YAWL4Industry: Reflections on using YAWL for Industry Projects

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Abstract. The Yet Another Workflow Language (YAWL) language and environment has been used to prototype, verify, execute and analyse business processes in a wide variety of industrial domains, such as telephony, construction, supply chain, insurance services, medical environments, personnel management and the creative arts. These engagements offer the YAWL researcher community a great opportunity to validate our research findings within an industry setting, as well as discovery of possible enhancements from the end user perspective. This paper describes three such industry projects, discusses why YAWL was chosen and how it was used in each, and reflects on the insights gained along the way.

Keywords: YAWL, Case Studies, Industry Experience, Deployment, Uptake

1 Introduction

The YAWL language and environment is well-known in the areas of research, for topics such as verification, configuration, exception handling, visualisation, risk-awareness and cost-awareness, and teaching, having been taught in the courses of at least 36 universities across 20 countries. Originally intended as a reference implementation of workflow patterns, the open-source YAWL environment provides an ideal testbed for novel research ideas. In the decade since the YAWL language was first developed, we, as YAWL researchers, have modelled numerous YAWL processes that reflect various scenarios in different application domains – ranging from structured transactional processes (e.g., insurance claim, travel booking, conference paper review processes) to manual and flexible processes (e.g., scheduling of medical operations). In most cases, our main focus is on *evaluating a specific research artefact*. Hence, we abstract from things that are less relevant to our purpose, for example, in a particular research project we might not spend much time on the development of intuitive user interfaces or we might not fully integrate a YAWL process with external systems. In addition, there may be limited stakeholder involvement in terms of user acceptance testing of the results of particular projects.

In recent years, a number of organisations have initiated YAWL deployments to prototype, verify and execute their business processes. This paper summaries

the insights gained from our involvement in such projects in three different domains: construction, the creative arts, and telephony, whereby we *demonstrated how YAWL can be used to model and automate processes within a particular domain* in collaboration with domain experts who were actively involved in requirements analysis and design, process modelling, implementation and acceptance testing of the resulting system.

2 Case Studies

Each of the selected case studies was undertaken in close collaboration with domain experts, and each case delivered a YAWL environment tailored to organisational needs. The prototype process for construction is used for demonstration purposes, the YAWL4Film system was trialled and deployed in the real film production setting, and the system developed by first:utility was for ongoing production. A brief overview of the three case studies is given below.

2.1 Construction

Construction processes are complex, involving planning of activities from design to build, coordination between various teams (e.g. designers, contractors, builders, engineers, inspectors), and intensive use of building materials, equipment, and tools. In recent years, off-site manufacture (OSM) has been recognized as an effective way to reduce cost at the procurement stage of construction. Currently, construction management practices are predominantly manual and founded on the project manager's experience. This case study aimed to demonstrate how business process automation techniques can assist in capturing OSM requirements within a construction project.

A collection of process models (using BPMN notation) that represent the generic construction value chain was developed [2]. Based on the input from the domain experts from the Australian construction industry, key activities, resources, data and stakeholders involved in each activity within the construction value chain were identified. A prototype YAWL application was then developed to showcase the ability of workflow systems to support and coordinate OSM-related process activities [7] and demonstrated to stakeholders. The YAWL environment was chosen due to its ability to coordinate multiple parties involved in a construction project as well as its comprehensive support for rapid prototyping.

2.2 YAWL4Film

Processes in the field of screen business are characterised with high demands for creativity and flexibility. A typical process is one that supports film production, an important phase that encompasses when the majority of cast and crew are contracted and the majority of the equipment and resources are utilised. A film production is a highly manual process that requires handling large amounts of heterogeneous data on a daily basis and coordinating many geographically

distributed stakeholders. The benefits offered by applying automation to such a process are twofold: it may ultimately reduce the production costs by minimising errors and delays; and by saving time otherwise spent in costly and tedious procedural tasks, the production team can focus more on creative activities thus increasing the quality of the final product [4].

The development of a prototype system, namely *YAWL4Film* demonstrated that the benefits stated above can be brought to the field of screen business through the application of workflow technologies [3]. The process model captures the control flow (see Figure 1), data and resource perspectives of a standard film production process. An important feature of YAWL4Film lies in the modelling of intensive data associated with the process, which had led to the development of *customised user forms* to support templates used in professional film making, and implemented using JSP, XSLT, and related Web technologies. A trial application of the system was conducted during two student productions at the Australian Film, Television and Radio School in 2007, which was followed in 2008 by real deployment of the system in the production of a medium-budget feature film by Porchlight, an independent film production company.

2.3 first:utility

First Utility Ltd (first:utility) is an independent utilities group based in the United Kingdom. Amongst other interests, it provides a variety of competitive telephony services to its customers, through the leasing of wholesale telephony lines from British Telecom (BT), which it on-sells to customers at competitive rates [1]. BT provides a *Service Providers Gateway* (SPG) through which providers can access BT's internal systems. The gateway may be accessed via a browser based session, which is slow and open to input and transaction errors, or via an API, which is suitable for high volumes of order processing. Of particular interest is the use of the SPG to place an order to have a customer's telephone line transferred from BT to the provider. However, processing an order can involve a number of potential errors, or *exceptions*, which require suitable recovery and retry processing to ensure an order can be successfully completed.

An implementation of the YAWL environment was chosen by first:utility to provide workflow support for both back-office automation and the human-controlled work activities of their Customer Relationship Management (CRM) systems. For back-end automation such as the line transfer order process, YAWL provided a number of advantages. One was the ease with which a custom service could be developed to interface with the SPG. Another was the various mechanisms available to build-in exception detection and recovery into long-lived processes by design. For CRM workflows, first:utility developed their own worklist extension that generates web-based forms using runtime attributes and XSLT transformations.

3 Insights

3.1 The YAWL Language

For all three case studies, the YAWL language was found to be capable of supporting all the required control flow behaviours for the processes, making use of various complex control flow constructs including multiple instances, cancellation, advanced synchronisation, composite and timer tasks [6]. For example, Figure 1 shows the YAWL model of the film production process. Using an OR-join together with loop constructs, we were able to specify precisely the process logic in a less 'crowded' way. The graphical notation of YAWL was found to be easily understood by designers, domain experts and stakeholders. For the resource perspective, most tasks were modelled using the role-based allocation mechanism with additional constraints making use of separation of duties, retain familiar and pile execution resource patterns where appropriate. For the data perspective, the support for user-defined complex XML datatypes made the task of defining the data requirements straightforward.

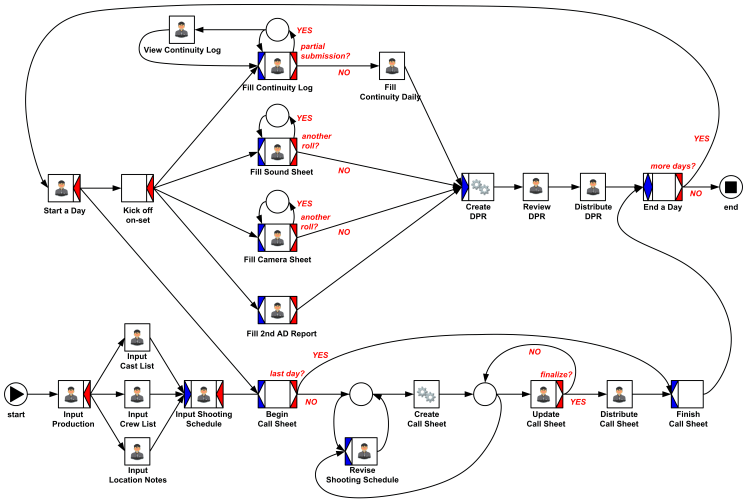

Fig. 1. The YAWL model of a film production process [3].

3.2 The YAWL Framework

Because the YAWL environment is built on a Service Oriented Architecture, it allows the central workflow engine to be readily extended through the development of value-added services [5]. A number of services are included in each YAWL core deployment, including those that extend the environment to include

the resource perspective, flexibility and exception handling, inter-process interoperability, resource and activity scheduling, cost-awareness, document sharing, email services and simulation. The environment can be further extended by organisations developing their own custom services to perform specific activities, such as the first:utility SPG interfacing service described earlier. In addition, by introducing a small number of extensions to the environment, first:utility was able to suspend and resume cases and manually raise compensation processes to manage exceptions.

Another advantage of the YAWL environment that made it attractive to first:utility was its scalability. With many thousands of concurrent process instances, first:utility was able to scale the environment across a number of servers, running several engine instances in parallel. They also created a 'quarantine' server, where processes that had experienced a failure could be ported and closely examined to determine the root cause of the problem. Once rectified, the process could be moved out of quarantine and back into the production environment.

Fig. 2. An example dynamic form (with extended attributes) created for the construction workflow case study.

3.3 User Customisations

Although the auto-generated web forms provided by the YAWL environment are very useful for rapid prototyping purposes, we found that most end users prefer customised web forms in the final product. The YAWL environment supports this customisation requirement in two ways. First, by using the extended attributes feature, the colour, font and label names of auto-generated forms can be customised at design time. This enables a YAWL consultant to quickly change the look-and-feel of auto-generated forms.

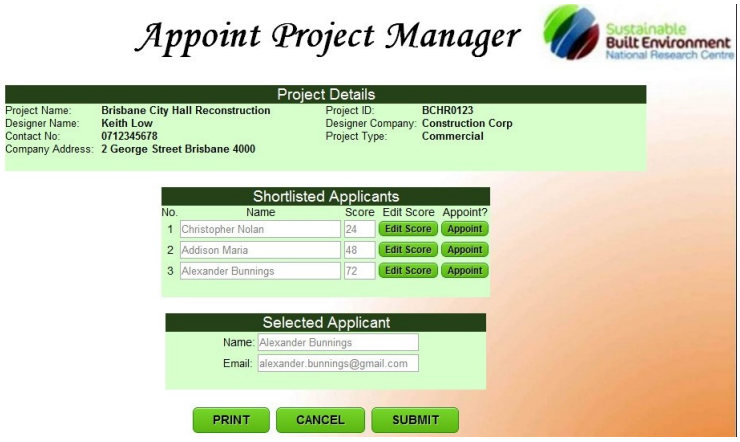

Fig. 3. An example custom form created for the construction workflow case study.

Figure 2 illustrates a screen shot of a dynamic form created for the construction workflow case study where the colour theme of the SBEnrc centre was utilised. Second, by allowing a custom web form to be associated with a YAWL task, a YAWL consultant is free to create custom forms from scratch and also add new functionalities to the form. In Figure 3, the user interface for the "Appoint Project Manager" task for the construction process is shown (where three additional functionalities were added - "Edit Score", "Appoint" and "Print"). A significant amount of time was spent to develop intuitive and easy-to-use user interfaces in all three case studies. This customisation capability is found to be an essential feature in improving usability and user acceptance of the YAWL environment within an industry setting.

4 Conclusion

Based on our experience in applying YAWL within industry settings, the key strengths of the YAWL environment can be summarised as follows.

- The YAWL language is expressive and supports all necessary constructs for industry projects.
- The YAWL environment is an excellent tool for rapid prototyping.
- The extensibility of the open-source YAWL environment makes it possible for organisations to develop their own customised services.
- The YAWL environment enables the development of customised user interfaces allowing organisations to ensure consistent look and feel across their applications.

Some of the key lessons learned from our experience to develop and deploy a YAWL system are as follows. First, although it is quick to develop a working

YAWL prototype, a significant amount of project time is spent on developing customised user interfaces and custom services in most cases. Secondly, to develop a YAWL system that makes appropriate use of complex control flow constructs supported by the YAWL environment, a YAWL consultant should be well versed in the semantics of the YAWL language. The same is true for the data and the resource perspectives supported by the YAWL environment. Finally, a YAWL consultant should take into account the fact that the YAWL environment is an open-source research environment with functionalities being added by many participants over time and that some of these functionalities may not have been extensively tested before their release.

Work currently in progress, including a redesign of the YAWL Editor and an automated system update facility, may encourage more widespread adoption of the YAWL language and environment in industry. More extensive training materials have also been identified by designers and domain experts as desirable.

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