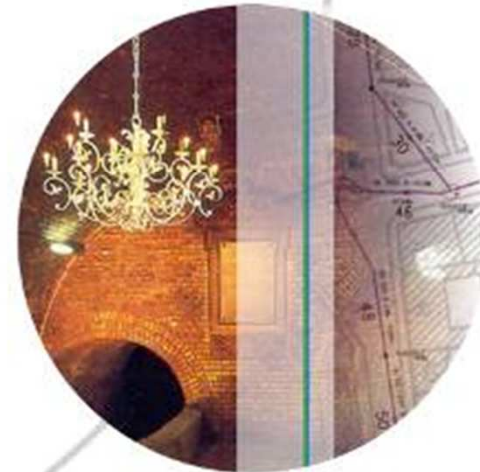


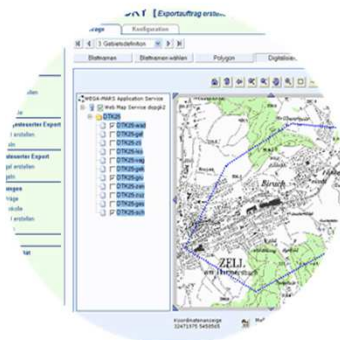
CityGML for environmental monitoring

Dr. Heino Rudolf, Volker Kraut

International SIG 3D and OGC Workshop on Requirements for
CityGML 3.0



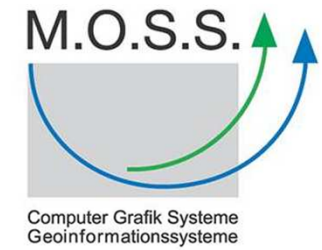
Content



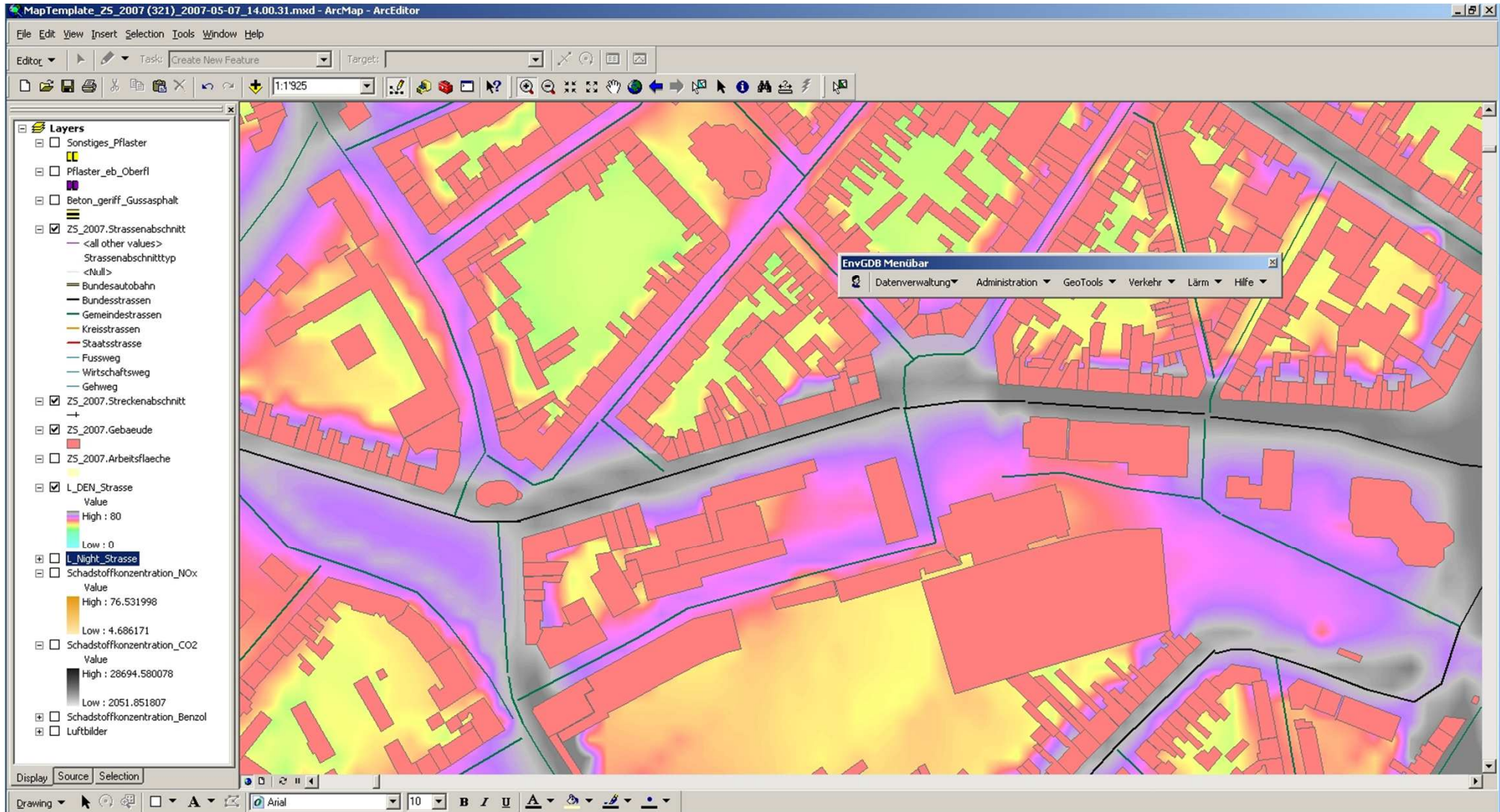
CityGML for environmental monitoring

- Environmental data management
(presented on practical examples)
- Problem-solving approach
- Approaches for CityGML usage
(presented on projects)

Environmental data management



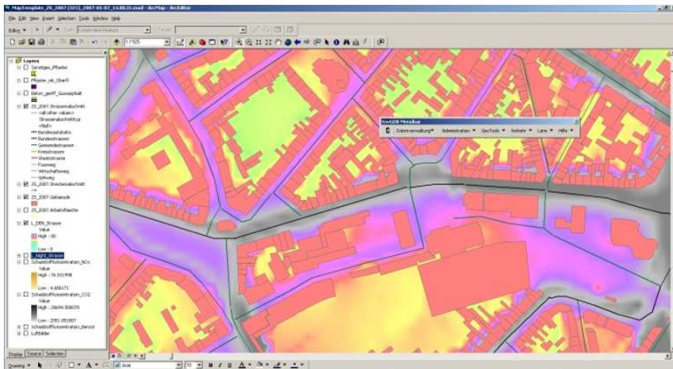
Environmental Noise Directive



Environmental Noise Directive

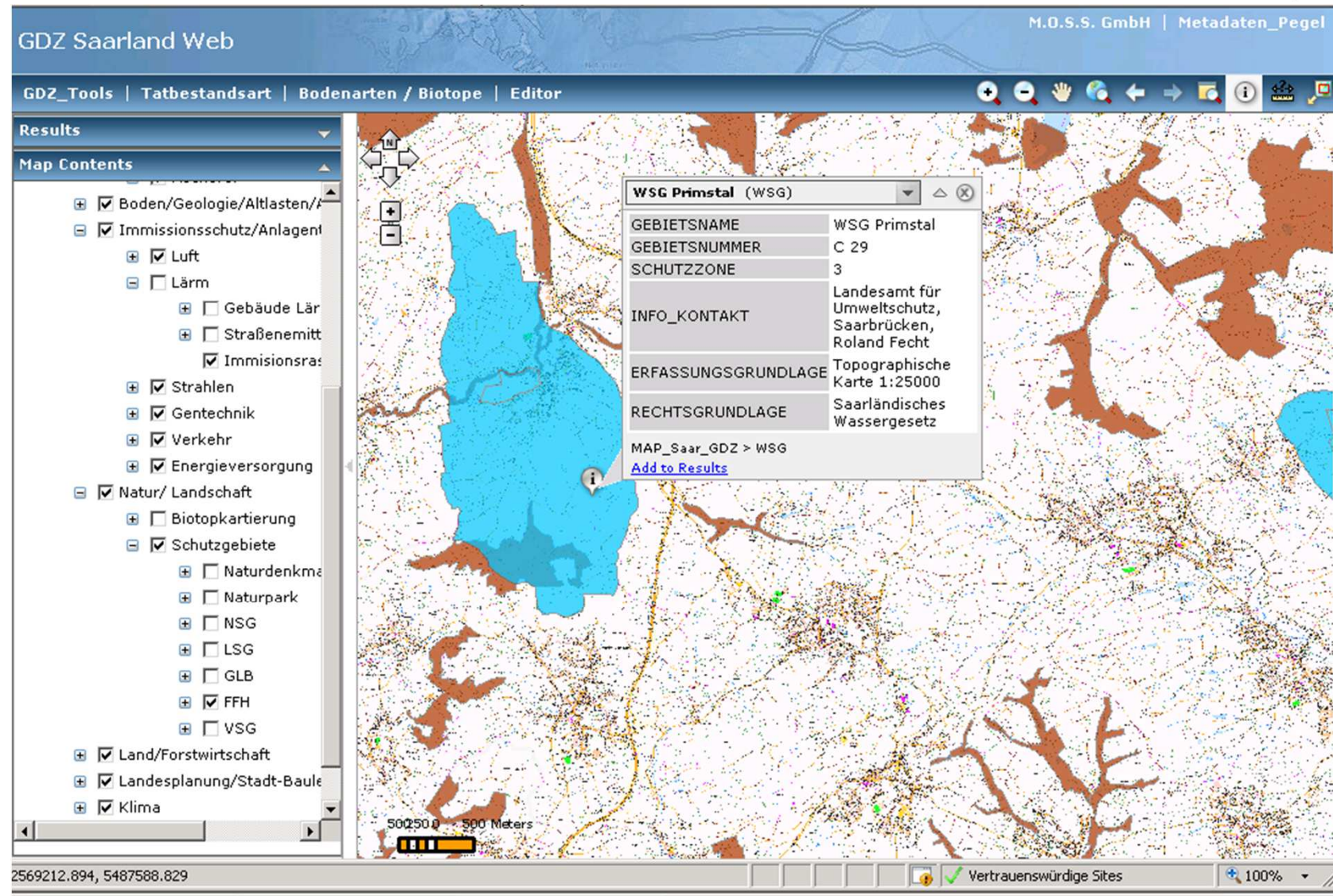
Observations & Conclusions:

- Sustainable data management with versioning for:
 - Transactions spanning a long timeframe
 - Management of reported environmental situations and planning data
- Interfaces to thematic simulation programs
- Improving the data quality for the simulation programs
- Organize a sustainable data management to enable the reuse of the qualified data

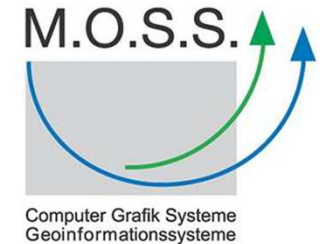


Environmental data management

Spatial Data Centre in Saarland

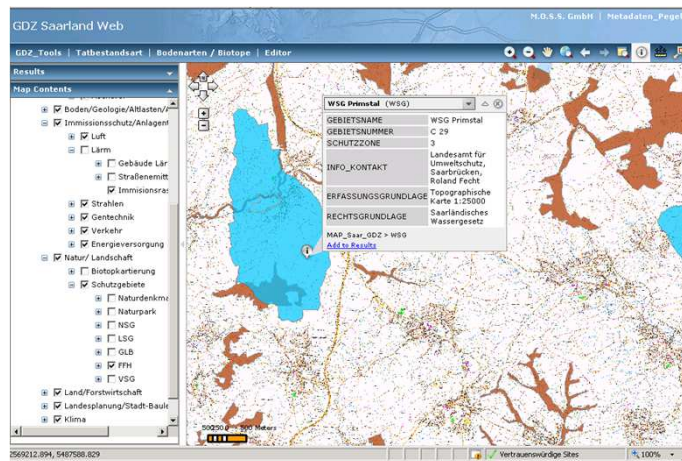


Environmental data management



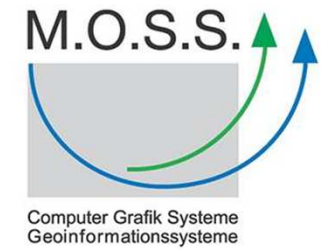
Spatial Data Centre in Saarland

Observations & Conclusions:



- Thousands of objects and attributes
- Conglomeration / mishmash of data structures
→ [example](#)
- Usage of reports, interpretations and analyses which base on data from all the different topics
- Cross-object data providing and management over all environmental topics
- One real object has often more than one graphical representation.

Environmental data management



Management System for the observation of mining (VATTENFALL)



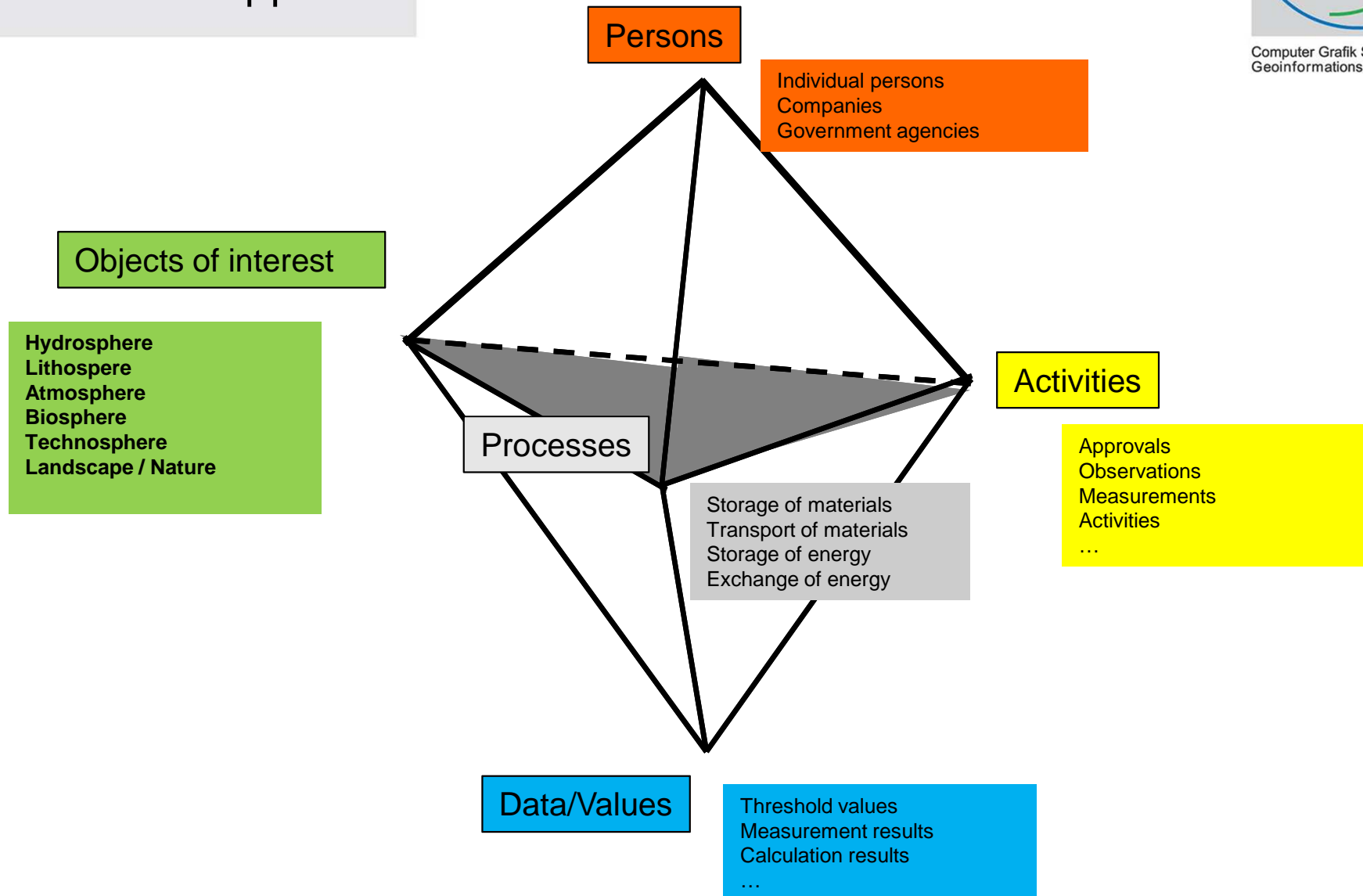
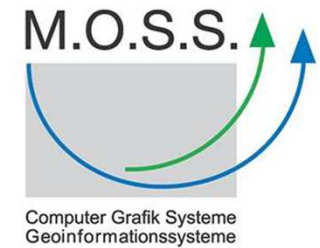
Management System for the observation of mining (VATTENFALL)

Observations & Conclusions:

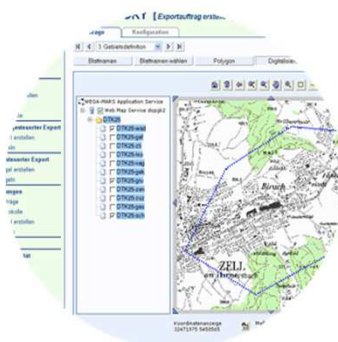


- Most of the data are without a spatial reference
- Interfaces to other information systems (e.g. SAP)
- Interfaces to real-time monitoring systems
- Necessity to manage equipment and operational procedures
- Necessity of an object oriented historiography
- Necessity of object oriented data access

Problem-solving approach



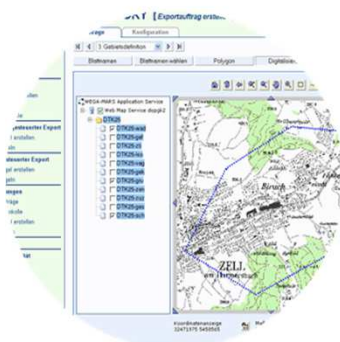
CityGML – the core



CityGML – the Core

- CityGML has a very compact, generic and flexible core (which we appreciate)
- This core allows to represent features with a spatial representation (within e.g. a city)
- The core provides mechanisms for storing a geometry, a visual representation and additional information like addresses or external references
- Also the core offers the ability to use generic objects and attributes
- The core is later on used to derive very specific objects like buildings, tunnels, rooms, windows, etc.

Challenges for CityGML



- For environmental monitoring often the human interaction with its environment is in the focus
 - **Activities:** which have consequences and therefore are monitored or regulated
 - **Persons:** which have to be regarded as independent entities because of their relations to other objects or activities
- environmental **processes**
 - Though they may have no fixed location or only occur at a specific time they are essential for understanding the environmental system
- Often **measurements or simulations** are conducted which produce values/results to describe features of interest within the environment

CityGML – Extension mechanisms



ADEs

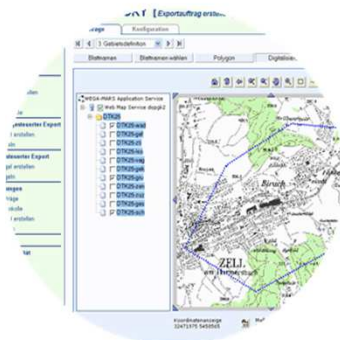
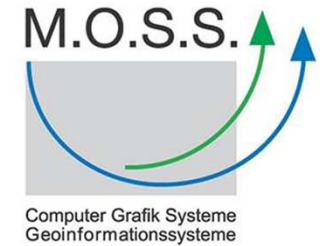
- flexible extension mechanism to make CityGML fit to domain specific needs
- ... often not supported from software
- have to be defined and agreed upon (which is a time-consuming process)

Generic Objects / Attributes

- mechanism to flexibly extend CityGML
- Supported from software
- Not that much of a “standard”

External References

- all the “intelligence” can be outsourced
- CityGML as spatial representation



Project i-SCOPE

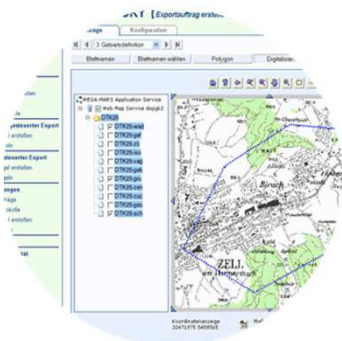
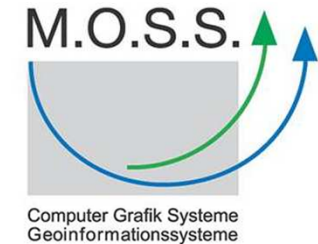
- “interoperable Smart City services through an Open Platform for urban Ecosystems”
- <http://www.iscopeproject.net/>
- 20 project partners from all over europe
- WP 3 evaluates the usability of CityGML for the topics
 - Noise pollution
 - Solar potential assessment
 - Routing (for disabled people)
- (and defines ADEs)



Project i-SCOPE

- Mission: "finding a mechanism which allows to flexibly attach measurement results to a cityObject "
- Secondary Goal: "make this mechanism work for different topics"
- Challenge: O&M / INSPIRE define the datatype "any" for values
- **Noise:** mobile application for smart phones to measure noise levels / spot values or time series / later on also aggregated to raster maps
- **Solar:** irradiation calculation
 - Irradiation results for Beam, Diffuse, Reflected & Total
 - Results per month & aggregated per year

time-dependent variable



- **What is a time-dependent variable?**

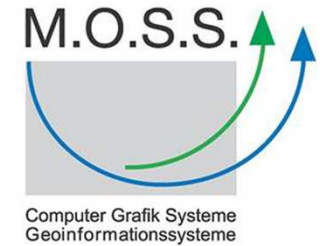
- Real-world objects may have dynamic properties that are varying over time
- Some phenomenon such as temperature or noise are highly dynamic over space and time
- A time-dependent variable defines property value(s) for a specific reference time

- **Requirements:**

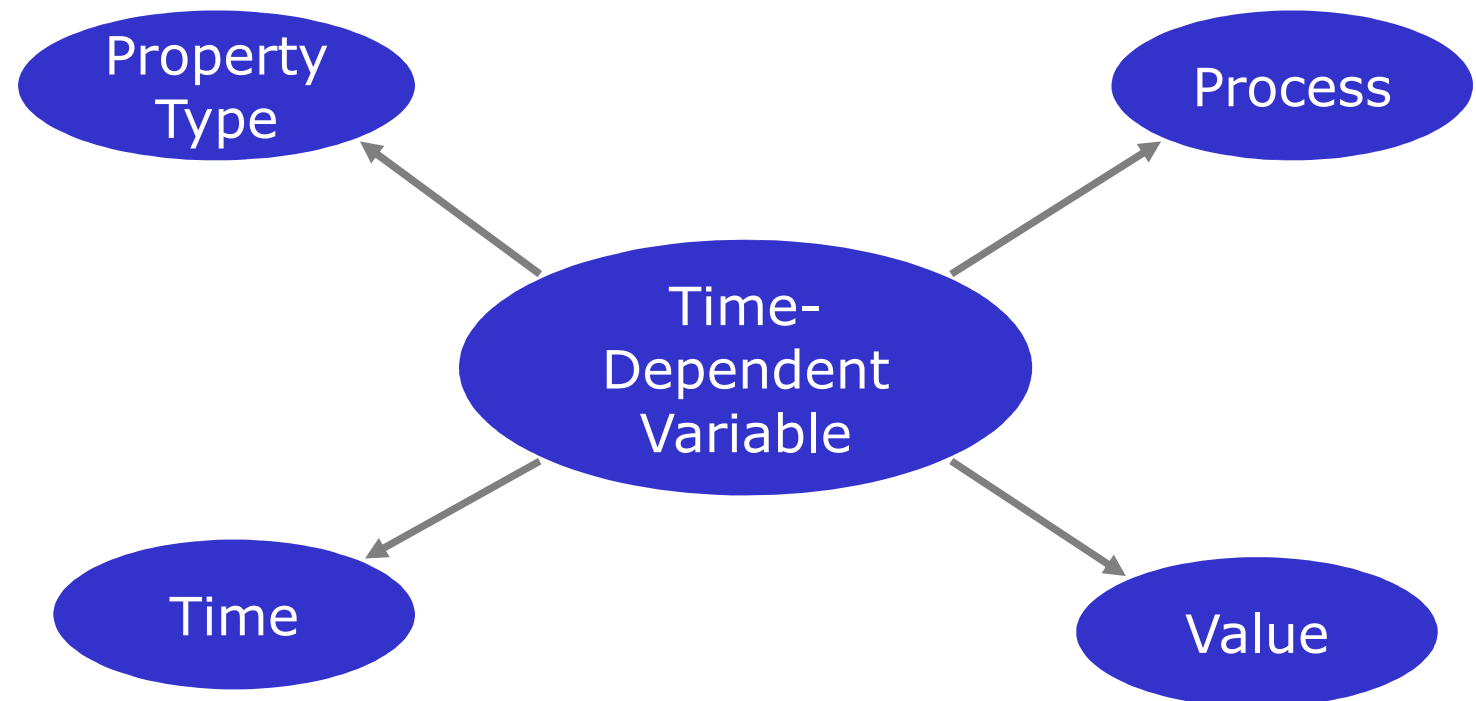
- Must be generic and can be applied to any City Object
- Support both simple and complex variables:
 - Single scalar value (i.e. indicator or measure)
 - Time-series
 - Composite scalar values (e.g. min, max, mean)
- Provide metadata about the time dependent variable
 - How was the time-dependent variable derived?

Source: Project i-Scope „CityGML - Time Dependent Variables“ Debbie Wilson, Peter Parslow, Volker Kraut 2013

time-dependent variable

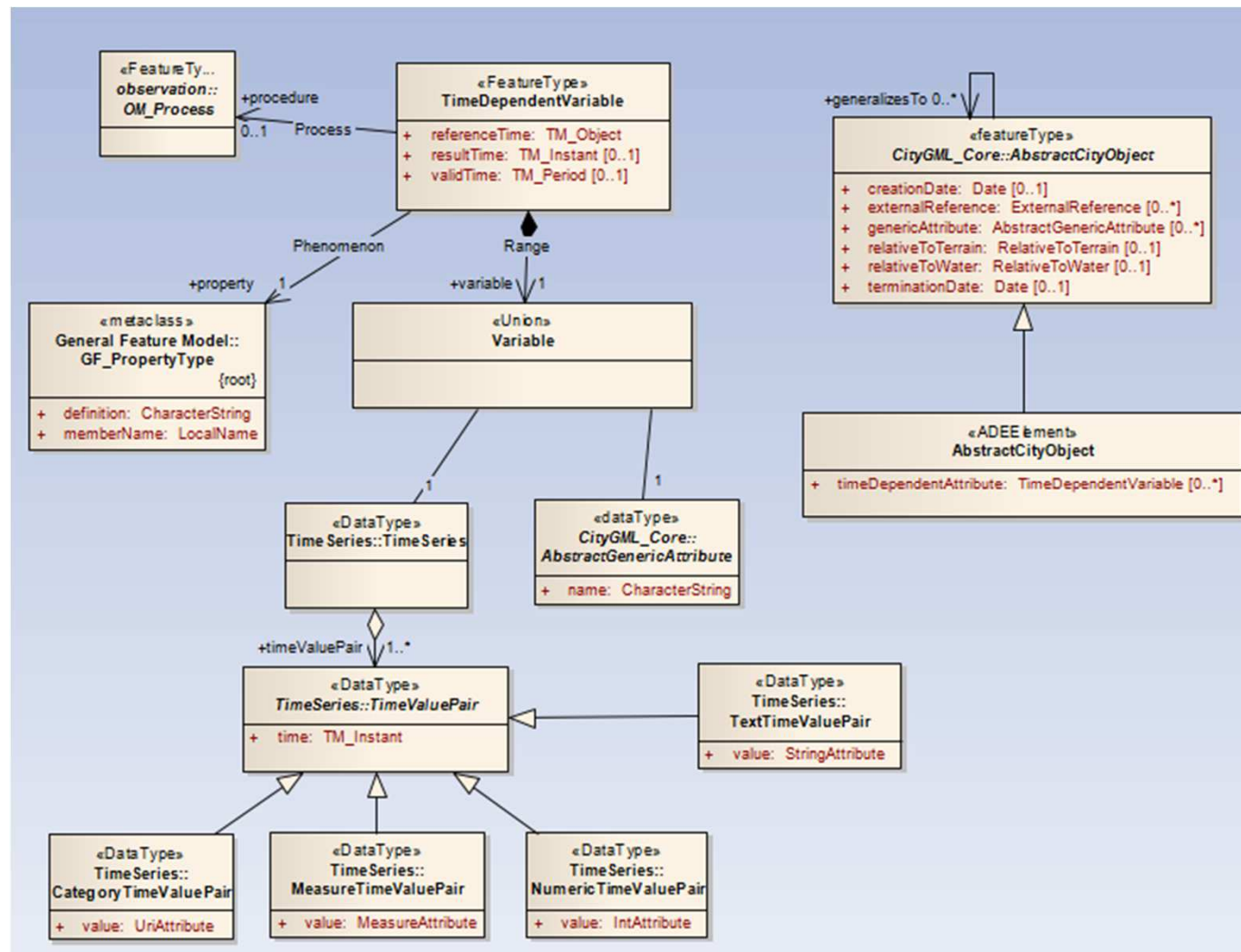


- Generic TimeDependentVariable <<FeatureType>> extends from Abstract City Object
- Follows similar modelling pattern to ISO 19156 – Observations and Measurements

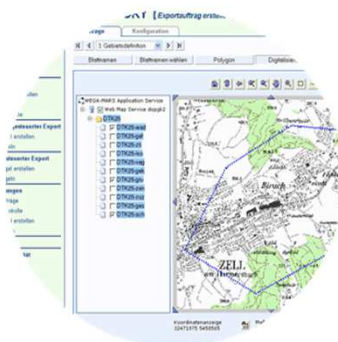


Source: Project i-Scope „CityGML - Time Dependent Variables“ Debbie Wilson, Peter Parslow, Volker Kraut 2013

time- dependent variable



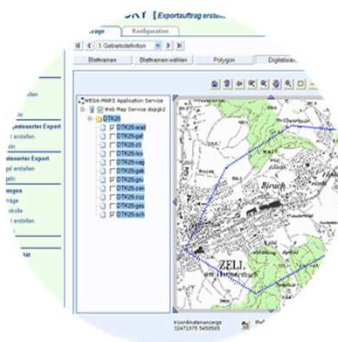
Source: Project i-Scope „CityGML - Time Dependent Variables“ Debbie Wilson, Peter Parslow, Volker Kraut 2013



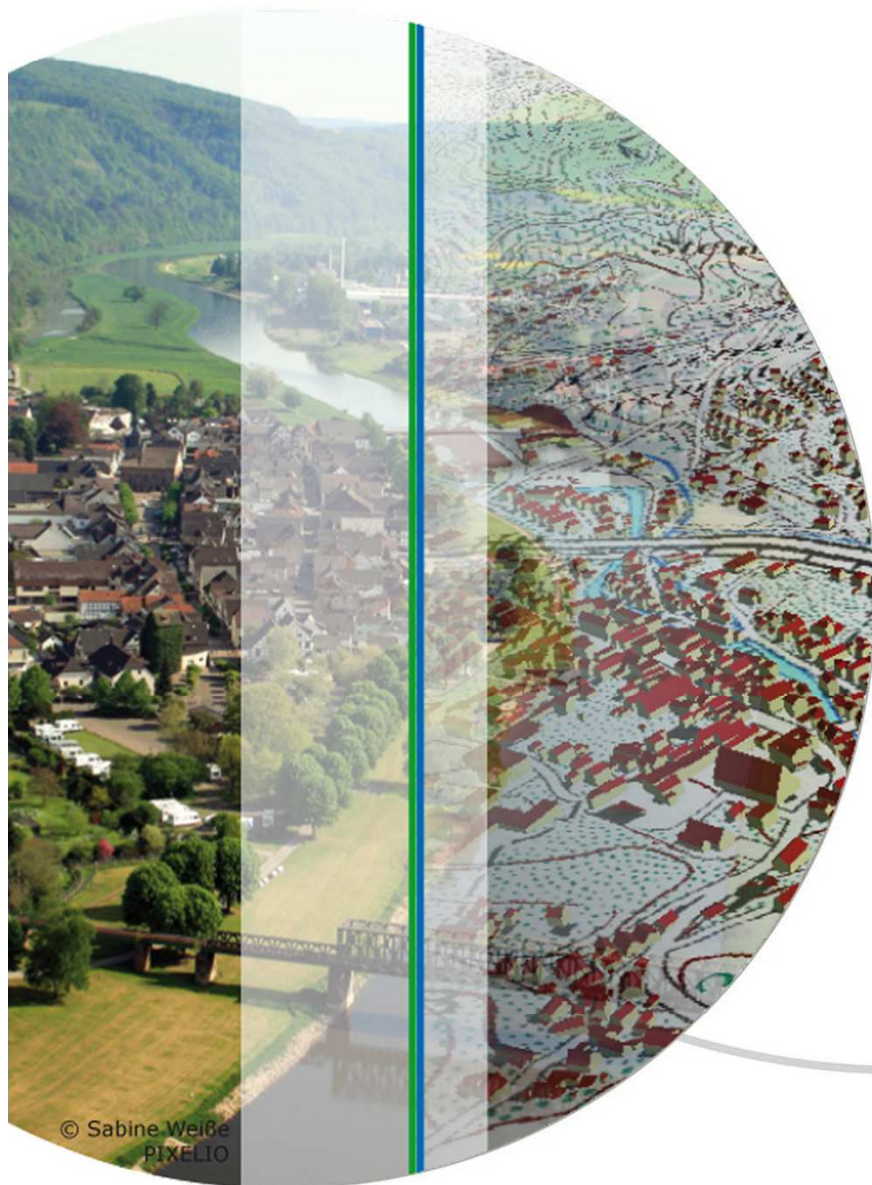
Heat demand in urban areas

- Project with HfT Stuttgart, GEF and others
 - Advancement of the modular built simulation tools
 - Provision of tool boxes for the simulation in urban areas based on a 3D-city model
- Heat requirements of the buildings
→ Net simulations
→ Simulation of scenarios
→ Dimension of the heat storages
→ Development of the heat requirements

Discussion



- Is there a way to combine these discussed approaches? What's the most practical solution, what's most effective one?
- Is it within the focus of CityGML to store "non 3D" objects? Is it intended to cover topics like environmental monitoring?
- Isn't the existing flexibility through extension mechanisms sufficient?
- Won't ADEs – when becoming more widespread – and covering the needs of many very complex and very individual topics become a science themselves?



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PIXELIO

Thank you very
much for your
attention!

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