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Georeferenced Libraries: expansion of services in the Cloud for Congress and community

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Abstract:

The Chilean Library of Congress began to work with geographical advisory services and territorial issues around the year 1996, based on the implementation of a Geographic Information System (GIS). Continued advisory services provided for Deputies and Senators generated a great many digital maps and cartographic representations, which could not be organized in the manner of a traditional library which are usually created to catalog texts.

So, after a first effort to distribute georeferenced data and maps throughout the Congress community, a second effort was made to make the large amount of digital maps produced available to that community. Although, the Library then had a wide range of live maps based on GIS server technology, it lacked a way to divulge and share its desktop-ready products, related to geographic analysis and thematic mapping.

In the 2014, the Library published its Mapoteca website (repository of digital maps), with the aim of becoming a new source for navigating the extensive and cumulative work in this area, so as to provide parliamentarians and their staff access, everywhere and at all times, to the previously requested or available thematic maps related to a law bill. This service involves depositing and managing georeferenced data in the cloud, gradually replacing the production of paper maps with customized and web-available digital products.

This paper discusses the demands involved in extending the services of a Georeferenced Library and shows a way to increase the distribution of products through the community, exploring new technologies and keeping in mind a balance between budget constraints and excellence in standards of service. Moreover, it delineates the future of the process, related to increasing the quantity of e-maps produced, standardizing production, and implementing a new workflow for the publication of digital maps based on desktop work, driven by the demands of Congresspersons.

Keywords: Georeferenced Products, Congressional Services, Accountability, Cloud Computing.

Introduction

The Library of Congress of Chile (BCN) was created in 1883 and, since then, has been at the service of Congresspersons, their staff and the general community. As a member of the South American libraries linked to legislative work, the Library's contemporary duties and the emerging needs of the society, together with developments in information technology and networking, have forced the BCN to broaden its channels and formats of communication to share its services and products.

In this context, at the beginning of this century and in view of the constitutionally assigned role of Deputies and Senators to represent territories, the Library undertook initiatives to diversify the designs and structures of its services and provide direct advisory services for Congress and, in subsidiary fashion, for the broader community. In this way, a very important issue to be addressed was related to relevant geographical and territorial affairs. That was the main stimulus for improving and upgrading an already extant specialized area within the Library, the Territorial Information Unit (SIIT), the main duties of which had been the confection of maps and the preparation of extensive statistical databases geared to the work of the Chilean Congress.

To achieve this new self-imposed standard, the Library improved the use of its GIS platform, based on ESRI's ArcView software, the system that underlies SIIT services, by implementing two ways for achieving its goals: the development and use of live maps for the internet community displayed on a website; and the production of cartographic representations and thematic mapping based on desktop work, mainly printed and elaborated on paper, to respond to congresspersons' demands. These efforts generated, on the one hand, a great deal of data available through the internet, but unavailable for customized use, while, on the other hand, many use-ready digital maps, formatted for printing, were stored in the Library, but in no particular order, not cataloged, and not available to the community.

When the present decade began, the Library matured in Informatics development and the implementation of networking infrastructure, generating new duties and gradually replacing many traditional services with internet based solutions. Several digital repositories were created, one of which admitted the customized maps elaborated by the geographers. This instance made it possible to store all the digital maps formatted for printing created by SIIT and included some cataloguing functionalities for browsing and recovering those maps, through an online interface.

At the same time, the concept of Cloud Computing became relevant, allowing services to evolve without new investments or funding for expensive hardware, software, and the physical allocation of server dependencies, or the hiring of highly specialized operators for implementing a web solution. It became simply necessary to deal with a service provider, through access to a full hardware/software solution or the use a few applications developed by the provider.

In 2014, aware of the extensive and significant amount of unpublished cartographic work that it had generated and understanding that its value for Congress and general public was enormous, the BCN decided to implement a solution to provide access to that content permanently, everywhere and at all times. However, at the same time, it was necessary to make progress in publishing and divulging the desktop services of the geographers at the Library. In view of these developments, the use of a GIS cloud solution became highly desirable, in order to extend and connect users and services easily.

The Geographical Information System: some concepts and use in the Library of Congress

Although, there are many definitions of Geographical Information Systems (GIS), there is general agreement about defining GIS as a computer-based technology and methodology for collecting, managing, analyzing, modeling and presenting geographical data for a wide range of applications. Thus, when thinking about a GIS, at least five components should be kept in mind: people, data, hardware, software, and methods. All of those factors are involved in geographical analysis and the creation of solutions or answers for spatial issues.

The reason for building a GIS within the Chilean Congressional Library was directly related to the need to manage and display georeferenced data for the advisory services tasked to the BCN and to display on-screen all the Districts represented by Congresspersons for simple navigation. As time passed, developments in computer and network systems, together with the growing needs of Congresspersons for more detailed and deeper facts and data related to their territories, generated increasing demands for georeferenced products. The first step was to build an alphanumerical database and a repository of digital cartography.

To do this, several resources were needed. Geographers and computer professionals were hired to deal with the development and implementation of the system. In the meantime, the Library built a network of partners with government agencies, signing agreements to interchange and receive different types of georeferenced products, all of which allowed the installation of a GIS in 1997, initially supported by the joint action of the actors indicated above.

In the year 2003, using new map server technology, and after a massive collection of geographical and statistical data, the Library of Congress made its geographical information system available online, designed to complement desktop work, and thus, through live services, to allow users to recover data and statistics by themselves, without having to resort to the SIIT unit in person. In this way, economies of funds and time were achieved, by diverting a large part of the requests to these new self-service systems, and significantly reducing the costs of dealing with all queries on paper.

However, given new information technologies and the need to increase coverage for service users, in 2007, an advanced version of the SIIT online GIS was released, which updated site technology, expanded relationships with users, and by extension enhanced SIIT capabilities with emerging territorial services (e.g. Google maps).

The desktop work of geographers was stored in one of the new institutional digital repositories, which allowed more efficient recovery of output. By definition, SIIT products were to be available to everyone, and should be as public as possible, enabling citizen access, with Internet indexing. In this way and for the first time, the gap between the availability of information through web services and desktop products was beginning to close, although this did not mean that the process was over. Conversely, it meant that an extra effort was necessary to achieve greater integration between the two spheres.

Connecting users: from local desktop work, to open and shared content

After an initial period of managing the new application, the BCN unit for territorial affairs and statistics (SIIT) began to exploit its geodatabase, as well as broaden Congressperson advisory services, with more detailed and in-depth products. Faced with budgetary and staffing constraints, SIIT sought to take advantage of new techniques and web spaces to expand both coverage and the range of services offered.

Due to the significant expansion of the Library of Congress that took place at the beginning of this decade, SIIT broaden its digital resources in order to carry out the goal to expand its services. Focused on the belief that there was still much accumulated work to be published, beyond the mere display of geographic data or statistical applications for data mining, the Library of Congress released the source files for making basemaps, in collaboration with the National Cartographic Agency (Instituto Geográfico Militar, I.G.M.). In this way, people could access vector files to create a map composition in desktop software by themselves, a minimum requirement at a time when national initiatives of this type were virtually nil. That initiative was greatly appreciated, although it did not quite achieve the sharing of unit content. At any rate, users could take advantage of improved vector files for the entire country.

As has been explained above, one of the major problems to be solved by this method was the lack of synchrony between two bodies of work: on one hand, office production, and, on the other, network services. SIIT began to solve this conundrum by using the data available in BCN institutional digital repositories, modifying current desktop workflows, and implementing a new extended work scheme. The situation is described in the following diagram:

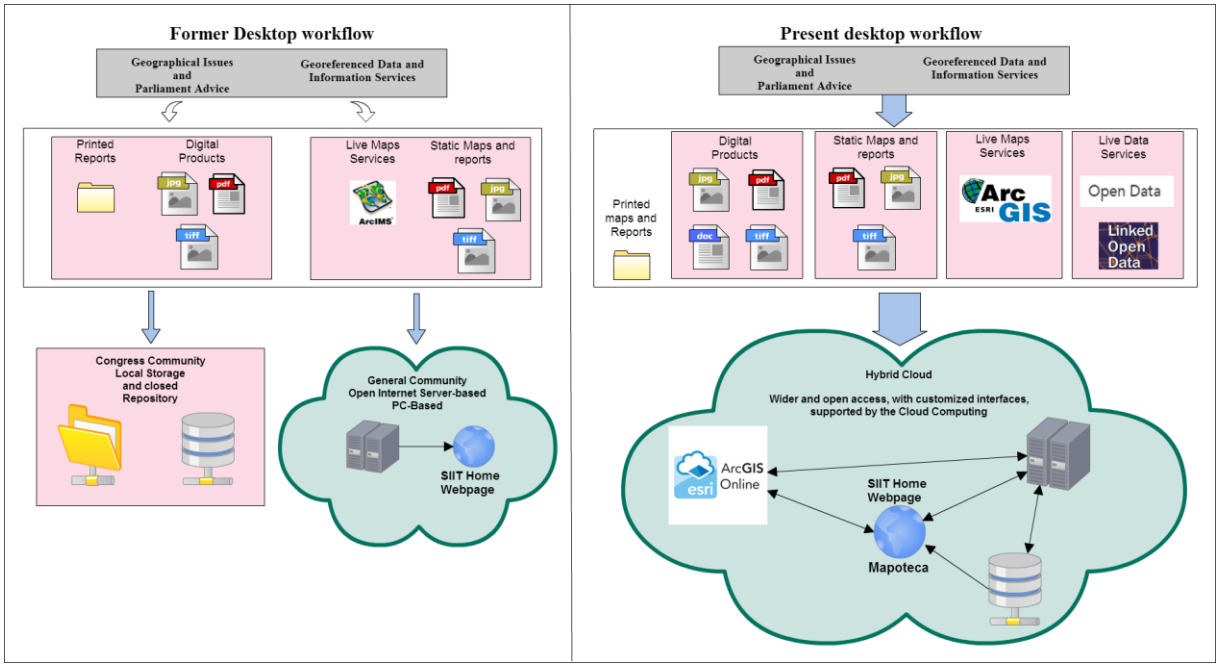

Figure 01: Former and present Desktop workflow at Geographical and Statistical Issues Unit.

The solutions for data delivery are based on a hybrid model of service management, which has begun to be more flexible and more responsive to end users. On the one hand, institutional capacity is used to deliver data and information, and on the other hand, information is published on a cloud service, ensuring visibility, accessibility, connectivity, and requirements fulfillment.

However, this situation did not yet allow access to the products already generated within the territorial affairs unit (SIIT). Thus, the Library began to develop a new strategy to allow Congresspersons and the public in general to use this information: implement a collection of digital maps served on a website, called Mapoteca, and at the same time, replicate these products using the spaces emerging from developments in Cloud Computing.

The Mapoteca Solution: a first step toward the distribution of open, shared content

In 2014, the Library of Congress released its Mapoteca website, a space designed to continue the expansion of mapping services, as well as promoting closer links with citizens by generating access to products accumulated over time. The central idea of the project was to channel and disseminate much of the thematic cartography associated with parliamentary advisory services, making it public and improving accountability.

As a pilot action, it was agreed to begin to broaden the availability of maps according to the basic and fundamental need of Congresspersons: their role of representing districts. To achieve this objective, this website section was loaded with nearly the whole basemap sets of regional, provincial, communal and electoral territorial levels, leaving as well a space for general user requests for the composition of a map as yet unavailable, if they considered it necessary.

Figure 02: a view of the Mapoteca website: a place to share desktop work with the community.

Initially, all basemap cartography was uploaded, for every level of the political divisions of Chile, covering a need for knowledge and cartographic representation of the different places that constitute the nation. Additionally, there is a mailbox for users that would like request a local basemap, or one for another political administrative unit not yet covered. In this way, the Mapoteca website became a new space for sharing the desktop production of territorial units with the community, where users can have access to a growing set of diversified content.

Figure 03: a view of the Mapoteca thematic maps section, covering in this case Demographics and Census, and Education.

In a second phase, SIIT began to share thematic cartography, generated as the result of congressional advisory services, mainly related to social and economic affairs. The aim was to take advantage of the large amount of thematic representations generated to date, so as to share them with the community, in a way that would allow users to utilize them for their own studies, or be of use in the assessment of an issue they were dealing with.

Cloud Computing and expansion throughout the web: principles and practical application in the BCN

Although the concept is widely known, for practical purposes, it is necessary to contextualize some insights about cloud computing so as to allow a fuller understanding of its use by SIIT.

Using the broadest definition of the National Institute of Standards and Technology (NIST, from USA), Cloud Computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. Due to budget restrictions, the model adopted by the BCN is a hybrid cloud with a development of "Software as a Service (SaaS)", a concept that implies the provision of end-user applications, which are delivered as a service rather than as "proprietary" or "installed on-premises" software. In this case, there is a mix between the "Esri cloud solution" (arcgis.com), and the institutional resources of the Library of Congress. This solution allows a balance between needs and financial sustainability.

The growth of GIS web mapping has been an on-going process at the Library, involving the development of new services, while maintaining the concurrent tasks of generating both paper (digital) and live mapping. At the end of the first decade of the XXI century, GIS and map server technologies have evolved, moving from proprietary/server solutions to a distributed and mainly Cloud Computing-based solution, A typical example of the integration of new technologies is the offer of full capabilities solution (including Hardware/Software/Development) in Amazon Cloud (EC2). At the same time, but on a parallel path, ESRI offered a new release of its web portal, called Arcgis.com. Using a SAAS model and creating an account, users can access an "in the cloud" solution for live map publishing and sharing. And that is precisely what has inspired the idea for innovations at SIIT.

In this way, the infrastructure of the BCN internal cloud began to be used to display information and convert the Library into a public entity for access to digital data, enhancing the relationship between Congress and Community. Despite a tight budget, it was possible to mix BCN computing resources to generate content, for example, the implementation of the institutional mapserver mashed up with internal databases, with access to digital objects from institutional repositories, and distribution the main BCN web page.

After consideration of several options, it was concluded that the Arcgis Cloud is best adapted to current SIIT demands, because it allows scalability and flexibility to respond to emerging information needs, enabling the development and distribution of information services based on cartographic or geographical presentations, without worry about the difficulties involved in programming applications, using internet, or dimensioning use by diverse target audiences. This frees up energy to work on demand services, for instance by easily adapting the geographical framework for a law bill so that it can be viewed and understood territorially.

This approach gives greater freedom to generate and release information objects, eliminating barriers to connectivity and location, because, by using the SAAS scheme, the provider of services ensures a distributed and multi-platform access. This solution allows for increased savings of financial resources and frees up man hours and IT support maintenance costs for these platforms. Day-to-day SIIT tasks are also simplified, because use of the Cloud eliminates the long and difficult analysis processes formerly performed on the desk top, but which are now done on the premises of the services provider.

The use of geographic cloud computing begins with the creation of a space within the arcgis.com platform (in this case, http://bcnchile.maps.arcgis.com). Through its superior privileges, the administrator of the system can incorporate diverse types of users with a variety of privileges, from read-only use of publications, to permission to publish products.

For practical application in the Library of Congress, and with some basic restrictions, the use of arcgis.com focuses on providing access to data and software, in different conditions, outsourcing the maintenance functions of computer support, and delivering flexibility and scalability, including access on mobile devices, either by installing the ArcGIS application or via a browser. This capability saves a great deal of the time formerly spent developing maps and information services for the Congressional community.

At present, desktop work has begun to be located and replicated in an institutional arcgis.com account, in order to meet growing demands for speed, access and support through a technological platform characterized by ease of development, overcoming the need to develop institutional applications or to train users in the use of the tool. In this way, users can begin to manage geographic data and services, without needing extensive technical knowledge about how this platform works. Now, SIIT has begun to create map services that allow users to fulfill their basic needs for information, such that they can use the platform to develop, mash up, or mix content or services, with products owned by the users themselves, and by extension, to accommodate digital objects to their individual needs. The main criterion has been to privilege new issue and emerging topics, such as the Calbuco Volcano eruption.

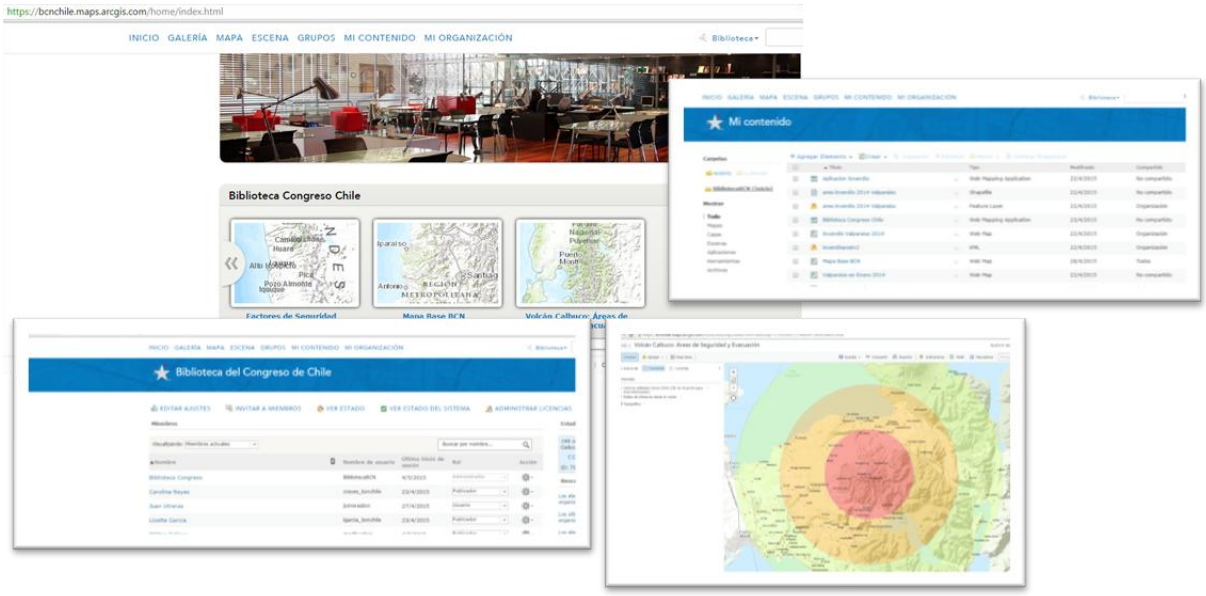

Figure 04: a view of the Arcgis.com cloud and some practical uses by BCN..

Another significant feature in the use of the geographic cloud computing relates to the possibility of extending the use of map services to communities with less developed digital skills. This concern allows for the easy integration and interoperability of proprietary platforms, through the use of REST services, or the recycling and reuse of services within the arcgis.com platform. It is also possible for users to sign in on this website to gain access to their own account and, therefore, take greater advantage of this technology.

Discussion and future tendencies for SIIT and its Desktop Work

The new relationship between Congress and the community presents new challenges regarding future developments, particularly with regard to technological contexts and how to interact with users. Given the main tendencies of growth in Cloud Computing, future work should evolve toward the gradual replacement of map production and desk work by practices that allow the production of a growing number of digital objects and services. From that perspective, SIIT has begun to outline a workflow that includes mapping and digital services, with subsequent storage in internal repositories for publication in the BCN Mapoteca and the release of most products through an online platform (arcgis.com). This implies that information and products will be ever more available to the online community, while work continues on increasing interoperability based on open standards.

These expansions of services to the community and the systematic replacement of the production of maps and information products on paper are being developed in conformity to emerging international standards, which allow better understanding between different platforms. Mainly for the sake of transparency, desk work on territorial information should be kept open to the Congressional community and the general public, optimally framed in terms of international conventions and regulations for the organization of data and metadata.

For this it is necessary to fully adopt the standards of institutions offering hierarchies and taxonomies to organize georeferenced data, such as the recommendations of the ISO 19.115 standard for metadata. This is very useful when promoting the interoperability of systems and, hence, increased use mainly based on the development of tools for Open Data and Linked Open Data connections.

Additionally, it is necessary to expand the scope of the territorial issues to be covered to include a database capable of switching between national / local and other regional / global models, so as to cover the need for statistical information and georeferenced data holistically, by collecting information from different official sources at different scales and integrating it easily and massively into the tools used by community of Congress and externally for other users.

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