Representation and Management of Evolving Features in OS MasterMap ITN Data

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1 Background

At the heart of any geographic information system (GIS) is a database system. Data representing geographic entities and spatial features are stored in these GIS and manipulated and visualised according to the user's input. The rapid emergence of GIS has demanded the evolution of database systems to support these spatial data, and to provide powerful analysis operations and functions to assist in decision support, projections, predictions, and simulations in a wide variety of problem domains. The research reported on in this paper investigates a specific area of interest in geospatial database systems, that of the management and representation of evolving features. Features in a GIS group together entities or areas that are of particular interest from a specific viewpoint, such as counties, population, or in this case, roads.

(This project is funded by an EPSRC CASE award and is carried out in collaboration with the Ordnance Survey (OS), and as such will utilise Oracle Spatial and OS MasterMap Integrated Transport Network (subsequently referred to as ITN) data).

2 Project Aims

The aims of the research are as follows:

- to apply object versioning techniques to ITN data within an object-relational data model
- to extend the Oracle Spatial data type to implement spatiotemporal data
- to devise and implement a spatiotemporal data model for ITN data
- to enable the retrieval and manipulation of spatiotemporal ITN features

3 ITN Data

The ITN layer provides a topologically structured representation of the UK's driveable roads. Each road link is supplied with a unique topographic identifier, or TOID, that can be shared with other users across different applications and systems. ITN data is continually updated, capturing real-world change as part

R. Cooper and J. Kennedy (Eds.): BNCOD 2007, LNCS 4587, pp. 160–163, 2007.

of the national geographic database. The data is increasingly used in commercial markets by organisations requiring a variety of information regarding Great Britain's road network. The data supports applications for routing, tracking, scheduling and fleet management and informs traffic analysis and accessibility studies.

4 Object Versioning

The versioning of objects in database systems [7, 4] has been developed within the design engineering environment in CAD systems to represent the evolution of complex design artifacts (composite objects)[6]. Here versions can be defined both at the component level and at the composite object level. The proliferation of configurations of composite objects in CAD versioning has led to the development of versioning models that represent a configuration as a generic object, containing no specific versions of its components. The generic object stores references to its components' types, and specific versions are resolved at run-time by a process called Dynamic Reference Resolution (DRR)[6, 3, 2, 5]. DRR thus minimises version percolation, (where an update to a component triggers cascading updates in the configurations) and allows the free combination of components to create new configurations.

4.1 The Structure of ITN Data

The basic unit of the road feature is the roadlink. Roadlink objects are comprised of a polyline geometry with a roadnode object at each end. A road feature is an aggregate of roadlink objects (see Figure 1). The road feature does not contain the road's geometry, only a reference to its constituent roadlink objects. A roadlink's nodes are marked as 'start' and 'end' to maintain topology.

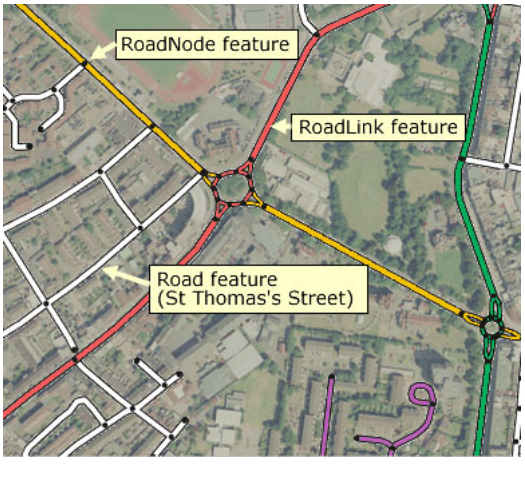

Fig. 1. Road features are comprised of links and nodes