An Enterprise Viewpoint Proposal for SDI Architectural Specifications

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In contrast with traditional enterprise GIS systems, SDI promote data sharing and reuse, interoperability based in common standards and wide availability of geodata and geoprocessing services. To make SDI to work is not enough to deal with technological issues but involves also organizational, legal, human and financial resources, polices and agreements such as other kind of infrastructures. In direct relation with the growing interest with SDI, an increasing number of research papers are arising in recent years. These papers deal with a variety of issues ranging from specific technological SDI components to broader views like SDI assessment or SDI architectures (mainly from the computational viewpoint). All that interest makes to arise problem of common understanding of the concepts and components involved, the role they play and the relations they have in an specific SDI. This is more apparent for example in many SDI assessment works where the specification of the SDI to be assessed is very fuzzy and, although it is difficult to clearly specify the concrete problem domain components, better and more adequate views are missing and some progress in clarify and limit the elements involved will be very welcome. An additional problem is that SDI topics actually are becoming quite the thing in the geospatial community which has provoked an explosion of the use without a clear notion of the meaning. This fact causes to use SDI related topics or to provide a SDI sense in situations where it is not specially adequate and indeed leads to confusion or meaning loose.

A typical engineering way to deal with these problems is to use some kind of modeling technique to establish an architectural view of the SDI. Creating a model of an SDI usually requires a set of well-known components, and a way to express these components and how they are related, behave and interact. Models can usually be expressed in diagrams to easy analysis, design and development phases and, in some cases, can even generate formalized views if needed. For the model to get bigger acceptance and consensus it better be based on recognized standards.

A shared terminology and guideline to create the diagrams of an SDI may also facilitate discussions and the exchange of knowledge during the creation and evolution of the infrastructure, this is specially facilitated if the modeling approach is based on standards. The establishment of more precise and homogeneous SDI models and derived components also facilitate the assessment and comparison between different SDI. Additionally, more formal techniques could be used to study some properties of SDIs, and to test how different approaches would affect those properties.

To deal with the inherent complexity of large distributed systems, work on specification models for information technology and information system governance divide the design activity into several areas of concerns, each one focusing on a specific aspect of the system. A viewpoint is an abstraction that yields a specification of the whole system restricted to a particular set of concerns \cite{IEEE00}. Of particular interest is the standard Reference Model of Open Distributed Processing, RM-ODP, aslo named ITU-T Rec. X.901-X.904 and ISO/IEC 10746, of the International Organization for Standardization. Although RM-ODP provides five generic and complementary viewpoints (enterprise, information, computational, engineering and technology), this work will be focused on the enterprise architecture viewpoint which is concerned with the purpose and behaviors of the system as it relates to the business objective and the business processes of the organization. The enterprise viewpoint is not designed to include data, data models, the functional decomposition of the system, or the infrastructure and technology required to support distribution. These concerns would be included in other viewpoints.

In this work, an approach to model some of the technical and non-technical components of an SDI using a software architecture pattern is proposed. This pattern allows to model SDIs as federations of autonomous organizations, where technical and non-technical components interact, under the guidelines and constraints of several policies, to achieve certain objectives. The RM-ODP enterprise language provides a set of well-defined concepts used to create the enterprise viewpoint on a system. This viewpoint addresses its purpose, expected behaviour and policies. There is also a standardized way to express these concepts as diagrams in the Unified Modeling Language (UML), and the possibility to formalize them if needed. Because of the use of RM-ODP and UML, the proposal is a graphical and formalizable approach to the modelling of SDIs. It also intends to provide a shared vocabulary for SDI concepts which have appeared in previous research with different names, or that were implied but not explicitly identified.

As an example of components the proposed pattern, table 1 describes the proposed actor role types whereas the figure 1 illustrates its corresponding icons in UML.

Table 1. Actor role types in the enterprise viewpoint of an SDI

Actor role	Description	Rationale
User	They are the main beneficiaries of the SDI.	This role is needed to de_ne many interactions and processes in an SDI, specially those related with the sub-objectives `spatial asset availability' and `infrastructure creation'.
Contributor	They contribute and/or withdraw the assets, i.e. datasets or services, they own or control. A contribution is understood as a way to make some assets available to the users of an SDI. It does not require the assets are for free and it may be necessary, for instance, to get a license from the contributor.	Contributors posses some of the characteristics of several actors mentioned in the GSDI Cookbook and other SDI references: `contributor to the catalogue', `data producer', `product provider' and `service provider'. They help to achieve `spatial asset availability' and `infrastructure creation' (when providing core assets).
Custodian	They create and maintain core assets, and are responsible for its quality and availability.	Described in (Thompson et al. 2003), they help to achieve `infrastructure creation'.
Governing body	They are in charge of creating, removing and changing policies. They also partici-	This role includes characteristics of the `coordination body' de_ned in the GSDI cookbook and (Warnest 2005), the `coordinator' in (Ra-

	pate in the decision making activities in an SDI, for those activities not regulated by any policy.	jabifard et al. 2000) the `policy maker' in (Hjelmager et al. 2005) or the `executive level personnel' in (Warnest 2005). The governing body helps to achieve `infrastructure creation' and `cooperation & coordination'.
Operational body	They are responsible for carrying out most activities in an SDI: systems administration, technical support, quality assurance or relationships among the members. They enforce policies, and initiate, or respond to, some processes and interactions.	This role includes, for instance, the responsibilities of the `catalogue administrator' and `gateway manager' in the GSDI cookbook, or the `operational level personnel' in (Warnest 2005). They participate in every sub-objective of the SDI.
Contact	They represent a community, not necessarily an SDI, in their interactions with other SDIs, and with the members of those SDIs.	This role will have some responsibility in the coordination activities mentioned in most SDI references: for instance, it would include some of the responsibilities of the `broker' in (Hjelmager et al. 2005) or would participate in the formal and informal engagements among SDIs described in (Warnest 2005, p. 188). They are fundamental to achieve `cooperation & coordination'
Educator	They are responsible for the teaching and learning activities intended to cultivate the skills, technical competence, knowledge and best practices needed to maintain and use an SDI.	Providing education on the SDI is considered by most SDI initiatives. Capacity building is pointed out as a characteristic of the current generation of SDIs for instance by Rajabifard et al. (2006): educators would hold responsibilities on information and training for capacity building as described in (Georgiadou and Groot 2001). It does not need to be a `formal' educator: for instance, any user my ful_ll this role when sharing his/her experiences with other users. Educators help to achieve `infrastructure creation', by contributing to capacity building and providing a supporting environment.
Promoter	They are responsible for publicizing an SDI, components, objectives and bene_ts, and for keeping the di_erent actors informed of news and changes.	The promotion of the SDI is an activity mentioned in the GSDI cookbook. Promoters help fundamentally to achieve `infrastructure creation', by helping to provide a supporting environment, and also to achieve `cooperation & coordination' by helping the di_erent actors to be informed of news and changes that can a_ect the coordination activities.
Funder	They provide the funds needed to keep the SDI.	The GSDI cookbook highlights the importance of funding, gives some examples for di_erent SDIs, and makes some suggestions in order to ensure funding and persuade funders (p. 110-112). Funders are needed in order to achieve `infrastructure creation'.

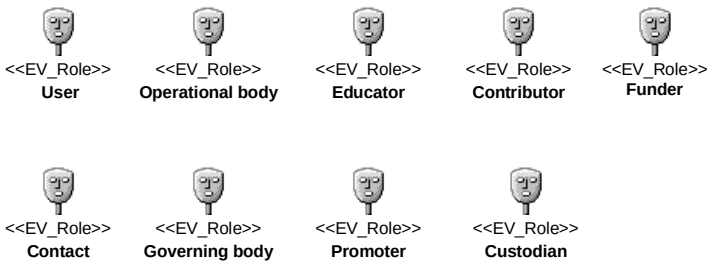

Figure 1. Actor Role Types in UML