Problem Set 4, Part a

Due: Wednesday, April 19, 2006
Problem sets will be collected in class. Please hand in each problem on a separate page, with your name on it.

Reading

Point-to-point routing	Perkins, Royer: AODV routing algorithm
	Chen, Murphy: Disconnected transitive communication *(optional)*
	Gafni, Bertsekas: Link reversal routing algorithm
	Busch *et al.*: Analysis of link reversal routing *(optional)*
	Park, Corson: TORA routing algorithm
Location-free routing	Rao, Papadimitriou *et al.*: Geographical routing without location information
	Fonseca, Ratsanamy *et al.*: Beacon vector routing *(optional)*
	Fang, Gao *et al.*: GLIDER routing algorithm

Reading for next week

Location-based routing	*** Ko, Vaidya: LAR, location-aided routing algorithm
	Ko, Vaidya: Geocasting in mobile networks *(optional)*
	Kranakis, Singh, Urrutia: Compass routing *(optional)*
	*** Karp, Kung: GPSR routing algorithm *(Read this one carefully)*
	Bose, Morin *et al.* Routing with guaranteed delivery
	Barriere, Fraignaud, Narayanan: Robust position-based routing
	*** Kuhn, Wattenhofer *et al.*: Geometric ad hoc routing

Problems

1. The AODV routing algorithm, described in the Perkins and Royer paper, contains a path maintenance routine that has nodes monitor their local connectivity. When a node detects a break in a link to a next hop contained in its routing table, it propagates a special RREP message upstream on this route to trigger a repair.

   Section 4.2 of the paper mentions the possibility of allowing the intermediate node that detects the link breakage to seek out a new path on its own, thus repairing the break locally. Imagine instead, that we want to try to eliminate even this delay by having nodes on an active route maintain "back-up" next hops that they can instantly switch to if they detect that the link to their "primary" next hop has been broken.

   (a) Provide a high-level description of what modifications to AODV would be necessary to facilitate this functionality.

   (b) What are the downsides of these modifications?

2. The Gafni-Bertsekas paper describes two versions of the partial link-reversal algorithm: an "abstract" version based on lists of neighbors who have reversed their links recently, and a "concrete" version based on using (α_u, β_u, u) triples as heights.

(a) Discuss the relationship between the abstract and concrete versions. Under what assumptions are they the same? Why?

(b) Assume for the concrete version, that the network is connected and initialized as specified in the Gafni-Bertsekas paper, with all α components equal to $\mathbf{0}$. Describe an execution in which one node fires at each step, and that takes $\Omega(b^2)$ steps, where b is the number of bad nodes.

3. The Rao *et al.* paper proposes using virtual coordinates in the plane for routing. Their algorithm starts with all non-perimeter nodes having the same initial coordinates. Discuss how this initialization affects the performance of their algorithm.

4. The GLIDER paper presents a 2-phase strategy whereby information about the global topology of the network is pre-calculated, and then used at run-time for routing. Suppose we want to use similar ideas in a network that is changing—nodes are introduced and removed from the network, and nodes undergo continual motion. Discuss issues involved in adapting the GLIDER approach to such a dynamic setting. You may assume the rate of change is small relative to the speed of communication.