The use of Business Rules with Workflow Systems

Anthony Rowe[1], Susie Stephens[2], Yike Guo[1]

1- InforSense Ltd
2 - Oracle.

Background

Classic Rules Systems

The classic approach to rules based computational systems comes from work on logical programming and deductive databases. Such theoretical concepts have found practical use in expert system shells[i] and in the development of rational agent based systems[ii].

Logic based systems typically use a collection of Condition -> Action rules to encode the behaviour and response of the system to a specific set of events. These systems function by having a working memory of facts. By adding, removing or changing facts in the working memory, the rules system can see which (if any) rules need triggering. If the effect of a rule changes a state in the working memory then rules will be re-evaluated.

These systems suffer due to the large effort involved in generating the original rules base for any reasonable sized problem, and by the need to check that the rules base that is generated is sound and consistent. In addition, during the execution of the system, the fact table needs to be maintained so that it is consistent with the external world that it is modelling.

Business Rules Systems

The current set of commercial Business Rules systems seek to apply aspects of rule technology to build rules based logic into specific business processes. We briefly describe two such systems.

One is an embeddable rules engine such as that provided by iLog[iii]. The iLog system provides an embeddable business rules engine such that any specific business application can be linked to a rules-based reasoning system. Rules are specified in a simple to use "if -> then" format. A business application can add/remove and change the state of business objects in the working memory, and allows the rules engine to reason about these and update the original application by triggering events or invoking specific processes based on the outcome of the rules.

An alternative approach to including rules in an application is to use rules for the decision-making capabilities as part of a workflow based solution. One example of this is a rules modelling system provided by Rules Power[iv]. Rules power uses a workflow model to describe a business process and has embedded in the workflow the ability to include business rule based decision making points that can operate over predefined business objects.

Semantic Web

The Semantic Web[v] project seeks to find standard representations for data and methods that are used in the project. Recently this has involved the definition of OWL to define ontologies. The ontology model provides details about objects and their relationships to each other. As such it can be used to model the business objects that are used in business rules systems.

InforSense Workflow

InforSense[vi] provides a software product called InforSense KDE. The core technology is a workflow system that has been heavily used for developing analytical workflows in the life science and business intelligence worlds.

The main difference between InforSense's workflows and Rules Power's workflows, is that InforSense provides a *data centric* approach rather than the more process centric model used by Business Process Modelling (BPM) systems.

The data centric nature of the InforSense system enables workflows to combine heterogeneous data sources, perform data transformations and provide analytical tools such as data mining functionality in a structured process-oriented fashion.

The data centric model allows large collections of data to be processed and passed between different functions within the workflow. Recently this capability has been extended to invoke specific functions in the Oracle[vii] Database such as Oracle SQL, Oracle Data Mining, Oracle Text, and Oracle Statistics.

The data centric functionality allows us to operate directly over data and metadata in the database so that users can develop complex processes without having to move data out of the production database.

THE USE OF RULES IN WORKFLOW SYSTEMS

Currently we have described two classes of business workflow systems: Process centric systems such as BPM and data centric systems such as those provided by InforSense for analysis and data transformation.

Process centric workflow systems compose different tasks together into a process. Each of these tasks represents an action that the workflow author considers to be an atomic part of the workflow.

Process centric workflows use business rules to imperatively make decisions during the flow. For example, "if credit risk is > 50% then refuse loan" or if data collection is complete then email data owner. These types of rules are all encapsulated in a rules task in the workflow and an embedded rules engine is used (when invoked) to process over the current state of the business objects to see if the conditions of any rules are met and subsequently execute any resulting action.

Data centric workflows use expressions within workflows to make decisions about individual items of data. These expressions are typically realised as filtering processes that select a subset of data that meets certain conditions, for example: “filter all genes where the expression value is < 2”.

Filters are the closest a pure data centric workflow system has to business rules. These types of filter could be considered rules with one limitation: The filter only acts over the data, there is no model to operate on an external business objects or to invoke some other type of action.

A standard for business rules should be able to express rules that operate in both the process centric and data centric worlds.

Application of Business Rules to InforSense

It is clear that both models of workflow described so far use rules for there own purpose. However typically they have been used independently to solve different problems.

We propose that both the process centric and data centric models be combined into a system for performing analysis of data. Because it allows a separation of the business logic and the implementation of the specific steps required to build that task.

As an example we consider a specific task from Cheminformatics: The design of a new chemical library. The process looks like:

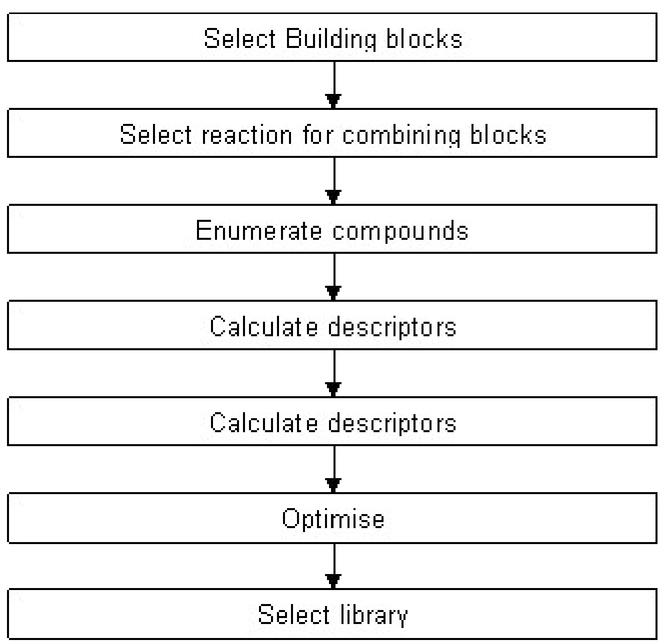

Figure 1. Workflow for designing a new chemical library.

Each of the steps above represents a high level task. However, many of the steps are independent and could also be applied in different Cheminformatics tasks.

The process-based model efficiently deals with the tasks at an end user level abstracting them to an ordered list of tasks that need to be performed. In short, it represents *what* the process is. What this process does not show is *how* each of these individual tasks is implemented.

Opening up each of the steps enables us to drill down to the implementation of the task. It is the implementation of each of the tasks that is the data centric part of the process. Returning to our chemistry example we show how one specific task is implemented.

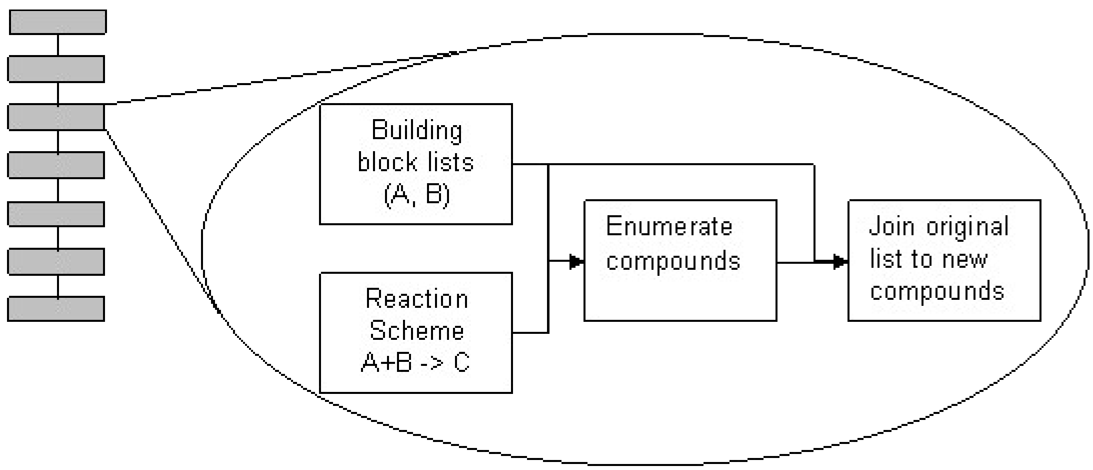

Figure 2. Rules involved in the implementation of a cheminformatics task.

The implementation of each of the cheminformatics tasks is an individual data centric workflow. The task takes an initial data set(s), performs the necessary data transformations, , runs any specified modelling steps, and then post processes the data into the required format for the results.   Results of each implementation step are made available to the next task in the high level workflow.

As individual users follow the high level process to answer a specific problem, the workflow system automatically invokes the implementation of the next task in the workflow.

By combining the two different workflow models, business rules can be undertaken at both the task level for automating different decisions and at the data level for implementing filters over the data.

Business rules can also be used to define operational features of a workflow, such as what to do when a specific task fails.

CONCLUSIONS

We show a model of how rules are important in the design and execution of workflows and how different classes of workflow systems express rules.

We describe how for scientific data intensive applications both workflow models are required to separate the actual scientific tasks being performed from the implementation of those tasks.

Finally we conclude that both rules and business objects definable by ontology are crucial components to the implementation of workflow systems. The definition of a rules standard must be developed not just as an extension to the existing Semantic Web technology i.e. to add rules based reasoning on top of ontologies, but by the requirement of technologies like workflow that will consume and execute the rules as part of a larger application.

[i] http://herzberg.ca.sbandia.gov/jess/
[ii] http://www.agentlink.org/
[iii] www.ilog.com
[iv] www.rulepower.com
[v] http://www.w3.org/2001/sw/
[vi] www.inforsense.com
[vii] www.oracle.com