



CityGML – Interoperable Access to Virtual 3D City Models

Dr. Thomas H. Kolbe

Dr. Gerhard Gröger

22 June 2005

Demands on a Unified 3D City Model

- Open, vendor-independent; GIS standards
 - Suitability for Spatial Data Infrastructures
 - Applicable for large areas and small regions
 - Models represented in low and high detail
 - Consideration of economic aspects
 - Reusable and combinable models
 - Representation of geometry, topology, semantics, and appearance
 - Multipurpose: different application fields
 - Prerequisite for market development
- ISO 191xx**
GML3
- Multi-scale model**
- Consensus needed regarding modeled entities & properties**



Unified 3d City Modelling: CityGML

- **Exchange** and **storage** of 3D city models
 - Sites, DTM, Vegetation, Water bodies, Transport
- Conforming to **Spatial Data Infrastructures (SDI)**
 - based on ISO/OGC standards (**ISO 191xx, GML3**)
 - data exchange by 3D **Web Feature Services**
- developed by the **Special Interest Group 3D (SIG 3D)** of the SDI North Rhine-Westphalia (**GDI NRW**)
 - result of consensus process (60 institutions from different disciplines)
 - ongoing work since 2002



SIG 3D members (excerpt)

Municipalities

- Berlin
- Hamburg
- Cologne
- Düsseldorf
- Bremen
- Essen
- Leverkusen
- Wuppertal
- Bochum
- Stuttgart

Administration

- State surveying agencies

Companies

- T-Mobile
- Bayer Industry Services
- Rheinmetall
- 3D Geo
- CPA Geoinformation
- Con Terra
- GraphiX
- GIStec
- Inpho
- Citygrid (AT)
- CyberCity (CH)
- Snowflake (UK)

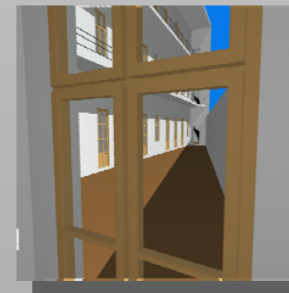
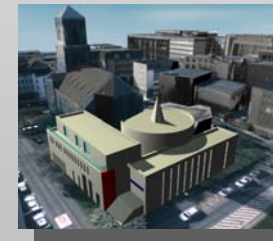
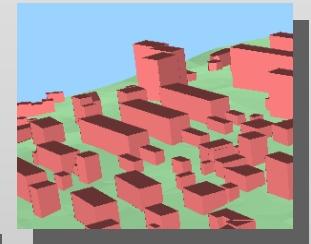
Science

- Univ. of Bonn
- Univ. of Hamburg
- Univ. of Potsdam
- Univ. of Hannover
- Univ. of Dortmund
- Univ. of Münster
- Fraunhofer Institute for Computer Graphics, Darmstadt
- Research center Karlsruhe
- Univ. of Applied Sciences Stuttgart



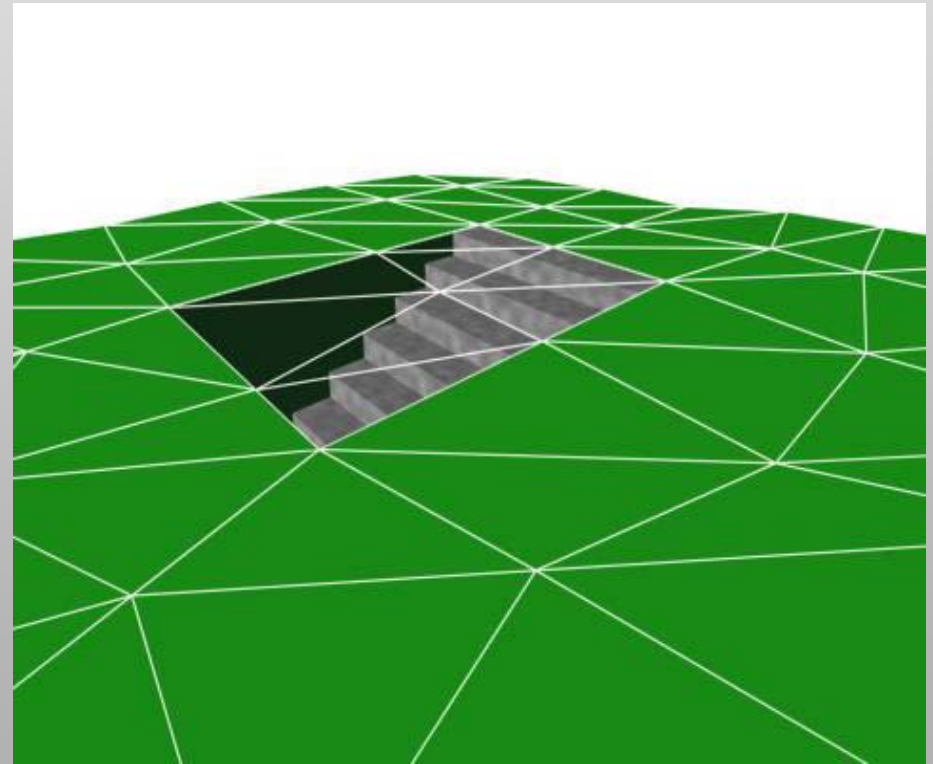
Multi-scale modelling: 5 level of details

- LOD 0 – Regional model
 - 2.5D Digital Terrain Model
- LOD 1 – City / Site model
 - “block model” w/o roof structures
- LOD 2 – City / Site model
 - textured, differentiated roof structures
- LOD 3 – City / Site model
 - detailed architecture model
- LOD 4 – Interior model
 - “walkable” architecture models



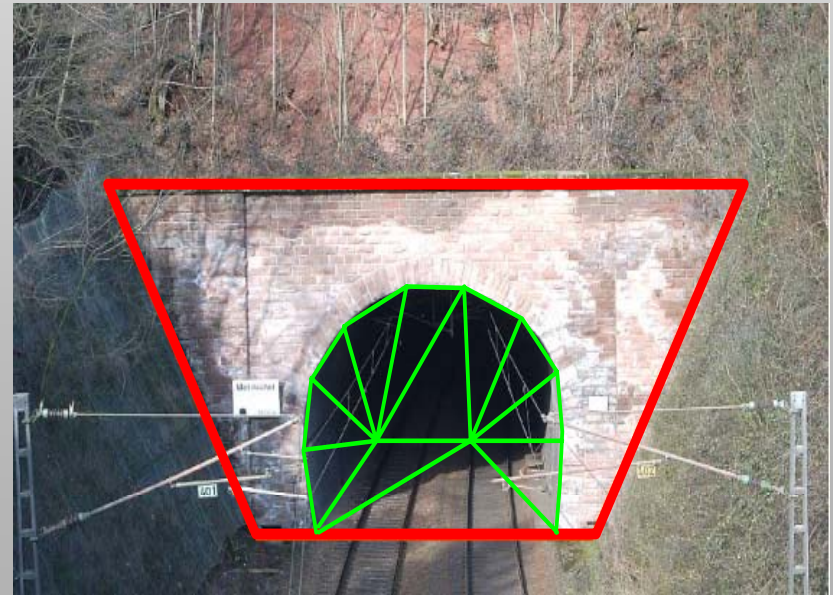
Closure Surfaces

- „Seal open 3D objects“
 - in order to be able to compute their volumes

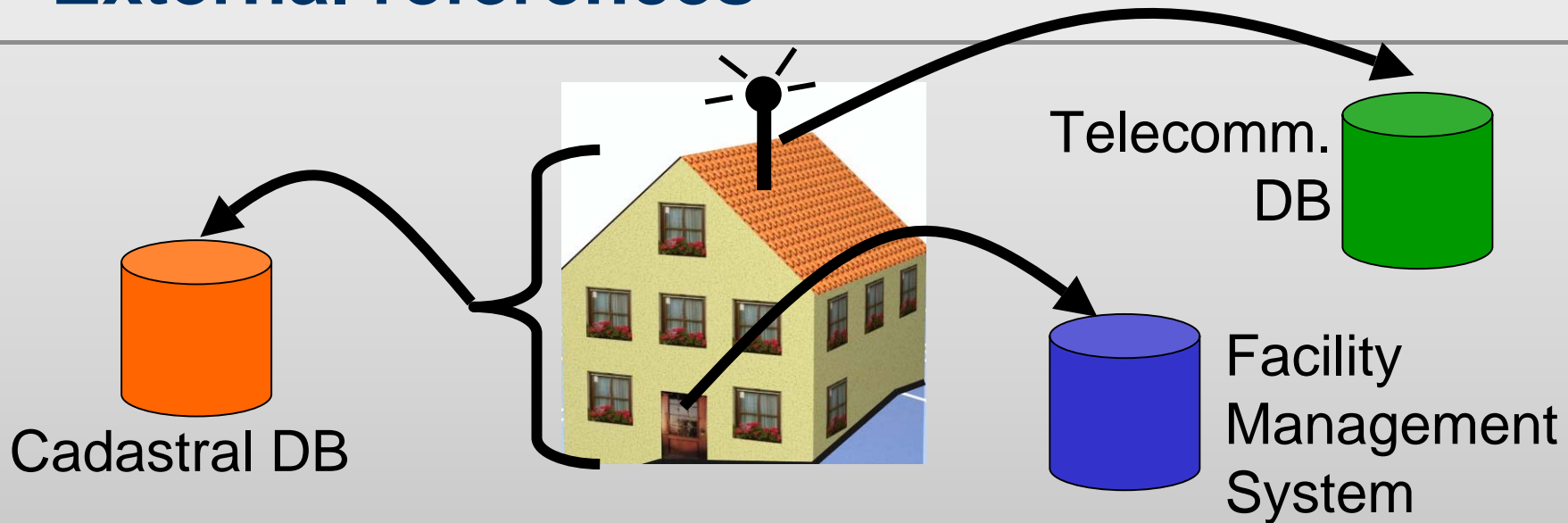


Terrain Intersection Curve (TIC)

- „Interface between 3D objects and the terrain“
 - ensure matching of object textures with the DTM
 - DTM may be locally warped to fit the TIC



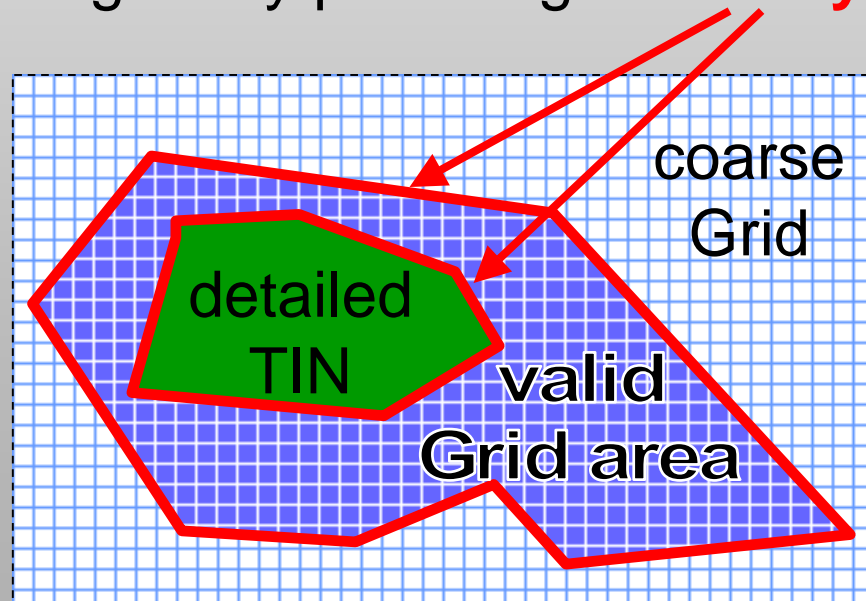
External references



- Every object (part) may have **references** to **corresponding objects** in **external databases**
- Connection with external information, e.g.:
 - building: link to cadastre, owner's contact information
 - door, antenna: link to facility management systems

Digital Terrain Models

- DTM for each Level of Detail can be composed of
 - **TINs** (Triangulated Irregular Network), **Grids**, **3D Breaklines**, and **3D Mass Points**
 - Each DTM component may be restricted to be valid in a specific region by providing a **validity extent polygon**



Validity extent polygon can have holes which allow **nested DTMs!**

Summary

- **CityGML** is an **application profile for GML3**
 - applicable to many different domains
 - consensus on the data model within GDI NRW (70 participants from different professional domains)
- **CityGML** represents
 - **Geometry, Topology, Semantics, and Appearance**
 - **5 consecutive Levels of Detail**
 - **3D Volumetric** and **Multisurface** objects
 - **DTM** in a flexible way (Raster, TIN, Masspoints, Breaklines)
- First Testbed realised (until 03/2005):
 - Berlin, Hamburg, Düsseldorf, Recklinghausen + Universities + Companies. Free test data and viewer available!