

INTERACTIVE STYLE GENERATION FOR LAYER VISUALIZATION THROUGH A WMS

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Abstract: *When visualizing the different layers of geographic information through a map server, the layers are obtained with a pre-defined style virtually never meeting the user's visual needs. A tool has been developed allowing definition and interactive application of the different styles created by the user.*

The tool allows listing of all layers of a Web Map Service and depending on the type of geometry of everyone of them, the parameters in accordance with the style defined by the user could be chosen, such as colour, thickness, size and text's font style.

As a result, a cartographic document in real time is achieved from a map server with the styles defined by the user for every layer, as well as the possibility of interactively changing the layers. It also allows saving of the developed styles in a file that could be applied to another cartographic document at any time.

The functioning of the tool is based on server's standard requests, such as GetCapabilities, GetStyles and GetMap that will be successively run according to the user's interaction with the application. The application is essentially based on the specification Style Layer Descriptor [1]. Different XML documents defining styles will be developed with the application. These generated styles will be sent within the GetMap request so as to show the wanted image to the user.

Keywords: Web Map Server (WMS), Web Feature Server (WFS), Web Coverage Server (WCS), Styled Layer Descriptor (SLD), Filter Encoding (FE), java application interactive, filter request, geometry finding, tool-client interaction, symbology, cartographic semiology.

INTRODUCTION

Present situation

In order to contend with all kinds of cartography, especially thematic cartography, adaptation to the new Geographic Information Systems online may only offer us countless advantages. If years ago the application of computer systems in cartography resulted in the paradigm of interactivity as a cartographic revolution in the possibilities of map-user communication, the Internet has shown itself to be the most effective way having the widest possibilities for summarizing, distributing and visualizing digital cartography in which appears to be a new cartographic revolution.

The initial limitation, namely the obligation of use of proprietary software, is overcome by an increase in interoperability between the different elements and systems making up a global cartographic network. An unequivocal, most effective communication without any ambiguities shall be based of necessity on a standard. As a site to reach a consensus on geospatial standards, the Open Geospatial Consortium (OGC) has emerged, a key organization drawing together public and private efforts to achieve this aim.

The Web Map Server (WMS), Web Feature Server (WFS), Web Coverage Server (WCS) and others, such as Gazetteer, Geocoder, Catalogue Services, etc. are OGC standardized geoservices for visualization, review, unloading and update of Geographic Information worth mentioning.

However, because of the initial development of these services, the matter of adaptation from the point of view of cartographic design (whereof we will mention its traditional components), has not been solved as yet. We may talk about an aesthetic component and a technological component –perhaps preferably “functional”. Within the present approach to SDI technologies, the greatest efforts are focused on the development of strategies and technologies of communication and interaction with the user (functional component), but the strategies and methodologies guaranteeing

that the final cartographic document meets the basic principles of graphic composition are overlooked or at least they are not yet sufficiently studied in depth.

This matter may induce to consider the preparation of a map through a web service as a mechanical process, i.e. a plain addition of information layers that are finally materialized on screen or paper. In practice, this may give rise to valid documents as far as geometric accuracy of data, though they may be erroneous documents due to incorrect legibility, clarity, visual balance and hierarchical organization of the different graphic elements making up the whole. The actual final user is lastly held responsible for the cartographic process of map composition. With that aim, the proprietary desktop applications offer control of this process of application of the adequate symbology through different user interfaces. Logically geographic information users in the web are also in need of this capability in order to guarantee the cartographic quality of their documents.

If we assume the need the spatial data users in the web have to control the visual representation of the geographic information they are working with, the necessity of a symbolization regulation in accordance with the concept of interoperability is raised. For that purpose OGC has created the specification Styled Layer Descriptor (SLD) [1], as a basic tool to qualify the user to define styles on different elements, extracted from a map server, that will make up the final cartographic document.

Content

The remainder of the document is structured following these guidelines: in the first place, the description of the technological bases for the building of the application that is presented is approached, and the structure of the application is outlined with an activity diagram. In the second place, the result obtained is shown and small examples are added. Finally, conclusions are presented that are of use to outline future work perspectives.

METHODOLOGY FOR TOOL IMPLEMENTATION

Design of an interactive tool for style editing and content visualization through a WMS

The objective of this tool devised in this document is to allow interactive visualization of layers of a map server (WMS) wherein the presentation style is to be dynamically modified. The definition of those styles is based on the SLD specification. In this manner the request (GetMap) will be dynamically built on the Web Map Server (WMS) that holds the geographic information layer of interest. The result will be the presentation of the layer with the correctly applied styles that had been previously defined through a user interface.

The parameter that shall be used for the WMS to be able to apply a style different than the one stored by default is called SLD_BODY. This parameter shall be accompanied by the definition of the chosen symbolization style to be applied in the form of a formal document subject to the SLD specification. In this document, the application of a specific style for each layer or geographic element is made possible.

```
<StyledLayerDescriptor>
  <NamedLayer>
    <Name>CAPA1</Name>
    <UserStyle>
      . . . . .
    </UserStyle> } Definición de estilo
                  para CAPA1
  </NamedLayer>
  <NamedLayer>
    <Name>CAPA2</Name>
    <UserStyle>
      . . . . .
    </UserStyle> } Definición de estilo
                  para CAPA2
  </NamedLayer>
</StyledLayerDescriptor>
```

Table 1: General structure of a SLD document

At this point the reader should be warned that the sending of a SLD in a request type GetMap before a WMS must be made through a XML document in conformity with the mentioned specification. However, the sending shall be pre-processed to carry out the substitution of characters as specified in *Table 2*. This necessary substitution is due to the encoding accepted by the HTTP protocol when the method Get is going to be used in the process of sending of the request.

Characters	\n	#	" "	:	\	<	/	>	=
HTTP encoding	%0A	%23	%20	%3A	%5C	%3C	%2F	%3E	%3D

Table 2: Character re-encoding

In the following schema, an example of the necessary pre-processing of the request GetMap for obtaining a map with symbology defined by the user is shown:

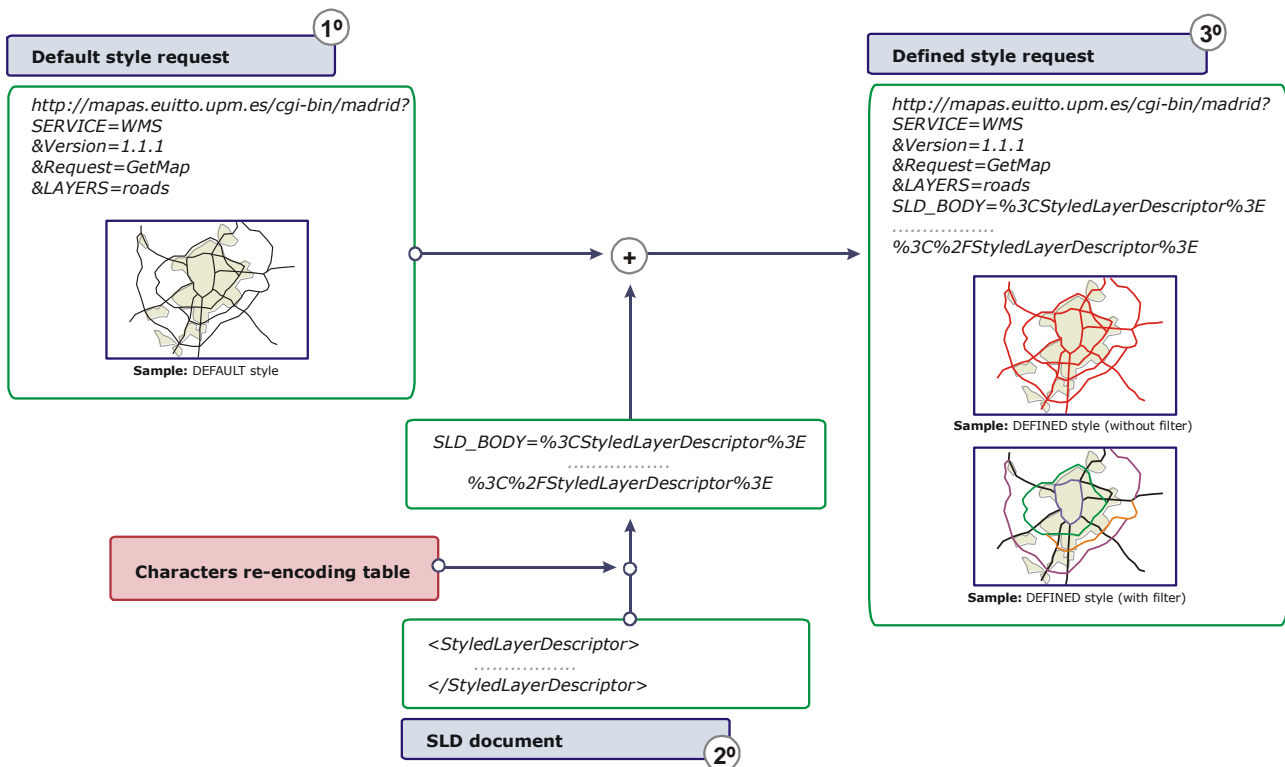


Figure 1: GetMap request transformation schema

Parameter definition in the SLD document according to layer geometry

In order to be able to apply different symbolization styles to different types or classes of features within the same information layer, there is a coding language called Filter Encoding (FE) [2]. The application of such feature selection filters on the basis of one or several stored attributes (e.g. traffic load in a road, surface of corporation limits, etc) is formally materialized in rules that are applied for the achievement of a more complex symbolization.

The SLD specification defines five types of symbolization: LineSymbolizer, PolygonSymbolizer, PointSymbolizer, TextSymbolizer and RasterSymbolizer. In other words, the regulation classifies the symbolization type depending on the layer geometry (linear, polygonal, punctual, textual and raster). The parameters are defined within the SLD document on the basis of geometry. These parameters, which are necessary for application programming, show up in the Styled Layer Descriptor specification in detail.

The style parameters that can be controlled with this tool are defined as follows:

















Geometry	Parameter	Defines ...		
LINE	Stroke	Line colour		
	Stroke-width	Line width		
POLYGON	Stroke	Contour line colour		
	Stroke-width	Contour line width		
	Fill	Fill colour		
POINT	Fill	Point colour		
	Size	Point size		
TEXT	Font-family	Fuente de texto	Madrid	Madrid
	Font-size	Tamaño de texto	Madrid	Madrid
	AnchorPointX	Anchoring X of the label to the main-geometry point	Madrid	
	AnchorPointY	Anchoring Y of the label to the main-geometry point	Madrid	
	Fill	Text colour	Madrid	Madrid

Table 3: Parameters subject to change with application

Obtaining geometry

From the previous table it may be concluded that on the basis of feature geometry, the visualization attributes will be different. Therefore it is of interest to automatically detect the feature geometry. To achieve this, a request type GetStyles to the map server is previously carried out. This request will return a document in XML format with the SLD of the layer whose style is asked for. In this document, the labels of “LineSymbolizer”, “PointSymbolizer”, “PolygonSymbolizer”, and “TextSymbolizer” are lodged, whereby the geometry can be inferred from.

If the request GetStyles is not implemented in the server, geometry cannot be automatically detected. In this case, it is necessary for the user to specify the geometry type to be considered.

Tool-client interaction

After having found the way of defining styles through the request GetMap, the conditions previous to the design of a tool for interactively building the flow of requests to the map server are met, depending on symbolization preferences as defined by the user. The user will be shown an interface through which the value of the parameters may be pointed out. These are the parameters necessary to define a style considered adequate depending on the geometry of the layer of interest and depending on the needs of the cartographic document that is being produced.

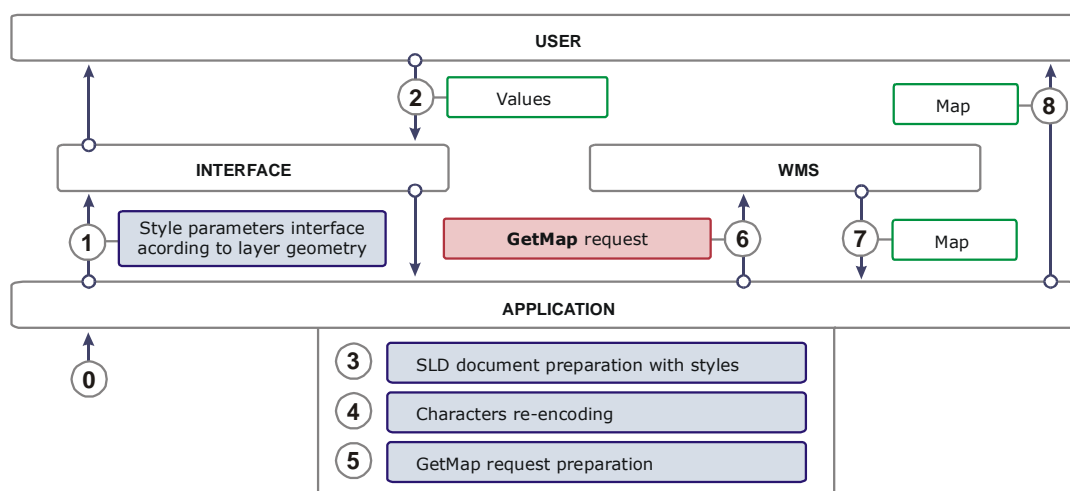


Figure 2: Application-user interaction

Re-using styles

The tool is designed so that this work may be persistently stored in a XML-encoded file and may be retrieved at any time. This document may also be used at a later date to modify the styles of presentation of the geographic features by a WMS.

OBTAINING THE TOOL. RESULTS:

A tool is obtained based on the guidelines previously developed in agreement with the following activity diagram:

Activity diagram

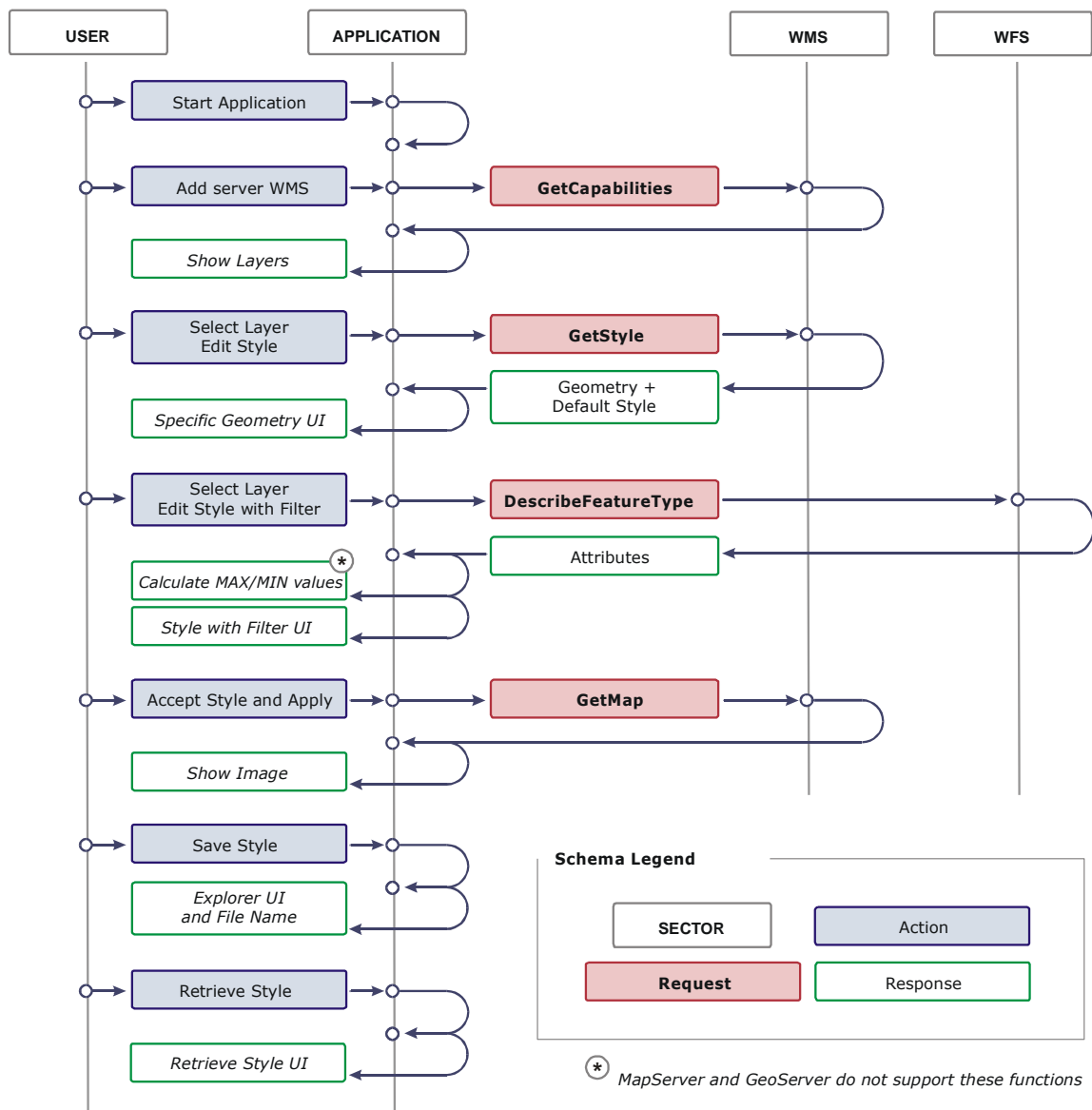
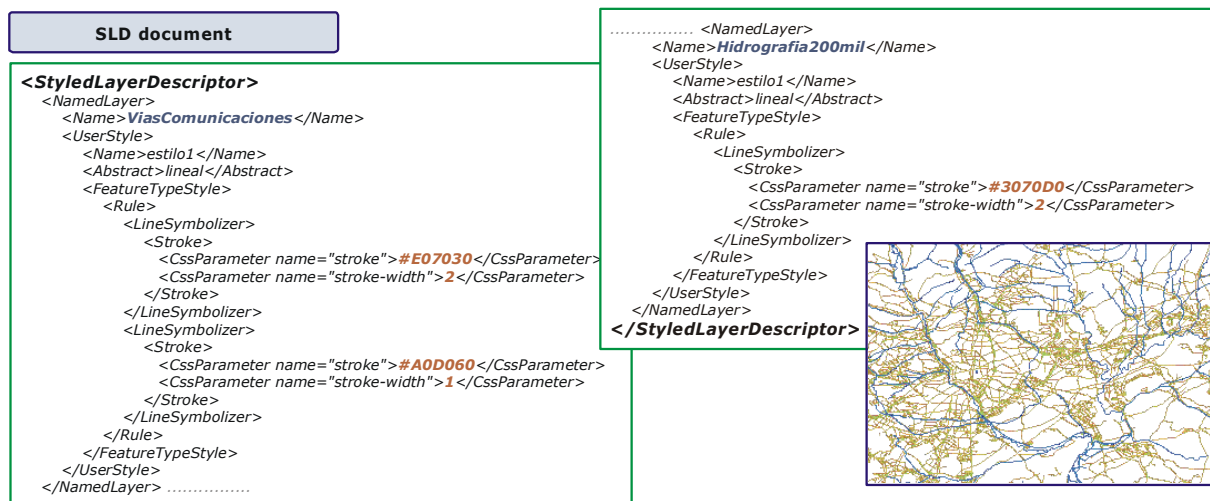


Figure 3: Application activity diagram

Results and examples

After implementation of the tool, results are obtained as expected, namely to be able to choose the style for layer visualization through a WMS, including the possibility of classifying the different features through the adequate filter application (FE).



CONCLUSIONS

As this study is trying to show, the application of the Styled Layer Descriptor opens up the possibility of automatically and quickly obtaining any kind of map depending on each user's needs such as is the case with desktop GIS applications, but with the added advantage of being able to work with remote geographic data.

- With this language the visualization of any map obtained through a WMS, WFS or WCS may be manipulated.
- The tool, through the CGI parameter SLD_BODY, introduces the SLD document without the user having to know the functioning of map servers.

Two requirements are necessary for the accomplishment of above:

- That the service, therefore the operation GetMap, supports the parameter SLD_BODY. Not all web map services support this parameter.
- The request GetStyles, necessary for the tool to be able to automatically obtain the geometry of each layer. This request is not obligated, and then more WMS do not implement it. This is a deficiency in this regard. This problem would be solved by adding the geometry of each layer to the Capabilities document.

In addition, through the Filter Encoding (FE) specification, symbolization rules may be defined individually affecting each feature, which allows drawing up thematic maps with complex symbologies. To do that it is necessary in the majority of cases to know the attributes' maximum and minimum values that one wants to classify. This could be obtained through the element "Function" of FE, though at the present time the majority of servers do not implement it.


FUTURE WORK PERSPECTIVES

In desktop systems as well as in remote systems it is the final user who is held responsible for the cartographic process of map composition. This does not mean he does not have the cartographic knowledge necessary to create an adequate symbolic document. The trend will be toward defining help assistants for the creation of visualization styles appropriate to the nature of the information to be represented, however always using open, international standards that will make interoperability possible. These assistants should guarantee the best they can that the final document will have a correct graphic semiology, regardless of user's skills. Other possible work perspective is related to implementation of this same functionality in the Geoserver project.

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Ana Maldonado was born in Madrid. She is an Engineer in Surveying by Universidad Politécnica in Madrid (2002). Recently she has successfully completed upper studies of Engineering in Geodesy and Cartography by the same University, and at the present time she is working toward the Doctor degree in Geographic Engineering, which she is making compatible with her work in the Mercator Research Group.

She is integrated in this group thanks to her ability and interest in developing programs and applications of use to build different applications in the field of spatial data infrastructures. Her already presented previous work is actually based on the programming of tools of support of different fields within the Geomatics. She has particularly focused on Java language programming. At present, within the Research Group, she is developing modular tools whose aim is to greatly optimize the management of styles for the visualization of geographic information through Web Map Servers on the basis of the adequate principles and guidelines as previously defined.

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Javier Moya was born in Madrid. He has always developed his professional activity in the field of Geomatics and Image. Technical Engineer in Surveying by the Universidad Politécnica of Madrid (2002), at the present time he is about to finish his studies in Geodesy and Cartography in that University.

In September 2002, after 18 months of work with his colleague David Jiménez, he presented his “Atlas of Ancient History. Development of a Multimedia Educational Tool Applied to Local Environment (CD/Intranet) and General Environment (the Internet)”. This project was recognized with several awards, among which is the Premio Nacional XIX Möbius Barcelona Multimedia PMBM in the category of “Best scientific multimedia application in Spain and Portugal” in February 2004.

By thinking out the idea that in the present society the image concept as a communication base has an utmost importance; his career is definitely focused on a future of expertise in multimedia communication supported on the new computer and telecommunication technologies.



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