Intelligent Communication Transmission Experiments using the COMETS ATM Satellite Link

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1. Introduction

In usual communication systems, information is treated as a sequence of numbers. The actual meaning of the information is given little attention. Intelligent communication involves looking at the meaning of the information and then applying transmission techniques appropriate for the type of information being sent.

In this experiment, we examine the channel coding problem from an intelligent communication viewpoint [1][2]. In particular, we consider the transmission of information with varying levels of importance. A situation like this can arise, for example, in the transmission of English text. Every letter in a word has a different importance level as does every word in a sentence.

2. Experimental System

The transmission equipment used in our experiment is shown in Figure 1. The data is encoded using a workstation (W.S.1) and then transmitted using the TCP/IP protocol to an ATM switch (ATM SW). The ATM switch transmits the data to a modem, which in turn sends the data to the COMETS satellite via the ground station (ES).

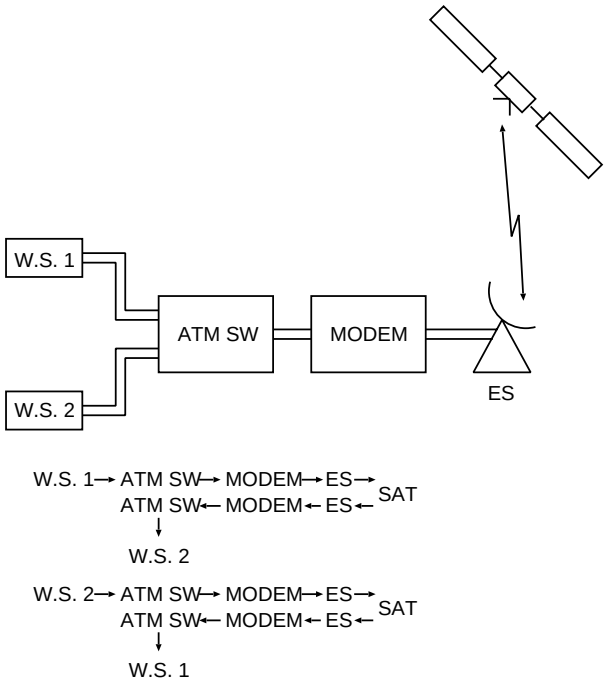

Figure 1: Intelligent Communication Experimental System

On the reverse link, the data is sent to the receiving workstation (W.S.2) and decoded.

3. Results

Using the experimental system described above, binary data was encoded and transmitted via the COMETS satellite. In all, 14 different sets of data were transmitted 10 times each for a total of 2.54×10^8 transmitted bits. The received data was compared with the transmitted data and it was found that even without encoding the data, no errors occurred. This indicates with high confidence that the probability of a bit error through this channel is less than 10^{-6}.

The reason for such a low error probability is due to the fact that there is additional error control coding that is added by the TCP/IP and ATM protocols and the modem. Therefore, in order to evaluate channel coding techniques, a transmission system that does not include extra error control coding is necessary.

However, in order to get some idea of the transmission conditions, we measured the transmission speed of data through the experimental system. For one set of data, the results are shown in Table 1. We can see that the speed at which the data is sent is larger than the reception speed. This can be attributed to the overhead in the communication protocols and to any errors which cause retransmissions.

Table 1: File 1 (100250 bytes)

Run	Tx. Time (seconds)	Tx. Speed (bytes/s)	Rx. Time (seconds)	Rx. Speed (bytes/s)
1	1.009108	99345.164244	1.285972	77956.596256
2	0.819562	122321.435108	1.088159	92128.080547
3	0.902640	111063.103784	1.168493	85794.266632
4	0.803545	124759.658762	1.071754	93538.255980
5	0.980323	102262.213577	1.252972	80009.768774
6	0.864698	115936.430985	1.133505	88442.485918
7	0.878787	114077.700285	1.140951	87865.298334
8	0.895719	111921.261020	1.165603	86006.985226
9	0.913288	109768.222072	1.193319	84009.388940
10	0.819670	122305.317994	1.093245	91699.481818

4. Conclusions

In this experiment, an attempt to evaluate an intelligent communication system was made. Due to the transmission equipment, no errors occurred, which indicated that the error probability of the communication channel was below 10^{-6}. Some measurements of the transmission speed were also made.

References

[1] D. K. Asano and R. Kohno, "Serial unequal error protection codes based on trellis coded modulation," *IEEE Trans. Commun.*, vol. 45, pp. 633–636, June 1997.

[2] M. Matsunaga, D. K. Asano, and R. Kohno, "Unequal error protection based on multidimensional coded modulation using several convolutional encoders," *Proc. of the ISPACS '96*, Nov. 1996.