The Network Dynamics of the Brazilian Public Software

Ângela M. ALVES
Centro de Tecnologia da Informação Renato Archer, CTI
Campinas, SP, 13.069-901, Brazil

Marcius F. H. CARVALHO
Centro de Tecnologia da Informação Renato Archer, CTI
Campinas, SP, 13.069-901, Brazil

Jarbas L. CARDOSO Jr.
Centro de Tecnologia da Informação Renato Archer, CTI
Campinas, SP, 13.069-901, Brazil

ABSTRACT

This paper introduces a project for the development of a reference model for the Brazilian Public Software (BPS) [1]. The project will be developed cooperatively, so as to assure that the successful experiences of the partners involved are taken as a basis for the model. The environment for the development and application of the reference model will be the Brazilian Public Software Portal (BPSP), in order to guarantee immediate engagement of each subproject result. The great challenger of the project is in its definition, upheld by the law, of the BPS concept, around which are been created networks, sub-networks, network nodes, relations and formalizations to raise the project of such a nature as well as to guarantee its sustainability. The BPS concept has been started in Brazil in the 90's. The first experience upheld conceptual hues shared only in the public sector to complete liberation of the public software to the society. The trend for complete liberation of the public software for the society is recent. Its format stems from experiences made by the Federal Government, state governments and municipalities. As a service model is consolidated, for public administration based on the ICT, the administration is charged with a series of responsibilities and obligations. That brings up the need to convey solid steps to bring the public software into a formatted concept assure its development and build up a model of functioning.

Keywords: Public Software. Commons. Software license. Ecosystem. Software communities. Social network.

1. INTRODUCTION

The concept of software in Brazil has its first public records of discussion in the 90's [1]. The first experiments supported conceptual nuances that had different scales, ranging from the software to be shared only in the public sector to the total release to society.

In 1995 the state computing companies, captained by the Brazilian Association of State Entities of Information and Communication Technology - ABEP, began a process of discussion on what later became the concept of Brazilian Public Software, BPS [2]. At that time the intention was to accelerate cooperation in the government, in order to reduce developmental efforts, assign costs and rationalize resources.

The trend for the total release of solutions to society is recent. Their format comes from the experience of the federal government ([1], [9], [10], [11], [12], [13], [14]) and of a municipality of Itajaí [3]. As a model of public administration services based on the use of Information and Communication Technologies (ICT) is built, the need to discuss quality standards, interoperability, reliability, maturity of process, among others. Such standards should be applied both to the consumer and to the developer of applications for support services needed by the government, such as e-government services. It makes it necessary to build stronger steps toward the concept of formatting public software, ensuring their development and to build a model of operation. Also the question is raised as to whether or not to generalize the discussion to other sectors than the public.

This work is an evolution of other recently published by the same authors due to the dynamics of a topic of discussion subject to constant and rapid change (see, e.g., [4], [5], [6], [7]).

Session 2 of this article deals with the definition of the SPB. Session 3 describes aspects of its construction. Session 4 defines its ecosystem. Session 5, in its turn, presents a model for the management of the ecosystem. Session 6 is devoted to conclusions and suggestions for future work.

The ecosystem is defined as the set of relationships that hold between specific elements and leads to their interdependence. The elements of BPS are classified as: entities, artifacts and communities which may be exposed to various degrees of disintegration. These breakdowns can be follow formal or informal hierarchies.

2. BRAZILIAN PUBLIC SOFTWARE

The increasingly strategic nature of the software to governments and society, the similarity of the demands of public entities, the restriction of human and material resources for their care and the diversity of solutions developed by different powers and spheres, justify government initiatives for cooperation to share and publicize the software. The real scenario, however, is another. Practices of sharing software performed by public entities and from the society are still sporadic in Brazil, as far as can be seen in the world. To make them practices, cultural, technological and even legal aspects must be discussed. The following aspects can be cited in a non-exhaustive way:

(i) The fear of the institution as a developer: overloaded by demand for support services and customization by the other users of the solution, without compensation; possible restrictions arising from the legal sale and use of goods produced within the public sector; risks to the security of governmental information handled by the government solution, arising from the publication of its source code; risk of appropriation of the code by private institutions, with the consequent "closure" of access to improved production; and the maintenance of quality of solution to meet the growing demands.

(ii) The fear of potential users in relation to changes in rules for access to software, as the discontinuity of the solution, procedures for incorporation of improvements, etc.

(iii) The lack of universal standards for producing and documenting programs.

(iv) The lack of similar good practices.

(v) The complex relationship between the public sector, private, third sector and an individual contributor, where all actors have their roles included for the full operation of a Community.

The consolidation of key licensing terms associated with the software (including the publication of the CC/GPL in Portuguese [8], recognized by the Brazilian government) provides, in theory, a conducive environment to overcome many of the obstacles, especially those referring to "fears of institutions might have of potential developers and users." As a consequence, many of the guarantees required would be possible through the adoption of GPL licensing in the software mode to be publicized. Questions such as not closing the codes derived from the originally free version in the future; the impossibility to change the mode of licensing of a given version; and the public right to the improvements in software are directly addressed by this type of licensing.

In this context the concept of Brazilian Public Software has been associated to strategies for large advertisement of the software developed by the government and providing treatment to all the restrictions previously mentioned [9]. Still, a successful experience that could be felt by a significant portion of the society and that could materialize the new form of licensing and management model was missing.

The public software in Brazil is being sponsored by the federal government with the aim of offering free electronic tools for both the government and private services, needed by a large number of people.

3. THE CONSTRUCTION OF THE BRAZILIAN PUBLIC SOFTWARE

The software technology as a tool for building relations of production/consumption, experience and power is a fundamental ingredient of human action that produces and modifies the social structure and motivates the emergence of a new culture. In particular, the BPS Portal is starting its journey, still in an empirical way, as a component that "facilitates the establishment of new administrative tools in different governmental sectors, promotes the integration between the federative units and offers a range of public services for society based on software as a public good" [10].

The BPS concept has been used as one of the foundations on determination of the policy of use and development of software by the public sector in Brazil. This policy encompasses the relationship among public institutions, including all units of the federation (federal agencies, states and municipalities) and spheres of power (executive, legislative and judiciary), and those with private sector and society. The BPS follows the principles and patterns that have been used for free software development where participants cooperate intensively without apparent restrictions. The experience of the inventory system CACIC, available from DATAPREV under the General Public License, GPL, demonstrates how the vision of sharing was extended to all society ([2], [10], [11]).

The BPS model gives to the artifacts (software, modeling, methodologies, certifications, plans, qualifications, reference documents etc.) that have been developed, financed and managed by the government, the principle inherent to any public good that can be shared between government agencies and the society. In addition, these artifacts can be subject to public policy implementation. Similar to free software development pattern, the BPS proposes a model of shared development of software, including a set of additional services offered by entities that provide the solutions or by those interested in taking on the public commitment of project leadership. Also, BPS must include in its list of services: user manual, installation manual, discussion lists, forums, management model and support level.

At present, the BPS Portal is almost two years old and has about forty thousand members in communities. These facts can be understood as the first signs of maturity and sustainability. It is still premature to say that a definitive and structured model has been established. Natural condition for a concept that is under construction and is frequently reviewed by the society. Evolutionary changes have occurred according to the learning process of governmental entities, and the relationship of these with other sectors of the society.

The objective of this article is to describe a preliminary model to deal with the software as a public good for the country and consequently to establish a framework for the BPS. CACIC [11]; E-PROINFO [12], SISAU [13], and InVesalius [14] are examples of software as public good.

Undoubtedly, the success of the model will have an impact on the current social structure and may lead it to a new culture based on the collaboration and the sharing of knowledge will contribute to enhance the process of dissemination and

sustainability of the initiatives related to software as a public good.

4. THE CURRENT STATUS OF THE BRAZILIAN PUBLIC SOFTWARE

The first community of this ecosystem was the CATIR (Virtual Public Sector Portal), focused on Knowledge Management. In a sequence, the methodology established by the SPB was transferred to CATIR, as a desirable feedback for all communities in the system. The SPB had its genesis to the public in February 2007 and with five attractors or software solution. Currently, the SPB has twenty one solutions or attractors and about forty thousand members [1]. The largest community in number of users is CACIC (Controller Automatic Collection of Information and Computing) [1]. Another evolution of the SPB is 4CMBR an action has been agreed in the AFC (Federal Committee on Coordination) which generated the commitment to a national agenda to support municipalities' needs and has a direct action with the municipalities with low HDI (Human Development Index). SPB also derived from Virtual Public Market, which is under the responsibility of UNDP (United Nations Development Programme) [15], which has as its mission the creation of business solutions for the artifacts made available with the SPB.

The SPB is being consolidated as an innovative space for a new role and performance of the state, a new arrangement of Science, Technology and Innovation (ST&I) and as a development model of Free Software for developing countries.

5. BRAZILIAN PUBLIC SOFTWARE ECOSYSTEM

The ecosystem is defined as the set of relationships that specific elements have amongst them, which leads to their interdependence. The elements of BPS are classified as: entities, artifacts and communities which may be exposed to various degrees of disintegration. In these breakdowns formal or informal hierarchies can be set.

The entities are actors that act to modify the system by transferring different nature of resources, tangible and intangible, internal and external to feed the ecosystem so as to increase its importance and entropy over time. Their relationships are with the communities mainly, where they act as either users or owners of artifacts.

The artifacts are software, information, regulations, coordination mechanisms, prevention mechanisms, mechanisms for adoption of efficient behavior [16], indeed passive elements that regulate or suffer actions of entities and community elements. Each software can encourage, or not the existence of a community that generate the information, the rules of belonging to the community and mechanisms for use of the community content.

The communities are composed of actors which are related to artifacts motivated by the access to technical benefits. But, other benefits may occur as, for example, social benefits that take the spillover of the technology or investments in tools that complement the features of available artifacts or even the creation of new artifacts.

Two types of communities can be characterized: those of users and developers of software artifacts, and communities interested in contributing to the information, regulations and mechanisms. An actor may belong to more than one community. It can also contribute to the establishment of regulations and mechanisms for use of the content community. But all these actions must occur on a voluntary basis, and therefore, the existence of actions, managed by the entities, to encourage participation of the communities are of vital importance.

The relationship between entities and community is sponsored to offer incentives (financial, motivational, institutional, legal and political). Another important task assumed by the entity is to control the elements of the communities in the use of artifacts.

A set composed of elements with similar characteristics that allow them to be grouped together will be called cluster and can be found in any of the three elements of an ecosystem. In particular, there may be links between elements of a cluster with elements of another cluster. Also there may be links between elements of the same cluster. It is expected that the most intense relationship occurs within a sub-cluster, then within a cluster and finally between clusters formed by different elements.

Figure 1 shows the BPS ecosystem subdivided into clusters of artifacts, clusters of entities and clusters of communities. Each cluster is represented by a node and its relationships with other clusters by an arch. The set of nodes and arcs form the network. To illustrate the relationship, the cluster of artifacts is subdivided into three sub-clusters and cluster of entities in two sub-clusters according to features and similarities ([5], [6]). The network of public software can enable the configuration of multiple clusters and stimulate relations between them. The relationship between the elements of a cluster can also be object of study, either between clusters of actors, or between clusters of artifacts, either between clusters of actors and artifacts. Defining and developing this relationship are the actions that lead to the success of the proposed Brazilian Public Software.

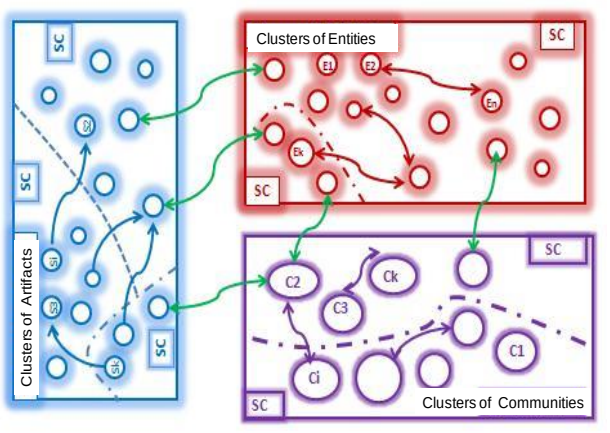

Figure 1 – Model of the Brazilian Public Software Network ([5], [6]).

6. ECOSYSTEM MANAGEMENT

The relationship between the active participants (entities and communities) in the public software should be managed to encourage, guide and regulate the actions of communities' elements. At the same time should have self management, understood here as exercised by members of a given community and initiatives of organizations to regulate the actions of users in artifacts to ensure that they work so as to improve them. Actions of incentives may occur by offering resources for actions of dissemination and sustainability as well as of regulation. For example, an important resource for the existence of the BPS could be to provide a platform where the artifacts are placed.

The objective of the mechanism of regulation is to provide a framework to regulate the use of the object (artifact). In a first layer this mechanism requires the registration of the user.

In a second layer, it allows the user to use the community resources, in a third time, allows the user actions that may modify the artifacts available in that community (software, information, control mechanisms etc.). The regulatory mechanisms should be prioritized, developed and exercised mostly by the community. Also, the entities should act in guiding the mechanisms and supplying resources so that these mechanisms may be exercised at the same time judging conflicts due to different positions with regard to a particular concept or behavior.

Another vision, encouraged by the entities, are the actions to integrate the passive element public software with others passive elements that define standards, framework of software with respect to, for example, quality, interoperability and security, to map the current state of software with a pattern established by the communities who study these patterns. It is important to emphasize that the initiative of integration must start from the community of software and should be addressed to each of the communities of methods. An example of evaluation is shown in Table 1. Notes that the software "2" was not evaluated regarding security because the community has not requested evaluation. The same occurs with the interoperability of the software "5". The request may not occur because it is not necessary, under the view that software community or because it might not be under the terms of the community.

Charac-teristic	Description	Soft _01	Soft _02	Soft _N
Quality	What is the quality of the project, the code, and the tests? What is the level of completeness? Is it error free?	3	1	5
Security	What is the level of software reliability?	2	---	5
Commu-nity	What is the level of interaction of the software community?	---	---	---
…				
Inter-operability	Data compatibility.	5	4	---

Table 1 – Example of a possible evaluation of the public software.

Table 1 gives a roadmap, for example, evaluation of software consists of two steps. The first would set those elements addressed by the participants of the community which express their opinion on a voluntary basis on the artifact. The second is technique, developed with the participation of the sub-communities of models, only when an artifact of software community requests. This last evaluation is an external vision of the software artifact.

7. CONCLUSIONS

As mentioned in previous sessions, the public software network tries to deal with two aspects: the social and the technical. The social aspects are concerned with opening up opportunities for network members. The technical aspects are concerned with providing solutions and expertise through the artifacts. All this is to be supported by tools for cooperative work. Further, the network environment provides agile mechanisms for rapid dissemination of content and knowledge.

So, some questions arise: How could we increase the effectiveness of different forms of collaboration, knowledge sharing and work through the Internet in a way that results converge to provide social wealth? How could we work together with the public sector to redesign the practice of government to explore the full potential of the Web? How could the public sector be enabled to get new skills of collaboration and practices of horizontal management, skills very much different from those traditional (highly vertical)? How can we join public servants, ICT professionals and researchers from different organizations in the assembly of collaborative and customized teams according to the demands of government?

As a consequence of the enormous potential for outputs, it is a fact that governments, at its different levels and powers, should work together and explore intensively the Internet. So, two more questions emerge: How can the government use the Web and at the same time preserve basic social values such as reliability, privacy, security, respect, rights of citizens? How should it use these facilities aiming at social inclusion?

Moreover, Berners-Lee et al, in their article [17], say that the new science Web should be inherently multidisciplinary. The authors highlight the role that computer science and information has nowadays in the representation and analysis of information and warn us about the need for greater attention to social and legal relationships behind this information. The transparency and control over these complex social and legal relationships are vital, but require a well defined set of templates and tools to be represented. More than just modeling the current Web, rather than designing new protocols for infrastructure, it is necessary to understand how the society into network uses these protocols. How can we avoid technical and social heehaw in the networks? How can we open the reuse of information (and artifacts) in an unexpected (or spontaneous) way? How can we ensure real benefits to society? Even more challenges may appear: how can we consult efficiently the network and its unlimited interconnected clusters? How can we align and map the different types of relationships? How can we view, model and navigate the huge and complex graph of resulting clusters? How can we control access to clusters combining intellectual protection, preserving intellectual property rights with the spirit of freedom, openness and sharing for the use of different

mechanisms for collaboration in the network? Friedman [18], in turn, emphasizes the social aspects of collaboration, with the question: "What can people be motivated to work together and at the same time be productive?"

Finally, the proposal of this work itself is challenging and represents a preliminary response to public software development. Therefore, it needs to be discussed in various forums because of its unique characteristic: the formation of unconventional structures linking social, artifacts and institutional network. Then, It opens various dimensions for new studies that promote the reception of a Brazilian original and novel technology that seek to integrate demands for artifacts dependent on the relationships to be configured dynamically, aiming the social interest of knowledge workers which, if consistently articulated, can sustain a different and competitive performance capable of building barriers to entry of competitors eager for disarticulated markets.

8. REFERENCES

[1] BPSP, 2007. Brazilian Public Software Portal. http://www.softwarepublico.gov.br/spb/ (in Portuguese).

[2] ABEP, 2007. Brazilian Association of Information and Communication Technology States Entities. http://www.abep.sp.gov.br (in Portuguese).

[3] Municipality of Itajaí. The i-SPB Public Software. A suite of free software oriented to public administration. Developed by CTIMA, Center of Information Technology and Administrative Modernization. http://i-spb.itajai.sc.gov.br/ or http://www.itajai.sc.gov.br (both in Portuguese).

[4] Cardoso, Jarbas L.; Carvalho, Marcius F. H.; Silva, Ralph S.; 2007. *O Conceito de Software Público Analisado sob a Perspectiva de Rede*. In Bueno, Tânia C. A. et al (orgs.); Anais da IV Conferência Sul-Americana em Ciência e Tecnologia Aplicada a Governo Eletrônico, IV CONEGOV, pp. 133-143, 20-22 de novembro, Palmas, Tocantins. Florinópolis (SC): Editora Digital Ijuris, ISBN 9788589587228.

[5] Cardoso, Jarbas L.; Carvalho, Marcius F. H.; Silva, Ralph S.; 2008. *Network Perspective for the Brazilian Public Software*. In The First International Conference on Open Source Software Quality, Rome, January 16-17th. In http://www.qualipso.org/sites/default/files/media/conference/QUALIPSO_Conf_Roma_OSSInWorld_Lopes.pdf and in http://www.qualipso.org/sites/default/files/media/conference/qualipso_conference_2008_-_final_report.pdf.

[6] Alves, Angela M.; Carvalho, Marcius F. H.; Cardoso Jr., Jarbas L.; 2008. *A Dinâmica da Rede do Software Público Brasileiro*. Anais da Conferência Ibero-Americana IADIS WWW/Internet 2008, Lisboa, Portugal, 10 - 12 Dezembro.

[7] Alves, Angela M.; 2008. *Reflexões Sobre o Software Público Brasileiro*. Anais da Conferência Ibero-Americana IADIS WWW/Internet 2008, Lisboa, Portugal, 10 - 12 Dezembro.

[8] In 2004 was published a Portuguese version of the GPL for free software license according to principles established by institutions: Creative Commons (http://www.creativecommons.org.br/) and Free Software Foundation (http://www.fsf.org/).

[9] PROCERGS, 2001. *Building a Technological Platform – The Brazilian Public Software*. In Portuguese. Mimeo.

[10] SPB, 2007. *The Brazilian Public Software: The CACIC Initiative*. In http://www.softwarepublico.gov.br/O_que_e_o_SPB (in Portuguese).

[11] Peterle, Anderson; Castro, Carlos A. J.; Meffe, Corinto; Bretas, Nazaré L.; Santos, Rogério S.; 2005. *Materialização do Conceito de Software Livre: Iniciativa CACIC*. **IP-Informática Pública**, v. 7, n. 2, setembro, pp. 19-28. Publicação da Empresa de Informática e Informação do Município de Belo Horizonte, PRODABEL. (In http://www.softwarepublico.gov.br/dotlrn/clubs/cacic.

[12] E-PROINFO, Sistema de Ensino à Distância. Desenvolvido originalmente pelo MEC, Ministério da Educação (Secretaria de Educação a Distância, SEED) – http://www.softwarepublico.gov.br/dotlrn/clubs/eproinfo.

[13] SISAU, Sistema de Atendimento ao Usuário, desenvolvido originalmente pelo Ministério do Desenvolvimento Agrário, MDA. http://www.softwarepublico.gov.br/dotlrn/clubs/sisau.

[14] INVERSALIUS; 2008. Prototipágem Rápida em Medicina. Ferramenta desenvolvida e utilizada na etapa de aquisição e tratamento de imagens médicas. Disponível em http://www.cenpra.gov.br/promed/ e também em http://www.softwarepublico.gov.br.

[15] http://www.undp.org/

[16] Brito, J.; 2002. *Cooperação Interindustrial e Redes de Empresas*. In Kupfer, D; Hansenclever, L., Economia Industrial, UFRJ, Rio de Janeiro.

[17] Berners-Lee, Tim; Hall, Wendy; Hendler, James; Shadbolt, Nigel; Weitzner, Daniel J.; 2007. *Creating a Science of the Web*. **Science**, v. 313, August, pp. 769-771.

[18] Friedman, Thomas; 2006. *The World is Flat A Brief History of the Twenty-First Century*. Farrar, Straus & Giroux, USA.

ACKNOWLEDGEMENTS

The authors acknowledge the researchers and colleagues Corinto Meffe of the Secretariat of Logistics and Information Technology (SLTI) of the Ministry of Planning, Budget and Management (MPOG), Romildo Monte, Clenio Figueiredo Salviano, Ralph Santos da Silva and Giancarlo Nuti Stefanutti, Paula Felicio Drummond de Castro of CTI , mainly for the valuable discussions regarding the concept of public software.

This work was partly supported by FINEP grants in the context of Brazilian Public Software Framework Project.