System Policies for Gradual Tuning of Security and Workload in Wireless Sensor Networks

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Outline

Wireless Sensor Networks

Composed of a large number of nodes:

- small;
- inexpensive;
- capabilities:
  - sensing,
  - processing,
  - communication.

Energy In WSN Nodes

- Local power source:
  - limited;
  - non-replaceable;
- not enough
  for environment monitoring applications:
  - energy harvesting.

Security for WSN

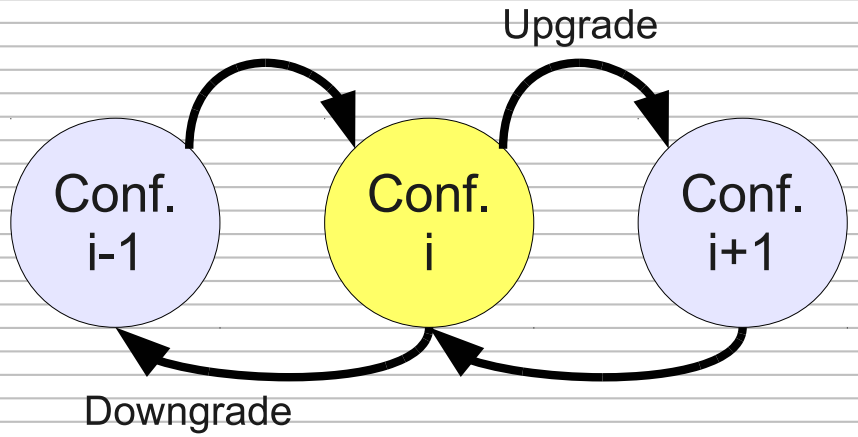
- Required by many applications;
- resource consuming;
- increases consumed energy;
- static.

Problem Statement

There may be periods of time in which the energy available is very limited.

- Goals
  - Maximize the number of running tasks.
  - Maximize task security level.
- Constraints
  - Satisfy task security requirements.
  - Satisfy constraints on energy consumption.

Gradual Adaptation



- Different **contiguous** configurations are adopted at each step.
- Adaptations governed by policies:
  - for tasks;
  - for self-adaptation.

Task Policies (1/2)

- Security:
  - algorithms classified by:
    - resources/energy requirements;
    - security level (classes of algorithms).
- Period
- Execution status

Task Policies (2/2)

- Task priority
- Adaptation order:
  - Auto
  - Security first
  - Period first
  - Suspend only
  - None

Self-adaptation Policies

- Task selection criterion:
  - Most energy-demanding tasks
  - Less-degraded tasks
  - Lower priorities first
  - Least recently-started tasks
- Number of tasks to be adapted
- Monitoring period

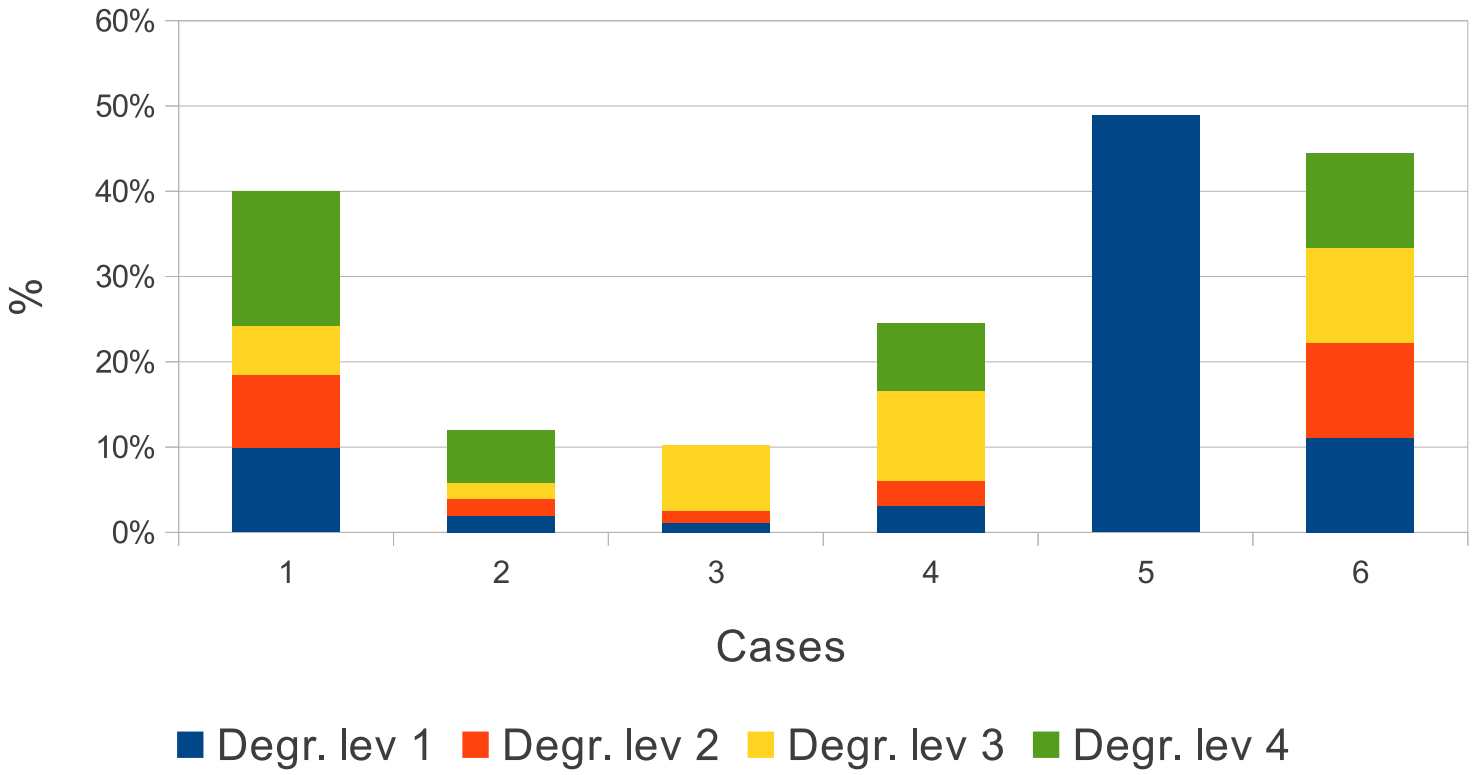
Case Study

- WSN composed by Sun SPOTs (Sun Small Programmable Object Technology)
- Secure communication among the nodes and the base station
- Periodic tasks with different sample to collects
- Tasks with different policies

Results: overhead

- Gradual adaptation provides the ability to meet the battery constraint (12 hours)
- Energy overhead of 0.3-0.6%
- Time overhead of 0.3-1.6%

Results: behavior of policies



Tasks degraded for 10-48% of total time.

Conclusions and Future Work

Conclusions:

- The mechanism and the policies allow the system to maximize the number of running tasks, their performance, and their security.
- The policies can be used to customize the behavior of the adaptation system.
- The overhead of the mechanism is acceptable.

Future work:

- The mechanism will be extended to support a more accurate energy consumption estimation.