

GISTools

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1 Background about Arkitektum as

One of Arkitektum's business areas is to develop and sell tools to help businesses become more effective in their use of conceptual UML models.

UML (Unified Modelling Language) is the preferred modelling language for conceptual models at international level (within the ISO/TC211 Geographic Information), in the work connected to the European INSPIRE directive, as well as in the national SOSI standardization in Norway.

Arkitektum has developed three tools to make the path from conceptual models to implementations easier. The three are PSTools, SOSI-plugin and GISTools. PSTools and GISTools are commercial products. SOSI-plugin is available for free in the Norwegian Geographical Information Infrastructure. In addition, Arkitektum has developed an ShapeChange user interface plugin to Enterprise Architect, making it possible to start the open Source ShapeChange program directly from the EA menus.

PSTools helps people defining their data product specifications according to the Norwegian implementation of ISO19131 Data Product Specification. PSTools needs a slightly modified version of the web-based feature catalogue as set up by www.geonorge.no. Both the user dialog and the output files have only Norwegian text for now.

The SOSI-plugin, another Enterprise Architect plugin, is the tool for transforming UML models into the Norwegian standard format for geographical data. The output from SOSI-plugin is of two kinds: One for people to read and understand, and one producing input files for the SOSI validation tool, SOSI-kontrol.

2 GISTools

GISTools is a Sparx Enterprise Architect (see <http://www.sparxsystems.com/products/index.html#desk>) extension that Arkitektum has developed to make the use of UML models and UML modelling more effective. One set of functionalities helps validating the UML model itself. The other set of functionalities is made to ensure that realizations of the UML conceptual models can be made in an easy and effective way.

Examples of realizations are producing GML-sample data, and producing SQL command file for creation of SQL-based databases conforming to the UML conceptual models.

All realizations need rules for how the UML language should be translated to the selected formats.

2.1 Validation of UML models

UML (see <http://www.uml.org/>) is a very general language to describe projects within digital information modelling. In geographical information context, the main emphasize has been on UML Class diagrams, and model elements needed for producing proper Class Diagrams. UML itself has some basic rules for the general language. The UML editor (Enterprise Architect) and the implemented GISTools functionality help users to fulfill most of these basic rules.

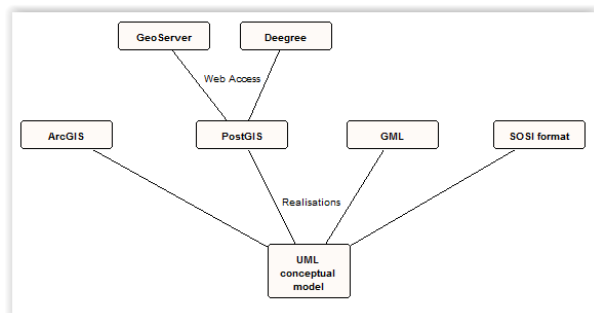
To be useful in a more specific area, such as conceptual modelling of geographic information, several additional sets of rules have been defined. Important sources for these additional rules are:

- ISO 19103 Geographic Information – Conceptual Schema Language
- ISO 10109 Geographic Information – Rules for Application Schema
- SOSI Del 1 Generell del – Regler for UML-modellering (only Norwegian)

In GISTools, the major parts of rules from these sources are implemented. In addition, some rules only derived from Best Practice, are added. In this context, this kind of UML model validation is a great help for people working with UML modelling.

2.2 Transforming UML models to other formats

The main purpose of conceptual models in UML is to use the models to create data conformant with the model. GISTools can help transforming models into PostGIS database, ArcGIS databases or structure of GML.



2.2.1 PostGIS database

PostGIS (see <http://postgis.net/>) is an extension to the general, open source SQL database PostgreSQL. With GISTools it is easy to create a SQL command file. By executing the command file in a PostgreSQL installation, a relational database is created with structure according to the UML conceptual model.



To be able to transform the UML model into SQL, PostgreSQL and PostGIS in a proper way, predefined transformation rules are defined, and validation against these rules are implemented. Before transformation is done, some additional checks of the UML model must be done. One example of checks needed is to ensure that SQL-reserved words not are (mis-) used in the UML models.

A proper transformation requires additional information, and important decisions to be taken. The GISTools PostGIS-transformation, let users add this information in a user dialog. Examples of input to the user dialog, is selection of a spatial reference system, and selection of methods for generating needed id's.

2.2.2 Generating ESRI ArcGIS databases

ESRI ArcGIS (See <http://www.esri.com/arcgis/about-arcgis>) is one of the world leading GIS tools. An extension tool for transforming UML conceptual models to ESRI ArcGIS data, is part of the initial



EnterpriseArchitect installation. The use of this tool requires the use of a special ArcGIS UML profile. The ISO 19109-metod for UML-modelling is not based on this ArcGIS UML-profile. Generation of ArcGIS-databases from ISO19109-based UML-models is a three-step conversion. Step one (the step

supported by GISTools) transforms the ISO19109-UML-model into an ArcGIS UML-profile based model. Step two, carried out by the initial EnterpriseArchitect plugin, transforms the ArcGIS UML-model into an ArcGIS workspace XML. Step three, supported by ESRI ArcCatalog, reads this ArcGIS workspace XML and creates the database.

2.2.3 Generating structure of GML documents

GML (Geographic Markup Language, see https://en.wikipedia.org/wiki/Geography_Markup_Language) is a XML-based datafile. The XSD-files gives the structure. Rules for transformation between ISO19109 UML and GML are defined in ISO 19136 annex D, and the rules are covered by the open Source software ShapeChange.

GISTools can, in addition to the XSD generated by ShapeChange, generate example datasets. Example datasets are very useful when you want to see the consequences of different ways of modelling applications in UML.

2.3 Generating data mappings between formats

2.3.1 GeoServer mapping files

Geoserver (see <http://geoserver.org/>) is “web interface” installed on top of a database, e.g. a PostGIS database. Geoserver makes it possible for web-applications to access the underlying database, and returns results as WFS/GML documents. GISTools can define the needed mapping files, ensuring that the PostGIS-database (created from an UML-model using GISTools) will be returned, using a WFS/GML structure conforming to the same UML-model.



2.3.2 Generating Deegree mapping files

Deegree (see <http://www.deegree.org/>) is a similar tool to Geoserver, i.e. it gives web-applications access to an underlying database, and returns WFS/GML documents. Deegree needs the similar mapping files as Geoserver.



2.3.3 Generating FME Schema mapper files

FME (FeatureManipulationEngine from Safe Software, see <http://www.safe.com/>) is a tool for transforming data from one format into another. The transformations can be predefined using FME SchemaMapper.

In the situation where GISTools have been used to define two different realizations of the same UML-model (e.g. one PostGIS database and a GML structure file), GISTools can be used to define a proper FME SchemaMapper file to transform datasets between these two.