ADVANCES IN DIGITAL PRODUCTION WORKFLOWS

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Abstract
Digital workflow is one of the key factors for improving efficiency in print media production. With the new buzzword "Print 4.0" the topic attracted even a wider attention lately.
This paper gives an overview of some current developments concerning workflows for print service providers (PSP).
Keywords: *Workflow, JDF, MIS, XJDF, Print Production*

Introduction

While *Workflow Management Systems* denote modularly designed applications that perform different tasks of print production under one graphical user interface, a digital/integrated workflow is a (not necessarily linear) sequence of processes based on data communication between independent devices or applications from possibly different manufacturers. The latter has already been pushed forward since the 90's with the *Print Production Format* and thereafter with the *Job Definition Format* (JDF). While originally a digital workflow in print production was mainly understood only in relation to technical processes in prepress, press and postpress, the term "Print 4.0" now also refers to interfaces concerning additional commercial and logistical data flows. We will discuss the following interfaces in this paper:
- Print Buyer (PB) and Print Service Provider (PSP),
- PSP and external (paper) supplier,
- PSP and logistic provider,
- Between technical production processes at the PSP's site.

In the end, we will give a few remarks concerning the special needs for major printing enterprises.

This paper is not based on a scientifically sound survey but is rather of subjective nature.

Interface PB and PSP

Classically, the communication channels between PB and PSP are simple: Everything from the request for quote to the invoice is handled by telephone, fax, email or postal mail. It is also common to have personal discussions between PSP's sales representatives and the PB. Print data is exchanged via data carrier (USB, DVD) or as e-mail attachments. Usually, a *Management Information System* (MIS) controls these transactions on the PSP side. In the meantime, however, the situation got far more complex: Orders are also created by Web-to-Print systems (W2P), which are either installed at the PSP's site or at a third-party provider's site, or directly through an *Enterprise Resource Planning* system (ERP) of the PB. The PSP receives different job data formats like private XML, JDF/JMF ([1],[2]), PrintTalk, text files, CSV files. The print data are forwarded via email attachments, portals and FTP servers to the PSP. Due to these various communication channels, different interfaces are required internally at the PSP, e.g. between W2P and MIS, which are also implemented by means of different data formats or by means of shared databases. Often there are gaps, private interfaces or different accesses to the technical processes of the production. The assignment of print data to the order data often requires the intervention of an operator. There are efforts to harmonize those channels, e.g. with the help of a controller (or a MIS) that collects all the order and print data, assigns them automatically, bundles data for the technical production processes (JDF/JMF) as well as for the orders to the external suppliers, for the logistics companies and for the internal warehouse.

Interface PSP and external (paper) supplier

The communication channels between PSB and external suppliers are quite manifold and depend on the geographical region. In many cases the placing of orders by the PSP to the paper supplier is still dominated by phone, fax or email. The delivery notes from the supplier are then later transferred manually into the masks of the storage system software. However, some suppliers have also implemented a W2P system, through which the PSP can order the requested resources.

However, there are also procedures which ensure better automation. For example, the supplier might send customer-specific price lists (e.g. in the form of CSV files) at regular intervals via email to the PSP. These can then be imported by the PSP into the MIS so that valid prices of the printing substrates are available when calculating a quote. Order software at the PSP can furthermore send order requests automatically as email attachments to the supplier. Finally, in some cases, invoices and

delivery notes of the supplier are scanned by the PSP, then OCR is carried out and the text is analyzed so that the stock booking is simplified. Email attachments can also be analyzed and evaluated in this way. These methods are quite specifically tailored to individual configurations. On the other hand, web services would be much more general, allowing direct communication between the order software at the PSP and the order management system at the supplier. This type of interface will certainly get a higher priority in the future.

Interface PSP and Logistic Provider

The interfaces between the PSP and the logistic providers are quite diverse, since the product orders and their approaches to the technical production processes are not unified (see section 2). Often, the PSP fills in forms for various logistic providers, either manually by an employee or automatically by an MIS or a dedicated shipment software.

Large logistic providers offer web services, so that XML data is exchanged between PSP and the logistics company. For this purpose, however, the MIS or a logistics software of the PSP must integrate the appropriate Web services, whereas different logistic providers have defined different APIs. Local logistics companies, however, or a delivery managed by the PSB will, in general, not support a Web services. A non-uniform allocation of logistic orders and/or dispatch of goods is the inevitable consequence. Integrating control software, which supports different logistic providers, but offers a single API for the MIS of the PSP are introduced in the market.

Interfaces between technical production processes of the PSP.

The interface between MIS and the technical production processes as well as interfaces between a production controller and devices in the production are dominated – at least for sheetfed offset and digital printing - by JDF/JMF. The product description, i.e. the set of intended properties from the PB's point of view, is usually entered into the MIS of the PSP while preparing a quote for the PB, or is defined implicitly by a W2P system. But a JDF file normally does not contain just the description of a product, but also the processes required to manufacture this product. The process details are added to the JDF file during production. Originally, there was a 1-1 relation between order, product description and production workflow description. However, this assumption became less and less valid in the last years: an order can consist of several products and several independent products can be combined to a single production workflow. Since the complete production workflow description is stored within a JDF

file, the structure is quite complicated and difficult to handle, especially with subsequent order changes. This has led to a new data format, the XJDF [3], which is still in a draft version right now. Unlike JDF, XJDF does not specify the technical production processes as a whole, instead it defines only a communication protocol between a workflow controller and different devices. The workflow description, on the other hand, is a private matter of a controller and is typically implemented with the help of non-public databases. This can make workflow implementations simpler, mainly due to the fact that a device no longer needs to be prepared to filter the needed information from the highly structured JDF file. With XJDF it receives only those process details which it requires. This should make it much easier to develop a XJDF device interface compared to a JDF interface.

In future, the product descriptions could also be transferred from the XJDF data into the PDF structure [4]. This would shift the responsibility from the PSP to the PB. For the implementation a PDF/VT technology is used, where individual pages of a PDF file are assigned to different (personalized) documents. In the case of the production description, individual pages could also be assigned to product parts such as cover and content of a brochure. Additional metadata can be associated to each document within PDF.

Major Printing Enterprises

In recent years, the concentration to increasingly large and internationally active printing companies has been growing. According to the study „The Future of Global Printing 2020" [5] 15 printing companies in 2013 had more than 3 billion volume of sales, in some cases even more than 15 billion. In comparison, the world's largest sheetfed offset machine manufacturer, Heidelberger Druckmaschinen, had a turnover of 2.4 billion in that year. This certainly implies that manufacturers of workflow solutions for PSPs have to pay extra attention to the needs of this target group. Since these features also affecting some medium-sized enterprises, some of them are listed here.

- Multisite MIS,
- Multisite production,
- APIs to WMS
- Cloud solutions.

Since the global players like to shift PB's orders from one production site to another, a multisite MIS seems to be a necessary condition. The same holds if a product will be produced in parallel at several production sites. Both situations have a lot of implications like handling different currencies, different tax laws and the like. If a production of a product is actually divid-

ed into several production sites, the integration of the sites need to become much tighter, since the shop floor data collection need to be centralized.

Even the global players in the industry are using standard WMS for different tasks in the print production. Since different sites might use different WMS and all of them need to be controlled by a multisite MIS, the WMS have to open up their functionality to external software. That is, APIs have to be established by the WMS manufactures.

Finally, the former client-server architecture of different application in the graphic industry will have to give way to Web services and cloud solutions. These are crucial properties not only for major print enterprises but also for midsize companies.

Summary

The main focus of the software companies that cater for automation solutions in the graphic industry seems to be more on the data flow concerning commercial and logistic aspects than concerning technical processes within the core of the print production. In both cases, however, simplification and unification of current data flows seems to be predominant. Web services, cloud solutions and browser based applications are becoming more important.

Bibiography

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