Routing in Quasi-Deterministic Delay Tolerant Networks

Internship summary

Title	Routing in Quasi-Deterministic Delay Tolerant Networks
Theme	Networks
Laboratory	INRIA, Sophia Antipolis, France
Team	MAESTRO (Models for the performance analysis and the control of networks)
Supervisors	Giovanni NEGLIA and Utku ACER (firstname.familyname@sophia.inria.fr)
Laboratory Director	Gerard GIRAUDON (gerard.giraudon@sophia.inria.fr)
Prerequisites	Solid background on probability, graph theory and programming
Duration	3 months

Research background. Delay Tolerant Networks (DTNs) are mobile wireless networks in which source-destination pairs are usually not connected by complete paths. Due to such intermittent connectivity, the routing protocols for DTNs utilize the "store-carry-forward" paradigm where intermediate nodes have to carry the packets in their buffers until the packets are delivered to the destination or forwarded to another intermediate node. In order to increase the probability of delivery and decrease the expected end-to-end delivery delay, the protocols may choose to "replicate" the packets and multiple copies of a packet may roam around the network. Current solutions to routing problem in DTNs have merely considered the two extreme cases where node mobility is deterministic and known in advance or node mobility is completely random and cannot be predicted.

Objectives. In this project, we consider the case where node movement patterns are known yet they may change because of random effects such as road congestion, accidents, etc. As an application scenario, we consider a public bus transportation network, where Wi-Fi enabled buses and stops may be used for data delivery as well as for the transportation of passengers. A data message may travel through the network on a bus, then be dropped at a kiosk placed at a bus stop until it is picked up by another bus. The mobility scenario does not fit the two cases generally considered in existing literature (deterministic mobility or random mobility without a-priori information), because the schedule and/or the frequency of the buses are known but this information is subject to random jitters.

Our purpose it to design routing algorithms for such a scenario. Note that this problem is not the traditional passenger itinerary problem considered in transportation because data messages can be replicated, i.e. multiple buses (that work on different lines) can carry copies of the same information. Performance metrics of interest for such a routing algorithm are message delivery delay, delivery probability by a given deadline and total number of message replicas.

This research project takes advantage of a cooperation with the bus transportation company in Turin in Italy that provides us bus schedules, stop locations and bus mobility traces. We are working on different aspects of this problem:

- characterization of bus mobility and bus network topology starting from real-world traces,
- study of existing routing algorithms for networks with stochastic waiting and transit times,
- proposal of offline and online routing algorithms,
- implementation of the new algorithms and of other standard ones for DTNs in order to compare their performance.

The intern would help us in one (or more) of these areas, also depending on his/her interests and skills.

More information about the research project (including a bibliography) may be found at `www-sop.inria.fr/members/Giovanni.Neglia/crasquidem/crasquidem.html`.