National Spatial Information Models

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SUMMARY

This paper describes current developments in the Netherlands to come to National standards for the use and exchange of Spatial Information. Current increased use of internet techniques and electronic information exchange created the need for standardised methods in communication. The basic concepts date back to 1995 when the Dutch National standard NEN3610, the "real estate Information Model" (terreinmodel vastgoed) was accepted by the Dutch National Normalisation Organisation. The model was accompanied by a standard exchange format NEN1878 still based on the classical concepts of "punch card" formatted files .The last few years several developments took place which led a call for updating these standards. Most important were the activities to encourage Dutch municipalities to make Spatial Plans digital exchangeable according the Information Model for Spatial Planning (IMRO), closely related to NEN3610. Secondly the efforts of the ministry of Agriculture to set up an Information Model for the so called "Green Space"(everything except urban areas).

KEYWORDS: *Information Modelling, Standards, Exchange Formats, Spatial Models, NEN3610, IMRO*

INTRODUCTION

In 1995 an national standard is accepted for spatial information in the Netherlands [NNI, 1995]. This information model is called NEN3610 according to the number of the "norm" given to it by the Dutch National Normalisation Organisation. Exchange was described according to a format, NEN1878, also named according to a number [NNI, 1993]. These standards are agreed upon between most important Dutch bodies dealing with spatial information. The Ravi a council institutionalised by the Dutch ministries of Internal Affairs and Spatial Planning is responsible for its maintenance. For specific domains more specific Information Models are defined in correspondence to the "parent model" called "terreinmodel vastgoed" in Dutch (real estate information model). Most imported one is IMRO the Information Model for Spatial Planning [IMRO, 2003].

Despite the fact that these models are National standards there has been little use of them in daily common practice. However since a few years one is becoming aware that there should be made use of commonly accepted standards in exchange of spatial information.

RECENT DEVELOPMENTS

The Ministry of Spatial Planning started a program to stimulate the use of digital exchangeable spatial plans (DURP) in 2000. This program was set up to encourage local, regional and national organisations to transform existing spatial plans or/and create new spatial plans in a standardised way. Main objective is to make spatial plans mutually exchangeable and suitable for comparison with other spatial plans and monitoring progress and/or realisation. One of the targets is to have 70% of all local plans (on municipality level) available in digital format, according to the IMRO-specifications.

The Ministry of Agriculture started a research in 2002 to investigate possibilities and shortcomings of available standards for use in spatial plans and policy making. Since there were no specific Information Models defined for the non-urban areas, NEN3610 and IMRO were judged on their usage. This study focussed on use in research instead of exchange of spatial information only. Objective was to come to a so-called "Green-Space Information Model" (GRIM), which fulfilled research needs specifically for policy making and monitoring [Vullings, 2003].

THE DUTCH CONTEXT

In the Netherlands there are several initiatives carried out to structure the Spatial information infrastructure. We already mentioned the "parent model" NEN3610 and accordingly the model for spatial planning (IMRO) as the most important existing models. Other ones are the topographic model (TopNL) and the information model for Water (IMWA). Both are also based on NEN3610. In figure 1 this is schematically shown.

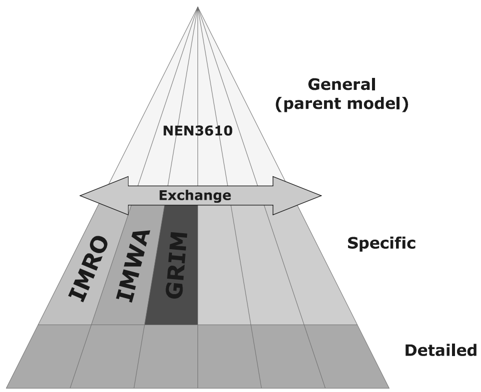

Figure 1: schematic representation of relationship between existing Dutch information models

This figure shows a certain hierarchy from general to more domain specific. The general level is more abstract and should be applied for all domains dealing with spatial information. The exchange format defined at this level is crucial for communication between domains. As is to be expected there will be a certain overlap between the different domains. That is where standardisation will help to communicate unambiguously. In figure 2 this is illustrated. It shows the importance to reach agreement in defining objects properly. So far the known models are used in drips and drabs. At one hand this is because integration between the different domains is not existing . At the other hand lack of information due to the fact that they are rarely used prevents further use. However current developments tend to an increased integration between domains, which will result in increased need for generally accepted information models!

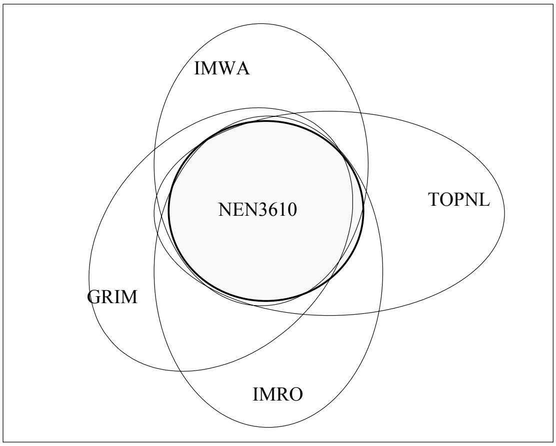

Figure 2: Schematical overview of overlapping domains

Another trend is to make use of more advanced analysis methods both in space and time which even so demands information models especially suited to carry out these analysis. In 2002 within the domain of the Green Space, which is roughly everything outside urban areas, a research is carried out to evaluate existing models and propose necessary extensions.

A SPATIAL INORMATION MODEL

In the research on the "Green Space Information Model (GRIM)" we used a theoretical approach [Vullings, 2003]. Despite the knowledge that information models do exist in the domain of spatial planning we tried to start from scratch. We started to define a framework in which defining models of the real world is described. The real world is recorded in what we call an information model. We define an information model as the formal definition of objects, its attributes, their mutual relationships and rules. An information model gives insight in structure and coherence of information within an organisation or system. We distinguish three levels within the modelling framework:

1. **Abstract Model**

This is the description of the real world on a conceptual level. Only those objects as part of the real world that are of interest within the context of the model are included. This means that the model specifically applies to a certain domain.

2. **Logical Model**

This is the description of the model on a functional level. It focuses on the relations between the relevant objects comprised in the model. The functionality is defined by the use of the model.

3. **Technical Model**

This is the description of the model on a technical level. It describes the implementation of the logical model in a certain technical environment.

All three levels describe the same model, but in different ways, to suit different purposes. There is a level dependency, which means you need level 1 to define level 2 and level 2 to define level 3. Besides full understanding is needed that the model itself is essentially the same on all three levels but differs in the way it is used. This means they should be fully consistent with each other.

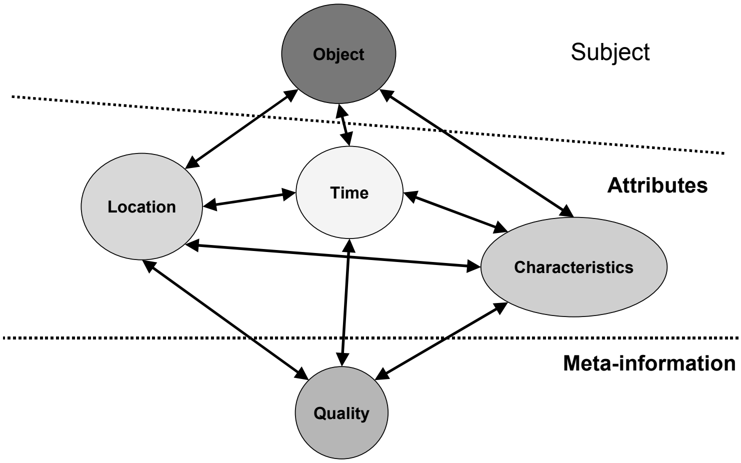

Figure 3: Schematic representation of GOBLET

Starting point for the information model is a spatial object. This generic object is called a GOBLET, a geo-object (GO) as a basic unit (B) for Location (L), Object-properties (E→ "Eigenschappen" in Dutch) and Time (T). Basically an object is described in a generic conceptual way for L(ocation) and T(ime) and domain specific in its properties (E). This has the great advantaged that the generic attributes are independently from the domain and the same for all the identified objects. This provides a consistent specification for exchange of spatial information. In figure 3 the GOBLET is schematically shown.

The subject (top of the diagram) is the physical object itself and on the meta-information level (bottom of the diagram) characteristics are identified to describe data about the object in a qualitative way. In specifying the three middle groups we wanted to identify all relevant uses of a Geo-object. For exchange, monitoring and policymaking this should be more than sufficient to fulfil all expectations.

LOCATION, TIME AND PROPERTIES

The three groups contain all the properties for an object to physically describe that object. We separated it into three categories to be able to cluster all the attributes in a coherent way. Space and Time seem to be relatively sector independent. They can be applied to all spatial objects in general.

Space being location properties basically contains geometric information and the co-ordinate system definition as metric parameters. Scale is an important factor because this will determine how an object will be referenced. Besides these properties more thematic spatial information can be added. For example in spatial planning it is common practice to limit areas in a more or less "vague" way. The problem of recording this object geometrical is that there is a known uncertainty for the co-ordinates of the specific object. These attributes also determine if and how spatial analysis methods can be applied to these objects.

Time properties will enable us to describe the life cycle of spatial objects. Time stamps to plan, construct, change or remove objects are the clearest properties for use. But there can be more specific properties if is necessary.

The third cluster comprises the domain specific properties. They can be divided into identifying properties and descriptive properties. The choice of which attributes are used depends on the domain in which they are used. However there will be an overlap of attributes which should be consistently defined.

Within the overlap it is very well possible that there is great difference in the degree of specification (could also be scale dependent).

IN PRACTICE

These concepts are evaluated for the current use of spatial information in spatial planning and policy making. We discovered that most of the existing models very well fit within our conceptual model. Not so surprising since it is a very general concept. But when the existing models are used more specifically it appeared that only part of the conceptual model is covered. The missing parts are the most difficult to measure (i.e. temporal attributes and more indicative geometric attributes like "vague" or "virtual" boundaries). The domain specific properties are usually well defined, but for these properties inconsistencies do appear. Most of the time this is caused by the way pragmatic choices are made in the process to define the model.

Nevertheless it is good that in a transition state to a new generation Information Models existing models can be used in accordance, be it with its shortcomings for more elaborate use.

INTERNATIONAL CONTEXT (existing standards)

On a European level the last 10 to 12 years a lot of initiatives are started related to standardisation of Geo-Information. In this paragraph a short overview [Aalders, 2004] is presented of most relevant activities.

In 1992 a specific Technical Commission (TC 287) on a European level is founded as part of the CEN (Comité Européen de Normalisation, [CEN, 2003]). The TC ended (and became "dormant") in 1999 and published a number of ENV's: European Norme Vorläufig (a combination of the three official languages within the CEN). It was assumed that ISO/TC211 took over the European GI-standardisation programme [ISO, 2003]. But since international standards are published Europe should decide for herself how to implement them in common practice. This is why TC287 is awakened in 2003 and started to bring standards within CEN and ISO together.

EC DG XIII (European Commission, Directorate General "Information Society") carried out several projects within the Framework Programmes 5 & 6 [EU, 2003]. Main goals where to stimulate use of digital techniques.

EUROGI, an Umbrella organisation for Geo-Information [EUROGI, 2003] founded in 1993 to stimulate the use of standards, the use of spatial infrastructure and Meta-information within the GI-society. This should accommodate the development of Global Spatial Data Infrastructures (GSDI).

The OGC (OpenGIS Consortium) is an international non-profit-organisation founded to improve interoperability for Geo-Information processing. OGC signed a Memorandum of Understanding with ISO/TC211 in which both work is acknowledged.

INSPIRE is an European initiative to implement European and International standards. INSPIRE today is dealing with the Environment, but it is intended to extent to other sectors as well [INSPIRE, 2003/2004].

These European efforts on standardisation do contribute to standardisation on a National level. That's why currently the published ENV's are harmonised with the ISO191xxx series.

These activities have led to a number of accepted standards which are adapted in common practice. Most of the standards focus on technical implementations for Geo-information and as an example we mention the Simple Feature specifications of the OpenGIS Consortium.

DISCUSSION AND FUTURE DEVELOPMENTS

Summarising on-going activities in the Netherlands it is clear there is a growing need for more elaborated information models. In general there is commitment on the fact that we need a new generation of standardised information models. The models are to be defined on an abstract level by leading national GI-organisations and accepted by normalisation institutes. The results hereof should be the base which makes it possible to build technical implementations by public and private parties.

Major achievements will be that integration over domains is seamless, and that it is extendable. To administer this a protocol to deal with proposals for change must be available. It will be in line with or include existing and accepted standards. Specific spatial specifications as for instance handling of “indicative” or “vague” boundaries are difficult. It will take time to come to an agreement how to specify this. But by making the Information Models extendable this can be added when time is ready. If properly defined there will be a lot of new possibilities for (spatial) analysis and monitoring.

The Ravi, the Dutch organisation to administer Spatial Information Models is started a project in 2003 to revise NEN3610, the “parent” Information Model. For domain models especially for spatial planning the existing Information Model (IMRO) is adjusted to make spatial plans on a local, regional and national scale digital exchangeable.

In the next few years Governmental Organisations wil more and more demand that Spatial Data Exchange will be according to the (Inter)national standards. This will speed up the process to define the new generation of National Information Models.

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