Title
Centralized Routing for Resource-Constrained Wireless Sensor Networks (SYS 5)

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Centralized Routing for Resource-Constrained Wireless Sensor Networks

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**CentralRoute:** Centralized routing protocol for motes

**Why centralized routing for motes**

- **Heterogeneous systems:** Collections of motes and microservers working together
- **Utilize heterogeneity**: shift routing decisions from resource-constrained motes to resource-rich microservers

**Centralized routing**

- Addresses problems of distributed protocols
- Provides global view of the entire mote network at each sink

**Heterogeneous Design Principle**

*Use the advantages of one platform to offset the disadvantages of another*

Corollaries for mote routing:

- **Centralize** decision making on a microserver to make routing decisions based on a complete set of information
- **Reduce** memory requirements of motes
- **Program** a significant part of the protocol in a familiar and resource-rich 32-bit environment

**Problems with Distributed Proactive Routing on Motes**

**Distributed Decision-Making with RAM Constraints**

- **Mote-specific problems:**
  - Distributed decision making in conjunction with storage constraints leads to routing instabilities and inconsistencies
  - Limited RAM also creates scalability challenges in terms of network density and network size
- **Additional problems:**
  - **Proactive nature** leads to increased energy consumption
  - **Distance-vector** leads to count-to-infinity scenarios and routing loops

**CentralRoute:** Protocol Details and Performance

**Protocol Details**

- **Runs on both** motes and their sink (microserver)
  - Motes forward control data to microserver
  - Decision-making logic implemented exclusively on microserver
- **On-demand** protocol
  - Tree maintained by data packets
- **Dynamic single-sink** support
  - Sink selected at runtime
  - Motes only send data to (and keep state for) one sink at a time
  - Multi-sink ambiguity resolved in microserver tier
- **Source Routing** used in both directions

**Tree Formulation**

- Motes broadcast beacons only when they wish to join a tree
- Any motes attached to the tree forward join beacons towards shepherd via unicast
- Microserver picks best path using an ETX metric and sends a unicast source-routed reply to the mote
- Mote attaches to tree and uses the last mote on the reverse path as its parent

**Performance**

**Improved connectivity at medium and high densities** due to lack of per-mote neighbor state

**Current status & Future Work**

**Current Status**

- Deployed at Botanical Gardens.
- Field deployment at James Reserve pending

**Future work**

- Utilize global view & centralization nature to design a transmission scheduler for Cyclops image transfer over multiple hops