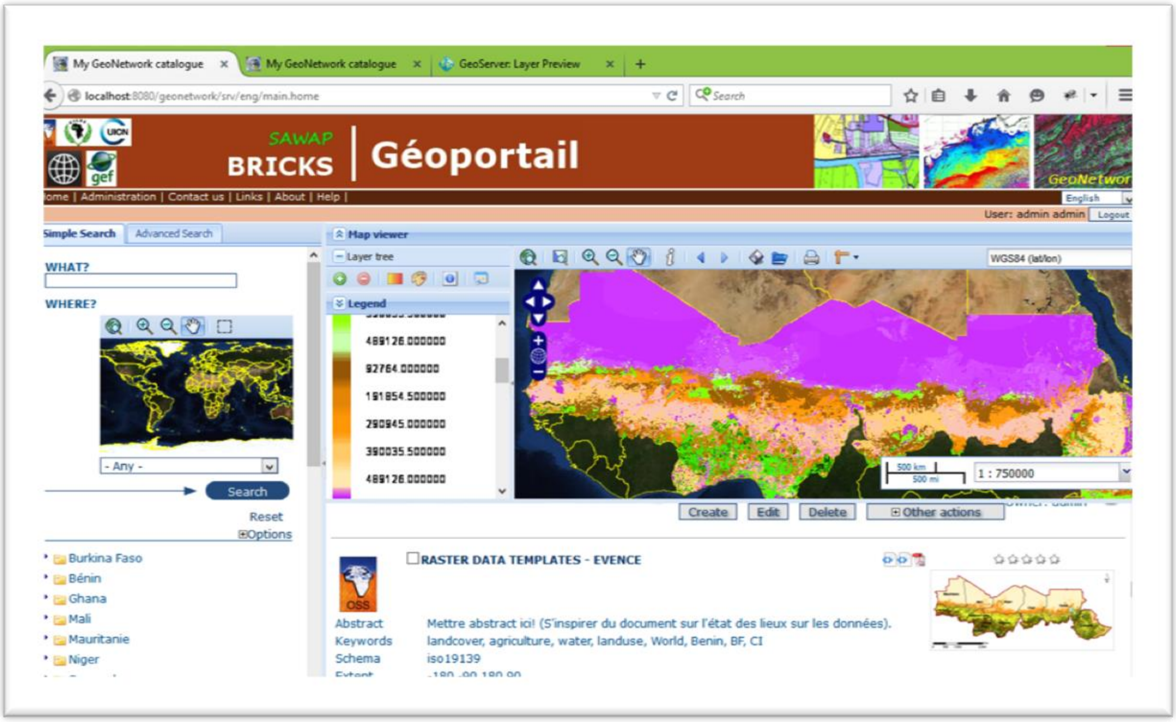
BRICKS PROJECT

BUILDING RESILIENCE THROUGH INNOVATION, COMMUNICATION AND KNOWLEDGE SERVICES

BENIN, BURKINA FASO, CHAD, ETHIOPIA, GHANA, MALI, MAURITANIA, NIGER, NIGERIA, SENEGAL, SUDAN, TOGO

CONCEPT NOTE OF THE BRICKS SPATIAL DATA INFRASTRUCTURE



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ABREVIATIONS ACRONYMS

- API : Application Programming Interface
- WB : World Bank
- BRICKS: Building Resilience through Innovation, Communication and Knowledge Services
- CILSS: Permanent Interstates Committee for Drought Control in the Sahel
- ESRI : Environmental System Research Institute
- FAO : Food and Agriculture Organization of the United Nations
- GEF : Global Environment Facility
- SLM : Sustainable Land Management
- SDI : Spatial Data Infrastructure
- GGWSSI : Great Green Wall for the Sahara and Sahel Initiative
- ISO : International Organization for Standardization
- IT: Information Technology
- NSIF: National Spatial Data Infrastructure Framework
- OGC : Open Geospatial Consortium
- OSS : Sahara and Sahel Observatory
- WFP : World Food Programme
- UNEP : United Nations Environment Programme
- REPSAHEL Improving the Sahelian populations' resilience to environmental changes
- NWSAS : North-Western Sahara Aquifer System
- SAWAP: Sahel and West Africa Programme
- IS-SLM : Information System for Sustainable Land Management
- SIG/GIS : Système d'Information Géographique/GIS Geographic Information System
- IUCN : International Union for the Conservation of Nature

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Context

Africa displays a great diversity of natural ecosystems including soil, vegetation, water and genetic diversity. These elements represent the main natural richness of the continent. Hence, they should be conserved and protected to ensure the survival of the African populations and their livelihoods that depend on the various services and products of these natural resources as food, water, wood, industrial products, etc. (Liniger, 2011). It is from the land that 60 percent of the people directly derive their livelihoods - from agriculture, freshwater fisheries, forestry and other natural resources (FAO 2004). However, these resources are often threatened due to overexploitation caused by population growth, which considerably reduces their availability in certain regions, notably the Sahel and Sahara countries involved in the Great Green Wall initiative.

Sustainable land management (SLM) is one of the major challenges for the development of the Sahara and Sahel region, and especially for the countries concerned with the Great Green Wall (GGW). The Sahel and West Africa Programme (SAWAP) aims to strengthen and support the Great Green Wall initiative and to resolve natural resources –related problems (including water and land) at the level of twelve sub-saharian countries (Benin, Burkina Faso, Ethiopia, Ghana, Mali, Mauritania, Niger, Nigeria, Senegal, Sudan, Chad and Togo) and at the regional level.

BRICKS project « Building Resilience through Innovation, Communication and Knowledge Services” has been launched in support to the SAWAP programme. It aims to provide the twelve SAWAP national projects with a support in terms of M&E, knowledge sharing and good practices, through three major components. The first component concerns knowledge management, the second is devoted to monitoring and evaluation and the third focuses on the project management. BRICKS is implemented by three regional organizations: the Permanent Interstates Committee for Drought Control in the Sahel (CILSS), the Sahara and Sahel Observatory (OSS) and the International Union for the Conservation of Nature (IUCN).
As part of its role within the second component of the BRICKS project, OSS provides technical support and is in charge of the programme monitoring through the development of new tools and the organization of capacity building activities. These activities could be divided into two parts:

- Monitoring & evaluation activities ;
- Development of geospatial applications to ensure the monitoring, modelling and evaluation, of land, water resources and changes in land use at the regional level.

A part of the work consists then in elaborating, putting online and regularly feeding a regional platform for information and data publication, exchange and dissemination (geospatial and non-spatial) in near real time. Such platform could contribute to the establishment of a Spatial Data Infrastructure (SDI) to centralize and better valorize this data/information. It will enable to disseminate, share and improve the products developed by the 12 projects.

Objectives

The main objective of this note is to describe the architecture of the Spatial Data Infrastructure and its technical components that allow to assemble, disseminate, and share information and data (geospatial and non-spatial) on sustainable natural resources best practices (land and water) among the 12 projects. It is a preliminary work for the set-up of a Geoportal at the level of the 12 countries involved in the BRICKS project.

1. Information System and geo-spatial data

2.1. General concept of the Information System

2.1.1. Definition

An information system (IS) is a set of organized resources (materials, soft wares, staff, data and procedures) that allow to collect, filter, process and disseminate data on a given environment (Semoud, 2006). Information Systems are of great importance for all structures (institutions, organizations, companies, etc.).In fact, given the vital role that information plays in the decision-making process in this new age, each structure must devote a great part of its efforts and activities to data and information collection, processing, stocking, and dissemination.

The advances brought by Information and Communication Technology (ICT) helped to further confirm the importance of information systems. Their impressive capacity for processing huge volumes of data, inter-connection between site webs, resources or geographically remote operators, account for the wide use of these advanced technologies in information processing and dissemination in real time, instead of using classical and slow means of communication .

2.1.2. Information system, environment and sustainable development

❖ At the global scale

Sustainable development, according to the *International Institute for Sustainable Development (IISD), "is* development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: the concept of *needs*, in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of *limitations* imposed by the state of technology and social organization on the environment's ability to meet present and future needs."

In general, sustainable development poses the challenge of managing large volumes of unstructured information and knowledge. For that, several methods have emerged: the semantic web techniques based on ontologies and metadata; knowledge engineering projects, wiki systems like Encyclopedia Ekopedia[1], or Wikia_Green[2] ; Spatial Data Infrastructure systems (SDI, read more details on page 5)

In order to face several challenges, it is deemed necessary to rely on information systems and restructure them into a new architecture: that of the Sustainable Information System (SIS), combining thus the Master Data Management System (MDM), Business Rule Management System (BRMS) and Business Process Management (BPM)[3].

❖ African Context

At the level of Africa and other different levels, several initiatives conducted by national, regional and international actors led to the establishment of information systems aiming at supporting decision-making on natural resources, risks and disasters management (Essahli & Ben Khattra, 2009, Audouard, 2002 ; Shumilov *et al,* 2008, etc.). Other several experiences led by international organizations invested in the creation of operational devices in terms of information systems. Most of them are efficient sources for data updating and cover both regional and sub-regional levels. .

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[1] http://www.ekopedia.org/
[2] http://green.wikia.com/wiki/Wikia_Green
[3] http://fr.wikipedia.org/wiki/D%C3%A9veloppement_durable#cite_note-121

The information and data issued by these information systems are generally reliable and produced (in a regular basis) according to particular standard. This information relates to land use/cover, ecology, agriculture/agronomy, hydrology, bio-climate indices, desertification and land degradation, famine, food security, health, environment, etc.

Among the most known information systems in the field, we can mention:

- Global Information Early Warning System on Food and Agriculture (GIEWS[4])of FAO ;
- Fews net (Famine Early Warning System Network[5]) of the US Agency for International Development (USAID);
- Africa Data Dissemination Service (ADDS)[6]of l'USGS;
- Agrhymet Information System[7], covering the CILSS sub-region ;
- Information System on Desertification
- le Systèmes d'Information et de Suivi de l'Environnement par Internet (SID-SISEI)[8];
- West African Spatial Data Infrastructure for Climate Change and Adapted Land Use, of WASCAL[9]
- Etc.

2.2. Spatial Data Infrastructure and Geoportal

2.2.1. Spatial Data Infrastructure

The term Spatial Data Infrastructure (SDI) was coined in 1993 by the U.S National Research Council to denote a framework of technologies, policies, and institutional arrangements, that together facilitate the creation, exchange, and use of geospatial data and related information resources across an information-sharing community (Zorica et al., 2006). Such a framework can be implemented narrowly to enable the sharing of geospatial information within an organization or more broadly for use at a national, regional or global level.

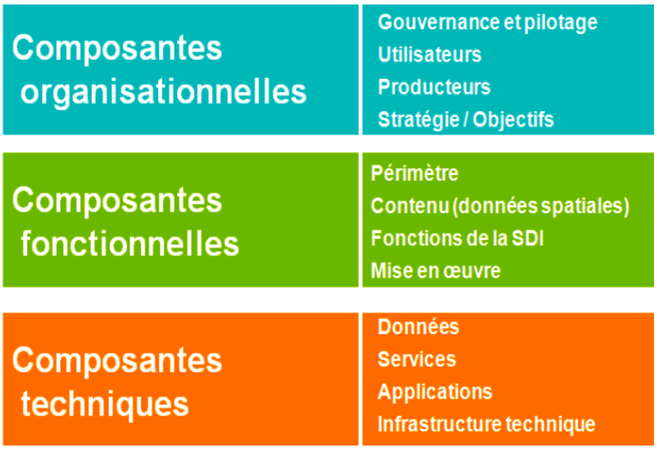
A formal definition of a SDI was given by the US Federal Government in 2002 which states that a SDI is "the technology, policies, standards, human resources, and related activities necessary to acquire, process, distribute, use, maintain, and preserve spatial data." A SDI is potentially formed by the convergence of different geospatial data providers – each one of them enabling access to data through specific internet services.

SDI is composed of three components: organizational component, functional component, and technical component. Each component includes several other sub-components (Figure 1).

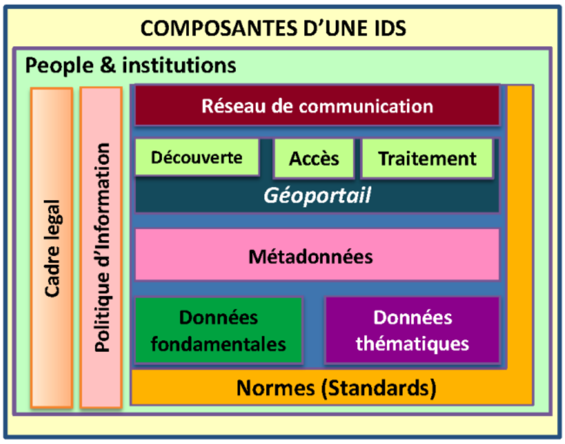
For Nebert & Lance (2002), SDI components include:

- Communication networks, forming the physical and logic infrastructure component;
- Geospatial data as well as their sources, forming the geospatial data directory;
- Geographic Information System (GIS) to communicate the different elements;
- Interoperability norms and standards;
- Institutional policies and arrangements;
- Institutions, agencies, partner organizations, etc.

[4]http://www.fao.org/Giews/french/index.htm
[5]http://www.fews.net/
[6]http://earlywarning.usgs.gov/fews/
[7]http://www.agrhymet.ne/
[8]http://www.environnement.gov.tn/envir/sid/
[9]https://icg4wascal.icg.kfa-juelich.de/wadi-data-portal



(a) Ghaemi *et al.* (2010)



(b) Nebert & Lance (2002)

Figure 1. Main components of A SDI

2.2.2. Role of the Geoportal in SDI

OGC defines Geoportal as « a human interface to a collection of online geospatial information resources, including data set and services" (OGC, 2004).

Geoportals could be divided into two groups: catalog geoportals and application geoportals (Akinci & Cömert, 2007).

- Catalog geoportals are concerned primarily with organizing and managing access to Geographic Information. We have for example the FAO's geoportals (http://www.fao.org/geonetwork),and the UNSDI's (http://www.geonetwork.nl), etc.
- Application geoportals provide on-line dynamic geographic web services, for example, MapQuest provides routing services (www.mapquest.com), National Geographic provides mapping services (http://www.nationalgeographic.com/maps/), etc.

A distinction must be made between a Spatial Data Infrastructure and Geoportal. Geoportal is an integral part of the SDI and contributes to its construction. In SDI, the geoportal ensures three major functions: data publication, research and download **(Figure 2)**.

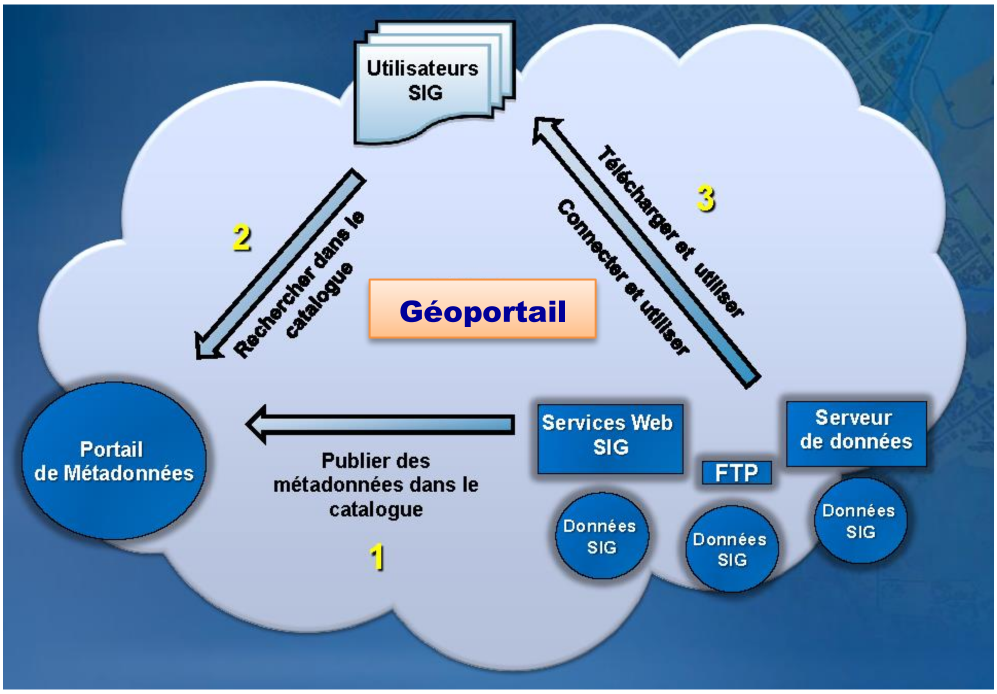


Figure 2. Main functions of a Geoportal

2.3. Geospatial Portal Reference Architecture and Technical Properties

The Geospatial Portal Reference Architecture, illustrated in Figure3, represents the guide of the Open Geospatial Consortium (OGC) for the implementation of a standardized geospatial portal (Horakova *et al.*, 2007). This architecture is translated by a set of documents that define fundamental elements and a set of interoperability agreements that establish instructions to remediate difficulties facing different organizations and communities in sharing their geospatial data. This architecture is based on the Service-Oriented Architecture (SOA). The Service-oriented Architecture is an approach that allows to construct distributed systems that provide application functionalities as services to end-user applications or to build other services (Colan, 2004). As it favors interoperability, SOA is the most popular and widespread architecture.

OGC specifies 4 types of services inherent for a complete implementation of a normalized geospatial geoportal. It also identifies the OpenGIS interoperability standards applicable to these services. These four types are classified respectively as: portal services, catalog services, representation services and data services.

- **Portal services** : provide access to geospatial, portal and users management and administration;
- **Catalog services** : allow the collection, storing, and management of descriptive information on data stored in the database;
- **Data services** : provide access to spatial content in databases ; they allow data encoding using a defined common interface;
- **Representation services:** allow geospatial information access and visualization through interactive mapping services.

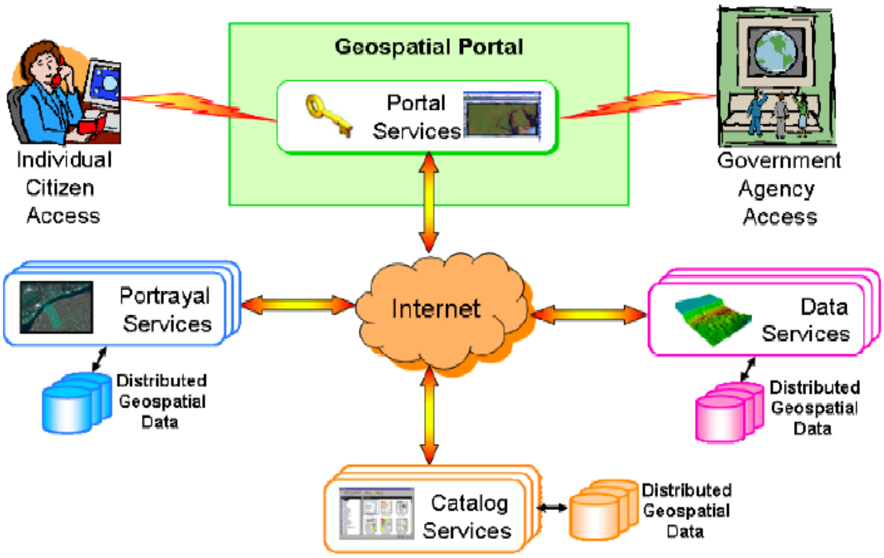


Figure 3.geospatial portals architecture (Horakova *et al,* 2007)

3. Design and Implementation Strategy of BRICKS Information System

3.1. BRICKS Geoportal: technical properties and architecture

3.1.1. Software

The main software that constitutes the BRICKS geoportal are mainly free-license and based on international norms and standards: FOSS (Free and Open Source Software (FOSS), ISO/TC211 (International Organization for Standardization/Technical Committee 211) and OGC (Open Geospatial Consortium). These software are largely used for sharing and disseminating thematic geographic information worldwide. Combined, these software allow the implementation of an information system (BRICKS geoportal) whose web services (catalog services, interactive maps services) will be standardized[10] and can thus be connected through the web to other information systems based on the same standards and protocols.

These software are:

- GeoNetworkOpenSource (serves as web applications catalog and portal) and
- OpenGeo-Suite, a platform bringing together many components: GeoServer (web-mapping server), GeoExplorer (web application for visualizing and composing maps), OpenLayers, GeoExt, GeoWebCache,PostGIS, QGIS, etc. OpenGeo-Suite is interoperable with ESRI, Google, Microsoft and Oracle.

These software will be associated to others support software. Given that the GeoNetwork and the OpenGeo Suite components will be deployed and used on-line for a production environment, the selection of support software included: Java Development Kit (JDK) and Java Runtime Environment (JRE), Apache Tomcat, Apache Web Server, PostgreSQL and PostGIS, which will be installed in advance.

Apache Tomcat will be used as *servlet container* to host GeoNetwork and the OpenGeo Suite components. Tomcat will be hosted by the Web Apache Server. In addition, the PostgreSQL parameters will be defined in such a way that it accepts connections, on the one hand, and to be set-up and used as

[10] Web services developed according to the Standardization Organization (ISO) standards.

the manager of the GeoNetwork database, on the other. PostgreSQL could be supported by PostGIS in order to improve requests' performance in general, and spatial requests in particular[11].

Other GIS/Remote sensing software will also be exploited for data and WMS preparation.These software include: ArcGIS, Arc2SLD_converter, Arc2Earth; uDig, QGIS, ERDAS Imagine, ENVI, etc.

3.1.2. Architecture of BRICKS Geoportal (main components)

The general architecture of BRICKS geoportal (figure 4) shows that the latter will be composed of 3 main parts (designated by letters *a* and *h* in figure 4).

i. The geoportal component (letter *a*) is composed of the GeoNetwork and GeoExplorer that constitute the visible and public part of the infrastructure. Together, these two resources allow access to two different interfaces offering thus to the public two choices:

- ***GeoNetwork interface*** : more completed and elaborated; it will allow to efficiently perform the researches, the requests, and the analyses and especially grants access to all available resources and services (metadata, interactive and static maps, graphs, audio-video resources, reports, spatial and non-spatial datasets , photos, applications, etc.).
- ***GeoExplorer* Interface:** allows access to a simple page with basic functions, allowing to visualize and examine interactive maps, to perform information request, to navigate through basemaps, etc.

(The GeoNetwork and GeoExplorer interfaces could be personalized purposefully).

ii. Data Store Component (Figure 4, letter *b*) allows the storage of users' files, data and metadata. Data store is highly important as it represents the basis or core from which the GeoNetwork and GeoExplorer extract their data and metadata to be published or disseminated. In fact, it is thanks to the Data Store (and to the map server also), where all data and files are centralized and hierarchized, that the external user (letter e) has the possibility, through GeoNetwork and GeoExplorer, to visualize, conduct researches, save, download/upload, analyze resources and manage systems.

iii. Map server component assumes the role of connector between the two first components, namely geoportal and data store components (letter *c*). It will be based on GeoServer. It is through this component that:

- The data store is defined and better hierarchized;
- The BRICKS program and its different projects' themes are hierarchized;
- The geospatial data are stored in the data store;
- The interactive resources are prepared according to appropriate formats and styles;
- The Geoportal primary resources are defined (primary metadata), it is also through this server that the requests and their nature are planned, etc.

The BRICKS Geoportal could be connected to other on-line geoportals and metadata catalogs (illustrated in figure 4 by the letter *d*). Others operators like Google and specific external map servers will also be exploited, notably to import Google Maps (Google Physical Map, Google Street Map, Google Hybrid) as well as OpenStreet Map and WMS displaying themes of interest for BRICKS.

[11] PostgreSQL already includes basic geometric types. PostGIS adds extra geospatial types and functions that make spatial data management in a database easier and more efficient.

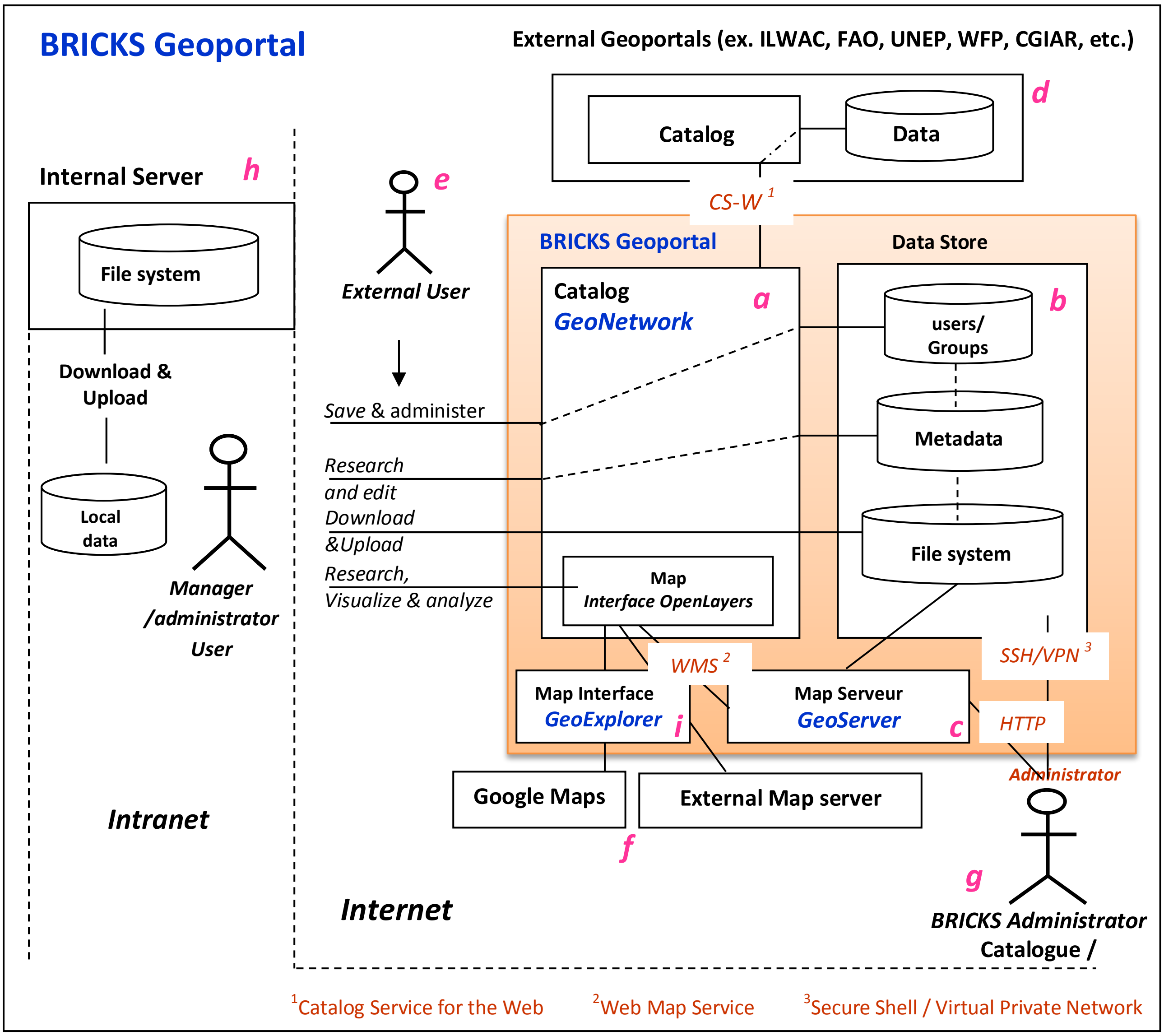


Figure 4. Architecture of and access to BRICKS Geoportal

The main functions of the BRICKS Geoportal are summarized in figure 4. It could be presented as follows:

- ✓ Local access to and downloading/uploading of data, maps, graphs, documents and other types of content materials;
- ✓ Direct and immediate access to external metadata catalogs and other products hosted by the latters ;
- ✓ Online metadata editing with a *template* system ;
- ✓ Interactive maps visualization interfaces allowing to combine map layers issued from map servers distributed worldwide (including google maps).

3.1.3. Organizational Structure of BRICKS Geoportal

For an efficient use of BRICKS geoportal by the different members of the BRICKS project, it is necessary to formulate certain rules and constraints regulating its utilization. This will also allow to respond to the needs of local actors involved in the national projects. A number of requirements determined by the system's architecture are listed below.

3.1.3.1. Access to Geoportal

All resources, information, and data (spatial and non-spatial) must be accessible online via BRICKS geoportal web interface by all users. Certain data and resources will be freely accessible to public users. The search, visualization, and download of these free data in the BRICKS metadata catalog will be possible even without having a user account.

However, access to personal and/or restricted data and metadata and their download requires the user to have specific user account. Same applies to the administrative tasks on the Geoportal.

In order to ensure the security of the system, it would be better to use SSH and SCP[12] to get access to BRICKS servers. A wide variety of file formats must be directly uploaded in the geoportal (metadata catalog). However, each transfer on the BRICKS server must also be done SSH and SCP.

3.1.3.2. Data

The BRICKS metadata catalog must only contain data and resources to which consistent metadata were elaborated and inserted in BRICKS geoportal. These metadata must contain exhaustive information on their respective data/metadata. This information must be elaborated according to the specific requirements of the ISO 19115/ISO 19139[13] standards while observing the requirements related to data policies of the projects' member countries.

Each metadata must offer a series of information on data, describing for example the places or infrastructures where data could be found, its authors and formats, etc.

3.1.3.3. Links and interconnexions

BRICKS geoportal could be related to other internal information systems, including the interoperable systems developed by OSS within its projects, namely ILWAC, Afromaison, and Geo-aquifer. etc. (see annexes 1, 2 and 3, page 22). It can also be connected to other external pertinent information systems , including those of FAO, OMS, CGIAR, UNEP, ISRIC, VBA, WHO, WASCAL[14], etc. practically speaking, the user could search for data existing on several external information systems using directly the BRICKS metadata catalog interface .

3.1.4. Adapted use of BRICKS Geoportal to the BRICKS/SAWAP context

3.1.4.1. Data/resources integration and distribution in the Geoportal

BRICKS geoportal aims to centralize and manage the stock of data, services and other resources generated by the different BRICKS projects/countries according to their themes and interests. However, at the level

[12] Secure Shell (SSH) and Secure Copy (SCP) are encrypted remote login protocol and data secure transfer.

[13] ISO 19115 reference standard for geographic information in the metadata domain. ISO19139 provides the XML implementation schema for the ISO 19115 standard specifying the metadata registration format and can be used to describe, validate, and exchange the geospatial metadata prepared in XML format.

[14] links of information systems respectively of FAO, OMS, UNEP, WASCAL, and VBA http://131.220.109.2/geonetworkhttp://www.fao.org/geonetworkhttp://www.who.int/geonetworkhttps://icg4wascal.icg.kfa-juelich.de/geonetwork/apps/search/

of each of the 12 BRICKS member countries, each project has its own team whose members are in charge of data management. They are supposed then to interact with their respective information system (geoportal), to upload / download data under the supervision of the geoportal's administrator at OSS and according to their needs. Data flow from and into information systems must be regulated to guarantee property rights. Consequently, the BRICKS geoportal is an integrated system capable of defining duties/authorities/rights of the BRICKS projects teams using the « user », « group-users » and « users profiles » concepts.

In BRICKS geoportal, users' accounts with individual profiles offering specific advantages, including access to protected or restricted data, could be created and managed online by BRICKS geoportal administrator (illustrated by the letter *a* in figure 5). Hence, the members of each project could have an « administrator-user » account that the Geoportal's administrator (letter *a* in figure 5) could create.

The importance of this situation lies in the fact that : metadata as well as data and interactive maps download/upload editing, publication, revision and updating could be entirely managed and supervised by the team members of the concerned project/country.

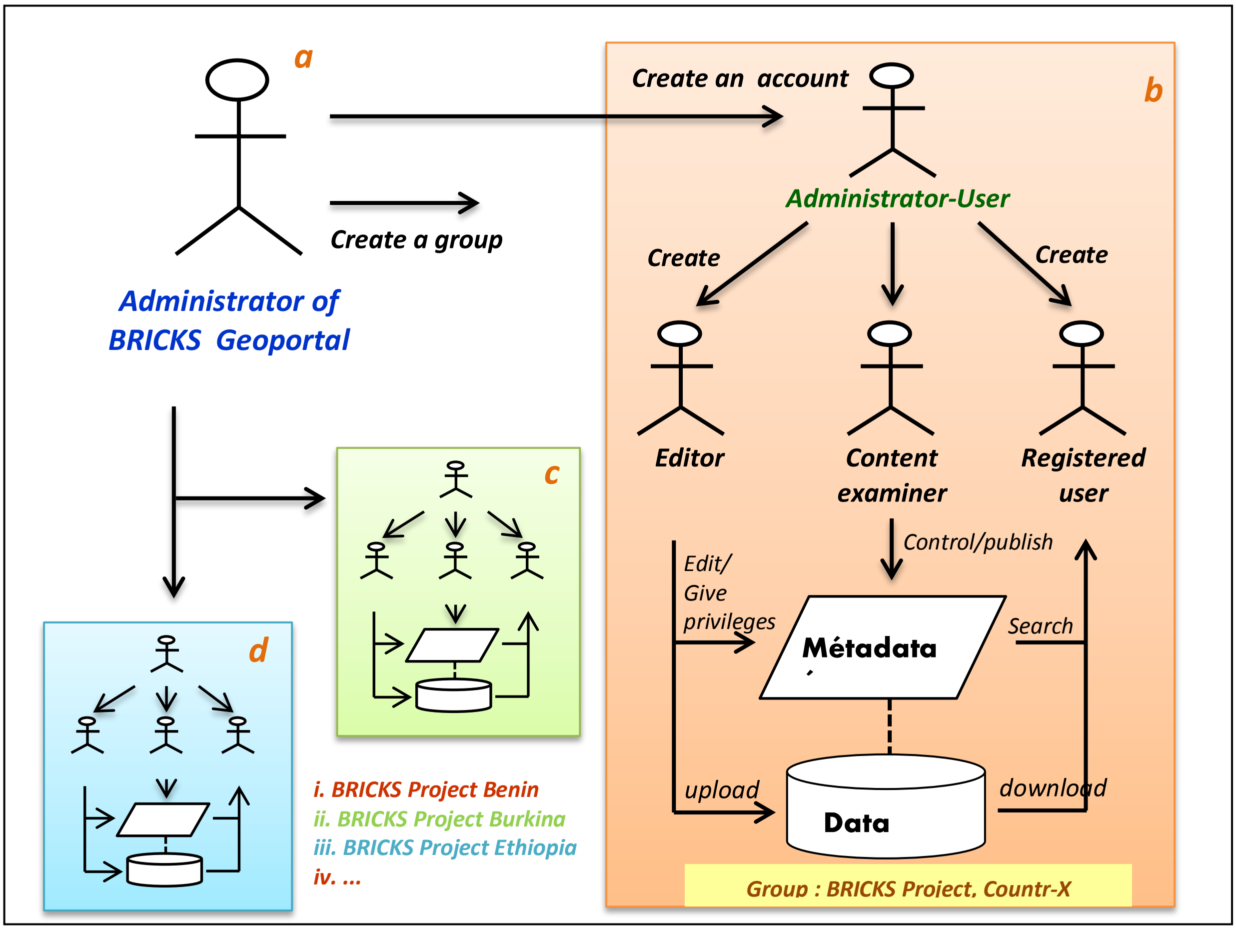


Figure 5. General diagram of users groups and profiles in BRICKS Geoportal

3.1.4.2 Meta Data Management

The data produced by the 12 BRICKS projects will have specific characteristics relative to their content, format, their code, access, restriction, etc. As mentioned above, BRICKS geoportal will adopt the ISO

19115[15] metadata standard, the reference standard for geographic information in the metadata domain. It is used for geodata exhaustive description and is composed of certain elements describing their metadata. In addition, the Dublin Core[16] metadata generic standard will be used to describe non-spatial documents and data.

Other elements could be associated to these two standards if needed. In order to guarantee the conviviality of the ISO 19115 standard, composed in reality of 400 metadata elements, a simplified version could be envisaged in certain cases. This version could then be transformed into another model called metadata *template* containing uniquely the necessary elements for the description of data or the resources in question. Within the framework of BRICKS, each project could proceed to the creation and personalization of its own *template*.

3.1.5. Geoportal Management

BRICKS geoportal development, initial feeding and management will be ensured by OSS, in collaboration with the experts in charge of data management in each project of the 12 countries involved. OSS partners, CILSS and UICN, will contribute to these tasks for a better use of the Geoportal's resources.

Data represent a very important element for the implementation of the 12 projects. Certain data are private or protected hence their access must be restricted. But, this should not prevent their description through metadata, which renders their existence public, known and disseminated. Better, these data could be spatially visible, which could enhance their dissemination and stir the users' interest in using them.

A number of agreements must be defined to set official, operational and protected data/resources management plans for the projects to be able to upload their data or to insert and publish their associated metadata. This implies the establishment of efficient data management, publication, and dissemination rules respecting data property and access rights.

All along the Geoportal implementation process, database stakeholders, including the countries concerned, should meet regularly to:

- Elaborate data management, dissemination and sharing plans and policies on detailed assessments of the countries/ projects' needs;
- Coordinate data management;
- Organize training sessions to ensure a better understanding/exploitation of the IS (geoportal and its components); and ensure capacity building in terms of common data management. .

3.2. Geoportal Implementation Strategies

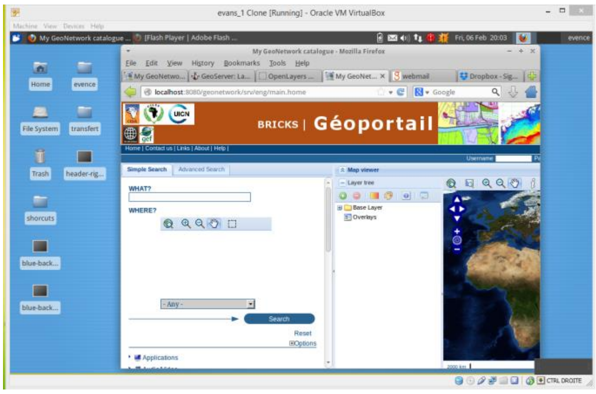
3.2.1. Implementation process

Initial works related to the Geoportal's setting-up have already been conducted by OSS (since October 2014). The crux of the system constituting the Geoportal (metadata catalog, map server) has already been developed locally under Xubuntu (Linux distribution, Xfce Desktop) and Kubuntu (KDE Plasma Desktop) as

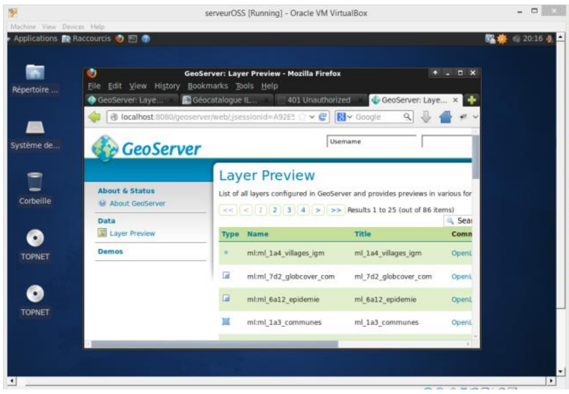
[15] ISO 19115-1:2014 defines the diagram required to describe geographic information and services by means of metadata. It provides information about the identification, the extent, the quality, the spatial and temporal aspects, the content, the spatial reference, the portrayal, distribution, and other properties of digital geographic data and services.

[16]Dublin Core is a generic metadata diagram that allows describing resources (digital or physical). It comprises officially 15 elements of formal description (title, creator, and editor), intellectuals (subject, description, language…) relative to intellectual property rights. Dublin Core is endorsed in the ISO 15836 International Standard.

a test (Figure 5). These local systems were fed with some WMS AND Metadata, and have actually given adequate results.



Xubuntu Linux distribution, Xfce Desktop)



Kubuntu (KDE Plasma Desktop)

Regional primary data, metadata and interactive maps will be fed into the geoportal as soon as the latter is put online. Accordingly, a number of demonstration and training sessions will be delivered prior to this phase (data feeding into the geoportal) to the persons concerned at the level of each project. Hence, a number of training/demonstration workshops will be organized to:

- Carry out a demonstration on the installed System's capacity;
- Discuss individual needs (per project) and the system's requirements;
- Formulate teams for the elaboration of data management plans;
- Distribute duties and define standards, and methods (policies) for data publication and sharing in the geoportal, etc.
- Identify external information systems to which the BRICKS geoportal will be connected (example: FAO, ILWAC, WASCAL systems, etc.).

3.2.2. Resources

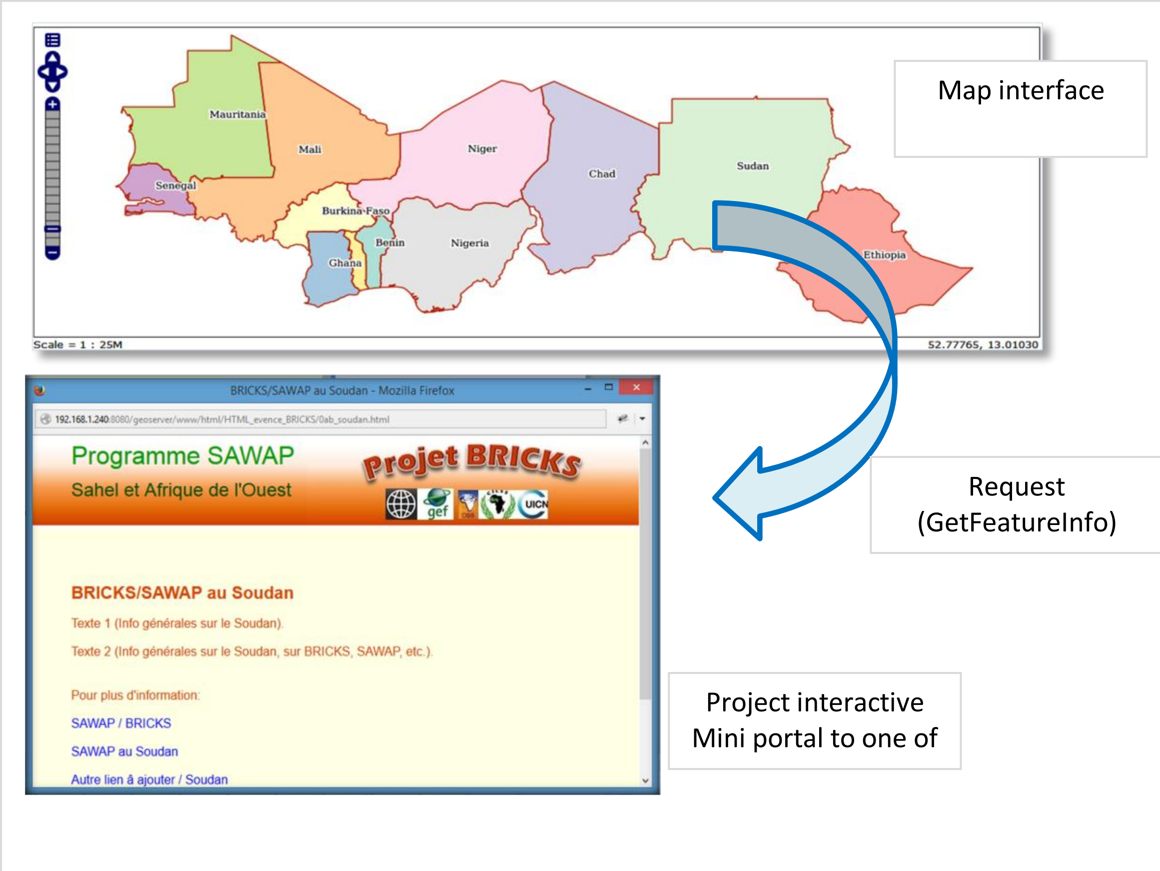
As indicated above, the software used for the building of the BRICKS/OSS geoportal are free of charge. The necessary means for hosting and putting it online exist already. Thus, the geoportal will be accessible to all the countries involved in the BRICKS project. It would be better to organize trainings for and implicate the persons in charge of data managements in the elaboration of metadata (and interactive maps if needed). All this could be done in close collaboration with BRICKS partners, CILSS and UICN, who should also be involved in this task (data management).

4. Geoportal Customization to promote the visibility of BRICKS national projects

4.1. Role of Geoportal in the visibility of BRICKS national projects

One of the main objectives of BRICKS is to promote innovation and knowledge by establishing effective communication and knowledge strategies among the 12 national projects. In this respect, each country/ project is supposed to have a mini interactive portal inside BRICKS geoportal, or at least a web page containing information on each project (general presentation of the project). Information and links to the different other projects as well as their outputs could be regularly published and updated on the projects' web pages and their associated sub-web page.

The structure of these mini portals or web pages has already been implemented in the Geoportal (Figure 5). The next step would be to make them public, accessible and visible via interactive maps relative to each country and project.



4.2. Personalization and selection of the HTML5 version

After the GeoNetwork implementation, a certain number of modifications and personalization measures, related to the operation as well as classical interface, should be made.

Concerning the Geoportal's personalization, we opted for the "HTML5UI" interface. There are four different types of user interfaces we can use to personalize GeoNework (using GeoNetwork 2.10). They are:

- **"Classic" interface**, the default interface of GeoNetwork. It is a simplified but complete interface (with all functionalities including those of other interfaces). Generally used in stable and basic environments, it consumes less JavaScript et Ajax codes ;

- **"Search" Interface**, uses the new widgets[17] library and is more sensitive and interactive than the classic interface to provide highly interactive search capacity ;

[17] Les Widgets are usually pieces of html that will be shown on the user interface. They should be placed on some html structure so they are visually arranged.

- **"TabSearch" Interface**, similar to the *Search* interface with a more focus on tabs use;
- **"HTML5UI" Interface** based also on widgets and uses the most recent web technologies.

All these interfaces are compatible with the Firefox, Chrome, Safari, etc. web navigators. Their adoption is possible thanks to the wide range of widgets proper to GeoNetwork, based on GeoExt[18] et ExtJS[19], which offer a list of independent code pieces enabling their construction in GeoNetwork.

4.3. Advanced Configuration of BRICKS geoportal

In order to render BRICKS geoportal more operational and convivial, a certain number of parameters (related to the presentation of the metadata catalog and request results) should be taken into consideration.

- **GeoNetwork and Google services**: connexion between the metadata catalog and Google map server so that the geoportal will have varied *baselayers* (Google PhysicalMap, Google StreetMap, Google Satellite, etc.). Hence, the geoportal configuration must be carried out in GeoNetwork and OpenLayers so that these services would be taken in charge by Google services;
- **Personalization of the "GetFeatureInfo" request**: connexion between the metadata catalog and the map server. Certain configuration must be carried out in GeoNetwork and OpenLayers in order to personalize the "GetFeatureInfo" requests icon as well as its content;
- Installation and configuration of a « *Backups* » system;
- Etc.

[18] **GeoExt** components and data utility classes extend map related functionality to equivalent classes in Ext. The API reference here documents the properties, methods, and events that are extensions or modifications to the Ext parent classes. GeoExt components and data utility classes extend map related functionality to equivalent classes in Ext. The API reference here documents the properties, methods, and events that are extensions or modifications to the Ext parent classes. http://geoext.org/lib/

[19] **ExtJS** is a pure JavaScript application framework for building interactive web applications using techniques such as Ajax, DHTML and DOM scripting. (***Ajax** ou **asynchronous JavaScript + XML***: is a group of interrelated Web development techniques used on the client-side to create asynchronous Web applications. ***DHTML** ou**Dynamic HTML:*** termegénérique for a collection of technologies used together to create interactive and animated web sites by using a combination of a static markup language (such as HTML), a client-side scripting language (such as JavaScript), a presentation definition language (such as CSS), and the Document Object Model. http://docs.sencha.com/extjs/4.0.7/. ***DOM** ou**Document Object Model***: is a cross-platform and language-independent convention for representing and interacting with objects in HTML, XHTML, and XML documents.

Figure 6. Main elements of BRICKS geoportal : metadata catalog, map server et assembler/WMS visualizer

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