Semantic 3D modeling of multi-utility networks in cities for analysis and 3D visualization

Abstract

Precise and comprehensive knowledge about 3D urban space, critical infrastructures, and belowground features is required for simulation and analysis in the fields of urban and environmental planning, city administration, and disaster management. In order to facilitate these applications, geoinformation about functional, semantic, and topographic aspects of urban features, their mutual dependencies and their interrelations are needed. Substantial work has been done in the modeling and representation of aboveground features in the context of 3D city and building models. However, standardized models such as CityGML and IFC lack a rich information model for multiple and different underground structures. In contrast, existing utility network models are commonly tailored to a specific type of commodity, dedicated to serve as as-built documentation and thus are not suitable for the integrated representation of multiple and different utility infrastructures. Moreover, the mutual relations between networks as well as embedding into 3D urban space are not supported. The Utility Network ADE of CityGML as proposed in 2011 provides the required concepts and classes for the integration of multi-utility networks into the 3D urban environment. While the core model covers only the topological and topographic representation of network entities, the functional and semantic classification of network objects is now introduced in this paper. This paper will show how concepts and classes can be
defined to fulfill the requirements of complex analyses and simulation, and how properties of specific
networks can be defined with respect to 3D topography but also network connectivity and functional
aspects.

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