Location Routing on Trees

J. Araoz[1], E. Fernandez[1], and S. Rueda[1]

Abstract: Location and routing problems are among core problems in multiple application areas as logistics and telecommunications. Both areas give rise to difficult optimization problems, which have received the attention of a large number of researchers. On the other hand, it is no secret that location and routing decisions are most often closely inter related. Indeed there are a number of location applications in which the selected locations will become the depots for the routes that will serve the demand of a given set of customers. However, location problems frequently ignore the tactical or operational routing decisions and focus on the strategic location/allocation decisions. On the other hand, in routing problems it is typically assumed that the depots for the routes are set in advance, despite the enormous influence that the location of such depots may have in the design of efficient service routes. Therefore, because of the impact that joint location/allocation decisions may have on the overall costs, a joint location/allocation approach is fully justified regardless of the increase in the difficulty of the resulting problem.

Various types of formulations and solution techniques have been proposed for different location/routing problems under different modeling assumptions. However, in contrast to location/allocation problems, little attention has been paid to the influence of the topology of the graph where the location/routing problem is defined. This is the focus of this work in which we will see that a number of location/routing problems can be optimally solved very efficiently when they are stated on a tree. We give polynomial time optimal algorithms for several location/routing problems in which demand is located both at the vertices or the edges of a given tree. These results, which can be easily extended to cacti, can be used as the basis for heuristics for other location/routing problems on more general graphs.

[1] Department of Statistics and Operations Research
Universitat Politcnica de Catalunya-BcnTech
Jordi Girona 1–3, 08034 Barcelona, Spain
julian.araoz@upc.edu, e.fernandez@upc.edu, salvador.rueda@upc.edu