Multiple Representations in Geographic Information Systems

Author: Clodoveu A. Davis Jr. (cdavis@uol.com.br)

Advisor: Alberto H. F. Laender (laender@dcc.ufmg.br)

Institution: Departamento de Ciência da Computação, Universidade Federal de Minas Gerais (www.dcc.ufmg.br)

Presentation date: September 22, 2000

Abstract

Geographic information systems (GIS) deal with data which can potentially be useful for a wide range of applications. However, the information needs of each application usually vary, specially in resolution, detail level, and representation style. To be able to deal with such diverse needs, while maintaining an efficient, non-redundant geographic database, GIS must offer features that allow multiple representations for each geographic entity or phenomenon. The specification of such features is usually carried out by building a conceptual schema, a fundamental part of the applications development process. In the case of geographic applications, however, other factors need to be taken into consideration, especially those related to the representation of spatial objects: if the representation is not defined up front, the specification of spatial and topological relationships becomes harder to achieve. This thesis presents a set of primitives that allow the specification of operational processes, such as transformations between representations, through the use of a dynamic schema. Primitives that enable the specification of different visual presentations for each modeled representation are also introduced, thereby defining a presentation schema. The proposed extensions allow geographic application design to incorporate multiple representation and multiple presentation aspects, which promote the sharing of the geographic database among different user groups. A comprehensive set of basic operators from computational geometry, spatial analysis, and map generalization are presented as tools with which to achieve the implementation of multiple representations and multiple presentations in GIS. The contributions are explored in a case study application, for which static, dynamic, and presentation schemas are developed and analyzed.