Flexible Power Scheduling for Sensor Networks

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Nest Retreat
June 2003
What is flexible power scheduling?

A distributed on-demand power-management protocol for collecting data in sensor networks. Power Scheduling aims to significantly reduce energy consumption while supporting fluctuating demand in the network and provide local routing information and synchronicity without global control. Energy savings are achieved by powering down routing nodes during idle times identified through dynamic scheduling.
A node can be in one of six states:

- Transmit (T) - Transmit a message upstream (toward the base station)
- Receive (R) - Receive a message from downstream
- Advertisement (A) - Broadcast an Advertisement for an available reservation slot
- Transmit Pending (TP) - Send a reservation request
- Receive Pending (RP) - Receive a reservation request
- Idle (I) - Listen for advertisements or power down
Actual schedules from a 6 node network.
MultiHopRoute receives messages
MultiHopSend forwards messages
PowerScheduler sends/receives advertisements

"Slackers"
Prototype
Experimental Setup

- Power Consumption
- Network Adaptation

Topology: A 3-hop network. Node 0 is the base station, Node 66 and Node 1 are intermediate nodes, and Node 6 is the sender.
Power Consumption

The measured current at Node 1 over 10 seconds while it is forwarding packets. Node 6 sends a 36 byte data packet once per cycle, every 2.6 seconds. There are 40 time slots per cycle and each time slot is 65 ms.
Network Response Time

Times represent the time when Node 66 reacts to a request for demand from the sending Node 6.

Histogram showing the distribution of 100 response times in the network.

2 cycles = 6.4 s
Network Adaptation

The network recovers from anomalies due to the randomness of positive reservation requests.

Node 1 and Node 66 adapt to fluctuating demand in the network as Node 6 increases and decreases its demand by 2. There are 40 slots per cycle and each time slot is 80 ms.
END