Research of Methods for Production Management and Making Reports through Digital Job Orders

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Abstract. *This paper publishes research results obtained on basis of the scientific project for improving workflows in graphic reproduction processes. The results shown refer to production management methods and reporting through digital job orders.*
The digital job order is defined as an XML record and alters dynamically along its journey between process phases within the graphic production computer network. Each job order phase must be noted down on time with great precision and this has been enabled by a developed related database model.
Engineer designs have been made for user interfaces to monitor diverse production phases. Each interface type has its specific attributes, signaling mechanisms and variables. Stress is placed on simplicity with as few interactions as possible and with the best previewing.
The data collected in the database are for making reports on the printing machines and operators. Time is noted down with the help of start-stop mechanisms through a system server clock. Comments made by operators and data on used material are also noted down. The production manager can see on the central preview interface which job phase is in production at the moment and its status. The digital job order is dynamically created in PDF format for different kinds of production with the help of XSLT and XSL-FO technology.
Keywords. Graphic Reproduction, Production Management, Digital Job Order, XML, PDF

1 Introduction

This paper contributes to former research within a reasearch project „Improving Workflows in Graphic Reproduction Processes". The results of this paper have been also used for a technology project „Software tools for programmed learning of graphic technology" since new interfaces will be also used for interactive student learning.

The aim is to elaborate and implement operational controls for production management and reporting through a digital job order necessarily institing on functionality as well as on simple and easy-to-consult usage. A digital job order is defined in the XML dictionary [1] and consequently gets changed dynamically through XML elements and attributes during its progress through the digital network of graphic production. It is necessary to record parameters of stages in the digital job order with great accuracy and security.

A hybrid relational database is a centar for gathering data and a source of all future queries and reports (SQL and Xquery queries). A precondition of the entire task is to carry out categorization of all positions in production (actions for grouping and dissolving). A computer within a work unit is assigned to each categorization.

2 Digital Job Order

Opening a job order is one of the most sensitive stages since it basically presents a production plan of a certain graphic product. Its workflow should be defined strictly with minimal ambiguities. A preliminary job calculation should exist before opening each job order. Production stages to be prepared by a technology officer should not necessarily correspond to the production stages envisaged during calculation for a prospective client.

A technology officer has a possibility to open a job order in three manners (Figure 1):
- by automatical generating from a preliminary calculation
- by loading another job order
- by generating a index number of a job order without parameters to be filled up later either manually or automatically.

This manner will minimize completely a possibilty for an error since a common copying of parameters no longer exists. Companies specialized for certain types of graphic products use very similar job orders. This is why they need a possibility for filling up from existing job orders with an identical calculation. However, there will be smaller organizational changes.

Following the first interface a technology officer may check in detail and elaborate all stages of production. Figure 2 shows an interface with a head filled up automatically with parameters from the previous step while waiting for drafts of graphic impositions as well as detailed descriptions and remarks for a specific stage that bears the most importance for the output product. It is for this reason that a new job order may be opended up from the previous one so that various detailed descriptions and warnings may be transferred into it automatically.

Figure 2. Interface with a head filled up automatically
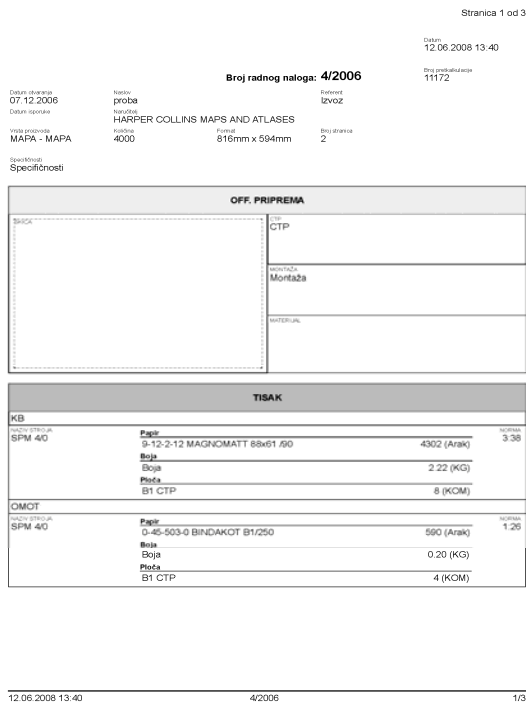

Figure 1. Opening a job order

Basic parameters of this job may be seen on the interface at Figure 1. These are global job variables and they are integrated attributively into the XML job order record at its root element. This manner enables job order search according to all of its attributes by the Xquery lanaguage.

All parameteres and details are recorded hybridly in the relational database, as well as in the XML job order records [2]. A digital job order may be shown dynamically in the PDF format at any moment. It has been very important to design this possibility, primarily beacuse we wanted to control a printout by a type of data, color and paging in the current standard printing PDF format. Figure 3 shows the first two of three dynamic PDF pages. The first page shows data on graphic prepress and printing stages, while the second one shows postpress stages.

Each stage of production is accompanied with estimated normative timing and estimated consumption of material. These parameters result from a preliminary job calculation [3]. It has been very important to elaborate a possibility that a layout is governed by data. It refers e.g. on a job order with many printing or postpress stages. It will certainly be under control in a manner that the next page will open up in color and with marked printing stages etc. as long as we have all the data from the same group.

Datum
12.06.2008 13:40

Broj radnog naloga: 4/2006

Broj predračunacije
11172

Datum otvaranja
07.12.2006

Naziv
proba

Referent
Izvoz

Datum isporuke

Naručitelj
HARPER COLLINS MAPS AND ATLASES

Vrsta proizvoda
MAPA - MAPA

Količina
4000

Format
816mm x 594mm

Broj stranica
2

Specifičnost
Specifičnosti

OFF. PRIPREMA	
SKICA	CTP CTP
	MONTAŽA Montaža
	MATERIJAL

TISAK			
KB			
NAZIV STROJA SPM 4/0	Papir 9-12-2-12 MAGNOMATT 68x61 /90	4302 (Arak)	NORMA 3:38
	Boja Boja	2.22 (KG)	
	Ploča B1 CTP	8 (KOM)	
OMOT			
NAZIV STROJA SPM 4/0	Papir 0-45-503-0 BINDAKOT B1/250	590 (Arak)	NORMA 1:26
	Boja Boja	0.20 (KG)	
	Ploča B1 CTP	4 (KOM)	

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Specifičnost
Specifičnosti

DORADA		
NAZIV	MATERIJALI	NORMA
REZANJE 4. araka do 100 g.		0:15
REZANJE 4. araka do 100 g.		0:15
GRUŠKANJE PAPIRA AB 1		0:26
BROJENJE PAPIRA brojenje falcanih prospekata - pojedinačno, osnovni normativ		0:45
PAKIRANJE GOTOVIH PROIZVODA AB 3. u kutije	• Kutije za izvoz	0:50
PALETIRANJE I RUČNO VAKUMIRANJE PALETA sa kuljanje, paletiranje - vakumiranje	• Palete i PVC vreće	0:10
VANJSKA USLUGA DOSTAVA 695 kg		0:00
FALCANJE HEIDELBERG AB - 1, 6 pregiba, 70 - 100 g/m2, paraletno		2:05
1 RUČNO SAVIJANJE KAO FINALIZACIJA PROIZVODA savijanje karata u B1 formatu i (harmonika), do AB 4, stojeći format		13:40
VANJSKA USLUGA BIGANJE		0:00
1 RUČNO SAVIJANJE KAO FINALIZACIJA PROIZVODA savijanje karata u B1 formatu i (nakon 2 biga na Rabolinju), do AB 4. stojeći format		9:05
VANJSKA USLUGA BIGANJE RABOLINI		0:00
REZANJE 5. araka 201 do 250 g.		0:05
REZANJE 14. plastificirani papir		0:20
2 RUČNO SAVIJANJE KAO FINALIZACIJA PROIZVODA savijanje mapa sa džepom, 3 pregib		8:15

Figure 3. Dynamic PDF pages of graphic prepress and printing stages (first page) and postpress stages (second page)

The applied XSLT technology maps data in a desired manner, as well as prepares XSL-FO records by using XSL-FO processor and creates a dynamic PDF document.
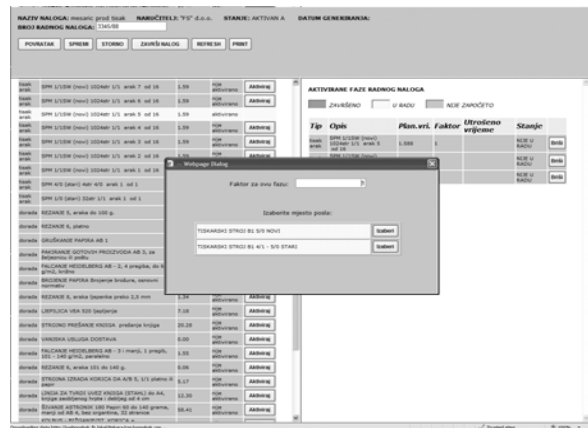
3 Putting job order stages into production

Each job order stage should have a visible status in every moment to be seen by a production manager. It should be also seen clearly when a job order gets completed. Figure 4 shows an interface for putting a job order stage into production and for reversing it. A left column shows estimated production stages as in the calculation. A technology officer puts a ceratin stage into production by its activation. It results in its transfer to the right column. Color and sign referring to the status of the production stage are changed dynamically during the whole period. In case that a certain production stage should be reversed into an inactive stage, it can be reversed and transferred to the left column. This is possible only for production stages that have not been started in production that is for those that have not entered into the Start-Stop mechanism.

When a technology officer activates a certain production stage, in case of certain production stages a window opens up and it is necessary to chose a machine (since there are various of the same type) and a factor for a norma. Using factors for putting norma hours into production enables a technology officer to review duration of a stage in case of using several parallel machines or staff in case of manual labor.

Figure 4. Interface for putting a job order stage into production

4 Recording and reporting

In a technology park computers are related to work places included into recording. Since this is the web technology system, computers may be added or changed independently from company staff. It enables to printing house management an independent control of number and quality of spots for recording production stages. The first screen interface following

logging on by a machine operator is a selection of a certain stage from a job order (Fig. 5).

Figure 5. Selection of a certain stage from a job order

After selecting a stage from the job order for a respective work place, the operator enters the interface for recording time and material of the production stage (Fig. 6).

Figure 6. Interface for recording time and material of the production stage

It is foreseen that the interaction with this interface should be by a touch screen. The Start-Stop mechanism records time by a system server clock. It implies that after the operator uses the Start interval the computer may be turned off or broken down since the start time has been recorded on the server. The Stop mechanism may be activated from every computer with the same Login and it records the end of the interval stage but not the end of the job stage. This makes it possible to replace one job with another priority job on the same machine.

Recording comments of a job stage head is possible after each Stop interval. The recording is offered as a select list in order to make a data base of typical breakdowns- statistics of breakdowns. Recording also includes material used for finalizing a job order stage. In addition to these records that need to be entered there is also a review of material

planned for a production stage during technology preparation. It enables a worker to know the amount of material that needs to be taken from the storage. It also enables a dynamic PDF display of a complete job order so that the operator could have a global view of a product (possibility for intervention). Since the PDF job order is dynamic a detail described in the job order can be changed at any time, and the dynamic PDF will enable the operator to see it.

5 Reports on the printing machines and operators

This manner of collecting data in real time enables dynamic reports by machines and operators for any required period. Figure 7 shows a monthly report of work at a printing machine. It shows all starting and ending time for all stages and subintervals as well as operators working at the time. It also shows quantities used and possible comments.

Figure 7. Monthly report at a printing machine

Figure 8 shows a monthly report for an operator and the respective work on each job order. This report enables control over prompt realization of all obligations and job quality. It may be used for introducing the system of automatic reward for exceeding normas.

Figure 8. Monthly report for an operator and the respective work on each job order

6 Conclusion

Today there must be re-designing of the existing habits and workflows in the graphic reproduction process. Precise description of all operations in all phases must be brought to a higher level, beginning from the publisher, printing works, external collaborators in one or more work phases, and from the graphic product ordering party too.

The corresponding data must be gathered from any production phase in order to pre-modify the workflow into real time. Productivity and quality improvement may be reached through workflow modification. How do new technologies and markets influence these processes? How should new technologies be implemented into today's environment and how should they be used to improve the existing operations and workflows? Every producer offers his limited workflow model. This applies to the equipment producers and producers of graphic make ready programs, printing machine producers, finishing machine producers and producers of programs for production integration. But when there is necessary transition to the next link in the production chain, the enterprise is left to do its own linking and analysis.

The result of this article is to elaborate and implement operational controls for production management and reporting through a digital job order necessarily insiting on functionality as well as on simple and easy-to-consult usage.

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