Title
Data Mule Scheduling in Sensor Networks: Scheduling under Location and Time Constraints

Authors
Sugihara, Ryo
Gupta, Rajesh

Publication Date
2007-10-29

Peer reviewed

Data Mule Scheduling in Sensor Networks: Scheduling under Location and Time Constraints

Ryo Sugihara (ryo@ucsd.edu) and Rajesh K. Gupta (rgupta@ucsd.edu)

October 29, 2007

Abstract

Unlike multi-hop forwarding, an alternative and relatively new approach for efficient data collection in sensor networks is to exploit the mobility. Particularly, we consider collecting data from static sensor nodes using a "data mule" via wireless communication. A data mule is a mobile node that has wireless communication capability and also a sufficient amount of storage to store the data from the sensors in the field. A data mule travels across the sensing field and collects data from each sensor node when the distance is short, and later deposits all the data to the base station. In this way, each sensor node can conserve a significant amount of energy, since it only needs to send the data over a shorter distance and has no need to forward other sensors' data all the way to the base station. In this paper, we are interested in the following problem: "how to control a data mule such that it collects data from all the nodes in the minimal amount of time". We call it the *data mule scheduling problem*, as we formulate it as a scheduling problem, viewing communication from each node as a job. We can control the movement of the data mule (path, speed) as well as its communication (i.e., which node it collects data from at certain time duration), where the latter corresponds to job allocation in classical scheduling problems. Despite the similarities, one of most notable differences from real-time scheduling is that the data mule scheduling problem has location constraints as well as time constraints. Availability of each job is determined by the range of wireless communication, which primarily depends on the distance from a node and thus serves as a location constraint. On the other hand, by assuming the bandwidth of wireless communication is constant, we also have a time constraint for each node necessary for transmitting the data to a data mule. The movement of data mule determines how the location constraints map to time constraints and produces different real-time scheduling problems.

A copy of this technical report can be obtained by sending a request to Ryo Sugihara (ryo@ucsd.edu).