RAL Solver: a Tool to Facilitate Resource Management in Business Process Models[⋆]

Cristina Cabanillas, Adela del-Río-Ortega, Manuel Resinas, and
Antonio Ruiz-Cortés

Universidad de Sevilla, Spain
{cristinacabanillas, adeladelrio, resinas, aruiz}@us.es

Abstract. Business process (BP) modelling notations tend to stray their attention from resource management, unlike other aspects such as control flow or even data flow. On the one hand, the languages they offer to assign resources to BP activities are usually either little expressive, or hard to use for non-technical users. On the other hand, they barely care about the subsequent analysis of resource assignments, which would enable the detection of problems and/or inefficiency in the use of the resources available in a company. We present RAL Solver, a tool that addresses the two aforementioned issues, and thus: (i) allows the specification of assignments of resources to BP activities in a reasonably simple way; and (ii) provides capabilities to automatically analyse resource assignments at design time, which allows extracting information from BP models, and detecting inconsistencies and assignment conflicts.

1 Motivation

Business processes (BPs) are often analysed in terms of control flow, temporal constraints, data and resources. From all of these aspects, resources have received much less attention than other aspects, specially control flow. However, the participation of people in BPs guides the execution of BPs, so human resources should be considered when designing and modelling the BPs used in an organization. In the following we present a tool that is the result of previous work we have carried out addressing different problems on human resource management (*resource management* for short) in BP models [1, 2].

In [1] we dealt with the assignment of resources to the activities of a BP model, aiming at easing and improving the way resources can be associated to the process activities. Some approaches pursuing a similar purpose had been introduced in the last years [3–5], but they were in general either too complex to be used by technically unskilled people, or not expressive enough to provide powerful resource management in workflows (WFs) and BPs. In that work

[⋆] This work has been partially supported by the European Commission (FEDER), Spanish Government under project SETI (TIN2009-07366); and projects THEOS (TIC-5906) and ISABEL (P07-TIC-2533) funded by the Andalusian Local Government.

we introduced RAL (Resource Assignment Language), a DSL (Domain Specific Language) specifically developed to express resource assignments in BP activities. RAL expressions cover from simple assignments of activities to specific individuals of the company, to complex assignments containing access-control constraints (e.g. Segregation of Duty -SoD-) between activities, as well as compound expressions. As can be seen in the following examples, its syntax close to natural language increases its understandability:

```
RAL 1: IS Samuel
RAL 2: NOT (IS PERSON WHO DID ACTIVITY CreateResolutionProposal)
RAL 3: (HAS ROLE DocumentWriter) OR (HAS ROLE DocumentSigner)
```

In [2] we presented the design-time analysis capabilities provided by RAL. In particular, information such as (i) the potential performers of each BP activity, i.e., the set of people that meet the resource-related constraints imposed in the model (by means of assignment expressions); or (ii) the potential set of activities each person of an organization can be allocated at run time; can be automatically obtained from *RAL-aware BP models*. This has been managed by providing formal semantics to RAL based on description logics (DLs), which allows us to use DL reasoners to automatically infer information about resource management from RAL expressions. Some benefits of design-time resource-related analysis are that it informs the company about the possible workload of its employees, and warns about potential allocation problems that may arise at run time. Furthermore, it eases the detection of inconsistencies between the resource assignments associated to activities of a BP model and the structure of the organization where it is used, e.g. non-existent roles or persons.

RAL Solver has been developed both to prove the use of RAL expressions in BP models, and the benefits of its DL-based semantics to analyse RAL-aware BP models.

2 RAL Solver. Definition and Architecture

As explained in [1], RAL can be easily used in conjunction with BPMN 2.0 [6], but it could also be integrated into other WF modelling notations, provided that they offer some mechanism to include resource assignments in a process model. In the case of BPMN, class *ResourceAssignmentExpression* works as an extension mechanism that allows to specify free resource assignments. These expressions are specifically configured in class *FormalExpression*, which contains two main attributes. In our case, attribute *language* would take value "RAL" and the RAL expression would be set in attribute *body*.

RAL Solver has been implemented as a plug-in for Oryx, a powerful process modelling infrastructure that emerged as an Academic Initiative of researchers of the HPI in Potsdam [7]. What we do is to add RAL assignments to the activities of the BPMN diagrams modelled with Oryx, making use of the aforementioned BPMN features. Besides, the organizational structure of the company that uses the plug-in has to be modelled as an ontology (*myOrganization.owl*) on the basis

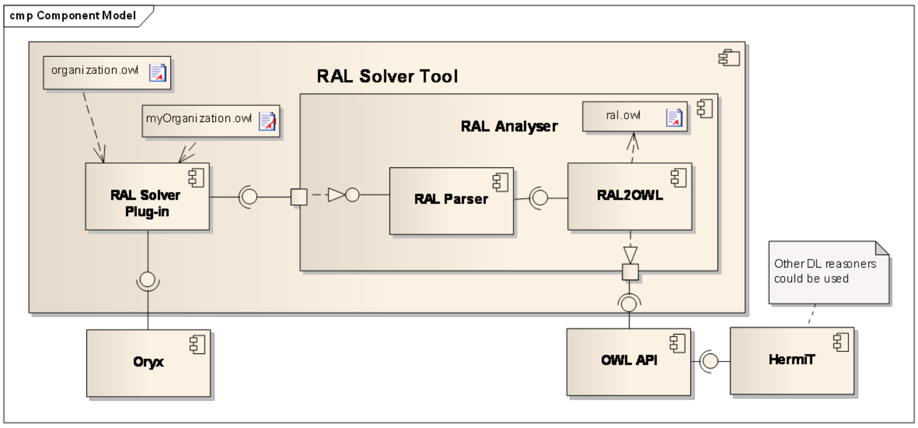


Fig. 1: RAL Solver's Architecture

of an ontology provided by RAL (*organization.owl*), which is implicitly included in the tool. This can now be done with an ontology editor such as Protégé[1], but we intend to automate this task so that *myOrganization.owl* is automatically generated from the organizational model of the company.

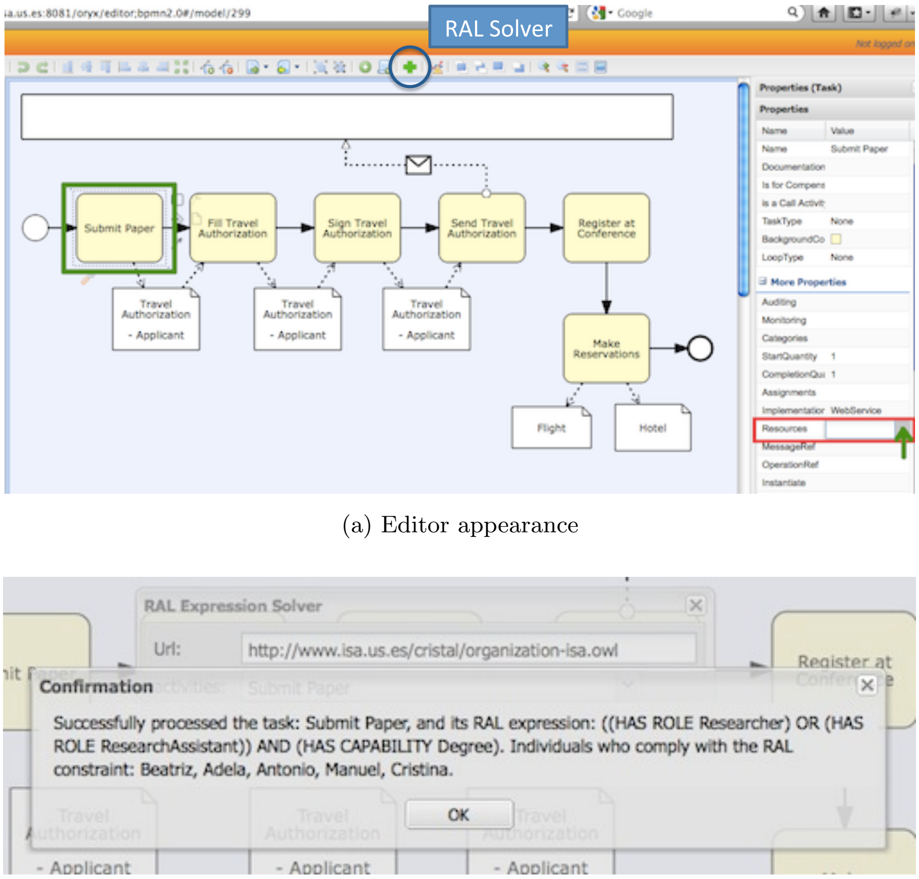
After receiving these entries the *RAL Analyser* component is launched. This component could also be integrated and used in other platforms. Within it, *RAL Parser* takes the RAL expressions of the BP activities and defines them with *XText*[2] in order to check their syntax and prepare them for the next step. Then, the RAL expressions are automatically mapped into an OWL ontology necessary to later infer knowledge related to how resources are managed in the process. File *ral.owl* is thus created by component *RAL2OWL*. Finally, *OWL API* is used to check the ontologies, and a DL reasoner can be used to compose and execute analysis operations over the resource assignments (in our case *HermiT*).

3 How to Use the Tool

The current version of RAL Solver allows the design-time analysis of RAL-aware BPMN models to calculate the set of candidate persons to perform every activity of a process.

Our distribution of Oryx including the plug-in can be accessed by opening `http://labs.isa.us.es:8081/backend/poem/repository` in Firefox. As shown in Figure 2a, Oryx lets modify certain properties of the BP activities, among them the resource assignments. In the emerging window the RAL expression must be written in field *ResourceAssignmentExpression* and, optionally, we can set field *Language* to *RAL* to give further information about the language

[1] `http://protege.stanford.edu/`
[2] `http://xtext.itemis.com/`



(a) Editor appearance

Url: http://www.isa.us.es/cristal/organization-isa.owl

Activities: Submit Paper

Successfully processed the task: Submit Paper, and its RAL expression: ((HAS ROLE Researcher) OR (HAS ROLE ResearchAssistant)) AND (HAS CAPABILITY Degree). Individuals who comply with the RAL constraint: Beatriz, Adela, Antonio, Manuel, Cristina.

(b) Result of the analysis

Fig. 2: Integration of RAL Solver into Oryx

used. Afterwards, when we run RAL Solver we must indicate the *myOrganization.owl* file we are going to use as organizational structure, and select the BP activity for which we want to know the potential performers. The result of the analysis is returned in a new window as illustrated in Figure 2b.

With this analysis operation we get to know whether, given a collection of resource assignments, all the activities of the process can be performed at run time or, on the contrary, certain constraints set produce the absence of potential performers for any task. To implement more analysis operations we would make use of other operations provided by the DL reasoner.

Further information about RAL, its analysis features, and how to use RAL Solver can be found at `http://www.isa.us.es/cristal`. The tool is available on demand via email.

References

1. C. Cabanillas, M. Resinas, and A. Ruiz-Cortés, “RAL: A High-Level User-Oriented Resource Assignment Language for Business Processes,” in *Business Process Management Workshops (BPD’11)*, pp. 50–61, 2012.
2. C. Cabanillas, M. Resinas, and A. Ruiz-Cortés, “Defining and Analysing Resource Assignments in Business Processes with RAL,” in *ICSOC*, pp. 477–486, 2011.
3. A. Awad, A. Grosskopf, A. Meyer, and M. Weske, “Enabling Resource Assignment Constraints in BPMN,” tech. rep., BPT, 2009.
4. C. Wolter, P. Miseldine, and C. Meinel, “Verification of Business Process Entailment Constraints Using SPIN,” in *Engineering Secure Software and Systems*, vol. 5429 of *Lecture Notes in Computer Science*, pp. 1–15, Springer Berlin / Heidelberg, 2009.
5. M. Strembeck and J. Mendling, “Modeling process-related RBAC models with extended UML activity models,” *Inf. Softw. Technol.*, vol. 53, pp. 456–483, 2011.
6. “BPMN 2.0,” recommendation, OMG, 2011.
7. G. Decker, H. Overdick, and M. Weske, “Oryx - an open modeling platform for the BPM community,” in *Business Process Management (BPM)*, pp. 382–385, Springer-Verlag, 2008.