



UWSN Kickoff meeting, Mar. 28th, 2006

Power Issues in Underwater Wireless Sensor Networks

Yunsi Fei

Department of Electrical and Computer Engineering
University of Connecticut



UConn



Power issues in UWSNs

- Design goal of UWSN: Long operation time
 - low power
 - Energy saving becomes more critical
 - ◆ Acoustic communications, memory, air-bladder, etc., more power-hungry
 - ◆ Energy harvesting difficult: solar and wind energy are not available
- Energy-efficient design and resource management
- Lifetime estimation

Energy-efficient design at the node level

- Design choices: ASIC, ASIP, FPGA, microcontroller
- Power-efficient design of individual components
 - Acoustic communication modules
 - Flexible packet relaying circuit
 - ◆ Only wake up the microcontroller when needed
- Proper task assignments and scheduling
 - Sampling, processing, storing, transmitting, receiving, and forwarding
- Exploiting opportunities in the underwater environment
 - Long and frequent sleep mode due to the long delay of acoustic channels

Power management at the network level



- Power-aware routing algorithms
 - Short-range vs. long-range communications
 - Reliability vs. energy trade-offs
- Power-aware localization algorithms
 - Accuracy vs. energy trade-offs
- Configuration strategy
 - Choosing working parameters adaptively in the field
- In-network computations
 - Utilizing short-range one-hop communications
 - Balance the power consumption of nodes located in different areas



Lifetime estimation model

- Impact of network design parameters on power consumption
 - Average one-hop signal transmission distance
 - Data transmission period
 - Acoustic channel frequency
 - Network topology (3-D, distances, clustering, etc.)
 - Sensor lifetime
- Simulation of UWSNs
 - Hierarchical energy model
 - Output: statistic information, e.g., data communication throughput, retransmission rate, data drop rate, average power consumption, and sensor network lifetime.
 - Current practice: PowerTOSSIM adaptation by Jeff Wroten (CompE senior)