Brief Announcement: The Sound of Silence — Guessing Games for Saving Energy in Mobile Environment*

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The existence of powerful portable computers and the development of infrastructure for wireless communication, triggers researchers, designers and developers to investigate different aspects of this new technology. One of the most important properties of mobile computers is the limited battery power. This limitation is in fact crucial for message transmission that consume much more battery power than message receptions. Thus, communication protocols that require as few as possible message transmissions of the mobile host, are of great interest.

A mobile host communicates with other computers through fixed location mobile support stations. The mobile support stations do not have the energy limitations that the mobile hosts have. One would like to convey, in some "magical" way, energy from the mobile support station to the mobile host. The idea we suggest is simple, the mobile support station will guess (see [1]) the message that the mobile host wants to transmit; On the other side the mobile host will approve a correct guess (sending a single signal) or stay silent, otherwise. There are two contradicting parameters for the design of such a guessing scheme, time and energy. In one extreme where time is not an issue, the mobile support station will guess the message to be transmitted by the mobile host in lexicographic order, one after the other. In this case a single signal will be sent by the mobile host. On the other extreme when energy is not an important issue but time is important, the message will be transmitted by the mobile host as is.

In this work we explore the time/energy tradeoff for such guessing schemes. First we consider the case in which the time for transmitting a message is bounded and present a strategy for guessing games that achieves the minimal expected energy within this time bound. Then we turn to the compliment case, in which the energy for message transmission is bounded and we present a scheme that achieves the minimal expected transmission time.

A different approach is suggested for the case in which neither an upper bound on time nor an upper bound on the energy is imposed. We present an extension of the well known Lempel-Ziv technique [2] that reduces the amount of energy (number of ones) in the compressed data (resulting in some cases in a slightly less efficient compression).

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References

[1] J. van Leeuwen, N. Santoro, J. Urrutia and S. Zaks, "Guessing games and distributed computations in synchronous networks", *Proceedings of the 14nd International Colloquium on Automata (ICALP 87), Lecture Notes in Computer Science*, Vol. 267, Springer-Verlag, Berlin, 1987, pp. 347-356.

[2] J. Ziv and A. Lempel, "Compression of individual Sequences via Variable Rate Coding", *IEEE Trans. Information Theory*, Vol. IT-24, pp. 530-536, Sept. 1978.