A self organizing network management framework for Wireless Sensor Networks

Student: Trang Cao Minh
PhD Advisors: Dr. Boris Bellalta
Dr. Miquel Oliver
Scenario
Management Protocols

- Role Election
- Collection
- Context-aware Reaction
Role Election Protocol

- Self election function
  - threshold = \[w1*Pwr + w2*(1-1/NoNbr)]*w3\]
    - \(w1, w2, w3 < 1\)
    - \(w1 + w2 = 1, w1 > w2\)
    - Pwr: Percent of remaining battery
    - NoNbr: number of neighbors
    - w3: used to adjust the number of managers in network
  - If \(p < \text{threshold} \Rightarrow \) node is a candidate for manager

- Packet Types
  - Role Offer message (ROF): used to self elect as manager to other nodes
  - Role Confirm message (ROC): used to confirm that it agrees a node as its manager
Role Election Protocol
Main process of Role Election Protocol
Packet formats

- **ROF**
  - Message Type (4 bits)
  - Source Address (2 bytes)
  - Destination Address (2 bytes)
  - Hopcount (4 bits)
  - Threshold (4 bytes)

- **ROC**
  - Message Type (4 bits)
  - Source Address (2 bytes)
  - Destination Address (2 bytes)
  - Hopcount (4 bits)
Collection Protocol

• Each node $i$ sends its information to its manager every $T_i$
• Collect Data (COD) message format
  • Message Type (4 bits)
  • Source Address (2 bytes)
  • Destination Address (2 bytes)
  • Location Info (8 bytes)
  • Battery Level (4 bytes)
Context-aware Reaction

- Manager detects a context match event
  - Ex: redundant nodes without affecting to full sensing coverage
- Send Reaction Command (REC) message to nodes in its sub network
- Nodes receive REC, implement the command as requested
  - Ex: turn off sensing function
- REC format
  - Message Type: 4 bits
  - Command Type: 4 bits
  - Number of Reacting Nodes: 2 bytes
  - Reacting Nodes List: 2 * Number of Reacting Nodes
Simulation Parameters

- Area: 200 x 200 m
- Sensing radius: 25m
- Number of Nodes: 10-100
- IEEE 802.11
- Time: 3000s
- Sensing frequency: 10s
- Hello frequency: 100s
- Collecting frequency: 500s
- App Packet Size: 20 bytes
- Decision frequency: 1000s
- Role Election frequency: 1500s
Simulation Results - Packet Deliver Rate

![Graph showing the packet delivery rate versus the number of nodes with different scenarios: w/o DISON, DISON 1-hop, and DISON 2-hop.](image-url)
Average End to End Delay
Percent of Coverage

![Graph showing percent of coverage vs nodes with different conditions: w/o DISON, DISON 1-hop, and DISON 2-hop.](image-url)
Percent of Used Energy
Thank you & Question