

WMS Integrator: continuous access to neighboring WMS

Miguel-A. Manso-Callejo⁽¹⁾, María-T. Manrique-Sancho⁽¹⁾, Paloma Abad-Power⁽²⁾

(1) LatinGEO, UPM, ETSI en Topografía, Geodesia y Cartografía, Ctra de Valencia Km7 Madrid
28031, m.manso@upm.es, maytemanrique@topografia.upm.es

(2) Dirección general del Instituto Geográfico Nacional, C/ General Ibáñez de Ibero, 3 28003, Madrid
pabad@fomento.es

ABSTRACT

The INSPIRE Directive¹, and SDI initiatives, promote that geographic data (GI) is updated and maintained in the most appropriate level or who is responsible. This fact motivates the emergence of many map services (WMS) that offer the same data in different geographical contexts. The atomization of WMS, for geographic domains, difficult the use for users interested in a topic: they must search for WMS, select layers and handle overlapping. This poster presents a facilitator node that manages WMS: URLs, layers, CRS, formats and versions, and offering a seamless WMS that integrate horizontally and vertically layers offered by WMS cascaded. The most important contributions of developed facilitator node (WMS-integrator) are the ability to: carry out some verifications, requests to the different WMS versions, mask spatially responses by boundaries polygons and merge the responses to finally deliver a single image as result that avoid data overlapping.

RELATED WORK

Memon (2005) in GEON (GEOscience Network)² propose a distributed infrastructure of GI that relies on catalogue to search: WMS URL, service envelope, supported WMS version, layer names, layer styles and layer projections, used by WMS Integration Service (WIS). Authors pinpoint in this service to a number of problems that have to be resolved: projection negotiation, layer sequencing and granularity of integration. Then they propose the use of the Web Map Context as output of WIS. They displace integration complexity to the client side. Some problems keep out of scope such as: projection changes, when none of the coordinate systems offered by a service to be integrated or geographic boundaries for the responses offered by the integrated WMS.

Zevenbergen *et al.* (2007) state "*A more difficult issue is the integration of the datasets covering the same topic but different areas. A WMS-integrator was developed to overcome the technical issues of integration but more importantly, what still remained is the integration of the content.*" The WIS³ may carry out horizontal and vertical integration of layers. Horizontal and Vertical integration are illustrated on Figure 1. GeoLoketten proposed as solution new service accomplishing the integration. The lack of information doesn't allow knowing the technology used or how to service configuration is done. Our hypothesis about this implementation is that WIS doesn't consider data overlapping.

Brunclik (2007) describes the functions for which the Cascade functionality of WMS specification is commonly used. This function is used to enhance results of WMS: supporting more formats, new service versions and increase coordinate systems transformation capabilities.

Then we have analyzed cascade capabilities of popular Open Source (OS) related projects and concluded that only MapServer⁴ and Deegree⁵ may offer them. After analysed configuration

¹ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:108:0001:0014:EN:PDF>

² <http://www.geogrid.org/>

³ http://www.geoloketten.nl/wms_integrator_service.html

⁴ <http://mapserver.org/>

⁵ <http://www.deegree.org/>

documentation some experiments have been made to integrate horizontally a set of topographic layers offered by two neighbouring regions. The conclusions are:

- Both provide layers coming from cascaded WMSs identifying: URL, layers, SRS, formats, etc.
- Mapserver provides geographic extent through a BBOX and Deegree through a GML polygon.
- Deegree doesn't use polygon to mask information not contained within.

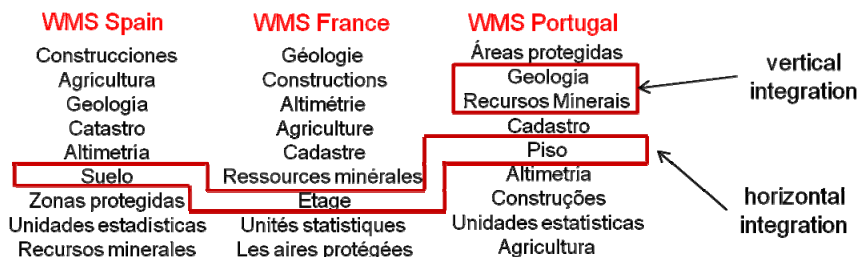


Figure 1: Horizontal and vertical integration (based on GeoLoketten)

In both cases has been confirmed that the overlap of the data provided by the underlying WMS persists as a consequence of providing data outside of its boundaries. Figures 2 show this problem.

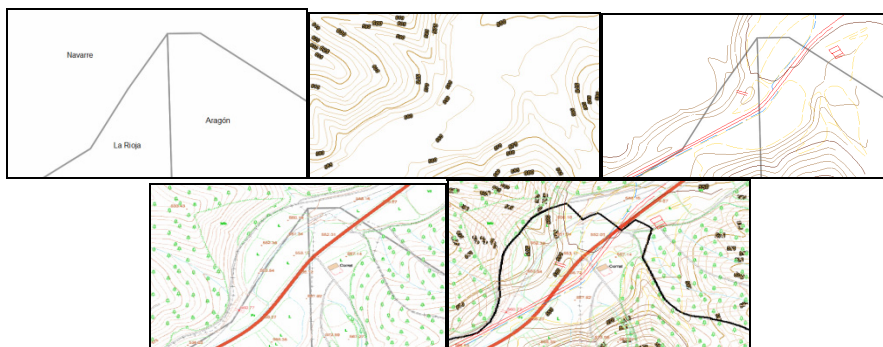


Figure 2: Boundaries of Autonomous Communities (a), WMS of Aragón (b), La Rioja (c), Navarre (d) and overlap of them (e)

IMPLEMENTED DESIGN

Requirements of implementation:

- WMS must support several versions and implement mandatory operations.
- Service offers single layer.
- Information needed by service is defined in a configuration file, including WIS metadata.
- Boundaries polygons of each Layer and information related to each remote WMS are defined in a *shapefile*. Necessary information for every polygon, describing the remote WMS, will be stored: URL, layers, supported SRS, image-format, service version, timeout, etc.
- Development language is Java.

Following figures show: high level architecture of the Web service, activities diagram, sequences diagram, *shapefile* class diagram, service configuration and service logging class diagram, and service and layer metadata class

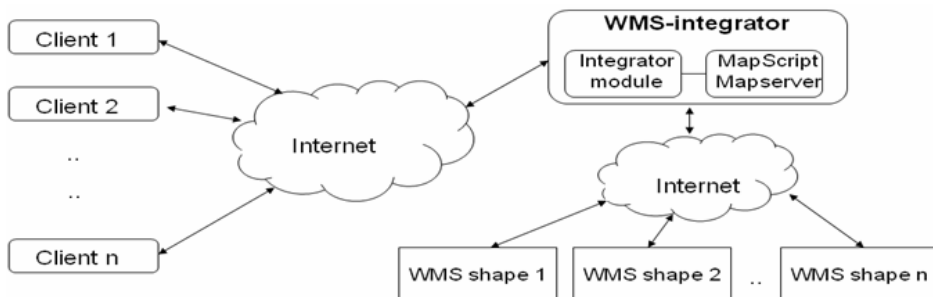


Figure 3: High level architecture

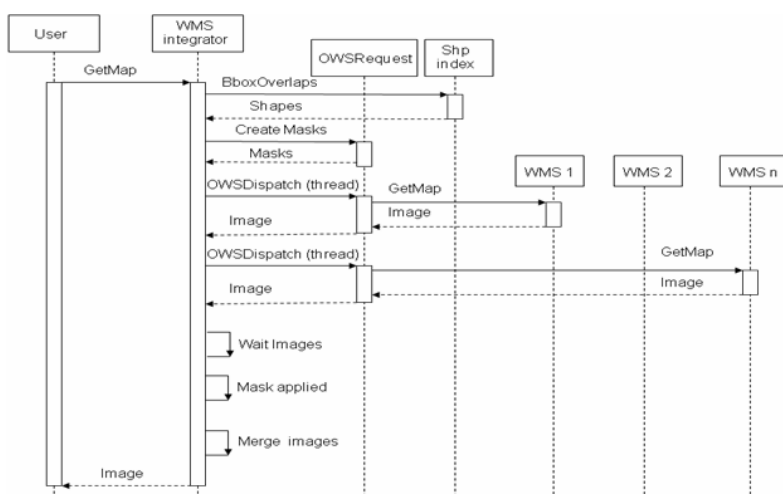


Figure 4: Activity diagram

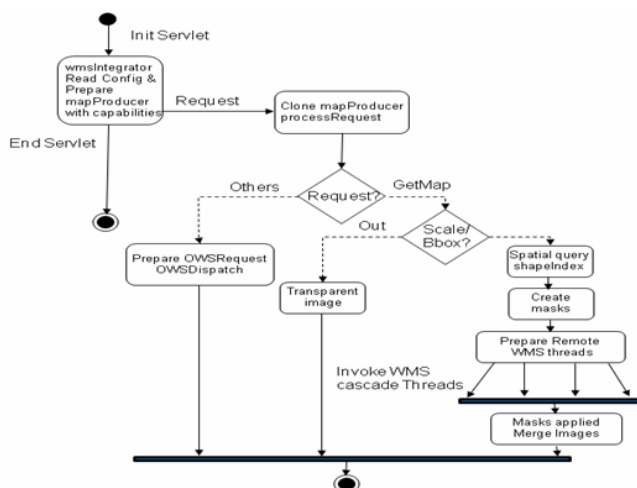


Figure 5: Sequence diagram

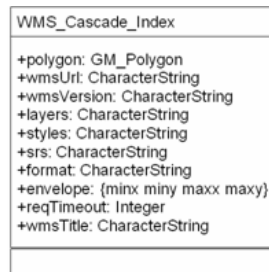


Figure 6: Classes diagram of the shapefile-index

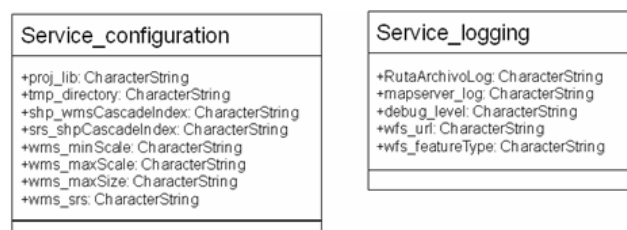


Figure 7: Classes diagram for Service_configuration and Service_logging

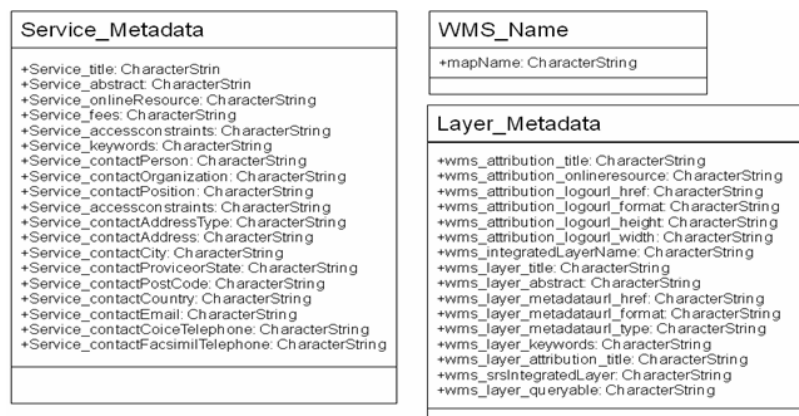


Figure 8: Classes diagram WMS_Name, Service_Metadata and Layer_Metadata

On starts *wmsIntegrator servlet* reads configuration information about classes by means of keyword pair values (KVP) from *wmsIntegrator.properties* file and store in memory. All request causes cloning of *wmsIntegratorMapProducer* that coordinate the operation flow.

GetMap requests validate the query and check that the scale and the spatial context are correct. Next the affected remote WMSs are spatially computed creating needed threads and launched to retrieve cascade images. The process awaits arrival of all responses or overcome timeout established through a synchronisation mechanism. Once the responses are received, masks are applied over each one of them and the results are merged. Finally the resulting image is returned to the client and the life time of the object ends.

Optional WMS operations have been implemented: *getSchemaExtension*, *describeLayer*, *getLegendGraphic* and *getStyles*. In addition *getStatus* operation enable query the service to know the

remote services status. Service makes a *GetCapabilities* request to everyone and interprets the response to detect whether the server is active or has undergone changes in its configuration.

RESULTS AND CONCLUSIONS

We have reviewed WMS integration and OS projects Cascade capabilities. A new WMS with capability for horizontal and vertical integration has been implemented that avoids data overlaps caused by cascade WMS as is show (figure 9) solving problems presented (figure 2).

Conclusions and remarkable characteristics of the service are:

- Is based on OS, thus the service may be deployed many times without increasing cost.
- Response times are not good but are due to the subrogated services. The worst time is the highest timeouts established to cascades WMS.
- Service replication may be considered because service *per se* does not provide data.
- The developed service may be used to generate a cache of WMS-Tiled service.
- Integrated service Topic is defined in a *shapefile* by mean of polygon, URL, layers, SRS, etc.
- Several thematic integration services can be deployed based on the search results obtained from catalogue service and associating administrative boundaries polygons.
- Users may interact with the integrated services in a transparent manner through WMS clients.

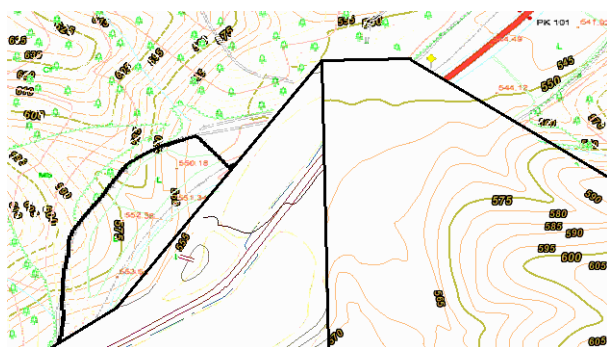


Figure 9: Integration of the Autonomous Communities of Aragón, La Rioja and Navarre

ACKNOWLEDGEMENTS

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