CO-435

METHODS FOR VISUALIZATION ENHANCEMENT IN MULTI-SOURCE WEB MAPPING SERVICES USING BASIC CARTOGRAPHY RULES.

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BACKGROUND AND OBJECTIVES

This Long Paper describes the ongoing work with my ideas on the demands for co-ordinated web cartography in order to give us user friendly geodata services.

If the possibilities of co-presenting (overlays of viewable spatial data sets) today's geodata services are not improved, then the benefit of this promising technology will diminish considerably, and also the customers'/users' interest.

My interest in map services on the Internet began as early as 1997, when, as a GIS co-ordinator at the City of Stockholm, I was responsible for a national project, The Swedish Association of Local Authorities and Regions, "Kartor på Internet – Projekt-Teknik-Upphandling" ("Maps on the Internet—Project-Technology-Purchasing").

At the time the technology was in its infancy and demanded heavy investments in computers, software, and the clarification of one's own and other people's geodata.

Today, the situation is completely different and now I myself can run and test my ideas with the help of Open Source for GIS. I often use Quantum GIS (QGIS) which shows the WMS, WFS, and WPS services of the GeoServer with Swedish geodata stored in PostgreSQL/PostGIS.

My thoughts on making it easier for users of map services began in August 2008, when I wrote a report for The Swedish Standards Institute, "Behov av standard för kartsymboler och verktygsikoner i webbtjänster med kartstöd" ("The Need for a Standard for Map Symbols and Tool Icons in Web Services with Map Support"). The advantage of and need for a common language of map symbols is steadily increasing, as more and more geodata services are being reached via www.geodata.se, the Geodata Portal, The Swedish Portal for Inspire.

A natural continuation was the applying of these thoughts on the Swedish geodata services, which were described in Mapping and Image Service, The Swedish Cartographic Society, 2009:2, "Förändra utseendet på geodata så att det passar dina behov – geodatatjänster och kartsymboler" ("Change the Looks of Geodata So That They Suit Your Needs—Geodata Services and Map Symbols"), edited in June 2009.

In order to show the new possibilities of reaching and using, among other things, the geodata services, I summarized these possibilities in the December edition of Mapping and Image Science, 2009:4, "Paradigmskifte inom geografisk informationsteknologi (GIT) – OGC viewers är en viktig del av den framtiden" ("Paradigm Change within Geographic Information Technology (GIT)—OGC Viewers Play An Important Part in That Future").

The Swedish Association of Local Authorities and Regions ordered a report in October 2009 on "Quality and Status within Web GIS on various municipalities' the web-sites". Also this report, "Goda exempel på kommunala karttjänster" ("Good Examples of Communal Map Services"), focused on how to make user friendly map services on the Internet.

In June 2010, the report (see picture) on ”Behov av en samordnad kartografi för OGC-tjänster (WMS, WFS m.fl.)” (”The Need for A Co-ordinated Cartography for OGC Services (WMS, WFS et al.”) was edited, this time for the Swedish Land Survey, NSDI Co-ordination Unit.

It is a new paradigm for GIS and cartography practices to produce collective geospatial knowledge. Web Mapping is the ultimate platform to discover, explore, share, and create content by combining distributed information and services.

These new possibilities in web mapping also have disadvantages. Combining different geodata sources may result in conflicting presentation styles and, consequently, in confusing maps.

The disadvantages can be reduced by:

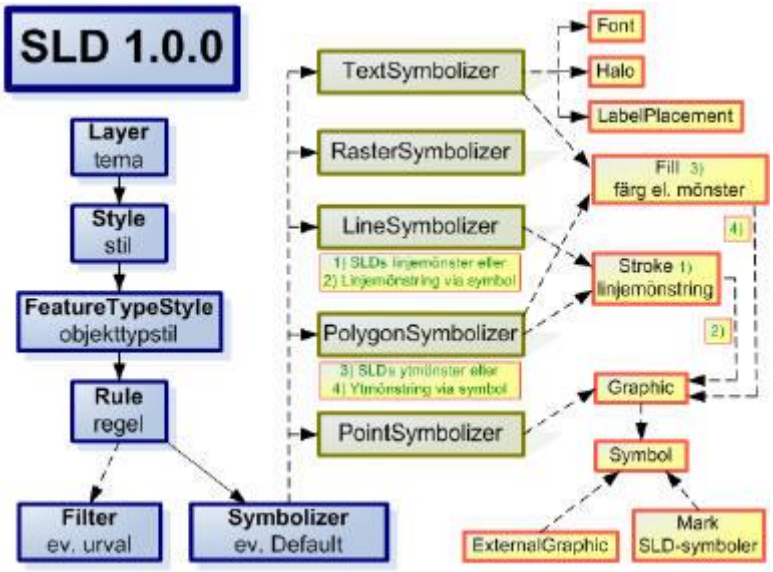
• Basic coordination and adaptation of basic rules for web cartography is being implemented

• Opportunities being offered where a webservice can be presented with a different cartography that is appropriate for the scope, e.g. crisis management or comprehensive planning

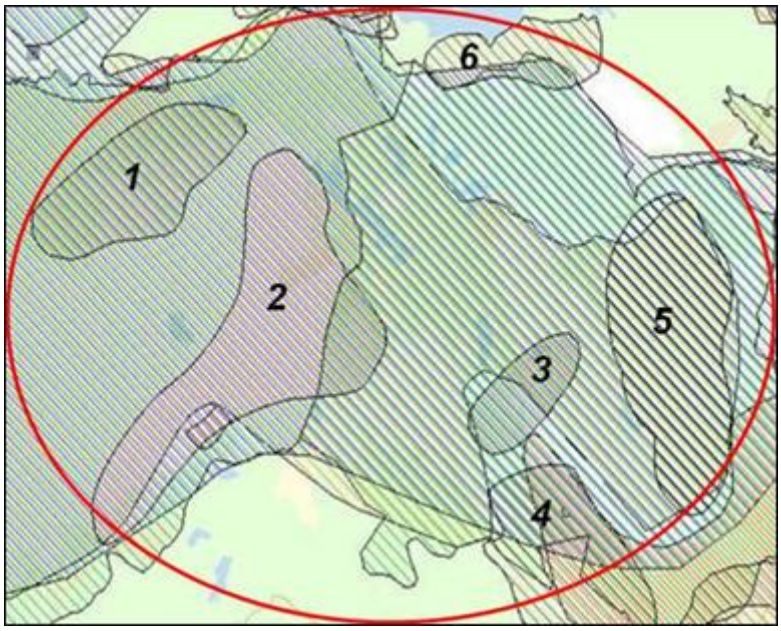
APPROACH & METHODS

The appearance of the map that meets the user in a WMS service is governed by a style (SLD).

The technique is standardized and in WMS 1.1.1 via SLD (Styled Layer Descriptor).



A geodata service normally consists of many geodata layers. Every geodata layer in a WMS service offers one or, at best, many styles, which transform the geographic vector information into a screen image which is sent to the user. The person who wishes to change the appearance of all of, or parts of, the map style of a geodata layer will normally do that by adding a URL link to a SLD in their call to the WMS service.



Many web map services use solid, one pixel thick lines which are often horizontal, vertical or diagonal. If the distance between lines and choice of colour is inappropriate, the interpretation is hampered significantly when different surfaces with similar patterning overlap. Area 1 – 6 in this picture are supposed to look the same!

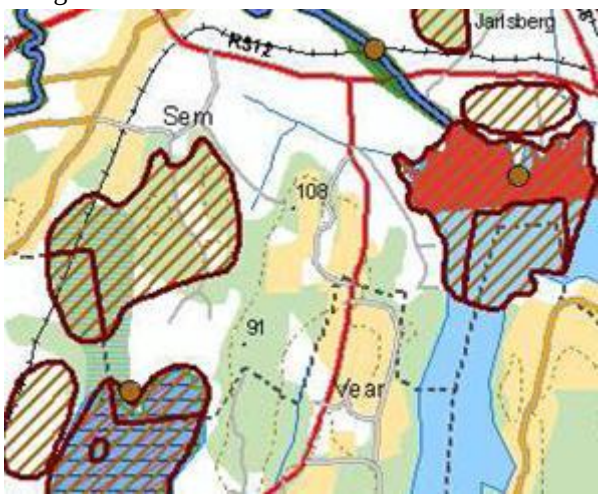
In Sweden, we have not yet seen examples of thematic geodata services via www.geodata.se. To many "GIS unaccustomed" users of these services will be more important than the geodata deliverers' "original services" respectively. It is because they are:

• Thematically clarified so that all layers needed for a certain user group are collected in one single service.

• The map style is clarified so that it is readable together with an appropriate background map and taking into consideration somebody's own, supplementary map information or the analyses which are to be made.

• Also the background map can be adapted, and certain themes can be taken away or enhanced by the help of a clearer map style.

• Integral geodata should be quality secured so that critical information is consistent and appropriate, which can mean that one has to make it more extensively quality secured than is needed for the basic data being used.



In Norway they have done practical work with a co-ordinate cartography during more than ten years. System deliverers, municipality representatives, and state authorities have taken part. There are a great number of documents with guide-lines and specifications. The result is a usable basis for today, in order to facilitate the work with map styles and thematic geodata services. In this picture area patterning with thin lines gives the same problem. For us in Sweden, there is here to be found both inspiration, tips and models for how to catch up with the Norwegians!

Why pay attention to this now? During 2011, a great number of geodata services will "be born", due to Inspire, and rules for an improved overlays of viewable spatial data sets should be there before too many users start working with Swedish geodata services.

What Do Swedish Geodata Services on www.geodata.se Look Like right now?

No Swedish geodata service will today permit the WMS/GetMap call to an external style model. This is why I have been forced to "copy" Swedish geodata services, i.e., the ones also offering raw data which normally comes as shape files.

My comments concern both general views on presently chosen map styles and problems which I have observed when there is overlays of viewable spatial data sets from different geodata deliverers.

The NSDI Co-ordination Report mentions seven cartographic problem areas in today's geodata services which should be observed.

1. Surface patterning with lines and dots
2. Map symbols which hide each other
3. Legend (GetLegendGraphics)
4. Map style adapted to different scale areas
5. Surface and line styles with covering colour
6. Covering layers, with many themes which cover all the other geo data
7. The same feature has a divergent map style in different WMS services

This obstructs the readability in geodata services already there, and it gets even worse as the overlays of viewable spatial data sets from many geodata services are to be done.

In addition to these seven problem areas, four more requisites are being described, and needing to be observed:

8. Meta data for every layer and not only for the whole geodata service
9. Very detailed information on meta data about, e.g., attributes and range intervals
10. Guiding lines on the naming of geodata services
11. Common storage place for the SLD style models and map symbols.

The Report's Propositions for Guiding-lines of Web Cartography

The report to the NSDI Co-ordination Unit mentions seven propositions for guiding-lines for overlays of viewable spatial data sets of geodata services.

1.Two different propositions for basic cartographic principles

a. Cartography adapted according to application areas (Thematic geodata services)

b. Cartography adapted to subject categories

2. Surface patterning with the help of vector based symbols (SVG)
3. Guidelines on the naming of geodata services
4. Named styles or an SLD style of one's own
5. Common storage place for SLD styles and map symbols
6. Common register for SLD styles and map symbols

Ideas and Propositions after the Publication of the Report to the NSDI Co-ordination Unit in June 2010

By way of introduction I'll make some topical commentaries to the conclusions of the report, based on my ongoing work.

I. Thematic geodata services—i.e., cartography adjusted according to areas of application—is the only practicable road. Cartography adjusted to subject categories should also be tried in order to see if it is possible further to facilitate readability at a co-presentation (overlays of viewable spatial data sets) of many geodata services.

II. Symbols, covering all the needs of geodata services, should be based on vectors, and I have used the SVG standard, as the GeoServer permits this format. Inspire states the PNG and the GIF, which limits the possibilities when working with style models.

III. Surface patterning of polygons and line patterns offers the possibility of an intuitive understanding of a geodata layer. However, one must here presuppose clever choices of symbol size compared to different scale intervals, which must be further tested.

IV. The need of a basic standard of mapsymbols is growing stronger and stronger! Is a reindeer symbol to signify Riksintressen Rennäring (National Interests of Reindeer Industry) and, in that case, what is the reindeer symbol to look like? I do personally believe that we ought to start out from The Land Surveyors'

symbols on our common maps, the road signs of the National Road Office, and other similarly known symbols.

V. An accessible compilation of map styles in use is called for, among other things because a fresh production of style patterns must not look like the map styles we already have.

Further experiences of the ongoing work with web cartography during the summer of 2010

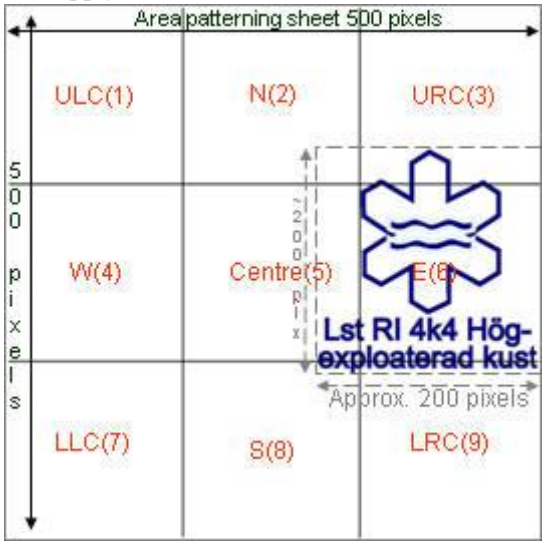
1) Styles used in today's WMS services rarely adapt styles for different scales, which is often needed. Extensive testing of up to seven different scale intervals has been made.

2) Basic guidelines of map styles for different subject categories of geodata might consist of a combination of colours, line style, area rendering and text composition, and the selection of an appropriate number of scale intervals of the associated map symbol sizes. The basic principles must be simple. A combination of geodata should be possible to interpret without having to examine the legend in detail.

3) Text from attributes. Thematic geodata services mean that important information of the object's attributes can elucidate the contents of the layer. This presupposes that a number of scale intervals are being used, as supplementing text information should often be used but in rather big scales.

4) Text labels behave differently in GeoServer depending on the shape and size of the polygons. A compilation of different vendor system characteristics should here be made, in order to show possibilities and limitations when text is to be added from the object's attributes in geodata services.

5) Label placement being used for lines, should also be investigated, in order to avoid text strings overlapping each other. Here also, the GeoServer "behaves" in a much too "temperamental" way; this can also apply to other WMS SW as well.



6) One promising alternative is the using of map symbols in order to render polygons instead. Map icons are selected which can easily be associated with the surface theme, e.g., the Panda for the restricted areas from the [Swedish] National Environmental Protection Agency (see picture in 8) below).

By rendering with a 500x500 pixels area/square, the map symbols, which are approximately 200x200 pixels, can be placed in nine different positions within the square. This reduces the risk of overlapping symbols.

The "surface patterning sheet", 500x500 pixels, which I use in scale 0-1 025 covers a vast area (125x125meters/15 625 square meters when there are .25mm pixels on the screen).

There is a great risk that a 200x200px symbol (50x50m) will not "be seen/land" exactly where the polygon for, e.g., a normally sized plot of land (1 000-2 000 square meters) is in the map window. One way of solving this is to let the SLD estimate an appropriate size of the surface patterning symbol, so that at least half a symbol will always show in a polygon.

7) Phenomena with comparatively small areas, independent of scale intervals, make surface patterning with symbols impossible, especially using my technique to avoid symbols to be written on top of each other. Then the GeoServer can instead write a text/label which could be one way of clarifying what a certain polygon represents. If prime colours are used, based on subject category, then it is clear, however, that the polygon represents, e.g., area industries.this can only be applied in a few scale intervals, normally between 1:20 000 and 1:100 000.

8) To make it easier for the eye to detect a certain theme I have tried to develop visible patterns. When I convey a particular quality to a surface patterning symbol, the readability of that layer increases considerably, when 3-6 simultaneous geodata layers are shown against a background map. The panda's black ears in RI Naturvård (RI Nature Care) and the man's woollen hat in RI Rörligt friluftsliv (RI Active Outdoor Life) are both examples thereof.

The picture shows that the symbol for Active Outdoor Life is easily discernible without concealing the background map underneath. This way of "monkeying about" must be adapted to each thematic geodata service in question, as it otherwise runs the risk of becoming too "messy" a web cartography.

9) Symbols which contain several phenomena. Is a (1) common symbol to be depicted or are all the symbols representing each phenomenon to be used? Here is shown an example of Corine's ground classes.

10) Another and similar question is whether a symbol is to be allowed to contain several picture examples collected from the phenomenon in question. See here RI Friluftsliv (RI Outdoor Life) which I found difficult to describe in one symbol only.

11) "Meta data" for symbols. Background, design, format and so on should be easily accessible for symbols being recommended to be used in Sweden.

12) Symbol design. I take the star-shaped snow crystal to represent everything that has to do with environment protection, as is already the case on our Swedish signs in nature protection areas. I then add various aspects of environment protection.

Thus the star-shaped snow crystal with the international symbol for Biological Diversity (CBD) becomes the surface patterning symbol for biotope protection. Swampy forests are examples of biotope protection—I let the biotope protection show by the CBD symbol only. Is this an appropriate way of building the "logic" in a map symbol?

made the symbol for Natura 2000 into a copy of the EU symbol. It must be remade, as it hides too much of possible layers behind, as well as the background map. A somewhat stronger mountain outline of the green colour of the EU symbol plus only blue outlines of the swans, maybe with necks and heads filled by blue in order to give the same recognizing effect as the "woollen hat" in RI Outdoor Life. My opinion is that map symbols must be made as "airy" as possible not to hide underlying geo data.

We ought at least to agree on the crude guiding principles of how to build up the symbol language for web cartography. This must be done as soon as possible, before too many people invent their own variants which might be difficult to change according to common guiding principles!

13) I normally write the importance/origin of the surface patterning symbol en clair in scales larger than 1:10 000 to 1:20 000; e.g., Lst RI Natura2000. Does it make the readability clearer or does it make the map picture all too "messy"?

14) The surface patterning of polygons should possibly take into consideration the average area of the phenomenon in question and also whether there are great deviations thereof.

I have not tried to do this and I do not even know if it is possible.

15) Which possibilities are there to add into the data base important information concerning web cartography? E.g., the area of polygons when missing, or an all-embracing name for, e.g., Moose Hunting Area which can be used to label certain scale intervals where the polygons are too small to be using surface patterning.

RESULTS

Tests have shown that the number of WMS layers which can be understood has doubled in most cases. Users directly understand which geodata themes are being referred to when intuitive map symbols are used in the patterning of the surfaces. By adding special features in the map symbols the eye perceives the extent of each WMS layer. Regarding load or speed issues I have so far not been able to detect any problems in this area. Of course "bad" SLD styles can have an effect on server speed, but that is a problem that should be solved by quality control before using the SLD.

CONCLUSION AND FUTURE PLANS

Rendering polygons with map symbols has been shown significantly to improve readability. The accompanying text, which appears in larger scales, makes interpretation easier. Different prime colours for subject categories according to ISO191 15 give an overview of the themes on the screen.

Future tests include:

1st The size of map symbols takes into account the area of the polygon to be rendered.

2nd Futher test on Customizing map styles depending on user needs and

thematic web map services.

3rd Accompanying text from available attributes. Further tests with textplacement along line features and labels on small polygons.

I have hitherto been working for 24 man months altogether—since February 2008—with map symbols and tool icons, WMS/SLD (styles) and Swedish geodata services (WMS).

Less than 250 hours out of these 3 850 hours have been financed via commissions.

Thus, there is an enormous personal engagement behind my wish to invoke an understanding that vigorous efforts must now be made, if the Inspire’s geodata services are to be usable.