Federal University of Santa Catarina (UFSC)
Santa Catarina - Brazil

LaPeSD
Laboratório de Pesquisas em Sistemas Distribuídos

A Middleware for OSCAR and Wireless Sensor Network Environments

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Summary

- Introduction and Motivation
- Sensor Networks and Cluster Computing
- Proposed Approach
- Experiments
- Conclusion and Future Works

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Introduction

HABITAT MONITORING STRUCTURAL MONITORING INTRUSION DETECTION
MEDICAL MONITORING MILITARY SURVEILLANCE INVENTORY TRACKING SMART BUILDINGS

Network Computing

Pervasive Computing

Introduction

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Network Computing

Pervasive Computing

HETEROGENEITY

PDAs + clusters + desktops + high performance stations +sensors + cell phones ...

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MOBILITY

Logical and physical

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HIGH DISPONIBILITY OF SERVICES AND DATA

No matter dispositive, place or time

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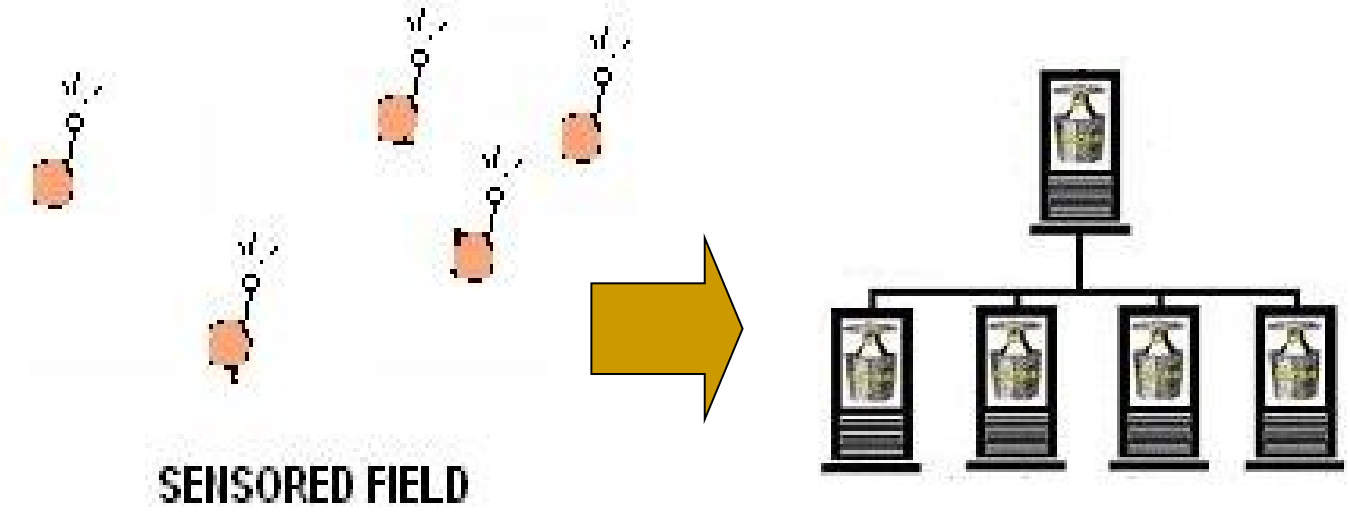
RESOURCE STATE ADAPTATION

Introduction

- Monitoring Issues:
  - High data stream;
  - Generates large amount of information;
  - Answer application tasks



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Introduction

- *Available facilities from OSCAR software environment, represents an interesting option to manage clusters of workstations.*
- *The use of wireless sensor networks has a steady increase in number of configurations and kind of utilizations.*

Motivation

- *Design and implement a middleware prototype, which could creates for a sensor network an extra facility to process tasks inside a OSCAR cluster configuration.*

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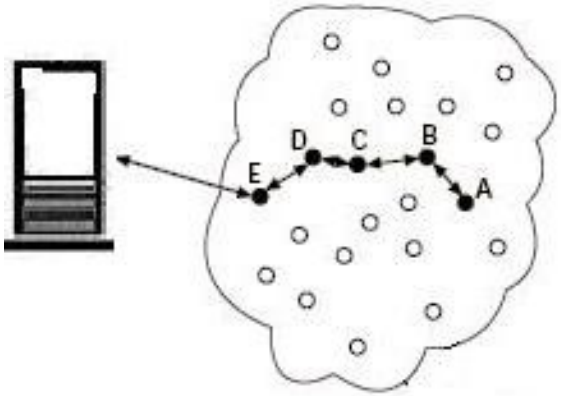
Wireless Networks

- Provides:
  - Software mobility;
  - Faster communication;
  - Low structure cost
- Challenges:
  - Bandwidth;
  - limited resources;
  - frequent disconnections

Wireless Sensor Networks

- Collect data from the environment;
- Brings new paradigms to applications;
- High deployed;
- Energy constricts;
- High information stream;
- Frequently disconnections.
- Communication routing;
- Data fusion.



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Wireless Sensor Networks

- sensor nodes characteristics:
  - Low capacity of processor, communication and battery;
  - Functions: sensor or routing;
  - Can have a level of intelligence;
  - 1 J to transmit 1 bit
  - 0.5 J to receive 1 bit
  - 0.8 J to 208 CPU cycles

OSCAR Cluster Computing

- Manages globally and transparently cluster resources
- Provide some level of security, availability and tools to easy management of the environment.
- OSCAR consists of a fully integrated and easy to install software bundle designed for high performance computing cluster.

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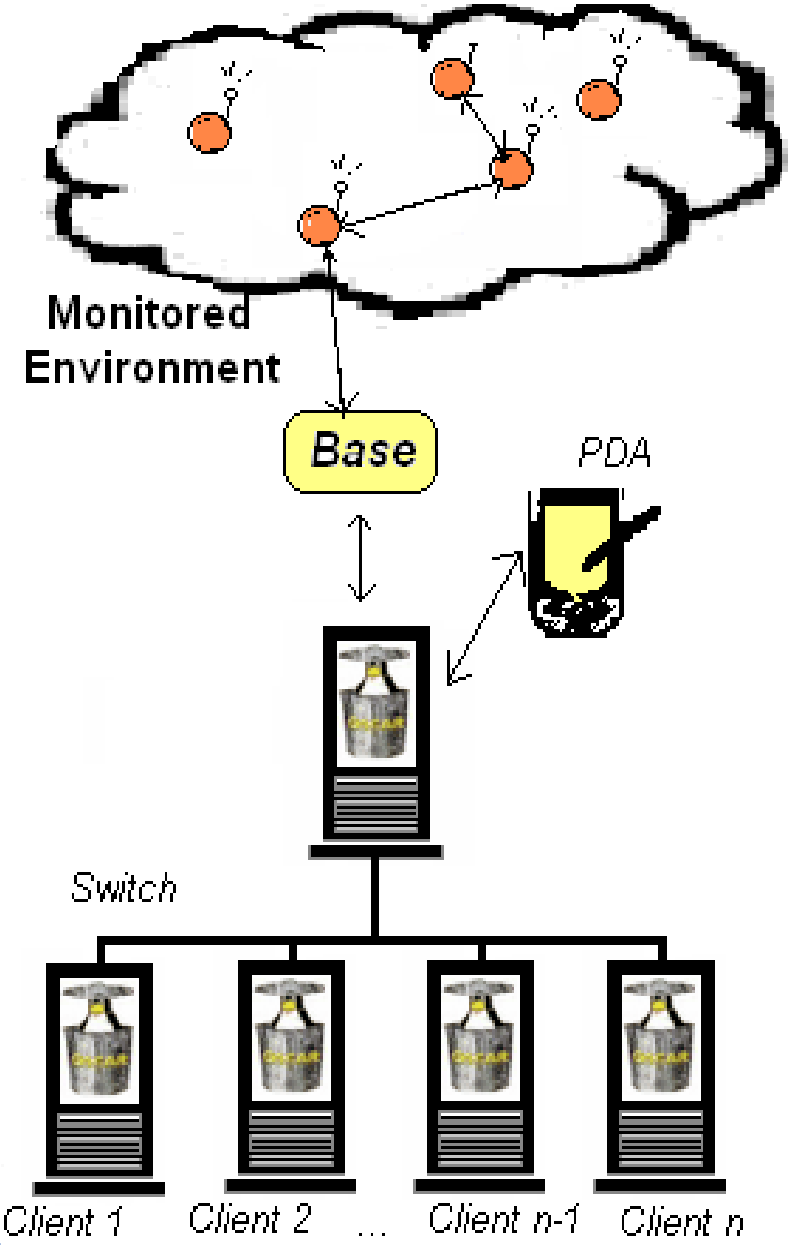
Proposed Approach

- Why integrate wireless sensor networks and Clusters?

  - Sensors are densely deployed on environments;
  - There is a high information stream;
  - Avoid overload the system with so much data;
  - Store large amount of data;
  - Provides remote access
  - OSCAR: a solution to cluster management

Proposed Approach



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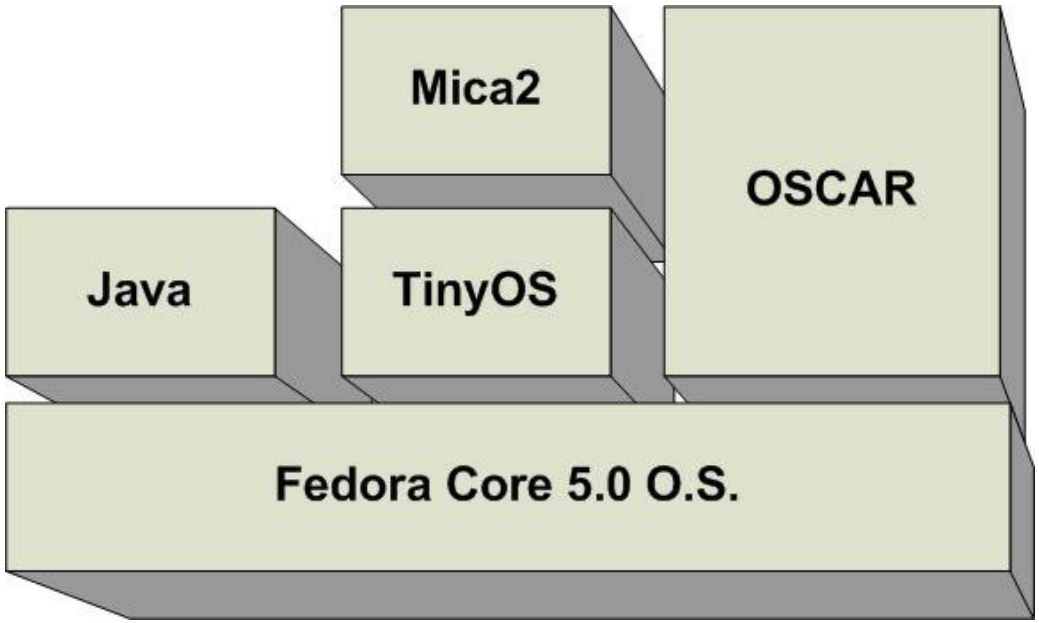
Environment Configuration



- TinyOS: operating system for wireless sensor networks;
- Event driven;
- handles power consumption, radio communication

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Environment Configuration

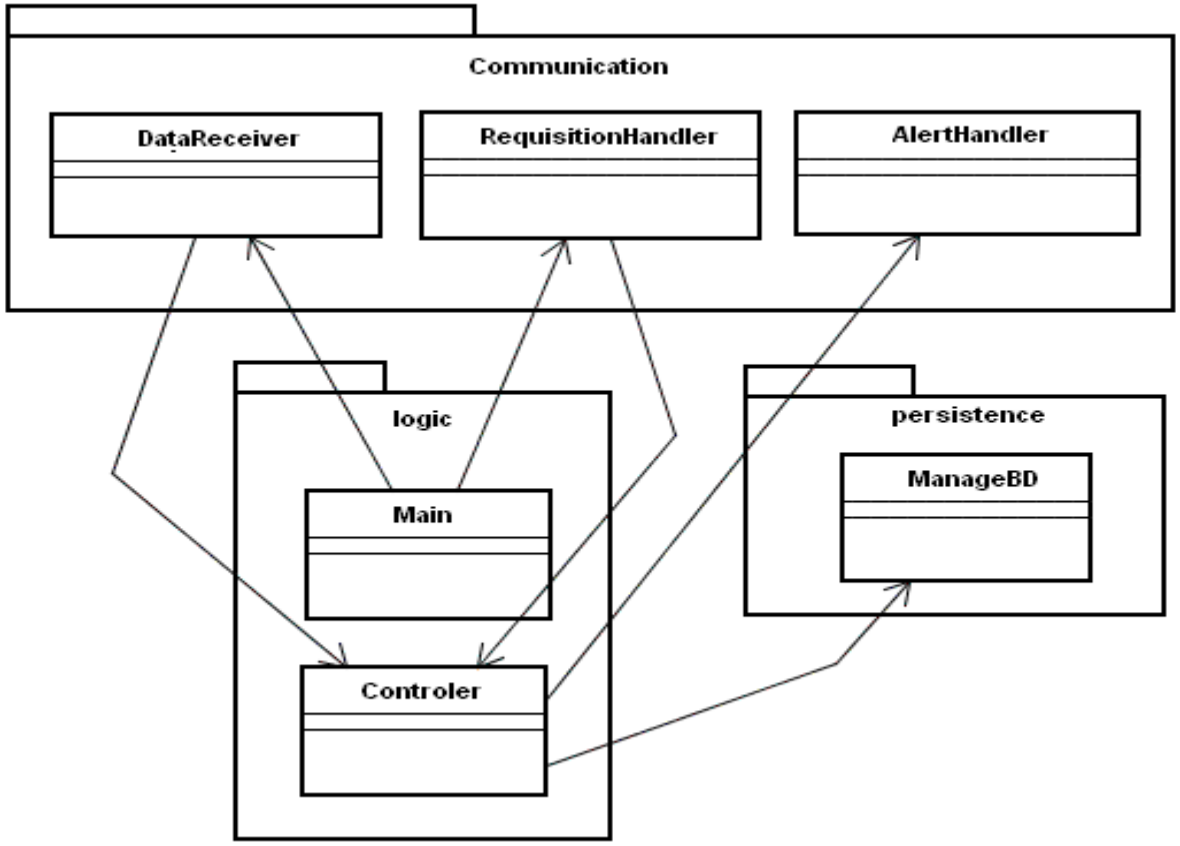
Table 1. OSCAR Cluster Characteristics

Master	Slave	Palm Tungsten
1.8 Ghz	1 Ghz	400 MHz
Pentium IV	Via Nehemiah	Intel XScale
512 Mb	1 Gb	64 Mb
Fedora Core 5.0	Fedora Core 5.0	Palm O.S.

Table 2. Wireless Sensor Network Components

Component	Model	Radio Frequency
Sensor Node	Mica2	915 Mhz
Sensor Board	MTS300	-
Programming Board	MIB510	-

Proposed Approach



Class Diagram

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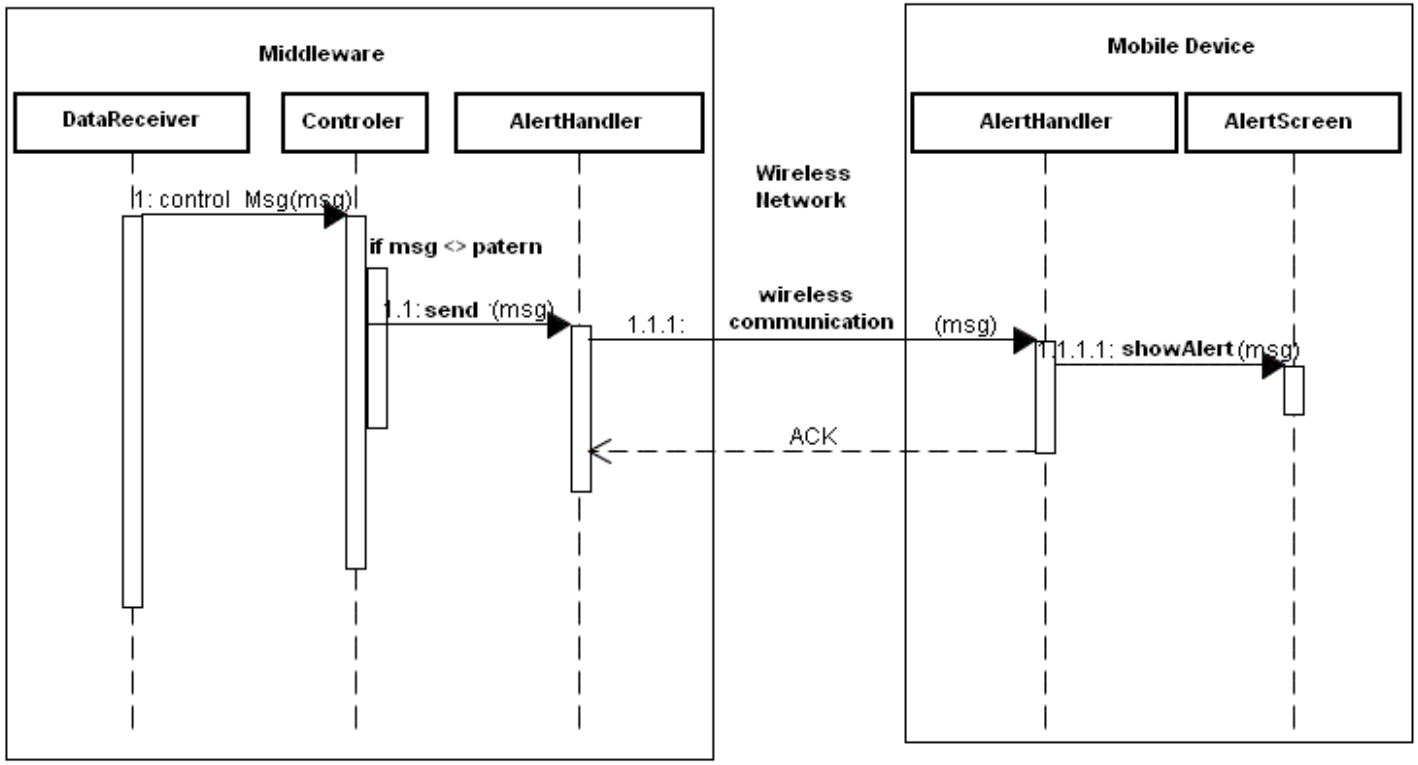
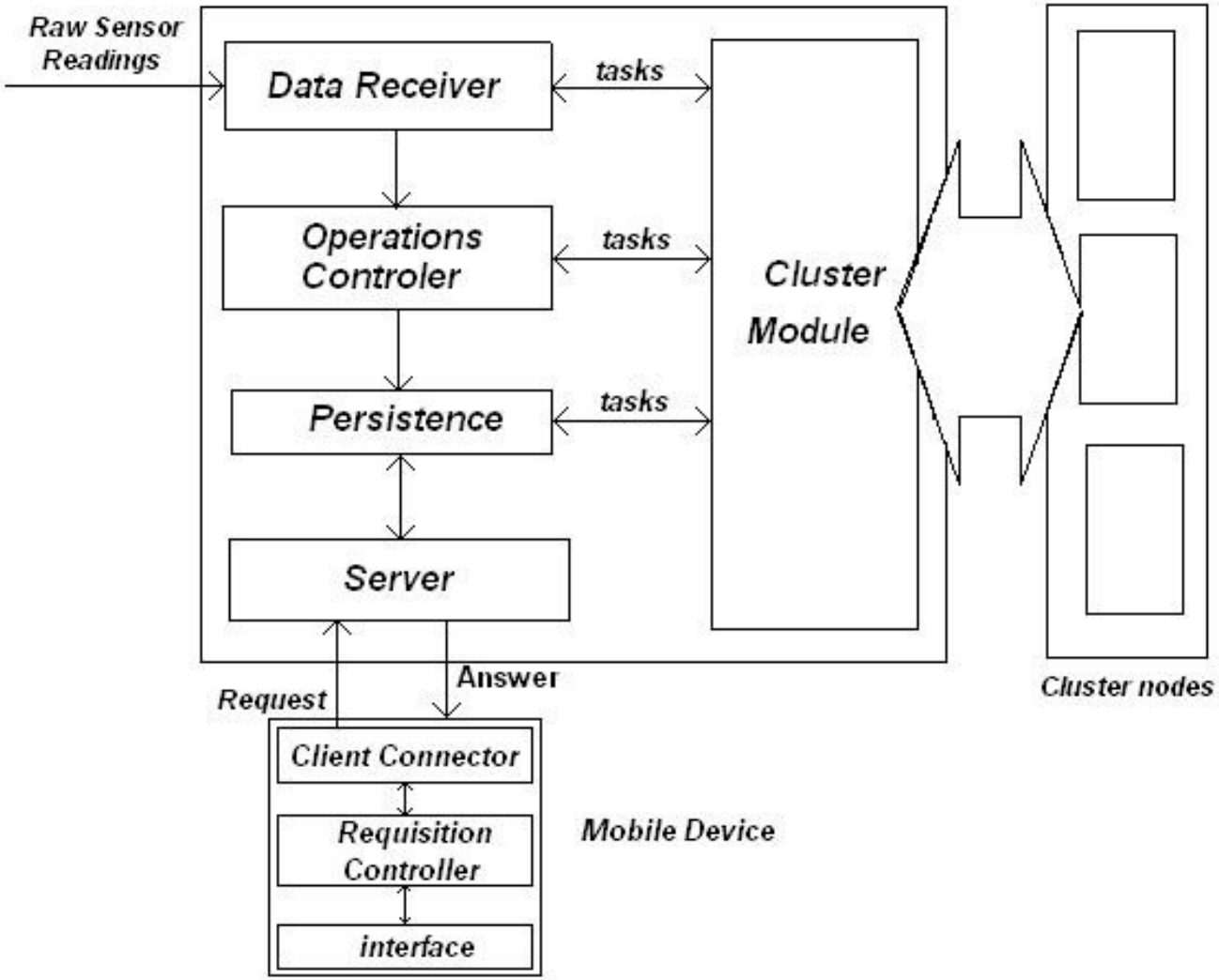
Proposed Approach



Sequence Diagram

The Middleware



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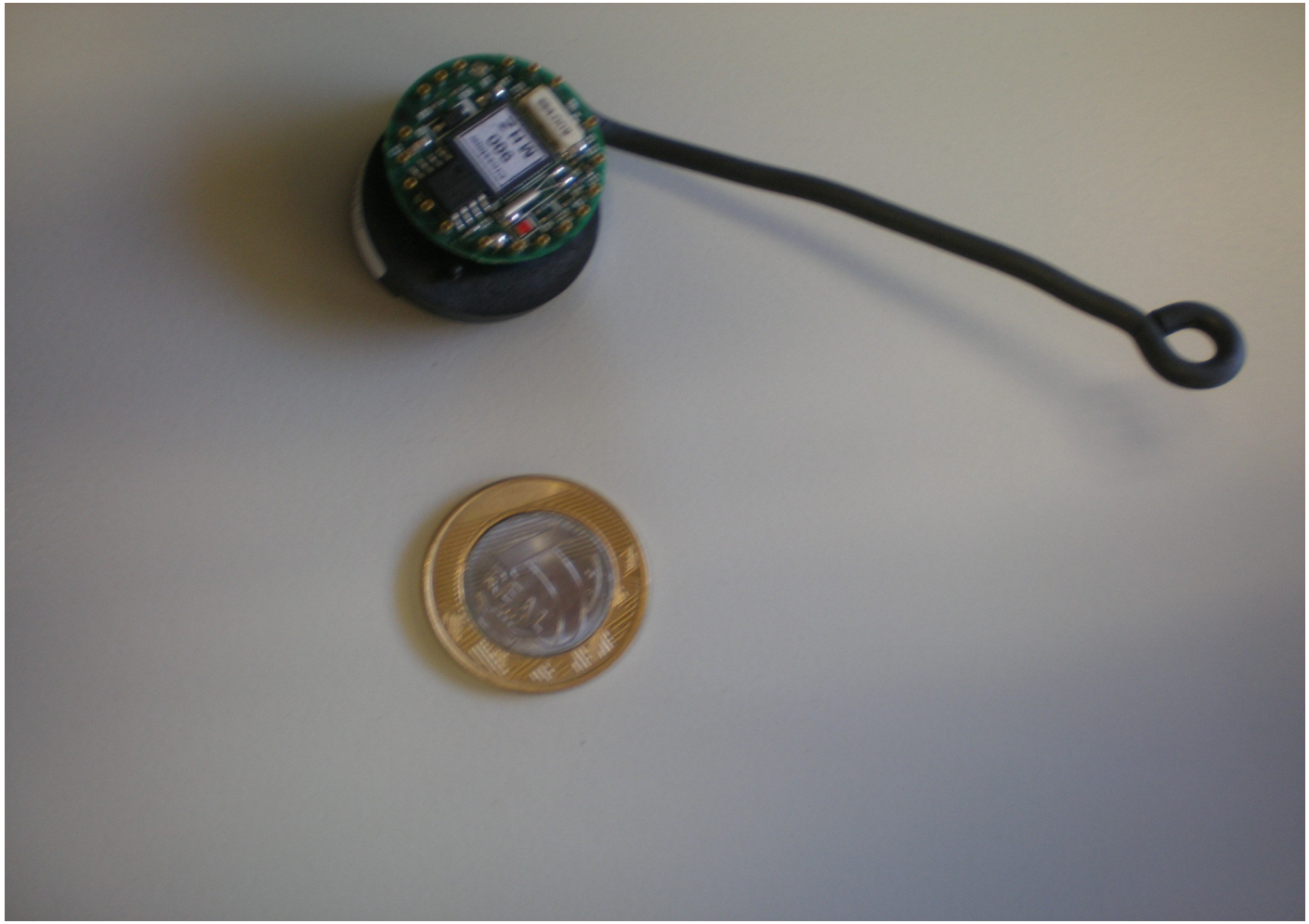

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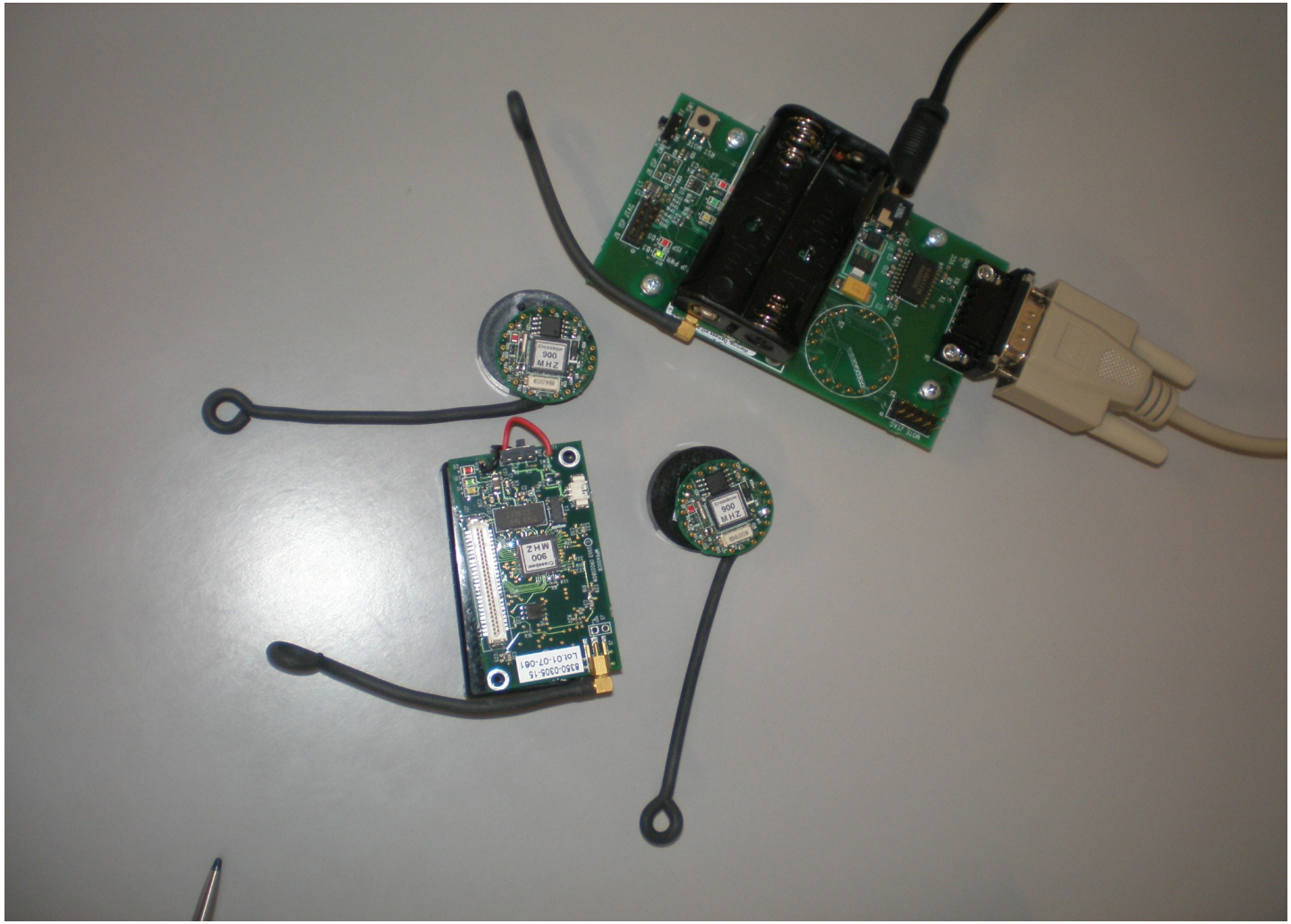

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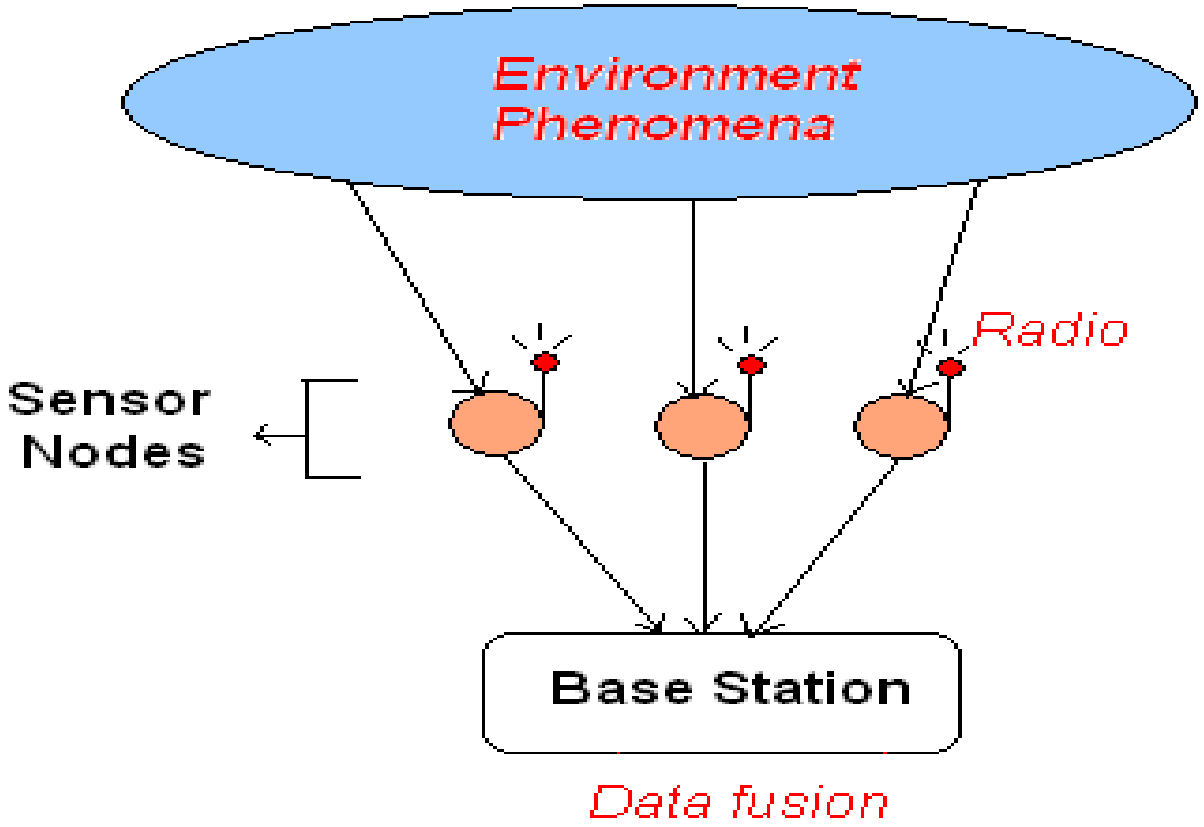

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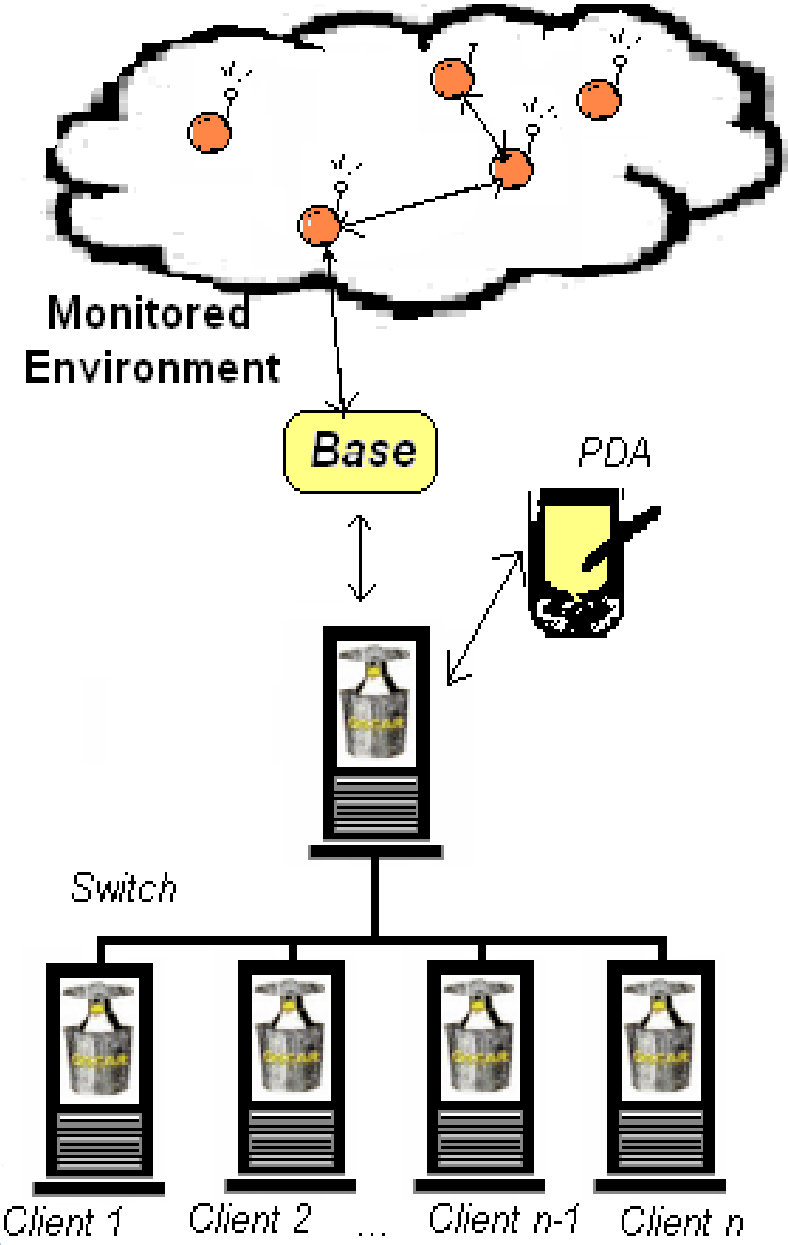

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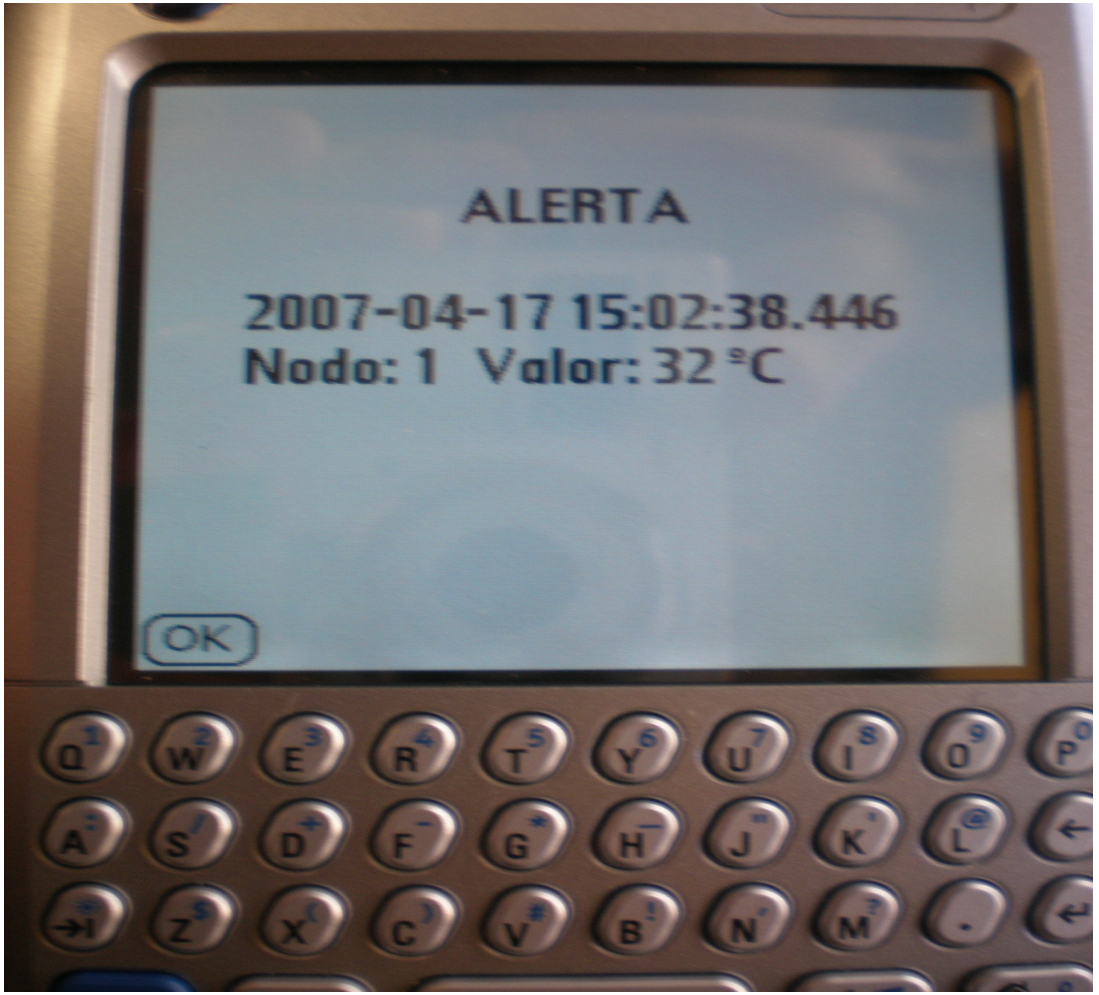

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Conclusion and Future Work

In this article we have presented a middleware that was designed and implemented to improve the processing characteristic of a wireless sensor network through the use of the OSCAR software environment.

Conclusion and Future Work

Our prototype considered:

- a number of motes to sensor a field in a real time;
- data are sent to a *base station* that will send the data to a OSCAR Cluster;
- after a *processing time* the *middleware* notifies *online* a mobile device.

Conclusion and Future Work

Challenges to be solved as a near future are:

- Test the implementation for some routing topologies of sensors;

- Enhance the alerts for different kinds of mobile devices;

- Make available the final version of the middleware for the Oscar Group.

Questions?

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