



Effective and systematic handling of the distribution of geographic information

Documentation

Version history:

Version	Date	Person responsible	Amendment
0.1	24/01/2014	Peter Huber	Document created
0.2	30/01/2014	Peter Huber	First edit and addition of past principles
0.3	31/01/2014	Peter Huber	Addition of figures
0.4	17/02/2014	Peter Huber	Edited following work meeting
0.5	27/02/2014	Peter Huber	Figures edited
0.6	04/03/2014	Peter Huber	Edited following work meeting
0.7	30/10/2014	Flemming Nissen	Edited for English translation (illustrations adjusted)
0.8	12/01/2015	Flemming Nissen	Edited for minor translation issues
0.9	23/01/2015	Flemming Nissen	Edited by others with minor changes

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Introduction and background

Geographic information is maintained in a number of management systems used by various authorities. Other authorities and private operators are experiencing an increasing need to use these data in business processes. The public reference architecture “Stedet som nøgle” [“Location as key”]¹ describes the concept of distributing geographic information via services.

This document presents general ideas about how geographic information distributed in this manner might be handled effectively and systematically, e.g. by an authority.

Data modelling is an activity that is necessary to allow rational creation and distribution of data. Before now the focus has mainly been on designing a system with a database intended to contain data objects with an appropriate set of attributes. It is now necessary to model this updating and storing of data, in addition to a distribution model, in a way that is easy to maintain for business, technical and, of course, documentation purposes.

Reuse of INSPIRE’s well-founded modelling and method basis, which is based on ISO and OGC standards, provides a number of possibilities. The perspective is **model-driven development**, which collates the maintenance of data models and documentation in one location and allows for the fully automatic generation of logical/physical schemas. This forms a basis for optimisation and may contribute to ensuring transparency in the development and management of both the creation and use of data.

The ideas behind this work go hand in hand with the work carried out under the auspices of INSPIRE and in the Basic Data Initiative² as part of the public digitisation strategy.

Target audience and document series

This document is aimed at all authorities responsible for geographic information and thus for making data available to other operators. This applies in particular to authorities responsible for INSPIRE data and authorities responsible for geographic information that constitutes basic data, e.g. GST³ and MBBL⁴.

This document is the first of several:

1. This document, which describes the concept
2. Common model rules for basic data in the Basic Data Initiative. Maintained by DIGST⁵
3. Modelling method. Method focusing on geographic information as a supplement to document 2. Relates specifically to information models for geographic information in UML.
Target audience: those modelling or ensuring the quality of distribution models for geographic information
4. Tool guidance/“cookbook”
Target audience: those modelling using the same tools as in GST or looking for inspiration for the creation of a comparable environment

¹ SERVICEFÆLLESSKABET FOR GEODATA. *Stedet som nøgle - Referencearkitektur for stedbestedt information, version 1.0 (udkast)* [online]. 2010. Tilgængelig på: <http://digitaliser.dk/resource/447643>

² 1. DIGITALISERINGSSTYRELSEN. Basic Data | Digitaliseringsstyrelsen. [online]. Tilgængelig på: <http://www.digst.dk/ServiceMenu/English/Digitisation/Basic-Data>

³ GST = Geodatastyrelsen = Danish Geodata Agency. See also <http://gst.dk>

⁴ MBBL = Ministeriet for By, Bolig og Landdistrikter = Ministry of Housing, Urban and Rural Affairs. See also <http://mbbl.dk>

⁵ DIGST = Digitaliseringsstyrelsen = Danish Agency for Digitisation. See also <http://www.digst.dk>

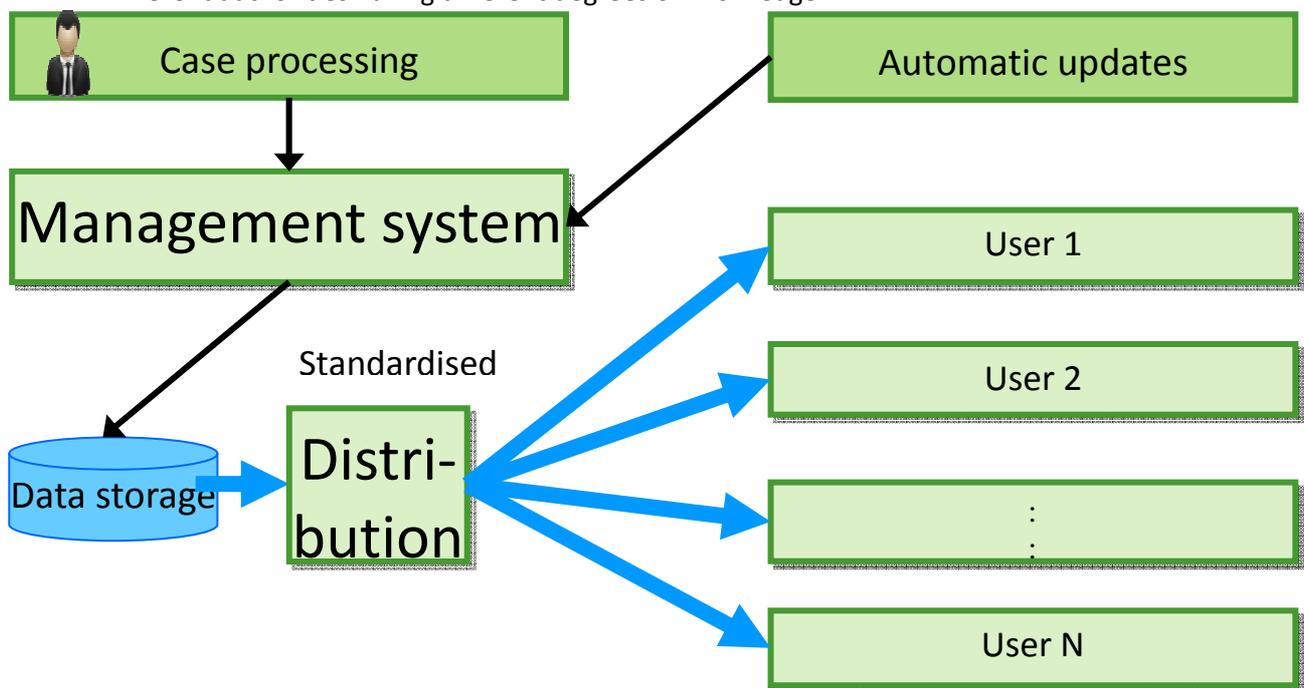
5. Prepared example

Target audience: those modelling, using or ensuring the quality of distribution models for geographic information

Current issues

At present, the handling and distribution of geographic information is characterised by:

- Each authority using its own methods, techniques, tools and infrastructure
- Processes often not being automated, which means that time-consuming hand coding is widespread and a source of error
- Different models and terms making cross-authority matching difficult
- A random selection of approach and methodology, which results in different solutions and distribution types
- Data management not being a developed discipline
- Different authorities having different degrees of knowledge



Target illustration

Figure 1: Systematic and standardised distribution of data

This document gives a general description of how an authority responsible for geographic information can distribute such data from a management system identified as a source (master) more effectively. Data are distributed through an infrastructure such as that labelled “Distribution” in Figure 1. This might be an individual or common infrastructure, e.g. a data distributor, received by a number of data users via standardised interfaces.

Principles for effective handling of the distribution of geographic information

A change to a more effective and systematic distribution and use of geographic information as shown in the target illustration can be achieved using the principles below as a guide. They are described in more detail in Appendix 1:

1. Common methodology for distributing geographic information

2. Common methodology must be model-based
3. Consistent information models
4. The INSPIRE models are used as they are or as inspiration for structure
5. Greatest possible automation during development

Advantages for those distributing data

The above principles and the method described in this document series allow authorities to distribute data:

- To ensure consistency with other authorities' data using models
- To use recognised international standards
- To make use of effective tools for development and maintenance
- To share knowledge and experience with others responsible for data
- To establish "data building blocks" for cross-authority composition
- To see the synergy between different distribution requirements, e.g. INSPIRE and basic data
- Better control of versions
- Better opportunities for testing and finding any errors quickly

Advantages for data users

The above principles and the method described in this document series allow authorities or private operators using others' data:

- To gain access to a well-documented basis from which to consume data
- To reuse and integrate data structures from different data sources (see Figure 2)
- Access to more standardised data that use the same data types etc.
- An easier way of using geographic information, thereby reinforcing user innovation

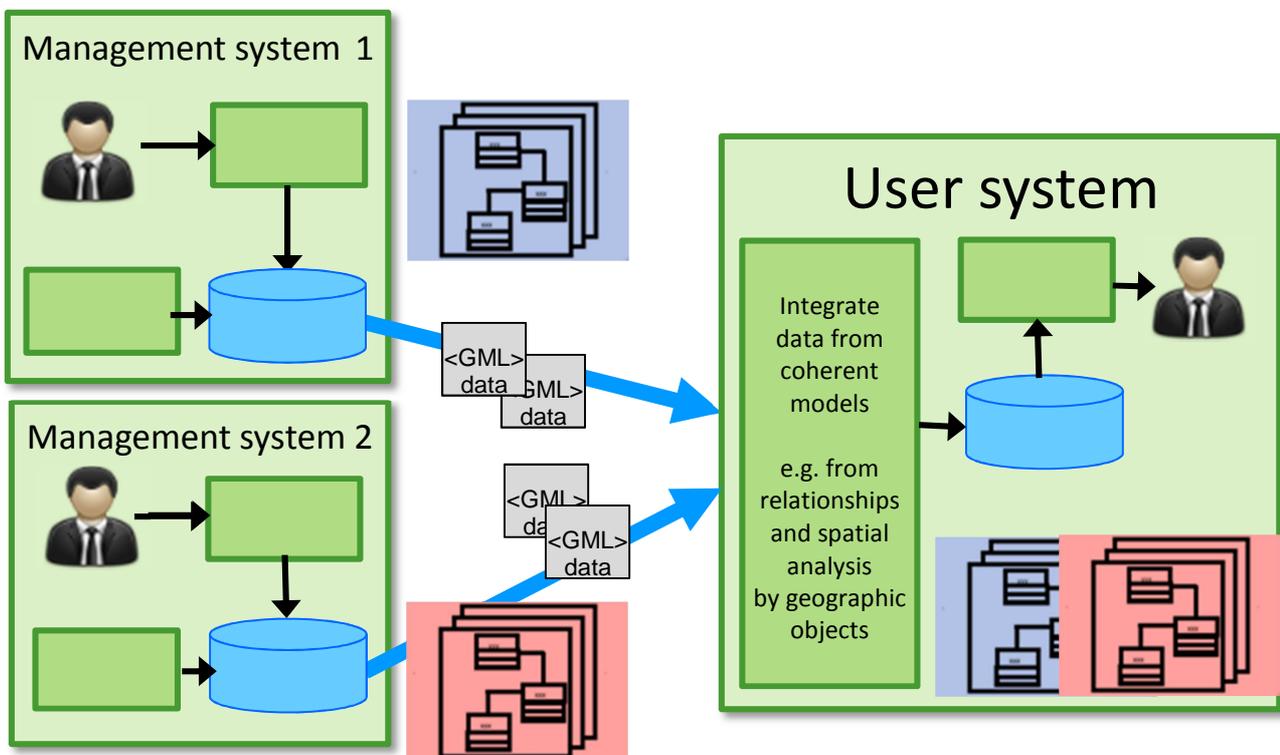


Figure 2: User opportunity to integrate data from different sources

Model-based development is the key

To work effectively and systematically with the distribution of geographic information, principle 2 puts the emphasis on model-based development. An information model for distribution data shows all the details of the data being exchanged in schemas in data services. It is this elevation from a physical schema to a more manageable and communicable so-called logical model that gives this approach value.

Figure 3 compares model-based development within IT with corresponding disciplines/models within the construction industry. The resultant building is built after thorough architecture models are prepared, partly with the customer as the target audience and partly with the builders as the target audience. The customer naturally expects there to be a consistency and similarity between the models and the actual building. If, during the project, decisions are made to change the building, this should happen on the basis of the drawings prepared. This is an advantage of good documentation throughout the project and for later maintenance.

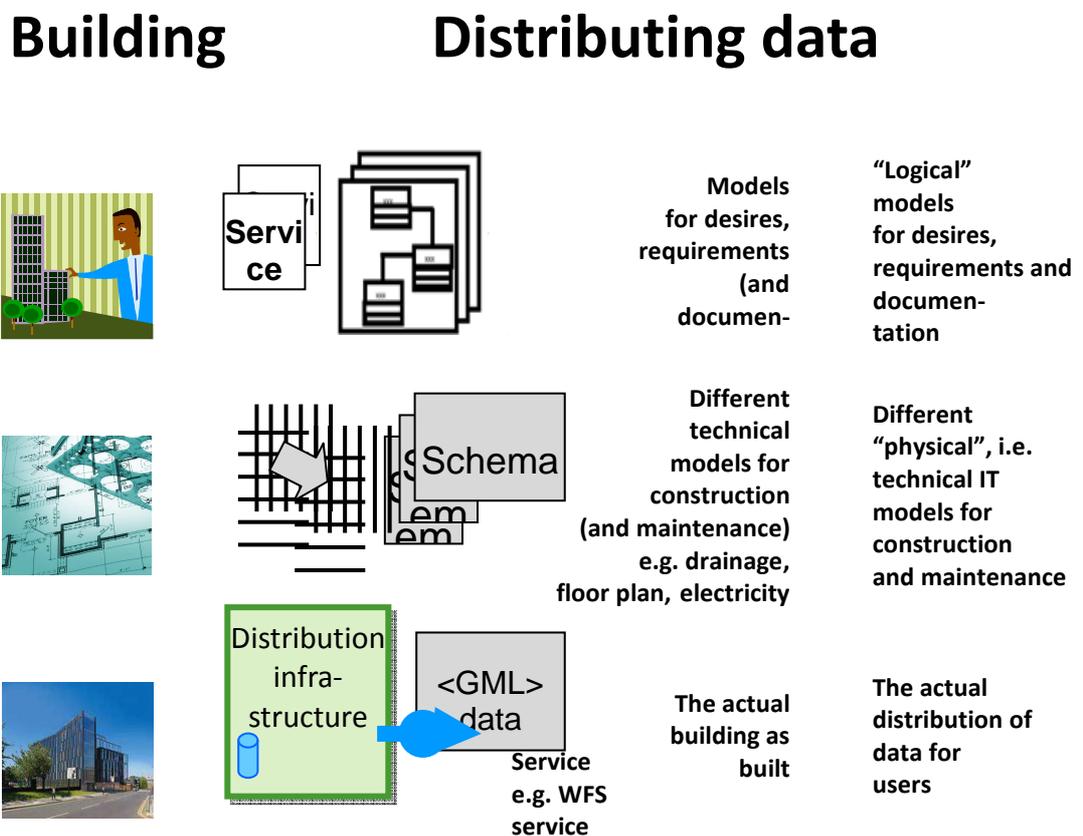


Figure 3: Model-based development within the construction industry and IT industry

Work was carried out in collaboration with the Basic Data Initiative. For basic data that are also geographic information, models can be built that both observe the common model rules from the Basic Data Initiative (document 2 in the series) and make use of techniques, standards and best practice from the geographic community, which is described in general terms here and in the more detailed documents (documents 3 to 5 in the series)

One important framework condition is well-established, good and solid practice in the form of INSPIRE’s ISO methodology framework specific to geographic information. A number of guidelines for the preparation

of data specifications/models have been published under the auspices of the international standardisation work involving INSPIRE. These guidelines are based on the ISO 19100 standards concerning digital geographic information including e.g. Geography Markup Language (GML), Web Map Services (WMS) and Web Feature Services (WFS). These ISO standards are typically quite abstract, but the guidelines published in connection with INSPIRE help to operationalise them. The guidelines form the basis of current Danish methodological work in the form of principles and particularly emphasis methodological guidance as to how INSPIRE and the ISO standards can be used as a basis for modelling and specifications as regards the distribution of geographic information.

Necessary frameworks used by authorities responsible for geographic information

In order to work more effectively with the distribution and use of geographic information, skills must be developed to handle the method described with associated tools and good practice. This must be combined with good management and maintenance of the information models prepared. This is important both in-house and in communication with other parties responsible for data and the steadily increasing number of users.

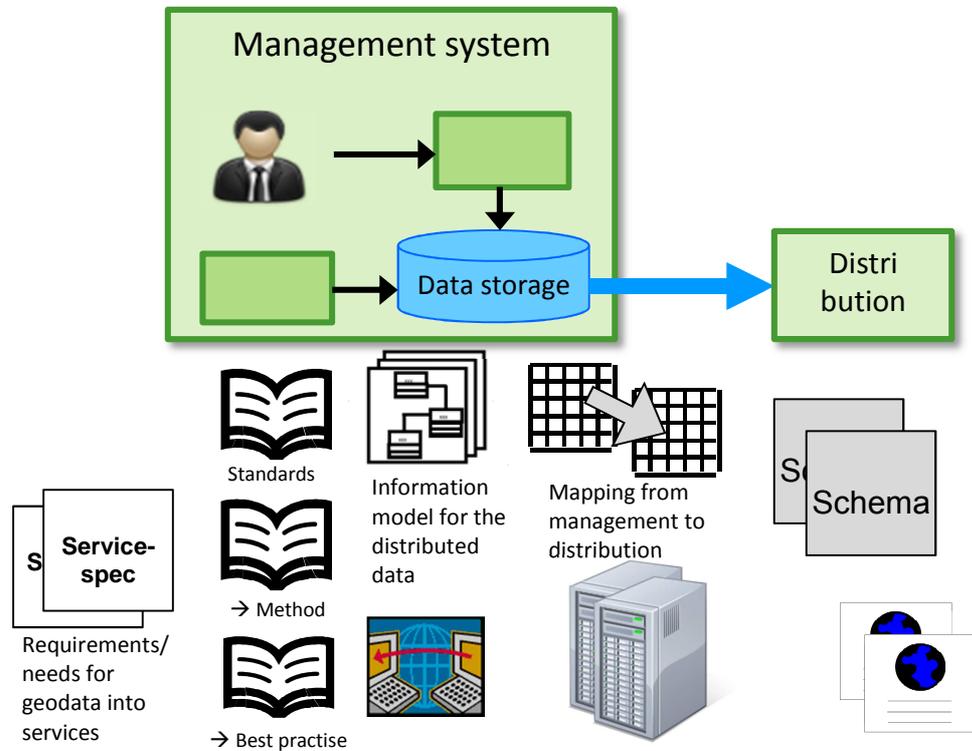


Figure 4: Elements for the effective and systematic distribution of geographic information

Using the standards and methods described in this document series, good practice and tools as a starting point, authorities responsible for data can, by themselves or with help from external resources, establish a set-up that supports the following systematic and effective process:

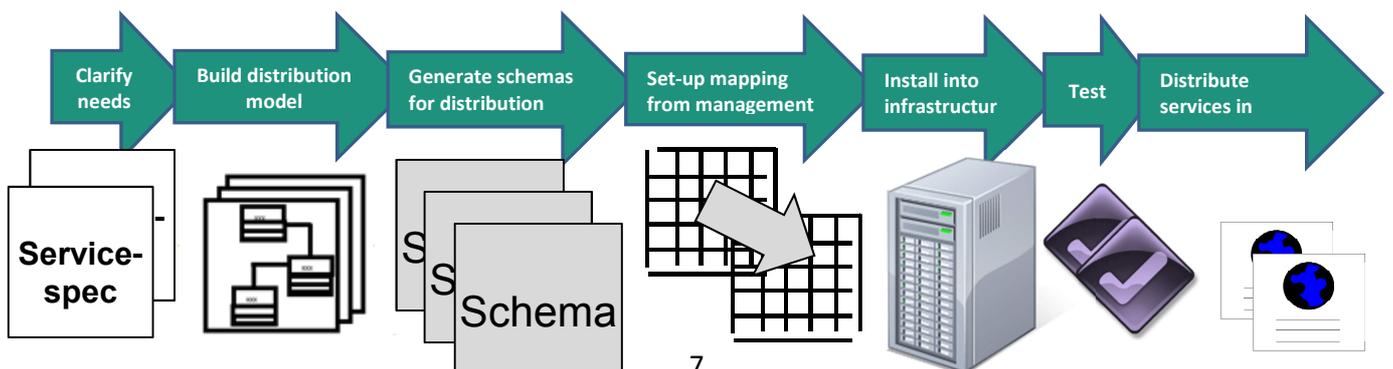


Figure 5: Process used by authorities responsible for data as regards distribution of data

The following documents describe details of methods for distributing models (document 3 and 5) and a set-up with specific tools used by GST (document 4).

Appendix 1: Principles for the effective and systematic distributing of geographic information

Principle 1	Common methodology for distributing geographic information
Description	Common methodology used in the development of data deliveries based on INSPIRE's ISO-based framework.
Rationale	<ul style="list-style-type: none"> • INSPIRE has a well-developed, ISO-based framework that was used successfully in INSPIRE's standardisation work • One common methodology • Skills development and interdisciplinary knowledge sharing
Consequences	<ul style="list-style-type: none"> • Coordination of methodological work, e.g. common terminology • Users get more uniform access to information about data • Users get more uniform access to data

Principle 2	Common methodology must be model-based
Description	Development of the structure of the data distribution based on UML models with associated integrated business-related descriptive documentation
Rationale	<ul style="list-style-type: none"> • This is best practice for data management • Effectiveness • Better traceability and transparency • Documentation is aggregated in one tool • Better understanding of data rather than just physical schemas • Easier to exchange data descriptions
Consequences	<ul style="list-style-type: none"> • Develop modelling skills within individual authorities • Uniformity e.g. use of the same date format for all data, the same naming conventions and use of UML structures

Principle 3	Consistent information models
Description	Consistent information models are used to distribute data for multiple authorities e.g. via the data distributor, to INSPIRE and other public data deliveries.
Rationale	<ul style="list-style-type: none"> • Synergy in modelling work • Reuse of models • Integration to other authorities' data
Consequences	<ul style="list-style-type: none"> • Common repository or systematic sharing of models • Common elements can be used • Common generation methods can be used • Interoperability between domains and organisations • Easier for users to integrate data

Principle 4	The INSPIRE models are used as they are or as inspiration for structure
Description	Models for geographic information covered by INSPIRE are modelled as described here or at least inspired by what is described here.
Rationale	<ul style="list-style-type: none"> • Make use of extensive pan-European work wherever possible • Prepare later specification extensions • Forward-looking European distribution made simpler
Consequences	<ul style="list-style-type: none"> • Need to read up on INSPIRE models • National extensions of INSPIRE can be built systematically in UML

Principle 5	Greatest possible automation during development
Description	Greatest possible automation, e.g. using tool-supported mapping from data interface management systems and generating schemas with associated documentation material from UML models
Rationale	<ul style="list-style-type: none"> • Increasing number of models • Effectiveness • Traceability from model to schema • Consistent documentation
Consequences	<ul style="list-style-type: none"> • Methodological work on tools and scripts • Generation to GML is already established for geographic information • Corrections carried out in models