDXP packet header is 32Byte, and the UDP packet header is 8Byte, as shown in Figure 1.

| UDP | PDXP | Data |
|-----|------|------|
| 8 Byte | 32 Byte | 15876 Byte |

**Figure 1. Telemetry data UDP encapsulation format**

After the UDP encapsulated data packet is sub-packaged, the total length of a single packet transmitted by the network is 16136 bytes (UDP encapsulation packet + IP packet), wherein the first packet includes an IP header, a UDP header, a PDXP header, and a data packet Data1. The second to eleventh packets are IP header plus data packet Data2-Data10. The fragmented UDP protocol header and PDXP protocol header are only present in the first 1136 byte fragmentation packet, and the IP protocol header is in 11 slices. There are sub-packages, as shown in Figure 2.

| IP | UDP | PDXP | Data1 |
|----|-----|------|-------|
| 20 Byte | 8 Byte | 32 Byte |  |

| IP | Data2 |
|----|-------|
| 20 Byte |

| IP | Data11 |
|----|-------|
| 20 Byte |

**Figure 2. Telemetry packet format after marketization**
3. Test verification

(a) Test verification

Using a unidirectional measurement and control information joint timing, through the central machine simulation center and baseband equipment, the telemetry original code data transmission test is conducted on the central direction. The test is carried out in three groups. The network posts are captured and analysed at the router 1 wide area network exit. The situation is shown in Table 5 below.

Figure 3. Communication link

Table 1. Telemetry transmission packet loss

|       | Test 1-1                          | Test 1-2                          | Test 1-3                          |
|-------|-----------------------------------|-----------------------------------|-----------------------------------|
| Packet loss | The ping packet is lost, and the telemetry packet is not lost. | No packet loss occurred in the ping packet, and the telemetry packet was not lost. | No packet loss occurred in the ping packet, and the telemetry packet was not lost. |
|         | The priority is EF (5). The telemetry packet is not lost. The priority is BE (3) Ping packet loss. | /                                  | /                                  |
| Data source | Newly developed baseband equipment to send | Central machine simulation transmission | Central machine simulation transmission |

(b) Traffic statistics analysis

A 10 ms level IO icon was drawn for the test 1-1 and test 1-2 data, respectively. As shown in Figure 4, in the test 1-1, the burst rate reached 27 MBit/s. During the test, the packet loss occurred in the Ping packet. In the experiment 1-2, the data traffic was relatively stable, and the burst rate was 12.5 MBit/s. No packet loss occurred during the test.
For the test 1-1 and the test 1-2, the scatter statistics are performed on the time slot in the packet loss phase, as shown in FIG. 5. In Test 1-1, the time slot of the packet is relatively random, mainly concentrated around 3ms and 30ms, and the packet is sent at intervals of 3ms, resulting in an increase in burst traffic. In Test 1-2, the packet transmission time slot is relatively stable, the packet transmission interval is 25 ms, and the data traffic is relatively stable.
It can be concluded from the above-mentioned time slot statistics chart that the current central machine is sent to the central telemetry by simulation, and the packet transmission time slot is relatively stable, all of which are in the vicinity of 25 ms, and no packet loss occurs in the Ping packet; The time slots are mainly concentrated in the vicinity of the 30ms and 3ms time slots, and the packet loss occurs in the Ping packet.

(d) Integrated baseband equipment test verification

After several tests and test verifications, the integrated baseband equipment can confirm that the buffer of 10ms does not affect the central machine to send telemetry data to the center. The central machine sends telemetry data to the center without a surge in traffic, and the interval between packets is about 23ms.

4. Conclusion

(a). From the above transmission data mechanism and transmission data analysis, it can be concluded that the new baseband equipment increases the buffer size to 30ms, causing the central machine to send 2 packets of data to the center every 150ms, and the data transmission interval of the two packets is
shortened to 3ms. Left and right, resulting in a surge in network transmission data traffic, prone to packet loss problems.

(b). the buffer size of the integrated baseband device is 10ms, and the time interval for the central machine to send each packet to the center is kept at >20ms, which is not prone to packet loss.

(c). the optimal baseband device buffer size is 10ms without affecting the central machine's transmission of data.

References
[1] Zhao Jinglei et al. Research on pre-sharding and recombination technology of ultra-long UDP data packets [J]. Telemetry and Remote Control. 2016.
[2] Liu Yuan, Zhang Gang. Firepower and Command Control [J]. 2017.
[3] Wang Wei, He Qiuyan, Wang Lukai. Design of Reliability Transmission Protocol Based on UDP Improvement [J]. Computer Knowledge and Technology, 2015.