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# Benefits and limits of OGC-Web Services to the new SoDa Service on Solar Energy

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## Abstract

The SoDa Service (website: [www.soda-is.com](http://www.soda-is.com)) is providing an easy and standardized access to valuable information related to solar energy for professionals. Several providers offer via the SoDa Service an access to for-free and for-pay Web services and off-line services delivering data on solar radiation, atmospheric optics, position of the sun and many others. Since the launch of the Service in 2003, the SoDa team is making efforts to improve the quality of the service to customers. After the duplication of the whole system in 2010 for a better reliability, and the development of a more esthetic website in summer 2012, the team is now populating the new SoDa Service with new Web services. This is a perfect opportunity to explore different standards in order to increase the dissemination and acceptance of the existing and new services by the community of users. After several trials, the Open Geospatial Consortium (OGC) standards were selected. This communication discusses the OGC-compliant Web services and how the decision for developments within the new SoDa website was taken.

## 1. Introduction

A common feedback received from the community of users in solar radiation is that access to valuable information remains a permanent issue (Cros et al. 2004). Despite recent efforts made to adopt standards, users are still struggling to retrieve information which is relevant to their application. In addition, the profiles of the users are very diverse, making the fulfillment of requirements difficult to providers. For instance, large research centers are more likely involved in long-term projects at the European scale, and potentially have the money and the skilled manpower for investigating potential sources of information and developing appropriate specific tools. This is not the case for small- and medium-size enterprises (SMEs) with a small number of employees which are mainly involved in very short-term projects at a local scale. Several websites and brokers are now available online to retrieve the relevant information. The SoDa Service is one of these solutions. It has a large number of users and it is currently taking a strategic turn.

The current SoDa Service ([www.soda-is.com](http://www.soda-is.com)) is a mature co-operative/collaborative system for professionals in solar energy since the end of the EC-funded SoDa project in 2003 (Wald et al. 2002, 2004). It offers a one-stop access to different resources and databases in a standardized manner. In collaborative systems, the various sources of information (database, data sets, maps, applications...) are called services. In a few cases, these services can also be Web services, i.e. applications that can be invoked on the Web according to the World Wide Web definition. This application can be invoked via a protocol (HTTP, SOAP...). To widen the acceptance of Web services by different users, a standard may be adopted. Among the advantages are the publication in catalogs and the possibility to be directly invoked by the user's own application. Besides these strong assets for the information dissemination, a Web service that obeys a standard also imposes several constraints on the provider side.

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The SoDa Service is currently being fully redesigned and redeveloped. This communication proposes a discussion about Open Geospatial Consortium (OGC) standards, already well accepted and followed by the geography community. OGC-compliant Web services are planned to be developed to populate this new version of the SoDa Service for an increasing acceptance by the community of users.

## 2. The SoDa Service

The SoDa Service is the outcome of the research project having the same name. In 2003, the SoDa website was created at MINES ParisTech, in Sophia Antipolis, France. Access to the SoDa Service was regularly increasing in the following years. Overwhelmed by the numerous requests from users, MINES ParisTech decided to entrust the SoDa Service to the company Transvalor from Apr. 2009. This SME, approx. 45 employees, is in charge of the operational and commercial aspects of the SoDa Service. In 2010, the system has been duplicated to provide a more reliable and robust service to the customers. The mirror system (pro.soda-is.com) is hosted by Transvalor in Mougins, France.

The SoDa Service realizes the integration of many different resources: fifty-nine Web Services are offered for free to the community and thirty-nine Web Services are available for pay. A series of on-delivery/off-line services is also proposed.

The for-free Web Services have several providers located in Europe and the USA. Five services are provided by the company Meteotest from Switzerland, five others by the ENTPE engineering school from France, one by the NCEP from USA, two by the NASA from USA, two by the ISAC from Italy, and finally forty-four by the MINES ParisTech (See Fig. 1). These services are organized in application domains, such as astronomy, climate, energy daylighting, geography, meteorology, and solar radiation data.

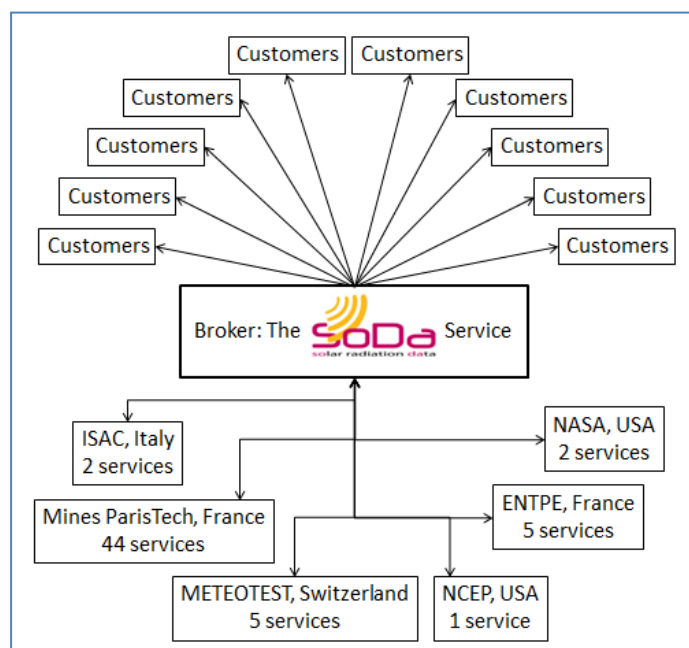


Figure 1  
The SoDa Service/broker

The Web Services for pay covers the accesses to the HelioClim-3 database, since Feb. 2004 onwards, except the year 2005 whose access is for-free. Three versions of this database are now available: version2,

3, and since April 2013, version4. The most advanced one is version4, which demonstrates better performances on most tested sites when compared to ground-based measurements.

The on-delivery services are numerous, but only part of this supply is provided on the SoDa website, mainly because of the difficulty for the commercial team to update the website matching the pace of the innovations proposed by the MINES ParisTech. The SoDa support can also be contacted to order off-line services such as maps of radiation, a few time series, a calibration, a Typical Meteorological Years, or any other specific requests requiring or not some research and development.

The statistics of accesses of the SoDa website reveal more than 35 000 unique visitors for the year 2012 from nearly all countries in the world. This number continuously exceeds 30 000 since 2008. The number of automatic accesses to the databases has also reached a record by exceeding 2.5 million for the year 2012. The audience is composed of SMEs, large companies in charge of the energy management, public authorities, universities, research centers, individual consultants...

### 3. Toward a SoDa new generation

At the beginning of the SoDa project, the notion of Web service was emerging and standards were not as developed as today. The SOAP protocol was available but was judged as uneasy to handle. The SoDa project has thus developed its own standard, named SoDa XML. Since its inception, the SoDa Service is regularly re-designed and enhanced to increase the dissemination of the information. That is the reason why MINES ParisTech participated to the MESoR project (2007-2009). One of the objectives of the project was to adopt the World Wide Web Consortium (W3C) standards. This standard did not receive the expected enthusiasm from the public. Benefiting of the expertise of MINES ParisTech in interoperability (Gschwind et al. 2005, 2007; Ménard et al. 2012), the SoDa team is getting more and more involved in OGC-compliant developments, which is already well accepted by the geography community (See Fig. 2).

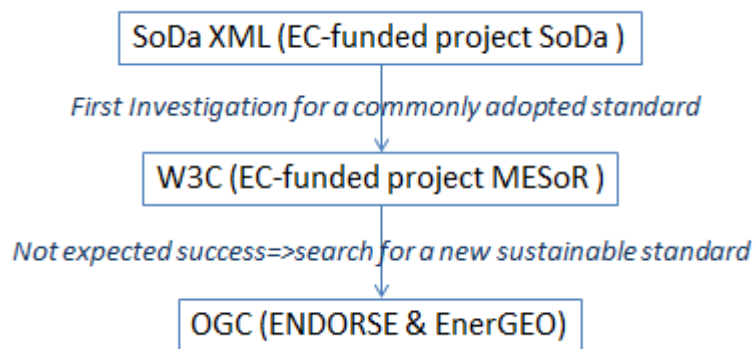


Figure 2  
The history between SoDa and the standards

At the same time, it is worth noticing that the technology of the current SoDa website is old-fashioned. A visitor hardly finds his way to the needed information in the website which contains a huge quantity of not so well-organized information. This remark justifies the development of a more ergonomic and esthetic website. The design has been defined in summer 2012, and integrated in a new Content Management System (CMS) named Liferay in January 2013. The hierarchy of the pages has also been revised, and the website is now ready to welcome services and information.

The existing Web services need to be transferred and adapted to the new technology. This change is an opportunity to add new Web services obeying the new standards. Three prototypes of services developed

in the FP7-funded project ENDORSE ([www.endorse-fp7.eu](http://www.endorse-fp7.eu)) have received a warm feedback from users during their test phase and are now hosted in the newly designed website. The new SoDa website should be completed and operational by the end of the year 2013.

#### **4. OGC-compliant Web services: advantages and drawbacks**

To meet the requirements of recent standards, an effort has been made in 2012 to explore the tools for interoperability that are compliant with the standards developed within GEOSS and INSPIRE. The aim of this communication is to present our experience about the fit-for-purpose of OGC (Open Geospatial Consortium) standards for Web processing services (WPS) (Percivall et al. 2011), as well as Web mapping services (WMS) for the development of the Web services within the new SoDa website.

The deployment of OGC-compliant Web services on a community platform contributes to information technologies in geography and interoperability, and exposes them for automated exploitation. The returned flow can be exploited for a direct visualization on the browser of the user, for doing multiple requests to carry out a research project, or for the exploitation in a value-added service for making business. The visibility of such services is also increased by their publication into catalogs. Most of the Web services developed within the framework of EU-funded projects must obey the OGC standards.

MapServer or GeoServer are examples of free and open-source WMS servers. A Web mapping service is a very effective tool to display and handle maps with online GIS tools. The provider uploads the map on a WMS server for publication. The upload of the maps into different spatial resolutions ensures a good access time to the user when he navigates through the scales. The user queries the WMS to retrieve the maps in the format defined by the provider. The latter has several options to limit and protect his information in a WMS. He may provide for instance a degraded version of the map. The availability of the image can be limited to a coarser version of the image, or to an image with a limited quantification: images originally in 32 bits format may be made available in 8 bits integer format. The image retrieved by the WMS can also have a maximum size. This will contribute to control any overload of the server or a too large use of the bandwidth during the download. Another advantage of WMS is the existence of free and open-source tools with user-friendly interfaces to question the WMS, such as QuantumGIS. In our opinion, there are no major drawbacks associated with the use of WMS.

The case of WPS is a bit different. The user can easily interrogate the WPS server in order to retrieve the list of available WPS, or to get the properties of a given WPS. GeoServer or the INTECS Toolbox are examples of WPS servers. As far as we know, no simple WPS client exists to exploit easily the outputs from a WPS. Users need to develop the WPS client by themselves. Once this done, users are able to retrieve as many information from the WPS as they need.

On the side of the provider, the main issue is the load on the servers. If the WPS server is not correctly set up, the system can be endangered by burst requests of a user, or by many requests made in parallel by many different users at the same time. This is particularly an issue in the case of SoDa. MINES ParisTech is willing to develop WMS and WPS following the OGC recommendations in order to better share information within the solar community. Transvalor has the constraint to provide services for pay, and to guarantee a certain level of availability. For that purpose, Transvalor has invested time and money for the duplication of the whole SoDa service, from the acquisition chain of the Eumetsat images to the current free Web services. The number of servers on both sides is limited, and for cost reasons, there is no server dedicated only to the for-pay services. As a consequence, this mirroring enables a certain level of service quality, which can be endangered by too many requests to for-free WPS services.

A provider of the WPS has a few options to avoid such inconvenience. One option is to hide the WPS from the external network. The WPS is then only usable for users located inside the internal network on a machine that is not visible from the Internet. As the main benefit of a WPS lies in its capability of being

visible from the Web and accessed by many computers to increase the dissemination and the extent of the services, the interest of developing a complicated WPS is thus limited

To control the amounts of automatic accesses in the current SoDa Service, the MINES ParisTech has opted for an access checking based on IP addresses. Only the IPs specified in a list of users are authorized to access the data with specific rights associated to each IP. This IP-based check was originally only applied to the for-pay services, and could be extended to the for-free WPS. The rights can be user-tailored for a better control of the WPS. This solution forces the user to be identified in the SoDa Service, and in our opinion, this is contrary to the idea of for-free Web services with no restriction access.

Another option is to limit the bandwidth dedicated to for-free WPS. Another alternative could be to impose a time lag between two requests; when several requests are made simultaneously on the WPS, there are put in a queue executed with a first-come, first-served strategy. Finally, as in the case of the WMS, the quantity of retrieved data for each request can also be limited.

## **5. How SoDa will get along with OGC standards**

Regarding this list of advantages and drawbacks, decisions have been and are still being taken by the different service providers concerning the Web services to be available in the new SoDa website. The decision to populate the new website with OGC-compliant services depends on the reaction and the acceptance of the community, and also depends on our ability to protect our system for a sustainable SoDa service.

So far and as previously written, the new SoDa website already welcomes a few Web services. Two of them are WPS: Solar-Geometry-2 or SG2 (<http://www.soda-pro.com/solar-geometry-2>) and McClear (<http://www.soda-pro.com/gmes-products>). They enable to retrieve respectively the position of the sun in the sky with a very good accuracy, and time series of irradiation that would be observed in a specific site under clear sky conditions. Both of them are outcomes of European projects: SG2 is an achievement of ENDORSE and McClear of MACC-II project. The choice for adopting OGC-compliant tool was driven by the requirement of both projects. No restriction has been applied yet on these Web services so far. MACC-II imposes that the users must be logged in to use the interface. This identification will be applied in a very short-term.

Two achievements of the ENDORSE project will be introduced in the new SoDa website. A WMS is planned to provide a visualization of the maps of radiation and all additional layers available in the PACA Atlas (<http://www.endorse-fp7.eu/pre-market-services/local-atlas-generation>). A priori, no restriction of access will be applied on the layers of this WMS which will be free of access. An interesting feedback from the customers during the testing of the service was that a free access to such high quality atlas depreciates the potential value added brought by such service. After the end the project, an access with a limited fee will be contemplated.

The second ENDORSE outcome is the Typical Meteorological Year generation service (<http://www.endorse-fp7.eu/pre-market-services/tmy-generation>). A simple version of this service will be available online. The service will be available very soon but will not obey OGC-standards. Several reasons explain this decision, the first one being the lack of time. A WPS requires more development time than older technologies, and only a few people in our team have the ability to develop such service. In addition we did not receive requests from customers for an extensive use of the service that would justify such development. The last reason is that the service will be restricted and for pay. The need for a WPS is less strong since this tool is not dedicated to the community.

Afterwards, all the free Web services of the ancient website developed with the proprietary SoDa xml format will be first left unchanged and made initially available using iframes to speed-up their deployment in the new Web site.

## 6. Conclusion

It is very important that the providers of solar radiation related services and data have a good knowledge of their audience to provide a more adjusted service. New developments are user-driven, i.e. the users contribute to define orientation and priorities in the future developments via surveys and interviews. One of the most common users requirements is a quick and easy access to the relevant information with service adjusted to their own needs and applications. Most of them do not have the time to develop their own routines to transform the retrieved data.

All along the years, a lot of efforts have already been made by the providers of services, putting more and more data available online. Still too many different information and formats are available. One of the solutions is that the whole community of the providers and the users adopt a common standard. The years of experience of the SoDa team with the standards push them to bet on the OGC-compliant standards to drive the development of the new Web services. As every new standard, OGC tools which already received a warm adoption from the geography community, require to learn new methods and thus to train both users and providers.

The SoDa team is convinced that the strategy which consists of adopting a standard, training the provider so that they acquire the skills to protect their data, and informing the community with the information of this standard will answer the need of creating notoriety while providing a high quality service.

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