Virtual city models ("digital cities") have become one of the most important planning instruments for the configuration of the future of our vital space, in particular for our cities (e.g. Day and Radford, 1998, Voigt and Linzer, 1999, Dokonal and Martens, 2001).

Space & Time

The concept of a "data-pipeline" (Voigt et al. 2002) basically transfers a dataset relevant to the current situation from recording systems and existing management systems in a structured manner to a visualizing or simulation environment.

For analysis or planning purposes, however, a comparison of the data at different points of time - past, present, future - will be required. Therefore, all data imported into the pipeline are to be stored with specific "timestamps" and only then are to be passed on through suited filters or by queries to the graphics and visualizing level, thus introducing the dimension time. The concept "(Urban) Space-related Content Management (SCM)" was implemented to meet this demand.

Multi-dimensional Digital City Models

Voigt, Andreas, Achleitner, Elke, Linzer, Helena, Schmidinger, Elmar, Walchhofer, Hans Peter
Vienna University of Technology, Austria
http://wwwifoer.tuwien.ac.at eMail: voigt@ifoer.tuwien.ac.at

Abstract. Based on many years of experience with the digital city model of the Upper-Austrian capital city “Linz” (http://www.linz.at/) possible “dimensions” of a digital model are discussed in the present contribution putting to use: space & time (changes in space over a period of time call for a dynamic space concept); variants & versions (real only exists in a current state, planning mostly allows for several variants) and “Level-of-Object-Presentation” (accounting for the distance observer / object – depending on proximity of presentation the objects are divided into various sub-objects, i.e. the so-called “scene” is scale-dependent). Further key terms illustrated are the concepts “data-pipeline” and “urban-space-related content-management”.

Keywords. Digital Cities, Digital City Models, Data-pipeline, Space-related Content Management, Level of Detail (LOD), Level of Object Presentation (LOOP)

Figure 1. Variants of a building-up structure with identical gross cubic capacity - example Linz-Katzbach
Variants & Versions

Variants of data are used in order to provide parallel storing in the SCMS-system of different planning states and findings resulting from simulation based on the same source data.

Versions are used in order to provide for sequential storage in the SCMS-system of modified data from source data.

SCMS link available information (planning-relevant space-related information, meta-information providing them as “rich-media”; they manage and archive various versions and correlate existing modules (GIS, database, etc.). Thematic queries generate specific models and simulations accordingly. An export-module grants amongst others the data exchange, quality checks, the XML-export and the connection of special simulation-modules (visual simulation in CAVE, GIS-based simulations, complex spatial simulations, etc.). Linkage of SCMS-objects with existing services of other modules (GIS, database, etc.) is achieved via the 3D-object-IDs (identity specification). The access to the SCMS-data is to be available via links / URLs.

Figure 2. Versions (current and planned status) – example Linz-Eisenhandstraße

Level-of-Detail (LOD), Level-of-Object-Presentation (LOOP)

Regarding “space” and preparing activities via urban and regional development planning - which are to conserve or change the physical structure of space or its utilization possibilities -
we always rely on models with different degrees of spatial resolution (scales, grids or degree of details.).

Varying the details provided is of utmost importance considering modeling of urban space - different „levels of detail, LODs“ (Bourdakis 2001, Voigt et al. 2002) are to be differentiated:

• on the one hand these “LODs” act as auxiliary constructions handling complex and large data quantities;

• on the other hand the different LODs reflect the differing states of realization of spaces in the planning process (from the abstract “city volume” to the concrete architectural building).

According to the scale used single objects turn into one object of presentation (e.g. several buildings into a block of buildings). The “level-of-
object-presentation, LOOP* used in SCMS takes into account that the degree of detail of the object represented can also interact with planning-relevant information.

Utilization and Implementation of a Multi-dimensional City Model

A meaningful utilization and implementation of a multi-dimensional city model will basically focus on:

- providing and utilizing possibilities of data for and by as many “data-participating” facilities (e.g. geodata management, city surveying services, urban planning and traffic planning, building administration, demography and statistics, city archeology, etc.);
- a stepwise expansion possibility of data and systems both regionally and concerning their degree of complexity;
- good planning of information structures and requirements of the participating groups in the “digital 3D-acts”;
- tailoring the city model to the differentiated requirements of the “actors” of space, particularly concerning “experimenting” with urban space.

Further Research

The question as to which data really should be included into the models depends on the type of utilization, the structure of the user group and the requirements of the users. Providing an optimum source data set suited for the complete planning-, decision- and communication process throughout all spatial issues as well as the specifically required level of detail and the validation of simulation techniques (e.g. Markelin and Fahle, 1979, Keul and Martens, 1995) call for further studies in the field of planning sciences (e.g. Schönwandt 1999) also integrating environmental and perceptual psychology.

References


