Chapter VIII

Distributed Data Warehouse for Geo-spatial Services

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ABSTRACT

This chapter introduces the research issues on spatial decision-making in the context of distributed geo-spatial data warehouse. Spatial decision-making in a distributed environment involves access to data and models from heterogeneous sources and composing disparate services into a meaningful integration. The chapter reviews system integration and interoperability issues of spatial data and models in a distributed computing environment. We present a prototype system to illustrate the collaborative access to data and as a model for supporting spatial decision-making.

INTRODUCTION

Distributed access to data and services brings closer involvement of different communities, regardless of geographic locations and social orientations. Diverse tools and Web services are now available to extract data and models from online repositories. The vision of geo-spatial data warehouse challenges the fundamental criticism directed against Geographic Information
Distributed Data Warehouse for Geo-spatial Services: being an “elitist” tool that harbors the gap between system users and non-users (Pickles, 1995). A unique advantage of having a distributed geospatial data warehouse is that access to geospatial information and services for decision makers and planners will promote Collaborative Spatial Decision Making (CSDM, NCGIA, 1995). Hence, many complex environmental problems can be resolved through collaboration, which would have been difficult to resolve otherwise. This chapter reviews the research issues of distributed GIS services and geospatial data warehouses in the context of collaborative decision-making. In the following sections, we identify some essential features of a distributed spatial data warehouse relevant to spatial decision-making, with respect different standards and protocols. Then, we discuss system integration and interoperability issues of spatial data and models. A prototype collaborative decision support system is presented to illustrate collaborative access to data, and model for supporting spatial decision. Finally, we identify the future research trends of distributed data warehouse in the framework of emerging research trends of semantic Web.

BACKGROUND

It has been reported that as much as 80% of general information contains spatial components (OGC, 2001). Typically, these include spatial data or georeferenced information, such as digital or analog map, network, GPS data and satellite-based imagery. As spatial data and services are increasingly becoming available, there is a growing demand for robust information processing for explorative analysis, where a user is empowered to extract multiple services from different repositories. The use of spatial data cuts across many disciplines, ranging from ecosystem modeling to location commerce. This has resulted in many stand-alone native spatial data structures and domain models. The challenge is, however, to enable interoperability of the heterogeneous systems to communicate in a distributed computing environment.

Standards and Protocols

Serving spatial data from disparate sources and disseminating them to target users is also the vision of NSDI (National Spatial Data Infrastructure), expressed by the Mapping Science Committee (NRC, 1993). However, the vision of NSDI could not conceive of the enormous growth of Internet, which underemphasizes the importance of effective processes of dissemination to users (NRC, 1999). At the object level, the Open GIS Consortium (OGC) is developing a number of specifications. The Open Geodata Interoperability Specification (OGIS) defines types and methods required for an interoperable
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