A Unique Solution: The Workflow Engine

Workflows in support of resource scheduling

As part of a recent symposium organized by the "Institut für Rundfunktechnik" (Institute for Broadcast Technology) in Munich, Germany, Mr. Tobias Soppa of CEITON technologies GmbH reported on the subject "Uniform production planning and production control via dynamic Workflow management". In this first part we would like to introduce you to the subject of "Workflow management". The second part will use application examples to show the potential of this unique solution.

In the media branch virtually all aspects of a production have been affected by the move to digital. As a result the commercial processes of the enterprise are more complicated and varied, and in particular more dynamic. In addition to well known media like CD's, broadcasting and movies, a variety of new delivery platforms (DVD, PSP UMD, mobiles, streaming/download, iTV, etc.) have achieved a credible market presence. These new media generate new requirements for the production process. Driven by advancements in information technology this development is accelerating at a rapid pace - HD TV in all its permutations is only the most recent change that has to be mastered.

Workflow management enables the visualization, planning and control of varied commercial processes (e.g. television production or DVD production). In other industries (chemical, automobile, logistics etc.) such systems have been implemented, providing for the central and uniform control of all necessary working steps in the production or service. The difficulty of implementing such systems and the required expenditure in manpower, material and machine time has traditionally limited their usage to large organizations. However it is well known that all endeavors can profit from the organizational efficiencies achieved. At the end of the day and in increasingly competitive markets efficiency and flexibility will determine the success or failure of the enterprise.

If an enterprise wishes to remain competitive, even the smallest recurring tasks require organizing for uniformity, at the same time the ability to flexibly meet the needs of a changing marketplace must remain in place. Many companies have already documented their commercial processes, but much more potential lies in the software supported optimization of processes and structures. These structures evolved to meet requirements (analog systems etc.) which may no longer apply and are thus ripe for optimization. In the case of a new or renewed customer order the question of scheduling needs to be answered. Even if this is the same job as in the preceding order, changes in material procurement, engineering requirements, machine bookings, personnel availability, etc. may require a change in the workflow in order to meet the delivery requirements.

Current approaches still use paper forms, Excel sheets with various modifications, or time consuming communication by phone, fax and e-mail. These methods provide no transparency or uniform control and result in job/departmental thinking instead of promoting an awareness of the interaction and interdependence of all steps in the process. In addition, processing

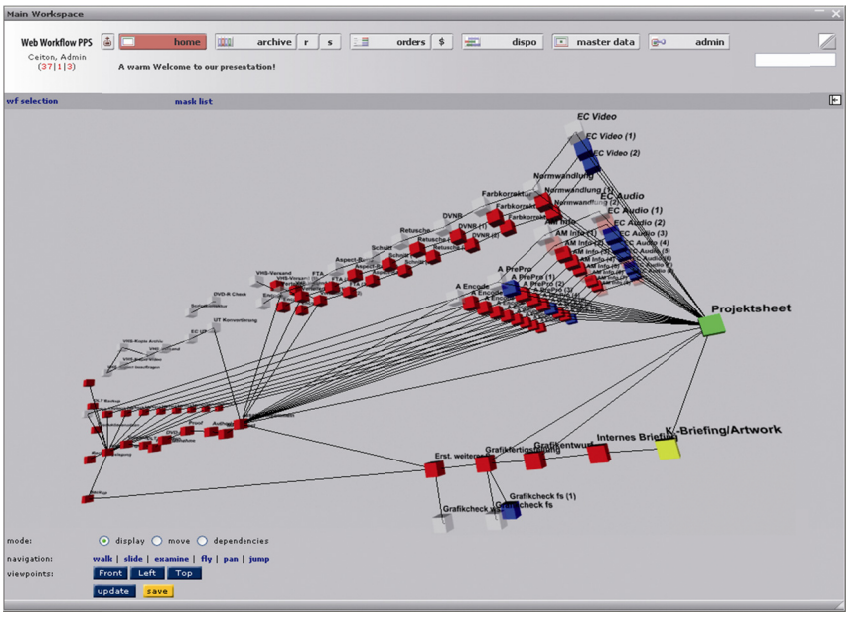

Fig.1 – A Workflow in 3D representation. A cube corresponds to a job.

flexibility and modularity cannot be achieved.

The results are well known: As the market forces us to do more with less the probability of errors increases and meeting deadlines is only possible by increasing employee workload resulting in multitasking which, without adequate information, results in more mistakes etc. Automated systems, as so successfully implemented in other Industries, do not result in the expected efficiencies when applied to media production processes. Creative tasks dominate too much of the process (editorial staff, camera, graphic arts, editing, makeup, etc.) and such tasks cannot easily be automated.

A breakdown of the process into definable, repeatable tasks via standardization, centralization and optimization has a much better chance of success. If one then automates the coordination of these tasks via software systems, one speaks of workflows and no longer of individual processes. Hence we refer to "Visibility through Interdependence" or the 4R rule: "The right task in the right state at the right time in the right place" - only if everything fits together allowing a seamless flow will it be possible to achieve an increase in value. If employees are relieved of coordination tasks, they can then concentrate on their real activities and have been known to achieve 50-100% more time for these.

During the presentation such a system was demonstrated "Web Workflow PPS" and shown to meet the requirements for workflow based production planning and production control system (PPS). Just how does a Workflow management system designed specifically for the media industry work? The first step is to define each task which can be viewed as a closed case i.e. all information required to complete the task can be delivered with the task. The next phase is to model the interaction of these tasks. Workflows must be defined so that dependencies and the required information for each task can be implemented and delivered by the computer system. In a television broadcasting station the rough cut can only be completed after the location footage has been shot and is available to the editor.

MPEG Encoding for DVD production cannot take place until the chapter points have been defined and all preproduction tasks such as standards conversion, editing, aspect ratio conversion, etc. have been completed. The employee also needs to know which assets are to be encoded, at what bit rates, which audio formats (PCM, AC3, DTS) are required, etc. For this purpose so called forms or screens (see **Fig. 2**) are freely defined in the Workflow system, these will most likely resemble the existing forms or Excel sheets. These forms will be made available to the user, with all the required information filled in, when all prerequisites (dependencies) for the task have been met. Each user/department has a home area where tasks awaiting completion are listed. By clicking on a task the user initiates state changes and receives the relevant form. Upon completion in the manner defined by the system (dependencies) the next task will be made available to the user/department defined as being capable of carrying out the required work.
Workflows consist therefore of two components:

- the description of functions including the required information necessary to carry out these functions and the ability to impart information as required for further processing; forms or screens
- the structures of these functions and how they interact with other tasks within the workflow; dependencies.

With these functionalities integrated into the Workflow Engine it is, in principle, possible to model every step of a production by defining the dependencies and designing the input screens such that they can be changed at any time without any

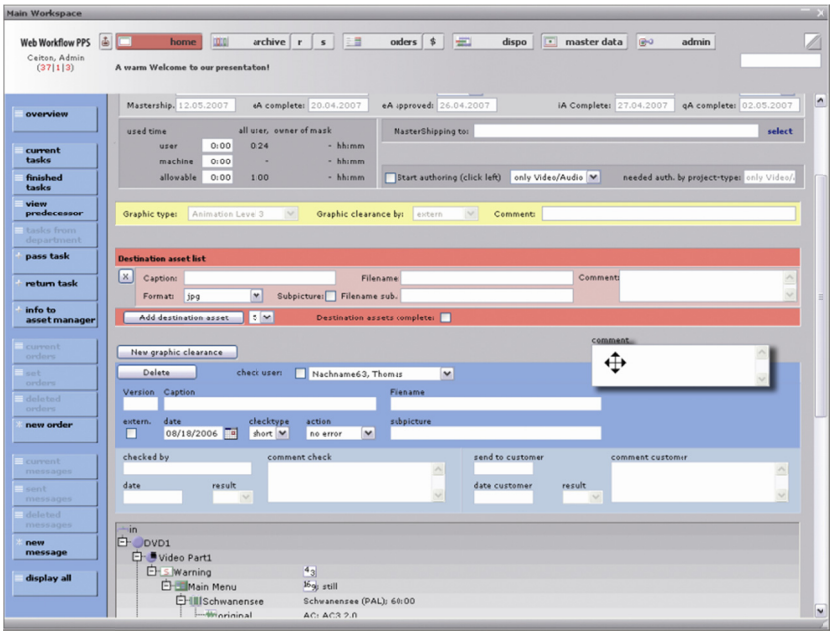

Fig. 2 – A form from a Workflow in the demonstration in which a text field is moved

programming knowledge required. However, compared to the static processes encountered in banking or other management support applications, modeling the dynamic tasks found in creative areas requires a much higher level of complexity. No production resembles another and changes happen frequently during the work. Therefore we must look to a "highly dynamic Workflow engine", which adapts workflows dynamically to the requirements of each production at initialization, as a core of the system: if assets do not meet quality standards, the aspect ratio is wrong, the standard on-tape is not the same as that ordered, or additional external resources are required, the Workflow engine reacts automatically, generating the required tasks or notifying the required parties when this is not possible.

A Workflow management system consists of a program which is installed on one or more servers.

Clients access the system via a web browser which makes available all functionalities independent of place, time or platform. The automatic planning of all activities can be globally or individually controlled and/or changed depending on the authorization level of the user logged in.
Therefore, the system fulfills three essential functions:

- coordination of decentralized tasks via a central controlling authority
- monitoring of all current processes, independent of user location
- integration of foreign systems i.e. asset management or automation

In order to provide a clear overview of the status of the myriad tasks required to complete a project (workflow instance) CEITON has developed a three-dimensional representation which may be viewed in any web browser. Comparable to a wire scaffolding (see **Fig. 1**), both dependencies and current status are displayed. This display is active; therefore as a task is completed its color will change in this view. As this view is available in any web browser it is possible to follow the progress of each project from any Internet connected computer.

The usage of computer assisted workflows is recommended when: employees (internal or external) must share continually changing information, individual systems or machines must function in an integrated manner, processes repeat themselves (instance-able), processes are halted due to changing parameters, quality has the highest priority, or decentralized data acquisition concerning running processes is
required. The implementation of a workflow-assisted PPS results in the following improvements due to the focus on the relationship between individual tasks and the automatic coordination of these tasks via the Workflow Engine:

- Increased transparency of the complete flow
- Lowering of communication costs
- Improvements in the controlling process
- Lower processing time
- Avoidance of mistakes
- More projects completed on time without extra effort
- Rise of flexibility
- (Outsourcing)
- Accounting accuracy
- Automatic archiving of all processes

The second part of this article will show how an individual project related workflow instance is generated from a master Workflow with all specific data and required steps for a unique production. It will also be shown how the system supports the planning of resources and personnel. In closing we will address the requirements for accurate billing, capacity planning and process control.

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Part II

Workflows in support of resource scheduling

In the preceding issue it was shown how computer assisted workflows can be generated from existing business processes and the resulting advantages. In this second part we will go into the details of the scheduling system based upon the presentation at the IRT symposium by CEITON technologies.

Workflow management systems typically generate a huge number a jobs and distribute them more or less automatically to the individual employee. In order to manage this distribution it is necessary that a scheduling module be included in any workflow. This scheduling module must provide information concerning the current status of each project and each task within the project, and the capability of manually adjusting those tasks. In addition it must be possible to view the status differently, depending upon the information required, from the smallest increment to a global overview (**Fig. 3**) clearly showing all current processes and tasks. On the basis of this information it should then be possible to determine where and what intervention is required.

Milestones can be shifted, priorities and capacities changed, or additional tasks inserted, including quality control or reworks, depending upon changing requirements.

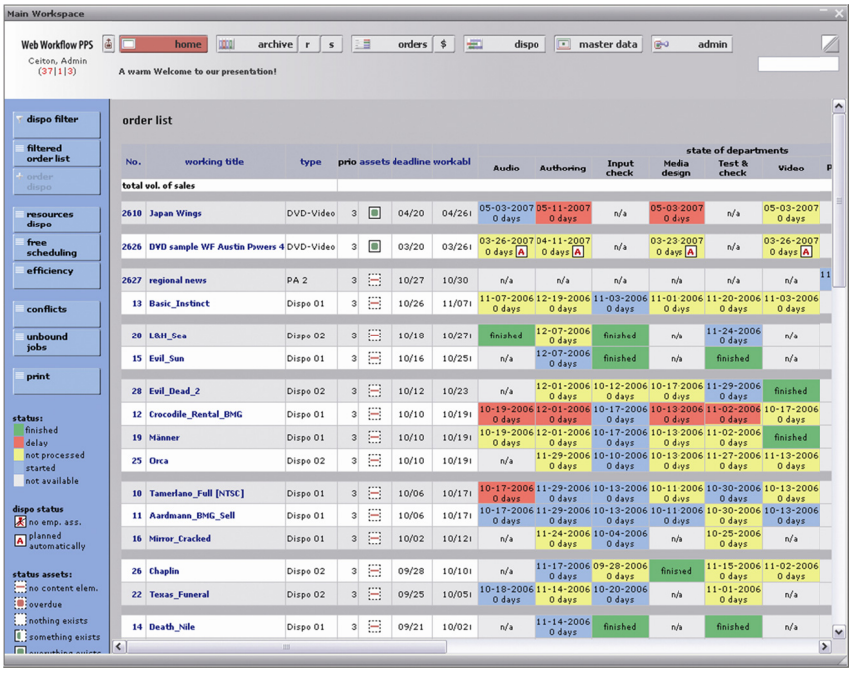

Fig. 3 – Combined view of all current projects

During the live demonstrations in Munich it was shown how it is possible, even without a workflow, to use the scheduling module to assign resources and personnel and to change these assignments based on available capacity. Based upon information contained in the project proposal or specifications the scheduling system can determine which tasks are required to complete the project. The person responsible for scheduling the jobs is thus relieved of the tasks of determining which jobs are to be scheduled and where conflicts may exist and thus can concentrate on the actual task of scheduling i.e. the scheduling of resources and resolution of conflicts. In addition, the information supplied by the system allows for the generation of all reports required by the controlling instance at the click of a button.

The beginning of every project is either a specification and/or proposal. (**Fig. 4**). Based upon the predefined tasks specific for both the business and project type, it is possible to define the project in a structured manner (**Fig. 5**). For DVD authoring the tasks would include input checks, encoding of all input elements based upon the actual asset durations, flowchart generation etc. In the case of a post-production process the tasks would be different i.e. telecine transfer, compositing, play out, etc., whereas a broadcaster would require acquisition related tasks including location sound and video etc. One of the biggest advantages of such a structured approach is the automatic generation of budget information in specific formats for clients as well as for internal planning purposes. The thus generated preliminary budget can then be fine tuned by adding or subtracting services or changing the prices of individual tasks while at the same time maintaining an overview of the profitability of the entire project.

For example, once the system knows that two video streams at HD Resolution with a total length of 75 minutes need to be processed and which processes are to be applied, then it can generate the necessary jobs, assign employees on the basis of predefined capabilities and calculate times required for each individual task based upon duration and complexity.

For example, once the system knows that for a studio production on the February 28, 2008, eight cameramen, a studio and a control room is required, then the necessary resources (personnel, equipment and spaces) can be automatically booked, thus relieving the scheduling department of the necessity of reserving each resource individually. It is only then required that the automatic scheduling be reviewed in order to ascertain if any corrections should be made. The interface enables an overview of all resources assigned and allows the reassignment via drag-and- drop of input fields and selection boxes.

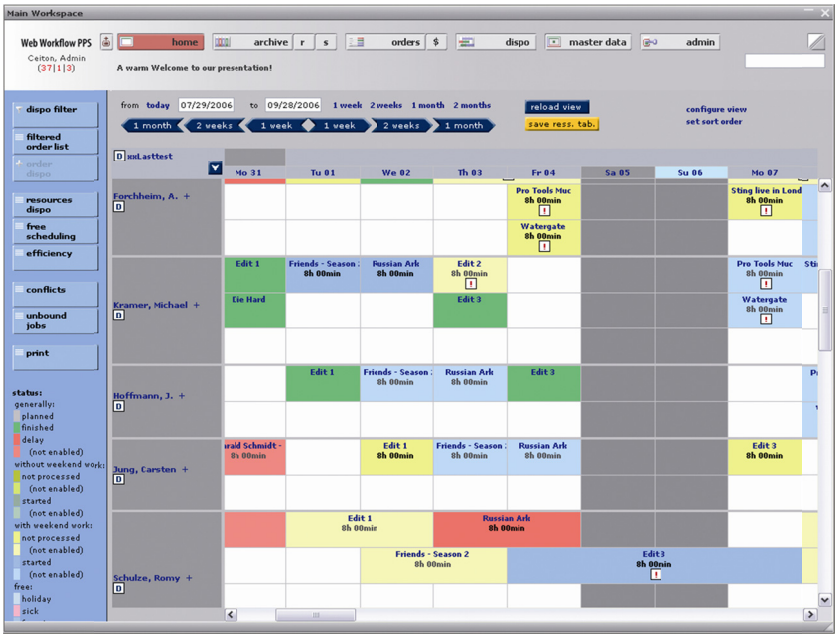

Fig. 4 – Resource availability and assignment

The primary tool used for resource disposition is a web-based interactive Gantt chart (**Fig. 4**) displaying each project. This chart includes drill down capabilities allowing granularity on an hourly basis for each individual task (form) or group of tasks (step). All planned tasks are assigned one or more resources (persons, machines, rooms, etc.), thus it is also possible to view the current assignments for each resource and adjust these assignments as capacity dictates. In addition the non-availability of employees including freelancers due to illness, vacation or business travel and machines (maintenance, repair, etc.), can easily be ascertained. Conflicts, double bookings or unavailable resources are automatically recognized and presented to the person responsible for resolution. This feature is especially important for public broadcasters where adherence to strict regulations regarding delivery is required. Other features included in the resource scheduling module provide information regarding overtime and whether a production will result in increased costs due to scheduling requirements. This information is immediately reflected in the planning therefore allowing for the avoidance of unnecessary labor costs. The information regarding overtime rates is available for modification to the registered (password protected) users.

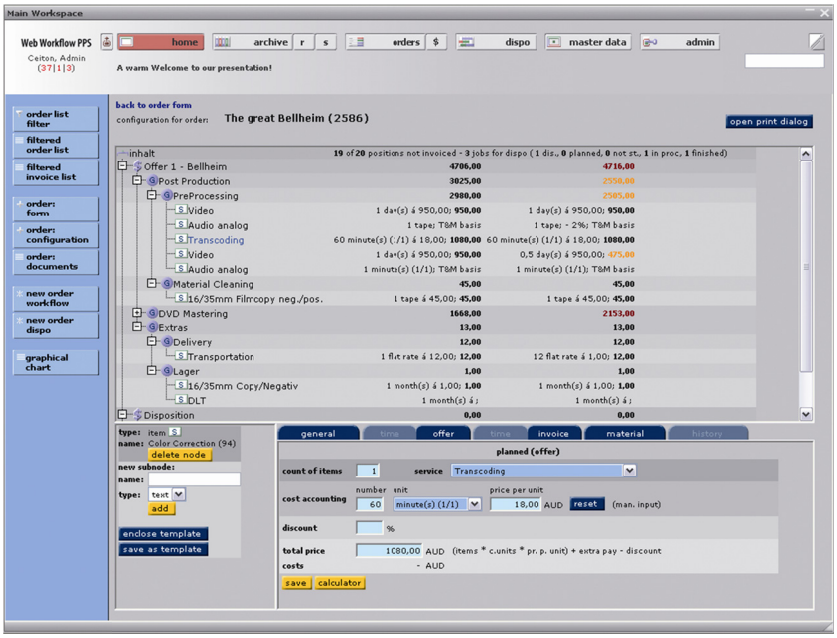

Fig. 5 – Proposal cost estimates and actual value comparison

The employees can receive the information regarding planned tasks (workflow or ad-hoc) either on-line or via printout. If via workflow the system will only make the task

available when all prerequisites have been met otherwise the scheduler will give the job to the assigned employee. While it is unlikely that the stagehand will use a PC as a daily tool, employees in the QC or post production will receive all information and assignments on-line. This information is presented as a web input form or mask (**Fig. 5**) and includes selection criteria and input fields as well as time tracking. Information fields are presented with the results of previous steps in the process as well as special instructions for the operator. As all information (including time-to-date and supplies consumed) is on-line and current department managers and project coordinators can stay ahead of the curve and prevent cost overruns or delivery slippage. The printouts used by non on-line employees include planned times and, when the work is completed, these can be filled out with actual times so that the scheduler will immediately note any differences.

Larger organizations can immediately determine productivity as well as costs on a departmental basis. Again the on-line nature of this information allows for cost analysis in real time. Billing information can be simply printed out from within the application or the billing can be carried out by an external application (SAP etc.). The export of all information can take place via XML or DAV. Before this takes place it is possible to do an analysis of the actual costs vs. planned costs. The actual invoice may be automatically generated by the system (billing on an hourly basis or a fixed offer) or adjusted to reflect additional unplanned costs or rebates.

The workflow system supports not only the process itself, but also the scheduler and all parties involved in production planning. The universal purpose is to relieve the employees from routine and coordination tasks, thus enabling the free flow of the creative production process. As the system is web-based, users can access from an internet café in Afghanistan if required. The scalability of the database engine allows for application by large corporations and boutique production houses alike. Further information is available on the Internet at the address http://www.workflow.tv.

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