Steadfast aeronautical communication based on LBTM MAC

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ABSTRACT

In this paper, the steadfast aeronautical communication based on location based time division multiple access. LBTM MAC protocol to reduce the increasing the data traffic and air to air communication. ACK need long guard time for steadfast multicast in the aeronautical environment, because it is long distance communication. To overcome this problem. Here, reduce the guard time of ACK and collision.

Index Terms---Media access control, Air to Air communication delay, LBTM (MAC), Aeronautical communication, aircraft systems.

1. INTRODUCTION

First, aeronautical communication started voice communications using double sideband amplitude modulation. Now the aeronautical communication used addressing and reporting system. (ACARS) is used for reporting the aircraft and ground station. Location based TDMA MAC supports unicast, multicast and broadcast. It provides both air to air communications. Aircraft used to transmit the weather information. We suggest location based TDMA MAC the TDMA multicast MAC in aeronautical communication to solve this problem. Our work has four work features.LBTM provides both air to air communications. Then aircraft want to transmit weather information, the aircraft can quickly transmit weather information to a multicast group of aircraft. LBTM can achieve full reliability using ARQ. The guard time of ACK is variable according to the multicast group aircraft to compensate for the free space propagation delay. Here, calculate the maximum location information error caused by the movement of aircraft and we add this location error in the calculation of ACK arrival time. Utilizing this knowledge, we can reduce the guard time of ACK and transmit ACK collision LBTM able to reduce the average total time.

2. TRAFFIC ANALYSIS

From this block the sender send the data to each aircraft. Each data contain location information and Aircraft ID and with time slot ending time, because here TDMA MAC is used to sharing the position information and time slot ending time. Due to movement of aircraft the location error occurs. The error rectifies by using location information error. TDMA MAC use location information reduced the ACK guard time and collision.

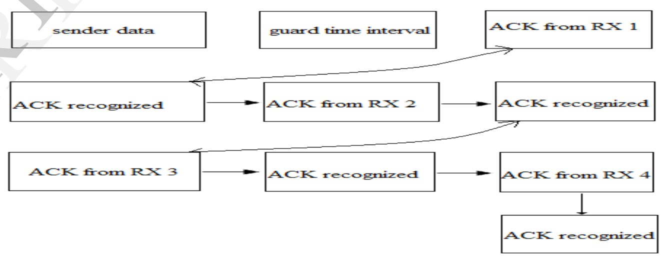


Fig: 1 Block diagram

2.1 data and ack transmission step of lbtm multicast

Here, the multicast group consists of one sender and n receivers. The sender transmits the packet using the number of minis lots to the multicast group. Each aircraft calculates the ACK transmission time, using location information to reduce the collision at the sender. The sender wait until the all ACK arrival after its packet transmission, if sender cannot receive all ACK it will reconstructs the packet retransmission. LBTM does not need guard time, because each aircraft receiver can use location information to calculate their transmission time reduced the collision at the sender.

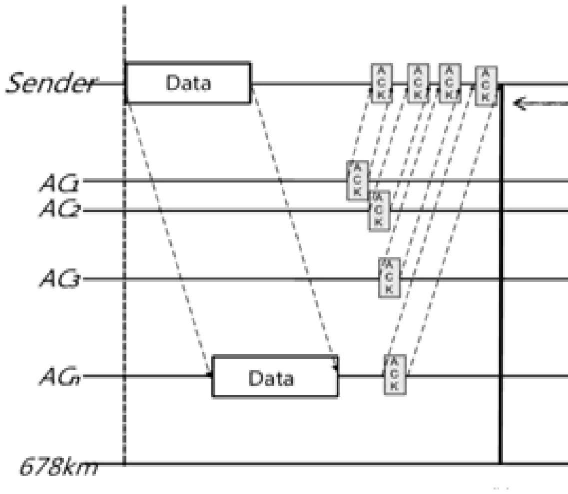


Fig: 2 Data and ACK Transmission Step of LBTM Multicast

2.2 aircraft information error

An aircraft information error is reduced by LBTM MAC. LBTM MAC requires to sharing the location information and time slot ending time. Aircraft can use this information as the packet, each packet contain as position information and aircraft ID and time slot ending time. Three information are transmitted by the sender. The distance between aircraft can be obtained from the periodic exchanges of location information of each aircraft. Aircraft move between the periodic transmissions of their location information. The distance can differ from that calculated based on the latest aircraft location information, need to add the location error guard time to tolerate any movement of aircraft between periodic exchanges of location information.

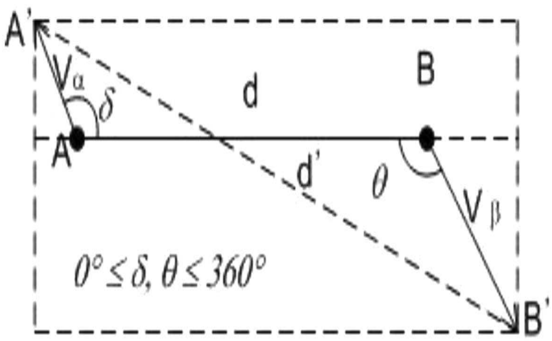


Fig: 3 Aircraft location error

2.3 Calculation of ACK Transmission Time at Each Aircraft

2.3.1 ACK Transmission Time of AC_1:

When AC_n finishes receiving data, AC_1 begins ACK transmission. Thus, AC_1 first should know the ending time of packet reception at the ACn. The ending time of packet reception at the ACnTD is calculated, as follows:

$$T_D = \left[\frac{DATA}{r * Tms}\right] \times T_{ms} + P_{(s,Max_{-node})} \qquad (3.1)$$

where DATA is the number of bits of the data packet; r is the data rate (bit/s);

$$TOA_{ACK(AC1,S)} = TD + P_{(AC1,S)} \qquad (3.2)$$

Where P (AC_1, S) is propagation time from AC_1 to the sender.

2.3.2ACK Transmission Time of AC_2:

The ACK of AC_2 should arrive after the sender finishes receiving ACK ofAC_1. The ACK arrival time of AC_2 to the sender TOA ACK (AC_2, S) is calculated as follows:

$$TOA\_ACK_{(AC_2,S)} = TOA_{ACK(AC1,S)} + \left[\frac{ack}{r * Tms}\right] \times T_{ms} + 2\rho$$

Where ACK is the number of bits to transmit the ACK packet. We know the arrival time of AC_2 ACK by (3.3). Equation (3.4) substitutes for (3.5), we can calculate the transmission time of AC2 ACK TOT (AC_2, S) as follows:

$$TOA\_ACK_{(AC_2,S)} = TOT_{(AC_2,S)} + P_{(AC_2,S)} \qquad (3.4)$$

$$TOT_{(AC_2,S)} = TOA_{ACK(AC_1,S)} + \left[\frac{ack}{r * T_{ms}}\right] \times T_{ms} + 2\rho - P_{(AC_2,S)} \qquad (3.5$$

In wireless communication, the RTS/CTS extension is not used for broadcast/multicast; and the receivers are not required to return an ACK. As a result, the quality of broadcast/multicast service is not as good as that of unicast

2.4 lbtm frame structure

2.4.1random access section

A random access section contains the reservation request packet with uplink M section.

2.4.2 time slot section

The time slot is divided into listening, control message, DATA, and ACK

2.4.3 listening section

The listening section compensates for the retransmission. Even if the time Slot is owned by the sender, it must listen to the network in the listening section, because the listening section includes the transmitter address section.

2.4.4 control message

The control message is divided into frame type, transmitter address, multicast group receiver's address, and timeslot ending time.

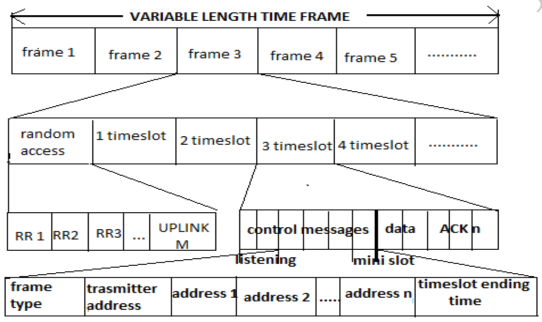
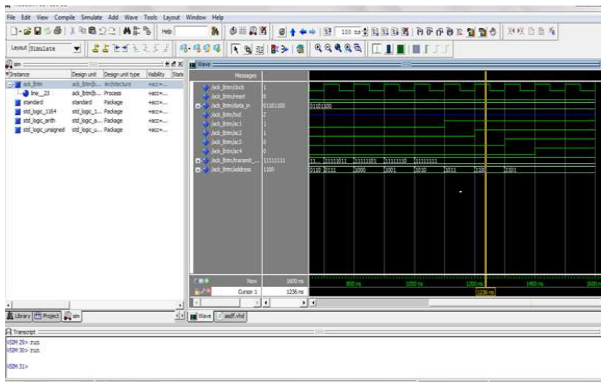


Fig.4 LBTM frames structure.

3. SIMULATION AND RESULTS

Here, evaluate the location based TDMA MAC protocol delay performance by increasing the number of aircraft. We use modelsim for the simulation. VDL and LBTM have different MAC structure and transmission mode. Second, each aircraft calculates the ACK transmission time, using location information to prevent collisions at the sender. Third, the sender waits for all ACK arrivals after its packet transmission. If the sender cannot receive all ACKs, it reconstructs the retransmission packet. LBTM is able to reduce the time to complete a multicast communication. In simulation; LBTM has a lower delay and reduced the ACK guard time with collision.



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