

Digital Printing Front-Ends

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Abstract

Digital printers bypass the creation of film, plates, and other steps required for traditional printing. It is a technology that compresses the printing process. Digital files go directly from the creator to the press. The digital printing process takes fewer steps while shifting the emphasis to customer service. As such, digital printing offers significant advantages over offset printing.

New market opportunities arise. Hand in hand with these opportunities, new challenges have to be met resulting in a complete rethinking of the production process, from the creation of documents, over the processing up to the printing.

In this paper, front-end requirements are presented, illustrated with Chromapress IntelliStream® implementation examples.

Introduction

Digital printing presses combine imaging lasers or LEDs with new types of drums, and inks. Not only do digital presses let you image your documents directly on the press itself, but they also automate document management and make-ready, eliminating the time-consuming and costly preparation and calibration of film, plates and water-based inks. However, digital printing is not a replacement for traditional printing, it complements traditional offset printing and extends the printing potential.

Digital printing presses have a unique basic feature, namely, they don't make use of a physical intermediate master such as plates or film. One can say that digital printing presses make use of digital plates. The imaging of document pages is done digitally right on the press. Between two imaging phases the content of the digital plate can be changed. As a result of this, each subsequent printed sheet can be different in content.

The core benefit of this unique feature is the flexibility of digital printing, since the content can be changed, rearranged, or updated until the operator sends the digital file to the press. This flexibility is most valuable in the following primary digital printing applications:

- Short-run printing: print runs of 1,000 or less in full color
- On-demand printing: regularly updated, low-inventory print materials
- Variable-data printing: highly customized (text, graphics and images), high-quality print pieces with a specific message targeted to a specific individual or group
- Distribute-and-print: print files distributed via networks for convenient (and potentially customized) local output on digital presses

Digital Printing Market Opportunities

Historically the economics of publishing have always favored mass delivery. The drawback to mass communication is that you're forced to find a single message for a single audience. That means finding the "lowest common denominator" – a message that appeals to the largest number of people. A message that must hold some appeal for many is often a message that few people identify strongly with. Digital printing changes this way of thinking in favor for those companies that could identify their customers as individuals. The key to understanding digital printing doesn't relate to the printing systems themselves, but rather to what you do with the digital features of the system.

Short-run printing is just as it sounds fewer impressions than we could normally economically undertake with offset printing. The digital presses are designed for fewer copies – as few as one copy. Therefore, you can print just what you need, when you need it.

The step from short-run printing to on-demand printing is small. Shorter runs have higher unit costs, but this is often compensated by the decreased storage cost and, more importantly, by the much greater flexibility. Print jobs can be assembled, imposed and stored prior to printing. When they are due to be printed, they are moved to the digital printing system. They can be printed several times, even last minute changes can be carried out before sending the print job to the digital printing system for reprint.

With variable-data printing you can create "customer-centric" publications instead of "product-centric" publications. A customer-centric publication describes the product benefits for a specific individual or group. The degree of variability leads to different types of variable-data printing. Short runs that vary can be described as versions. Versioning is targeted towards a specific audience. Different versions of a publication can speak more directly to different group of readers. Of course the shortest run length is a run length of one. Varying the message for each recipient is the most powerful form of variable-data printing. Within each individualized document, text, graphics, images, and even document layout can change. This is called "personalization" or "customization &

segmentation". The name for this new kind of marketing is "One-to-One Marketing".

Digital printing makes the concept of distribute-and-print a reality. This concept is based on the principle of separating document creation from document printing and delivery. Documents can be completed in one site and electronically distributed to another or various sites for printing. This reduces shipping costs and other issues associated with the traditional print-and-distribute concept.

Digital Front-End Challenges

Short-run color printing presents a number of challenges, especially to the front-end workflow and management of print jobs. Users expect to have a rapid access to the printing performance of the digital presses. The preparation time of short-run print jobs should balance the printing time.

In order to reduce reprint, the predictability of the outcome should be high, in respect to job processing as well as to the print quality. The predictability of processing is closely related to what is called preflighting. Preflighting is the process of up-front checking that all fonts, external referenced images, and graphics have been included so that you can properly process and print your job. Keeping the print quality up to the desired level over a long period of time is a prerequisite for having a predictable print quality. Hence, calibration techniques with which the color quality can be quantitatively measured and eventually adapted are necessary.

Also related to short-run color printing is the smooth order processing. Due to the shortness of print jobs their lifetime within the front-end system and digital printing system is very short. Print job tracking and accounting is an essential part of each print job management system. This is related to the possibility to uniquely define a print job. A print job ticket should accompany print jobs. This print job ticket contains all relevant information needed for successful processing. It contains apart from the necessary process parameters such as: imposition scheme, number of copies…, also information regarding the originator of the print job. After a print job is printed, job information should flow back to this originator. Smooth order processing further involves the use of extensive delivery and order administration.

On-demand printing provides the user with the capability of reprinting a previously printed job with or without changes. The production of jobs is triggered by order and not by the amount of available stock. This feature requires rapid access to previously processed jobs. The user must be able to reprint a job without processing the job again. This leads to a requirement, to a challenge of archiving print jobs in such a way that the reprinting can be done independently from the engine calibration state.

Apart from the archiving requirements, the format in which the print jobs are stored must be editable for reprints. This editability of the job must be accomplished with regard to job ticket aspects, such as: number of copies, print order…, with regard to structure, such as: pages, images, with regard to delivery and accounting information.

The key feature of variable-data printing is the ability to print runs with a run length of one. A run is to be regarded as multiple copies of the same document, as such, a run of one means printing a document only once. Within one run each digital image on the digital presses drum can be different Ultimately the digital front-end must be able to generate digital images which vary 100% at both sides between consecutive printed pages. This will put a tremendous challenge on the rate at which the digital front-end can generate and transfer data to the digital press.

Parts of the digital image will not vary. In order to reduce processing time parts of the digital image can be stored for later reuse in the same or in a different run. On the other hand, it is sometimes not economical to store "once-used" parts. As such, they have to be processed by the digital front-end system in the corresponding print time. The processing performance of the digital front-end should balance this need.

Variable-data printing is not only a matter of processing the job but puts also its challenges on the creation process. The creation of variable-data jobs require specialized software in order to accommodate the designers needs for having a complete freedom in job layout using all standard graphic arts layout features, such as: graphics, typographic, image, etc. The designer should have easy access to a database environment that holds the variable parts of its layout. One run of a variable data job means printing a number of booklets. Parts of the layout that don't change over booklets are called master objects. On the other hand, parts that changes between consecutive booklets of the variable data job are called variable objects. As part of the layout features, variable- and master objects may overlap. The nature of variable objects may not be limited to text but should be extended to images and graphics as well.

Distributed-printing on digital presses presents a number of challenges, especially related to job integrity and job transfer. Job integrity must be assured on all locations. Fonts, images and job ticket information should be at the right spot when needed. Ideally, a job should be transferred in a 100% resolved format. Color management systems at both ends help make colors consistent Job management systems should be at place to track delivery and accounting information.

Job transfer is closely related to network technologies. Though fiber optic and ISDN lines are being established, many customers might still have to submit files via slower methods, which can present a significant bottleneck. As such, job transfer should be accompanied with compact movable job formats thereby reducing storage and transfer cost.

Intelligent Streamer

Digital color printing requires a significant rethinking of the production process. It requires high productivity since press runs are shorter. It requires job archiving, since files are often used again with or without changing the job parameters. Print order schemes like electronic collation and reverse order printing should be changed in a flexible last minute way.

The digital front-end system must be capable of generating digital masters that can be different for each printed sheet. This leads to a much higher "real" data throughput compared to offset printing. Once the digital press is started the press must be fed with data. Any interruption in the data flow will bring the digital press to a stop with possible paper waste and loss of production time as a result.

The network, the pre-press applications, the RIP is much too slow to really feed the digital press real-time. The following presents an overview of some data rates:

Quickmaster DI-46 (2400dpi @max. size @ 1bitperpixel)	460 MByte/sec
Chromapress 50D (600 dpi @ 500 mm @ 4 bpp)	136 MByte/sec
Chromapress 32D (600 dpi @ 320 mm @ 4 bpp)	88 MByte/sec
Fast-Ethernet	10 MByte/sec
ISDN	0.064 MByte/sec

The data rate for the Quickmaster DI-46 must be provided by the digital front-end system when writing the on-press plate that is not a real-time issue. The data rates for the Chromapress systems must be generated by the digital front-end system at a sustained rate. Compared to these data rates, the most common network data rates are magnitudes smaller. Therefore an intelligent streamer between pre-press processing and press is a requirement.

An intelligent streamer can bring advanced capabilities to the digital printing process. This intelligent streamer can be regarded as a raster data store between pre-press processing application (incl. RIP) and the digital press.

Figure 1 presents an overview of the IntelliStream® configuration.

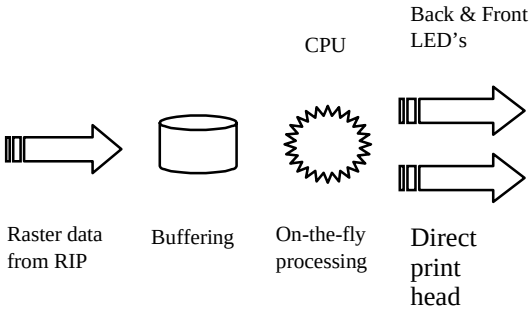

Figure 1. IntelliStream® Configuration

In an IntelliStream® configuration, the RIP compresses PostScript® & Portable Document Format® documents into IntelliPac®, special device-independent print files. IntelliPac® files are segmented and highly compressed raster files. Depending on the disk capacity, the IntelliStream® can store multi-thousands of pages on-line. During the print cycle, the IntelliStream® will decompress the files real-time, performs the necessary calibration and screening and will feed the engine with a sustained data stream. Apart from these basic features, decompression, calibration and screening, the IntelliStream® implements flexible print order schemes s.a. electronic- and mechanical collation, reverse order printing, and variable-data printing at printing speed. Master IntelliPac® file, constituting the fixed part of a print job, can be merged with variable IntelliPac® files on every printed sheet at printing speed. Variable IntelliPac® files constitutes the variable part of a print job.

IntelliStream® Workflows

The IntelliStream® raster buffer provides the customer with a range of new capabilities and benefits.

Since the calibration and screening is done at print time, IntelliStream® highly extends the life of an archived IntelliPac® job. The self-contained character of an Intellipac® makes it place- and time independent. The preparation of an IntelliPac® job for printing can be done anywhere at anytime. The IntelliPac® job is even press independent due to the fact that press parameters (calibration/screening) are added at printing time. These capabilities enforced by the highly compressed data format (minimum 10:1 in comparison to conventional raster files) makes the IntelliStream® extremely useful in a distribute-and-print environment. It also streamlines on-demand printing by allowing archived IntelliPac® files to be run in real-time for printing.

Regarding to variable–data printing, the IntelliStream® merges master- and variable-objects in real-time. The variable objects may span the entire printed sheet. Due to the fact that the variable data objects are rasterized up-front in the digital front-end system before downloading to the IntelliStream®, variable data can be processed without any limitation on coverage (printed sheet can be 100% variable) and without any limitations on position, color and overlap.

The intelligent streamer architecture lets the user define a range of pipelined workflows that increases productivity. Apart from the normal print flow controlled by IntelliStream®, figure 2 presents three additional workflows.

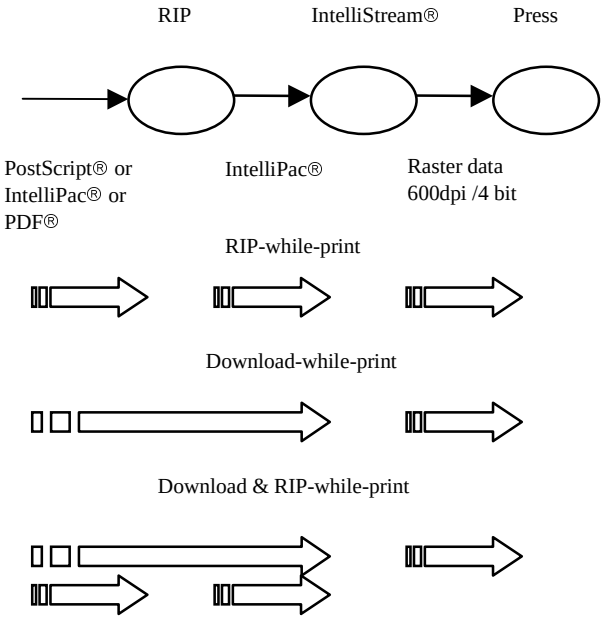

Figure 2. Pipelined Workflows

With the RIP-while-print workflow the IntelliStream® simultaneously supports two data flows: the downloading of rasterized and compressed image data from the RIP and the sending of raster data to the digital press. This type of pipelined workflow allows the system to switch between two downloaded jobs without stop and start.

With the download-while-print workflow the IntelliStream® behaves exactly the same. In this case, the data downloaded through the RIP to the IntelliStream® consists of IntelliPac® files. These IntelliPac® files could be rasterized and compressed on a separate RIP system. This separate RIP system is then part of on offline digital front-end system. Such a system can create IntelliPac® files and store them on an appropriate medium. Online digital front-end system has an IntelliStream® and digital press connected to it. By using offline digital front-ends in combination with online digital front-ends, the user can establish a high flexibility of workload balancing (on-site or off-site).

With the download & RIP-while-print workflow the IntelliStream® simultaneously support three data flows. The IntelliStream® supports the downloading of rasterized and compressed data in combination with the downloading of IntelliPac® files. As such, the user can define IntelliPac® jobs that are in itself a combination of pre-RIPed raster data (IntelliPac® files) and presently RIPed data.

Conclusion

In the present paper the market opportunities and requirements were challenged against the Chromapress IntelliStream® solution. A solution that provides the user with two basic tools, the IntelliPac® print file and the IntelliStream® workflow.

The IntelliPac® print file accommodates the need for a compact file format especially useful in the distribute-and-print environment as well as in the on-demand printing world. The IntelliPac® files are resolved, no additional fonts, images,… are needed for printing. The place-, time- and press independent feature of an IntelliPac® supports their use for distribute-and-print applications.

The IntelliStream® features accommodate variable data printing at press speed. It supports rapid access to preprocessed data in combination with flexible print schemes which makes the IntelliStream® useful in short-printing and on-demand printing applications. The pipelined workflows provides the user a flexible way of streamlining and load-balancing his production process.

Job management features with regard to tracking, ticketing, delivery and accounting didn't had much emphasis in this paper. Nevertheless, they are equally if not more important.

Biography

Pierre Vennekens received his Civil Engineer degree from the Catholic University of Leuven in 1981. P. Vennekens joined Agfa N.V. in 1982 at the engineering department He has joined the Digital Printing Systems division in 1994 were he is now the R&D manager for variable data printing.