Workflow Requirements for Hardcover-on-Demand

Michael Thielen, Michael Reiche, Arved Hübler, and Klaus Kreulich*
Institute for Print and Media Technology, TU Chemnitz, Germany and
** Short Run Solutions, Lugano, Switzerland*

Abstract

Hard cover binding is one of the most complex processes in book production. Today, a lot of reasons are given against the use of hard cover technologies in PoD production. One of these is the question how the production workflow could be integrated and automated. This paper presents an analysis of today's state of the art in PoD workflow tools with regard to hard cover applications. The XML-based job-definition-format is compared to other PoD-finishing standards. Other requirements for hardcover book production are also discussed.

Introduction

Today the printing quality of Print-on-Demand (PoD) products seems to be accepted by the market. But at the moment only the softcover production is realized as a PoD feature.

In the future it could be important for publishing houses to not only have paperbacks but also hardcover books in their PoD portfolio. Those are the products which publishers and consumers refer to the most when they talk about "books". Therefore the hardcover book production could give the producers new arguments for the whole idea of printing on demand.

In addition a PoD product is very often a book which has a lot of personal value for the consumer. For this reason he is interested in getting very high quality and in having the impression and the guarantee that this quality is durable.

A further argument for the production of hardcover books in PoD-processes is that PoD is mentioned very often referring to preprints and reprints. In those cases it is unavoidable that the whole appearance of the book is identical to those which are produced on conventional book lines in large quantities.

But there are lots of supplementary requirements for the profitable PoD-production of hardcover books. The following paper deals with an analysis of these requirements focusing on the development and utilization of an intelligent digital workflow which assists the controlling of the whole process from ordering to delivering.

What Is Needed to Produce a Hardcover Book

To get an overview over the production steps of hardcover books compared to paperbacks see figure 1.

The processes of printing, cutting, folding and gathering are the same in both working orders, depending on the printer which could work with cutsheets or from a web.

The following steps belong to the finishing. Even if the processes of sewing or milling and notching are the same for softcover and hardcover books, they are mentioned twice to compare the finishing of soft- and hardcovers.

Usually the milling and notching process is a part of perfect binding, but to express that milling/notching and sewing are alternative processes, the milling/notching is shown separately.

For softcover there are only three processes necessary, the perfect binding with hotmelt glue, afterwards the cooling of the hotmelt and in the end the three-knife-trimming. The duration of the cooling depends on the glue and the "philosophy" of the book binder. There are glues on the market which are ready for further production after several seconds, so this cooling usually holds a small part in the softcover production. The stacking and packaging in the end is self-explanatory.

As shown in figure 1, the production of a hardcover book is a bit more complex. Before the perfect binding the end-sheets have to be attached to the sides of the block. Then the perfect binding is usually realized by spine taping with cold emulsion glue. Therefore the following drying process is very important for the quality of the fixation because the cold emulsion needs to be absolutely dry before the three-knife-trimming. To accelerate the drying process, it is possible to use infrared or microwaves.

If it should be a rounded hardcover book, the block must be rounded and backed after the trimming.

Beside the above mentioned processes for the production of the book block, a case has to be made. Here it depends on the kind of case. If it should be a printed case, the cloth must be printed, cut and then pasted together with the boards. If it's a case of a special material like leather or linen, which doesn't need to be printed, the cloth also has to be cut, the case has to be made and maybe an embossing is stamped onto the case.

The next step is to put the head- and tale-band on the book block and assemble block and case. This step is called casing-in. Afterwards the hardcover book is ready. At this stage it depends on whether the customer also wants a jacket for his book. In this case the jacket has to be printed and placed around the book. Also in the hardcover production the final step is the stacking and packaging to be ready for delivery.

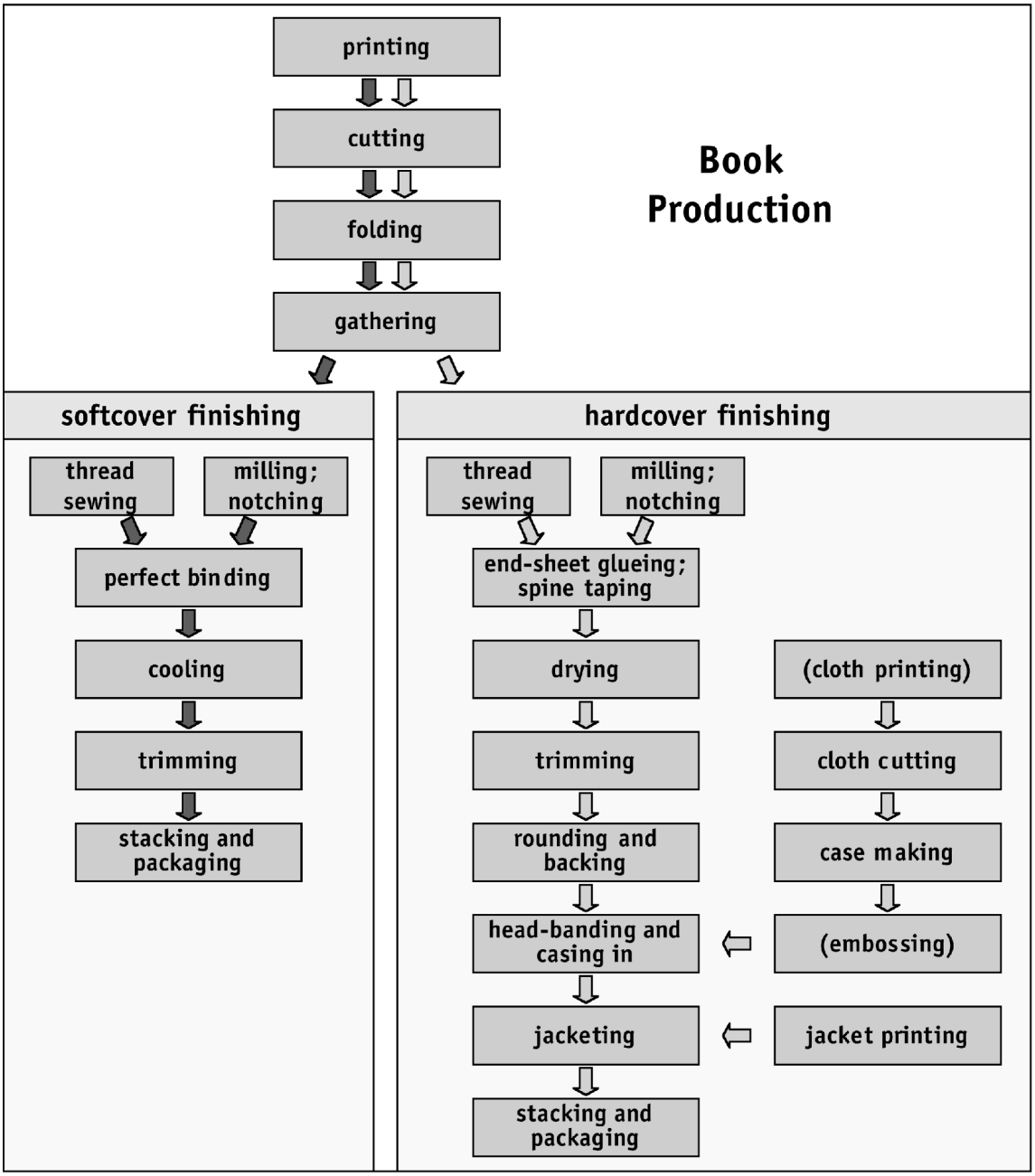

Figure 1. Processes of soft- and hardcover book production

Right now the machines to produce hardcover books in low quantities are available on the market. They distinguish themselves from conventional book lines by lower make ready times, lower speeds and lower prices. Some of them use different and new processes and materials to reach the goal of copying the quality of the books which are made on conventional book lines.

The different approaches fit to different demands, concepts and quantities and therefore they don't really compete with each other.

What is the State of the Art in Workflow Tools and What Could Be Used for the Pod-Hardcover Production

If you look at PoD productions today you find high-tech regarding the data transfer from the prepress department to the printing unit. Every following process is kept on a very manual status. That means that printer manufacturers who mostly supply the printer users with workflow software, put their focus on the requirements of their printers, while lots of manufacturers of the finishing equipment seem not to be very interested in the

implementation of a digital workflow. This might be justifiable in softcover production because limited information is needed to define the book (thickness, height, length and the offcuts at the head). So it is no problem to setup the finishing machines by hand. But if you look at a hardcover book there is a lot of further information needed which can already be defined in the production planning so that the implementation of a digital workflow would assist dramatically the increase of productivity.

This implementation means that for example a perfect binder gets the product relevant information in a digital way by a network or a disc or maybe printed on a barcode and use this information for the binding of the book. Additionally there must be several status data about the binding job which should be given back to the workflow software to give the operator the possibility to control and influence the production process.

In the nearer future there will be finishing equipment also for the softcover production which will be able to deal with digital information. Then there has to be a solution to integrate the finishing into the digital workflow.

At the moment there are several approaches of different printer manufacturers for exchanging information between the different devices of a production line. Those are the first steps in the direction of a digital workflow. Usually they use predefined data which is given from the printer to the following machines.

To show in detail which data is given to the finishing devices by those approaches, two of them are shown in table 1. The first one is the DFA level 1 specification from Xerox. The second one is the approach of several machine manufacturers who defined the UP^{3}I standard.

Table 1. Comparison of DFA Level 1 and UP^{3}I

	DFA Level 1 – specification	UP^{3}I – standard
Mechanical connection	specified	not specified
Physical connection	male 37-pin D-shell connector	IEEE1394
Form of signals	”high” and “low”-signals	defined packets
Data to the finishing equipment (starting at the sewing or milling)	- sheet exit - end of set - cycle up - end of job - (first special function: ”on”) - (second special function: ”on”)	not specified, but there is a possibility to define it “manually”
Data from the finishing equipment	- off-line - faulted - full - sheet delivered - set delivered	not specified, but there is a possibility to define it “manually”

This table shows that the two approaches come from different sides: The DFA Level 1 specification is defined to make sure that the printer is able to run with an inline periphery. If you look at what exactly is defined, you find out that the most important thing is to make sure that nothing on the printer has to be changed. Therefore there is a very strict definition about the mechanical connection as well as the physical interface which is in the focus of this specification. The form of the signals seems to be a bit old-fashioned, but as long as the finishing equipment is not able to process more information than what is given, it’s not necessary to go beyond the scope. For the future also those specifications are planned to be upgraded to offer the possibility of exchanging more data than listed in table 1.

The UP^{3}I-standard is created on a more general and even more modern level. The mechanical connection is not specified and the physical connection is realized by using a standard bus-system so that every integrated machine can be easily adapted. The form of the signals, the defined packets, is the important specification and standardization of UP^{3}I. The fact that the data to be sent to the finishing devices is not yet explicitly specified, shows the priorities of this standard. In the future it is quite possible, that such a specified packet will be defined also for the finishing devices.

What else is there in the market? By having a look at the ”regular” book production with offset printers and fast book lines, we find a new trendsetting approach – the ”Job-Definition-Format” (JDF). This format is designed by the CIP4-organization to streamline information exchange between different applications and systems. It includes every information which is needed to define the whole print job from genesis through completion. As long as it is just a format you can use it to write your own workflow software around it by using the data you need for your production or your customer. The goal is to make a computer integrated manufacturing (CIM) possible, that’s why accounting information is also integrated into JDF.

The Job-Definition-Format is based on XML (eXtensible Markup Language), which is a Meta- Markup-Language, providing a syntax for defining a user-specific Markup on demand. It provides a sophisticated format that is easily read and manipulated by both – humans and computers. Since XML is system independent and future-proof, it not only provides a standard syntax for representing and handling of information, it also includes a philosophy and tools that allows to create, maintain and update a specific standard for structuring the information. At present there are powerful tools available, while XML and the related standards are permanently growing and consequently fast development cycles should be taken into consideration.

To give an overview of the data JDF can provide for the finishing devices, table 2 is given. This information only refers to the finishing of books – softcover or hardcover. As table 2 points out, the whole softcover finishing can be described with JDF. There is a definition for

thread sewing or back preparing, for perfect binding and for trimming.

For the hardcover finishing the processes are defined up to the trimming of the book block. But at least the end-sheet gluing and spine taping are implemented. The following steps which are already shown in figure 1 need to be implemented into JDF. Those steps are in detail for the case: the cloth cutting, the case making and the embossing. For the block treatment the rounding and backing and the head- and tale-banding are needed to be adjusted. Furthermore also the processes of casing-in and jacketing belong to the hardcover production and need to be implemented into JDF.

But since JDF is based on XML, it will be possible to extend the format for the individual needs as long as there is no standard. Those individual extensions could be used as a suggestion for the CIP4-organization to increase the speed of the implementation of the hardcover books into the JDF-standard.

Table 2. Finishing-data in JDF

	JDF finishing data
Softcover relevant data	- back preparation (milling, notching) - thread sewing - glue application - cover application - trimming
Hardcover relevant data	- end sheet gluing - back preparation (milling, notching) - thread sewing - glue application - spine taping - trimming

Additionally there are several other reasons, why the utilization of the JDF-standard seems to be a good approach. The first reason is that there is a well thought-out basis where you can be sure that every necessary information is included. Then there is a lot of support in form of software programs, mailing lists or internet forums. A very important advantage is the possibility to exchange the format with other users of JDF, for example if you do reprints and the producer of the regular run already applied JDF in his production you can skip the data-entry and use his JDF-file to define your print-job.

What Else Needs to be Included Into a Digital Workflow for a Profitable Production of Hardcover Books In Low Quantities

As mentioned above for the hardcover production in PoD-processes the implementation of the digital workflow is even more important than in the softcover production. But the already remarked points about the data for the setup of the machines are just a small part of the whole workflow idea.

To find out the requirements and also the restrictions of the hardcover book production in PoD-processes, figure 2 shows a model of an implemented workflow for a production of hard- or softcover books.

Before starting with the requirements a short explanation of the model should be given: A customer places an order – here it doesn't matter how he does it – by a letter, on the phone or over the internet. This order arrives at an administration unit, whose purpose is to plan and control the whole job. This is the starting point of the digital workflow.

The administration unit has to communicate with all other included departments. It has to make sure that the needed materials are in storage, it has to "explain" the job to the prepress, so that the prepress knows what is needed for the production, it has to organize and plan the whole production – also job tracking, it has to advise the accounting department to make sure that the invoice will be printed out and brought to the delivery and it has to interact with the delivery department to make sure that the customer gets his products.

The storekeeping unit has to deliver the materials to the production. In this figure the storekeeping is also responsible for digital storages like a databank - that's why it has to communicate with the prepress.

The prepress has also to communicate with the production to hand over the job relevant data. In the production the different possibilities of "book features" are realized. The finished book is brought to the delivery department, where the book is brought together with the invoice and sent to the customer.

The requirements for this model start at the communication between the customer and the administration unit. In PoD productions the customer often doesn't know, how a book can be described. For this communication a tool like a well thought out internet portal could avoid mistakes.

The communication to the storekeeping does not seem to be a problem but the storekeeping itself could be a stumbling block for the hardcover production because there are several materials in different sizes which have to be stored to ensure the production of every desired book. In the beginning there will be a lot of work done by hand but it should be possible for those manual steps to be automated in the future. Those automations always mean higher costs. Therefore it would help the producer if formats and materials are standardized so that the costs for the storekeeping don't go beyond the scope. Also in the production unit a standardization and simplification would improve productivity, for example an embossing or a jacket could be left out.

Another important point could be the logistics for the different parts of the job, starting with the different materials for the cases, going on with different papers for the printing and ending in bringing book block and case together.

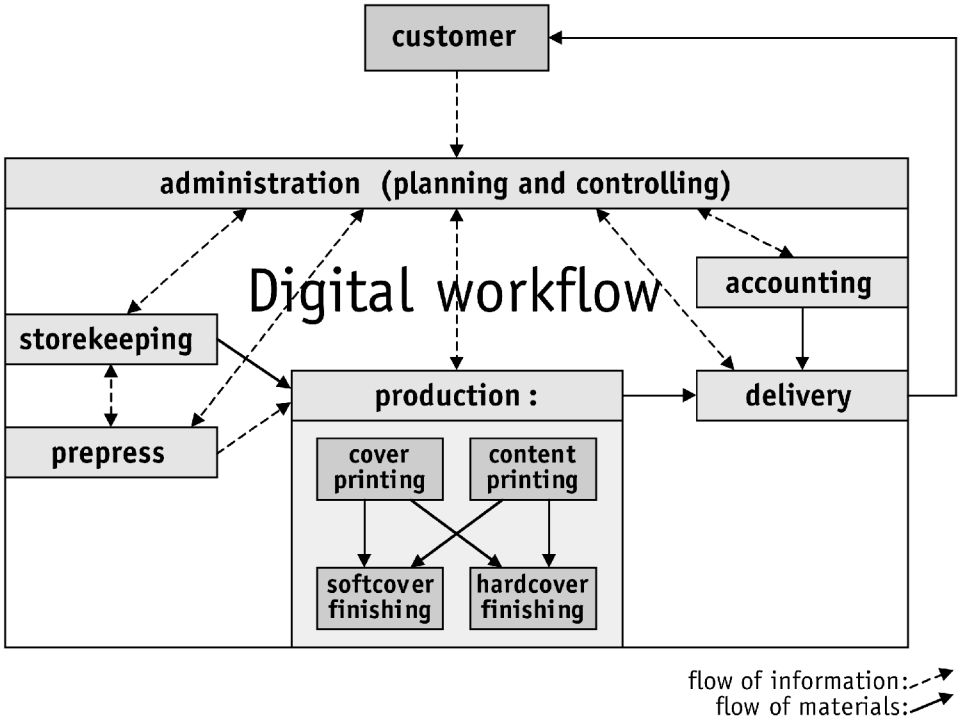

Figure 2. Model of an implemented digital workflow

Last but not least the book producer has to think about the equalization of the different speed potentials. Therefore the processes for the hardcover book production are more complex and more extensive than for the paperback, the finishing equipment for the hardcover production is more expensive. Because of this it is necessary to use the full potential of the machinery. The problem is that a digital printer requires different times for different books because it depends on the number and the size of pages, whereas the finishing machinery always needs the same time for the binding of a book. Therefore it seems unavoidable to think about the realization of intermediate storages.

The goal should be to automate the departments of the administration, the storekeeping, the prepress and the accounting to decrease the costs for the production. The requirement for that is an entire digital workflow, which could be kicked off by the customer via internet.

Conclusion

The hardcover book production is a complex exercise. The existing tools for an integration into the surrounding of a PoD-production are not suitable to the needs of the hardcover finishing equipment. The most promising approach for the implementation of a digital workflow seems to be the XML-based Job-Definition-Format which has to enlarge its specifications.

Also other restrictions are given, starting at storekeeping and ending in logistics but right now there is a demand for Print-on-Demand hardcover books and therefore the mentioned problems must be solved.

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Biography

Michael Thielen finished his studies as mechanical engineer at the University of Technology Aachen in 1999. Since 1999 he is working on his Ph.D. at the Institute for Print and Media Technology at Chemnitz Technical University with the subject of hardcover binding on demand. At the same time he is project manager at SRS Short Run Solutions, Lugano – a machine manufacturer which has specialized on bookbinding machines for small quantities.