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The e-MapScholar project—an example of interoperability in GIScience education

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Abstract

The proliferation of the use of digital spatial data in learning and teaching provides a set of opportunities and challenges for the development of e-learning materials suitable for use by a broad spectrum of disciplines in Higher Education. Effective e-learning materials must both provide engaging materials with which the learner can interact and be relevant to the learners' disciplinary and background knowledge. Interoperability aims to allow sharing of data and materials through the use of common agreements and specifications. Shared learning materials can take advantage of interoperable components to provide customisable components, and must consider issues in sharing data across institutional borders. The e-MapScholar project delivers teaching materials related to spatial data, which are customisable with respect to both context and location. Issues in the provision of such interoperable materials are discussed, including suitable levels of granularity of materials, the provision of tools to facilitate customisation and mechanisms to deliver multiple data sets and the metadata issues related to such materials. The examples shown make extensive use of the OpenGIS consortium specifications in the delivery of spatial data.

Keywords: E-learning; Interoperability; Metadata; GIS; Spatial data

1. Introduction

The potential of the Internet as a medium for delivering e-learning has led to a proliferation of materials and initiatives throughout Higher Education (Gardner, 2003). E-learning resources typically use a range of media (Zerger et al., 2002), are increasingly interactive and customisable and are related to a wide range of traditional learning activities—from lectures and seminars (Ludwig, 1999), through laboratory-based work to field courses (Dykes et al., 1999). Their integration in curricula can span their use as additional reference materials, through 'blended teaching' to curricula which are primarily delivered through the Internet.

The Internet has driven a similar proliferation in the availability of digital spatial data. Such data may be literally freely available (e.g. from the US Geological Survey's EarthExplorer[1]) or available through a variety of pricing models from National Mapping Agencies (NMAs) and commercial organisations (e.g. the

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[1]USGS EarthExplorer. http://edcsns17.cr.usgs.gov/EarthExplorer/

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Ordnance Survey's MasterMap[2] and TeleAtlas's Multi-Net[3]). Whatever the access model, students today have access to a plethora of spatial data, which they can freely manipulate and visualise with access to appropriate skills and knowledge. In the United Kingdom (UK), Higher Education Institutes (HEIs) have negotiated through the JISC (Joint Information Services Committee)[4] access to electronic data from the NMA (the Ordnance Survey) for Great Britain.[5] These data are available to students at subscribing institutions through the EDINA Digimap service,[6] for which more than 86 UK HEIs have now signed up (Medyckyj-Scott and Morris, 1998).

The Digimap service provides three routes to spatial data—in the first a simple client receives tightly constrained but cartographically sensible data from the server in the form of map images. The user can control the features displayed and zoom and pan, but the appropriateness of display at particular scales is controlled by the server. The second mode of use allows the user to select data from different data sets to visualise maps in a Java applet, with the only constraints being imposed by service considerations (for instance it is not possible to create a map for the whole of Great Britain using 1:10 000 source data). The final mode of use of the service allows the user to download raw data as provided by the Ordnance Survey. Such data can then be imported into an appropriate package and manipulated, integrated with other data sources or visualised as required by the user. Users of the Digimap service come from a wide range of disciplinary backgrounds, many of which have a limited tradition in the application of spatial data (Purves et al., 2002). Users from such subject areas are unlikely to have been exposed to a GIScience curriculum, such as are commonly found in the geosciences. Wider use of spatial data across a broad disciplinary background brings with it a need to provide learning materials, which teach the key skills and concepts required to work effectively with spatial data.

The e-MapScholar project[7] is a response to this issue and delivers teaching materials that promote the use of geospatial data in learning and teaching, thus also growing the market for the use of spatial data in Higher Education. The project seeks to support learners through the provision of a range of materials that develop skills in the use of digital map data and knowledge of geospatial concepts applicable to a variety of disciplinary backgrounds. Thus, the aim of the project is not to teach students about GIS functionality, but rather about key concepts in utilising spatial data with examples contextually relevant to their discipline.

The development of the e-MapScholar project addresses key issues in the provision of educationally 'interoperable' teaching materials and the application of functional interoperability in the provision of such teaching materials. This paper describes the project by exploring three key questions about interoperability in GIScience education, namely:

- What is interoperability in GIScience education?
- Why have interoperability in GIScience education?
- How can interoperability be provided in GIScience education?

2. What is interoperability in GIScience education?

Voisard and Schweppe (1998) described a view of an interoperating GIS as a 'system of communicating services that manipulate alphanumeric or spatial information'. Such a definition envisages that component 'services' may be developed and hosted independently thus moving away from a traditional monolithic view of software architecture towards distributed services. Such approaches allow services with no knowledge of each other to communicate through a set of agreed contracts (or in the parlance of software engineering *interfaces*). Indeed, Včkovski (1998), in setting out a definition of interoperability, argues that by examining both technical and non-technical examples of interoperability it is clear that a key issue in achieving interoperability is defining a contract with agreed common features.

In GIScience the OpenGIS consortium (OGC) was founded in the belief that new and emerging technologies could fundamentally alter the way in which geospatial data and geoprocessing could be accessed (Cuthbert, 1999). The OGC provides an open process for defining interfaces and specifications designed to help promote interoperability between geospatial data and geoprocessing, for example through GML[8] and

[2]UK Ordnance Survey MasterMap. http://www.ordsvy.gov.uk/os_mastermap/

[3]TeleAtlas homepage http://www.teleatlas.com

[4]The Joint Information Service Committee homepage. http://www.jisc.ac.uk/

[5]Note that Great Britain consists of England, Wales and Scotland, while the UK also includes Northern Ireland. However, the UK is served by two national mapping agencies, Ordnance Survey GB (covering Great Britain) and Ordnance Survey NI (covering Northern Ireland). The JISC negotiated access for UK institutions to data provided by the Ordnance Survey GB.

[6]Digimap homepage. http://digimap.edina.ac.uk/

[7]e-MapScholar homepage. http://edina.ac.uk/projects/mapscholar/

[8]Cox, S., Daisey, P., Lake, R., Portele, C., Whiteside A. (Eds.). OpenGIS Implementation Specification #02-009: OpenGIS Geography Markup Language (GML) implementation specification, v2.1.1, Open GIS Consortium, 2002. http://www.opengis.org/docs/02-023r4.pdf