The Impact of Localisation on Semantic Web Standards

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Executive Summary:
In this paper we focus on two fields: i) information content globalisation, internationalisation, localisation, translation (GILT) and ii) Semantic Web (SW). We focus particularly on *open* standards, firstly in general, describing their advantages and disadvantages, and then specifically on *open* standards of these two fields. There is need for open standards with explicit semantic metadata in GILT and also for multilingual support in Semantic Web standards. For example, when comments, i.e. non-translatable content, are confused with the translatable content, this is a SW gap.
The goal of our research is to describe on which levels interoperability can take place between GILT and SW. Interoperability between open standards in these two fields is necessary and crucial for a Multilingual Semantic Web (MSW). MSW exists already, as the provision of multilingual ontology-based resources or recycling of thesauri in multilingual ontologies prove. However, MSW as such (and not the resources or technologies) is something relatively new, it has limitations. Our research contribution is to recognise these limitations and find potential and viable solutions.
In e-Government context, and specifically in Government-to-Consumer (G2C) and Government-to-Employees (G2E) relationships, tools and technologies should be based on open standards to attract more actors, enhance competitiveness, and improve interoperability. We focus on information and communication technology (ICT) at an

international and not local or regional level. By definition, localisation is the adaptation of digital content to a target locale (combination of language and culture). In order for the digital content to be international in public sectors, it should be localised in other languages (see GILT), apart from English, to allow non-English speakers to search, find, and structure (see SW) relevant public information.

Keywords: Interoperability, Localisation, open standards, Semantic Web

Key sentence: There is need for open standards with explicit semantic metadata in localisation and multilingual support in Semantic Web.

1. Introduction

The Semantic Web is the extension of the World Wide Web that enables people to share *content* beyond the boundaries of applications and websites[1]. The term ‚Semantic Web' was coined by Tim Berners-Lee et al. (2001). Multilinguality in Semantic Web means multilingual ontological systems, multilingual semantic tools, multilingual search engines, and so on. When these are missing, then it is a non-multilingual Semantic Web. Generally speaking, lack of multilinguality means that only one language, often the lingua franca English, is basic ingredient in all computationally linguistic resources. Accordingly, research is monotone and limited, as linguistic phenomena of other languages are not taken into account and relevant software and hardware covering multilingual aspects are not being developed. In e-governmental context, it means less actors participating, excluding non-English participants and/or enforcing them to use English for different purposes. Publicly accessible information services should be available in languages apart from English to cover a wider target audience.
Undheim and Friedrich (2008) pointed out that:

[1] http://semanticweb.org/wiki/Main_Page, 16/02/2011

> *Sharing pieces of technology and turning them into a standard facilitates (global) market access and opens opportunities for new businesses, both large and small, not only in the software development area but, for instance, to a large extend in the services sector.*

Daddiecko (2004) explored the benefit of ontologies for improved retrieval of subject domain knowledge through his study of building an ontology for export controls. He states that e-Government systems hold great potential for circumventing past information management deficiencies, and ontologies have a role in the transition from information systems to knowledge systems. The benefits of developing ontologies for e-Government systems are to centralise and reuse critical knowledge, share domain knowledge across a variety of settings within organisations, across organizations nationally, and within communities of practice that extend across borders, and preserve this knowledge.

A recent relevant initiative is the project EnAKTing[2] which is in the process of transforming datasets from UK government data into linked data[3] and to create simple and useful visualisations that everyone can explore. These data sets include UK Parliament Dataset, UK Crime Dataset, UK Population Dataset, and so on.

Moreover, Nishio et al. (2010) carried out an empirical study examining public access information websites in Ireland in order to see how many languages were covered. The overall results of the study seemed to point to some weaknesses in the provision of information to those who do not speak English or Irish, although they statistically constitute a considerable portion of the implied receivers. The Citizens Information Board website supported only the official languages (English and Irish), with a few exceptions. The departments of 'Enterprise, Trade and Innovation' and 'Communications, Energy and

[2] http://www.enakting.org/, 16/02/11

[3] Linked data refers to RDF and related technologies for enabling data to be published in a decentralised fashion on the Web.

Natural Resources' do not provide a language selection for the Irish language. The department of Social Protection provides 'Social Welfare Services Information' as separate documents under 'Services in other languages' (English, Irish, Arabic, Chinese, French, Polish, Portuguese, Romanian, Russian and Spanish). However, its customer charter does not mention languages for the provision of services while the rest of the 15 websites declare their provision of services in Irish language in their customer charters. Nishio et al. (2010) concluded that the marginalisation of minorities causes trouble in the future. In multinational, multilingual, and unified society, providing basic information for living must be considered crucial, particularly for newcomers and new members. It is precisely in this e-Government context that language policy and technology should work together for the common goal of information accessibility in a multilingual society.

2. Requirements, Pros, and Cons of Open Standards

It is difficult to clearly define open standards, as for a specific domain, person, or company, it means different things. We adopt the definition of the Digital Standards Organization (DIGISTAN[4]) which states that:

> *An open standard must be aimed at creating unrestricted competition between vendors and unrestricted choice for users.*

According to the 'Open Source Initiative'[5], the requirement for open standards is the following:

> *[Open standards] must not prohibit conforming implementations in open source software.*

More precisely, the criteria an open standard must satisfy are the following:

[4] http://www.digistan.org/text:rationale, 19/10/10
[5] http://opensource.org/osr, 19/10/10

1. No intentional secrets;
2. Availability;
3. Patents;
4. No agreements;
5. No open standards requirements (OSR)-incompatible dependencies.

Open standards must be freely and publicly available (point 2 above), provide all necessary information for interoperable implementation (1), and also, all technologies required for the implementation of the standard should be OSR-compatible (5). Moreover, there are requirements for all patents essential to implementation of the standard (3), and there must not be any requirement for execution of a license agreement (4).
Apart from the public benefit corporation 'Open Source Initiative', a not-for-profit organization related to open standards is 'OpenStandards.net'[6]. OpenStandards.net connects people and standards setting organisations and integrates various resources within the IT industry in favor of international IT collaboration. The relationship between open standards and innovation is stated by OpenStandards.net:

> *Open standards is a means to increase unity and sharing to decrease duplication. With insatiable demand for improvement, competitive innovation will always have a place, and become more productive as it is able to leverage a global infrastructure built on unity and openness. The greater the optimization and accessibility of the infrastructure built through open standards, the greater the demand for innovation leveraging it.*

In other words, replicated standardisation efforts can be avoided through a unified infrastructure. This infrastructure should have the

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[6] http://www.openstandards.net/viewOSnet3C.jsp?showModuleName=about, 19/10/10

characteristics of innovation, open access, and information sharing. Open standards are adopted as far as there is improvement and optimisation. There are also other open standards-related organisations, such as the Open Group[7], Foundation for a Free Information Infrastructure[8] and others.

According to our opinion, open standards have both benefits and shortcomings and in the next paragraphs we shed light on both of them. As far as the benefits is concerned, open access is the most important one. Everybody, from information publisher or tool provider to end-user can have access to the standard. This provides equality to every actor and unrestricted choices in information science field. Apart from the 'open access' benefit, 'customisation' is another benefit of open standards. Actors can adapt the standard using custom extensions according to their needs and preferences. A third important benefit is the transparency of process. Every standard is open to the public for review before it is published. This allows for adaptation from the standardisation committee taking into account feedback and personalised requirements of the actors/users.

According to Multilingual Web[9] project, standards enable interoperability of data (see section 3) and improve the efficiency of processes for producing, localising, and disseminating information. Moreover, standards provide targets that push applications to consider the requirements for supporting multilingual aspects of the Web for creation, display and management of content.

As for the drawbacks of open standards, often there is lack of awareness. It should be mentioned here that lack of awareness of standards is not only related to open standards, but to 'closed'/proprietary standards as well. The difference is that in the latter case, people have to use these proprietary standards, that is why there are known, but only to a specific group. In the former case, open standards are not tied with a specific software, that is why less people

[7] http://www.opengroup.org/, 26/10/10
[8] http://www.ffii.de/wiki/offenestandards, 03/11/10
[9] http://www.multilingualweb.eu/en/about-the-project, 16/02/11

might be not familiar with them, but more people interested in open standards have the potential to get to know it. In a nutshell, the difference is between *can* know (open standards) and *must* know (closed standards).

In fact, many people are not familiar with some open standards although they may have been existed for many years. In our survey (Anastasiou, 2010a), 17% heard of XLIFF (XML Localisation Interchange File Format), but they were not really aware of its functionality, although it has been available since 2002.

Another drawback of open standards is 'extreme customisation'. We referred to customization previously as an advantage, but in fact, it is a 'double-edged sword'. When used between accepted borders, it can be an advantage, but when used to an extreme, then it turns into a disadvantage. Often developers customise the standard to an extreme extent, so that the standard gets various forms, the so-called 'flavors'. Some flavors often have no resemblance with the original proposed rigid structure of a standard. These various flavors have as impact different tool support of the same standard, which hinders interoperability. That means that a file created with a specific application can be corrupted when used later by another application.

In the next paragraphs we refer to some specific examples both from the field of globalisation, internationalisation, localisation, translation (GILT) and of Semantic Web, and then we propose a symbiotic relationship between them. The term GILT is coined by Cadieux and Esselink (2004) and stands for globalisation, internationalisation, localisation, translation. According to the Localization Industry Standards Association (LISA)[10]:

> *Globalization involves changing the way an organization does business. [It] is more than a technical process and involves both internationalization and localization.*

[10] http://www.lisa.org/What-Is-Globalization.48.0.html, 27/10/10.

More specifically, globalisation is the strategy of bringing an internationalised and localised product or service to the global market; thus globalisation involves sales and marketing.
Now we provide the definition of internationalisation according to LISA:

> *Internationalization encompasses the planning and preparation stages for a product in which it is built by design to support global markets.*

In other words, internationalisation makes sure that the product or service is functional in any language and content. LISA states that when a product is not properly internationalised, it takes twice as long and costs twice as much to localise a product. Internationalisation is about making a product easily localisable. LISA defines localisation as follows:

> *Localization refers to the actual adaptation of the product for a specific market. It includes translation, adaptation of graphics, adoption of local currencies, use of proper forms for dates, addresses, and phone numbers, and many other details, including physical structures of products in some cases.*

To sum up, the global product developing cycle starts with internationalisation (design and development) and continues with localisation (actual adaptation to a target locale). Globalisation is concerned with marketing support and product requirement analysis. Globalisation, internationalisation, and localisation include more tasks than the transfer from one language to another, namely translation. Project management, engineering, testing, marketing, and other tasks are parts of the global product developing cycle.
As far as the predominance of English in software localisation is concerned, Esselink (2000: 4) states that approximately 80% of software products are localised from English into other target

languages; as an example of the predominance of the USA in the area of localisation, one translation and localisation company[11] adapted the original LISA definition (a.) of localisation to read as in (b):

a. *Localization involves taking a product and making it linguistically and culturally appropriate to the target locale (country/region and language) where it will be used and sold.*

b. *Localization involves taking a product and making it linguistically and culturally appropriate to the target locale (country/region and language) where it will be* ***U.S.ed*** *and sold.*

As GILT is a vast field including many sub-tasks, the existence of standards is necessary to achieve unity and data sharing. Open standards, in addition, provide bigger adoption potential, transparency, and regular updates and improvement.
Among others, some important GILT open standards follow. The following standards are representative from a domain and also well known in this and other domains. They are open because they fulfill all the requirements presented in section 2.

1. Internationalization Tag Set (ITS) by W3C;
2. Translation Memory eXchange (TMX) by LISA;
3. Terminology DataBase eXchange (TBX) by LISA;
4. XML Localisation Interchange File Format (XLIFF) by the Organization for the Advancement of Structured Information Standards (OASIS).

As some of the standards' names imply, the ITS (1) relates to internationalisation and XLIFF (4) to localisation. TMX and TBX

[11] http://www.lztranslation.com/localization.html, 15/11/09.

(standards 2 and 3) are concerned more with digital content maintenance by means of Translation Memories and Terminology Databases. Although they might seem not strictly tied with localisation, they facilitate content reusage and leverage, and terminology consistency, which are crucial steps in localisation process. We describe briefly XLIFF, as achievement of interoperability between XLIFF and RDF is one of our goals (see section 3). XLIFF joined OASIS in December 2001 and was standardised in 2002. XLIFF stores localisable data and carries it from one step of the localisation process to the other, thus allowing interoperability between tools. XLIFF is an intermediate file format, i.e. a file in an original format (txt, docx, xml) can be converted into XLIFF and back to the original. OASIS is a not-for-profit consortium that develops, converges, and adopts open standards for the global information society. Some other OASIS standards are Universal Business Language, Cross-Enterprise Security and Privacy Authorization, and many Web Services-related standards.

OASIS is relevant to e-Gov community, as it has an e-Government Member Section which serves as a focal point and platform for discussions of governmental and public administration requirements for e-business standardisation. It brings together representatives from global, regional, national, and local government agencies, who share a common interest in directing and understanding the impact of open standards on the public sector[12].

We now move to the field of Semantic Web and the open standards available there, as these are needed for a Multilingual Semantic Web (MSW). The predominant open standard model is the 'Resource Description Framework' (RDF) by W3. RDF is a standard model for data interchange on the Web. It allows structured and semi-structured data to be mixed, exposed, and shared across different applications.

[12] http://www.oasis-egov.org/, 16/02/2011

One of the main purposes of RDF is to declare machine-processable metadata. Apart from RDF, we present below some (and not all) other open standards under the big umbrella of the Semantic Web:

1. Web Ontology Language (OWL) by W3C;
2. Simple Object Access Protocol (SOAP) by W3C;
3. SPARQL Query Language for RDF by W3C;
4. Web Services Description Language (WSDL) by W3C.

Noteworthy is the web services interoperability organization[13] (WSI) which establishes best practices for web services interoperability and standards across platforms, operating systems, and programming languages.
In the next section we try to define data and standards interoperability, inform about some ongoing localisation-Semantic Web initiatives, provide reasons for interoperability failure, and solutions to avoid it.

3. Interoperability

Generally speaking, the key to interoperability is the freedom to change between different software packages, platforms, and vendors. The goal of interoperability is, among others, to avoid data and metadata loss through aggregation, sharing, and exchanging information.
It is important to distinguish between two kinds of interoperability:

i. Interoperability between data based on standards;
ii. Interoperability between (open) standards.

These points are not as far away from each other as they may seem. Point i. can be seen as the immediate outcome of ii., thus if the ii. is missing, i. cannot exist either. As data is saved in file formats and many file formats are standardised, then the connection is very close. According to Multilingual Web project, standards enable

[13] http://www.ws-i.org/, 20/10/10

interoperability of data, which maximises the potential for access to information, and ensures longevity and usability of data.
Open file formats/standards bring one step towards data interoperability. However, more steps[14] of interoperability can be made at different levels:

i. Clarify which standard is for which domain;
ii. Support the relevant standard(s);
iii. Conform with the specifications/not extreme custom extensions;
iv. Create XSLTs for conversions and 'translations' from one standard to another;
v. Provide open APIs and web services for better interaction between software programs.

Moreover, at a last stage, peer review, interoperability testing, or standards interoperability analysis can and should be carried out in order to achieve quality and interoperability assurance. It is needless to say that if developers support and conform with the specifications of each standard (ii and iii), then interoperability is mostly successful and the stage (iv) can become, in this case, redundant. Open APIs (v) are important, because they provide a consistent development platform and help sharing content.
If one of the above steps is not done properly or in an inefficient way, then interoperability failure between data – as result of failure between standards – is inevitable. Specifically to XLIFF, an experiment between commercial tools and their mostly unsuccessful XLIFF interoperability can be found in Anastasiou (2010b). The main reasons for the interoperability failure in our experiment were version update, extreme extensibility, and lack of converters. Every application used a different converter, whereas there is lack of open source converters. As for the extreme extensibility, the flavors we aforementioned pose an

[14] These steps are not for open standards only, but for closed ones too. However, they are more applicable to open standards, because of more freedom and openness of related data which enable low-level experimentation.

interoperability challenge, as new elements and attributes are introduced, which are not recognised by another application. The version update, although an advantage in itself, often is not considered by some applications, which leads to lack of interoperability.

Now we focus on scenarios combining localisation and Semantic Web. For the time being there is lack of literature about a single actual proposal of a symbiotic scenario. Characteristically, Krieger and Schäfer (2010: 588) point out that 'ontologies, on the one hand, and resources for natural language processing, on the other hand, though closely related, are often maintained independently, thus constituting a duplication of work'. However, there are some very interesting related projects, such as the Multilingual Web[15] project, Flarenet[16], META-NET[17], and Monnet[18]. The Multilingual Web project contributes to better awareness of standards and best practices in the area of the multilingual Web. Flarenet (Fostering Language Resources Network) creates a shared policy for language resources and technologies. META-NET builds the technological foundations of a multilingual European information society creating an open distributed facility for the sharing and exchange of resources (META-SHARE). Monnet combines Machine Translation and Semantic Web for better cross-language information access and develops multilingual ontologies for networked knowledge.

Also, in 2010 the first Multilingual Semantic Web workshop was hosted at the 19th International World Wide Web Conference. Among its topics[19], was the use of ontologies for cross-lingual mapping, multilingual extraction, and user-profile enrichment.

The current state of the art, from the Semantic Web's side, is that ontologies are in most cases monolingual and mostly English. It is an arbitrary decision which natural language is used for describing the

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[15] http://www.multilingualweb.eu/en, 20/10/10

[16] http://www.flarenet.eu/?q=Vienna09_Session5, 20/10/10

[17] http://www.meta-net.eu/, 07/11/10

[18] http://www.monnet-project.eu/Monnet/Monnet/English?init=true, 16/02/11

[19] The proceedings of the workshop are available at: http://sunsite.informatik.rwth-aachen.de/Publications/CEUR-WS/Vol-571/, 07/11/10

ontologies' contents. This is why ontologies' contents/labels should be translated and thus the term Ontology Localization (Suarez-Figueroa & Gomez-Perez, 2008) was created: "Ontology Localization is the adaptation of an ontology to a particular language and culture". In other words, Ontology Localisation includes i) translation of ontology labels into another natural language than its original and ii) adaptation of monolingual ontology labels to cultural characteristics, including spelling variations.

In localisation, from the other side, semantics is what is lacking in the existing open standards. XLIFF is an exception, as it carries heavy metadata, such as coordinates of dialogue boxes, file creation date, author details, and so on.

Common approach nowadays is the alignment of ontologies based on lexical properties of their labels, however often there is 'confusion' between data and metadata leading to an incorrect alignment. The metadata has nothing necessarily to do with the ontological content apart from describing it and this should be considered in the alignment.

As far as the multilingual use of semantic web, Hahn and Vertan have discussed already in 2005 how it can function:

1. Translation of websites can be supported especially through the use of ontologies;
2. Knowledge management can be also improved through websites. Such an example is the development of resources for group, project or company knowledge, especially in multilingual form for international institutions;
3. International communication base for industry and commerce is created. Such an example is international lists of products, names of products or custom regulations.

The third point is valuable for government policies. Digital public governmental content, services, and products should be multilingual, at least in all official languages of the country, and preferably even in more, to attract more citizens and consumers.

Additional to these three uses, the reasons of having a Multilingual Semantic Web are, among others, to have a more efficient named entity recognition, cross-lingual search, and Information extraction and Retrieval. Then the information aggregation and sharing in resources and international lists will be more efficient.

Our vision is a Multilingual Semantic Web which is based on open standards from Globalisation, Internationalisation, Localisation and Translation (GILT) and Semantic Web, as it is illustrated on the Diagram 1. The semantic metadata of the former and the multilingual support of the latter can create an interoperable framework. The advantage of this framework-relationship is the creation, management, sharing, and publishing multi- and crosslingual resources in Semantic Web applications. Localisation has an impact on Semantic Web on the basis that the former enables multilingual support in the latter's applications. Localisation and Semantic Web data, tools, and their users can more easily and efficiently communicate without data and metadata loss. Standards, in general, provide a unified framework and are a means of data, tools, and users' communication.

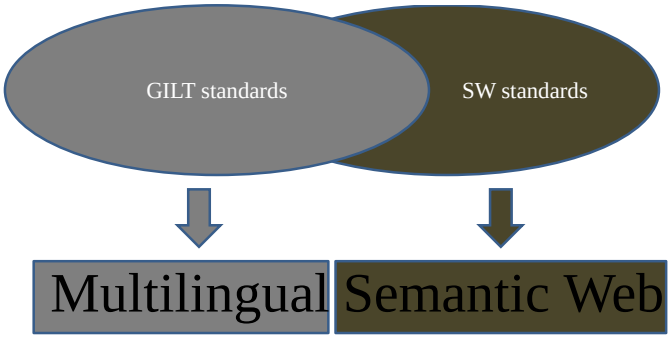

Diagram 1. Multilingual Semantic Web based on open standards

In this initiative based on open standards, we suggest the following methodology steps:

i. Internationalisation should be taken into account when standards are developed in the field of Semantic Web and semantics should be considered when GILT standards are created;
ii. Both Localisation and Semantic Web standards should have requirements which should be compatible with each other;
iii. Conformance clauses should include criteria about compliance with both Localisation and Semantic Web standards.

As far as the point (i) is concerned, labels should be internationalised, i.e. easily localisable. Localisable content should be distinguished by the unlocalisable content and this should be clear in the ontology labels. The same holds for metadata, which in most cases, should not be translated, but transferred as such.

In Localisation, metadata with explicit semantics, such as resource descriptions, links to external references, e.g. which glossary/dictionary/Translation Memory or Machine Translation technology has been used for a specific term, will help increase transparency, provide context, and evaluate quality.

The point (ii) is concerned with standardisation requirements. In Localisation, often one standard is prerequisite for another, however, not yet between Localisation and Semantic Web. A framework of a MSW will not be efficient if it is based on many standards, some of them with an inflexible structure with different requirements and thus purposes and uses. Common requirements of Localisation and Semantic Web standards and a potential single Localisation-Semantic Web standard is a basic step towards building the Multilingual Semantic Web framework. As the creation of a single Localisation-Semantic Web standard is both complex and time consuming, common requirements of different standards and conformance clauses which take into consideration different requirements of each field (point iii) is an initial step.

As for a practical implementation of the theoretical framework, we designed an XLIFF to RDF (XLIFF2RDF) conversion tool which

translates XLIFF files into RDF representation. The converter is under the Mozilla Public License and is hosted on Google code hosting[20] website. It is applicable in many domains and many tools. As XLIFF is an intermediate file, any file format which can be converted into XLIFF can be then converted to RDF. Hence interoperability between other formats (and not only XLIFF) and RDF is achieved.

4. Conclusion

Open standards and accordingly standards-based data interoperability is important for information aggregation and sharing. Although interoperability between standards should be the right path for flexibility, usability, open access, and collaboration, often there are challenges which hinder this achievement. Localisation and Semantic Web are not really connected yet, but both fields and their open standards have the potential to interoperate and gain advantage from each other. XLIFF can be used to translate ontology labels and in addition, ontologies can be populated with localisation metadata. Having started with an XLIFF2RDF open source converter, we intend to extend this interoperability connecting more open standards.

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