Plug & Manage Heterogeneous Sensing Devices

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Outline

- Context and motivation
- Related Work
  - Device Management
  - Management of Sensor Networks
- Management of Sensing Devices
  - Integrated management framework
- Implementation
- Conclusion and future work
Extensive research on processing sensor data

Sensor data processing

SELECT ... FROM ... WHERE ...
What about managing sensors?
What about managing sensors?
Related Work
Device Management

- Remote management of end-user devices (e.g. domotic).
- Integrated management of network, system and application related functions.
- Emerging standards: TR-069 of Broadband Forum, DM of OMA, DM of UPnP, ...

- **Home security**
- **Intelligent Building**
- **Health, urban, environment monitoring**
- **Automation**
- **Application management**
- **System management**
- **Network management**
Management in Sensor Networks

- **Network management**
  - Energy efficient topology management [1], adaptive routing [2] and reconfiguration [3]

- **System management**
  - System software update on sensors [4], dynamic reconfiguration[5], performance monitoring [6]

- **Application management**
  - Scripts on virtual machines [7], software bundles on modular environment [8] and mobile agents on middleware [9].
Management in Sensor Networks

• Network management
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Solutions are sensor and domain specific

No generic integrated management mechanism
Management of Sensing Devices
Management in sensors’ context

• Sensors more and more present in critical applications (e.g., industrial, domotic, medical)
• Efficient management necessary for better quality of service, reliability, security and integrity.
• Existing work deals with either network, system or application management.

We propose a management mechanism having

• 3 main functions: software management, configuration and performance monitoring
• a hierarchical architecture based on the manager-agent model
• a simple and extensible data model, and a set of generic management operations
Data model and management operations

- A simple Management Information Base (MIB)
- Hierarchical extensible data model
- Generic Management Operations
  - get, set, act, notify

```
get("/GeneralInfo/MeasurementType")
Get all measurement types of the sensor

set("/Configuration/SamplingRate","1000")
Set the sampling rate of the sensor to 1000 ms.

act("install","SoftwareURI")
Install a software module from the given URI

notify("/Software/OS/Version")
Notify when the OS version is modified
```
Implementation

Prototype implemented on the top of SSStreaMWare [10], a service oriented middleware for sensor data management middleware:

SSStreaMWare

SQS : Sensor Query Service
GQS : Gateway Query Service
PQS : Proxy Query Service

Query GUI

SELECT ...
FROM ...
WHERE ...

Region A

Region B

gateway

adapters
proxies

sensing
devices
XSStreaMWare: eXtending SSStreaMWare for management

Manager/control site

Sub-manager/gateway

GMS: Gateway Management Service
PMS: Proxy Management Service

get, set, act, notify

Management GUI

SMS: Sensor Management Service

Region A
Region B

Sensing devices
Adapter agents
Proxy agents
Conclusion

- Sensors more and more numerous and heterogenous in various applications requiring quality of service
- They should be efficiently managed
- A simple, extensible, scalable management mechanism is needed
- XSSstreamWare: eXtending SStreamWare for management
Conclusion and Future work

- Sensors more and more numerous and heterogeneous in various applications requiring quality of service
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- A simple, extensible, scalable management mechanism is needed
- XSStreAMWare: eXtending SStreAMWare for management

- Integrating more sensing devices
- Dealing with non-functional properties
  - security, reliability, transactional integrity...
- Autonomic management
References