Designing two-echelon distribution networks under demand uncertainty

Imen Ben Mohamed*[1,2,3], François Vanderbeck[1,2], and Walid Klibi[3,4]

[1]RealOpt (INRIA Bordeaux - Sud-Ouest) – Université Sciences et Technologies - Bordeaux I, INRIA – 200 avenue de la Vieille Tour 33405 Talence, France

[2]Institut de Mathématiques de Bordeaux (IMB) – CNRS : UMR5251, Université Sciences et Technologies - Bordeaux I, Université Victor Segalen - Bordeaux II, Université Sciences et Technologies Bordeaux I, Université Victor Segalen – Bordeaux II – 351 cours de la Libération 33405 TALENCE CEDEX, France

[3]KEDGE Business School – Ministère de l'Enseignement Supérieur et de la Recherche Scientifique – 680, Cours de la Libération, 33405 Talence Cedex, France

[4]Centre Interuniversitaire de Recherche sur les Réseaux d'Entreprise, la Logistique et le Transport (CIRRELT) – Pavillon André-Aisenstadt, bureau 3520 2920, Chemin de la Tour Montréal (Québec) H3T 1J4 CANADA, Canada

Abstract

Goods delivery from manufacturing platforms to demand zones is often managed through one or more intermediate locations where storage, transshipment and consolidation activities are performed. When distribution activities cover a large geographical area, depend on hierarchical inventory rules, or concern urban deployment, multi-echelon network configurations are more appropriate. In this work, a two echelon distribution network is considered, and the strategic problem of designing the network structure under demand uncertainty is tackled. It is modeled as a stochastic multi-period two-echelon location-routing problem integrating decisions on the location and the size of second echelon facilities, decisions on the flows assignment between the echelons, and on delivery routes to serve demand zones. Furthermore, a multi-year planning horizon is considered to design the distribution network, and the uncertain customers demand is characterized by a set of scenarios. To solve the problem for large scale instances, a solution method, using a decomposition approach, is developed. Computational experiments on several instances are performed to validate the approach and to derive insights from the results obtained.

*Speaker