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Route Optimization Algorithm and Solution for Web Service Engineering

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Abstract

Many modern service systems rely on a network of hub facilities to help concentrate flows of freight or passengers to exploit the economies of scale in transportation. Whereas ,the possible defect that bypass cost caused by hub or intermedia seem unvoided. This paper employs a novel optimal hub-and-spoke network based decision approach which unite "bypass cost " and "congestion effect" effectively,presents a algorithm in time effect compared with tradional algorithm, sets up a computational work which performed on a personal computer with data for postal operations in Sydney,Australia and draw a conclusion that the approach presented in this paper are much better in time than traditional way.

Keywords:extended , route optimization,bypass cost, engineering

1. introduction

The Service-Oriented Computing(SOC)paradigm foresees the creation of business applications from independently developed services.In this vision,Service Providers(SPs)offer similar competing services corresponding to a functional description and the best set of Web Services(WSs)can be selected at run-time in order to maximize the Quality of Service(QoS) and minimize the price for end users.

Furthermore,Internet application workloads can vary by orders of magnitude even within the same business day(Chase et al.,2001)[1].Hence optimization has to be performed when the BPEL process execution starts and has to be iterated at run-time in order to take into account workload fluctuations.In real world ,the price and Qos in users' vision are close to volume of flow, especially the extended Web service such as physical flow ,human flow etc. In this paper we exploit and refine the ideas first presented by Rosario,Luo [2,3], and we propose a hub-arc based framework which allows the optimal service composition optimazing a set of QoS and cost objective.

Hub arc models presented by Compell relax the restriction that the flow cost between every pair of hubs is discounted.The hub arc location problem seeks to locate hub arcs,the end points of which are hubs,whereas it can not solve the confict of "scale economy" and "bypass cost",even the "congestion effect" for it is excessively depended on "scale economy".

This paper presents a Route Optimize Algorithm and Solution for Web Service Network,ROASWSN problem,which addresses a major deficiency of the p-hub arc location model and try to unite "scale economy" and "bypass cost".

There are the three differences between ROASWSN and p-hub-arc problem.

（1）in p-hub arcs problem , The number of hub arcs is limited explicitly,rather than being determined by flow volume on hub arcs.

While the ROASWSN design decision is to select hub arcs only if the flow consolided in some path exceed thredhold and,as a consequence,the total number of hub arcs is not limited explicitly.

(2)in p-hub arc location problem ,each origin-destination paths include at least one hub node,but in

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ROASWSN,the direct paths connected with od nodes is permitted even the od nodes are not hub nodes.

Above all, the hub arc location problem may include three types of arcs:(1)hub arcs joining two hubs(with reduced unit flow cost),(2)access arcs joining a nonhub origin/destination and a hub,and (3)bridge arcs joining two hubs,but without the reduced unit flow costs.

Compared with hub arcs location problem, ROASWSN include incompletely different types of arcs: (1)hub arcs joining two hubs(with reduced unit flow cost),(2) direct arc ;(3) not hub arc but a transfer arc,on which include at least one od flow, but it is not a hub arc because that the agglomeration of flow on it cannot reach a given value.

Therefore , ROASWSN does not belong to a hub station location problem, is also different from the hub arc location problem presented by Compell.The primary decision-making of ROASWSN is to determine the optimal route, strictly speaking, it belongs to route optimization problem.

The remainder of this paper is organized as follows.In Section 2,we provide some background and a formulation of the model.Section 3 describes the solution algorithm and Section 4 includes computational results using real airlines'data.In Section 5,we give concluding remarks and mention some future work.

2. Model description

This section presents MILP formulations for ROASWSN. ROASWSN can be formulated in a variety of ways,depending on the selection of the decision variables.Different integer programming formulations have different properties and lead to different solution approaches. Li and Krishnamoorthy(1996,1998a)[4,5,6] introduced an approach that tracks the flow from each origin(but not for each origin-destination pair).In this approach, Z_{ik} is the flow on an access arc from origin i to hub k.The four subscript formulation introduced by Campbell(1994)[7]is perhaps the clearest,where X_{ij}^{km} is the flow from origin i to destination j via hubs k and l,in order i→k→l→j.This approach easily incorporates multiple allocation,because each origin-destination flow is tracked separately.In this paper ,we use the latter approach introduced by Campbell.

2.1 Notation

This section presents MILP formulations for hub arc location problems.These are designed to allow efficient solution using a mixed-integer LP solver.

We formulate the ROASWSN which tracks flows on arcs for each origin.Consider a complete graph G(V,E) with a node set V={1… n},where nodes correspond to origins/destinations and potential hub locations.The flow from node i and node j is r_{ij} and the distance from node i to node j is d_{ij} ,where these distances satisfy the triangle inequality.

The parameter c_{ij}^{km} is unit cost of od flow i-j along i-k-m-j. let the binary varible y^{km}=1,which denote that the arc k-m is difined as hub arcs related with economy of scale;otherwise, y^{km}=0.

Furthermore , y^{km}=1 is based on the assumption that the flow exceed αr_{km} ,e.c.the arc k-m will be seleced as hub arc of which the aggregated coefficient exceed α , and hub arc enjoy a discounted unit cost presented by a given factor a(0<a<1).

Parametre αr_{km} is threshold of hub arc k-m; R_{km} is flow volume aggregated by arc k-m which