Chapter 5

Improving Spatial Decision Making in Cloud Computing

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ABSTRACT

The increasing capabilities of the Internet have caused a qualitative change in the management of spatial information while recent advances in Web 2.0 technologies have enabled the integration of data and knowledge in intuitive thematic maps. This has wide-ranging indirect effects in supporting the ways stakeholders make a decision based on information coming from various distributed resources, but the real question is, What applications and technologies are in place to deal with these decisional environments? Aiming at giving an answer to this question, this chapter explores the feasibility of a computational environment that supports the Web-based exploration and the spatial analysis in real estate decisional processes. It relies on the concept of dataspace as a new scenario for accessing, integrating, and analyzing geo-spatial information regardless of its format and location. Built on top of a cloud environment, it is made up of specialized modules, each of which provides a well-defined service. Mash-ups integrate data from different resources on the Internet and provide the user with a flexible and easy-to-use way for geo-referencing data in the maps provided by Google Maps and Google Earth. Through an interactive process, the user arrives at some interesting maps, glimpses the most important facets of the decisional problem, and combines them to fashion a solution. Applicative experiments demonstrate the effectiveness of the computational environment proposed.

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1. INTRODUCTION

To be effective in supporting decision making, computational tools should give the user a simple method to access and analyze data and directly link the data and analysis results to other computer applications such as word processing, spreadsheets etc. As well, the user should be allowed to extract (when this extraction is allowed) appropriate data from external databases and append to these local data either directly or from other databases. Data acquisition results in a very difficult task when data can soon become unmanageable or even unworkable since they are scattered in heterogeneous resources as authorities, agencies, municipal archives, government archives and so on. Data integration requires different structures and formats to be merged with full consideration of the data complexities and intricacies. It is also essential when undertaking this type of data integration that valuable information is not lost.

This integration is becoming a necessity for facing planning processes characterized by interactions between environmental and socio-economic systems which result in the possibility of diverse decision alternatives. This integration is the principal aim of our paper which explores how spatial analysis resources can be interfaced within decision making environments in a single framework, namely a Spatial Decision Support System (SDSS).

Leveraging on recent research work (Dittrich & Salles, 2006; Dong & Halevy, 2007; Franklin et al., 2005; Halevy et al., 2006), this paper adopts the concept of dataspace as a new integration paradigm characterized by a very loosely structured data model and geared towards the management of data coming from a diverse set of distributed resources. A dataspace consists of components (also called participants) and a set of relationships among them. Each participant contains information about the kind of data it contains, the data allocation, the storage format. Our basic philosophy is to integrate the dataspace participants (i.e. the distributed sources of information) within GIS services available in Internet (i.e. Google Earth and Google Maps). This results in a dataspace that creates a highly productive symbiosis between the computational environment and the user who can manipulate maps to rapidly gain insight about data.

Specifically, we investigate how application services can become innovative components of these emerging decisional supports in order to automatically offer functionalities that are not longer locked to a static infrastructure, as it happens in data warehousing systems or enterprise databases, but refer to computational resources made available through a computer network. We try to explore the features of a reference model for designing a flexible decisional environment by identifying its critical aspects, the limits of its applicability and its scope.

On the IT management side, we propose that the SDSS be hosted with the aid of cloud computing technology which enables to host and easily scale services up or down as needed. Leveraging on Software-as-a-Service (SaaS) philosophy (Mell & Grance, 2011), our SDSS focuses on providing mechanisms for: (1) abstract the complexity of integrating data in heterogeneous computing environments and (2) provide a decisional support with a high level of flexibility to the user needs. The level of flexibility is intrinsically linked to the way in which these mechanisms are able to integrate information, regardless of its format and location, and make complementary the different aspects of decision processes.

The main contribute of this paper focuses on proposing:

- A flexible service oriented data integration which gathers data from heterogeneous networked sources, interfaces business tools and added-values services offered