



ALBERT-LUDWIGS-
UNIVERSITÄT FREIBURG

Algorithms for Radio Networks

Wireless Sensor Networks - Special Problems

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WSN

Types of Applications

- ▶ **Types of interaction between source and sink**
- ▶ **Event detection**
 - nodes detect events
 - report to sinks
- ▶ **Periodic measurement**
 - environmental data collection, tracking
- ▶ **Approximation of a function**
 - sensor network approximates a function of environmental data
 - e.g. temperature map

WSN

Types of Applications

▶ **Border detection**

- Find limits or other structure
- e.g. fire border, freezing border

▶ **Tracking**

- position detection or tracking a target object
- e.g. intruder alarm, rare animal detection

Placement of the Mote

- ▶ **How are the sensors?**
- ▶ **Ejected from aircraft**
 - random deployment
 - results in uniform random distribution
 - theoretically, often considered rare in practice
- ▶ **Planned placement**
 - regular deployment
 - depends on the task

Placement of Motes

► Mobile sensor nodes

- can move
 - e.g. to improve insertion site
- passive transport
 - wind, water, parasitic
- search for area of interest

Maintenance of the Network

- ▶ **Is it possible to supply the sensor nodes**
 - battery replacement
 - replacement of defective equipment
 - software update
 - Necessary?
- ▶ **Energy supply options**
 - limited
 - with power supply
 - from network
 - from the environment, e.g. solar cells

Typical Requirements

▶ **Service of a WSN**

- not (only) message forwarding
- application is in the foreground, e.g. measurement of environment
- geography is part of the WSN
- other networks see geography as obstacles

▶ **Quality of service**

- differently than in traditional networks

Typical Requirements

▶ **Fault tolerance**

- Node failure should be compensated
 - empty batteries
 - destruction

▶ **Lifetime**

- Lifetime of the network as an important node

Typical Requirements

▶ **Scalability**

- Large number of nodes possible

▶ **Density can vary greatly**

- node density depends on application

▶ **Programmability**

- in the field may be necessary nodes need to be reprogrammed
- i.e. programming via radio

Typical Requirements

► Maintainability

- WSN has to adapt to change
- Self-control and self-monitoring
- Loss of nodes, and (re) admission of nodes is normal

Necessary Mechanisms

- ▶ **Multi-hop routes**
 - Accessibility, energy efficiency
- ▶ **Energy-efficiency**
 - communication, computation, sensors, actuators
- ▶ **Self-configuration**
 - Manual configuration is not possible
- ▶ **Cooperation and computation within the network**
 - nodes in the network to work on common goal
 - processing of data in the network can increase efficiency

Necessary Mechanisms

▶ **Data-centric networking**

- focus is on data, not the node IDs (id-centric networking)
- increases the efficiency

▶ **Locality**

- Where possible process data locally

▶ **Trade-Offs**

- energy versus accuracy
- latency versus efficiency



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