Clonal Plasticity & Operator Placement

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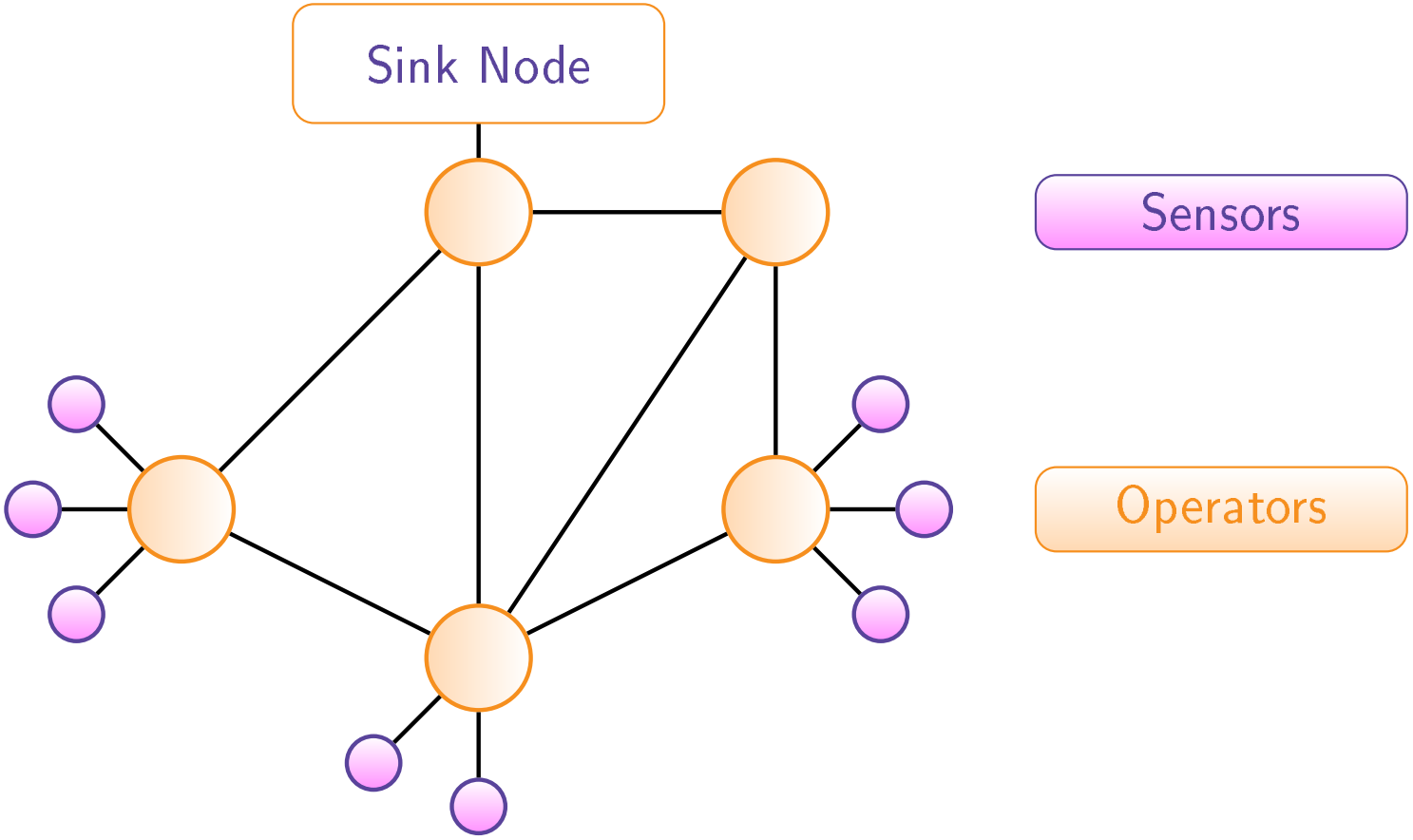
Domain: Operator Placement in Wireless Sensor Networks



The Problem

1. Cost of data transmission is at least two orders of magnitude greater than computation

2. Depending on number and position of operators, cost of operation varies widely for the same sensor network

3. Complicating factors:
   - 3.1 Sensor input changes with time
   - 3.2 Physical topology is difficult to change

Enter: Collaboration

Prior Art

Many complicated algorithms to determine optimal operator placement

Multiple Queries

do not play well with each other

1. Multiple sinks – multiple data input profiles
2. Simple model of collaboration

Use notion of *clonal plasticity*

1. Metaphor borrowed from plants
2. *Ramets* clone themselves
3. Deal with lack of sunlight, lack of nutrients, competition, etc.
4. The cloned ramet is subtly different from the original

Questions from "plasticity and its ecological implications..."

If you decide to clone an operator node...

- How much information should the clone share with the original?
- How do you decide *where* to clone?
- How do you decide *when* to clone?

When to clone – *Continuous Adaptation*

Basic Idea

- No 'monitoring' or 'planning' component at all
- The decision to clone, or not, is a result of evaluation of *forces*
- In contrast to classical self-adaptive systems' MAPE Loop

Where to clone – *Continuous Adaptation*

Basic Idea

- Whichever part of the network has resources
- Cloning may result in redundancy
- Or competition
- Allow for operator 'death'

Challenges in Continuous Adaptation

Open Questions (perhaps already answered in ecology?)

- Identification of *forces* that are natural to sensor networks, **and** in opposition
- Efficient calculation of the values of these forces

Measuring Plasticity: Axes of plasticity

- Axis of Distance
  - Phalanx
  - Guerilla
- Axis of Information Sharing
  - Integrator
  - Splitter

Does that help us?

- On what basis do we choose which end of spectrum?
- What does success look like?
  - Is the adaptation good?
  - Is it due to clonal plasticity?

Current status in implementation

- Experimenting with real WSN is expensive
- Two levels of simulation, simultaneously:
  - Simulation of clonal plasticity with low-fidelity
  - Simulation of high-fidelity WSN
  - Eventually – unify

That's all, folks!

Suggestions? Comments?