



Energy-efficient autonomous communication architecture for wireless sensor networks

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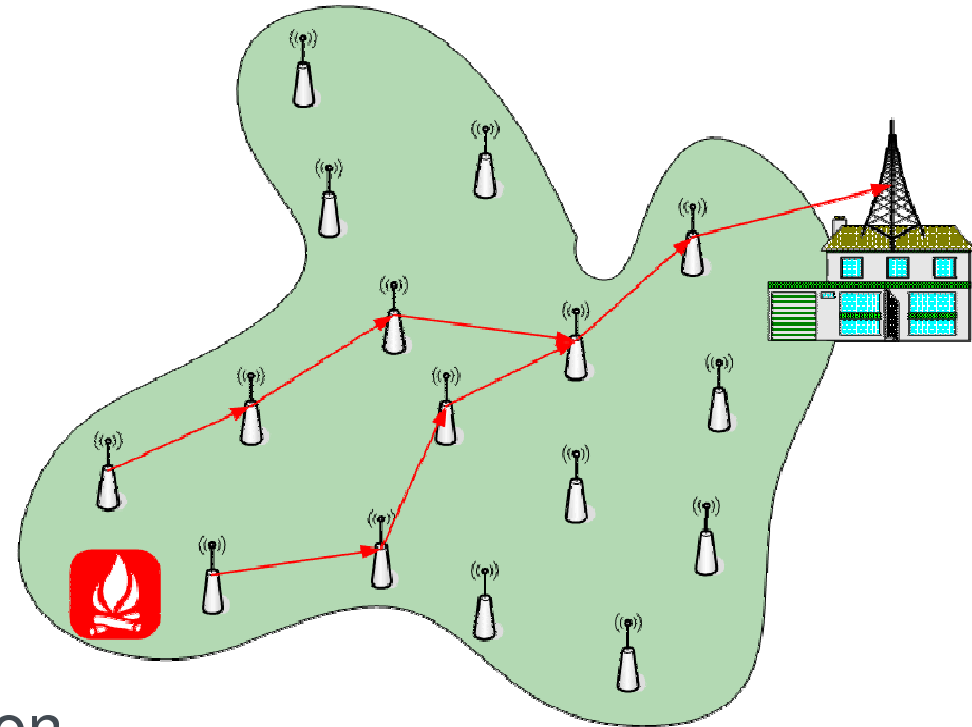
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Wireless Sensor Networks

- No fixed infrastructure
- Changing topology
- Multi-hop communication (many-to-some)



- Autonomous communication
- Scarce energy source
- Very low data rates



Directions

On-demand vs. proactive

- Very low data rate (e.g. one message per day)
- Low energy, "no messages, infinite lifetime"
- Generally "on-demand" solutions

Routing information

- On-demand solutions to be adopted
- Implicit organization -> geographic-like solutions
- Gradient based techniques, with low-energy setup phase

Increase lifetime

- Turn off the radio
- Scheduling sleep/wakeup cycles
- Preamble sampling MAC protocol
- Integrated cross-layered design



Performance Evaluation

Formal validation methods

- Validating parts of the system

Simulation

- Get a broader general idea of the system's performance

simulator	Cost	Ease-Of-Use	Extensibility	Scalability (# of nodes)	PHY	Power cons. model
OPNE I	Expensive	Graphical	Hard and expensive	1,000	11 stage fine model	None
Ns-2	Free	~flat (C++/Tcl)	Possible, open-source	1,000	3 models	None
GTSNetS	Free	Object-oriented (C++)	Easy, open-course	100,000+ (libsinc)	Complete 802.11	Wireless Sensors



Future Work

Medium Access

- Integrated Preamble-sampling

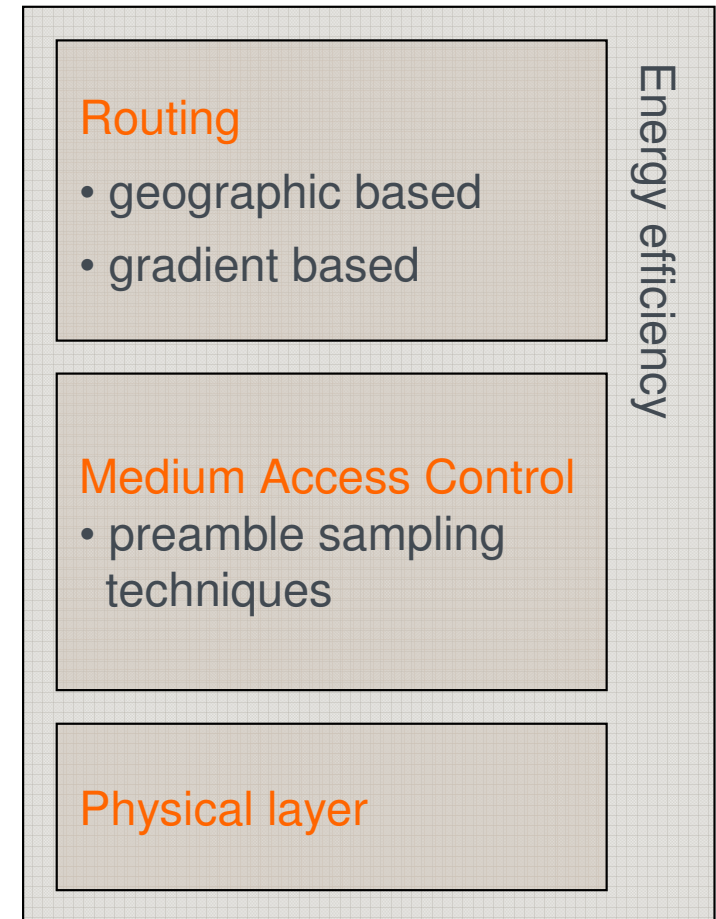
Autonomous communication

- Efficient setup phase
- How/when to update heights ?

Routing

- Adapting geographic routing concepts to gradient based routing

Cross-layering issues



Publications

Thomas Watteyne, Isabelle Augé-Blum and Stéphane Ubéda , *Dual-Mode Real-Time MAC Protocol for Wireless Sensor Networks: a Validation/Simulation Approach*, First International Conference on Integrated Internet Ad hoc and Sensor Networks (InterSense) [ACM], Nice, France, May 30-31, 2006.

Thomas Watteyne, Isabelle Augé-Blum and Stéphane Ubéda, *Formal QoS Validation Approach on a Real-Time MAC Protocol for Wireless Sensor Networks*, INRIA Research Report, RR-5782, December 2005.

Thomas Watteyne and Isabelle Augé-Blum, *Proposition of a Hard Real-Time MAC Protocol for Wireless Sensor Networks*, IEEE MASCOTS (Modeling, Analysis, and Simulation of Computer and Telecommunication Systems), Atlanta, USA, September 2005.

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