Camera, Set, Action: Automating Film Production via Business Process Management

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Abstract: The application of Business Process Management (BPM) technology can provide significant benefits to an organisation in terms of e.g. cost savings and responsiveness to changes. In this paper the application of this technology in the context of film production is investigated. A prototype called YAWL4Film was developed on top of a state-of-the-art BPM system. YAWL4Film supports collection and entering of production related data and automatic generation of reports required during film production. This system was deployed in two pilot projects at the Australian Film Television and Radio School.

Keywords: Business Process Management (BPM), YAWL, YAWL4Film, Screen Business, Film Production, Production Management, Production Office, Film and TV Scheduling.

1. Introduction

In recent years the field of *Business Process Management* (BPM) has risen to prominence in terms of its perceived importance by the IT industry. Successful BPM implementations may lead to significant efficiency gains, may help demonstrate compliance with standard practices and procedures, and may increase adaptiveness to changes in the environment in which a business operates. While there are several definitions of BPM sometimes emphasising different aspects, a core notion is the concept of *business process*. Examples of business processes include the processing of insurance claims, mortgage applications, and travel requests. BPM is concerned with the lifecycle of these processes, which not only involves their brief and execution, but also e.g. their post-execution analysis and subsequent improvement (van der Aalst, ter Hofstede, and Weske, 2003).

While BPM technology has reached a certain level of maturity in recent years and has great potential to deliver benefits in a wide range of application areas, it is typically applied by medium to large companies with a high adoption level of information technology. As part of the ARC Centre of Excellence for Creative Industries and Innovation (CCi)[1], we move well beyond the typical use of BPM and investigate how the application of BPM technology can deliver benefits to the field of *screen business*.

[1] CCi's website is available at http://www.cci.edu.au/.

The screen business comprises all creative and business related aspects and processes of film, television and new media content, from concept to production and finally distribution. A value chain model for the screen business consists of four major phases: *development*, *pre-production*, *production*, and *post-production* (Clevé, 2006). Whether it is a live action drama with actors, a documentary or animation, the production period is generally the most expensive in screen business. It is during production that the majority of cast and crew are contracted and the majority or equipment and resources are utilised. A production can be as short as a day, or last several years. During each shooting day, a number of activities such as acting, visual effects, camera and sound recording are performed in studio or on location. Whilst shooting is taking place, designated onset crew collect the information associated with each of these activities via corresponding production forms. For example, the Camera Assistant is responsible for filling in the camera sheet with details of each shot recorded while the Sound Recordist will complete a corresponding sound sheet of all dialogue or effects recorded on set. This information is later gathered and collated by the production offer to generate the daily progress report. The production office also monitors requirements for the subsequent shooting days and communicates this information prior to the start of the next shooting day. Traditionally the forms and reports are purely paper-based and the production of these documents is a highly manual process. Not surprisingly, such a process is time-consuming, tedious and error-prone, and can easily increase the risk of delays in the schedule.

In this paper, we demonstrate how film production can benefit from the application of BPM technology and discuss how we overcame innovation barriers that exist in the industry. In particular, a prototypical environment was developed that assists with the production of various forms and reports during the shooting of a film and ensures that information is available to cast and/or crew at the right time. The prototype, namely *YAWL4Film*, aims at automating the daily document procedure as much as possible by reducing manual data entry, by avoiding data re-entry and by performing the required data calculation, aggregation and synchronisation. The benefits are twofold. Firstly, the process automation may ultimately reduce the production costs by preventing errors and delays. Secondly, by saving time otherwise spent in costly and tedious procedural tasks, the production team can focus more on creative activities, such as problem solving, thus increasing the quality of the final product. This paper discusses the functionality offered by YAWL4Film and evaluates the system based on its trial application during two film productions at the Australian Film, Television and Radio School (AFTRS) in October 2007.

2. Research Methodology

As we were developing a new artifact in this research activity, we were faced with the fact that we had no access to empirical evidence. In order to deal with this challenge, there were extensive interactions with domain experts which formed the basis of the prototype deployed during the student film productions at the AFTRS. Hence, the research approach can be seen as in line with the Design Science methodology. There are seven guidelines for this methodology as reported by Hevner et al (2004).

The design of a purposeful IT artifact (Guideline 1) follows the observation that business process management in the screen business is widely regarded as important but not sufficiently addressed (Guideline 2). Through the close collaboration between Queensland University of Technology (QUT) and the AFTRS sufficient access to domain experts was available which was used for development and evaluation of our artifact (Guideline 3). Our research aims to contribute to the field of screen business (Guideline 4) and due to its roots

in established theory we regard the result as rigorous (Guideline 5). The research process though is not finished and the resulting artifact requires continuous questioning, revision, and extension (Guideline 6). This process is guided by exposing the research to both the IT community, among others through publications, and the screen business community, which includes the AFTRS (Guideline 7).

3. Dealing with Innovation Barriers

The barriers to innovation in the film industry are significant. They arise from the project orientation of the industry – the fact that production is organised as and when financing and other preconditions are satisfied. Cast and crew come together specifically to execute a pre-arranged production plan. They do not interact in a conventional corporate framework, with opportunities for training and experimentation. Innovation is therefore problematic for a production. Not only may it involve unplanned expenditure and risk in a context where risk and expenditures are tightly controlled, it is simply not part of the common, learned routines of the group. In designing process innovations such as those described in the paper, we have sought to counter anticipated resistance through a combination of measures including: careful negotiation of trial implementations with key production personnel, parallel implementations where traditional *paper*-based processes run alongside the new process, paying attention to design elements in the technology interface (this is an industry where design matters), and delivering a package of functions that fit users' expectations.

4. System: YAWL4Film

In the field of BPM, *workflow management systems* are a class of software that supports business processes by taking on their information logistics, i.e. they ensure that the right information reaches the right person at the right time (van der Aalst and van Hee, 2002). The word "workflow" here is used as a synonym for "business process". YAWL (Yet Another Workflow Language) (van der Aalst and ter Hofstede, 2005) is an open source workflow management system[2] with a well-established foundation partially derived from insights gained from the well-known Workflow Patterns Initiative[3]. The system offers comprehensive support for construction and enactment of process models with complex control flow, information handling and resource allocation, and is easily extensible.

YAWL4Film is developed over the general YAWL system to support the automation of film production processes. Hence, the order in which tasks need to be executed, the information they require and produce, and the roles that may perform them are formally captured. In addition customised forms were made for the manual tasks based on paper-based forms currently in use. During the shooting of a film, the resulting system thus can present required information to the involved cast/crew members at the right time using a professional look-and-feel.

3.1 Film Production Process Model

Figure 1 depicts the YAWL model capturing a film production process. Tasks are drawn as rectangles that may have an icon indicating whether they are *manual* or *automatic*. Intuitively, a manual task requires a user to enter information, while an automatic task is performed by the system (e.g. the generation of a specific report). A task without an icon represents a step in the process that exists purely for routing purposes. It is hoped that the

[2] The YAWL system can be downloaded at http://sourceforge.net/projects/yawl.
[3] The website of Workflow Patterns Initiative is available at http://www.workflowpatterns.com/.

subsequent informal explanation of the process together with the legend of Figure 1 provides a sufficient explanation to understand the process model shown.

The process begins with the collection of specific production documents (e.g. cast list, crew list, location notes, and shooting schedule) generated during the pre-production phase. Next, the shooting process starts and is carried out on a daily basis. Each day, tasks are performed along two main parallel streams: one involving the production of a call sheet, the other involving the production of the Daily Progress report (DPR).

The stream involving the production of a call sheet starts with the task *Begin Call Sheet* and ends with the task *Finish Call Sheet*. A call sheet is a daily shooting schedule for a specific day. It is usually maintained by the production office and is sent out to all cast and crew the day prior. A draft call sheet can be created from the shooting schedule. It may go through any number of revisions before it is finalized, and most of the revisions result from the changes to the shooting schedule.

The stream involving the production of a DPR starts with the task *Kick Off on-set* and ends with the task *Distribute DPR*. As mentioned specific crew members on set collect data regarding on-set activity. The Continuity person fills in the continuity log and then the continuity daily report, the Sound Recordist produces the sound sheet, the Camera Assistant produces the camera sheet, and the 2nd Assistant Director (AD) is responsible for the 2nd AD report. It is possible to interrupt filling in the continuity log and the 2nd AD report, e.g. for a meal break, and then to resume the work after the break. Also, there can be many camera and sound sheets to be filled in during a shooting day. Upon completion of these on-set documents, a DPR can be generated and passed onto the Production Manager for review. After the review is finished, the DPR is circulated to certain crew members such as Producer and Executive Producer.

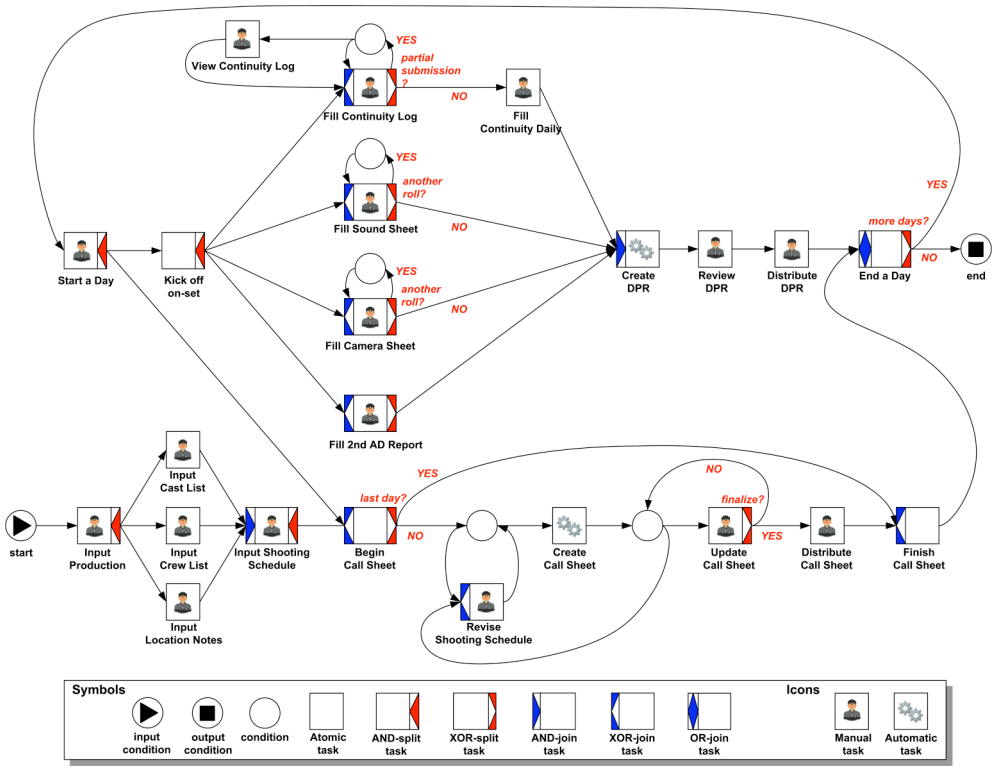

Figure 1. A film production process model in YAWL.

3.2 Customised User Forms

The film production process model of Figure 1 can be executed via the YAWL engine to support a running production. Performing a manual task requires a user to enter information in a form. In YAWL4Film these forms are custom-made Web forms based on templates used in professional filmmaking.

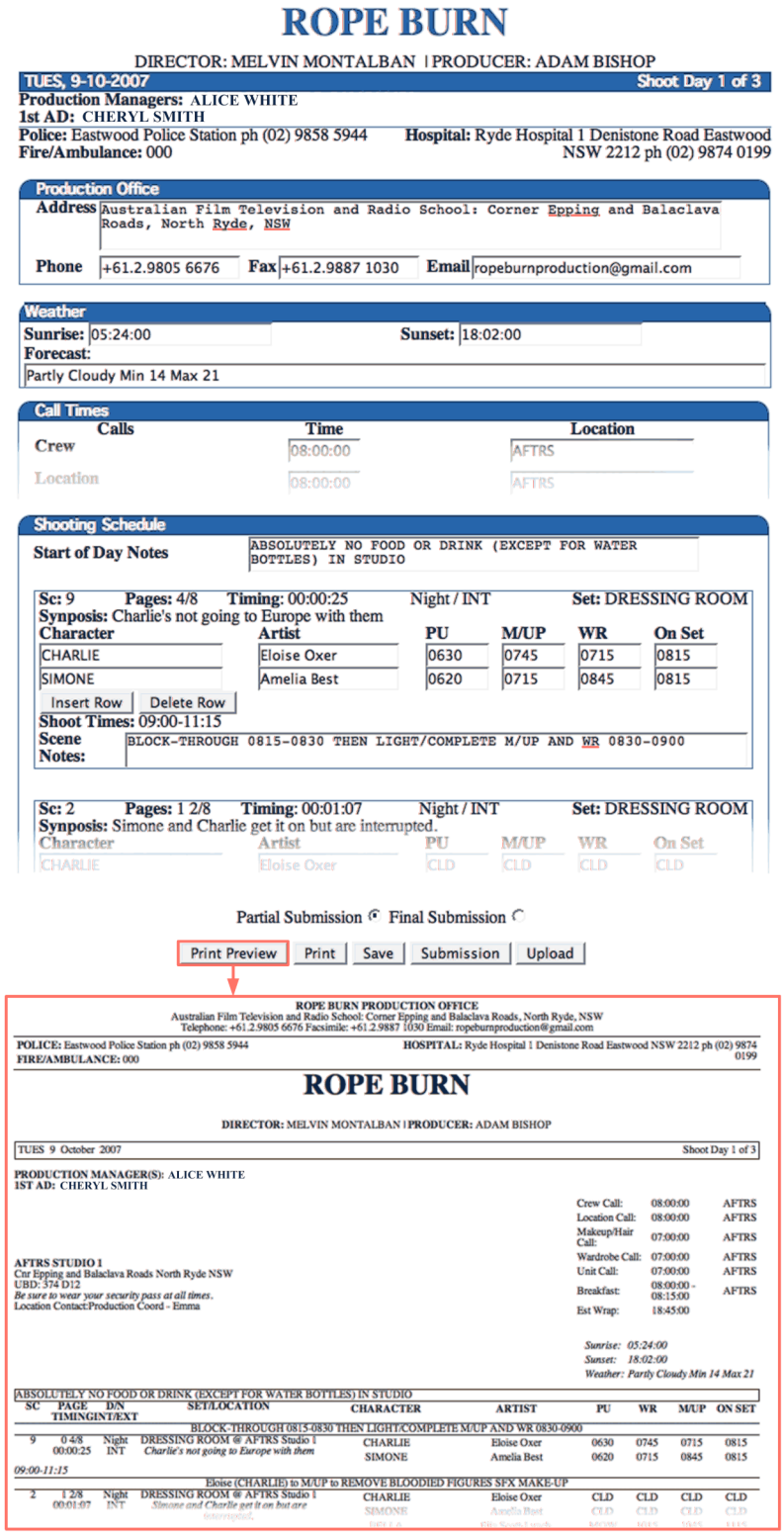

Figure 2. From the screen to the printer: an example of user form – call sheet.

An example of such a form can be seen in Figure 2 which depicts the form for a call sheet. This form is presented when the task *Update Call Sheet* is started. It contains editable data fields for user input such as crew call time, location information and individual cast call times including pickup (PU), makeup (M/UP), wardrobe (WR), and on set calls. There is also read-only information on the form which is taken from other documents, e.g. the scene number (sc) or the number of pages of the script (pages), both taken from the Shooting Schedule.

On each form there are five buttons that implement form-related functions, which we shall discuss in their order from left to right. A *print preview* function allows the user to generate a printer-ready document from the Web form that resembles the hard copy format used in practice. The *print* function sends the document to a printer, after which it can be distributed to crew members. At the bottom of Figure 2 one can see what the printed version of the call sheet looks like. Next, as we are dealing with lengthy forms, a *save* function has been implemented that allows one to save the data entered thus far on the local machine. Clicking the *submission* button indicates that the user is ready with the form (and therefore that the task is completed) and the result is that the data is sent to the YAWL engine whereafter the data is saved on the server that runs the engine. Note that in some cases the system may warn that errors have been made which need to be corrected by the user before the form can be accepted. Finally, to reduce data entry, the *load* function allows the user to open a copy of a previously saved document into the current Web form.

The forms are easy to use and in line with the paper-based forms currently in use. Hence, the learning process should be straightforward and no dramatic changes are required on the part of the people involved. The use of YAWL4Film does not lead to interference with best practices as they currently exist. Furthermore, the forms used are system-independent and can be used on PCs, laptops and even tablet PCs.

5. Deployment: “Rope Burn” and “Family Man”

The Australian Film Television and Radio School (AFTRS) is the national training and research facility for Graduate Diploma, Masters courses and short courses in film, and TV production. A core component of the full time course is the short film production slates that occur throughout the academic year. These slates range from 1 to 20 days of filming and aim to mirror professional industry standards. Student teams are provided with a budget, resources allocation and facilities from development, pre-production, production, through to post-production and distribution.

YAWL4Film was deployed on two film productions at the AFTRS in October 2007. The crew for each production consists of approximately ten students, ten full time or contract staff, and any number of volunteer crew. Project 1, “Rope Burn”, was a three-day shoot in studio with 30 onset crew, 6 cast and 6 production office crew. The office was run by a professional Production Manager, and supervised by a student Producer. Project 2, “Family Man”, was a three-day shoot on location and in studio with 35 crew, 5 cast and 4 production office crew. A semi-professional Production Manager was contracted and supervised by a student Producer. In both projects, laptops and tablet PCs (with stylus-enabled user input) were used by Continuity and 2nd AD, while Camera and Sound students were not part of the testing and the system supervisor and technical assistant entered their data manually into the system.

During the two productions, YAWL4Film shadowed the process of call sheet generation, DPR generation, and cast and crew database update. For “Rope Burn” the system was used

on-set alongside the traditional paper method of data capture for Continuity and 2nd AD; and later for "Family Man" the system totally replaced the paper-based method for the two crew members.

From the feedback from both projects, it was clear that the system would save time, and create more precise documentation:

"*I have managed over a dozen productions offices, and the amount of time this tool could save is incredible. Seeing the system up and running makes me realize how manual and laborious many of the activities are in any production office.*"

- Production Manager in "Rope Burn"

"I found the electronic form simple and easy to fill in. It was really just the same as using a paper form, but much cleaner and neater, e.g., no messy handwriting, smudges or crumpled paper."

- 2nd AD in "Family Man"

"I so often make errors when calculating DPR or even the Call Sheet, it is much easier to use the tool to double check figures and ratios."

- Production Manager in "Family Man"

The feedback also indicated that, once users became familiar with the tablet PC, the data input was significantly streamlined:

"There is a bit of a knack to filling in the details using an electronic tablet and pen, but with a small amount of practice I found a way to do it that I was most comfortable with."

- 2nd AD in "Rope Burn"

"Writing on the machine should as fast as handwriting. The system in itself is pretty easy to use."

- Continuity in "Family Man"

Finally, the crew members in both projects indicated that the more information one could store, such as scripts and schedule, the more useful the tool could become. Such feedback suggests that YAWL4Film should be used right from the pre-production phase, e.g., during script reading and schedule editing, so that information gathered during the pre-production phase can be exploited to better coordinate the production phase.

6. Outlook

The positive feedback and comments received from the two pilot production projects at the AFTRS bode well for the deployment of YAWL4Film in an educational setting and increased our confidence in the potential of this system for future use in real-world film production processes. At the time of writing, we are working towards a possible deployment of the system for a medium-budget and live-action feature film by an independent film production company. The work involved to achieve this includes extensions to the current system. For example, the system needs to be more flexible and even more user-friendly in its interactions with users. To this end, a Web-based highly interactive user interface is being developed.

Also, as is clear from the feedback of crew members of the pilot projects, YAWL4Film would benefit from providing support for activities in the pre-production phase such as

scripting, scheduling, cast, crew, and location management. Hence, work is ongoing on a light-weight scheduling tool that can interface with YAWL4Film and that allows a schedule to be easily changed as that may frequently happen after shooting has started. It is expected that the earlier the system is introduced in the filmmaking lifecycle, the more significant the impact and efficiency gains will be.

Finally, understanding the reasons for the industry's resistance to process innovation is crucial to the success of this research. We will continue to pay close attention to these issues in the further development of our tool.

Acknowledgement: We would like to thank Eloise Koger from the Faculty of Creative Industry at QUT for her support with the deployment of YAWL4Film in the pilot projects. We would also like to thank Jessica Prestedge and Guy Redding from the Faculty of Information Technology at QUT for their support with the implementation of YAWL4Film.

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