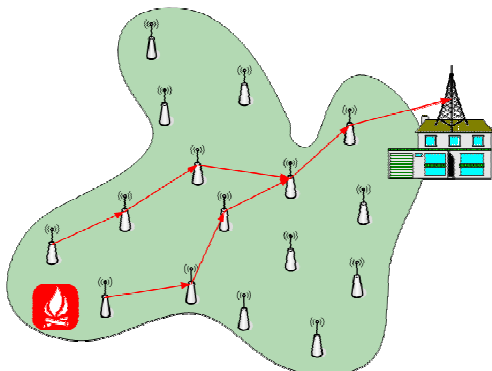# Real-Time and Energy Considerations in Designing Communication Protocols for Wireless Sensor Networks

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Real-Time Applications.

An example: forest fire detection

Communication node capabilities

- wireless communication
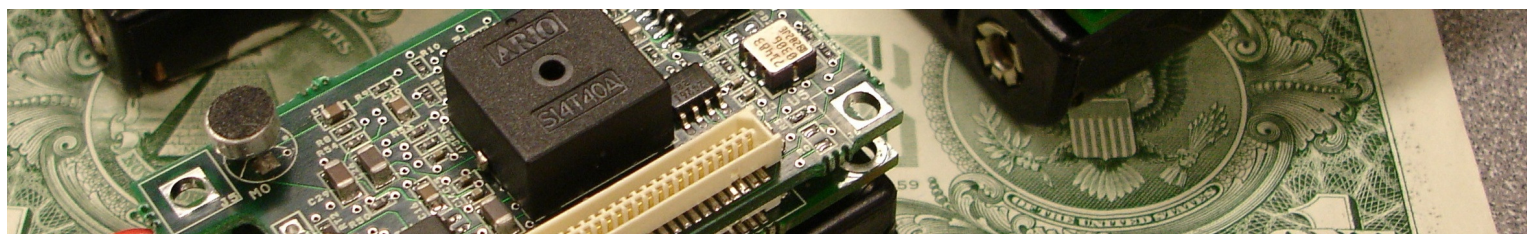
- multi-hop ad-hoc communication

Constraints

- embedded systems: limited energy, power, bandwidth
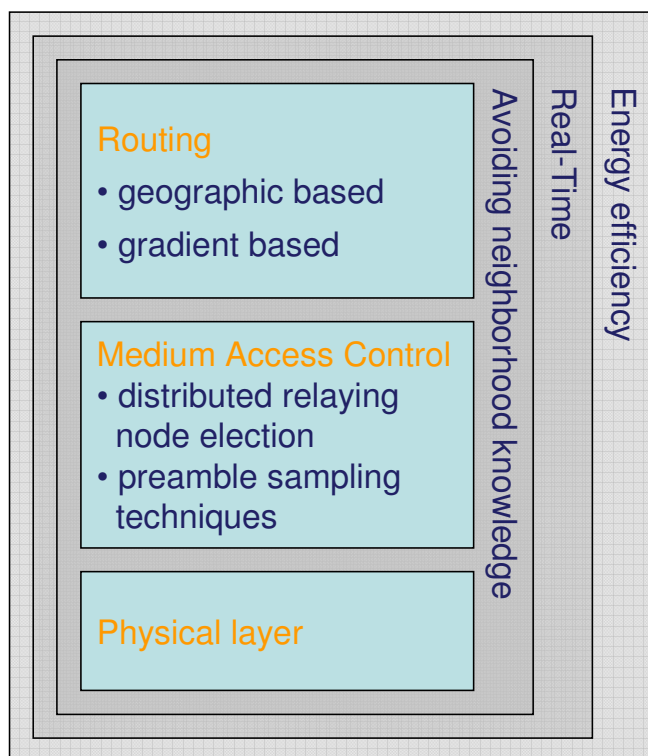
- random deployment

Goals

- network lifetime (5+ years)

- real-time communication constraints (end-to-end delay)

- robustness (topological changes due to node failure)

New protocol proposals using a cross-layer design approach.

Routing

- geographic based

- gradient based

Medium Access Control

- distributed relaying node election

- preamble sampling techniques

Physical layer

Energy efficiency | Real-Time | Avoiding neighborhood knowledge

Communication architecture

Formal Validation.

- **Behavior** of the communication architecture

- **Timeliness** behavior: real-time constraints

Timed automata based modeling and model-checking methodology *(UPPAAL)*

Simulation.

Study the communication architecture's performances:

- energy consumption, lifetime

- timeliness

Event-driven simulation *(GTSNetS, OPNET Modeler)*

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