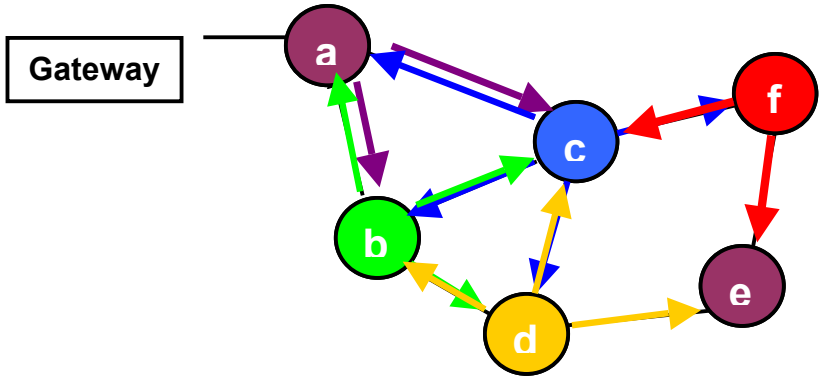

ESE519 - Wireless Sensor Networks – Fall 2013

University of Pennsylvania

Lab Assignment 4

Reports Due Date: Tue Nov 19, 2013 at 4:59pm.

Demo in Detkin Lab 4:30-6:30pm on Tue Nov 19, 2013.

Build Your Own Sensor Network

Objective:

Develop your own custom sensor network routing protocol.

- Multi-hop mesh network connected to a gateway
  - Maximum number of hops = 4
  - Maximum number of nodes = 6 (including-1 gateway node)

Requirements:

1. Update Rate

a. All nodes should report temperature and light and at peak rate of 1 reading every 30 seconds

2. Configurability

a. Sensor data reporting should be configurable from the gateway at run time

3. Reflectivity

a. Sensor nodes should create neighbor lists at run-time

b. Neighbor list information should be available at the gateway

c. Include RSSI values associated with links

4. Routing Support

a. Peer-to-Gateway communication through explicit routes

b. Peer-to-Peer communication need not necessarily be routed

c. Gateway-to-Peer communication need not necessarily be routed

5. Performance

a. Optimize the performance for metrics relevant to your course project.

Example metrics include (but aren't limited too):

i. Throughput

ii. Bounded Latency

iii. Timeliness
iv. Reliability
v. Energy
vi. Mobility

b. In your lab write-up, clearly specify the following
i. Why you chose the particular metrics
ii. How you optimized for each of them
iii. Measurement and Estimates for each metric (If any)
iv. Comparison against a baseline protocol (LPL-CSMA flooding)

Design Options

Use one of the following link layers (or devise your own):
a. RT-link (TDMA)
b. BMAC (LPL-CSMA) – easier as no configuration is required

Getting started

1. Make a plan on paper on how the protocol should work – at each node and at the gateway. What should be in the 'network header' of the packet? What should be in the routing table of each node? How often should nodes update? How large should the routing table be?
2. You will be provided with some skeleton code through canvas.
3. basic_bmac
   a. Check out this project if you intend to use bmac as your link-layer
   b. For many projects this might be the easiest starting point

Deliverables

1. Code for your project needs to be uploaded to the Canvas Website by deadline
2. Write-up describing your architecture and implementation
   a. Include the section on performance metrics
3. Demo session with the TAs on the last lab session (Nov. 19th)

Extra Credits -- one team mate can focus on this

Graphical User Interface to view the topology and data
a. Take a look at GraphViz if you want http://www.graphviz.org/
b. If you are a Java Buff, VC++ guru or a web wiz, that's fine too

References

- Josh Broch, David A. Maltz, David B. Johnson, Yih-Chun Hu, and Jorjeta Jetcheva. 1998. A performance comparison of multi-hop wireless ad hoc network routing protocols. ACM MobiCom'98.
- Anthony Rowe, Rahul Mangharam and Raj Rajkumar, "RT-Link: A Time-Synchronized Link Protocol for Energy-Constrained Multihop Wireless Networks", IEEE SECON, 2006.
- Joseph Polastre, Jason Hill and David Culler, "Versatile Low Power Media Access for Wireless Sensor Networks", Proceedings of the 2nd International Conference on Embedded Networked Sensor Systems 2004 (SenSys).