

HOMEWORK # 4:

DESIGN OF AN UNDERWATER SENSOR NETWORK ROUTING PROTOCOL

Design your own routing protocol for an underwater sensor network that operates on acoustic links.

Use the UWAN-MAC protocol for your MAC layer.

You must design a novel routing protocol. You will be graded on:

(1) Originality: (compared with your classmates' solutions, and against the existing ideas in the literature).

(2) Technical soundness.

A. The set-up of the problem is as follows:

(1) You have an underwater network of 100 sensor nodes. There is a single collection site that is located on the bottom of a buoy. The 100 sensor nodes are randomly deployed. They generate CTD (conductivity-temperature-depth) measurements at a rate of roughly 5 kbits/hour, UNLESS an important event happens. There are already detectors built into the sensors to observe such important events. When an important event happens, the sensor node starts sampling more frequently and starts generating much more data (up to 10 times the amount of data that it usually generates). This activity is called "adaptive sampling"; when an important event is detected, the sensors start sampling at a much higher rate. After the event goes away, the sampling rate goes back to normal. (This adaptive sampling function is already built into the sensors, so it has already been designed.)

(2) You need to build a routing protocol. Note that UWAN-MAC has no support for data acknowledgements. If a collision happens, UWAN-MAC does not have any built-in data retransmissions. You have to decide whether or not such retransmissions will be necessary. If your routing protocol assumes ACK's (either link layer, or end-to-end), you have to build that in, explicitly. Any design decisions must be appropriately justified.

(3) If you will use routing tables, you need to decide what will be held in the routing tables, and how the routing tables will be updated. (Note: You do not have to have routing tables. It depends on the design of the routing protocol you propose.)

B. Your routing protocol must be cognizant of the following issues:

(1) The propagation delay of the underwater acoustic medium. UWAN-MAC solves this problem to a large extent; however, the routing protocol must be still cognizant of this fact, as there are interactions between the MAC and routing layers.

(2) If you need to develop a topology control protocol, for your routing protocol to work, you must also develop that protocol (jointly) in detail. If you are assuming a certain simple topology control protocol, you must state your assumptions clearly.

(3) You have to realize that localization underwater is difficult to do. If you will need localization, you must develop appropriate localization schemes that make sense and which can be implemented in practice.