schemes, namely frequency hopping and direct sequence. This work is focusing on direct sequence CDMA or DS/CDMA. The DS/CDMA system has several properties, such as i) soft capacity, ii) soft handoff, iii) anti-multipath capabilities, etc., which make it more attractive in terms of capacity over other multiple access methods, such as FDMA and TDMA (Alex *et al.*, 1996).

This work studies a code division multiple access protocol for application to LEO systems. Voice user terminals and data user terminals are considered, with different characteristics for the packet generation process and QoS (Quality of service) requirements (Meejoung *et al.*, 2005). The voice quality and data transmission is measured by the probability P_{loss}, which is the summation of P_{drop} that a packet is dropped by the MAC layer and the P_{error} due to excessive multiple access interference. Ploss limits of 1% and 0.1% were considered (Chen *et al.*, 2005).

This paper is made up of five sections. In section II voice and data traffic model are presented. The studied protocol is described in section III. The performance evaluation of this protocol through simulation results is then discussed for voice and data users separately. Finally section *V* concludes this work.

2. Traffic source models

This section describes the adopted traffic models for both VTs (voice terminals) and DTs (data terminals). In the following, we denote by T_f the frame duration, by R_C the channel transmission bit-rate and by the voice source bit-rate.

2.1. Voice source model

A speech source creates a pattern of talkspurts and gaps, as classified by a speech activity detector. A speech activity detector responds to the principal talkspurts and gaps related to the talking, pausing, and listening patterns of a conversation (Alagöz, 2003). All spurts and gaps can be modelled as having exponentially distributed durations. The durations of all spurts and gaps are statistically independent. The mean duration of talkspurts and gaps are t_1= 1s and t_2 = 1.35s, respectively (Giuliano *et al.*, 2002). This yields a voice activity factor of 0.425. The probability that a principal talkspurt with mean duration t_1 seconds ends in a time is

$$\sigma_v = 1 - \exp(-\tau / t_1) \quad (1)$$

That is, the probability of a transition from the talking state to silent state. Correspondingly, the probability that a silent gap of mean duration t_2 ending in a time is

$$\gamma_v = 1 - exp(-\tau / t_2) \quad (2)$$

That is the transition probability from silent state to talking state. Figure 1 shows the two–state speech model and its transition probabilities.

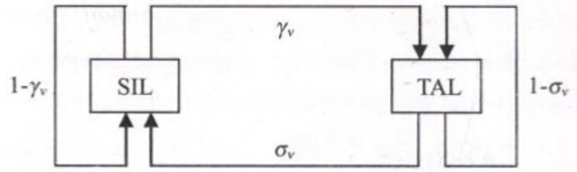

Fig. 1. A speech activity model.

2.2. Data source model

For data, one is interested on the ABR traffic (Available Bit Rate) that represents traffics of file transfer. The subsystem of data is constituted of a number of users that generates gusts following an independent Poisson process of an average λ . A gust is of a length distributed geometrically of means in bits Lb. Therefore, it is constituted of a number of packets distributed geometrically and of a mean

$$L_s = \frac{L_b}{R_s T_f} \quad (3)$$

Figure 2 shows the two–state speech model and its transition probabilities.

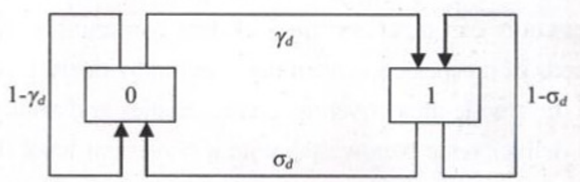

Fig. 2. A data model.

With

$$\gamma_d = 1 - exp(-\lambda\tau) \quad (4)$$