CS222 Project Update
Data Compression on Wireless Sensor Networks

Jason Waterman
Daniel Shteremberg

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1 Recap

The goal of this project is to analyze the performance and energy costs of compression in Wireless Sensor Networks. We proposed to implement the LZ77 compression algorithm on a mote and measure the energy associated with compressing one bit of information. We also proposed to examine three data sets obtained from real life Wireless Sensor Network deployments and determine their compressibility. Finally, armed with compression ratios for real life data, and energy costs associated with compression, we proposed to examine the trade-offs related to compression. We want to answer the question of Ẅill compressing data result in energy savings when the data will be transmitted?Ïn addition, we proposed to consider multi-hop routing topologies. If it is more expensive (energy wise) to compress the data than to send the uncompressed data, we proposed to examine how deep the routing trees must be in order to amortize the energy savings over the entire network as the compressed packet moves up the tree.

2 Accomplished Tasks

We have obtained three data sets from real-life Wireless Sensor Network deployments. The first is a set of accelerometer and gyro data from a body sensor network. The second is the acoustic data of marmot sounds. The third is the seismic data of a network deployed to monitor a volcano. We have calculated the entropy of some of these data sets and found that so far they are not very compressible. However, it is theoretically possible to compress this data by 25%.

We have an LZ77 implementation on a mote. We are currently in the process of loading the data sets into the flash memory of the mote devices and running the compression algorithms on the motes.

We have implemented a simulator that will help us examine the trade-offs once we have the energy data. This simulator will make this analysis easier because we will no longer have to be running experiments on the motes, which is often a tedious and time consuming task.

3 Future Tasks

We plan to measure the energy associated with compressing this data directly from the mote. We will remove the overhead of reading and writing to flash by performing the experiment without compression. Then we will run the experiment with compression and take the difference to remove the overhead.

Once we have the energy data, we will use our simulator to examine the trade-offs related to compression. Our simulator will also help us examine multiple routing topologies and determine if compression is worth the radio power savings under these circumstances. One common problem in Wireless Sensor Networks is that a node is not usually able to transmit power to a neighbor if the neighbor requires it. However, with compression we can do something similar. If a node has data to transmit, it can compress the data (even if it will waste more energy), but the next node in the routing tree will save energy because the data is not as large. In essence, a node is able to pass on the energy savings of compression to another node and this is a useful mechansim that we want to explore in our simulations.

We have about 2 weeks left to finish our project, which we believe is sufficient time to accomplish our future tasks and write the paper.