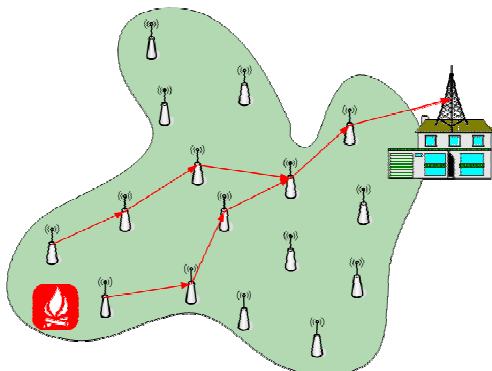


Real-Time and Energy Considerations in Designing Communication Protocols for Wireless Sensor Networks

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Real-Time Applications.



Communication node capabilities

- wireless communication
- multi-hop ad-hoc communication

Constraints

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

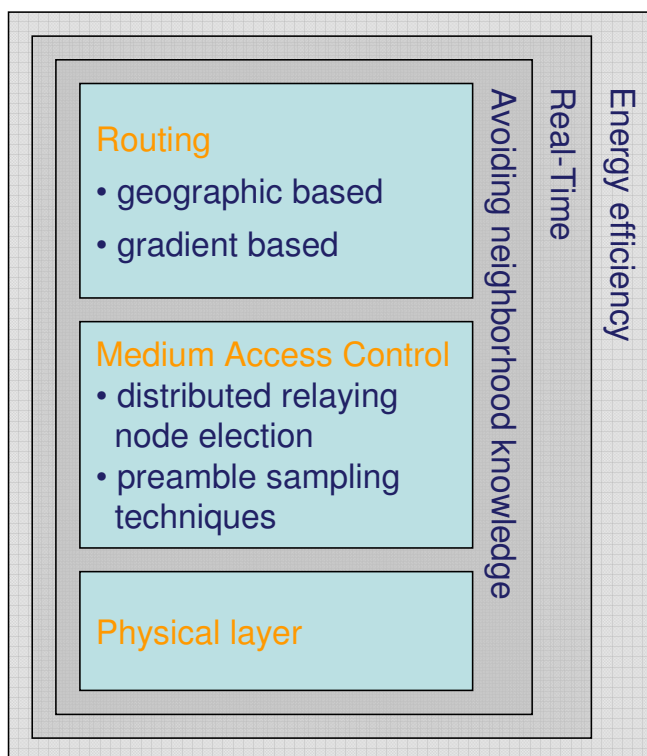
Goals

- network lifetime (5+ years)
- real-time communication constraints (end-to-end delay)
- robustness (topological changes due to node failure)

An example: forest fire detection



New protocol proposals using a cross-layer design approach.



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*)