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## Protocols for Sensor Networks and Embedded Networking

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19 July 1999

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## Embedded Networking Today

We know how to *build* lots of small, cheap sensors.

Their use will *everything* about how computers and people interact with the physical world:

- security
- condition-based maintenance
- industrial automation
- health-care
- smart spaces and ubiquitous computing

**But how can we affordably *develop*, *deploy* and *maintain* sensor networks?**

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### **SCADDS Research Goal**

Coordination and control algorithms for  
large scale,  
highly dynamic,  
unattended,  
distributed systems.

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### **Sensor Network Challenges**

Dynamics:

- dynamic operating conditions: node movement, addition, failure
- resources dynamics: changing energy, communications
- dynamic task assignment

Scale:

- many computer per person
- 1000s of nodes

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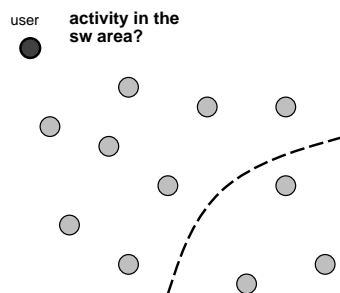
### Research Themes

- *exception-free* operation (assume continual change)
- *empirically adapt* to observed environment
- use *localized interactions* to produce desired global behavior

Two algorithms: data diffusion, adaptive fidelity.

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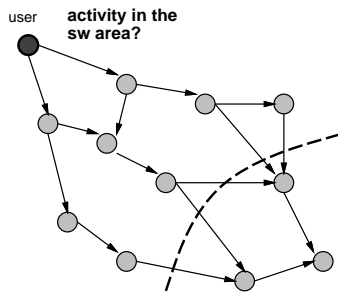
### Data Diffusion



Replace end-to-end routing with data-driven queries.

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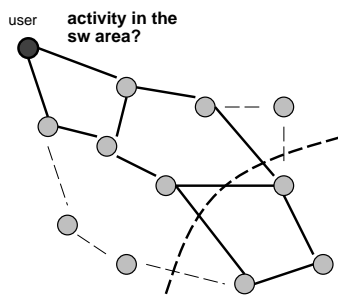
### Data Diffusion



Replace end-to-end routing with data-driven queries.

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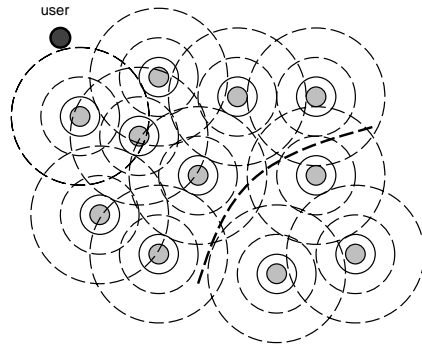
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Replace end-to-end routing with data-driven queries.

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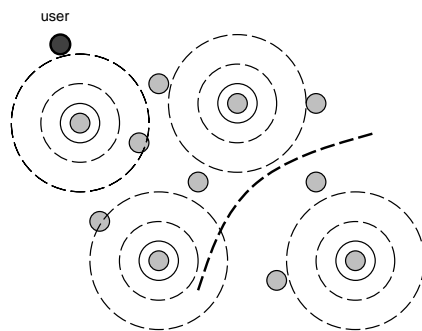
### Adaptive Fidelity



Optimize use of many sensors (conserve power, improve answer).

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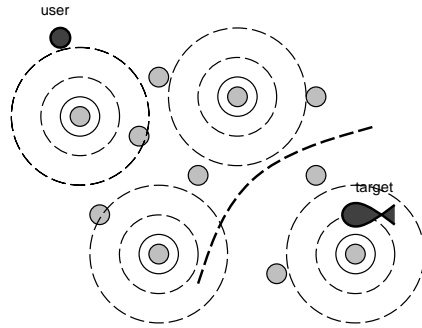
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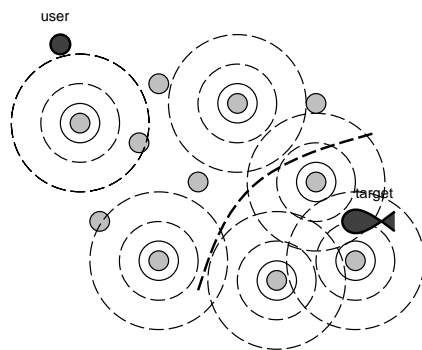
### Adaptive Fidelity



Optimize use of many sensors (conserve power, improve answer).

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### Adaptive Fidelity



Optimize use of many sensors (conserve power, improve answer).

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**More Information**

<http://www.isi.edu/div7/scadds/>

*Next Century Challenges: Scalable Coordination in Sensor Networks* by Estrin, Govindan, Heidemann, and Kumar. To appear, Mobicom '99.