

Research of New Graphic Production Planning Methods with SVG Technology

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The parameters of the already determined plan in graphic production may change at any moment with the expanding complexity of the production. The usual manner of planning is entering and altering data on paper or through various software tables that may be found in standard modules for planning in the market.

In this research article the time planning matrix is shown in a completely different manner, resembling a chess field and the planner playing against time in certain resources. The time table and the state of unit resources are described in XML format, and later recorded in the XML Data field of the relational database with the possibility of hybrid question forms with SQL and Xquery queries. As the SVG record is an XML derivate, these technologies are fully compatible with accentuated independence of the contents from its display.

Such approaches are a complete novelty in the planning process in general and they are developed primarily for planning those kind of productions where a great many workflows exist for completely different final products. Developed planner algorithms dynamically change the appearance of time segments in case there are some certain planner states derived on basis of analyzing the newly derived data.

Introduction

Planning in graphic production is a complex process requiring constant adjustments and solving of relations between the existing machines, resources and people. In many aspects graphic production is very different if compared with other types of production. One of its most significant possibilities is that the same product may be produced by using different machines, i.e. workflows. Production parameters may be altered at the last moment on a daily basis. The usual way of planning in the graphic industry is based on input and modification of the planned phases by writing them down on paper or by using various software tables that may be found in the market in standard planning modules. It is difficult, sometimes even impossible to carry out re-planning of the existing production plan in the described manner.

Additional characteristic of workflows in graphic production where certain production phases may be used for producing totally different products increase the planning complexity. For instance, the printing phase of a B1 format job on a five-color printing machine may be used for printing of a book block in the same way as it may be used for printing a poster. The difference for both of the jobs is in the type and the manner of assembling digital information on the sheet that will be printed on a CTP offset plate. The described situation is even more pronounced in digital print-

ing where printing of a single product may be changed in a real-time period by printing a completely different product in respect to format and number of colors. This is possible because the source of information for printing is no longer on the offset plate but in the bitmap memory where data may be altered at a set moment.

In order to be able to investigate all aspects of graphic production it was necessary to create the adequate standards described in XML language and stored in the relative database. Resources, operations and process links have been described in this manner enabling electronic calculations to be carried out and also to make working digital models of the graphic production. The described foundation is the basis for entering the graphic production planning process.

Complex planning processes in the graphic industry require extensive user interactivity and software linkage with the relational database. The modern SVG (Scalable Vector Graphics) technology has been chosen because it is not only an XML derivate but also the representative Web technology, and this was a requirement set at the beginning. In this manner independence of contents was obtained in respect to their representation.

SVG technology research during the planning process

Research of SVG technology has resulted in completely new ways of graphic presentation, new interactivity methods and new approaches in the planning process. SVG is a web technology based on the native XML record that is interpreted with the help of the SVG processor inside the web browser or other software environment.

It may also be noticed that learning of new languages i.e. technologies based on XML is very much simplified because all commands are determined within the XML elements and attributes on basis of a dictionary determined in advance with a hidden micro-code that is to be entered by an SVG processor on the determined operative system. In this manner the SVG XML record is fully independent of hardware, software and the manner of transferring data. SVG technology has been used for obtaining an interactive quality in planning as well as a software interface in respect to the relational database. This interface operates in real time.

There is use of software path creating possibilities, Bezier curves, that of grouping and controlling various graphic objects, as well as different animation techniques for warning the planner when he is making the wrong tactical decisions. The main software interface over these vector graphic objects is the SVG DOM (Document Object Model) through which the altering of the SVG graphics was performed in real time and at the same time user interactions were being received.

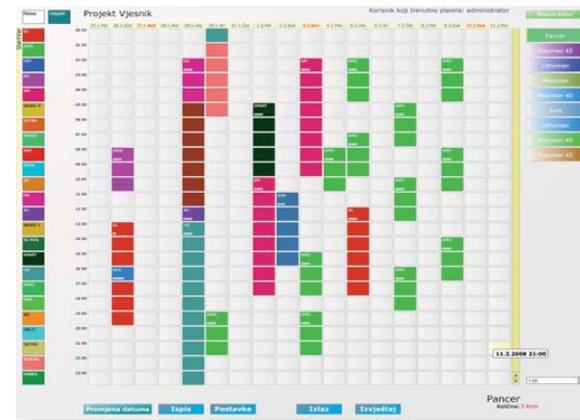


Figure 1: Time matrix

By learning and studying XML technologies in different variations such as XSLT, X-Path and X-Query, new ideas have sprung up about the manner of an operator's work and the interactive quality of the planning process.

The plan's time matrix

The plan's time matrix as well as the state of the planned resources are described constantly in XML format that is recorded in the XML data field of the relational database. In this manner it was made possible to set forward hybrid queries towards the database in SQL and Xquery languages.

We have defined the basic time segment in the planning time matrix as a rectangular form. A time matrix is created in the database at the very beginning and it is assigned to a certain planning project. Time segments are taken up by user interventions and SVG algorithms positioning them in the desired states. This is evidenced in the relational database and is sent through XML values to the SVG processor that visualizes this new state afterwards.

Developed planner algorithms dynamically change the appearance of time segments in case there are some certain planner states derived on basis of analyzing the newly derived data. The time matrix may be adapted dynamically to the desired display formats. Through the SVG DOM interface the time segment's color may be changed, as well as the job's identification code, the planner's notes and many other characteristics. It is here that new ideas are generated for additional properties that a certain time segment, i.e. resource might have because the goal is to accentuate and display each property visually.

Owing to this manner of carrying out the job it is not necessary to use record and editing variants through various table type systems that are otherwise the usual ones in standard planning modules found in the market. There is an unlimited time matrix in the relational base for a determined planning project.

Planning of graphic production phases according to production resources

Resources that we wish to plan in graphic production fall into three groups: graphic prepress, printing and graphic postpress. Figure 2 shows the module for creating resources where resources are also linked to a certain created category.

Four basic parameters are defined in the resource making process: category, title, quantity and color. The categorization does not have to cover only the three basic types of graphic production, and additional categorization may be carried out; for instance – per printing type, such as sheet printing, web printing or per B1 or B2 format, and similar. The introduced title will be subsequently referenced in many dynamic reports and Gantt chart connections. The number of resources may function in a multipurpose manner. At the same time it may be the number of similar machines that the planner plans as a group or the resource capacity used up during the period of a certain production phase. Color is a very significant characteristic of a resource because in all reports and dynamic displays after a certain amount of experience planners begin to make references to a certain resource on basis of observing certain colors, and not by reading the titles. Such a resource acquires its time matrix, the time segment of which may be observed at all times through the time interval display as shown in Fig. 1. Such a time matrix is thus ready to be filled up by time segments of certain workflows phases in graphic production.

The resource production plan may be carried out by direct input of a certain production phase from the job order database, by input from the planner template database and by independent input of completely new jobs.

Figure 3 shows a module for direct input of unit production phases from the job order database. A preliminary condition for a job to be carried out is a job order module category dictionary that has been brought into coordination and a module for planning. This means that when a production phase is entered it «sees» its resource category in the plan and makes efforts to become part of the plan. Record is kept through the phase status variable on the already planned phases, and on the ones that have not been planned yet.

Many jobs that need to be planned do not yet have their identification code for entering production, but there must be planning for such jobs in respect to machines and sources being occupied. This applies to weekly editions, monthly editions and different regular campaigns for various marketing firms or large concerns. Contracting of such jobs usually takes place at the beginning of each business year. When deadlines are not

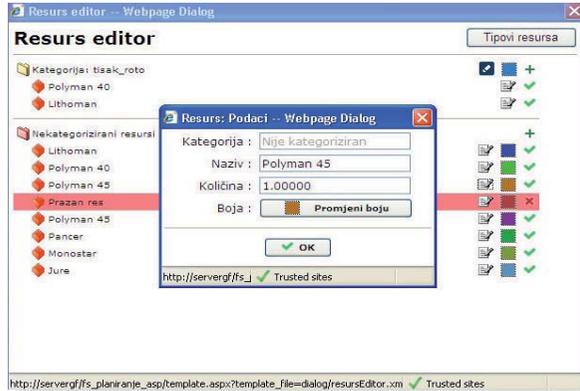


Figure 2: Module for creating resources

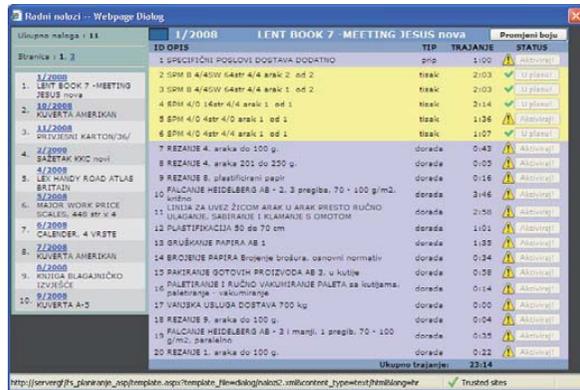


Figure 3: Direct input of unit production phases from the job order database

met in respect to such jobs there are major losses and it is, therefore, necessary to have especially good planning skills and precise evidencing. Figure 4 shows a planner templates organizing module. The user may create his own personal organizing template lists that he will use per wish during planning. The template is created from the already planned job or at the moment of creating a new one. The planner must not forget regular machine maintenance during production, and this can be planned a year in advance.

Independent planning of a new job is shown in Figure 4. In such cases the planner must determine the job's title and the code under which all the records will be kept, interactive display and dynamic reporting in future. The color that must

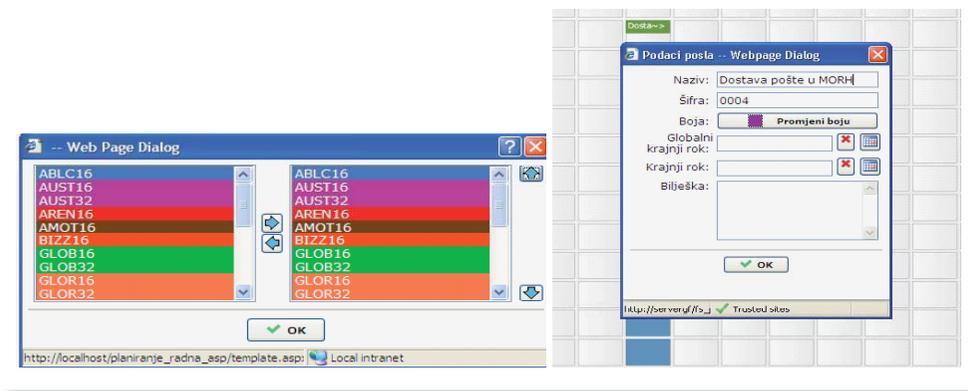


Figure 4: Planner templates and independent planning of a new job

be chosen is very important in order to distinguish the job from other jobs. The classical palette manner of visual color choice is possible with input of a hexadecimal code with the help of which the color is recorded in the XML job record and in the database. The planner may also use the hexadecimal record for coloring other job phases that he wishes to merge with the existing one. This would be impossible to guess in case of a palette color choice. It is possible, but not obligatory to mark

the global deadline for the whole job while we are still evidencing only one of the job's phases, and also the local deadline for only this independent phase as part of the job. For instance, if it is a case of an outsourcing job phase, then the other company gives its deadline for that certain job phase linked with its own planned occupation and deadlines.

After the deadline has been entered, a mechanism is started for a deadline animation as soon as we select the job phase on the resource time matrix. When the planner alters the job phase position with a determined deadline, it may occur that the deadline is not met. Then the algorithm discards the wished planning and informs the planner that his move is not allowed. The planner may enter a great deal of useful text into the note variable that may be read by any user who is observing the plan.

Figure 5 shows the interactivity of the SVG time matrix plan. As soon as a certain phase is selected, a dynamic window appears with the title, code and planned beginning and planned ending. Repanning is simple and is carried out by dragging phase hours to another free position in the matrix.

In case another job is creating obstacles, the selected phase will independently split into two subphases, one being before the obstacle and the other following after the obstacle. The split phases are aware at all times of their entirety, so that if we replan the split job once again, it will carry on as a whole; it will not be split any more.

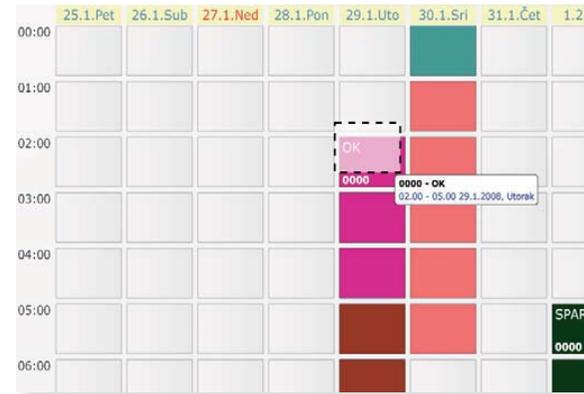


Figure 5: Interactivity of the SVG time matrix plan

Methods of alarming planner's moves

An animation for the time deadline is built into the planner's SVG matrix so that if the random job is under SVG focus, the animation starts blinking the deadline. When there is transferring, i.e. re-planning of certain job time segments, it may occur that there is a planner's transferring of the determined deadline. In case of such a situation, the algorithm stops the desired resource re-planning and warns the planner that this is a move that is not allowed.

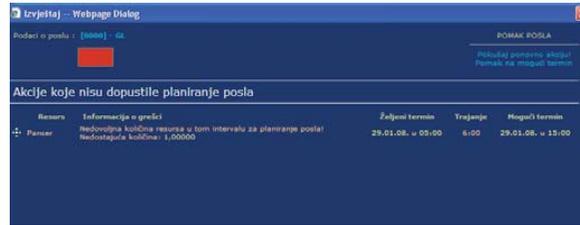


Figure 6: Alarming planner's moves

Five types of alarms have been installed during interactive planning:

- the deadline;
- impossibility of planning due to interconnection of the phases (Gantt chart connections);
- impossibility of planning due to parallelism;
- insufficient resource quantity;
- resource working time.

All alarms are triggered in four planner activities during job phases:

- moving the job phase in the matrix;
- creating the job phase in the matrix;
- deleting the job phase in the matrix;
- altering the job phase data.

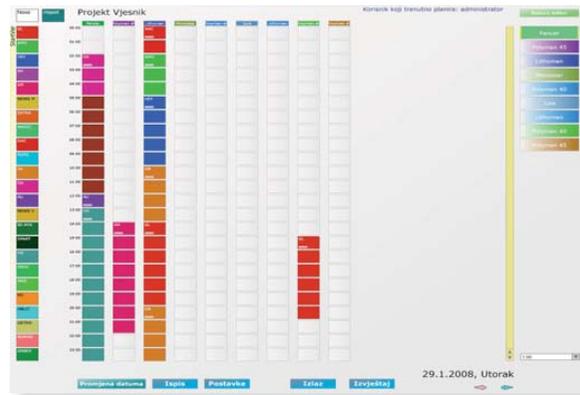


Figure 7: Daily planning

Daily planning

In graphic production daily planning is the top priority and an especially developed method for daily planning is, therefore, shown in this paper. Its basic characteristic is an instant parallel display of all resource engagements for each single day (Fig 7).

In daily planning it is allowed to move jobs from one resource to the other. Jobs may be planned in a simple way on several parallel machines if it is evident that such planning is the only solution against bottlenecks caused by some slower machine. Many printing works will almost always apply daily planning and navigation is installed for instant moves to the wished date. The formerly described planner interactivity, as well as the alarming system operates in daily planning in an identical manner as in the matrix display.

Gantt chart

It is possible for the planner to choose the entirety he wishes to see and analyze. A list of all jobs that have been entered into the plan is given in

the module for selecting entities for the Gantt display (Figure 8). Depending on the focus of interest the planner chooses individual or group Gantt chart displays in the wished time period.

After selecting the wished jobs and time periods a dynamic query is created to the relational database that returns the result in the form of an XML record taken over subsequently by the SVG DOM, and is then shown through the SVG interpreter (Figure 9).

It is possible to install connections in this display, i.e. to determine border conditions for starting and finishing certain job phases. This includes installing a trap mechanism that does not allow the planner to replan certain phases without control. When there is need to connect certain job phases, it is only necessary to select the wished segment in Gantt and to transfer it to the aimed connection segment. The module for connecting phases is then selected (Figure 10).



Figure 8: Module for selecting entities for the Gantt display

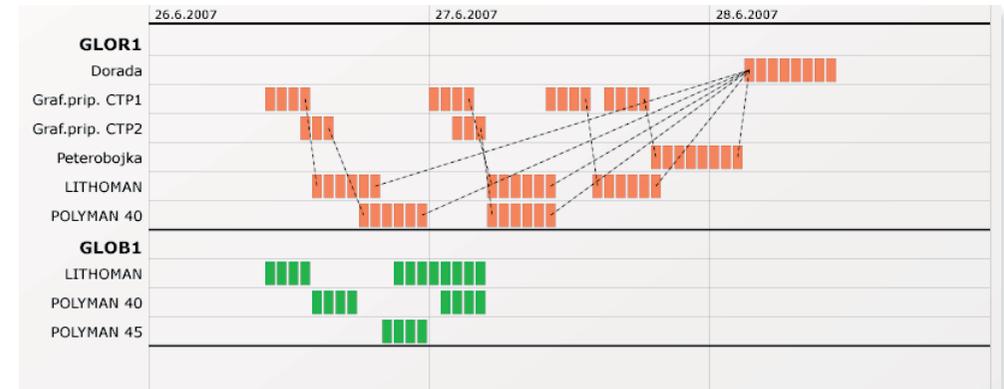


Figure 9: Gantt chart

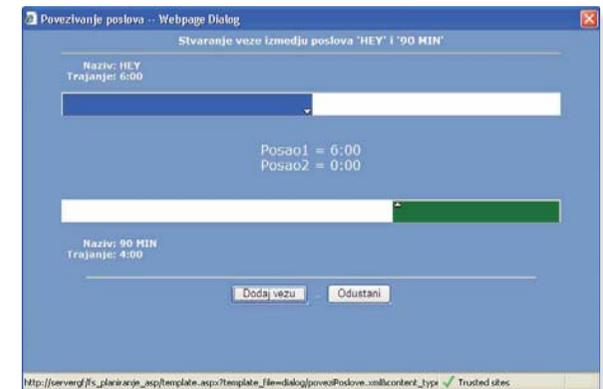


Figure 10: Module for connecting phases

Time limits in planning

At any point in time the planner can change the working hours for the whole firm in the module for time limits (Figure 11).

Working hours can be altered for single days at a time. Working Saturdays can be included in the plan, or even working Sundays on demand in order to meet set deadlines. All holidays, i.e. non-working hours are in the database, with the option to be edited by the planner. It is possible to determine working hours for each resource separately, and this is especially interesting for people working on computers in the graphic prepress in comparison to the work of the printing machine that may take place in the newspaper web printing press from 0 – 24 hours. Thus it is possible to plan leaves for the operators, and some of the jobs will not be planned when certain people are absent.

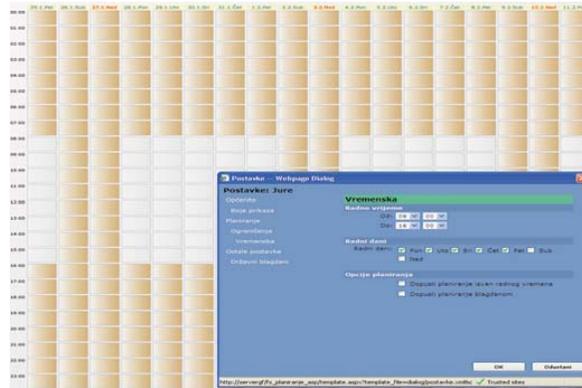


Figure 11: Module for time limits

Conclusion

This paper is a research on graphic production planning with the help of the method that is based on new possibilities of the SVG (Scalable Vector Graphics) technology. The interactive manner of operation and the visual display frees the user completely from entering planner information in the usual table type procedure. Each plan covering certain entities is described in XML format with stressed content separateness in respect to its presentation.

The newly formed resource acquires its time matrix, the time segment of which may always be viewed through the time interval display. This time matrix is ready for input of time segments of certain workflow phases in graphic production. Jobs may be planned in a simple way on several parallel machines in daytime planning. During interactive planning five types of deadline alarms are installed: impossibility of planning due to interlinked phase connections (Gantt chart connections), impossibility of planning due to parallelism, shortage of resource quantity and resource working time. All alarms are triggered in four planner actions during job phases: shifting of the job phase in the matrix, creating a job phase in the matrix, deleting a job phase in the matrix and altering data in the job phase.

Connections may be installed in the Gantt chart display, i.e. the border conditions for starting and finishing certain phases may be set in

the defined overlaps in respect to the final deadline range of the previous job. This SVG approach is new in the planning processes in general, and it is developed primarily for the graphic industry where there are a great number of parallel production jobs.

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