Planning Method Development with SVG Dynamic Tools in Graphic Production

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Abstract. *This paper is on the research of methods for planning in graphic production with especially developed SVG dynamic tools. The job time intervals are put forward visually through user interaction over the time matrix. The plan is recorded dynamically in XML format. Each time segment of the job is subject to repeated planning in the variable line of time.*

Daily planning automatically shows all the required planning factors in a parallel manner, beginning from the machine, planning phase to people, the crew and recourses. The work process with the planner's notes, codes and color is visually interactive.

Keywords. Modeling and Simulation, Graphic Reproduction, Digital Workflows, SVG

1. Introduction

Recognizing of printing processes and conversion into the adequate standards as well as their mutual linking is made easier with the XML description in collaboration with database [2]. Once the resources, operations and process junctions are described in the XML language, it is possible to elaborate electronic calculations, job orders and production plans in a printing plant.

The scientific research potential should be motivated and improve the production and business processes in the printing business and publishing. Now it is a time to introducing databases into studying of printing technologies on basis of XML technology through web communication. Printing would be studied through digital standards and digital workflows in all headings and experimenting with new technologies into today's environment to improve the existing operations and workflows [3].

This paper investigates methods for planning in graphic production with especially developed SVG dynamic tools by dr. Pap and dr. Žiljak. The system configuration for the required machine planning, production chain, people or crew is fully autonomous for the users [1]. Planning is actually an interactive game with the goal being to investigate different production planning tactics. It is possible to make a dynamic printout in respect to a determined time interval for each required plan entity. The printout also contains all the notes that have been linked to time intervals during planning. A system has been developed for samples of typical planning jobs. In this manner known fixed or contracted jobs are planned and their output rhythm is known for as long as one year in advance.

2. The SVG Time Matrix

A table has been made in the relational database the records of which are jobs being planned. Time segments of each job, i.e. job order have been recorded in XML format within the XML field. This is has been much simplified in the new SQL Server 2005 having a native XML field as a type of data that may be searched through all records using XQuery language in combination with the SOL language.

In this manner there is an unlimited time matrix in the relational database for a certain planning project. All planner questions and dilemmas are forwarded towards the database. The goal is to clarify complex dilemmas for the planner with the help of dynamic interactive display through Web media. Being an XML derivate by itself, SVG technology was used as an ideal choice for achieving the goal of interactivity and vector display in Web interface.

This is in fact possible through manners of SVG language control over vector graphic forms, i.e. paths, over pixel images and texts. Lines, Bezier curves, and many circular forms that may be grouped and masked are available for programming paths. Alpha masks and complex filter effects may be created over each SVG object. The created SVG DOM (Document Object Model) provides powerful possibilities for user interaction with vector graphics. SVG DOM is a programming interface towards SVG elements and attributes over which data may be altered in real time as well as vector graphics behavior in the display.

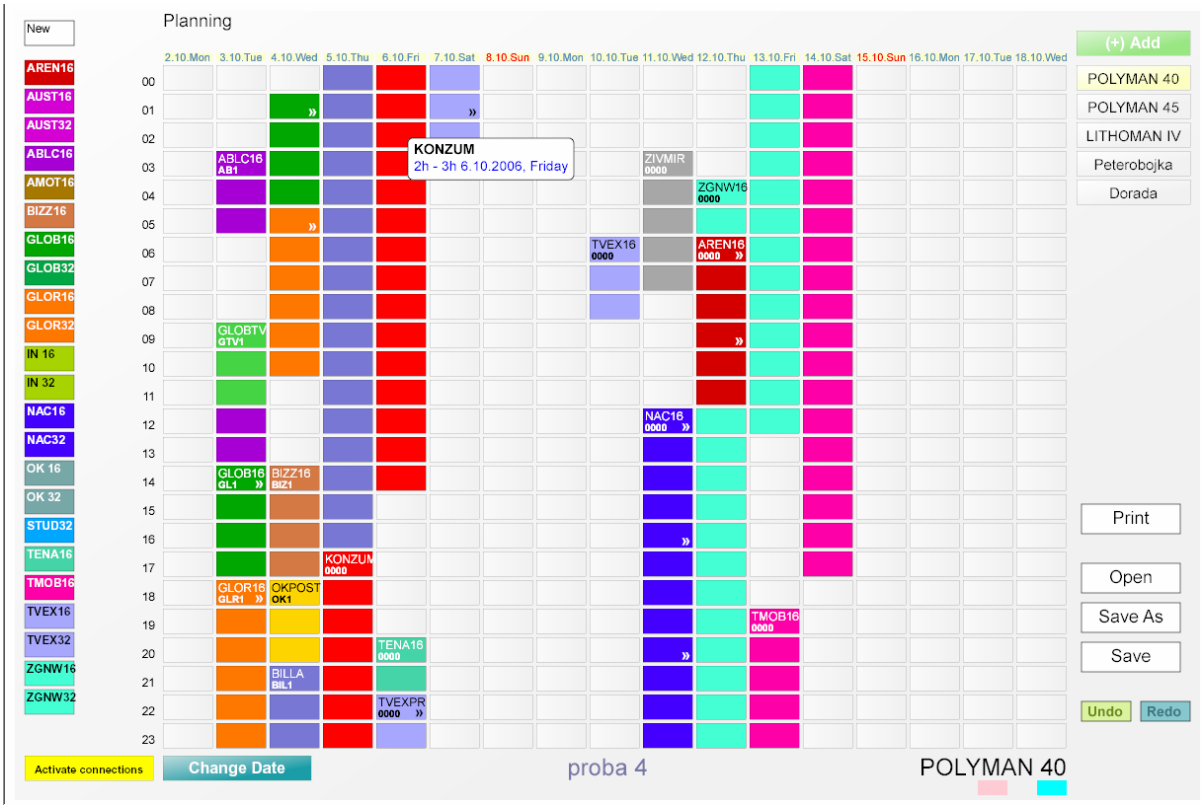


Figure 1. The SVG Time Matrix

Planning is executed in the display with variable time intervals in respect to days and hours for the task entity (machine, production phase, and people) where the daily time line is in columns and the hours 0-24 are in rows (Fig. 1).

Each matrix member is introduced in the form of a rectangle, the dimension of which may be changed dynamically depending on the required display format. Capturing of job time intervals are fully visual through user interaction with the plan time matrix.

Figure 2. Time SVG objekt

Through the SVG DOM interface there is a display where color attributes are changed, as well as ID, job order code, notes and many other attributes of the SVG object in question (Figure 2). In this way the contents, i.e. the information on time fragments recorded in the database are completely set apart from its physical display in SVG technology. Furthermore, due to the fact that work with notes, colors and conditions is visually interactive and incorporated in the very display part of the program, it is not necessary to go into table variants of input and editing.

3. Creating Resources for Planning

Creating resources for planning, i.e. system configuration for the required planning of machines, production lines, people or crews is fully automated through the SVG interface (Fig. 3).

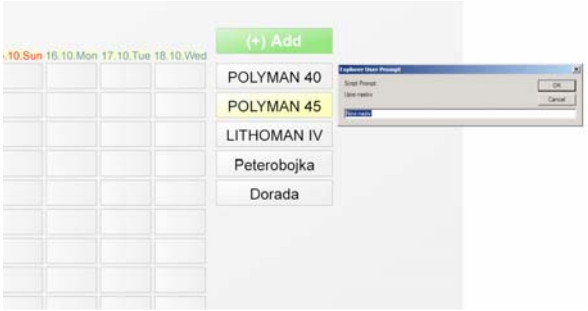


Figure 3. Creating Resources

The system that has once been configured is liable to be further expanded with new machines, editing the names of the existing machines as well as their

elimination from the plan. A new logic level is created by creating new recourses from the user point of view and a new time matrix is created from the point of view of the SVG display.

Each job that needs to be planned on this new resource may be copied and then planned in that resource or another one. It is possible to delete the whole job from the plan. The planned time segments of a job may be automatically chain compressed by interactive user moves during the complete time plan of a certain resource.

4. Template System

A template system has been developed for typical jobs to be planned. In this manner known jobs are planned on fixed terms or contract jobs for which the output rhythm is known.

Figure 4. Template System

An option is offered for each job that is planned for the first time to make it become a template for future planning of similar jobs (Fig. 4). This is very interesting for jobs such as weekly review printing or printing of monthly editions where the number of sheets and the graphic postpress is almost identical. This is why the template keeps the attributes first proposed such as color, name and duration but it does not contain the job order ID because it is not known yet. Working with templates is essential for future occupying of machines and resources, although the job details are not known yet.

5. Daily Planning

Daily planning automatically displays all the required planning factors in a parallel manner beginning with the machine, production phase and all the way to the people, crew and resource. All the machines or resources are in columns, whereas the hours 0-24 are in rows. Re-planning in the daily display offers everything the same as the matrix display per machine with additional alarms for not keeping with the daily hour schedule.

It is possible to work with templates in this display the same as in the matrix display. Interactive shifting from day to day with the "forward-backward" mechanism is a method that helps the scheduler in a major way to plan all the job phases on all machines and resources simultaneously (Fig. 5).

Figure 5. Daily Planning

With this method it is possible to easily transfer certain job phases from one machine to the other. Methods of copying and pasting all the job phases may be used as well as creating parallel cases in respect to resources in order to avoid production bottlenecks.

6. Phase Overlapping in Graphic Production

There are three main activities in graphic technology: prepress, printing and postpress. They are sometimes linked in a simple way, but most often in a complex manner. In order to have something printed the graphic prepress phase must be completed and the postpress phase may begin only when there is printed material. Quite often there is overlapping of the three basic activities and this is very much preferred in practice. If a printed review has 64 pages and we have B1 format machines, then the printing will be done on two different sheets, 32 pages each. If there are B2 format machines in the machine park, then printing will be on four sheets, 16 pages each. Even in respect to this relatively simple task there are uncertainties for the planner in respect to graphic prepress overlapping the printing and overlapping of the printing with the postpress phase.

6.1. Overlapping of the Graphic Prepress and Printing

The basic uncertainties for the planner in this phase is whether to start printing of a new sheet the

moment a graphic prepress job is ready or to wait for the moment when all the graphic prepress jobs for all the sheets are ready, in case there are more of them. It would be logical to begin the printing as soon as possible, but what if the printing of that sheet in a certain printing run will end before the graphic prepress for the next sheet is ready? Then the planner must decide whether he will begin with the next job for which he has the prepress ready, or will he leave the machine in standby mode for the next sheet for which the prepress job has not been completed yet. If the decision is brought to wait and continue to print the next sheet of the same job, it is a well known fact that the machine preparation will be shorter and that the technological waste for running in the printing of the next sheet will be less. It is also a well known fact that if the machine is not operating there will be loss due to this, and the planner must take this into consideration too.

Making decisions in respect to such uncertainties is the most difficult task for the planner. This is the reason for our visualizing to the maximum point every hour in the endless time matrix that is observed through the date mask in Gantt display (Fig. 6). Every hour of any job is chain linked with the hour of the preceding and the one following. In the daily display all resources are displayed simultaneously so that the planner can interactively try out any of his uncertainties. He can try to use tactics no. 1, return to the preceding state with the undo techniques and then try out tactics no. 2, and so on. He can get a quick solution in respect to his doubts by the game method, i.e. by trying out the variations.

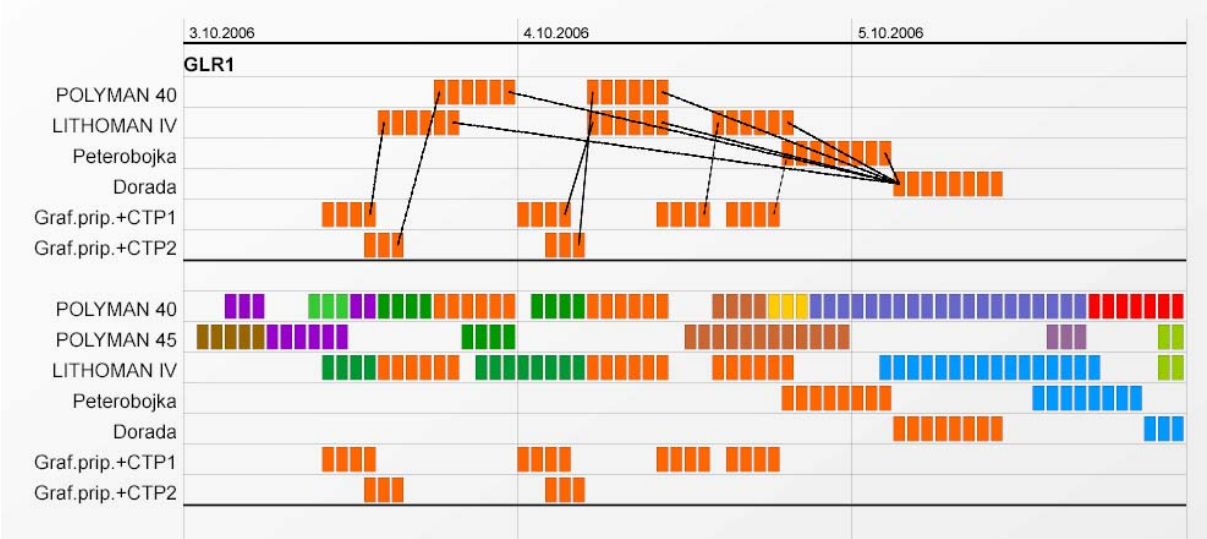


Figure 6. Gantt chart with overlapping of the graphic prepress, printing and postpress

6.1. Overlapping of Printing and Postpress

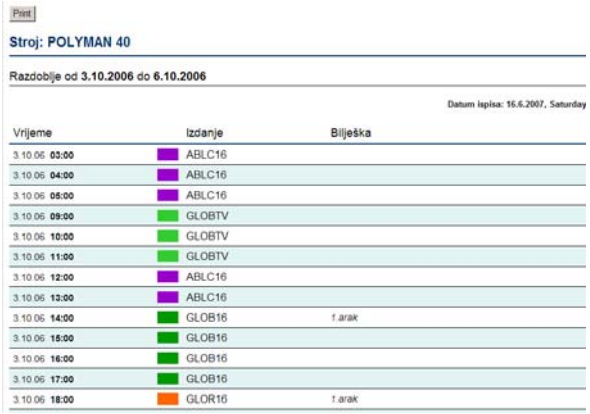
Depending on the type of graphic postpress activities that must be carried out after the printing phase, certain parallel actions may be planned in respect to overlapping of the printing phase and that of the graphic postpress. In the example with several sheets (with 32 pages, for instance), the phase following the postpress phase is folding of the sheet into the page format. After this phase there is the phase of assembling. In the folding phase it may be planned to overlap the printing phase in such a manner as to begin folding the sheet as soon as one sheet's printing run is completed and the next sheet has not yet gone into print.

When the printing run is large and as such is printed on big rotation printing machines, because of the fast speed there usually a folding unit as part of the machine at the printing line's end and so this phase is considered as part of the printing. In this case there is no such overlapping. The case may also be that the printing phase and the postpress phase overlap after a certain number of printed copies before the full printing run has been completed. This is usually done if the prepress run is done manually, i.e. if it is very slow and this slow phase must begin as soon as possible.

The Gantt display carried out in SVG technology shows when machines or resources are simultaneously occupied with the jobs we are planning. This display may be regulated with unit choice of job codes, and it is also possible to generate a SVG joint Gantt by choosing 2 or more jobs. It is possible to require an aggregate Gantt display at all times for the overall graphic production of a printing plant.

7. A Dynamic Plan Printout per Resource

For each required plan entity it is possible to make a dynamic color printout for the determined time interval. The printout contains all the notes that have been joined to the time segments during planning.



Print

Stroj: POLYMAN 40

Razdoblje od **3.10.2006** do **6.10.2006**

Datum ispisa: 16.6.2007, Saturday

Vrijeme	Izdanje	Bilješka
3.10.06 **03:00**	ABLC16	
3.10.06 **04:00**	ABLC16	
3.10.06 **05:00**	ABLC16	
3.10.06 **09:00**	GLOBTV	
3.10.06 **10:00**	GLOBTV	
3.10.06 **11:00**	GLOBTV	
3.10.06 **12:00**	ABLC16	
3.10.06 **13:00**	ABLC16	
3.10.06 **14:00**	GLOB16	1.arak
3.10.06 **15:00**	GLOB16	
3.10.06 **16:00**	GLOB16	
3.10.06 **17:00**	GLOB16	
3.10.06 **18:00**	GLOR16	1.arak

Figure 7. A Dynamic Plan Printout

Such a dynamic printout (Fig. 7) comes directly from the XML plan record that changes dynamically during the time when the planner is planning. It may be printed out in printing units and delivered to the machinery for a certain machine or person.

Such a display may remain in digital form in such a way as to be required from persons who are attending the machines in the equipment department with the belonging password on the client's computer. Each of such printouts is the query result for a base in respect to a certain period of time per the specific machine ID, i.e. resource.

8. The XML Plan Record

The plan record is dynamically recorded in XML format in a set dictionary created for the needs of making these planner models and methods. It is in Croatian although the planer SVG programming model is multi-lingual for users. This record keeps the plan contents and it is taken over by the SVG module for display.

Figure 8 shows the XML record for machine planning under the name of POLYMAN 40. It is a

```
- <root StrojID="1" Naziv="POLYMAN 40">
  - <AKCIJA Novo="true" Boja="#9900CC" Naslov="ABLC16" Sifra="AB1">
      <FRAGMENT Termin="2006/10/03 03:00" Biljeska="" />
      <FRAGMENT Termin="2006/10/03 04:00" Biljeska="" />
      <FRAGMENT Termin="2006/10/03 05:00" Biljeska="" />
      <FRAGMENT Termin="2006/10/03 12:00" Biljeska="" />
      <FRAGMENT Termin="2006/10/03 13:00" Biljeska="" />
    </AKCIJA>
  - <AKCIJA Novo="true" Boja="#33CC33" Naslov="GLOBTV" Sifra="GTV1">
      <FRAGMENT Termin="2006/10/03 09:00" Biljeska="" />
      <FRAGMENT Termin="2006/10/03 10:00" Biljeska="" />
      <FRAGMENT Termin="2006/10/03 11:00" Biljeska="" />
    </AKCIJA>
  - <AKCIJA Novo="true" Boja="#009900" Naslov="GLOB16" Sifra="GL1">
      <FRAGMENT Termin="2006/10/03 14:00" Biljeska="1.arak" />
      <FRAGMENT Termin="2006/10/03 15:00" Biljeska="" />
      <FRAGMENT Termin="2006/10/03 16:00" Biljeska="" />
      <FRAGMENT Termin="2006/10/03 17:00" Biljeska="" />
      <FRAGMENT Termin="2006/10/04 01:00" Biljeska="2.arak" />
      <FRAGMENT Termin="2006/10/04 02:00" Biljeska="" />
      <FRAGMENT Termin="2006/10/04 03:00" Biljeska="" />
      <FRAGMENT Termin="2006/10/04 04:00" Biljeska="" />
    </AKCIJA>
  + <AKCIJA Novo="true" Boja="#FF6600" Naslov="GLOR16" Sifra="GLR1">
  + <AKCIJA Novo="true" Boja="#CC6633" Naslov="BIZZ16" Sifra="BIZ1">
  + <AKCIJA Novo="true" Boja="#FFCC00" Naslov="OKPOST" Sifra="OK1">
  + <AKCIJA Novo="true" Boja="#6666CC" Naslov="BILLA" Sifra="BIL1">
  + <AKCIJA Novo="true" Boja="#FF0000" Naslov="KONZUM" Sifra="0000">
  + <AKCIJA Novo="true" Boja="#999999" Naslov="ZIVMIR" Sifra="0000">
  + <AKCIJA Novo="true" Boja="#33CC99" Naslov="TENA16" Sifra="0000">
  + <AKCIJA Novo="true" Boja="#9999FF" Naslov="TVEXPR" Sifra="0000">
  + <AKCIJA Novo="true" Boja="#33FFCC" Naslov="ZGNW16" Sifra="0000">
  + <AKCIJA Novo="true" Boja="#CC0000" Naslov="AREN16" Sifra="0000">
  + <AKCIJA Novo="true" Boja="#FF0099" Naslov="TMOB16" Sifra="0000">
  + <AKCIJA Novo="true" Boja="#9999FF" Naslov="TVEX16" Sifra="0000">
  + <AKCIJA Novo="true" Boja="#3300FF" Naslov="NAC16" Sifra="0000">
  </root>
```

Figure 8. The XML Plan Record

web machine in the possession of many printing plants all over the world for printing reviews that have huge printing runs. The XML record structure for a plan linked with a machine consists of XML elements named AKCIJA with attributes such as color, name and job code. Their children are elements named FRAGMENT with the attributes of time period and notes.

Such an XML record uses SVG DOM for display in the time matrix. At the same time this record freshens up the relational base where recording takes place all the time. The listed attributes of the element AKCIJA match the relational base field, whereas its children in the form of elements having the name FRAGMENT are literally recorded in the XML data field. This means that the time fragments are searched for in the base with XQuery language, whereas the rest of the data is searched with the SQL language. Furthermore, the SQLXML Web services are used and the overall approach to the relational base is hybrid.

9. Conclusion

This paper researches methods for planning in graphic production with especially developed SVG dynamic tools. The job time intervals are put forward visually through user interaction over the time matrix. The plan is recorded dynamically in XML format. Daily planning automatically shows all the required planning factors in a parallel manner, beginning from the machine, planning phase to people, the crew and recourses. The work process with the planner's notes, codes and color is visually interactive and thus it is not necessary to check the entries and editing table variants. The system configuration for the required machine planning, production chain, people or crew is fully autonomous for the users. Planning is actually an interactive game with the goal being to investigate different production planning tactics. It is possible to make a dynamic printout in respect to a determined time interval for each required plan entity. The printout also contains all the notes that have been linked to time intervals during planning. A system has been developed for samples of typical planning jobs. In this manner known fixed or contracted jobs are planned and their output rhythm is known for as long as one year in advance.

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