

Abstract:

With different names and characteristics, relays play a crucial role in the design of transportation and telecommunication networks. In transportation networks, relays are strategic locations where exchange of drivers, trucks or mode of transportation takes place. In green transportation, relays become the refu-elling/recharging stations extending the reach of alternative fuel vehicles. In telecommunication networks, relays are regenerators extending the reach of optical signals. We study the network design problem with relays and present a multi-commodity flow formulation and a branch-and-price algorithm to solve it. Motivated by the practical applications, we investigate the special case where each demand has a common designated source. In this special case, we can show that there exists an optimal design that is a tree. Using this fact, we replace the multi-commodity flow formulation with a tree formulation enhanced with Steiner cuts. Employing a branch-and-price-and-cut schema on this formulation, we are able to further extend computational efficiency to solve large problem instances.