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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

Network Computing
Pervasive Computing
Introduction

Network Computing
Pervasive Computing

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

Network Computing
Pervasive Computing

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

MOBILITY
Logical and physical
Introduction

Network Computing
Pervasive Computing

HIGH DISPONIBILITY OF SERVICES AND DATA
No matter dispositive, place or time
Introduction

Network Computing
Pervasive Computing
Introduction

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

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

Table 1. OSCAR Cluster Characteristics

<table>
<thead>
<tr>
<th>Master</th>
<th>Slave</th>
<th>Palm Tungsten</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.8 Ghz</td>
<td>1 Ghz</td>
<td>400 MHz</td>
</tr>
<tr>
<td>Pentium IV</td>
<td>Via Nehemiah</td>
<td>Intel XScale</td>
</tr>
<tr>
<td>512 Mb</td>
<td>1 Gb</td>
<td>64 Mb</td>
</tr>
<tr>
<td>Fedora Core 5.0</td>
<td>Fedora Core 5.0</td>
<td>Palm O.S.</td>
</tr>
</tbody>
</table>

Table 2. Wireless Sensor Network Components

<table>
<thead>
<tr>
<th>Component</th>
<th>Model</th>
<th>Radio Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor Node</td>
<td>Mica2</td>
<td>915 Mhz</td>
</tr>
<tr>
<td>Sensor Board</td>
<td>MTS300</td>
<td>-</td>
</tr>
<tr>
<td>Programming Board</td>
<td>MIB510</td>
<td>-</td>
</tr>
</tbody>
</table>
Proposed Approach

Class Diagram
Proposed Approach

Sequence Diagram
The Middleware
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Experiments
Experiments
Experiments
Experiments
Experiments

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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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