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Outline

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Introduction
Introduction

- Provide secure monitoring services, supported by flexible and cheap systems, in areas where ordinary networks are unsuitable is one of today interesting challenges

- Wireless Sensor Networks represent a promising technological solution but resource constraints and exposure to external attacks could limit their employment
Introduction

• In such a context, this work focuses on design and implementation issues of a security framework suitable for WSN monitoring applications.

• We have exploited the Platform-Based Design methodology to define a Secure Platform.
  – In particular, the distributed nature of the problem led us to consider an agent-based approach.
Platform-Based Design
Platform-Based Design

• Architecture of the proposed framework
Platform-Based Design

• Main design choices
  – Clustered network topology for the underlying WSN
    • Cluster heads host functions related to the cluster as a whole while ordinary cluster members host node-specific functions
  – Static SW components (SWC)
  – Agent-based Middleware
    • We have exploited the AGILLA middleware

• Application Execution Environment
  – Composed by the SWC API and the MW services set
Platform-Based Design

- Mobile Agents AEE
  - Agents implement cluster-domain functions
  - SWC implement node-domain functions
Secure Platform Internal Architecture
Secure Platform Internal Architecture

• Two main security functions should be mapped to mobile agents and SW components
  – Intrusion Detection System (IDS)
    • Based on Weak Process Models
  – Cryptographic Scheme (CS)
    • Based on Topology Authenticated Key Scheme (TAKS)
Secure Platform Internal Architecture

• **IDS function**
  – ADL/TM blocks are mapped into SWC while IRL and IRLA blocks into an agent (Intrusion Reaction Agent)
    • This design choice allows optimal code distribution for those functions that should not be implemented anywhere
      – IRA will be hosted only on WSN cluster heads
Secure Platform Internal Architecture

• CS function
  – CS functions that supports secured data exchange are mapped on a single SW component
Secure Platform Internal Architecture

- Final architecture
PBD using AGILLA agents
PBD using AGILLA agents

- The “mobile-agents”-based MW AGILLA provides several useful functions
  - Tuple Space
  - Neighbor List
  - Agent Migration

However, current version of AGILLA does not allow direct interaction with external SW components
PBD using AGILLA agents

• Therefore we have extended the AGILLA architecture defining new interfaces between external SWC and internal components
  – Communication Unit
  – Neighbors List
  – Tuple Space

• Some of such enhancements have been implemented as an embedded SW stub developed in NesC
Implementation Issues
Implementation Issues

• The AGILLA extension implemented is related to interfacing Communication Unit and SWC
  – A mechanism to make able agents to retrieve information about the radio traffic from the nodes
    • The node-part has been modified to allow the evaluation of some customizable indicators about the radio traffic
    • The interface of the MW has been modified to allow agents to get such indicators
Implementation Issues

• In order to validate such extension (while starting to build the proposed framework) we have developed a simple demo application
  – The final goal is to detect nodes that present a radio traffic indicator out of reference values
• TupleOut, Dynamic, Alarm
Conclusion and Future Works
Conclusion and Future Works

• We have presented an agent-based design of a Security Platform for WSN Monitoring Applications
  – Security functions are executed directly by nodes and complexity in IDS management is reduced due to the use of mobile agents and clustered tree topology

• Currently we are carrying on early experimentations on MicaZ and working on the full implementation of the proposed architecture