EXCHANGE OF DATA

by Søren Riff Alexandersen

National Survey and Cadastre - Denmark

Why do we have to exchange data, can't we use one big common system ?

The historical background for using GIS in Denmark will be gone through. The different national as well as international standards for exchanging CAD-data and GIS-data will be expounded.

Finally the Danish standard for exchanging geographical related information - the so-called DSFL-format - will be explained, and so will the possibility of updating data without losing the connection between the graphic-data and the attribute-data.

KEY WORDS: Data Exchange, GIS/LIS, Standards.

Why exchange of data?

The fewest users of geographic information systems collect all the necessary data themselves. Usually, "the map" is bought as semi-manufactured articles from e.g. photogrammetric firms, chartered surveyors and Kort- og Matrikelstyrelsen (National Survey and Cadastre-Denmark). These data are merged into your own data to a proper geographic information system, used later on within the organization. In order to "defend own values" it might be of importance to "sell" data to others.

Consequently, it is a question of being able to receive data from others as well as being able to deliver data to others. If we all used one and the same central geographic information system, such a sequence of operation would not cause great problems, but we are indeed Danes. We cannot run away from the Danish mentality implying "we will do it ourselves", "we can do it ourselves" and "we are better than others". A typical example is that three of our regional natural gas companies build up different systems in spite of the fact that they have to solve the same task with equipment from the same supplier - that is Danish.

If we want to keep this independence to build up our own systems covering our own needs, it is necessary that we, at the same time, bind ourselves to exchange data with others in a standardized way. The advantage of standards for exchange of data is partly that the same system supplier can deliver and maintain the necessary edp-programmes and partly that you are free to exchange data with other systems as long as they observe the same standards. The previously mentioned Danish mentality is probably the reason why we in Denmark started early to deal with the question of standards for exchange of digital map related information, and that, already in 1982, we got a Danish standard in this field, the one we colloquially call the DSFL-format.

What does the term "exchange" cover?

When you talk about a standard for exchange of geographic information, the standardization normally comprises the following three items:

- the medium of transport

  The exchange of digital geographic information is normally not time critical, for which reason you often choose to use a text format stored on magnetic tape or discettes depending on the amount of data. Even if we stick to international standards, we often have problems with the Danish letters "æ", "ø" and "å".

  In future, it will be of current interest to be able to exchange digital geographic information via edp-net. Abroad tests have been made with online updating of decentralized geographic information systems.

- description of syntax

  To make it possible to exchange the coherence of data, it is necessary that the data arrive in a fixed succession, i.e. follow a certain syntax. If e.g. you want to exchange a set of co-ordinates in system 34, the syntax will be that the y-value shall arrive before the x-value. In a standard for exchange of geographic information you lay down the coherence to be exchanged and describe the syntax belonging to it.

  At present international efforts are being made to avoid these "rigid" syntax rules and instead to exchange information about the data coherence simultaneously with the exchange of data.

classification

By exchange of geographic information it is important that sender and receiver have the same perception of the physical world. If e.g. you want to exchange data about a lake it is important that you have the same perception of what a lake is, and why it cannot be e.g. a water hole.

This is why the classification of the physical world plays an important role when stipulating standards for exchange of geographic information, i.e. establishing codes and belonging descriptions.

What is being exchanged?

During many years it has been possible to exchange drawing data as well as data between CAD/CAM-systems. It is here a question of "exchange of drawings" with importance to colour, line-type and symbols. These standards for exchange are all international and colloquially are called "drawing formats".

Of current interest is e.g. the following:

- IGES — system independent standard
- HPGL — a drawing standard developed by Hewlett Pachard especially for drawing machines
- DXF — a CAD/CAM standard developed by Auto-Cad
- STEP — a new system independent standard.

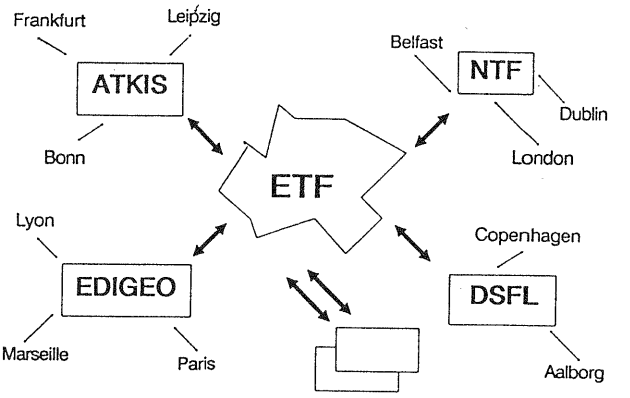
Today it is however also necessary to exchange data between geographic information system attaching the greatest importance to the exchange of coherence between data. So far, there are no international standards within this area, but a lot of national ones.

- Denmark has the DSFL-format
- Norway has SOSI (Standardisert Opleg for Stedfæstet Information)
- Sweden has ISOK (?)
- Finland has EDI (Electronic Data Interchange)
- England has NTF (National Transfer Format)
- USA have SDTS (Spatial Data Transfer Standard)
- NATO has DIGEST (DIgital Geographic information Exchange STandard)

and there are many more.

Work is going on to develop an international standard in this field, but instead of developing a common standard at a technician level, the struggle, at present, takes place by means of lobbyism in the fine corridors in Strasbourg and other places, where the different interested parties try to promote their own national standard to become an international standard.

E.g. the following proposal for a common European standard has been put forward - EEC and all that talk of the free market in 1992 - and there is a striking similarity between the letters "NTF" and "ETF":



A Proposed European Transfer Format (ETF)

At present there is a struggle between the English format NTF and the NATO-standard DIGEST, which i.a. is heavily supported by the French.

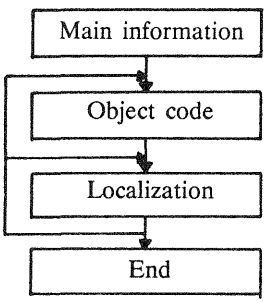
What next?

Time will show "who the winner is", but we certainly will have an international standard. Until then, i.e. for the next 5-10 years, we can use our national standard, the DSFL-format, which compared with other national standards is a very well-developed standard. The force of the DSFL-format is that it is a "de facto-standard", developed by a group of interested parties, independent of the system suppliers. The format has since 1982 been developed quietly, only influenced by the users' wishes, and the individual user has always had a "short way" to the working group, who delevops and maintains the DSFL-format.

Short about the DSFL-format

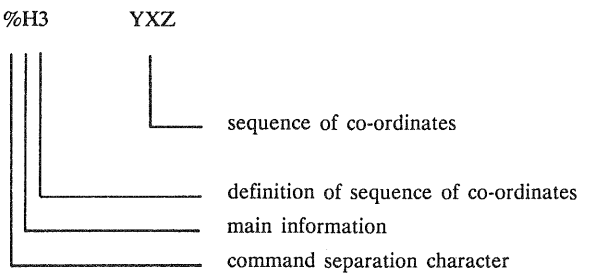
When, in the beginning of the eighties, the DSFL-format was "designed", the object describing data model was chosen, i.e. what you wanted to exchange was descriptive data about physical objects in nature. This "perception of the world" has later become the "truth", and it is probably the reason why the DFSL-format "is still going strong".

The leading principle of the DSFL-format was originally:



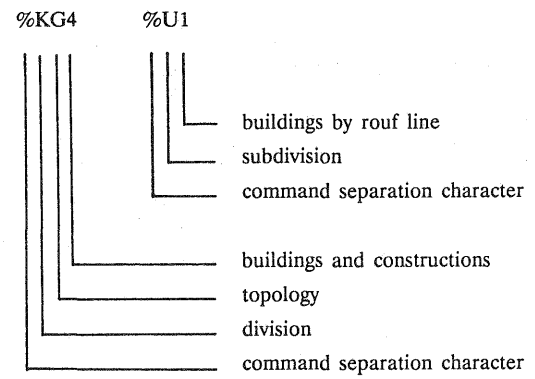
The main information contains e.g. the co-ordinate system used, the sequence of co-ordinates, the producer and receiver of data and the time for generation of data. Furthermore, it is possible to inform of the covering of area by means of map sheet number and by stating minimum and maximum of co-ordinates.

E.g.



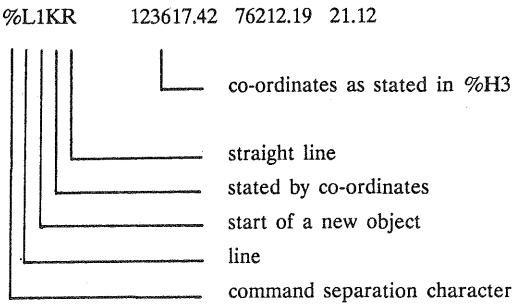
In the object code the classification of the physical object you want to describe is stated. The DSFL-format is built up hierarchically with classification in divisions and sub-divisions.

E.g.



In the localization geographic data are stipulated either as a point, a line or an area. As regards lines and areas you may state straight lines, splines, arcs of circles and clotoides.

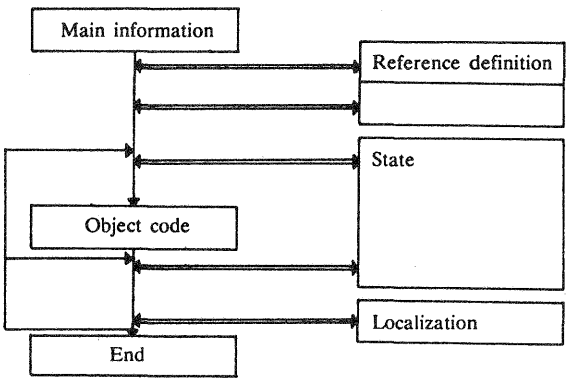
E.g.



After the statement of a localization it is possible to continue with a new localization of the same object, e.g. because it proceeds from a straight line into a spline. You can also continue with the localization of a new object with the same object code, or you can start all over and state a new object code.

Data are terminated by the command %S.

Since then the DSFL-format has developed and today has the following structure:



In a reference difinition, immediately after the main information, it is possible to state information which later can be referred to. Typical is information of different accuracy groups where in the reference definition a close description of accuracy is given, whereas later on you only refer to the number of the accuracy group, to which the data belong. Another typical piece of information under the reference definition is the description of reference points, - lines and - areas. In this way it is e.g. possible uniquely to express that the same point appears as a punctiform object and at the same time is part of a linear object.

Under "state" it is possible to annex more descriptive data to the physical objects, classified under the object code. Typical information attached to a building might be municipality, name of a road and house number.

E.g.

%N	2	%B Accuracy group
%D111	217	%B County/municipality number
%D112	6919	%B Road code
%D131	Snerlevej	%B Name of road
%D132	5a	%B House number
%KG4	%U1	%B Building by rouf line
%L1KR	y1 x1 z1	
	y2 x2 z2	
	y3 x3 z3	
	y4 x4 z4	
	y1 x1 z1	
%D		%B Cancel all data fields

It is important, when annexing descriptive data, that you remember to cancel the descriptions, otherwise they are transmitted to the succeeding objects. If e.g. you did not cancel the descriptions with %D, and a new object followed, e.g. a lake, the lake would inherit the same descriptive data as the building, and that would cause nonsense.

Under "state" there is a possibility of stating data in another data model than the object describing. By introducing the idea "tables" it is possible to state relational connections, surveyors' data, digital high models and raster data. As a consequence, localization has been removed from the main structure, and has become something you do not need to use.

As an example you can mention that it will now be possible, by means of the DSFL-format, to inform of the legal house numbers of each road in a municipality without having to state a geographic placing.

You may say that earlier the descriptive data were linked to the geometric localization of physical object whereas the localization now has become descriptive data equal to the rest of the descriptive data.

Under "state" it is also possible to transmit updating. Whereas formerly, when updating, all data were often exchanged once more, it is now possible to exchange +/- data. Updating is based on the following command structure:

%AF	%B	Updating begin
.		
.		the object to be updated is
.		identified here
.		
%AT	%B	Updating to
.		
.		the result after the updating
.		is stated here
.		
%AS	%B	Updating end

In the new version of the DSFL-format, the format has been extended to being able to include "stupid drawings". It is now possible, to an object, to attach details of colour, line-type, etc. which normally are used at an outdrawing. Furthermore, object codes for map frames, grid points and other map frame information are introduced. Finally, an extension of the object codes and a strong revision of the text and some of the examples has taken place.

These additions to the DSFL-format are the result of applications from the users who have expressed a wish to exploit these possibilities. It is my hope that it will be possible to keep the DSFL-format alive through the good cooperation between the users of the DSFL-format and the working group who develops and maintains the DSFL-format, until in the course of 5-10, years we will obtain an international standard in this field.