Sindh Univ. Res. Jour. (Sci.Ser.), Vol: 34-B (2) 11-14 (2002)

STATISTICAL TIME DIVISION MULTIPLEXING WITH CYCLIC PACKET DROPPING ALGORITHM FOR LOW BANDWIDTH CHANNEL

M. Arain, A. Shah and Salma Bhatti

Department of Computer Science, Isra University, Hyderabad

Abstract

One of the disadvantages of random packet loss algorithm is that, the same user can be picked up for consecutive packet losses. This will adversely affect the speech quality of that user. To overcome this situation the cyclic packet-dropping algorithm is adopted. The experimental results show that for the same amount of packet loss this scheme performs better than the random packet loss algorithm and the incidences of successive loss of speech packets of the same user is essentially avoided.

Keywords: Multiplexing, Packet Dropping,Cyclic

Introduction

Bandwidth savings of any communication channel can be achieved by various means; Statistical Multiplexing is one of them [1]. In this paper we are going to present architecture of Statistical Time Division Multiplexer working at low bit rate speech for thin route channels. The thin route channels are the channels of 64 -128 kbps [2].

In case of Statistical Multiplexing the number of sources allowed to access the link is always higher than the output link capacity. Assuming that all the speech sources (N) multiplexed at the input panel of the channel are employing Voice Activity Detection (VAD) [3][4]. The VAD is responsible to detect talkspurts (active parts) and silences (non-active parts) of speech for each user. When the number of users allowed is more on the channel, then at any time instant the number of talkspurts may also be more than the bandwidth capacity of the outgoing channel. The number of users to access the link at any time instant is nine, each of which is operating at 6.4 k bits/s. Full bandwidth utilization of outgoing channel can be achieved by allowing more than nine users at the input pannel of multiplexer because each user is employing VAD. In case of higher activities if active users are more than 9, then some of the users will be forced to drop the packets, that means they are denied the access to the channel. There can be so many packet discarding algorithms, one of them is cyclic packet discarding. In which, each user's data is discarded during higher activities, on a round-robin (Cyclic) basis. In this paper the Cyclic packet discarding technique is presented.

Cyclic Frame Discarding Algorithm:

As soon as multiplexer detects higher activities the cyclic frame discarding mechanism starts from first user to discard frames as shown in Figure 1.

CamScanner

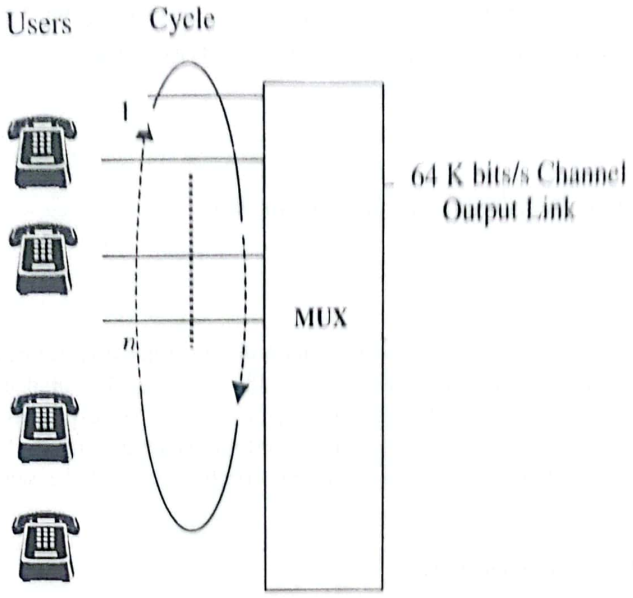


Figure 1. Schematic Diagram for STDM with Cyclic Packet Discarding.

The pseudo-code of this algorithm is given in Figure 2, and flow chart is illustrated in Figure 3.

The above algorithm can be used to discard frames of speech from the users as per segment until the required numbers of users' frames are available. Every time frame discarding is activated when input traffic is more than the output bandwidth capacity of the channel.

```
BEGIN
        Position = First
        IF State Is Active THEN
                Drop the Packet
        END_IF
        IF Position Is N THEN
                Position = 1
        ELSE
                Position = Position + 1
        END_IF
END
Where
N        = Total Number of Users.
State    = Current State of user (Active = Talkspurt, InActive = Silence)
Position = Position of user which is going to be discarded.
```

Figure 2. Pseudo-code of the Cyclic Frame Discarding Algorithm

CamScanner

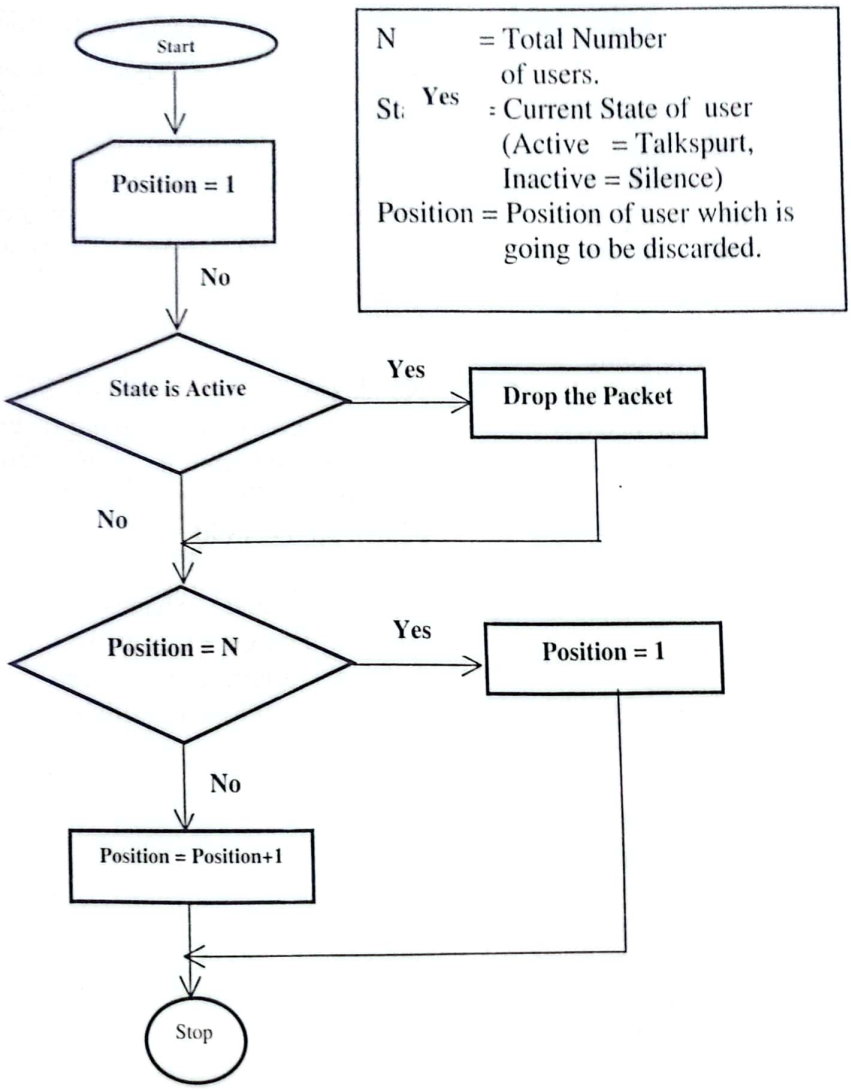


Figure 3. The Flow Chart of Cyclic Frame Discarding Algorithm.

MOS Results Discarding in Cyclic Frame

The Mean Opinion Score (MOS) results are indicated in Table 1 for cyclic design. Generally MOS results indicate a decay as number of users increases. It is important to note that the speech quality deterioration with users does not cause an abrupt change in the distortion. This is due to the fact that the loss of frames was regulated and consecutive loss of Francs is avoided.

Users	File (a)	File (b)	File (c)	File (d)	File (e)
9	3.5	3.8	3.5	3.5	3.0
10	3.5	3.8	3.0	3.5	2.5
11	3.0	3.8	3.0	3.0	2.5
12	3.0	3.5	2.7	2.5	2.0
13	2.2	3.0	2.7	2.5	2.0
14	2.0	2.7	2.0	2.0	1.7
15	1.0	1.5	1.5	1.2	1.2

Table 1. MOS for Cyclic Frame Discarding

CamScanner

Discussion

Speech packet discarding is a new concept in STDM design 5. Users at the input of STDM are allowed beyond the capacity of multiplexer to handle. When all users are active then excessive (X – 9) users are forced to be discarded or denied the access to outgoing channel. Which user is going to be discarded is based upon various methods as discussed in 6. It has been proved that this technique performs better than random technique because in this a consecutive loss does not occur. Therefore, the quality of speech remains stable.

Conclusion

As shown in MOS results, with 9 users all the files indicate their best scores. As soon as number of users grows from 9 to 15, the discarding of frames occurs at higher rate. When that is the case, the discarded frames are reconstructed at higher rate. This in fact effects on quality of speech. The quality indicates that instead of 9, 12 users can be accommodated upon a channel of interest. Therefore a ratio of 12/9 = 1.33 is achieved.

References

[1] Held G. "The Multiplexer Reference Manual". John Willy and Sons Ltd 1992.

[2] Chakraborty. D. " VSAT Communications Networks - An Overview". IEEE Communications Magazine.

[3] Gruber. J. G. "A Comparison of Measured and Calculated Speech Temporal Parameters Relevant to Speech Activity Detection". IEEE Trans. on Communications, 30 (4): 728-738, April 1982.

[4] Srinivsan K. and Gersho A. "Voice Activity Detection For Cellular Networks". Technical Report CA 93106 U.S.A, Center for Information Processing Research, Department of Electrical and Computer Engineering University of California.

[5] Kondoz A. Shah A. Atungsiri S. and Evans B. Lossy multiplexing of low bit rate speech in thin route telephony. IEE Electronics Letters, 32 (2): 95-97, 1996.

[6] Shah A. and Shams-ul-Arfeen Laghari. Design of statistical time division multiplexer based on random packet loss algorithm.

CamScanner