

# RECOGNITION OF COMMON INTENT IN SMART e-GOVERNMENT SERVICES

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## ABSTRACT

As Europe develops towards a politically and economically integrated body, agencies, organisations and enterprises from various nations face the challenge of having to collaborate and provide services to achieve common goals and create prior negotiated, intended outcomes. While European and national legislations set context and rules for such business conduct in multi-national service-oriented ecosystems, agile business process management needs more than an underpinning ontology to ensure semantic interoperability. It requires a complete business process management language (BPML) based on a formal grammar to support inter-nation administrative business processes automatically. This case study addresses the collaborative exploitation of common intent in the context of pan-European e-Government services for a typical life-event of a citizen: moving residence from Germany to Belgium.

**Keywords:** smart process management, e-Government, business process management language, life event support.

## 1 PROBLEM SPACE

The political mandate of the European Union is the creation of a barrier-free, yet safe European inner market. Considered indispensable for that is the implementation of ‘one-stop government’ for any ‘life event’ (also called ‘change of circumstance’) of a person or an enterprise.

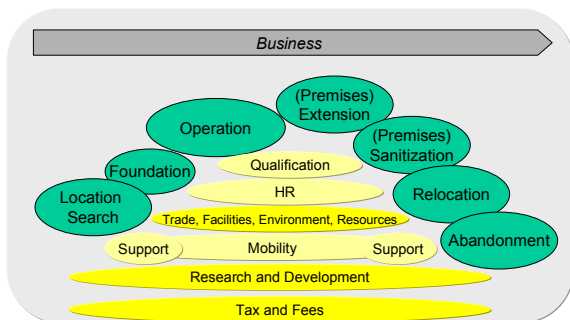


Figure 1: Lifecycle Events of an Enterprise

As indicated in Figure 1, each life event calls for the definition and implementation of cross-discipline semantic models and process bundles needing interoperability according to a few interaction scenarios unfolding from the processes.

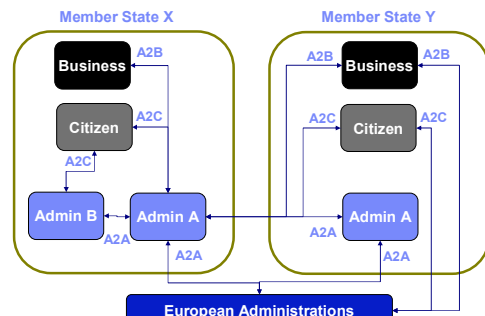


Figure 2: Interaction Scenarios [1]

The interactions as shown in Figure 2 can be either direct between a business or citizen and one particular administration agency (A2B, A2C) or involve data exchange between administrations in one or more EU member states or the European Commission.

For the purpose of our case study, we picked the following scenario:

Fritz Meier works for the German company ABC which is an established supplier for the European Space Agency (ESA). His wife, the famous architect Christophera Troglodyte-Mignon, just got the permit to establish her business in Brussels, therefore the family (2 kids, 12 and 20) wants to move from Cologne to the greater area of Brussels. Their personalized process bundle as a one-stop government solution according to current law in Germany and Europe

includes (among others):

- information about residential property to rent or buy in the area of interest,
- information about available education facilities (schools and universities),
- notice of departure in Cologne,
- residential registration in Brussels,
- waiver for compulsory schooling in Germany,
- application for child benefits (because Fritz is still employed in Germany),
- cross-country taxation scheme (because his wife has income in Belgium),
- supplementary health insurance for the family (AOK),
- enrolment of younger child in highschool,
- application at Brussels EU Law School for older child,
- information regarding the physical relocation, e.g. customs (excise duty) or moving contractors with international license, and
- contract with moving company in Cologne.

## 2 A2ABC COMMUNICATION

Communications need a language. For our purposes the language expressions need to be processable by systems. Therefore, the language we would like to propose has to be a formal one, and one that follows specific linguistic principles that we will present and explain in the following.

### 2.1 Linguistic Principles

A formal language is the set of all expressions that can be generated by a formal grammar. In general, a grammar consists of a lexicon and a set of rules. The lexicon provides the words of the language, and the rules determine how to combine them. In order to specify the semantics of the language, one has to give meaning to every word of the lexicon. In addition, one has to determine how to concatenate the meanings of the words to form the meaning of an expression. In principle, this entails giving meaning not only to the words but also to the rules. For example, if the terms “to” and “Brussels” are put together by a rule to form the phrase “to Brussels”, the respective rule has to ensure that the location referred to by “Brussels” is specified as the destination (of a moving action) as indicated by “to”.

Linguists use the term “constituent” for expressions that are part of a sentence but nevertheless form information units by themselves. For example, in the sentence “Fritz Meier wants to move from Cologne to Brussels”, there are three constituents besides the verb complex (“wants to move”), namely “Fritz Meier”, “from Cologne”, and “to Brussels”. The first constituent refers to the executer of the action, the

second provides the origin, and the third the destination of the desired move. Constituents fill thematic roles ([2]) within a sentence. In the example, the roles filled are agent (the initiator of the action denoted by the verb = executer), origin and destination. (We will denote thematic roles by underlining them.) The roles can be seen as labels assigned to the information units. A role describes the function of the constituent in question in the context of the whole sentence.

Verbs come with a frame ([3], [4]). The frame determines which kind of constituents are mandatory and which are optional for the verb in question. The linguistic principle of completeness demands the occurrence of the mandatory constituents, and the linguistic principle of coherence prohibit the occurrence of constituents that are not at least optional. To incorporate these principles in a formal grammar is essential to assign the correct meaning to the grammar’s rules. The principles also prevent meaningless sentences like “Christophera Troglodyte-Mignon constructs towards north”. In the example, the principle of coherence is violated as a constituent of type direction is connected to “construct” although “construct” neither requires nor allows such a constituent. In addition, the principle of completeness is violated as “construct” demands a result, namely the result of the construction process, which is absent in the example.

### 2.2 A Formal Language

In the past, we used these linguistic principles (formal grammar, thematic roles, verb frames, and the principles of completeness and coherence) to guide the development of tools in different fields. One is the Command and Control Lexical Grammar (C2LG) developed in cooperation with the centre of excellence for C4I, George Mason University, Fairfax, Virginia ([5], [6], [7], [8]), the other is Language Ware ([9]). For the work described here, we combined these efforts. In a latter section, we will discuss the contribution of Language Ware whereas in this section, we will show what C2LG offers for formalizing A2ABC communications.

C2LG defines a version of Battle Management Language (BML) as proposed by NATO RTO MSG-048 ([10]). The main purpose of a BML is to enable the communication between commanders (and their C2 systems) and simulated units (units in a simulation system): For purposes of training and decision support the simulated units get orders to which they respond and send reports back to their (human) commander. The C2LG allows expressing directives (e.g., requests) ([5]), statements (e.g., reports) ([7]), and intent ([8]). Although C2LG expressions differ in the vocabulary from what we need here, the structure of these expressions and the way they are processed can

be adopted for A2ABC communications. The following shows examples for a request (1), a statement (2), and an intent (3) for which the C2LG rules have been applied to A2ABC communication expressions.

- *Example (1)* request: provide “Fritz Meier” AOK “supplementary health insurance for family” to “Fritz Meier” end before 30/06/09 label-req90024;

This expression is a request from Fritz Meyer to the German health insurance company AOK to provide the supplementary health insurance for his family before the 30<sup>th</sup> of June 2009. The last item in the request is a unique id (label) that is assigned to each expression such that the expression can be referred to.

- *Example (2)* statement: is\_instance\_of “Eccole Europeenne de Bruxelles I” highschool at “B-1180 Bruxelles, Avenue du Vert Chasseur, 46” ongoing at 31/05/09 label-st-76321;

This statement says that the Eccole Europeenne de Bruxelles I is currently a highschool in Brussels, located at Avenue du Vert Chasseur, 46. (This information the system might send to Mr. Meier searching for a highschool in his younger child can enroll.)

- *Example (3)* intent: move “Fritz Meier” from Cologne to Brussels start after /01/07/09/ end not later than 31/08/09 fact label-int-23911;

This expression denotes the intent of Mr. Meier to move from Cologne to Brussels in July or August 2009.

### 2.3 The Role of Intent

We propose that a citizen F (or a business) that enters the e-Government Services first expresses her or his intent, e.g., the intent to move residence from Country A to Country B. The services then can analyse the intent and respond with respective information, especially the whole set of sub-processes F has to take into account and the set of sub-processes that are not mandatory but which might be of use for F’s purpose. If F would enter the services with a request instead of an intent, the services could deal with this request, but they could not call F’s attention to mandatory processes F has to take into account but did not know about. They also could not inform F if his or her request is unnecessary for F’s purpose.

In addition, the services might inform F about their own intent (the administration’s intent) with respect to F’s intent. For example, they might inform F about new development areas in the city F intends

to move to and where the administration would like to see people settle, and may even offer some kind of incentives. In cases in which the services’ customers and the services negotiate on intents they may reach a *common intent* that can be used as a basis for a win-win-situation.

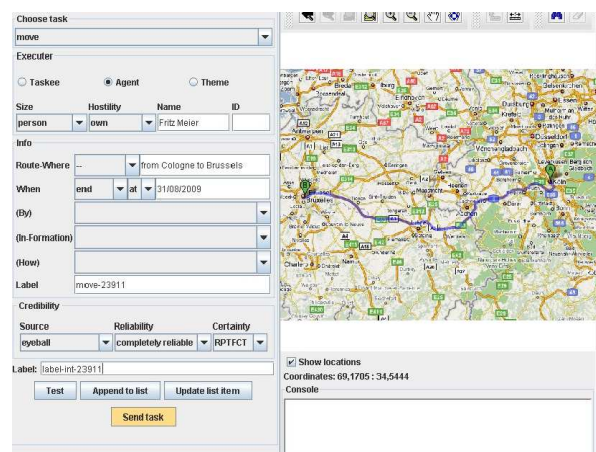
### 3 DEVELOPMENT OF THE LANGUAGE

To develop the formal language fully, we need to identify two things in particular, the lexicon fitting our e-Government domain and the frames (and thus the thematic roles) of the verbs used in this domain. For this purpose, by using Protégé ([10]) we have prototypically defined a core ontology of the domain from scratch to show quick results.

Then we took natural language texts from the domain and applied a linguistic analysis extracting persons, organisations, places, relationships and capabilities. This analysis builds on the existing vocabularies in the product LanguageWare ([9]). As a result, we got sentences like

- agency A issues permit X
- certificate B is needed for application Y
- service provider C belongs to guild Z
- any child between 6 and 16 needs to attend compulsory education in Germany.

Based on these facts, we subsequently identified relevant lexical terms like “agency”, or “income statement” together with their syntactic categories. Finally, we used the facts (in RDF format) to augment the ontology. In the end, we got frames for the verbs used from this approach which allowed us to set up a GUI that can be used to formulate A2ABC expressions (see **Figure 3** for an example).

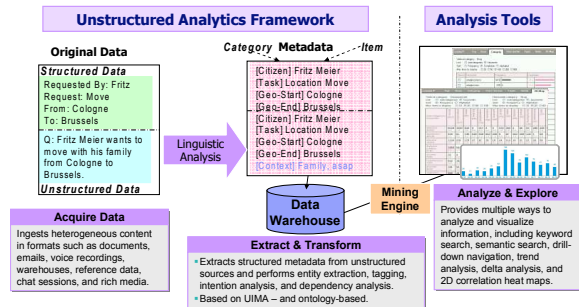


**Figure 3:** Snapshot of the GUI

### 4 LANGUAGE SETS BUSINESS RULES

The language analysis process also had been inte-

grated in a UIMA (the open-source and open-standard unstructured information management architecture) framework ([11]) as shown in **Figure 41**.



**Figure 41:** Linguistic Analysis based on UIMA

The RDF facts extracted by the linguistic analysis were used to augment the ontology and thus to carry on the language development. They were also stored in a data warehouse (RDF triple store) where they can subsequently be searched to detect additional business process rules that govern the life event specific process bundles.

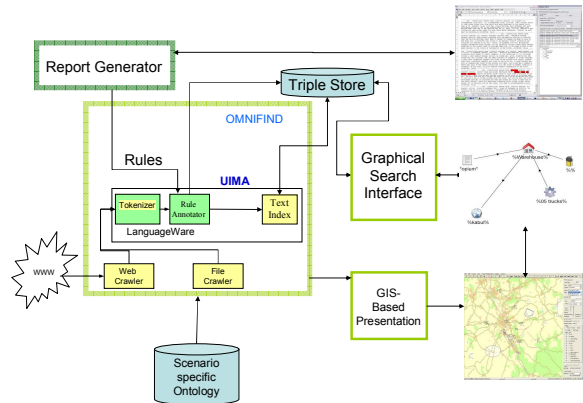
Based on the Object Management Group (OMG) Business Motivation Model (BMM, [12]), business rules and policies govern one-stop government value networks by specifying design aspects other than information and operational models.

The application of policies in the life event context leads to their description with highly structured, discrete and atomic statements – expressed in terms of the task-specific vocabulary. This concept of using structured English to express policies in a practicable and enforceable manner as rules is standardized by the BMM and the OMG Semantics of Business Vocabulary and Rules (SBVR, [13]). Rules within the business architecture are about strategic requirements, not tactical execution. They specify modalities about what is necessary, possible, impossible, obligatory, permitted or prohibited. **Error! Reference source not found.** lists the key modalities defined in SBVR as well as an example for each.

	Modality Type	Example in SBVR Structured English *)
Structural	Necessity	<b>An application always has exactly one point of single contact</b>
	Possibility	It is possible that a <u>process</u> has more than one <u>task</u>
	Impossibility	<b>A transaction never includes another transaction</b>
Behavioural	Obligation	<b>Each transaction must be processed within the set execution time</b>

Permission	<b>An architect may engage a building company</b>
Prohibition	<b>A civil servant must not change the negotiated service level</b>
*) SBVR keywords are given in <b>boldface</b> , terms (names for objects) are <u>underlined</u> and verbs (names for relationships) are <i>italic</i> .	

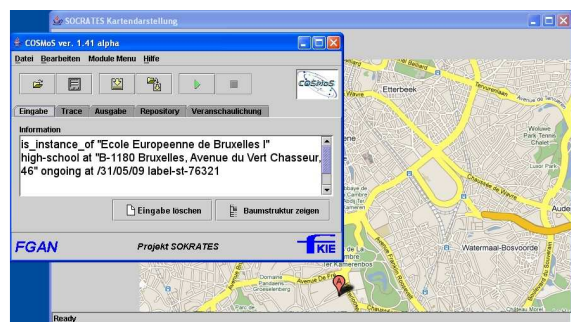
**Table 1:** Types of Business Rules expressed in SBVR Modalities



**Figure 5:** UIMA compliant Analytics Module

These atomic statements can be transformed into complex rules by the use of logical connectors that link the clauses built from relationships in the triple store. **Figure 5** conveys the components behind our case study in which core we use the above-mentioned semantic query builder and semantic search to provide Fritz Meier with the necessary information and subsequent task list for processing his request to move from Cologne to Brussels as a semantically-enabled citizen self-service.

For the presentation of the information, we modified the so-called “Socrates” tool which has been developed for graphically presenting the content of military reports on a map ([14]). **Figure 6** shows the adapted Socrates displaying the information of example (2) above.



**Figure 6:** The adapted Socrates Tool for displaying geo-based Information

## 5 SUMMARY

In this paper, we have described the semantics of the business architecture of pan-European e-Government services as well as the building blocks of an agile SOA foundation fabric to support them.

We have also shown how a complete business process management language based on linguistic principle can help support decision makers and administration service applicants by recognizing the common intent for a task at hand.

For the sample scenario, the next step will be the implementation in a widely accessible demonstration center based on a robust SOA infrastructure as described in [15]. Certainly, we also encourage the semantic modelling of other life events leveraging the same approach.

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