Weekly Report (2011-01-04)

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1) Learn the Lyapunov Optimization again and try to digest two papers utilizing Lyapunov Optimization for utility optimization in cognitive radio networks [6], [9]. However, these two papers have apparent drawbacks:
   - Both of them assume the channel availability/occupancy to be a Markovian process with finite states and fixed transition probabilities. However, according to the measurement study in [2], we know that the procedure of channel state is anamnestic and follows a not-exact exponential distribution, *e.g.* the channel is consecutively available for x time slots with probability of $a+be^{-cx}$ (a, b and c are nonnegative constants).
   - Neither of the papers considers the routing design in cognitive radio networks. In [9], each secondary node communicates with the access point directly, which requires no routing procedure. In [6], the routing problem is circumvented by treating all secondary users as receivers and multicasting with structured network coding [8], in which way each packet is equally novel to the receiver. However, in our problem model, secondary users are divided into several relation groups and the set of receivers of one multicast session constitutes only a subset of the secondary user set. Furthermore, only single multicast session is considered in [6] while our application may have to handle multiple multicast sessions in cognitive radio network.
2) Read papers on routing design in delay tolerant networks (DTN), which is quite similar with cognitive radio networks with dynamic network topology. I think exploring this area can give insight to our routing design in cognitive radio networks. There are two categories of routing mechanisms:
   - Mobility-based: The routing decision is made based on the successful delivery probability, which is predicted from the mobility pattern, of each potential relay node.
   - Social-aware [1], [3]–[5], [7]: Social network analysis is utilized. Several parameters are proposed for relay selection: Betweenness, Distance, Similarity and Social Contact.

Our problem in hand is to set appropriate channel availability model for cognitive radio networks and possibly to leverage social-aware parameters for routing algorithm in the cross-layer design.

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