Flexible Power Scheduling

for multihop sensor networks

Barbara Hohlt <hohltb@cs.berkley.edu>

Eric Brewer <brewer@cs.berkeley.edu>

Nest Retreat

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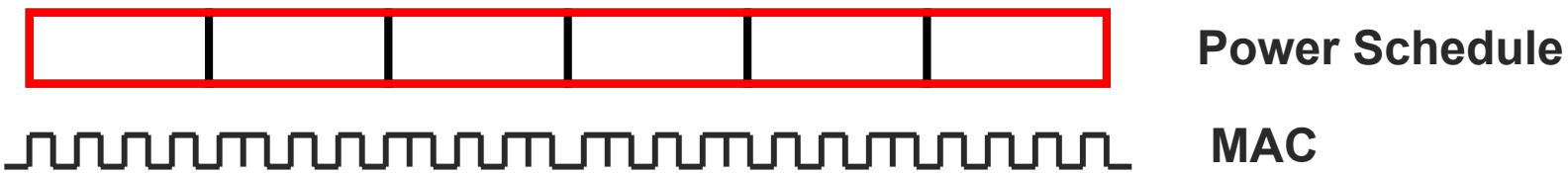
FPS Two-Level Architecture

- Coarse-grain time division scheduling
  - Distributed local adaptive schedules
  - No global phases
  - Schedules Tx, Rx, and radio off times
- Fine-grain CSMA MAC underneath
  - Collision avoidance, slot sharing



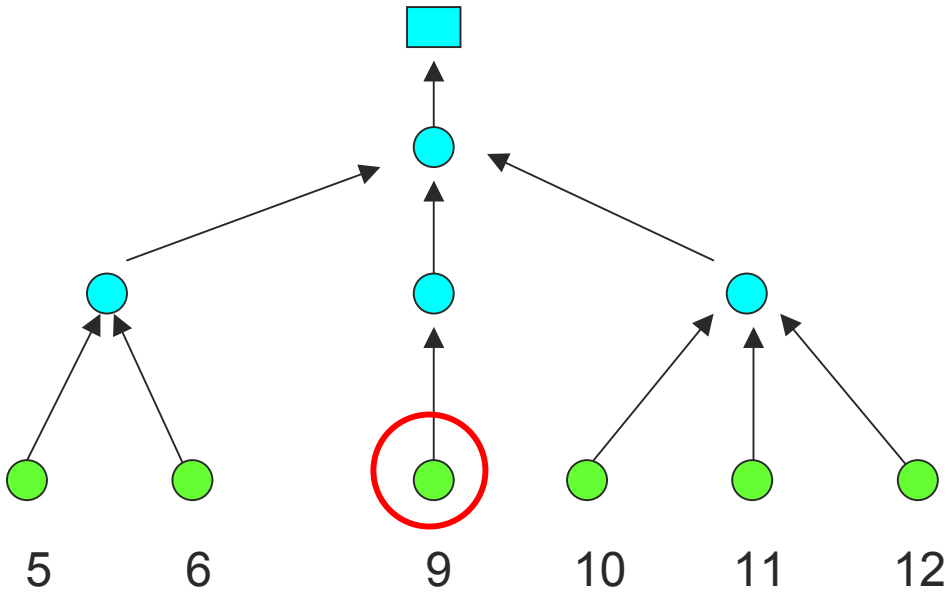
Benefits of Slotted Schedules

- Power savings:
  it is clear when to turn the radio off
- Fair bandwidth allocation
- Reserved bandwidth for the flow
- No traffic correlation effect

Tests

- Tests
  - 10 MICA1 motes plus base station
  - 6 motes send 100 messages across 3 hops
  - One message per cycle (3200ms)
  - Begin with injected start message
  - Repeat 11 times
- Software
  - FPS - 80ms slots, 40 spc, power management off
  - Naïve - simple multihop, store and forward

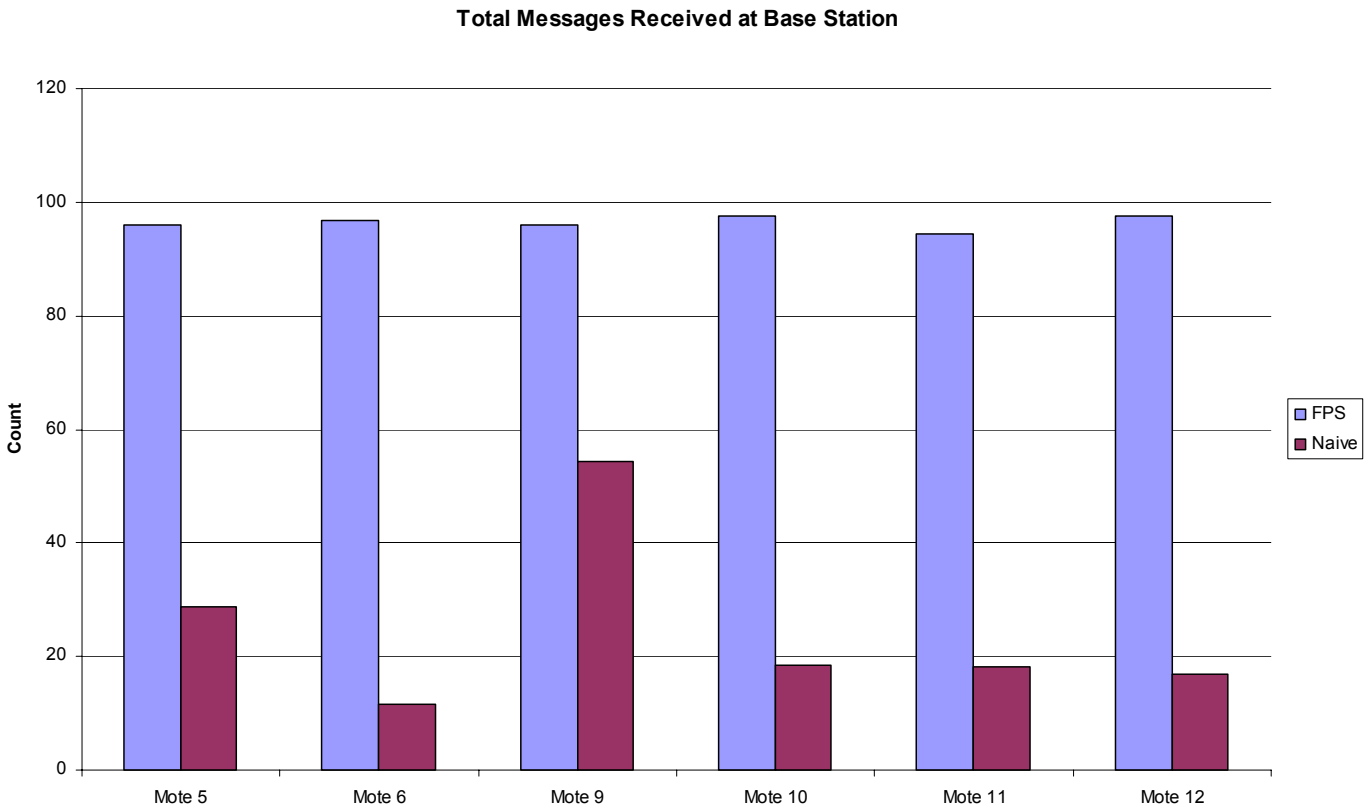
Two Test Topologies



- Dinnertable
  - one area
  - 8’ x 3’4”
- Household
  - five areas
  - motes are 9’-22’ apart

*Note: In FPS tests, Mote 9 is 3 hops from the base station.
In Naïve tests, Mote 9 is 2 hops from the base station.

Household Yield Tests



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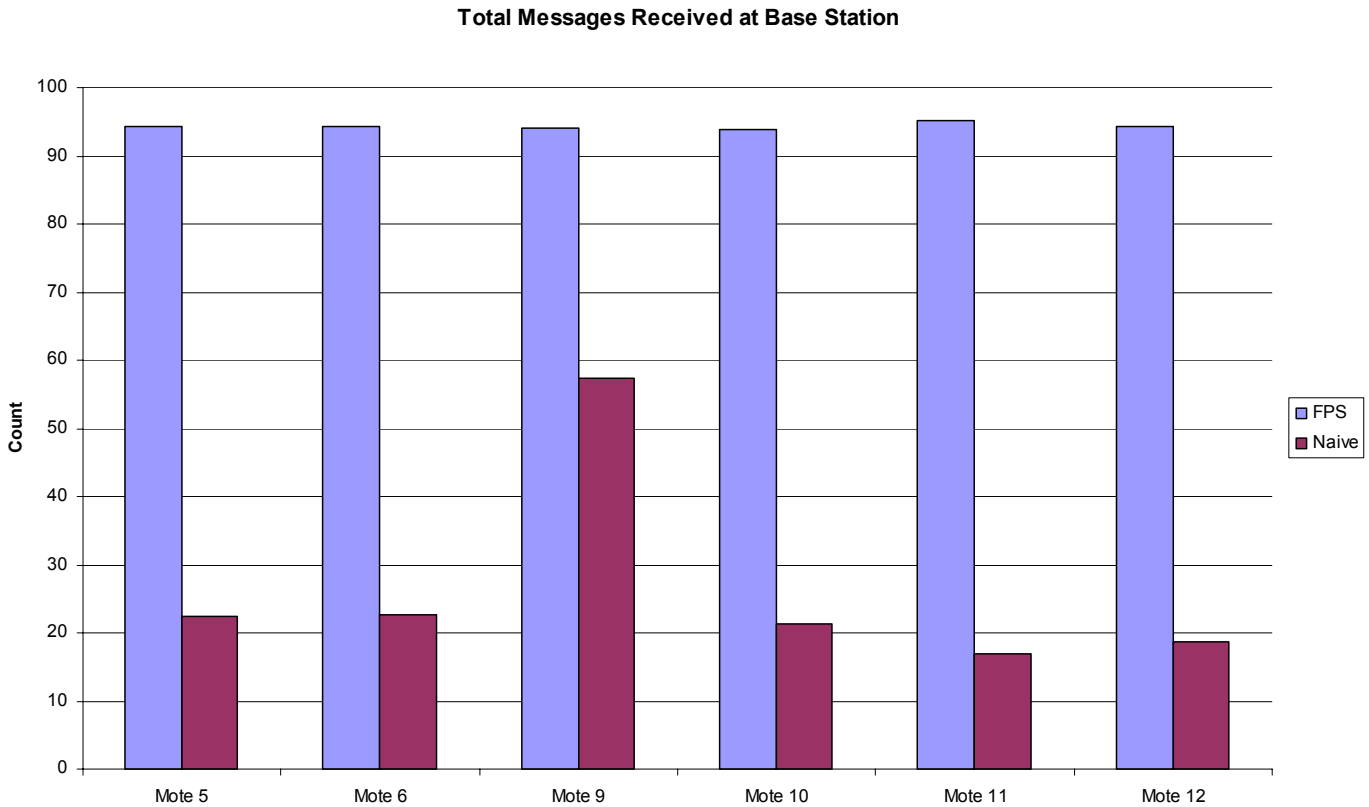
Dinnertable Yield Tests



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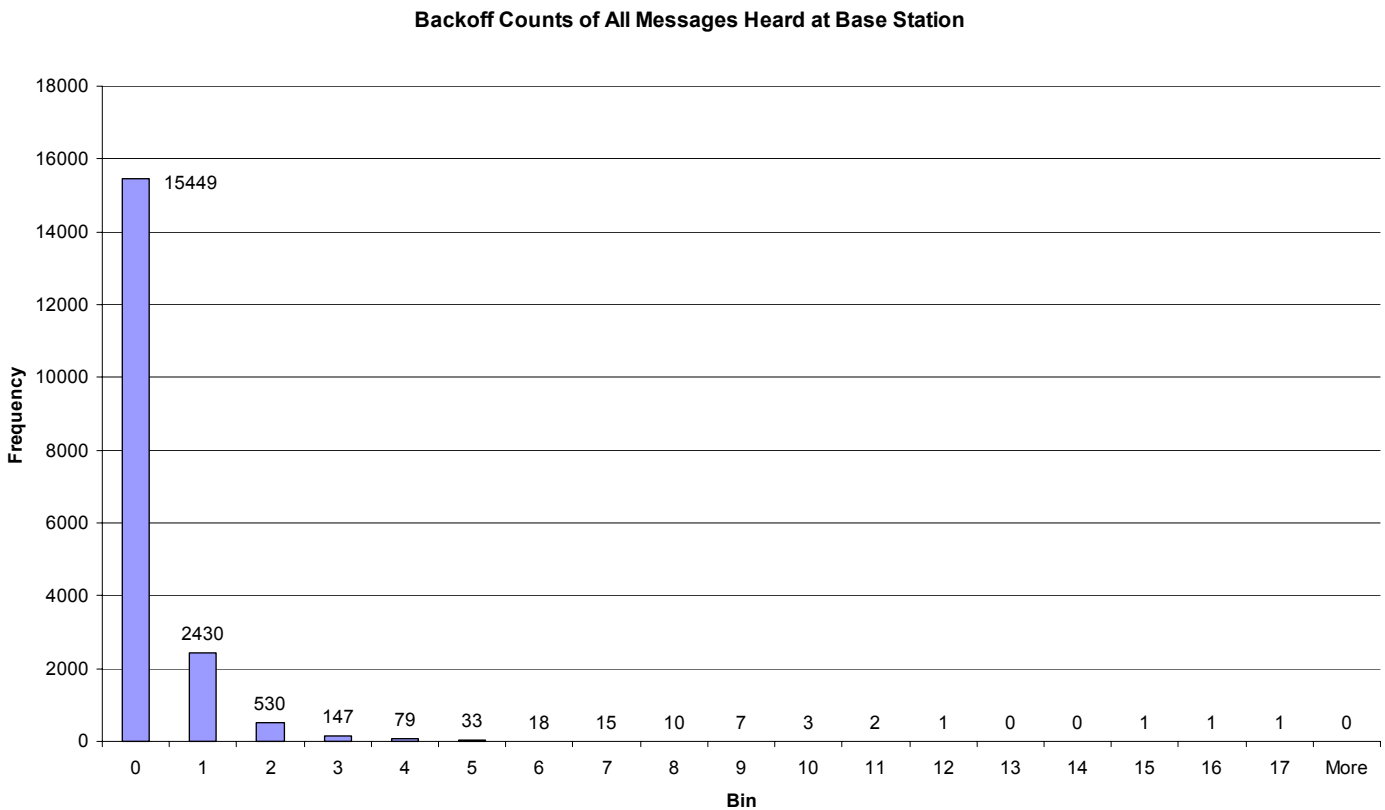
Dinnertable Backoff Histogram

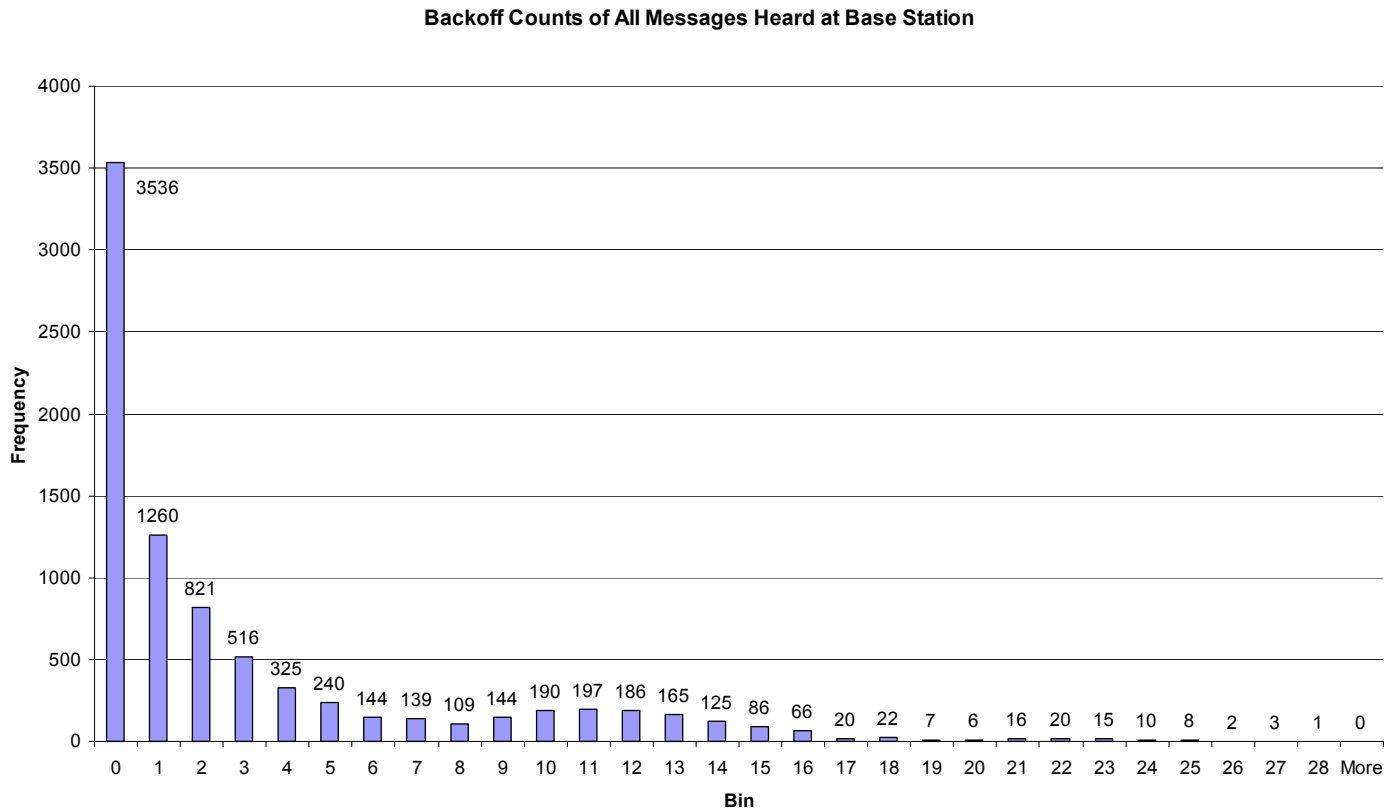
FPS



18727 of 19800 Messages Heard Across All Hops

Dinnertable Backoff Histogram

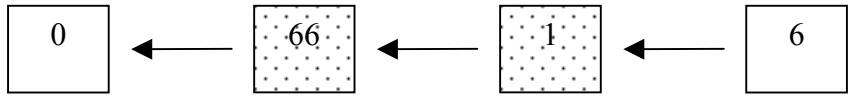
Naive



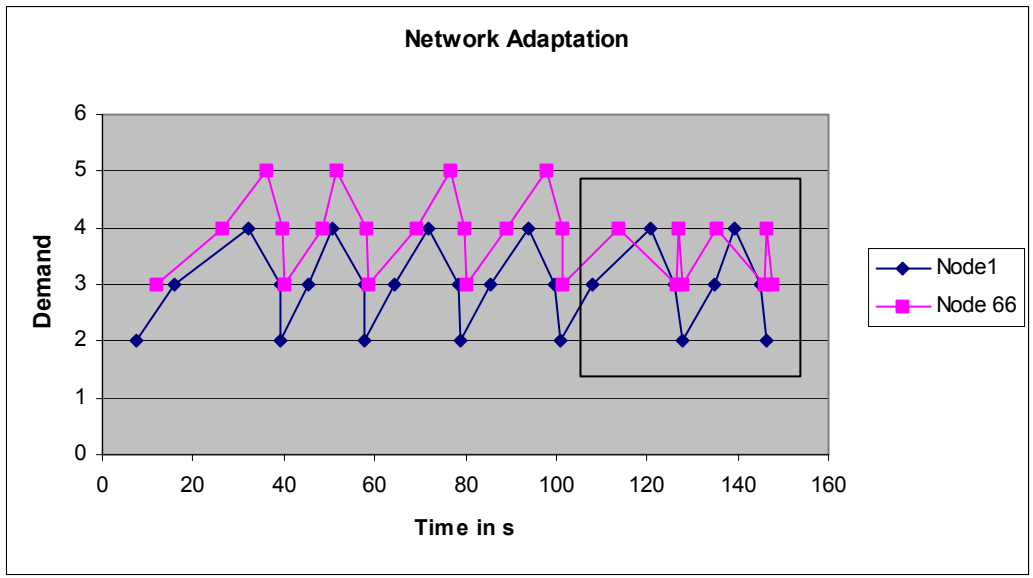
8379 of 19800 Messages Heard Across All Hops

END

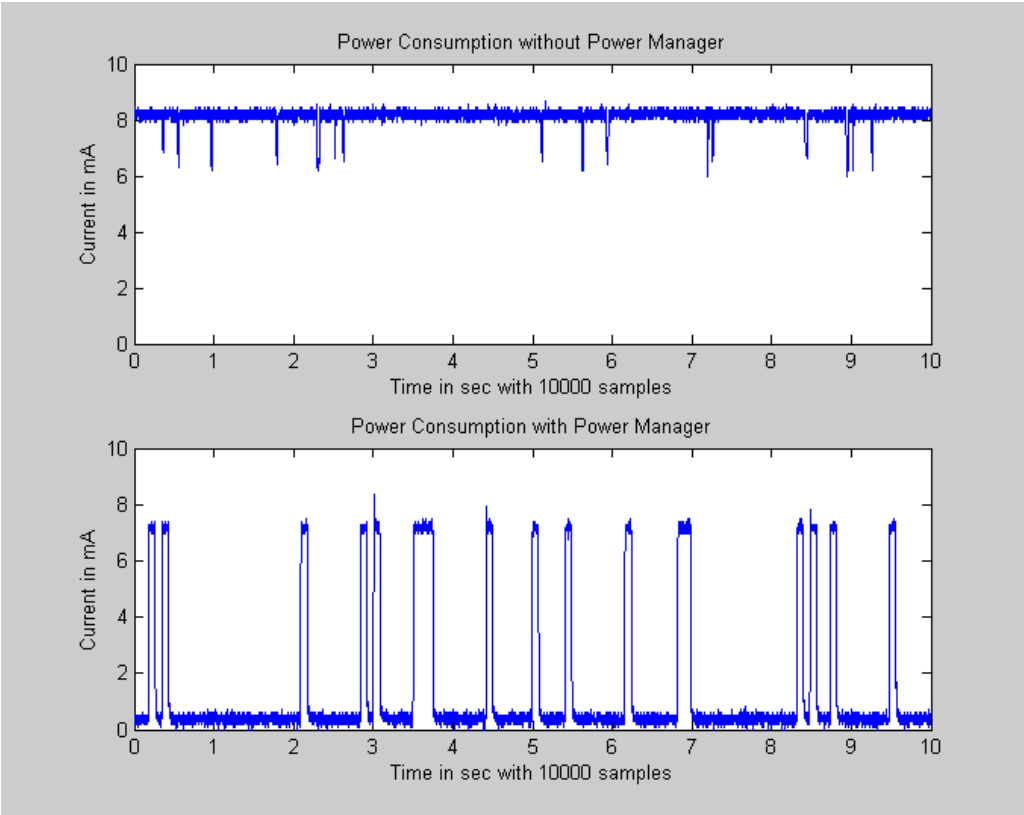
Network Adaptation



Node 1 and Node 66 adapt to fluctuating demand in the network as Node 6 increases and decreases its demand by 2.



Power Consumption



The measured current at an intermediate node over 10 seconds. A data packet is received and forwarded once per cycle, every 2.6 seconds.

Principles of Power Scheduling

- Need to know when to listen (whole stack)
- Schedule flows not packets
- Adaptive
- Two-levels
- Nodes that want to change listen
- Requires global and local views

END