Chapter 8
GML-Based nD Data Management With a Big Geo Data Semantic World Modeling Approach

Juergen Rossmann
RWTH Aachen University, Germany

Martin Hoppen
RWTH Aachen University, Germany

Arno Buecken
RWTH Aachen University, Germany

ABSTRACT

3D simulation applications benefit from realistic and exact forest models. They range from training simulators like flight or harvester simulators to economic and ecological simulations for tree growth or succession. The nD forest simulation and information system integrates the necessary methods for data extraction, modeling, and management of highly realistic models. Using semantic world modeling, tree data can efficiently be extracted from remote sensing data – even for very large areas. Data is modeled using a GML-based modeling language and a flexible data management approach is integrated to provide caching, persistence, a central communication hub, and a versioning mechanism. Combining various simulation techniques and data versioning, the nD forest simulation and information system can provide applications with historic 3D data in multiple time dimensions (hence nD) as well as with predicted data based on simulations.

DOI: 10.4018/978-1-5225-5625-1.ch008

INTRODUCTION

At 3D GeoInfo 2012, we presented an innovative and efficient way to generate "Virtual Forests" from remote sensing data (Bücken & Rossmann, 2013). Individual trees are delineated from normalized digital surface models and annotated with height and species. This approach is the first step towards various forestall simulation applications based on real-world data like the simulation of forest machines (Figure 1), a flight simulator, a tree growth or a succession simulation. To provide a basis for an efficient and modern data management of such vast datasets, a database-driven method for 3D simulation systems previously presented at 3D GeoInfo 2010 is used (M Hoppen, Rossmann, Schluse, & Waspe, 2010). It provides a persistence layer and a common data schema for simulation systems. Now, it is enhanced by techniques for database-driven, distributed data management and simulation, for data versioning and for the use of big, heterogeneous geo data.

In this revised work, we focus on the integration, enhancement, and on future trends regarding these two core technologies of a large-scale nD forest simulation and information system. In particular, algorithms for the attribution of the individual tree, details on the GML-based (Open Geospatial Consortium (OGC), n.d.), object-oriented schema family ForestGML for forestry data, and the concept of database-driven communication are presented. Overall, a shared world model is

Figure 1. Driver training by means of an advanced forest machine simulator