Law-driven eGovernment Applications and Interoperability

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Abstract: The paper reports on the work of the IST project ESTRELLA. The well established growth of legal knowledge tools (LKTs) and the rapid growth of vendors and specialist tools of different kinds means differing vendor formats for legal knowledge representation restrict interchange between legal drafters and legal knowledge users in different government departments, and between business users in the Member States. ESTRELLA has delivered a successful interchange strategy to free-up the market and to enable improved legal drafting, legal analysis, and production of regulation-dependent applications for online services to all.

Keywords: Legal Knowledge, Interchange, eGovernment, Knowledge Models.

1. Introduction and Overview

1.1 European Legal Context

Integration within the European Union aims to ensure that goods, services, and citizens move freely across European borders. Achievement of this general objective relies on the incorporation of EU-wide legislation into that of the Member States. As a consequence, it is generally identified that democratic institutions must be strengthened as well as being made more responsive to the will of European citizens, while Public Administrations must be made more efficient and more economical [1].

The legal systems of EU Member States contain heterogeneous and often conflicting regulations concerning health care, education, employment, business operation, consumer protection, pensions, and other areas of societal concern. However, harmonisation across EU legal systems, as well is incorporation of EU-wide legislation, is complex, expensive, and potentially problematic. For pragmatic reasons, citizens, commerce and public authorities are each concerned that laws addressing employment, taxes and pensions, for example, be comparable across national borders so as to allow freedom of movement and trade. In the context of improving participation and democratic process, there is general concern to improve the functioning of the legal system to optimise compliance, transparency, citizen support and involvement. Furthermore, simplification and greater stability in the legislative domain is sought by companies and administrations who seek to reduce administrative burden and cost [2].

1.2 Example of Problems Addressed

Many Government and Commercial services are implemented in response to Government Policy. Such policy is often expressed relative to the framework of existing laws, or may include requirements for changes in existing laws and regulations, or even creation of new

regulations. In some cases the regulations are the service (e.g. the tax office implement new rules), while in other cases services are shaped in response to regulation (e.g. government departments, companies and banks redevelop service practices in response to legislation). As a consequence, those implementing new services, adjusting existing services, or even managing services, must pay heed to the underlying legal context. This is also true of citizens and businesses who use government services – they must comply with laws and regulations underpinning the societal framework within which such services operate.

Organisations have long sought technology support for dealing with the complexity of laws. For example, rule-supported reasoning (using legal knowledge tools - LKTs) is used by organisations such as the DTCA and UWV (enforcement organisations for social security in the Netherlands) who are dealing with mass application processes. They apply technology supported rules of reason instead of "black letter", plus a careful analysis by human operators, and this is shown to be more appropriate for cases that go to court [3].

Indeed, it is shown that analysis of laws conducted purely by humans is inefficient and highly prone to error [4], and legislative drafters showed significant problems in testing legislation because they could not handle complexity without support from LKTs. They looked at only some alternatives, used only some testing criteria, operationalised them poorly and only calculated some of the consequences of a draft. Humans supported by a legal knowledge based system perform better (more consequences calculated, more criteria taken into account, etc.). Importantly, when confronted with these results the drafters agreed that a man-machine combination improves quality in testing.

As LKTs have developed in sophistication, the complexity of developing regulations and managing the governmental, business and social processes determined by these regulations, is being reduced. In most European Member States, LKTs operate in tandem with sophisticated Legal Knowledge-Bases (LKBs). These technologies operate upon 'rules' extracted from complex legal sources (laws, court decisions, etc.) and so provide the core functionality of knowledge-based systems supporting human experts in their tasks.

This approach has been proven to save much human effort in locating, interpreting, and operationalising relevant rules, for example in preparation of financial products for foreign markets [5]. However, the spread of potential benefits is limited by fragmentation in the market. LKTs have emerged as very specialist applications, often developed for specific clients in the first instance, or for a highly specialised market segment. The exploitation potential of LKTs, and the transformation of governmental and business processes they can enable, has been limited by unintentional vendor lock-in.

Vendors wish to open the LKT market so as to generate higher business volumes and wider societal benefits, but a significant block has been the differences in vendor representations of laws, and the inability to exchange legal knowledge (LK) between different tools and platforms. This leads to exchange problems between departments, between organisations, and between Member States.

The work of ESTRELLA starts in a scenario where it is widely accepted that LKTs, in conjunction with human experts, can greatly improve performance, productivity and quality in the legal knowledge chain from drafting through to usage of laws – but only if interchange of legal knowledge can be effectively enabled. The remainder of this paper reports on the study objectives and the approach, and then provides a summary of selected results that have implications for the further development of the LKT market.

2. Objectives

The pilot work in ESTRELLA began with the objective to develop a legal knowledge interchange format (LKIF) supported by a reference architecture incorporating artificial intelligence techniques and knowledge-based systems. In support of that objective, a partnership of vendors, government agencies, and researchers in semantic web and artificial

intelligence set out to develop a series of pilots to demonstrate usage of LKIF and the reference architecture. A primary intention was to show different vendor tools linked into the reference architecture, and able to exchange and use legal knowledge between them: such legal knowledge either originating from usage of these vendor tools (e.g. draft laws), or originating from other sources (e.g. existing laws, European Directives, and knowledge models of these).

3. Methodology, Technology and Business Case

ESTRELLA operated three pilots to test the complete value chain, and to show realistic usage by relevant actors in the key target processes:

- Legal analysis of EU Directives and Existing National Laws
- Legal drafting of new national regulations in response to EU Directives
- Modelling and explanation of rules in different laws
- Identification of conflicts in laws, adjustment of laws
- Explanation of laws by visualisation techniques
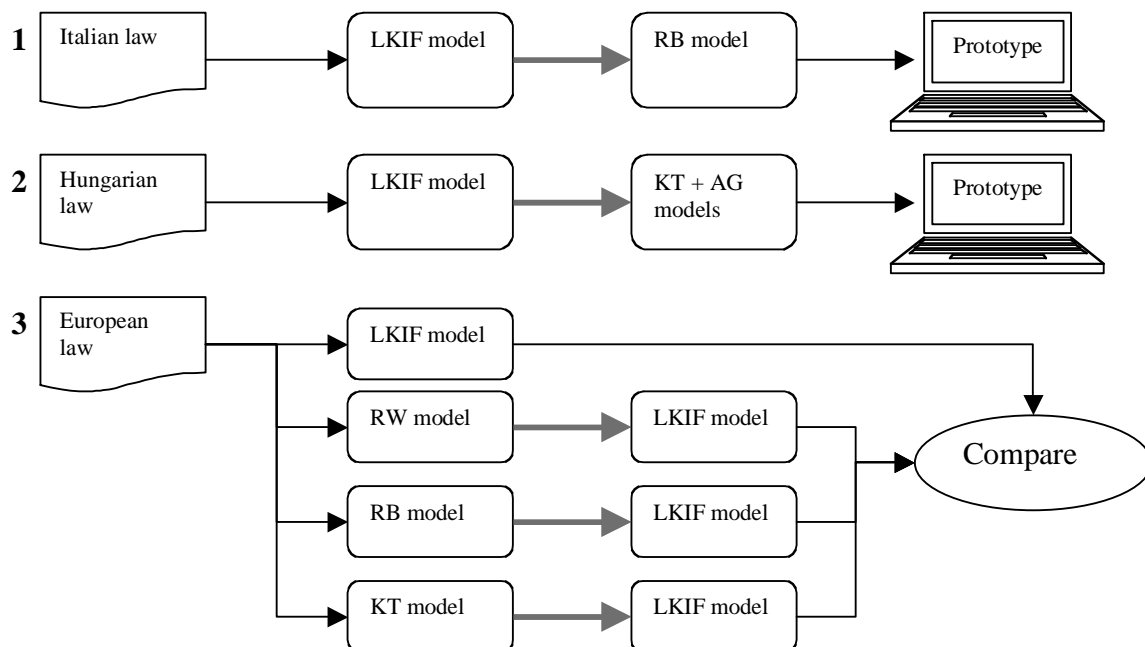- Exporting of models to operational tools for eGov application building

Figure 1. Three Pilots - Comparison of Legal Knowledge Models from Different Tools

The LKTs used in the pilots were RuleWise (RW), RuleBurst (RB), knowledgeTools (KT), AllexGold (AG), plus Carneades, and Pellet (reasoning engines).

The pilot tasks were designed to show usage of multiple vendor tools whose interoperability was enabled by the ESTRELLA technical solution (LKIF) and a reference platform for realistic demonstration. Each pilot took existing legal problems such as drafting a law in response to an EU directive (Figure 1, pilot 1), comparing VAT legislation in different countries (Figure 1, pilot 2), exporting newly drafted rules to automatically update citizen and business eGov applications (Figure 1, pilot 2), clarifying legislation for different end-users (Figure 1, pilot 3) (see [6]).

The ESTRELLA technology solution extends standardisation work whereby a candidate legal mark-up language was refined, adapted to the needs of the ESTRELLA target user group, and promoted as a standard (now a CEN standard – METALEX [5]). In parallel, the legal knowledge interchange format (LKIF) was developed by researchers working in close

association with vendors to ascertain the expressive power of different vendor tools and their usage, along with specific representation characteristics of the vendor formats [7].

To demonstrate LKIF (interchange mechanism) in realistic usage, a reference platform was provided and included reasoning engine, a set of vendor tools, and a set of API's and translation modules. The reasoner is available as an open source application (Carneades), and the APIs and translators are distributed to allow vendor tools to exploit LKIF [8].

The business case for ESTRELLA is predicated on the mass of problems evident in legal drafting and usage of laws and rules by governments and their customers. Extracting and modelling operable rules (so as to support humans in their tasks) is now possible thanks to knowledge-based systems, but the previous lack of exchange capability limited interoperability, and greatly reduced scope for export of rules to application developers. A vendor-independent representation language for legal rules was clearly required to bridge between vendor formats so as to reduce administrative burden and legal complexity, as well as cutting time and costs for application development. Following the successful pilots [9], vendors outside of the ESTRELLA team are already adopting LKIF.

4.   Illustrative Results

The users in the ESTRELLA pilots were primarily government workers normally involved in drafting and amending laws (see Methods section preceding). They conducted the assigned tasks using the tools provided, and participated in an evaluation involving focus groups, task observations, interviews and formal questionnaires. Testing addressed technology suitability, usability, operational effectiveness, as well as user satisfaction with the technical and operational solutions

In all cases the enormous value of the LKTs as task support was clearly identified, and the new way of working using the ESTRELLA approach was strongly welcomed. Specific issues that arose in the evaluation are fully detailed elsewhere [9], and selected results from Hungarian, Dutch and Italian pilots are presented here to illustrate the main findings and to expose the need for future RTD and support of the user community.

4.1   Plug'n'play LKTs

Users were able to conjoin the different LKTs as part of the operational platform, and could transfer LK between them via LKIF as part of the local work task. However, introducing new tools needed new API/Translation efforts, and users want a technology scenario like any other 'office technology' scenario where tools are plug'n'play and come equipped with API/translation solutions [10].

4.2   Improving Visualisation

Government users introduced to LKTs for the first time were initially challenged by the new technology but, when adapted, identified that reasoning about complex rule-relationships is easier when visual representations are added to textual representations (e.g. argument graphs / decision trees). They request that more visualisation capability is introduced in future to assist with reasoning about effects of rule changes. This is a significant change to the traditional way of working.
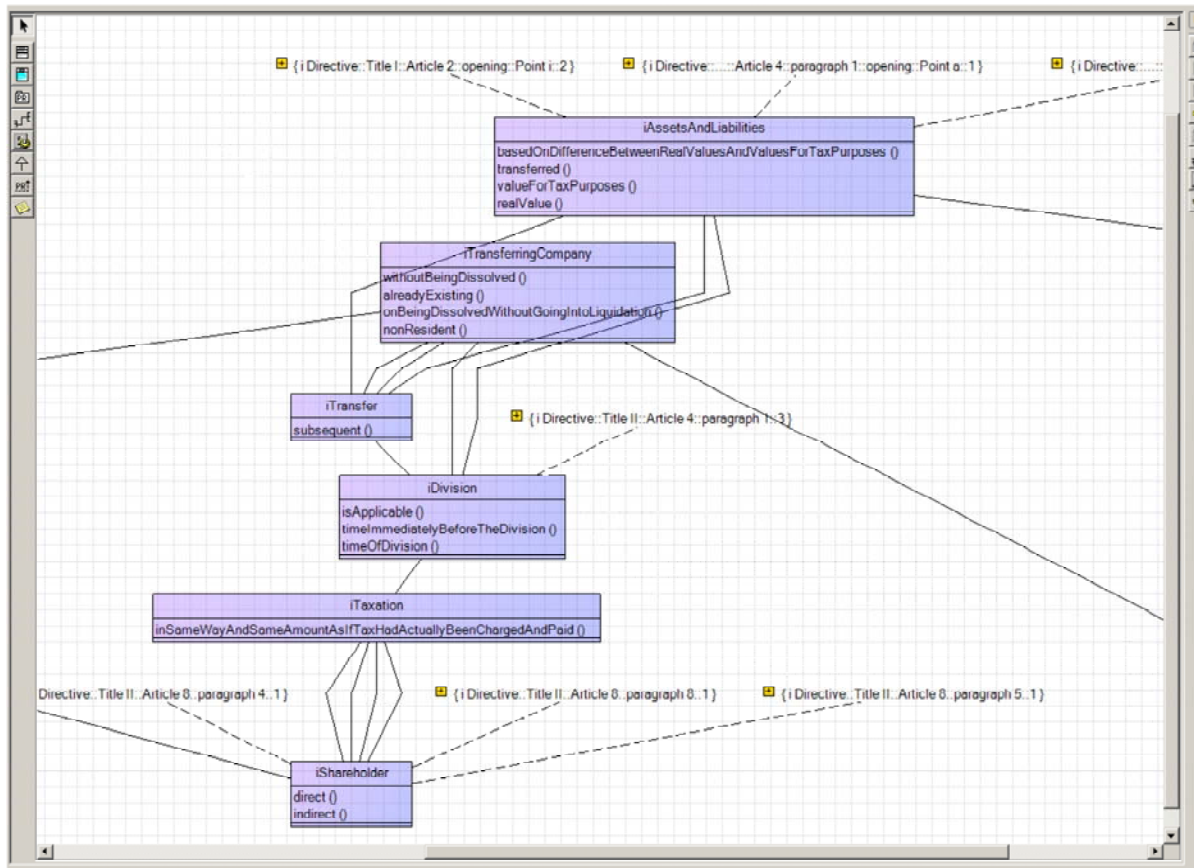
Figure 2. Part of a RuleWise Model Showing Visualisation of Rules, Relationships and Sources

4.3 Adapting Administrations

Some aspects of the new ways of working created by LKTs can be mastered by existing staff, while some cannot (e.g. more complex modelling tasks) and so there is both a learning challenge, and an organisational challenge. Organisations need to identify the extent to which existing staff can be 'upgraded' (new skills) and where new staff / expertise may be needed in addition. As staff turnover progresses the emphasis may shift to one of selection rather than adaptation (hiring new disciplines as part of the mix), or creation of partnerships (specialists provided by external providers). eGovernment transformation in Europe in the immediate future must pay significant attention to this issue.

4.4 Improving Interchange

Having seen how well legal knowledge can be exchanged between different tools, and hence between different task contexts, users identify attractive opportunities for wider exchange between organisations:

- Work invested in modelling made available to the semantic web community.
- New web services and tools using legal knowledge as content.
- Easier access to legal knowledge via a shared pool within a user community.

The above ideas imply the need to organise the user community in new ways. This will require something akin to an Open Source (OS) type of community model wherein contribution of content, and collaboration over usage of content will be paramount. Since much of the content is based around Public Sector Information (PSI) then the relationship with the PSI Directive [11] and ensuing national legislation will have to be considered. An OS model for future ESTRELLA participation is currently under review by the consortium.

4.5 Legal Knowledge Process Improvement

Based on early experience and success with the pilot target tasks, users indicate a number of areas where they can see potential for process improvement beyond the limited scope of ESTRELLA pilots:

- Improved automation exploiting natural language processing.
- Simulation of consequences of particular legal models / adaptations.
- Traceability of acquired LK and models / propagation of changes.
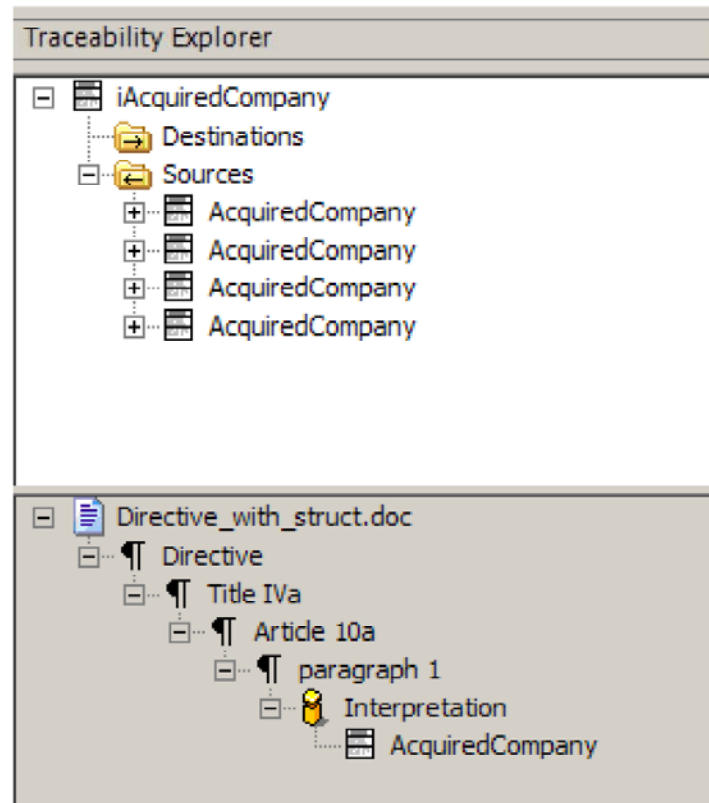- Identifying users of shared knowledge resources (intelligence and support)

Figure 3. User Interface showing Traceability Explorer

While ESTRELLA provides traceability (see Fig 3) within the knowledge sources held locally, the users in this case were asking for the ability to trace resources obtained from distant contributors (e.g. for validation), and the ability to automate updating when remote sources were changed (e.g. updates to laws in another country). In addition to this they seek the ability to identify who the holders of remote knowledge resources are (e.g. for validation, collaboration), and the ability to model consequences of possible changes in laws / regulations forming part of their used LK-database (e.g. in what-if scenarios). Putting all of this together with enhanced legal knowledge processing would, in the users' view, greatly improve the work process and its management.

4.6 Developing the Community

Users uniformly identify that removal of the blockage caused by lack of interchange not only opens avenues for new ways of using legal knowledge, but also invites discussion of how the 'community' of users can be better supported. Already they are in discussion about how to derive a model for a community of practice based on 'open source' and similar models suited to public sector information and co-dependent user groups.

4.7 Technology and Standards Outputs

Although ESTRELLA primarily aimed to demonstrate interchange between vendor tools in the legal-knowledge domain, a number of usable products have also emerged:

- The METALEX markup language is now a CEN standard through support from the ESTRELLA initiative.
- LKIF is already an open standard adopted by the partners in the project, and also by two external tools vendors exploiting interoperability.
- The Carneades inference engine (reasoner) is provided as an open source component for ESTRELLA-like architectures and platforms.

The eager acceptance and adoption of ESTRELLA outputs even at this early stage is taken to indicate both extreme interest and the need present in the target user community. Uptake of LKIF as a de facto standard for interchange now begins to stimulate interchange exploitation and should naturally lead the user community to begin the debate on how to improve and further develop interchange (a shift from "how to do" to "how to improve").

5. Conclusions and Next Steps

The results of ESTRELLA illustrate the positive impact of LKIF and LKTs on governmental processes of different kinds. The pilots expose the benefits identified by process actors who use these tools to support human reasoning about laws, rules and their impacts. The development of applications within the project (e.g. Hungarian Tax Advice) stemming from interchangeable legal knowledge content, illustrate the future promise of LKIF usage – improved eGovernment applications using knowledge-based systems supported by legal-knowledge interchange.

In order to fully realise such benefits, we clearly need to consider further how to support a wider community of users. They require a shared knowledge space arranged to support exchange and exploitation of public sector information that has added value contributed by various governmental and non-governmental processes. Initial steps towards forming such a community are being taken by the ESTRELLA consortium.

The participants in the future community of open LK exchange require improved support from vendors providing plug'n'play solutions in which visualisation of knowledge models and their impacts are better supported. They will also need access to shared knowledge repositories, or other means of declaring and making available the resulting knowledge models and LK resources for community access.

Organisations whose members participate in this community of shared LK resources will themselves have to adapt to new ways of working with enhanced LKTs, and will have to address training and re-skilling of existing staff, as well as redefining competence models for the organisation.

While ESTRELLA has been completely successful in its initial objectives to design and demonstrate a workable "legal knowledge interchange format" supported by a suitable reference platform, the realisation of the reported new objectives emerging from our pilot user experience will take us further in satisfying the EU-level context. That is to say: reinforcing the knowledge-based (legal) support for free movement of goods, services and citizens around Europe; strengthening democratic institutions; improving citizen participation in creation and usage of society's laws; and helping to make public institutions more efficient and economical.

Acknowledgement

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[10] See Universal Plug'n'play Forum for industry perspective and latest specifications in different application areas : http://www.upnp.org/

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